SCHEDULE C MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Environmental Study Report
for the Rehabilitation of the Boulevard Lake Dam

December 2018

SCHEDULE C MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT REPORT

For the Rehabilitation of the Boulevard Lake Dam

Prepared for:

City of Thunder Bay

Prepared by:

Arcadis Canada Inc.

121 Granton Drive, Suite 12

Richmond Hill, Ontario L4B 3N4

Tel 905.764.9380

Our Ref.:

351254

Date:

December 2018

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SUPPORTING DOCUMENTS

ACRONYMS AND ABBREVIATIONS

Arcadis Canada Inc.	Arcadis
Boulevard Lake Area Improvement Plan	BLAIP
British Columbia Ministry of the Environment	BC MOE
Canada-Wide Standard	CWS
Canadian Ambient Air Quality Standard	CAAQS
Canadian Council of the Ministers of the Environment	CCME
Class Environmental Assessment	Class EA
Construction Environmental Management Plan	CEMP
Environmental Approvals Access and Service Integration Branch	EAASIB
Environmental Study Report	ESR
Escherichia coli	*E. Coli*
Fort William First Nation	FWFN
Infrastructure Ontario	IO
Lakehead Region Conservation Authority	LRCA
Lakes and Rivers Improvement Act	*LIRA*
Lowest Effect Level	LEL
microgram per cubic metre	µg/m^3
microgram per gram	µg/g
Métis Nation of Ontario	MNO
Ministry of the Environment, Conservation and Parks	MECP
Ministry of Natural Resources and Forestry	MNRF

Ministry of Tourism, Culture and Sport	MTCS
Municipal Class Environmental Assessment	MCEA
Nitrogen Dioxide	NO_2
Nitrogen Oxide	NO_x
National Ambient Pollution Surveillance Program	NAPS
Northern Steelhead Salmon Association	NSSA
Ontario's Ambient Air Quality Criteria	AAQC
Ontario *Environmental Assessment Act*	*EA Act*
Ontario Provincial Standard Specification	OPSS
Particulate matter less than 2.5 microns	$PM_{2.5}$
Permit To Take Water	PTTW
Polycyclic Aromatic Hydrocarbons	PAH
Public Information Centre	PIC
Severe Effect Level	SEL
Volatile Organic Compounds	VOC

EXECUTIVE SUMMARY

Project Background

The Boulevard Lake Dam is approximately 100 years old and is of concrete construction with a series of spillways and sluice gates, equipped with stop logs to manage flow.

Several structural modifications to the dam have been undertaken, the most significant was the installation of post-tensioned steel tendons complete with the construction of additional sluiceways, in 1963 and the addition of four sluiceways in 1976 to pass the Regulatory Flood.

A Condition Assessment of the dam was completed in 2000 and updated in 2008. This assessment identified issues associated with: the deterioration of the protective concrete on the dam, the ability of the dam to withstand the force of floodwaters associated with the regulatory storm, and the need to meet requirements in the *Lakes and Rivers Improvement Act* for redundancies to enhance the strength of the dam. The purpose of the project is to provide strength redundancy and make required repairs to the Boulevard Lake Dam. The project will not alter the flow regime over and through the dam.

The dam was originally constructed for the generation of and provision of hydroelectricity for streetcars in Port Arthur. The dam has also resulted in the creation of Boulevard Lake behind the dam and over time the lake has become a significant recreational feature within the City of Thunder Bay. Today, the lake is used for a variety of recreational activities including swimming and paddle sports and the dam is part of a 5-kilometre (km) trail network around the lake.

Environmental Assessment Framework

The City initially undertook a Schedule B Class Environmental Assessment (Class EA) pursuant to the Municipal Class Environmental Assessment (MCEA) process. The Project File Report submitted in March 2015 was found to have a number of deficiencies and was the subject of two Part II Order Requests for a more detailed assessment.

To address the deficiencies identified with the initial Schedule B assessment process, the City has chosen to restart the Environmental Assessment (EA) process as a Schedule C project.

Existing Conditions

Project planning documented in this ESR involved an extensive assessment of the existing environment (i.e., the natural, cultural, and socio-economic characteristics of the study area). Information was obtained from a combination of field studies and secondary sources. Specific field studies undertaken included water quality sampling, vegetation surveys, Species at Risk, sediment quality, fish occupancy, lake bathymetry, benthic invertebrates, hydrology, archaeology, and park usage. A wide variety of secondary sources were consulted including previous reports prepared for the City of Thunder Bay and for the Lakehead Region Conservation Authority

(LRCA). In addition, relevant information was obtained through consultations with municipal and provincial government agencies and other stakeholders.

Assessment of Alternatives

The City of Thunder Bay considered the following alternatives for solving the structural problems affecting Boulevard Lake Dam: do nothing, rehabilitate the existing dam, construct a new dam, and remove the existing dam. These alternatives were assessed, and dam rehabilitation was chosen as the preferred alternative.

There are several alternative design concepts for achieving the dam rehabilitation. These include the following components:

- Alternative ways to enhance strength of dam to meet LRIA requirements for redundancy.
- Alternative ways to repair the protective concrete.
- Alternative ways to achieve and enhance public access across the dam structure.
- Alternative ways to operate the dam to improve responsiveness and avoid conflict with recreational users.
- Alternative ways to undertake construction.

Each set of alternatives was assessed and a preferred alternative was chosen for each and combined into an overall preferred alternative. The Preferred Design Concept is described as follows:

- Strength requirements addressed by installing a redundant set of post-tensioned tendons in every buttress along the east retaining wall.
- Rehabilitation of concrete through patching.
- The deck of the dam will be widened to the City of Thunder Bay standard trail width.
- With respect to dam operations, wooden stop logs will be replaced with manually operated mechanical gates. This combination will help regulate and maintain water levels in accordance with the Permit to Take Water (PTTW) and allow for easier operations. In order to pass the Regulatory Flood, stop logs must be replaced at all sluiceways.
- Construction will occur over a two-year period and will be staged from a laydown area and access road south of the dam. The construction of the access road will be undertaken from June to September and will follow best construction practices for erosion control, sediment control, and stormwater management. Relevant environmental standards will be followed. Water levels will be lowered for 2-4 weeks in the first year of construction, but will be maintained at winter set, and two cofferdams (in two stages) will be used to complete upstream construction. The cofferdams will be constructed in accordance with

best construction methods. All upstream work, such as the construction of the cofferdams, will be completed during the first year of construction. The construction contractor will be required to complete the construction as per Ontario Provincial Standard Specification (OPSS) and regulations.

Summary of Environmental Effects for the Preferred Alternative

The effects from both the construction and operation of the preferred alternative were assessed including the consideration of mitigation measures to minimize effects. The following table from Section 6.4 summarizes the assessment:

Table ES-1 Environmental Effects Summary Table

Environmental Effects Associated with Construction			
Environmental Component	**Potential Effects**	**Mitigation Measures**	**Net Effects**
Vegetation	• Access road will require removal of <0.1 ha of vegetation.	• Replanting of removed vegetation.	Negligible
Wildlife	• No significant impacts on wildlife or habitat are expected. • Localized potential temporary disturbance from noise. • Winter/summer drawdown could temporarily affect amphibians, semiaquatic mammals, nesting/migrating waterfowl.	• Drawdowns and in-water work to be completed during the frost-free period to minimize impacts on hibernating reptiles and amphibians and will avoid peak staging periods for migrating waterfowl. • Duration of drawdown during summer construction will last only 2-4 weeks to reduce impacts on shoreline wildlife and nesting waterfowl. • Winter drawdown will be as per current practice and wildlife and habitat have adapted already.	None
Sediment Quality	• Localized erosion and migration of reservoir sediments during lake drawdown. This activity is consistent with current dam operations.	• Gradual lowering of the lake water level, and gradual opening of sluice gates to minimize sediment discharge.	None
Fish Habitat and Species	• Lake level drop could result in temporary loss of 41.7 ha of fish habitat between Thanksgiving and the May long weekend or 58.4 ha during the rest of the year. • Potential temporary loss of low quality fish habitat, spawning habitat, access to nursery habitat, connectivity, foraging habitat, potential increased vulnerability to predation and/or angling. • Lower flow in the bypass reach between the dam and the tailrace during cofferdam construction.	• Drawdowns during June 15 - September 1 to avoid spring and fall spawning periods for Walleye and Brook Trout. • Lake level dropped gradually to permit fish to move to remaining basin. • Duration of drawdown minimized to reduce impacts on fish. • Maintenance of base flow in accordance with 2018 PTTW and DFO direction. Stranded fish and wildlife in the reservoir and the bypass reach will be manually transferred to deeper water during the ramping down of water levels.	Negligible
Aquatic Vegetation	• Loss of productivity during summer drawdown.	• Drawdowns will be limited to 2-4 weeks.	None

Table ES-1 Environmental Effects Summary Table (Cont'd)

Environmental Effects Associated with Construction			
Environmental Component	**Potential Effects**	**Mitigation Measures**	**Net Effects**
Benthic Invertebrates	• Potential temporary loss of invertebrate species due to lake drawdown and could be subject to temporary increased predation.	• Drawdowns will be limited to 2-4 weeks.	None
Species at Risk	• Bald Eagles perching in the trees may be disturbed by construction. • Canada Warbler is not known to nest or be present near the dam, will likely not affect this species.	• Construction work at the dam will be completed during the summer months to avoid period of peak use by Bald Eagles.	None
Noise	• Temporary, localized and intermittent construction noise of short duration (i.e., heavy equipment).	• Compliance with City Noise By-law.	None
Air and Odour	• Construction is expected to generate dust. • Localized increases in hydrocarbon emissions from construction vehicles. • Lowering of the water in the dam could release odours from decaying organic material.	• Water used to control dust. • Application of odour mitigation such as avoidance of construction during extreme hot temperatures / strong wind.	None
Residential	• Construction nuisance effects to nearby residents due to temporary noise, dust, increase in traffic/heavy vehicles on local roads. • Heavy vehicle traffic volume expected to be less than 5 vehicles/hour.	• Vehicles to use dedicated access road for construction purposes. • Disruptions will be of short duration.	None

Table ES-1 Environmental Effects Summary Table (Cont'd)

Environmental Effects Associated with Construction			
Environmental Component	**Potential Effects**	**Mitigation Measures**	**Net Effects**
Recreation	• Access to the pedestrian walkway across Boulevard Lake Dam will be closed throughout construction. • During drawdowns the use of Boulevard Lake for recreation such as swimming and paddle sports will be limited.	• Pedestrians will be re-routed to the Cumberland Street Bridge just downstream of the dam.	Negative - Temporary displacement of recreational uses on the lake during drawdown periods will occur
Archaeology	• May be effects to "underwater" resources, which have yet to be identified, during the marine archaeological assessment slated to take place during construction.	• Mitigation (through avoidance) of structures will be attempted, after being fully documented (drawings and photographs).	None
Environmental Effects Associated with Operation			
Fish Habitat and Species	• Increased ability to regulate the flow of water through the fish ladder may improve upstream passage for Rainbow Trout spawning.	• None	Positive
Recreation	• Widened walkway will eliminate existing constraints, congestion, and improve accessibility.	• None	Positive
Safety	• Worker safety improved. Reduced risk of injury from manoeuvering stop log. • Improved ability of dam to withstand extreme storm, reduce flooding risk.	• None	Positive

Consultation

Integral to the Class EA planning process, was a wide-ranging stakeholder consultation program. Various stakeholders including the general public, relevant federal and provincial ministries, the City of Thunder Bay, interest groups, and Indigenous Communities, were consulted throughout the planning for the Boulevard Lake Dam Rehabilitation Class EA. The following efforts were made to notify and consult with these stakeholders about the project:

- Notice of Commencement was published in *The Chronicle-Journal* newspaper on May 28, 2016. The Notice also included an invitation to the first Public Information Centre (PIC) which was held on June 14, 2016.
- Notice of Commencement letters were sent on June 1, 2016 to relevant agency stakeholders (federal and provincial ministries), municipal stakeholders, the conservation authority, interested parties, interest groups, and Indigenous communities.
- Notice of Public Information Centre #2 inviting the public and interested stakeholders to the second PIC was published in *The Chronicle-Journal* newspaper on August 26, 2017.
- Letters providing notice of the second PIC were sent on August 25, 2017 to relevant agency stakeholders (federal and provincial ministries), municipal stakeholders, the conservation authority, interested parties, interest groups, and Indigenous communities.
- Additionally, meetings were held with regulatory agencies and other stakeholders throughout this Class EA process. All comments received through the PICs, issue-specific meetings, and other consultations have been documented and addressed, as appropriate, as part of this Class EA.

1.0 PROJECT OVERVIEW

1.1 Project History

The Boulevard Lake Dam is approximately 100 years old and is of concrete construction with a series of spillways and a series of sluice gates with stop logs to manage flow. The dam was originally constructed for the generation of and provision of hydroelectricity for streetcars in Port Arthur. The dam also created Boulevard Lake behind the dam and overtime this has become a significant recreational feature within the City of Thunder Bay. Today, the lake is used for a variety of recreational activities including swimming and paddle sports and the dam is part of a 5 kilometre (km) trail network around the lake.

In the 1970's, the Province was concerned about the ability of the dam to withstand flooding associated with the regulatory storm. In response to this concern post tension rods were installed in the buttresses of each spillway and sluice gate to reinforce the dam against the floodwaters associated with the regulatory storm. In the 1990's, a fish ladder was installed to encourage the migration of Rainbow Trout.

A Condition Assessment of the dam was completed in 2000 and updated in 2008. This assessment identified issues associated with the deterioration of the protective concrete on the dam and the ability of the dam to withstand the force of floodwaters associated with the regulatory storm and the need to meet requirements in the *Lakes and Rivers Improvement Act* for redundancies to enhance the strength of the dam. The City determined that the dam should be rehabilitated.

The original iterations of the Boulevard Dam rehabilitation project ('the Project') undertaken by the City followed a Schedule B assessment pursuant to the Municipal Class Environmental Assessment (MCEA) process. The Project File Report submitted in March 2015 was found to have a number of deficiencies and was the subject of two Part II Order Requests for a more detailed assessment.

The deficiencies identified in the Project File Report are summarized as follows:

- lack of rationale to understand scoping of project and nature of project being addressed;
- insufficient details on alternative solutions;
- insufficient inventory of existing conditions;
- lack of consultation and associated consultation records;
- failure to identify magnitude of net positive and negative effects for each alternative;
- no traceability in choosing preferred alternative;
- no monitoring plan; and,

- failure to evaluate effects of full scope of project.

The first of the two Part II Orders was made by the Current River Hydro Partnership and the second by the Northern Steelhead Salmon Association (NSSA):

- current River Hydro Partnership was generally concerned with the operation of the fish ladder, its ability to generate power and consultation with First Nations groups; and,
- the NSSA was generally concerned with the priority of operations, ensuring the fish ladder was prioritized over power generation and improvements to the fish ladder were completed.

In light of these issues, the City chose to restart the Environmental Assessment (EA) process as outlined below.

1.2 Project Purpose

The purpose of the project is to provide strength redundancy and make required repairs to the Boulevard Lake Dam. The focus of the project is the rehabilitation of the Boulevard Lake Dam in order to ensure its structural integrity. Aside from the proposed installation of manual gates in sluiceways to replace stop-logs, the project is not expected to materially affect the operation of the dam.” The project will not alter the flow regime over and through the dam.

1.3 Water Management

The flow of water over and through the dam is managed through a water management plan. The plan proponent is the City of Thunder Bay and was approved by the MNRF. The current water management plan was created in 2006. Direction on minimum flows has additionally been provided by Fisheries and Oceans Canada (DFO). The storage of water behind the dam is regulated by an existing Permit to Take Water (PTTW), Number 4321-6RVR23 dated April 30, 2018, granted to the City of Thunder Bay by the Ministry of Environment, Conservation and Parks (MECP). The works and activities associated with any changes to the dam will permit a variety of flows to pass over and through the dam and will not change flow regimes and priorities set out in other legally binding documents. Conversely, any changes to the flow regimes and priorities set by the existing water management plan and/or DFO and/or the existing PTTW can be accommodated within the operation of the rehabilitated dam. The City will continue to liaise with the MNRF, MECP and DFO on all relevant aspects pertaining to compliance with the existing PTTW Number 4321-6RVR23 dated April 30, 2018.

The City will also liaise with Fisheries and Oceans Canada (DFO) to ensure compliance with the *Fisheries Act*, and will ensure that all necessary *Fisheries Act* permits are obtained. The City expects that the works and activities will not affect the City’s ability to provide the minimum flows over and through the Dam as specified by DFO. Work is not expected to interfere with fish migration or spawning.

1.4 Environmental Approval Requirements

This section provides an explanation of the Class EA planning process, including the rationale for developing the project under the Class EA process. It includes a description of this report and its purpose.

1.4.1 Overview of Municipal Class EA (MCEA) Process

This report has been prepared in accordance with the MCEA, June 2000 (amended in 2007 and 2011). The Class EA provides a planning process, pursuant to the Ontario *Environmental Assessment Act (EA Act)*, for municipal infrastructure projects which are small in scale and scope, frequently occurring, and have known and mitigable effects. The Class EA establishes a process whereby a municipal project as defined in the MCEA can be planned, designed, constructed, operated, maintained, rehabilitated and retired, provided the approved EA planning process is followed.

The MCEA follows a five-phase planning process, which is summarized as follows:

Phase 1: **Problem and Opportunity**. Identification of the problem, deficiency, or opportunity, and development of a clear statement of the issues that are to be addressed.

Phase 2: **Alternative Solutions**. Identification of the reasonable alternative solutions that could be implemented to address the issues. The preferred solution is established based on an assessment of the environmental effects, including consideration of stakeholder input.

Phase 3: **Alternative Design Concepts for Preferred Solution**. Identification of the alternative methods of implementing the preferred solution and establishing the preferred method based on an assessment of the environmental effects, including consideration of stakeholder input.

Phase 4: **Environmental Study Report (ESR)**. Compilation of all relevant study information, project description, study rationale, environmental considerations, the consultation process, and recommendations, into an Environmental Study Report (ESR), and making the document available for review by the public, including interested or affected parties.

Phase 5: **Implementation**. The preferred method of addressing the issues is implemented, including completion of contract documents and construction of any recommended works. Implementation is monitored for adherence to environment provisions and commitments, as well as the operation of completed facilities, where prescribed.

Projects subject to the MCEA are classified into three schedules according to their environmental significance (Schedule A, B or C). The level of complexity and the potential effects of a project will determine the schedule of the project. The schedule of the project will then determine which phases need to be addressed.

Schedule A projects are limited in scale, have minimal adverse effects and include the majority of municipal road maintenance and operational activities. These projects are approved and may proceed directly to Phase 5 for implementation, without following Phase 2 to 4 of the Class EA process.

Schedule B projects generally include improvements and minor expansions to existing facilities. These projects have some potential for adverse environmental impacts, and consultation with those who may be affected is required. Examples of Schedule B projects include construction of new parking lots, the installation of traffic control devices, smaller road-related works or the extension of certain types of municipal water/wastewater infrastructure. These kinds of projects require completion of Phases 1 and 2 of the Class EA process.

Schedule C projects generally include the construction of new facilities and major expansions of existing facilities.

The MCEA denotes projects like the Boulevard Dam Rehabilitation generally as a Schedule B project; however, given the scope and complexity of the project and the issues raised by intervenors, the project has been elevated through two Part II Order Requests for a more detailed assessment, and subsequently planned as a Schedule C project pursuant to the Municipal Class EA. All phases of the Class EA planning process have been carried out. In order to address deficiencies in the previous EA a number of environmental field studies were undertaken during 2016 and 2017 to provide a comprehensive understanding of the environment likely to be affected by this project.

In addition to provincial legislation, the City's EA planning process has considered the goals, objectives and directions set out in the City's 2002 Official Plan (OP) and Council adopted 2018 OP. The Project conforms with the OP. The Project furthers the OP's goal to provide services and facilities that will enhance the health, safety and well-being of city residents, and the goal of preserving and enhancing the quality of the natural, social and cultural environments.

The EA planning process was focused on the project works and activities associated with the rehabilitation of Boulevard Lake Dam. It is noted that in addition to the dam at this location on the Current River, there also exists a small hydro generating station. A fish ladder immediately below the dam assists Rainbow Trout in moving upstream and downstream of the dam. To date, stakeholder issues raised with respect to the rehabilitation of the dam have been influenced by on-going discussions with respect to the City's existing PTTW for the dam and the Water Management Plan for the Current River. The 2018 PTTW sets thresholds that conform with Department of Fisheries and Oceans (DFO) direction for ensuring there is sufficient flow of water below the dam in order to maintain ecological health and to allow for operation of the generating station.

2.0 PROBLEM/OPPORTUNITY ASSESSMENT

2.1 Problem/Opportunity Statement

The Boulevard Lake Dam is owned and operated by the City of Thunder Bay. The Boulevard Lake Dam is located approximately 700 metres (m) upstream of where the Current River discharges into Lake Superior. The existing dam structure is approximately 112 m long and is oriented in an east/west direction. The associated waterpower facility is operated by the Current River Hydro Partnership, under a lease from the City of Thunder Bay. The term of the lease with the Current River Hydro Partnership began May 1, 1985 and ends on April 30, 2025. The dam consists of the following components:

- A reinforced concrete retaining wall at the east approach.
- The gatehouse which houses valves for the hydroelectric facility penstock and operating equipment for the dam is located at the east approach.
- The intakes for the generating station are located at the east concrete retaining wall.
- One reinforced concrete sluiceway, complete with fish ladder and timber stop logs at the east end of the structure.
- Eleven reinforced concrete sluiceways with eight timber stop logs at the east section of the structure:
    - At the sluiceways, a 225 millimetre (mm) thick x 2.1 m wide precast concrete deck is supported by 0.9 m x 2.1 m x 4 m tall exposed portion of the concrete buttresses.
    - An overhead steel monorail system exists at the sluiceways and is used to remove/replace stop logs.
    - Steel checker plate exists at the openings in the slab through which stop logs are removed/replaced.
- Seventeen reinforced concrete weir spillways at the west section of the structure:
    - At the spillways, a 100 mm thick x 1.5 m wide cast in place concrete deck is supported by arch-beams, which are supported by 0.6 m x 1.4 m x 1.2 m tall exposed portion of the concrete buttresses.
    - Upstream of the spillways, a 300 mm thick concrete facing wall is cast against the upstream face of the dam.
- Post-tensioned steel tendons at every buttress location and along the east retaining wall, constructed with a cathodic protection system.
- A handrail consisting of posts, top rail, mid rail, and chain link fence exists at both sides of the deck.

A concrete stair at the west end of the dam that leads to the bedrock downstream. The stair has been closed to pedestrian access to prevent users from easily accessing the area downstream of the dam.

A reinforced concrete retaining wall with timber capping and rock berm at the west approach. The purpose of the wall is to retain the maximum theoretical water surface elevation during the Inflow Design Flood.

The rock berm at the west approach is approximately 440 m long. The berm also functions as a walkway as part of the recreational trail system around Boulevard Lake.

The manmade Boulevard Lake has a surface area of approximately 61.5 hectares (ha) at high water level, with a maximum depth between 4 to 5 m. The primary use of the lake is recreational. The Boulevard Lake Dam is operated three times per year outside of actions taken during isolated weather events and maintenance requirements. The lake is drawn down in the fall to establish winter water elevation. Stop logs are replaced in the spring to allow the water level to rise and also take into consideration minimum spawning flow requirements. At the end of spawning season, stop logs are set to establish summer water elevation. Stop logs are stored on the deck when they are not in use in the sluiceways. The configuration of stop logs during summer and winter set are such that there are always stop logs present on the deck top.

Condition of the Dam

The Boulevard Lake Dam was constructed in the early 1900's. Several structural modifications have been constructed over the past 100 years; the most significant was the installation of post-tensioned steel tendons complete with the construction of additional sluiceways in 1963.

The Boulevard Lake Dam is an aging structure. The last major restoration project was completed in 1976, when four sluiceways were constructed in order to pass the Regulatory Flood. Minimal maintenance has been performed since then.

JML Engineering completed condition surveys of the Boulevard Lake Dam in 2000 and 2008. Generally, the overall dam appears to be in fair physical condition. However, progressive deterioration has continued since the last condition survey was completed. Given this deterioration, the proposed dam rehabilitation should be undertaken as soon as possible.

The most significant structural deficiencies observed at the time of inspection included:

- Severe spalling and delamination of the east retaining wall.
- Severe cracking and significant separation of the upstream concrete facing wall from the upstream face of the dam at the spillways.
- Soft concrete, spalling, delamination, and erosion at numerous buttress locations.
- Significant spalling, cracking, and erosion throughout the spillway and sluiceway aprons, and at the spillway slab.

- Spalling of the concrete slabs at the existing railing post locations and at a few locations at the underside of the sluiceway slabs. There are severe longitudinal cracks at the spillway slabs.

The additional non-structural observations included:

- It is unknown if the cathodic protection system for the post-tensioned steel tendons has been effective over the past 50 years. Although the tendons have performed satisfactorily for 50 years, the remaining life expectancy is unknown.
- The existing guards do not satisfy the requirements of the Ontario Building Code or the Canadian Highway Bridge Design Code. The top rail is too large in diameter to serve as a handrail and is positioned too low to function as a proper guard. The chain link fence fastened to the guard extends above the top rail.
- The deck width does not match the Boulevard Lake trail width, and the width of the walkway changes at the transition between the sluiceways and spillways.
- There is a choke point for pedestrian traffic flow at the gatehouse.
- Poor illumination along the dam.
- An outdated, yet effective means of controlling flow over and through the dam using timber stop logs.
- There is a conflict between recreational trail users crossing the dam and dam operations.

The physical condition of the Boulevard Lake Dam is reflective of the age of the various structural components. Deterioration has advanced since the last assessment of the dam structure. Emergency repairs to the walkway were required in the summer of 2018 due to the advancement of the already deteriorated concrete. Deterioration will continue to progress at an accelerated rate if the structural damage is not repaired in the near future. The structural stability of the dam could be affected if the deficiencies are not addressed. Rehabilitation of the dam, combined with regular maintenance, is necessary to ensure that the dam will perform satisfactorily into the future and be able to withstand the regulatory storm.

2.2 Study Area

The Boulevard Lake Dam is situated in the Current River watershed and the structure is an important feature which has resulted in the creation of Boulevard Lake. The dam lies entirely to the northwest of the Canadian Pacific Railway (CPR) line and just north of Cumberland Street North. The Boulevard Lake and dam are located within Boulevard Lake Park. The location of the approximate Study Area is outlined in Figure 2-1. An aerial view of the Boulevard Lake Dam can be seen in Figure 2-2.

All the proposed activities considered in this Class EA are contained within the Study Area. It is within this area that alternatives for the provision of the required upgrade to the dam will be considered. The environmental baseline studies have covered a broader area.

Figure 2-1 Subject Site Study Area

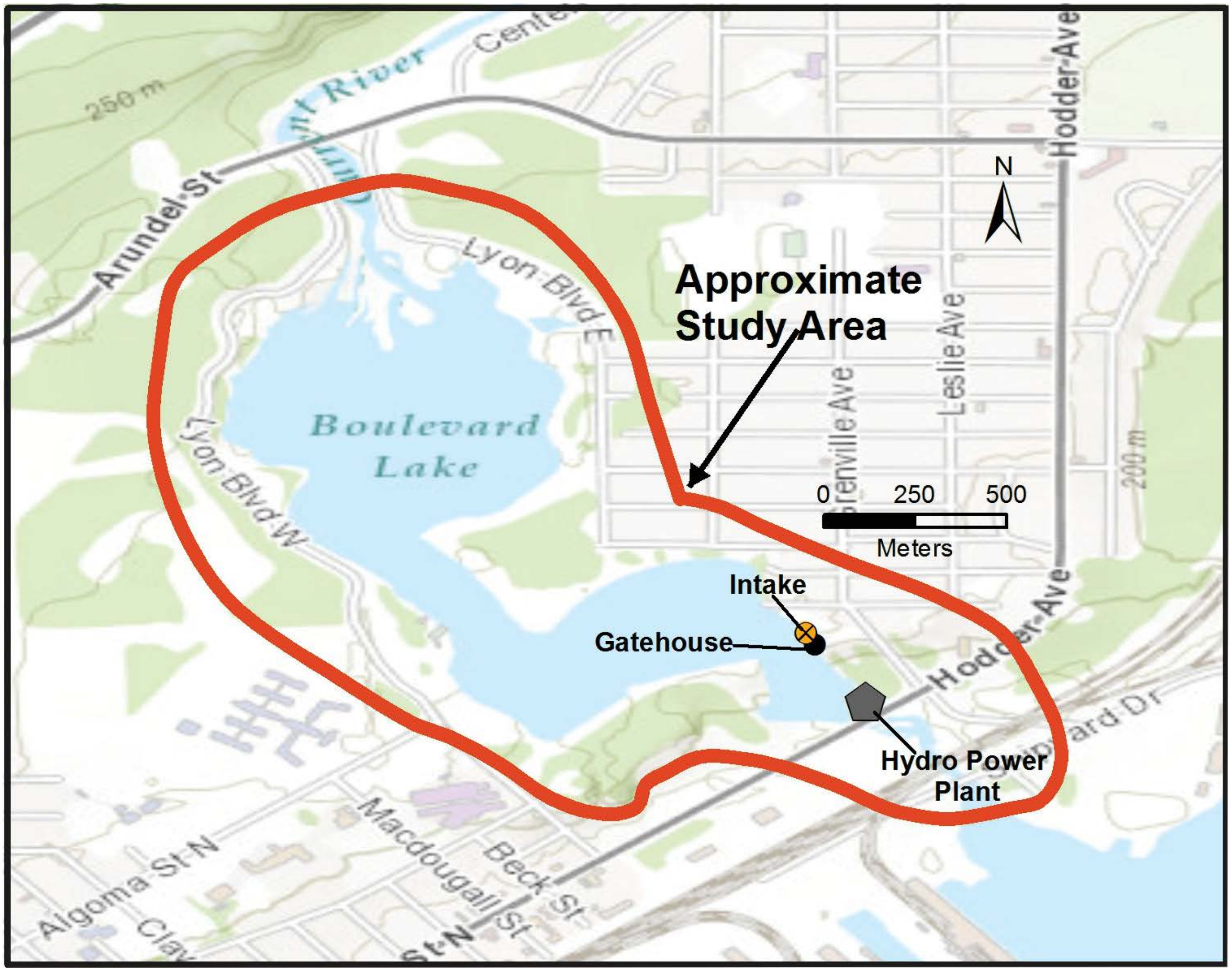


Figure 2-2 Aerial View of Boulevard Lake Dam

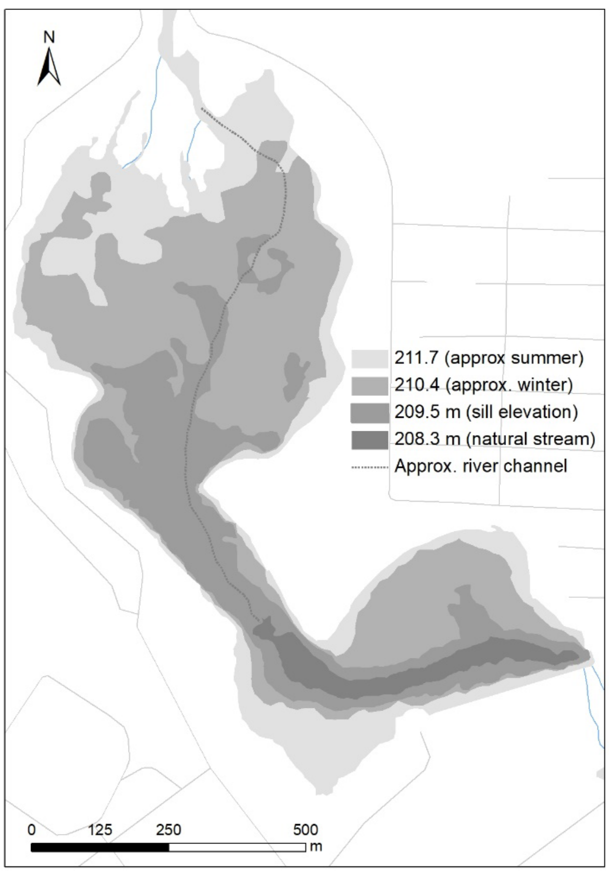
2.3 Temporal Boundaries

To carry out the proposed dam rehabilitation activities, construction would likely take place over two construction seasons due to the scale of the project and to the number of proposed activities. In the first year, construction would likely begin after the fish spawning season, where the lake would be lowered to winter set (Figure 2-3) to perform upstream repair work. During coffer dam construction in year one, the lake will be lowered to natural stream elevation on three occasions (Figure 2-3). During the second year of construction, the lake will be maintained at regular summer set water levels (Figure 2-3). As the construction work is weather dependent, it is not anticipated that any work will be taking place between December and April. Pending receipt of all required approvals, the tendering and awarding of project work, as well as completion of relevant permits is slated to occur in 2019, with construction anticipated to begin in 2020.

Potential Boulevard Lake water levels that are anticipated during various phases of the project are shown in Figure 2-3.

For more details on construction activities, refer to Section 6.2.

Figure 2-3 Boulevard Lake Water Levels



3.0 EXISTING ENVIRONMENT

This chapter includes a description of the existing environment (i.e., the natural, cultural, and socio-economic characteristics of the study area). Information for this chapter has been obtained from a combination of field studies and secondary sources. Specific field studies undertaken for this project include water quality, fish occupancy, lake bathymetry, hydrology, archaeology, and park usage. A wide variety of secondary sources were consulted including previous reports prepared for the City of Thunder Bay such as the Boulevard Lake Water Management Plan, Boulevard Lake Dam Condition Survey, Boulevard Lake Area Improvement Plan, Boulevard Lake Park usage survey, and other studies conducted for the Lakehead Region Conservation Authority (LRCA) on the Current River Watershed, among many others. In addition, relevant information was obtained through consultations with municipal and provincial government agencies and other stakeholders.

3.1 Current River Watershed

Boulevard Lake is part of the Current River watershed, which drains an area of approximately 625 square km (km^2). The Current River watershed is located partly in the northern portion of the City of Thunder Bay and extends into the unorganized townships of Jacques and Gorham and the Municipality of Shuniah, as well as a portion of the District of Thunder Bay.

A map of the Current River and the Boulevard Lake Dam is shown as Figure 3-1.

There are three main tributaries on the river system:

- the Current River;
- the North Current River; and
- Ferguson Creek.

The Current River falls approximately 300 m over its 64 km length, with a basin slope of 0.5%. The river originates at Current Lake, flows south through Ray Lake and Boulevard Lake, and finally discharges into Lake Superior.

Figure 3-1 Base Map Showing Current River and Boulevard Lake Dam

The watershed contains a large number of both large and small lakes that are fairly uniformly distributed throughout the upper reaches. These lakes provide natural flow attenuation and some have been dammed in the past for flow control and power generation purposes. These dams are:

- Boulevard Lake Dam   Operated by City of Thunder Bay
- Hazelwood Lake Dam   Operated by LRCA
- Ray Lake Dam   Operated by MNRF

Boulevard Lake, located at the downstream end of the watershed, has been maintained by the City of Thunder Bay primarily for recreational purposes and it is a major attraction for local residents. In 1986, a small hydroelectric project was developed to generate electricity below the dam (the Current River Hydro Partnership).

3.2 Physical and Natural Environment

This section describes the existing physical, terrestrial and aquatic environment in the Study Area.

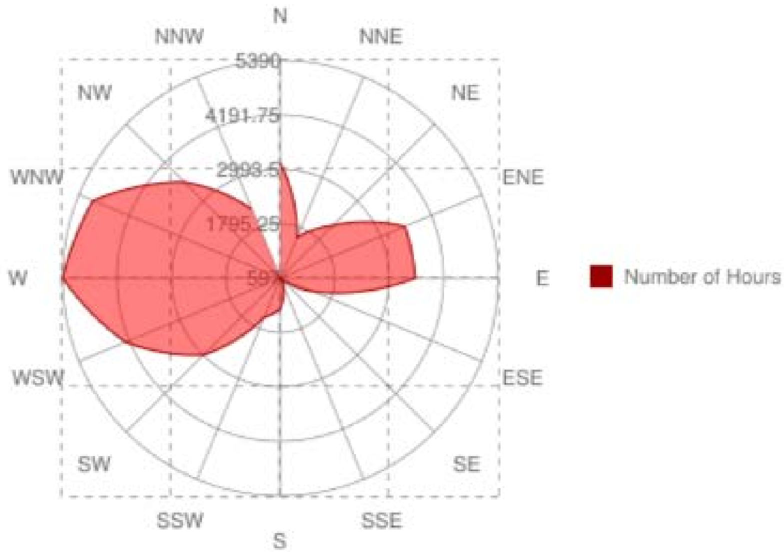
The inventory of the natural environment provided in this section focuses only on Boulevard Lake and excludes the other two larger lakes associated with the three main tributaries of the Current River system, namely Hazelwood Lake and Onion Lake. Boulevard Lake lies within the City of Thunder Bay and the management and operation of the lake and related facilities are the responsibility of the City's Parks and Recreation and Engineering Departments.

3.2.1 Climate

The climate in the Current River Watershed is characterized as “modified continental” where the mean temperature difference between summer and winter is 35 degrees Celsius (°C). Mean daily temperatures for January and July are -13.7°C and 18.0°C respectively based on data from 1996 to 2015. (Source: http://thunderbay.weatherstats.ca/download.html). This region is marked by a pattern of low winter and high summer precipitation. In summer, successions of cyclonic storms pass through the area (Environment Canada, 2015).

Wind data (including direction and speed) for the past five years (2011-2016) within the study area, as generated by Environment Canada, indicate that the dominant wind direction is from the west (see Figure 3-2 below). The wind speeds for this area tend to be highest in the second quarter (April to June) of the year.

Figure 3-2 Wind Direction (5 years data)[2]



Direction	Number of Hours
N	3,135 hour(s)
NNE	1,570 hour(s)
NE	2,240 hour(s)
ENE	3,566 hour(s)
E	3,567 hour(s)
ESE	1,379 hour(s)
SE	597 hour(s)
SSE	781 hour(s)
S	1,281 hour(s)
SSW	1,530 hour(s)
SW	2,992 hour(s)
WSW	4,280 hour(s)
W	5,390 hour(s)
WNW	5,059 hour(s)
NW	3,587 hour(s)
NNW	2,238 hour(s)

The average daily water temperatures in June and July 2002 ranged from 13-26°C for the Current River and Ferguson Creek (OMNR, 2002). Water temperatures measured in Boulevard Lake on August 27, 2016 were probably close to the annual maximum but vary with weather and rate of discharge from the Current River. Surface water temperatures were coolest (17.4°C) at the inflow of the river at the north end of Boulevard Lake, and warmed to between 20°C and 21.5°C elsewhere. Further details on water temperature in Boulevard Lake are provided later in sub-section 3.2.4.2.

3.2.2 Physiography, Geology, and Soils

3.2.2.1 Physiography

The Current River watershed, including Boulevard Lake, is located within the physiographic units known as the Severn Upland and the Port Arthur Hills. These units are subdivisions of the James Region of the Precambrian Shield. The boundary between the Severn Upland and the Port Arthur Hills trends northwesterly through Hazelwood Lake and Spirit Lake, so that most of the watershed is located in the Port Arthur Hills.

The Severn Upland, a large physiographic unit, covers most of northwestern Ontario and is bound to the southeast by the Port Arthur Hills. The area is characterized by broadly rolling terrain, consisting, for the most part, of Early Precambrian Rock.

The Port Arthur Hills physiographic unit is located as a broad band along the shoreline of Lake Superior. This is a much smaller unit consisting mainly of Proterozoic metasediments and sills with a southwards strike.

The watershed is generally characterized by a rolling topography typical of the Canadian Shield. Small hills and rock knobs as well as some steep slopes are scattered throughout the area. The watershed also has a number of low-lying areas with gentle slopes. Wetlands, in the form of marshes, swamps and bogs are generally associated with these areas.

3.2.2.2 Geology

The watershed is underlain by bedrock from the Early Precambrian age which is common in the Canadian Shield. The bedrock is usually covered by a thin overburden of glacial drift; however, as already mentioned, a substantial portion of the surficial geology in the area consists of Precambrian bedrock knolls and outcrops. The overburden generally consists of glacio-fluvial outwash deposits of the Quaternary period. Other deposits include tills and local sand and gravel deposits.

The surficial geologic components found in the area surrounding Boulevard Lake consist mainly of discontinuous glacio-fluvial deposits (in this case thin outwash sands) that are underlain by till or bedrock. The bedrock is chiefly shales of low porosity and permeability resulting in marginal groundwater supply.

The Current River flows in a meltwater channel that appears to have been active during the retreat of the Superior Ice Lobe some 10,000 years ago. Materials and meltwater were carried from the Dog Lake Lobe breaching the Mackenzie Moraine and into the Lake Superior Basin. This meltwater channel, formed in a glacially over-deepened bedrock valley, contains extensive glacio-fluvial outwash sand and gravel deposits.

3.2.2.3 Soils and Erosion

The soils occurring just south of Trowbridge Falls and eventually surrounding Boulevard Lake, have been classified as Mietzle soils which are orthic eutric brunisols. These soils are underlain by undulating to smooth, stratified, gravelly and sandy fluvial outwash. Since the materials are coarsely textured, the areas are generally well to excessively drained, which may account for part of the low flow situation seen in the Current River. The soils have a medium to strong acidity with low concentrations of plant nutrients.

Nolalu soils exist north of Trowbridge Falls as well as south of the dam at Boulevard Lake to Lake Superior. These soils are also orthic eutric brunisols consisting of non-calcareous, fine, sandy loams, which are underlain by hale-derived stony glacial till. These soils exhibit good drainage.

The operating procedures of Boulevard Dam includes lowering of the reservoir in the fall and maintaining a low water level throughout the winter. Lowering of the reservoir by more than 1 m each year has resulted in the exposure of a substantial portion of the reservoir bottom. The sediment and soil are exposed to precipitation and a new temporary shoreline is established. These events have occurred over many years and sediment erosion or soil instability issues have not arisen that warrant the implementation of special measures. This past operating performance is considered favourable. Furthermore, during much of the period when the water level is low the sediment is in a frozen condition, and therefore not readily susceptible to erosion.

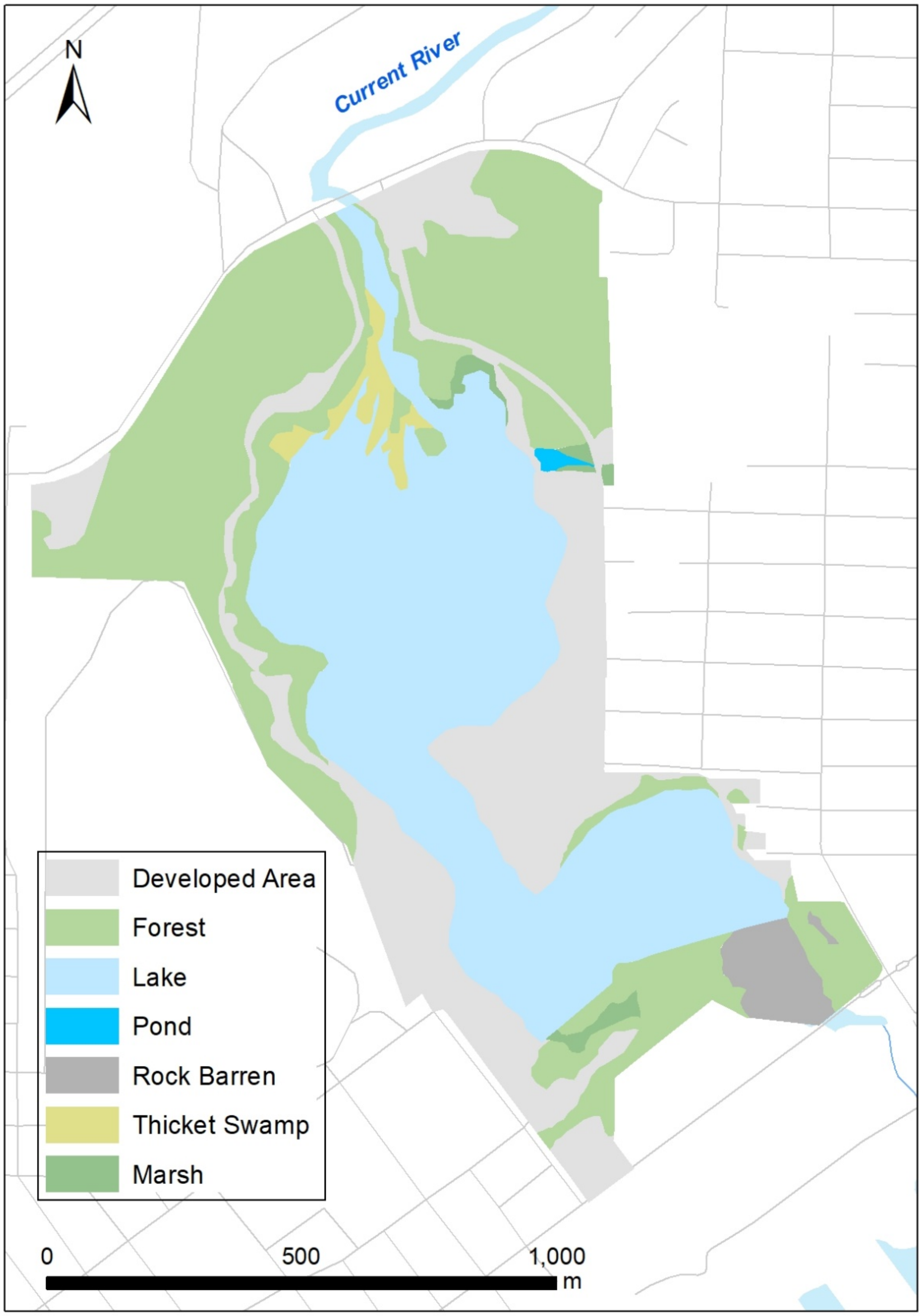
3.2.3 Terrestrial Environment

Details on the terrestrial environment within the study area are contained in Supporting Document 1, Boulevard Lake Aquatic and Terrestrial Report 2016. A summary of the report is provided below.

3.2.3.1 Vegetation

Boulevard Lake Park includes about 51 ha of forest cover, mainly at the north end of the park with a section below the dam (Figure 3-3). The largest forest blocks include two relatively contiguous patches of 13 ha and 22 ha.

Figure 3-3 Vegetation Map Showing Proposed Laydown Area – Boulevard Lake 2016



Most of the forest consists of mature mixed wood of White Spruce, Trembling Aspen, White Birch and Balsam Fir on fine sand and loamy soils (Ecosite 052; OMNR 2009) (Figure 3-4). Occasional large White Cedar and White Pine are also present. Many older trees, especially White Spruce, are dying and creating gaps in canopy with young Balsam Fir trees colonizing the openings. The forest areas are crossed by numerous trails and walkways, but otherwise relatively intact with little evidence of human disturbance and few invasive species.

An area of thicket swamp with willows and Speckled Alder (Ecosite B134; OMNR 2009) is found on the floodplain of the Current River at the north end of Boulevard Lake (Figure 3-4). This community is periodically flooded by river water.

Figure 3-4 Mature Mixed Forest (Ecosite B052) – Boulevard Lake 2016

Rock barren (Ecosite 160; OMNR 2009) occurs on the bedrock shelf below the dam (Figure 3-5). This area is scoured by water flowing over the dam during high flows but is typically exposed for most of the year (Foster 2011).

Figure 3-5 North Part of Proposed Access Road Showing Rock Barren on River Floodplain

High flows have washed away most soil, organic material, sand and gravel. Patches of sedges and Sweet Gale are confined to a few deeper crevices. Some pools of standing water persist through the summer.

Most of the remainder of the park is open lawn and wooded lawn.

3.2.3.2 Wildlife

Bird point count data are summarized in Table 3-1 and in Supporting Document 1. A total of 25 species was tallied and include species commonly associated with boreal mixed wood forests (e.g. White-throated Sparrow, Red-eyed Vireo) as well as those more common in urban area (e.g. American Crow, Ring-billed Gull). The passerine species include seven warblers, three sparrows and a variety of other species, most of which probably nest in the park. Eight area sensitive bird species (i.e. those requiring large areas of suitable habitat; OMNR 2000) were observed in 2016 (Table 3-1), suggesting that the patches of forest habitat are large enough to support breeding populations of these species.

Table 3-1 Bird Species Tallied in Point Counts at Boulevard Lake, July 1, 2016

Species	Total
American Crow	17
White-throated Sparrow	10
Red-eyed Vireo	8
Common Grackle	7
Common Raven	7
Nashville Warbler	6
Black-capped Chickadee	5
Magnolia Warbler (AS)	4
Red-breasted Nuthatch (AS)	4
American Robin	3
Black-and-White Warbler (AS)	3
Ovenbird (AS)	3
American Goldfinch	2
Merlin	2
American Redstart (AS)	1
Black-throated Green Warbler	1
Blue Jay	1
Canada Warbler (AS)	1
Chipping Sparrow	1
Dark-eyed Junco	1
Herring Gull	1
Northern Flicker	1
Pileated Woodpecker (AS)	1
Ring-billed Gull	1
Winter Wren (AS)	1

Note: Area sensitive species (OMNR 2000) are indicated “AS”.

White-tailed Deer are common year-round residents in the forested part of the park (Harris pers. obs.). Other large mammal species, such as Moose and Black Bear, probably use the park on occasion but are unlikely to be permanent residents given the relatively small forested area and high level of human use. Beaver use Boulevard Lake in summer but the winter drawdown probably limits use of the lake year-round (Harris pers. obs.).

The significant wildlife habitat assessment is summarized in Table 3-2 and Table 3-3 (OMNR 2000). Among the possible significant habitat values are waterfowl and landbird migratory stopover habitat, nesting habitat for area sensitive bird species, and presence of mature forest cover. Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline occurs nearby (NHIC 2016) and may be present on the Current River upstream of Boulevard Lake. The Boulevard Lake Park shorelines may act as a corridor for animals moving from the largely forested area to the north to the Lake Superior shoreline.

Table 3-2 Assessment of Seasonal Concentrations of Wildlife in Boulevard Lake Study Area

Type of Seasonal Concentration	Present in Study Area?	Notes
White-tailed deer winter yard	No	None documented. White-tailed deer are present in winter but little closed conifer forest is present.
Moose late winter habitat	No	None documented. Unlikely to occur with the high level of human use and lack of closed conifer forest.
Waterfowl stopover and staging areas	Yes	Flocks of > 100 Canada Geese and smaller numbers of other waterfowl are present on Boulevard Lake annually in spring and fall and probably exceed 700 use-days (Harris pers. obs.).
Waterfowl nesting areas	Possible	Broods of Mallard and Common Goldeneye were observed in 2016 but number of broods is unknown. Suitable nesting habitat is present in shoreline marshes and thicket swamps and surrounding forest.
Colonial bird nesting sites	No	No suitable habitat present.
Shorebird migratory stopover areas	Possible	Small flocks of shorebirds are present annually in spring and fall, particularly when water levels are low but number of use-days are unknown.
Landbird migratory stopover area	Possible	Not documented but the presence of forest cover within the city and relatively close to the Lake Superior shoreline may provide stopover habitat for migrants.
Raptor wintering areas	No	Not documented. Extensive fields and other suitable habitats are absent. Significant numbers of raptors are unlikely to be supported.
Bald Eagle winter feeding and roosting areas	No	Not documented. Unlikely to be significant in the park given the absence of a reliable source of food.
Wild turkey winter range	No	Wild Turkeys do not occur in the area.
Turkey vulture summer roost	No	None documented. Unlikely to occur with the high level of human use.
Reptile hibernacula	No	None documented.
Bat hibernacula	No	None documented. No suitable habitat present.
Butterfly migratory stopover areas	No	None documented.
Bullfrog concentration areas	No	Bullfrogs do not occur in the area.

Table 3-3 Assessment of Rare Vegetation Communities or Specialized Habitat for Wildlife in Boulevard Lake Park (from Table Q-2 in OMNR 2000)

Natural Feature	Present in Study Area?	Notes
Rare vegetation communities	Possible	Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline may be present on the Current River upstream of Boulevard Lake.
Habitat for Area Sensitive Species (from Appendix C in OMNR 2000; OBBA 2015)	Yes	Area sensitive bird species including Pileated Woodpecker, Red-breasted Nuthatch, Winter Wren, Magnolia Warbler, Black-and-white Warbler, American Redstart, Canada Warbler and Ovenbird were observed in nesting habitat in 2016.
Forest providing high diversity of habitats	No	Large, old, undisturbed forest stands not present.
Amphibian Woodland Breeding Pools	Possible	Vernal pool habitat may be present in forest.
Old growth or mature forest	Yes	Mature mixed-wood forest present.
Foraging Areas with Abundant Mast	No	No oaks or other nut-bearing trees. Fruit bearing shrubs present, but restricted to a small portion of the study area.
Osprey, Bald Eagle nesting habitat	No	None documented. Unlikely to occur given the high level of human use.
Turtle Nesting Habitat	No	None documented.
Moose aquatic feeding areas	No	No suitable habitat.
Mink and otter feeding /denning sites	Unknown	Otters observed in 2016. No feeding or denning sites documented, but shoreline habitat present.
Marten and fisher denning sites	No	No large contiguous coniferous or mixed forests with abundant large trees.
Areas of High Diversity • Seeps and Springs • Cliffs • Caves	No	None documented. Seeps are present on the lakeshore (but none observed in forest habitat.

3.2.3.3 Species at Risk

Species at risk known to occur in the surrounding area include two fish, seven vascular plants, four butterflies, four non-vascular plants (mosses, liverworts, and lichens), one turtle, and eight birds.

Among the bird species at risk, Canada Warbler was observed on the northwest side of Boulevard Lake in 2016 and probably nests here. Potential nesting habitat is also present for Eastern Wood-Pewee. Bald Eagles sometimes perch in the trees near the Current River below the dam (Harris pers. obs.). Common Nighthawk, Chimney Swift, Bank Swallow, Barn Swallow, and Yellow-headed Blackbird may occasionally forage in the park, but nesting habitat is absent.

Scabrous Black Sedge (*Carex atratiformis*), a provincially rare plant, was collected on the lawn on the east side of Boulevard Lake in 1999 (Harris 1999). Other arctic alpine plants species are found on the Current River at Trowbridge Falls associated with Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline (Bakowsky pers. comm.).

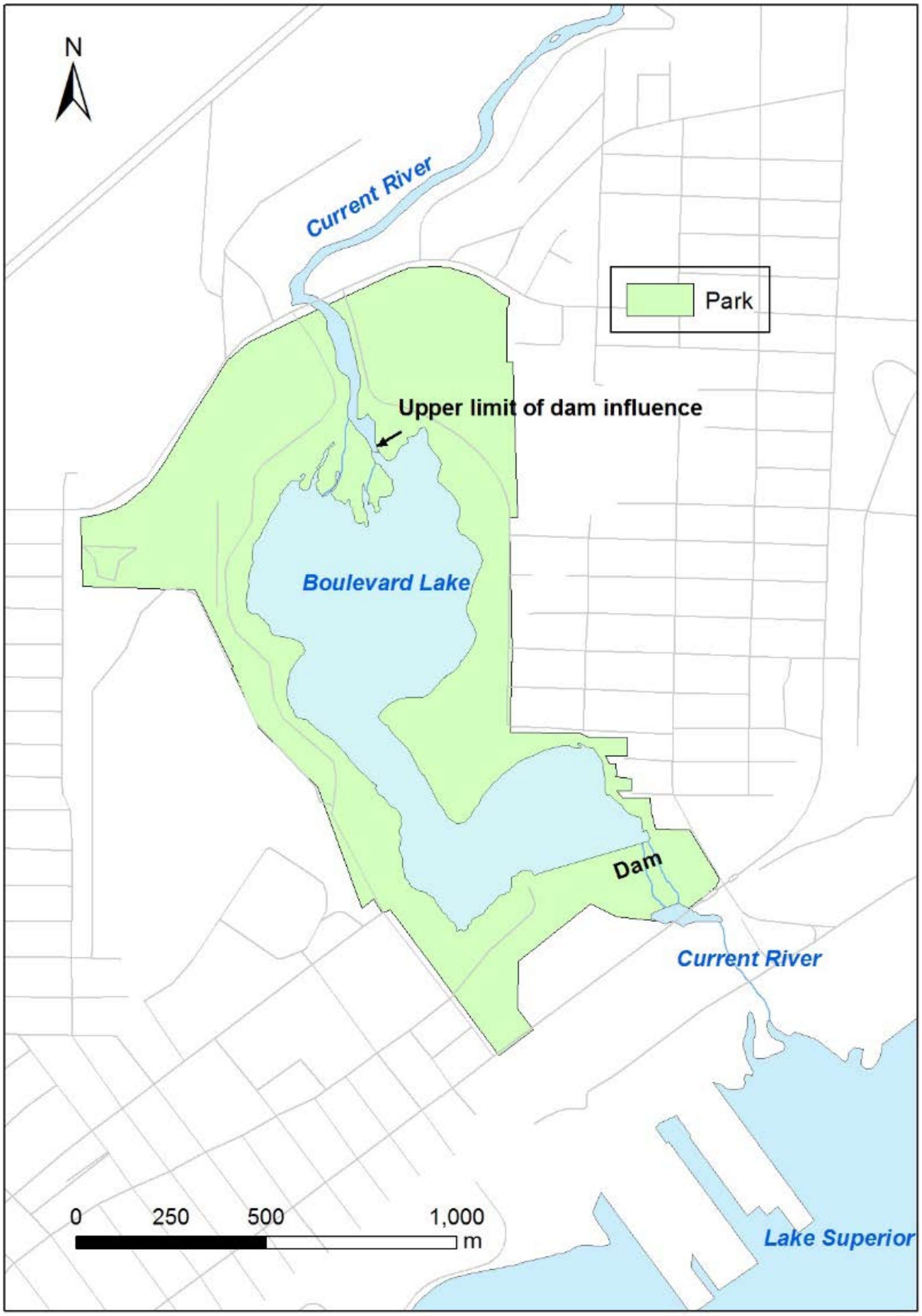
The fish species (Lake Sturgeon and Northern Brook Lamprey) have apparently not been documented in the Current River. There is an historical record of American Eel from the Current River below the dam (Hartviksen and Momot 1989).

3.2.4 Aquatic Environment

Details on the aquatic environment within the study area are contained in Supporting Document 1, Boulevard Lake Aquatic and Terrestrial Environmental Report 2016. A summary of the report is provided below.

The Boulevard Lake aquatic study area is shown in Figure 3-6. The lake water is relatively clear (Secchi depth of 2 m), but varies with the amount of sediment in the inflow (unpublished OMNR lake survey data). The morphoedaphic index (MEI), an index of lake productivity based on total dissolved solids and mean depth, is 25.2. This is somewhat higher than the mean MEI of 18.9 for 160 lakes in Thunder Bay District that are less than 100 ha in size; however, MEI was not developed for use in small reservoirs with short residence times (unpublished OMNR lake survey data).

Figure 3-6 Boulevard Lake Aquatic Study Area



The Current River above Boulevard Lake drops over a series of bedrock shelves, separated by pools and rapids and ends in a shallow delta. Gravel and cobble bars are common at the estuary (Figure 3-7).

Figure 3-7 Bedrock Shelf at the Mouth of the Current River at the North End of Boulevard Lake

The Current River downstream from the dam to Cumberland Street (about 200 m) consists of a bedrock shelf (about 70% of the channel) with small patches of cobble (about 30%) (Foster 2011). This reach is scoured by high flow during spring freshet, but less than half of the bankfull width is wetted during low flows (Foster 2011). The pools provide migration and feeding habitat for Walleye, Rainbow Trout, Brook Trout, White Sucker and other fish species even during low flows (Foster 2011). Spawning, nursery, and overwintering habitats are probably limited in this section due to the predominantly bedrock substrate, shallow water depth, and highly variable flow conditions. Spawning habitat for several fish species occurs at the estuary; about 200 m to 600 m downstream from the dam (a discussion on Fish Habitat and Species is provided in a subsequent section).

3.2.4.1 Bathymetry

The surface area of Boulevard Lake at high water is about 61 ha and consists of two main basins separated by a narrows. The lake is shallowest at the north and south ends with a deeper channel following the former river channel through the narrows to the dam (Figure 3-8).

About 70% of the lake is less than 2 m deep and about 3% of the lake is deeper than 5 m (when the lake is at the high water level). The maximum recorded depth was 5.3 m. Most of the Current River inflow is through the main channel at the northeast edge of the lake, but during high water, the river also spills through several overflow channels. In August 2016, the overflow channels were filled with backwater from Boulevard Lake but were separated from the Current River by cobble bars.

3.2.4.2 Water Temperature and Dissolved Oxygen

Water temperatures measured on August 27, 2016 were probably close to the annual maximum but vary with weather and rate of discharge from the Current River. Surface water temperatures were coolest (17.4ºC) at the inflow of the river at the north end of Boulevard Lake, and warmed to between 20ºC and 21.5ºC elsewhere (Figure 3-9). Temperatures at the lake bottom were similar to surface temperatures except where the cooler water from the Current River tracked through the north part of the lake to the narrows (Figure 3-9).

Cooler temperatures (as low as 9.9ºC) were measured at a series of seeps along the northwest shore of the lake.

The relatively similar temperatures (and dissolved oxygen) levels at the surface and bottom suggests that Boulevard Lake does not stratify. This is not surprising given the relatively shallow waters and high turnover with river inflow.

In August 2016, much of the lake was within the optimum temperature range for Walleye (20ºC to 24ºC; McMahon *et al.* 1984) and Northern Pike (19ºC to 21ºC; Harvey 2009) but warmer than preferred by Brook Trout and Rainbow Trout, which prefer water less than about 20ºC and 18ºC respectively (Scott and Crossman 1973; Raleigh *et al.* 1984). Cooler water near the Current River inflow could provide late summer thermal refuge for trout. Submerged upwellings of cooler groundwater may also occur.

Dissolved oxygen levels were highest (9.23 mg/L) near the inflow of the Current River at the north end of Boulevard Lake. Surface oxygen levels were generally higher than those near the bottom of the lake. The lowest values (5.25 mg/L) were observed at a depth of 3.5 m just above the dam (see Figure 3-10).

Levels were generally above critical levels for freshwater aquatic life in warm water lakes and streams (6 mg/L for early life stages and 5.5 mg/L for other life stages; CCME 1999), except perhaps in water greater than 3.5 m deep. Oxygen levels probably vary throughout the year depending on water temperatures, ice cover, and inflow.

Figure 3-8 Boulevard Lake Bathymetry Map

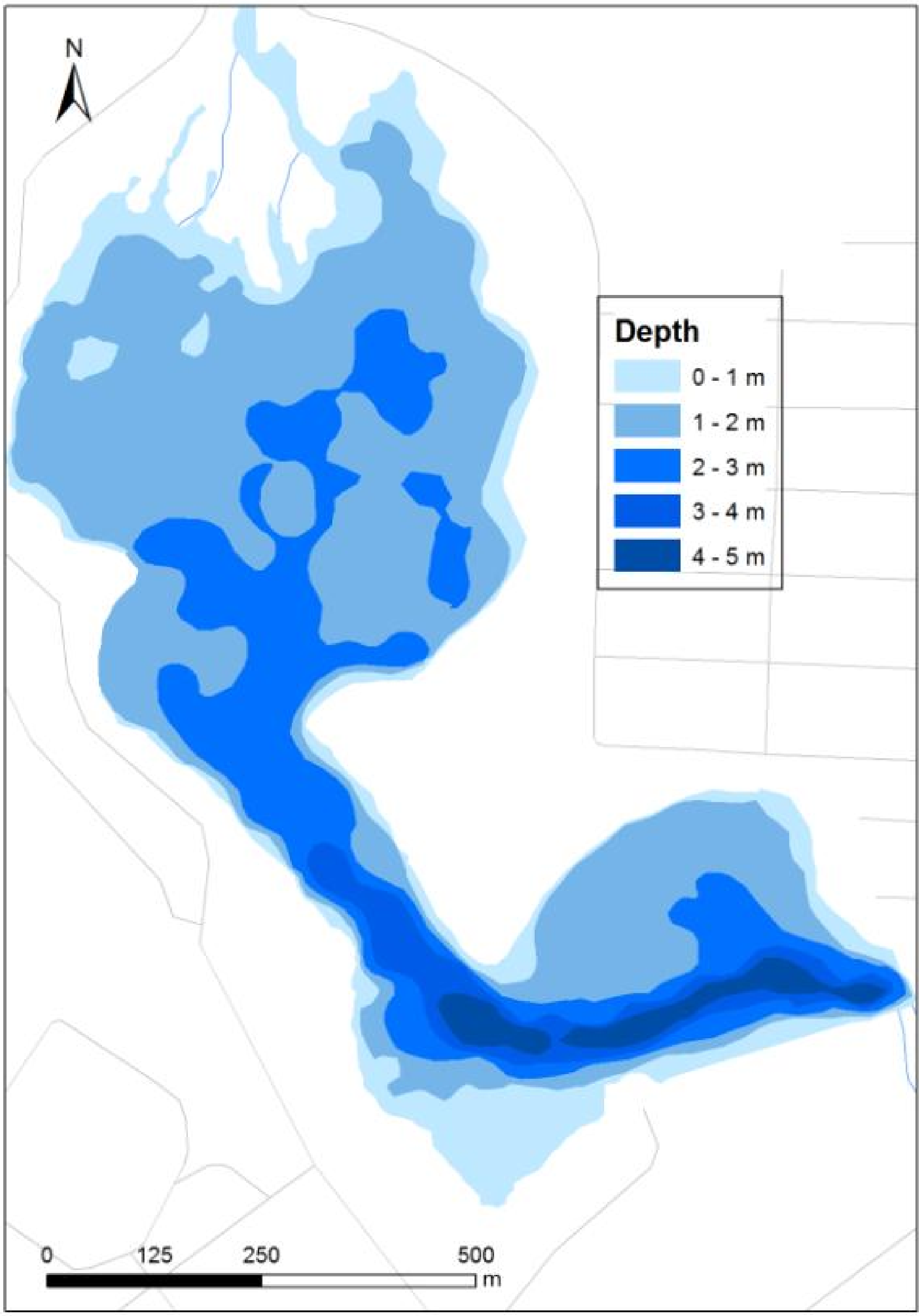


Figure 3-9 Water Temperature at Surface and Bottom of Boulevard Lake

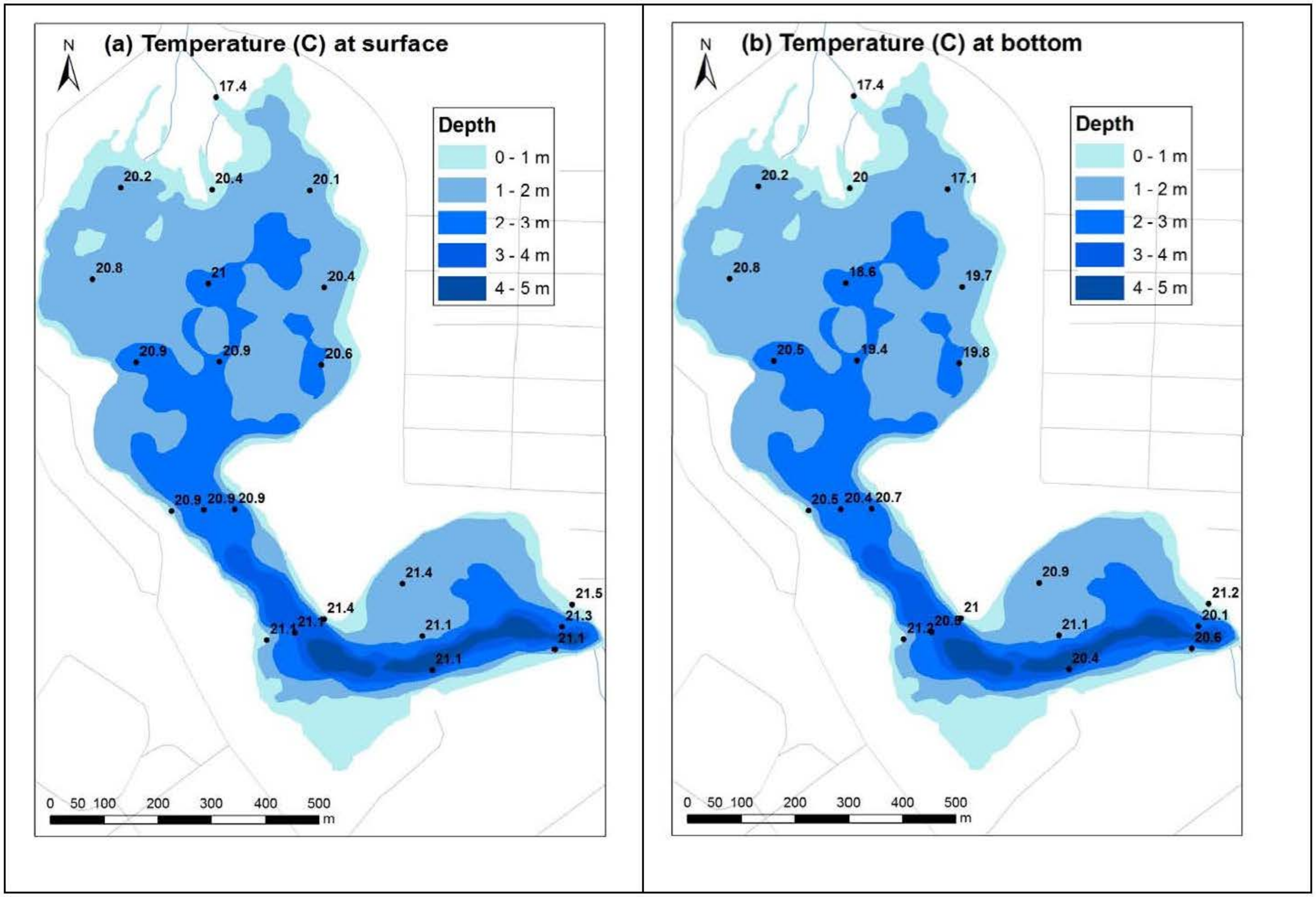
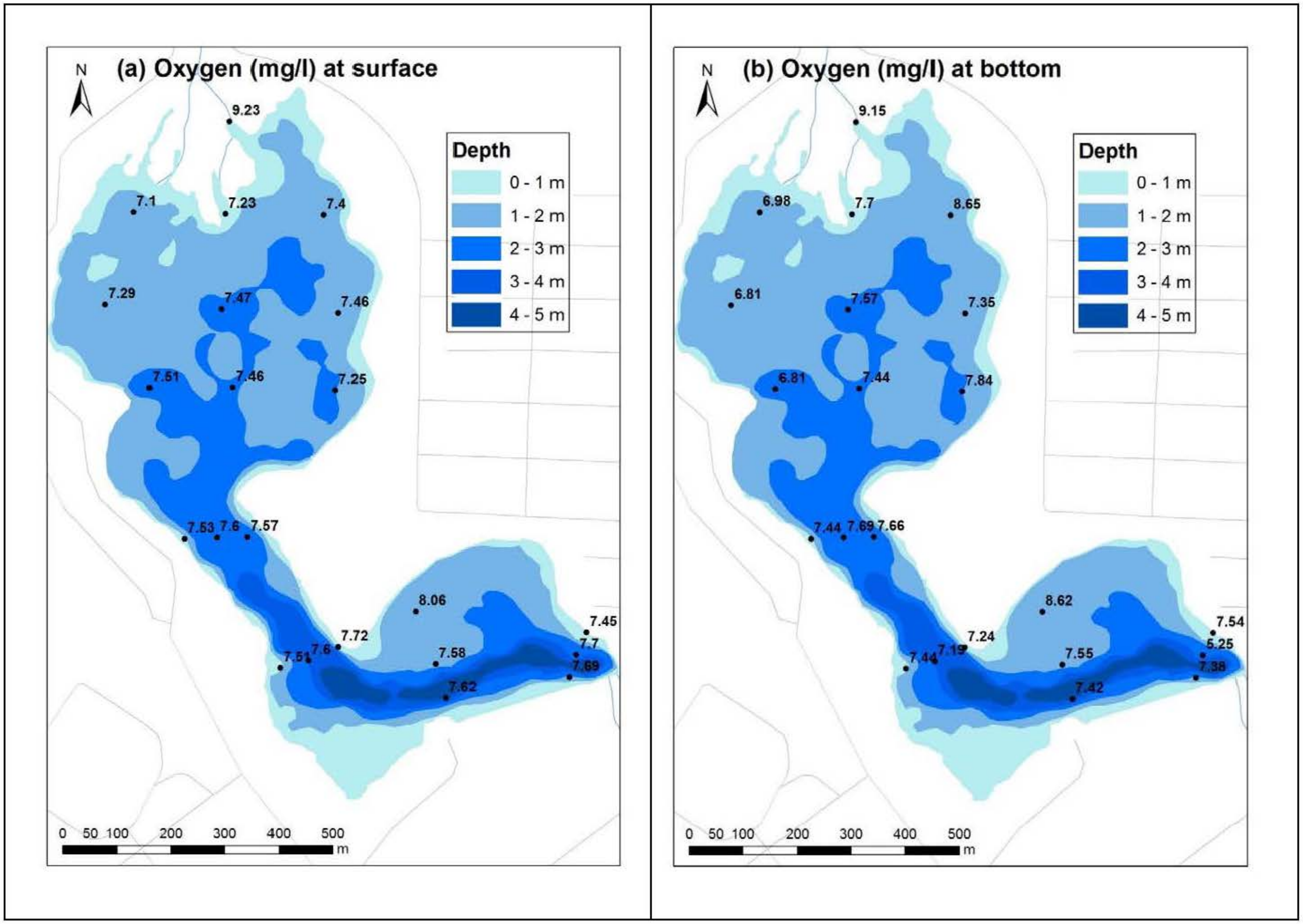


Figure 3-10 Dissolved Oxygen (mg/L) at Surface and Bottom of Boulevard Lake



3.2.4.3 Shoreline Classification

The shoreline classification is summarized in Table 3-4 and Figure 3-11. The total shoreline length is 5010 m.

About a third of the shoreline of Boulevard Lake is marsh, concentrated at the north end of the lake (Table 3-4, Figure 3-11). Most of the marsh consists of a narrow fringe of sedges (*Carex spp*.) or cattail (*Typha spp*.) backed by lawn or forest (Figure 3-12). A few larger patches of emergent marsh are found near the inflow of the Current River. Many of the marshes are flooded during high water but do not extend into the lake and are therefore inaccessible to fish when water levels drop during winter drawdown and summer low water events.

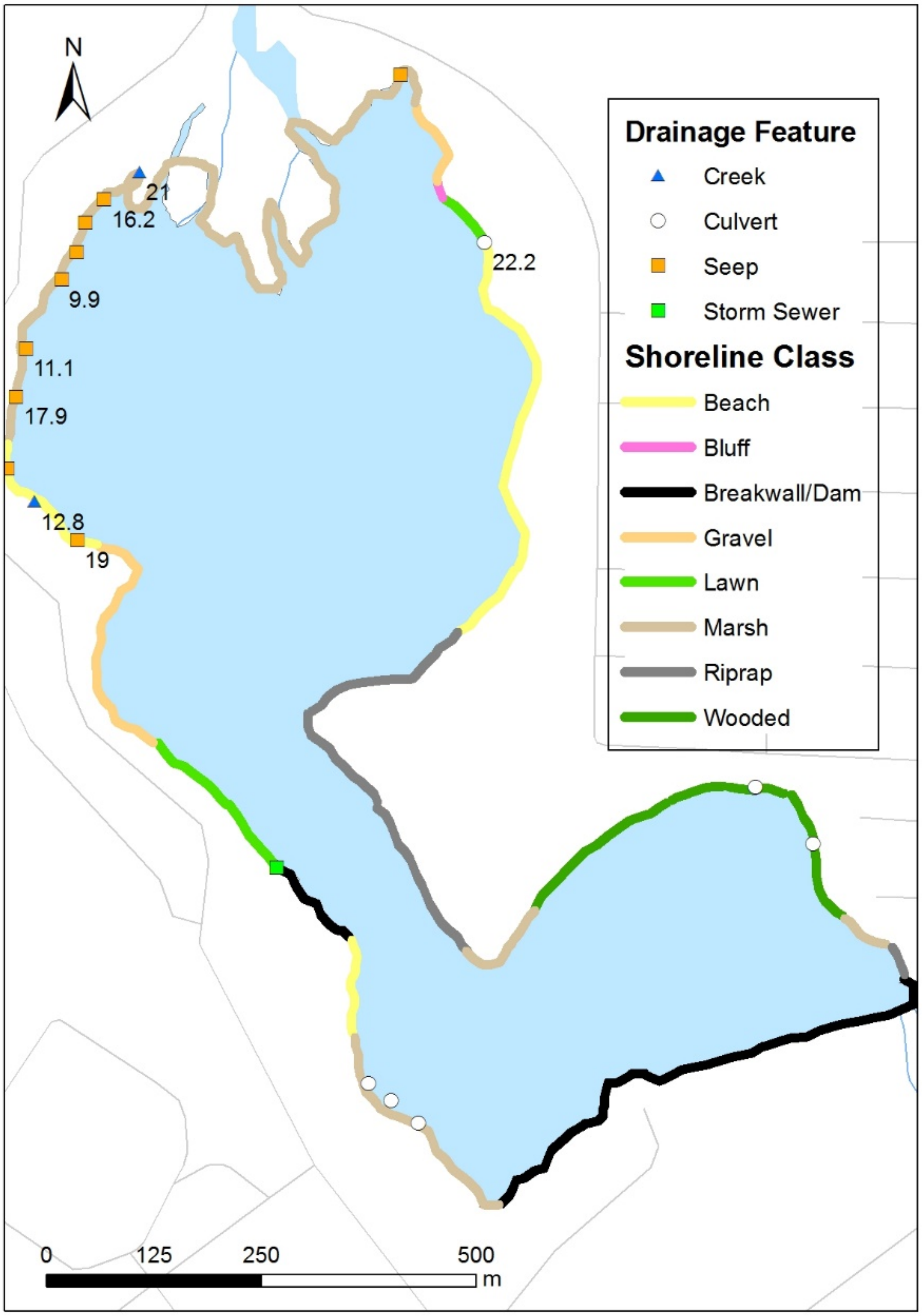
A small wetland (about 0.4 ha) with cattail marsh and submergent vegetation occurs in a basin on the east side of the lake. The marsh is connected to Boulevard Lake through a culvert when the lake level is high, but more or less isolated during low water.

About 25% of the shoreline is artificially hardened (riprap, breakwall and dam) and another 5% is maintained as lawn. Beaches make up 16% of the shore.

Table 3-4 Shoreline Classification Summary, Boulevard Lake 2016

Shoreline Class	Length (m)	%
Beach	792.8	16
Bluff	17.8	<1
Breakwall/dam	723.4	14
Gravel	398.4	8
Lawn	264.6	5
Marsh	1765.3	35
Riprap	572.4	11
Wooded	475.4	9
Total	**5010.0**	**100**

Figure 3-11 Shoreline Classification, Boulevard Lake



3.2.4.4 Water Quality

During consultations with the City of Thunder Bay it was reported that over the years Boulevard Lake has had to be closed to swimming on several occasions due to poor water quality, primarily elevated levels of *Escherichia coli*. It was surmised that feces from water birds congregating in and around the lake was a potential cause.

The Current River Watershed Study undertaken by Proctor and Redfern in 1991 for the LRCA observed that 'from time to time' in summer water quality issues relating to high fecal coliform levels (above MOE standards) occurred at Boulevard Lake, resulting in beach closures. Further, the study noted that the reasons for the high levels of bacterial contamination were not fully understood. The study stated that high levels of bacterial contamination typically occurred during hot, dry spells, but one closure had also occurred after a significant rain event.

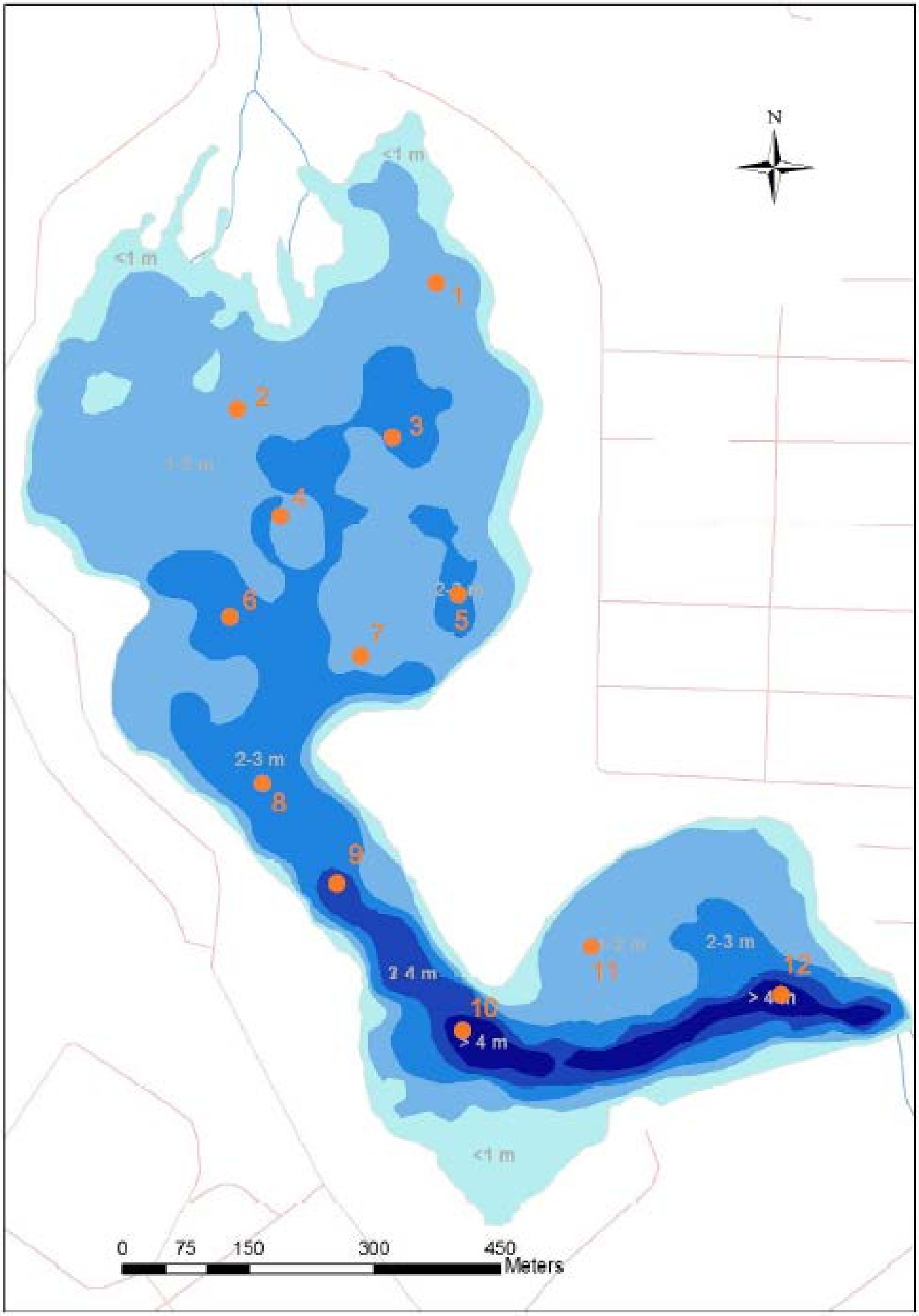
In 2009, water sampling and testing were done at Boulevard Lake and upstream locations by Conestoga-Rovers and Associates as part of a comprehensive water quality study commissioned by the City of Thunder Bay. This study only assessed bacterial counts in the lake as well as upstream locations. The study reported that overall, water quality at the three public beach locations at Boulevard Lake was better in 2009 than in the previous four years. The study surmised that this was possibly due to the fact that beach usage was down and temperatures and significant rain events were low during the summer of 2009. A literature review undertaken as part of that study utilized only studies that were conducted in 1990 or earlier. Two of the studies reviewed indicated that a possible reason for reduced water quality at Boulevard Lake could be attributed to reduced water flow through the area during the summer months owing to the highly drained topography.

As part of this project, the quality of water in Boulevard Lake was assessed. A total of 36 samples were drawn from various locations and depths across the lake as follows:

- six samples on May 30, 2016 (sampling location points 1 through 6);
- six samples on May 31, 2016 (sampling location points 7 through 12);
- twelve samples on July 28, 2016 (sampling location points 1 through 12); and
- twelve freshet samples on April 18, 2017 (sampling location points 1 through 12).

These sample locations are depicted on Figure 3-12 below.

Figure 3-12 Water Quality Sampling Locations, Boulevard Lake



All samples were assessed for the following parameters that are determined to be important for protecting aquatic life and recreational uses:

- Physical Tests:
  - Color;
  - pH;
  - Total Suspended Solids;
  - Turbidity.
- Anions and Nutrients:
  - Ammonia, Total (as N);
  - Nitrate (as N);
  - Total Kjeldahl Nitrogen;
  - Phosphorus, Total (as P).
- Bacteriological Tests:
  - *Escherichia coli (E. Coli).*
- Aggregate Organics:
  - Oil and Grease, Total.

In addition, all twelve samples from July 2016 and all twelve samples from April 2017 were also tested for a total of 39 metals. The following provides a summary of the key results from the analyses:

- All 36 water quality samples (May and July, 2016; and April, 2017) met the water quality criteria established by the province of Ontario to protect aquatic life and recreational uses (PWQO criteria) (MOEE 1994).
- For the 12 water quality samples of July 2016 that were assessed for metals, all samples met the PWQO's quantitative criteria for all metals, except for total iron (concentrations of which exceeded PWQO's criterion for all 12 of these samples).
- For the 12 water quality samples of April 2017 that were assessed for metals, all samples met the PWQO's quantitative criteria for all metals, with the following exceptions:
  - o one sample exceeded PWQO's quantitative criteria for both total copper and total iron.

The exceedances for total iron concentrations should not be of major concern based on the use of the lake for recreational purposes for the following reasons:

- It is recognized that the sources of iron in freshwater bodies include: weathering of rocks and soils, mining and processing of iron ores, steel making and metal fabricating, burning of fossil fuels, and corrosion of iron or steel products. One likely cause for the elevated iron concentration at Boulevard Lake could be from natural weathering of rocks and soils in the Current River's flow.
- The high iron concentrations observed could also be due to iron being reduced to the ferrous form and being present in solution. Additionally, iron could also be released from lake sediments. As will be discussed in a subsequent section, our assessment of sediments revealed high concentrations of iron.
- A recent study investigating the complexation properties of iron and humic acid in a water environment suggests that in freshwater bodies, the iron - humic acid complex could reach high levels in the warm season with mild sunlight radiation. The temperature at the project area during sampling was around 23 degrees Celsius (Fang *et al*. 2015).
- The total iron concentrations of all 12 water quality samples were between 0.56 mg/L and 0.64 mg/L. For purposes of comparison in other jurisdictions, we note that both BC MOE and US EPA have an aquatic life criterion of 1 mg/L for total iron (BC MOE 2008; US EPA 2017).

Overall, existing water quality in the lake appears to be satisfactory for recreational purposes as well as for the protection of aquatic life. Comprehensive data for all samples are provided in Appendix A to this ESR.

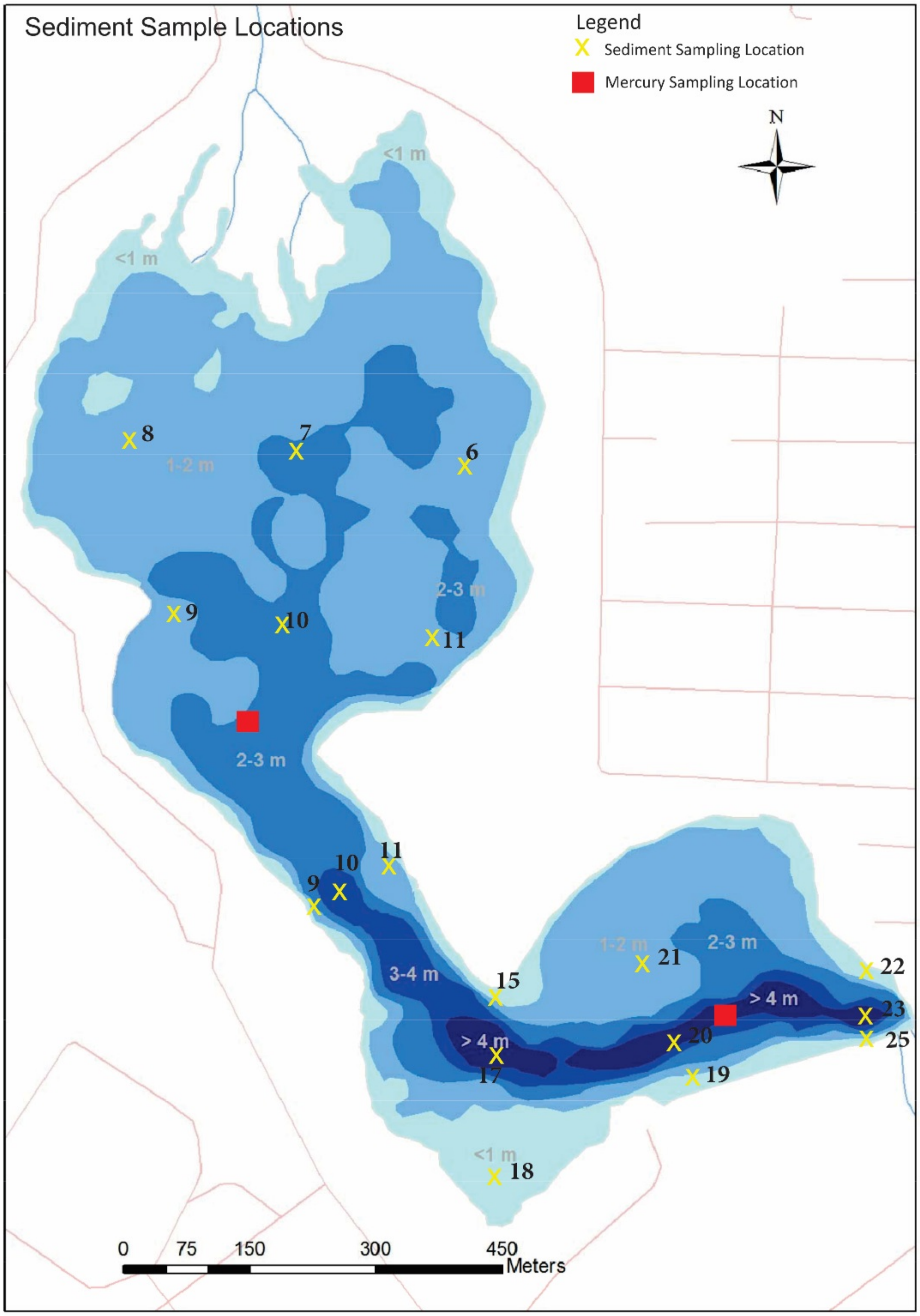
3.2.4.5 Sediment Quality

The quality of sediment from various locations and depths across Boulevard Lake was assessed. A total of 22 samples were drawn:

- nine samples on August 8, 2016 (sampling location points 6 through 14);
- nine samples on August 9, 2016 (sampling location point 15 and location points 17 through 25); and
- four samples, taken at two locations, on April 24, 2017. These samples were only analyzed for mercury.

These sample locations are depicted on Figure 3-13 below.

Figure 3-13 Sediment Sample Locations, Boulevard Lake



All samples were analyzed for the following parameters that are determined to be important for protecting aquatic life and recreational uses:

- Physical Tests:
  - % Moisture.
- Bacteriological Tests:
  - *E. Coli;*
  - Total Coliforms.
- Metals:
  - 33 metals.
- Aggregate Organics:
  - Oil and Grease, Total.
- Volatile Organic Compounds:
  - 8 VOCs.
- Polycyclic Aromatic Hydrocarbons:
  - 21 PAHs.

Although most of the chemicals were within the criteria (i.e. less than the Lowest Effects Level (LEL) for sediment standards set by Ontario MOECC (MOECC 2008). Table 3-5 provides a summary of those which exceeded the standards, including LEL and Severe Effect Level (SEL) exceedances. Comprehensive data for all samples are provided in Appendix A of this ESR.

Table 3-5 Exceedance of Ontario Sediment Standards

Chemical	Ontario Sediment Standards (ppm)		Value of Highest Exceedance Above LEL
	LEL	SEL	
Arsenic (As)	6	33	7
Cadmium (Cd)	0.60	10	0.63
Chromium (Cr)	26	110	51
Copper (Cu)	16	110	43
Iron (Fe)	2%	4%	4.92%
Manganese (Mn)	460	1100	1460
Nickel (Ni)	16	75	37
Phosphorus (P)	600	2000	801
Zinc (Zn)	120	820	127
Benzo(a)anthracene	0.32	1480	0.66
Benzo(a)pyrene	0.37	1440	0.76
Benzo(g,h,i)perylene	0.17	320	0.63
Benzo(k)fluoranthene	0.24	1340	0.33
Chrysene	0.34	460	0.9
Dibenzo(ah)anthracene	0.06	130	0.12
Fluoranthene	0.75	1020	1.8
Indeno(1,2,3-cd)pyrene	0.20	320	0.57
Phenanthrene	0.56	950	0.86
Pyrene	0.49	850	1.39
PAH	4	10000	>9.31

Despite the iron exceedance measured in the water samples and those shown in the sediment (Table 3-5 above), it is determined that overall these exceedances do not pose a threat to aquatic species or to the use of Boulevard Lake for recreational purposes.

The results of 2016 water quality sampling in Boulevard Lake as reported by the City of Thunder Bay Health Unit, have indicated exceedances in *E. Coli* concentrations. These high *E. Coli* levels resulted in the posting of two swimming advisories for Boulevard Lake beaches, for a total of four days, on July 27-29, and August 30-31. Boulevard Lake was sampled 12 times during the official swimming season (June 30th to August 31st) as part of the Health Unit Sampling Program and the exceedances were observed on two of these occasions. Overall, the beaches were opened 59 out of a possible 63 days, or approximately 94% of the time. Beach conditions were generally found to be sanitary, however, some unsanitary conditions were observed, consisting of piles of goose and gull faeces in beach areas and close to the water.

Concerns were raised by stakeholders about the potential for elevated mercury levels in the lake and this was investigated by reviewing existing studies and by conducting additional sediment sampling.

One study reviewed was the *Onion Lake Dam Environmental Impact Study*. The study was undertaken during 2004-2005 to evaluate the process of decommissioning Onion Lake Dam. As part of this study, analyses of metals (including mercury) were carried out from five sediment samples at Onion Lake. The amount of mercury in the sediments were below Ontario MOE limits for all samples (see Table 3-6). The study concluded that no systematic or hazardous contamination was present at Onion Lake and that metals found in the lake sediments were reflective of the shield bedrock and overburden.

Table 3-6 Mercury Levels in Onion Lake Sediment

Sampling Period	Location	Mercury Content (µg/g*)
July 2015	Transect 1-5	< 0.1
July 2015	Transect 2-3	< 0.1
July 2015	Transect 3-4	< 0.1
July 2015	Transect 4-3	0.15
July 2015	Transect 5-4	< 0.1

*microgram per gram (µg/g)

As part of the current Class EA for the rehabilitation of Boulevard Lake Dam, four sediment samples were taken from two locations (top and bottom sample at each location) in Boulevard Lake in April 2017 and analyzed for total mercury, as shown on Figure 3-14. It should be noted that sediment is a more suitable medium than water since it integrates all the accumulation of mercury deposits. All four samples indicated levels below MECP guideline level of 0.2 µg/g (below the lowest effect level) as shown in Table 3-7.

Figure 3-14 Sediment Sample Locations, Boulevard Lake – Total Mercury – April 2017

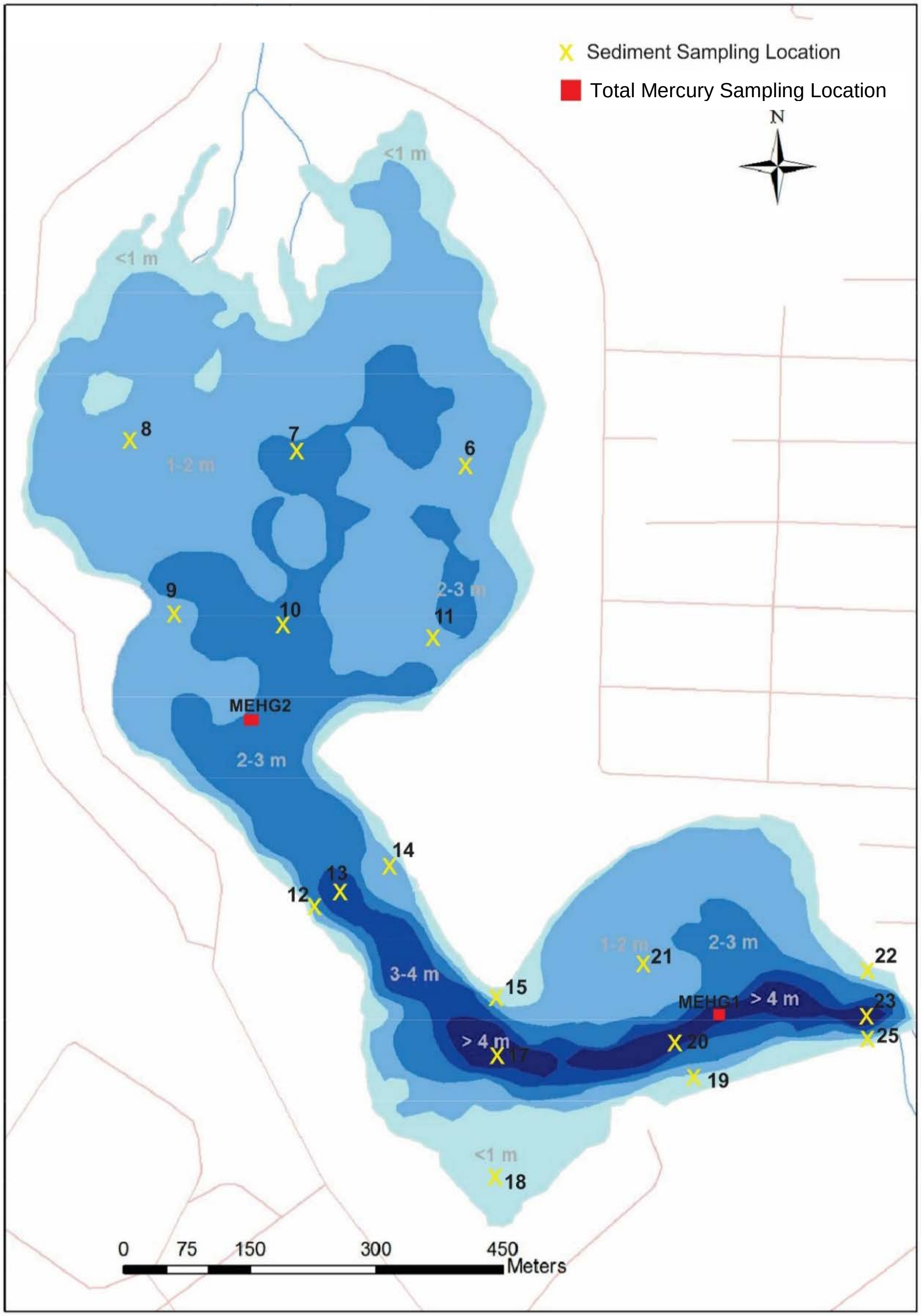


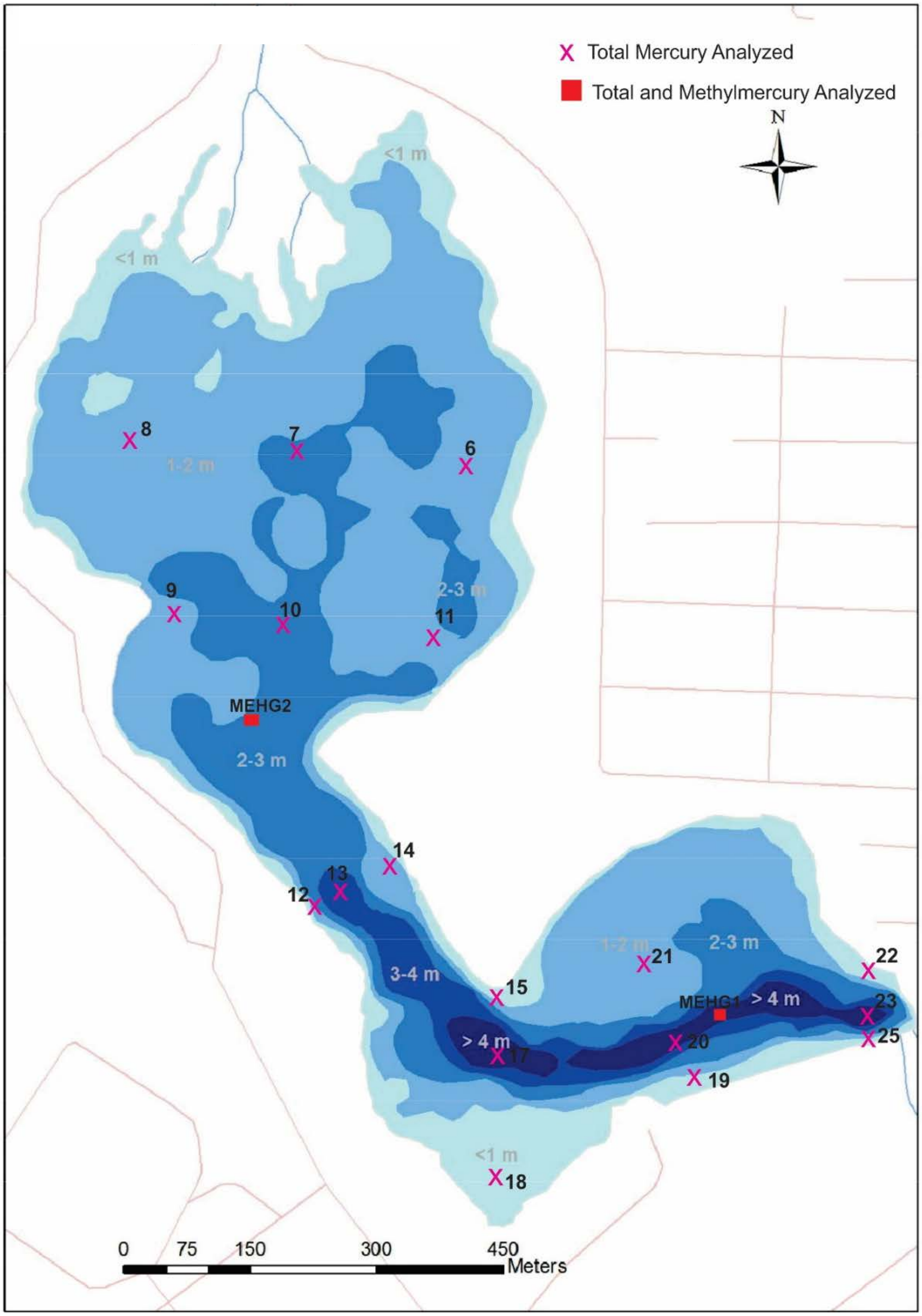
Table 3-7 Total Mercury and Methylmercury Levels Measured in Boulevard Lake Sediment

Sampling Period	Location	Mercury Content (µg/g)
Total Mercury		
April 2017	MEHG2 - Top	0.132
April 2017	MEHG2 - Bottom	0.125
April 2017	MEHG1 - Top	0.111
April 2017	MEHG1 - Bottom	0.1
June 2017	6	0.0517
June 2017	7	0.0700
June 2017	8	0.109
June 2017	9	0.0371
June 2017	10	0.119
June 2017	11	0.0503
June 2017	12	0.116
June 2017	13	0.0957
June 2017	14	0.0331
June 2017	15	0.0354
June 2017	17	0.121
June 2017	18	0.0939
June 2017	19	0.0808
June 2017	20	0.110
June 2017	21	0.134
June 2017	22	0.0998
June 2017	23	0.135
June 2017	25	0.0926
Methylmercury		
June 2017	MEHG2	0.000281
June 2017	MEHG1	0.000058

Note: Ontario Provincial Water Quality Objectives for total mercury is 0.2 µg/g

A more extensive sampling program was conducted in June of 2017 to investigate mercury levels in Boulevard Lake sediment. In total 18 samples were collected from 18 locations and analyzed for total mercury, and samples at two locations were analyzed for methylmercury (see Figure 3-15). Total mercury levels in all 18 samples analyzed were found to be below the MECP guideline level of 0.2 µg/g (below the lowest effect level) as shown in Table 3-7. Similarly, the two methylmercury levels in the two analyzed samples were found to very low, 0.000281 mg/kg and 0.000058 mg/kg, respectively. The detailed lab results are included in Appendix A of this ESR.

Figure 3-15 Sediment Sample Locations, Boulevard Lake – Total and Methylmercury – June 2017



Thus overall, levels of both total mercury and methylmercury are very low. While the methylmercury guideline is based on levels in fish, the levels measured in the Boulevard Lake sediment are so low that it is unlikely that bioaccumulation in fish would occur at a rate that could exceed the existing guidelines.

In summary, it appears that sediments in Boulevard Lake are generally compliant with provincial Objectives; however, historical and current monitoring results indicate that high *E. Coli* levels can occasionally result in swimming advisories being posted. Contributing factors to these occasional exceedances are likely the buildup of goose and gull faeces in the beach areas, warmer water temperatures during the summer months and reduced water flow in the lake.

3.2.4.6 Fish Habitat and Species

Fourteen fish species have been documented from Boulevard Lake, of which 12 were observed as part of the aquatic monitoring undertaken for this project. An additional seven species have been recorded in the Current River below the dam and eight more in the river upstream of Boulevard Lake (Additional details are provided in Supporting Document 1). Sampling effort in the lake to date has been relatively light and more effort may discover additional species.

Boulevard Lake has a cool water lake fish community where the large fish species include White Sucker, Northern Pike, Walleye, and Yellow Perch. As described above, late summer water temperatures are optimal for Walleye and Northern Pike but marginally high for Brook Trout and Rainbow Trout. Dissolved oxygen levels are unlikely to limit fish species. The physical habitat of most of the lake is relatively uniform with flat, fine textured substrate and patches of submergent vegetation especially in the 1 – 2 m depth range. Islands, shoals, and extensive wetlands are lacking. The north end of the lake at the Current River mouth has coarser substrate (cobble and gravel), cooler water, and higher dissolved oxygen and supports several fish species not observed elsewhere.

Fish can move downstream from the Current River into Boulevard Lake and the presence of fish species does not necessarily indicate that the lake provides year-round habitat. Some species may occupy the lake seasonally or opportunistically, or represent transient individuals. In the 1990's, a fish ladder was installed at Boulevard Lake Dam to encourage the migration of Rainbow Trout.

A list of the species that form the habitat is provided in Table 3-8 below (* indicates the ones that were observed during the current study).

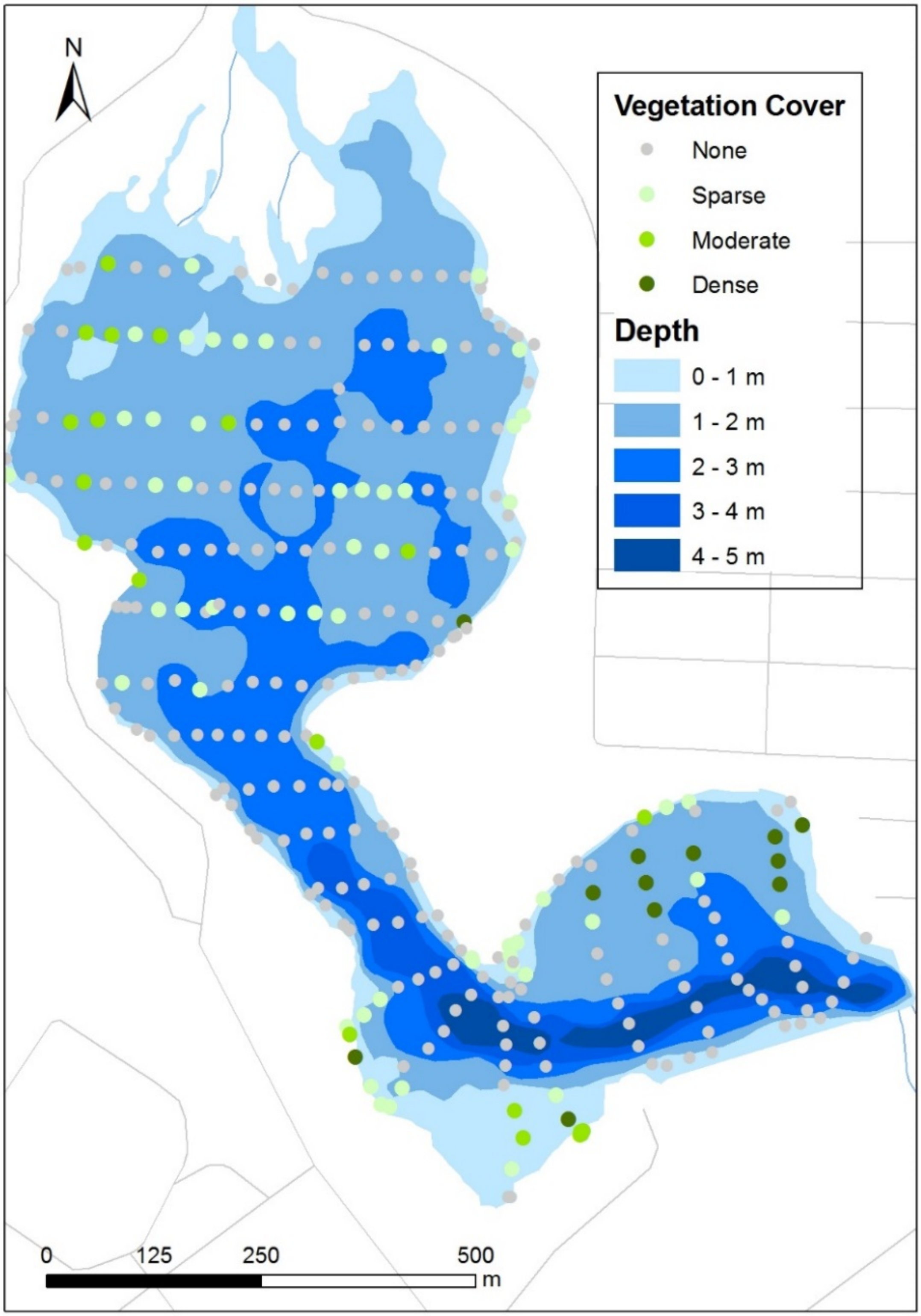
Table 3-8 Fish Species with Habitat in Boulevard Lake

Fish Family	Fish Species
Salmon	Rainbow Trout
	Brown Trout
	Brook Trout
Smelt	Rainbow Smelt
Mudminnow	*Central Mudminnow
Pike	Northern Pike
Minnow	Finescale Dace
	Lake Chub
	Blackchin Shiner
	* Blacknose Shiner
	* Spottail Shiner
	Fathead Minnow
	* Blacknose Dace
	Longnose Dace
	Creek Chub
	Pearl Dace
Sucker Family	Longnose Sucker
	White Sucker
Eel	American Eel
Cod	* Burbot
Stickleback	Brook Stickleback
Trout-Perch	* Trout-perch
Sunfish	Smallmouth Bass
Perch	* Yellow Perch
	* Walleye
	* Johnny Darter
	* Logperch
Sculpin	Slimy Sculpin

3.2.4.7 Aquatic Vegetation

Most of the lake has sparse (<25% cover) or no aquatic vegetation (Figure 3-16). Of the 310 sample points, 69% (n=214) had no aquatic vegetation and 21% (n=64) had sparse vegetation. Most of the sample points with moderate (25% to 75% cover; n=20) or dense (>75% cover; n=12) are between the 1 and 2 m depth contours, particularly in the south end of the lake (Figure 3-16). Development of submergent vegetation in shallower water may be limited by the winter draw down, which has the potential to damage roots and rhizomes by desiccation, freezing, or ice scour. Submergent species include various pondweeds (*Potamogeton spp.*), Slender Naiad (*Najas flexilis*), Arrowhead (*Sagittaria sp.*), and others.

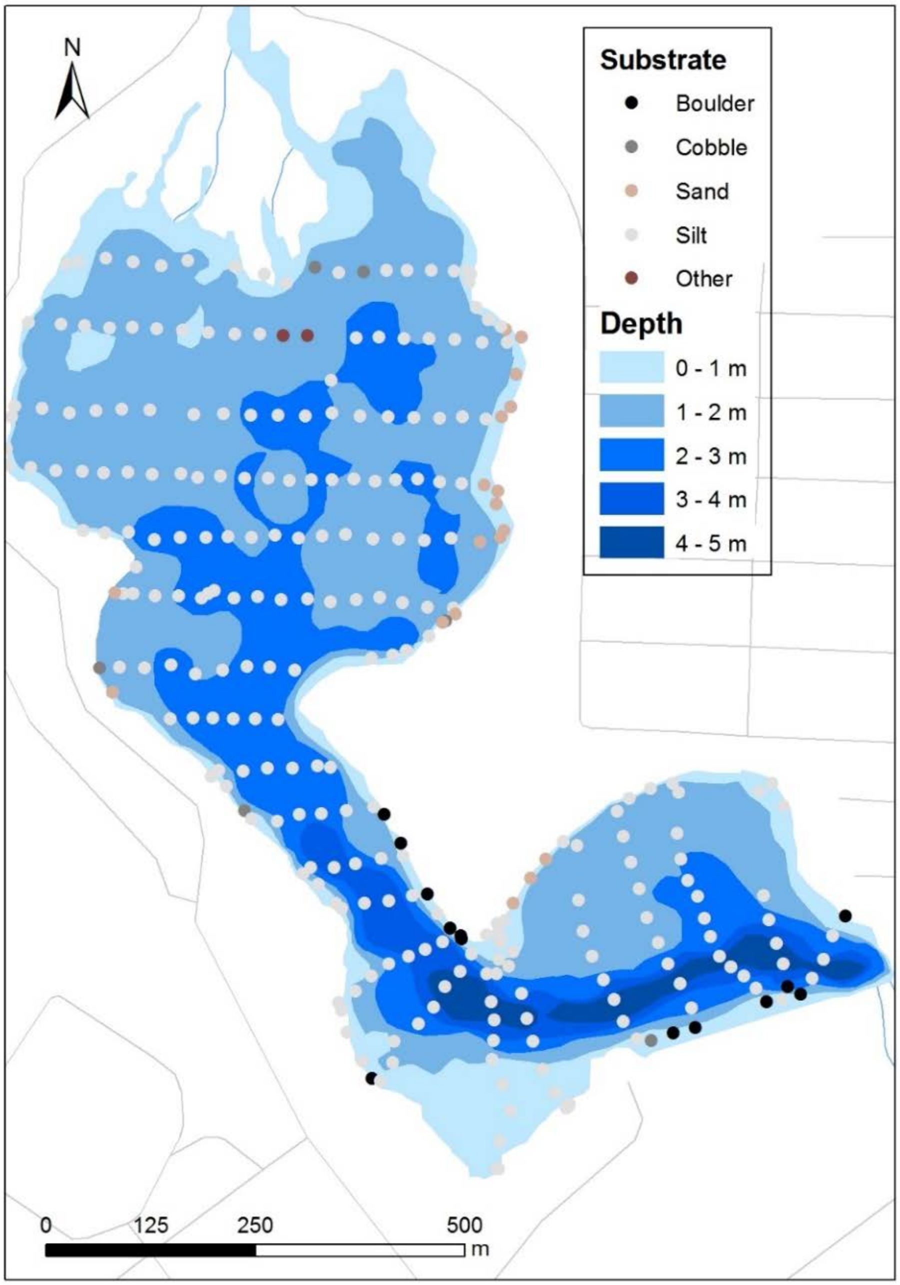
Figure 3-16 Aquatic Vegetation Cover, Boulevard Lake



3.2.4.8 Aquatic Substrate

Most of the aquatic substrate of Boulevard Lake was classified as silt (including sites with a thin film of silt over sand or gravel) (Figure 3-17). Boulder, sand, and cobble are largely restricted to shallow areas near the shores. The lakebed is largely flat and featureless. Scattered boulders are found throughout the south basin and logs and other woody debris deposited from the river are common in the north basin.

Figure 3-17 Substrate Map, Boulevard Lake. 2016



3.2.4.9 Benthic Invertebrates

This section describes benthic invertebrate sampling at Boulevard Lake. Benthic invertebrates were sampled at 21 points (Figure 3-18) on August 15, 2016 using a petite ponar sampler. A minimum of 50 mL of substrate was collected at each site. In some cases, several grabs were required to sample this volume. Samples were sieved through a 100 micron mesh to remove silt and small organic debris and preserved in ethanol.

Invertebrate samples were removed from the substrate using the “bucket method” (Jones *et al*. 2007) until 100 individuals were extracted. All invertebrates were removed from the sample where less than 100 individuals were present. Invertebrates were identified to the family level where possible.

Summary statistics from benthic invertebrate samples are provided in Table 3-9. Details of the sample locations are provided in Appendix B and raw data are provided in Appendix C.

Although it is difficult to interpret these indices without conducting a much more detailed study, the samples are composed of a relatively high proportion of Chironomids and low proportion of EPT (taxonomic orders of Ephemeteroptera, Plecoptera and Trichoptera). In comparison, samples from ten streams on the north shore of Lake Superior had % chironomids ranging from 17% to 44% and % EPT ranging from 16% to 60% (Deacon and Lavoie 2009). Most of the Boulevard Lake samples are outside this range, possibly due to the relatively low oxygen as expected in a reservoir with predominantly soft substrates but may also indicate nutrient enrichment from anthropogenic sources.

Figure 3-18 Benthic Invertebrate Sample Locations at Boulevard Lake, August 2016

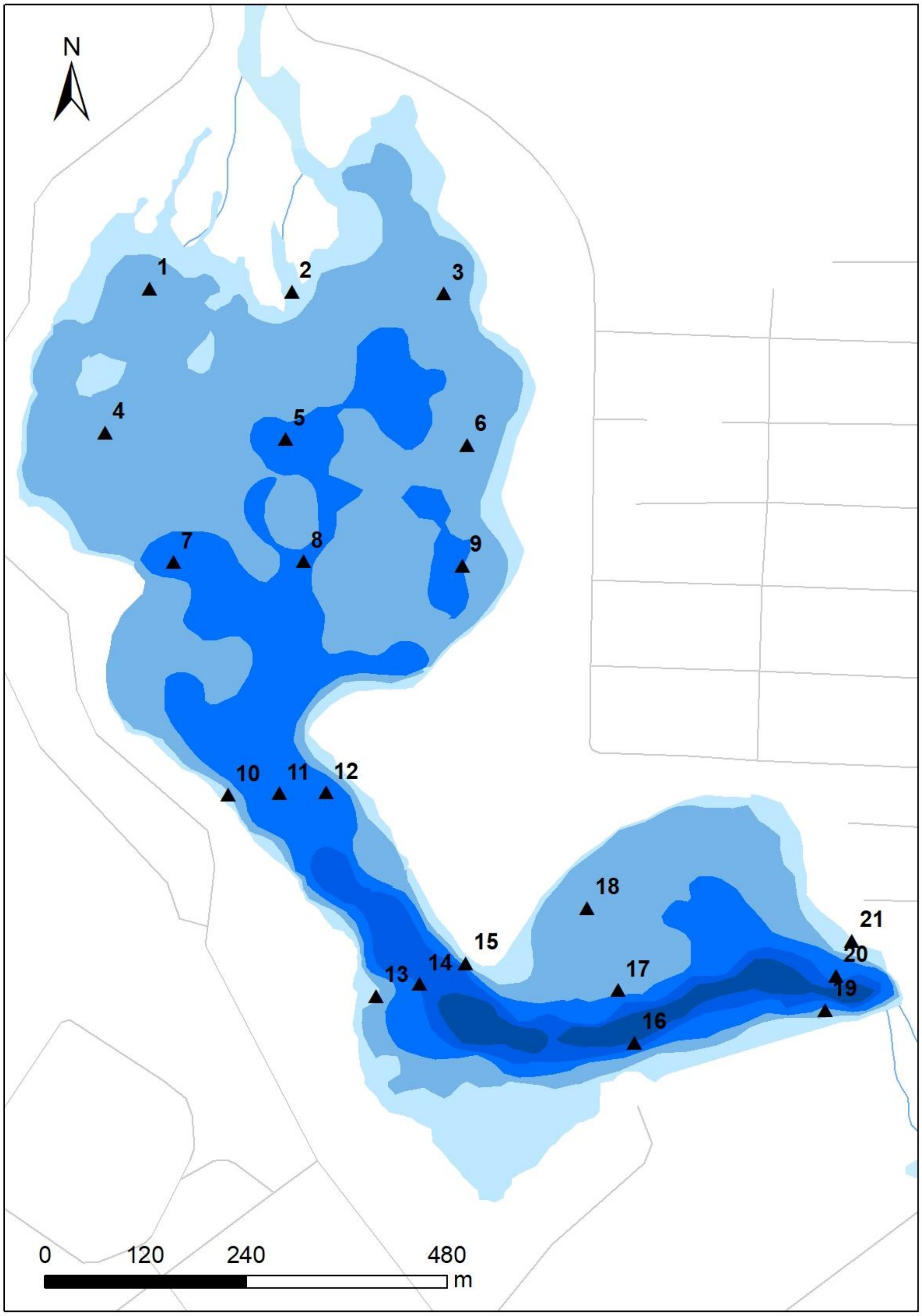


Table 3-9 Summary Statistics from Benthic Invertebrate Samples, Boulevard Lake. August 2016

Sample	No. Individuals	No. Taxa	% EPT	% Chironomids
1	90	8	3	84
2	70	7	6	73
3	66	11	3	70
4	81	9	4	69
5	37	8	8	38
6	46	8	4	35
7	49	8	12	61
8	41	7	5	68
9	40	8	10	70
10	99	11	5	80
11	32	9	3	41
12	31	5	32	45
13	53	3	4	96
14	5	3	20	60
15	50	9	16	70
16	23	6	9	65
17	25	5	0	60
18	49	6	6	76
19	8	7	25	13
20	23	6	4	22
21	30	6	3	60
Mean	**45**	**7**	**9**	**60**

3.2.5 Existing Atmospheric Environment

3.2.5.1 Background Air Quality Data Sources

Boulevard Lake Dam is located in an area characterized by parkland, green space, and forest. There are also residences in close proximity to the Dam, but there are no commercial or industrial operations, or major roadway adjacent to it. Therefore, air quality within the study area is expected to be generally good.

Air quality monitoring stations within Environment Canada's National Ambient Pollution Surveillance Program (NAPS) were selected to obtain representative ambient background concentrations for the study area. Data were obtained for the most recent available consecutive five years from each of the selected monitoring stations.

Particulate matter less than 2.5 microns ($PM_{2.5}$) and nitrogen oxides (NO_x) were chosen for review for this assessment as these are likely to be the two major compounds of concern that will be present during the rehabilitation of Boulevard Lake Dam.

For $PM_{2.5}$, and nitrogen dioxide (NO_2), station # 60809 at 421 James Street South is the only active monitoring site located in the general vicinity of the Study Area and is representative of the local climate. Table 3-10 below outlines the recent measurement history and a summary of the data used for this Assessment.

Table 3-10 NAPS Background Concentration Data

Monitoring Station	Contaminant	Years					
		2011	2012	2013	2014	2015	5-yr avg
421 James Street South Thunder Bay NAPS_ID 60809	**$PM_{2.5}$ (µg/m^{3*})**						
	24-hr 98th percentile	14	11	16	16	16	14.6
	24-hr 90th percentile	9	8	11	12	10	10
	Annual Mean	5	4	6	7	6	5.6
	NO_2 (µg/m^3)						
	1-hr 90th percentile	32	27	26	27	28	28
	24-hr 90th percentile	27	23	23	23	24	24

* microgram per cubic metre (µg/m^3)

Note: $PM_{2.5}$ calculated was the 3-year average of the annual 98th percentile of the Dailey 24-hour average concentrations.

3.2.5.2 Ambient Air Quality Criteria

The Ontario MECP has developed Ambient Air Quality Criteria (AAQC) as measures to protect outdoor air quality. An AAQC is a desirable concentration based on the protection against adverse effects on health and/or the environment and is meant to be used to assess general or "ambient" air quality conditions from all sources. Criteria for $PM_{2.5}$ and NO_x are discussed below.

Table 3-11 Ambient Air Quality Criteria for $PM_{2.5}$

Pollutant	Averaging Period	Source	Air Quality Criteria
$PM_{2.5}$	24-hour	CAAQS	27 µg/m^3 [a]
	Annual	CAAQS	8.8 µg/m^3 [b]

Notes:

[a] The Canadian Ambient Air Quality Standard (CAAQS) for 24-hr $PM_{2.5}$ is 28 µg/m^3 in 2015 and 27 µg/m^3 in 2020 based on the 98th percentile of 24-hour average concentrations, averaged over 3 consecutive years (CCME 2012). Since the Project will operate beyond 2020, the 2020 CAAQS was used.

[b] The CAAQS for annual $PM_{2.5}$ is 10 µg/m^3 in 2015 and 8.8 µg/m^3 in 2020. Since the Project will operate beyond 2020, the 2020 CAAQS was used.

Table 3-12 Ambient Air Quality Criteria for NO_2

Pollutant	Ambient Air Quality Criteria (µg/m³)			
	Annual	24-hour	8-hour	1-hour
NO_2	--	200	--	400

Table 3-13 compares the NAPS background concentration from station #60809 to the ambient air quality thresholds. The background values used in the analysis for $PM_{2.5}$ and NO_2 are much less than their relevant thresholds. The NAP station #60809 is located near the Thunder Bay airport in a mixed land use area consisting of industrial, commercial and residential zoning. A higher background concentration would be expected at the NAP station location compared to the Dam Study Area due to the contribution of emissions from industrial and commercial operations, as well as from airport and residential traffic. As a result, this background concentration can be considered conservatively high for the existing conditions within the Study Area.

Table 3-13 Comparison of Background Concentration to AAQC Limit

Pollutant	Background Concentration (µg/m³)	AAQC (µg/m³)	Percent of AAQC (%)
$PM_{2.5}$ (Annual)	5.6	8.8	64%
$PM_{2.5}$ (24-hour)	10	27	37%
NO_2 (1-hour)	28	400	7%
NO_2 (24-hour)	24	200	12%

3.2.6 Existing Noise Environment

The existing noise in the study area is dominated by the sound of water falling over Boulevard Lake Dam, sounds of nature such as rustling leaves and chirping birds, and normal conversations of people using Boulevard Lake Park for a variety of casual recreational activities. The volume of traffic in the immediate vicinity of Boulevard Lake Park is low, and as a result, traffic-generated noise is not a significant contributor to the overall sound environment in the study area.

3.3 Socio-Economic Environment

3.3.1 Description of Existing Land Uses

3.3.1.1 General

The study area is located within the Current River neighbourhood and has a population of about 5,500 people (Statistics Canada 2012a and 2012b). While Boulevard Lake Park, including the Boulevard Lake and dam, are the dominant features, there are residential dwellings located less than 40 m northeast of the dam. In addition, there are two schools, St. Ignatius High School and Claude E Garton Public School, the Current River Arena and Current River Community Centre, and the Thunder Bay Jail, surrounding the park.

3.3.1.2 Recreation

Boulevard Lake Park is used extensively for recreational purposes year-round, but especially in the summer. The lake is widely used by recreational flat-water paddlers and hosts events such as dragon boat races.

The following list describes the primary recreational uses within the park, as reported in the Boulevard Lake Area Improvement Plan (BLAIP) 2016:

- multi-modal circulation, including trails and roadway travel for walking, running, cycling, roller blading, etc.;
- non-motorized boating (paddle sports) on the water, such as canoeing and kayaking;
- nature appreciation such as bird watching and photography;
- formally programmed events such as dragon boat festival and running events;
- picnicking in various areas;
- swimming, in one of three main beach areas;
- mini-putt, operated by a third party vendor;
- public art with a sculpture garden area;
- formal play on playground equipment, disc golf and tennis courts; and,
- fishing.

3.3.1.3 Economic Activities

As discussed above, the Current River Hydro Partnership generates electricity and is the only economic activity associated with the dam and the park outside of park operations, recreation, and maintenance activities.

3.3.1.4 Planned Improvements

Future improvements are proposed for Boulevard Lake and park, as articulated in the BLAIP. The plan includes the development of an overall vision for the future use and maintenance of Boulevard Lake Park (BLAIP 2016). Implementation of these improvements is not part of the dam rehabilitation project.

The plan includes recommendations for improvement of five primary areas:

1. Improving Water Quality;
2. Enhancing Ecological Diversity;
3. Environmental Stewardship and Partnerships;
4. Vehicular and Multi-Modal Transportation; and,
5. Amenities, Programs and Events.

3.3.1.5 Park User Survey and Spot Counts

As part of the current Class EA, a park user survey was conducted to determine existing usage levels and patterns at Boulevard Lake Park. The survey was distributed using various methods:

- handed out at PICs;
- administered at various locations throughout the park; and
- made available online on the project page of the City of Thunder Bay website.

As most of the park users are engaged in active recreation such as walking, jogging, biking, cycling, they were often unable or unwilling to stop their individual activity to complete the survey. In such cases an information slip was handed to the park user directing them to the survey on the City's website where they can complete the survey at a more convenient time.

The survey was carried out during the summer, fall, and winter of 2016-2017 and a total of 292 respondents completed the survey. All of the survey questions as well as comprehensive analyses of all of the responses for each of the questions are included in Appendix D.

In addition to the survey, spot counts were also carried out. Spot counts were aimed at obtaining a 'snapshot' of Boulevard Lake Park usage and activities by observing patrons, when a comprehensive survey could not be administered.

The key results of the survey and spot counts are discussed below.

Frequency and Time of Park Use

Close to 90% of respondents indicated that they visit the park and about 47% responded that they used the park 1 to 2 times per week or more. Close to 74% indicated that they visit the park during both weekdays and the weekend. The results indicated that the majority, more than 70%, of respondents use the park either in the afternoons or in the evenings, or both. Over 54% of respondents reported spending between 1 to 2 hours at the park per visit.

Seasonality

The results show that over 61% of the respondents indicated that they used the park most frequently during the summer months, while over 66% reported that they used the park the least frequently during the winter season.

Activities at the Park

Overall, the survey revealed that park users are generally engaged in active recreation. On average, respondents noted that they participated in more than four primary activities while at the park, with 75% indicating that they had more than two primary activities. Walking was identified as the most common recreational activity of the respondents, with close to 80% of the respondents listing walking as one of their primary activities.

With regards to other activities, close to 30% of the respondents indicated that cycling was their primary activity, and a similar percentage indicated that walking the dog was their primary activity. Running was indicated as the primary activity by 27% of respondents. The rest of the responses were represented by 25% or lower of the total respondents, including: jogging (23%), use of playground (21%), meeting friends (20%), and golfing (17%).

Enjoyment of the Park

The survey results indicated that Boulevard Lake Park is enjoyed by its users. Over 61% of respondents agreed that they enjoyed their visits to the park. In terms of the best features of the park, the top three choices were: walking path (80%), Boulevard Lake (69%), and trees (68%). Other features enjoyed by a majority of park users included trails (58%), naturalized areas (50%), and bicycle paths (49%). As part of a standalone question in the survey, over 75% considered Boulevard Lake Dam as an important feature of the park.

The users of the park seemed to be of the opinion that maintenance of the park was 'Good' (the mean score was 2.11 out of a scale of 1 through 4, with 1 being 'Excellent' and 2 being 'Good'.

Improvements to the Park

Regarding park improvements, 64% of respondents indicated that providing wider trails was their top choice. This was followed by 41% who responded that public safety was the most important improvement to the Dam, and 40% of the respondents preferred the widening of pinch point at the gatehouse.

In this context, it is noted that 38% of the survey respondents rated the current pedestrian crossing as being in 'fair' condition and about 24% rated it as being in 'poor' condition.

In addition to the survey, spot counts were also carried out. Spot counts were aimed at obtaining a 'snapshot' of park usage and activities by observing patrons, when a comprehensive survey could not be administered. Spot counts were done on 13 days between July and September 2016. Walking/hiking were the top activities for users at the park, followed by jogging, running and cycling. Overall, 53% of users were female and 47% were male. Over 81% of users were over 15 years old and just under 19% were under 15 years of age.

3.4 Cultural Environment

3.4.1 Archaeological Resources

Stage 1 and 2 archaeological resource assessments were carried out for this project along with a marine archaeological assessment. A brief summary is provided in this section and the full report is provided in Supporting Document 2.

A total area of approximately 11.78 ha was subject to archaeological assessment, which included the study area (north of Cumberland Road, and west of Grenville Avenue) as well as the access road to the dam, and the laydown area.

Background research indicated that there are two registered archaeological sites within 1 km of the study area. There is also one unregistered site located in Boulevard Lake itself, an approximately 22 m wide circle of stones.

The field assessment methodology consisted of test pitting of the entire area, where test pitting was feasible, conducted at 5 m intervals. There were areas within the project that could not be test pitted due to various factors, some of which include: presence of slopes in excess of 20 degrees, permanent wet areas, intermittent creeks, and gravel roadbeds. Further details are described in Supporting Document 2.

An area of modern disturbance was also test pitted to ensure that all materials were from the 20th century, and not representative of an earlier site. Test pitting verified that materials were of recent vintage, dating to the mid-20th century. This area was not considered to have cultural heritage value or interest.

3.4.2 Built Heritage Resources and Cultural Heritage Landscapes

No built heritage resources were identified in the study area.

3.5 Aboriginal Communities

The City of Thunder Bay falls within the Robinson-Superior Treaty (1850) area. Based on the location of the project and consultations with the MECP, it was determined that the two communities described in Table 3-14 would have an interest in the project.

Table 3-14 Aboriginal Communities Contacted and Consulted at Project Commencement

Name	Description
Fort William First Nation	Archaeological records indicate that the Lake Superior Region (near Thunder Bay) was occupied by Aboriginal peoples of several successive cultural traditions for the last 10,000 years. The ancestors of the present day Fort William First Nation, the Ojibway Indians inhabiting Lake Superior (Kitchigami), called themselves the Anishnabe, meaning "first or original people". In historic texts they are often referred to as Chippewas, an English corruption of Ojibway, which itself originates from "o-jib-i-weg", meaning "the people who make pictographs". The present day Fort William Reserve was created in 1853, as a condition of the Robinson-Superior Treaty (FWFN, 2016).
Métis Nation of Ontario (MNO)	The Métis are a distinct Aboriginal people comprised of descendants of people born of relations between Indian women and European men, and territory that includes the waterways of Ontario, surrounds the Great Lakes, and spans what was known as the historic Northwest. Distinct Métis settlements emerged as an outgrowth of the fur trade, along freighting waterways and watersheds. In Ontario, these settlements were part of larger regional communities, interconnected by the highly mobile lifestyle of the Métis, the fur trade network, seasonal rounds, extensive kinship connections and a shared collective history and identity (MNO, 2016).

4.0 ALTERNATIVES TO THE UNDERTAKING

Alternatives to the undertaking are functionally different ways of solving the identified problem. For this project, there are four alternatives to be evaluated. Each alternative is described and then evaluated against the full definition of the environment:

- Do Nothing – No repairs to the dam would be made, and the concrete would continue to deteriorate at an accelerated rate. No redundancies in strength would be provided. The dam would continue to operate through stop log operations. Pedestrian traffic would remain unchanged at the dam. The dam will continue to perform satisfactorily for a limited horizon.

- Rehabilitate the Dam – All required concrete repairs would be completed and the *Lakes and Rivers Improvement Act* requirement for redundancies in strength would be met. Pedestrian traffic and movement across the dam would be improved. Stop log operations can be enhanced or replaced with gates to ensure the dam can adequately pass the regulatory storm.

- Reconstruct the Dam – Construct a new dam upstream or downstream of the existing dam. The new structure would be designed to all applicable codes and standards. Flow control, fish passage, and power generation could be greatly improved. The existing structure would be demolished.

- Remove the Dam – Completely remove all dam infrastructure and allow the Current River to return to its natural watercourse. Boulevard Lake, an important recreation area within Thunder Bay since 1909, would be eliminated.

A summary of the alternatives is presented in Table 4-1.

Table 4-1 Summary of Alternatives

Component	Criteria	Do Nothing	Rehabilitate	Reconstruct	Remove
Natural	Change to aquatic species and habitat	No changes anticipated	Most Preferred – Construction timing and methods may have short term effects on species and habitats.	Most Preferred – Construction timing and methods may have short term effects on species and habitats.	Least Preferred – Dam removal would return Current River flows to pre-development conditions. Demolition activities may have short term effects on species and habitat. With no dam, Steelhead salmon could presumably move upstream. Undesirable invasive species such as Sea Lamprey could also invade the Current River watershed.
	Change to function/operation of existing fish ladder	No change anticipated	Most Preferred – May be opportunities to improve fish ladder function.	Most Preferred – May be opportunities to improve fish ladder function.	Least Preferred – Fish ladder would be removed impeding fish movement.
	Change to terrestrial habitat	No changes anticipated.	Most Preferred – No changes anticipated.	Least Preferred - Depending on size of construction footprint some terrestrial vegetation may be removed temporarily.	Most Preferred – Additional lands associated with drained Boulevard Lake would now be available for re-population as terrestrial habitat. It is unknown at the time of this assessment as to whether or not those lands would require remediation or restoration to make them usable.

Table 4-1 Summary of Alternatives (Cont'd)

Component	Criteria	Do Nothing	Rehabilitate	Reconstruct	Remove
Social	Change to recreational opportunities available in Boulevard Lake Park	No changes	No changes	No changes	Most Preferred – Land area available for recreational activities may be increased as lake disappears.
	Change in recreational opportunities available in Boulevard Lake	No changes	Most Preferred – Recreational opportunities will be disrupted during construction but rehabilitated dam will permit continued use of lake.	Most Preferred – Recreational opportunities will be disrupted during construction but reconstructed dam will permit continued use of lake.	Least Preferred – Recreational opportunities currently available in Boulevard Lake will disappear.
	Change in the ease of pedestrian access on top of the dam	Least Preferred – Over time the pedestrian access over the bridge may become unusable due to deterioration of concrete.	Most Preferred – Temporary restriction of pedestrian access during construction. Opportunity to provide wider access with proper handrails and to alleviate user conflict with dam operations.	Most Preferred – Temporary restriction of pedestrian access during construction. Opportunity to provide wider access with proper handrails and to alleviate user conflict with dam operations.	Least Preferred – Access will be lost permanently as a result of loss of the dam.
	Change to viability of small hydro generation	Most Preferred – No changes	Most Preferred – Small hydro generation would remain viable at existing capacity. There may be a short-term disruption during the construction period.	Most Preferred – Small hydro generation would remain viable and may be available at increased capacity depending on design of new dam. There may be a short-term disruption during the construction period.	Least Preferred – Small hydro generation would not be viable if dam was removed.

Table 4-1 Summary of Alternatives (Cont'd)

Component	Criteria	Do Nothing	Rehabilitate	Reconstruct	Remove
Technical	Ability of Dam strength to withstand flood waters associated with the regulatory storm	Least Preferred – No redundancies in strength will be provided increasing the risk of dam failure.". Removal of stop logs is slow.	Moderately Preferred – Redundancies in strength shall be provided. Some stop logs may be replaced by gates, reducing time required to adjust the dam to manage the regulatory storm.	Most Preferred – Redundancies in strength shall be provided. The new structure will be designed for rapid response to the regulatory storm.	N/A
	Ease of dam operations	Least Preferred – Stop log operations are labour intensive and slow.	Moderately Preferred – Some stop logs may be replaced with gates.	Most Preferred – The new structure will be designed with a modern means to control flow.	N/A
	Ability of the dam to withstand flood waters associated with the Inflow Design Flood	Least Preferred – No redundancies in strength to withstand the Regulatory Flood. Risk of potential dam failure due to continued deterioration. Removal of stop logs is slow.	Moderately Preferred – Redundancies in strength shall be provided. Some stop logs may be replaced with gates, reducing time required to adjust the dam for the Inflow Design Flood.	Most Preferred – Redundancies in strength shall be provided. The new structure will be designed for rapid response to the Inflow Design Flood.	N/A
Cost	Capital Cost	Most Preferred – No additional costs to the City of Thunder Bay to do nothing.	Moderately Preferred – Capital costs will be required on the part of the City of Thunder Bay to rehabilitate the dam.	Least Preferred – Significant capital costs will be required to reconstruct the entire dam.	Moderately Preferred – Capital costs will be required on the part of the City of Thunder Bay to remove the dam.
	Operating and Maintenance Cost	Least Preferred – Repairs will be required soon due to the rapidly deteriorating concrete.	Moderately Preferred – Maintenance will eventually be required on areas not rehabilitated, as a result of this project.	Moderately/Most Preferred – Maintenance will eventually be required on the new structure; however, it will likely deteriorate slower that the rehabilitated structure.	Most Preferred – Elimination of operating and maintenance costs of dam.

5.0 ALTERNATIVE METHODS

5.1 Identification of Alternative Methods

As shown in Chapter 4, rehabilitation is the preferred solution for addressing the current structural issues with the Boulevard Lake Dam. Rehabilitating the dam, however, requires consideration of several alternative design methods.

Several options were considered under each sub-alternative and were identified by the study team based on professional experience, project specific considerations and issues and input from the public. The following is a list of the alternatives identified and then evaluated.

The components of any alternative method for this project include:

- alternative ways to address the need for redundancies in strength;
- alternative ways to rehabilitate the protective concrete;
- alternative ways to provide public access across the dam infrastructure;
- alternative ways to operate the dam; and
- alternative ways to undertake construction.

The alternatives within each component are described in the tables below (Table 5-1 through Table 5-5).

Table 5-1 Addressing the Need for Redundancies in Strength

Description of Sub-Alternatives: Addressing Need for Redundancies in Strength					
Technical Criteria	**Option 1A Provide Redundant Set of Post-Tensioned Anchors**	**Option 1B Provide Additional Mass Upstream/Downstream**	**Option 1C Convert Spillways to Sluiceways – Increase Hydraulic Capacity**	**Option 1D Construct Emergency Sluiceway**	**Option 1E Construct New Storage Reservoir**
Description of Alternative	• Install a redundant set of post-tensioned tendons in every buttress and along the east retaining wall. The new anchors would be designed for the full design forces without considering the benefit of the existing anchors.	• Add mass by approximately doubling the width of the dam base. The additional mass would make the effects of the existing post-tensioned anchors obsolete.	• Convert spillways to sluiceways increasing the hydraulic capacity of the dam, which would lower the water level during the Inflow Design Flood and reduce the design forces imparted on the dam. However, to maintain a factor of safety of 1.5 at the sluiceways (considering the existing post-tensioned tendons as the redundant element), the water level must be maintained approximately 300 mm lower than the current summer set elevation. Option 1A or Option 1B must also be done, but with a reduced strengthening solution (i.e. weaker anchors or less mass), since the water elevation during the IDF is lowered with this option.	• Construct an emergency spillway which would lower the water level during the Inflow Design Flood and reduce the design forces imparted on the dam. However, to maintain a factor of safety of 1.5 at the sluiceways (considering the existing post-tensioned tendons as the redundant element), the water level must be maintained approximately 300 mm lower than the current summer set elevation.	• Construct a new storage reservoir upstream of Boulevard Lake that would control the inflow into Boulevard Lake and reduce the water level during major rainfall events. An additional solution is still required at the sluiceways, or the water level must be maintained approximately 300 mm lower than the current summer set elevation. Option 1A or Option 1B must also be done, but with a reduced strengthening solution (i.e. weaker anchors or less mass), since the water elevation during the IDF is lower with this option. The additional solution must be implemented for redundancy during normal water levels.

Table 5-1 Addressing the Need for Redundancies in Strength (Cont'd)

Description of Sub-Alternatives: Addressing Need for Redundancies in Strength					
Technical Criteria	**Option 1A Provide Redundant Set of Post-Tensioned Anchors**	**Option 1B Provide Additional Mass Upstream/Downstream**	**Option 1C Convert Spillways to Sluiceways – Increase Hydraulic Capacity**	**Option 1D Construct Emergency Sluiceway**	**Option 1E Construct New Storage Reservoir**
Description of Alternative (Cont'd)				• Therefore, an additional solution (new post-tensioned tendons or adding mass) must be implemented in conjunction with this alternative. • Option 1A or Option 1B must also be done, but with a reduced strengthening solution (i.e. weaker anchors or less mass), since the water elevation during the IDF is lower with this option.	
Description of Construction	• Drill rig and specialized equipment required to core holes to install anchors (steel rods) through the deck and each buttress into bedrock.	• A large volume of concrete (26 m^3 per sluiceway, 20 m^3 per spillway) could be provided upstream, dowelled to the existing structure, and keyed in or dowelled to the bedrock base. • Lakebed material must be removed down to bedrock to pour concrete.	• The concrete at the spillways would be removed full height between buttresses, and new sills complete with stop log gains (steel channels in which the stop logs are stacked) and stop logs or gates would be provided.	• A concrete sluiceway would need to be constructed to divert water around the dam, likely at the west approach. • Significant design and approval timelines required.	• Site of new reservoir and size of dam would need to be determined. • Construction would involve significant laydown and construction areas including access roads.

Table 5-1 Addressing the Need for Redundancies in Strength (Cont'd)

Description of Sub-Alternatives: Addressing Need for Redundancies in Strength					
Technical Criteria	**Option 1A Provide Redundant Set of Post-Tensioned Anchors**	**Option 1B Provide Additional Mass Upstream/Downstream**	**Option 1C Convert Spillways to Sluiceways – Increase Hydraulic Capacity**	**Option 1D Construct Emergency Sluiceway**	**Option 1E Construct New Storage Reservoir**
Description of Construction (Cont'd)	• The relatively small buttresses with aged concrete would now be compressed by two post tensioned anchors. • Desirable to construct in above freezing temperatures. • Work in water is not required for this alternative.	• A cofferdam would be required in Year 1 to construct upstream. • Alternatively, the downstream face could be encapsulated for additional mass. • Work should be done with ambient temperatures above 0°C. Otherwise, heating and hoarding may be required.	• Removal of large volume of concrete at the spillways may weaken the adjacent buttresses. • Dynamics induced in structure during removal process may further damage the buttresses. • Additional gates/stop logs must be provided. • Depending on the water level maintained during construction, may need to be done inside a temporary cofferdam. • Work should be done with ambient temperatures above 0°C. Otherwise, heating and hoarding may be required. • Construction of reduced version of options 1 or 2 would also be required.	• Significant addition to the currently envisioned repair scope of work for this project. • An additional redundancy solution would still be required (post-tensioned anchors or add mass). • A cofferdam would be required to construct the spillway. • Construction of reduced version of options 1 or 2 would also be required.	• Significant addition to the currently envisioned repair scope of work for this project. • An additional redundancy solution would still be required (i.e. post-tensioned anchors or add mass). • Work should be done with ambient temperatures above 0°C. Otherwise, heating and hoarding may be required. • Construction of reduced version of options 1 or 2 would also be required.
	• 8 to 12 weeks to construct.	• 16 to 20 weeks to construct. • May be difficult to complete all upstream work in one construction season.	• 20 to 24 weeks to construct. • Would be difficult to complete work in one construction season.	• 20 to 24 weeks to construct. • 1 year ± for design/approvals.	• 1 to 2 years to construct. • 2+ years for design/approvals.

Table 5-2 Rehabilitation of Concrete

Description of Sub-Alternatives: Rehabilitation of Concrete				
Technical Criteria	**Option 2A Patching**	**Option 2B Refacing**	**Option 2C Repair and Encapsulating**	**Option 2D Replacing**
Description of Alternative	• Involves removing deteriorated concrete locally, abrasive blast cleaning the existing reinforcing steel, providing new reinforcing steel if required, and replacing the concrete. This solution is appropriate for random surface deterioration. The end product may appear "patchy".	• Involves removing the surface layer of concrete globally, abrasive blast cleaning the existing reinforcing steel, providing new reinforcing steel if required, and replacing the concrete. This solution is appropriate for global deterioration of a particular element. The end product appears uniform; however sound concrete may be replaced in the process.	• Involves doweling into and pouring new reinforced concrete up against the existing concrete. The deteriorated elements are cleaned, and structural cracks are repaired by epoxy injection prior to encapsulating.	• Involves removing the deteriorated concrete element in its entirety and replacing it with new. All deteriorated aspects are addressed with this method.
Description of Construction	• Remove spot areas of deteriorated concrete down to first layer of reinforcing steel. • Overlay may be required over entire surface to improve aesthetics. • Unknown reinforcing steel location and condition may require new reinforcing steel and dowelling. • Structural crack repairs to be done prior to patching.	• Remove entire surface area to a pre-determined depth. • Some sound concrete may be removed. • Unknown reinforcing steel location and condition may require new reinforcing steel and dowelling. • Structural crack repairs to be done prior to refacing.	• Provide new concrete over existing concrete. • Structural repairs to be done prior to encapsulating. • Additional mass is effective for dam stability.	• Replace deteriorated elements with new concrete. • More feasible than other repairs for elements with significant deterioration such as the thin slabs over the spillways.
Life Expectancy of Repairs	• Lowest	• Medium	• Medium	• Highest

Table 5-3 Pedestrian Movement at the Dam

Description of Sub-Alternatives: Pedestrian Movement at the Dam					
Technical Criteria	**Option 3A Existing Geometry to Remain (Do Nothing)**	**Option 3B Widen Deck at Spillways to Match Width at Sluiceways**	**Option 3C Widen Entire Deck to City of Thunder Bay Standard Trail Width**	**Option 3D Close Deck to Pedestrian Traffic**	**Option 3E Close Deck and Provide Alternative Pedestrian Route**
Description of Alternative	• The walkway width would be left as is across the dam. The existing deck at the sluiceways is narrower than the Boulevard Lake pedestrian trail, and is further narrowed by stop logs stored on the deck. The existing deck is narrower at the spillways and at the gatehouse, potentially affecting pedestrian traffic flow.	• The deck width at the spillways would be widened to 2.134 m clear to provide a more uniform width across the dam. A pedestrian bridge would be provided near the gatehouse to widen the walkway and move pedestrian traffic away from the building. Alternatively, a widening solution could be implemented at the gatehouse with pedestrian traffic continuing to travel within proximity of the building. The walkway width would be narrower than the Boulevard Lake pedestrian trail, and would still be impeded by stop logs stored on the deck at the sluiceways.	• The deck width at the spillways, sluiceways, and near the gatehouse would be widened to provide a uniform width across the dam consistent with the pedestrian trail. A pedestrian bridge could be included near the gatehouse. The deck width could be further widened at the sluiceways to account for stop logs stored on the deck.	• Dam operations can proceed unhindered by pedestrian movement. Pedestrian traffic would be rerouted to cross the Current River at the Cumberland Street bridge.	• Dam operations can proceed unhindered by pedestrian movement. A new pedestrian bridge over the Current River could be considered. Pedestrian traffic would be rerouted to cross the Current River at the new pedestrian bridge.
Description of Construction	• Slab repairs still required. • Railing system to be replaced with code compliant system.	• Replace deck at spillways. • Railing system to be replaced with code compliant system. • Pedestrian bridge to be provided to eliminate bottleneck at gatehouse and improve horizontal alignment.	• Replace deck at spillways, widen or replace deck at sluiceways. • Pedestrian bridge to be provided to eliminate bottleneck at gatehouse and improve horizontal alignment.	• Structural repairs still required. • Entrances to be barricaded.	• Patching repairs to be completed. • Alternative route to be established. • Large pedestrian bridge to be constructed as alternative to cross Current River.

Table 5-4 Dam Operation

Description of Sub-Alternatives: Dam Operations				
Technical Criteria	**Option 4A Existing Stop Logs Remain**	**Option 4B Provide Mechanical Gates at Three Locations with Remaining Stop Logs to be Replaced with Manual Gates**	**Option 4C Provide Mechanical Gates at all Locations**	**Option 4D Provide Automated Gates at all Locations**
Description of Alternative	• Stop logs are removed/replaced utilizing the overhead steel monorail system. The process is labour intensive and time consuming. Coarse adjustments are made to the water level by removing/replacing 300 mm thick stop logs. For the dam to pass the Inflow Design Flood, all eight stop logs in all 11 sluiceways must be removed. It may be physically impossible to remove the lower logs utilizing the current method with flow over and through the dam.	• Mechanical gates allow the control of flow by manually operating the gates by a hand crank. Mechanical gates are significantly less time consuming and labour intensive than stop log operations. Gates allow a finer adjustment of water levels. However, during a flood event, dam personnel must still travel to the site to operate the gates. • The stop logs at the east end of the structure are most frequently operated to respond to rainfall events. However, at least one stop log is removed at every sluiceway seasonally to adjust between summer set elevation and winter set elevation. Gates could be installed to ease operations with priority given to the east end of the structure.	• Mechanical gates allow the control of flow by manually operating the gates by a hand crank. Mechanical gates are significantly less time consuming and labour intensive than stop log operations. Gates allow a finer adjustment of water levels. However, during a flood event, dam personnel must still travel to the site to operate the gates. • Gates at all sluiceways greatly improves the emergency readiness of the dam. Due to the infrequency of the Inflow Design Flood, the six western gates would only be operated within the top 300 mm of their range.	• Automated gates allow the control of flow by raising and lowering the gates with electronic controls, on or off site. Gates allow a finer adjustment of water levels. Automated gates reduce the overall time required to respond to flood scenarios.

Table 5-4 Dam Operation (Cont'd)

Description of Sub-Alternatives: Dam Operations				
Technical Criteria	**Option 4A Existing Stop Logs Remain**	**Option 4B Provide Mechanical Gates at Three Locations with Remaining Stop Logs to be Replaced with Manual Gates**	**Option 4C Provide Mechanical Gates at all Locations**	**Option 4D Provide Automated Gates at all Locations**
Description of Construction	• Local repairs to gains and surrounding concrete required. • Access for workers must be maintained. • Logs require periodic maintenance and/or replacement.	• All existing stop logs will be removed. • Manually operated mechanical gates installed at sluiceways 1, 3, and 4, with the remainder of the stop logs replaced with fully manual gates. • Buttress extensions required at these locations. • Mechanical gates are capable of conversion to automation at a later date, if required. • Must be installed behind temporary cofferdam.	• Buttress extensions required. • Access must be provided for workers to manually manipulate cranks to raise/lower gates. • Must be installed behind temporary cofferdam.	• Buttress extensions required. • Must be installed behind temporary cofferdam.
Description of Operation	• During flood events, workers must manually remove logs using overhead monorail. • Workers manually manipulate logs twice a year for summer/winter water elevation. • At least one stop log is removed from each of the 11 sluiceway twice yearly. • All stop logs (8 per sluiceway) must be removed during the IDF.	• During flood events or regular water surface manipulation, workers must manually adjust gates.	• During flood events or regular water surface manipulation, workers must manually adjust gates.	• During flood events or regular water surface manipulation, workers adjust the gates remotely.

Table 5-5 Ways to Undertake Construction

Description of Alternatives: Construction Methods						
Technical Criteria	Construction Methods				Water Surface Elevations (In Combination with Construction Methods)	
	Option 5A Two Cofferdams	Option 5B Several Small Cofferdams	Option 5C No Cofferdam, Repairs in the Wet	Option 5D Cofferdams, Winter Construction	Lower Water Level During Construction	Maintain Regular Water Levels During Construction
Description of Alternative	• Construct cofferdams in two stages to complete upstream construction. Minimum flow of 0.4 m^3/s must be maintained over and through the dam. Therefore, all sluiceways cannot be rehabilitated at the same time.	• Construct a single, smaller, mobile cofferdam to complete upstream construction in several stages. Numerous construction joints are expected with this method. Flows can be more easily maintained over and through the dam. However, the duration of construction is increased.	• Removal of debris at the upstream toe of the dam and installation of concrete forms/reinforcement can be installed by diving crews. This method is riskier for those performing the work, and there is less opportunity for quality control/assurance. Therefore, higher risk of earlier/more expensive repairs in the future. Costs and duration are higher than other alternatives.	• The lake is lowered to normal winter levels during the late fall and winter months. The lowered water surface elevation could reduce the length and cost of the cofferdam but cold weather construction is slower and more costly.	• The water level during dam rehabilitation can be maintained lower than the normal summer set elevation (potentially as low as 208.34 m) throughout construction to reduce the cost of the temporary cofferdam, where applicable, and to reduce the risks associated with cofferdam construction and project resiliency to extreme weather events. Not required for 5C. • Depending on lowered water level, flow over and through the dam of 0.4 m^3/s can still be maintained.	• Water level to be maintained in compliance with existing water management plan at normal summer set elevation throughout the duration of construction.
Description of Construction	• Lake may be lowered to natural stream elevation (208.3 m) three times in year one during construction to facilitate installation and removal of two stages of cofferdam.	• Lake may be lowered to natural stream several times during construction to facilitate several stages of cofferdam.	• Removal of debris, installation of reinforcement and forms can be done by diving crews.	• Lowered water level during construction may reduce cost of cofferdam. • Ice effects would need to be considered. • Winter construction methods may increase the cost of concrete repairs.	• To reduce the costs and risks associated with the cofferdam, the water level during dam rehabilitation may be lowered. • Less seepage below/through cofferdam.	• Cofferdam difficult to construct in normal water level. • Minimum flow of 0.4 m^3/s must be maintained at all times.

Table 5-5 Ways to Undertake Construction (Cont'd)

Description of Alternatives: Construction Methods						
Technical Criteria	Construction Methods				Water Surface Elevation (In Combination with Construction Methods)s	
	Option 5A Two Cofferdams	Option 5B Several Small Cofferdams	Option 5C No Cofferdam, Repairs In the Wet	Option 5D Cofferdams, Winter Construction	Lower Water Level During Construction	Maintain Regular Water Levels During Construction
Description of Construction (Cont'd)	• Cofferdams must be designed to restrain a minimum water surface elevation and minimum flood event. (Normal summer elevation = 211.71 m, Normal winter elevation = 210.4 m, sluiceway sill = 209.5 m). • Cofferdams will be designed based on a minimum two-year storm return level. • Water from inside cofferdam must be treated when dewatered. A larger area dewatered behind cofferdam will increase dewatering/treatment required. • More construction alternatives can be done behind large cofferdam.	• Cofferdams must be designed to restrain a minimum water surface elevation and minimum flood event. • Dewatering and treatment simplified when using a smaller cofferdam. • Less construction alternatives behind smaller cofferdam.	• Less quality control. • Dredging inside the water course at toe is required. • Specialized diving crews will be required. • Unique, expensive construction techniques required.	• No change in water levels during winter construction. • Heating and hoarding is required to ensure proper concrete curing, increasing costs.	• Easier to initially install cofferdam in lowered water level.	

Table 5-5 Ways to Undertake Construction (Cont'd)

	Description of Alternatives: Construction Methods					
Technical Criteria	**In the Dry**				**Water Surface Elevations**	
	Option 5A Two Cofferdams	**Option 5B Several Small Cofferdams**	**Option 5C No Cofferdam, Repairs in the Wet**	**Option 5D Cofferdams, Winter Construction**	**Lower Water Level During Construction**	**Maintain Regular Water Levels During Construction**
Duration	• Two to four weeks required to install each cofferdam stage. • Three installation/removal events during a single year of upstream work. • Upstream work will be completed in a single season barring significant unforeseen issues.	• One to two weeks required to install each stage of cofferdam. • Ten or more (10+) installs required. • Two or more construction seasons will likely be required for upstream work.	• Two or more construction seasons for upstream work.	• Work can be done outside of normal construction windows. • Work in the winter will result in increased costs.	• Entire construction season. Minimum flow of 0.4 m^3/s still maintained over and through the dam as per the PTTW.	• Entire construction season. • Water level to remain at normal level, always.
Risks	• Large dewatered area could be affected by an unusually larger flood event. • Seepage concerns through foundation below cofferdam base especially if summer lake level remains unchanged. • More seepage/dewatering results from maintaining the lake level higher.	• Smaller cofferdam, smaller dewatered area carries less risk during larger flood event. • More seepage / dewatering results from maintaining the lake level higher.	• Diving crews performing work take on risk. • A poorer end product may result due to less quality control due to poor visibility and few people have the opportunity to inspect.	• A slightly poorer end product may result due to reduced ability to control quality during winter construction. • Failure of heating/hoarding would negatively impact the final product and result in schedule delays. • Cofferdam risks also apply to this option.	• Lesser risks with less water pressure on cofferdam. • Possible temporary impact to habitat and aquatic life.	• Greater risk of seepage, dewatering and weather event delays. • Potentially huge increase in costs. • Seepage into dewatered area must be pumped out and treated in order to complete works in the dry.

5.2 Comparative Evaluation of Alternatives

5.2.1 Comparative Evaluation Framework

The alternatives within each component have been assessed and compared to choose the most preferred component. All of the preferred components will be combined into one preferred alternative. The evaluation of the alternatives was undertaken using comparative criteria and indicators representing the full definition of the environment. The evaluation criteria are all considered to have equal levels of importance.

The comparative evaluation of alternatives for each component involved three key steps as listed below:

1. finalization of comparative evaluation criteria and indicators;
2. assessment of effects (positive and negative) by indicator for each alternative and determination of the alternatives relative preference ranking at a criterion level; and,
3. comparative evaluation of the alternatives for each component to identify the alternative that best resolves the problems identified with minimal impact and value for cost.

Each option within each sub-alternative was compared to a number of specific criteria to determine their level of preference, ranging from least preferred to most preferred. The criteria considered included among others, natural environmental effects, waste management, effects on park usage and enjoyment, and costs. The criteria also reflect the issues and concerns raised by the local community, regulatory agencies and other stakeholders. Table 5-6 summarizes the evaluation of the alternative design methods that were considered providing redundancies in strength for the Boulevard Lake Dam. The criteria used are presented as potential environmental effects within the table.

Table 5-6 Addressing the Need for Redundancies in Strength

Screening of Sub-Alternatives: Addressing Need for Redundancies in Strength					
Potential Environmental Effects	**Option 1A Provide Redundant Set of Post-Tensioned Anchors**	**Option 1B Provide Additional Mass Upstream/Downstream**	**Option 1C Convert Spillways to Sluiceways – Increase Hydraulic Capacity**	**Option 1D Construct Emergency Spillway**	**Option 1E Construct New Storage Reservoir**
Natural Environment	No effects to natural environment.	Lakebed will be disturbed.	• Unknown implications for habitat in the bypass reach (between the dam and the tailrace).	• Lakebed will be disturbed. • Shoreline disturbed at west approach. • Unknown implications for habitat in the bypass reach (between the dam and the tailrace). • Alternate discharge flow route would occupy new footprint of natural habitat.	• Inundating a large area of forest/greenspace. • New lake formed. • Loss of river habitat. • Access roads/ laydown area through forests. • Another barrier for fish on Current River. • Potential for elevated mercury in fish. • Warming effect on Boulevard Lake water with increased surface area and residence time.
Water Quality and Quantity	Post-tensioned anchors are installed out of water	Stream flow would need to be maintained and coordinated/diverted during construction.	Stream flow would need to be maintained and coordinated/diverted during construction.	Stream flow would need to be maintained and coordinated/diverted during construction.	Diversion of the river around new dam required.
Waste Management	Slurry from drilling to be contained then disposed off site.	Dredged material from lakebed. Concrete formwork debris.	Debris from demolition to be contained, then disposed off site. Concrete formwork debris.	Disposal of excavated soil and/or rock. Concrete formwork debris.	Disposal of excavated soils and/or rock from footprint of dam and outflow discharge spillway. Concrete formwork debris.

Table 5-6 Addressing the Need for Redundancies in Strength (Cont'd)

Screening of Sub-Alternatives: Addressing Need for Redundancies in Strength					
Potential Environmental Effects	**Option 1A Provide Redundant Set of Post-Tensioned Anchors**	**Option 1B Provide Additional Mass Upstream/Downstream**	**Option 1C Convert Spillways to Sluiceways – Increase Hydraulic Capacity**	**Option 1D Construct Emergency Spillway**	**Option 1E Construct New Storage Reservoir**
Potential to contribute GHG to atmosphere or diminish available carbon sink	None anticipated.	Large amount of CO_2 generated in production of additional cement for the concrete.	Large amount of CO_2 generated in production of additional cement for the concrete.	Large amount of CO_2 generated in production of additional cement for the concrete.	Inundating a large area of forest/greenspace. Large amount of CO_2 generated in production of additional cement for the concrete.
Erosion Potential	No change.	Minor erosion potential if downstream mass installed. If upstream mass installation requires lake dewatering then erosion potential increases. Reduced with cofferdam.	Some erosion potential with partial lake dewatering, Reduced with cofferdam dam use.	Some erosion potential with partial lake dewatering, Reduced with cofferdam use. Some downstream erosion potential for new spillway.	Greatest erosion potential with new area cleared and flooded. Potential for floating wood debris etc.
Potential to effect hydro power generating facility	No change anticipated.	Generating capacity may be reduced during construction.	Generating capacity may be reduced during construction.	Generating capacity may be reduced during construction.	Generating capacity may be reduced during construction.
Potential to effect park use and enjoyment	No pedestrian movement across dam during construction.	• Pedestrian movement across the dam may continue during construction. • Recreational use of lake will be affected if lake drawdown occurs. • Park areas near exposed lakebed may not be desirable for recreational activities.	• No pedestrian movement across dam during construction. • Recreational use of lake will be affected if lake drawdown occurs. • Park areas near exposed lakebed may not be desirable for recreational activities.	• No pedestrian movement across the dam during construction. • Recreational use of lake will be affected if lake drawdown occurs. • Park areas near exposed lakebed may not be desirable for recreational activities.	None anticipated.

Table 5-6 Addressing the Need for Redundancies in Strength (Cont'd)

Screening of Sub-Alternatives: Addressing Need for Redundancies in Strength					
Potential Environmental Effects	**Option 1A Provide Redundant Set of Post-Tensioned Anchors**	**Option 1B Provide Additional Mass Upstream/Downstream**	**Option 1C Convert Spillways to Sluiceways – Increase Hydraulic Capacity**	**Option 1D Construct Emergency Spillway**	**Option 1E Construct New Storage Reservoir**
Potential for nuisance effects to residents and park users	• Construction noise. • Construction traffic and changes to access. • Dust.	• Construction noise. • Potential release of odours from exposed lakebed. • Construction traffic and changes to access. • Dust.	• Construction noise. • Construction traffic and changes to access. • Dust.	• Construction noise. • Construction traffic and changes to access. • Dust.	• Construction noise. • Construction traffic and changes to access. • Dust. • Potential residents affected are geographically removed from Boulevard Lake.
Aesthetics	No visible change.	A larger concrete mass will be exposed, particularly if placed on the downstream.	Uniformity of sluiceways across the full length of the dam will change aesthetics.	Emergency spillway will significantly alter the appearance of the west approach.	No visible change to Boulevard Lake Dam.
Cost	Low	Medium	High	High	Highest
SUMMARY	Alternative has fewest potential effects which are generally mitigable and lowest cost. **MOST PREFERRED**	Alternative has moderate potential effects which are generally mitigable and moderate cost. It is generally preferable to rely on a large mass for dam stability instead of slender anchors. **MODERATELY PREFERRED**	Alternative has moderate potential effects which are generally mitigable and high cost. Existing spillway anchors will now be additionally stressed with the elimination of mass concrete. **LEAST PREFERRED**	Alternative has moderate potential effects some which may be difficult to mitigate depending on spillway location and high cost. **SECOND LEAST PREFERRED**	Alternative has most potential effects depending on location of reservoir and dam and highest cost. **LEAST PREFERRED**

With respect to addressing the need for redundancies in strength, Option 1A is most preferred overall as it has the fewest effects to the environment and the lowest cost. Potential nuisance effects related to construction activities are easily mitigated.

Table 5-7 summarizes the evaluation of the alternative design methods that were considered for rehabilitation of concrete for the Boulevard Lake Dam.

Table 5-7 Rehabilitation of Concrete

Screening of Sub-Alternatives: Rehabilitation of Concrete				
Potential Environmental Effects	**Option 2A Patching**	**Option 2B Refacing**	**Option 2C Repair and Encapsulate**	**Option 2D Replacing**
Waste Management	Concrete wastewater would be generated. Concrete wastewater is considered a deleterious substance under the *Fisheries Act*. Concrete leachate is alkaline and highly toxic to fish and other aquatic life.	Concrete wastewater would be generated. Concrete wastewater is considered a deleterious substance under the *Fisheries Act*. Concrete leachate is alkaline and highly toxic to fish and other aquatic life. Additional waste from removal of good concrete.	Concrete wastewater would be generated. Concrete wastewater is considered a deleterious substance under the *Fisheries Act*. Concrete leachate is alkaline and highly toxic to fish and other aquatic life.	Concrete wastewater would be generated. Concrete wastewater is considered a deleterious substance under the *Fisheries Act*. Concrete leachate is alkaline and highly toxic to fish and other aquatic life. Additional waste generated from removal of good concrete.
Potential to contribute GHG to atmosphere or diminish available carbon sink	Least amount of CO_2 generating cement used for concrete.	Some CO_2 generating cement used for concrete.	Some CO_2 generating cement used for concrete.	Greatest amount of CO_2 generating cement used for concrete.
Aesthetics	May appear patchy when complete.	Uniform appearance when complete.	Uniform appearance.	Uniform appearance.
Cost	Lowest initial cost but subsequent repairs likely required.	Medium initial cost, medium lifespan.	Medium initial cost. Medium lifespan.	Highest initial cost but longest repair lifespan.
SUMMARY	Alternative has fewest potential effects which are generally mitigable and lowest cost. Least amount of CO_2 generating cement used for concrete. Lowest initial cost but subsequent repairs likely required. **MOST PREFERRED**	Alternative has moderate potential effects which are generally mitigable and moderate cost. Some CO_2 generating cement used for concrete. Medium initial cost, medium lifespan. **MODERATELY PREFERRED**	Alternative has moderate potential effects which are generally mitigable and moderate cost. Some CO_2 generating cement used for concrete. Medium initial cost, medium lifespan. **MODERATELY PREFERRED**	Alternative has most potential effects and highest initial cost, but longest repair lifespan. Greatest amount of CO_2 generating cement used for concrete. **LEAST PREFERRED**

With respect to the alternatives for the rehabilitation of concrete, Option 2A patching is most preferred.

Table 5-8 summarizes the evaluation of the alternative design methods that were considered for pedestrian movement at the dam.

Table 5-8 Pedestrian Movement at the Dam

Screening of Sub-Alternatives: Pedestrian Movement at the Dam					
Potential Environmental Effects	**Option 3A Existing Geometry to Remain**	**Option 3B Widen Deck at Spillways to Match Width at Sluiceways**	**Option 3C Widen Entire Deck to City of Thunder Bay Standard Trail Width**	**Option 3D Close Deck to Pedestrian Traffic**	**Option 3F Close Deck and Provide Alternative Pedestrian Route**
Construction related effects		Changes to deck will be simultaneous with efforts to improve strength and fix concrete. No additional construction effects anticipated.	Changes to deck will be simultaneous with efforts to improve strength and fix concrete. No additional construction effects anticipated.		Effects associated with construction of alternative pedestrian route could be considerable depending on location of route and bridge.
Pedestrian Traffic	• Existing bottlenecks at spillways and gatehouse will remain.	• Uniform width between spillway and sluiceway. • Conflict remains between dam operation (i.e. stop logs) and pedestrian movement. • Walkway still narrower than the approach trail and City of Thunder Bay standard (2.4 m). • Stop logs will still be stored on deck, narrowing walkway at sluiceways.	• 1.5 m width will be provided on walkway at sluiceways to ameliorate accessibility. • Widened walkway mitigate conflict between users.	• Pedestrians rerouted to Cumberland Street Bridge. • Loss of well used trail connection.	• City of Thunder Bay standard walkway width can be provided across a newly constructed bridge and trail system.
Cost	Lowest	Low - Moderate	Moderate	Lowest	Highest

Table 5-8 Pedestrian Movement at the Dam (Cont'd)

Screening of Sub-Alternatives: Pedestrian Movement at the Dam					
Potential Environmental Effects	**Option 3A Existing Geometry to Remain**	**Option 3B Widen Deck at Spillways to Match Width at Sluiceways**	**Option 3C Widen Entire Deck to City of Thunder Bay Standard Trail Width**	**Option 3D Close Deck to Pedestrian Traffic**	**Option 3F Close Deck and Provide Alternative Pedestrian Route**
SUMMARY	Alternative provides no alleviation of existing problems. **LEAST PREFERRED**	Alternative provides some alleviation of existing problems but some problems remain. Very little benefit achieved given cost. **MODERATELY PREFERRED**	Despite moderate cost, this alternative provides a viable solution of the effective movement of users across the dam. **MOST PREFERRED**	Effects associated with loss of trail connection will be highly negative for users. **LEAST PREFERRED**	No additional benefit achieved by building a new pedestrian bridge and trail to avoid dam. **LEAST PREFERRED**

With respect to providing for improved pedestrian movement across the dam to alleviate bottlenecks near the gatehouse and user conflicts Options 3C is most preferred with widen the deck to City of Thunder Bay trail width standard.

Table 5-9 summarizes the evaluation of the alternative design methods that were considered for operation of the Boulevard Lake Dam. In the table two types of gates are referenced; stop gate and adjustable gate. Both are solid gates that will be manually operated through a mechanized system of gears. Stop gates will either be in place or removed fully. Adjustable gates will have the ability to vary flow rates through their associated sluices. Both types of gates will have provisions to be fully automated in the future.

Table 5-9 Dam Operation

Screening of Sub-Alternatives: Dam Operations				
Potential Environmental Effects	**Option 4A Existing Stop Logs Remain**	**Option 4B Provide Adjustable Gates at Three Locations with Remaining Stop Logs to be Replaced with Stop Gates**	**Option 4C Provide Adjustable Gates at all Locations**	**Option 4D Provide Automated Gates at all Locations**
Natural Environment	• Flows dictated in PTTW over and through the dam to maintain fish habitat between the dam and tailrace is more difficult to control and maintain.	• Regulated flow of water over and through the dam to maintain fish habitat between the dam and tailrace is easier to control and maintain. • Improved ability to regulate flow over and through the dam to meet regulated flow requirements.	• Regulated flow of water over and through the dam to maintain fish habitat between the dam and tailrace is easier to control and maintain. • Improved water flow over and through the dam to meet regulated flow requirements.	• Regulated flow of water over dam to maintain fish habitat between the dam and tailrace is easier to control and maintain. • Improved water flow over and through the dam to meet regulated flow requirements.
Ability to manage water flow through dam	• No improvement to ability to manage water flow. • Coarse adjustment of water surface elevation (1 ft high logs). • It may be impossible to remove all logs during extreme weather events, which could have disastrous consequences.	• Fine adjustment of water surface elevation. • Much faster and easier than stop logs. • Response time greatly improved for extreme weather events with manually operated mechanical gates over stop logs.	• Fine adjustment of water surface elevation. • Much faster and easier than stop logs. • Response time for extreme weather events greatly improved with mechanical gates over stop logs.	• Gates can be remotely operated. • Best response time in the case of extreme weather events. • Much faster, more reliable, and easier to operate than stop logs. • Fine adjustment of water surface elevation.
Potential to ease conflict between dam operations and pedestrians	• Conflict with pedestrian movement remains.	• Conflict, with pedestrian movement minimized.	• Conflict with pedestrian movement minimized.	• Conflict removed.
Cost	Lowest	Medium	High	Highest

Table 5-9 Dam Operation (Cont'd)

Screening of Sub-Alternatives: Dam Operations				
Potential Environmental Effects	**Option 4A Existing Stop Logs Remain**	**Option 4B Provide Mechanical Gates at Three Locations with Remaining Stop Logs to be Replaced with Manual Gates**	**Option 4C Provide Mechanical Gates at all Locations**	**Option 4D Provide Automated Gates at all Locations**
SUMMARY	More difficult to maintain regulated flow of water over dam, no improvement to ability to manage water flow, and impossible to remove all logs during extreme weather events. Conflict with pedestrian movement would remain. **LEAST PREFERRED**	Best option for regular dam operations. **MOST PREFERRED** for regular dam operations.	Superior to a stop log solution to reliably address opening sluiceways to pass the Inflow Design Flood (IDF). **MOST PREFERRED OVERALL**	Remotely addresses opening sluiceways to pass the IDF, but is expensive and unnecessary for daily dam operations. **MODERATELY PREFERRED**

With respect to dam operations, the replacement of all stop logs and provision of a minimum of three manually operated adjustable mechanical gates, Options 4B is most preferred. The number of gates adjustable gates will be determined at detailed design.

Table 5-10 summarizes the evaluation of the construction methods that were considered for the Boulevard Lake Dam.

Table 5-10 Ways to Undertake Construction

Screening of Alternatives: Construction Methods						
Technical Criteria	Construction Methods				Water Surface Elevations (In Combination with Construction Methods)	
	Option 5A Two Cofferdams	Option 5B Several Small Cofferdams	Option 5C No Cofferdam, Repairs in the Wet	Option 5D Cofferdams, Winter Construction	Lower Water Level During Construction	Maintain Regular Water Levels During Construction
Natural Environment	Temporary loss of up to 750 m^2 of aquatic habitat behind cofferdam. Lake may be lowered to natural stream three times for about two-four weeks each time.	Temporary loss of up to 50 m^2 of aquatic habitat behind cofferdam. Lake may be lowered to natural stream several times for one to two weeks each time.		Temporary loss of aquatic habitat.	• Temporary loss of up to 58 ha (95%) of aquatic habitat. • Fish strandings (adults, young, eggs) as water levels drop. • Fish cut off from marsh and other shoreline habitat. • Loss of benthic invertebrate production. • Loss of aquatic vegetation production. • Loss of fish year class if spawning fails or low survival of young. • Possible odours due to exposed, retraced shoreline.	No change.
Erosion Potential			No change from normal operations.	No change over normal winter reservoir lowering. Exposed sediments will freeze, minimizing erosion. Mobile cofferdams would likely have to be installed before winter.	Greatest potential for erosion as large areas of sediment will be exposed. Small or no sedimentation pond available upstream of dam. Variety of erosion control methods could be employed.	No change from normal operations.

Table 5-10 Ways to Undertake Construction (Cont'd)

Screening of Alternatives: Construction Methods						
Technical Criteria	Construction Methods				Water Surface Elevations (In Combination with Construction Methods)	
	Option 5A Two Cofferdams	Option 5B Several Small Cofferdams	Option 5C No Cofferdam, Repairs in the Wet	Option 5D Cofferdams, Winter Construction	Lower Water Level During Construction	Maintain Regular Water Levels During Construction
Potential effect to hydro generation	Hydro generation depends on water surface elevation and flow diversion. Hydro intake is behind cofferdam for east retaining wall and sluiceway 1 construction, and will be affected when larger cofferdam encompasses this area. Hydro generation will be affected during lake drawdowns to natural stream.	Hydro intake is behind cofferdam for east retaining wall and sluiceway 1 construction. Hydro generation will be affected during lake drawdowns to natural stream.	Not possible to generate power when there are divers in the water near the intake.	No effect in winter months.	Hydro intake is behind cofferdam for east retaining wall and sluiceway 1 construction therefore power generation will be affected during localized repairs only. Lowered water level is above intake elevation.	Hydro intake is behind cofferdam for east retaining wall and sluiceway 1 construction therefore power generation will be affected during localized repairs only.
Potential to change use and enjoyment of Boulevard Lake for recreation during construction	Change depends on water level chosen. Will be affected during two lake drawdowns to natural stream.	Change depends on water level chosen. Will be affected during several lake drawdowns to natural stream.	No change.	No change.	Less paddling, swimming, general use of lake since lake will be smaller, have to cross muddy lakebed to get to water. Park areas near exposed lakebed may not be desirable for recreational activities.	No change.
Cost	Moderate Costs could be lower if water elevation is lower.	High, regardless of water elevation.	High	High Additional construction cost to manage freezing conditions.	Lower water elevation reduces cost of cofferdam. The cofferdam cost is directly proportional to water level during construction.	High

Table 5-10 Ways to Undertake Construction (Cont'd)

Screening of Alternatives: Construction Methods						
Technical Criteria	Construction Methods				Water Surface Elevations (In Combination with Construction Methods)	
	Option 5A Two Cofferdams	Option 5B Several Small Cofferdams	Option 5C No Cofferdam, Repairs in the Wet	Option 5D Cofferdams, Winter Construction	Lower Water Level During Construction	Maintain Regular Water Levels During Construction
SUMMARY	Water level will be maintained at winter set (210.4 m) during construction to minimize temporary effects on aquatic habitat and recreation. Temporary loss of up to 750 m^2 of aquatic habitat behind cofferdam. Lake may be lowered to natural stream (approximately 208.3 m) three times when cofferdams are built and removed for about two to four weeks each time. This will result in dewatering of up to 58.4 ha of aquatic habitat. Costs could be lower, if water elevation is lower. Hydro generation will be affected during lake drawdowns to natural stream to build the cofferdams and when it is behind cofferdam. Lowest cost option. **MOST PREFERRED**	Temporary loss of up to 50 m^2 of aquatic habitat behind cofferdam. Lake may be lowered to natural stream several times for one to two weeks each time. Costs are moderate regardless of water elevation. Hydro generation will be affected during lake drawdowns to natural stream and when it is behind cofferdam. **MODERATELY PREFERRED**	No change from normal operations. Removal of debris at the upstream toe of the dam and installation of concrete forms/reinforcement completed by diving crews. Riskier work with less quality control involved due to nature of the work. Not possible to generate power when there are divers in the water near the intake. Moderate cost. Unique, expensive construction techniques required and less quality control, therefore a poorer end product may result due to poor visibility underwater, with few people having the opportunity to inspect. **MODERATELY TO LEAST PREFERRED**	Temporary loss of aquatic habitat. No change over normal winter reservoir lowering. Exposed sediments will freeze, minimizing erosion. Mobile cofferdams would likely have to be installed before winter. No effect to hydro generation in winter months. Moderate cost. Additional cost to construction, to manage freezing conditions. **LEAST PREFERRED**	This alternative has the greatest potential for temporary environmental effects but the lowest cost. Water level will be at natural stream elevation of 208.3 during cofferdam construction. Water level will be maintained at winter set (210.4 m) during dam rehabilitation, to minimize temporary environmental effects. **MOST PREFERRED**	This alternative has the lowest potential for environmental effects but the highest cost. **MODERATELY PREFERRED**

The preferred construction method is Option 5A which involves the use of two cofferdams. Throughout the evaluation of alternatives, it became apparent that there is a trade-off between lowering water levels and maintaining water levels within Boulevard Lake. Lowering water levels is the cheaper alternative and poses less risk to workers as well as to the ability of the City to manage a storm event during construction, however, there may be more effects to the aquatic environment and on recreational use around the lake during construction, albeit of a temporary nature. Maintaining water levels is costlier and somewhat riskier but it minimizes the potential for temporary effects to the aquatic environment and does not diminish the appeal of the lake for recreation during construction. Water level will be maintained at winter set (210.4 m) during dam rehabilitation, to minimize temporary environmental effects as benthic invertebrates are used to this water elevation. Cofferdam construction will occur at natural stream run levels. A minimum flow of 0.4 m^3/s below and through the dam will be maintained.

The preferred alternative will be constructed in a waterway that supports a recreational fishery. As such, the City will liaise with the DFO and obtain all necessary *Fisheries Act* approvals.

6.0 DETAILED ASSESSMENT OF PREFERRED ALTERNATIVE

This chapter presents the assessment of effects for both construction and operation of the preferred alternative. The assessment is based on criteria reflective of the full definition of the environment. An effect is a change from the existing conditions caused by the activities associated with rehabilitation of the dam as described in Section 6.1 and can be positive or negative.

6.1 Description of the Preferred Alternative Method

The previous chapter identified the reasonable alternative design methods that were considered for undertaking the rehabilitation of Boulevard Lake Dam. The following sections describe the selected preferred alternative. Overall, this alternative will provide the required redundancy in the dam's strength, improve management of water flow through a combination of at least three manually operated adjustable mechanical gates (with the potential for future automation), widens the pedestrian walkway, and repairs the deteriorating concrete. The key elements of the preferred alternative for the dam rehabilitation are described below.

6.1.1 Addressing Redundancy in the Dam's Strength

A redundant set of post-tensioned tendons will be installed in every buttress and along the east retaining wall of the dam. The new anchors would be designed for the full design forces without considering the benefit of the existing anchors. The work will be accomplished by using a drill rig and specialized equipment required to core holes to install anchors (steel rods) through the deck and each buttress into bedrock. The relatively small buttresses with aged concrete would now be compressed by two post tensioned anchors. It is desirable to undertake this construction in above freezing temperatures. This construction phase should take 8-12 weeks.

This work is expected to have little to no effects on the natural environment. Post-tensioned anchors will be installed out of water and as a result no adverse effects are anticipated for water quantity or quality. Slurry from drilling will be contained then disposed offsite, therefore avoiding any waste management issues. No changes in GHG, erosion potential and the operations of the hydroelectric generating facility are anticipated.

6.1.2 Dam Operations – Maintenance of Water Flow

The preferred alternative will replace wooden stop logs as the sole means of controlling water flow and instead utilize at least three manually operated adjustable mechanical gates (with the potential for future automation), in the place of stop logs. This combination would help regulate and maintain water levels and promote ease of operations.

Manual adjustable mechanical gates allow the control of flow by manually operating the gates by a hand crank, which is significantly less time consuming and labour intensive than stop log operations. Additionally, at least three adjustable mechanical gates have potential for future automation. Gates also allow a finer adjustment of water levels. However, during a flood event, dam personnel must still travel to the site to operate the gates. Mechanical gates would be also beneficial to maintaining summer set (elevation 211.71 m) during low flow periods, as well as in regulating the flow needed for power generation. The City has determined that replacing all stop logs with gates (both adjustable and stop gates) is sufficient to effectively handle water flow under extreme conditions, fits within the City's economic plan, and fits within the construction window for the proposed project.

The stop logs at the east end of the structure are most frequently operated to adjust flow rates to respond to rainfall events. Currently, at least one stop log is removed at every sluiceway seasonally to adjust between summer set elevation and winter set elevation. Gates will be installed at all sluices to ease operations with adjustable gates to the east end of the structure. The number of adjustable gates needed to manage regulated flows as well as manage storm events will be determined during detailed design.

As per *Lakes and Rivers Improvement Act* (*LIRA*) requirements, there is a necessity for dam operations to have the capability to drain the lake, should this ever be required, as there will be no other method to drain the lake once mechanical gates are installed, and all stop logs removed. Three (3) knife gate valves will be installed, which will serve as an emergency bypass to aid in managing the regional storm. These valves are only to be used in emergency situations.

6.1.3 Widening of Pedestrian Walkway

The deck width at the spillways, sluiceways, and near the gatehouse would be widened to provide a uniform width across the dam consistent with the pedestrian trail (a minimum of 1.5 m in width). A pedestrian bridge would be included near the gatehouse to eliminate the bottleneck at the gatehouse and improve horizontal alignment. The changes to the deck will be made simultaneously with concrete rehabilitation, therefore no additional construction effects are anticipated.

6.1.4 Rehabilitation of Concrete

Local repairs will be made to the deteriorating concrete on the dam structure using abrasive blast cleaning of the existing reinforcing steel, providing new reinforcing steel if required, and replacing the concrete. This solution is appropriate for random surface deterioration even though the end product may appear "patchy". This work will entail removal of spot areas of deteriorated concrete down to the first layer of reinforcing steel. Structural cracks will be injected with epoxy. In some cases, an entire section may be overlaid with new concrete based on deterioration to improve efficiency and aesthetics. Unknown reinforcing steel location and condition may require new reinforcing steel and dowelling. Extent of repairs will be determined during detailed design and in the field.

Cofferdams will be constructed in two stages to complete upstream construction in the dry. They will be constructed in accordance with best construction methods and will take into account any soil loads, current forces on structure, wave forces and loads due to construction equipment. The cofferdams will be constructed during the first construction year when upstream concrete repairs are underway. Flow must be maintained over and through the dam at all times to pass a minimum flow of 0.4 cubic metres per second (cms), per the 2018 PTTW and DFO direction, to 20 cms (high average monthly flow) to 85 cms (two year return period flood). Water elevation will be determined during detailed design. The construction may involve the following elements:

- Boulevard Lake may be lowered to natural stream elevation (208.3 m) three times during construction to facilitate installation/removal of the two stages of the cofferdam;
- the cofferdams will be designed to restrain a minimum water surface elevation and minimum flood event;
- during dam rehabilitation, the water surface elevation will be maintained at winter set (210.4 m), to reduce costs and risks associated with the cofferdam;
- water from inside the cofferdam will be treated when dewatered. A larger area dewatered behind the cofferdam will increase the dewatering/treatment required.

A minimum of two to four weeks will be required to install each cofferdam stage. One to two construction seasons may be required for upstream work depending upon the water surface elevation of Boulevard Lake.

There are a few risks associated with installing larger cofferdams. These include:

- the large dewatered area could be affected by an unusually larger flood event; (if an unusually large flood event occurs, the cofferdams may overtop and a larger dewatered area may be flooded);
- seepage concerns through foundation below the cofferdam base especially if summer lake level remains unchanged;
- more seepage/dewatering results from maintaining the lake level higher;
- the intake for the hydro power station is located behind the cofferdam for east retaining wall and sluiceway 1 construction, and water flow will be affected when larger cofferdam encompasses this area; and
- hydro power generation will be affected during lake drawdowns to natural stream.

Concrete waste will be handled according to Ontario Provincial Standard Specification (OPSS) 180. The Standard requires that waste be disposed as non-hazardous solid industrial or commercial waste at receiving sites designated in the Contract Documents or at sites designated by the Contractor. The waste is to be transported from the working area directly to a site that has a Certificate of Approval for Waste Disposal Site that is valid for non-hazardous solid industrial or commercial waste.

6.1.5 Laydown Area and Access Road

Figure 6-1 below shows the proposed laydown area and access road. The laydown area for the contractor will be in the parking lot located off of Cumberland Street, south of the dam. An access road will be constructed from the parking lot to the downstream side of the dam, through the wooded area and across the exposed bedrock. The construction of the access road will follow best construction methods for erosion mitigation and minimal site disturbance. Relevant environmental standards will be followed. There are no other reasonable alternatives.

All of these areas were subject to archaeological assessment.

Figure 6-1 Location of Proposed Laydown Area and Access Road

6.1.6 Summary of Key Construction Activities

The proposed scope of rehabilitation work would include the following key activities likely over two construction seasons:

Year 1 of Construction:

1. Install environmental protection.

2. Setup laydown area and construct access road.
3. Provide temporary cofferdam and dewatering operations.
4. Complete concrete rehabilitation at upstream side of dam (upstream wall at spillways, aprons at spillways/sluiceways, buttresses, beams at spillways, east retaining wall).
5. Construct new concrete sill at B1 Sluiceway and upstream face buttress extensions at Buttresses B1 - B4.
6. Provide mechanical gates at all sluiceways.
7. Provide three knife gate valves at Sluiceway 1.
8. Reline/modify hydro intakes.
9. Remove environmental protection and cofferdam.

Year 2 of Construction:

1. Install environmental protection.
2. Construct post-tensioned anchorage at buttresses and east retaining wall.
3. Complete concrete rehabilitation at downstream side of dam.
4. Construct new widened deck slab.
5. Replace monorail system.
6. Construct new precast concrete walkway bridge at gatehouse.
7. Construct new aluminum railing system.
8. Provide lighting and electrical system.
9. Complete restoration works at approaches.
10. Remove environmental protection.

Due to the scale of the project, construction must be staged over two to three years (spanning from 2020 to 2022). In the first year of construction the lake must be lowered to install the cofferdams and perform upstream repair work, which would likely disrupt recreational activities. All downstream work, including buttress/underside of deck repairs, are scheduled to take place in 2021. Remaining construction work, including repair of the underside of the deck, is scheduled for construction in 2021 to 2022. During the final year of construction, the lake will be maintained at regular summer set water levels.

Construction works will occur after fish spawning periods as set by MNRF. This rehabilitation option effectively addresses all existing deficiencies, while providing additional cost-effective benefits for a long-term solution.

6.2 Impact Management

General mitigation measures will be implemented throughout the construction phase of the project, through Best Management practices. All work will be carried out in accordance with governing codes and by-laws related to environmental management, in order to complete the work in a safe and efficient manner including obtaining any necessary DFO *Fisheries Act* approvals. These measures are described in more detail throughout the sections below.

6.3 Effects Assessment

6.3.1 Physiography, Geology, and Soils

6.3.1.1 Physiography

Effects During Construction

The construction of the proposed project is not expected to have any adverse effects on the physiography of the study area. All construction activities associated with the proposed project will occur within the existing dam footprint or adjacent to the dam in the case of the laydown area and access road. It is anticipated that a layer of topsoil may be removed and replaced with gravel/aggregate for the construction of the access road; however, the depth of the excavation is not expected to alter existing physiography. None of these activities would result in an alteration of the landscape of Boulevard Lake Park, the footprint of Boulevard Lake Dam, or the Current River.

Effects During Operation

The operation of the rehabilitated dam will not change significantly from current operation and is therefore expected to have no adverse effects on the physiography of the study area.

6.3.1.2 Geology

Effects During Construction

As noted earlier, the construction of the access road will require some limited amount of excavation to remove the layer of topsoil. Given the nature of the soils and the depth to bedrock, the excavation is unlikely to have any negative effects on the geology of the study area. None of the in-water work will involve deep excavations or dredging and this work is not expected to have any adverse effects on geology.

Effects During Operation

The dam will operate in essentially the same manner and within the same footprint as it currently does, therefore no adverse effects are anticipated on geology.

6.3.1.3 Soils

Effects During Construction

The proposed project does not necessitate any substantial modification to the surrounding lands.

Topographic information indicates that the lands surrounding Boulevard Lake are typically gently sloping and the slopes are not particularly high. Bedrock is frequently present at shallow depths below ground surface. Drawdown of the lake level is not anticipated to result in any significant slope instability concerns due to the shallow water depths involved and the coarse underlying soil conditions.

Access roadways and construction laydown areas will be required to facilitate completion of the work. Provided that standard grading, surface preparation and erosion/dust control practices are followed, no significant environmental effects are anticipated to result during the course of construction.

Effects During Operation

Upon completion of the rehabilitation of the dam, operation of the dam and lake will return to procedures similar to that before the work. Therefore, no significant effects are anticipated for the soils surrounding the reservoir.

Standard grading, surface preparation and erosion/dust control measures will be implemented. These will include, but would not be limited to use of silt curtains, minimization of exposed surfaces, where possible, gradual dewatering of the lake, installation of drainage where needed, etc.

6.3.2 Terrestrial Environment

6.3.2.1 Vegetation

Effects During Construction

The proposed laydown and access road areas will cover about 0.3 ha and 0.4 ha, respectively. The laydown area currently consists of paved parking and manicured lawn with some mature Green Ash trees. The access road corridor is about 200 m long and extends from the laydown area to the dam. The southern third of the corridor consists of lawn with some small planted trees. The corridor crosses a narrow strip of forest consisting of mature Balsam Poplar and small White Cedar and White Birch. The remaining two thirds of the corridor crosses the river floodplain comprised of rock barren interspersed with numerous shallow pools. Vegetation is largely confined to bedrock crevices.

Construction could remove much of the vegetation within this area for the duration of the project, but given the small area of natural vegetation (< 0.1 ha) and durability of the bedrock, no significant residual effects are expected.

Effects During Operation

The dam will operate in essentially the same manner and within the same footprint as it currently does, therefore no adverse effects are anticipated on vegetation.

6.3.2.2 Wildlife

Effects During Construction

As described under Vegetation (Section 6.2.2.1), there will be a loss of about 0.1 ha of natural vegetation in the proposed laydown and access road areas. No Significant Wildlife Habitat was documented in this area and no significant impacts on wildlife habitat are expected. Construction will not cause fragmentation of intact blocks of forest and is unlikely to impair travel corridor functions.

Noise disturbance during construction could temporarily displace wildlife from the area; however, such disturbance to wildlife is expected to be localized near the dam and will be intermittent and of short duration.

As described above, Boulevard Lake could be reduced from about 61.5 ha to 3.1 ha for two to four weeks on three occasions during cofferdam construction and removal. Potential effects on wildlife include:

- winter drawdown below the present winter level could affect hibernating frogs and turtles;
- summer drawdown could cause standing of amphibian larvae or increased predation as they are concentrated into smaller areas;
- use of shoreline habitat by semiaquatic mammals (Beaver, Muskrat, Mink, River Otter) may be impaired when the shoreline vegetation is isolated from the edge of the water;
- summer drawdown could impair nesting success for waterfowl as the distance between shoreline nests and the water is increased; and,
- spring or fall drawdown could reduce the function of Boulevard Lake as stopover area for migrating waterfowl.

The nature and duration of the project, when combined with specific preventative measures taken during construction would help to mitigate the potential adverse construction effects described above. These include:

1. The drawdowns and in-water work will be completed during the frost-free period to minimize the impacts on hibernating reptiles and amphibians, and Beaver food supplies.

2. The drawdowns will also avoid the peak staging periods for migrating waterfowl.
3. The duration of the drawdown will be minimized lasting only two to four weeks to reduce impacts on shoreline wildlife and nesting waterfowl.

With mitigation, no permanent net environmental effects are anticipated.

Effects During Operation

The dam will operate in essentially the same manner and within the same footprint as it currently does, therefore no adverse effects are anticipated on wildlife.

6.3.2.3 Species at Risk

Effects During Construction

Bald Eagles (Special Concern) sometimes perch in the trees near the Current River below the dam during the fall and winter, possibly to feed on fish below the dam. Construction activities could displace the eagles from the area. Canada Warblers (Special Concern) nest elsewhere in forest around Boulevard Lake but have not been documented in the area directly impacted by construction.

The construction work at the dam will be mostly completed between March and November to avoid the period of peak use by Bald Eagles. Any potential noise will be intermittent and of short duration.

With mitigation, no permanent net environmental effects are anticipated.

Effects During Operation

The dam will operate in essentially the same manner and within the same footprint as it currently does, therefore no adverse effects are anticipated on Species at Risk.

6.3.3 Aquatic Environment

6.3.3.1 Fish Habitat and Species

Effects During Construction

During cofferdam construction and removal, the lake level could drop to 208.3 m elevation. This could result in the temporary loss of about 41.7 ha of fish habitat if drawdown occurs between Thanksgiving and the May long weekend or 58.4 ha if the drawdown occurs during the rest of the year. Most of the lake will be drained for two to four weeks on up to three occasions during cofferdam construction and removal. Potential temporary effects on fish and fish habitat during cofferdam construction and removal include:

- stranding of fish trapped in isolated pools during drawdown;

- stranding of fish eggs or larvae, resulting in loss of all or part of the year class;
- loss of access to nursery habitat in shoreline marshes;
- loss of spawning habitat for summer spawning species;
- loss of connectivity with the pond on the east side of the lake and potentially with cool water associated with spring-fed tributaries;
- increased predation when small fish are forced into concentrated areas with predatory species;
- loss of fish habitat in the bypass reach;
- increased vulnerability to angling and predation; and,
- loss of up to 58.4 ha of foraging habitat.

During dam repairs (i.e. when the cofferdams are in place and the lake is reflooded) the lake level will be maintained at winter set (210.4 m). Aquatic species and benthic invertebrates are used to this water level during winter. Compared to a normal summer, the flooded area will be reduced from 61.5 ha to approximately 44.8 ha. Potential effects on fish and fish habitat will be similar to, but less extreme than described above and could include:

- loss of access to nursery habitat in shoreline marshes;
- loss of spawning habitat for summer spawning species;
- increased predation when small fish are forced into concentrated areas with predatory species;
- increased vulnerability to angling; and,
- loss of foraging habitat.

There will be a temporary loss of < 1 ha of aquatic habitat displaced by the cofferdams.

Part of the year-class of some species might be lost during the drawdown as young fish are stranded or forced to leave nursery habitat. The long-term negative impacts on fish are expected to be low. Populations are expected to recover within a few years with no long term impacts on the fishery. Walleye, White Sucker, and Northern Pike can produce thousands of eggs and are relatively long-lived. Populations can therefore survive a poor year class (Scott and Crossman 1979). The range of natural fluctuation in year-class strength fluctuates by eight-fold to 40-fold in Yellow Perch and by 12-fold to 74-fold in Walleye (Koonze *et al.* 1977; Kerr *et al*. 1977). Changes similar to those expected during construction probably occurred in Boulevard Lake during the summer drawdown in 2008, and fish species have remained in the lake. Recolonization of fish moving downstream from the Current River is likely to contribute to restoration of the community.

Following are mitigation measures that are specifically designed to address the potential adverse environmental effects identified above:

1. The drawdowns and in-water work will be completed between June 15 and September 1 to avoid the spring and fall spawning periods for Walleye and Brook Trout respectively. In fact, all in-water construction activities (i.e. cofferdam installation and removal) will be performed outside of important fish life stage windows (i.e. spawning, nursery, egg incubation, etc.).
2. During cofferdam construction and removal, the lake level will be dropped gradually (over the course of 5-7 days) to permit fish to move to the remaining basin. This issue, including ramping rates, will be addressed further at the permitting stage of the proposed project.
3. Approximately 3 ha of the lake basin will be maintained to act as a refuge for fish.
4. Isolated pools left by the retreating water will be searched for stranded fish and turtles, which will be transported and released in the remaining basin.
5. The duration of the drawdown during cofferdam construction and removal will be minimized (approximately two to four weeks for each of the three periods of construction/removal) to reduce impacts on fish and other aquatic life. The cofferdams will be in place for the duration of Year 1 construction.
6. Sediment control measures will be implemented during construction to reduce sedimentation and siltation downstream of the cofferdam to ensure water quality in Boulevard Lake is not degraded. Best practices will be employed, such as those described below, in Section 6.3.4.5.
7. The installation, use, and removal of cofferdams will be in accordance with B-6: *Guidelines for Evaluating Construction Activities Impacting on Water Resources* including managing impacts such as sediment generated by construction activities and the entrapment of fish (MOECC, 1995).
8. The installation, use, and removal of the access road and laydown will be in accordance with the best management practices document entitled *Environmental Guidelines for Access Roads and Water Crossings,* prepared by the MNRF (MNRF, 2014).

As necessary, mitigation measures will remain in place until final rehabilitation of temporary work areas is completed. For example, mitigation measures required at construction and/or laydown areas and access road during the construction period of the project will remain until they are remediated or reclaimed to minimize the potential for off-site movement of sediment-laden water and any contaminant toward any surface water feature. Stormwater management during the construction phase will also be designed to effectively mitigate roadbed stormwater runoff.

With these mitigation measures in place, no net environmental effects are anticipated.

Effects During Operation

Increased ability to regulate the flow of water over and through the dam may improve upstream passage for Rainbow Trout during their spawning run. This will increase availability of spawning habitat for Rainbow Trout in the Current River and potentially increase the numbers of trout returning to Lake Superior.

Increased numbers of Rainbow Trout in the Current River could increase predation on, and competition with, Brook Trout and other native species. The fish populations will eventually reach a new equilibrium if Rainbow Trout numbers increase above the dam.

Sea Lamprey are apparently unable to pass the existing dam and there will be no changes to the structure of the fish ladder that would enable them to pass after construction.

Loss of the flow between the old stop logs may cause the loss of fish habitat below the dam during low flow; however, the flow will be maintained at 0.4 m^3/s through the bypass reach to provide ecological function. Flow will be maintained at 2.1 m^3/s from April 1st through June 15th below the tailrace for walleye and spawning functions at the mouth of the Current River into Lake Superior.

6.3.3.2 Aquatic Vegetation

Effects During Construction

Temporary drawdowns during cofferdam construction and removal could cause Boulevard Lake to be reduced in area from about 61.5 ha to 3.1 ha and expose aquatic vegetation to desiccation or freezing. The presence of vegetation in the elevation zone between 211.80 m and 210.34 m (between the summer and winter levels) indicates that some aquatic plants are able to survive these conditions. Potential effects on aquatic vegetation include:

- Increased mortality of aquatic plants caused by exposure to drying and freezing. Impacts will probably be greatest in the elevation zone below 210.34 m, which is not regularly drained;
- Loss of productivity during summer drawdown.

Some shifts in the aquatic vegetation community may occur but germination of aquatic plants species may be stimulated by drawdown (Keddy, 2000), and contribute to recovery of the community. Similar changes probably occurred during the summer drawdown in 2008 and a range of aquatic plants survived.

The following measures will be implemented to mitigate the potential adverse construction effects on aquatic vegetation:

1. The drawdowns during cofferdam construction and removal will be limited to two to four weeks to maintain moist substrates and minimize mortality to aquatic vegetation.

2. Drawdowns will be conducted during the non-freezing period to further minimize mortality to aquatic plants.

With these mitigation measures in place, no net environmental effects are anticipated.

Effects During Operation

The dam will operate in essentially the same manner and within the same footprint as it currently does, therefore no adverse effects are anticipated on aquatic vegetation.

6.3.3.3 Benthic Invertebrates

Effects During Construction

Drawdowns during cofferdam construction and removal could have the following potential effects on benthic invertebrates:

- drawdown could change the benthic invertebrate community through desiccation and cause reduced numbers and shifts in species composition. The greatest effects may be experienced in the zone below the normal winter water level (210.34 m);
- surviving invertebrates may be subjected to increased predation if they are forced into concentrated areas with predatory species; and,
- temporary loss of access to aquatic vegetation may reduce benthic invertebrate production.

Some shifts in the benthic invertebrate community are expected to occur, but the changes will probably be of relatively short duration (Paterson and Fernando 1969; Furey *et al.* 2006). Similar changes probably occurred during the summer drawdown in 2008. Recolonization by downstream drift from the Current River is likely to contribute to restoration of the community.

The following measures will be implemented to mitigate the potential adverse construction effects on benthic invertebrates:

1. The drawdowns during cofferdam construction and removal will be limited to two to four weeks to maintain moist substrates and minimize mortality to benthic invertebrates.
2. Drawdowns will be conducted during the non-freezing period to further minimize mortality to benthic invertebrates.

With these mitigation measures in place, no net environmental effects are anticipated.

Effects During Operation

The dam will operate in essentially the same manner and within the same footprint as it currently does, therefore no adverse effects are anticipated on aquatic benthic invertebrates.

6.3.4 Water Quality

6.3.4.1 Water Temperature

Effects During Construction

The construction of the proposed project is not expected to have any significant effect on water temperature in Boulevard Lake (although the water may be slightly cooler due to the shorter residence time). As was noted earlier in Chapter 3, the relatively similar temperatures (and dissolved oxygen) levels at the surface and bottom suggests that Boulevard Lake does not stratify. This is not surprising given the relatively shallow waters and high turnover with river inflow.

Effects During Operation

The operation of the proposed project is not expected to have any impact on water temperature in Boulevard Lake.

6.3.4.2 Dissolved Oxygen

Effects During Construction

The construction of the proposed project is not expected to have any impact on dissolved oxygen levels in Boulevard Lake.

Effects During Operation

The operation of the proposed project is not expected to have any impact on dissolved oxygen levels in Boulevard Lake.

6.3.4.3 Microbiology (e.g., E. Coli, Total Coliform, etc.)

Effects During Construction

While it is anticipated that construction activities will have no effect on levels of *E.coli*, there is a potential for slight increases in coliform levels during this phase. Coliform occurs naturally in soil, therefore in-water or lakeside activities that disturb soil, such as the placement of cofferdams, could release coliform into the water column, thus resulting in temporary increases in lake levels.

Effects During Operation

Once construction is completed, Boulevard Lake Dam will operate essentially the same way as it currently does and therefore there will be no added effect on *E.coli* or coliform levels.

6.3.4.4 Physical Chemical Characteristics (e.g., Metals, Colour, Hardness, BOD, etc.)

Effects During Construction

The rehabilitation of Boulevard Lake Dam could potentially temporally affect the physical and chemical characteristics of the water in the lake. In particular, in-water works such as the placement of cofferdams could potentially disturb metals in soil/sediment and in the water column. Similarly, the disturbance is likely to increase turbidity resulting in short-term change in water colour when the in-water works are occurring. No effects on BOD are anticipated since there should be no release of wastewater during the construction phase.

Effects During Operation

Once construction is completed, Boulevard Lake Dam will operate essentially the same way as it currently does and therefore no changes are anticipated in the physical and chemical characteristics of the lake.

6.3.4.5 Sediment Quality

Effects During Construction

Bathymetry of Boulevard Lake confirms that the base of the lake is quite flat and it has been described as featureless. Some cobbles, boulders and logs are present on the lake bottom. Photographic evidence of these conditions was obtained during the August 30, 2008 drawdown of Boulevard Lake. Underwater video obtained in 2016, revealed that 87% of substrate was classified as silt, 6% sand, 4% boulder, and 3% other. These conditions are favourable in minimizing the potential for sediment erosion and migration during lake drawdown.

As lake drawdown is not to occur until after the MNRF specified fish spawning season has been completed, the lake will not be drawn down during the spring runoff period or potential heavy spring rainfalls. Drawdown would take place during the summer and fall when less sediment erosion would be expected.

Localized erosion of lake sediments is expected; however, this can be controlled by standard methods and best practices, such as installation of erosion control methods at regular intervals, as required. Sediment erosion can also be mitigated by gradual lowering of the lake water level, and gradual opening of sluice gates to minimize sediment discharge.

Some measures that can be carried out to minimize upstream erosion and sedimentation include:

- controlling the rate of reservoir drawdown, as previously stated above (5 to 7 days);
- developing a detailed erosion and sedimentation control plan;
- carrying out regular inspections of exposed reservoir sediments;
- installing straw bales, erosion mating, erosion control rolls or similar materials where needed to control sediment transport;
- considering the use of crushed stone/ rip rap drainage check dams within drainage channels that potentially develop;
- considering the viability of diverting and lengthening surface drainage courses through exposed sediments to reduce gradient and sediment transport; and,

- establishing a regular program of erosion control system maintenance.

In the vicinity of the cofferdam, erosion control measures which could be employed include:

- requiring the construction contractor to provide a detailed methodology for cofferdam installation, operation and removal, as well as overall erosion and sediment control in their bid submission, in response to tender, and evaluation;
- installing floating silt curtains in advance of cofferdam installation to control sediment migration;
- limiting the amount of fill placed at any one time to minimize sediment loading;
- if necessary, pumping water with high sediment loadings at the time of cofferdam installation to a sedimentation pond prior to downstream discharge; and,
- conducting regular program of environmental/ hydrological inspection to assess erosion and sedimentation conditions throughout the construction period.

With the implementation of these mitigation measures, and any other measures that the construction contractor deems appropriate, at the time of construction, no net environmental effects are anticipated.

Effects During Operation

Upon completion of the dam rehabilitation the lake will return to past levels and sediment erosion will be similar as in the past, therefore no significant environmental effects will result.

6.3.4.6 Noise

Effects During Construction

Heavy equipment and power tools such as backhoes, excavators, dump trucks, power saws for vegetation removal, and dewatering pumps during the construction of the laydown area, access road, cofferdams, widened crossing, etc., are potential sources of localized construction noise. Overall, it is anticipated that the access road construction is likely to generate the most noise as it would involve the use of multiple pieces of equipment operating simultaneously.

In addition to being localized, it is anticipated that any potential noise would be intermittent and also of short duration. For example, the construction of the access road is expected to take approximately three weeks, and approximately two to four weeks will be required to install each cofferdam stage.

The City plans to limit construction activities to regular daytime hours. This coincides with the hours of highest ambient noise levels at the closest residential areas. Users of the Boulevard Lake Park may experience elevated noise levels when in close proximity to construction areas, but as noted before, most park uses are engaged in active recreation (walking, jogging, biking, running, etc.), therefore, their exposure to such noise is expected to be intermittent and of very short duration. In addition, the park is quite large and park users would have the option to detour around active construction areas.

Several standard measures will be implemented to mitigate noise during the construction phase of the proposed project. These measures include:

- compliance with the City of Thunder Bay Protection By-laws, specifically Chapter 915 (Noise);
- limiting construction to daytime hours when ambient sound levels are already elevated, to the greatest extent possible, to reduce the impact of any excess noise;
- sequencing work such that the simultaneous operation of noisy equipment is minimized, where possible;
- ensuring that all trucks and other heavy equipment operating at the project site are well maintained and are equipped with appropriate mufflers;
- minimizing engine idling of heavy construction vehicles when operating at the construction site; and
- maintaining on-site truck route in good condition with no potholes and ruts in order to prevent truck tray noise caused by driving over uneven roadway.

Effects During Operation

The operation of the rehabilitated dam is not expected to generate any more noise than is currently experienced.

6.3.4.7 Air and Odour

Effects During Construction

Construction of the laydown area and access road is expected to generate dust in the immediate vicinity of the construction zone, especially if conditions are windy. In addition, the use of heavy construction machinery, and truck traffic, will result in localized increases in hydrocarbon emissions. Considering the relatively small size of the active construction areas in relation to the overall size of Boulevard Lake Park, no noticeable change in air quality is anticipated during the construction phase due to these emissions, except when in the immediate area of the operating construction equipment.

As noted earlier, the construction of cofferdams will require the lowering of lake levels. The lowering of the water in the lake could potentially result in a release of odours as there is a likelihood of encountering submerged decaying organic material within the construction zone. The likelihood for odours is greatest during periods of high wind speeds and high temperatures.

The highest temperatures in the study area occur during the summer months, especially July and August and the wind speeds for this area are highest in the second quarter of the year (April to June).

High temperatures and high winds in the late spring or early summer could potentially result in the release of odours if lake drawdown occurs at this time. The lake depth ranges from 1 to 4 metres depending on the location, as discussed earlier. With the bed being below grade from the closest residential and park lands, the odours are not expected to be easily dispersed within the residential and recreational areas.

Non-chemical dust suppressants, including water trucks, will be used to control dust from construction activities, especially in the laydown area and along the access road. When possible, dust-generating construction activities will be reduced or delayed during periods of high wind to limit the potential for wind-blown dust.

It is understood that construction activities at the dam site will only last a few months. Should someone lodge an odour complaint, temperature, wind speeds and direction could be monitored, and these data can then be used to further mitigate odours (i.e. a cover, spray, etc.).

Effects During Operation

Once rehabilitated, the dam would operate the same way as it currently does. Odour is not an issue of current concern and is not expected to cause any adverse effects once the dam is operational.

6.3.4.8 Hazardous Materials

Effects During Construction

There is a potential for spills to occur during construction activities. Fuel, oils, lubricants, grease, etc. could accidentally leak from on-site construction vehicles/equipment such as trucks travelling to and from the laydown area.

As was noted earlier, the laydown area for the contractor will be in the parking lot located off of Cumberland Street, south of the dam. An access road will be constructed from the parking lot to the downstream side of the dam, through the wooded area and across the exposed bedrock. Gravel/aggregate material will be laid for the access road that will be used by trucks and other equipment involved in the construction, so the likelihood of fuel/oil/chemical spills in areas that could affect groundwater is slim. Minimal, restrictive equipment operation is expected to occur in-water within Boulevard Lake Dam. Therefore, the Construction Environmental Management Plan (CEMP) for the construction contractor will incorporate mitigation measures, such as deployment of spill booms, in the event of in-water spills from construction.

The construction contractor will be required to ensure that all on-site machinery are operated according to manufacturers' requirements in order to avoid malfunctions that could result in spills.

A Spills Response Plan will be developed and implemented for the transportation, storage and handling of hazardous materials during the construction phase of the proposed project. The selected construction contractor will be required to have appropriate containment, spill kit, and clean up equipment on-site in accordance with the Spill Response Plan to ensure a rapid response to any spill. Spills are to be reported to the Ontario Ministry of the Environment, Conservation and Parks – Spills Action Centre (1-800-268-6060), and the City of Thunder Bay. Furthermore, a contingency plan will be developed to inform decision making in the event mitigation measures are not effective.

Effects During Operation

Once rehabilitated, the dam would operate the same way as it currently does. Chemical spills are not an issue of current concern and is not expected to cause any adverse effects once the dam is operational.

6.3.5 Socio-Economic Environment

Effects During Construction

The closest residences to the proposed project are located on the east side of Boulevard Lake. Construction activities could result in nuisance effects such as noise, dust and odour caused by activities such as the movement of trucks and other heavy equipment along the access road/laydown area, placement of the cofferdams, repairs to the existing dam structure using abrasive blast cleaning of the existing reinforcing steel, etc. As noted above, high temperatures during the peak summer construction season, could potentially result in the release of odours as a result of the decomposition of the organic materials within the in-water construction zone. All of these potential nuisances are expected to be localized and of short duration.

The proposed project will increase the number of construction trucks and other heavy vehicles travelling in the immediate vicinity of Boulevard Lake Dam, thereby increasing the potential risk of delays and accidents. These vehicles will utilize the dedicated construction access road in the immediate vicinity of the project site, but would also travel along local roads such as Cumberland Street, and will share these roads with local residential traffic. Owing to the size and nature of the proposed construction project, however, the volume of heavy vehicle traffic is expected to be very small, less than five vehicles per hour at the peak of construction. Thus, the increased risk of delays or accidents is expected to be similarly very small.

As was discussed earlier, Boulevard Lake Park is a major recreational asset in the City of Thunder Bay. Construction activities within and around the lake could potentially cause annoyances and disrupt normal recreational activities.

Noise, dust and odour are the most likely nuisances. All of these potential nuisances, however, are expected to be localized and of short duration. Taking into consideration the size of Boulevard Lake Park, recreational users would be able to easily avoid areas of active construction to reduce their exposure to increased noise, dust or odour.

Access to the pedestrian walkway across Boulevard Lake Dam will be completely closed when the walkway is being widened and through both years of construction. This pedestrian access is an important part of the trail system within the park and its removal from service could be a potential inconvenience and annoyance to park users. Pedestrians will be re-routed to the Cumberland Street Bridge just downstream of the dam.

Signage will be posted on the trail with wording similar to “Dam under construction, water levels subject to change without notice, keep away from exposed lakebed”. As needed, fencing will be erected in the immediate vicinity of construction areas to limit public access. In addition, public access in the immediate vicinity of the construction zone will be controlled/limited. It is likely that in some instances these limitations may mean that local residents may need to make minor detours while travelling to their homes on foot through Boulevard Lake Park. Such disruptions are expected to be of short duration and conditions would return to normal once the location of the construction shifts.

During construction the lower water levels in the lake will reduce flows through the generating facility, reducing their ability to produce power for short periods of time. The legal agreement in place recognizes that, during maintenance and refurbishment activities, this effect may occur.

To protect the health and safety of the general public, the construction contractor will be required to erect signs denoting the construction zone.

No net environmental effects are anticipated with the implementation of these mitigation measures.

Effects During Operation

The area will return to conditions similar to those that existed prior to the undertaking.

Once the construction activities are concluded, it is anticipated that the recreational activities on Boulevard Lake and within Boulevard Lake Park will continue as they were prior to the construction phase. Since a component of the proposed project involves the widening of the pedestrian walkway across Boulevard Lake Dam, the proposed project will have an overall positive effect on recreational users. This widening of the pedestrian walkway will eliminate the current congestion and tripping hazard posed to runners, joggers, cyclists, etc., due to the narrow walkway, further compounded by the storage of the wooden stop logs on the walkway.

6.3.6 Cultural Environment

6.3.6.1 Archaeological Resources

Effects During Construction

The site DcJh-21 was relocated (original found in the 1960s) within the study area. It is a Shield Archaic chipping station. Avoidance of the site requires monitoring of any construction activities within a 70 m radius of the site. The site will not be fenced during construction and should construction activities occur within a 70 m radius of the site these activities would be monitored. Fort William First Nation would like a monitor on site during construction, should monitoring be required, to accompany a licensed archaeologist.

The marine archaeological assessment will coincide with the cofferdam establishment. At that time, the front face of the dam area will be archaeologically assessed, with a Fort William First Nation monitor on site as well. Based on previous photographs of the dewatered area of the dam in previous years, there appear to be remnant structures possibly related to one of the older dams, and possibly cofferdams. Effects during construction on this resource are not known, as the resources have not yet been documented.

There may be effects to the "underwater" resources. These resources have yet to be identified. Construction might impact that existing former infrastructure. Mitigation (that is, avoidance) of these former dam related infrastructures should be attempted, after being fully documented (drawings and photographs).

Effects During Operation

Operation will be the same as existing so there will be no effects.

6.3.6.2 Built Heritage Resources and Cultural Heritage Landscapes

Effects During Construction

Other than the dam, there are no identified built heritage resources in the study area, or abutting the study area. The front of the dam, as seen from Cumberland, is a cultural heritage landscape. The cultural heritage landscape will be affected during construction, as rehabilitation of the dam will introduce machinery and construction activities and infrastructure. These are considered to be temporary only.

Effects During Operation

There will be no effects during operation of the dam on the cultural heritage landscape of the dam.

6.4 Environmental Effects Summary

The environmental effects summary table (Table 6-1) below summarizes the positive and negative net effects associated with construction and operation of the preferred alternative, and mitigation measures.

Table 6-1 Environmental Effects Summary Table

Environmental Effects Associated with Construction			
Environmental Component	**Potential Effects**	**Mitigation Measures**	**Net Effects**
Vegetation	• Access road will require removal of <0.1 ha of vegetation.	• Replanting of removed vegetation.	Negligible
Wildlife	• No significant impacts on wildlife or habitat are expected. Localized potential temporary disturbance from noise. • Summer drawdown could temporarily affect amphibians, semiaquatic mammals, nesting/migrating waterfowl.	• Drawdowns and in-water work to be completed during the frost-free period to minimize impacts on hibernating reptiles and amphibians and will avoid peak staging periods for migrating waterfowl. • Duration of drawdown last only 2-4weeks to reduce impacts on shoreline wildlife and nesting waterfowl.	None
Sediment Quality	• Localized erosion and migration of reservoir sediments during lake drawdown. This activity is consistent with current dam operations.	• Gradual lowering of the lake water level, and gradual opening of sluice gates to minimize sediment discharge.	None
Fish Habitat and Species	• Lake level drop could result in temporary loss of 41.7 ha of fish habitat between Thanksgiving and the May long weekend or 58.4 ha of fish habitat during the rest of the year. • Potential temporary loss of low quality fish habitat, spawning habitat, access to nursery habitat, connectivity, foraging habitat, potential increased vulnerability to predation and/or angling. • Lower flow in the bypass reach below the dam during cofferdam construction. Minimum flows of 0.4 cubic m^3/s can be maintained at all times.	• Drawdowns during June 15 - September 1 to avoid spring and fall spawning periods for Walleye and Brook Trout. • Lake level dropped gradually to permit fish to move to remaining basin. • Duration of drawdown during cofferdam installation/removal minimized to reduce impacts on fish. • Maintenance of base flow in accordance with the existing 2018 PTTW during the majority of the construction period. • Stranded fish and wildlife in the reservoir and the bypass reach will be manually transferred to deeper water during the ramping down of water levels.	Negligible
Aquatic Vegetation	• Loss of productivity during summer drawdown.	• Drawdowns for cofferdam installation will be limited to 2-4 weeks.	None

Table 6-1 Environmental Effects Summary Table (Cont'd)

Environmental Effects Associated with Construction			
Environmental Component	**Potential Effects**	**Mitigation Measures**	**Net Effects**
Benthic Invertebrates	• Potential loss of invertebrate species due to lake drawdown and could be subject to temporary increased predation.	• Drawdowns for cofferdam installation will be limited to 2-4 weeks.	None
Species at Risk	• Bald Eagles perching in the trees may be disturbed by construction. • Canada Warbler is not known to nest or be present near the dam, will likely not affect this species.	• Construction work at the dam will be completed during the summer months to avoid period of peak use by Bald Eagles.	None
Noise	• Temporary, localized and intermittent construction noise of short duration (i.e., heavy equipment).	• Compliance with City Noise By-law.	None
Air and Odour	• Construction is expected to generate dust. • Localized increases in hydrocarbon emissions from construction vehicles. • Lowering of the water in the dam could release odours from decaying organic material.	• Water used to control dust. • Application of odour mitigation such as avoidance of construction during high temperatures / strong wind.	None
Socio-Economic	• Construction nuisance effects to nearby residents due to temporary noise, dust, increase in traffic/heavy vehicles on local roads. • Heavy vehicle traffic volume expected to be less than 5 vehicles/hour. • Short term reduction in ability to produce power at generating station. • Access to the pedestrian walkway across Boulevard Lake Dam will be closed throughout construction. • During drawdowns the use of Boulevard Lake for recreation such as swimming and paddle sports will be limited.	• Vehicles to use dedicated access road for construction purposes. • Disruptions will be of short duration. • Pedestrians will be re-routed to the Cumberland Street Bridge just downstream of the dam.	Negative - Temporary displacement of recreational uses on the lake during drawdown periods will occur

Table 6-1 Environmental Effects Summary Table (Cont'd)

Environmental Effects Associated with Construction			
Environmental Component	**Potential Effects**	**Mitigation Measures**	**Net Effects**
Archaeology	• May be effects to "underwater" resources, which have yet to be identified, during the marine archaeological assessment slated to take place during construction.	• Mitigation (through avoidance) of structures will be attempted, after being fully documented (drawings and photographs).	None
Environmental Effects Associated with Operation			
Fish Habitat and Species	• Increased ability to regulate the flow of water over and through the dam.	• None	Positive
Socio-Economic	• Widened walkway will eliminate existing constraints, congestion, and improve accessibility. • Increased worker safety during operation of the dam with the removal of stop logs and addition of manually operated mechanical gates.	• None	Positive

7.0 MONITORING

The City is committed to preparing a Construction Environmental Management Plan (CEMP), which will govern construction activities and it will outline monitoring and reporting of environmental impacts, along with corrective actions/mitigation measures to be employed should environmental impacts be observed, measured, etc.

The above-mentioned CEMP will document sediment and erosion control plans. Sediment and erosion control measures will be in place in advance of construction, through construction and into operations, and will incorporate routine inspection of such control.

As part of the above-mentioned CEMP, the City will develop a water quality monitoring program to be carried out during the life of the construction project. Parameters to be monitored will include, but not be limited to, temperature, dissolved oxygen, total suspended solids (TSS), and turbidity. The sampling program will be mindful of direction included in MECP's 1995 guidance document entitled: B-6 *Guidelines for Evaluating Construction Activities Impacting on Water Resources*. The Canadian Council of Ministers of the Environment (CCME) *Canadian Water Quality Guideline* for the Protection of Aquatic Life for suspended sediment and turbidity will be followed where bankside, in-stream and/or dewatering work is required (CCME, 2014).

Trigger/threshold values will be established, and sampling will occur before, during and after such work is undertaken.

The monitoring program will be structured as follows:

- daily sampling of the above-mentioned parameters during the life of the construction project;
- daily sampling during cofferdam installation and removal (prior to in-water work and following in-water work);
- sampling sites to include one upstream reference site, one site within Boulevard Lake immediately upstream of the construction activities, and one 25 metres downstream of the dam;
- development of a turbidity/TSS correlation curve, in order to reduce number of samples to be collected for TSS analysis; and
- development of a turbidity value that would trigger cessation and a hold on in- water work until turbidity levels have dropped.

The ongoing water sampling for *E.coli* and other fecal bacteria will continue in Boulevard Lake as per the City of Thunder Bay District Health Unit (TBDHU) requirements, regardless of whether the lake will be closed to swimming and other recreational activity during the proposed project. The TBDHU conducts sampling on a weekly basis, collecting five (5) samples on each occasion, while also inspecting the area for health hazards and recording the general condition of the beach. The samples are tested for *E. coli* and total coliforms, and results are obtained within 24-48 hours. Yearly results are used to calculate the percentage of samples that are adverse, which are incorporated into a 5-year running average. Signage reflecting the previous year's average is posted the following season.

A post-project benthic invertebrate sampling program will be carried out following completion of the proposed rehabilitation project and Boulevard Lake water levels returning to normal operating levels. The assessment will replicate that which was carried out for the baseline assessment completed for this ESR. The benthic community is expected to recover to pre- construction conditions within a few years of project completion. The water regime will be essentially the same as it was before construction and invertebrates are expected to recolonize the habitat by downstream drift from the McIntyre River and through dispersal by flying adults (Diptera, mayflies, caddisflies, and other insect species). The pre-construction community had a relatively high proportion of Chironomids and low proportion of Ephemeteroptera, Plecoptera and Trichoptera (EPT), as expected in a reservoir with predominantly soft substrates. If post construction benthic monitoring shows that the community has degraded significantly (i.e. reduced abundance and richness, higher proportion of Chironomids, lower proportion of EPT), a review of the water management plan will be conducted and alternate flow regimes will be considered.

8.0 STAKEHOLDER, ABORIGINAL AND PUBLIC AND AGENCY CONSULTATION

This chapter includes a complete description of the consultation process and an explanation of how concerns raised by stakeholders, Aboriginal communities, and review agencies have been addressed in developing the project. The MCEA requires that, for a Schedule C Class EA, the minimum mandatory notification requirements include consulting with: the public (property owners who may be affected by the project and citizens who express a general interest in the project, and general public), review agencies, and Aboriginal Peoples.

Additionally, the MCEA stipulates that the mandatory contact points for a Schedule C project should take place at three stages of the process:

1) Notice of Project Commencement;
2) The review of alternatives with the public and agencies to assist in the selection of the preferred design for the chosen solution; and,
3) Notice of Completion of Environmental Study Report, which is to advise the public and those who have expressed a desire and interest to stay involved where the ESR may be seen and reviewed, and the manner in which public comment is to be received. The duration of the public review period will be a minimum of 30 calendar days.

A description of the public and agency consultation is outlined in Sections 8.1 to 8.4 and consultation with Aboriginal communities is outlined in Section 8.5.

8.1 Initial Contact and Notifications

Various stakeholders including the general public, relevant agency stakeholders (federal and provincial ministries), municipal stakeholders, interest groups, and Aboriginal communities, were identified during the early planning stage of the Boulevard Lake Dam Rehabilitation Class EA. The following efforts were made to notify and consult with these stakeholders about the commencement of the project and about public meetings to discuss the project:

- Notice of Commencement was published in *The Chronicle-Journal* newspaper on May 28, 2016. The Notice also included an invitation to the first Public Information Centre (PIC) which was held on June 14, 2016. This newspaper is the Thunder Bay area's only daily newspaper, that reaches 60 communities across 1,200 km and with distribution coverage of over two thirds of Ontario's geographic area. A copy of the newspaper advertisement is provided in Appendix E.
- Notice of Commencement letters were sent on June 1, 2016 to relevant agency stakeholders (federal and provincial ministries), municipal stakeholders, the conservation

authority, interested parties, interest groups, and Aboriginal communities. The letter provided a brief introduction to the project and a map of the study area, and a copy of the Notice of Commencement. Copies of the letter and mailing distribution list (stakeholder contact list) are provided in Appendix F.

- Notice of Public Information Centre #2 inviting the public and interested stakeholders to the second PIC was published in *The Chronicle-Journal* newspaper on August 26, 2017. A copy of the newspaper advertisement is provided in Appendix E.

- Letters providing notice of the second PIC were sent on August 25, 2017 to relevant agency stakeholders (federal and provincial ministries), municipal stakeholders, the conservation authority, interested parties, interest groups, and Aboriginal communities. The letter provided a brief summary of the project and a map of the study area, as well as describing the purpose of the second PIC. Copies of the letter are provided in Appendix F.

8.2 Agency Consultation

Prior to sending out the Notice of Commencement, a kick-off meeting was held with the Ontario MECP and MNRF on April 27, 2016. This meeting was held to discuss the previous Class EA conducted for the dam rehabilitation and agency comments on it, the concerns raised in the Part II Order Requests with respect to the previous EA, the scope of the EA studies proposed for this Class EA and likely issues of concern. Issues pursuant to the existing 2018 Permit to Take Water and the Water Management Plan as they relate to the Class EA were also discussed.

Notice of Commencement letters were then sent to approximately 13 federal, provincial and municipal agencies on June 1, 2016. Of the agencies contacted, two (2) provided comments. These comments are summarized in Table 8-1, and the notification letters are included in Appendix F.

Additionally, meetings with regulatory agencies were held throughout the planning process. The details of these meetings are outlined in Table 8-2.

Table 8-1 Agency Responses to Notice of Commencement Letters

Agency	Date of Response	Subject Matter	Comments
Lakehead Region Conservation Authority	June 24, 2016	LRCA Permit	The subject location, as shown on the enclosed sketch is affected by the Lakehead Region Conservation Authority's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulations. In general, the placing or dumping of fill, the construction of any building or structure, or an alteration to the existing channel of a watercourse or shoreline may require a permit from the Conservation Authority.
		Natural Heritage	Please contact the Ministry of Natural Resources regarding Natural Heritage Features including Species at Risk in the area.
Ontario Ministry of Tourism, Culture and Sport (MTCS)	June 24, 2016	Archaeological Resources	Recommended that the project should be screened with the MTCS *Criteria for Evaluating Archaeological Potential* in order to determine if an archaeological assessment would be necessary.
		Built Heritage Resources Cultural Heritage Resources	Indicated that the MTCS *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* should be completed in order to determine whether the EA project may impact cultural heritage resources.
Ontario Ministry of Natural Resources and Forestry (MNRF)	August 8, 2016	Environmental Studies	The MNRF Thunder Bay District Office has requested to be kept informed of the Schedule C Class EA studies mentioned in the Notice of Commencement, as they are completed.

Table 8-2 Meetings with Regulatory Agencies

Agency	Date of Meeting	Topics Discussed
MECP and MNRF	April 27, 2016	Scope of EA and MECP comments on previous iterations of the EA/Environmental Study Report.

8.3 Public Consultation

8.3.1 First Public Information Centre (PIC)

The first Public Information Centre (PIC) for the Thunder Bay Boulevard Lake Dam Rehabilitation Schedule C Class EA occurred on June 14, 2016 from 4:00 pm to 8:30 pm at the Current River Community Centre, with a presentation given at 6:30 pm. The local community and key interest groups were notified about the project and invited to attend the PIC by way of a newspaper advertisement (in conjunction with the Notice of Commencement) in the *Chronicle Journal* on May 28, 2016 (see Appendix E), a media advisory, a media release, a Public Service Announcement which ran daily on the local radio station from Friday June 3, 2016 up until the date of the PIC, and posting on City social media. Agencies were contacted in the manner described in the previous section, and information was posted on the City's website (see Section 8.3.3 below), under the *Notices to the Public* section.

The objectives of the first PIC were to promote effective communication between the City and stakeholders and the general public; present information and scope of the Boulevard Lake Dam Rehabilitation Class EA; inform and discuss project plans, obtain input for the project, and identify and resolve concerns about the proposed project; obtain input and feedback about the PIC; and outline future steps in the EA process.

At the PIC, panels were displayed which provided a description of the project, regulatory requirements, timelines, key issues, and next steps, and a presentation was given to provide insight into the project. Following the presentation, participants were invited to ask questions and voice any concerns about the project, and were encouraged to talk one-on-one with the project team. A total of 34 individuals attended the PIC, each of whom received a questionnaire on which to provide written comments and feedback to the project team (see Appendix G for PIC materials). All PIC attendees were also provided with the opportunity to complete the Boulevard Lake Park User Survey (results of the survey are discussed in Section 3.4 1.5 – Park User Survey and Sport Counts). A total of ten (10) surveys were completed at the First PIC.

Public Comments Following the First PIC

Comments from the public were received both orally and in written form via the questionnaire. Of the ten (10) questionnaires received, all were in favour of the rehabilitation of the dam. The most common concerns voiced by the public with respect to the rehabilitation revolved around:

- the timing of the rehabilitation. Most felt that the rehabilitation is needed soon;
- the need to incorporate an expanded walkway at the top/deck of the dam which would support two-way pedestrian and bicycle traffic;
- the importance of preserving the lake, beach, and improving water quality;
- the need to preserve local wildlife;
- minimizing environmental impacts; and
- minimizing project costs, overruns, and the potential for ministry funding for the project.

All comments received from the public at the PIC are included in Table 8-3.

Table 8-3 Summary of Comments and Questions Received at the First PIC

Issue	Comments and Questions Received
Boulevard Lake	Can the lake remain full during the winter months, for winter recreational use: ice-fishing, skating, etc.
	Around Boulevard Lake, recreation and outdoor physical activities are important.
	The dam is required to hold back the ever decreasing (shallow) water table, which is drying up.
	Maintain public access to the lake.
	Maintain the beach and improve water quality.
	The lake is an asset to the city.
	If the lake is drawn down again, is there an opportunity to clean up the areas around the secondary beach (not the main one), so that its use can be increased?
	Rock circle formation, at the bottom of the lake, could be a ceremonial circle. This should be preserved and not affected by dredging or draining, so that university professors and students are able to study it.
	Acid rain studies were conducted in the 80s and 90s which revealed the top end of the water table has dropped. Do you know how much of the total “watershed budget” is held back by the dam?
	The lake is full of garbage, wood, etc. Will this project consider how to remediate this? The amount of debris is especially obvious during draw down time. Will the project seriously consider how to clean up the lake?
	The beach is often closed due to goose excrement. Will this project also investigate cleaning up the beach? What did the City do for Chippewa Park, to address this issue? Is it possible to measure how much goose excrement is in the lake?
Boulevard Lake Park	Maintain the beauty of park walkways, and those near the dam.
	Ensure the park is kept open and accessible.
	The dam and park are a jewel to pass on to future generations. Please proceed with care.
	Maintain the trail system and continued public access across the dam and around the lake, including walking, biking, etc.
	No motorized vehicle activity in the park.
	Maintain all recreation areas because they are important.
	The former Lakehead Psychiatric Hospital (LPH) greenspace is part of the Boulevard Lake experience.
	The park is important because it is conveniently located (close to a bus route and within walking or cycling distance) for locals that don’t own camps.
	Has there been an evaluation on how many people use the park per day? How do you plan to do this?

Table 8-3 Summary of Comments and Questions Received at the First PIC (Cont'd)

Issue	Comments and Questions Received
Class Environmental Assessment	Why does this project qualify as a Schedule C Class EA? The criteria for a Schedule C project does not appear to match what is being proposed for the dam.
	Please share more information about the preferred alternative.
	Does this EA just pertain to the impact of construction, and not the dam and its associated facilities?
	Is rehabilitation the only option?
	What information/data were used to decide that rehabilitation is the only option?
Cost/Funding	How much will the rehabilitation project cost taxpayers?
	Consider investigating provincial and federal funding.
	Is it possible to access Ministry funding of some kind since proposed widening of the walkway increases accessibility?
	Costs of the project were estimated at $5.3 million last year, and will only go up, especially with the EA process being repeated. Since we are fulfilling requirements of other levels of government, is there a way to approach them to contribute?
	Was the cost for complete reconstruction prohibitive?

Table 8-3 Summary of Comments and Questions Received at the First PIC (Cont'd)

Issue	Comments and Questions Received
Dam Construction/Rehabilitation	Is it possible to remove silt build-up from previous years?
	How long will construction take?
	It would be nice to have the walkway open to the public as much as possible during construction.
	They area is used year-round. Please minimize disruptions.
	Ensure that the park and trails are kept open and accessible during construction.
	Consider an increase in the width of the pedestrian walkway across the dam (hopefully two lanes), so that bicycles, wheelchairs, and two way traffic can be accommodated. It should at least be widened to the same width as the recreation paths that surround the rest of the lake.
	A good walkway over the dam is needed.
	Consider increasing the height of the fences along the walkway over the dam.
	Consider the construction of a viewing platform.
	Ensure that construction is completed properly, and not just a "patch" job.
	Are there more modern elements that could be added to the dam for water level control, etc.?
	Concern that the change to the dam will be too drastic.
	When selecting the sand/gravel mix for the new dam concrete work, ensure the material is "stress" free, so that it can withstand the extremes of the Thunder Bay climate.
	An engineering study on the integrity of the dam is needed.
	Concern that the dam is too old for refurbishing and for structural issues. The life span of cement is 75 years.
	Build a new dam to accommodate fish, pedestrians, hydroelectric activity, a new lookout area, etc.
	Concern that the over 100 year old dam will be demolished and replaced with something new and different, and that the new dam will also soon need repairs.
	Suggest completing good, basic rehabilitation work, and nothing too fancy.
	I am not concerned about dam construction/rehabilitation.
	Incorporate good water control (for less fluctuation in lake levels) into the rehabilitation.
	Concern about the absence of a barrier system to prevent ingestion of fish into the power turbine. Implement a solution during dam rehabilitation.

Table 8-3 Summary of Comments and Questions Received at the First PIC (Cont'd)

Issue	Comments and Questions Received
Dam Construction/Rehabilitation	Incorporate fish passage improvements into the rehabilitation.
	There is an opportunity to work with the North Shore Steelhead Association and funding partners affiliated with the Department of Fisheries and Oceans to conduct work on the dam and upgrade facilities to incorporate hydraulic gates for more efficient operation of the fish ladder.
	Incorporate a good trail/walkway and viewing platforms into the rehabilitation.
	Why was nothing done between the condition assessment and now?
	Consider removing the dam completely as an option, rather than rehabilitation.
Electricity Production	Would it be possible to expand electricity production at the dam?
	We will need more electricity in order to electrify public transit.
Environmental Aspects/Effects	Maintain the quality of the environment.
	Preserve the natural environment features, flora, and fauna, as they are important.
	Concern that the local deer population will be affected.
	Ensure natural beauty, trees, pathways, and water are not affected.
	Ensure that fish and fish habitat, both above (upstream) and below (downstream) the dam, are improved/preserved. Improve fish migration in both directions.
	Protect the passage of fish at the dam by stabilizing water flows.
	The dam has impacts on fish migration and the natural movement of sediment to provide fish habitat below the dam. As compensation for the blockage of sediment, when sediment is dredged from the lake bottom it should be used for fish habitat somewhere below the dam. Consult the Lake Superior Remedial Action Plan Public Advisory Committee for possibilities.
	Ensure that the fish ladder is maintained, to improve fish passage.
	Expand the study on "Fish Occupancy" to include fish access and mobility to and from the lake.
	How will the project affect fish? Consider how flow rates will be maintained if the lake is drawn down and also determination of the minimum capacity.
	Will the dam rehabilitation also consider where the fish ladder attaches to the dam?
	What if a problem with fish passage and the dam is determined during the rehabilitation process? Would it not make sense to do modifications to improve fish passage as part of the dam rehabilitation anyway?

Table 8-3 Summary of Comments and Questions Received at the First PIC (Cont'd)

Issue	Comments and Questions Received
Environmental Aspects/Effects	Please describe what is involved in the fish occupancy study.
	Consider looking into preventing fish mortality, and preventing fish from entering turbines, etc. during the rehabilitation work.
	The dam has had a negative impact on the fishery. I am surprised this process does not look at how to prevent further harm. The City has ownership of the dam, and therefore a responsibility to prevent harm to the fishery.
	How can solutions to protect the fish population be incorporated into the dam rehabilitation design if it is not known what is causing harm to the fish in the first place?
	Maintain corridors for animal/wildlife movement around the park.
	Concern regarding damage to fish and wildlife during construction.
	Concern regarding improvements and maintaining of habitat for all aquatic organisms (invertebrates, fish, birds, otter, etc.)
	There is an opportunity through this project to work with community partners to increase fish and other wildlife habitat.
	Concern regarding improvements to shoreline and wetland biodiversity.
Hydroelectric Facility	A package containing background documentation comprising previous communications on the Boulevard Lake Dam and the hydroelectric facility, spanning from 1992 to 2015, was provided to the City of Thunder Bay by a stakeholder.

Table 8-3 Summary of Comments and Questions Received at the First PIC (Cont'd)

Issue	Comments and Questions Received
Miscellaneous	Concern that the project is not ministry approved.
	This project should be advertised better. An ad could have been placed in media that is delivered to most homes in the area.
	I have no concerns about the rehabilitation project, because it needs to be done, as soon as possible.
	I have no concerns and do what is required to preserve the dam's natural appearance in such a natural setting.
	Consider widening the scope of the project to include the LPH greenspace, and a potential wildlife corridor.
	Concern that there is already too much encroachment on Centennial Park, and residential use of the LPH greenspace may deteriorate/cause further encroachment of the Boulevard Lake area.
	Please provide further clarification regarding what the project applies to. Does it apply to just the dam, or the whole lake?
	What are the issues that you are specifically seeking public input on? It appears that rehabilitation is a firm decision, so what are you asking the public to comment on. Can public input be provided on the materials used, etc.?
	Communication about the project needs to be consistent and constant, especially during construction. People will tolerate some disruption as long as they are adequately informed. Ensure that there will be adequate signage during construction, and communication needs to be targeted to all users of the dam (e.g., dragon boaters).
	When communicating about this project, the City needs to ensure all outlets and channels are used (both traditional and social media) to reach as many people as possible.
	There is an opportunity to provide historical education through this project (e.g. power to first electric buses and transit).
	Concern that the City is contravening the federal *Fisheries Act*.
	Has a federal authorization been granted for Boulevard Lake Dam wherein it is not necessary for the dam to provide fish passage according to the *Fisheries Act*?
	Concern that the City is appropriating green space for development, and to consider the development of brown space first.

Table 8-3 Summary of Comments and Questions Received at the First PIC (Cont'd)

Issue	Comments and Questions Received
Public Information Session	Suggestions that advertising for public information sessions needs to be improved by using outlets like the Source.
	What will the next public information session focus on? Will it be much of the same or will it focus on next steps, what the City has done to date, and how to move the project forward.
Timing	After all the delays, why is the project still not ready to proceed?
	Ensure the rehabilitation is done before it is too late.
	It is time to fix the dam, and hopefully it will not take years.
	Do the rehabilitation correctly the first time, no matter how long it takes.
	Suggestion to have the project move ahead in 2017, although there is an understanding that it is unlikely.
	Will rehabilitation last as long as reconstruction?
Water and Water Quality	It is important to improve water flow.
	It is important to improve water quality.
	Improve water quality in the summer months.
	It would be great to improve water quality for full season swimming (i.e., through dredging or improvement of the shore).
	Concern for the control of water levels and avoidance of draw down.
	Provide stormwater management details on how the dam will withstand the effects of the LPH redevelopment. There are plans to include a lot of impervious surfaces, which will increase flow of surface water to Boulevard Lake.
	Water that drains from the street should be adequately filtered before it enters the lake.

8.3.2 Second Public Information Centre (PIC)

The second PIC for the Thunder Bay Boulevard Lake Dam Rehabilitation Schedule C Class EA occurred on September 7, 2017 from 4:00 pm to 8:30 pm at the Current River Community Centre, with presentations given at 5:00 pm and 7:00 pm. The local community and key interest groups were notified about the project and invited to attend the PIC by way of a newspaper advertisement in the *Chronicle Journal* on August 26, 2017 (see Appendix E), a media advisory, a media release, and posting on City social media. Agencies were contacted in the manner described in the previous section, and information was posted on the City's website (see Section 8.3.3), under the *Notices to the Public* section.

The objectives of the second PIC were to promote effective communication between the City and stakeholders and the general public; present updated information on the Boulevard Lake Dam Rehabilitation Class EA; inform and discuss project plans, obtain input for the project, and identify and resolve concerns about the proposed project; obtain input and feedback about the PIC; and outline future steps in the EA process.

Panels were displayed which provided an opportunity for the public to learn more about the project, environmental studies and assessment of environmental effects, and to comment on the options for the rehabilitation of the Boulevard Lake Dam. Participants were also provided information on next steps of the project and how to participate in the Class EA process. Following each of the presentations, participants were invited to ask questions and voice any concerns about the project, and were provided the opportunity to speak with project team members. A total of 39 individuals attended the PIC, each of whom received a questionnaire on which to provide written comments and feedback to the project team (see Appendix G for PIC materials). A total of nine (9) surveys were completed at the second PIC, and three (3) surveys were completed online during the month of September, following the PIC. Thus, twelve (12) were completed in total.

Public Comments Following the Second PIC

Comments from the public were received both orally and in written form via the questionnaire. Of the twelve (12) questionnaires received, the most common concerns voiced by the public with respect to the rehabilitation revolved around:

- the timing of the rehabilitation;
- pedestrian access;
- safety of the bypass and pathway for users;
- dam construction, alternatives and longevity;
- investment and construction contract payment;

- evaluation of alternatives and mitigation measures;
- minimizing environmental impacts; and,
- water and water quality, including concerns over contaminated water.

All comments received from the public at the second PIC and all questionnaires completed online via the City's website are included in Table 8-4.

Table 8-4 Summary of Comments and Questions Received at the Second PIC

Issue	Comments and Questions Received
Access	Allow people to continue to be able to walk around the lake. Access required from Grenville Avenue and Cumberland to the walk area. Consider a paved walkway path past dam.
	Consider closing walkway at 2:00 am. Automated gates remotely controlled where and by whom, 24 hours/day?
	Good to widen trail and improve access.
Class Environmental Assessment	The material presented at the PIC made it look like the decision as to what exactly to do was already made.
	Satisfied with the level of study that has been completed.
	Satisfied with proposed mitigation measures.
Cost/Funding	I hope the City looks to make lasting concrete repairs that may cost more now but provide lasting savings in the long run.
	It is important that, once completed, the area affected by construction be returned to its original state. That requirement should be part of any contract and full payment should not be made until it is completed.
Dam Construction/Rehabilitation	For rehabilitation of concrete, consider planning for longer lasting option 2C, so repairs are not needed frequently. For dam operations, consider using option 4D, automation allows for quick responses to storm and drought effects to respond to fish migrations immediately (dependent on flow and temperature). For construction methods, consider use of several small cofferdams over two cofferdams (prefer 5B over 5A), since less temporary habitat area lost.
	I would like repair to provide another 100 years of use.
	Would like to see the alternate trail across Cumberland Street bridge maintained throughout construction. Care should be taken to ensure the cofferdams can withstand a regional storm and not cause flooding elsewhere.
	In order to ensure the continued use of the beach areas and upper reaches of the lake, a cofferdam needs to be constructed.
Environmental Aspects/Effects	Protect fish and wildlife species and habitat including rainbow trout, brook trout, walleye. Look for opportunities to improve shoreline habitat.
	Do not restrict the fish way / fish ladder. Make sure it is a working part of the reconstruction.
Miscellaneous	I am happy to suffer inconvenience as a user to see repair.

Table 8-4 Summary of Comments and Questions Received at the Second PIC (Cont'd)

Issue	Comments and Questions Received
Safety	Problem with alternate bypass walking route. Not safe, especially at night. This needs to be addressed.
	It is important that normal use of the lake and safety of walkers and bikers using the pathway is paramount in any plans.
	During this time, ensure that Boulevard Lake will be cleaned and drainage fixed so kids can swim in the lake past July without getting sick.
	Ensure there is appropriate lighting in the area.
Public Information Session	Well done.
	Clear explanation of the process
	Consultants answered my questions
	Appreciate the level of detail in the study and with what was presented.
Timing	Concerns – timely, dam requires repairs.
	Recreation lake downtime should be planned for non-peak use especially regarding the use of the lake. Consider convenience for residents over construction companies.
Water and Water Quality	Not much consideration given to potential water issues above dam at Boulevard. Wetlands designation North of North Branch Road will affect downstream flooding on Current River.
	The addition of mechanical gates presents new options for updating the water management plan. If water management cannot improve *E.coli* levels, this should be pursued.

8.3.3 Project Website

To further facilitate public access to information relating to the project and the opportunity to provide feedback, a project website for the Boulevard Lake Dam Rehabilitation Project was created on the City's website at: http://thunderbay.ca/boulevardlake.

The web page provides an overview of the project, information and display panels from the first PIC, and access to the Boulevard Lake Park User Survey, which allows the public to submit responses and comments with regard to the dam and park use. The website also provides project contact information for those who have questions about the project. The web page is being updated as new information becomes available. A copy of the web page is provided in Appendix H.

8.4 Consultation with Special Interest Groups and the Current River Hydro Partnership

Throughout the project planning process, the City has sought to ensure that local community and special interest groups have had access to project information and have had an opportunity to make project related inquiries as well as provision of input to the project team. To date, the City has ensured inclusivity of communication with the North Shore Steelhead Association (NSSA) and the Current River Hydro Partnership. Both are stakeholder interest groups with direct ties to the dam, who have a vested interest in the outcome of the dam rehabilitation project. A letter from the NSSA is located in Appendix I.

Additionally, meetings with the above mentioned special interest stakeholder groups were held throughout the planning process. The details of these meetings are outlined in Table 8-5.

Table 8-5 Meetings with Special Interest Groups

Special Interest Group	Date of Meeting	Topics Discussed
NSSA	June 21, 2016	• Dam operations. • Dam rehabilitation. • Water levels and lake drawdown. • Fish ladder. • Power generation.
Current River Hydro Partnership	July 6, 2016	• Overview of scope of the Boulevard Dam Rehabilitation Class EA. • Dam rehabilitation activities and effects, including effects to power generation. • Opportunities to enhance dam infrastructure with respect to power generation (i.e., intakes). • Next steps in the Class EA and ongoing consultation.

8.5 Consultation with Aboriginal Communities

As part of the consultation process required under the MCEA, one First Nation and one Métis community (see Table 3-1 in Section 3.4) were contacted during project commencement, subsequent to consultation and confirmation by the MECP.

The communities were contacted by letter via registered mail on June 1, 2016. The two communities were identified early in the EA and planning process by consulting with the Aboriginal Consultation Advisor at the MECP Environmental Approvals Access and Service Integration Branch (EAASIB) to obtain a confirmed list of communities to consult with respect to the proposed project (outlined in Table 8-6). Correspondence is included in Appendix J.

Additionally, meetings with the Aboriginal Communities were held throughout the planning process. The details of these meetings are outlined in Table 8-7. A summary of correspondence with the Aboriginal communities is provided in Table 8-8.

Table 8-6 Aboriginal Communities Contacted

Community Contacted	Leader(s) Contacted and Position(s) if Applicable	Contact Information
Fort William First Nation (FWFN)	Chief Peter Collins	90 Anemki Drive, Suite 200 Fort William First Nation, Ontario P7J 1L3 807-623-9543, Ext. 235
Métis Nation of Ontario (MNO)	C/O Thunder Bay Métis Council, Cameron Burgess	226 May Street South P7E 1B4 807-624-5018

To date, there have been no formal letter responses or comments, resulting from the initial Notice of Commencement letter which was sent to the communities listed in Table 8-6. Additional information has been requested in communications reported in Table 8-7.

Table 8-7 Meetings with Aboriginal Communities

Aboriginal Community	Date of Meeting	Topics Discussed
Fort William First Nation (FWFN)	November 21, 2016	• Scope of Class EA project. • Archaeological findings, avoidance, planned work in June of 2017. • Site access for archaeological studies. • Information on PICs to be held in the future.
Métis Nation of Ontario (MNO)	April 26, 2017	• Presentation and information exchange. • History of the dam. • Introduction of the project. • Details regarding the Class EA project scope, including problem assessment, alternative solutions, alternative design concepts, and potential evaluation criteria. • Details regarding the baseline environmental studies that had been undertaken thus far.
Métis Nation of Ontario (MNO)	May 11, 2017	• Depth of the lake. • Improvements to water quality. • Effects of dam removal. • Construction in the wet versus construction in the dry. • Environmental baseline and environmental effects of the project. • Date of EA submission. • Effect of dam rehabilitation on Steelhead and native species. • Archaeology and archaeological assessments. • Mercury levels.

Table 8-8 Correspondence with Aboriginal Communities

Aboriginal Community	Communication Date	Method of Communication	Topics Discussed
Métis Nation of Ontario (MNO)	June 7, 2017	E-mail (Outgoing)	• The City provided Archaeological Assessment report and reporting related to biology (Aquatic and Terrestrial Environmental Report) as well as a letter specifically relating to mercury concerns that were outlined at the meeting on May 11, 2017.
Métis Nation of Ontario (MNO)	July 7, 2017	E-mail (Incoming)	• Following review of the Aquatic and Terrestrial Environmental Report, the Consultation Committee and a knowledge holder who specializes in water quality noticed a few gaps in the document: 1) No page numbers and report difficult to navigate. 2) No data on mercury for fish and no discussion of benthic invertebrates in Boulevard Lake. • Missing information requested.
Métis Nation of Ontario (MNO)	August 14, 2017	E-mail (Outgoing)	• The City responded indicating that the report will be updated with page numbers and analysis which includes the current mercury discussions and additional information on benthic invertebrates. It was to be later provided as soon as the updates were completed. • Within the Aquatic and Terrestrial Environment Report, it is noted that construction activities associated with the Boulevard Lake Dam should have no impact on mercury levels in fish. The specific comments are as follows: *"Ontario currently has regulations for total mercury in water, and methylmercury in fish. In general, FNs are generally concerned about methylmercury in fish in lakes where fish are caught for consumption. To date, we have sampled for total mercury in Boulevard Lake water and sediment, and methylmercury in Boulevard Lake sediment. The lab results based on water samples taken at 18 locations in the Lake show compliance with total mercury limits at all locations. The lab results based on methylmercury sampled in sediments at two locations in the Lake also show very low methylmercury levels in the Lake sediment. Our opinion, based on these results, is that the very low levels of methylmercury in the Lake sediment strongly suggest that that bioaccumulation in fish to levels that could possibly exceed guidelines would be very unlikely"* • As such, the City has no plan to do any specific testing in the fish as it has been advised by the consultant that this issue is not related to dam rehabilitation activities, nor would rehabilitation activities have an effect on mercury levels in fish.
Métis Nation of Ontario (MNO)	August 14, 2017	E-mail (Incoming)	• The MNO informed the City that they will pass the comments regarding mercury to their Consultant, and that they were also waiting for final base line reports. • Asked for the name of the City's consultant that conducted the mercury studies, and requested a copy of reports pertaining to their samples.

Table 8-8 Correspondence with Aboriginal Communities (Cont'd)

Aboriginal Community	Communication Date	Method of Communication	Topics Discussed
Métis Nation of Ontario (MNO)	August 15, 2017	E-mail (Outgoing)	• The City advised that technical studies will not be final until the final submission of the Environmental Study Report (ESR) later this fall. • MNO will receive a copy of the draft ESR and the final along with the supporting appendices when they are released for review. • There is no new information to provide at this time. Included in the finalized information will be the independent laboratory results of the testing of the sediment and water samples. • The water and sediment quality work is being done by the City's consultant, Arcadis Canada Inc.
Métis Nation of Ontario (MNO)	September 19, 2017	E-mail (Incoming)	• The MNO expressed concerns regarding information heard at the City of Thunder Bay's second PIC for the Boulevard Lake Dam Rehabilitation Project, which took place on September 7, 2017. • An MNO citizen who was in attendance overheard that the MNO has no issues with the project. • The MNO has clarified that this is not the case and there are some outstanding concerns that may or may not be alleviated once the final technical studies and Environmental Study Report are received.

9.0 CONCLUSION

Project planning documented in this ESR involved an extensive investigation of the existing environment. Information was obtained from a combination of field studies and secondary sources. Specific field studies undertaken included water quality sampling, vegetation surveys, Species at Risk, sediment quality, fish occupancy, lake bathymetry, benthic invertebrates, hydrology, archaeology, and park usage. A wide variety of secondary sources were consulted including previous reports prepared for the City of Thunder Bay and for the Lakehead Region Conservation Authority (LRCA). In addition, relevant information was obtained through consultations with municipal and provincial government agencies and other stakeholders.

The City of Thunder Bay considered the following alternatives for solving the structural problems affecting Boulevard Lake Dam: do nothing, rehabilitate the existing dam, construct a new dam, and remove the existing dam. These alternatives were assessed, and dam rehabilitation was chosen as the preferred alternative.

The alternative design concepts for achieving the dam rehabilitation include the following components:

- Alternative ways to enhance strength of dam to meet LRIA requirements for redundancy.
- Alternative ways to repair the protective concrete.
- Alternative ways to achieve and enhance public access across the dam structure.
- Alternative ways to operate the dam to improve responsiveness and avoid conflict with recreational users.
- Alternative ways to undertake construction.

Each set of alternatives was assessed, and a preferred alternative was chosen for each, and subsequently combined into an overall preferred alternative. The Preferred Design Concept is described as follows:

- Strength requirements addressed by installing a redundant set of post-tensioned tendons in every buttress along the east retaining wall.
- Rehabilitation of concrete through patching.
- The deck of the dam will be widened to the City of Thunder Bay standard trail width.
- With respect to dam operations, wooden stop logs will be replaced with manually operated mechanical gates. This combination will help regulate and maintain water levels in accordance with the Permit to Take Water (PTTW) and allow for easier operations. In order to pass the Regulatory Flood, stop logs must be replaced at all sluiceways.
- Construction will occur over a two to three-year period and will be staged from a laydown area and access road south of the dam. The construction of the access road will follow best construction practices for erosion control, sediment control, and stormwater

management. Relevant environmental standards will be followed. Work in water will be started after June 15 each year to minimize impact to fish spawning. Water levels will be maintained at winter set during the rehabilitation work, and drawn down additionally three times for two to four week to install and remove two cofferdams (in two stages). Cofferdams will be used to complete upstream rehabilitation in the dry. The cofferdams will be constructed in accordance with best construction methods. All upstream work, such as the construction of the cofferdams, will be completed during the first year of construction. The construction contractor will be required to complete the construction as per Ontario Provincial Standard Specification (OPSS) and regulations.

Pending receipt of all required environmental approvals, the design, tendering and awarding of project work, as well as completion of relevant permits is slated to occur in 2019, with construction is anticipated to begin in 2020. Due to the scale of the project, construction must be staged over two to three years (spanning from 2020 to 2022). In the first year of construction the lake must be lowered to install the cofferdams and perform upstream repair work. All downstream work, including buttress repairs and post tensioning are scheduled to take place in 2020. Remaining construction work if necessary, including repair of the underside of the deck, is scheduled for construction in 2021 to 2022.

The ESR is presently being made available for stakeholder review and comment for a 30-day review period, in conjunction with the publication and distribution of the Notice of Completion of Environmental Study Report. As such, interested parties may provide written comments to the City of Thunder Bay within 30 calendar days. Comments should be directed to:

Mr. Mike Vogrig

Project Engineer, Infrastructure & Operations Division

Phone: 807-625-4321

E-mail: mvogrig@thunderbay.ca

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APPENDIX A

Comprehensive Water Quality Sampling Results

ARCADIS Canada Inc. - Richmond Hill
ATTN: Allan Harris
Northern Bioscience
363 Van Horne Street
Thunder Bay ON P7A 3G3

Date Received: 08-AUG-16
Report Date: 02-SEP-16 11:35 (MT)
Version: FINAL

Client Phone: 807-344-7213

Certificate of Analysis

Lab Work Order #: L1809795

Project P.O. #: NOT SUBMITTED
Job Reference: NORTHERN BIOSCIENCE
C of C Numbers:
Legal Site Desc:

Rikki Thomson
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-1 BOULEVARD LAKE WAYPOINT 6							
Sampled By: Client on 08-AUG-16 @ 09:46							
Matrix: Soil							
Physical Tests							
% Moisture	73.6		0.10	%	10-AUG-16	11-AUG-16	R3523375
Bacteriological Tests							
E. Coli	<10		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527130
Total Coliforms	3380		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527120
Metals							
Aluminum (Al)	16600		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Antimony (Sb)	0.30		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Arsenic (As)	6.45		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Barium (Ba)	146		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Beryllium (Be)	0.44		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Bismuth (Bi)	<0.20		0.20	ug/g	12-AUG-16	12-AUG-16	R3526027
Boron (B)	<5.0		5.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Cadmium (Cd)	0.562		0.020	ug/g	12-AUG-16	12-AUG-16	R3526027
Calcium (Ca)	8540		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Chromium (Cr)	45.0		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Cobalt (Co)	15.0		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Copper (Cu)	37.3		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Iron (Fe)	33700		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Lead (Pb)	12.1		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Lithium (Li)	15.7		2.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Magnesium (Mg)	6030		20	ug/g	12-AUG-16	12-AUG-16	R3526027
Manganese (Mn)	1060		1.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Molybdenum (Mo)	1.02		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Nickel (Ni)	31.6		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Phosphorus (P)	695		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Potassium (K)	700		100	ug/g	12-AUG-16	12-AUG-16	R3526027
Selenium (Se)	0.59		0.20	ug/g	12-AUG-16	12-AUG-16	R3526027
Silver (Ag)	0.13		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Sodium (Na)	772		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Strontium (Sr)	22.7		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Sulfur (S)	<5000		5000	ug/g	12-AUG-16	12-AUG-16	R3526027
Thallium (Tl)	0.175		0.050	ug/g	12-AUG-16	12-AUG-16	R3526027
Tin (Sn)	<2.0		2.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Titanium (Ti)	923		1.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Uranium (U)	2.34		0.050	ug/g	12-AUG-16	12-AUG-16	R3526027
Vanadium (V)	107		0.20	ug/g	12-AUG-16	12-AUG-16	R3526027
Zinc (Zn)	110		2.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Zirconium (Zr)	2.7		1.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Aggregate Organics							
Oil and Grease, Total	<500		500	mg/kg	11-AUG-16	11-AUG-16	R3526198
Volatile Organic Compounds							
Benzene	<0.020	ABL	0.020	ug/g	10-AUG-16	11-AUG-16	R3523878

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-1 BOULEVARD LAKE WAYPOINT 6							
Sampled By: Client on 08-AUG-16 @ 09:46							
Matrix: Soil							
Volatile Organic Compounds							
Ethylbenzene	<0.054	ABL	0.054	ug/g	10-AUG-16	11-AUG-16	R3523878
Toluene	<0.24	ABL	0.24	ug/g	10-AUG-16	11-AUG-16	R3523878
o-Xylene	<0.060	ABL	0.060	ug/g	10-AUG-16	11-AUG-16	R3523878
m+p-Xylenes	<0.090	ABL	0.090	ug/g	10-AUG-16	11-AUG-16	R3523878
Xylenes (Total)	<0.11		0.11	ug/g		11-AUG-16	
Surrogate: 4-Bromofluorobenzene	77.9		70-130	%	10-AUG-16	11-AUG-16	R3523878
Surrogate: 1,4-Difluorobenzene	85.3		70-130	%	10-AUG-16	11-AUG-16	R3523878
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Acenaphthylene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Anthracene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)anthracene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)pyrene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(b)fluoranthene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(g,h,i)perylene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(k)fluoranthene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Chrysene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Dibenzo(ah)anthracene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluoranthene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluorene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Indeno(1,2,3-cd)pyrene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
1+2-Methylnaphthalenes	<0.13		0.13	ug/g		17-AUG-16	
1-Methylnaphthalene	<0.090	DLHM	0.090	ug/g	10-AUG-16	17-AUG-16	R3526058
2-Methylnaphthalene	<0.090	DLHM	0.090	ug/g	10-AUG-16	17-AUG-16	R3526058
Naphthalene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Phenanthrene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Pyrene	<0.15	DLHM	0.15	ug/g	10-AUG-16	17-AUG-16	R3526058
Surrogate: 2-Fluorobiphenyl	103.4		50-140	%	10-AUG-16	17-AUG-16	R3526058
Surrogate: p-Terphenyl d14	95.9		50-140	%	10-AUG-16	17-AUG-16	R3526058
Report Remarks : ABL-Analysis compromised due to type of sample jar received. Losses may have occurred according to 511 Regulation. Detection Limit Adjusted: Sample has High Moisture Content.							
L1809795-2 BOULEVARD LAKE WAYPOINT 7							
Sampled By: Client on 08-AUG-16 @ 09:56							
Matrix: Soil							
Physical Tests							
% Moisture	57.4		0.10	%	10-AUG-16	11-AUG-16	R3523375
Bacteriological Tests							
E. Coli	<10		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527130
Total Coliforms	2190		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527120
Metals							
Aluminum (Al)	16200		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Antimony (Sb)	0.35		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Arsenic (As)	7.21		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-2 BOULEVARD LAKE WAYPOINT 7 Sampled By: Client on 08-AUG-16 @ 09:56 Matrix: Soil							
Metals							
Barium (Ba)	140		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Beryllium (Be)	0.50		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Bismuth (Bi)	<0.20		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Boron (B)	<5.0		5.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Cadmium (Cd)	0.389		0.020	ug/g	11-AUG-16	11-AUG-16	R3524218
Calcium (Ca)	5270		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Chromium (Cr)	44.9		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Cobalt (Co)	17.1		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Copper (Cu)	29.1		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Iron (Fe)	43200		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lead (Pb)	8.80		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lithium (Li)	20.4		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Magnesium (Mg)	5940		20	ug/g	11-AUG-16	11-AUG-16	R3524218
Manganese (Mn)	1360		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Molybdenum (Mo)	1.23		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Nickel (Ni)	32.8		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Phosphorus (P)	540		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Potassium (K)	590		100	ug/g	11-AUG-16	11-AUG-16	R3524218
Selenium (Se)	0.38		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Silver (Ag)	<0.10		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Sodium (Na)	598		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Strontium (Sr)	16.3		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Sulfur (S)	<5000		5000	ug/g	11-AUG-16	11-AUG-16	R3524218
Thallium (Tl)	0.175		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Tin (Sn)	<2.0		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Titanium (Ti)	724		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Uranium (U)	2.24		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Vanadium (V)	96.7		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Zinc (Zn)	104		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Zirconium (Zr)	1.6		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Aggregate Organics							
Oil and Grease, Total	<500		500	mg/kg	11-AUG-16	11-AUG-16	R3526198
Volatile Organic Compounds							
Benzene	<0.010	ABL	0.010	ug/g	10-AUG-16	11-AUG-16	R3523878
Ethylbenzene	<0.027	ABL	0.027	ug/g	10-AUG-16	11-AUG-16	R3523878
Toluene	<0.12	ABL	0.12	ug/g	10-AUG-16	11-AUG-16	R3523878
o-Xylene	<0.030	ABL	0.030	ug/g	10-AUG-16	11-AUG-16	R3523878
m+p-Xylenes	<0.045	ABL	0.045	ug/g	10-AUG-16	11-AUG-16	R3523878
Xylenes (Total)	<0.054		0.054	ug/g		11-AUG-16	
Surrogate: 4-Bromofluorobenzene	86.1		70-130	%	10-AUG-16	11-AUG-16	R3523878
Surrogate: 1,4-Difluorobenzene	95.5		70-130	%	10-AUG-16	11-AUG-16	R3523878
Polycyclic Aromatic Hydrocarbons							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-2 BOULEVARD LAKE WAYPOINT 7							
Sampled By: Client on 08-AUG-16 @ 09:56							
Matrix: Soil							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Acenaphthylene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Anthracene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)anthracene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)pyrene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(b)fluoranthene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(g,h,i)perylene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(k)fluoranthene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Chrysene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Dibenzo(ah)anthracene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluoranthene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluorene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Indeno(1,2,3-cd)pyrene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
1+2-Methylnaphthalenes	<0.064		0.064	ug/g		17-AUG-16	
1-Methylnaphthalene	<0.045	DLHM	0.045	ug/g	10-AUG-16	17-AUG-16	R3526058
2-Methylnaphthalene	<0.045	DLHM	0.045	ug/g	10-AUG-16	17-AUG-16	R3526058
Naphthalene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Phenanthrene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Pyrene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Surrogate: 2-Fluorobiphenyl	103.4		50-140	%	10-AUG-16	17-AUG-16	R3526058
Surrogate: p-Terphenyl d14	94.0		50-140	%	10-AUG-16	17-AUG-16	R3526058
Report Remarks : ABL-Analysis compromised due to type of sample jar received. Losses may have occurred according to 511 Regulation. Detection Limit Adjusted: Sample has High Moisture Content.							
L1809795-3 BOULEVARD LAKE WAYPOINT 8							
Sampled By: Client on 08-AUG-16 @ 10:05							
Matrix: Soil							
Physical Tests							
% Moisture	65.5		0.10	%	10-AUG-16	11-AUG-16	R3523375
Bacteriological Tests							
E. Coli	<10		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527130
Total Coliforms	2520		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527120
Metals							
Aluminum (Al)	14100		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Antimony (Sb)	0.23		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Arsenic (As)	4.96		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Barium (Ba)	122		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Beryllium (Be)	0.38		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Bismuth (Bi)	<0.20		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Boron (B)	<5.0		5.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Cadmium (Cd)	0.345		0.020	ug/g	11-AUG-16	11-AUG-16	R3524218
Calcium (Ca)	5300		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Chromium (Cr)	39.6		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-3 BOULEVARD LAKE WAYPOINT 8 Sampled By: Client on 08-AUG-16 @ 10:05 Matrix: Soil							
Metals							
Cobalt (Co)	14.7		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Copper (Cu)	25.8		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Iron (Fe)	33300		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lead (Pb)	9.22		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lithium (Li)	16.8		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Magnesium (Mg)	5120		20	ug/g	11-AUG-16	11-AUG-16	R3524218
Manganese (Mn)	930		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Molybdenum (Mo)	0.80		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Nickel (Ni)	28.4		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Phosphorus (P)	583		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Potassium (K)	650		100	ug/g	11-AUG-16	11-AUG-16	R3524218
Selenium (Se)	0.37		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Silver (Ag)	<0.10		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Sodium (Na)	728		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Strontium (Sr)	17.2		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Sulfur (S)	<5000		5000	ug/g	11-AUG-16	11-AUG-16	R3524218
Thallium (Tl)	0.143		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Tin (Sn)	<2.0		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Titanium (Ti)	839		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Uranium (U)	1.70		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Vanadium (V)	92.6		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Zinc (Zn)	104		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Zirconium (Zr)	2.2		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Aggregate Organics							
Oil and Grease, Total	<500		500	mg/kg	11-AUG-16	11-AUG-16	R3526198
Volatile Organic Compounds							
Benzene	<0.014	ABL	0.014	ug/g	10-AUG-16	11-AUG-16	R3523878
Ethylbenzene	<0.036	ABL	0.036	ug/g	10-AUG-16	11-AUG-16	R3523878
Toluene	<0.16	ABL	0.16	ug/g	10-AUG-16	11-AUG-16	R3523878
o-Xylene	<0.040	ABL	0.040	ug/g	10-AUG-16	11-AUG-16	R3523878
m+p-Xylenes	<0.060	ABL	0.060	ug/g	10-AUG-16	11-AUG-16	R3523878
Xylenes (Total)	<0.072		0.072	ug/g		11-AUG-16	
Surrogate: 4-Bromofluorobenzene	85.1		70-130	%	10-AUG-16	11-AUG-16	R3523878
Surrogate: 1,4-Difluorobenzene	93.1		70-130	%	10-AUG-16	11-AUG-16	R3523878
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Acenaphthylene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Anthracene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)anthracene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)pyrene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(b)fluoranthene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(g,h,i)perylene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-3 BOULEVARD LAKE WAYPOINT 8 Sampled By: Client on 08-AUG-16 @ 10:05 Matrix: Soil							
Polycyclic Aromatic Hydrocarbons							
Benzo(k)fluoranthene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Chrysene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Dibenzo(ah)anthracene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluoranthene	0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluorene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Indeno(1,2,3-cd)pyrene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
1+2-Methylnaphthalenes	<0.085		0.085	ug/g		17-AUG-16	
1-Methylnaphthalene	<0.060	DLHM	0.060	ug/g	10-AUG-16	17-AUG-16	R3526058
2-Methylnaphthalene	<0.060	DLHM	0.060	ug/g	10-AUG-16	17-AUG-16	R3526058
Naphthalene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Phenanthrene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Pyrene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Surrogate: 2-Fluorobiphenyl	105.1		50-140	%	10-AUG-16	17-AUG-16	R3526058
Surrogate: p-Terphenyl d14	93.8		50-140	%	10-AUG-16	17-AUG-16	R3526058
Report Remarks : ABL-Analysis compromised due to type of sample jar received. Losses may have occurred according to 511 Regulation. Detection Limit Adjusted: Sample has High Moisture Content. Volatile test was conducted on sample with headspace. Results may be biased low.							
L1809795-4 BOULEVARD LAKE WAYPOINT 9 Sampled By: Client on 08-AUG-16 @ 10:17 Matrix: Soil							
Physical Tests							
% Moisture	48.4		0.10	%	10-AUG-16	11-AUG-16	R3523375
Bacteriological Tests							
E. Coli	<10		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527130
Total Coliforms	1810		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527120
Metals							
Aluminum (Al)	14900		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Antimony (Sb)	0.24		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Arsenic (As)	5.42		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Barium (Ba)	125		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Beryllium (Be)	0.43		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Bismuth (Bi)	<0.20		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Boron (B)	<5.0		5.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Cadmium (Cd)	0.366		0.020	ug/g	11-AUG-16	11-AUG-16	R3524218
Calcium (Ca)	5620		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Chromium (Cr)	40.1		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Cobalt (Co)	13.8		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Copper (Cu)	29.5		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Iron (Fe)	38000		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lead (Pb)	10.1		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lithium (Li)	18.1		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Magnesium (Mg)	5510		20	ug/g	11-AUG-16	11-AUG-16	R3524218
Manganese (Mn)	676		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-4 BOULEVARD LAKE WAYPOINT 9							
Sampled By: Client on 08-AUG-16 @ 10:17							
Matrix: Soil							
Metals							
Molybdenum (Mo)	0.77		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Nickel (Ni)	28.9		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Phosphorus (P)	572		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Potassium (K)	680		100	ug/g	11-AUG-16	11-AUG-16	R3524218
Selenium (Se)	0.37		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Silver (Ag)	<0.10		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Sodium (Na)	789		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Strontium (Sr)	16.9		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Sulfur (S)	<5000		5000	ug/g	11-AUG-16	11-AUG-16	R3524218
Thallium (Tl)	0.148		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Tin (Sn)	<2.0		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Titanium (Ti)	778		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Uranium (U)	1.84		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Vanadium (V)	89.5		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Zinc (Zn)	100		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Zirconium (Zr)	2.6		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Aggregate Organics							
Oil and Grease, Total	<500		500	mg/kg	11-AUG-16	11-AUG-16	R3526198
Volatile Organic Compounds							
Benzene	<0.0068	ABL	0.0068	ug/g	10-AUG-16	11-AUG-16	R3523878
Ethylbenzene	<0.018	ABL	0.018	ug/g	10-AUG-16	11-AUG-16	R3523878
Toluene	<0.080	ABL	0.080	ug/g	10-AUG-16	11-AUG-16	R3523878
o-Xylene	<0.020	ABL	0.020	ug/g	10-AUG-16	11-AUG-16	R3523878
m+p-Xylenes	<0.030	ABL	0.030	ug/g	10-AUG-16	11-AUG-16	R3523878
Xylenes (Total)	<0.050		0.050	ug/g		11-AUG-16	
Surrogate: 4-Bromofluorobenzene	85.3		70-130	%	10-AUG-16	11-AUG-16	R3523878
Surrogate: 1,4-Difluorobenzene	95.3		70-130	%	10-AUG-16	11-AUG-16	R3523878
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Acenaphthylene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Anthracene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)anthracene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)pyrene	0.052		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(b)fluoranthene	0.081		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(g,h,i)perylene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(k)fluoranthene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Chrysene	0.060		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Dibenzo(ah)anthracene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluoranthene	0.135		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluorene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Indeno(1,2,3-cd)pyrene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
1+2-Methylnaphthalenes	<0.042		0.042	ug/g		17-AUG-16	

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-4 BOULEVARD LAKE WAYPOINT 9 Sampled By: Client on 08-AUG-16 @ 10:17 Matrix: Soil							
Polycyclic Aromatic Hydrocarbons							
1-Methylnaphthalene	<0.030		0.030	ug/g	10-AUG-16	17-AUG-16	R3526058
2-Methylnaphthalene	<0.030		0.030	ug/g	10-AUG-16	17-AUG-16	R3526058
Naphthalene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Phenanthrene	0.080		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Pyrene	0.104		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Surrogate: 2-Fluorobiphenyl	102.4		50-140	%	10-AUG-16	17-AUG-16	R3526058
Surrogate: p-Terphenyl d14	95.8		50-140	%	10-AUG-16	17-AUG-16	R3526058
Report Remarks : ABL-Analysis compromised due to type of sample jar received. Losses may have occurred according to 511 Regulation.							
L1809795-5 BOULEVARD LAKE WAYPOINT 10 Sampled By: Client on 08-AUG-16 @ 10:26 Matrix: Soil							
Physical Tests							
% Moisture	56.2		0.10	%	10-AUG-16	11-AUG-16	R3523375
Bacteriological Tests							
E. Coli	<10		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527130
Total Coliforms	2220		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527120
Metals							
Aluminum (Al)	18400		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Antimony (Sb)	0.29		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Arsenic (As)	7.34		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Barium (Ba)	174		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Beryllium (Be)	0.48		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Bismuth (Bi)	<0.20		0.20	ug/g	12-AUG-16	12-AUG-16	R3526027
Boron (B)	<5.0		5.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Cadmium (Cd)	0.545		0.020	ug/g	12-AUG-16	12-AUG-16	R3526027
Calcium (Ca)	6190		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Chromium (Cr)	50.8		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Cobalt (Co)	19.4		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Copper (Cu)	36.8		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Iron (Fe)	49200		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Lead (Pb)	11.0		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Lithium (Li)	16.8		2.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Magnesium (Mg)	6410		20	ug/g	12-AUG-16	12-AUG-16	R3526027
Manganese (Mn)	1420		1.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Molybdenum (Mo)	1.02		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Nickel (Ni)	36.8		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027
Phosphorus (P)	720		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Potassium (K)	740		100	ug/g	12-AUG-16	12-AUG-16	R3526027
Selenium (Se)	0.46		0.20	ug/g	12-AUG-16	12-AUG-16	R3526027
Silver (Ag)	0.11		0.10	ug/g	12-AUG-16	12-AUG-16	R3526027
Sodium (Na)	828		50	ug/g	12-AUG-16	12-AUG-16	R3526027
Strontium (Sr)	18.4		0.50	ug/g	12-AUG-16	12-AUG-16	R3526027

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-5 BOULEVARD LAKE WAYPOINT 10							
Sampled By: Client on 08-AUG-16 @ 10:26							
Matrix: Soil							
Metals							
Sulfur (S)	<5000		5000	ug/g	12-AUG-16	12-AUG-16	R3526027
Thallium (Tl)	0.172		0.050	ug/g	12-AUG-16	12-AUG-16	R3526027
Tin (Sn)	<2.0		2.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Titanium (Ti)	1090		1.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Uranium (U)	2.32		0.050	ug/g	12-AUG-16	12-AUG-16	R3526027
Vanadium (V)	124		0.20	ug/g	12-AUG-16	12-AUG-16	R3526027
Zinc (Zn)	127		2.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Zirconium (Zr)	2.3		1.0	ug/g	12-AUG-16	12-AUG-16	R3526027
Aggregate Organics							
Oil and Grease, Total	<500		500	mg/kg	11-AUG-16	11-AUG-16	R3526198
Volatile Organic Compounds							
Benzene	<0.010	ABL	0.010	ug/g	10-AUG-16	11-AUG-16	R3523878
Ethylbenzene	<0.027	ABL	0.027	ug/g	10-AUG-16	11-AUG-16	R3523878
Toluene	<0.12	ABL	0.12	ug/g	10-AUG-16	11-AUG-16	R3523878
o-Xylene	<0.030	ABL	0.030	ug/g	10-AUG-16	11-AUG-16	R3523878
m+p-Xylenes	<0.045	ABL	0.045	ug/g	10-AUG-16	11-AUG-16	R3523878
Xylenes (Total)	<0.054		0.054	ug/g		11-AUG-16	
Surrogate: 4-Bromofluorobenzene	76.4		70-130	%	10-AUG-16	11-AUG-16	R3523878
Surrogate: 1,4-Difluorobenzene	81.7		70-130	%	10-AUG-16	11-AUG-16	R3523878
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Acenaphthylene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Anthracene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)anthracene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)pyrene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(b)fluoranthene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(g,h,i)perylene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(k)fluoranthene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Chrysene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Dibenzo(ah)anthracene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluoranthene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluorene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Indeno(1,2,3-cd)pyrene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
1+2-Methylnaphthalenes	<0.064		0.064	ug/g		17-AUG-16	
1-Methylnaphthalene	<0.045	DLHM	0.045	ug/g	10-AUG-16	17-AUG-16	R3526058
2-Methylnaphthalene	<0.045	DLHM	0.045	ug/g	10-AUG-16	17-AUG-16	R3526058
Naphthalene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Phenanthrene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Pyrene	<0.075	DLHM	0.075	ug/g	10-AUG-16	17-AUG-16	R3526058
Surrogate: 2-Fluorobiphenyl	102.6		50-140	%	10-AUG-16	17-AUG-16	R3526058
Surrogate: p-Terphenyl d14	93.9		50-140	%	10-AUG-16	17-AUG-16	R3526058

Report Remarks : ABL-Analysis compromised due to type of sample jar received. Losses may have occurred according to 511 Regulation. Detection

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-5 BOULEVARD LAKE WAYPOINT 10 Sampled By: Client on 08-AUG-16 @ 10:26 Matrix: Soil							
Limit Adjusted: Sample has High Moisture Content. Volatile test was conducted on sample with headspace. Results may be biased low.							
L1809795-6 BOULEVARD LAKE WAYPOINT 11 Sampled By: Client on 08-AUG-16 @ 10:38 Matrix: Soil							
Physical Tests							
% Moisture	39.5		0.10	%	10-AUG-16	11-AUG-16	R3523375
Bacteriological Tests							
E. Coli	<10		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527130
Total Coliforms	481		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527120
Metals							
Aluminum (Al)	12500		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Antimony (Sb)	0.19		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Arsenic (As)	3.98		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Barium (Ba)	110		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Beryllium (Be)	0.33		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Bismuth (Bi)	<0.20		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Boron (B)	<5.0		5.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Cadmium (Cd)	0.269		0.020	ug/g	11-AUG-16	11-AUG-16	R3524218
Calcium (Ca)	5330		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Chromium (Cr)	37.8		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Cobalt (Co)	14.7		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Copper (Cu)	29.7		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Iron (Fe)	36100		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lead (Pb)	6.66		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lithium (Li)	14.9		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Magnesium (Mg)	5550		20	ug/g	11-AUG-16	11-AUG-16	R3524218
Manganese (Mn)	873		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Molybdenum (Mo)	0.63		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Nickel (Ni)	32.3		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Phosphorus (P)	506		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Potassium (K)	670		100	ug/g	11-AUG-16	11-AUG-16	R3524218
Selenium (Se)	0.25		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Silver (Ag)	<0.10		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Sodium (Na)	670		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Strontium (Sr)	16.2		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Sulfur (S)	<5000		5000	ug/g	11-AUG-16	11-AUG-16	R3524218
Thallium (Tl)	0.122		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Tin (Sn)	<2.0		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Titanium (Ti)	1080		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Uranium (U)	1.34		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Vanadium (V)	146		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Zinc (Zn)	84.6		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Zirconium (Zr)	2.5		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-6 BOULEVARD LAKE WAYPOINT 11							
Sampled By: Client on 08-AUG-16 @ 10:38							
Matrix: Soil							
Metals							
Aggregate Organics							
Oil and Grease, Total	<500		500	mg/kg	11-AUG-16	11-AUG-16	R3526198
Volatile Organic Compounds							
Benzene	<0.0068	ABL	0.0068	ug/g	10-AUG-16	11-AUG-16	R3523878
Ethylbenzene	<0.018	ABL	0.018	ug/g	10-AUG-16	11-AUG-16	R3523878
Toluene	<0.080	ABL	0.080	ug/g	10-AUG-16	11-AUG-16	R3523878
o-Xylene	<0.020	ABL	0.020	ug/g	10-AUG-16	11-AUG-16	R3523878
m+p-Xylenes	<0.030	ABL	0.030	ug/g	10-AUG-16	11-AUG-16	R3523878
Xylenes (Total)	<0.050		0.050	ug/g		11-AUG-16	
Surrogate: 4-Bromofluorobenzene	86.9		70-130	%	10-AUG-16	11-AUG-16	R3523878
Surrogate: 1,4-Difluorobenzene	94.8		70-130	%	10-AUG-16	11-AUG-16	R3523878
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Acenaphthylene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Anthracene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)anthracene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)pyrene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(b)fluoranthene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(g,h,i)perylene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(k)fluoranthene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Chrysene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Dibenzo(ah)anthracene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluoranthene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluorene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Indeno(1,2,3-cd)pyrene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
1+2-Methylnaphthalenes	<0.042		0.042	ug/g		17-AUG-16	
1-Methylnaphthalene	<0.030		0.030	ug/g	10-AUG-16	17-AUG-16	R3526058
2-Methylnaphthalene	<0.030		0.030	ug/g	10-AUG-16	17-AUG-16	R3526058
Naphthalene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Phenanthrene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Pyrene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Surrogate: 2-Fluorobiphenyl	101.1		50-140	%	10-AUG-16	17-AUG-16	R3526058
Surrogate: p-Terphenyl d14	92.1		50-140	%	10-AUG-16	17-AUG-16	R3526058
Report Remarks : ABL-Analysis compromised due to type of sample jar received. Losses may have occurred according to 511 Regulation.							
L1809795-7 BOULEVARD LAKE WAYPOINT 12							
Sampled By: Client on 08-AUG-16 @ 11:55							
Matrix: Soil							
Physical Tests							
% Moisture	47.0		0.10	%	11-AUG-16	12-AUG-16	R3524011
Bacteriological Tests							
E. Coli	492		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527130
Total Coliforms	6560		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527120
Metals							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-7 BOULEVARD LAKE WAYPOINT 12							
Sampled By: Client on 08-AUG-16 @ 11:55							
Matrix: Soil							
Metals							
Aluminum (Al)	15600		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Antimony (Sb)	0.22		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Arsenic (As)	5.36		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Barium (Ba)	121		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Beryllium (Be)	0.38		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Bismuth (Bi)	<0.20		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Boron (B)	<5.0		5.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Cadmium (Cd)	0.364		0.020	ug/g	11-AUG-16	11-AUG-16	R3524218
Calcium (Ca)	6170		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Chromium (Cr)	44.4		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Cobalt (Co)	15.9		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Copper (Cu)	32.1		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Iron (Fe)	44800		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lead (Pb)	9.70		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lithium (Li)	16.9		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Magnesium (Mg)	5980		20	ug/g	11-AUG-16	11-AUG-16	R3524218
Manganese (Mn)	753		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Molybdenum (Mo)	0.77		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Nickel (Ni)	35.1		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Phosphorus (P)	635		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Potassium (K)	790		100	ug/g	11-AUG-16	11-AUG-16	R3524218
Selenium (Se)	0.36		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Silver (Ag)	<0.10		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Sodium (Na)	835		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Strontium (Sr)	18.4		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Sulfur (S)	<5000		5000	ug/g	11-AUG-16	11-AUG-16	R3524218
Thallium (Tl)	0.137		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Tin (Sn)	<2.0		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Titanium (Ti)	1140		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Uranium (U)	1.70		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Vanadium (V)	145		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Zinc (Zn)	109		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Zirconium (Zr)	2.8		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Aggregate Organics							
Oil and Grease, Total	<500		500	mg/kg	11-AUG-16	11-AUG-16	R3526198
Volatile Organic Compounds							
Benzene	<0.0068	ABL	0.0068	ug/g	10-AUG-16	11-AUG-16	R3523878
Ethylbenzene	<0.018	ABL	0.018	ug/g	10-AUG-16	11-AUG-16	R3523878
Toluene	<0.080	ABL	0.080	ug/g	10-AUG-16	11-AUG-16	R3523878
o-Xylene	<0.020	ABL	0.020	ug/g	10-AUG-16	11-AUG-16	R3523878
m+p-Xylenes	<0.030	ABL	0.030	ug/g	10-AUG-16	11-AUG-16	R3523878

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-7 BOULEVARD LAKE WAYPOINT 12							
Sampled By: Client on 08-AUG-16 @ 11:55							
Matrix: Soil							
Volatile Organic Compounds							
Xylenes (Total)	<0.050		0.050	ug/g		12-AUG-16	
Surrogate: 4-Bromofluorobenzene	86.4		70-130	%	10-AUG-16	11-AUG-16	R3523878
Surrogate: 1,4-Difluorobenzene	97.2		70-130	%	10-AUG-16	11-AUG-16	R3523878
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Acenaphthylene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Anthracene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)anthracene	0.056		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)pyrene	0.071		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(b)fluoranthene	0.123		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(g,h,i)perylene	0.063		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(k)fluoranthene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Chrysene	0.089		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Dibenzo(ah)anthracene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluoranthene	0.158		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluorene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Indeno(1,2,3-cd)pyrene	0.057		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
1+2-Methylnaphthalenes	<0.042		0.042	ug/g		17-AUG-16	
1-Methylnaphthalene	<0.030		0.030	ug/g	10-AUG-16	17-AUG-16	R3526058
2-Methylnaphthalene	<0.030		0.030	ug/g	10-AUG-16	17-AUG-16	R3526058
Naphthalene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Phenanthrene	0.059		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Pyrene	0.122		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Surrogate: 2-Fluorobiphenyl	100.7		50-140	%	10-AUG-16	17-AUG-16	R3526058
Surrogate: p-Terphenyl d14	92.7		50-140	%	10-AUG-16	17-AUG-16	R3526058
Report Remarks : ABL-Analysis compromised due to type of sample jar received. Losses may have occurred according to 511 Regulation.							
L1809795-8 BOULEVARD LAKE WAYPOINT 13							
Sampled By: Client on 08-AUG-16 @ 12:12							
Matrix: Soil							
Physical Tests							
% Moisture	60.9		0.10	%	11-AUG-16	12-AUG-16	R3524011
Bacteriological Tests							
E. Coli	24		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527130
Total Coliforms	4780		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527120
Metals							
Aluminum (Al)	14900		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Antimony (Sb)	0.24		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Arsenic (As)	4.90		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Barium (Ba)	117		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Beryllium (Be)	0.40		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Bismuth (Bi)	<0.20		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Boron (B)	<5.0		5.0	ug/g	11-AUG-16	11-AUG-16	R3524218

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-8 BOULEVARD LAKE WAYPOINT 13							
Sampled By: Client on 08-AUG-16 @ 12:12							
Matrix: Soil							
Metals							
Cadmium (Cd)	0.441		0.020	ug/g	11-AUG-16	11-AUG-16	R3524218
Calcium (Ca)	6410		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Chromium (Cr)	42.7		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Cobalt (Co)	14.3		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Copper (Cu)	33.3		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Iron (Fe)	36100		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lead (Pb)	10.8		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lithium (Li)	16.8		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Magnesium (Mg)	5630		20	ug/g	11-AUG-16	11-AUG-16	R3524218
Manganese (Mn)	787		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Molybdenum (Mo)	0.74		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Nickel (Ni)	30.4		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Phosphorus (P)	647		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Potassium (K)	690		100	ug/g	11-AUG-16	11-AUG-16	R3524218
Selenium (Se)	0.40		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Silver (Ag)	<0.10		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Sodium (Na)	826		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Strontium (Sr)	20.0		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Sulfur (S)	<5000		5000	ug/g	11-AUG-16	11-AUG-16	R3524218
Thallium (Tl)	0.152		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Tin (Sn)	<2.0		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Titanium (Ti)	862		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Uranium (U)	2.00		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Vanadium (V)	98.9		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Zinc (Zn)	108		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Zirconium (Zr)	2.6		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Aggregate Organics							
Oil and Grease, Total	700		500	mg/kg	11-AUG-16	11-AUG-16	R3526198
Volatile Organic Compounds							
Benzene	<0.014	ABL	0.014	ug/g	10-AUG-16	11-AUG-16	R3523878
Ethylbenzene	<0.036	ABL	0.036	ug/g	10-AUG-16	11-AUG-16	R3523878
Toluene	<0.16	ABL	0.16	ug/g	10-AUG-16	11-AUG-16	R3523878
o-Xylene	<0.040	ABL	0.040	ug/g	10-AUG-16	11-AUG-16	R3523878
m+p-Xylenes	<0.060	ABL	0.060	ug/g	10-AUG-16	11-AUG-16	R3523878
Xylenes (Total)	<0.072		0.072	ug/g		12-AUG-16	
Surrogate: 4-Bromofluorobenzene	84.0		70-130	%	10-AUG-16	11-AUG-16	R3523878
Surrogate: 1,4-Difluorobenzene	92.9		70-130	%	10-AUG-16	11-AUG-16	R3523878
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Acenaphthylene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Anthracene	0.12	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)anthracene	0.66	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-8 BOULEVARD LAKE WAYPOINT 13							
Sampled By: Client on 08-AUG-16 @ 12:12							
Matrix: Soil							
Polycyclic Aromatic Hydrocarbons							
Benzo(a)pyrene	0.76	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(b)fluoranthene	1.19	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(g,h,i)perylene	0.63	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(k)fluoranthene	0.33	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Chrysene	0.90	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Dibenzo(ah)anthracene	0.12	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluoranthene	1.78	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluorene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Indeno(1,2,3-cd)pyrene	0.57	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
1+2-Methylnaphthalenes	<0.085		0.085	ug/g		17-AUG-16	
1-Methylnaphthalene	<0.060	DLHM	0.060	ug/g	10-AUG-16	17-AUG-16	R3526058
2-Methylnaphthalene	<0.060	DLHM	0.060	ug/g	10-AUG-16	17-AUG-16	R3526058
Naphthalene	<0.10	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Phenanthrene	0.86	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Pyrene	1.39	DLHM	0.10	ug/g	10-AUG-16	17-AUG-16	R3526058
Surrogate: 2-Fluorobiphenyl	100.0		50-140	%	10-AUG-16	17-AUG-16	R3526058
Surrogate: p-Terphenyl d14	83.1		50-140	%	10-AUG-16	17-AUG-16	R3526058
Report Remarks : ABL-Analysis compromised due to type of sample jar received. Losses may have occurred according to 511 Regulation. Detection Limit Adjusted: Sample has High Moisture Content.							
L1809795-9 BOULEVARD LAKE WAYPOINT 14							
Sampled By: Client on 08-AUG-16 @ 12:23							
Matrix: Soil							
Physical Tests							
% Moisture	35.9		0.10	%	11-AUG-16	12-AUG-16	R3524011
Bacteriological Tests							
E. Coli	52		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527130
Total Coliforms	3900		10	CFU/g dwt	10-AUG-16	11-AUG-16	R3527120
Metals							
Aluminum (Al)	11800		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Antimony (Sb)	0.18		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Arsenic (As)	2.88		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Barium (Ba)	83.9		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Beryllium (Be)	0.24		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Bismuth (Bi)	<0.20		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Boron (B)	<5.0		5.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Cadmium (Cd)	0.197		0.020	ug/g	11-AUG-16	11-AUG-16	R3524218
Calcium (Ca)	6380		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Chromium (Cr)	35.5		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Cobalt (Co)	11.1		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Copper (Cu)	25.2		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Iron (Fe)	29100		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Lead (Pb)	7.79		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-9 BOULEVARD LAKE WAYPOINT 14							
Sampled By: Client on 08-AUG-16 @ 12:23							
Matrix: Soil							
Metals							
Lithium (Li)	11.5		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Magnesium (Mg)	5150		20	ug/g	11-AUG-16	11-AUG-16	R3524218
Manganese (Mn)	477		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Molybdenum (Mo)	0.43		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Nickel (Ni)	26.8		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Phosphorus (P)	560		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Potassium (K)	690		100	ug/g	11-AUG-16	11-AUG-16	R3524218
Selenium (Se)	<0.20		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Silver (Ag)	<0.10		0.10	ug/g	11-AUG-16	11-AUG-16	R3524218
Sodium (Na)	944		50	ug/g	11-AUG-16	11-AUG-16	R3524218
Strontium (Sr)	18.5		0.50	ug/g	11-AUG-16	11-AUG-16	R3524218
Sulfur (S)	<5000		5000	ug/g	11-AUG-16	11-AUG-16	R3524218
Thallium (Tl)	0.082		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Tin (Sn)	<2.0		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Titanium (Ti)	992		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Uranium (U)	0.917		0.050	ug/g	11-AUG-16	11-AUG-16	R3524218
Vanadium (V)	116		0.20	ug/g	11-AUG-16	11-AUG-16	R3524218
Zinc (Zn)	74.5		2.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Zirconium (Zr)	3.3		1.0	ug/g	11-AUG-16	11-AUG-16	R3524218
Aggregate Organics							
Oil and Grease, Total	890		500	mg/kg	11-AUG-16	11-AUG-16	R3526198
Volatile Organic Compounds							
Benzene	<0.0068	ABL	0.0068	ug/g	10-AUG-16	11-AUG-16	R3523878
Ethylbenzene	<0.018	ABL	0.018	ug/g	10-AUG-16	11-AUG-16	R3523878
Toluene	<0.080	ABL	0.080	ug/g	10-AUG-16	11-AUG-16	R3523878
o-Xylene	<0.020	ABL	0.020	ug/g	10-AUG-16	11-AUG-16	R3523878
m+p-Xylenes	<0.030	ABL	0.030	ug/g	10-AUG-16	11-AUG-16	R3523878
Xylenes (Total)	<0.050		0.050	ug/g		12-AUG-16	
Surrogate: 4-Bromofluorobenzene	91.1		70-130	%	10-AUG-16	11-AUG-16	R3523878
Surrogate: 1,4-Difluorobenzene	97.8		70-130	%	10-AUG-16	11-AUG-16	R3523878
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Acenaphthylene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Anthracene	0.052		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)anthracene	0.514		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(a)pyrene	0.585		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(b)fluoranthene	0.971		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(g,h,i)perylene	0.520		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Benzo(k)fluoranthene	0.268		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Chrysene	0.723		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Dibenzo(ah)anthracene	0.094		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Fluoranthene	1.48		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1809795-9 BOULEVARD LAKE WAYPOINT 14 Sampled By: Client on 08-AUG-16 @ 12:23 Matrix: Soil							
Polycyclic Aromatic Hydrocarbons							
Fluorene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Indeno(1,2,3-cd)pyrene	0.474		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
1+2-Methylnaphthalenes	<0.042		0.042	ug/g		17-AUG-16	
1-Methylnaphthalene	<0.030		0.030	ug/g	10-AUG-16	17-AUG-16	R3526058
2-Methylnaphthalene	<0.030		0.030	ug/g	10-AUG-16	17-AUG-16	R3526058
Naphthalene	<0.050		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Phenanthrene	0.588		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Pyrene	1.15		0.050	ug/g	10-AUG-16	17-AUG-16	R3526058
Surrogate: 2-Fluorobiphenyl	100.5		50-140	%	10-AUG-16	17-AUG-16	R3526058
Surrogate: p-Terphenyl d14	95.5		50-140	%	10-AUG-16	17-AUG-16	R3526058
Report Remarks : ABL-Analysis compromised due to type of sample jar received. Losses may have occurred according to 511 Regulation.							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Total Coliforms	RRQC	L1809795-1, -2, -3, -4, -5, -6, -7, -8, -9

Comments: RRQC- Duplicate RPD exceeded DQO Limit, sample result was 2 and the dup result was 1 on the dilution 0.001mL. Results have been confirmed.

Sample Parameter Qualifier key listed:

Qualifier	Description
ABL	Approximate Result: May Be Biased Low
DLHM	Detection Limit Adjusted: Sample has High Moisture Content
RRQC	Refer to report remarks for information regarding this QC result.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BTX-511-HS-WT	Soil	BTEX-O.Reg 153/04 (July 2011)	SW846 8260

BTX is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
EC-SOLID-MF-WT	Soil	E. coli on sludge or solid	SM 9222D
MET-200.2-CCMS-WT	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

ALS Test Code	Matrix	Test Description	Method Reference**
METHYLNAPS-CALC-WT	Soil	ABN-Calculated Parameters	SW846 8270
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
OGG-TOT-WT	Soil	Oil and Grease, Total	APHA 5520 B

Sample is extracted with an acetone:hexane mixture followed, extract is then evaporated and residue is weighed to determine total oil and grease.

ALS Test Code	Matrix	Test Description	Method Reference**
PAH-511-WT	Soil	PAH-O.Reg 153/04 (July 2011)	SW846 3510/8270

A representative sub-sample of soil is fortified with deuterium-labelled surrogates and a mechanical shaking techniqueis used to extract the sample with a mixture of methanol and toluene. The extracts are concentrated and analyzed by GC/MS. Depending on the analytical GC/MS column used benzo(j)fluoranthene may chromatographically co-elute with benzo(b)fluoranthene or benzo(k)fluoranthene.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

ALS Test Code	Matrix	Test Description	Method Reference**
TC-SOLID-MF-WT	Soil	Total coliforms on sludge or solid	SM 9222D
XYLENES-SUM-CALC-WT	Soil	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1809795 Report Date: 02-SEP-16

Client: ARCADIS Canada Inc. - Richmond Hill
Northern Bioscience 363 Van Horne Street
Thunder Bay ON P7A 3G3

Contact: Allan Harris

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX-511-HS-WT	**Soil**							
Batch R3523878								
WG2364789-2 LCS								
Benzene			106.5		%		70-130	11-AUG-16
Ethylbenzene			101.7		%		70-130	11-AUG-16
m+p-Xylenes			104.3		%		70-130	11-AUG-16
o-Xylene			114.7		%		70-130	11-AUG-16
Toluene			102.3		%		70-130	11-AUG-16
WG2364789-1 MB								
Benzene			<0.0068		ug/g		0.0068	11-AUG-16
Ethylbenzene			<0.018		ug/g		0.018	11-AUG-16
m+p-Xylenes			<0.030		ug/g		0.03	11-AUG-16
o-Xylene			<0.020		ug/g		0.02	11-AUG-16
Toluene			<0.080		ug/g		0.08	11-AUG-16
Surrogate: 1,4-Difluorobenzene			113.3		%		70-130	11-AUG-16
Surrogate: 4-Bromofluorobenzene			103.6		%		70-130	11-AUG-16
EC-SOLID-MF-WT	**Soil**							
Batch R3527130								
WG2364695-2 DUP		**L1809795-1**						
E. Coli		<10	<10	RPD-NA	CFU/g dwt	N/A	75	11-AUG-16
WG2364695-1 MB								
E. Coli			<10		CFU/g dwt		10	11-AUG-16
MET-200.2-CCMS-WT	**Soil**							
Batch R3524218								
WG2365336-2 CRM		**WT-CANMET-TILL1**						
Aluminum (Al)			99.8		%		70-130	11-AUG-16
Antimony (Sb)			96.6		%		70-130	11-AUG-16
Arsenic (As)			105.5		%		70-130	11-AUG-16
Barium (Ba)			98.4		%		70-130	11-AUG-16
Beryllium (Be)			92.4		%		70-130	11-AUG-16
Bismuth (Bi)			99.7		%		70-130	11-AUG-16
Cadmium (Cd)			98.6		%		70-130	11-AUG-16
Calcium (Ca)			103.0		%		70-130	11-AUG-16
Chromium (Cr)			100.8		%		70-130	11-AUG-16
Cobalt (Co)			98.5		%		70-130	11-AUG-16
Copper (Cu)			95.9		%		70-130	11-AUG-16
Iron (Fe)			96.5		%		70-130	11-AUG-16
Lead (Pb)			91.7		%		70-130	11-AUG-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3524218								
WG2365336-2 CRM		**WT-CANMET-TILL1**						
Lithium (Li)			102.9		%		70-130	11-AUG-16
Magnesium (Mg)			101.3		%		70-130	11-AUG-16
Manganese (Mn)			98.3		%		70-130	11-AUG-16
Molybdenum (Mo)			92.9		%		70-130	11-AUG-16
Nickel (Ni)			98.7		%		70-130	11-AUG-16
Phosphorus (P)			97.3		%		70-130	11-AUG-16
Potassium (K)			98.9		%		70-130	11-AUG-16
Selenium (Se)			99.8		%		70-130	11-AUG-16
Silver (Ag)			101.1		%		70-130	11-AUG-16
Sodium (Na)			105.0		%		70-130	11-AUG-16
Strontium (Sr)			104.6		%		70-130	11-AUG-16
Thallium (Tl)			98.9		%		70-130	11-AUG-16
Tin (Sn)			91.3		%		70-130	11-AUG-16
Titanium (Ti)			94.4		%		70-130	11-AUG-16
Uranium (U)			104.1		%		70-130	11-AUG-16
Vanadium (V)			102.6		%		70-130	11-AUG-16
Zinc (Zn)			97.2		%		70-130	11-AUG-16
WG2365336-3 LCS		**1+2**						
Aluminum (Al)			96.1		%		80-120	11-AUG-16
Antimony (Sb)			100.6		%		80-120	11-AUG-16
Arsenic (As)			99.7		%		80-120	11-AUG-16
Barium (Ba)			98.1		%		80-120	11-AUG-16
Beryllium (Be)			98.2		%		80-120	11-AUG-16
Bismuth (Bi)			101.8		%		80-120	11-AUG-16
Boron (B)			92.9		%		80-120	11-AUG-16
Cadmium (Cd)			99.2		%		80-120	11-AUG-16
Calcium (Ca)			98.2		%		80-120	11-AUG-16
Chromium (Cr)			94.9		%		80-120	11-AUG-16
Cobalt (Co)			95.9		%		80-120	11-AUG-16
Copper (Cu)			94.8		%		80-120	11-AUG-16
Iron (Fe)			95.6		%		80-120	11-AUG-16
Lead (Pb)			105.2		%		80-120	11-AUG-16
Lithium (Li)			107.0		%		80-120	11-AUG-16
Magnesium (Mg)			96.6		%		80-120	11-AUG-16

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3524218								
WG2365336-3 LCS		**1+2**						
Manganese (Mn)			96.1		%		80-120	11-AUG-16
Molybdenum (Mo)			101.2		%		80-120	11-AUG-16
Nickel (Ni)			94.8		%		80-120	11-AUG-16
Phosphorus (P)			104.3		%		80-120	11-AUG-16
Potassium (K)			100.1		%		80-120	11-AUG-16
Selenium (Se)			101.9		%		80-120	11-AUG-16
Silver (Ag)			99.98		%		80-120	11-AUG-16
Sodium (Na)			100.5		%		80-120	11-AUG-16
Strontium (Sr)			106.1		%		80-120	11-AUG-16
Sulfur (S)			96.7		%		80-120	11-AUG-16
Thallium (Tl)			102.1		%		80-120	11-AUG-16
Tin (Sn)			98.1		%		80-120	11-AUG-16
Titanium (Ti)			94.2		%		80-120	11-AUG-16
Uranium (U)			101.5		%		80-120	11-AUG-16
Vanadium (V)			98.0		%		80-120	11-AUG-16
Zinc (Zn)			93.2		%		80-120	11-AUG-16
Zirconium (Zr)			97.2		%		80-120	11-AUG-16
WG2365336-1 MB								
Aluminum (Al)			<50		mg/kg		50	11-AUG-16
Antimony (Sb)			<0.10		mg/kg		0.1	11-AUG-16
Arsenic (As)			<0.10		mg/kg		0.1	11-AUG-16
Barium (Ba)			<0.50		mg/kg		0.5	11-AUG-16
Beryllium (Be)			<0.10		mg/kg		0.1	11-AUG-16
Bismuth (Bi)			<0.20		mg/kg		0.2	11-AUG-16
Boron (B)			<5.0		mg/kg		5	11-AUG-16
Cadmium (Cd)			<0.020		mg/kg		0.02	11-AUG-16
Calcium (Ca)			<50		mg/kg		50	11-AUG-16
Chromium (Cr)			<0.50		mg/kg		0.5	11-AUG-16
Cobalt (Co)			<0.10		mg/kg		0.1	11-AUG-16
Copper (Cu)			<0.50		mg/kg		0.5	11-AUG-16
Iron (Fe)			<50		mg/kg		50	11-AUG-16
Lead (Pb)			<0.50		mg/kg		0.5	11-AUG-16
Lithium (Li)			<2.0		mg/kg		2	11-AUG-16
Magnesium (Mg)			<20		mg/kg		20	11-AUG-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3524218								
WG2365336-1 MB								
Manganese (Mn)			<1.0		mg/kg		1	11-AUG-16
Molybdenum (Mo)			<0.10		mg/kg		0.1	11-AUG-16
Nickel (Ni)			<0.50		mg/kg		0.5	11-AUG-16
Phosphorus (P)			<50		mg/kg		50	11-AUG-16
Potassium (K)			<100		mg/kg		100	11-AUG-16
Selenium (Se)			<0.20		mg/kg		0.2	11-AUG-16
Silver (Ag)			<0.10		mg/kg		0.1	11-AUG-16
Sodium (Na)			<50		mg/kg		50	11-AUG-16
Strontium (Sr)			<0.50		mg/kg		0.5	11-AUG-16
Sulfur (S)			<5000		mg/kg		5000	11-AUG-16
Thallium (Tl)			<0.050		mg/kg		0.05	11-AUG-16
Tin (Sn)			<2.0		mg/kg		2	11-AUG-16
Titanium (Ti)			<1.0		mg/kg		1	11-AUG-16
Uranium (U)			<0.050		mg/kg		0.05	11-AUG-16
Vanadium (V)			<0.20		mg/kg		0.2	11-AUG-16
Zinc (Zn)			<2.0		mg/kg		2	11-AUG-16
Zirconium (Zr)			<1.0		mg/kg		1	11-AUG-16
Batch R3526027								
WG2366217-2 CRM		**WT-CANMET-TILL1**						
Aluminum (Al)			102.1		%		70-130	12-AUG-16
Antimony (Sb)			95.5		%		70-130	12-AUG-16
Arsenic (As)			106.4		%		70-130	12-AUG-16
Barium (Ba)			102.7		%		70-130	12-AUG-16
Beryllium (Be)			90.7		%		70-130	12-AUG-16
Bismuth (Bi)			95.5		%		70-130	12-AUG-16
Cadmium (Cd)			100.8		%		70-130	12-AUG-16
Calcium (Ca)			104.4		%		70-130	12-AUG-16
Chromium (Cr)			104.0		%		70-130	12-AUG-16
Cobalt (Co)			101.2		%		70-130	12-AUG-16
Copper (Cu)			97.7		%		70-130	12-AUG-16
Iron (Fe)			97.5		%		70-130	12-AUG-16
Lead (Pb)			88.8		%		70-130	12-AUG-16
Lithium (Li)			91.5		%		70-130	12-AUG-16
Magnesium (Mg)			102.2		%		70-130	12-AUG-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3526027								
WG2366217-2 CRM		**WT-CANMET-TILL1**						
Manganese (Mn)			101.1		%		70-130	12-AUG-16
Molybdenum (Mo)			93.0		%		70-130	12-AUG-16
Nickel (Ni)			101.7		%		70-130	12-AUG-16
Phosphorus (P)			108.2		%		70-130	12-AUG-16
Potassium (K)			100.3		%		70-130	12-AUG-16
Selenium (Se)			95.9		%		70-130	12-AUG-16
Silver (Ag)			103.5		%		70-130	12-AUG-16
Sodium (Na)			103.4		%		70-130	12-AUG-16
Strontium (Sr)			98.7		%		70-130	12-AUG-16
Thallium (Tl)			90.1		%		70-130	12-AUG-16
Tin (Sn)			90.7		%		70-130	12-AUG-16
Titanium (Ti)			103.4		%		70-130	12-AUG-16
Uranium (U)			98.2		%		70-130	12-AUG-16
Vanadium (V)			105.4		%		70-130	12-AUG-16
Zinc (Zn)			99.1		%		70-130	12-AUG-16
WG2366217-3 LCS		**1+2**						
Aluminum (Al)			96.2		%		80-120	12-AUG-16
Antimony (Sb)			93.9		%		80-120	12-AUG-16
Arsenic (As)			95.2		%		80-120	12-AUG-16
Barium (Ba)			102.2		%		80-120	12-AUG-16
Beryllium (Be)			90.1		%		80-120	12-AUG-16
Bismuth (Bi)			91.9		%		80-120	12-AUG-16
Boron (B)			89.5		%		80-120	12-AUG-16
Cadmium (Cd)			91.7		%		80-120	12-AUG-16
Calcium (Ca)			95.6		%		80-120	12-AUG-16
Chromium (Cr)			93.2		%		80-120	12-AUG-16
Cobalt (Co)			93.4		%		80-120	12-AUG-16
Copper (Cu)			91.9		%		80-120	12-AUG-16
Iron (Fe)			94.0		%		80-120	12-AUG-16
Lead (Pb)			93.5		%		80-120	12-AUG-16
Lithium (Li)			87.2		%		80-120	12-AUG-16
Magnesium (Mg)			98.3		%		80-120	12-AUG-16
Manganese (Mn)			96.4		%		80-120	12-AUG-16
Molybdenum (Mo)			93.5		%		80-120	12-AUG-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3526027								
WG2366217-3 LCS		**1+2**						
Nickel (Ni)			93.0		%		80-120	12-AUG-16
Phosphorus (P)			96.4		%		80-120	12-AUG-16
Potassium (K)			99.1		%		80-120	12-AUG-16
Selenium (Se)			92.5		%		80-120	12-AUG-16
Silver (Ag)			97.5		%		80-120	12-AUG-16
Sodium (Na)			92.6		%		80-120	12-AUG-16
Strontium (Sr)			98.9		%		80-120	12-AUG-16
Sulfur (S)			92.8		%		80-120	12-AUG-16
Thallium (Tl)			95.0		%		80-120	12-AUG-16
Tin (Sn)			91.0		%		80-120	12-AUG-16
Titanium (Ti)			94.6		%		80-120	12-AUG-16
Uranium (U)			91.6		%		80-120	12-AUG-16
Vanadium (V)			96.9		%		80-120	12-AUG-16
Zinc (Zn)			88.8		%		80-120	12-AUG-16
Zirconium (Zr)			89.3		%		80-120	12-AUG-16
WG2366217-1 MB								
Aluminum (Al)			<50		mg/kg		50	12-AUG-16
Antimony (Sb)			<0.10		mg/kg		0.1	12-AUG-16
Arsenic (As)			<0.10		mg/kg		0.1	12-AUG-16
Barium (Ba)			<0.50		mg/kg		0.5	12-AUG-16
Beryllium (Be)			<0.10		mg/kg		0.1	12-AUG-16
Bismuth (Bi)			<0.20		mg/kg		0.2	12-AUG-16
Boron (B)			<5.0		mg/kg		5	12-AUG-16
Cadmium (Cd)			<0.020		mg/kg		0.02	12-AUG-16
Calcium (Ca)			<50		mg/kg		50	12-AUG-16
Chromium (Cr)			<0.50		mg/kg		0.5	12-AUG-16
Cobalt (Co)			<0.10		mg/kg		0.1	12-AUG-16
Copper (Cu)			<0.50		mg/kg		0.5	12-AUG-16
Iron (Fe)			<50		mg/kg		50	12-AUG-16
Lead (Pb)			<0.50		mg/kg		0.5	12-AUG-16
Lithium (Li)			<2.0		mg/kg		2	12-AUG-16
Magnesium (Mg)			<20		mg/kg		20	12-AUG-16
Manganese (Mn)			<1.0		mg/kg		1	12-AUG-16
Molybdenum (Mo)			<0.10		mg/kg		0.1	12-AUG-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3526027								
WG2366217-1 MB								
Nickel (Ni)			<0.50		mg/kg		0.5	12-AUG-16
Phosphorus (P)			<50		mg/kg		50	12-AUG-16
Potassium (K)			<100		mg/kg		100	12-AUG-16
Selenium (Se)			<0.20		mg/kg		0.2	12-AUG-16
Silver (Ag)			<0.10		mg/kg		0.1	12-AUG-16
Sodium (Na)			<50		mg/kg		50	12-AUG-16
Strontium (Sr)			<0.50		mg/kg		0.5	12-AUG-16
Sulfur (S)			<5000		mg/kg		5000	12-AUG-16
Thallium (Tl)			<0.050		mg/kg		0.05	12-AUG-16
Tin (Sn)			<2.0		mg/kg		2	12-AUG-16
Titanium (Ti)			<1.0		mg/kg		1	12-AUG-16
Uranium (U)			<0.050		mg/kg		0.05	12-AUG-16
Vanadium (V)			<0.20		mg/kg		0.2	12-AUG-16
Zinc (Zn)			<2.0		mg/kg		2	12-AUG-16
Zirconium (Zr)			<1.0		mg/kg		1	12-AUG-16
MOISTURE-WT	**Soil**							
Batch R3523375								
WG2364726-2 LCS								
% Moisture			103.3		%		90-110	11-AUG-16
WG2364726-1 MB								
% Moisture			<0.10		%		0.1	11-AUG-16
Batch R3524011								
WG2365370-3 DUP		**L1809795-7**						
% Moisture		47.0	47.0		%	0.1	20	12-AUG-16
WG2365370-2 LCS								
% Moisture			102.7		%		90-110	12-AUG-16
WG2365370-1 MB								
% Moisture			<0.10		%		0.1	12-AUG-16
OGG-TOT-WT	**Soil**							
Batch R3526198								
WG2365439-4 DUP		**L1809795-1**						
Oil and Grease, Total		<500	680	RPD-NA	mg/kg	N/A	40	11-AUG-16
WG2365439-2 LCS								
Oil and Grease, Total			96.8		%		70-130	11-AUG-16
WG2365439-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
OGG-TOT-WT	**Soil**							
Batch R3526198								
WG2365439-1 MB								
Oil and Grease, Total			<500		mg/kg		500	11-AUG-16
WG2365439-5 MS		**L1809795-1**						
Oil and Grease, Total			106.5		%		50-150	11-AUG-16
PAH-511-WT	**Soil**							
Batch R3526058								
WG2364603-2 LCS								
1-Methylnaphthalene			103.3		%		50-140	15-AUG-16
2-Methylnaphthalene			109.1		%		50-140	15-AUG-16
Acenaphthene			90.7		%		50-140	15-AUG-16
Acenaphthylene			91.8		%		50-140	15-AUG-16
Anthracene			90.9		%		50-140	15-AUG-16
Benzo(a)anthracene			92.6		%		50-140	15-AUG-16
Benzo(a)pyrene			95.8		%		50-140	15-AUG-16
Benzo(b)fluoranthene			83.0		%		50-140	15-AUG-16
Benzo(g,h,i)perylene			94.3		%		50-140	15-AUG-16
Benzo(k)fluoranthene			98.4		%		50-140	15-AUG-16
Chrysene			97.4		%		50-140	15-AUG-16
Dibenzo(ah)anthracene			95.4		%		50-140	15-AUG-16
Fluoranthene			90.6		%		50-140	15-AUG-16
Fluorene			90.0		%		50-140	15-AUG-16
Indeno(1,2,3-cd)pyrene			91.0		%		50-140	15-AUG-16
Naphthalene			95.3		%		50-140	15-AUG-16
Phenanthrene			94.3		%		50-140	15-AUG-16
Pyrene			96.9		%		50-140	15-AUG-16
WG2364603-1 MB								
1-Methylnaphthalene			<0.030		ug/g		0.03	15-AUG-16
2-Methylnaphthalene			<0.030		ug/g		0.03	15-AUG-16
Acenaphthene			<0.050		ug/g		0.05	15-AUG-16
Acenaphthylene			<0.050		ug/g		0.05	15-AUG-16
Anthracene			<0.050		ug/g		0.05	15-AUG-16
Benzo(a)anthracene			<0.050		ug/g		0.05	15-AUG-16
Benzo(a)pyrene			<0.050		ug/g		0.05	15-AUG-16
Benzo(b)fluoranthene			<0.050		ug/g		0.05	15-AUG-16
Benzo(g,h,i)perylene			<0.050		ug/g		0.05	15-AUG-16
Benzo(k)fluoranthene			<0.050		ug/g		0.05	15-AUG-16

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-511-WT	**Soil**							
Batch R3526058								
WG2364603-1 MB								
Chrysene			<0.050		ug/g		0.05	15-AUG-16
Dibenzo(ah)anthracene			<0.050		ug/g		0.05	15-AUG-16
Fluoranthene			<0.050		ug/g		0.05	15-AUG-16
Fluorene			<0.050		ug/g		0.05	15-AUG-16
Indeno(1,2,3-cd)pyrene			<0.050		ug/g		0.05	15-AUG-16
Naphthalene			<0.050		ug/g		0.05	15-AUG-16
Phenanthrene			<0.050		ug/g		0.05	15-AUG-16
Pyrene			<0.050		ug/g		0.05	15-AUG-16
Surrogate: 2-Fluorobiphenyl			102.6		%		50-140	15-AUG-16
Surrogate: p-Terphenyl d14			93.5		%		50-140	15-AUG-16
TC-SOLID-MF-WT	**Soil**							
Batch R3527120								
WG2364697-1 MB								
Total Coliforms			<10		CFU/g dwt		10	11-AUG-16

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

GRAIN SIZE DETERMINATIONS

Client:	Northern Bioscience~TB	Sample Location:	
Project Number:	18648	Sample ID:	B. LAKE WAYPOINT 6
Sampler:		Sample Depth:	
Technician:	AB5	Date Sampled:	8/8/2016
Lab ID Number:	L1809795-1	Date Submitted:	8/8/2016
		Date Completed:	09/01/16

Total Sample Weight	125 grams		Specific Gravity:	2.650
Hydro. Sample Weight	50.000 grams		Liquid Specific Gravity:	1.000
% Past #10	1.000 * 100		Grav Factor:	1.606
Sub Factor	2.500			

Sieve Size	Weight Retained (grams)	Percent Retained	Diameter (mm)	Cum. % Retained	Cum. % Passing
38.1 mm. DIA.:	0.000	0.000	38.100	0.000	100.000
25.4 mm. DIA.:	0.000	0.000	25.400	0.000	100.000
19.0 mm. DIA.:	0.000	0.000	19.000	0.000	100.000
9.5 mm. DIA.:	0.000	0.000	9.500	0.000	100.000
NO. 4 SIEVE :	0.000	0.000	4.500	0.000	100.000
NO. 10 SIEVE :	0.000	0.000	2.000	0.000	100.000
NO. 20 SIEVE :	1.000	2.000	0.850	2.000	98.000
NO. 40 SIEVE :	2.000	4.000	0.425	6.000	94.000
NO. 60 SIEVE :	2.000	4.000	0.250	10.000	90.000
NO. 100 SIEVE:	3.000	6.000	0.150	16.000	84.000
NO. 200 SIEVE:	4.000	8.000	0.075	24.000	76.000

Time (min)	Hydrometer Reading	Temperature (C)	Diameter (mm)	% Suspended (Subsample)	% Suspended (Total Sample)
1.00	20.0	19.8	0.045	54.802	54.802
2.00	17.0	19.8	0.033	45.166	45.166
4.00	15.0	19.8	0.024	38.741	38.741
8.00	13.0	19.8	0.017	32.317	32.317
15.00	12.0	19.8	0.013	29.105	29.105
30.00	11.0	19.8	0.009	25.893	25.893
60.00	9.0	19.8	0.007	19.469	19.469
120.00	9.0	19.8	0.005	19.469	19.469
240.00	9.0	19.8	0.003	19.469	19.469
480.00	9.0	19.8	0.002	19.469	19.469
1440.00	9.0	19.8	0.001	19.469	19.469

GRAIN SIZE	% BY WT.	DIA. RANGE (mm)
% GRAVEL :	0.00	> 4.5
% COARSE SAND :	0.00	2.0 - 4.5
% MEDIUM SAND :	6.00	0.425 - 2.0
% FINE SAND :	18.00	0.075 - 0.425
% SILT :	56.53	0.075 - 0.002
% CLAY :	19.47	< 0.002
% CLAY :	19.47	< 0.005

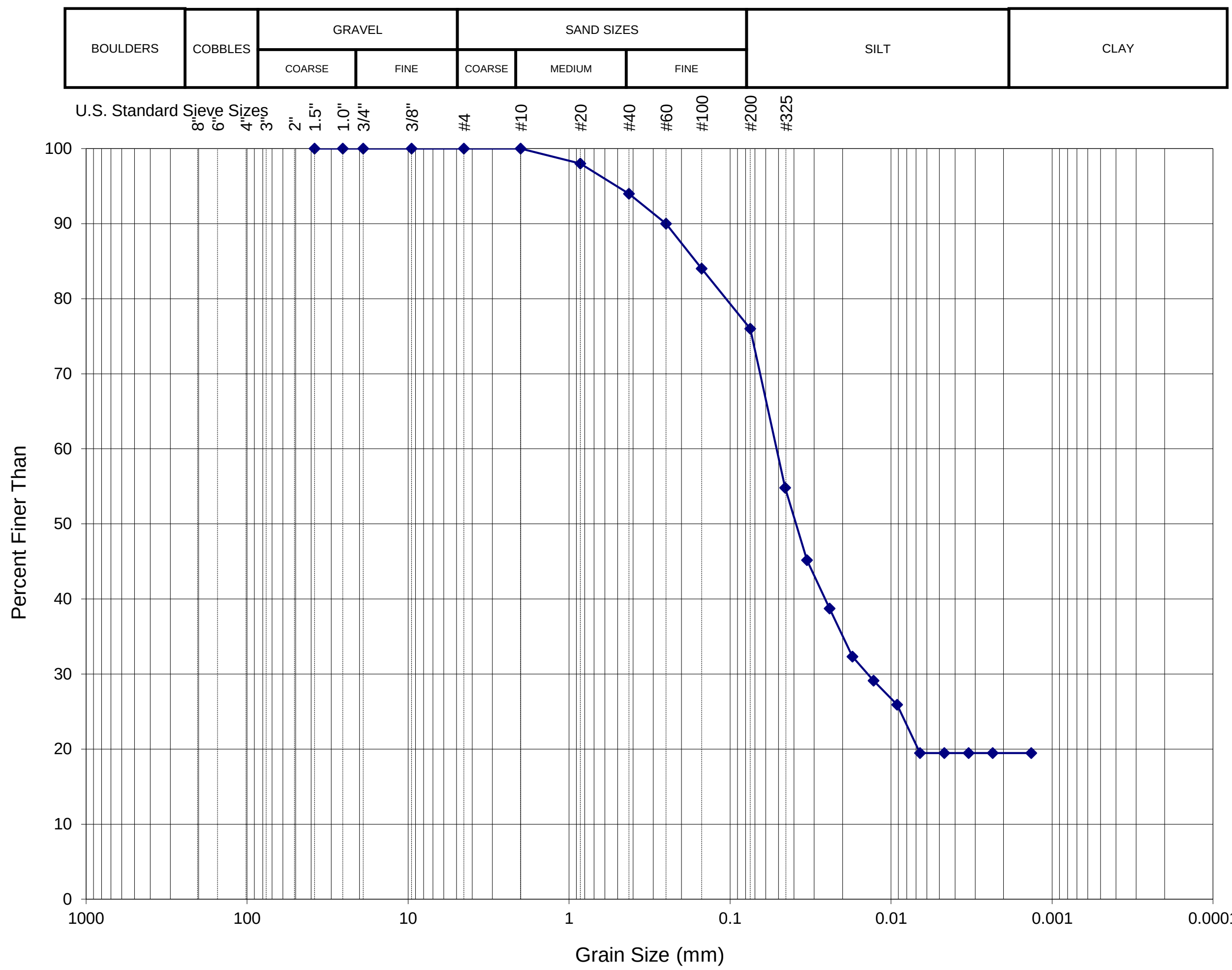
ALS Environmental

WATERLOO

PARTICLE SIZE DISTRIBUTION CURVE

ASTM METHOD D422-63

Project Name:	Northern Bioscience~TB
Project Number:	18648
Sample Location:	
Sample Number:	B. LAKE WAYPOINT 6
Sample Depth:	
Lab ID Number:	L1809795-1
Technician:	AB5
Sampler:	
Dates:	
Collected On:	8/8/2016
Analyzed:	9/1/2016



DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY	
SANDY SILT WITH CLAY	AND	36 - 50 %	GRAVEL	0 %
FINE GRAINED	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	24 %
ESTIMATED HAZEN NUMBER: 1.66E-05 cm/s	WITH	11 - 20 %	SILT + CLAY	76 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM	TRACE	1 - 10 %		

GRAIN SIZE DETERMINATIONS

Client:	Northern Bioscience~TB	Sample Location:	
Project Number:	18648	Sample ID:	B. LAKE WAYPOINT 7
Sampler:		Sample Depth:	
Technician:	AB5	Date Sampled:	8/8/2016
Lab ID Number:	L1809795-2	Date Submitted:	8/8/2016
		Date Completed:	09/01/16

Total Sample Weight	84	grams	Specific Gravity:	2.650
Hydro. Sample Weight	50.000	grams	Liquid Specific Gravity:	1.000
% Past #10	1.000	* 100	Grav Factor:	1.606
Sub Factor	1.680			

Sieve Size	Weight Retained (grams)	Percent Retained	Diameter (mm)	Cum. % Retained	Cum. % Passing
38.1 mm. DIA.:	0.000	0.000	38.100	0.000	100.000
25.4 mm. DIA.:	0.000	0.000	25.400	0.000	100.000
19.0 mm. DIA.:	0.000	0.000	19.000	0.000	100.000
9.5 mm. DIA.:	0.000	0.000	9.500	0.000	100.000
NO. 4 SIEVE :	0.000	0.000	4.500	0.000	100.000
NO. 10 SIEVE :	0.000	0.000	2.000	0.000	100.000
NO. 20 SIEVE :	0.000	0.000	0.850	0.000	100.000
NO. 40 SIEVE :	2.000	4.000	0.425	4.000	96.000
NO. 60 SIEVE :	2.000	4.000	0.250	8.000	92.000
NO. 100 SIEVE:	3.000	6.000	0.150	14.000	86.000
NO. 200 SIEVE:	16.000	32.000	0.075	46.000	54.000

Time (min)	Hydrometer Reading	Temperature (C)	Diameter (mm)	% Suspended (Subsample)	% Suspended (Total Sample)
1.00	11.0	21.4	0.049	26.895	26.895
2.00	11.0	21.4	0.035	26.895	26.895
4.00	9.0	21.4	0.025	20.471	20.471
8.00	8.0	21.4	0.018	17.259	17.259
15.00	7.0	21.4	0.013	14.047	14.047
30.00	7.0	21.4	0.009	14.047	14.047
60.00	6.0	21.4	0.007	10.834	10.834
120.00	6.0	21.4	0.005	10.834	10.834
240.00	6.0	21.4	0.003	10.834	10.834
480.00	6.0	21.4	0.002	10.834	10.834
1440.00	5.0	21.4	0.001	7.622	7.622

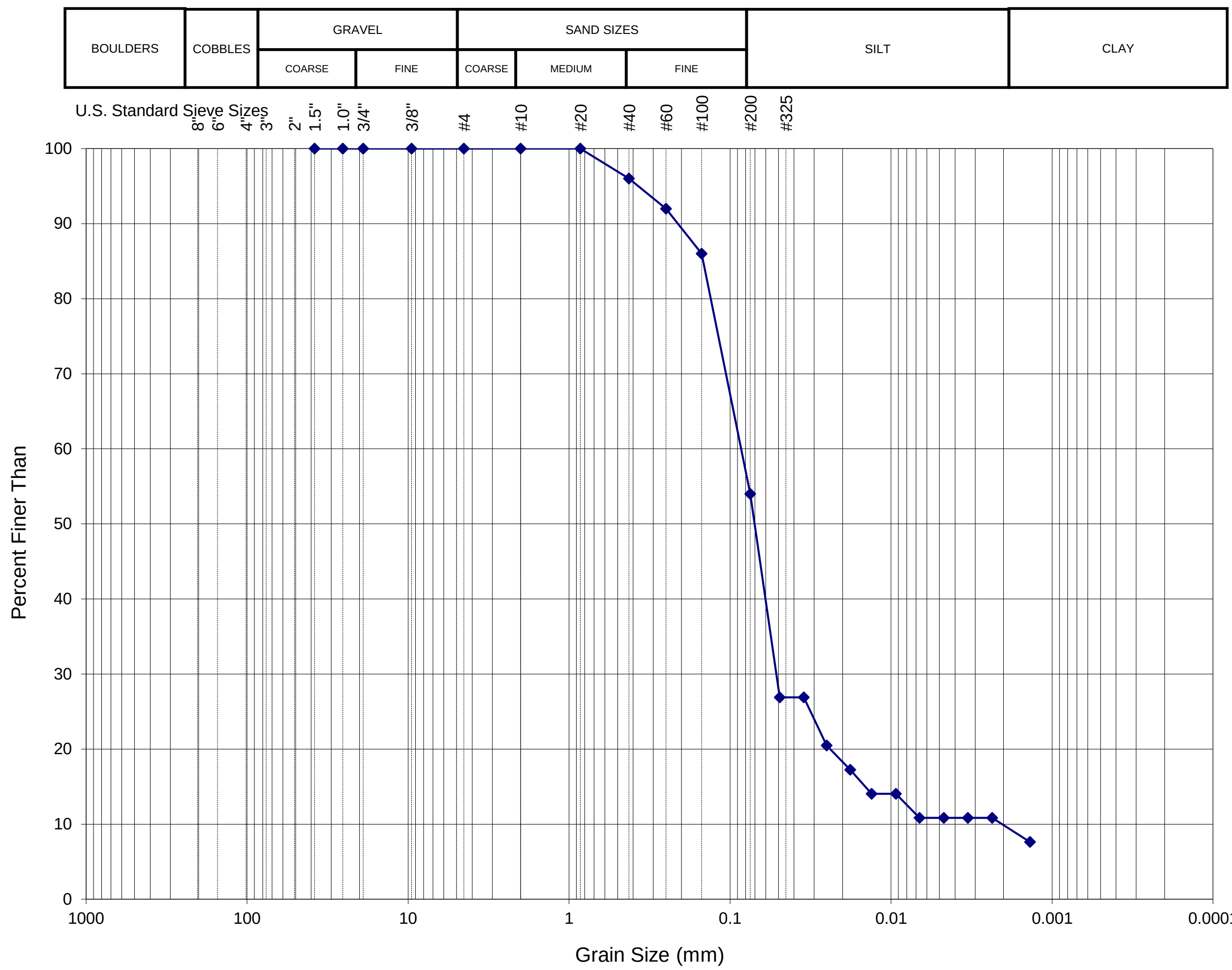
GRAIN SIZE	% BY WT.	DIA. RANGE (mm)
% GRAVEL :	0.00	> 4.5
% COARSE SAND :	0.00	2.0 - 4.5
% MEDIUM SAND :	4.00	0.425 - 2.0
% FINE SAND :	42.00	0.075 - 0.425
% SILT :	44.13	0.075 - 0.002
% CLAY :	9.87	< 0.002
% CLAY :	10.83	< 0.005

ALS Environmental
WATERLOO

PARTICLE SIZE DISTRIBUTION CURVE

ASTM METHOD D422-63

Project Name:	Northern Bioscience~TB
Project Number:	18648
Sample Location:	
Sample Number:	B. LAKE WAYPOINT 7
Sample Depth:	
Lab ID Number:	L1809795-2
Technician:	AB5
Sampler:	
Dates:	
Collected On:	8/8/2016
Analyzed:	9/1/2016



DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY	
SAND AND SILT, TRACE CLAY	AND	36 - 50 %	GRAVEL	0 %
FINE GRAINED	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	46 %
ESTIMATED HAZEN NUMBER: 3.72E-05 cm/s	WITH	11 - 20 %	SILT + CLAY	54 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM	TRACE	1 - 10 %		

GRAIN SIZE DETERMINATIONS

Client:	Northern Bioscience~TB	Sample Location:	
Project Number:	18648	Sample ID:	B. LAKE WAYPOINT 8
Sampler:		Sample Depth:	
Technician:	AB5	Date Sampled:	8/8/2016
Lab ID Number:	L1809795-3	Date Submitted:	8/8/2016
		Date Completed:	09/01/16

Total Sample Weight	157	grams	Specific Gravity:	2.650
Hydro. Sample Weight	50.000	grams	Liquid Specific Gravity:	1.000
% Past #10	0.975	* 100	Grav Factor:	1.606
Sub Factor	3.060			

Sieve Size	Weight Retained (grams)	Percent Retained	Diameter (mm)	Cum. % Retained	Cum. % Passing
38.1 mm. DIA.:	0.000	0.000	38.100	0.000	100.000
25.4 mm. DIA.:	0.000	0.000	25.400	0.000	100.000
19.0 mm. DIA.:	0.000	0.000	19.000	0.000	100.000
9.5 mm. DIA.:	0.000	0.000	9.500	0.000	100.000
NO. 4 SIEVE :	1.000	0.637	4.500	0.637	99.363
NO. 10 SIEVE :	3.000	1.911	2.000	2.548	97.452
NO. 20 SIEVE :	0.000	0.000	0.850	2.548	97.452
NO. 40 SIEVE :	0.000	0.000	0.425	2.548	97.452
NO. 60 SIEVE :	0.000	0.000	0.250	2.548	97.452
NO. 100 SIEVE:	4.000	7.796	0.150	10.344	89.656
NO. 200 SIEVE:	14.000	27.287	0.075	37.631	62.369

Time (min)	Hydrometer Reading	Temperature (C)	Diameter (mm)	% Suspended (Subsample)	% Suspended (Total Sample)
1.00	15.0	19.8	0.048	38.741	37.754
2.00	13.0	19.8	0.035	32.317	31.494
4.00	10.0	19.8	0.025	22.681	22.103
8.00	9.0	19.8	0.018	19.469	18.973
15.00	8.0	19.8	0.013	16.257	15.842
30.00	7.0	19.8	0.010	13.044	12.712
60.00	7.0	19.8	0.007	13.044	12.712
120.00	7.0	19.8	0.005	13.044	12.712
240.00	6.0	19.8	0.003	9.832	9.582
480.00	6.0	19.8	0.002	9.832	9.582
1440.00	6.0	19.8	0.001	9.832	9.582

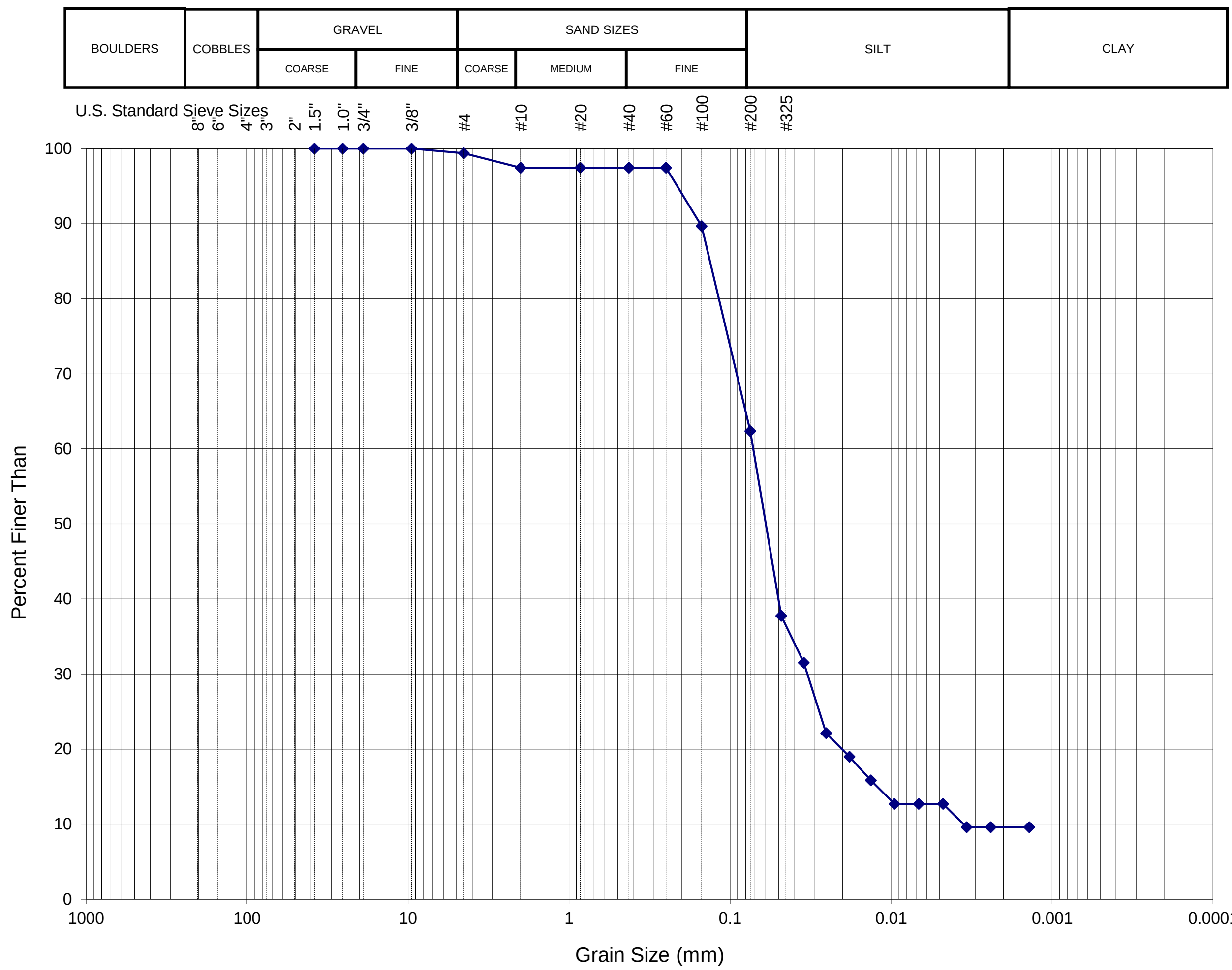
GRAIN SIZE	% BY WT.	DIA. RANGE (mm)
% GRAVEL :	0.64	> 4.5
% COARSE SAND :	1.91	2.0 - 4.5
% MEDIUM SAND :	0.00	0.425 - 2.0
% FINE SAND :	35.08	0.075 - 0.425
% SILT :	52.79	0.075 - 0.002
% CLAY :	9.58	< 0.002
% CLAY :	12.71	< 0.005

ALS Environmental
WATERLOO

PARTICLE SIZE DISTRIBUTION CURVE

ASTM METHOD D422-63

Project Name:	Northern Bioscience~TB
Project Number:	18648
Sample Location:	
Sample Number:	B. LAKE WAYPOINT 8
Sample Depth:	
Lab ID Number:	L1809795-3
Technician:	AB5
Sampler:	
Dates:	
Collected On:	8/8/2016
Analyzed:	9/1/2016



DESCRIPTION	**SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS**		**SUMMARY**		
SILT AND SAND, TRACE CLAY, TRACE GRAVEL	AND	36 - 50 %	GRAVEL	1	%
FINE GRAINED	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	37	%
ESTIMATED HAZEN NUMBER: 1.26E-05 cm/s	WITH	11 - 20 %	SILT + CLAY	62	%
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM	TRACE	1 - 10 %			

GRAIN SIZE DETERMINATIONS

Client:	Northern Bioscience~TB	Sample Location:	
Project Number:	18648	Sample ID:	B. LAKE WAYPOINT 9
Sampler:		Sample Depth:	
Technician:	AB5	Date Sampled:	8/8/2016
Lab ID Number:	L1809795-4	Date Submitted:	8/8/2016
		Date Completed:	09/01/16

Total Sample Weight	156 grams		Specific Gravity:	2.650
Hydro. Sample Weight	50.000 grams		Liquid Specific Gravity:	1.000
% Past #10	1.000 * 100		Grav Factor:	1.606
Sub Factor	3.120			

Sieve Size	Weight Retained (grams)	Percent Retained	Diameter (mm)	Cum. % Retained	Cum. % Passing
38.1 mm. DIA.:	0.000	0.000	38.100	0.000	100.000
25.4 mm. DIA.:	0.000	0.000	25.400	0.000	100.000
19.0 mm. DIA.:	0.000	0.000	19.000	0.000	100.000
9.5 mm. DIA.:	0.000	0.000	9.500	0.000	100.000
NO. 4 SIEVE :	0.000	0.000	4.500	0.000	100.000
NO. 10 SIEVE :	0.000	0.000	2.000	0.000	100.000
NO. 20 SIEVE :	1.000	2.000	0.850	2.000	98.000
NO. 40 SIEVE :	4.000	8.000	0.425	10.000	90.000
NO. 60 SIEVE :	5.000	10.000	0.250	20.000	80.000
NO. 100 SIEVE:	6.000	12.000	0.150	32.000	68.000
NO. 200 SIEVE:	9.000	18.000	0.075	50.000	50.000

Time (min)	Hydrometer Reading	Temperature (C)	Diameter (mm)	% Suspended (Subsample)	% Suspended (Total Sample)
1.00	15.0	19.8	0.048	38.741	38.741
2.00	13.0	19.8	0.035	32.317	32.317
4.00	10.0	19.8	0.025	22.681	22.681
8.00	9.0	19.8	0.018	19.469	19.469
15.00	8.0	19.8	0.013	16.257	16.257
30.00	7.0	19.8	0.010	13.044	13.044
60.00	7.0	19.8	0.007	13.044	13.044
120.00	7.0	19.8	0.005	13.044	13.044
240.00	7.0	19.8	0.003	13.044	13.044
480.00	7.0	19.8	0.002	13.044	13.044
1440.00	6.0	19.8	0.001	9.832	9.832

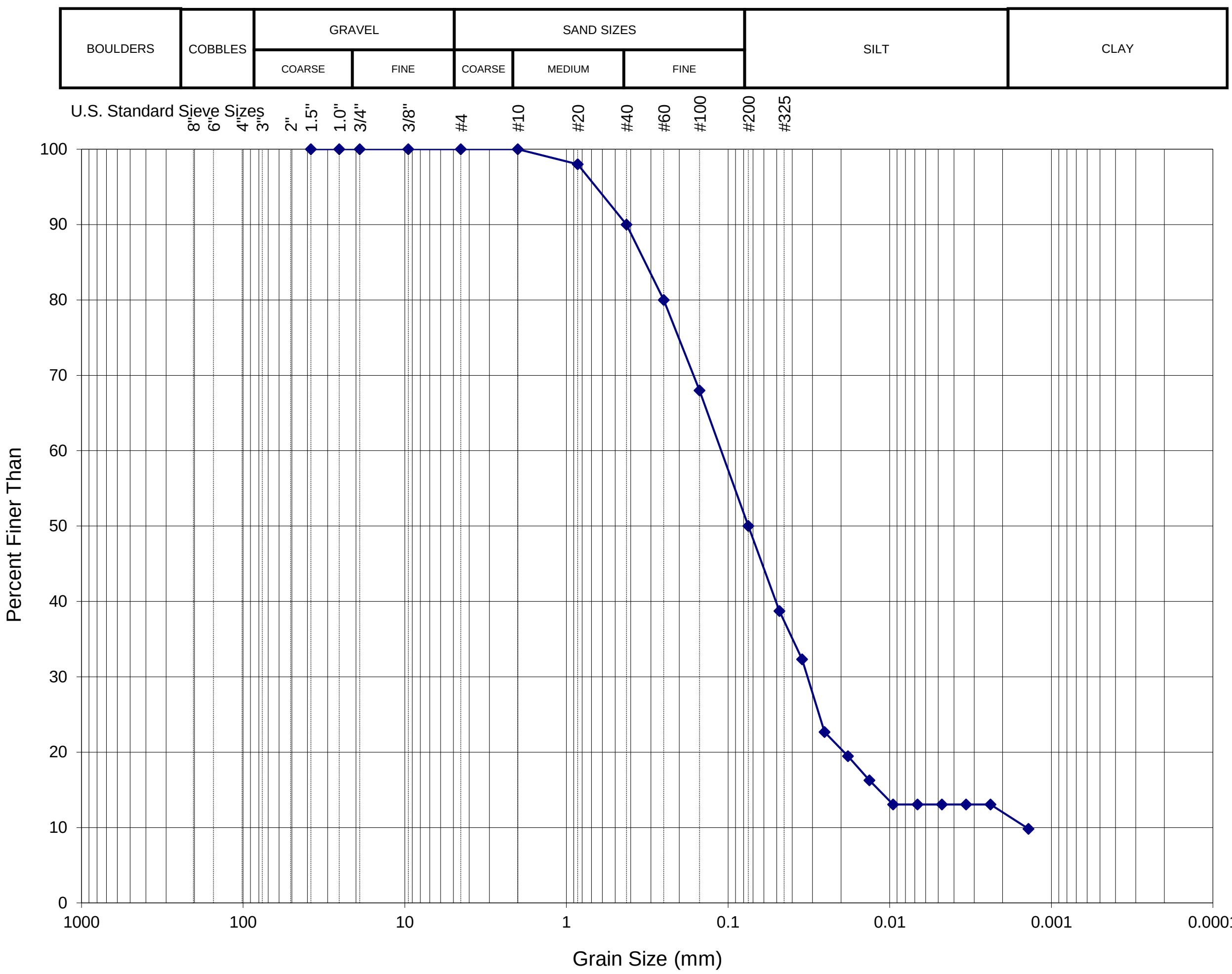
GRAIN SIZE	% BY WT.	DIA. RANGE (mm)
% GRAVEL :	0.00	> 4.5
% COARSE SAND :	0.00	2.0 - 4.5
% MEDIUM SAND :	10.00	0.425 - 2.0
% FINE SAND :	40.00	0.075 - 0.425
% SILT :	37.99	0.075 - 0.002
% CLAY :	12.01	< 0.002
% CLAY :	13.04	< 0.005

ALS Environmental
WATERLOO

PARTICLE SIZE DISTRIBUTION CURVE

ASTM METHOD D422-63

Project Name:	Northern Bioscience~TB
Project Number:	18648
Sample Location:	
Sample Number:	B. LAKE WAYPOINT 9
Sample Depth:	
Lab ID Number:	L1809795-4
Technician:	AB5
Sampler:	
Dates:	
Collected On:	8/8/2016
Analyzed:	9/1/2016



DESCRIPTION	**SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS**		**SUMMARY**
SAND AND SILT WITH CLAY	AND	36 - 50 %	GRAVEL 0 %
FINE GRAINED	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND 50 %
ESTIMATED HAZEN NUMBER: 2.03E-06 cm/s	WITH	11 - 20 %	SILT + CLAY 50 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM	TRACE	1 - 10 %	

GRAIN SIZE DETERMINATIONS

Client:	Northern Bioscience~TB	Sample Location:	
Project Number:	18648	Sample ID:	B. LAKE WAYPOINT 10
Sampler:		Sample Depth:	
Technician:	AB5	Date Sampled:	8/8/2016
Lab ID Number:	L1809795-5	Date Submitted:	8/8/2016
		Date Completed:	09/01/16

Total Sample Weight	114 grams	Specific Gravity:	2.650
Hydro. Sample Weight	50.000 grams	Liquid Specific Gravity:	1.000
% Past #10	1.000 * 100	Grav Factor:	1.606
Sub Factor	2.280		

Sieve Size	Weight Retained (grams)	Percent Retained	Diameter (mm)	Cum. % Retained	Cum. % Passing
38.1 mm. DIA.:	0.000	0.000	38.100	0.000	100.000
25.4 mm. DIA.:	0.000	0.000	25.400	0.000	100.000
19.0 mm. DIA.:	0.000	0.000	19.000	0.000	100.000
9.5 mm. DIA.:	0.000	0.000	9.500	0.000	100.000
NO. 4 SIEVE :	0.000	0.000	4.500	0.000	100.000
NO. 10 SIEVE :	0.000	0.000	2.000	0.000	100.000
NO. 20 SIEVE :	0.000	0.000	0.850	0.000	100.000
NO. 40 SIEVE :	1.000	2.000	0.425	2.000	98.000
NO. 60 SIEVE :	1.000	2.000	0.250	4.000	96.000
NO. 100 SIEVE:	5.000	10.000	0.150	14.000	86.000
NO. 200 SIEVE:	12.000	24.000	0.075	38.000	62.000

Time (min)	Hydrometer Reading	Temperature (C)	Diameter (mm)	% Suspended (Subsample)	% Suspended (Total Sample)
1.00	16.0	21.4	0.047	42.956	42.956
2.00	14.0	21.4	0.034	36.531	36.531
4.00	13.0	21.4	0.024	33.319	33.319
8.00	12.0	21.4	0.017	30.107	30.107
15.00	11.0	21.4	0.013	26.895	26.895
30.00	9.0	21.4	0.009	20.471	20.471
60.00	9.0	21.4	0.006	20.471	20.471
120.00	8.0	21.4	0.005	17.259	17.259
240.00	8.0	21.4	0.003	17.259	17.259
480.00	8.0	21.4	0.002	17.259	17.259
1440.00	8.0	21.4	0.001	17.259	17.259

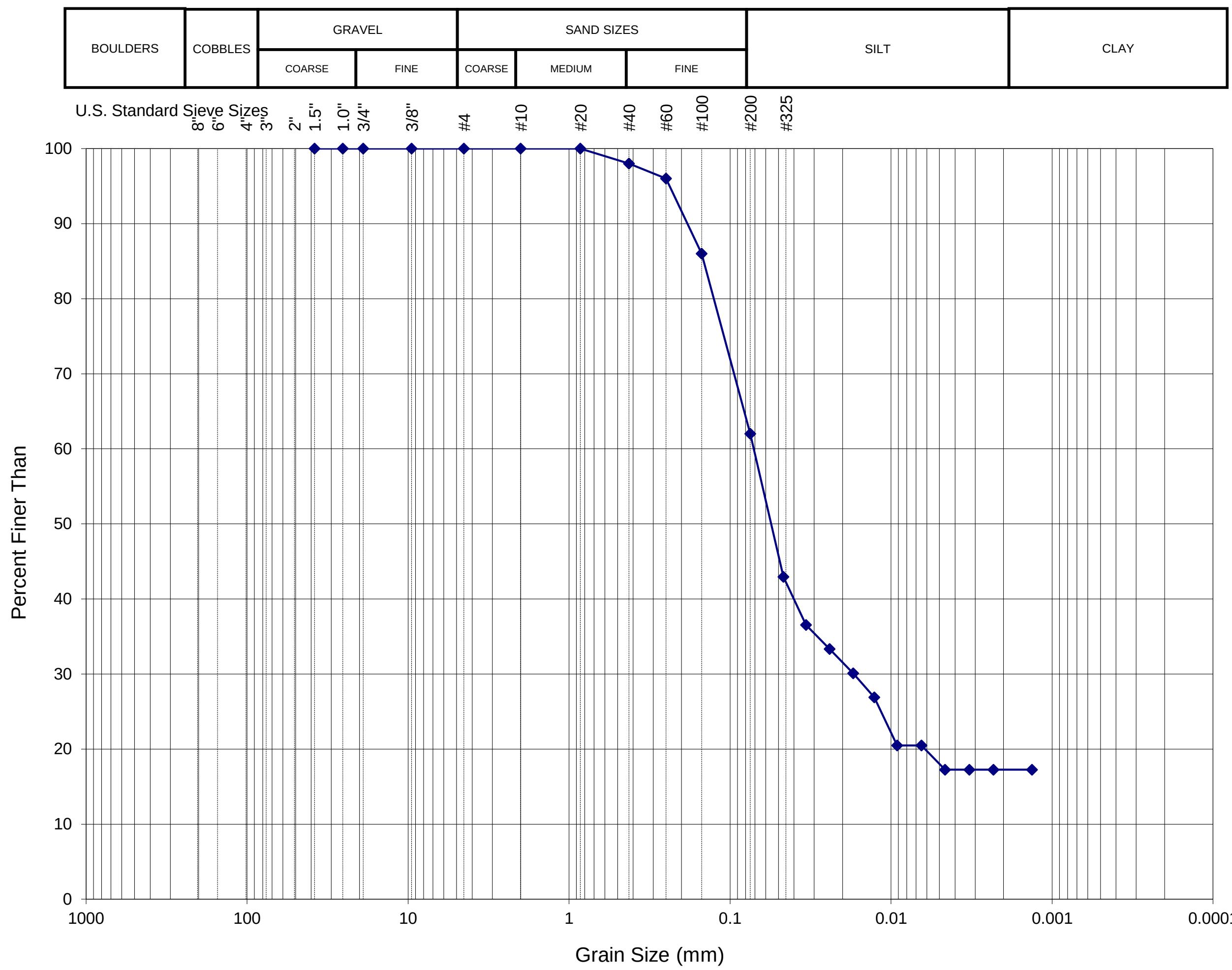
GRAIN SIZE	% BY WT.	DIA. RANGE (mm)
% GRAVEL :	0.00	> 4.5
% COARSE SAND :	0.00	2.0 - 4.5
% MEDIUM SAND :	2.00	0.425 - 2.0
% FINE SAND :	36.00	0.075 - 0.425
% SILT :	44.74	0.075 - 0.002
% CLAY :	17.26	< 0.002
% CLAY :	18.01	< 0.005

ALS Environmental
WATERLOO

PARTICLE SIZE DISTRIBUTION CURVE

ASTM METHOD D422-63

Project Name: Northern Bioscience~TB
Project Number: 18648
Sample Location:
Sample Number: B. LAKE WAYPOINT 10
Sample Depth:
Lab ID Number: L1809795-5
Technician: AB5
Sampler:
Dates:
Collected On: 8/8/2016
Analyzed: 9/1/2016



DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY		
SILT AND SAND WITH CLAY	AND	36 - 50 %	GRAVEL	0	%
FINE GRAINED	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	38	%
ESTIMATED HAZEN NUMBER: 4.65E-06 cm/s	WITH	11 - 20 %	SILT + CLAY	62	%
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM	TRACE	1 - 10 %			

GRAIN SIZE DETERMINATIONS

Client:	Northern Bioscience~TB	Sample Location:	
Project Number:	18648	Sample ID:	B. LAKE WAYPOINT 11
Sampler:		Sample Depth:	
Technician:	AB5	Date Sampled:	8/8/2016
Lab ID Number:	L1809795-6	Date Submitted:	8/8/2016
		Date Completed:	09/01/16

Total Sample Weight	291 grams		Specific Gravity:	2.650
Hydro. Sample Weight	50.000 grams		Liquid Specific Gravity:	1.000
% Past #10	1.000	* 100	Grav Factor:	1.606
Sub Factor	5.820			

Sieve Size	Weight Retained (grams)	Percent Retained	Diameter (mm)	Cum. % Retained	Cum. % Passing
38.1 mm. DIA.:	0.000	0.000	38.100	0.000	100.000
25.4 mm. DIA.:	0.000	0.000	25.400	0.000	100.000
19.0 mm. DIA.:	0.000	0.000	19.000	0.000	100.000
9.5 mm. DIA.:	0.000	0.000	9.500	0.000	100.000
NO. 4 SIEVE :	0.000	0.000	4.500	0.000	100.000
NO. 10 SIEVE :	0.000	0.000	2.000	0.000	100.000
NO. 20 SIEVE :	2.000	4.000	0.850	4.000	96.000
NO. 40 SIEVE :	7.000	14.000	0.425	18.000	82.000
NO. 60 SIEVE :	12.000	24.000	0.250	42.000	58.000
NO. 100 SIEVE:	10.000	20.000	0.150	62.000	38.000
NO. 200 SIEVE:	8.000	16.000	0.075	78.000	22.000

Time (min)	Hydrometer Reading	Temperature (C)	Diameter (mm)	% Suspended (Subsample)	% Suspended (Total Sample)
1.00	9.0	19.8	0.051	19.469	19.469
2.00	9.0	19.8	0.036	19.469	19.469
4.00	8.0	19.8	0.026	16.257	16.257
8.00	7.0	19.8	0.018	13.044	13.044
15.00	7.0	19.8	0.013	13.044	13.044
30.00	6.0	19.8	0.010	9.832	9.832
60.00	6.0	19.8	0.007	9.832	9.832
120.00	6.0	19.8	0.005	9.832	9.832
240.00	6.0	19.8	0.003	9.832	9.832
480.00	6.0	19.8	0.002	9.832	9.832
1440.00	6.0	19.8	0.001	9.832	9.832

GRAIN SIZE	% BY WT.	DIA. RANGE (mm)
% GRAVEL :	0.00	> 4.5
% COARSE SAND :	0.00	2.0 - 4.5
% MEDIUM SAND :	18.00	0.425 - 2.0
% FINE SAND :	60.00	0.075 - 0.425
% SILT :	12.17	0.075 - 0.002
% CLAY :	9.83	< 0.002
% CLAY :	9.83	< 0.005

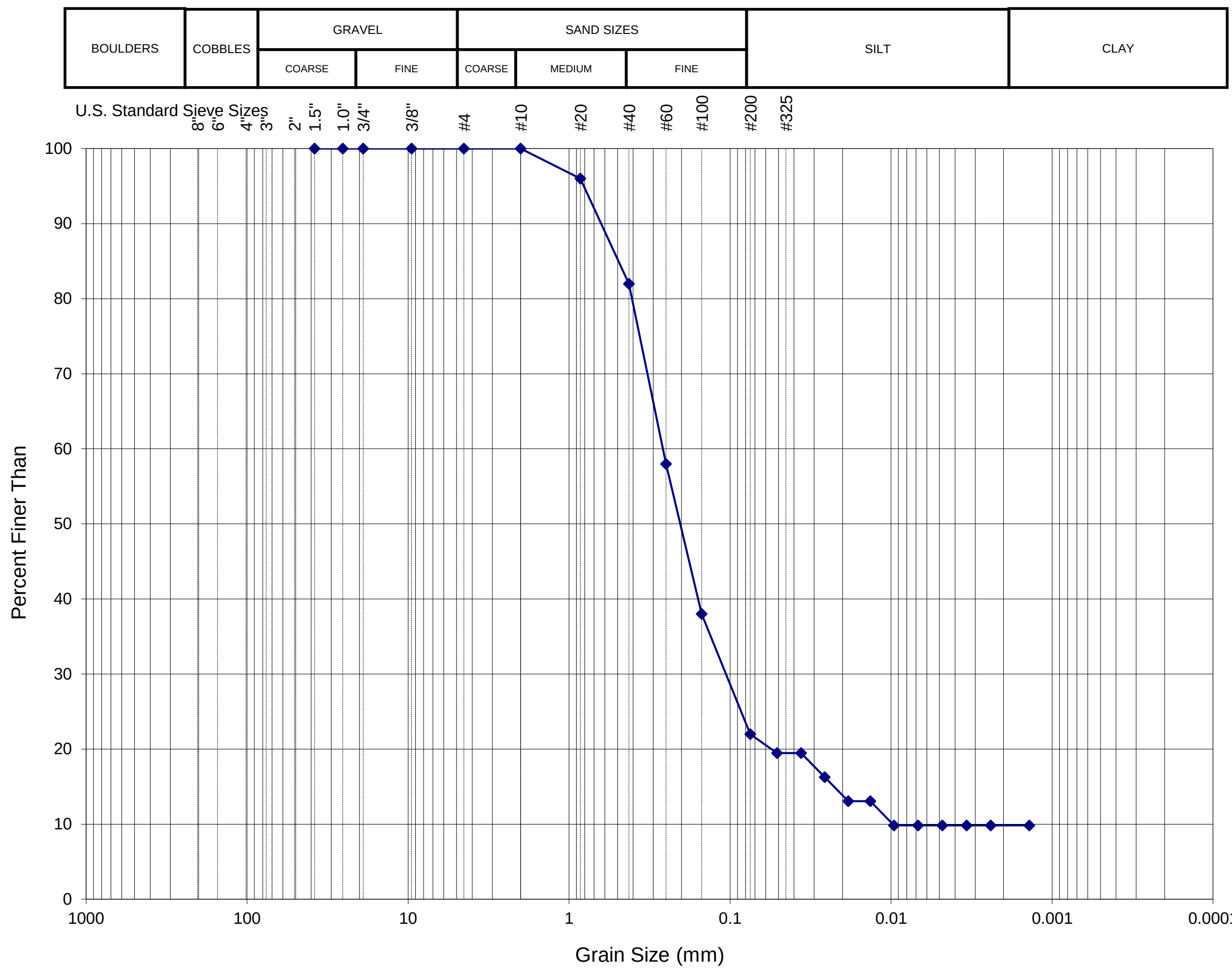
ALS Environmental

WATERLOO

PARTICLE SIZE DISTRIBUTION CURVE

ASTM METHOD D422-63

Project Name:	Northern Bioscience~TB
Project Number:	18648
Sample Location:	
Sample Number:	B. LAKE WAYPOINT 11
Sample Depth:	
Lab ID Number:	L1809795-6
Technician:	AB5
Sampler:	
Dates:	
Collected On:	8/8/2016
Analyzed:	9/1/2016



DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY	
SAND WITH SILT, TRACE CLAY	AND	36 - 50 %	GRAVEL	0 %
COARSE GRAINED	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	78 %
ESTIMATED HAZEN NUMBER: 9.55E-05 cm/s	WITH	11 - 20 %	SILT + CLAY	22 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM	TRACE	1 - 10 %		

GRAIN SIZE DETERMINATIONS

Client:	Northern Bioscience~TB	Sample Location:	
Project Number:	18648	Sample ID:	B. LAKE WAYPOINT 12
Sampler:		Sample Depth:	
Technician:	AB5	Date Sampled:	8/8/2016
Lab ID Number:	L1809795-7	Date Submitted:	8/8/2016
		Date Completed:	09/01/16

Total Sample Weight	120	grams	Specific Gravity:	2.650
Hydro. Sample Weight	50.000	grams	Liquid Specific Gravity:	1.000
% Past #10	0.825	* 100	Grav Factor:	1.606
Sub Factor	1.980			

Sieve Size	Weight Retained (grams)	Percent Retained	Diameter (mm)	Cum. % Retained	Cum. % Passing
38.1 mm. DIA.:	0.000	0.000	38.100	0.000	100.000
25.4 mm. DIA.:	0.000	0.000	25.400	0.000	100.000
19.0 mm. DIA.:	0.000	0.000	19.000	0.000	100.000
9.5 mm. DIA.:	2.000	1.667	9.500	1.667	98.333
NO. 4 SIEVE :	9.000	7.500	4.500	9.167	90.833
NO. 10 SIEVE :	10.000	8.333	2.000	17.500	82.500
NO. 20 SIEVE :	2.000	3.300	0.850	20.800	79.200
NO. 40 SIEVE :	3.000	4.950	0.425	25.750	74.250
NO. 60 SIEVE :	5.000	8.250	0.250	34.000	66.000
NO. 100 SIEVE:	8.000	13.200	0.150	47.200	52.800
NO. 200 SIEVE:	11.000	18.150	0.075	65.350	34.650

Time (min)	Hydrometer Reading	Temperature (C)	Diameter (mm)	% Suspended (Subsample)	% Suspended (Total Sample)
1.00	11.0	21.4	0.049	26.895	22.188
2.00	9.0	21.4	0.035	20.471	16.888
4.00	8.0	21.4	0.025	17.259	14.238
8.00	7.0	21.4	0.018	14.047	11.588
15.00	7.0	21.4	0.013	14.047	11.588
30.00	6.0	21.4	0.009	10.834	8.938
60.00	6.0	21.4	0.007	10.834	8.938
120.00	6.0	21.4	0.005	10.834	8.938
240.00	6.0	21.4	0.003	10.834	8.938
480.00	5.0	21.4	0.002	7.622	6.288
1440.00	5.0	21.4	0.001	7.622	6.288

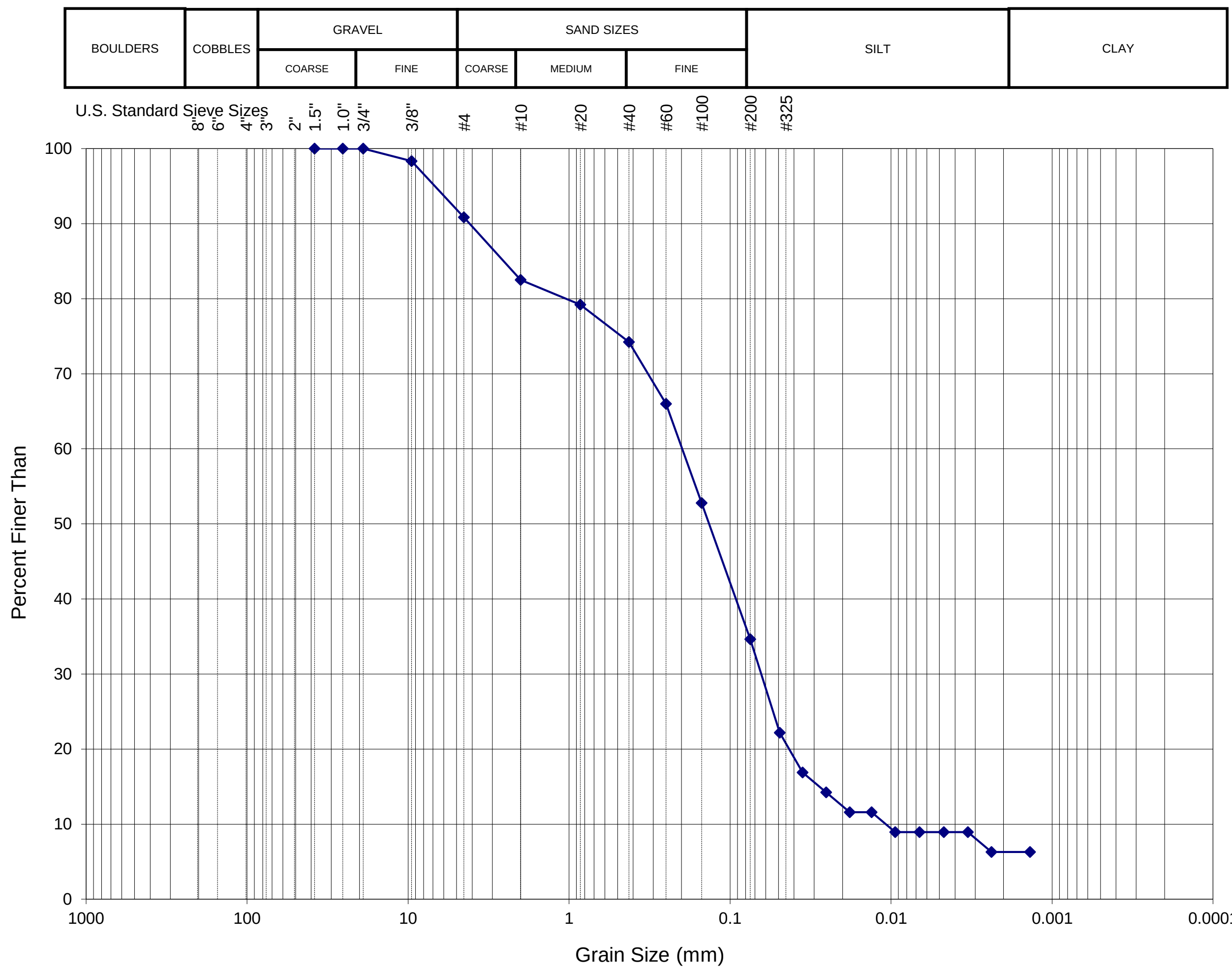
GRAIN SIZE	% BY WT.	DIA. RANGE (mm)
% GRAVEL :	9.17	> 4.5
% COARSE SAND :	8.33	2.0 - 4.5
% MEDIUM SAND :	8.25	0.425 - 2.0
% FINE SAND :	39.60	0.075 - 0.425
% SILT :	28.36	0.075 - 0.002
% CLAY :	6.29	< 0.002
% CLAY :	8.94	< 0.005

ALS Environmental
WATERLOO

PARTICLE SIZE DISTRIBUTION CURVE

ASTM METHOD D422-63

Project Name:	Northern Bioscience~TB
Project Number:	18648
Sample Location:	
Sample Number:	B. LAKE WAYPOINT 12
Sample Depth:	
Lab ID Number:	L1809795-7
Technician:	AB5
Sampler:	
Dates:	
Collected On:	8/8/2016
Analyzed:	9/1/2016



DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY	
SILTY SAND TRACE GRAVEL, TRACE CLAY	AND	36 - 50 %	GRAVEL	9 %
COARSE GRAINED	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	56 %
ESTIMATED HAZEN NUMBER: 2.18E-04 cm/s	WITH	11 - 20 %	SILT + CLAY	35 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM	TRACE	1 - 10 %		

GRAIN SIZE DETERMINATIONS

Client:	Northern Bioscience~TB	Sample Location:	
Project Number:	18648	Sample ID:	B. LAKE WAYPOINT 13
Sampler:		Sample Depth:	
Technician:	AB5	Date Sampled:	8/8/2016
Lab ID Number:	L1809795-8	Date Submitted:	8/8/2016
		Date Completed:	09/01/16

Total Sample Weight	107 grams		Specific Gravity:	2.650
Hydro. Sample Weight	50.000 grams		Liquid Specific Gravity:	1.000
% Past #10	1.000 * 100		Grav Factor:	1.606
Sub Factor	2.140			

Sieve Size	Weight Retained (grams)	Percent Retained	Diameter (mm)	Cum. % Retained	Cum. % Passing
38.1 mm. DIA.:	0.000	0.000	38.100	0.000	100.000
25.4 mm. DIA.:	0.000	0.000	25.400	0.000	100.000
19.0 mm. DIA.:	0.000	0.000	19.000	0.000	100.000
9.5 mm. DIA.:	0.000	0.000	9.500	0.000	100.000
NO. 4 SIEVE :	0.000	0.000	4.500	0.000	100.000
NO. 10 SIEVE :	0.000	0.000	2.000	0.000	100.000
NO. 20 SIEVE :	0.000	0.000	0.850	0.000	100.000
NO. 40 SIEVE :	1.000	2.000	0.425	2.000	98.000
NO. 60 SIEVE :	2.000	4.000	0.250	6.000	94.000
NO. 100 SIEVE:	5.000	10.000	0.150	16.000	84.000
NO. 200 SIEVE:	6.000	12.000	0.075	28.000	72.000

Time (min)	Hydrometer Reading	Temperature (C)	Diameter (mm)	% Suspended (Subsample)	% Suspended (Total Sample)
1.00	18.0	19.8	0.047	48.378	48.378
2.00	15.0	19.8	0.034	38.741	38.741
4.00	11.0	19.8	0.025	25.893	25.893
8.00	9.0	19.8	0.018	19.469	19.469
15.00	8.0	19.8	0.013	16.257	16.257
30.00	7.0	19.8	0.010	13.044	13.044
60.00	7.0	19.8	0.007	13.044	13.044
120.00	7.0	19.8	0.005	13.044	13.044
240.00	7.0	19.8	0.003	13.044	13.044
480.00	7.0	19.8	0.002	13.044	13.044
1440.00	6.0	19.8	0.001	9.832	9.832

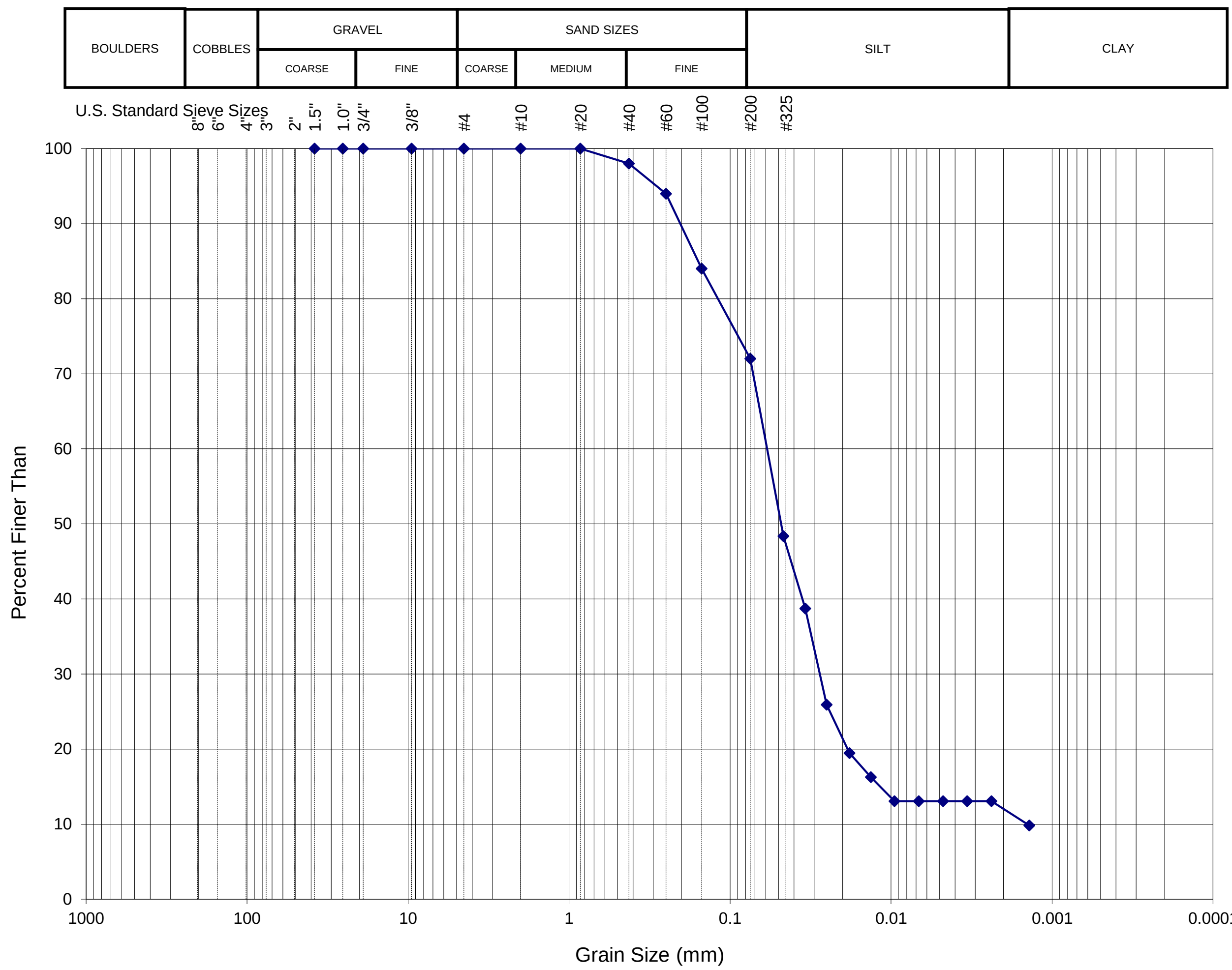
GRAIN SIZE	% BY WT.	DIA. RANGE (mm)
% GRAVEL :	0.00	> 4.5
% COARSE SAND :	0.00	2.0 - 4.5
% MEDIUM SAND :	2.00	0.425 - 2.0
% FINE SAND :	26.00	0.075 - 0.425
% SILT :	59.99	0.075 - 0.002
% CLAY :	12.01	< 0.002
% CLAY :	13.04	< 0.005

ALS Environmental
WATERLOO

PARTICLE SIZE DISTRIBUTION CURVE

ASTM METHOD D422-63

Project Name:	Northern Bioscience~TB
Project Number:	18648
Sample Location:	
Sample Number:	B. LAKE WAYPOINT 13
Sample Depth:	
Lab ID Number:	L1809795-8
Technician:	AB5
Sampler:	
Dates:	
Collected On:	8/8/2016
Analyzed:	9/1/2016



DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY	
SANDY SILT WITH CLAY	AND	36 - 50 %	GRAVEL	0 %
FINE GRAINED	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	28 %
ESTIMATED HAZEN NUMBER: 2.03E-06 cm/s	WITH	11 - 20 %	SILT + CLAY	72 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM	TRACE	1 - 10 %		

GRAIN SIZE DETERMINATIONS

Client:	Northern Bioscience~TB	Sample Location:	
Project Number:	18648	Sample ID:	B. LAKE WAYPOINT 14
Sampler:		Sample Depth:	
Technician:	AB5	Date Sampled:	8/8/2016
Lab ID Number:	L1809795-9	Date Submitted:	8/8/2016
		Date Completed:	09/01/16

Total Sample Weight	125	grams	Specific Gravity:	2.650
Hydro. Sample Weight	50.000	grams	Liquid Specific Gravity:	1.000
% Past #10	0.824	* 100	Grav Factor:	1.606
Sub Factor	2.060			

Sieve Size	Weight Retained (grams)	Percent Retained	Diameter (mm)	Cum. % Retained	Cum. % Passing
38.1 mm. DIA.:	0.000	0.000	38.100	0.000	100.000
25.4 mm. DIA.:	0.000	0.000	25.400	0.000	100.000
19.0 mm. DIA.:	0.000	0.000	19.000	0.000	100.000
9.5 mm. DIA.:	8.000	6.400	9.500	6.400	93.600
NO. 4 SIEVE :	8.000	6.400	4.500	12.800	87.200
NO. 10 SIEVE :	6.000	4.800	2.000	17.600	82.400
NO. 20 SIEVE :	2.000	3.296	0.850	20.896	79.104
NO. 40 SIEVE :	4.000	6.592	0.425	27.488	72.512
NO. 60 SIEVE :	5.000	8.240	0.250	35.728	64.272
NO. 100 SIEVE:	5.000	8.240	0.150	43.968	56.032
NO. 200 SIEVE:	11.000	18.128	0.075	62.096	37.904

Time (min)	Hydrometer Reading	Temperature (C)	Diameter (mm)	% Suspended (Subsample)	% Suspended (Total Sample)
1.00	7.0	21.4	0.051	14.047	11.574
2.00	7.0	21.4	0.036	14.047	11.574
4.00	6.0	21.4	0.026	10.834	8.928
8.00	6.0	21.4	0.018	10.834	8.928
15.00	5.0	21.4	0.013	7.622	6.281
30.00	5.0	21.4	0.009	7.622	6.281
60.00	5.0	21.4	0.007	7.622	6.281
120.00	5.0	21.4	0.005	7.622	6.281
240.00	4.0	21.4	0.003	4.410	3.634
480.00	4.0	21.4	0.002	4.410	3.634
1440.00	4.0	21.4	0.001	4.410	3.634

GRAIN SIZE	% BY WT.	DIA. RANGE (mm)
% GRAVEL :	12.80	> 4.5
% COARSE SAND :	4.80	2.0 - 4.5
% MEDIUM SAND :	9.89	0.425 - 2.0
% FINE SAND :	34.61	0.075 - 0.425
% SILT :	34.27	0.075 - 0.002
% CLAY :	3.63	< 0.002
% CLAY :	6.28	< 0.005

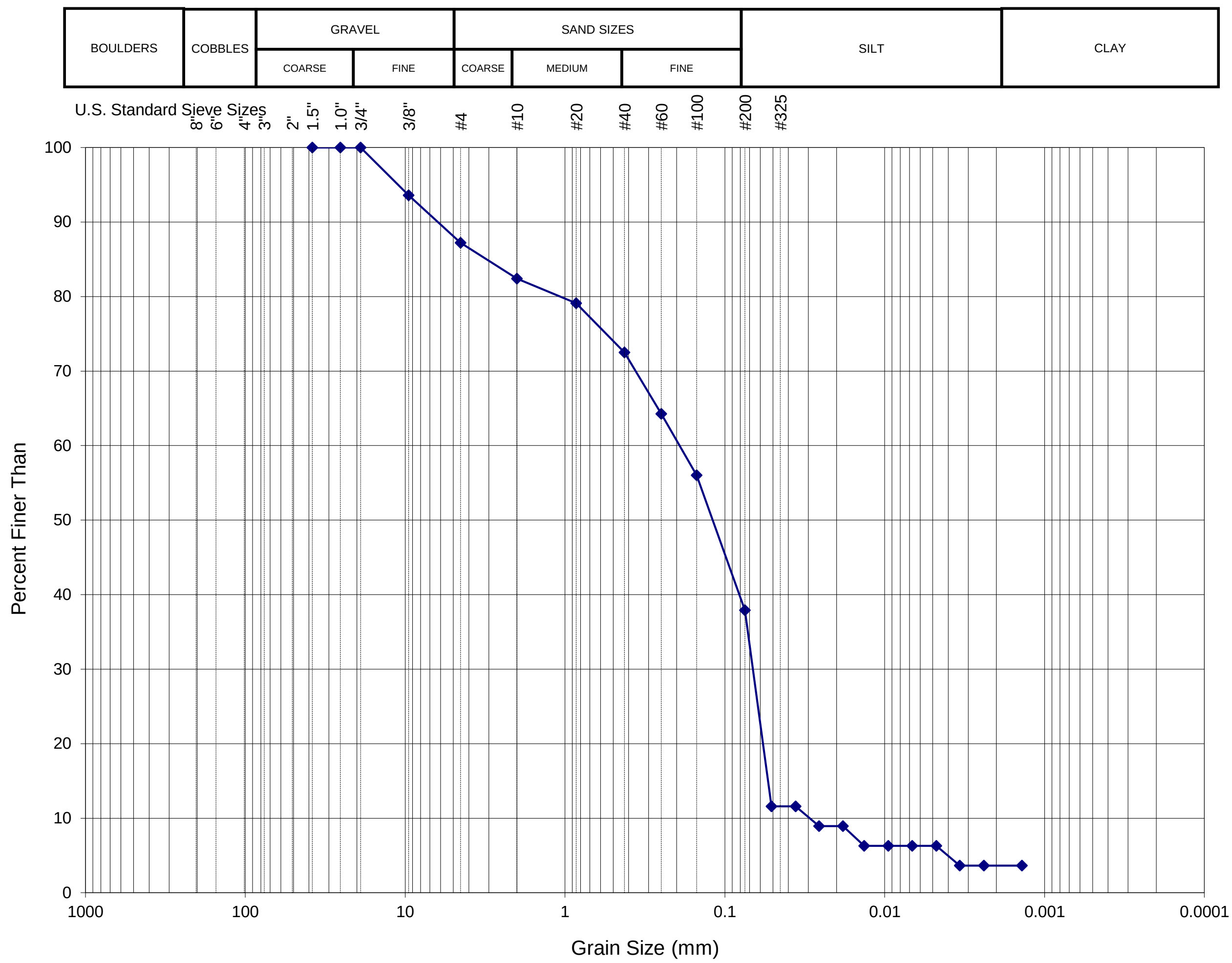
ALS Environmental

WATERLOO

PARTICLE SIZE DISTRIBUTION CURVE

ASTM METHOD D422-63

Project Name: Northern Bioscience~TB
Project Number: 18648
Sample Location:
Sample Number: B. LAKE WAYPOINT 14
Sample Depth:
Lab ID Number: L1809795-9
Technician: AB5
Sampler:
Dates:
Collected On: 8/8/2016
Analyzed: 9/1/2016



DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY		
SILTY SAND WITH GRAVEL, TRACE CLAY	AND	36 - 50 %	GRAVEL	13	%
COARSE GRAINED	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	49	%
ESTIMATED HAZEN NUMBER: 8.73E-04 cm/s	WITH	11 - 20 %	SILT + CLAY	38	%
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM	TRACE	1 - 10 %			

ALS Environmental

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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1809795-COFC

COC Number: 15 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	Northern Bioscience
Contact:	Al Harris
Phone:	807-346-4950
	Company address below will appear on the final report
Street:	363 Van Horne Street
City/Province:	Thunder Bay, ON
Postal Code:	P7A 3G3
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☒ YES ☐ NO
Company:	Arcadis
Contact:	Fred Bernard 905 764 9380

Report Format / Distribution

Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☒ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: aharris@tbaytel.net

Email 2: Yousry.Hamdy@arcadis.com

Email 3: Fred.Bernard@arcadis.com

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Fred.Bernard@arcadis.com

Email 2:

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ 3 day [P3] ☐ 2 day [P2] ☐

EMERGENCY: 1 Business day [E1] ☐ Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only): L1809795

ALS Contact:

Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	GRAIN SIZE-WT	TC-SOLID-MF-WT	EC-SOLID-MF-WT	OGG-TOT-WT	MET-200.2-CCMS-WT	PAH-511-WT	BTX-511-HS-WT	Number of Containers
	Boakvard Lake Waypoint 6	08-08-16	9:46		✓	✓	✓	✓	✓	✓	✓	
	" " " 7		9:56									
	8		10:05									
	9		10:17									
	10		10:26									
	11		10:38									
	12		11:55									
	13		12:12									
	14		12:23									

Drinking Water (DW) Samples [1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human drinking water use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☒

Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☒

Cooling Initiated ☒

INITIAL COOLER TEMPERATURES °C: 24.4

FINAL COOLER TEMPERATURES °C:

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date: 8/8/16	Time: 15:15	Received by: JRR	Date: Aug 8/16	Time: 3:50

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION   WHITE - LABORATORY COPY   YELLOW - CLIENT COPY

1. If any water samples are taken from a Regulated Drinking Water (DW) System please submit using an Authorized DW COC form

ARCADIS Canada Inc. - Richmond Hill
ATTN: Allan Harris / Yousry Hamady
Northern Bioscience
363 Van Horne Street
Thunder Bay ON P7A 3G3

Date Received: 18-APR-17
Report Date: 26-APR-17 14:49 (MT)
Version: FINAL

Client Phone: 807-344-7213

Certificate of Analysis

Lab Work Order #: L1914002

Project P.O. #: NOT SUBMITTED
Job Reference: NORTHERN BIOSCIENCE
C of C Numbers:
Legal Site Desc:

C. Paradis

Christine Paradis
Project Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-1 BOULEVARD 1 Sampled By: Client on 18-APR-17 @ 09:00 Matrix: Water							
Physical Tests							
Color, True	67.0		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	46.7		3.0	uS/cm		19-APR-17	R3703073
pH	7.17		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	3.6		2.0	mg/L		19-APR-17	R3703592
Total Dissolved Solids	49		10	mg/L		18-APR-17	R3702706
Turbidity	1.45		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.151		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.32		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0099		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	12.0		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	8		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	172		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.128		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00021		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0119		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000052		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.17		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00049		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00012		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00138		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.278		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000079		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.77		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0116		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000107		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00071		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.494		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00113		0.00020	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-1 BOULEVARD 1 Sampled By: Client on 18-APR-17 @ 09:00 Matrix: Water							
Total Metals							
Selenium (Se)-Total	0.000062		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.67		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.87		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0123		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.77		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00177		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000087		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00067		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	24-APR-17	24-APR-17	R3707668
L1914002-2 BOULEVARD 2 Sampled By: Client on 18-APR-17 @ 09:05 Matrix: Water							
Physical Tests							
Color, True	66.9		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	52.0		3.0	uS/cm		19-APR-17	R3703073
pH	7.16		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703592
Total Dissolved Solids	50		10	mg/L		18-APR-17	R3702706
Turbidity	1.41		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.156		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.37		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0116		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	11.7		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	5		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	155		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.122		0.0030	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-2 BOULEVARD 2 Sampled By: Client on 18-APR-17 @ 09:05 Matrix: Water							
Total Metals							
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00020		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0113		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000069		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.24		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00047		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00011		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00134		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.282		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000066		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.75		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0144		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000098		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00069		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.471		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00106		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Selenium (Se)-Total	0.000077		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.57		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	2.12		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0124		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.79		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00157		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000089		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00063		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	24-APR-17	24-APR-17	R3707668
L1914002-3 BOULEVARD 3							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-3 BOULEVARD 3 Sampled By: Client on 18-APR-17 @ 11:08 Matrix: Water							
Physical Tests							
Color, True	66.8		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	48.4		3.0	uS/cm		19-APR-17	R3703073
pH	7.23		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703592
Total Dissolved Solids	61		10	mg/L		18-APR-17	R3702706
Turbidity	1.89		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.153		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.40		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0103		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	12.0		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	8		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	133		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.129		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00022		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0117		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000060		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.13		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00076		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00011		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00137		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.295		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000069		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.73		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0140		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000100		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00087		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.466		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00111		0.00020	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-3 BOULEVARD 3 Sampled By: Client on 18-APR-17 @ 11:08 Matrix: Water							
Total Metals							
Selenium (Se)-Total	0.000077		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.56		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.98		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0123		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.72		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00165		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000090		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00066		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	24-APR-17	24-APR-17	R3707668
L1914002-4 BOULEVARD 4 Sampled By: Client on 18-APR-17 @ 09:14 Matrix: Water							
Physical Tests							
Color, True	67.3		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	48.9		3.0	uS/cm		19-APR-17	R3703073
pH	7.22		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703592
Total Dissolved Solids	57		10	mg/L		18-APR-17	R3702706
Turbidity	1.79		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.153		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.35		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0102		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	12.0		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	1		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	137		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.126		0.0030	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-4 BOULEVARD 4 Sampled By: Client on 18-APR-17 @ 09:14 Matrix: Water							
Total Metals							
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00022		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0114		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000069		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.16		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00050		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00012		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00140		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.292		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000072		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.75		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0142		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000102		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00072		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.490		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00114		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Selenium (Se)-Total	0.000065		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.44		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.98		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0124		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.67		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	0.00014		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00171		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000089		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00069		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	24-APR-17	24-APR-17	R3707668
L1914002-5 BOULEVARD 5							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-5 BOULEVARD 5							
Sampled By: Client on 18-APR-17 @ 11:14							
Matrix: Water							
Physical Tests							
Color, True	67.0		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	48.0		3.0	uS/cm		19-APR-17	R3703073
pH	7.23		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703592
Total Dissolved Solids	47		10	mg/L		18-APR-17	R3702706
Turbidity	2.19		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.150		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.32		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0112		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	11.6		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	7		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	110		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.126		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00021		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0114		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000052		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.11		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00049		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00011		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00140		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.278		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000072		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.73		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0134		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000090		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00066		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.480		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00110		0.00020	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-5 BOULEVARD 5 Sampled By: Client on 18-APR-17 @ 11:14 Matrix: Water							
Total Metals							
Selenium (Se)-Total	0.000055		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.66		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.82		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0123		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.87		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00166		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000088		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00066		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	24-APR-17	24-APR-17	R3707668
L1914002-6 BOULEVARD 6 Sampled By: Client on 18-APR-17 @ 11:19 Matrix: Water							
Physical Tests							
Color, True	67.8		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	47.0		3.0	uS/cm		19-APR-17	R3703073
pH	7.23		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703592
Total Dissolved Solids	53		10	mg/L		18-APR-17	R3702706
Turbidity	1.76		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	0.023		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.151		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.42		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0109		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	11.6		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	5		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	140		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.123		0.0030	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-6 BOULEVARD 6 Sampled By: Client on 18-APR-17 @ 11:19 Matrix: Water							
Total Metals							
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00021		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0115		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000057		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.03		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00049		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00011		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00136		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.275		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000067		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.74		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0111		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000105		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00072		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.458		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00116		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Selenium (Se)-Total	0.000069		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.58		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.74		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0124		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.80		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00148		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000088		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00064		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	24-APR-17	24-APR-17	R3707668
L1914002-7 BOULEVARD 7							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-7 BOULEVARD 7							
Sampled By: Client on 18-APR-17 @ 11:23							
Matrix: Water							
Physical Tests							
Color, True	67.2		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	50.9		3.0	uS/cm		19-APR-17	R3703073
pH	7.24		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	2.1		2.0	mg/L		19-APR-17	R3703251
Total Dissolved Solids	55		10	mg/L		18-APR-17	R3702706
Turbidity	1.38		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	0.026		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.154		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.40		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0098		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	11.7		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	9		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	144		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.120		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00020		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0113		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000060		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.21		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00049		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00011		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00192		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.277		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000079		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.68		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0130		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000085		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00066		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.458		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00114		0.00020	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-7 BOULEVARD 7							
Sampled By: Client on 18-APR-17 @ 11:23							
Matrix: Water							
Total Metals							
Selenium (Se)-Total	0.000062		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.52		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	2.15		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0124		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.68		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	<0.0024	DLM	0.0024	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000087		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00065		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	24-APR-17	24-APR-17	R3707668
L1914002-8 BOULEVARD 8							
Sampled By: Client on 18-APR-17 @ 11:29							
Matrix: Water							
Physical Tests							
Color, True	67.7		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	47.7		3.0	uS/cm		19-APR-17	R3703073
pH	7.24		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703251
Total Dissolved Solids	49		10	mg/L		18-APR-17	R3702706
Turbidity	1.34		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.153		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.32		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0097		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	11.6		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	15		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	134		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.131		0.0030	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-8 BOULEVARD 8 Sampled By: Client on 18-APR-17 @ 11:29 Matrix: Water							
Total Metals							
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00021		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0112		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000095		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.07		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00051		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00012		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00800		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.322		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000520		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.71		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0129		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000087		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00070		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.468		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00115		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Selenium (Se)-Total	0.000081		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.65		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.79		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0123		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.69		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00179		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000093		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00068		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	0.0052		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	24-APR-17	24-APR-17	R3707668
L1914002-9 BOULEVARD 9							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-9 BOULEVARD 9 Sampled By: Client on 18-APR-17 @ 11:36 Matrix: Water							
Physical Tests							
Color, True	67.8		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	47.9		3.0	uS/cm		19-APR-17	R3703073
pH	7.23		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703251
Total Dissolved Solids	57		10	mg/L		19-APR-17	R3703198
Turbidity	1.92		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.150		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.34		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0113		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	11.5		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	17		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	172		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.125		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00020		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0114		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000063		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.02		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00048		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00012		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00135		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.286		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000072		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.62		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0132		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000270		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00067		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.457		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00116		0.00020	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-9 BOULEVARD 9 Sampled By: Client on 18-APR-17 @ 11:36 Matrix: Water							
Total Metals							
Selenium (Se)-Total	0.000061		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.61		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.81		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0124		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.71		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	<0.0033	DLM	0.0033	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000088		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00068		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	24-APR-17	24-APR-17	R3707668
L1914002-10 BOULEVARD 10 Sampled By: Client on 18-APR-17 @ 11:42 Matrix: Water							
Physical Tests							
Color, True	67.7		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	47.7		3.0	uS/cm		19-APR-17	R3703073
pH	7.24		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703251
Total Dissolved Solids	61		10	mg/L		19-APR-17	R3703198
Turbidity	1.31		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.151		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.33		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0098		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	11.6		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	4		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	172		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.125		0.0030	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-10 BOULEVARD 10 Sampled By: Client on 18-APR-17 @ 11:42 Matrix: Water							
Total Metals							
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00023		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0116		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000075		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.10		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00050		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00011		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00136		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.297		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000074		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.69		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0132		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000098		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00080		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.454		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00106		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Selenium (Se)-Total	0.000065		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.51		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.84		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0125		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.67		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00192		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000090		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00063		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	25-APR-17	25-APR-17	R3708354
L1914002-11 BOULEVARD 11							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-11 BOULEVARD 11							
Sampled By: Client on 18-APR-17 @ 11:48							
Matrix: Water							
Physical Tests							
Color, True	67.6		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	47.7		3.0	uS/cm		19-APR-17	R3703073
pH	7.23		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703251
Total Dissolved Solids	41		10	mg/L		19-APR-17	R3703198
Turbidity	1.85		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.152		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.35		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0106		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	11.9		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	8		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	201		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.129		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00021		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0114		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000062		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	4.98		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00049		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00012		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00142		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.289		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000075		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.72		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0134		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000085		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00069		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.471		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00119		0.00020	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-11 BOULEVARD 11							
Sampled By: Client on 18-APR-17 @ 11:48							
Matrix: Water							
Total Metals							
Selenium (Se)-Total	0.000079		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.47		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.85		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0122		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.69		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00178		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000090		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00066		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	25-APR-17	25-APR-17	R3708354
L1914002-12 BOULEVARD 12							
Sampled By: Client on 18-APR-17 @ 11:55							
Matrix: Water							
Physical Tests							
Color, True	67.5		2.0	CU		19-APR-17	R3702667
Conductivity (EC)	47.8		3.0	uS/cm		19-APR-17	R3703073
pH	7.23		0.10	pH		19-APR-17	R3703073
Total Suspended Solids	<2.0		2.0	mg/L		19-APR-17	R3703251
Total Dissolved Solids	35		10	mg/L		19-APR-17	R3703198
Turbidity	1.96		0.10	NTU		18-APR-17	R3702192
Anions and Nutrients							
Ammonia, Total (as N)	<0.020		0.020	mg/L		19-APR-17	R3702761
Nitrate (as N)	0.150		0.020	mg/L		18-APR-17	R3702415
Nitrite (as N)	<0.010		0.010	mg/L		18-APR-17	R3702415
Total Kjeldahl Nitrogen	0.42		0.25	mg/L	19-APR-17	24-APR-17	R3705886
Phosphorus (P)-Total	0.0133		0.0030	mg/L	19-APR-17	20-APR-17	R3703366
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					19-APR-17	R3702432
Dissolved Organic Carbon	11.8		1.0	mg/L	19-APR-17	19-APR-17	R3703098
Bacteriological Tests							
Escherichia Coli	12		0	MPN/100mL		18-APR-17	R3702554
Total Coliforms	145		0	MPN/100mL		18-APR-17	R3702554
Total Metals							
Aluminum (Al)-Total	0.135		0.0030	mg/L	19-APR-17	19-APR-17	R3703097

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1914002-12 BOULEVARD 12							
Sampled By: Client on 18-APR-17 @ 11:55							
Matrix: Water							
Total Metals							
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Arsenic (As)-Total	0.00022		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Barium (Ba)-Total	0.0117		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Boron (B)-Total	<0.010		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Cadmium (Cd)-Total	0.0000057		0.0000050	mg/L	19-APR-17	19-APR-17	R3703097
Calcium (Ca)-Total	5.07		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Chromium (Cr)-Total	0.00051		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Cobalt (Co)-Total	0.00011		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Copper (Cu)-Total	0.00175		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Iron (Fe)-Total	0.291		0.010	mg/L	19-APR-17	19-APR-17	R3703097
Lead (Pb)-Total	0.000096		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Lithium (Li)-Total	<0.0010		0.0010	mg/L	19-APR-17	19-APR-17	R3703097
Magnesium (Mg)-Total	1.70		0.0050	mg/L	19-APR-17	19-APR-17	R3703097
Manganese (Mn)-Total	0.0132		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Molybdenum (Mo)-Total	0.000101		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Nickel (Ni)-Total	0.00073		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Phosphorus (P)-Total	<0.050		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Potassium (K)-Total	0.478		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Rubidium (Rb)-Total	0.00114		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Selenium (Se)-Total	0.000067		0.000050	mg/L	19-APR-17	19-APR-17	R3703097
Silicon (Si)-Total	3.54		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Silver (Ag)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Sodium (Na)-Total	1.86		0.050	mg/L	19-APR-17	19-APR-17	R3703097
Strontium (Sr)-Total	0.0124		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Sulfur (S)-Total	0.74		0.50	mg/L	19-APR-17	19-APR-17	R3703097
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	19-APR-17	19-APR-17	R3703097
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Thorium (Th)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Tin (Sn)-Total	0.00014		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Titanium (Ti)-Total	0.00188		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Tungsten (W)-Total	<0.00010		0.00010	mg/L	19-APR-17	19-APR-17	R3703097
Uranium (U)-Total	0.000091		0.000010	mg/L	19-APR-17	19-APR-17	R3703097
Vanadium (V)-Total	0.00070		0.00050	mg/L	19-APR-17	19-APR-17	R3703097
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	19-APR-17	19-APR-17	R3703097
Zirconium (Zr)-Total	0.00059		0.00030	mg/L	19-APR-17	19-APR-17	R3703097
Aggregate Organics							
Oil and Grease, Total	<2.0		2.0	mg/L	25-APR-17	25-APR-17	R3708354

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Escherichia Coli	DUPM	L1914002-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Dissolved Organic Carbon	MS-B	L1914002-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Ammonia, Total (as N)	MS-B	L1914002-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DUPM	MPN duplicate results were outside default ALS Data Quality Objective, but within 95% confidence interval for MPN reference method. Sample results are reliable.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
COLOUR-TB	Water	Colour, True	APHA 2120 C

True Colour in aqueous matrices is analyzed using colourimetric detection. This is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using a platinum-cobalt standard.

ALS Test Code	Matrix	Test Description	Method Reference**
DOC-TB	Water	Dissolved Organic Carbon	APHA 5310 B modified

Water samples are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis. Analyzed by converting all carbonaceous material to carbon dioxide (CO2) by catalytic combustion at 850?C. The CO2 generated is measured by an infrared detector and is directly proportional to concentration of carbonaceous material in the sample

ALS Test Code	Matrix	Test Description	Method Reference**
EC-TITR-TB	Water	Conductivity	APHA 2510 B

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-T-CCMS-TB	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

ALS Test Code	Matrix	Test Description	Method Reference**
NH3-COL-TB	Water	Ammonia by Discrete Analyzer	APHA 4500-NH3 G. (modified)

Ammonia in aqueous matrices is analyzed using discrete analyzer with colourimetric detection.

ALS Test Code	Matrix	Test Description	Method Reference**
NO2-IC-N-TB	Water	Nitrite in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
NO3-IC-N-TB	Water	Nitrate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
OGG-TOT-WT	Water	Oil and Grease, Total	APHA 5520 B

The procedure involves an extraction of the entire water sample with hexane. This extract is then evaporated to dryness, and the residue weighed to determine Oil and Grease.

ALS Test Code	Matrix	Test Description	Method Reference**
P-T-COL-TB	Water	Total Phosphorus by Discrete Analyzer	APHA 4500-P B, F, G (modified)

Phosphorus in aqueous matrices is analyzed using discrete Analyzer with colourimetric detection.

ALS Test Code	Matrix	Test Description	Method Reference**
PH-TITR-TB	Water	pH	APHA 4500-H

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

ALS Test Code	Matrix	Test Description	Method Reference**
TC,EC-QT97-TB	Water	Total Coliform and E.coli	APHA 9223 B

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture of hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

ALS Test Code	Matrix	Test Description	Method Reference**
TDS-TB	Water	Total Dissolved Solids	APHA 2540 C (modified)

Aqueous matrices are analyzed using gravimetry and evaporation

ALS Test Code	Matrix	Test Description	Method Reference**
TKN-COL-TB	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg (modified)

Total Kjeldahl Nitrogen in aqueous matrices is analyzed using a discrete analyzer with colourimetric detection.

ALS Test Code	Matrix	Test Description	Method Reference**
TSS-TB	Water	Total Suspended Solids	APHA 2540 D (modified)

Aqueous matrices are analyzed using gravimetry

ALS Test Code	Matrix	Test Description	Method Reference**
TURBIDITY-TB	Water	Turbidity	APHA 2130 B-Nephelometer

Aqueous matrices are analyzed using nephelometry with the light scatter measured at a 90” angle.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Reference Information

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
TB	ALS ENVIRONMENTAL - THUNDER BAY, ONTARIO, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: ARCADIS Canada Inc. - Richmond Hill
Northern Bioscience 363 Van Horne Street
Thunder Bay ON P7A 3G3

Contact: Allan Harris / Yousry Hamady

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
COLOUR-TB	**Water**							
Batch R3702667								
WG2513352-3 DUP		**L1914002-1**						
Color, True		67.0	68.2		CU	1.8	20	19-APR-17
WG2513352-2 LCS								
Color, True			101.6		%		85-115	19-APR-17
WG2513352-1 MB								
Color, True			<2.0		CU		2	19-APR-17
DOC-TB	**Water**							
Batch R3703098								
WG2513151-3 DUP		**L1914002-1**						
Dissolved Organic Carbon		12.0	12.0		mg/L	0.1	20	19-APR-17
WG2513151-2 LCS								
Dissolved Organic Carbon			105.8		%		80-120	19-APR-17
WG2513151-1 MB								
Dissolved Organic Carbon			<1.0		mg/L		1	19-APR-17
WG2513151-4 MS		**L1914002-1**						
Dissolved Organic Carbon			N/A	MS-B	%		-	19-APR-17
EC-TITR-TB	**Water**							
Batch R3703073								
WG2513522-6 DUP		**L1914002-2**						
Conductivity (EC)		52.0	50.7		uS/cm	2.5	10	19-APR-17
WG2513522-2 LCS								
Conductivity (EC)			98.9		%		90-110	19-APR-17
WG2513522-5 LCS								
Conductivity (EC)			99.6		%		90-110	19-APR-17
WG2513522-1 MB								
Conductivity (EC)			<3.0		uS/cm		3	19-APR-17
WG2513522-4 MB								
Conductivity (EC)			<3.0		uS/cm		3	19-APR-17
MET-T-CCMS-TB	**Water**							
Batch R3703097								
WG2513272-2 LCS								
Aluminum (Al)-Total			101.7		%		80-120	19-APR-17
Antimony (Sb)-Total			105.1		%		80-120	19-APR-17
Arsenic (As)-Total			102.2		%		80-120	19-APR-17
Barium (Ba)-Total			108.7		%		80-120	19-APR-17
Beryllium (Be)-Total			96.5		%		80-120	19-APR-17
Bismuth (Bi)-Total			100.7		%		80-120	19-APR-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R3703097								
WG2513272-2 LCS								
Boron (B)-Total			91.4		%		80-120	19-APR-17
Cadmium (Cd)-Total			102.6		%		80-120	19-APR-17
Calcium (Ca)-Total			106.3		%		80-120	19-APR-17
Cesium (Cs)-Total			107.1		%		80-120	19-APR-17
Chromium (Cr)-Total			99.8		%		80-120	19-APR-17
Cobalt (Co)-Total			102.3		%		80-120	19-APR-17
Copper (Cu)-Total			99.9		%		80-120	19-APR-17
Iron (Fe)-Total			106.5		%		80-120	19-APR-17
Lead (Pb)-Total			105.1		%		80-120	19-APR-17
Lithium (Li)-Total			93.5		%		80-120	19-APR-17
Magnesium (Mg)-Total			97.8		%		80-120	19-APR-17
Manganese (Mn)-Total			101.7		%		80-120	19-APR-17
Molybdenum (Mo)-Total			104.7		%		80-120	19-APR-17
Nickel (Ni)-Total			101.8		%		80-120	19-APR-17
Phosphorus (P)-Total			106.5		%		70-130	19-APR-17
Potassium (K)-Total			105.1		%		80-120	19-APR-17
Rubidium (Rb)-Total			108.2		%		80-120	19-APR-17
Selenium (Se)-Total			104.1		%		80-120	19-APR-17
Silicon (Si)-Total			101.4		%		60-140	19-APR-17
Silver (Ag)-Total			104.5		%		80-120	19-APR-17
Sodium (Na)-Total			101.2		%		80-120	19-APR-17
Strontium (Sr)-Total			107.2		%		80-120	19-APR-17
Sulfur (S)-Total			99.4		%		80-120	19-APR-17
Tellurium (Te)-Total			98.1		%		80-120	19-APR-17
Thallium (Tl)-Total			102.9		%		80-120	19-APR-17
Thorium (Th)-Total			89.9		%		80-120	19-APR-17
Tin (Sn)-Total			103.5		%		80-120	19-APR-17
Titanium (Ti)-Total			98.7		%		80-120	19-APR-17
Tungsten (W)-Total			101.6		%		80-120	19-APR-17
Uranium (U)-Total			106.0		%		80-120	19-APR-17
Vanadium (V)-Total			101.7		%		80-120	19-APR-17
Zinc (Zn)-Total			100.3		%		80-120	19-APR-17
Zirconium (Zr)-Total			103.6		%		80-120	19-APR-17
WG2513272-1 MB								

ALS Environmental

Quality Control Report

Workorder: L1914002 Report Date: 26-APR-17

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R3703097								
WG2513272-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	19-APR-17
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	19-APR-17
Arsenic (As)-Total			<0.00010		mg/L		0.0001	19-APR-17
Barium (Ba)-Total			<0.000050		mg/L		0.00005	19-APR-17
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	19-APR-17
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	19-APR-17
Boron (B)-Total			<0.010		mg/L		0.01	19-APR-17
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	19-APR-17
Calcium (Ca)-Total			<0.050		mg/L		0.05	19-APR-17
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	19-APR-17
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	19-APR-17
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	19-APR-17
Copper (Cu)-Total			<0.00050		mg/L		0.0005	19-APR-17
Iron (Fe)-Total			<0.010		mg/L		0.01	19-APR-17
Lead (Pb)-Total			<0.000050		mg/L		0.00005	19-APR-17
Lithium (Li)-Total			<0.0010		mg/L		0.001	19-APR-17
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	19-APR-17
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	19-APR-17
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	19-APR-17
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	19-APR-17
Phosphorus (P)-Total			<0.050		mg/L		0.05	19-APR-17
Potassium (K)-Total			<0.050		mg/L		0.05	19-APR-17
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	19-APR-17
Selenium (Se)-Total			<0.000050		mg/L		0.00005	19-APR-17
Silicon (Si)-Total			<0.050		mg/L		0.05	19-APR-17
Silver (Ag)-Total			<0.000010		mg/L		0.00001	19-APR-17
Sodium (Na)-Total			<0.050		mg/L		0.05	19-APR-17
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	19-APR-17
Sulfur (S)-Total			<0.50		mg/L		0.5	19-APR-17
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	19-APR-17
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	19-APR-17
Thorium (Th)-Total			<0.00010		mg/L		0.0001	19-APR-17
Tin (Sn)-Total			<0.00010		mg/L		0.0001	19-APR-17
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	19-APR-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-TB	**Water**							
Batch R3703097								
WG2513272-1 MB								
Tungsten (W)-Total			<0.00010		mg/L		0.0001	19-APR-17
Uranium (U)-Total			<0.000010		mg/L		0.00001	19-APR-17
Vanadium (V)-Total			<0.00050		mg/L		0.0005	19-APR-17
Zinc (Zn)-Total			<0.0030		mg/L		0.003	19-APR-17
Zirconium (Zr)-Total			<0.00030		mg/L		0.0003	19-APR-17
NH3-COL-TB	**Water**							
Batch R3702761								
WG2513213-2 LCS								
Ammonia, Total (as N)			98.1		%		85-115	19-APR-17
WG2513213-6 LCS								
Ammonia, Total (as N)			99.1		%		85-115	19-APR-17
WG2513213-1 MB								
Ammonia, Total (as N)			<0.020		mg/L		0.02	19-APR-17
WG2513213-5 MB								
Ammonia, Total (as N)			<0.020		mg/L		0.02	19-APR-17
NO2-IC-N-TB	**Water**							
Batch R3702415								
WG2512431-6 LCS								
Nitrite (as N)			99.7		%		90-110	18-APR-17
WG2512431-5 MB								
Nitrite (as N)			<0.010		mg/L		0.01	18-APR-17
NO3-IC-N-TB	**Water**							
Batch R3702415								
WG2512431-6 LCS								
Nitrate (as N)			99.6		%		90-110	18-APR-17
WG2512431-5 MB								
Nitrate (as N)			<0.020		mg/L		0.02	18-APR-17
OGG-TOT-WT	**Water**							
Batch R3707668								
WG2515917-2 LCS								
Oil and Grease, Total			93.1		%		70-130	24-APR-17
WG2515917-3 LCSD		**WG2515917-2**						
Oil and Grease, Total		93.1	92		%	0.7	40	24-APR-17
WG2515917-1 MB								
Oil and Grease, Total			<2.0		mg/L		2	24-APR-17

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
OGG-TOT-WT	**Water**							
Batch R3708354								
WG2516604-2 LCS								
Oil and Grease, Total			90.8		%		70-130	25-APR-17
WG2516604-3 LCSD		**WG2516604-2**						
Oil and Grease, Total		90.8	90		%	1.1	40	25-APR-17
WG2516604-1 MB								
Oil and Grease, Total			<2.0		mg/L		2	25-APR-17
P-T-COL-TB	**Water**							
Batch R3703366								
WG2513280-3 DUP		**L1914002-5**						
Phosphorus (P)-Total		0.0112	0.0096		mg/L	15	20	20-APR-17
WG2513280-2 LCS								
Phosphorus (P)-Total			101.2		%		80-120	20-APR-17
WG2513280-1 MB								
Phosphorus (P)-Total			<0.0030		mg/L		0.003	20-APR-17
WG2513280-4 MS		**L1914002-5**						
Phosphorus (P)-Total			84.4		%		70-130	20-APR-17
PH-TITR-TB	**Water**							
Batch R3703073								
WG2513522-6 DUP		**L1914002-2**						
pH		7.16	7.20	J	pH	0.04	0.2	19-APR-17
WG2513522-2 LCS								
pH			6.01		pH		5.9-6.1	19-APR-17
WG2513522-5 LCS								
pH			5.98		pH		5.9-6.1	19-APR-17
TC,EC-QT97-TB	**Water**							
Batch R3702554								
WG2512821-2 DUP		**L1914002-3**						
Total Coliforms		133	135		MPN/100mL	1.5	65	18-APR-17
Escherichia Coli		8	4	DUPM	MPN/100mL	67	65	18-APR-17
WG2512821-1 MB								
Total Coliforms			0		MPN/100mL		1	18-APR-17
Escherichia Coli			0		MPN/100mL		1	18-APR-17
TDS-TB	**Water**							
Batch R3702706								
WG2512792-2 LCS								
Total Dissolved Solids			99.6		%		85-115	18-APR-17
WG2512792-1 MB								

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TDS-TB	**Water**							
Batch R3702706								
WG2512792-1 MB								
Total Dissolved Solids			<10		mg/L		10	18-APR-17
Batch R3703198								
WG2513267-2 LCS								
Total Dissolved Solids			98.3		%		85-115	19-APR-17
WG2513267-1 MB								
Total Dissolved Solids			<10		mg/L		10	19-APR-17
TKN-COL-TB	**Water**							
Batch R3704099								
WG2513135-2 LCS								
Total Kjeldahl Nitrogen			97.2		%		75-125	21-APR-17
WG2513135-1 MB								
Total Kjeldahl Nitrogen			<0.25		mg/L		0.25	21-APR-17
TSS-TB	**Water**							
Batch R3703251								
WG2513628-3 DUP		**L1914002-9**						
Total Suspended Solids		<2.0	<2.0	RPD-NA	mg/L	N/A	20	19-APR-17
WG2513628-2 LCS								
Total Suspended Solids			99.1		%		85-115	19-APR-17
WG2513628-1 MB								
Total Suspended Solids			<2.0		mg/L		2	19-APR-17
Batch R3703592								
WG2513456-2 LCS								
Total Suspended Solids			98.7		%		85-115	19-APR-17
WG2513456-1 MB								
Total Suspended Solids			<2.0		mg/L		2	19-APR-17
TURBIDITY-TB	**Water**							
Batch R3702192								
WG2512797-3 DUP		**L1914002-12**						
Turbidity		1.96	1.87		NTU	4.7	15	18-APR-17
WG2512797-2 LCS								
Turbidity			101.0		%		85-115	18-APR-17
WG2512797-1 MB								
Turbidity			<0.10		NTU		0.1	18-APR-17

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUPM	MPN duplicate results were outside default ALS Data Quality Objective, but within 95% confidence interval for MPN reference method. Sample results are reliable.
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L1914002-COFC

COC Number: 14 -

Page ___ of ___

Report To	
Company:	Northern Bioscience
Contact:	
Address:	363 Van Horne Street, Thunder Bay, ON, P7A 3G3
Phone:	807-346-4950

Report Format / Distribution

Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☐ Yes ☐ No
☐ Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)

R ☐ Regular (Standard TAT if received by 3 pm - business days)
P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Specify Date Required for E2,E or P:

Invoice To: Same as Report To ☑ Yes ☐ No
Copy of Invoice with Report ☑ Yes ☐ No
Company: Arcadis
Contact:

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2

Project Information

ALS Quote #:
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

Approver ID: | Cost Center:
GL Account: | Routing Code:
Activity Code:
Location:

ALS Lab Work Order # (lab use only): L1914002

ALS Contact: | Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conductivity, TDS, Total Metals	NO2, NO3, DOC, Colour	pH, TSS, Turbidity, NH3	TKN, Total Phos, TC,EC	OGG	Number of Containers
	Boulevard 1	18-Apr-17	09:00	Water						
	" 2	"	09:05	"						
	" 3	"	11:08	"						
	" 4	"	09:14	"						
	" 5	"	11:14	"						
	" 6	"	11:19	"						
	" 7	"	11:23	"						
	" 8	"	11:29	"						
	" 9	"	11:36	"						
	" 10	"	11:42	"						
	" 11	"	11:48	"						
	" 12	"	11:55	"						

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☑ No

Are samples for human drinking water use? ☐ Yes ☑ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☒
Ice packs Yes ☐ No ☒ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C: 4.6
FINAL COOLER TEMPERATURES °C:

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received By: JM	Date: 18/4/17	Time: 14:10	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

JM

Northern Bioscience
ATTN: Allan Harris
363 VAN HORNE ST.
THUNDER BAY ON P7A 3G3

Date Received: 24-APR-17
Report Date: 04-MAY-17 14:31 (MT)
Version: FINAL

Client Phone: 807-346-4950

Certificate of Analysis

Lab Work Order #: L1916350
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Christine Paradis
Project Manager

ALS Environmental

CRITERIA REPORT

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Criteria Specific Limits	Analyzed	Batch
L1916350-1 BOULEVARD LAKE 1-1 TOP							
Sampled By: Client on 24-APR-17 @ 11:31							
Matrix: Sediment					ON-PWQO		
Individual Analytes							
Mercury (Hg)	0.132		0.0050	ug/g		03-MAY-17	R3713691
L1916350-2 BOULEVARD LAKE 1-2 BOTTOM							
Sampled By: Client on 24-APR-17 @ 11:31							
Matrix: Sediment					ON-PWQO		
Individual Analytes							
Mercury (Hg)	0.125		0.0050	ug/g		03-MAY-17	R3713691
L1916350-3 BOULEVARD LAKE 2-1 TOP							
Sampled By: Client on 24-APR-17 @ 11:44							
Matrix: Sediment					ON-PWQO		
Individual Analytes							
Mercury (Hg)	0.111		0.0050	ug/g		03-MAY-17	R3713691
L1916350-4 BOULEVARD LAKE 2-2 BOTTOM							
Sampled By: Client on 24-APR-17 @ 11:44							
Matrix: Sediment					ON-PWQO		
Individual Analytes							
Mercury (Hg)	0.100		0.0050	ug/g		03-MAY-17	R3713691

* Detection Limit for result exceeds Criteria Specific Limit. Assessment against Criteria Limit cannot be made.

** Analytical result for this parameter exceeds Criteria Specific Limit listed on this report.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
HG-200.2-CVAA-WT	Soil	Mercury in Soil by CVAAS		EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA		

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of criteria limits is provided as is without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Quality Control Report

Client: Northern Bioscience
363 VAN HORNE ST.
THUNDER BAY ON P7A 3G3
Contact: Allan Harris

Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-200.2-CVAA-WT		**Soil**							
Batch	**R3713691**								
WG2521086-2	**CRM**		**WT-CANMET-TILL1**						
Mercury (Hg)				102.4		%		70-130	03-MAY-17
WG2521086-6	**DUP**		**WG2521086-5**						
Mercury (Hg)			0.0260	0.0275		ug/g	5.6	40	03-MAY-17
WG2521086-3	**LCS**								
Mercury (Hg)				109.5		%		80-120	03-MAY-17
WG2521086-1	**MB**								
Mercury (Hg)				<0.0050		mg/kg		0.005	03-MAY-17

Quality Control Report

Workorder: L1916350 Report Date: 04-MAY-17

Client: Northern Bioscience
363 VAN HORNE ST.
THUNDER BAY ON P7A 3G3
Contact: Allan Harris

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1916350-COFC

COC Number: 15 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	Northern Bioscience
Contact:	Al Harris
Phone:	807-346-4950
	Company address below will appear on the final report
Street:	363 Van Horne Street
City/Province:	Thunder Bay, ON
Postal Code:	P7A 3G3
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)	
Quality Control (QC) Report with Report ☐ YES ☐ NO	
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Email 1 or Fax	aharris@tbaytel.net
Email 2	
Email 3	
Invoice Distribution	
Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX	
Email 1 or Fax	
Email 2	

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R]	☐ Standard TAT if received by 3 pm - business days - no surcharges apply
PRIORITY (Business Days): 4 day [P4] ☐	EMERGENCY: 1 Business day [E1] ☐
3 day [P3] ☐	Same Day, Weekend or Statutory holiday [E0] ☐
2 day [P2] ☐	
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:	
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only): L1916350

ALS Contact:

Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	HG-200.2-CVAA-WT	Number of Containers
	BOULEVARD LAKE 1-1 TOP	24-04-17	11:31	SEDIMENT	✓	
	" " 1-2 BOTTOM	24-04-17	11:31	"	✓	
	" " 2-1 TOP	24-04-17	11:44	"	✓	
	" " 2-2 BOTTOM	24-04-17	11:44	"	✓	

Drinking Water (DW) Samples [1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐	SIF Observations Yes ☐ No ☑
Ice Packs ☑ Ice Cubes ☐	Custody seal intact Yes ☐ No ☐
Cooling Initiated ☑	
INITIAL COOLER TEMPERATURES °C: 10.5	FINAL COOLER TEMPERATURES °C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by: MM	Date: 24Apr17	Time: 1249	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System please submit using an Authorized DW COC form

JRR

APPENDIX B

Benthic Invertebrate Sampling Site Data, Boulevard Lake. August 2016

Appendix B. Benthic invertebrate sampling site data, Boulevard Lake. August 2016.

Site	Depth (m)	Dissolved Oxygen (surface) (mg/L)	Water Temp (surface) (C)	Easting	Northing	Substrate Type	Sample Volume (ml)
1	0.8	6.98	20.2	337316	5370190	Gravel/Sand	650
2	0.6	7.7	20	337486	5370186	Sand	750
3	2.0	8.65	17.1	337668	5370184	Sand	700
4	0.95	6.81	20.8	337263	5370018	Organic	250
5	1.5	7.57	18.6	337479	5370010	Organic	100
6	1.1	7.35	19.7	337695	5370003	Organic	500
7	2	6.81	20.5	337345	5369863	Sand/Organic	250
8	1.5	7.44	19.4	337500	5369864	Organic	200
9	1.5	7.84	19.8	337690	5369859	Organic	250
10	2	7.44	20.5	337410	5369585	Gravel/Sand	400
11	2	7.69	20.4	337471	5369587	Organic	200
12	1.5	7.66	20.7	337527	5369588	Organic	200
13	0.5	7.44	21.2	337587	5369345	Sand/Gravel	200
14	2.5	7.19	20.5	337639	5369359	Organic/Sand	50
15	0.5	7.24	21	337694	5369384	Gravel	300
16	3	7.42	20.4	337895	5369289	Organic/Sand	250
17	1	7.55	21.1	337876	5369352	Organic	200
18	1	8.62	20.9	337839	5369450	Organic	250
19	2	7.38	20.6	338123	5369328	Organic	200
20	3.5	5.25	20.1	338136	5369369	Organic	100
21	0.3	7.54	21.2	338155	5369411	Organic	100

APPENDIX C

Results of Taxonomic Classification of Benthic invertebrates, Boulevard Lake. August 2016

Appendix C. Results of Taxonomic Classification of Benthic invertebrates, Boulevard Lake. August 2016.

		Boulevard Lake																					
Order	Family	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Site 21	total
NEMATODA				2							8											1	11
Gastropoda	Planorbidae	1			1																		2
Bivalvia	Sphaeriidae					3			1		1				1			1			1	1	9
ANNELIDA	Oligochaeta	1	5	6	1	9	1	5	5	1	3	9				1	3	3		1	7	8	69
Megaloptera	Sialidae										1												1
Ostracoda		8	9	2	9	2	7	6	4	4	1	3	6			1	2	5	6	2	8	1	86
Amphipoda	Hyalellidae															3			1				4
Isopoda	Asellidae		1	1	7	3	18		1	2		2	1			1			2	1			40
Conchostraca		1		2														1			1		5
ARACHNIDA	Immature / Damaged											1											1
Ephemeroptera	Immature / Damaged						1				1			1		1							4
Ephemeroptera	Ephemeridae	1	2			3				1	1	1	1		1	6					1		18
Hemiptera	Corixidae			1			1																2
Coleoptera	Elmidae			3		2						1								1			7
Trichoptera	Immature / Damaged	1						1	1		1			1			1		2				8
Trichoptera	pupa																		1				1
Trichoptera	Philopotamidae		1																				1
Trichoptera	Dipseudopsidae	1	1	1	1		1	3	1	2	2		9				1			1			24
Trichoptera	Leptoceridae			1	2			2		1						1				1		1	9
Diptera	Pupa				3	1	1	1		1		1											8
Diptera	Ceratopogonidae			1	1			1			1	1				1	1						7
Diptera	Chironomidae	76	51	46	56	14	16	30	28	28	79	13	14	51	3	35	15	15	37	1	5	18	631
Total	**Total Individuals**	**90**	**70**	**66**	**81**	**37**	**46**	**49**	**41**	**40**	**99**	**32**	**31**	**53**	**5**	**50**	**23**	**25**	**49**	**8**	**23**	**30**	**948**
	Total Species	**8**	**7**	**11**	**9**	**8**	**8**	**8**	**7**	**8**	**11**	**9**	**5**	**3**	**3**	**9**	**6**	**5**	**6**	**7**	**6**	**6**	

APPENDIX D

Park User Questionnaire and Results

Boulevard Lake Dam and Park
User Survey

The City of Thunder Bay would like to hear from you! We have previously conducted a survey in preparation of the Boulevard Lake Area Improvement Plan. This current survey is being conducted in preparation of the Boulevard Lake Dam rehabilitation project.

Please take a few minutes to complete the following questionnaire regarding how you use and enjoy the Boulevard Lake Dam and Park. Your input will help us understand the effect of the dam rehabilitation on park use and activities.

1. Describe your use of Boulevard Lake Park (Check all that apply)

I am a nearby resident	☐	I walk to the Park frequently	☐	I drive to the Park frequently	☐
I seldom come to the Park	☐	I am a member of a club or organization that uses the Park (Describe below):	☐		

____

____

2. How often, on average, do you use the Boulevard Lake Park? (Check one response)

Daily	☐	Between 3 and 5 times a week	☐	1 to 2 times per week	☐
Once per week	☐	2-4 times per month	☐	A couple times per month	☐
Once a month	☐	A few times a year	☐	First time	☐

I have never used the park ☐

3. What is your primary activity at the Boulevard Lake Park? (Check all that apply)

Walk or hike	☐	Running	☐	Jogging	☐	Unstructured activity	☐
Organized activity	☐	Passing through	☐	Cycling	☐	Picnicking	☐
Community Event	☐	Special event	☐	Walking the dog	☐	Playground	☐
Disc Golfing	☐	Mini Putting	☐	Dragon Boating	☐	Canoeing	☐
Kayaking	☐	Pedal Boating	☐	Swimming	☐	Meeting Friends	☐
Volunteer	☐	Sporting Event	☐	Fishing	☐	Tennis	☐
Snow Shoeing	☐	Cross Country Skiing	☐	Tobogganing/Sledding	☐	In-line Skating	☐

Other ______________________ ☐

4. Generally, when do you visit Boulevard Lake Park? (Check appropriate response)

   Weekdays ☐ Weekends ☐ Both ☐

5. What time of day do you most often visit Boulevard Lake Park? (Check appropriate response)

   Morning ☐ Afternoon ☐ Evening ☐

6. How much time do you generally spend at Boulevard Lake Park each visit? (Check one response)

   Less than 30 min ☐ 30 minutes to 1 hour ☐ 1 to 2 hours ☐

   2 to 4 hours ☐ More than 4 hours ☐

7. In order of least frequent to most frequent, with 1 being the least and 4 being the most, during which seasons of the year do you use the park? (check appropriate response)

   Spring ☐ Summer ☐ Fall ☐ Winter ☐

8. Please check the option below that best represents your opinion. "I enjoy my visits to Boulevard Lake Park". (Check one response)

   Strongly Agree ☐ Agree ☐ Neutral ☐

   Disagree ☐ Strongly Disagree ☐

9. On a scale of 1 to 4, with 1 being least important and 4 being most important, how would you rate the importance of Boulevard Lake Dam as a feature of the park? (Check one response)

   1 ☐ 2 ☐ 3 ☐ 4 ☐

10. In your opinion, how would you rate the current pedestrian crossing at the top of Boulevard Lake Dam? Please check the most suitable rating.

    Very Good ☐ Good ☐ Fair ☐ Poor ☐ Very Poor ☐

11. In your opinion, what are the best features of the Boulevard Lake Park? (Check all that apply).

Trees	☐	Naturalized Areas	☐	Walking Path	☐	Trails	☐
Bicycle Paths	☐	Play Structures	☐	Flower Beds	☐	Rapids Sightseeing	☐
Picnic Areas	☐	Sports Fields	☐	Mini Putt	☐	Disc Golf Course	☐
Tennis Courts	☐	Beach Area	☐	Boulevard Lake	☐	Other___________	☐

12. In your opinion, the maintenance of the park is: (Check one)

Excellent ☐ Good ☐ Fair ☐ Poor ☐

13. What are the most important improvements to the Dam that should be considered? (Check your response)

Provision of wider trail	☐	Provision of handrails	☐	Widening of pinch point at power station	☐	Improvement of opportunities for viewing fish ladder and rapids	☐
Public safety	☐	Lighting	☐	Other ____________	☐		

14. Are you interested in learning more about the Boulevard Lake Dam rehabilitation project?

Yes ☐ No ☐ (Check one response)

15. What is your postal code? ____________

16. What is your gender? (Check your response) Male ☐ Female ☐

17. What age group do you fall within? (Check your response)

15 to 25	26 to-35	36 to 45	46 to 55	56 to 65	66 or older
☐	☐	☐	☐	☐	☐

18. Do you visit the park with children under the age of 15? (Check your response)

Yes ☐ No ☐

19. What is your opinion regarding the water quality in Boulevard Lake?

20. In your opinion, what aspects or features of the Boulevard Lake Park require improvements?

<u>Summary of survey results</u>

A total of 235 respondents answered the survey (summer of 2016). All of the survey questions (except for the qualitative questions 19 and 20 as well as question 15 pertaining to postal code) are listed below followed by a summary of key results.

Q1: Describe your use of Boulevard Lake Park.

- Close to 40% of the respondents indicated that they were a nearby resident
- Over 30% indicated that they walk to the Park frequently
- Over 64% indicated that they drive to the Park frequently
- Over 11% indicated that they seldom go to the park

Q2: How often, on average, do you use the Boulevard Lake Park?

- Over 7% use the Park on a daily basis
- Over 19% use the Park between 3 and 5 times a week
- Over 21% use the Park 1 to 2 times per week
- Over 15% use the Park 2-4 times per month

Q3: What is your primary activity at the Boulevard Lake Park?

This question allowed the respondents to choose as many options as they desired.

- 75% of the respondents indicated that they had more than two primary activities. On average, respondents indicated that they had more than four primary activities in the Park. About 25% of the respondents had five or more primary activities.
- Close to 80% of the respondents indicated walking as one of primary activities.
- Some of the other choices for activities include:
    - Running: 27%
    - Cycling: 30%
    - Walking the dog: 29%
    - Jogging: 23%
    - Use of playground: 21%
    - Meeting friends: 20%
    - Golfing: 17%
- Less than 10% of respondents indicated the following to be their primary activity at the Park: Mini Putting, Dragon Boating, Canoeing, Pedal Boating, Volunteering, Sporting Event, Fishing, Tennis, Snow Shoeing, Cross Country Skiing, Tobogganing/Sledding and In-line Skating

Q4: Generally, when do you visit Boulevard Lake Park??

- Just over 13% indicated that they visit the park in the weekdays
- About 12% indicated that they visit the park in the weekend
- Close to 74% indicated that they visit the park during both weekdays and the weekend

Q5: What time of day do you most often visit Boulevard Lake Park?

A majority of respondents visit the park either in the afternoon or in the evening or appear to visit the park both during the afternoon and the evening.

- Over 28% indicated that they visit the park only in the evening
- 25% indicated that they visit the park only in the afternoon
- 18% indicated that they visit the park both in the afternoon and evening

Q6: How much time do you generally spend at Boulevard Lake Park each visit?

- Over 54% spend between 1 to 2 hours
- Just over 30% spend between 30 minutes to 1 hour

Q7: In order of least frequent to most frequent, with 1 being the least and 4 being the most, during which seasons of the year do you use the park?

- Over 61% indicated that summer was the most frequent season of the year that they use the park
- Over 10% indicated that spring was the most frequent season
- Only 13% indicated that fall was their most frequent season of the year that they use the park
- Over 66% indicated that winter was their least frequent season of the year that they use the park

Q8: Please check the option below that best represents your opinion. "I enjoy my visits to Boulevard Lake Park".

- 61% indicated that they strongly agree with this statement.
- 30% indicated that they agree with this statement.
- Over 7% indicated that they were neutral with this statement.
- Less than 1% indicated that they disagreed with this statement.

Q9: On a scale of 1 to 4, with 1 being least important and 4 being most important, how would you rate the importance of Boulevard Lake Dam as a feature of the park?

- Over 75% considered Boulevard Lake Dam as an important feature of the park (response on the scale being either 3 or 4)
- 16% marked this as a 2 on the scale
- Over 7% considered Boulevard Lake Dam as the least important feature of the park (response on the scale being 1)

Q10: In your opinion, how would you rate the current pedestrian crossing at the top of Boulevard Lake Dam? Please check the most suitable rating.

- 38% rated the current pedestrian crossing as being in 'fair' condition
- About 24% rated the current pedestrian crossing as being in 'poor' condition
- Only 4% felt this was in 'very good' condition
- Over 20% felt this was in 'good' condition

Q11: In your opinion, what are the best features of the Boulevard Lake Park?

This question allowed the respondents to choose as many options as they desired.

- Walking Path: 80%
- Trees: 68%
- Boulevard Lake: 69%
- Trails: 58%
- Naturalized Areas: 50%
- Bicycle Paths: 49%
- Rapids Sightseeing: 35%
- Picnic Areas: 30%
- Play Structures: 25%
- Beach Area: 29%
- Disc Golf Course: 23%
- Flower Beds: 14%
- Mini Putt: 10%
- Tennis Courts: 9%
- Sports Fields: 8%

Q12: In your opinion, the maintenance of the park is: (Check one)

On a scale of 1 to 4 where 1 = Excellent, 2 = Good, 3 = Fair, 4= Poor, the average score was 2.11, which indicates average response that the maintenance of the park is good.

Q13: What are the most important improvements to the Dam that should be considered?

This question allowed the respondents to choose as many options as they desired.

- Provision of wider trail: 64%
- Widening of pinch point at power station: 40%
- Public safety: 41%
- Lighting: 38%
- Improvement of opportunities for viewing fish ladder and rapids: 25.7%
- Provision of handrails: Close to 21%

Q14: Are you interested in learning more about the Boulevard Lake Dam rehabilitation project?

- Close to 55% indicated that they were interested in learning more about the Boulevard Lake Dam rehabilitation project
- 42.5% indicated that they were not interested

Q16: What is your gender?

- Close to 62% of the respondents were female
- About 36% were male

Q17: What age group do you fall within?

- 15 to 25: 12.7%
- 26 to-35: 26.7%

- 36 to 45: 30%
- 46 to 55: 14.4%
- 56 to 65: 12.3%
- 66 or older: 3.4%

Q18: Do you visit the park with children under the age of 15?

- Just over 47% indicated that they visit the park with children under the age of 15
- 50% indicated that they do not visit the park with children under the age of 15

Additional interpretations (combination of responses from two questions)

Enjoyment of visits to Boulevard Lake Park. Please check the option below that best represents your opinion. "I enjoy my visits to Boulevard Lake Park".

- Age group 15 to 25: 51% strongly agree
- 26 to-35: 63% strongly agree; 32% agree
- 36 to 45: 58% strongly agree
- 46 to 55: 62% strongly agree
- 56 to 65: 69% strongly agree
- 66 or older: 60% strongly agree

Length of stay at the park by age group

- Age group 15 to 25: Close to 49% spend 30 minutes to 1 hour; 35% spend 1 to 2 hours
- 26 to-35: 64% spend 1 to 2 hours
- 36 to 45: Close to 58% spend 1 to 2 hours
- 46 to 55: 52% spend 1 to 2 hours
- 56 to 65: 50% spend 1 to 2 hours; close to 42% spend 30 minutes to 1 hour
- 66 or older: 40% spend 1 to 2 hours; 40% spend 30 minutes to 1 hour

Frequency of use by age group

- Age group 15 to 25: Close to 30% use it A few times a year; close to 11% use it Between 3 and 5 times a week and 24% use it 2-4 times per month
- 26 to-35: 23% use it Between 3 and 5 times a week and 20% use it 1 to 2 times per week
- 36 to 45: 27% use it 1 to 2 times per week
- 46 to 55: 26% use it Between 3 and 5 times a week; close to 24% use it 1 to 2 times per week
- 56 to 65: 19% use it daily, close to 17% use it Between 3 and 5 times a week, close to 17% use it A few times a year
- 66 or older: 20% use it Between 3 and 5 times a week, 30% use it 1 to 2 times per week, 20% use it 2-4 times per month

Level of enjoyment of the park based on whether respondents have kids

- For those respondents that visit the park with children under the age of 15
  - Close to 64% strongly agree with the statement "I enjoy my visits to Boulevard Lake Park".

    - Close to 32% agree with the statement “I enjoy my visits to Boulevard Lake Park”.
- For those respondents that do not visit the park with children under the age of 15
    - 57.5% strongly agree with the statement “I enjoy my visits to Boulevard Lake Park”.
    - 29% agree with the statement “I enjoy my visits to Boulevard Lake Park”.

Length of stay at the park based on whether respondents have kids

- For those respondents that visit the park with children under the age of 15
    - 54% spend 1 to 2 hours
    - 25% spend 30 minutes to 1 hour
- For those respondents that do not visit the park with children under the age of 15
    - 53% spend 1 to 2 hours
    - 35% spend 30 minutes to 1 hour

Frequency of use based on whether respondents have kids

- For those respondents that visit the park with children under the age of 15
    - 27.5% use the park 1 to 2 times per week
    - 19.5% use the park Between 3 and 5 times a week
- For those respondents that do not visit the park with children under the age of 15
    - 20.5% use the park Between 3 and 5 times a week

APPENDIX E

Notices / Newspaper Advertisements

Executive axed over Ghomeshi scandal sues for 'political' firing

BY COLIN PERKEL
THE CANADIAN PRESS

TORONTO — A former top CBC executive who became a casualty of the Jian Ghomeshi scandal is suing the broadcaster for wrongful dismissal, saying he was scapegoated for political reasons.

In a statement of claim rejected by the CBC, Todd Spencer says he was shocked when he was fired in April 2015.

"The CBC terminated Spencer's employment for cause for political reasons, and has publicly used Spencer as a scapegoat for the Ghomeshi affair," his unproven claim states.

Jian Ghomeshi

"CBC fired him to send a message to the Canadian public that the CBC takes matters of workplace harassment seriously." According to his claim, the CBC told the human resources executive director that he had failed or refused to investigate allegations, and lied or withheld information from management.

"Spencer assumed the majority of these false allegations were about the Ghomeshi affair, but given the vague and generic nature of the allegations, (he) does not know what the allegations refer to," he says.

Things began to unravel for the successful executive in May 2014 when a freelance journalist complained about Ghomeshi's "sexual preferences and treatment of women." At the time, Ghomeshi was the star host of the radio show Q.

Spencer, 45, of Toronto, says Chris Boyce, then head of radio who was also fired, told him about the complaint and he began to investigate informally.

He says he told a higher up that Heather Conway, executive vice-president of English services, was "leading the decision making" on the Ghomeshi file. He also claims top CBC management, including president Hubert Lacroix, were "deeply involved with and aware of" how he was handling the situation.

The CBC fired Ghomeshi in October 2014 after seeing what it called "graphic evidence" that he had injured a woman. The popular host had said publicly he enjoyed "rough sex" but that it was always consensual. Amid mounting criticism of how it had handled the scandal, CBC retained lawyer Janice Rubin to look into the situation in November 2014. In January 2015, it announced it was putting Spencer on paid leave during her investigation.

Spencer says Roula Zaarour, another vice-president, told him he needed a break, while Conway said the forced leave was because of "inconsistencies" in what he had told them during his probe of the Ghomeshi allegations. He felt "abandoned," he says in the claim.

Rubin's report in April 2015 criticized the broadcaster for its internal failings in dealing with the scandal. CBC fired him two days later.

In its statement of defence filed this month, CBC faults Spencer's investigation. "Spencer determined that there had not been any inappropriate conduct in the CBC workplace by Ghomeshi," the defence statement says.

THE CANADIAN PRESS

An officer loads up the trunk of a police cruiser with confiscated marijuana and other products in front of the Cannawide marijuana dispensary during a raid by Toronto Police as part of Operation Claudia in Toronto.

Health concerns behind pot raid

THE CANADIAN PRESS

TORONTO — "Genuine" health concerns and "significant" community complaints prompted a string of police raids on unregulated marijuana dispensaries across Toronto, the city's police chief said Friday as angry pot-smoking activists protested outside his office.

Police Chief Mark Saunders emphasized that the operation – dubbed Project Claudia – would not prevent anyone with a prescription for medical marijuana from accessing the drug.

"I want to be very clear about our intentions," Saunders told a news conference that drew a mix of journalists and marijuana activists.

"Project Claudia is not an attack on the lawful production, distribution or purchasing of marijuana for medical purposes," Saunders said. "It's a genuine heath concern because there is no regulatory process behind this."

The operation angered some Torontonians, who took to social media to denounce it as a waste of police time and resources.

Others also questioned the timing of the move just months after the federal government announced it will introduce legislation to legalize and regulate marijuana next spring. But Saunders fended off the criticism even as his news conference was frequently interrupted by the angry protesters.

Since March, he said, the number of marijuana dispensaries has doubled in the city – with half of the facilities investigated by police located within 300 metres of schools.

After consulting municipal officials and the Public Prosecution Service of Canada, Saunders said he had to make the "hard decision" to clamp down on the proliferation of pot shops.

"Once I had a full understanding of what the health concerns were, that was when I decided to take the action," he said. "This is about public safety."

Search warrants were carried out on 43 locations by police who were accompanied by city municipal licensing and standards officials, Saunders said.

The action resulted in 90 people being arrested and a slew of charges laid — 71 criminal charges and 186 under the Controlled Drugs and Substances Act.

About 270 kilograms of dried cannabis as well as hundreds of kilograms of pot-laced food products such as chocolate, brownies and candies were seized during the raid.

Mystery remains after arrest in killing of Toronto-born Florida professor

BY GARY FINEOUT AND JOE REEDY
THE ASSOCIATED PRESS

TALLAHASSEE, Fla. — Relatives of a Canadian law professor who was gunned down two years ago in Florida say they are grateful for the investigation that led to an arrest this week, though "it does not diminish their immense pain."

Daniel Markel's parents and sister, who all live in Canada, issued a statement after police in Tallahassee announced that a South Florida man had been arrested in connection with the July 2014 killing.

Daniel Markel

The family said it would not comment further at this time. Ruth Markel, the mother of Daniel Markel, declined to answer questions when reached by phone at her home in Toronto.

Daniel Markel, who was teaching at the Florida State University, was shot dead in the garage of his Tallahassee home. Police have said he was the shooter's intended target.

But the arrest of 34-year-old Sigfredo Garcia hasn't answered a long line of questions about why Markel was killed.

Garcia, charged with cocaine possession and murder, appeared briefly in a Broward County court on Thursday where a judge ordered that he remain in jail.

Top police officials in Tallahassee are releasing scant details about how they linked Garcia, who lists a Miami Beach address, to the slaying or whether others are involved. They also got a judge to seal records related to the case.

Hallandale Beach police arrested Garcia at a gas station late Wednesday night.

Tallahassee Police Chief Micheal DeLeo said the case was still active and that they made the request to keep the records private "in order not to jeopardize this ongoing investigation." DeLeo and other Tallahassee police officials refused to answer any questions about whether other arrests are coming or what led them to Garcia.

"The intimate details of this case cannot be discussed as it was sealed by a judge," David Northway, the force's spokesman, said. "Once the case is unsealed, we will release all the documents, per state law."

Markel's shooting in the middle of the day stunned colleagues as well as residents inside the upscale neighbourhood where he lived in Tallahassee. He was shot in the head and died later at a nearby hospital.

The 41-year-old Markel was well known in national and international legal circles. The father of two boys and a 2001 graduate of Harvard Law School, he practised white-collar criminal defence and civil litigation before joining the Florida State law school faculty in 2005. He was tenured in 2010.

Markel finalized a contentious divorce from his ex-wife, Wendi Adelson, in 2013. The two had split custody of sons Benjamin and Lincoln, but they had follow-up litigation over money settlements. Adelson, who is also a lawyer, had worked at FSU but moved to Miami Beach about a year and a half ago.

Police initially had few leads in the case and eventually circulated pictures of the car believed to have been used by those involved in the killing.

When he appeared in court, Garcia declined a public defender. He told Judge Mary Rudd Robinson he has a lawyer, but just met him Wednesday and couldn't remember the name.

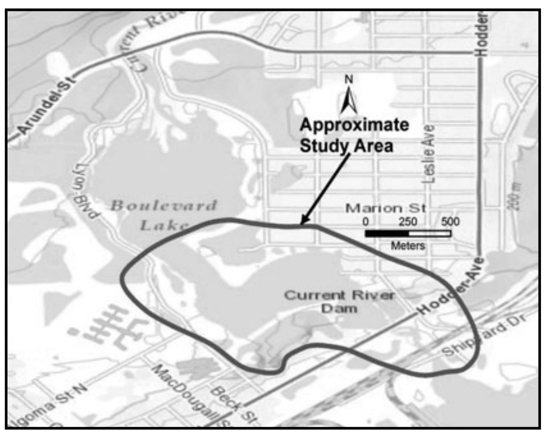
PUBLIC NOTICE

NOTICE OF COMMENCEMENT and PUBLIC INFORMATION SESSION #1

City of Thunder Bay Schedule C Class Environmental Assessment Boulevard Lake Dam

THE STUDY

The Boulevard Lake Dam fulfills many purposes including managing flows in the Current River, small hydro generation and creating Boulevard Lake, which is used by residents for recreation. Recent studies have indicated that the dam may require rehabilitation to repair deteriorated concrete and to ensure that the dam can withstand floodwaters associated with severe storms (the regulatory storm). The City of Thunder Bay is initiating a Schedule C Class Environmental Assessment (EA) to study if and how the Boulevard Lake Dam should be rehabilitated and the potential environmental and social effects of those activities (see map for study area).



THE PROCESS

This study is being undertaken in accordance with the planning process defined in the Municipal Class Environmental Assessment (October 2000, amended in 2007 and 2011). This project is being planned as a Schedule C project. As such, the City is required to identify the problem; identify and assess alternative solutions and recommend a preferred solution; identify and evaluate alternative design concepts and recommend a preferred concept; and complete a detailed assessment of the recommended solution. Public input will be sought during many of these steps.

PUBLIC INFORMATION SESSION

Public consultation is a key element of the Class EA process, and public input will be sought throughout this study. The first Public Information Session will present project planning information to the public, and seek input and comment from interested members of the public:

Time: 4:00 pm to 8:30 pm with presentation at 6:30 pm

Date: Tuesday June 14, 2016
Location: Current River Community Centre
450 Dewe Avenue, PO Box #22010
Thunder Bay, ON P7A 8A8

Following the Public Information Session, further comments are invited for incorporation into the planning and design of this project, and will be received until July 8, 2016. For further information, please contact Mike Vogrig, Project Engineer, City of Thunder Bay, at the address listed below.

The City would appreciate hearing any comments you may have regarding the project. To provide your comments or to request additional information concerning the project, please contact:

Mike Vogrig, Project Engineer
City of Thunder Bay
111 Syndicate Ave S., P.O. Box 800
Thunder Bay, Ontario, P7C 5K4
Tel: 807-625-4321, Fax: 807-625-3588
E-mail: mvogrig@thunderbay.ca

This Notice issued 28 May, 2016.

CITY OF Thunder Bay
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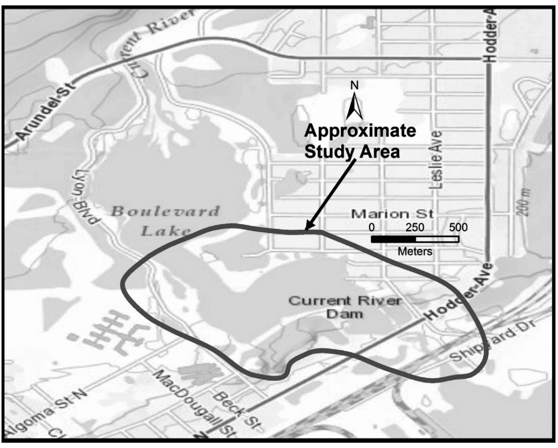
www.thunderbay.ca

PUBLIC NOTICE

NOTICE OF PUBLIC INFORMATION CENTRE #2
City of Thunder Bay
Schedule C
Class Environmental Assessment
Boulevard Lake Dam

THE STUDY

Recent studies have indicated that the Boulevard Lake Dam requires rehabilitation to repair deteriorated concrete and to ensure that the dam can withstand floodwaters associated with the regulatory storm. The City of Thunder Bay has initiated a **Schedule C Class Environmental Assessment (EA)** to study how the Boulevard Lake Dam should be rehabilitated and the potential environmental and social effects of those activities (see map for study area). This study is being undertaken in accordance with the planning process defined in the Municipal Class Environmental Assessment (October 2000, amended in 2007 and 2011). This Project is being planned as a **Schedule C** project.



THE CITY OF THUNDER BAY INVITES YOU TO OUR SECOND PUBLIC INFORMATION CENTRE

Public and review agency consultation is a key element of the Class EA process, and public input will be sought throughout this study. We will be holding a second Public Information Centre (PIC) to provide the results of the evaluation of alternatives and the detailed assessment of the preferred alternative to the public, and seek input and comment from interested members of the public:

Time: 4:00 pm to 8:30 pm
Date: Thursday September 7, 2017
Location: Current River Community Centre
450 Dewe Avenue, PO Box #22010
Thunder Bay, ON P7A 8A8

Following the Public Information Centre, further comments are invited, for incorporation into the planning and design of this project, and will be received until September 29, 2017.

The City anticipates submission of the Draft Environmental Study Report(ESR) for review later this fall. It will be available for a 30-day review period and then the ESR will be finalized for formal review and approval.

The City would appreciate hearing any comments you may have regarding the project. To provide your comments or to request additional information concerning the project, please contact:

Mike Vogrig, Project Engineer
City of Thunder Bay
111 Syndicate Ave S.
Thunder Bay, Ontario
P7E 6S4
Tel: 807-625-4321
Fax: 807-625-3588
E-mail: mvogrig@thunderbay.ca

This Notice issued 24 August, 2017.

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thunderbay.ca

APPENDIX F

Stakeholder Contact List and

Notification Letters

Stakeholder Contact List

Government Level	Agency	Contact Information
Federal	Fisheries & Oceans Canada	Fisheries Protection Program 867 Lakeshore Road Burlington, ON L7S 1A! Phone: 1-855-852-8320 Fax: (905) 336-4447 Email: fisheriesprotection@dfo-mpo.gc.ca
	Aboriginal Affairs and Northern Development Canada	Aboriginal Affairs and Northern Development Canada 8th Floor 25 St. Clair Avenue East Toronto, OntarioM4T 1M2 Phone: (416) 973-6234 Fax: (416) 954-6329
Provincial	Lakehead Region Conservation Authority	Mervi Henttonen General Manager/Secretary-Treasurer Tammy Cook, Watershed Manager Lakehead Region Conservation Authority 130 Conservation Road PO Box 10427 Thunder Bay, ON P7B 6T8 Phone: (807) 344-5857 Fax: (807) 345-9156 Email: info@lakeheadca.com
	Ministry of Aboriginal Affairs	Ministry of Aboriginal Affairs Environmental Assessment Consultation 4th Floor, 160 Bloor Street East Toronto ON M7A 2E6 Phone: 1-866-686-6072 Fax: 416-326-4017 Email: maa.ea.review@ontario.ca
	Ministry of Agriculture Food and Rural Affairs	John O'Neill Rural Planner Ministry of Agriculture, Food and Rural Affairs 59 Ministry Rd. Box 2004 Kemptville, ON K0G 1J0 Phone: (613) 258-8341 Fax: (613) 258-8392 Email: John.o'neill@ontario.ca

Government Level	Agency	Contact Information
Provincial, cont.	Ministry of Tourism Culture and Sport	Ministry of Tourism, Culture and Sport Rosi Zirger Heritage Planner Culture Services Unit Programs and Services Branch 401 Bay Street, Suite 1700 Toronto, ON M7A 0A7 Tel: (416)314-7159 Email: rosi.zirger@ontario.ca
	Infrastructure Ontario	Yolanda Zhang Environmental Associate Infrastructure Ontario 1 Dundas St. West, Suite 2000 Toronto, Ontario M5G 2L5 Phone: (416)-327-6921 Email: Yolanda.Zhang@infrastructureontario.ca
	Ministry of Environment and Climate Change	Derek Moggy Phone: 705-564-3254 Fax: 705-564-4180 Email: derrick.moggy@ontario.ca Michelle Heyens, Senior Environmental Officer Thunder Bay/Kenora District Office, Northern Region 3rd Floor Suite 331B 435 James St S Thunder Bay, ON, P7E6S7 Phone: [807-475-1733 Email: michelle.heyens@ontario.ca Antonia Testa Special Project Officer Project Coordination - Team 2 1st Floor, 135 St Clair Ave W Toronto ON, M4V1P5 Phone: 416-325-5500 Email: Antonia.testa@ontario.ca
	Ministry of Municipal Affairs and Housing	Shannon Dodd Smith, Manager Community Planning and Development Ontario Ministry of Municipal Affairs Northern Municipal Services Office Suite 223, 435 James Street South Thunder Bay ON P7E 6S7 Phone: 807-475-1651 or 1-800-465-5027 Fax: 807-475-1196 Email: mininfo.mah@ontario.ca

Government Level	Agency	Contact Information
Provincial, cont.	Ministry of Natural Resources and Forestry	Heather Nelson District Planner Ministry of Natural Resources and Forestry Thunder Bay District Office 435 James St. S. ,Suite B001, Thunder Bay, ON, P7E 6S7 Phone (807) 475-1457 Email: heather.nelson@ontario.ca Laura Darby Management Biologist Ministry of Natural Resources and Forestry Thunder Bay District Office 435 James St. S. ,Suite B001, Thunder Bay, ON, P7E 6S7 Email: laura.darby@ontario.ca
	Ministry of Northern Development and Mines	159 Cedar Street Sudbury, ON P3E 6A5 General Inquiry - 705-670-5755 Toll Free - 1-888-415-9845 Media Contact - 416-314-6275 ndmminister@ontario.ca
	Thunder Bay District Health Unit	Lee Sieswerda Environmental Health Manager Thunder Bay District Health Unit 999 Balmoral St. Thunder Bay ON P7B 6E7 Phone: (807) 625-5900 Fax: (807) 623-2369 Email: lee.seiswerda@tbdhu.com
Municipal	City Council and Mayor	Attn: Brenda Hamalainen Executive Assistant to the Mayor 500 Donald Street East Thunder Bay, ON P7E 5V3 Phone: (807) 625-3601 Fax: (807) 623-1164 Email: bhamalainen@thunderbay.ca

Government Level	Agency	Contact Information
Municipal, cont.	Parks Manager (Acting)	Gordon John 111 S Syndicate Ave Thunder Bay, ON P7E 6S4 Phone: (807) 474-4853 Fax: (807) 473-9460 Email: GJohn@thunderbay.ca
	Director, Engineering	Kayla Dixon 111 S Syndicate Ave Thunder Bay, ON P7E 6S4 Phone: (807) 625-3022 Fax: (807) 625-3588 Email: kdixon@thunderbay.ca
	Director, Environmental Division	Michelle Warywoda 111 S Syndicate Ave Thunder Bay, ON P7E 6S4 Phone: (807) 625-2836 Fax: (807) 625-3588 Email: MWarywoda@thunderbay.ca
	General Manager, Infrastructure and Operations	Kerri Marshall 111 S Syndicate Ave Thunder Bay, ON P7E 6S4 Phone: (807) 625-3077 Fax: (807) 625-3588 Email: kmarshall@thunderbay.ca

Stakeholder Type	Stakeholder Name	Contact Information
Private / Other	Current River Hydro Partnership	203 County Blvd. Thunder Bay, ON P7A 7P3 General Email Inquiries: customer.relations@ieso.ca
	Northshore Steelhead Association	PO Box 10237 Thunder Bay, Ontario P7E 6T7 Phone: (807) 475-7712 Fax: (807) 475-7712 northshoresteelhead@gmail.com

Stakeholder Type	Stakeholder Name	Contact Information
Indigenous	Chief Peter Collins	Fort William First Nation 90 Anemki Drive, Suite 200 Fort William First Nation, ON P7J1L3 P: (807) 623 9543 F: (807) 623 5190 Toll Free: 1 (866) 892 8687 ijb@fwfn.com
	Metis Nation of Ontario	Jacqueline Barry c/o Thunder Bay Métis Council Métis Nation of Ontario 226 May Street South Thunder Bay, ON P7E 1B4 JacquelineB@metisnation.org
	Red Sky Metis Independent Nation	Dean Whellan 406 East Victoria Avenue Thunder Bay, Ontario P7C 1A5 807-623-4635 consultation@rsmin.ca

CITY OF Thunder Bay
Superior by Nature

INFRASTRUCTURE &
OPERATIONS DEPARTMENT

Victoriaville Civic Centre
111 Syndicate Avenue South, 2nd Floor
P.O. Box 800
Thunder Bay, ON P7C 5K4

Tel: (807) 625-2266
Fax (807) 625-3588

June 1st, 2016

Subject: Notice of Commencement of Schedule C Class EA for the Rehabilitation of Boulevard Lake Dam, City of Thunder Bay

Dear Sir/Madam:

This letter is to inform you that the City of Thunder Bay has initiated a Class Environmental Assessment (EA) Study for the rehabilitation of the Boulevard Lake Dam. A Notice of Commencement/invitation to a public information session was published in the Chronicle Journal on May 28. A Study Area Map is included as Figure 1. The proposed undertaking is designated as a Schedule C, and follows the Municipal Engineers Association's (MEA) Municipal Class Environmental Assessment (as amended in 2007 and 2011). This EA is subsequent to the previous EA the City undertook but did not complete.

The Boulevard Lake Dam fulfills many purposes including managing flows in the Current River, small hydro generation and creating Boulevard Lake, which is used by residents for recreation. Recent studies have indicated that the dam may require rehabilitation to repair deteriorated concrete and to ensure that the dam can withstand floodwaters associated with the regulatory storm. A wide ranging stakeholder consultation program has been initiated including Aboriginal groups, the general public, regulatory agencies, etc.

In order to present a comprehensive description of the environmental components likely to be affected by the works and activities associated with the dam rehabilitation project the following field studies will be undertaken: fish occupancy survey; lake bathymetry study; water quality; hydrology; soils and erosion Study; odour study; vegetation and flora study; review/listing of built heritage resources or landscapes; archaeological; and survey of dam use.

The City would appreciate hearing any comments you may have regarding the project. In addition, we would like to seek your advice on how you would like to be consulted to fully meet your needs. To provide your comments, to request additional information concerning the project or to discuss the process of consultation, please contact the following member of the project team:

Mike Vogrig, Project Engineer,
City of Thunder Bay
111 Syndicate Ave S, Thunder Bay, Ontario, P7E 6S4
Tel: 807-625-4321 ~ Fax: 807-625-3588
E-mail: mvogrig@thunderbay.ca

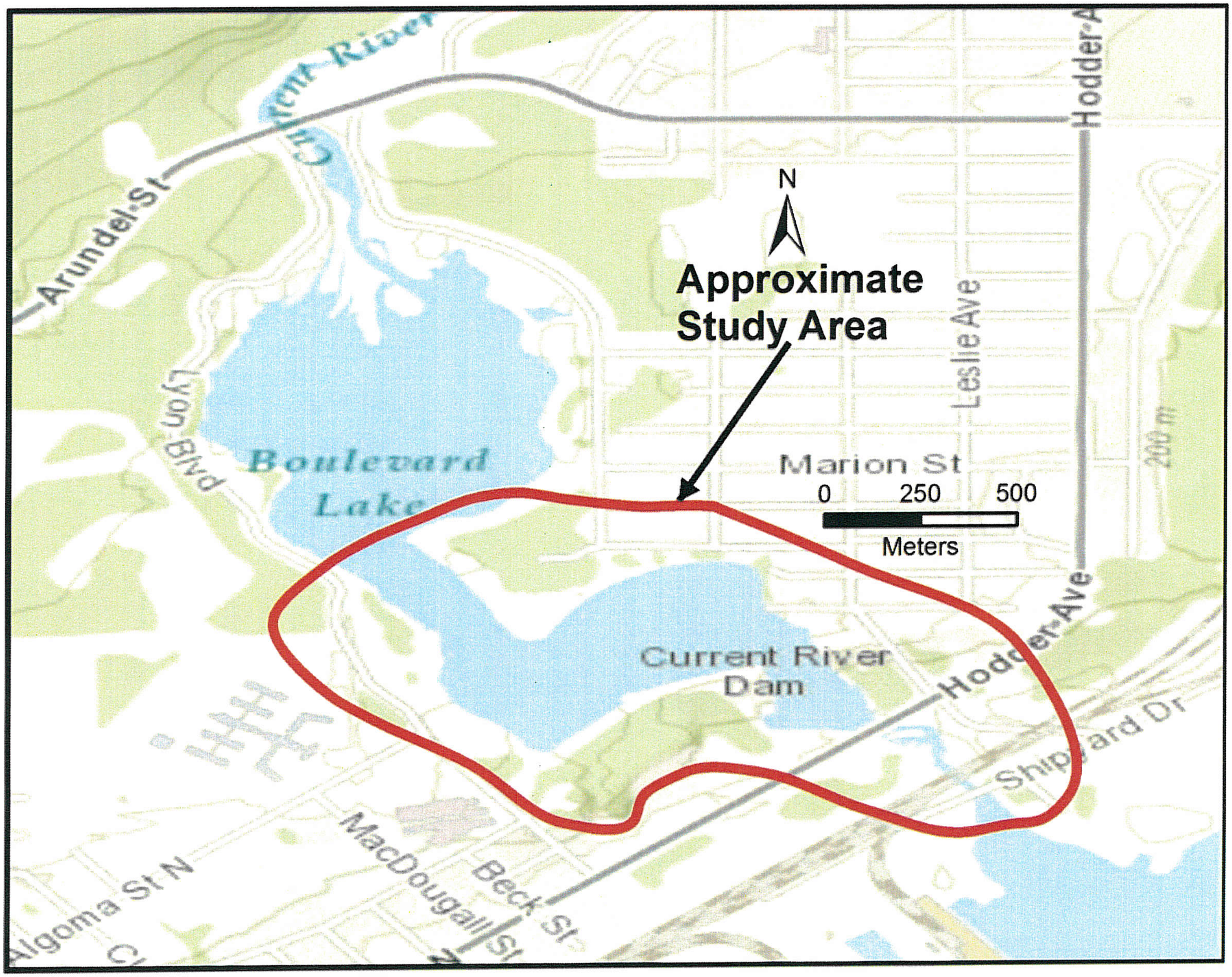
Yours very truly,

Mike Vogrig, P.Eng.
Project Engineer

Encl.

MV:nr

Figure 1 - Study Area Map



APPENDIX G

Public Information Centre Materials

Welcome to the Boulevard Lake Dam Class Environmental Assessment

Public Information Session #1

June 14, 2016

Boulevard Dam - Overview

- Built approximately 100 years ago
- Owned and operated by the City of Thunder Bay
- Associated waterpower facility is operated by Current River Hydro Partnership under a lease from the City of Thunder Bay
- Located approximately 700 m upstream of where the Current River discharges into Lake Superior
- The existing dam structure is approximately 112 m long and is oriented in an east/west direction
- Concrete construction with a series of concrete spillways and a series of log controlled sluiceways
- East approach is concrete retaining wall and west approach is 440 m rock berm

Boulevard Dam - Overview

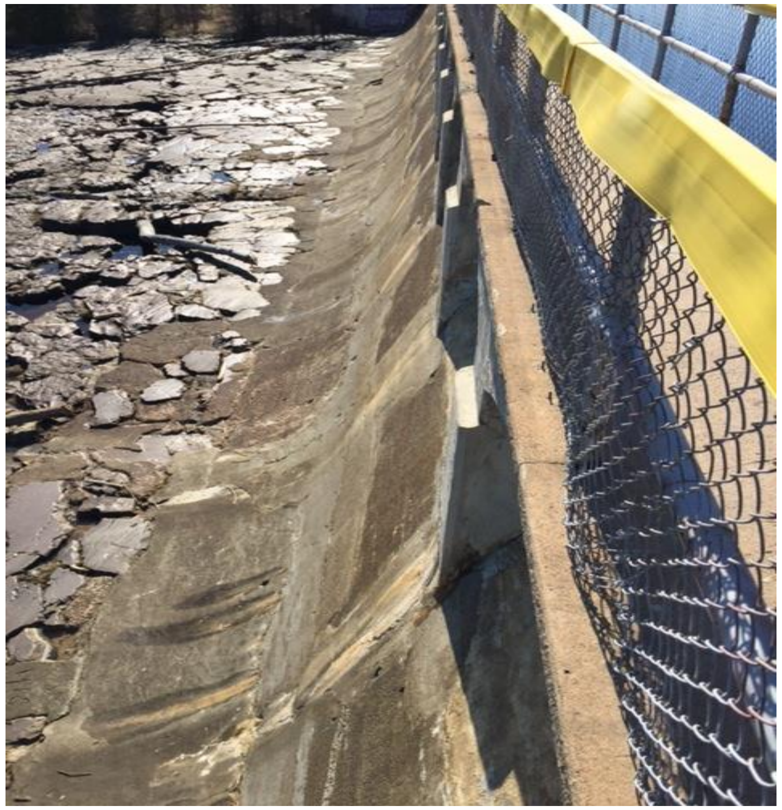
- 1960s post tension anchors installed in each buttress to address risk of floodwaters associated with regulatory storm event
- 1990's Fish ladder installed to facilitate movement of Steelhead for spawning upstream
- Walkway on top of dam used as part of trail system
- Dam created Boulevard Lake which is a recreational resource used by residents
- The Boulevard Lake Dam is operated twice a year outside of actions taken during isolated weather events and maintenance requirements; water levels are drawn down in fall and raised in summer

Sluiceways

Downstream

Upstream

Downstream Spillways



History of Boulevard Dam Project

- Boulevard Lake Dam is an aging structure: The last major restoration project was completed in 1976, when four sluiceways were constructed in order to pass the Regulatory Flood
- Minimal maintenance has been performed since then
- Original Condition Assessment of the Dam complete in 2000 by JML Engineering and updated in 2008
- Condition assessment identified potential issues with:
  - Deterioration of concrete all over the structure
  - Ability of dam to withstand flood waters associated with regulatory storm in accordance with the Lakes and Rivers Improvement Act (LRIA)
  - Some issues associated with use of walkway across dam
- Initial iterations of project identified project activities as Schedule A+ under the Municipal Class EA
- Project File report submitted in March 2015 and found deficient by MOECC in a number of areas
- EA being restarted to resolve deficiencies
- Opportunities to implement potential Boulevard lake improvements may be examined

Problem Assessment

- Protective concrete at exterior of dam infrastructure is deteriorating and needs rehabilitation
  - Severe spalling and delamination of the east retaining wall
  - Severe cracking and significant separation of the upstream concrete facing wall at the spillways
  - Soft concrete, spalling, delamination, and erosion at numerous buttress locations
  - Significant spalling, cracking, and erosion throughout the spillway and sluiceway aprons, and at the spillway slab
  - Spalling of the concrete slabs at the existing railing post locations and at a few locations at the underside of the sluiceway slabs
  - Severe longitudinal cracks at the spillway slabs
- Structural strength of dam is not sufficient to meet *Lake and Rivers Improvement Act (LRIA)* requirements for redundancies, should there be a regulatory storm event

Opportunity Assessment

- Parks undertook a community driven effort to identify potential long term improvements to Boulevard Lake and Park
- Some of the improvements could be addressed during the rehabilitation of the dam depending on the construction method chosen
- Water quality in Boulevard Lake is an on-going issue and should the lake be drawn down during construction there may be the opportunity to improve water quality
- Paddle sports using Boulevard Lake have identified the need for dredging to improve water depth for dragon boating
- The opportunity to address these issues is likely contingent on the method of construction

Evaluation of Alternative Solutions

Do Nothing

- No repairs to the dam would be made, and the concrete would continue to deteriorate at an accelerated rate
- No redundancies in strength would be provided
- The dam would continue to operate through stop log operations
- Pedestrian traffic would remain unchanged at the dam
- The dam will continue to perform satisfactorily for a limited horizon

- On balance negative effects of doing nothing outweigh benefits therefore, this alternative is eliminated from further consideration

Evaluation of Alternative Solutions

Rehabilitate the Dam

- All required concrete repairs would be completed and the Lakes and Rivers Improvement Act requirement for redundancies in strength would be met
- Pedestrian traffic and movement across the dam would be improved
- Stop log operations can be enhanced or replaced with gates to ensure the dam can adequately pass the Inflow Design Flood
- Potential to look at opportunities to improve water quality depending on construction method chosen

- On balance benefits of dam rehabilitation outweigh the negative effects therefore, this alternative is preferred and is carried forward for more detailed consideration

Evaluation of Alternative Solutions

- Reconstruct the Dam
  - Construct a new dam upstream or downstream of the existing dam
  - The new structure would be designed to all applicable codes and standards
  - Flow control, fish passage, and power generation could be greatly improved
  - The existing structure would be demolished
  - Provision of new improved trail connection over new bridge and provisions of better connections onto and off of dam
  - Cost of reconstruction is significantly higher than for rehabilitation or removal
- On balance negative effects of dam reconstruction outweigh benefits therefore, this alternative is eliminated from further consideration

Evaluation of Alternative Solutions

Remove the Dam

- Completely remove all dam infrastructure and allow the Current River to return to its natural watercourse
- Boulevard Lake, an important recreation area within Thunder Bay since 1909, would be eliminated
- Removal of barrier against migration of invasive species, such as Sea Lamprey, up Current River
- Removal of fish ladder and opportunity to facilitate migration of Steelhead
- Removal of trail connection in this location
- Removal of power generation capacity; termination of contract with private operator would incur financial penalty

- On balance negative effects of dam removal outweigh benefits therefore, this alternative is eliminated from further consideration

Alternative Design Concepts

- Rehabilitation of the Dam is the preferred alternative solution, therefore, alternative design concepts will include the following components:
  - Alternative ways to enhance strength of dam to meet LRIA requirements for redundancy
  - Alternative ways to repair the protective concrete
  - Alternative ways to achieve and enhance public access across the dam structure
  - Alternative ways to operate the dam to improve responsiveness and avoid conflict with recreational users
  - Alternative ways to undertake construction
  - Alternative ways to enhance function of the fish ladder

- Each set of alternatives will be assessed and combined into an overall preferred alternative
- Depending on the resultant preferred alternative, the team will examine additional opportunities to improve water quality and potential for dredging to facilitate paddle sports as per the Park Strategic Plan

Potential Evaluation Criteria

Environmental Component	Criteria
Natural	Change to aquatic species and habitat
	Change to function/operation of existing fish ladder
	Change to terrestrial habitat
	Change to water quality
Social	Change to recreational opportunities available in Boulevard Park
	Change in recreational opportunities available in Boulevard Lake
	Change to operation of small hydro generation
	Potential for nuisance effects associated with construction (noise, odour, dust, traffic, access, etc.
	Potential for disruption of archaeological and heritage resources.
Technical	Ease of construction
	Duration of construction
	Ease of operation.
	Ability to manage water levels.
Cost	Capital Cost
	Operation and Maintenance Cost

Baseline Studies - 2016

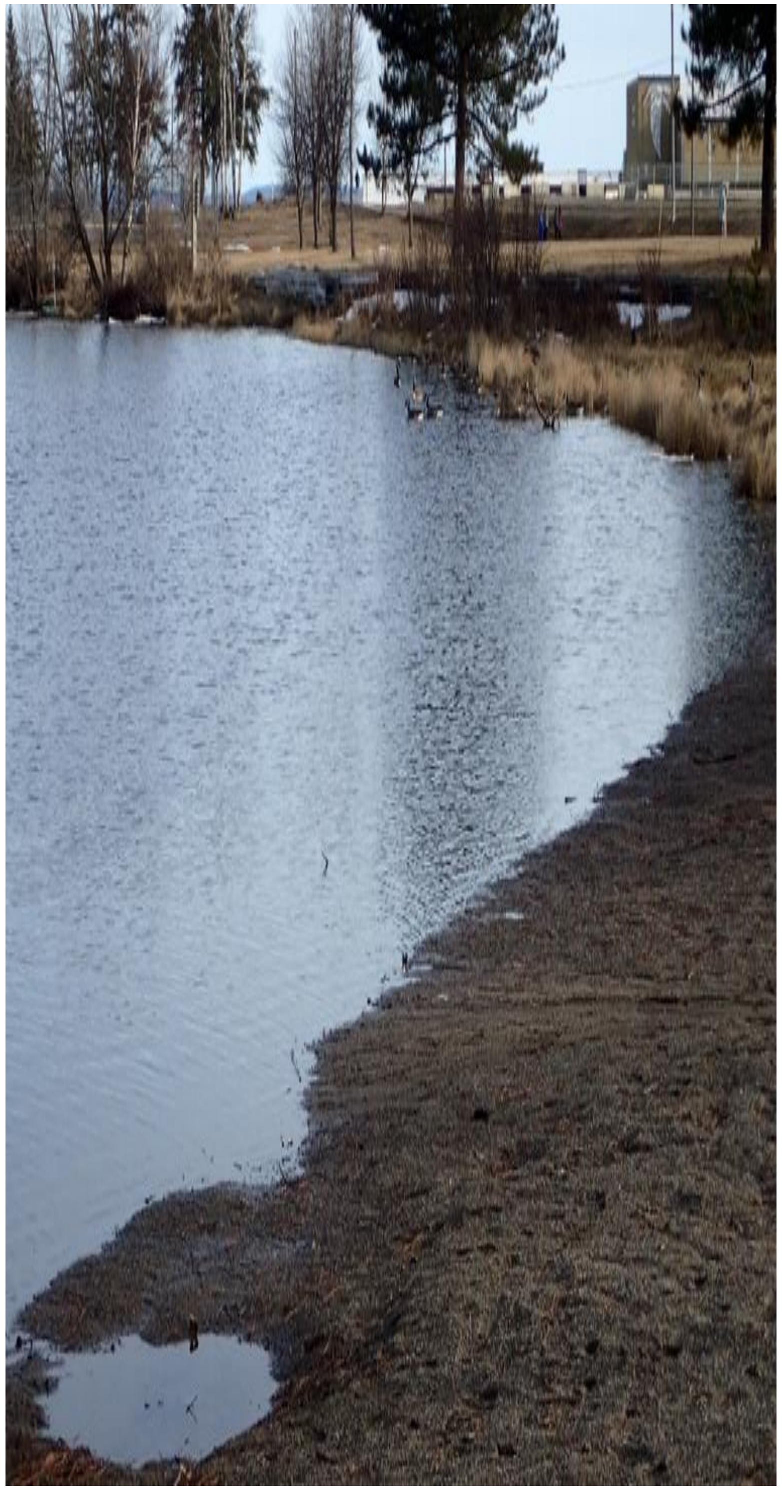
- Bathymetry
- Vegetation and Flora
- Fish Occupancy
- Soils and erosion
- Hydrology
- Water quality
- Odour
- Archaeology/Built Heritage Resources and Landscapes
- Survey of Dam/Park Use

Baseline Ecologic Conditions

Aquatic

- Limited data on fish community in Boulevard Lake: field studies currently on-going
- Walleye, Brook Trout, Rainbow Trout, Northern Pike found in Current River upstream
- Rainbow Smelt, Walleye, Brook Trout, Rainbow Trout and suckers found in Current River below the dam
- Dam prevents most fish species from moving upstream, including invasive species such as Sea Lamprey
- The fish ladder was built in 1991 to allow Rainbow Trout (Steelhead) to migrate upstream but its effectiveness is unknown
- Most of the lake is less than 2 m deep - the maximum depth is over 5 m
- The winter drawdown probably harms fish habitat by killing off aquatic plants and invertebrates in the shallow water
- Small areas of wetland at the north of the lake and in a basin on the east side

Baseline Ecologic Conditions



Terrestrial

- Boulevard Lake Park includes 40 ha of mature mixed forest; remainder is mostly open lawn and wooded lawn
- White-tailed Deer and Beaver are common residents
- Breeding bird community includes warblers, thrushes, and vireos
- Flocks of migrating shorebirds and Canada Goose use the lake and lawns for feeding and staging, especially in the spring and fall
- The park may act as a corridor for animals moving from the largely forested area to the north to the Lake Superior shoreline
- A provincially rare plant, Scabrous Black Sedge (*Carex atratiformis*) grows on the east side of the lake
- Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline may be present on the Current River upstream of Boulevard Lake

Overview of Class EA Process

- The Municipal Class EA is a 5 phase project planning process study for municipal projects including road, water and wastewater projects
- The process includes evaluation of impacts on the natural and social environment (i.e., impacts to wildlife, soils, traffic patterns, local residents/businesses)
- Municipal projects are classified into schedules based on the scale and scope of the project to determine the level of assessment required:
  - **Schedule A:** Generally includes normal or emergency operational and maintenance activities where the environmental effects of these activities are usually minimal, and therefore these projects are pre-approved
  - **Schedule B:** Generally includes improvements and minor expansions to existing facilities where there is the potential for some adverse environmental impacts and therefore, the municipality is required to proceed through a screening process including consultation with those who may be affected
  - ✓ **Schedule C:** Generally includes the construction of new facilities and major expansions to existing facilities, and these projects proceed through a five phased environmental assessment planning process
    - **Boulevard Lake Dam Rehabilitation Project is considered Schedule C**

Overview of Schedule C Class EA Process

5 Phase Environmental Planning Process

1. Identify Problem or Opportunity
2. Identify Alternative Solutions to Problem or Opportunity
3. Alternative Design Concepts for Preferred Solution
4. Environmental Study Report completed and placed on public record for 30-day review period
   - Public has opportunity to comment and request Part II Order
5. Implementation

Next Steps

- Undertake field studies
- Develop and evaluate alternative methods
- Undertake effects assessment
- Next Public Information Session – Fall 2016

How can I participate in the Class EA?

- Public consultation is a fundamental part of the EA process
- The City hosts Public Information Sessions in the community as well as consults directly with municipal councils, review agencies, interest groups, and stakeholders
- Project information will be posted on the City website
- Please complete a comment sheet

Schedule C Class Environmental Assessment For
Proposed Boulevard Lake Dam Rehabilitation Project – First Public Information Session Sign-In Sheet
June 14, 2016

PLEASE PRINT CLEARLY

First Name	Last Name	Street Address, City	Postal Code	Phone Number(s)	E-mail Address	Would you like to receive project information?	How would you like to receive information?
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail

Schedule C Class Environmental Assessment For
Proposed Boulevard Lake Dam Rehabilitation Project
First Public Information Session

June 14, 2016

4:00 p.m. to 8:30 p.m.

Current River Community Centre, Thunder Bay

Please take a few minutes to complete this questionnaire and leave it with a Public Information Session representative. The City of Thunder Bay is interested in hearing your comments and questions regarding the proposed Boulevard Lake Dam Rehabilitation Project.

1. What aspects of the Boulevard Lake Dam, Park, and vicinity are most important to you?

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2. Do you have concerns about the proposed Boulevard Lake Dam rehabilitation project?

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3. Do you have concerns about the construction phase of the Boulevard Lake Dam rehabilitation project?

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4. Do you have comments about the outcome of the proposed Boulevard Lake Dam rehabilitation project?

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5. What aspects of the local environment and your community are most important to you?

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If you would like City of Thunder Bay personnel to provide follow-up information or address questions, please leave your name and address below. ***Please print clearly.***

Name ___________________________________ Phone number __________________________

E-mail Address ____

Street address ____

City ___________________________ Postal code _____________________

Please leave your completed form with a Public Information Session representative. You may also send the form by fax, e-mail or mail to:

Mike Vogrig, Project Engineer
City of Thunder Bay
111 Syndicate Ave S.
Thunder Bay, Ontario
P7E 6S4
Tel: 807-625-4321
Fax: 807-625-3588
E-mail: mvogrig@thunderbay.ca

CITY OF Thunder Bay
Superior by Nature

Welcome to the Boulevard Lake Dam Class Environmental Assessment

Public Information Session #2

September 7, 2017

Study Overview

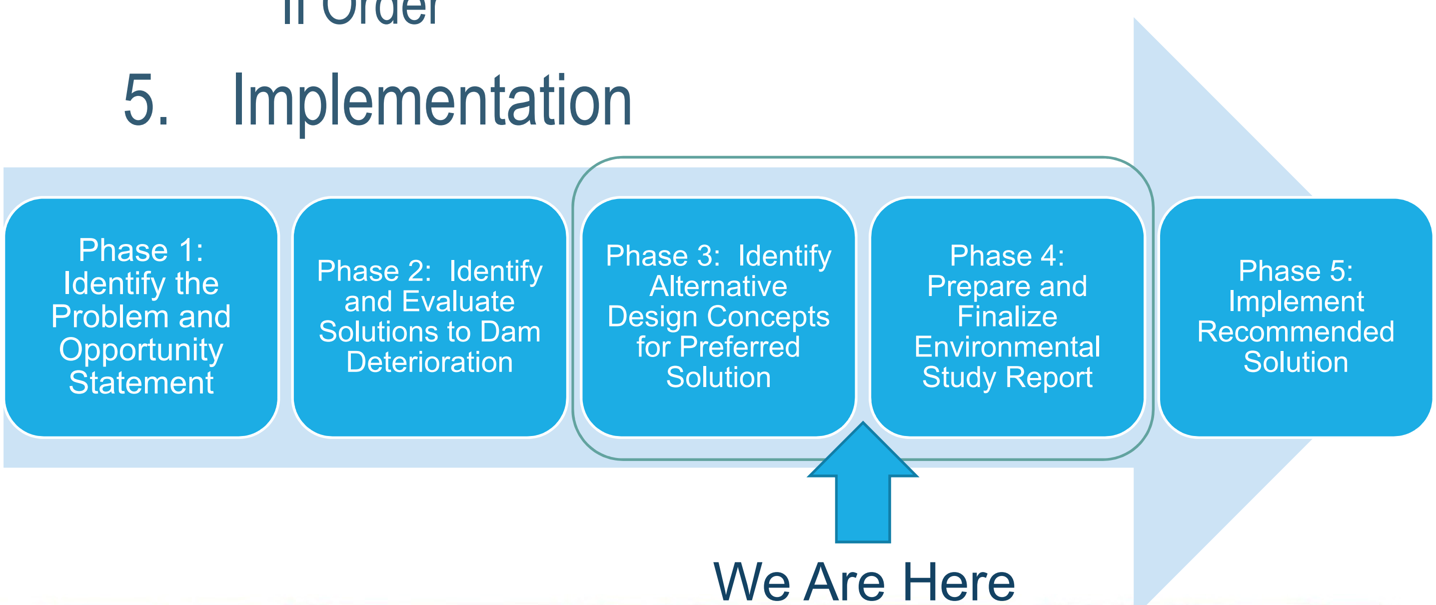
- The Environmental Assessment is being undertaken to identify the most viable option to address the deteriorating condition of the Boulevard Lake Dam
- The study follows the requirements of the Municipal Class Environmental Assessment (EA) process for a Schedule 'C' Project
- Rehabilitation of the dam is the preferred alternative solution

Overview of Schedule C Class EA Process

5 Phase Environmental Planning Process

We Are Here

1. Identify Problem or Opportunity
2. Identify Alternative Solutions to Problem or Opportunity
3. **Alternative Design Concepts for Preferred Solution**
4. **Environmental Study Report completed and placed on public record for 30-day review period**
   - Public has opportunity to comment and request Part II Order
5. Implementation



Topics Covered in the First Public Information Session

- Held on June 14, 2016
- History and Overview of Boulevard Dam
- Overview of Class EA Planning
- Phase 1 of Class EA: Problem and Opportunity Assessment
- Phase 2 of Class EA: Evaluation of Alternative Solutions to the Deterioration of the Boulevard Dam
- Phase 3 of Class EA: Introduction of Alternative Design Concepts and Potential Comparative Evaluation Criteria
- Description of baseline ecologic conditions: aquatic and terrestrial background conditions

Purpose of this Session

The purpose of this Public Information Session is to:

- Provide an Overview of Boulevard Lake Dam
- Provide an Overview of Environmental Inventories and Background Studies
- Present details and seek feedback on:
  - ➢ The selection of the preferred design concept
  - ➢ The assessment of environmental effects
  - ➢ The details of the preferred design concept, including how it will be constructed

Environmental Inventories and Background Studies: 2016 - 2017

A number of environmental investigations and background studies were conducted in 2016 and 2017:

- Flora and Fauna
- Bathymetry
- Hydrology
- Water and Sediment Quality
- Fish Occupancy
- Atmospheric Environment
- Survey of Dam/Park Use
- Archaeology/Built Heritage Resources and Landscapes

Walkway and Stop Logs

Environmental Inventories and Background Studies

Study	Overview
Flora	• Park is mostly open and wooded lawn, including 51 ha of forest cover (mainly in the north end).
Fauna  Red-eyed Vireo	• 25 bird species found during 2016 and 2017 field investigations, including: 10 White-throated Sparrow, 8 Red-eyed Vireo, 17 American Crow, 7 warbler species, 3 sparrow species, 8 area sensitive bird species, requiring large areas of suitable habitat (4 Magnolia Warbler, 4 Red-breasted Nuthatch, 3 Black and White Warbler, 3 Ovenbird, 1 American Redstart, 1 Canada Warbler, 1 Pileated Woodpecker, and 1 Winter Wren) • White-tailed Deer common year-round residents in the forested part of the park. Moose and Black Bear may use park occasionally. Beaver use Boulevard Lake in summer.
Species at Risk (SAR)  Canada Warbler	• SAR birds observed in 2016 and 2017 field investigations include: Canada Warbler (Special Concern) and Bald Eagle (Special Concern).
Bathymetry	• The Lake is shallow. About 70% of the lake is less than 2 m deep and about 3% of the lake is deeper than 5 m (when the lake is at the high water level). The maximum recorded depth was 5.3 m.
Hydrology 	• Current River above Boulevard Lake drops over a series of bedrock shelves, separated by pools and rapids and ends in a shallow delta. • Current River downstream from the dam to Cumberland Street consists of a bedrock shelf with small patches of cobble.

Environmental Inventories and Background Studies

Study	Overview
Water Quality 	• Sampling conducted in 2016 and 2017: 24 samples in May 2016, 12 in July 2016, 12 in April 2017. Tested for nutrients, pH, metals, bacteria, organics. • Results found water quality satisfactory for recreational purposes and the protection of aquatic life.
Sediment Quality 	• Sampling conducted in 2016 and 2017: 18 samples in August 2016, 4 in April 2017. Tested for nutrients, pH, metals, bacteria, organics. • Results found sediments in the lake are compliant with provincial objectives for all categories with the exception of occasional high *E. Coli* levels. • Mercury Study: 4 sediment samples taken from two locations in Boulevard Lake in April 2017. All 4 samples indicated levels below MOECC guideline level of 0.2 ug/g (below the lowest effect level).
Fish Occupancy  Yellow Perch	• Aquatic monitoring undertaken in 2016. • 12 fish species were observed: Central Mudminnow, Northern Pike, Blacknose Shiner, Spottail Shiner, Blacknose Dace, White Sucker, Burbot, Trout Perch, Yellow Perch, Walleye, Johnny Darter, Logperch.
Atmospheric Environment	• Air quality within the study area is generally good, and falls below the MOECC Ambient Air Quality Criteria (AAQC) for $PM_{2.5}$ and No_x. • Noise levels are generally low.

Environmental Inventories and Background Studies

Study	Overview
Survey of Dam/Park Use   	• 47% of respondents use the park 1 to 2 times per week or more, and the majority (74%) use it on both weekends and weekdays. • Majority (over 61%) use the park most frequently during the summer months. • Primary Activities of Park Visitors: Walking (80%), Cycling (30%), Walking the Dog (30%), Running (27%), Jogging (23%), Use of Playground (21%), Meeting Friends (20%), and Disc Golfing (17%). • Park's best features (top three choices) were: Walking Path (80%), Boulevard Lake (69%), Trees (68%), Trails (58%), Naturalized Areas (50%), and Bicycle Paths (49%). **Over 75% considered Boulevard Lake Dam as an important feature of the park.** • Majority (64%) indicated that providing wider trails was their top priority for park improvements. Other improvements included: Public Safety (41%) and Widening of Pinch Point at Power Station (40%).
Archaeology/ Built Heritage Resources and Landscapes	• 2 registered archaeological sites within 1 km of study area. • No built heritage resources identified in the study area.

Phase 2 of Class EA: Alternative Solutions to Address Problem/ Opportunity Statement and Evaluation

Alternative Solutions	Evaluation Comments
1. Do Nothing	• No change and the dam would continue to perform satisfactorily for a limited time horizon • No repairs, continued concrete deterioration • No redundancies in strength provided
2. Rehabilitate the Dam	• All required concrete repairs would be completed and the LRIA requirement for redundancies in strength would be met • Pedestrian traffic and movement across the dam would be improved • Stop log operations can be enhanced or replaced with gates to ensure the dam can adequately pass the Inflow Design Flood
3. Reconstruct the Dam	• Demolish existing structure • Provision of new improved trail connection over new bridge and provisions of better connections onto and off of dam • Cost of reconstruction is significantly higher than for rehabilitation or removal
4. Remove the Dam	• Removal of all dam infrastructure, allows the Current River to return to its natural watercourse • Boulevard Lake, an important recreation area within Thunder Bay since 1909, would be eliminated • Removal of barrier against migration of invasive species up Current River • Removal of trail connection at dam • Removal of power generation capacity; termination of contract with private operator would incur financial penalty

After evaluation of the 4 different alternatives, Alternative #2, rehabilitation of the dam, is the preferred alternative solution.

Phase 2 and 3 of Class EA
Alternative Design Methods - Evaluation Criteria

- Five (5) alternative design methods were considered.
- The evaluation of the alternatives was undertaken using comparative criteria and indicators representing the full definition of the environment.
- The evaluation criteria are all considered to have equal levels of importance.
- The criteria also reflect the issues and concerns raised by the local community, recreational users, regulatory agencies and other stakeholders.

Environmental Component	Criteria
Natural	Change to aquatic species and habitat
	Change to function/operation of existing fish ladder
	Change to terrestrial habitat
	Erosion potential
	Potential to contribute greenhouse gases to atmosphere or diminish available carbon sink
Water Quality and Quantity	Change to water quality and/or water quantity
Waste Management	Potential to create waste
Social	Potential to affect Boulevard Park use and enjoyment
	Potential to affect Boulevard Lake use and enjoyment
	Change to operation of small hydro generation
	Potential for nuisance effects associated with construction (noise, odour, dust, traffic, access, etc.) to residents and park users
Cultural Heritage	Potential for disruption of archaeological and heritage resources
Technical	Ease of construction
	Duration of construction
	Ease of operation
	Ability to manage water levels
Economic	Capital Cost
	Operation and Maintenance Cost

Phase 3 of Class EA:
Alternative Design Methods

- **Evaluation of Alternative Design/Construction Methods with respect to the Evaluation Criteria Resulted in the following most preferred methods, which have the fewest overall potential effects and best value:**

1. Addressing the Need for Redundancies in Strength				
Option 1A: Provide redundant set of post-tensioned anchors	**Option 1B: Provide Additional Mass Upstream/ Downstream**	**Option 1C: Convert Spillways to Sluiceways**	**Option 1D: Construct Emergency Spillway**	**Option 1E: Construct New Storage Reservoir**
Alternative has fewest potential effects which are generally mitigable and lowest cost. **MOST PREFERRED**	Alternative has moderate potential effects which are generally mitigable and moderate cost. **MODERATELY PREFERRED**	Alternative has moderate potential effects which are generally mitigable and high cost. Existing spillway anchors will now be additionally stressed with the elimination of mass concrete. **LEAST PREFERRED**	Alternative has moderate potential effects, some which may be difficult to mitigate depending on spillway location and high cost. **SECOND LEAST PREFERRED**	Alternative has most potential effects depending on location of reservoir and dam and highest cost. **LEAST PREFERRED**

Phase 3 of Class EA:
Alternative Design Methods

- **Evaluation of Alternative Design/Construction Methods with respect to the Evaluation Criteria Resulted in the following most preferred methods, which have the fewest overall potential effects and best value:**

2. Rehabilitation of Concrete			
Option 2A: Patching	**Option 2B: Refacing**	**Option 2C: Repair and Encapsulate**	**Option 2D: Replacing**
Alternative has fewest potential effects which are generally mitigable and lowest cost. Least amount of CO_2 generating cement used for concrete. Lowest initial cost but subsequent repairs likely required. **MOST PREFERRED**	Alternative has moderate potential effects which are generally mitigable and moderate cost. Some CO_2 generating cement used for concrete. Medium initial cost, medium lifespan. **MODERATELY PREFERRED**	Alternative has moderate potential effects which are generally mitigable and moderate cost. Some CO_2 generating cement used for concrete. Medium initial cost, medium lifespan. **MODERATELY PREFERRED**	Alternative has most potential effects and highest initial cost, but longest repair lifespan. Greatest amount of CO_2 generating cement used for concrete. **LEAST PREFERRED**

Phase 3 of Class EA: Alternative Design Methods

- **Evaluation of Alternative Design/Construction Methods with respect to the Evaluation Criteria Resulted in the following most preferred methods, which have the fewest overall potential effects and best value:**

3. Pedestrian Movement at the Dam				
Option 3A: Existing Geometry to Remain	**Option 3B: Widen Deck at Spillways to Match Width at Sluiceways**	**Option 3C: Widen Entire Deck to City of Thunder Bay Standard Trail Width**	**Option 3D: Close Deck to Pedestrian Traffic**	**Option 3E: Close Deck and Provide Alternative Pedestrian Route**
Alternative provides no alleviation of existing problems. **LEAST PREFERRED**	Alternative provides some alleviation of existing problems but some problems remain. Very little benefit achieved given cost. **MODERATELY PREFERRED**	Despite moderate cost, this alternative provides a viable solution of the effective movement of users across the dam. **MOST PREFERRED**	Effects associated with loss of trail connection will be highly negative for users. **LEAST PREFERRED**	No additional benefit achieved by building a new pedestrian bridge and trail to avoid dam. **LEAST PREFERRED**

4. Dam Operations			
Option 4A: Existing Stop Logs Remain	**Option 4B: Provide Mechanical Gates at Three Locations**	**Option 4C: Provide Mechanical Gates at all Locations**	**Option 4D: Provide Automated Gates at all Locations**
More difficult to maintain regulated flow of water over dam, no improvement to ability to manage water flow, and impossible to remove all logs during extreme weather events. Conflict with pedestrian movement would remain. **LEAST PREFERRED**	Best option for regular dam operations. It would be unlikely that all logs in remaining sluiceways could be removed for extreme weather events. **MOST PREFERRED** for regular dam operations.	Superior to a stop log solution to reliably address opening sluiceways to pass the Inflow Design Flood (IDF). **MOST PREFERRED OVERALL**	Remotely addresses opening sluiceways to pass the IDF, but is expensive and unnecessary for daily dam operations. **MODERATELY PREFERRED**

Phase 3 of Class EA: Alternative Design Methods

- **Evaluation of Alternative Design/Construction Methods with respect to the Evaluation Criteria Resulted in the following most preferred methods, which have the fewest overall potential effects and best value:**

5. Construction Methods			
Option 5A: Two Cofferdams	**Option 5B: Several Small Cofferdams**	**Option 5C: In the Wet**	**Option 5D: Winter Construction**
Temporary loss of up to 750 m^2 of aquatic habitat behind cofferdam. Lake may be lowered to natural stream twice for about two-four weeks each time. Costs could be lower, if water elevation is lower. Hydro generation will be affected during lake drawdowns to natural stream and when it is behind cofferdam. Water level will be determined based on available mitigation.	Temporary loss of up to 50 m^2 of aquatic habitat behind cofferdam. Lake may be lowered to natural stream several times for one to two weeks each time. Costs are moderate regardless of water elevation. Hydro generation will be affected during lake drawdowns to natural stream and when it is behind cofferdam.	No change from normal operations. Removal of debris at the upstream toe of the dam and installation of concrete forms/reinforcement completed by diving crews. Riskier work with less quality control involved due to nature of the work. Not possible to generate power when there are divers in the water near the intake. Moderate cost. Unique, expensive construction techniques required and less quality control, therefore a poorer end product may result due to poor visibility underwater, with few people having the opportunity to inspect.	Temporary loss of aquatic habitat. No change over normal winter reservoir lowering. Exposed sediments will freeze, minimizing erosion. Mobile cofferdams would likely have to be installed before winter. No effect to hydro generation in winter months. Moderate cost. Additional cost to construction, to manage freezing conditions.
MOST PREFERRED	**MODERATELY PREFERRED**	**MODERATELY TO LEAST PREFERRED**	**LEAST PREFERRED**

Phase 3 of Class EA: Alternative Design Methods

- The Preferred Design Concept is described as follows:
  - Strength requirements addressed by installing a redundant set of post-tensioned tendons in every buttress along the east retaining wall.
  - Rehabilitation of concrete through patching.
  - The deck of the dam will be widened to the City of Thunder Bay standard trail width.
  - With respect to dam operations, wooden stop logs will be replaced with a combination of automated mechanical gates, aluminum stop logs and wooden stop logs. This combination will reduce the existing water leakage through the dam, and help regulate water levels.
- Construction will occur over a 2 year period and will be staged from a laydown area and access road south of the dam. Water levels will be lowered for the first year of construction and two cofferdams (in two stages) will be used to complete upstream construction.

Summary of Effects During Construction

Environmental Component	Potential Effects	Mitigation Measures	Net Effects
Vegetation	• Access road will require removal of <0.1 ha of vegetation.	• Replanting of removed vegetation.	Negligible
Wildlife	• No significant impacts on wildlife or habitat are expected. Localized potential temporary disturbance from noise. • Winter/summer drawdown could temporarily affect amphibians, semiaquatic mammals, nesting/migrating waterfowl.	• Drawdowns and in-water work to be completed during the frost-free period to minimize impacts on hibernating reptiles and amphibians and will avoid peak staging periods for migrating waterfowl. • Duration of drawdown last only 2-3 weeks to reduce impacts on shoreline wildlife and nesting waterfowl.	None
Sediment Quality	• Localized erosion and migration of reservoir sediments during lake drawdown. This activity is consistent with current dam operations.	• Gradual lowering of the lake water level, and gradual opening of sluice gates to minimize sediment discharge.	None
Fish Habitat and Species	• Lake level drop could result in temporary loss of 41.7 ha of fish habitat between Thanksgiving and the May long weekend or 58.4 ha during the rest of the year. • Potential temporary loss of low quality fish habitat, spawning habitat, access to nursery habitat, connectivity, foraging habitat, potential increased vulnerability to predation and/or angling.	• Drawdowns during June 20 - September 1 to avoid spring and fall spawning periods for Walleye and Brook Trout. • Lake level dropped gradually to permit fish to move to remaining basin. • Duration of drawdown minimized to reduce impacts on fish. • Maintenance of base flow in accordance with Water Management Plan.	Negligible
Aquatic Vegetation	• Loss of productivity during summer drawdown.	• Drawdowns will be limited to 2-3 weeks.	None
Benthic Invertebrates	• Potential loss of invertebrate species due to lake drawdown and could be subject to temporary increased predation.	• Drawdowns will be limited to 2-3 weeks.	None
Species at Risk	• Bald Eagles perching in the trees may be disturbed by construction. • Canada Warbler is not known to nest or be present near the dam, will likely not affect this species.	• Construction work at the dam will be completed during the summer months to avoid period of peak use by Bald Eagles.	None
Noise	• Temporary, localized and intermittent construction noise of short duration (i.e., heavy equipment).	• Compliance with City Noise By-law.	None

Summary of Effects During Construction

Environmental Component	Potential Effects	Mitigation Measures	Net Effects
Air and Odour	• Construction is expected to generate dust. • Localized increases in hydrocarbon emissions from construction vehicles. • Lowering of the water in the dam could release odours from decaying organic material.	• Water used to control dust. • Application of odour mitigation such as avoidance of construction during high temperatures / strong wind.	None
Residential	• Construction nuisance effects to nearby residents due to temporary noise, dust, increase in traffic/heavy vehicles on local roads. • Heavy vehicle traffic volume expected to be less than 5 vehicles/hour.	• Vehicles to use dedicated access road for construction purposes. • Disruptions will be of short duration.	None
Recreation	• Access to the pedestrian walkway across Boulevard Lake Dam will be closed throughout construction. • During drawdowns the use of Boulevard Lake for recreation such as swimming and paddlesports will be limited.	• Pedestrians will be re-routed to the Cumberland Street Bridge just downstream of the dam.	Negative - Temporary displacement of recreational uses on the lake during drawdown periods will occur
Archaeology	• May be effects to “underwater” resources, which have yet to be identified, during the marine archaeological assessment slated to take place during construction.	• Mitigation (through avoidance) of structures will be attempted, after being fully documented (drawings and photographs).	None

Summary of Effects During Operation

Environmental Component	Potential Effects	Mitigation Measures	Net Effects
Fish Habitat and Species	• Increased ability to regulate the flow of water through the fish ladder may improve upstream passage for Rainbow Trout spawning.	• None	Positive
Recreation	• Widened walkway will eliminate existing constraints, congestion, and improve accessibility.	• None	Positive

No changes/effects to the following environmental components due to dam construction or operations: Physiography, Geology, Soils, Bathymetry, Water Quality, Built and Cultural Heritage, Aboriginal Communities (Land Use)

Stakeholder Consultation: Overview of Comments Received

The most common comments/concerns received from stakeholders to date with respect to the rehabilitation project revolved around:

- Timing of rehabilitation – Proceed with conducting the repairs as soon as possible
- Concern about effectiveness of fish ladder
- Concern about effect of construction on use of the lake for recreation
- Improvement of the trail over the dam, to support two-way pedestrian and bicycle traffic
- Maintain scenic beauty
- Preserve local wildlife
- Minimize environmental impacts
- The importance of preserving the lake, beach, and improving water quality
- Minimizing project costs, overruns, and improving the potential for other levels of government funding for the project

Next Steps

- Phase 4 of Class EA: Preparation and Finalization of Environmental Study Report (ESR)
- Phase 5 of Class EA: Implement Recommended Solutions

How can I participate in the Class EA?

- Public consultation is a fundamental part of the EA process
- The City hosts Public Information Sessions in the community as well as consults directly with municipal council, regulatory agencies, interest groups, and stakeholders
- This is the second and final Public Information Session – thank you for attending this evening
- Project information will be posted on the City website
- Please complete a comment sheet before leaving the meeting tonight, or online on the City website

Welcome to the Boulevard Lake Dam Class Environmental Assessment

Public Information Session #2

September 7, 2017

Study Overview

- The Environmental Assessment is being undertaken to identify the most viable option to address the deteriorating condition of the Boulevard Lake Dam
- The study follows the requirements of the Municipal Class Environmental Assessment (EA) process for a Schedule 'C' Project
- Rehabilitation of the dam is the preferred alternative solution

At the First Public Information Session…..

- History and Overview of Boulevard Dam
- Phase 1 of Class EA: Problem and Opportunity Assessment
- Phase 2 of Class EA: Evaluation of Alternative Solutions to the Deterioration of the Boulevard Dam and **Confirmation of Rehabilitation of the Dam as the preferred alternative**
- Phase 3 of Class EA: Introduction of Alternative Design Concepts and Potential Comparative Evaluation Criteria
- Description of baseline ecologic conditions: aquatic and terrestrial background conditions

What we have heard…….

- Timing of rehabilitation – Proceed with conducting the repairs as soon as possible
- Concern about effectiveness of fish ladder
- Concern about effect of construction on use of the lake for recreation
- Improvement of the trail over the dam, to support two-way pedestrian and bicycle traffic
- Maintain scenic beauty
- Preserve local wildlife
- Minimize environmental impacts
- The importance of preserving the lake, beach, and improving water quality
- Minimizing project costs, overruns, and improving the potential for other levels of government funding for the project

The purpose of this Public Information Session is to:

- Present results of environmental inventories and background studies
- Present and seek feedback on:
    - The selection of the preferred design concept
    - The detailed assessment of environmental effects
    - The details of the preferred design concept, including how it will be constructed

Environmental Inventories and Background Studies

Red-eyed Vireo

Study	Overview
Flora	• Park is mostly open and wooded lawn, including 51 ha of forest cover (mainly in the north end).
Fauna	• 25 bird species found during 2016 and 2017 field investigations, including: White-throated Sparrow, Red-eyed Vireo, American Crow, warbler species, sparrow species, area sensitive bird species, requiring large areas of suitable habitat (Magnolia Warbler, Red-breasted Nuthatch, Black and White Warbler, Ovenbird, American Redstart, Canada Warbler, Pileated Woodpecker, and Winter Wren) • White-tailed Deer common year-round residents in the forested part of the park. Moose and Black Bear may use park occasionally. Beaver use Boulevard Lake in summer.
Species at Risk (SAR)	• SAR birds observed in 2016 and 2017 field investigations include: Canada Warbler (Special Concern) and Bald Eagle (Special Concern).
Bathymetry	• The Lake is shallow. About 70% of the lake is less than 2 m deep and about 3% of the lake is deeper than 5 m (when the lake is at the high water level). The maximum recorded depth was 5.3 m.
Hydrology	• Current River above Boulevard Lake drops over a series of bedrock shelves, separated by pools and rapids and ends in a shallow delta. • Current River downstream from the dam to Cumberland Street consists of a bedrock shelf with small patches of cobble.

Canada Warbler

Environmental Inventories and Background Studies

Yellow Perch

Study	Overview
Water Quality	• Sampling conducted in 2016 and 2017: 24 samples in May 2016, 12 in July 2016, 12 in April 2017. Tested for nutrients, pH, metals, bacteria, organics. • Results found water quality satisfactory for recreational purposes and the protection of aquatic life.
Sediment Quality	• Sampling conducted in 2016 and 2017: 18 samples in August 2016, 4 in April 2017. Tested for nutrients, pH, metals, bacteria, organics. • Results found sediments in the lake are compliant with provincial objectives for all categories with the exception of occasional high *E. Coli* levels. • Mercury Study: 4 sediment samples taken from two locations in Boulevard Lake in April 2017. All 4 samples indicated levels below MOECC guideline level of 0.2 ug/g (below the lowest effect level).
Fish Occupancy	• Aquatic monitoring undertaken in 2016. • 12 fish species were observed: Central Mudminnow, Blacknose Shiner, Spottail Shiner, Blacknose Dace, Burbot, Trout Perch, Yellow Perch, Walleye, Johnny Darter, Logperch.
Atmospheric Environment	• Air quality within the study area is generally good, and falls below the MOECC Ambient Air Quality Criteria (AAQC) for $PM_{2.5}$ and No_x. • Noise levels are generally low.

Environmental Inventories and Background Studies

Study	Overview
Survey of Dam/Park Use	• 47% of respondents use the park 1 to 2 times per week or more, and the majority (74%) use it on both weekends and weekdays. • Majority (over 61%) use the park most frequently during the summer months. • Primary Activities of Park Visitors: Walking (80%), Cycling (30%), Walking the Dog (30%), Running (27%), Jogging (23%), Use of Playground (21%), Meeting Friends (20%), and Disc Golfing (17%). • Park's best features (top three choices) were: Walking Path (80%), Boulevard Lake (69%), Trees (68%), Trails (58%), Naturalized Areas (50%), and Bicycle Paths (49%). **Over 75% considered Boulevard Lake Dam as an important feature of the park.** • Majority (64%) indicated that providing wider trails was their top priority for park improvements. Other improvements included: Public Safety (41%) and Widening of Pinch Point at Power Station (40%).
Archaeology/ Built Heritage Resources and Landscapes	• 2 registered archaeological sites within 1 km of study area. • No built heritage resources identified in the study area.

Phase 3 of Class EA: Alternative Design Methods

- Five (5) alternative design methods were considered.
- The evaluation of the alternatives was undertaken using comparative criteria and indicators representing the full definition of the environment.
- The evaluation criteria are all considered to have equal levels of importance.
- The criteria also reflect the issues and concerns raised by the local community, recreational users, regulatory agencies and other stakeholders.

Phase 3 of Class EA:
Alternative Design Methods

1. Addressing the Need for Redundancies in Strength				
Option 1A: Provide redundant set of post-tensioned anchors	Option 1B: Provide Additional Mass Upstream/ Downstream	Option 1C: Convert Spillways to Sluiceways	Option 1D: Construct Emergency Spillway	Option 1E: Construct New Storage Reservoir
Alternative has fewest potential effects which are generally mitigable and lowest cost. MOST PREFERRED	Alternative has moderate potential effects which are generally mitigable and moderate cost. MODERATELY PREFERRED	Alternative has moderate potential effects which are generally mitigable and high cost. Existing spillway anchors will now be additionally stressed with the elimination of mass concrete. LEAST PREFERRED	Alternative has moderate potential effects, some which may be difficult to mitigate depending on spillway location and high cost. SECOND LEAST PREFERRED	Alternative has most potential effects depending on location of reservoir and dam and highest cost. LEAST PREFERRED

Phase 3 of Class EA:
Alternative Design Methods

2. Rehabilitation of Concrete			
Option 2A: Patching	Option 2B: Refacing	Option 2C: Repair and Encapsulate	Option 2D: Replacing
Alternative has fewest potential effects which are generally mitigable and lowest cost. Least amount of CO_2 generating cement used for concrete. Lowest initial cost but subsequent repairs likely required. MOST PREFERRED	Alternative has moderate potential effects which are generally mitigable and moderate cost. Some CO_2 generating cement used for concrete. Medium initial cost, medium lifespan. MODERATELY PREFERRED	Alternative has moderate potential effects which are generally mitigable and moderate cost. Some CO_2 generating cement used for concrete. Medium initial cost, medium lifespan. MODERATELY PREFERRED	Alternative has most potential effects and highest initial cost, but longest repair lifespan. Greatest amount of CO_2 generating cement used for concrete. LEAST PREFERRED

Phase 3 of Class EA: Alternative Design Methods

3. Pedestrian Movement at the Dam				
Option 3A: Existing Geometry to Remain	Option 3B: Widen Deck at Spillways to Match Width at Sluiceways	Option 3C: Widen Entire Deck to City of Thunder Bay Standard Trail Width	Option 3D: Close Deck to Pedestrian Traffic	Option 3E: Close Deck and Provide Alternative Pedestrian Route
Alternative provides no alleviation of existing problems. LEAST PREFERRED	Alternative provides some alleviation of existing problems but some problems remain. Very little benefit achieved given cost. MODERATELY PREFERRED	Despite moderate cost, this alternative provides a viable solution of the effective movement of users across the dam. MOST PREFERRED	Effects associated with loss of trail connection will be highly negative for users. LEAST PREFERRED	No additional benefit achieved by building a new pedestrian bridge and trail to avoid dam. LEAST PREFERRED

Phase 3 of Class EA:
Alternative Design Methods

4. Dam Operations			
Option 4A: Existing Stop Logs Remain	Option 4B: Provide Mechanical Gates at Three Locations	Option 4C: Provide Mechanical Gates at all Locations	Option 4D: Provide Automated Gates at all Locations
More difficult to maintain regulated flow of water over dam, no improvement to ability to manage water flow, and impossible to remove all logs during extreme weather events. Conflict with pedestrian movement would remain. LEAST PREFERRED	Best option for regular dam operations. It would be unlikely that all logs in remaining sluiceways could be removed for extreme weather events. MOST PREFERRED for regular dam operations.	Superior to a stop log solution to reliably address opening sluiceways to pass the Inflow Design Flood (IDF). MOST PREFERRED OVERALL	Remotely addresses opening sluiceways to pass the IDF, but is expensive and unnecessary for daily dam operations. MODERATELY PREFERRED

Phase 3 of Class EA: Alternative Design Methods

5. Construction Methods			
Option 5A: Two Cofferdams	Option 5B: Several Small Cofferdams	Option 5C: In the Wet	Option 5D: Winter Construction
Temporary loss of up to 750 m^2 of aquatic habitat behind cofferdam. Lake may be lowered to natural stream twice for about two-four weeks each time. Costs could be lower, if water elevation is lower. Hydro generation will be affected during lake drawdowns to natural stream and when it is behind cofferdam. Water level will be determined based on available mitigation. MOST PREFERRED	Temporary loss of up to 50 m^2 of aquatic habitat behind cofferdam. Lake may be lowered to natural stream several times for one to two weeks each time. Costs are moderate regardless of water elevation. Hydro generation will be affected during lake drawdowns to natural stream and when it is behind cofferdam. MODERATELY PREFERRED	No change from normal operations. Removal of debris at the upstream toe of the dam and installation of concrete forms/reinforcement completed by diving crews. Riskier work with less quality control involved due to nature of the work. Not possible to generate power when there are divers in the water near the intake. Moderate cost. Unique, expensive construction techniques required and less quality control, therefore a poorer end product may result due to poor visibility underwater, with few people having the opportunity to inspect. MODERATELY TO LEAST PREFERRED	Temporary loss of aquatic habitat. No change over normal winter reservoir lowering. Exposed sediments will freeze, minimizing erosion. Mobile cofferdams would likely have to be installed before winter. No effect to hydro generation in winter months. Moderate cost. Additional cost to construction, to manage freezing conditions. LEAST PREFERRED

Phase 3 of Class EA: Alternative Design Methods

The Preferred Design Concept is described as follows:

- Strength requirements addressed by installing a redundant set of post-tensioned tendons in every buttress along the east retaining wall.
- Rehabilitation of concrete through patching.
- The deck of the dam will be widened to the City of Thunder Bay standard trail width.
- With respect to dam operations, wooden stop logs will be replaced with a combination of automated mechanical gates, aluminum stop logs and wooden stop logs. This combination will reduce the existing water leakage through the dam, and help regulate water levels.


Proposed Access Road
Proposed Laydown Area
Construction will occur over a 2 year period and will be staged from a laydown area and access road south of the dam. Water levels will be lowered for the first year of construction and two cofferdams (in two stages) will be used to complete upstream construction.

Summary of Environmental Effects

Construction

- Temporary disturbance of aquatic habitat during drawdowns
- Removal and replanting of vegetation for access road and laydown area
- Pedestrian walkway over dam to be closed during construction
- Disruption to use of lake for recreation during drawdowns
- Disruption to hydro generation during drawdowns and when cofferdam is located at north end of dam
- Minimal localized nuisance effects to residents and park users from construction noise, dust and traffic

Operation

- No real change from existing operation
- Better ability to regulate water flows to support downstream fisheries
- Widened trail across dam will remove existing bottlenecks and user conflicts

Next Steps

- Information from this meeting will be posted on the City website
- Please complete a comment sheet before leaving the meeting tonight, or online on the City website

- Phase 4 of Class EA: Preparation and Finalization of Environmental Study Report (ESR)
- The draft ESR will be available for a 30 day public review period later this fall and then once finalize the final ESR will be available for a second 30 day review period

- Phase 5 of Class EA: Implement Recommended Solutions

CITY OF Thunder Bay
Superior by Nature

Schedule C Class Environmental Assessment For
Proposed Boulevard Lake Dam Rehabilitation Project – Second Public Information Session Sign-In Sheet
September 7, 2017

PLEASE PRINT CLEARLY

First Name	Last Name	Street Address, City	Postal Code	Phone Number(s)	E-mail Address	Would you like to receive project information?	How would you like to receive information?
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail
						[ ] YES [ ] NO	[ ] E-mail [ ] Mail

Schedule C Class Environmental Assessment For
Proposed Boulevard Lake Dam Rehabilitation Project
Second Public Information Session

September 7, 2017
4:00 p.m. to 8:30 p.m.
Current River Community Centre, Thunder Bay

Please take a few minutes to complete this questionnaire and leave it with a Public Information Session representative. The City of Thunder Bay is interested in hearing your comments and questions regarding the proposed Boulevard Lake Dam Rehabilitation Project.

1. Where do you live?

☐ **City of Thunder Bay** ☐ **Other**

2. Do you have any comments on the study information presented and/or the preliminary recommended design?

____

____

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____

3. Do you have comments about the construction phase of the Boulevard Lake Dam rehabilitation project?

____

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____

____

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4. Do you have comments about environmental effects and mitigation measures presented?

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____

5. Do you have any other comments or questions at this time?

____

____

____

____

____

If you would like City of Thunder Bay personnel to provide follow-up information or address questions, please leave your name and address below. ***Please print clearly.***

Name ___________________________________ Phone number __________________________

E-mail Address ____

Street address ____

City ___________________________ Postal code _____________________

Please leave your completed form with a Public Information Session representative. You may also send the form by fax, e-mail or mail to:

Mike Vogrig, Project Engineer
City of Thunder Bay
111 Syndicate Ave S.
Thunder Bay, Ontario
P7E 6S4
Tel: 807-625-4321
Fax: 807-625-3588
E-mail: mvogrig@thunderbay.ca

Thank you for participating in this study. To review the information on the boards presented tonight please visit our website at:
http://www.thunderbay.ca/Living/recreation_and_parks/Parks/boulevardlake.htm

Comments and information regarding this study are being collected to assist the City of Thunder Bay in meeting the requirements of the Environmental Assessment Act. With the exception of personal information, all comments will be included in the Environmental Study Report and will become part of the public record.

CITY OF Thunder Bay
Superior by Nature

APPENDIX H

Copy of Project Web Page

BOULEVARD LAKE DAM REHABILITATION PROJECT

Boulevard Lake is one of the City's most treasured parks for recreation and special events. Like any other City facility, Boulevard undergoes regular maintenance so it can continue to meet the needs of everyone who uses it.

The City has determined that repairs and improvements are necessary for the Boulevard Lake Dam, an important structure that creates the lake. Before the City proceeds with the upgrades, it will complete a Municipal Class Environmental Assessment to identify potential environmental effects on the surrounding area and to give community members an opportunity to comment on the project.

PUBLIC INFORMATION SESSION #1

On Tuesday, June 14, 2016 the City hosted a public information session in collaboration with members of its consulting team from Arcadis Canada, JML Engineering, and Northern Bioscience. You are invited to view the presentation from the session to learn more about the project:

Adobe PDF, 20 pages, 1.30 MB

A comment card about the proposed rehabilitation project was distributed at the session. If you missed the event, we invite you to complete the comment card on or before July 8, 2016:

Boulevard Lake Dam Rehabilitation Project Comment Card

A Boulevard Lake Dam and Park User survey was also distributed at the session. The user survey will help the project team understand the effect of the dam rehabilitation on park use and activities. We invite you to complete the user survey on or before July 8, 2016:

Boulevard Lake Dam and Park User Survey

Contact Us: We welcome questions and comments. Please contact Mike Vogrig, Project Engineer at 625-4321 or mvogrig@thunderbay.ca for more information about the project.

APPENDIX I

Letter from NSSA

NORTH SHORE Steelhead ASSOCIATION

PO Box 10237
Thunder Bay, ON P7E 6T7
phone 807.475.7712

fax 807.475.7712
e.mail northshoresteelhead@gmail.com
visit northshoresteelhead.com

Mr. Mike Vogrig
Project Engineer
City of Thunder Bay
Victoriaville Civic Centre
111 Syndicate Avenue South
Thunder Bay ON
P7E 6S4

Wednesday, 13 July 2016

Dear Mike

Re: Schedule C Class Environmental Assessment for Proposed Boulevard Lake Dam Rehabilitation Project

Pursuant to the information session on June 14th 2016, and on behalf of the North Shore Steelhead Association (NSSA), the following summarizes our feedback and concerns.

We remain of the view that expanding the study on "Fish Occupancy" to include fish access and mobility to and from the lake would be appropriate. We anticipate either the Provincial or Federal authorities or both will eventually require the City, as the dam owner/operator to undertake a study pursuant to fish passage and prevention of harm to fish. We feel efficiencies and economies could be realised by conducting such a study. The objective would be to reveal any needed modifications to the Dam and/or Fishway necessary for the safe transfer of fish from the lake to the lower river and vice-versa.

Such a study could also establish the minimum water flow required to prevent harm to fish during spring and fall migrations and seasonal smolting, and establish timeframes when fish need to transit the dam. In our view adequate flows are required throughout the open water period ie. March to December to facilitate all salmonid movement. The study could also establish the water storage, in Boulevard Lake, that is required to ensure the minimum flow rate is maintained during periods of low precipitation or low flow rates of the Current River. This "reserve capacity" is necessary to prevent harm to fish, and would also enhance recreational use of the lake.

Contrary to statements made at the open house, Brook Trout are in fact capable of navigating the fishway. Experience in the field tells us that migratory Brook Trout successfully navigate other North Shore tributaries that have natural challenges, previously assumed to be barriers, which are more challenging than the fishway (assuming acceptable water flow rates). Brook Trout are capable of jumping 73.5cm barriers from 40cm deep plunge pools [Kondratieff & Myrick, American Fisheries Society 2006].

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visit northshoresteelhead.com

We believe an automated, remotely monitored solution will be needed to properly manage water flows and request that this eventuality is established as one design criterion for the dam rehabilitation project. To be clear, this will involve ensuring some design elements are incorporated during dam rehabilitation so that automation can be added without modification to the rehabilitated dam. NSSA is ready to partner with the City in order to realise an optimal flow management solution. This would include both knowledge sharing and fundraising efforts (for fishery specific projects).

Another issue that must be resolved, and makes most sense for it to be addressed during Dam rehabilitation, is the functionality of the fishway during low water conditions. Currently when the level of Boulevard Lake drops below the level of the fishway intake, the fishway ceases to function. In the past this has resulted in both power generation and recreation continuing at the expense of the fishery which of course is opposite of what is required by law.

We continue to have concerns about the absence of any barrier or system to prevent ingestion into the power turbine of young-of-the-year/smolting fish/post spawning adults returning to Lake Superior. The mortality rate of these fish is naturally high and the absence of any means of protecting fish is likely an important contributing factor to the slow recovery of the current river fishery. We recommend that the necessary research and engineering be accomplished prior to the rehabilitation project so that the solution can be implemented, at the latest, during Dam rehabilitation.

We recommend dam modifications should include elements that make it impossible for the Hydro Electric plant operator to unilaterally draw the level in Boulevard Lake below that required to maintain flow through the fishway. The fishery/fishway has priority to the available water i.e. the fishway must have the appropriate water flow rate, and Boulevard Lake have sufficient reserve capacity, to prevent harm to fish prior to any water being taken for any other purpose.

We note that generally, approval from the MNRF and/or DFO is needed prior to draining the lake. We would hope that such approval would be contingent upon the City executing a plan to actively manage and protect the fishery during the project.

NSSA has invested considerable time and resources in the Current River project over more than three decades. We remain convinced that the limiting factor of the fishery is protection of fish passage at the dam. We believe stable and adequate water flows combined with modifications necessary to prevent fish ingestion into the power turbine are needed prevent further harm to fish. In addition to the current run of Steelhead Trout, we believe the Coaster Brook Trout population can recover and there is potential for Pacific Salmon as well.

We remain available to provide any assistance we can and will appreciate receiving information on any developments as the EA process unfolds. We would also like to be involved at the design

NORTH SHORE
Steelhead
ASSOCIATION

PO Box 10237
Thunder Bay, ON P7E 6T7
phone 807.475.7712

fax 807.475.7712
e.mail northshoresteelhead@gmail.com
visit northshoresteelhead.com

stage, particularly the design of any elements associated with fish passage, water flow control, turbine ingestion prevention, and any other elements necessary to prevent harm to fish.

Sincerely

Frank Edgson

Frank Edgson
Chair Current River Fishery Committee

c.c. NSSA Executive and General Membership

Current River Rainbow Trout History

NORTH SHORE Steelhead ASSOCIATION Conservation & Preservation

Background information:

Prior to the early 1900's the Current River which flows into Thunder Bay Harbour (AOC) was a free flowing river with a healthy population of Brook Trout and no obstruction to fish migration. In the early 1900's the former City of Prince Arthur's Landing (Port Arthur) decided to construct a dam in order to produce hydroelectricity and to develop the area around the flooded land into a park for the community to enjoy. This construction effectively destroyed the spawning runs of Brook Trout in the Current River. In 1912 Rainbow Trout were introduced into McVicar's Creek in the District of Thunder Bay by the Department of Natural Resources (OMNRF) and in the years following established self sustaining populations in all of the rivers along the North Shore of Lake Superior. Although the Dam on the Current River was rebuilt several times over the years due to flood damage however; there was no effort made to preserve the existing fisheries at that time.

In 1991 the NSSA gained approval to build a fish ladder on the existing dam for the purpose of developing a self sustaining population of Rainbow Trout. Our project partners included the City of Thunder Bay, the Ministry of Natural Resources (MNR), the Lakehead Regional Conservation Authority (LRCA) and the Ministry of Northern Mines and Development (MNMD), and the Great Lakes Clean-Up Fund, who together invested $345,000.00, of which $129,000.00 was provided by the NSSA. The fish ladder was completed in the spring of 1992. Additional remediation of the river bed was done in 1995 with funding secured from the Remedial Action Plan (RAP) in conjunction with the NSSA's contribution of $43,000.00.

In the years 1993-1997 approximately 100 adult Rainbow Trout were captured in the McIntyre River and McVicar Creek and transferred to the upper regions of the Current River with the expectation that these fish would spawn and thereby stock the river system. These fish were tagged and several of these tagged fish were subsequently captured in other rivers in Thunder Bay indicating that they were able to descend the dam successfully. Also in operation during this time was an upwelling box which was successful in rearing 12,000 fry over the two years of operation. Electro-fishing in the subsequent years of 1993 and 1995 revealed numerous young of the year Rainbow Trout in all locations tested. All seemed well and we expected to see fish attempting to ascend the river in the years 1998-1999. By 2000 we were concerned because there was no visual evidence of fish migration. To validate our concerns we purchased and installed a Video camera in the fish ladder expecting to capture fish migrating on videotape. We reviewed the 30 days worth of tapes and did not see a single fish pass over the last step in the ladder. In 2001 our members attempted to capture by means of angling, adult Rainbow Trout that should have been schooling up at the mouth of the river, with the idea that we would implant electronic monitors and track the movement of the fish as it attempted to ascend the river and thereby determine if the fish could migrate past the Cumberland St. falls and locate the existing fish ladder. All of the other urban rivers had a run of Rainbow Trout during this time. Unfortunately, no fish were caught by angling, so the Ministry of Natural Resources attempted to net Rainbow Trout in the river, and this effort also proved unsuccessful.

Current River Rainbow Trout History

In 2010 following a below average spring flow, the fishladder was shutdown in order to allow the water to be used for hydro generation as per the existing Permit to Take Water issued in 1992 by the Ministry of the Environment (MOECC). During the shutdown adult Rainbow Trout were observed to be trapped in the cells of the fishladder by members of the MNR, DFO, MOE, COTB, and the NSSA. These fish were captured by netting and transferred upstream into Boulevard Lake. Inorder to ensure fish passage the NSSA agreed to compensate the hydro producer the amount of 3580.00 + GST in compensation for revenue lost to the diversion of water to the fishladder. The City of Thunder Bay was subsequently fined for dewatering the lower river and causing a fish kill by the MOECC. In an effort to prevent further disputes the MOECC applied for a new PTTW on Oct. 4th 2012 (EBR 011-7286) which would ensure that suitable water flows would be established to maintain riverine conditions in the lower Current River. However, this protection will only protect the Walleye population in the lower river and does not ensure suitable water is available for migratory species such as Brook Trout and Rainbow Trout which is in contravention of the Federal Fisheries Act. Subsequently the application to the EBR was cancelled and a new Permit applied for by the COTB on June 20th of 2014 (EBR 012-2012). This permit has yet to be approved.

Prepared by: Frank Edgson
Secretary, North Shore Steelhead Association.

APPENDIX J

Consultation with Aboriginal Communities: Correspondence

Boulevard Lake Dam

Class Environmental Assessment

MNO Information Exchange

April 26, 2017

Boulevard Dam - Overview

- Built approximately 100 years ago
- Owned and operated by the City of Thunder Bay
- Associated waterpower facility is operated by The Power Producer under a lease from the City of Thunder Bay
- Located approximately 700 m upstream of where the Current River discharges into Lake Superior
- The existing dam structure is approximately 112 m long and is oriented in an east/west direction
- Concrete construction with a series of concrete spillways and a series of log controlled sluices
- East approach is concrete retaining wall and west approach is 440 m rock berm

Boulevard Dam - Overview

- 1970s post tension anchors installed in each buttress to address risk of floodwaters associated with regulatory storm event
- Fish ladder installed to facilitate movement of Steelhead Salmon for spawning upstream
- Walkway on top of dam used as part of trail system
- Dam created Boulevard Lake which is a recreational resource used by residents
- The Boulevard Lake Dam is operated twice a year outside of actions taken during isolated weather events and maintenance requirements. Water levels are drawn down in fall and raised in summer.

Sluice Gates

CITY OF Thunder Bay Superior by Nature

Upstream side; Sluice Gates

Downstream; Sluice Gates

Downstream Spillways

History of Boulevard Dam Project

- Boulevard Lake Dam was constructed in the early 1900's
- Several structural modifications over the past 100 years
  - Most significant was the installation of post-tensioned steel tendons concurrent with construction of additional sluiceways in 1963
- Boulevard Lake Dam is an aging structure:
  - The last major restoration project was completed in 1976, when four sluiceways were constructed in order to pass the Regulatory Flood.
  - Minimal maintenance has been performed since then.
- Original Condition Assessment of the Dam complete in 2000 by JML Engineering and updated in 2008
- Condition assessment identified potential issues with:
  - Deterioration of concrete all over the structure
  - Ability of dam to withstand flood waters associated with regulatory storm in accordance with the Lakes and Rivers Improvement Act (LRIA)
  - Some issues associated with use of walkway across dam
- Initial iterations of project identified project activities as Schedule A+ under the Municipal Class EA
- Project File report submitted in March 2015 and found deficient by MOECC in a number of areas
- EA being restarted to resolve deficiencies

Problem Assessment

- Protective concrete exterior of dam infrastructure is deteriorating and needs rehabilitation
  - Severe spalling and delamination of the east retaining wall
  - Severe cracking and significant separation of the upstream concrete facing wall from the upstream face of the dam at the spillways
  - Soft concrete, spalling, delamination, and erosion at numerous buttress locations
  - Significant spalling, cracking, and erosion throughout the spillway and sluiceway aprons, and at the spillway slab
  - Spalling of the concrete slabs at the existing railing post locations and at a few locations at the underside of the sluiceway slabs
  - Severe longitudinal cracks at the spillway slabs

- Structural strength of dam is not sufficient to meet *Lake and Rivers Improvement Act (LRIA)* requirements for redundancies, should there be a regulatory storm event

Alternative Solutions

- Functionally different ways of solving the identified problem

- We Assessed Four (4) Alternatives:
  - Do Nothing
  - Rehabilitate the Dam
  - Reconstruct the Dam
  - Remove the Dam

- Do Nothing

  - No repairs to the dam would be made, and the concrete would continue to deteriorate at an accelerated rate
  - No redundancies in strength would be provided
  - The dam would continue to operate through stop log operations
  - Pedestrian traffic would remain unchanged at the dam
  - The dam will continue to perform satisfactorily for a limited horizon

- On balance negative effects of doing nothing outweigh benefits therefore, this alternative is eliminated from further consideration.

- Rehabilitate the Dam

  - All required concrete repairs would be completed and the *Lakes and Rivers Improvement Act* requirement for redundancies in strength would be met
  - Pedestrian traffic and movement across the dam would be improved
  - Stop log operations can be enhanced or replaced with gates to ensure the dam can adequately pass the Inflow Design Flood
  - Potential to look at opportunities to improve water quality depending on construction method chosen

- On balance benefits of dam rehabilitation outweigh the negative effects therefore, this alternative is preferred and is carried forward for more detailed consideration.

- Reconstruct the Dam

  - Construct a new dam upstream or downstream of the existing dam
  - The new structure would be designed to all applicable codes and standards
  - Flow control, fish passage, and power generation could be greatly improved
  - The existing structure would be demolished
  - Provision of new improved trail connection over new bridge and provisions of better connections onto and off of dam
  - Potential for significant disruption to recreational use of lake and power generation during construction period
  - Cost of reconstruction is significantly higher than for rehabilitation or removal

- On balance negative effects of dam reconstruction outweigh benefits therefore, this alternative is eliminated from further consideration.

- <u>Remove the Dam</u>

  - Completely remove all dam infrastructure and allow the Current River to return to its natural watercourse
  - Boulevard Lake, an important recreation area within Thunder Bay since 1909, would be eliminated
  - Removal of barrier against migration of invasive species, such as Sea Lamprey, up Current River
  - Removal of fish ladder and opportunity to facilitate migration of Steelhead
  - Removal of trail connection in this location
  - Removal of power generation capacity; termination of contract with private operator would incur financial penalty

- On balance negative effects of dam removal outweigh benefits therefore, this alternative is eliminated from further consideration.

Alternative Design Concepts

- Rehabilitation of the Dam is the preferred alternative to, therefore, alternative methods will include the following components:
  - Alternative ways to enhance strength of dam to meet *LRIA* requirements for redundancy
  - Alternative ways to repair the protective concrete
  - Alternative ways to achieve and enhance public access across the dam structure
  - Alternative ways to operate the dam to improve responsiveness and avoid conflict with recreational users
  - Alternative ways to undertake construction

- Each set of alternatives will be assessed and combined into an overall preferred alternative

Potential Evaluation Criteria

Environmental Component	Criteria
Natural	Change to aquatic species and habitat
	Change to function/operation of existing fish ladder
	Change to terrestrial habitat
	Change to water quality
Social	Change to recreational opportunities available in Boulevard Park
	Change in recreational opportunities available in Boulevard Lake
	Change to operation of small hydro generation
	Potential for nuisance effects associated with construction (noise, odour, dust, traffic, access, etc.)
Technical	Ease of construction
	Duration of construction
Cost	Capital Cost
	Operation and Maintenance Cost

Baseline Studies - 2016

- Bathymetry
- Vegetation and Flora
- Fish Occupancy
- Soils and erosion
- Hydrology
- Water quality
- Odour
- Archaeology/Built Heritage Resources and Landscapes
- Survey of Dam/Park Use

Walkway and Stop Logs

SUPPORTING DOCUMENT 1

Boulevard Lake Aquatic and Terrestrial Environmental Report 2016

Boulevard Lake Aquatic and Terrestrial Environmental Report 2016

December 11, 2018

Prepared for:
City of Thunder Bay

Prepared by:
Allan Harris

NORTHERN BIOSCIENCE
ECOLOGICAL CONSULTING

EXECUTIVE SUMMARY

This report describes aquatic and terrestrial studies completed in 2016 to support an environmental assessment for repairs to the Boulevard Lake dam.

Boulevard Lake covers about 61.5 ha at high water but under the water management plan typically drops to 44.8 ha in winter. During high water, about 70% of the lake is less than 2 m deep and 3% is greater than 5 m deep.

Dissolved oxygen levels in August 2016 were above 6.8 mg/l (with the exception of a single reading of 5.25 mg/l in a deeper hole) and adequate for most fish species. Water temperatures were coolest (17.4° C) at the inflow of the Current River and warmed to 20° C to 21.5° C over most of the rest of the lake. Temperatures were similar at the surface and at the bottom except where the river inflow penetrated the north basin of the lake, where the surface water warmed more quickly than the deeper water. These temperatures are within the optimum range for Northern Pike and Walleye but marginally high for trout, except at Current River inflow. Temperature and oxygen data indicate that the lake was not stratified.

Most of the lake has sparse (<25% cover) or no aquatic vegetation but some dense patches of pondweeds are present, particularly the between the 1 m and 2 m depth contours.

About a third of the shoreline is marsh most consisting of a narrow fringe of sedges or cattails. About 25% of the shoreline is artificially hardened (riprap, breakwall and dam) and another 5% is maintained as lawn.

The lake supports a cool water fish community with White Sucker, Northern Pike, Walleye and Yellow Perch. Young of the year of all these species were collected in 2016, indicating that spawning and/or nursery habitat is present. Rainbow Trout and Brook Trout were not observed in 2016 but inhabit the Current River above and below the lake and may occupy parts of the lake at least seasonally. The dam prevents most fish species from moving upstream but fish can move to and from the Current River upstream of Boulevard Lake.

Boulevard Lake Park includes 51 ha of mature mixed forest. The remainder is mostly open lawn and developed areas. The breeding bird community includes warblers, sparrows, and vireos. Flocks of migrating Canada Goose and other waterfowl use the lake and lawns for feeding and staging, especially in the spring and fall. The park may act as a corridor for animals moving from the largely forested area to the north to the Lake Superior shoreline. A provincially rare plant, Scabrous Black Sedge, grows on the east side of the lake. Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline may be present on the Current River upstream of Boulevard Lake.

Contents

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INTRODUCTION

This background report describes studies on aquatic habitat, the fish community, and the terrestrial environment to support an environmental assessment of impacts related to repairs to the Boulevard Lake dam.

METHODS

Study Area

The aquatic study area extends from the dam upstream to the lowest set of rapids on the Current River. This is the upstream extent of the zone of influence defined in the Water Management Plan (OMNR 2006). The terrestrial study area includes the park with emphasis on forested areas and areas near the dam that could be disturbed during dam repair (Figure 1).

Background Data

Existing data on the fish community, aquatic environment, wildlife, and vegetation of Boulevard Lake, the Current River, and surrounded areas were summarized from existing sources. The Natural Heritage Information Centre (NHIC 2016) and Breeding Bird Atlas (BBA 2016) databases were queried for records of species at risk in the two squares overlapping the park (16CU36 and 16CU37). Species at risk include including those listed under Ontario's Endangered Species Act or the federal Species at Risk Act as well as provincially rare species listed by the Natural Heritage Information Centre. This report incorporates the results of a preliminary assessment completed in 2015.

Bathymetry

Lake depths were measured using a Garmin depth finder (Fishfinder 2300C) and GPS (Garmin GPSMap 60cx). Transects were paddled across the lake with a canoe in May 2016 when water levels were close to the annual maximum. The lake boundaries were mapped by recording a GPS track while walking the water edge (approximating the high water mark). About 13,000 readings were recorded, each with a depth and UTM coordinate.

Lake levels varied during fieldwork and depths were standardized using the daily surface water elevation readings at the Boulevard Lake dam. Standardized depths were then converted to lakebed elevations.

Point data were converted to an elevation layer using Arcview Spatial Analyst. Depth contours were created at 50 cm intervals and at the following critical elevations:

1. Potential minimum lake level during dam repairs: 208.3 m
2. Alternative lake level during dam repairs: 209.5 m
3. Normal minimum winter level: 210.34 m

The area of lakebed that will be potentially dewatered during dam repairs was estimated and mapped from contour data.

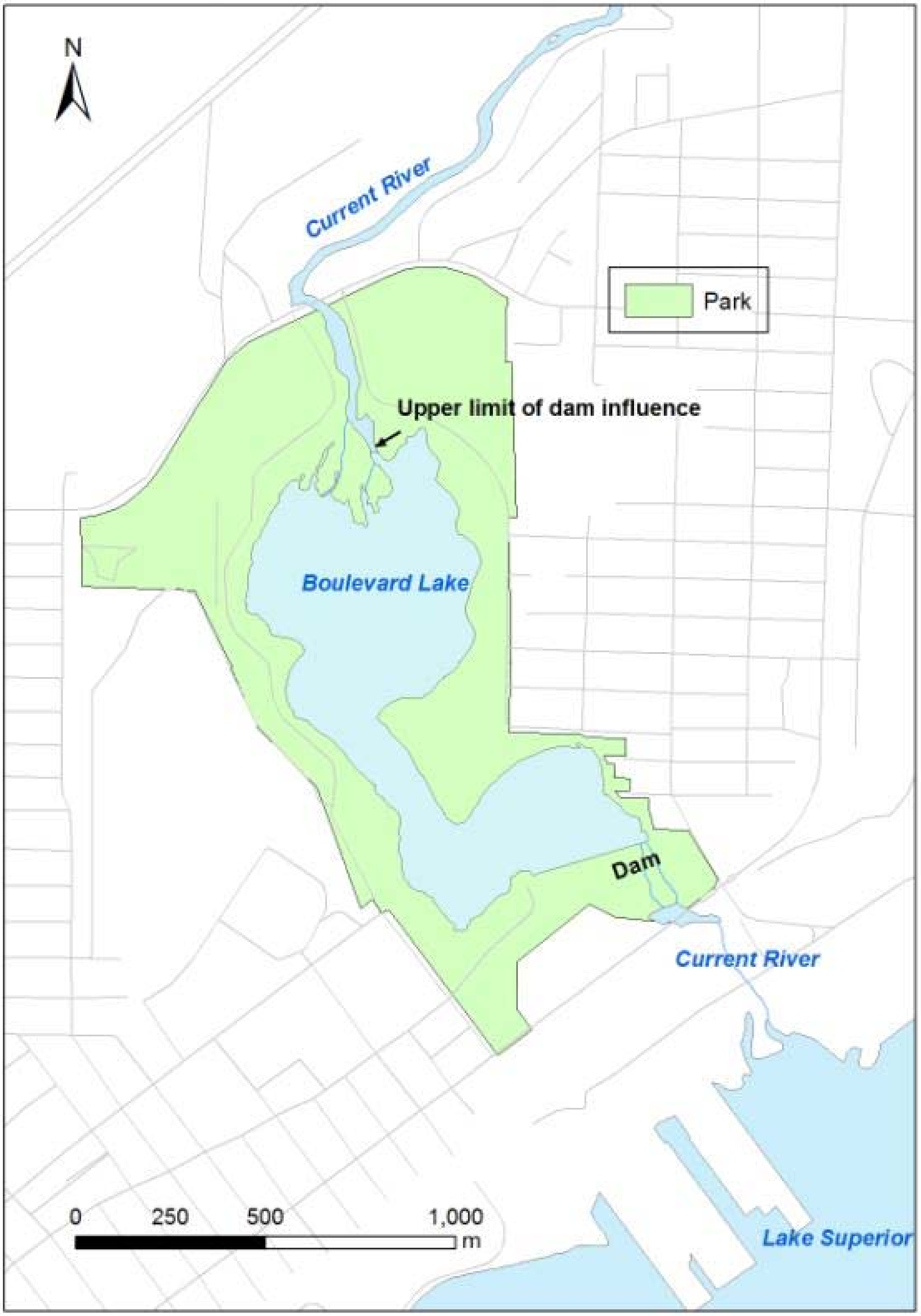

Figure 1. Boulevard Lake study area.

Aquatic Vegetation and Substrate

Underwater video for assessing aquatic vegetation and substrate was collected on July 16 2016 and August 12 2016.

Video was recorded using a canoe-mounted SeaViewer “Sea Drop 950” color video camera (with LED lighting), the “Sea Trak” GPS video overlay unit, and a video capture unit (DVR-SD) for storing the video to SD cards. This system allows for GPS coordinates and time/date to be overlain on the video as it is recorded, which allowed for precise georeferencing of all images. The camera unit was suspended by hand over the side of the boat using the kevlar-reinforced video cable.

A grid of 21 transects spaced approximately 75 m apart was surveyed (Figure 2). Approximately 7 km of underwater video was collected.

Videos were downloaded and viewed on-screen using custom software provided by SeaView as well as Windows MediaPlayer. Georeferenced sample points were extracted every 20 seconds (roughly 30 m) along the survey tracks and attribute data were entered into a spreadsheet, which was then brought into ArcGIS for mapping and analysis. The entire video footage was viewed during the analysis, and representative still images (jpeg) were extracted from the video (Figure 3). A total of 310 video points was extracted.

At each sample point the following was recorded:

- Submerged aquatic vegetation cover in the following classes: (i) none, (ii) sparse (< 25%, (iii) moderate (25%-75%) and (iv) dense (>75%);
- Vegetation group (adapted from the Ontario Wetland Evaluation System; OMNR 2013): floating leaved, Chara, waterweed, ribbongrass, coontail-naiad-milfoil, narrowleaf pondweed, broadleaf pondweed, Isoetid, other;
- Substrate type (silt, sand, gravel, cobble, boulder, bedrock, bark, log, other);
- Cover of woody debris (sticks, logs and bark).

Benthic Invertebrates

Benthic invertebrates were sampled at 21 points (Figure 2) on August 15 2016 using a petite ponar sampler. The same volume of substrate (2.4 l) was collected at each site. In some cases, several grabs were required to sample the full volume. Samples were sieved through a 100 micron mesh to remove silt and small organic debris and preserved in ethanol.

Dissolved Oxygen and Temperatures

Dissolved oxygen and water temperate were measured were sampled at 22 points (Figure 2, **Appendix 1**) on August 27 2016 using a YSI55 DO meter. Measurements were taken at the surface, at 1 m intervals, and at about 10 cm above the bottom. Temperature readings at springs and seeps were also taken during shoreline mapping fieldwork.

Fish Community

Fish sampling was conducted to characterize the late summer fish community and assess potential impacts of dam repair. Effort focused on the north end of the lake to avoid swimmers, dragon boats, and other recreational users.

Electrofishing

Electrofishing was conducted with a two-person crew using a Smith-Root LR-24 backpack electrofishing unit at selected sites at the north end of the lake. Seven sites were sampled, totalling 3759 seconds of shocking time at 500 V on August 8-9 2016 (Figure 2; Appendix 2).

Minnow traps

Small fish sampling was conducted using standard 9" diameter minnow traps baited with dog food. Traps were set near dusk on August 16 and checked in the morning on August 17 2016. Total sampling effort was 20 trap-nights (Figure 2; Appendix 2).

Seines

Beach seining was conducted in the evening of August 11 2016 with a two-person crew at four locations (Figure 2; Appendix 2). The seine net was 1.2 m x 8.5 m with a 5 mm (1/4") mesh.

Gill nets

Gill netting was conducted overnight at three sites (Figure 2;Appendix 2) using a small mesh River Index Net (Jones and Yunker 2009).

Shoreline Habitat

Shoreline habitat was mapped on August 27 2016. Shoreline (i.e. the approximate high water mark) segments were assigned to one of the following categories: beach, bluff, breakwall /dam, gravel, lawn, marsh, riprap, or wooded (see **Figure 4** for examples) and mapped in ArcGIS.

Terrestrial Vegetation and Wildlife

Terrestrial Vegetation

Terrestrial vegetation was mapped and described boreal ecosites (OMNR 2009). Emphasis was on patches of forest and areas that may be disturbed during dam repairs.

Ecosite data was supplemented with general descriptions of forest conditions including stand age, disturbance, and invasive species.

Songbirds and Wildlife

Bird point counts were conducted on July 01 2016 at seven sites in mature forest habitat in order to characterize the songbird community (

Appendix 3). Ten minute listening stations were conducted and all birds observed or heard were tallied by distance from the count centre (< 50 m, 50-100 m, and > 100 m).

Incidental observations of wildlife and wildlife habitat were made during other fieldwork. Terrestrial wildlife habitat was assessed using OMNR's Significant Wildlife Habitat guide (OMNR 2000).

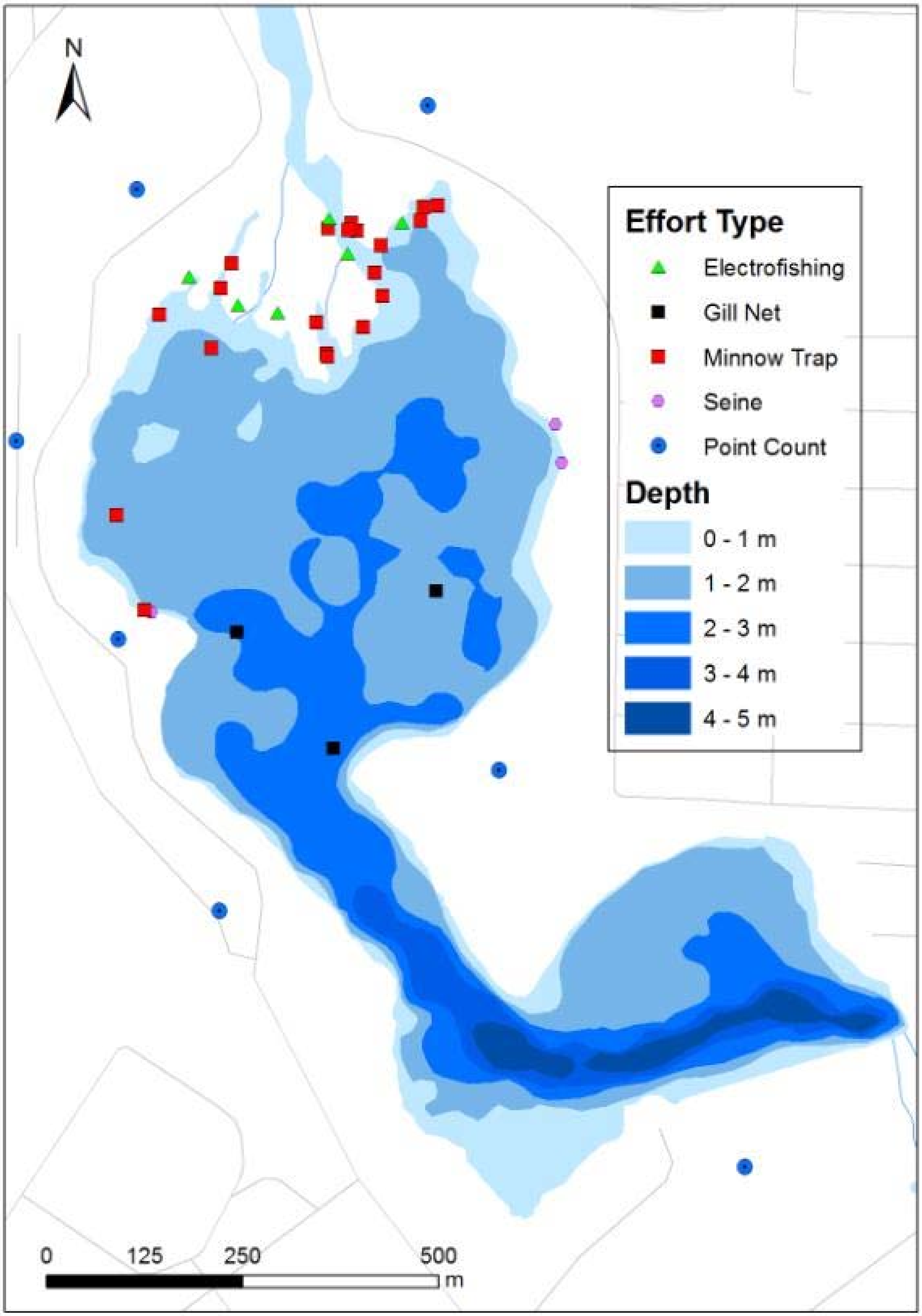

Figure 2. Sampling effort map. Boulevard Lake 2016.

Figure 3. Sample images from aquatic video. Boulevard Lake 2016.

Figure 4. Shoreline habitat classes. Boulevard Lake 2016.

RESULTS AND DISCUSSION

Aquatic Habitat

Boulevard Lake is in the Current River watershed, which covers about 650 km^2 and consists of 10 subwatersheds drained by three major streams: Current River, North Current River and Ferguson Creek (OMNR 2006). On average the river discharge at Stepstone (20 km upstream of the study area) is about 1 m^3/second in February rising to 13 m^3/second during the spring freshet in April and May (Figure 7).

The lake water is relatively clear (Secchi depth of 2 m), but varies with the amount of sediment in the inflow (unpublished OMNR lake survey data). The morphoedaphic index (an index of lake productivity based on total dissolved solids and mean depth) is 25.2. This is somewhat higher than the mean MEI of 18.9 for 160 lakes in Thunder Bay District that are less than 100 ha in size; however, MEI was not developed for use in small reservoirs with short residence times (unpublished OMNR lake survey data).

The Current River above Boulevard Lake drops over a series of bedrock shelves, separated by pools and rapids and ends in a shallow delta. Gravel and cobble bars are common at the estuary (
Figure 5).

The Current River downstream from the dam to Cumberland Street (about 200 m) consists of a bedrock shelf (about 70% of the channel) with small patches of cobble (about 30%) (Foster 2011). This reach is scoured by high flow during spring freshet, but less than half of the bankfull width is wetted during low flows (Foster 2011). The pools provide migration and feeding habitat for Walleye, Rainbow Trout, Brook Trout, White Sucker and other fish species even during low flows (Foster 2011). Spawning, nursery, and overwintering habitats are probably limited in this section due to the predominantly bedrock substrate, shallow water depth, and highly variable flow conditions. Spawning habitat for several fish species occurs at the estuary; about 200 m to 600 m downstream from the dam (see Fish Community).

Bathymetry

The surface area of Boulevard Lake at high water is about 61 ha and consists of main two basins separated by a narrows. The lake is shallowest at the north and south ends with a deeper channel following the former river channel through the narrows to the dam (Figure 8). About 70% of the lake is less than 2 m deep and about 3% of the lake is deeper than 5 m (when the lake is at the high water level). The maximum recorded depth was 5.3 m.

Most of the Current River inflow is through main channel at the northeast edge of the lake, but during high water, the river also spills through several overflow channels. In August 2016, the overflow channels were filled with backwater from Boulevard Lake but were separated from the Current River by cobble bars.

Drawdown zones of Boulevard Lake under different management options are shown in Figure 9 and summarized in Table 1. Portions of the lake above 210.34 m elevation are dewatered annually between about mid-October and mid-May (OMNR 2006), except when river inflow exceeds the dam's capacity to discharge water (as often happens during spring runoff). The lake area can decrease to about 44.8 ha from the summer high of 61.5 ha during this period.

During dam repairs, Option 1 would see the lake level drop to 208.34 m, resulting in a decrease in lake surface area to about 3.1 ha. Most of the lake will be exposed during dam repair except for the original location of the Current River channel (Figure 9). The approximate location of the channel is shown in Figure 9. Figure 6 shows a photo of the channel in August 2008 when a drawdown of similar magnitude occurred.

Under Option 2, the lake level would drop to 209.5 m, resulting in in a decrease in lake surface area to about 16.5 ha. Most of the north basin would be dewatered under this option.

Table 1. Approximate area of Boulevard Lake under water management options.

Elevation (m)	Description	Lake Area (ha)
Approx. 211.80	Summer (May – October)	61.5
Below 210.34	Winter (October – May)	44.8
Below 209.5	Dam Repair Option 2	16.5
Below 208.34	Dam Repair Option 1	3.1

Figure 5. Bedrock shelf at the mouth of the Current River at the north end of Boulevard Lake.

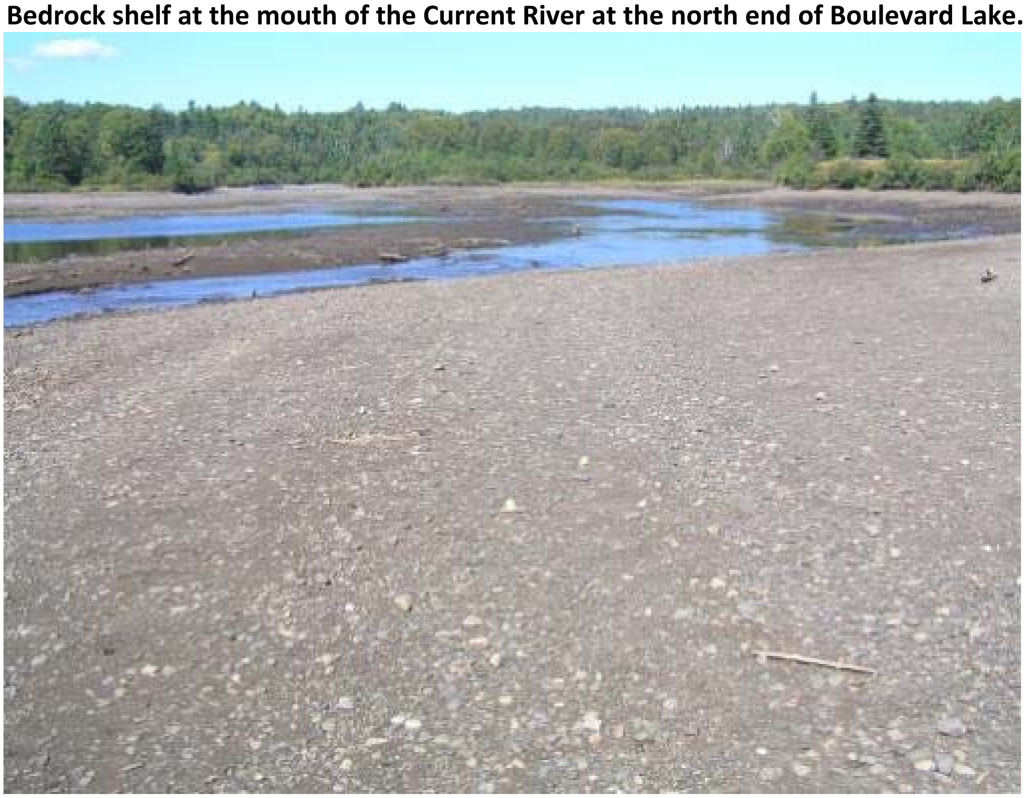

Figure 6. Boulevard Lake during drawdown on August 30 2008 showing the Current River channel.

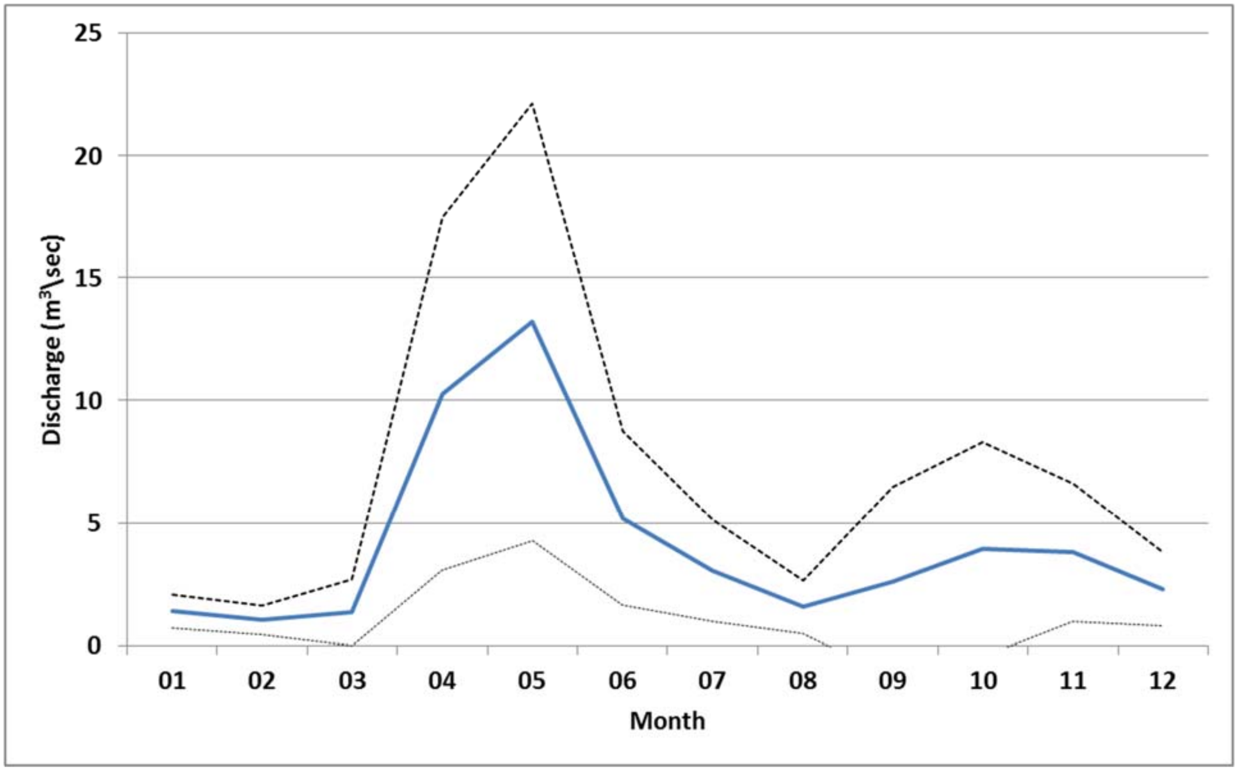

Figure 7. Mean monthly discharge of Current River at Stepstone (20 km upstream of the study area) 1972 to 2013 (data from Environment Canada 2015). Dashed lines are the mean plus and minus one standard deviation.

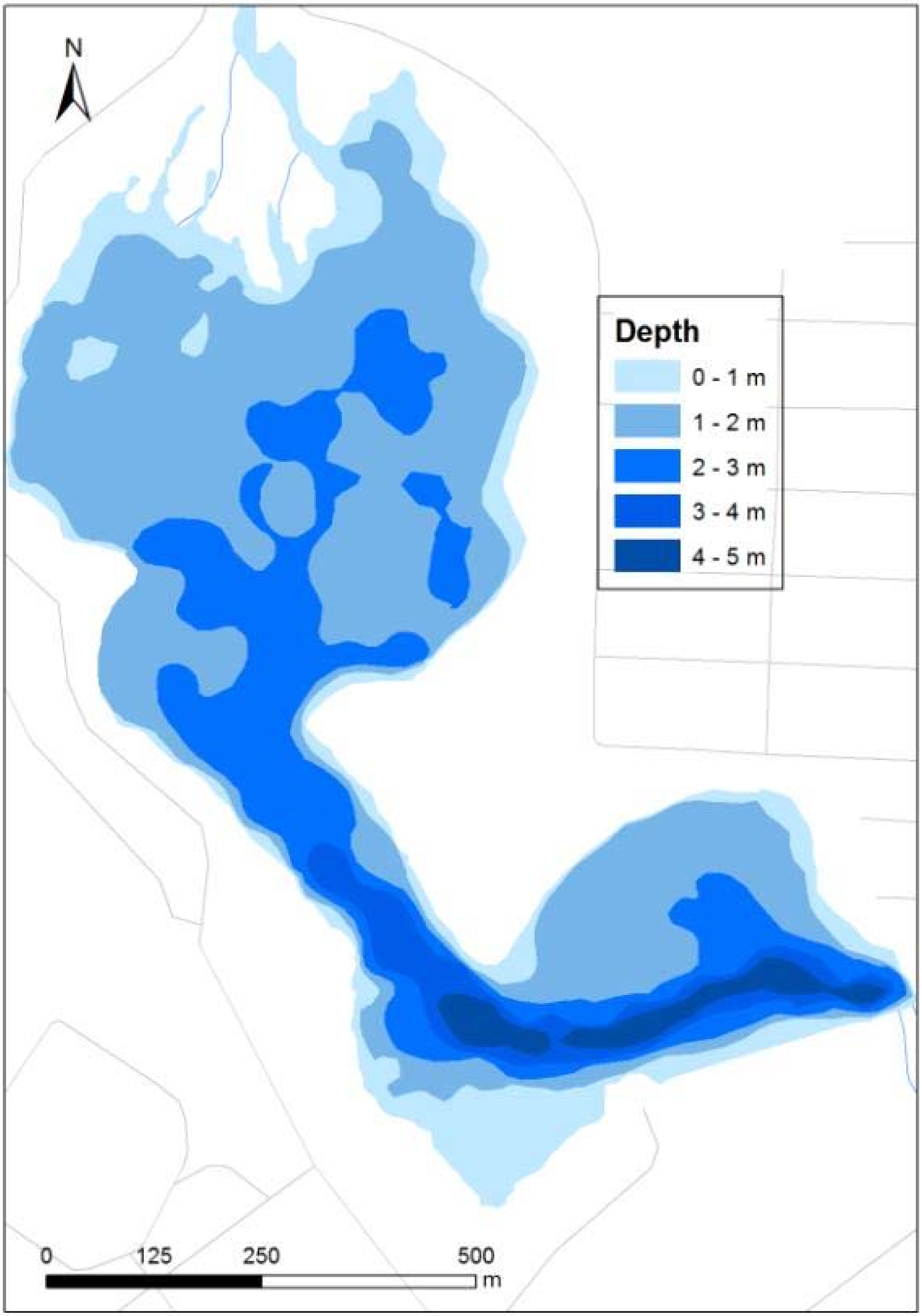

Figure 8. Boulevard Lake bathymetry map. May 2016.

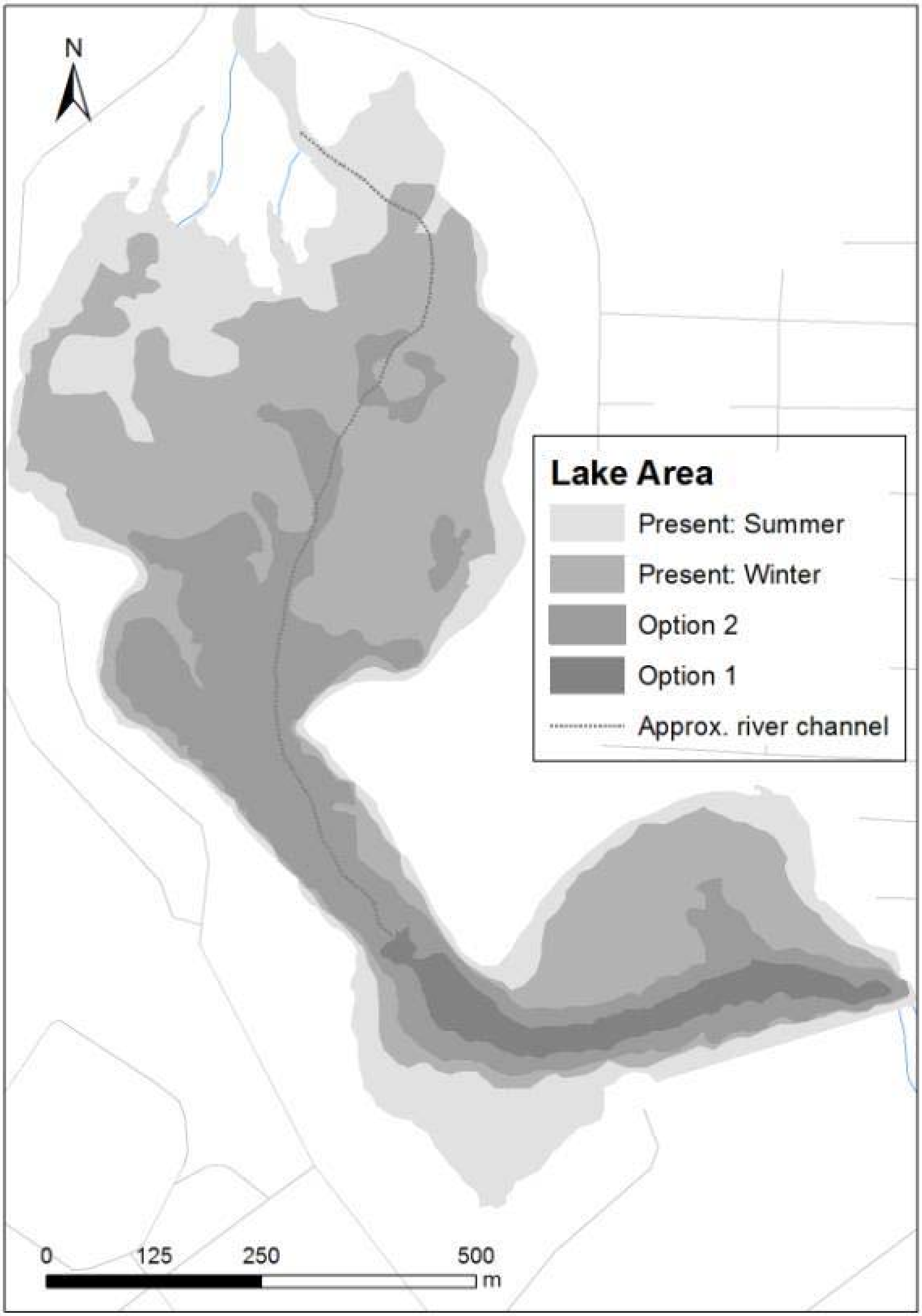

Figure 9. Boulevard Lake bathymetry map showing drawdown zones.

Dissolved Oxygen

Dissolved oxygen levels were highest (9.23 mg/l) near the inflow of the Current River at the north end of Boulevard Lake (Figure 10). Surface oxygen levels were generally higher than those near the bottom of the lake. The lowest values (5.25 mg/l) were observed at a depth of 3.5 m just above the dam.

Levels were generally above critical levels for freshwater aquatic life in warmwater lakes and streams (6 mg/l for early life stages; 5.5 mg/l for other life stages; Canadian Council of Ministers of the Environment 1999), except perhaps in water greater than 3.5 m deep. Oxygen levels probably vary throughout the year depending on water temperatures, ice cover, and inflow.

Water Temperatures

Water temperatures measured on August 27 2016 were probably close to the annual maximum but vary with weather and rate of discharge from the Current River. Surface water temperatures were coolest (17.4^{o} C) at the inflow of the river at the north end of Boulevard Lake, and warmed to between 20^{o} C and 21.5^{o} C elsewhere (Figure 11). Temperatures at the lake bottom were similar to surface temperatures except where the cooler water from the Current River tracked through the north part of the lake to the narrows (Figure 11).

Cooler temperatures (as low as 9.9 ^{o}C) were measured at a series of seeps along the northwest shore of the lake (Figure 14).

The relatively similar temperatures (and dissolved oxygen) levels at the surface and bottom suggests that Boulevard Lake does not stratify, not surprising given the relatively shallow waters and high turnover with river inflow.

In August 2016, much of the lake was within the optimum temperature range for Walleye (20 ^{o} C to 24 ^{o} C; McMahon *et al.* 1984) and Northern Pike (19^{o} C to 21^{o} C; Harvey 2009) but warmer than preferred by Brook Trout and Rainbow Trout, which prefer water less than about 20^{o} C and 18^{o} C respectively (Scott and Crossman 1973; Raleigh *et al.* 1984). Cooler water near the Current River inflow could provide late summer thermal refuge for trout. Submerged upwellings of cooler groundwater may also occur.

The potential effects of a summer drawdown on lake temperatures are described below. Water will have a shorter residence time in the lake and therefore will have less exposure to sunshine and less time to warm up. The surface area of the lake is expected to decrease from a maximum of about 61.5 ha to 3.1 ha and the warming effect in shallow waters will be reduced. The shading effect of shoreline trees and shrubs will be reduced but that effect is probably small even at high water levels because only about 9% of the lakeshore is wooded (Figure 14). The net effect will probably be somewhat cooler temperatures, but given its smaller volume, the lake temperature will probably change more quickly with changing air temperatures and inflow temperatures.

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Aquatic Vegetation

Most of the lake has sparse (<25% cover) or no aquatic vegetation (Figure 12). Of the 310 sample points, 69% (n=214) had no aquatic vegetation and 21% (n=64) had sparse vegetation. Most of the sample points with moderate (25% to 75% cover; n=20) or dense (>75% cover; n=12) are between the 1 and 2 m depth contours, particularly in the south end of the lake (Figure 12). Development of submergent vegetation in shallower water may be limited by the winter draw down, which has the potential to damage roots and rhizomes by desiccation, freezing, or ice scour. Submergent species include various pondweeds (*Potamogeton* spp.), Slender Naiad (*Najas flexilis*), Arrowhead (*Sagittaria* sp.), and others.

Substrate

Most of the substrate of Boulevard Lake was classified as silt (including sites with a thin film of silt over sand or gravel) (Figure 13). Boulder, sand, and cobble are largely restricted to shallow areas near the shores. The lakebed is largely flat and featureless. Scattered boulders are found throughout the south basin and logs and other woody debris deposited from the river are common in the north basin.

Shoreline Classification

The shoreline classification is summarized in Table 2 and Figure 14. The total shoreline length was 5010.0 m.

About a third of the shoreline is marsh, concentrated at the north end of the lake (Figure 14, Table 2). Most of the marsh consists of a narrow fringe of sedges (*Carex* spp.) or cattail (*Typha* spp.) backed by lawn or forest (**Figure 4**). A few larger patches of emergent marsh are found near the inflow of the Current River. Many of the marshes are flooded during high water but do not extend into the lake and are therefore inaccessible to fish when water levels drop during winter drawdown and summer low water events. A small wetland (about 0.4 ha) with cattail marsh and submergent vegetation occurs in a basin on the east side of the lake. The marsh is connected to Boulevard Lake through a culvert when the lake level is high, but more or less isolated during low water.

About 25% of the shoreline is artificially hardened (riprap, breakwall and dam) and another 5% is maintained as lawn. Beaches make up 16% of the shore.

Table 2.Shoreline classification summary. Boulevard Lake 2016.

Shoreline Class	Length (m)	%
Beach	792.8	16
Bluff	17.8	<1
Breakwall/dam	723.4	14
Gravel	398.4	8
Lawn	264.6	5
Marsh	1765.3	35
Riprap	572.4	11
Wooded	475.4	9
Total	**5010.0**	**100**

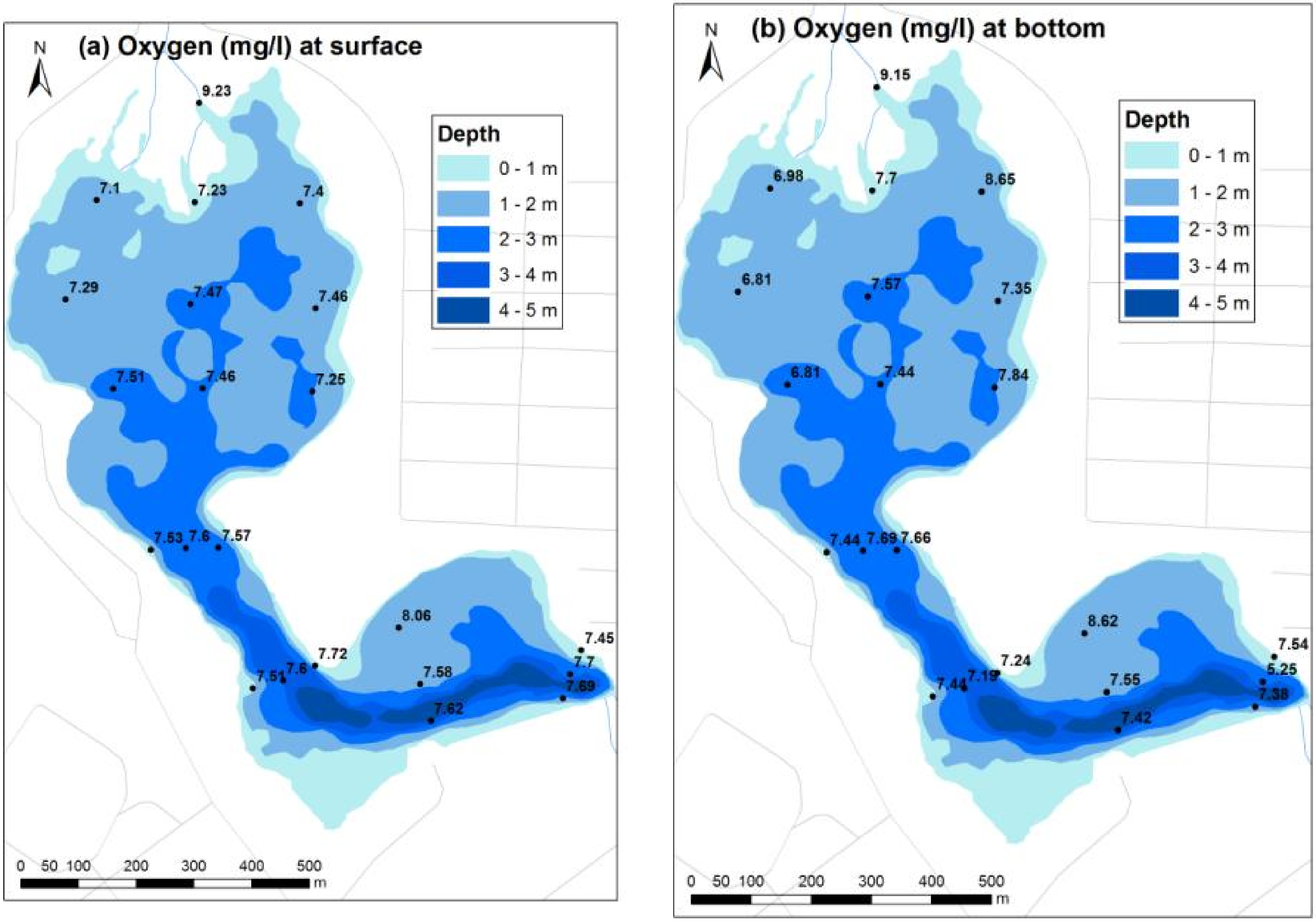

Figure 10. Dissolved oxygen. Boulevard Lake, August 27 2016.

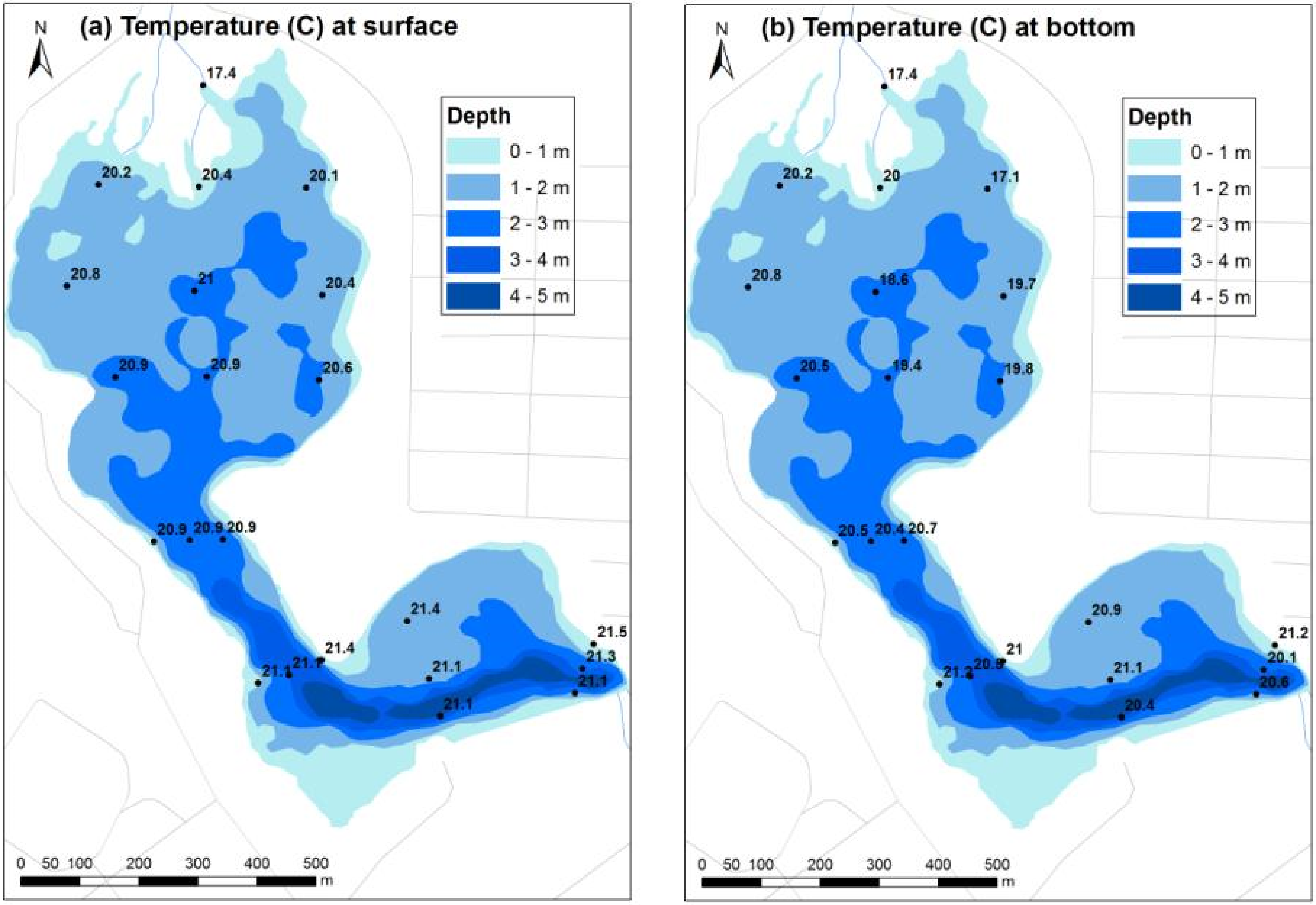

Figure 11. Water temperatures. Boulevard Lake, August 27 2016.

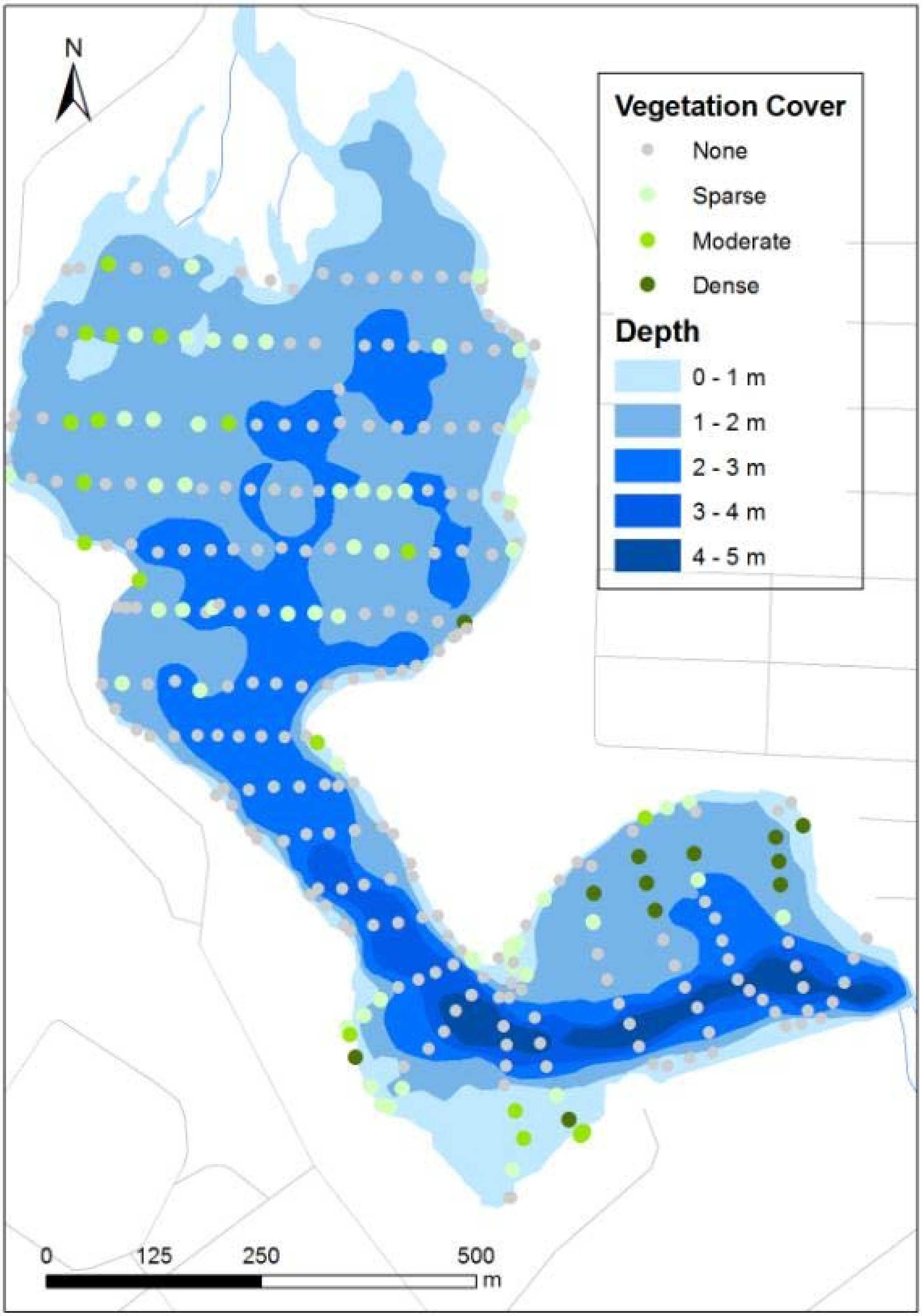

Figure 12. Aquatic vegetation map. Boulevard Lake 2016.

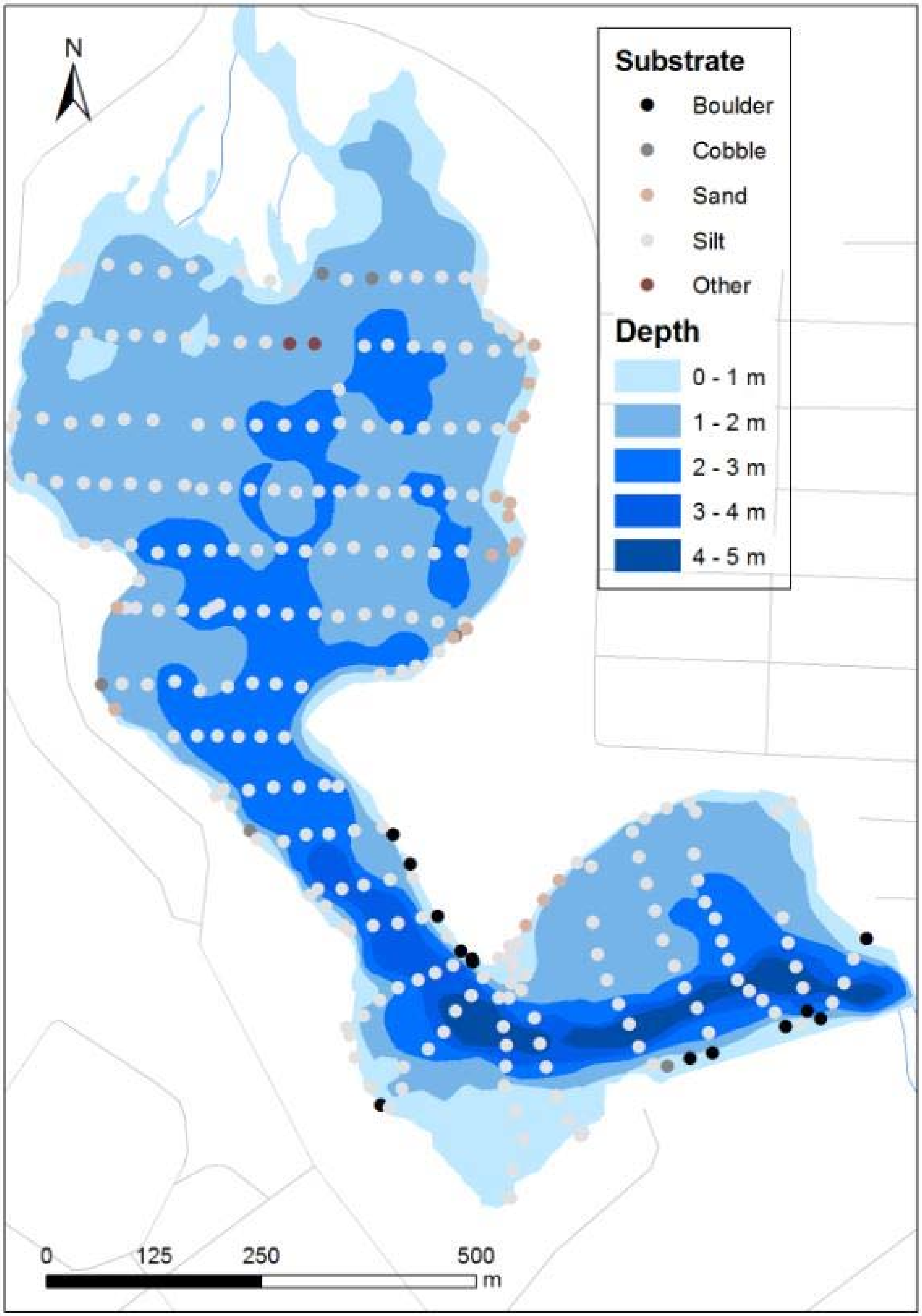

Figure 13. Substrate map. Boulevard Lake 2016.

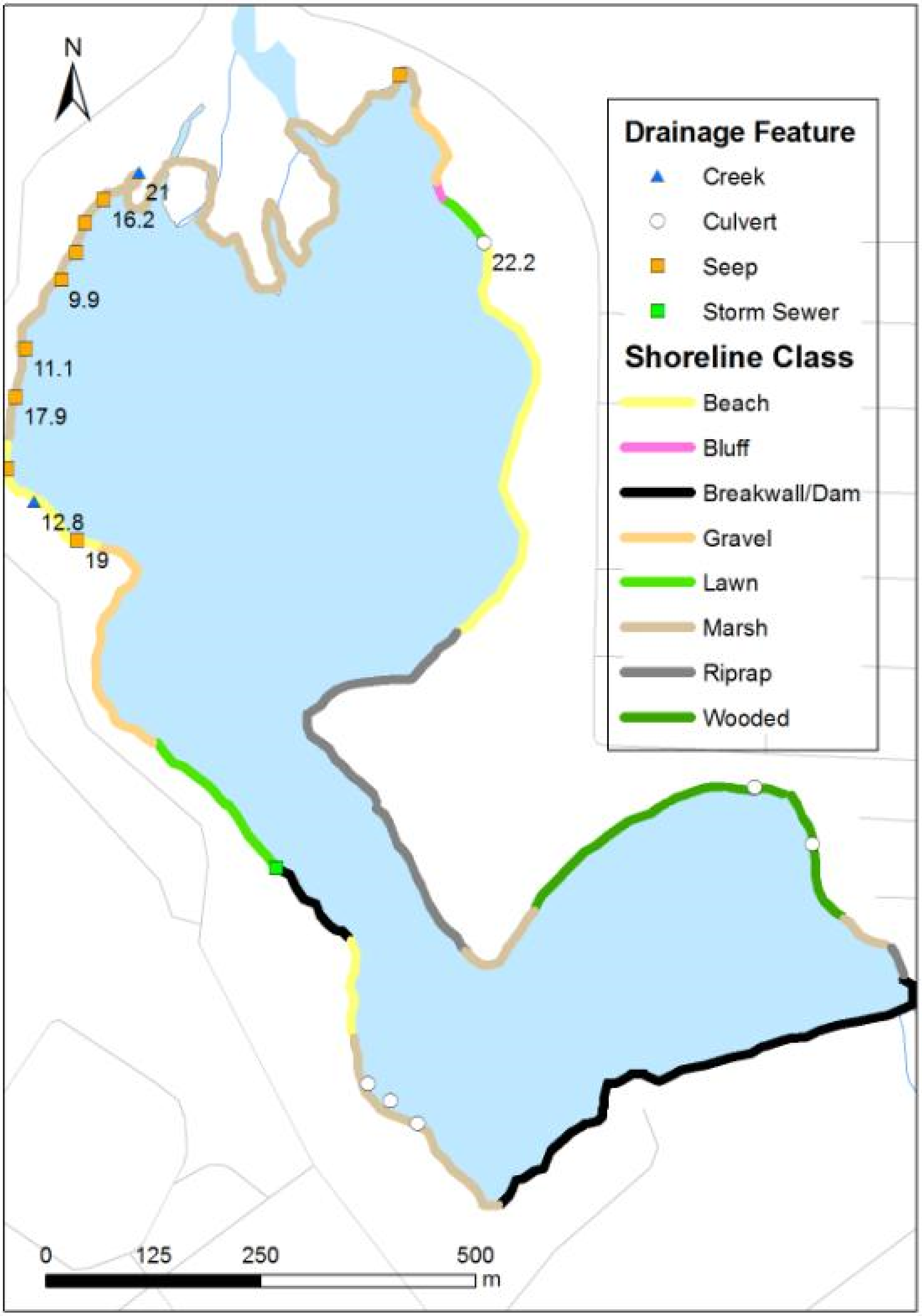

Figure 14. Shoreline classification. Numbers are water temperatures (°C) at seeps and springs. Boulevard Lake 2016.

Fish Community

Fourteen fish species have been documented from Boulevard Lake, of which 12 were observed in the present study. An additional seven species have been recorded in the Current River below the dam and eight more in the river upstream of Boulevard Lake (Figure 1; Appendix 1 to **Appendix 8**). Sampling effort in the lake to date has been relatively light and more effort may discover additional species.

Boulevard Lake has a cool water lake fish community where the large fish species include White Sucker, Northern Pike, Walleye, and Yellow Perch. As described above, late summer water temperatures are optimal for Walleye and Northern Pike but marginally high for Brook Trout and Rainbow Trout. Dissolved oxygen levels are unlikely to limit fish species. The physical habitat of most of the lake is relatively uniform with flat, fine textured substrate and patches of submergent vegetation especially in the 1 – 2 m depth range. Islands, shoals, and extensive wetlands are lacking. The north end of the lake at the Current River mouth has coarser substrate (cobble and gravel), cooler water, and higher dissolved oxygen and supports several fish species not observed elsewhere.

Fish can move downstream from the Current River into Boulevard Lake and the presence of fish species does not necessarily indicate that the lake provides year-round habitat. Some species may occupy the lake seasonally or opportunistically, or represent transient individuals.

The following is a discussion of the large fish species and their habitat.

White Sucker

White Suckers were the most common species observed during gill netting; 26 adults were collected. Most were collected in 2 – 3 m of water. Size ranged from 30 g to 1670 g, suggesting that multiple year classes are present. In contrast, only a single young-of-the year White Sucker was collected during electrofishing. Potential White Sucker spawning habitat is present at the estuary of the Current River at the north end of Boulevard Lake but spawning has not been documented. The fact that only a single young of the year was collected (young suckers often make up a large proportion of small fish samples) suggests that there was a poor year-class in 2016 or that spawning does not occur in Boulevard Lake.

Northern Pike

Two young Northern Pike were collected during electrofishing in the overflow channels at the north end of the lake and several others were observed but not captured. The two captured fish were 165 mm and 250 mm, the smaller of which is within the upper size range for a young of the year, suggesting that shallow areas of the lake function as nursery habitat. Adult pike are also present; a large (approximately 1 kg) adult was found dead in late August and pike are sometimes caught by anglers in Boulevard Lake (Jeff Black pers. comm.). Pike spawn on flooded vegetation in early spring. Access to this habitat depends on high water levels just after ice out, and may be limited under the present waster regime.

Walleye
Two adult (100 g and 220 g) and one young of the year Walleye were collected in the 2016 survey. A large (approximately 1 kg) adult was also found dead in late August. Potential Walleye spawning habitat is present at the estuary of the Current River at the north end of Boulevard Lake but spawning has not been documented. They are known to spawn at the mouth of the Current River (Bobrowicz 2011), but the dam is an impassable barrier for upstream movement of Walleye (as well as White Sucker and other non-jumping fish species). Walleye are found upstream in Onion Lake and throughout the upper Current River and may move downstream from the upper Current River to the river below the dam and therefore contribute to recovery of stocks in Thunder Bay (Foster 2011). The reflooding of Boulevard Lake in late May typically occurs near the end of the Walleye spawning period. Temperature and dissolved oxygen levels in August 2016 were suitable to support Walleye populations.

Yellow Perch
Yellow Perch was the second most common species observed during gill netting when 15 adults were collected. Size ranged from 30 g to 300 g, suggesting that multiple year classes were represented. A young of the year was collected in a minnow trap. Typical spawning habitat (submergent vegetation) is present in water less than about 2 m deep, especially in the south basin.

Rainbow Trout
No Rainbow Trout were observed in the present study but they spawn in the Current River below Boulevard Lake and were introduced into the upper Current River in the early 1950s (Beak Consultants Ltd. 1990) and again in the early 2000s (Addison 2007). Lake-run Rainbow Trout (steelhead) have been observed using the fish ladder during the spawning season, but high flows may prevent them from passing in some years (Jeff Black pers. comm.). Numbers of fish and spawning locations upstream of the dam are unknown. Young fish observed in the Current River may represent a non-migratory, resident population or the offspring of migratory individuals (Addison 2007). Rainbow Trout typically spawn in April when water temperatures reach 10^{o}C to 15.5^{o}C (ref). The spawning run occurs before reflooding of Boulevard Lake.

Boulevard Lake has a low habitat suitability index for Rainbow Trout (Beak Consultants Ltd. 1990) but is suitable for passage of spawning adults and smolts returning to Lake Superior.

Brook Trout
Brook Trout occur upstream and downstream of the dam but population and habitat use in Boulevard Lake are unknown. The Current River downstream of the dam formerly supported a spawning run of coaster Brook Trout (Bobrowicz 2011). Boulevard Lake has occasionally been stocked with Brook Trout to support a put-and-take recreational fishery (Jeff Black pers. comm.). In 2001, 480 adult Brook Trout were stocked (OMNR no date) but data are apparently unavailable for other years. Brook Trout typically spawn in late September to November with the eggs spending some or all of the winter in the substrate before hatching. If spawning occurs in Boulevard Lake, eggs are potentially at risk of stranding when the level drops in October. Brook Trout may be limited by warm water in late summer except at the Current

River inflow.

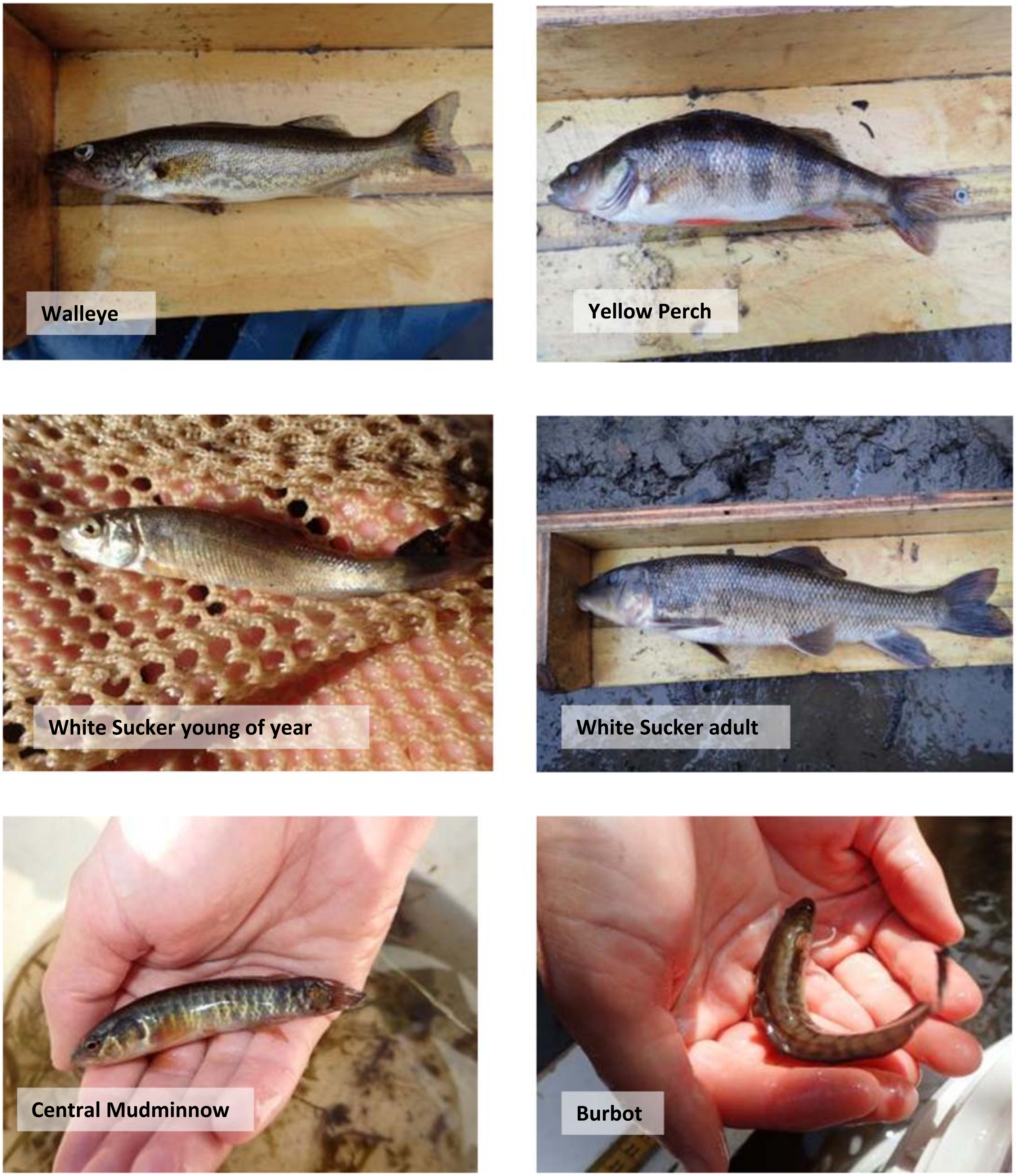

Figure 15. Fish species observed in Boulevard Lake 2016.

Terrestrial Vegetation and Wildlife

Vegetation

Boulevard Lake Peak includes about 51 ha of forest cover, mainly at the north end of the park with a section below the dam (Figure 16). The largest forest blocks include two relatively contiguous patches of 13 ha and 22 ha.

Most of the forest consists of mature mixed wood of White Spruce, Trembling Aspen, White Birch and Balsam Fir on fine sand and loamy soils (Ecosite 052; OMNR 2009) (Figure 17). Occasional large White Cedar and White Pine are also present. Many older trees, especially White Spruce, are dying and creating gaps in canopy with young Balsam Fir trees colonizing the openings. The forest areas are crossed by numerous trails and walkways, but otherwise relatively intact with little evidence of human disturbance and few invasive species. Most of the forested habitat is unlikely to be affected by dam repairs.

An area of thicket swamp with willows and Speckled Alder (Ecosite B134; OMNR 2009) is found on the floodplain of the Current River at the north end of Boulevard Lake (Figure 17). This community is periodically flooded by river water.

Rock barren (Ecosite 160; OMNR 2009) occurs on the bedrock shelf below the dam (Figure 21). This area is scoured by water flowing over the dam during high flows but is typically exposed for most of the year (Foster 2011). High flows have washed away most soil, organic material, sand and gravel. Patches of sedges and Sweet Gale are confined to a few deeper crevices. Some pools of standing water persist through the summer.

Most of the remainder of the park is open lawn and wooded lawn.

Laydown and Access Road Area

The proposed laydown and access road area will be used during dam repair (Figure 16, Figure 19) and cover about 0.3 ha and 0.4 ha respectively below the dam.

The proposed access area consists exclusively of paved parking and manicured lawn (Figure 20). Mature Green Ash trees have been planted along the edges of the parking lot.

The proposed access road corridor is about 200 m long and extends from the laydown area to the dam. The southern third of the consists of lawn with some small (1 - 2 m) planted Red Pine and oak trees. The corridor crosses a narrow strip of forest consisting of mature (10 m tall) Balsam Poplar with a shrub layer of Red-osier Dogwood and Red Raspberry. Closer to the river, the trees become smaller as the soil becomes shallower and small White Cedar and White Birch (5 m tall) become common (Figure 21).

The remaining two thirds of the corridor crosses the river floodplain . It consist of rock barren interspersed with numerous shallow pools. Vegetation is largely confined to bedrock crevices and includes sedges (*Carex* spp.), rushes (*Juncus* spp.), Sweetgale, and willows (*Salix* spp.)

(Figure 22). Pondweeds (*Potamogeton* spp.) are present at low cover in pools. Seepage from a wetland to the north flows across the corridor. A seep with iron precipitate was noted about midway up the bedrock slope which appeared to be hydrologically feeding a small wetland.

Wildlife

Bird point count data are summarized in Table 3 and Appendix 9. A total of 25 species was tallied and include species commonly associated with boreal mixedwood forests (e.g. White-throated Sparrow, Red-eyed Vireo) as well as those more common in urban area (e.g. American Crow, Ring-billed Gull). The passerine species include seven warblers, three sparrows and a variety of other species, most of which probably nest in the park. Eight area sensitive bird species (i.e. those requiring large areas of suitable habitat; OMNR 2000) were observed in 2016 (Table 3), suggesting that the patches of forest habitat are large enough to support breeding populations of these species.

White-tailed Deer are now apparently common year-round residents in the forested part of the park (Harris pers. obs.). Other large mammal species, such as Moose and Black Bear, probably use the park on occasion but are unlikely to be permanent residents given the relatively small forested area and high level of human use. Beaver use Boulevard Lake in summer but the winter drawdown probably limits use of the lake year-round (Harris pers. obs.).

The significant wildlife habitat assessment is summarized in Table 4 and Table 5 (OMNR 2000). Among the possible significant habitat values are waterfowl and landbird migratory stopover habitat, nesting habitat for area sensitive bird species, and presence of mature forest cover. Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline occurs nearby (NHIC 2016) and may be present on the Current River upstream of Boulevard Lake. The Boulevard Lake Park shorelines may act as a corridor for animals moving from the largely forested area to the north to the Lake Superior shoreline.

Table 3. Bird species tallied in point counts. Boulevard Lake, July 1 2016. Area sensitive species (OMNR 2000) are indicated "AS".

Species	Total
American Crow	17
White-throated Sparrow	10
Red-eyed Vireo	8
Common Grackle	7
Common Raven	7
Nashville Warbler	6
Black-capped Chickadee	5
Magnolia Warbler (AS)	4
Red-breasted Nuthatch (AS)	4
American Robin	3
Black-and-White Warbler (AS)	3
Ovenbird (AS)	3
American Goldfinch	2
Merlin	2
American Redstart (AS)	1
Black-throated Green Warbler	1
Blue Jay	1
Canada Warbler (AS)	1
Chipping Sparrow	1
Dark-eyed Junco	1
Herring Gull	1
Northern Flicker	1
Pileated Woodpecker (AS)	1
Ring-billed Gull	1
Winter Wren (AS)	1

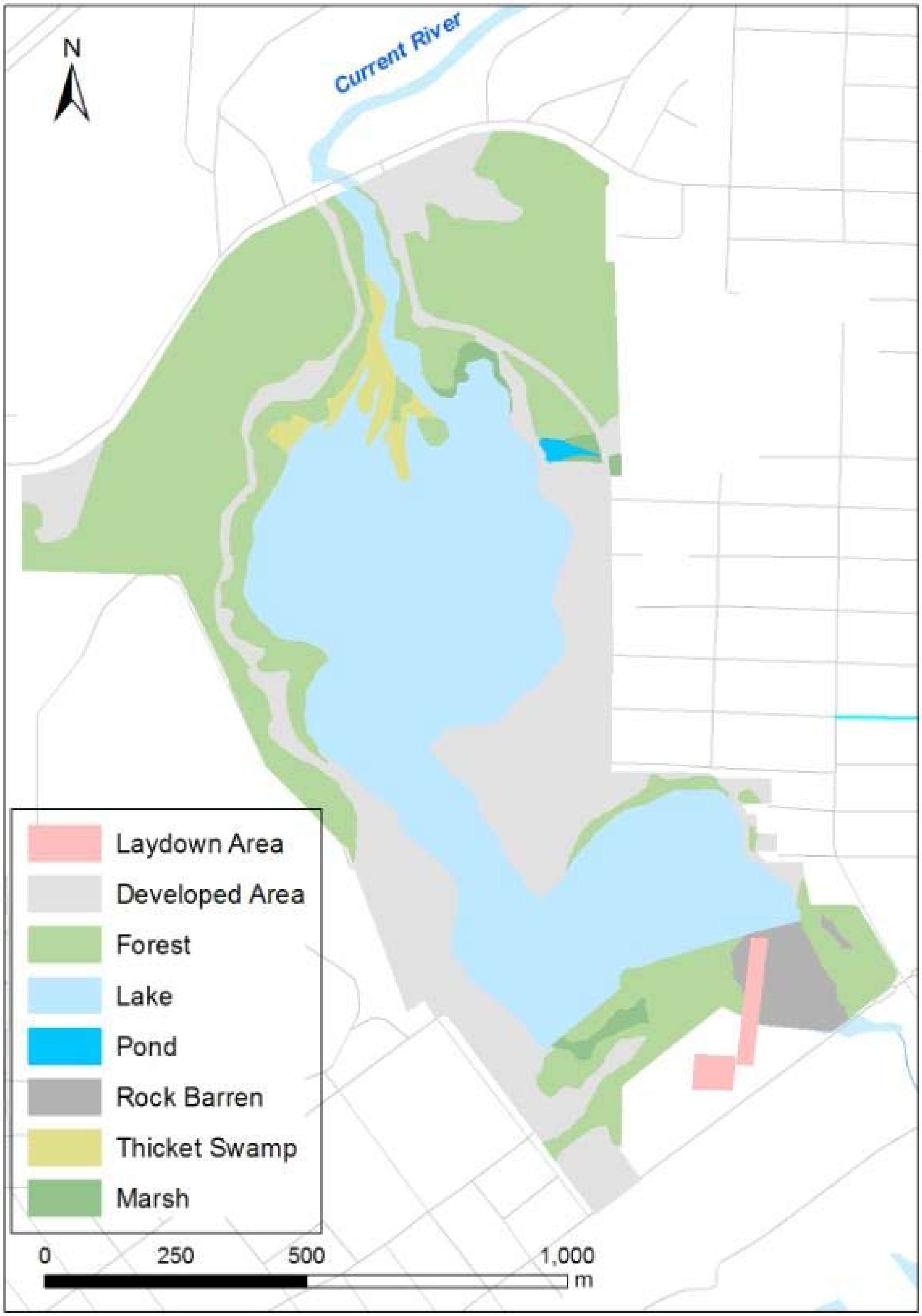

Figure 16. Vegetation map showing proposed laydown area. Boulevard Lake 2016.

Figure 17. Mature mixed forest (Ecosite B052). Boulevard Lake 2016.

Figure 18. Thicket swamp community at the Current River upstream of Boulevard Lake.

Figure 19. Aerial view of proposed laydown and access road area.


Figure 20. South part of proposed laydown area showing lawn and parking lot.

Figure 21. North part of proposed access road showing rock barren on river floodplain.

Figure 22. North part of proposed access road showing pools of standing water.

Species at Risk

Species at risk known to occur in the surrounding area are listed in **Error! Reference source not found.** (NHIC 2016, OBBA 2016). Species include two fish, seven vascular plants, four butterflies, four non-vascular plants (mosses, liverworts, and lichens), one turtle, and eight birds.

Among the bird species at risk, Canada Warbler was observed on the northwest side of Boulevard Lake in 2016 and probably nests here. Potential nesting habitat is also present for Eastern Wood-Pewee. Bald Eagles sometimes perch in the trees near the Current River below the dam (Harris pers. obs.). Common Nighthawk, Chimney Swift, Bank Swallow, Barn Swallow, and Yellow-headed Blackbird may occasionally forage in the park, but nesting habitat is absent.

Scabrous Black Sedge (*Carex atratiformis*), a provincially rare plant, was collected on the lawn on the east side of Boulevard Lake in 1999 (Harris 1999). Other arctic alpine plants species are found on the Current River at Trowbridge Falls associated with Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline (Bakowsky pers. comm.).

The fish species (Lake Sturgeon and Northern Brook Lamprey) have apparently not been documented in the Current River (Hartviksen and Momot 1989). There is an historical record of American Eel from the Current River below the dam (Hartviksen and Momot 1989).

Table 4. Assessment of seasonal concentrations of wildlife in Boulevard Lake study area (from Table Q-1 in OMNR 2000).

Type of Seasonal Concentration	Present in Study Area?	Notes
White-tailed deer winter yard	No	None documented. White-tailed deer are present in winter but little closed conifer forest is present.
Moose late winter habitat	No	None documented. Unlikely to occur with the high level of human use and lack of closed conifer forest.
Waterfowl stopover and staging areas	Yes	Flocks of > 100 Canada Geese and smaller numbers of other waterfowl are present on Boulevard Lake annually in spring and fall and probably exceed 700 use-days (Harris pers.obs.).
Waterfowl nesting areas	Possible	Broods of Mallard and Common Goldeneye were observed in 2016 but number of broods is unknown. Suitable nesting habitat is present in shoreline marshes and thicket swamps and surrounding forest.
Colonial bird nesting sites	No	No suitable habitat present.
Shorebird migratory stopover areas	Possible	Small flocks of shorebirds are present annually in spring and fall, particularly when water levels are low but number of use-days are unknown.
Landbird migratory stopover area	Possible	Not documented but the presence of forest cover within the city and relatively close to the Lake Superior shoreline may provide stopover habitat for migrants.
Raptor wintering areas	No	Not documented. Extensive fields and other suitable habitats are absent. Significant numbers of raptors are unlikely to be supported.
Bald Eagle winter feeding and roosting areas	No	Not documented. Unlikely to be significant in the park given the absence of a reliable source of food.
Wild turkey winter range	No	Wild Turkeys do not occur in the area.
Turkey vulture summer roost	No	None documented. Unlikely to occur with the high level of human use.
Reptile hibernacula	No	None documented.
Bat hibernacula	No	None documented. No suitable habitat present.
Butterfly migratory stopover areas	No	None documented.
Bullfrog concentration areas	No	Bullfrogs do not occur in the area.

Table 5. Assessment of Rare Vegetation Communities or Specialized Habitat for Wildlife in Boulevard Lake Park (from Table Q-2 in OMNR 2000).

Natural Feature	**Present in Study Area?**	**Notes**
Rare vegetation communities	Possible	Great Lakes Arctic-Alpine Basic Open Bedrock Shoreline may be present on the Current River upstream of Boulevard Lake
Habitat for Area Sensitive Species (from Appendix C in OMNR 2000; OBBA 2015)	Yes	Area sensitive bird species including Pileated Woodpecker, Red-breasted Nuthatch, Winter Wren, Magnolia Warbler, Black-and-white Warbler, American Redstart, Canada Warbler and Ovenbird were observed in nesting habitat in 2016
Forest providing high diversity of habitats	No	Large, old, undisturbed forest stands not present.
Amphibian Woodland Breeding Pools	Possible	Vernal pool habitat may be present in forest
Old growth or mature forest	Yes	Mature mixedwood forest present.
Foraging Areas with Abundant Mast	No	No oaks or other nut-bearing trees. Fruit bearing shrubs present, but restricted to a small portion of the study area.
Osprey, Bald Eagle nesting habitat	No	None documented. Unlikely to occur given the high level of human use.
Turtle Nesting Habitat	No	None documented.
Moose aquatic feeding areas	No	No suitable habitat.
Mink and otter feeding /denning sites	Unknown	Otters observed in 2016. No feeding or denning sites documented, but shoreline habitat present.
Marten and fisher denning sites	No	No large contiguous coniferous or mixed forests with abundant large trees.
Areas of High Diversity • Seeps and Springs • Cliffs • Caves	No	None documented. Seeps are present on the lakeshore (but none observed in forest habitat.

ACKNOWLEDGEMENTS

We thank Jeff Black, Tim Cano and Laura Darby for information on the fish community and aquatic environment of Boulevard Lake and the Current River. Reg Nelson (Lakehead University Department of Geography and the Environment) performed the bathymetry analysis.

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Appendix 1. Dissolved oxygen and water temperatures. Boulevard Lake. August 27 2016.

Site	Depth	DO (mg/L)	Water Temp (C)	Easting	Northing
1	Surface	7.1	20.2	337316	5370190
1	0.8m/Bottom	6.98	20.2	337316	5370190
2	Surface	7.23	20.4	337486	5370186
2	0.6m/Bottom	7.7	20	337486	5370186
3	Surface	7.4	20.1	337668	5370184
3	1m	8.22	18.1	337668	5370184
3	2m/Bottom	8.65	17.1	337668	5370184
4	Surface	7.29	20.8	337263	5370018
4	0.95m/Bottom	6.81	20.8	337263	5370018
5	Surface	7.47	21	337479	5370010
5	1m	7.42	19.9	337479	5370010
5	1.5m/Bottom	7.57	18.6	337479	5370010
6	Surface	7.46	20.4	337695	5370003
6	1.1m/Bottom	7.35	19.7	337695	5370003
7	Surface	7.51	20.9	337345	5369863
7	1m	7.33	20.6	337345	5369863
7	2m/Bottom	6.81	20.5	337345	5369863
8	Surface	7.46	20.9	337500	5369864
8	1m	7.52	20.4	337500	5369864
8	1.5m/Bottom	7.44	19.4	337500	5369864
9	Surface	7.25	20.6	337690	5369859
9	1m	7.51	20	337690	5369859
9	1.5/Bottom	7.84	19.8	337690	5369859
10	Surface	7.53	20.9	337410	5369585
10	1m	7.56	20.5	337410	5369585
10	2m/Bottom	7.44	20.5	337410	5369585
11	Surface	7.6	20.9	337471	5369587
11	1m	7.61	20.8	337471	5369587
11	2m/Bottom	7.69	20.4	337471	5369587
12	Surface	7.57	20.9	337527	5369588
12	1m	7.62	20.8	337527	5369588
12	1.5/Bottom	7.66	20.7	337527	5369588
13	Surface	7.51	21.1	337587	5369345
13	0.5m/Bottom	7.44	21.2	337587	5369345
14	Surface	7.6	21.1	337639	5369359
14	1m	7.54	21	337639	5369359
14	2m	7.48	20.6	337639	5369359
14	2.5m/Bottom	7.19	20.5	337639	5369359

Site	Depth	DO (mg/L)	Water Temp (C)	Easting	Northing
15	Surface	7.72	21.4	337694	5369384
15	0.5m/Bottom	7.24	21	337694	5369384
16	Surface	7.62	21.1	337895	5369289
16	1m	7.51	20.9	337895	5369289
16	2m	7.64	20.6	337895	5369289
16	3m/Bottom	7.42	20.4	337895	5369289
17	Surface	7.58	21.1	337876	5369352
17	1m/Bottom	7.55	21.1	337876	5369352
18	Surface	8.06	21.4	337839	5369450
18	1m/Bottom	8.62	20.9	337839	5369450
19	Surface	7.69	21.1	338123	5369328
19	1m	7.56	20.8	338123	5369328
19	2m/Bottom	7.38	20.6	338123	5369328
20	Surface	7.7	21.3	338136	5369369
20	1m	7.56	20.7	338136	5369369
20	2m	7.24	20.5	338136	5369369
20	3m	7.11	20.3	338136	5369369
20	3.5m/Bottom	5.25	20.1	338136	5369369
21	Surface	7.45	21.5	338155	5369411
21	0.3m/Bottom	7.54	21.2	338155	5369411
Current River Mouth	Surface	9.23	17.4	337493	5370358
Current River Mouth	0.4m/Bottom	9.15	17.4	337493	5370358

Appendix 2. Fish sampling effort. Boulevard Lake 2016.

Site Name	Date	Easting	Northing	Set Time	Check Time	Description	Gear
Gill Net01	Aug 11	337361	5369845	20:45	8:05	west side	Small Mesh RIN
Gill Net02	Aug 11	337484	5369698	21:00	7:30	off Birch Point	Gill Net
Gill Net03	Aug 11	337615	5369898	21:10	8:30	mid lake off beach on east side	RIN
Seine01	Aug 11	334283	5366970	20:05		beach on west side	1/8" mesh; 10 m long
Seine02	Aug 11	337252	5369870	20:15			1/8" mesh; 10 m long
Seine03	Aug 11	337767	5370110	21:30		beach on east side	1/8" mesh; 10 m long
Seine04	Aug 11	337775	5370061	21:45		beach on east side	1/8" mesh; 10 m long
Minnow Trap 01	Aug 17	337617	5370389	19:45	9:00		
Minnow Trap 02	Aug 17	337599	5370387	19:45	9:00		
Minnow Trap 03	Aug 17	337595	5370370	19:45	9:00		
Minnow Trap 04	Aug 17	337545	5370338	19:45	9:00		
Minnow Trap 05	Aug 17	337514	5370357	19:45	9:00		
Minnow Trap 06	Aug 17	337507	5370367	19:45	9:00		
Minnow Trap 07	Aug 17	337503	5370358	19:45	9:00		
Minnow Trap 08	Aug 17	337477	5370360	19:45	9:00		
Minnow Trap 09	Aug 17	337537	5370303	19:45	9:00		
Minnow Trap 10	Aug 17	337547	5370274	19:45	9:00		
Minnow Trap 11	Aug 17	337522	5370234	19:45	9:00		
Minnow Trap 12	Aug 17	337462	5370240	19:45	9:00		
Minnow Trap 13	Aug 17	337475	5370200	19:45	9:00		
Minnow Trap 14	Aug 17	337476	5370196	19:45	9:00		
Minnow Trap 15	Aug 17	337243	5369873	19:45	9:00		
Minnow Trap 16	Aug 17	337208	5369994	19:45	9:00		
Minnow Trap 17	Aug 17	337262	5370250	19:45	9:00		
Minnow Trap 18	Aug 17	337340	5370284	19:45	9:00		
Minnow Trap 19	Aug 17	337354	5370315	19:45	9:00		

Site Name	Date	Easting	Northing	Set Time	Check Time	Description	Gear
Minnow Trap 20	Aug 17	337329	5370207	19:45	9:00		
Electrofishing01	Aug 08	337413	5370253	9:25			468 sec; 500 v
Electrofishing02	Aug 08	337362	5370263	10:25		Overflow channel at north end of lake. Presently no flow	498 sec; 500 v
Electrofishing03	Aug 08	337478	5370373	11:30		Main channel of Current River 30 m from north end of Boulevard Lake	610 sec; 500 v
Electrofishing04	Aug 09	337571	5370368	8:22		marshy bay at northeast corner of lake	251 secs; 500 v
Electrofishing05	Aug 09	337300	5370298	9:16		northwest coner of lake - marshy channel with sedimentary organic substart	244 secs; 500 v
Electrofishing06	Aug 09	337300	5370298	9:35		Slackwater channel at north end	563 secs; 500 v
Electrofishing07	Aug 09	337502	5370328	12:40			1125 secs; 500 v

Appendix 3. Point count locations, Boulevard Lake. July 1 2016.

Count	Observer	Waypoint	Time	Beaufort	Weather	Easting	Northing
1	BDR	143	6:59	1	Clear, 8C	337604	5370516
2	BDR	144	7:15	2	Clear, 8C	337233	5370408
3	BDR	145	7:32	2	Clear, 9C	337080	5370088
4	BDR	147	7:47	2	Clear, 9C	337210	5369835
5	BDR	148	8:01	3	Clear, 10C	337338	5369489
6	BDR	149	8:16	3	Clear, 10C	338008	5369163
7	BDR	150	8:34	3	Clear, 10C	337694	5369669

Appendix 4. Fish species known to occur in Boulevard Lake and the Current River. * indicates observed in the present study. Other records from Hartviksen and Momot 1989, Nelson *et al.* 2006, Foster 2011, Jeff Black, pers. comm. 2015, Laura Darby, pers. comm. 2016.

Salmon Family	**FAMILY SALMONIDAE**	**Boulevard Lake**	**Current River**	**Below Dam**
Rainbow Trout	*Oncorhynchus mykiss*	X	X	X
Brown Trout	*Salmo trutta*		X	
Brook Trout	*Salvelinus fontinalis*	X	X	X
Smelt Family	**FAMILY OSMERIDAE**			
Rainbow Smelt	*Osmerus mordax*			X
Mudminnow	**FAMILY UMBRIDAE**			
* Central Mudminnow	*Umbra limi*	X		X
Pike Family	**FAMILY ESOCIDAE**			
* Northern Pike	*Esox lucius*	X	X	
Minnow Family	**FAMILY CYPRINIDAE**			
Finescale Dace	*Phoxinus neogaeus*		X	
Lake Chub	*Couesius plumbeus*		X	
Blackchin Shiner	*Notropis heterodon*		X	
* Blacknose Shiner	*Notropis heterolepis*	X		
* Spottail Shiner	*Notropis hudsonius*	X		
Fathead Minnow	*Pimephales promelas*		X	
* Blacknose Dace	*Rhinichthys atratulus*	X	X	
Longnose Dace	*Rhinichthys cataractae*		X	X
Creek Chub	*Semotilus atromaculatus*		X	
Pearl Dace	*Margariscus margarita*		X	
Sucker Family	**FAMILY CATOSTOMIDAE**			
Longnose Sucker	*Catostomus catostomus*		X	X
* White Sucker	*Catostomus commersoni*	X	X	X
Eel Family	**FAMILY ANGUILLIDAE**			
American Eel	*Anguilla rostrata*			X
Cod Family	**FAMILY GADIDAE**			
* Burbot	*Lota lota*	X	X	
Stickleback Family	**FAMILY GASTEROSTEIDAE**			
Brook Stickleback	*Culaea inconstans*		X	X

Trout-perch	**FAMILY PERCOPSIDAE**			
* Trout-perch	*Percopsis omiscomaycus*	**X**	**X**	
Sunfish Family	**FAMILY CENTRARCHIDAE**			
Smallmouth Bass	*Micropterus dolomieu*			**X**
Perch Family	**FAMILY PERCIDAE**			
* Yellow Perch	*Perca flavescens*	**X**	**X**	
* Walleye	*Stizostedion vitreum*	**X**	**X**	**X**
* Johnny Darter	*Etheostoma nigrum*	**X**		**X**
* Logperch	*Percina caprodes*	**X**	**X**	**X**
Sculpin Family	**FAMILY COTTIDAE**			
Slimy Sculpin	*Cottus cognatus*		**X**	

Appendix 5. Electrofishing data. Boulevard Lake. August 8-9 2016.

Site	Species	n	Total Length (mm)	Notes
Electrofishing01	Mudminnow	1	28	about 10 more escaped (70 - 90 mm)
Electrofishing01	Mudminnow	15	75 - 89	
Electrofishing01	Burbot	1	64	size indicates young of year
Electrofishing02	Burbot	1	110	
Electrofishing02	Johnny Darter	23	23-50	
Electrofishing02	Blacknose Shiner	4	23	
Electrofishing02	White Sucker	1	59	size indicates young of year
Electrofishing03	Northern Pike	1	165	possibly YOY but at larger end of the expected size range
Electrofishing03	Mudminnow	1	76	
Electrofishing03	Logperch	2	55-75	
Electrofishing03	Johnny Darter	22	30-70	
Electrofishing03	Blacknose Dace	2	25-28	
Electrofishing04	Mudminnow	7	20-87	about 12 more escaped
Electrofishing04	Johnny Darter	1	18	
Electrofishing05	Mudminnow	11	70-85	about 25 more escaped
Electrofishing05	Northern Pike	2	200-250	escaped
Electrofishing06	Mudminnow	10	55-86	about 20 more escaped
Electrofishing06	Johnny Darter	1	33	
Electrofishing06	Logperch	2	50	
Electrofishing07	Burbot	3	66-130	
Electrofishing07	Blacknose Dace	12	18-50	
Electrofishing07	Troutperch	3	45	
Electrofishing07	Johnny Darter	49	20-62	
Electrofishing07	Logperch	3	22	

Appendix 6. Seining data Boulevard Lake. August 11 2016.

Number	Species	n	Total Length (mm)	Notes
Seine01	Mudminnow	2	approx 20	
Seine01	Johnny Darter	1	approx 20	
Seine02	Johnny Darter	1	approx 25	
Seine03	Trout Perch	16	25 to 40	
Seine03	Log Perch	10	30 to 50	
Seine03	Johnny Darter	4	20 to 35	
Seine04	Walleye	1	110	size indicates young of year
Seine04	Johnny Darter	52	20 to 35	
Seine04	Trout Perch	9	25 to 40	
Seine04	Blacknose Shiner	1	24	collected
Seine04	Spottail Shiner	4	35	collected

Appendix 7. Gill net data Boulevard Lake. August 11-12 2016.

Location	Number	Species	Date	Total Length (mm)	Weight (g)	Notes
GN#01	1	Walleye	Aug 12 2016	226	100	dead
GN#01	2	White Sucker	Aug 12 2016	190	80	dead
GN#01	3	White Sucker	Aug 12 2016	160	60	dead
GN#01	4	White Sucker	Aug 12 2016	223	120	dead
GN#01	5	White Sucker	Aug 12 2016	127	30	dead
GN#01	6	White Sucker	Aug 12 2016	255	190	alive
GN#01	7	Yellow Perch	Aug 12 2016	132	50	dead
GN#01	8	Yellow Perch	Aug 12 2016	98		dead; partly eaten
GN#01	9	Yellow Perch	Aug 12 2016	145	60	dead
GN#01	10	Yellow Perch	Aug 12 2016	123	30	dead
GN#01	11	Yellow Perch	Aug 12 2016	144	50	dead
GN#03	12	White Sucker	Aug 12 2016	408	810	alive
GN#03	13	White Sucker	Aug 12 2016	456	1120	dead
GN#03	14	White Sucker	Aug 12 2016			alive - escaped
GN#03	15	White Sucker	Aug 12 2016	239	210	dead
GN#03	16	White Sucker	Aug 12 2016	521	1670	alive
GN#03	17	White Sucker	Aug 12 2016	469	1230	alive
GN#03	18	White Sucker	Aug 12 2016	506	1380	alive
GN#03	19	White Sucker	Aug 12 2016	456	1190	alive
GN#03	20	White Sucker	Aug 12 2016	426	980	dead
GN#03	21	White Sucker	Aug 12 2016	462	1060	alive
GN#03	22	White Sucker	Aug 12 2016	496	1580	alive
GN#03	23	White Sucker	Aug 12 2016	461	1170	alive
GN#03	24	Yellow Perch	Aug 12 2016	205	110	alive
GN#03	25	Yellow Perch	Aug 12 2016	150	50	alive
GN#03	26	Yellow Perch	Aug 12 2016	155	110	alive
GN#03	27	Walleye	Aug 12 2016	245	220	dead
GN#03	28	White Sucker	Aug 12 2016	482	1300	alive
GN#02	29	White Sucker	Aug 12 2016	476	1330	alive
GN#02	30	White Sucker	Aug 12 2016	352	460	alive
GN#02	31	Yellow Perch	Aug 12 2016	154	110	alive
GN#02	32	White Sucker	Aug 12 2016	165	60	dead
GN#02	33	Yellow Perch	Aug 12 2016	242	200	alive
GN#02	34	White Sucker	Aug 12 2016	502	1390	alive
GN#02	35	White Sucker	Aug 12 2016	511	1580	alive
GN#02	36	White Sucker	Aug 12 2016	469	1360	alive
GN#02	37	Yellow Perch	Aug 12 2016	147	50	alive

Location	Number	Species	Date	Total Length (mm)	Weight (g)	Notes
GN#01	38	Yellow Perch	Aug 12 2016	140	40	dead
GN#01	39	Yellow Perch	Aug 12 2016	142	40	dead
GN#01	40	White Sucker	Aug 12 2016			alive - escaped
GN#01	41	White Sucker	Aug 12 2016	480	1230	alive
GN#01	42	Yellow Perch	Aug 12 2016	140	40	alive
GN#01	43	Yellow Perch	Aug 12 2016	241	300	alive

Appendix 8. Minnow trapping data Boulevard Lake. August 16-17 2016.

Number	Species	n	Total Length (mm)	Notes
Minnow Trap 01				
Minnow Trap 02				
Minnow Trap 03	Yellow Perch	1	50	
Minnow Trap 04	Crayfish	3		
Minnow Trap 05	Crayfish	2		
Minnow Trap 06	Crayfish	2		
Minnow Trap 07	Crayfish	1		
Minnow Trap 08				
Minnow Trap 09	Crayfish	2		
Minnow Trap 10				
Minnow Trap 11				
Minnow Trap 12				
Minnow Trap 13	Crayfish	1		
Minnow Trap 14				
Minnow Trap 15				
Minnow Trap 16				
Minnow Trap 17				
Minnow Trap 18				
Minnow Trap 19	Crayfish	2		
Minnow Trap 20				

Appendix 9. Point count data, Boulevard Lake. July 1 2016.

Plot #	Species	First 5 minutes			Second 3 minutes			Last 2 minutes			Total
		<50	50-100	> 100	2nd 5 <50	2nd 50-100	2nd > 100	3rd <50	3rd 50-100	3rd> 100	
1	White-throated Sparrow	1									1
1	Red-eyed Vireo	1					1				2
1	Red-breasted Nuthatch	1									1
1	Nashville Warbler		1								1
1	White-throated Sparrow					1					1
1	Black-throated Green Warbler							1			1
1	American Crow			1							1
1	Pileated Woodpecker			1							1
1	Blue Jay								1		1
1	Magnolia Warbler								1		1
1	Ovenbird								1		1
2	Ovenbird	1									1
2	Black-and-White Warbler	1									1
2	American Robin									1	1
2	Merlin		1								1
2	Magnolia Warbler		1								1
2	American Crow			1							1
2	White-throated Sparrow						1				1
3	Ovenbird	1									1
3	Nashville Warbler	1	1								2
3	Black-capped Chickadee	2									2
3	Black-and-White Warbler				1						1
3	Canada Warbler							1			1
3	Red-breasted Nuthatch	2									2
3	Winter Wren			1							1
3	White-throated Sparrow			1						1	2
3	American Crow			1							1
4	Black-and-White Warbler							1			1
4	Merlin	1									1

Plot #	Species	First 5 minutes			Second 3 minutes			Last 2 minutes			Total
		<50	50-100	> 100	2nd 5 <50	2nd 50-100	2nd > 100	3rd <50	3rd 50-100	3rd> 100	
4	Nashville Warbler	1									1
4	Magnolia Warbler							1			1
4	Common Raven			5							5
4	American Robin		1	1							2
4	Red-breasted Nuthatch								1		1
4	Black-capped Chickadee									1	1
4	Northern Flicker									1	1
4	White-throated Sparrow									1	1
4	Red-eyed Vireo			1							1
5	Red-eyed Vireo	1	1	1							3
5	Common Grackle	6									6
5	American Crow	2									2
5	White-throated Sparrow	1								1	2
5	American Redstart							1			1
5	Black-capped Chickadee							2			2
5	American Crow									1	1
5	Chipping Sparrow									1	1
6	Common Raven							1			1
6	Magnolia Warbler	1									1
6	American Crow	5								1	6
6	White-throated Sparrow			1		1					2
6	Red-eyed Vireo		1			1					2
6	Dark-eyed Junco		1								1
6	Nashville Warbler	1									1
6	Common Grackle		1								1
7	American Crow	2									2
7	Herring Gull							1			1
7	American Goldfinch							2			2
7	Nashville Warbler			1							1
7	American Crow		1							2	3
7	Common Raven			1							1

Plot #	Species	First 5 minutes			Second 3 minutes			Last 2 minutes			Total
		<50	50-100	> 100	2nd 5 <50	2nd 50-100	2nd > 100	3rd <50	3rd 50-100	3rd> 100	
7	Ring-billed Gull			1							1

Appendix 10. **Species at risk occurring in the two 10 km X 10 km squares (16CU36, 16CU37) overlapping Boulevard Lake Park. Data from NHIC (2016) and Breeding Bird Atlas (2016). "COSEWIC " indicates species listed by Committee on the Status of Endangered Wildlife in Canada. "SARO" indicates species listed under the Species at Risk Act in Ontario.**

Common Name	Scientific Name	16CU36	16CU37	S RANK	COSEWIC	SARO
A Lichen	*Rhizocarpon oederi*	x	x	S2S3		
A Liverwort	*Mannia sibirica*	x	x	S1		
Blind's Bryum Moss	*Bryum blindii*	x	x	S2		
Copper Coscinodon	*Coscinodon cribrosus*	x	x	S1		
Auricled Twayblade	*Neottia auriculata*	x		S3		
Alpine Woodsia	*Woodsia alpina*	x	x	S2		
Northern Arnica	*Arnica lonchophylla*		x	S1		
Purple Milk-vetch	*Astragalus laxmannii*		x	SH		
Pumpelly's Brome	*Bromus pumpellianus*	x	x	SH		
Scabrous Black Sedge	*Carex atratiformis*	x	x	S2		
Ram's-head Lady's-slipper	*Cypripedium arietinum*	x	x	S3		
Northern Brook Lamprey	*Ichthyomyzon fossor*	x	x	S3	SC	SC
Lake Sturgeon	*Acipenser fulvescens*	x	x	S2	THR	THR
Purplish Copper	*Lycaena helloides*	x	x	S3		
Red-disked Alpine	*Erebia discoidalis*	x	x	S3		
Large Marble	*Euchloe ausonides*	x	x	S3		
Macoun's Arctic	*Oeneis macounii*	x	x	S3		
Snapping Turtle	*Chelydra serpentina*	x		S3	SC	SC
Bald Eagle	*Haliaeetus leucocephalus*	x		S2N	NAR	SC
Common Nighthawk	*Chordeiles minor*	x		S5B	THR	SC
Chimney Swift	*Chaetura pelagica*	x		S4B	THR	THR
Eastern Wood-Pewee	*Contopus virens*		x	S5B	SC	SC
Bank Swallow	*Riparia riparia*		x	S4B	THR	THR
Barn Swallow	*Hirundo rustica*		x	S4B	THR	THR

Common Name	Scientific Name	16CU36	16CU37	S RANK	COSEWIC	SARO
Canada Warbler	*Wilsonia canadensis*	x	x	S5B	THR	SC
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	x		S2B		
Gt Lakes Arctic-Alpine Basic Open Bedrock Shoreline		x	x	S3		

SUPPORTING DOCUMENT 2

Stage 1 and 2 Archaeological Assessment Boulevard Lake Dam Improvements

Ministry of Tourism, Culture and Sport

Archaeology Programs Unit
Programs and Services Branch
Culture Division
401 Bay Street, Suite 1700
Toronto ON M7A 0A7
Tel.: (807) 475-1628
Email: Paige.Campbell@ontario.ca

Ministère du Tourisme, de la Culture et du Sport

Unité des programmes d'archéologie
Direction des programmes et des services
Division de culture
401, rue Bay, bureau 1700
Toronto ON M7A 0A7
Tél. : (807) 475-1628
Email: Paige.Campbell@ontario.ca

Ontario

Apr 10, 2017

Scarlett Janusas (P027)
Scarlett Janusas Archaeology Inc.
PO BOX none Tobermory ON N0H 2R0

RE: Review and Entry into the Ontario Public Register of Archaeological Reports: Archaeological Assessment Report Entitled, "STAGE 1 AND 2 ARCHAEOLOGICAL ASSESSMENT BOULEVARD LAKE DAM IMPROVEMENTS CITY OF THUNDER BAY DISTRICT OF THUNDER BAY Original Report ", Dated Feb 17, 2017, Filed with MTCS Toronto Office on Mar 1, 2017, MTCS Project Information Form Number P027-0291-2016, MTCS File Number 0005173

Dear Ms. Janusas:

This office has reviewed the above-mentioned report, which has been submitted to this ministry as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c 0.18.[1] This review has been carried out in order to determine whether the licensed professional consultant archaeologist has met the terms and conditions of their licence, that the licensee assessed the property and documented archaeological resources using a process that accords with the 2011 Standards and Guidelines for Consultant Archaeologists set by the ministry, and that the archaeological fieldwork and report recommendations are consistent with the conservation, protection and preservation of the cultural heritage of Ontario.

The report documents the assessment of the study area as depicted in Map 19 of the above titled report and recommends the following:

Based upon the background research of past and present conditions, and the property inspection, the following is recommended:

•Stage 3 archaeological assessment is recommended for the site DcJh-21. Stage 3 should consist of placing and excavating 1 m square test units in a 5 meter grid across the site, and excavating additional test units, amounting to 20% of the grid total unit. It is suggested that there be five one metre square units excavated in total for the Stage 3 site; or;
•Avoidance of the site DcJh-21 must be conducted by the proponent (the proponent has opted to avoid the site) through monitoring of the site during construction;
•Monitoring of all construction activities in this area (see supplementary documentation) shall be conducted by a licensed archaeologist and accompanied by an Indigenous monitor from Fort William First Nation;
•The rehabilitation of the dam will include a marine archaeological assessment of areas that will be enclosed within a cofferdam. The proponent has arranged for this marine archaeological assessment to be conducted by Scarlett Janusas Archaeology Inc. upon dewatering of the area (mid-June 2017). It is

recommended that the proponent ensure that the marine archaeological assessment is conducted for the project.
•It is recommended that the remaining study area does not require any further archaeological assessment;
•Compliance regulations must be adhered to as described in Section 6 of this report.

Based on the information contained in the report, the ministry is satisfied that the fieldwork and reporting for the archaeological assessment are consistent with the ministry's 2011 Standards and Guidelines for Consultant Archaeologists and the terms and conditions for archaeological licences. This report has been entered into the Ontario Public Register of Archaeological Reports. Please note that the ministry makes no representation or warranty as to the completeness, accuracy or quality of reports in the register.

Should you require any further information regarding this matter, please feel free to contact me.

Sincerely,

Paige Campbell
Archaeology Review Officer

cc. Archaeology Licensing Officer
Fred Bernard,Arcadis Canada Inc.
Kayla Dixon,City of Thunder Bay

[1]In no way will the ministry be liable for any harm, damages, costs, expenses, losses, claims or actions that may result: (a) if the Report(s) or its recommendations are discovered to be inaccurate, incomplete, misleading or fraudulent; or (b) from the issuance of this letter. Further measures may need to be taken in the event that additional artifacts or archaeological sites are identified or the Report(s) is otherwise found to be inaccurate, incomplete, misleading or fraudulent.

STAGE 1 AND 2 ARCHAEOLOGICAL ASSESSMENT
BOULEVARD LAKE DAM IMPROVEMENTS
CITY OF THUNDER BAY
DISTRICT OF THUNDER BAY

Original Report

Prepared for

Arcadis Canada Inc.
and
Ministry of Tourism, Culture and Sport

SCARLETT JANUSAS ARCHAEOLOGY INC.
269 Cameron Lake Road
Tobermory, Ontario N0H 2R0
phone 519-596-8243 cell 519-374-1119
jscarlett@amtelecom.net
www.actionarchaeology.ca

License # P027, PIF #P027-0291-2016
February 17, 2017

Executive Summary

Arcadis Canada Inc. retained the services of Scarlett Janusas Archaeology Inc. (SJAI) to conduct a Stage 1 and 2 archaeological resource assessment on property proposed for the upgrading of the Boulevard Lake Dam and area. The proponent is the City of Thunder Bay who owns the Boulevard Lake Dam.

The study area is located north of Cumberland Road and west of Grenville Avenue in the City of Thunder Bay. Access to the dam for upgrading includes an access road, laydown area, etc. All of these areas were subject to archaeological assessment. The study area is owned by the City of Thunder Bay. An area of 11.78 hectares was subject to archaeological assessment.

The project is being conducted as a Schedule B project under the Municipal Engineers Association's Municipal Class Environmental Assessment (Class EA), which triggers the requirement for an archaeological assessment.

Background research indicated that there are two registered archaeological sites within one kilometer of the study area (one of these within the Project boundaries). There is also one unregistered site located in Boulevard Lake itself, an approximately 22 m wide circle of stones, located approximately 78 metres distant from the Project boundary.

Field assessment consisted of a test pitting methodology of the entire area, where feasible, conducted in five metre intervals. There were areas within the project that could not be test pitted due to slopes in excess of 20 degrees, permanent wet areas, intermittent creeks, gravel roadbeds, and deep and extensive development disturbance areas (power house and buried pipe from top of dam to power house, paved parking lots, and pedestrian/bicycle pathways). The parkland manicured sections were test pitted and found to be a gravel fill throughout – sporadic testing of these areas was conducted to verify disturbance throughout the parkland area within the study area. Exposed bedrock was subject to a pedestrian transect methodology conducted in five metre or less intervals.

The Stage 1 and 2 archaeological assessment of the study area was conducted under license P027, (Scarlett Janusas, PIF #P027-0291-2016) in July 2016.

An aceramic site, possibly Shield Archaic, was relocated during the archaeological assessment. This is the same registered site already known in the area as DcJh-21. Two positive test pits were excavated, the area around the two positive test pits intensified, and two one metre squares were excavated directly over the two positive test pits. Materials were primarily black and jasper taconite, are common resource in the area. There were no diagnostics located within the assemblage, and there were no features in either of the test units. The site is considered to have cultural heritage value or interest.

An area of modern disturbance was also test pitted to ensure that all materials were from the 20th century, and not representative of an earlier site. Test pitting verified that materials were of recent vintage, dating to the mid-20th century. This area was not considered to have cultural heritage value or interest.

Based upon the background research of past and present conditions, and the property inspection, the following is recommended:

- Stage 3 archaeological assessment is recommended for the site DcJh-21. Stage 3 should consist of placing and excavating 1 m square test units in a 5 meter grid across the site, and excavating additional test units, amounting to 20% of the grid total unit. It is suggested that there be five one metre square units excavated in total for the Stage 3 site; or;
- Avoidance of the site DcJh-21 must be conducted by the proponent (the proponent has opted to avoid the site) through monitoring of the site during construction;
- Monitoring of all construction activities in this area (see supplementary documentation) shall be conducted by a licensed archaeologist and accompanied by an Indigenous monitor from Fort William First Nation;
- The rehabilitation of the dam will include a marine archaeological assessment of areas that will be enclosed within a cofferdam. The proponent has arranged for this marine archaeological assessment to be conducted by Scarlett Janusas Archaeology Inc. upon dewatering of the area (mid-June 2017). It is recommended that the proponent ensure that the marine archaeological assessment is conducted for the project.
- It is recommended that the remaining study area does not require any further archaeological assessment;
- Compliance regulations must be adhered to as described in Section 6 of this report.

This archaeological assessment has been conducted under the 2011 Standards and Guidelines for Consultant Archaeologists (Ministry of Tourism and Culture, 2011).

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SD = Supplementary Documentation

IMAGES

MAPS

APPENDICES

Project Personnel

Project Manager Principal Archaeologist, And Report Preparation	Scarlett Janusas (P027)
Background Research	Scarlett Janusas (P027) Patrick Folkes
Field Director Field Director (mentored) Field Crew	Scarlett Janusas (P027) Jordon MacArthur Michelle Bell (A325) Stefan Bouchard (R476) Lauren Murphy Aubrey Panamick Ed Panamick Richard Thompson
Northern Ontario Advisors	William Fox Scott Hamilton

STAGE 1 AND 2 ARCHAEOLOGICAL ASSESSMENT
BOULEVARD LAKE DAM IMPROVEMENTS
CITY OF THUNDER BAY
DISTRICT OF THUNDER BAY
Original Report

1.0 PROJECT CONTEXT

1.1 Development Context

Arcadis Canada Inc. retained the services of Scarlett Janusas Archaeology Inc. (SJAI) to conduct a Stage 1 and 2 archaeological resource assessment on property proposed for the upgrading of the Boulevard Lake Dam and area. The proponent is the City of Thunder Bay. The study area is located north of Cumberland Road, and west of Grenville Avenue, in the City of Thunder Bay, District of Thunder Bay. Access to the dam for upgrading includes an access road, laydown area, etc. All of these areas were subject to archaeological assessment. An area of 11.78 hectares (ha) was subject to archaeological assessment (Maps 1 – 5). General coordinates of the project are: 48.456333 N latitude, 89.188444 W longitude. Images 1 – 2 illustrate the concept plan for the rehabilitation of the dam, and Maps 4 and 5 illustrate the study area, and area of proposed laydown and access road.

Access to the site area from Highway 11/17 near Thunder Bay, Ontario is to travel south on Hodder Avenue for approximately 3.5 kilometres (km), and turn right onto Grenville Avenue for about 200 metres. Access to the dam itself is by a footpath/bicycle path that runs alongside Boulevard Dam Lake. Other areas of the project can be accessed through Current River Park, directly off Cumberland (Hodder turns into Cumberland).

The project is being conducted as a Schedule B project under the Municipal Engineers Association's Municipal Class Environmental Assessment (Class EA), which triggers the requirement for an archaeological assessment.

The Stage 1 and 2 archaeological assessment of the study area was conducted under license P027, (Scarlett Janusas, PIF #P027-0291-2016) in July and October 2016. The area is considered to be "northern Ontario" as defined by the Standards and Guidelines for Consulting Archaeologists (hereafter referred to as the S & G's) (2011: 7). The Project Area (defined above) lies completely within the Canadian Shield (Map 1).

This archaeological assessment has been conducted under the 2011 Standards and Guidelines for Consulting Archaeologists (Ministry of Tourism and Culture, 2011).

1.2 Project Description

The preferred alternative is the rehabilitation of the existing Boulevard Lake Dam. This alternative will provide the required redundancy in the dam's strength, improve regulation of water flow through a combination of mechanical gates and wooden and aluminum stop logs, widens the pedestrian walkway, repairs the deteriorating concrete, and improves the functioning of the fish ladder.

“A second set of post-tensioned tendons will be installed in every buttress and along the east retaining wall of the dam. The new anchors would be designed for the full design forces without considering the benefit of the existing anchors. The work will be accomplished by using a drill rig and specialized equipment required to core holes to install anchors (steel rods) through the deck and each buttress into bedrock. The relatively small buttresses with aged concrete would now be compressed by two post tensioned anchors…

Post-tensioned anchors will be installed out of water. Slurry from drilling will be contained then disposed offsite.

The preferred alternative will replace wooden stop logs as the sole means of controlling water flow and instead utilize a combination of automated mechanical gates (maybe three), aluminum stop logs and wooden stop logs. This combination would reduce the existing water leakage through the dam, and help regulate water levels.

Mechanical gates allow the control of flow by manually operating the gates by a hand crank. Mechanical gates are significantly less time consuming and labour intensive than stop log operations. Gates also allow a finer adjustment of water levels. However, during a flood event, dam personnel must still travel to the site to operate the gates. Mechanical gates would be also beneficial to maintaining summer set (elevation 211.71 m) during low flow periods, as well as in regulating the flow needed for power generation.

The stop logs at the east end of the structure are most frequently operated to respond to rainfall events. At least one stop log is removed at every sluiceway seasonally to adjust between summer set elevation and winter set elevation. Gates will be installed to ease operations with priority given to the east end of the structure.

The deck width at the spillways, sluiceways, and near the pumphouse would be widened to provide a uniform width across the dam consistent with the pedestrian trail. A pedestrian bridge would be included near the pumphouse to eliminate the bottleneck at the pumphouse and improve horizontal alignment. The deck width could be further widened at the sluiceways to account for stop logs stored on the deck, therefore, even if stop logs are stored on the deck, the widened walkway will mitigate conflict between users. The changes to the deck will be made simultaneous with concrete rehabilitation.

Local repairs will be made to the deteriorating concrete on the dam structure using abrasive blast cleaning of the existing reinforcing steel, providing new reinforcing steel if required, and replacing the concrete. This solution is appropriate for random surface deterioration even though the end product may appear “patchy”. This work will entail removal of spot areas of deteriorated concrete down to first layer of reinforcing steel. Structural cracks will be injected with epoxy. In some cases the entire area may be overlaid with new concrete to improve aesthetics. In other cases, unknown reinforcing steel location and condition may require new reinforcing steel and dowelling.

Cofferdams will be constructed in two stages to complete upstream construction. Flow must be maintained through the dam at all times at four sluiceways to pass a design flow of 0.4 cms (minimum flow) to 20 cms (high average monthly flow) to 85 cms (two year return period flood) with an estimated water surface elevation between 209.5m (sluiceway sill) and 210.4m (normal winter elevation). The construction may involve the following elements:

- Boulevard Lake may be lowered to natural stream (elevation 208.3 m) three times during construction to facilitate installation/removal of the two stages of the cofferdam;
- the cofferdams must be designed to restrain a minimum water surface elevation and minimum flood event.
- The water surface elevation will be maintained lower than normal summer set (211.71 m) to reduce costs and risks associated with the cofferdam,
- water from inside the cofferdam will be treated when dewatered. A larger area dewatered behind the cofferdam will increase the dewatering/treatment required….

Concrete waste will be handled according to Ontario Provincial Standard Specification (OPSS) 180. The Standard requires that waste be disposed as non-hazardous solid industrial or commercial waste at receiving sites designated in the Contract Documents or at sites designated by the Contractor. The waste is to be transported from the working area directly to a site that has a Certificate of Approval for Waste Disposal Site that is valid for non-hazardous solid industrial or commercial waste.

The laydown area for the contractor will be in the parking lot located off of Cumberland Street, south of the dam. An access road will be constructed from the parking lot to the downstream side of the dam, through the wooded area and across the exposed bedrock. There are no other reasonable alternatives" (courtesy of Arcadis, 2016).

Images 1 - 2 illustrate the concept plan for the dam.

1.3 Indigenous Community Engagement

Indigenous Community was initiated by JML Engineering in March of 2015. The following Indigenous Communities were contacted: Fort William First Nation, Métis Nation of Ontario, Red Sky Métis Independent Nation. At the time of the archaeological assessment, there had been no input from the Indigenous communities that would bear on the archaeological assessment.

Subsequent to the completion of the field assessment, a meeting was held with the City of Thunder Bay, SJAI, and representatives of Fort William First Nation (see supplementary documentation).

1.4 Historic Context

1.4.1 Current Environment and Existing Features

The study area is bounded to the north by the Boulevard Lake Dam and recreational paved pathway, to the south by Current River Park, to the east by Grenville Avenue, and to the west by Gibson Avenue. An area of 11.78 ha was subject to archaeological assessment (Maps 1 – 5). General coordinates of the project are: 48.456333 N latitude, 89.188444 W longitude.

The Boulevard Lake Dam is located on the Current River, approximately 700 m upstream of the mouth of the Current River, which discharges into Lake Superior. Boulevard Lake is a man-made reservoir about 44 ha in size during the summer, and 32 ha in size during the winter. It is relatively shallow with only 4 to 5 metres (m) of depth. The dam has created a much larger flow (width wise) over the bedrock than the original course of the Current River. This flow can sometimes be quite strong depending on allowed discharge.

There is an existing step pool fishway at the east end of the dam built in 1992 to provide a passage way for adult rainbow trout (steelhead) migration. The steelhead run typically begins in April and finishes by mid-June. A small wooden clad building sits at the east end of the dam above the fishway, on a concrete foundation (Images 3 – 4). Extending from this building, but buried, is the pipeline (Images 5 and 36) that feeds the power generating station house at the south end of the project area (Images 6 - 7).

The concrete dam (Images 8 - 9) extends from the end of Boulevard Lake to the west about 112 m. During low water (partial draining of the lake) the dam was exposed showing it to be in need of repair (Images 10 -11). Below the dam on the west side of the Current River Falls is a concrete retaining wall (Image 12) measuring about 86.85 metres in length and about 14” (.1016 metres) in width at the top. On the north side of the retaining wall is a small creek and a very wet area. Also on the west side of the retaining wall and extending to the retaining wall itself and possibly under it, is an iron pipe that is partially buried, but a section of it has been exposed through excessive water action (Image 13).

There are several paved bicycle/pedestrian pathways (Image 14) that run along the top of the dam and along Boulevard Lake to the north of the study area, and also down into Current River Park. Additionally, Current River Park has several paved parking lots (Image 16) in the study area. A gravel roadway (Image 16) leads to the power station in the south end of the study area.

A hydro line bisects the study area on an approximate east-west orientation.

1.4.2 Prehistory of the Study Area

Table 1 provides an outline of the culture history of northern Ontario. Each region within Northern Ontario will have its own variations of the table.

Northern Ontario was covered by glacial ice to approximately 11,000 Before Christ (BC). Warming conditions began to melt the ice in a northeasterly direction, and southern parts of Northern Ontario were first freed from the ice circa 10,000 BC. The more northerly areas remained ice covered for quite some time, and were free of ice much later, circa 6,000 BC.

The Paleo Indian period, spanning from, 8000 BC – 5000 BC, represents the first human populations in northern Ontario. Circa 8000 BC, the climate changes dramatically. The glacial ice retreats (melts), and the Boreal Forest in the southern area appears. The western end of Lake Superior is free of ice, and there is a shift of grasslands in the north. This era is marked by the Plano culture. These people were big game hunters, subsisting largely on caribou and small mammals and fish. They were nomadic in nature, traveling large areas, but generally followed glacial strandlines. Sites tend to be located on relic lake shores north of Lake Superior, Huron and Georgian Bay. Sites in the Thunder Bay area tend to be located on the 221 m contour level (Dalla Bona 2011). Sites from this period are represented solely by lithic assemblages, characterized by lanceolate ripple-flaked biface tools. There are no registered sites from this period located within one kilometer of the Study Area. Hinshelwood (1992:3) suggests that there is a pattern of late paleoindian sites, from registered site data, being “primarily littoral or lakeshore occupations”. The characteristics for late PaleoIndian sites tend to be located “where lakeshores are intersected by rivers and at which taconite bearing outcrops and marsh/swamp areas occur” (ibid).

The Archaic period spans a large time period from 5000 B.C. to 400 B.C. Raw materials used by these nomadic people became much more diverse, and they remained hunters and gatherers. Tool kits included those suitable for wood working. Shield Archaic sites tend to be located near wetlands, creeks and streams and in areas where natural resources (i.e. for such activities as hunting, fishing and quarrying) would be available. Pictographs tend to be confined to the Canadian Shield whereas petroglyphs tend to be located to the south, although they can also be found on the Shield (one example in the Lake of the Woods area was found buried beneath an Archaic deposit). The pictographs found to date on the Canadian Shield, based on their iconography and geographic distribution have been associated with the ancestors of Algonkian peoples (for example, Cree, Ojibwa, Innu). About 6500 B.C., the Archaic peoples began to use copper, which was cold-hammered for tool production (spear points, knives, hooks) and also personal adornment, jewelry. The potential for locating sites of the Archaic period is high given the presence of the Nipissing Transgression Beach. A known registered archaeological site is located within the Project area from this cultural period.

The Woodland periods spans from 400 B.C. to 1600 Anno Domini (A.D.). The introduction of ceramics by about 500 B.C. marks the differentiation between the Woodland and Archaic periods. The Woodland period also sees an introduction to horticulture, later evolving to agriculture. With agriculture comes a more sedentary lifestyle and results in village formation, tribal differentiation and warfare. There are no registered archeological sites located within the Project area from this cultural period.

Laurel culture sites are most often found around large lakes and rivers, and is different from the proceeding Late Archaic Algonkian culture based primarily on the presence of lithics. The early ceramics included small pottery jars manufactured using a coil methodology. They exhibited conical bases and had an impressed decoration. Other than the presence of ceramics, the Laurel culture still practiced a lifestyle similar to their Late Archaic predecessors: hunting, fishing and gathering. Another difference between the Late Archaic and the Initial Woodland period is the development of extensive trade/exchange networks that ran to the eastern seaboard and west to the Rocky Mountains. Lake Superior copper has been located on many Woodland sites, and there are also exotic items such as shell beads from the coast of the Atlantic Ocean, stone tools of Knife River chalcedony originating in North Dakota, and even obsidian (volcanic glass) from Yellowstone Park, in Wyoming. Exchange of goods was facilitated by the abundance of waterways (transportation corridors).

The Terminal Woodland period is represented by two cultures: Selkirk and Blackduck. The Blackduck culture is represented closer to Lake Superior, and is “characterized by globular pottery vessels, textured with a cord-wrapped paddle” (Ministry of Culture and Recreation 1979: 9). In addition, there is the possibility of discovering Iroquoian pottery deriving from Southern Ontario, the Plains, and even Michigan. These may be the product of exchange, or adoption of women into the existing cultures. The Blackduck culture is typified by globular ceramic vessels, with cord wrapped paddled bodies and cord wrapped impressed collars. The Selkirk culture pottery is characterized by fabric impressed globular vessels.

1.4.3 Native Historic Period

The Native Historic Period is from circa 1600 Anno Domini (AD) to 1875 AD. This marks a period of interaction with missionaries and fur traders. Sites dating to this period are often characterized by the presence of “European goods” such as glass beads, axes, thimbles, and miscellaneous metal objects, often reworked.

The Fur Trade played a dominant part in the native historic and early Euro-Canadian periods. It became one of the most important economic activities in Northern Ontario, especially between the period of first contact and well into the 1800’s. There were two main routes that were used primarily to access the interior where hunting, trapping and trading would occur, as well as along the Lake Superior coastline.

The first route followed the Ottawa River to Lakes Nipissing and Huron, and from there moved north, (the second route) through Lake Superior and into Lake of the Woods and points north and west. The advantage of Northern Ontario fur trading was the abundance of lakes and rivers connecting the main fur trading posts.

The southerly route was dominated by French voyageurs that traded with the First Nations people of Northwestern Ontario. But by 1670 a second route had been established further north. In 1660, Médeard Chouart des Groselliers, a lay helper of the French Jesuits, travelled the route as far as Lake Superior. He and his brother in law, Pierre-Esprit Radisson, are believed to be the first Europeans to make contact with the Sioux Natives who inhabited the area. From the Sioux they learned of a potentially lucrative trading route further north, based around what are now known as James and Hudson's Bays. Upon their return to France, Groselliers and Radisson attempt to convince the French Government to invest in an expedition which would travel directly to these northern bays by following a route through the Labrador Sea, north of Labrador. Unsuccessful, they turned to merchants in New England. After two abortive attempts to reach Hudson and James Bays from the Eastern Seaboard, an emissary of England's Charles II convinced them to pursue financial backing from London. In 1668 the brothers-in-law accompanied two small vessels, the ***Eaglet*** *and the* ***Nonsuch****, in a voyage made directly from England to Hudson Bay. The* ***Eaglet*** *was damaged and had to return early on, but the* ***Nonsuch*** *completed a successful voyage. Its crew wintered at the mouth of the Rupert River and traded with approximately 300 people at a temporary post. When the ship returned to England in October of 1669, it carried a large cargo of beaver skins. The Hudson Bay Company was formed by the British Government the following spring, in May of 1670. The territory it commanded was named Rupert's Land, after the company's first governor and the King's cousin, the Duke of Cumberland, also known as "Prince Rupert of the Rhine"* (Hill n.d. Hydro One Transmission Line, Circuit D26A, Districts of Kenora and Rainy River).

The study area occupies an area below Rupert's Land and for the most part was considered to be part of New France in 1700. By 1775, it was now part of Quebec. In 1791, the area was part of Upper Canada, and remained so until the area became known as the Province of Canada circa 1849. In 1867 the area became part of Province of Ontario.

"Prior to Canada's Confederation in 1867, the northern boundary of Upper Canada (Canada West from 1841 to 1867) stretched along a line which varied from approximately 150 km to 200 km north of Lake Superior, westward to a point which included Fort William, now Thunder Bay (ibid)".

Additional information regarding the historic native period is derived from the Jesuit Relations of 1669 to 1670 (Thwaites 1896-1901: 149-153). Father Allouez comments:

It is thus that Providence has provided for these poor peoples, who in default of hunting and corn live for the most part on fish.

Alexander Henry (1809: 209) further commented on the availability of food for the native population in 1767,

..could not find food in the summer were it not for the fish in the streams and lakes.

There are no registered Historic Native sites located within one kilometre of the study area.

1.4.4 Métis History

The Métis Nation developed over a period of time, beginning as early as the 1600's when the fur trade brought Europeans to the area. The Hudson's Bay Company was established by Royal Charter in 1670. During the 1700's, employees and freeman working with/for the fur trade companies began to establish families with native women. By extension, the Métis were localized around these early fur trade activities/stations. The War of 1812 fought primarily in the southern Great Lakes area establishes the Canadian- United States of America border. The Métis population is the major group that establishes the site of present-day Winnipeg, Manitoba. From about 1815-1828, many Métis families move south from the Drummond Island area to east side of Lake Huron, and inland to areas of Owen Sound, Penetanguishene, Parry Sound, etc.

The Métis and various First Nations from Sault Ste. Marie and along the north shore of Lake Superior opposed the trespass activities of the Quebec Mining Company at Mica Bay in 1849-1850. This leads to the Robinson Treaty between the Crown and the First Nations groups, but not the Métis. Commissioner Robinson indicates that he has no mandate to deal with the Métis.

The Hudson's Bay Company, however, under treaties, includes the Métis (referred to then as "Halfbreeds") annuities for the Lake Superior region.

The Government of Canada purchased Rupert's Land (much of northern Ontario) from the Hudson's Bay Company in 1869-1870. No consultation with either First Nations or Métis communities was conducted. The Métis at the Red River settlement established the Métis National Committee – a provisional government, forcing the government into negotiations, including terms to create French language rights, and provision of lands for the Métis.

The Métis at Rainy Lake (Fort Francis) in 1875 successfully negotiate a "Halfbreed" adhesion to Treaty 3 – marking the only time the Métis are treated as a collective during historic treaties. The adhesion terms, were not, however followed through on by the government.

The Métis and First Nations in the Lake Nipigon area jointly petition the government of Canada for education and land related issues in 1880.

Many Métis living in Ontario tended not to self-identify as Métis during the 1900's in response to the negativity from the activities in western Canada uprising.

There are small inroads to recognition of the Métis over the subsequent years (Métis at Moose Factory have land grants and hunting rights recognized; Alberta Métis securing the Alberta Métis Settlement), but from the 1950's to the 1970's, both Métis and First Nations lobby for better living conditions, advancement of rights in Ontario and the rest of Canada.

The Métis are recognized as one of Canada's three aboriginal peoples in 1982 (First Nations, Métis and Inuit). A year later, the Métis National Council is established representing the Métis Nation from Ontario westward. The Métis Nation of Ontario is established in 1992, which provides a central registry of Métis peoples in Ontario.

Hunting rights of Métis are recognized as being similar to that of First Nations groups in 2004.

There are no registered Métis sites located within one kilometre of the study area.

1.4.5 Historical Background: Current River, Thunder Bay

The Current River is first labelled by name – Riviere aux Courants – on Henry W. Bayfield's Lake Superior chart of 1828 (Map 6), the result of his survey of 1822-23 (Bayfield 1828). No description in detail follows until the 1850's when government sponsored, exploratory surveys were undertaken of the landscape between Lake Superior and the distant settlement of Red River. Simon J. Dawson and party landed at Fort William on July 31st, 1857 and of the several prospective routes from the lake to the interior he focused on what he called the "Indian route" via the Current River to Dog Lake, a distance of some 25 miles (~40 km). From information obtained from John McIntyre, the Hudson Bay Company agent at Fort William, Dawson learned that in their winter journey the "Indians" proceeded from the post on the Kaministiquia River, round the coast to the Current River and then ascended what was said to be its "open and unencumbered course", reaching Dog Lake in one day (Dawson 1858).

Believing that the "Indian trail up the valley of Current River" was of singular importance, he directed a line of survey be run inland from the outlet of the river to Dog Lake (Holwell 1868). "A succession of rapids and cascades," he wrote, "which in the aggregate, perhaps, exceed 40 feet in height, occur within the space of half a mile from the mouth of the River, and forests of canoe-birch, balsam, white and black spruce, tamarack and cedar, with mountain ash and other small trees, fringe its rocky banks and occupy its lower valley (Dawson 1858: 159). Lindsay Russell, one of Dawson's compatriots, described the Current River as being "full of rapids and falls pouring through cliffs of up-heaved granite and slate" as it wandered among the steep rocky hills (Arthur 1973: 93).

The soil Dawson found was of "small depth, and reposes upon slates, generally without the intervention of a sub-soil, but is covered over large areas, with moss to a depth of one foot and more." There was also "red and black currents, raspberries, strawberries, and gooseberries". Survey member Henry Hind found an abundance of chive growing in the cracks and crevices of the shale on the river bank (Thunder Bay Historical Society 1925: 17). Farther upstream, 12 to 15 miles (~19 - 24 kms), according to McIntyre, there was better soil and bigger timber.

In Dawson's observations, the Current River falls at the outlet descended over a "precipitous ledge of black aquillaceous (sic) [argillaceous or clayey] Slate". Later scrutiny of the geology in the vicinity of the river, especially during the decades after the silver discoveries in the Thunder Bay area, would note the frequent presence of a grey chert (Tanton 1931: 28-34).

The first European occupancy at the mouth of the Current River was documented in 1860 by William Gibbard of the Crown Lands Department. He recorded that William McAllister and James Carroll had established a trading post there and had built "house" and made "small clearances" on both sides of the river. The Hudson Bay Company, perhaps in response, put up a "house" on the south side of the river in 1859 only to abandon it the following year, whereupon it came into McAllister's possession. In July of 1860, Gibbard gave him a "certificate" acknowledging his "improvements" (Gibbard 1861).

The census of 1861 list McAllister, age 26, as born in Edinburgh, Scotland, and Carroll, 28, in Perth, Canada West [Ontario]. Each man was entered in the census return as a "trader" (Province of Canada, Personal Census, 1861). Their tenure at the Current River appears to have been short-lived as their names are not to be found in the census of 1871, nor indeed that of 1881. It is likely that they could not hope to compete with the long established post of the Hudson Bay Company at Fort William and simply moved on.

William Gibbard also reviewed in 1860 the licensed claims sparked by a growing interest in the mineral potential of the Lake Superior country. Among the privileges he noted the prospect of John McKenzie on the "upper Current River", unexploited except for some "exploratory blasts" (ibid). More substantial were two mines developed later in the decade on silver-bearing veins inland from the lake and not far from the river.
The deposit on the boundary line of Lots 8 and 9 of McIntryre township was discovered in May of 1867, and subsequently promoted as the Shuniah Mine [the entire location comprised 1,680 acres (~679.8 hectares) [Across Lots 8 to 13]. Progress was intermittent due largely to financial difficulties and disputes among the owners. Closing for a time, it was reopened in 1870, then shut down again in 1873 only to restart later that year as the Duncan mine. A stamp mill was built, up to 100 men employed on occasion, and shafts dug and drifts driven underground. But the mine eventually proved unprofitable and closed in 1881 (Globe September 17, 1881).

Since the Shuniah/Duncan mine lay west of the Current River, it was supplied by a road connection to Prince Arthur's Landing. On an undated (but probably c. 1872) map (Map 7) by Hugh P. Savigny, "Plan of Survey of the Silver Mining District, Thunder Bay, Lake Superior" (Savigny, c. 1872), the Shuniah road ran from the mine to the mouth of McVicar's Creek.

Although the Current River was only a half mile (~.8 km) distant, the relationship of it to the mine was tenuous, perhaps only in the way of surface explorations as the vein was followed towards the river valley. The river itself bisected the Trowbridge claim (400 acres, ~162 ha) of 1865, within which no work, at least during the early years, was undertaken (Chapman 1869: 221-22).

In the autumn of 1866, silver was discovered in the south part of Lot 6 of Macgregor Township. The site, east of the Trowbridge property, was less than a mile (~.8 km) from the river. Developed by the Thunder Bay Silver Mining Company, the holding encompassed 1,750 acres (~708 hectares), including two miles (~3 kms) on the shore of the bay, within which was “the mouth and lower falls” of the Current River (ibid: 222). During the first phase of its existence (1867- 68) a wagon road was constructed from the mine site to the head of the shallow bay less than half a mile (~.8 km) to the east of the river. Here, a wharf, 200-feet (~60 metres) in length, was built of stone-filled cribs (McKellear 1874: 7). A sideroad connected the landing to the mouth of the river where a water-powered stamp mill was erected to process the ore (Mauro 1981:40).

On July 16th, 1868, the steamer **Algoma** drew alongside the “very recently built” dock. On board were passengers belonging to the Press Association, whose members represented newspapers in southern Ontario. Among the excursionists was a reporter of the Guelph "Mercury" who went ashore and walked to the mine. “At the mine,” he subsequently wrote, “we found that everything was in a rude and somewhat confused state. We saw little beyond the process of mining, and immense quantities of ore piled up in different directions. The mine is said to be very rich. The habitations at and about this mine are two small log houses at the foot of the mountain, another small house in the woods, where we saw two white women, one with a small child upon her knee, and a shanty on the shore, used by the fishermen and inhabited by Indians…” (no author, 1868: 489). When the **Algoma** got underway and bore away southward along the coast, the “Mercury’s” writer saw in the outlet of the Current River “a beautiful fall, and near it a number of Indian wigwams”.

The Thunder Bay mine shut down in 1869 but was reopened in 1874. A restart was likely delayed by the forest fire which swept through the surrounding countryside in the spring of 1870. The conflagration peaked in high winds on May 18th and although the buildings at the “depot” (where the Dawson Road began three miles south of the Current River) narrowly escaped destruction, “nearly all the settlers’ and miners’ houses in the vicinity of Thunder Bay were burned” (Canada, Sessional Papers 1871: 133). It is not certain, however, that the stamp mill was destroyed. More fires in 1873 may have caused damage in the landscape but both the Thunder Bay and Duncan (Shuniah) mines were reported running in 1875 (Globe July 15, 1875). There was a serious fire around the Current River in July 1878 although without causing substantial loss of property (Sentinel July 25 1878). The Thunder Bay mine was in decline when the catastrophic fire season of 1881 brought it to an end and “the last trace of the once substantial mill and dwelling houses were completely blotted out” (Roland 1887:167). Even before its brief episode of silver mining was underway, the Current River offered greater continuity as a fishing and recreational resource. In 1859 William Gibbard remarked on its distinction as a speckled trout stream (Gibbard 1860: 89). It achieved broad notice. The American writer John Disturnell called it a “dashing trout stream” in 1874 (Disturnell 1874: 189). A piece in the Thunder Bay “Sentinel” in 1878, by which time steamboat tourism to the head of Lake Superior was common, noted its fine trout fishery (Sentinel May 30 1878). A Canadian Pacific Railway employee could boast in 1886 of having caught a record speckled trout (3 lbs, 2 oz) in the Current River (ibid: May 14, 1886). This was a spring fishery. In 1889 it was reported that trout fishing in the river “is now all the rage among the small boys” and that “a large number of people with road and line in hand” were seen heading toward the river (ibid May 10, May 31, 1889). The annual trek continued – at least on the lower stretches of the river – until dams were constructed and Boulevard Lake was formed.

Beginning in the 1880’s spring angling coincided with sightseers from the growing town of Port Arthur drawn to the river’s spectacular runoff. By 1887 a walk to the Current River had become “a very popular promenade” on Sunday afternoons (ibid: May 19 1887). There was no road to the falls and the visits had become so popular that Port Arthur council directed the Board of Works to prepare cost estimates for extending Cumberland Street to the river (ibid). As late as 1896 there was still no road, or even a proper footpath. Walkers used the C.P.R. line to reach the river (ibid: April 24 1896). The Canadian Pacific Railway was completed from Nipigon to Port Arthur (with a bridge across the Current River below the falls) in 1883. The arrangements for the long-planned route into Port Arthur had not been finalized until the previous year in 1882. There had been difficulties over the ownership of the land, nominally in the right of Ontario, but this was resolved when a federal Order-in-Council (November 6, 1882) authorized the Department of Railway & Canals to define a corridor for the C.P.R. (Canada, Sessional Papers 1884: 19). The Company was permitted to expropriate a 200-foot (~61 m) wide strip between McVicar’s Creek northeastward to the Current River (ibid: 1883: 35). The Railway also desired the summary removal of houses and squatters on the intended route, but whether or not such occupancy had impinged on the river is not documented. An adjacent parallel line crossed the Current River with the construction of the Canadian Northern Railway in c. 1900. Map 8 presents the 1889 updated version of the earlier map of 1828, and shows the path of the rail line.

Fundamental change occurred on the lower river after the turn of the century. By 1907 a permanent dam was in place above the falls and the descending flow used to generate hydroelectric power. Railways and a road bridge (the Black Bay span of 1911 located north of the study area) spanned the river. From the early recreational use there evolved in the 1890s a movement to create a public park at the river. There was much controversy in 1895 (Sentinel March 8, 15, 22, 1895) as momentum grew, but gradually parkland was acquired by donation and purchase.

In 1901 a timber crib dam was constructed on the Current River by the falls, marking the beginning of the creation of the man-made reservoir known as Boulevard Lake, flooding the ancient course of the river and created a major public common for Port Arthur residents whose waterfront on Lake Superior had been given over almost entirely to commercial wharves and grain elevators. The dam “included a pair of wooden penstocks which fed the converted generation station at the mouth of the river. The original dam stood eight feet high, and had a storage capacity of 15 million gallons (68,000 cubic metres) (Bobrowicz 2012: 10). Image 17 illustrates the Current River in the area of the fall prior to the first dam construction. The original dam, under construction, is depicted in Image 18. The power house (Image 19) is depicted from the CPR railway bridge facing north. The original power house was located off the study area.

On May 28th, 1908, the Paquette dam bursts (upriver) sending a large quantity of water down the Current River and causing damage to the dam, the hydro penstocks, and further downriver, the civic railway bridge, the municipal water mains, and infrastructure within Current River Park. The water was of such quantity and force that five lives were lost in this disaster (Bobrowicz 2012: 13).

This dam was also used to generate electricity, as indicated above by the “hydro penstocks”. By 1910, a new dam replaced the 1901 dam (damaged in 1908) and had a maximum generating capacity of 1.50 kW (2,480 h.p.). Image 20 illustrates a ca. 1910 photograph of the second Current River Falls Dam.

In 1911, the Lyon family donates property surrounding the Port Arthur Service Reservoir (Boulevard Lake) to the city for the creation of a public park. Lyon Park, now known as Boulevard Park, was completed in 1912. Boulevard Park lies to the north and west of the study area.

Current River Park used to extend down to the shore of Lake Superior, but between 1916 and 1917, the City of Port Arthur (Thunder Bay) severs most of the shoreline to accommodate the construction of three grain elevators. By 1920, the City had removed all shoreline from the Current River Park to allow for industrial development.

In 1913, the City of Port Arthur (Thunder Bay) received many requests from farmers/loggers to float timber down the Current River, however, their requests were denied as there was no infrastructure to allow this to happen.

In 1917, a local logger named W.A. Kyron used the **Rivers and Streams Act** of 1913 giving people the right to float timber in rivers and streams during spring, summer and fall, and requires an apron or slide to be provided in dams to allow timber to run down a sluiceway. The City of Port Arthur modified bay No. 9 of the dam to accommodate the sluiceway. Timber then began to be floated downriver by 1918 during the spring (Bobrowicz 2012: 22).

The City of Port Arthur entered into a contract with Ontario Hydro Electric Power Commission December of 1920 to receive power generated from the Cameron Falls located on the Nipigon River. The Current River hydro facility is downgraded in required capacity and now served as a reserve for “local load control and emergency power”. This change, however, required the construction of an 110,000 volt transmission line to cross the Current River at Centennial Park (ibid: 23).

Detail of a map of the City of Port Arthur in 1924 illustrates the study area, which was occupied below the dam by a “tourist camp”. Details of the pipeline from the top of the dam south towards the power house are also shown on Map 9.

In 1925, the City of Port Arthur entered into an agreement with the Pigeon River Timber company to “manage the timber sluicing facility at the Current River dam” to assist with the Onion Lake area logging operations. In 1931, the Pigeon River Timber Company requests expansion of the timber sluicing facilities, and Bay No. 10 (Image 21) is opened to allow for additional timber to pass downriver each spring. “Guiding booms are installed below the dam to facilitate better passage over the bald rock” (ibid: 26-27). The spring log drives continue at this capacity until the late 1930’s.

The dam penstocks were replaced in 1939 (ibid: 28).

A year later, Current River Park is temporarily leased by the Department of National Defence as a training base, and renamed Current River Barracks. The “Tourist Camp” shown in the 1924 map of Port Arthur is now converted to Army barracks. The Casino dance hall (also shown in the 1924 map) is now converted to the mess hall. Towards the end of WWII, the area also held German prisoner of war individuals. The army barracks took over the tourist cabins that had been there, and left them early June of 1946. The City of Port Arthur council acted to immediately reoccupy the tourist cabins at Current River Park. The 1942 Fire Insurance Map (Map 10) shows the tourist camp in the study area. It is located south of the study area.

On May 3rd, 1951, the Current River floods again (Image 22), reaching a “maximum peak flow of 11,400 cubic feet per second (323 CMS) at the Boulevard Lake Dam. This is the highest peak flow ever recorded at the dam, though it is likely that the 1908 flood was higher” (ibid: 29). The waters were so high that they crossed Cumberland Avenue and washed out both the CNR and CPR main lines. A year later (1952) the dam was repaired and enlarged. Alterations to the dam increased flow capacity and this was beneficial in a subsequent flood of equal flow in 1957, where no damage was reported.

In January of 1958, the Casino Dance Hall Casino was destroyed by fire. By 1965, the city closed the Current River Tourist Camp.

The City of Thunder Bay undertook a Current River Recreation Strategy that was completed in 1974. The strategy included further renovations to the dam increased the storage capacity of Boulevard Lake. “The original hydro generation facilities are taken offline about this time and the penstocks are removed but the powerhouse remains in place until the mid-1980s” (ibid: 36). The powerhouse was demolished in 1984.

In 1986, the Current River Hydro Partnership constructed a small hydroelectric generating facility at the east end of the Boulevard Dam. In 1987, “the current hydro facility at the Boulevard Lake Dam comes online. The new Current River Generation station is rated at 500 kW, a fraction of the 1,850 kW capacity of the original hydro facility. The site is leased until [sic] to the Current River Hydro Partnership until 2025 (ibid).

"The waterpower facility draws water from the north side of the dam and diverts a maximum of 3.9 cubic metres per second through a 1,200 millimeter pipe approximately 200 metres downstream to the generating station. The generating station uses a single vertical propeller turbine known as a Kaplan turbine. The minimum estimated flow over the Boulevard Lake Dam under extreme drought conditions could drop to 0.2-0.3 cubic metres per second. This flow is considered to be barely enough to provide flow through one sluiceway (Lakehead Region Conservation Authority 2011).

The fishway is constructed in 1991, although priority for water is given first to "recreation and second to hydro generation" (Bobrowicz 2012: 37). In 1995, step pools are "blasted" into the bedrock below the fishway to allow for an easier approach by migrating fish.

Aerial photographs are presented from the years 1959, 1969, 1976, 1981 and 1987 (Maps 11 to 16). In addition, there is an aerial view of the study area that post dates 1987, but there is no associated date. All photographs were obtained through the archives in Thunder Bay. The 1959 aerial photograph depicts a long building in the western portion of the study area, which has been removed by 1969. It is unknown what function this building might have had. The Current River Tourist Camp, later the Army Barracks and Prisoner of War Camp, and later again, the Tourist Camp, was located just outside the study area, at the teo of the steep hill near the westerly situated parking lot.

1.4.5.1 Description of the Existing Dam

The following is taken from JML Engineering's report on the rehabilitation of the dam (JML Engineering 2015: 3).

"The Boulevard Lake Dam is owned and operated by the City of Thunder Bay. The associated waterpower facility is operated by The Power Producer under a lease from the City of Thunder Bay. The Boulevard Lake Dam is located approximately 700 metres upstream of where the Current River discharges into Lake Superior. The existing dam structure is approximately 112 metres long and is oriented in an east/west direction. It consisists of the following components:

- A reinforced concrete retaining wall at the east apprpoach.
- One reinforeced concrete sluicway c/w fish ladder and timber stop logs at the east end of the structure
- Eleven reinforced concrete sluiceways with eight timber stop logs at the east section of of the structure
- Seventeen reinforced concrete weir spillways at the west section of the structure.
- A reinforced concrete retaining wall with timber capping and rock berm at the west approach.

The rock berm at the west approach is approximately 400 metres long. The berm also functions as a walkway as part of the recreational trail system around Boulevard Lake.

The manmade reservoir (Boulevard Lake) is approximately 44 hectares in size, with a maximum depth of between four and five metres. The primary use of the lake is recreational. The Boulevard Lake Dam is operated twice a year outside of actions taken during isolated weather events and maintenance requirements. The lake is drawn down in the fall to establish winter water elevation. The stop logs are replaced in the spring to establish summer water elevation.

Power generation was restarted in 1986 with a small privatel owned hydro-electric generating station. The generating station used a one propeller turbine with a maximum flow capacity of 3.9 m^3/s. It has the potential to generate 0.5 MW of electric power. The current lease between the City of Thunder Bay and the private power generator (Current River Hydro Partnership) expires in 2025."

1.4.6 Plaques

Three sources were utilized to determine presence of, or relevance of, plaques relating to the study area. The first was the on line plaque guide of the Ontario Heritage Trust (formerly the Ontario Heritage Foundation) (http://www.heritagetrust.on.ca/Resources-and-Learning/Online-Plaque-Guide.aspx) and the second, Ontario's Historical Plaques (http://www.ontarioplaques.com/index.html). Only one plaque was determined to indirectly impact the study area (Robinson-Superior Treaty) archaeologically. The third source was obtained through a drive around of the immediate area resulting in three plaques/signs. In addition, a drive around located additional plaques and signage relating to the study area or near the study area.

<u>The Robinson-Superior Treaty</u>

Under this treaty, which was concluded in 1860, the Ojibwa surrendered territory extending some 640 kilometres along the shore of Lake Superior and northward to the height of land delineating the Great Lakes watershed. In return they received three reserves, including the Fort William reserve, a cash settlement, and a small annual stipend. (http://www.heritagetrust.on.ca/Resources-and-Learning/Online-Plaque-Guide.aspx)

On September 7, 1850 a treaty was concluded at Sault Ste. Marie between the Hon. W. B. Robinson, representing the government, and nine Ojibwa chiefs and head men. Under its terms the Ojibwa surrendered territory extending some 400 miles along the shore of Lake Superior, from Batchawana Bay to the Pigeon River, and northward to the height of land delimiting the Great Lakes drainage area. In return, the Indians were allotted three reserves, a cash settlement and a further small annual payment. The Fort William reserve, assigned to Chief Joseph Peau de Chat and his band, was laid out in 1854 by J.W. Bridgland P.L.S. substantially as it is today. (http://www.ontarioplquaes.com/index.html)

This plaque is located in Chippewa Park, at the southern approach to Thunder Bay.

Relevance to Project: Aboriginal peoples long populated northern Ontario, including the study area.

Two plaques/cairns were located in Centennial Park, located above the dam on the west side of Boulevard Lake. The first commemorates the Scott Jamboree of 1997.

"Scouts Canada" ""Site of the 9th Scouts Canada Jamboree, July 12-19, 1997. "Over 13,000 young people and volunteers leaders from Canada and abroad along with members of the First Nations, gathered here to celebrate the 90th Anniversary of the World Scout Movement".

Relevance to Project: Little direct relevance to the study area.

The second is a cairn made of quartzite pieces immediately adjacent to the Scout plaque, which speaks directly to the dam, its beginning, and subsequent upgrades.

"BOULEVARD LAKE 1901 1902
THE ORIGINAL DAM WAS CONSTRUCTED ON THE CURRENT RIVER FOR THE GENERATION OF ELECTRIC POWER AS A CIVIC ENTERPRISE. THE PRESENT DAM WAS CONSTRUCTED AFTER DISASTROUS FLOODS WASHED AWAY THE ORIGINAL DAM
1914
IN THIS YEAR THE PUBLIC UTILITIES COMMISSION WAS FORMED AND THE CITY OF PORT ARTHUR OBTAINED A LARGE PORTION OF LAND BORDERING THE RESERVOIR.
1936
THE CURRENT RIVER RESERVOIR WAS OFFICIALLY NAMED BOULEVARD LAKE. THE BOARD OF PARK MANAGEMENT OBTAINED PERMISSION FRM THE ONTARIO GOVERNMENT TO EXPEND CAPITAL FUNDS ON THE DEVELOPMENT OF THE PARK. UNEMPLOYED RELIEF LABOUR WAS LARGELY USED IN THE CONSTRUCTION".

Relevance to Project: Direct relevance as it pertains to the building and rebuilding of the dam, and to the creation of the Current River Park in which part of the study area lies.

In addition to the above, there is trail signage on the west side of Centennial Park.

Thunder Bay 2002
Boulevard Lake. The City of Port Arthur purchased this land from W.J. Lyon in 1892 and named it Lyon Park. Under Mr. Lyon's ownership the land had been both mined and logged. The lake was created in 1901 by a dam constructed at the south end to make a reservoir for pulp wood floated down the Current River. From 1920-30 pulpwood was floated down the river to the lake each spring. Due to the "parkland"

designation, it was required that the wood be removed from the lake by June 30th of each year. On February 20th, 1936, the park was renamed Boulevard Lake Park, and all mining and logging operations were ended.

This municipal park is the first is a series of parklands along the rivers shores. A wide range of recreational opportunities are offered here including swimming, biking, roller blading, walking, canoeing and kayaking. A five kilometer trail circles the lake and at the north end passes over the Black Bay Bridge, built in 1910. This bridge was the first single-spandrel reinforced concrete bridge ever constructed and was a technological wonder of its time.

While on this trail, you will encounter many plant and animal species native to the Thunder Bay Region. Located along Lyon Boulevard on the west side of the lake are groves of red pine and jack pine intermingled with maples, elms, willows and aspen. Many of these trees remain from a planting occurred in the late 1930s. On the north side of the lake is a stand of white pine, now rare in this area due to logging activities in the past.

Wild flowers illuminate your path as song birds harmonize to your footsteps. Flowers common in the park include: columbine, pearly everlasting, mustard, fireweed, purple vetch, daisy, black eyed susan, and clover. You many encounter shrubs such as raspberry, wild rose, red-osier dogwood, Labrador tea, and Saskatoon berry.

Due to the wetland habitat created by the reservoir, waterfowl including herring gulls, cormorants, Canada geese and loons are commonly seen in the marshes and along the beaches. Smaller animals and insects find sheltering habitats and plentiful food sources here. Butterflies and chipmunks will also greet you in your travels. Toward the north end of the lake in the wooded areas, foxes are known to roam."

Relevance to Project: Both direct and indirect. The signage provides some history of the area, the use of the dam, and the flora and fauna of the area.

1.4.7 Determination of Archaeological Potential

Features that are indicators of archaeological potential include, but are not limited to, the following (from Ministry of Tourism and Culture 2011 S & G's: 16-17):

- registered archaeological sites
- reported, but not registered, archaeological sites
- primary water sources (lakes, rivers, streams, and creeks) that are navigable
- secondary water sources (intermittent streams, wetlands, swamps, bog, etc.) are not considered as necessarily indicating archaeological potential for northern Ontario
- glacial shorelines (raised beaches, relic river or stream channels, prehistoric lake shorelines, cobble beaches, or wetlands)
- accessible or inaccessible shorelines demarcated as high bluffs, etc.

- elevated topography (mounds, drumlins, eskers, knolls, plateaus)
- pockets of well drained sandy soils
- distinctive land formations that may have meaning to Indigenous Communities – these make take the form of caves, rock formations, waterfalls, caverns, promontories and their bases; etc.
- resource areas (migratory bird and animal routes, spawning areas, mast forests, etc.)
- scarce raw materials (copper, quartzite, ochre, chert outcrops)
- early Euro-Canadian settlement and/or industry (trader's cabins, mining, logging, trapping, pioneer homesteads, farm complexes, mills, etc.)
- early transportation routes (portages, trails, railways, early roads)
- federal, provincial or municipal landmarks or historic sites
- local history sites identified by local informants, etc.

Features indicating low archaeological potential tend to be those that have been heavily and extensively disturbed through activities like road cutting, quarrying, building footprints, infrastructure such as sewage and other buried lines, and/or extant modern transportation routes. In addition, areas of extreme slope, in excess of 20°, areas of intermittent streams, bogs and wetland, and areas that are more than 150 m distant from the variables of archaeological potential are considered to have low archaeological potential (for Northern Ontario only).

The following standards have been actioned for the Stage 1 (MTC 2011 S & G's: Section 1.3.3, Section 1.4).

Standard 1.3.3	Descriptor	Action
1.	The lands to be assessed must be demonstrated to be located on the Canadian Shield.	Done – Map 1 Study Area lies wholly within the Canadian Shield
2.	There may be small pockets (e.g., sand plains, clay plains, glacial beach ridges, etc.) that possess a higher degree of potential and differing characteristics from most of the surrounding environment that should still be considered to have potential. Where such areas of higher potential are identified, undertake a complete assessment and systematic surveys.	The Nipissing Transgression Beach Ridge runs through the study area. Sandy areas lie along the ridge. Stage 2 undertaken.
Standard 1.3.4	Alternates for potential evaluation in special conditions: Remote areas	
1.	The degree of remoteness must be documented in sufficient detail to demonstrate that there are practical obstacles to achieving success. This will be primarily a matter of distance and lack of available transportation infrastructure (i.e. roads, trails) along with factors of visibility	Not applicable

Standard 1.3.3	Descriptor	Action
	(e.g. forest cover). Factors relating to seasonality (e.g. snow cover, flooding) should not be a factor in demonstrating difficulties of access.	
2.	Aerial photos, detailed engineering plans or other detailed mapped information may be used to determine that areas are of low potential. This information must be at a scale and of sufficiently detailed quality that allows for accurate evaluation of the presence and character of features of potential. The characteristics and quality of the sources of information (e.g. scale, source, how recently the information was acquired, general reliability) must be documented in sufficient detail to demonstrate its ability to support accurate evaluations of potential.	Not applicable - area considered to be one of archaeological potential based on glacial beach lines (prehistoric waterways) and presence of a registered archaeological site.
1.4	Stage 2 Recommendations under Special Conditions: (Remote Areas and Canadian Shield)	The study area lies wholly within the Canadian Shield (Map 1).
1.4.1	Recommending reduction of Stage 2 Test Pit Survey Coverage	
1	In addition to areas specified as exempt in 2.1 *Property Survey*, the Stage 1 evaluation may be the basis for recommending that areas be exempt from test pit survey, but only if all of the following conditions have been met:	
A	Both a background research and property survey have been done	No property inspection conducted – Stage 2 assessment.
B	The property inspection covered the entire property to document the areas proposed for exemption and to capture small pockets of archaeological potential. Do not recommend for any area that has not been inspected.	Not applicable.
c	No areas within 300 m of the following features of archaeological potential, located on or adjacent to the property, can be recommended for exemption from further assessment: i. previously identified archaeological sites ii. water sources iii. areas of early Euro-Canadian settlement	For Northern Ontario the limit is 50 m from existing water (not including intermittent streams, bogs or wetlands), and the testing limit for all other features of potential (ancient water, historic features, registered sites, etc.) is 150 m.

Standard 1.3.3	Descriptor	Action
	iv. locations identified through local knowledge or informants	
D	No areas within 100 m of early historic transportation routes can be recommended for exemption from further assessment	Navigable rivers are also considered early historic transportation routes. Current River is a navigable waterway except in area of study area, where the falls/former rapids area exists.
E	No areas within the property containing the following features of archaeological potential can be recommended for exemption from further assessment: i. elevated topography ii. pockets of well drained sandy soil iii. distinctive land formations iv. resource areas v. locations listed or designated by a municipality, or that is a historic landmark	There is elevated topography, areas of well drained sandy soil (ridge), distinctive land formations (Nipissing Transgressional Beach ridge), bedrock consisting of Gun Flint Formation. There are no locations of listed or designated sites in or near the study area. The dam can be considered an historic landmark in the area.
F	Areas documented as disturbed following background study and property inspection can be recommended to not require survey, despite the proximity of features of archaeological potential.	Not applicable – Stage 2 assessment conducted.
1.4.2	Municipal Archaeological Management Plans	
1	Stage 1 may only be used to recommend exempting a property from Stage 2 assessment where it has been a confirmed through a property inspection that potential for the entire project has been removed by extensive and deep ground disturbance.	No Municipal Archaeological Management Plans available.

1.4.8 Rationale for Fieldwork

The study area is occupied by woodlot, parkland, parking areas and bicycle pathways, gravel roadways, buried pipelines, permanent wet areas, and areas of extreme slope. All parts of the study area that were not determined to be areas of low archaeological potential (i.e. parking areas, paved pathways, gravel roads, power station, permanent wet areas and areas of extreme slope) were subject to test pitting in five metre intervals, or pedestrian transect for areas of exposed bedrock conducted in five metre or less intervals. The parkland (Current River Park) also formed part of the study area. Test pitting in this area showed that the area was extensively disturbed and had been levelled and fill deposits placed in the parkland. Sporadic test pitting in the parkland was conducted to confirm the continued disturbance throughout the parkland areas within the study area.   The disturbance showed gravelly soils with broken drainage tile and recent garbage.

Another area of disturbance was located in the western section of the study area (identified in record of finds section as “disturbed area”). Test pitting was conducted in the standard five metre intervals in this area, and intensified around positive test pits with four additional test units.   The Standards (MTC 2011) require eight additional test pits and a one metre test unit. The reason for the deviation with this methodology is that this area contained only 20th century materials – more specifically materials related to the mid-20th century.   As this area was not considered an “archaeological site” of cultural interest. This area was considered the subject of deep and extensive development disturbance.

Pedestrian transect of the exposed bedrock areas was conducted in July and again in October. When the lake levels had been drawn down to winter depths, this stopped flow over the Project area opening additional areas of bedrock. These were visually assessed with pedestrian transect conducted in five metre intervals or less, and concentrated on open areas as well as crevices between the bedrock where items could be lodged.

The site DcJh-21 was relocated during Stage 2 assessment.   Standard test pitting and excavation of one metre units was conducted in this area, as per the Standards and Guidelines for Consulting Archaeologists (MTC 2011).

1.5 Archaeological Context

1.5.1 Previously Known Archaeological Resources and Assessments

The MTCS reported (email March 22nd, 2015 from Robert von Bitter, Archaeological Site Data Coordinator, MTCS) that there are two registered sites located within one kilometer of the study area.

These sites include registered site DcJh-6, Pumping Station and DcJh-21, Posmituk. DcJh-6 was found near the site of the pumping station during its construction ca. 1920. It is identified as an Archaic findspot. Although the artifacts are now missing, they apparently consisted of four copper artifacts: two spatula-like chisel objects and two projectile points.

The second site, DcJh-21, is a chipping stone station, disturbed by a roadway cut, measuring 6.1 m by 6.1 m, found originally in 1976. Paige Campbell, MTCS Review Officer (2016 personal communication), indicated that the site had there was no associated report for the site, although there was a catalogue and description of the site for the approximate 10 artifacts recovered in this location.   The site consisted of two test pits and is affiliated with the Shield Archaic.

In addition to the two registered sites, another unregistered site was located by Dr. Scott Hamilton in Boulevard Lake as an accidental find. This site is a large 22 m diameter stone circle, opened at one end located within Boulevard Lake itself. Dr. Hamilton has conjectured that it might be a medicine wheel or other sacred site. It is not located within the study area, but is within 78 metres of the northwest end of the study area.

No systematic archaeological survey of the study area has been conducted previously, nor are there any nearby past archaeological assessments. There are “reported” finds north of the study area of copper artifacts (Dr. Scott Hamilton, personal communication, July 2016).

There is no archaeological potential mapping or archaeological management plan for the study area.

1.5.2 Physiography and Topography

The study area lies wholly within the Precambrian Canadian Shield physiographic region (Map 1), and in ecoregion 4W (Racey et al: 2000). Ecoregion 4 W is part of the transitional Great Lakes/St. Lawrence forest.

The topography of the area is mixed – generally falling in elevation from north to south. There are small areas of level plateaus, and level ground, but the majority of the property has steep slopes interspersed with wetlands. The parkland at the southwest end of the study area is level, and has been extensively landscaped and has paved parking lot areas, and pedestrian/bicycle pathways throughout. Slopes are often more than 20 degrees or more, and were not tested, as per the Standards and Guidelines.

1.5.3 Bedrock

Bedrock is primarily middle Precambrian of the Animikie series. It consists of gunflint and some formations containing greywacke, shale, iron formation and basalt. The gunflint formation consists of taconite, a material used by prehistoric peoples in the area. Taconite can range in colour from black to jasper coloured. In addition, the surficial geology consists mostly of sand and gravels derived from glaciofluvial deposits.

1.5.4 Prehistoric Shorelines

Until approximately 12,500 years ago Lake Superior was under the Wisconsin ice sheet. As the ice retreated northwards, Glacial Lake Duluth was the first lake to occupy the Lake Superior basin, and extended to just south of the Thunder Bay area. It was dammed up by ice along its northern shore until approximately 10,500 years ago (Zoltai 1968:16).

Lake Agassiz was a large ice dammed lake that formed in Hudson’s Bay during the last deglaciation, circa 12,000 (Before Present, calculated as 1950) BP to 8,000 BP. The extent of the associated strand line lies well north of the Study Area.

The last ice advance in the Superior basin was the Marquette lobe, which retreated around 9600 years BP. As the ice retreated to the north shore of Lake Superior, Lake

Minong filled the Superior Basin, bordered by ice along its northern shore. Further deglaciation northwards towards Hudson's Bay, and the opening of new drainage outlets resulted in the Post-Minong lake levels. Though lower than the earlier Minong levels, Post Lake Minong extended as far north as the Nakina I moraine (near Highway 11) along the Pic River Valley (Zoltai 1968).

Water levels continued to drop as new drainage outlets opened up, until the low Lake Houghton levels around 8000 BP. Isostatic rebound at the Sault Ste. Marie outlet caused a rise in water levels around 5,500-4,000 years BP during the Nipissing stage (Julig et al 1990:25). The Nipissing stage is terminated about 4000 years ago when the North Bay channel was abandoned due to differential uplift and the St. Clair channel was deepened due to erosion. Water levels continued to drop through the Algoma stage, which terminated in 3200 years BP and the Sault stages before reaching modern day levels (Zoltai 1968:19).

Lake Agassiz which lies to the west of the Thunder Bay area probably acted as a barrier to human occupation until it gradually receded northwards around 9000 years BP (Julig 199:25). People and animals followed the retreat of ice northwards as new habitat opened up. Lake Minong and other meltwater lakes were an important part of the seasonal round of Paleo Indian peoples. Camps were concentrated along these glacial lake shorelines as these areas gave them access to a variety of different habitats for hunting and gathering of materials (http://thunderbayarchaeology.ca/Mackenzie_1.html Western Heritage).

The study area lies south of the prehistoric Minong shoreline, but is also crossed by the Nipissing Transgression beach, where it is expected sites of the Archaic period might be present.

1.5.5 Soils

Soils are identified as Nolalu, consisting of loam, silt loam, sandy loam or gravelly sandy loam with good drainage (Land Resources Research Institute 1981). Areas of muck were identified in low lying areas adjacent to permanent wetlands. Exposed bedrock was also evident in the study area.

1.5.6 Drainage

The study lies within the Current River Watershed is located in the northern part of the City of Thunder Bay and extends north into the unorganized Townships of Jacques and Gorham, and into the Municipality of Shuniah. It drains an area of approximately 652 km^2. The watershed is drained by the Kaministiquia River system and numerous small rivers and creeks, including the Neebing, McIntyre, Current River and McVicar Creek.

The Current River is the main river within the study area, originating at Current Lake and flowing south through Ray Lake, then Boulevard Lake (man-made) and discharges into Lake Superior.

There are many wetland areas within the study area (as evidenced through standing water and water related vegetation), small intermittent creeks and streams, and Boulevard Lake (man-made) to the north, and to the south, the Current River.

1.5.7 Vegetation

Dominant trees in the forest exist on the steep slopes and level plateau areas. The trees are primarily poplar, white birch, balsam fir and black spruce. Also noted were white cedar and white spruce. Many of the trees are growing in swampy lowland areas. The forests have an understorey consisting of ferns, grasses, mosses, and in wet areas, rushes, cattails and other wetland species.

1.5.8 Dates of Field Work

Field work was conducted on July 12th (overcast/sunny, high of 22°C); July 13th (sunny, high of 27°C), and July 14th (overcast, high 19°C) and, October 27th, 2016 (overcast, high of 5°C). Lighting conditons were considered good for the Stage 2 field work. The last part of the survey of the front face (facing Lake Superior) of the dam was conducted in October when winter lake levels were reached, and there was little flow on the lakeward face of the bedrock below the dam.

1.5.9 Unusual Physical Features Affecting Fieldwork

There were no unusual physical features affecting the fieldwork.

2.0 Study Methods

2.1 Stage 1 (Background Research)

The purpose of a Stage 1 archaeological assessment is to document "…the property's archaeological and land use history and present condition."

As part of the background research, an examination of the following was conducted:

- the Site Registration Database (maintained by the MTCS) was examined for the presence of known archaeological sites in the Study Area and within a radius of one kilometer of the Project by contacting the data coordinator of the MTCS (2014);
- reports of previous archaeological fieldwork within a radius of 50 m around the property;
- topographic maps at 1:10 000 (recent and historical) or the most detailed map available;
- historic settlement maps such as the historic atlases;
- available archaeological management/master plans or archaeological potential mapping;
- commemorative plaques or monuments; and
- other avenues that assist in determining archaeological potential were examined.

2.2 Stage 2 (Field Assessment)

Stage 2 field assessment was conducted using a combined pedestrian transect survey over exposed areas of bedrock in five m or less intervals and a test pitting strategy conducted in five metre intervals in all other areas (except permanently wet areas, areas of extensive development disturbance, for example, parking lots, paved bicycle paths, gravel roadways, building footprints and gravel beds, buried pipelines; and slopes in excess of 20 degrees).

The Standards and Guidelines indicate that archaeological testing in Northern Ontario must be 50 m (5 m intervals) from modern waterways and that other areas of potential such as historic transportation routes, ancient waterways, etc. be subject to testing for the first 50 m in 5 metre intervals and then for an additional 100 metres in 10 m intervals.

All areas were documented with photography and record keeping, and those areas of low potential were also documented to indicate reasons for not physically testing these areas.

Test pits were excavated into sterile subsoil or stopped upon reaching either the top of a feature or bedrock (in the absence of subsoil). Test pits were a between 30 and 40 centimeters (cms) in diameter. Positive test pits were intensified by excavating eight additional test pits around the positive test pit in 2.5 m intervals. Where there were only a few positive test pits, one metre squares were excavated over the positive test pits.

All positive test pits were recorded using GPS with an accuracy of less than five m, and also marked on a field map.

3.0 RECORD OF FINDS

3.1 Summary of Finds

The following table identifies the standard within the Ministry of Tourism, Culture and Sports' Standards and Guidelines document (2011) and how they were met with respect to Stage 2 field assessment.

Standard Section	Standard	Action
Property Survey		
2.1, Standard 1	Survey the entire property, including lands immediately adjacent to built structures (both intact and ruins), excepting those areas identified by Section 2.1, Standard 2	Done – entire property subject to archaeological assessment, except as per Standard 2.1, Standard 2a. Areas were surveyed with both pedestrian transect conducted in 5 m intervals over exposed bedrock, and test pitted in 5 m intervals in other areas. No areas could be ploughed for assessment purposes.
2.1, Standard 2a	Survey is not required where: a. lands are evaluated as having no or low potential based on the Stage 2 identification of physical features of no or low archaeological potential, including but not limited to: permanently wet areas, exposed bedrock, steep slopes (greater than 20°) except in locations likely to contain pictographs or petroglyphs b. lands are evaluated as having no or low potential based on the Stage 2 identification of extensive and deep land alteration that has severely damaged the integrity of archaeological resources c. lands have been recommended to not require Stage 2 assessment by a Stage 1 report, where the ministry has accepted the Stage 1 report into the Ontario Public Register of Archaeological Reports d) lands are designated for forest management activity without potential for impacts to archaeological sites, as determined through the Stage 1 forest management plans process (see section 1.4.3)	Areas that could not be tested included: permanently wet areas, slopes greater than 20 degrees, areas with extensive and deep development disturbance (buildings and gravel pads – power generation buildings and enclosure), gravel roadways, pedestrian/bicycle pathways (paved), and paved parking lots. In addition, sporadic testing of the "parkland areas" showed that the area had been extensively disturbed down to bedrock and that soils/fill were placed here. Soils in these areas consisted of fill: gravel and drainage tile fragments. All parkland was tested sporadically to ensure that there were no areas of non-disturbance in the area (no areas of non-disturbance were located).

Standard Section	Standard	Action
	e) lands are formally prohibited from alteration such as areas in an environmental easement, restrictive setback, or prohibitive zoning, where the constraint prohibits any form of soil disturbance. (Open space and other designations where allowable uses include land alterations must be surveyed.) f) it has been confirmed that the lands are being transferred to a public land-holding body, e.g., municipality, conservation authority, provincial agency. (This does not apply to lands for which a future transfer is contemplated but not yet confirmed.)	
2.1, Standard 3	Survey the property when weather and lighting conditions permit good visibility of land features	Done – July 12 (overcast/sunny, high of 22°C), July 13 (sunny, high of 27°C), July 14 (overcast, high of 19°C), October 27th (overcast, high of 5°C)
2.1, Standard 4	Using the Global Positioning System (GPS) according to the requirements set out in section 5, record the locations of the following: all diagnostic artifacts; sufficient artifacts to provide and estimate of limits of archaeological site, and all fixed landmarks	Done – Positive test pits 1 and 2 constitute an aceramic site – these were recorded with GPS as well as a fixed landmark (hydro pole). In addition, break of slope was recorded with GPS for the site area. This was determined to be the same site as the previously registered DcJh-21. Positive test pits in area of former 20th building of unknown function. This area was determined to be disturbed and contained only modern refuse. It was not considered a site. A nearby hydro pole in both areas was recorded as fixed landmark.
2.1, Standard 5	Map all field activities (e.g., extent and location of survey methods, survey intervals) in reference to fixed landmarks, survey stakes and development markers. Mapping must be accurate to 5 m or to the best scale available. Use any mapping system that achieves this accuracy.	Done - GPS unit used has an accuracy of 5 m or less in northern Ontario. Trimble GeoExplorer 6000.
2.1, Standard 6	Photo-document examples of all field conditions encountered	Done

Standard Section	Standard	Action
2.1, Standard 7	Do not use heavy machinery (e.g., gas-powered augers, backhoes) to remove soil, except when removing sterile or recent fill covering areas where it has been determined that there is the potential for deeply buried or sealed archaeological sites	No heavy machinery was used during the Stage 2 assessment
Pedestrian Survey		
2.1.1, Standard 1	Actively or recently cultivated agricultural land must be subject to pedestrian survey.	Not applicable
2.1.1., Standard 2	Land to be surveyed must be recently ploughed. Use of chisel ploughs is not acceptable. In heavy clay soils ensure furrows are disked after ploughing to break them up further.	Not applicable
2.1.1, Standard 3	Land to be surveyed must be weathered by one heavy rainfall or several light rains to improve the visibility of archaeological resources.	Not applicable
2.1.1, Standard 4	Provide direction to the contractor undertaking the ploughing to plough deep enough to provide total topsoil exposure, but not deeper than previous ploughing.	Not applicable
2.1.1, Standard 5	At least 80% of the ploughed ground surface must be visible. If surface visibility is below 80% (e.g., due to crop stubble, weeds, young crop growth), ensure the land is re-ploughed and weathered before surveying.	Not applicable
2.1.1, Standard 6	Space survey transects at maximum intervals of 5 m	Done – for areas of exposed bedrock.
2.1.1, Standard 7	When archaeological resources are found, decrease survey transects to 1 m intervals over a minimum of a 20 m radius around the find to determine whether it is an isolated find or part of a larger scatter. Continue working outward at this interval until the full extent of the surface scatter has been defined.	No archaeological resources were located on open bedrock areas surveyed using pedestrian transects.
2.1.1, Standard 8	Collect all formal artifact types and diagnostic categories. For 19th	Not applicable

Standard Section	Standard	Action
	century archaeological sites, also collect all refined ceramic sherds (or, for larger sites collect a sufficient sample to form the basis for accurate dating).	
2.1.1, Standard 9	Based on professional judgment, strike a balance between gathering enough artifacts to document the archaeological site and leaving enough in place to relocate the site if it is necessary to conduct further assessment	Not applicable
Test Pit Survey		
2.1.2, Standard 1	Test pit survey only on terrain where ploughing is not possible or viable, as in the following examples: wooded areas, pasture with high rock content. abandoned farmland with heavy brush and weed growth, orchards and vineyards that cannot be strip ploughed (planted in rows 5 m apart or less), gardens, parkland or lawns, any of which will remain in use for several years after the survey properties where existing landscaping or infrastructure would be damaged. The presence of such obstacles must be documented in sufficient detail to demonstrate that ploughing or cultivation is not viable.	Done – wooded areas and small areas of parkland.
2.1.2, Standard 2	Test pits were spaced at maximum intervals of 5 m (400 test pits per hectare) in areas less than 300 m from any feature of archaeological potential.	Done – 5 m intervals or less.
2.1.2, Standard 3	Space test pits at maximum intervals of 10 m (100 test pits per hectare) in areas more than 300 m from any feature of archaeological potential	Not Applicable.
2.1.2, Standard 4	Test pit to within 1 m of built structures (both intact and ruins), or until test pits show evidence of recent ground disturbance	Done – the power generation buildings were in a fenced off enclosure (locked) but clearly the entire footprint had been subject to extensive and deep development disturbance. The area around the enclosure was test pitting right up to the fence enclosure. The building and enclosure date to 1986-87.

Standard Section	Standard	Action
2.1.2, Standard 5	Ensure that test pits are at least 30 cm in diameter.	Done – 30 – 40 cms in diameter.
2.1.2, Standard 6	Excavate each test pit, by hand, into the first 5 cm of subsoil and examine the pit for stratigraphy, cultural features, or evidence of fill.	Done
2.1.2 Standard 7	Screen soil through mesh no greater than 6 mm.	Done
2.1.2 Standard 8	Collect all artifacts according to their associated test pit	Done
2.1.2 Standard 9	Backfill all test pits unless instructed not to by the landowner.	Done

Map 17 presents general points with GPS mapping. Map 18 illustrates areas of archaeological potential. Map 19 illustrates survey methodologies. Map 20 (presented in the supplementary documentation) provides details of the prehistoric site location. Map 21 illustrates survey results for the disturbed 20th century area, and Maps 22 and 23 illustrates image locations and orientation.

The study area encompassed approximately 11.78 hectares. Exposed areas of bedrock were pedestrian survey methodology conducted in five metre intervals (Images 23, 26, 38, 40-44), and accounted for approximately .83 ha (7%) of the study area. Steep slopes in excess of 20° were documented (Images 35, 47, 72-73) but not subject to test pitting (.63 hectares, 5.3%). Permanently wet areas (Images 27, 29, 30, 39, 62, 68, 70, 78-79, and 82-83) were not tested (3.35 ha, 28.4%). The remaining areas (59.3%) were subject to test pitting in 5 m intervals. In addition, some areas were subject to intensified test pitting (Image 76) conducted in 2.5 m intervals (.08%).

Images 3-9, 12-16, and 23-88 illustrate conditions of the subject area.

Section 2.2 of the Standards and Guidelines (MTC 2011) sets out standards to determine the need for Stage 3 archaeological assessment.

Standard Section	Standard	Action
Section 2.2, Analysis, Determining Requirement for Stage 3 Assessment		
2.2 , Standard 1	Artifacts, groups of artifacts or archaeological sites meeting the following criteria require Stage 3 assessment	

Standard Section	Standard	Action
2.2., Standard 1a	Pre-contact diagnostic artifacts or a concentration of artifacts (or both)	Yes – subject to intensification around positive test pits (2.5 m, 8 pits) and one metre test unit excavation over each of the two positive test pits for the aceramic site. Determined to be same as previously registered site, DcHj-21.
2.2, Standard 1a, i	Within a 10 x 10 m pedestrian survey area	Not applicable
2.2, Standard 1a, i, (1)	At least one diagnostic artifact or fire cracked rock in addition to two or more non-diagnostic artifacts	No diagnostic artifacts or fire cracked rock.
2.2, Standard 1a, i, (2)	In areas east or north of the Niagara Escarpment, at least five non-diagnostic artifacts	Yes – Thunder Bay area – more than 600 non-diagnostic artifacts.
2.2, Standard 1a, i, (3)	In areas west of the Niagara Escarpment, at least 10 non-diagnostic artifacts	Not applicable
2.2, Standard 1a, ii	Within a 10 x 10 m test pitting area	Yes
2.2, Standard 1a, ii, (1)	At least one diagnostic artifact from combined test pit and test unit excavations	No diagnostic artifacts.
2.2, Standard 1a, ii, (2)	At least five non-diagnostic artifacts from combined test pit and test unit excavations.	Yes – more than five non-diagnostic artifacts from combined test pit and test unit excavations.
2.2, Standard 1b	Single examples of artifacts of special interest	none
2.2, Standard 1b, i	Aboriginal ceramics	none
2.2, Standard 1b, ii	Exotic or period specific cherts	Not applicable – Gun Flint Formation cherts, jasper taconite, grey taconite – locally available chert
2.2, Standard 1b, iii	An isolated Paleo-Indian or Early Archaic diagnostic artifact	none
2.2, Standard 1c	Post-contact archaeological sites containing at least 20 artifacts that date the period of use to before 1900.	Not applicable – 20th century evidence of former tourist camps and Army barracks 1920s to 1965. Considered an area of disturbance.
2.2, Standard 1d	Twentieth century archaeological sites, where background documentation or archaeological features indicate possible cultural heritage value or interest	No cultural heritage value or interest for area of disturbance with mid-20th century materials.
2.2, Standard 1e	The presence of human remains	Not applicable

Archaeological assessment determined that there were some areas of low potential (steep slopes in excess of 20 degrees), extensive and deep development disturbance (parking lots, gravel roadways, area of power house, buried water pipeline), and permanently wet areas.

Only one archaeological site was located during the Stage 2 archaeological assessment. This was a small, aceramic site. This is the previously registered archaeological site, DcJh-21, first found in 1976. It has been identified as Shield Archaic campsite or chipping station.

There was another area tested in the proximity of the former building that appears on the 1959 aerial photograph. This was found to be extensively disturbed and had only mid-20th century material coming from it.

Both are elaborated on in greater detail in Section 4.0.

3.2 Inventory of Documentary Records Made in Field

These are presented in Appendix C of this report.

3.3 Deposition of Artifacts

The material recovered from the 2016 Stage 2 archaeological investigation has been transferred to the northern office of the Ministry of Tourism, Culture and Sport, to join the other materials related to the same site (supplementary documentation).

4.0 ANALYSIS AND CONCLUSIONS

4.1 DcJh-21

One site was relocated during the Stage 2 assessment. This site, known as the Posmituk site, DcJh-21, an aceramic site (solely lithic material) (see supplementary documentation). This site was one of the two identified through the site data search. The site was relocated through standard interval (5 metre) test pitting.

There is very little information regarding the site from the site data search. Ms. Paige Campbell (2016 personal communication) of the Ministry of Tourism, Culture and Sport supplied additional information, but this too, was limited. The site was originally located in a road cut (presumably this is the bicycle/pedestrian path which is located south of the study area), was also small in size, and also aceramic. Materials recovered from the original site discovery are similar to those located in the relocation of the site, that is, consisting of taconite materials. The site was identified as a Shield Archaic campsite/chipping station in 1976. The evidence procured in the 2016 assessment supports the cultural affiliation of Shield Archaic, and suggests, based on the lithic material, that this was likely a chipping station.

The 2016 investigation relocated the site with two positive test pits located close to each other. Both of these positive test pits were further intensified with eight (8) additional test pits spaced at 2.5 m intervals from the positive test pits (see supplementary documentation). There were no additional positive test pits. A one metre square was placed directly over the centre of each test pit. The test units were excavated into sterile subsoil. There were no features located in either unit, although in the wall of Test Pit/Unit 1, a pocket of chert (without definition of soil stratigraphy) was located at the interface of the topsoil and subsoil (Images 54 ad 55 illustrate the drawn planview and profiles for each test unit, and Images 49-52 illustrate the photographs of the same). There was no stratigraphy other than the organic decomposed layer of forest vegetation over a sandy subsoil. Test Pit/Unit 2 produced a much smaller quantity of material (n=12) compared to Test Pit/Unit 1 (n=715). Both test pits/units produced modern material, which is not surprising given that the area was littered with garbage on the surface, recent and very recent (that is, someone bedding down adjacent to the site).

A full description of the location information for this site is presented in the supplementary documentation.

Table 2 presents a summary of artifacts from both excavated Test Units. The positive test pits for these areas were combined with the Test Unit assemblage. Aside from the modern refuse, the remaining material was all lithic – specifically, taconite. The taconite was both black and jasper taconite – both are from the Gun Flint formation, which is prevalent in this part of Thunder Bay.

The IMACS user's Guide (IMAC 2001) was used to analysis the lithics of the site. There are four main categories of flakes: decortication (unutilized flakes produced from core reduction usually with large amounts of cortex on the dorsal surface and greater than 30 mm in size); secondary flakes (any unutilized flake produced from core reduction with little cortex on the dorsal surface compared to large primary flakes, and usually between 15 and 30 mms in size); tertiary flakes or primary thinning flake (any unutilized flake from core reduction with less than 1% cortex on the dorsal surface and/or three or more dorsal flake scars, usually less than 15 mm in size); and shatter (unmodified pieces of material produced from core reduction without definite flake attributes). Cores were also described from the same source: any coleus of raw material from which flakes have been detached (IMAC 2001: 445 (1)).

In addition, all chert material was examined for evidence of tools or diagnostics. Only one side scraper was located, and it was made of jasper taconite and had one scraping edge. There was no hafting element on the scraper.

There were 13 pieces of decortication, 44 primary flakes, 120 secondary flakes, 527 pieces of shatter, two cores, and the one scraper (described above). Images 89 to 96 illustrate some of the materials recovered from the site.

The modern material consisted of a four-hole button, bottle glass, and an indeterminate metal container. The modern material is considered a by-product of recent activities in the area – a small campsite located adjacent to the site area, and a scatter of modern refuse on the surface.

The Posmituk site, DcJh-21, is considered to have cultural heritage value and significance. It dates to the Shield Archaic period and appears to be a chipping station (no evidence of campsite related artifacts).

4.2 Disturbed Area

A large disturbed area was found through standard interval (5 metre) test pitting. It was located north of one of the pedestrian/bicycle pathways and between a permanent wetland to the north. The area was disturbed as observed from surface conditions of gravel and concrete (Images 57 - 59), and a deposit of large rocks. This area was subject to test pitting in five metre intervals, and positive test pits were further intensified with an additional four test pits around each positive test pit spaced at 2.5 metre intervals (Map 21).

The methodology is <u>not</u> that prescribed by the MTC 2011 Standards and Guidelines for Consulting Archaeologists for Stage 2 assessments (test pitting, Standard 2.1) which addresses number of test pits to be excavated if resources are located during the survey. The justification for the modification to the Standard is that it became obvious very quickly that all materials were mid-20th century in date. The intensification around the primary positive pits was conducted to ensure that no possible earlier material was present. Appendix B provides an inventory of material from each of the positive test pits and any of the four surrounding test pits (placed at 2.5 m intervals around the positive test pit). Glass was modern (lead glass which is clear and colourless, soda lime glass for soda bottles, and amber glass, possibly from beer bottles, and safety glass – of which a large quantity was in abundance, being highly fragmented). Nails were also modern. All of the nails were wire, and most were of galvanized steel. There was also a large quantity of insulbrick noted – which was popular in the 1930's and 1940's. It was used to mimic more expensive brick, suggesting the building was wooden frame construction. The aerial photograph from 1959 (Map 11) shows a long rectangular building in this location. By 1969 (Map 12), the building is gone. By inference, the materials in this disturbed area are from this former building of unknown function. Other than the one aerial map of 1959, there are no other maps or aerial images that show this building.

A tourist camp and army barracks were located close to the study area (actually located at the toe of slope south of the study area).

Images 89 to 91 illustrate the materials recovered from the disturbed area (they are not retained). This area is not considered to have cultural heritage value or significance.

5.0 RECOMMENDATIONS

Based upon the background research of past and present conditions, and the property inspection, the following is recommended:

- Stage 3 archaeological assessment is recommended for the site DcJh-21. Stage 3 should consist of placing and excavating 1 m square test units in a 5 meter grid across the site, and excavating additional test units, amounting to 20% of the grid total unit. It is suggested that there be five one metre square units excavated in total for the Stage 3 site; or;
- Avoidance of the site DcJh-21 must be conducted by the proponent (the proponent has opted to avoid the site) through monitoring of the site during construction;
- Monitoring of all construction activities in this area (see supplementary documentation) shall be conducted by a licensed archaeologist and accompanied by an Indigenous monitor from Fort William First Nation;
- The rehabilitation of the dam will include a marine archaeological assessment of areas that will be enclosed within a cofferdam. The proponent has arranged for this marine archaeological assessment to be conducted by Scarlett Janusas Archaeology Inc. upon dewatering of the area (mid-June 2017). It is recommended that the proponent ensure that the marine archaeological assessment is conducted for the project.
- It is recommended that the remaining study area does not require any further archaeological assessment;
- Compliance regulations must be adhered to as described in Section 6 of this report.

This archaeological assessment has been conducted under the 2011 Standards and Guidelines for Consultant Archaeologists (Ministry of Tourism and Culture, 2011).

6.0 ADVICE ON COMPLIANCE WITH LEGISLATION

According to the 2011 Standards and Guidelines (Section 7.5.9) the following must be stated within this report:

This report is submitted to the Minister of Tourism and Culture as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Tourism, Culture and Sport, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the Ontario Heritage Act for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological Reports referred to in Section 65.1 of the Ontario Heritage Act.

Should previously undocumented archaeological resources be discovered, they may be an archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with sec. 48 (1) of the Ontario Heritage Act.

The Cemeteries Act, R.S.O. 1990 c. C.4 and the Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the Ontario Heritage Act and may not be altered, or have artifacts removed from them, except by a person holding an archaeological license.

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Table 1
Culture History for Northern Ontario

Period	***Group***	***Time Range***	***Comment***
Paleo-Indian	Plano	8000 – 5000 B.C.	Hunting animals such as caribou with spears; adaptation to a climate cooler than today; glacial ice still covered part of the region; huge stone tool quarry and workshop was started on Manitoulin Island.
Archaic	Shield Archaic; Old Copper Culture	5000 B.C. – 400 B.C.	Bow and arrow introduced around 1600 B.C.; the aboriginals settled at Sault Ste. Marie; sturgeon and suckers are harpooned and caught in fish traps in local rivers; copper is discovered a raw material for tools; stone axes, gouges and other heavy wood-working tools become common along Lake Superior and Lake Huron. By the middle of the Archaic period, almost every remote lake and river system in northeastern Ontario had some aboriginal settlements. The spread of people was rapid and thorough.
Middle Woodland	Laurel Culture	400 B.C. – A.D. 800	The start of seine net fishing in shallow water was developed; pottery was used for the first time.
Late Woodland	Eastern Algonkians; Selkirk; Blackduck; Wanikan	A.D. 800 – 1600	By the 15th century, the Ojibwa in northeastern Ontario had established strong trade ties with the Huron and Ottawa in southern Ontario; gill net fishing began; rock paintings on cliffs spread across the region; religious ceremonies developed; ancestors of the Ojibwa, Cree and Ottawa developed a specialized adaptation to northern Ontario and its seasonal cycle of food resources; the main sites were concentrated on large rivers and lakes, while campsites can be found almost anywhere.
Historic	Fur Trade; Pioneer (land surrenders and reserves)	A.D. 1600 to the present	Traditional lifestyles disappeared; the fur trade changed the landscape and settlements; European trade goods replaced stone and ceramic native tools.

Table 2
DcJh-21 Artifact Frequency by Test Unit/Pit

Provenience	Material	Type	Subtype	frequency
Test Pit/Unit 1	Glass	Prossor	Button	1
Test Pit/Unit 1	Glass	Amber	Bottle	2
Test Pit/Unit 1	Glass	Soda lime	Bottle	1
Test Pit/Unit 1	Glass	Colourless	bottle	1
Test Pit/Unit 1	Metal	Container	Indet.	1
Test Pit/Unit 1	Chert	Taconite	Cores	2
Test Pit/Unit 1	Chert	Taconite	Decortication flakes	13
Test Pit/Unit 1	Chert	Taconite	Primary flakes	42
Test Pit/Unit 1	Chert	Taconite	Scraper	1
Test Pit/Unit 1	Chert	Taconite	Secondary flakes	112
Test Pit/Unit 1	Chert	Taconite	Shatter	527
Test Pit/Unit 1				703
Test Pit/Unit 2	Ceramic	Brick	Red	1
Test Pit/Unit 2	Metal	Copper alloy	US 20th century penny	1
Test Pit/Unit 2	Chert	Taconite	Primary flakes	2
	Chert	Taconite	Secondary flakes	8
Test Pit/Unit 2				12
TOTAL				715

IMAGES

Image 1: Dam Rehabilitation Drawing

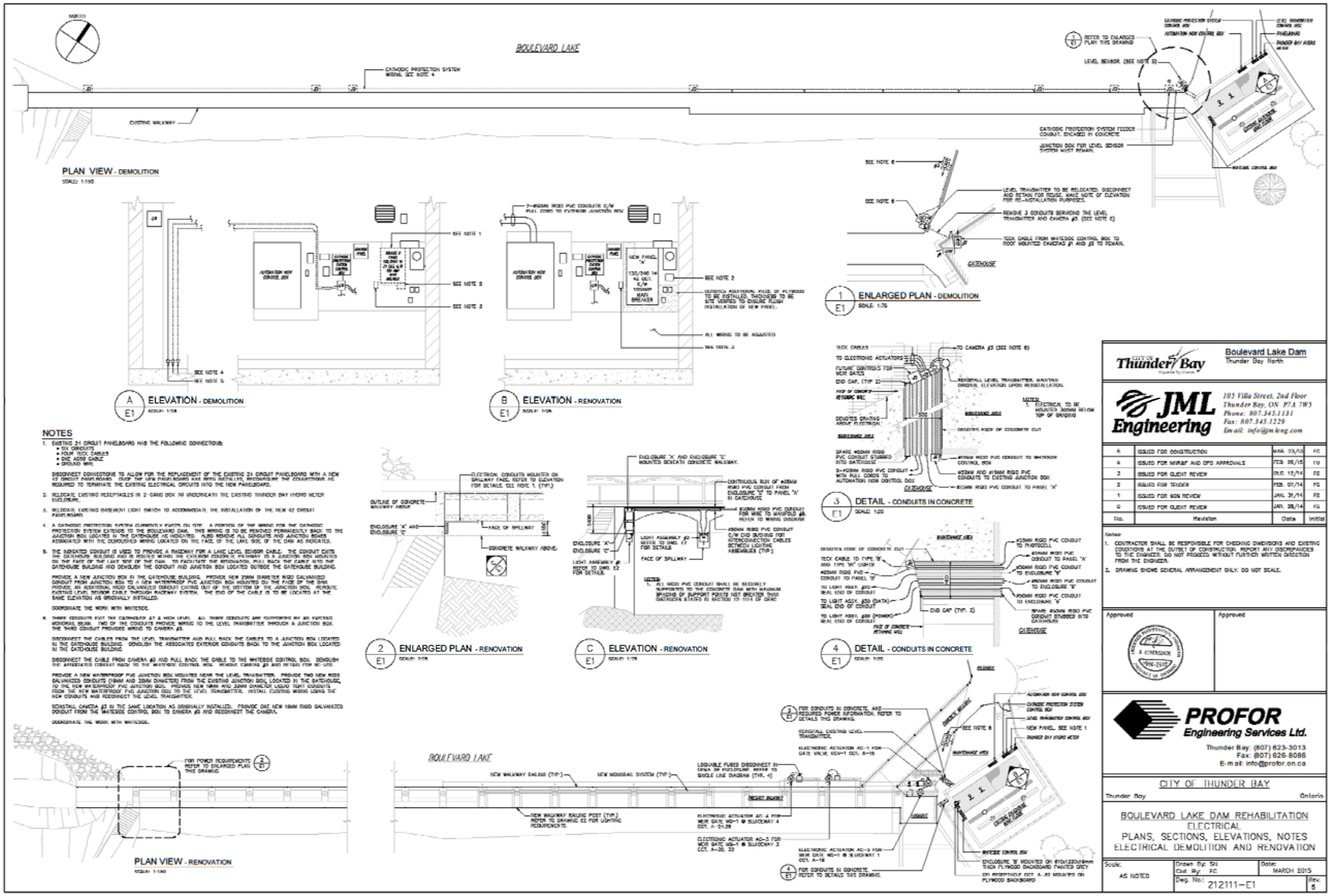


Image 2: Dam Rehabilitation Drawing

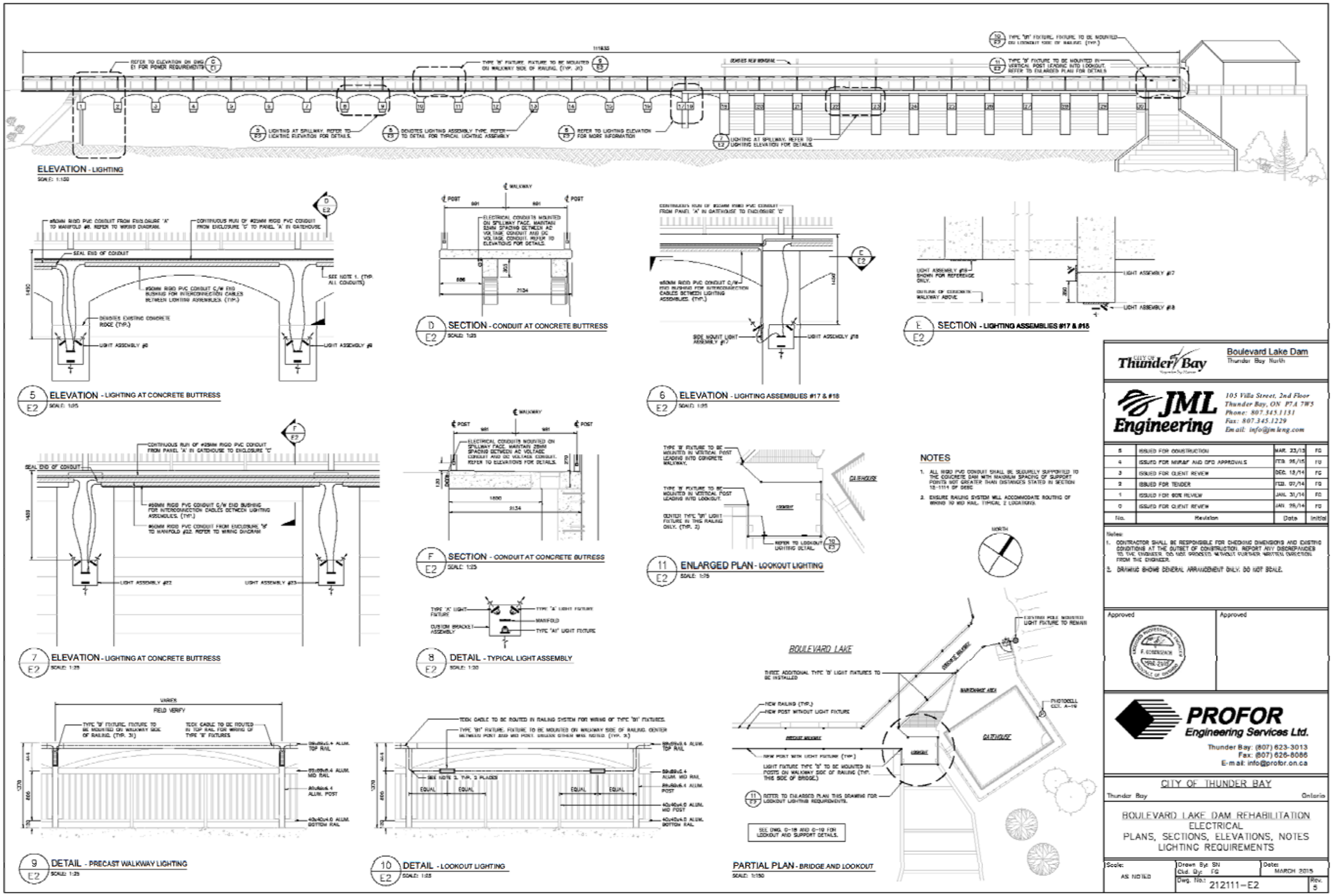


Image 3: Wooden Clad Fish Ladder Building facing West

Image 4: Wooden Clad Fish Ladder Building facing South

Image 5: Buried Pipe Line facing NNE

Image 6: Power Station facing SW

Image 7: Power Station Enclosure facing SW

Image 8: Dam from Boulevard Lake facing SW

Image 9: Boulevard Lake Dam facing N

Image 10: Dam in Poor Repair (from client October 15, 2008)

Image 11: Dam in Poor Repair (from client October 15, 2008)

Image 12: Retaining Wall facing E

Image 13: Iron Pipe intersecting Retaining Wall facing N

Image 14: Pedestrian/Bicycle Path facing E (background)

Image 15: Parking Lot facing North

Image 16: Gravel Road to Power Station facing N

Image 17: Current River Falls Prior to Dam Construction, c. 1900 (from Bobrowicz 2012: 11)

Image 18: First Current River Falls Dam c. 1905 (from Bobrowicz 2012: 12)

Image 19: Current River Powerhouse from the CPR Bridge, c. 1905 (from Bobrowicz 2012: 12)

Image 20: Second Current River Dam facing N (from Bobrowicz 2012: 18)

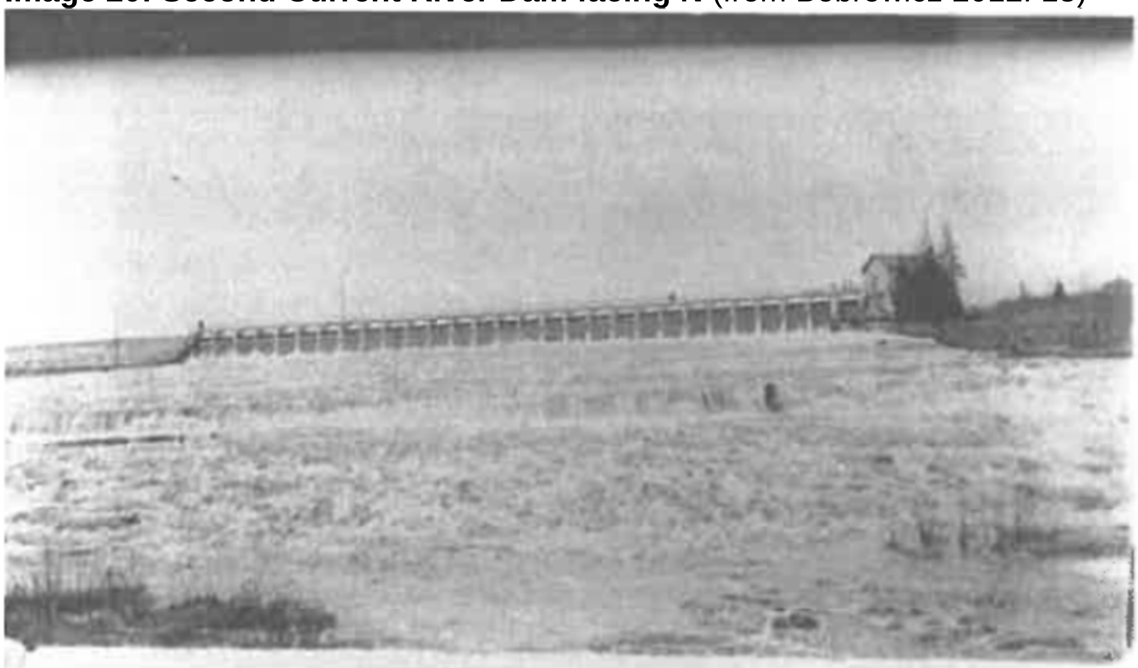


Image 21: Timber Sluiceway No. 9 (this might be No. 10, not 9 [SJAI]) (Bobrowicz 2012: 27)

Current River Dam from Cumberland Street bridge during the spring log drive, c. 1930. Photo courtesy of Mr. F. Gauley.

Image 22: 1951 Flood at Boulevard Lake Dam facing NNE (Bobrowicz 2012: 29)

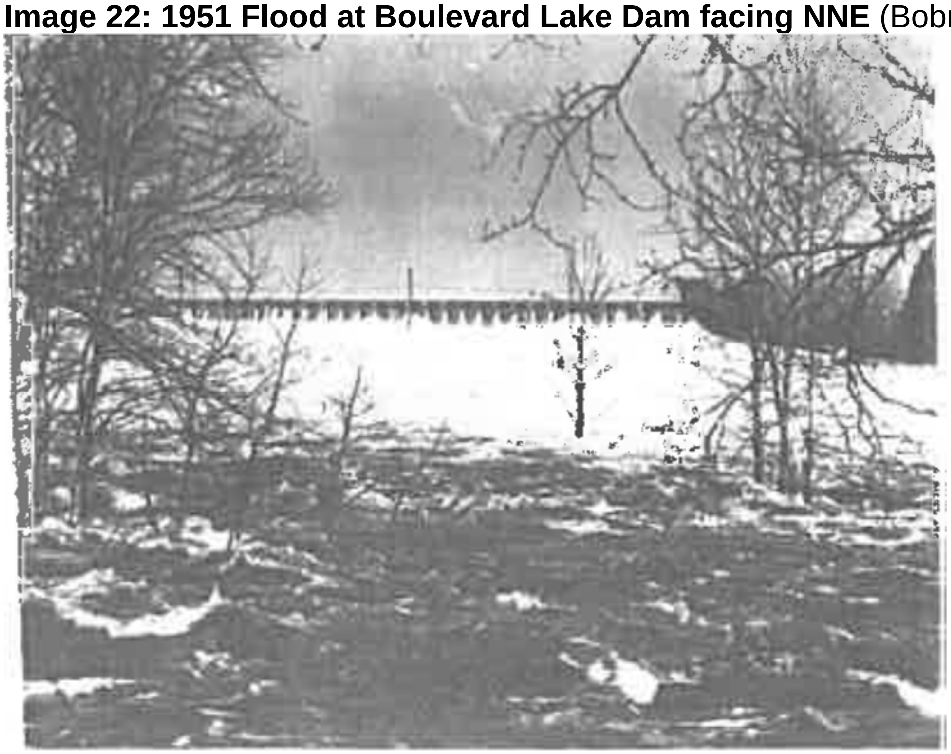


Image 23: Open bedrock, pedestrian transect facing NE

Image 24; Test Pitting beside open bedrock area facing E

Image 25: Culvert facing Northwest

Image 26: Exposed bedrock and shallow soils facing NW

Image 27: Permanently standing water – not tested – facing down

Image 28: Test pitting facing NE

Image 29: **Permanently wet low lying area, not test pitted facing S**

Image 30: **Test pitting facing S**

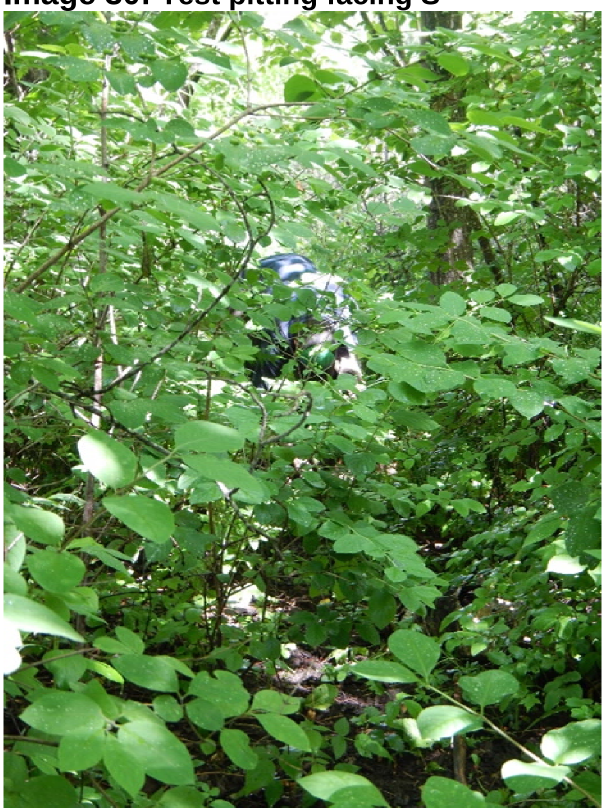


Image 31: **Test Pitting beside road culvert facing SW**

Image 32: **Permanently standing water facing SW**

Image 33: **Test pitting facing West**

Image 34: Test pitting facing NW

Image 35: 20 degree plus slope, not tested facing SW

Image 36; Buried pipeline facing N

Image 37: Test pitting disturbed area (recent fill) facing SE

Image 38: **Pedestrian transect of open exposed rock area facing SW**

Image 39: **Area behind retaining wall – permanently wet facing N**

Image 40: **Pedestrian transect of open exposed rock area facing SE**

Image 41: **Pedestrian transect of open exposed rock area facing E**

Image 42: **Pedestrian transect of open exposed rock area facing N**

Image 43: **Exposed bedrock with water flowing over it facing NNW**

Image 44: **Pedestrian transect of open exposed rock area facing NNW**

Image 45: **Test pitting facing NW**

Image 46: **Test pitting little jut out into lake facing NW**

Image 47: **Steep slope in excess of 20° degrees – not tested facing ESE**

Image 48: **Testing base of slope facing NE**

Image 49: Planview of Test Pit/Unit 2 facing 304°

Image 50: Profile of Test Pit/Unit 2 facing 304°

Image 51: Planview of Test Unit 1 facing 304°

Image 52: Profile of Test Unit 1 facing 304°

Image 53: Test Pitting facing NW

Image 54: Positive Test Pit #1 – Test Unit Planview and Profile

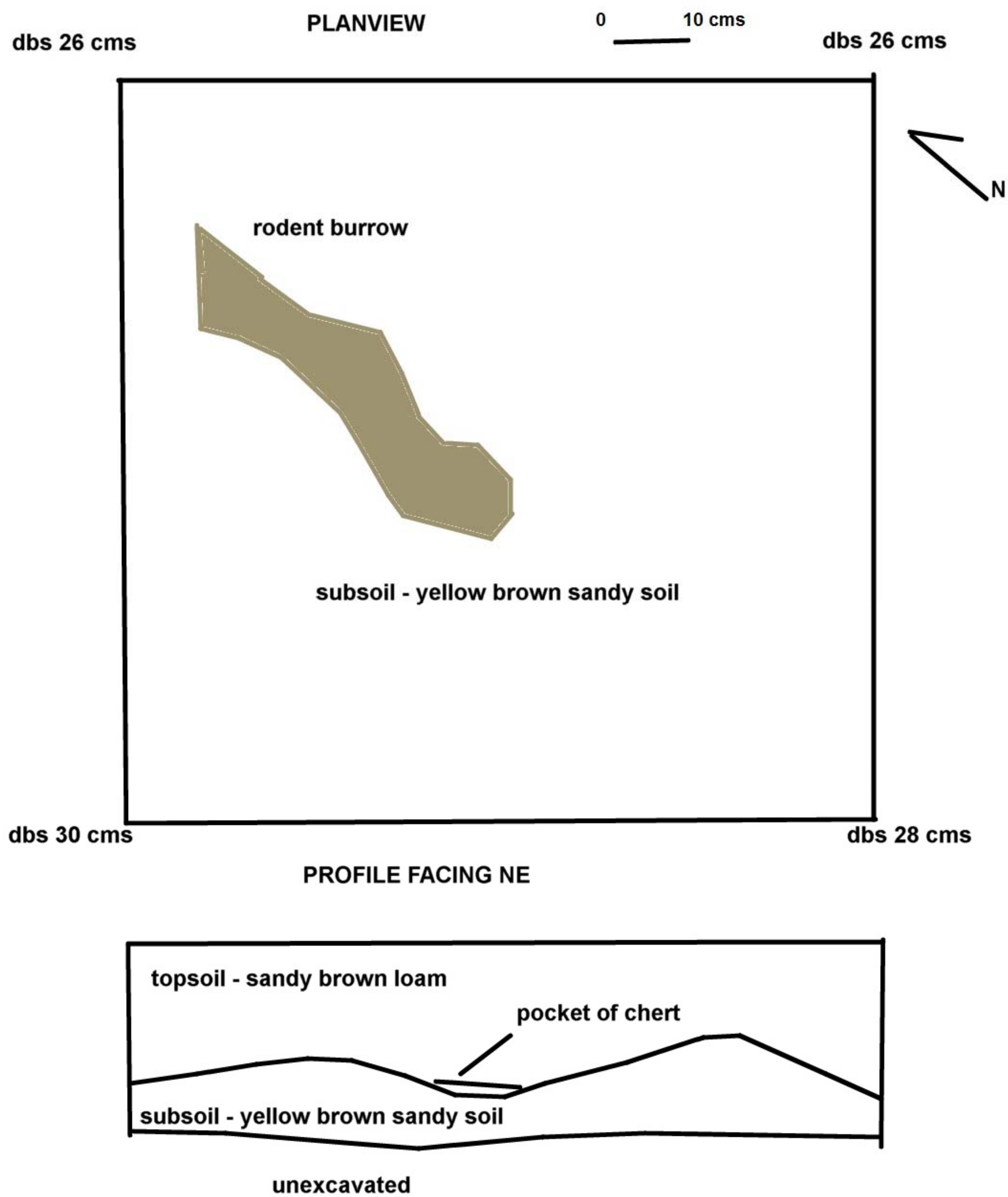


Image 55: Positive Test Pit #2 – Test Unit Planview and Profile

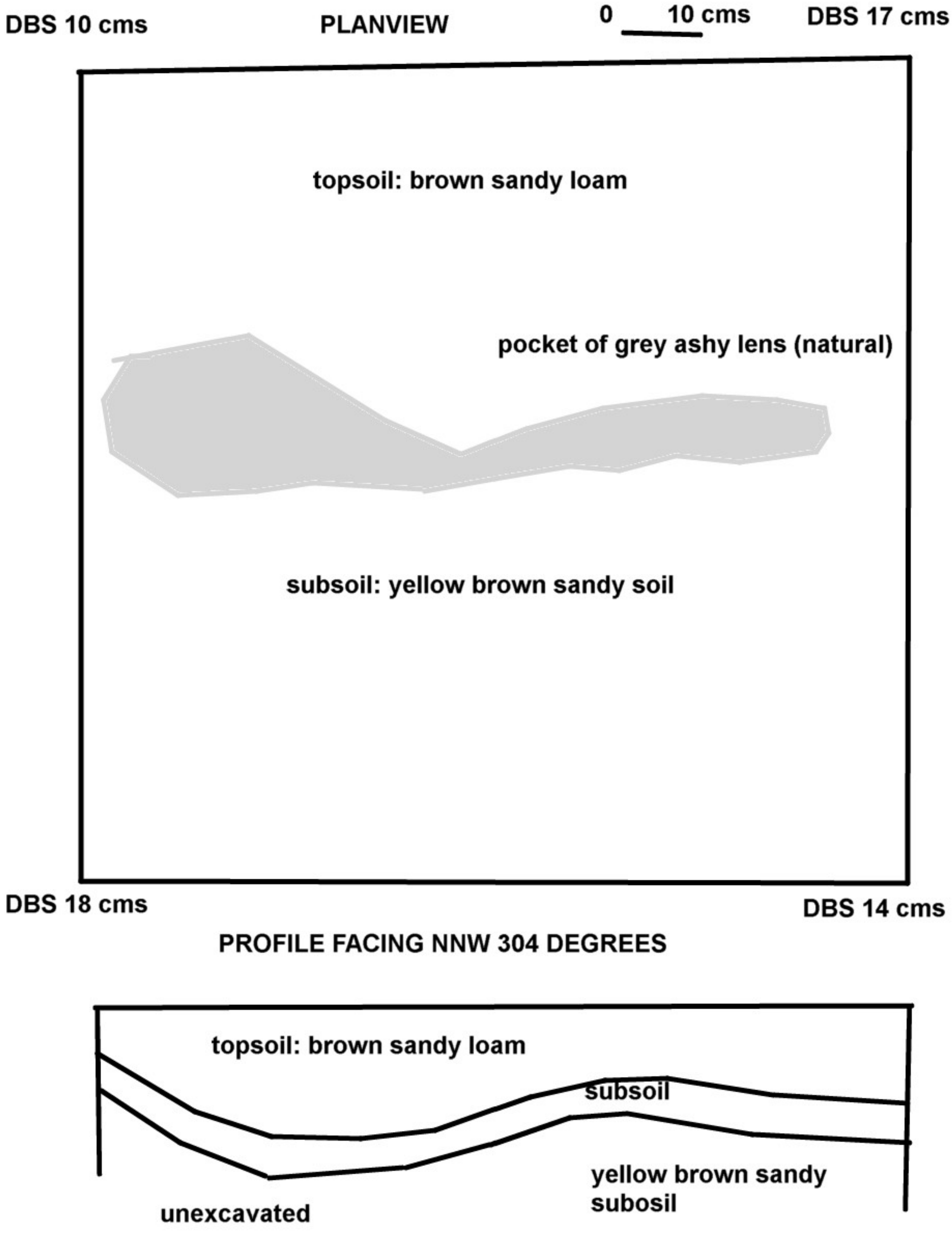


Image 56: **Test Pitting facing WNW**

Image 57: **Disturbed area – gravel facing NW**

Image 58: **Large redeposited rock pile facing ENE**

Image 59: **Disturbed soils facing down**

Image 60: **Area of disturbance being tested (intensified) facing NW**

Image 61: **Large concrete blocks in permanent wet area facing NE**

Image 62: Permanent wet area – not tested facing NE

Image 63: Concrete from test pits facing down

Image 64: Concrete on Surface facing NE

Image 65: West of bicycle path facing NW (note shovel at tree) – not tested

Image 66: Test Pitting facing NW

Image 67: Test pitting south of dam facing NW

Image 68: Permanently wet area – not tested facing down

Image 69: Test Pitting facing NE

Image 70: Permanently wet area – not tested facing SE

Image 71: Concrete on Surface facing SW

Image 72: 20 degree plus slope – not tested facing NW

Image 73: 20 degree plus slope along dam – not tested facing S

Image 74: Hydro pole (used as datum) facing NNE

Image 75: Disturbed parkland soils facing down

Image 76: Intensifying test pitting around positive test pit 1 facing WSW

Image 77: Test pitting facing N

Image 78: Permanently Wet Area facing S

Image 79: Permanently Wet Area facing N

Image 80: Test pitting break in slope around Test Units 1 and 2 facing NW

Image 81: Hydro Line facing ENE

Image 82: Permanently wet area – not tested facing N

Image 83: Permanently wet area – not tested facing W

Image 84: Open Bedrock facing east

Image 85: Open Bedrock facing southeast

Image 86: Open Bedrock facing southeast

Image 87: Open Bedrock facing south

Image 88: Pedestrian Survey of Open Bedrock facing southeast

Image 89 DcJh-21: Examples of Decortication

Image 90: DcJh-21 Examples of Primary Flakes

Image 91: DcJh-21 Examples of Secondary Flakes

Image 92: DcJh-21 Cores

Image 93: DcJh-21 Scraper

Image 94: Insulbrick and Nails from Disturbed Area - 1

Image 95: Safety Glass, Hard Paste Porcelain and Spent Fuel

Image 96: Bottle Glass, Coupling, Metal Container

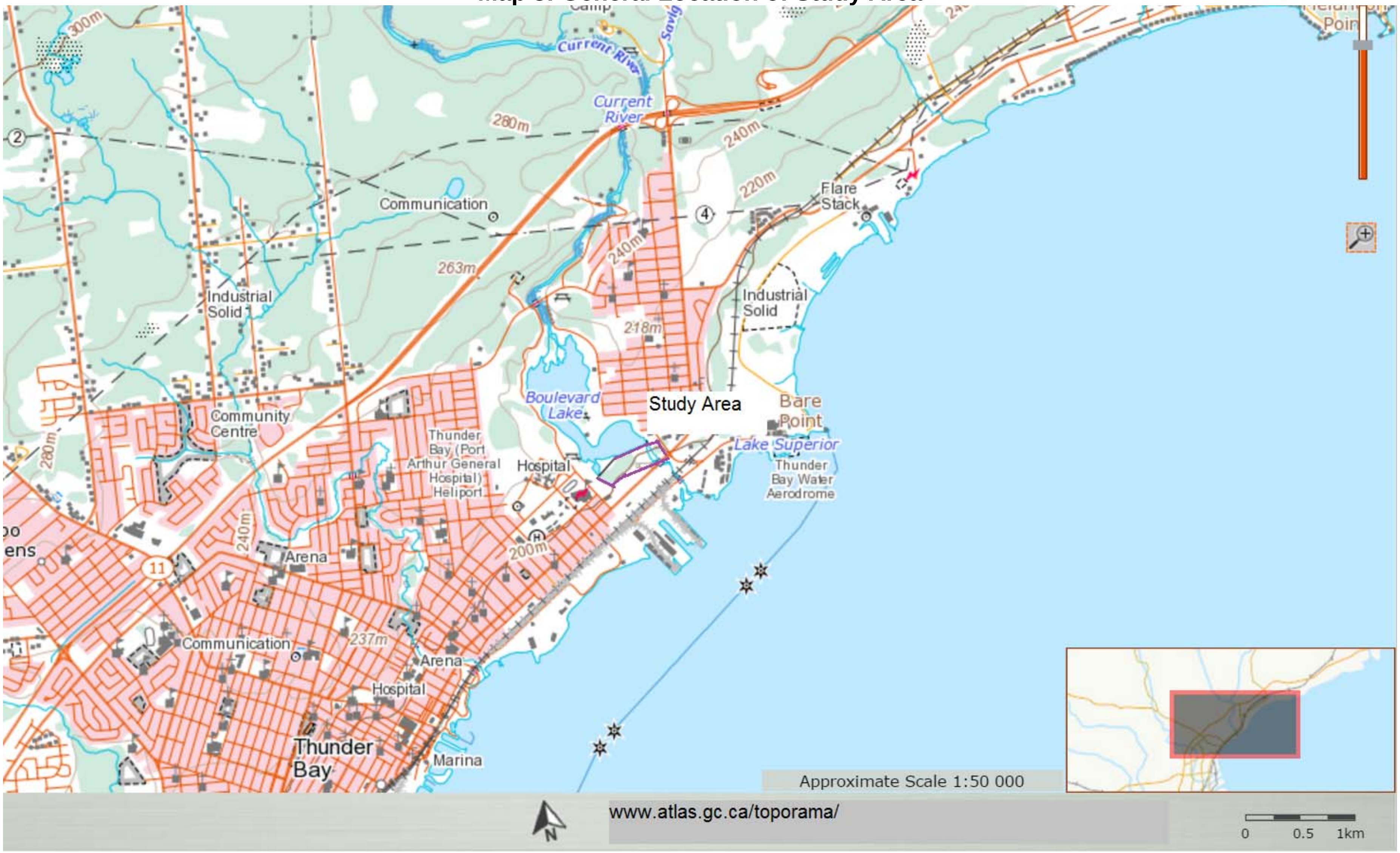
MAPS

Map 1: Canadian Shield

1

Map 2: Regional Setting

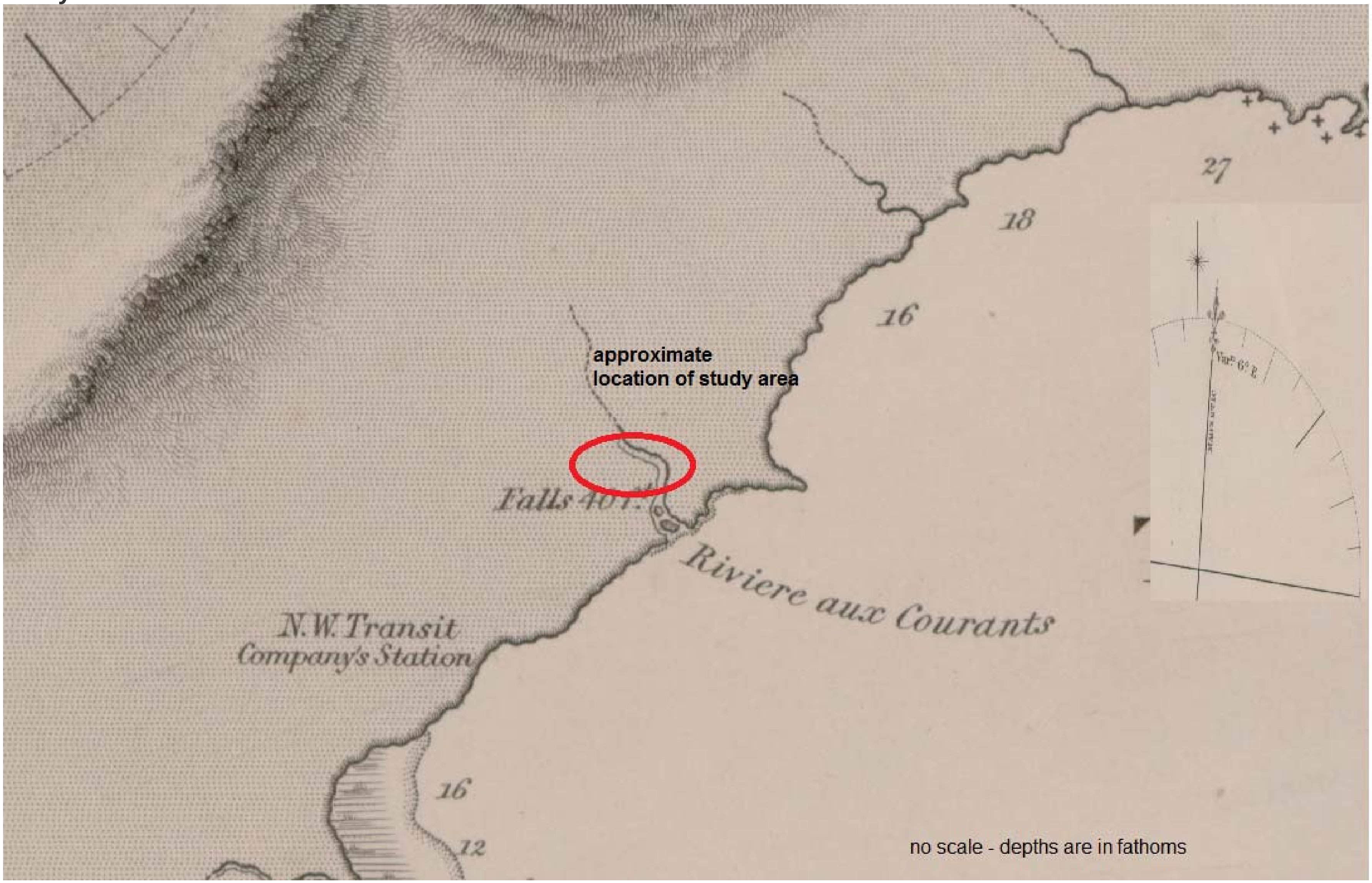
Map 3: General Location of Study Area



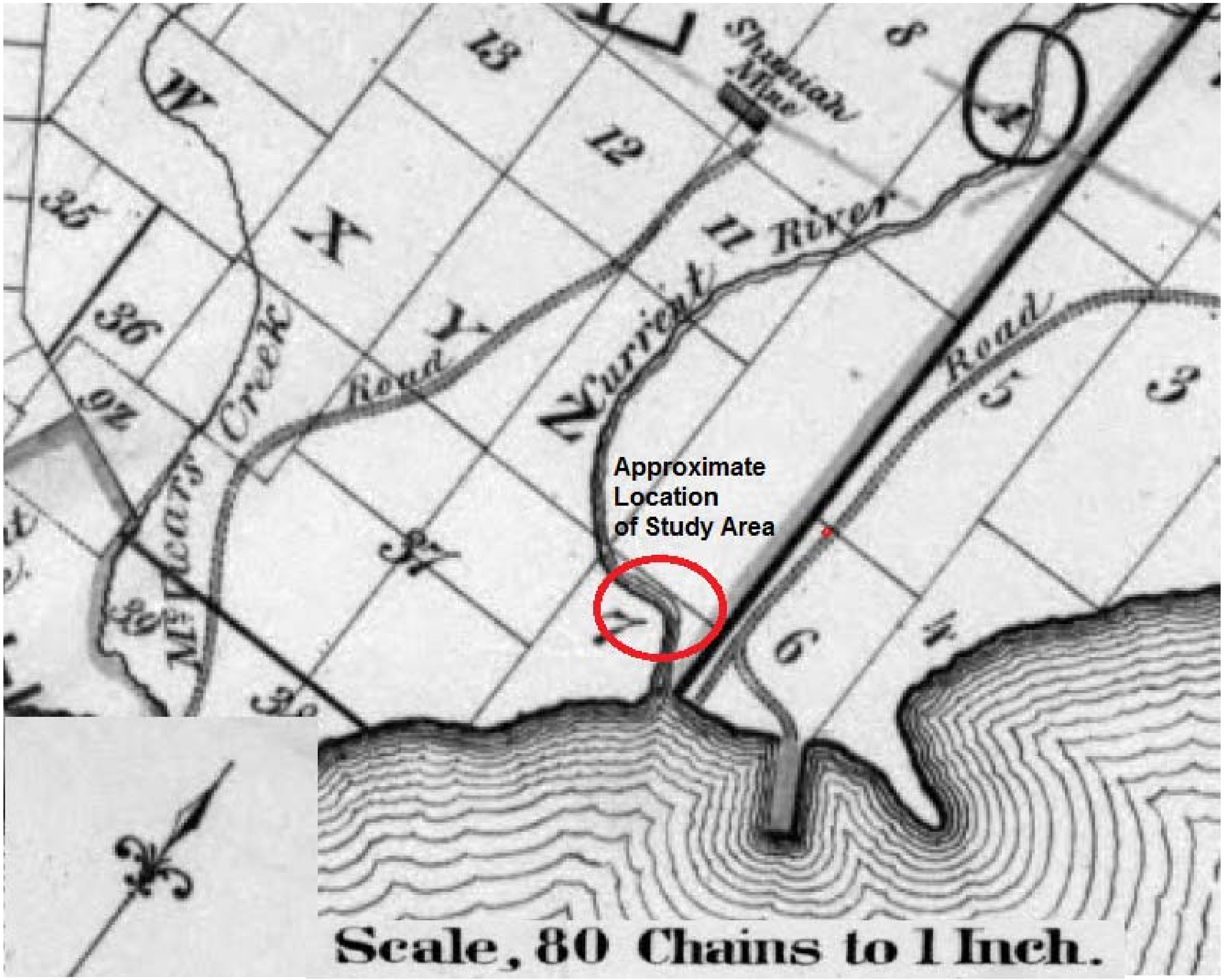
Map 4: Area of Stage 2 Archaeological Assessment

Map 5: Proposed Access Road and Laydown Area

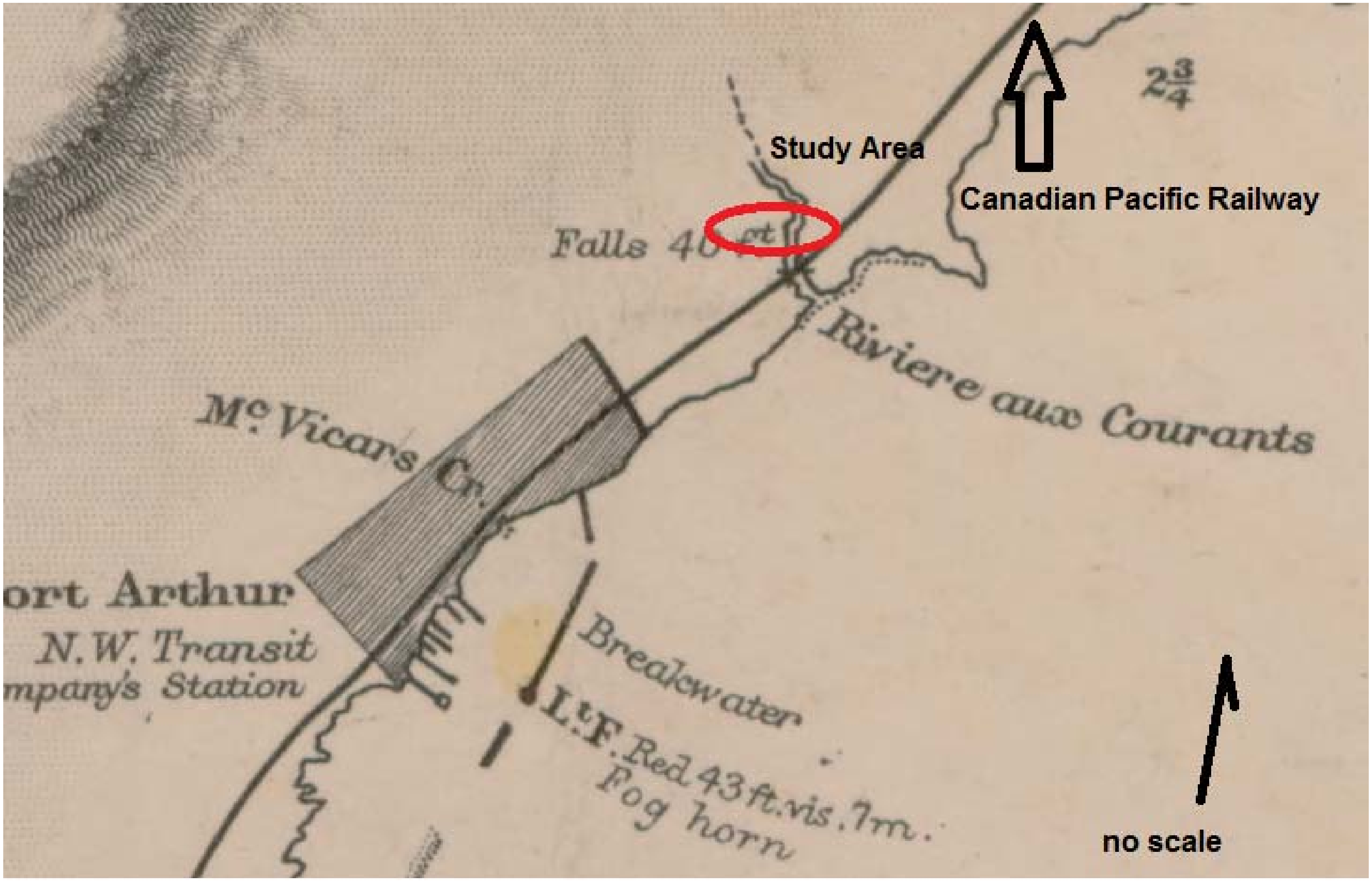
Map 6: Chart of part of the North Coast of Lake Superior, from Grand Portage Bay to Hawk Islet including Isle Royale 5 May 1828



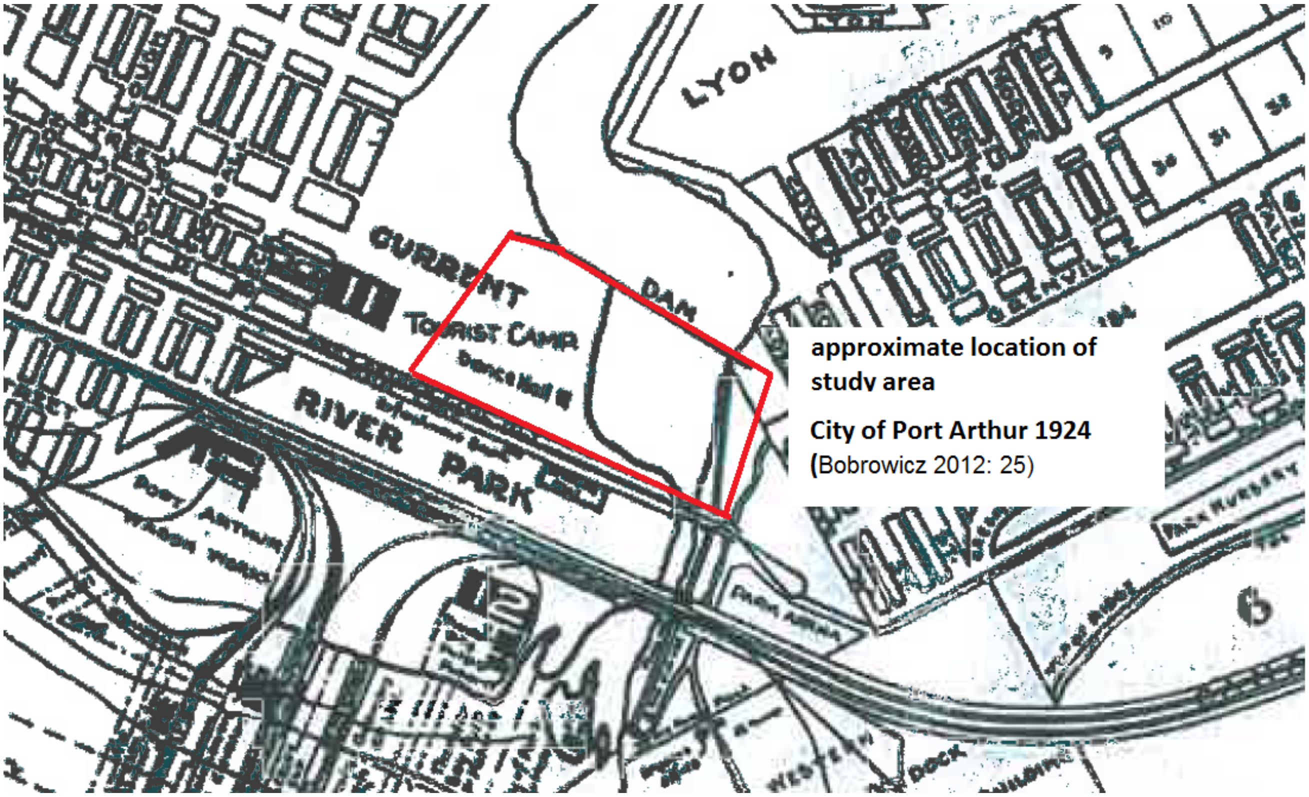
Map 7: Savigny, ca. 1872 Map of Study Area



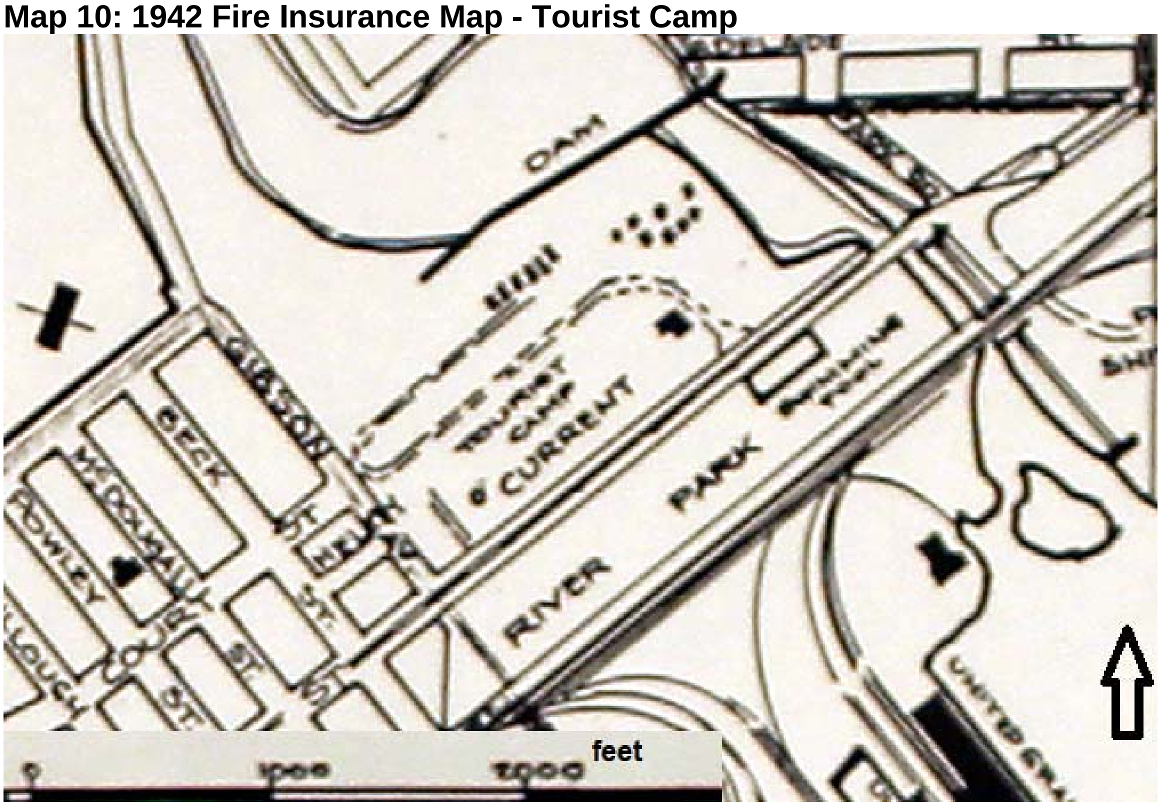
Map 8: Chart of part of the North Coast of Lake Superior, from Grand Portage Bay to Hawk Islet including Isle Royale 1889 (update)



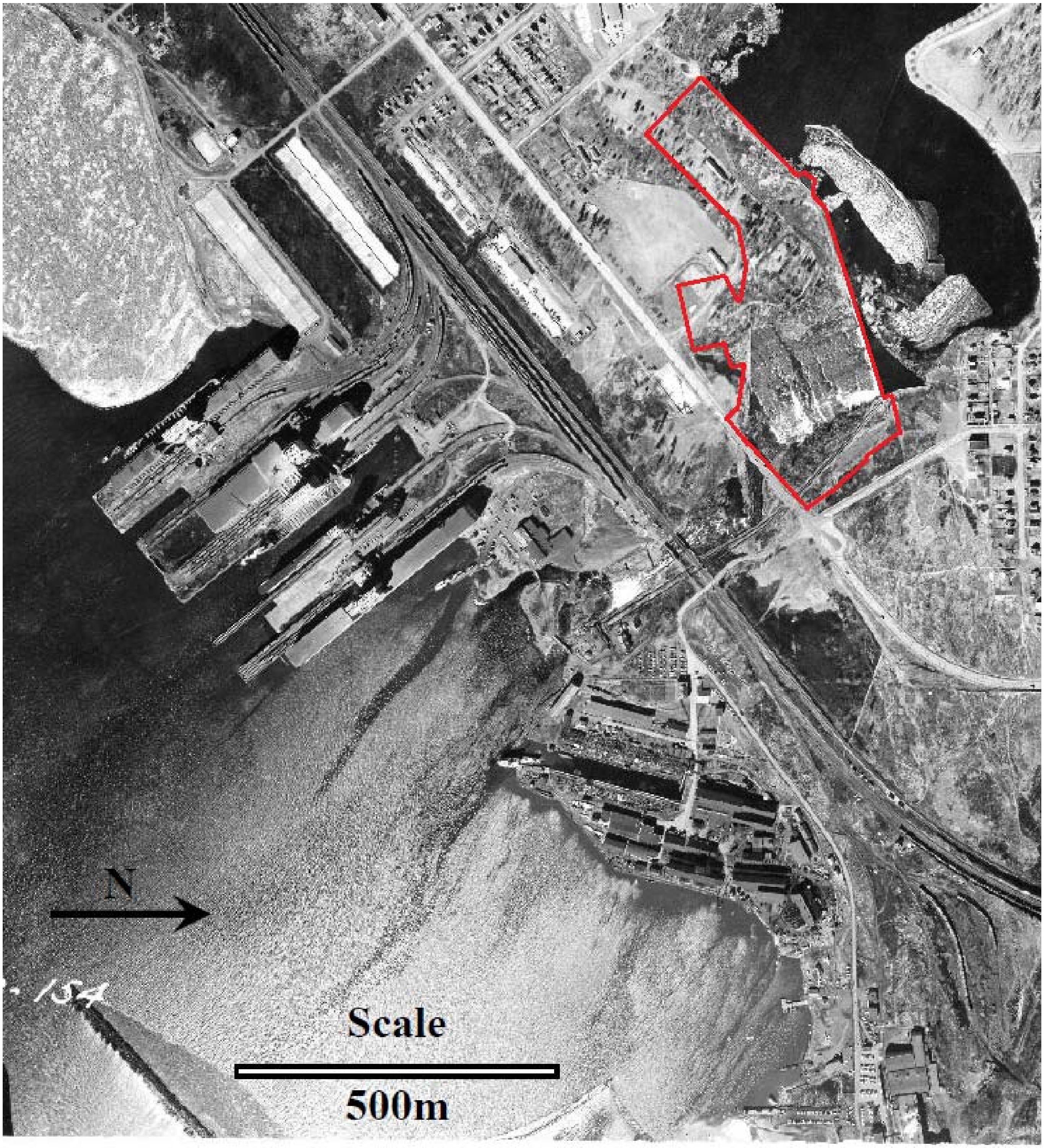
Map 9: 1924 Detail of a Map of City of Port Arthur



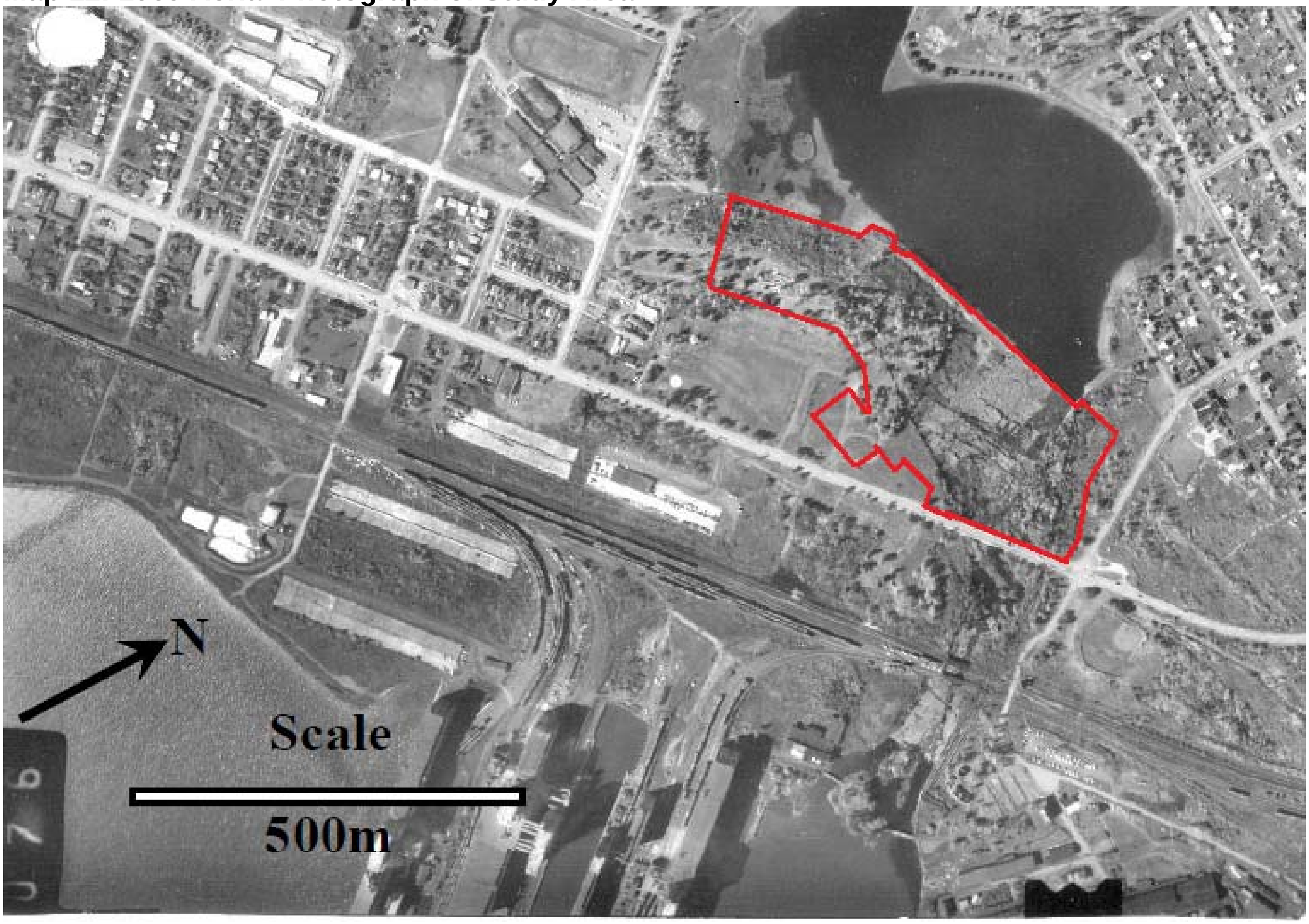
Map 10: 1942 Fire Insurance Map - Tourist Camp



Map 11: 1959 Aerial Photograph of Study Area



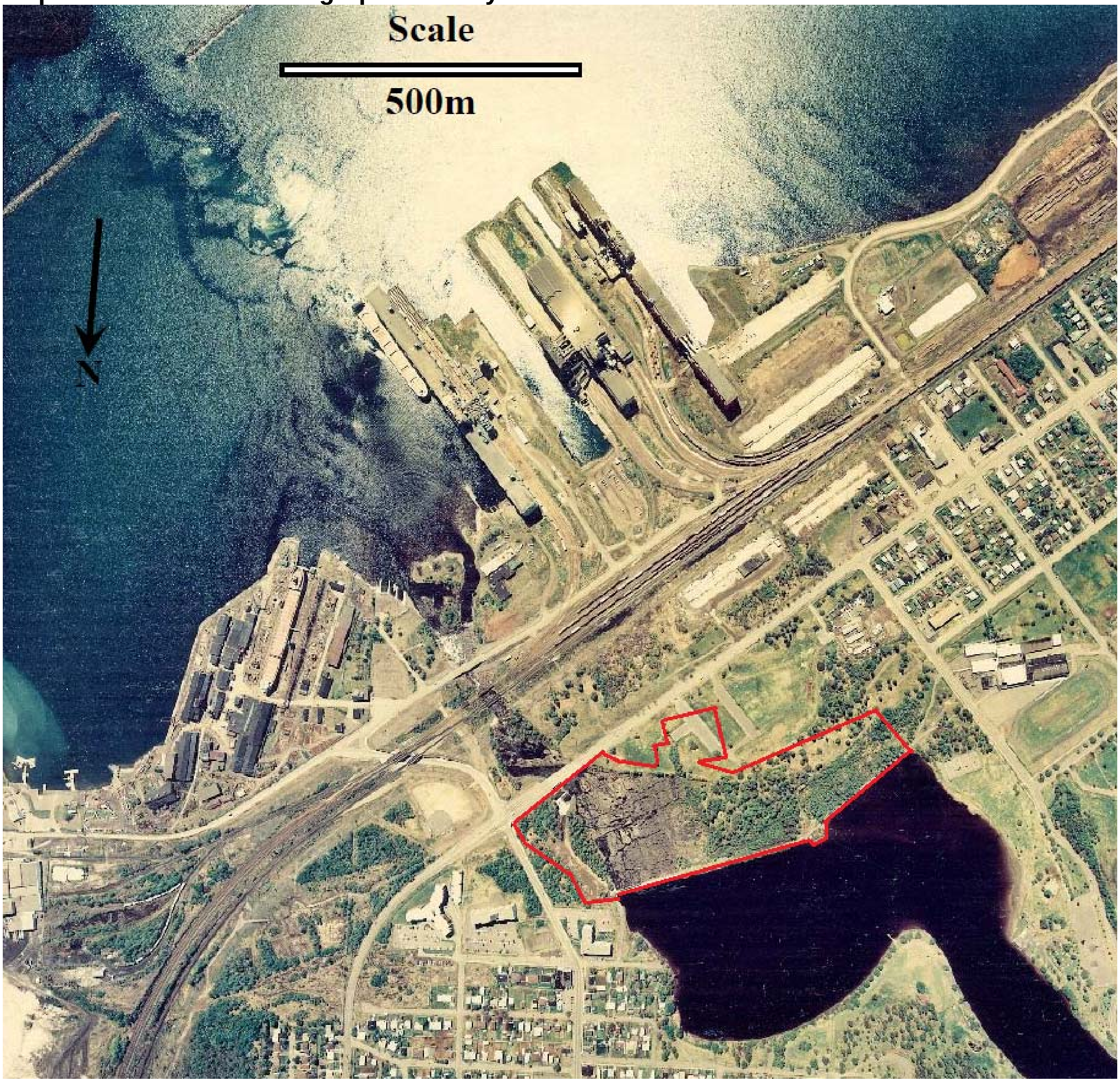
Map 12: 1969 Aerial Photograph of Study Area



Map 13: 1976 Aerial Photograph of Study Area

Map 14: 1981 Aerial Photograph of Study Area

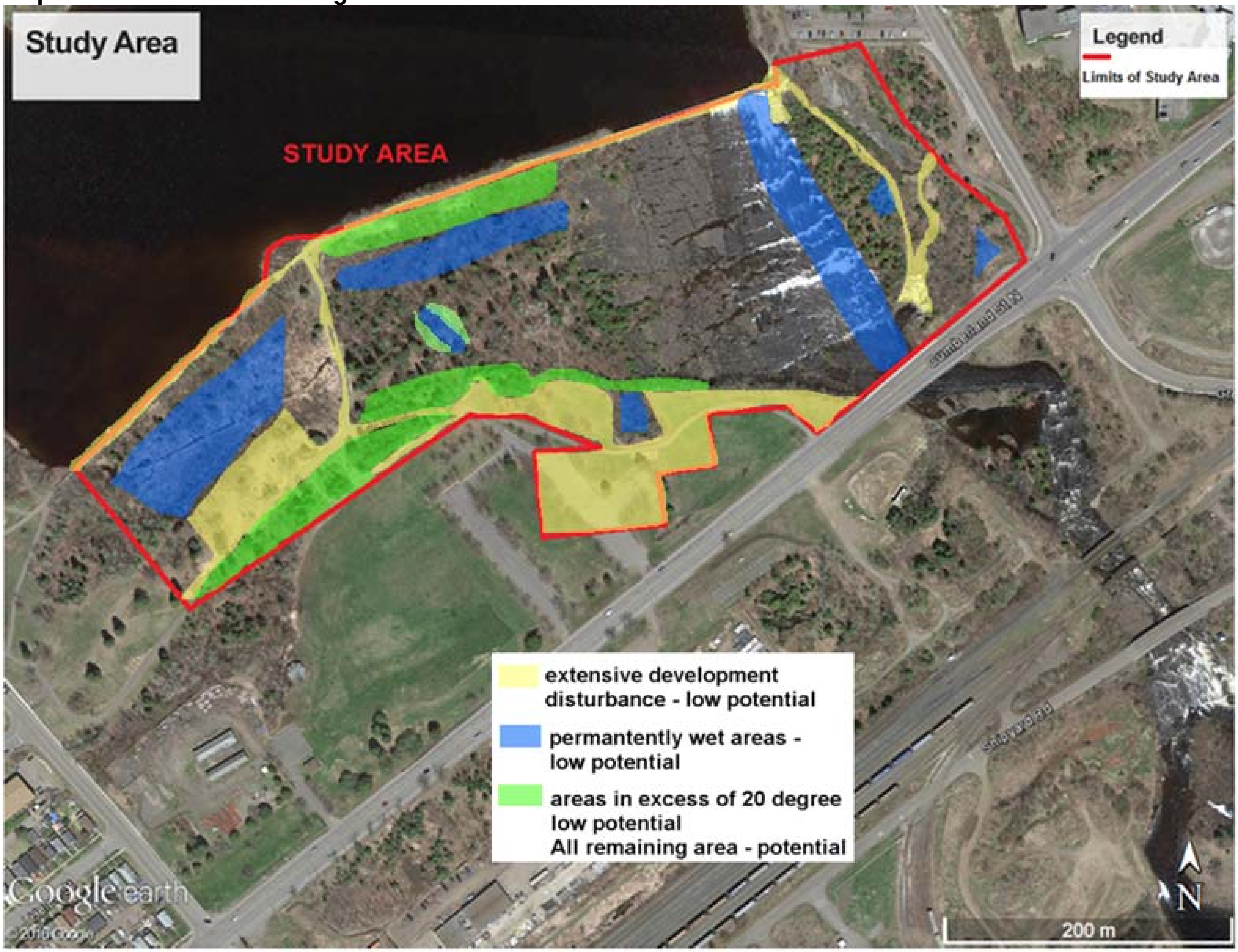
Map 15: 1987 Aerial Photograph of Study Area



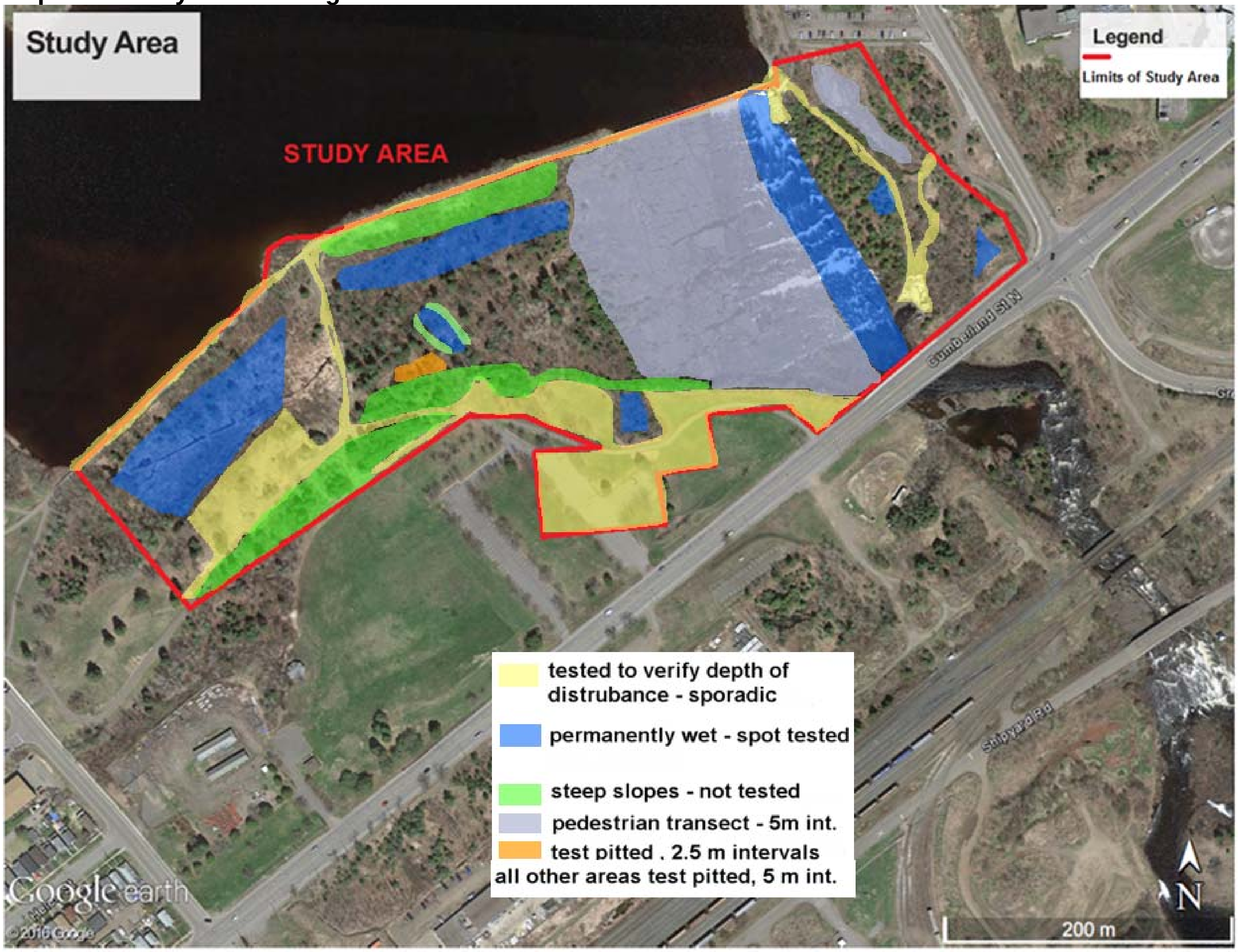
Map 16: Aerial Photograph post 1987

Map 17: Location of GPS Readings (general)

Map 18: Areas of Archaeological Potential



Map 19: Survey Methodologies



Map 20: Survey Results

See Supplementary Documentation

Map 21: Positive Test Pits in Area of Disturbance

Image 22: Image Locations and Orientation

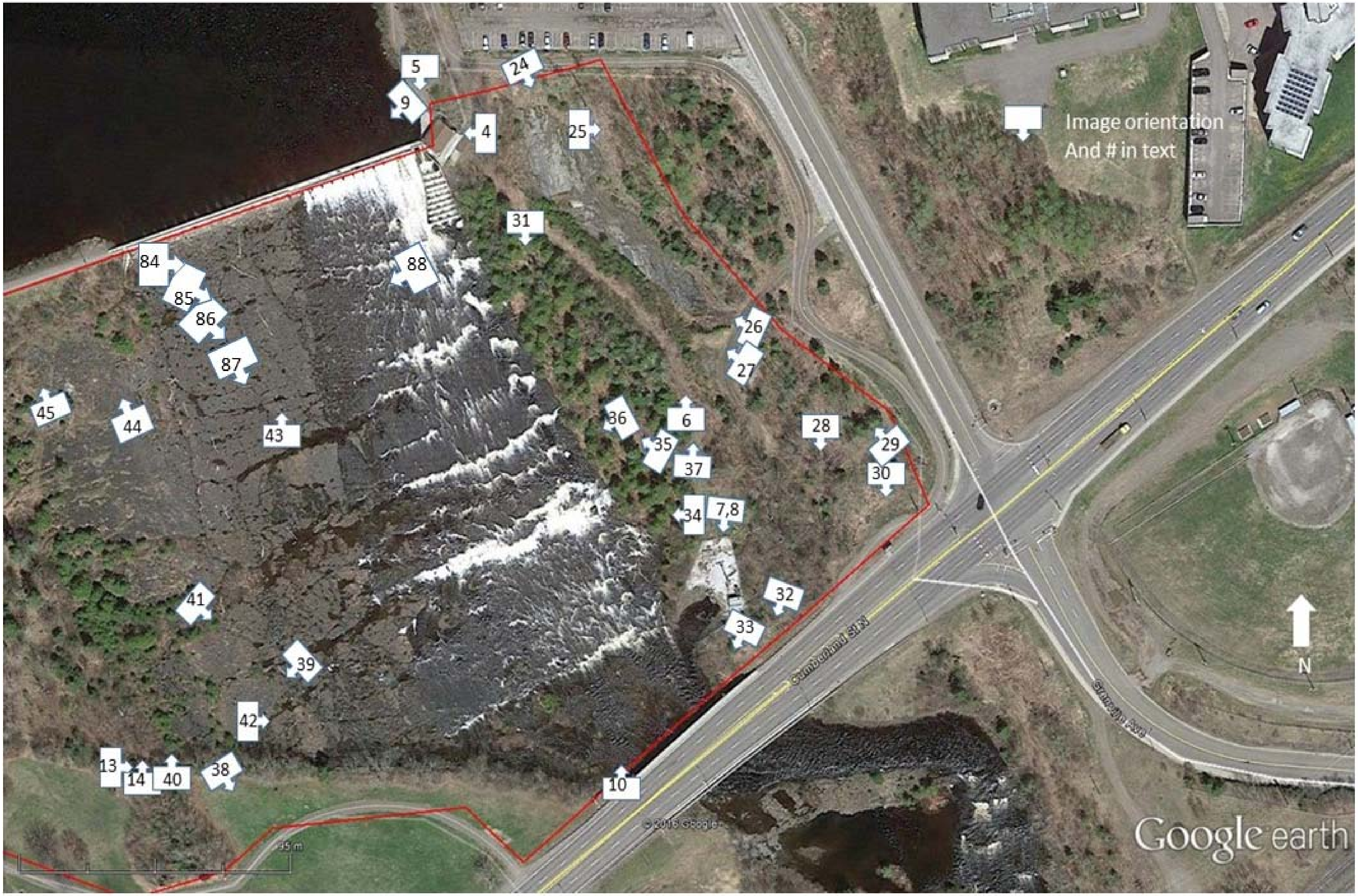


Image 23: Image Locations and Orientation

APPENDIX A: DcJh-21 SITE CATALOGUE

Inv No.	Provenience	Material	Type	Subtype	Length	Width	Thickness	Diameter	Freq.	Comments
1	Test Pit/Unit 1	ceramic	prosser	button				14.7	1	4 hole black
2	Test Pit/Unit 1	glass	mach made	amber					2	bottle
3	Test Pit/Unit 1	glass	mach made	soda lime					1	bottle
4	Test Pit/Unit 1	glass	mach made	clear					1	bottle
5	Test Pit/Unit 1	metal	container	indet.					1	
6	Test Pit/Unit 1	chert	black taconite	decortication	42.1	19.2	6.9		1	
7	Test Pit/Unit 1	chert	black taconite	decortication	37.7	11.6	8.2		1	
8	Test Pit/Unit 1	chert	black taconite	decortication	35.2	25.9	30.6		1	
9	Test Pit/Unit 1	chert	black taconite	decortication	53.1	53.5	42.5		1	
10	Test Pit/Unit 1	chert	black taconite	decortication	65.5	40.9	36.3		1	
11	Test Pit/Unit 1	chert	black taconite	decortication	89.3	44	38.7		1	
12	Test Pit/Unit 1	chert	black taconite	decortication	72.5	50.7	30.5		1	
13	Test Pit/Unit 1	chert	black taconite	decortication	48.5	18.3	10		1	
14	Test Pit/Unit 1	chert	black taconite	decortication	64.5	25	17		1	
15	Test Pit/Unit 1	chert	black taconite	decortication	36.2	27.8	11		1	
16	Test Pit/Unit 1	chert	black taconite	decortication	36.4	19.9	12		1	
17	Test Pit/Unit 1	chert	black taconite	decortication	49.1	28.1	10.4		1	
18	Test Pit/Unit 1	chert	black taconite	decortication	51.7	30.1	12.7		1	
19	Test Pit/Unit 1	chert	black taconite	primary flake	37	18	3		1	
20	Test Pit/Unit 1	chert	black taconite	primary flake	26.9	16.2	3.4		1	
21	Test Pit/Unit 1	chert	black taconite	primary flake	26.4	20.2	5.8		1	
22	Test Pit/Unit 1	chert	black taconite	primary flake	22.5	19.8	5		1	
23	Test Pit/Unit 1	chert	black taconite	primary flake	31.9	16	3.5		1	
24	Test Pit/Unit 1	chert	black taconite	primary flake	21.7	14.6	2.1		1	
25	Test Pit/Unit 1	chert	black taconite	primary flake	17.1	13.8	2.6		1	
26	Test Pit/Unit 1	chert	jasper taconite	primary flake	21.3	13	3		1	
27	Test Pit/Unit 1	chert	jasper taconite	primary flake	35.5	22.2	3.6		1	

Inv No.	Provenience	Material	Type	Subtype	Length	Width	Thickness	Diameter	Freq.	Comments
28	Test Pit/Unit 1	chert	jasper taconite	primary flake	40.9	21.3	3.7		1	
29	Test Pit/Unit 1	chert	jasper taconite	primary flake	20.2	12.2	3.7		1	
30	Test Pit/Unit 1	chert	jasper taconite	primary flake	21.1	21	4.3		1	
31	Test Pit/Unit 1	chert	jasper taconite	primary flake	29.7	28.1	4.9		1	
32	Test Pit/Unit 1	chert	jasper taconite	primary flake	16.4	18.2	4.2		1	
33	Test Pit/Unit 1	chert	jasper taconite	primary flake	21.1	17.6	2.7		1	
34	Test Pit/Unit 1	chert	jasper taconite	primary flake	15.5	9.1	0.9		1	
35	Test Pit/Unit 1	chert	jasper taconite	primary flake	11.1	7.6	1.3		1	
36	Test Pit/Unit 1	chert	jasper taconite	primary flake	9.7	7.3	1.3		1	
37	Test Pit/Unit 1	chert	jasper taconite	primary flake	10.8	7.3	0.9		1	
38	Test Pit/Unit 1	chert	jasper taconite	primary flake	16.2	14.1	2		1	
39	Test Pit/Unit 1	chert	black taconite	primary flake	19.6	15	5.2		1	
40	Test Pit/Unit 1	chert	black taconite	primary flake	17.9	10.4	1.6		1	
41	Test Pit/Unit 1	chert	black taconite	primary flake	17.8	12.1	1.6		1	
42	Test Pit/Unit 1	chert	black taconite	primary flake	14.6	9.8	2.3		1	
43	Test Pit/Unit 1	chert	black taconite	primary flake	24.1	17.5	4.1		1	
44	Test Pit/Unit 1	chert	black taconite	primary flake	20.1	15.8	1.8		1	
45	Test Pit/Unit 1	chert	black taconite	primary flake	18.9	16	2.4		1	
46	Test Pit/Unit 1	chert	black taconite	primary flake	19.4	17.8	3.3		1	
47	Test Pit/Unit 1	chert	jasper taconite	primary flake	27.1	18.4	3.5		1	
48	Test Pit/Unit 1	chert	black taconite	primary flake	30.1	21.4	3.5		1	
49	Test Pit/Unit 1	chert	black taconite	primary flake	29.8	29.3	3.9		1	
50	Test Pit/Unit 1	chert	black taconite	primary flake	18.2	16.8	2.7		1	
51	Test Pit/Unit 1	chert	black taconite	primary flake	21.5	15.2	2		1	
52	Test Pit/Unit 1	chert	black taconite	primary flake	19.3	11.7	2		1	
53	Test Pit/Unit 1	chert	black taconite	primary flake	10.3	6.2	1.5		1	
54	Test Pit/Unit 1	chert	black taconite	primary flake	16.1	14.9	2.5		1	
55	Test Pit/Unit 1	chert	black taconite	primary flake	12.6	14.9	1.5		1	
56	Test Pit/Unit 1	chert	black taconite	primary flake	16.4	13.9	2.2		1	

Inv No.	Provenience	Material	Type	Subtype	Length	Width	Thickness	Diameter	Freq.	Comments
57	Test Pit/Unit 1	chert	black taconite	primary flake	9.1	10	1.1		1	
58	Test Pit/Unit 1	chert	black taconite	primary flake	10.7	6.1	1.3		1	
59	Test Pit/Unit 1	chert	black taconite	primary flake	16	10.6	1.9		1	
60	Test Pit/Unit 1	chert	black taconite	primary flake	12.9	9.3	0.6		1	
61	Test Pit/Unit 1	chert	jasper taconite	secondary flk	26.8	11.8	11		1	
62	Test Pit/Unit 1	chert	jasper taconite	secondary flk	30.8	26.5	4.8		1	
63	Test Pit/Unit 1	chert	jasper taconite	secondary flk	27.3	22.1	7.1		1	
64	Test Pit/Unit 1	chert	jasper taconite	secondary flk	19.5	9.1	4.1		1	
65	Test Pit/Unit 1	chert	jasper taconite	secondary flk	32.6	22.5	10.3		1	
66	Test Pit/Unit 1	chert	jasper taconite	secondary flk	20.9	16.8	4.5		1	
67	Test Pit/Unit 1	chert	jasper taconite	secondary flk	17.9	9.8	2.2		1	
68	Test Pit/Unit 1	chert	jasper taconite	secondary flk	31.6	24.5	3.7		1	
69	Test Pit/Unit 1	chert	jasper taconite	secondary flk	32.4	22.6	5.2		1	
70	Test Pit/Unit 1	chert	jasper taconite	secondary flk	23.5	10.5	2.1		1	
71	Test Pit/Unit 1	chert	jasper taconite	secondary flk	32	34.2	7.7		1	
72	Test Pit/Unit 1	chert	jasper taconite	secondary flk	31	14.3	3.3		1	
73	Test Pit/Unit 1	chert	jasper taconite	secondary flk	49.1	31.9	7.1		1	
74	Test Pit/Unit 1	chert	black taconite	secondary flk	33.9	17.4	7.4		1	
75	Test Pit/Unit 1	chert	jasper taconite	secondary flk	23.8	20.2	4.3		1	
76	Test Pit/Unit 1	chert	jasper taconite	secondary flk	54	33	4.9		1	
77	Test Pit/Unit 1	chert	jasper taconite	secondary flk	27.6	19.5	2.96		1	
78	Test Pit/Unit 1	chert	jasper taconite	secondary flk	25.9	23.1	6.3		1	
79	Test Pit/Unit 1	chert	jasper taconite	secondary flk	41	28.9	8		1	
80	Test Pit/Unit 1	chert	black taconite	secondary flk	26.6	18.7	6.6		1	
81	Test Pit/Unit 1	chert	black taconite	secondary flk	39	25.6	4.4		1	
82	Test Pit/Unit 1	chert	jasper taconite	secondary flk	28.9	28.6	6.3		1	
83	Test Pit/Unit 1	chert	black taconite	secondary flk	27	17.7	8		1	
84	Test Pit/Unit 1	chert	black taconite	secondary flk	23.7	18.8	6.1		1	
85	Test Pit/Unit 1	chert	jasper taconite	secondary flk	19.1	23	2.7		1	

Inv No.	Provenience	Material	Type	Subtype	Length	Width	Thickness	Diameter	Freq.	Comments
86	Test Pit/Unit 1	chert	jasper taconite	secondary flk	23.6	19.9	5.4		1	
87	Test Pit/Unit 1	chert	jasper taconite	secondary flk	21.7	16.9	4		1	
88	Test Pit/Unit 1	chert	jasper taconite	secondary flk	33.3	18.1	7.7		1	
89	Test Pit/Unit 1	chert	jasper taconite	secondary flk	22.9	12.6	2.3		1	
90	Test Pit/Unit 1	chert	jasper taconite	secondary flk	24.8	16.3	3.7		1	
91	Test Pit/Unit 1	chert	jasper taconite	secondary flk	18.4	12.9	3.3		1	
92	Test Pit/Unit 1	chert	jasper taconite	secondary flk	36.5	17.8	6.3		1	
93	Test Pit/Unit 1	chert	jasper taconite	secondary flk	10.8	10.4	1.5		1	
94	Test Pit/Unit 1	chert	jasper taconite	secondary flk	16.5	12.8	2.6		1	
95	Test Pit/Unit 1	chert	jasper taconite	secondary flk	16.3	9.9	3.1		1	
96	Test Pit/Unit 1	chert	jasper taconite	secondary flk	29.2	18.6	4.5		1	
97	Test Pit/Unit 1	chert	jasper taconite	secondary flk	24.2	11.9	4.6		1	
98	Test Pit/Unit 1	chert	jasper taconite	secondary flk	34.9	24.3	5		1	
99	Test Pit/Unit 1	chert	jasper taconite	secondary flk	16	5.8	1.7		1	
100	Test Pit/Unit 1	chert	jasper taconite	secondary flk	14.9	13.7	3.4		1	
101	Test Pit/Unit 1	chert	jasper taconite	secondary flk	24.9	23.8	4.1		1	
102	Test Pit/Unit 1	chert	jasper taconite	secondary flk	21	10	3.5		1	
103	Test Pit/Unit 1	chert	jasper taconite	secondary flk	21.3	15.6	3.5		1	
104	Test Pit/Unit 1	chert	jasper taconite	secondary flk	22	16.2	4.4		1	
105	Test Pit/Unit 1	chert	black taconite	secondary flk	23	15.3	3.8		1	
106	Test Pit/Unit 1	chert	black taconite	secondary flk	22.7	10.1	3		1	
107	Test Pit/Unit 1	chert	black taconite	secondary flk	18.9	11.2	3.9		1	
108	Test Pit/Unit 1	chert	black taconite	secondary flk	33.8	11.3	8.6		1	
109	Test Pit/Unit 1	chert	black taconite	secondary flk	20.6	12.1	2.2		1	
110	Test Pit/Unit 1	chert	black taconite	secondary flk	17.5	16.6	5.1		1	
111	Test Pit/Unit 1	chert	black taconite	secondary flk	16.6	12.5	5.7		1	
112	Test Pit/Unit 1	chert	black taconite	secondary flk	16.7	13.4	4.1		1	
113	Test Pit/Unit 1	chert	jasper taconite	secondary flk	13.5	8.9	2.4		1	
114	Test Pit/Unit 1	chert	black taconite	secondary flk	24.2	20.3	26		1	

Inv No.	Provenience	Material	Type	Subtype	Length	Width	Thickness	Diameter	Freq.	Comments
115	Test Pit/Unit 1	chert	black taconite	secondary flk	18.3	14.7	3.2		1	
116	Test Pit/Unit 1	chert	black taconite	secondary flk	13	9.7	3		1	
117	Test Pit/Unit 1	chert	black taconite	secondary flk	14.9	12.4	2.6		1	
118	Test Pit/Unit 1	chert	black taconite	secondary flk	22.3	15.2	3.1		1	
119	Test Pit/Unit 1	chert	black taconite	secondary flk	16.3	10	2.9		1	
120	Test Pit/Unit 1	chert	black taconite	secondary flk	31.2	22.2	3.4		1	
121	Test Pit/Unit 1	chert	black taconite	secondary flk	16.8	11.5	1.8		1	
122	Test Pit/Unit 1	chert	black taconite	secondary flk	11.4	9.4	2		1	
123	Test Pit/Unit 1	chert	black taconite	secondary flk	12.1	12	1.4		1	
124	Test Pit/Unit 1	chert	black taconite	secondary flk	12.7	6.7	4.4		1	
125	Test Pit/Unit 1	chert	black taconite	secondary flk	11.8	8.5	3.9		1	
126	Test Pit/Unit 1	chert	black taconite	secondary flk	16	13.1	5.4		1	
127	Test Pit/Unit 1	chert	black taconite	secondary flk	18.6	16.2	1.9		1	
128	Test Pit/Unit 1	chert	black taconite	secondary flk	13.9	10.8	2.8		1	
129	Test Pit/Unit 1	chert	black taconite	secondary flk	23.9	14.6	5.5		1	
130	Test Pit/Unit 1	chert	black taconite	secondary flk	12.4	7.4	1.8		1	
131	Test Pit/Unit 1	chert	black taconite	secondary flk	18	11.8	2.4		1	
132	Test Pit/Unit 1	chert	black taconite	secondary flk	17.7	14.7	2.9		1	
133	Test Pit/Unit 1	chert	black taconite	secondary flk	255	12.9	3		1	
134	Test Pit/Unit 1	chert	black taconite	secondary flk	26.6	19.3	3.2		1	
135	Test Pit/Unit 1	chert	black taconite	secondary flk	22.8	13.1	2.6		1	
136	Test Pit/Unit 1	chert	jasper taconite	secondary flk	27.5	23.6	3.2		1	
137	Test Pit/Unit 1	chert	black taconite	secondary flk	16.4	10.9	1.8		1	
138	Test Pit/Unit 1	chert	black taconite	secondary flk	15.4	13.7	3		1	
139	Test Pit/Unit 1	chert	jasper taconite	secondary flk	24.8	11.4	2.9		1	
140	Test Pit/Unit 1	chert	black taconite	secondary flk	15.5	15.1	2.6		1	
141	Test Pit/Unit 1	chert	black taconite	secondary flk	20.8	15.9	7.2		1	
142	Test Pit/Unit 1	chert	black taconite	secondary flk	14.6	14	3.6		1	
143	Test Pit/Unit 1	chert	black taconite	secondary flk	8.8	8.6	1.5		1	

Inv No.	Provenience	Material	Type	Subtype	Length	Width	Thickness	Diameter	Freq.	Comments
144	Test Pit/Unit 1	chert	black taconite	secondary flk	16.5	8.2	4.2		1	
145	Test Pit/Unit 1	chert	black taconite	secondary flk	11.7	7.8	1.2		1	
146	Test Pit/Unit 1	chert	black taconite	secondary flk	10.6	6.7	2.8		1	
147	Test Pit/Unit 1	chert	black taconite	secondary flk	15.7	9.2	3.8		1	
148	Test Pit/Unit 1	chert	black taconite	secondary flk	19.4	9.2	2.2		1	
149	Test Pit/Unit 1	chert	black taconite	secondary flk	11.4	6.4	2.8		1	
150	Test Pit/Unit 1	chert	black taconite	secondary flk	18.4	12.4	2.3		1	
151	Test Pit/Unit 1	chert	black taconite	secondary flk	15.5	7	3		1	
152	Test Pit/Unit 1	chert	black taconite	secondary flk	20.2	9	4.2		1	
153	Test Pit/Unit 1	chert	black taconite	secondary flk	20.3	16.8	4.1		1	
154	Test Pit/Unit 1	chert	black taconite	secondary flk	15.8	11.7	1.7		1	
155	Test Pit/Unit 1	chert	black taconite	secondary flk	23.8	14.3	6.9		1	
156	Test Pit/Unit 1	chert	black taconite	secondary flk	13.4	12.3	2.6		1	
157	Test Pit/Unit 1	chert	black taconite	secondary flk	19.4	9.8	5.4		1	
158	Test Pit/Unit 1	chert	black taconite	secondary flk	28.4	13.5	4.4		1	
159	Test Pit/Unit 1	chert	black taconite	secondary flk	21.6	12.8	1.4		1	
160	Test Pit/Unit 1	chert	black taconite	secondary flk	26.1	15.4	3.8		1	
161	Test Pit/Unit 1	chert	black taconite	secondary flk	12.1	10.4	1.6		1	
162	Test Pit/Unit 1	chert	black taconite	secondary flk	13.5	12	1.9		1	
163	Test Pit/Unit 1	chert	black taconite	secondary flk	11.7	9.2	2		1	
164	Test Pit/Unit 1	chert	black taconite	secondary flk	12.9	11.4	2.7		1	
165	Test Pit/Unit 1	chert	black taconite	secondary flk	8.6	7.3	1.5		1	
166	Test Pit/Unit 1	chert	black taconite	secondary flk	16.1	11.8	2.3		1	
167	Test Pit/Unit 1	chert	jasper taconite	secondary flk	12.7	8.8	1.7		1	
168	Test Pit/Unit 1	chert	black taconite	secondary flk	9.4	7.4	2.5		1	
169	Test Pit/Unit 1	chert	black taconite	secondary flk	17.5	5.6	4.1		1	
170	Test Pit/Unit 1	chert	black taconite	secondary flk	11.1	6.8	2.1		1	
171	Test Pit/Unit 1	chert	black taconite	secondary flk	9.6	8.1	1.7		1	
172	Test Pit/Unit 1	chert	black taconite	secondary flk	9.5	6.7	1.1		1	

Inv No.	Provenience	Material	Type	Subtype	Length	Width	Thickness	Diameter	Freq.	Comments
173	Test Pit/Unit 1	chert	jasper taconite	scraper	45	33.1	5.9		1	scraper edge l=26.1
174	Test Pit/Unit 1	chert	jasper taconite	core frag	63.4	28	16.1		1	
175	Test Pit/Unit 1	chert	jasper taconite	core frag	44	45	19.8		1	
176	Test Pit/Unit 1	chert	taconite	shatter					527	
177	Test Pit/Unit 2	chert	black taconite	secondary flk	26	24.1	7.2		1	
178	Test Pit/Unit 2	chert	black taconite	secondary flk	25.4	21.5	5.2		1	
179	Test Pit/Unit 2	chert	black taconite	secondary flk	32.9	16.2	6.4		1	
180	Test Pit/Unit 2	chert	black taconite	secondary flk	18.8	15.4	8.1		1	
181	Test Pit/Unit 2	chert	black taconite	secondary flk	10.9	7.7	1.3		1	
182	Test Pit/Unit 2	chert	black taconite	primary flake	21.9	18.7	2.2		1	
183	Test Pit/Unit 2	chert	black taconite	secondary flk	38.1	20.8	12.6		1	
184	Test Pit/Unit 2	chert	jasper taconite	primary flake	37.6	21.5	5.9		1	
185	Test Pit/Unit 2	ceramic	brick	red					1	
186	Test Pit/Unit 2	stone	red shale	unworked					1	unworked
187	Test Pit/Unit 2	metal	copper	USA penny					1	corroded 20th C
188	Test Pit/Unit 2	chert	jasper taconite	secondary flk	39.6	30.1	12.4		1	
									715	

APPENDIX B: 20TH CENTURY MATERIAL FROM DISTURBED AREA (materials not retained)

Inv. No.	Provenience	Material	Freq.	Type	Comments
1	Test pit 4	Glass	1	Opaque container	
2	Test pit 4	Glass	1	Soda lime bottle	
3	Test pit 5	Glass	2	Amber bottle	
4	Test Pit 8B	Metal	1	Wire nail	
5	Test pit 6	Metal	Wire bolt	1	
6	Test pits 15A	Glass	Clear colourless container	3	
7	Test pit 15A	Glass	Amber bottle	2	
8	Test pit 3	Metal	Wire nail	1	L=62.7
9	Test Pit 16	Glass	Milk, container	9	
10	Test Pit 15	Metal	Crown cap	1	D=28.9
11	Test Pit 15	Metal	Screw	1	L=34.1
12	Test Pit 15	Glass	Clear colourless bottle	1	
13	Test Pit 15	Glass	Continuous threaded bottle finish	1	
14	Test Pit 12	Metal	Misc, unidentified	2	Corroded
15	Test Pit 11A	Metal	Wire nail	6	3 complete, L=78.7, 35.6, 76.4

Inv. No.	Provenience	Material	Freq.	Type	Comments
16	Test Pit 11A	Ceramic	Brick, red	2	
17	Test Pit 9	Metal	Wire nail	3	2 complete, L=67.9, 70.4
18	Test Pit 9	Glass	Clear colourless container	1	Embossed …AM 18
19	Test Pit 9	Glass	Safety glass, clear colourless	1	
20	Test Pit 11B	Glass	Olive green bottle	1	
21	Test Pit 10A	Ceramic	Hard paste porcelain, light fixture base	1	
22	Test Pit 10A	Metal	Wire nail	1	L=65.3
23	Test Pit 11C	Metal	Galvanized wire nail	1	
24	Test Pit 11C	Metal	Fence staple	1	
25	Test Pit 11C	Glass	Opaque container	1	
26	Test Pit 10	Ceramic	Hard paste porcelain, utility	1	Embossed …O..PAT..
27	Test Pit 8	Metal	Crown cap	1	
28	Test Pit 8	Glass	Clear colourless bottle	7	
29	Test Pit 9D	Metal	Wire nail	3	L=65., 67.5, 69

Inv. No.	Provenience	Material	Freq.	Type	Comments
30	Test Pit 7B	Metal	Wire nail	17	L=3 (49.40, 2(51.9),2 (54.2), 59.2
31	Test Pit 11	Metal	wIre nails	7	L=78.8, 78.7, 89.3, 63.7, 65.1, 65.7, 79.4
32	Test Pit 11	Organic	Jet	3	
33	Test Pit 14	Ceramic	Hard paste porcelain, utility	1	
34	Test Pit 7	Organic	Clinker, fuel	2	
35	Test Pit 7	Metal	Wire nail	1	
36	Test Pit 7	Glass	Clear colourless bottle	7	
37	Test Pit 13	Metal	Coupling	1	
38	Test Pit 10C	Metal	Wire nails	6	1 complete, L=91.7
39	Test Pit 10C	Ceramic	Hard paste porcelain, utility	3	
40	Test Pit 10C	Glass	Safety glass	63	
41	Test Pit 10C	Glass	Melted	3	
42	Test Pit 5A	Composite	Insulbrick sheeting	15	
43	Test Pit 5A	Metal	Container, indet.	9	
				191	

APPENDIX C: INVENTORY OF RECORDS MADE IN FIELD

Daily Record Forms – tracks personnel, date, weather, site conditions, hours, location, safety people, drivers, general notes – July 11 – 15 (2 days of driving, 3 field days)
Photographs – Colour Digital photographs: 141 with Nikon Coolpix AW110
- Colour digital photographs: 9 Iphone camera

Field Maps - 3 google earth maps for recording photographs and additional information
Square Forms – 2 planview and profile square forms
Field Notes: notebook
GPS Readings: Trimble Geoexplorer 6000 Series (Appendix C and supplementary documentation)

APPENDIX D – GPS CO-ORDINATES (NAD 83) (16U)
Accuracy 3 – 5 metres

Location	Easting	Northing	Elevation metres above sea level
Exposed bedrock NW corner	338240.91	536935.32	208
Exposed bedrock NE corner	338250.90	536351.34	209
Exposed bedrock SW corner	338298.96	5369283.43	203
Exposed bedrock SE corner	338305.40	5369285.81	203
Power station NW corner	338300.66	5369210.40	197
Power station NE corner	338310.19	5369211.77	197
Power station SE corner	338315.78	5369187.19	197
Power station SW fence line	338315.78	5369187.19	197
Gravel road at bend	338321.15	5369243.89	200
Gravel road at east boundary	338320.55	5369288.48	203
Hydro pole #140007	337966.33	5369164.99	207
Hydro pole disturbed area	337847.71	5369058.52	207
Test Pit 3	337847.88	5369065.29	208
Test Pit 4	337848.17	5369062.58	207
Test Pit 5	337825.89	5369058.16	207
Test Pit 6	337848.03	5369077.00	208
Test Pit 7	337840.88	5369089.05	208
Test Pit 8	337829.62	5369088.18	209
Test Pit 9	337836.96	5369096.58	209
Test Pit 10	3378843.91	5369101.51	210
Test Pit 11	337842.55	5369105.81	209
Test Pit 12	337853.96	5369108.43	209
Test Pit 13	337856.98	5369112.30	209
Test Pit 14	337809.07	5369038.92	208
Test Pit 15	337836.78	5369057.37	208
Test Pit 16	337821.82	5369047.07	208

See supplementary documentation for site location information

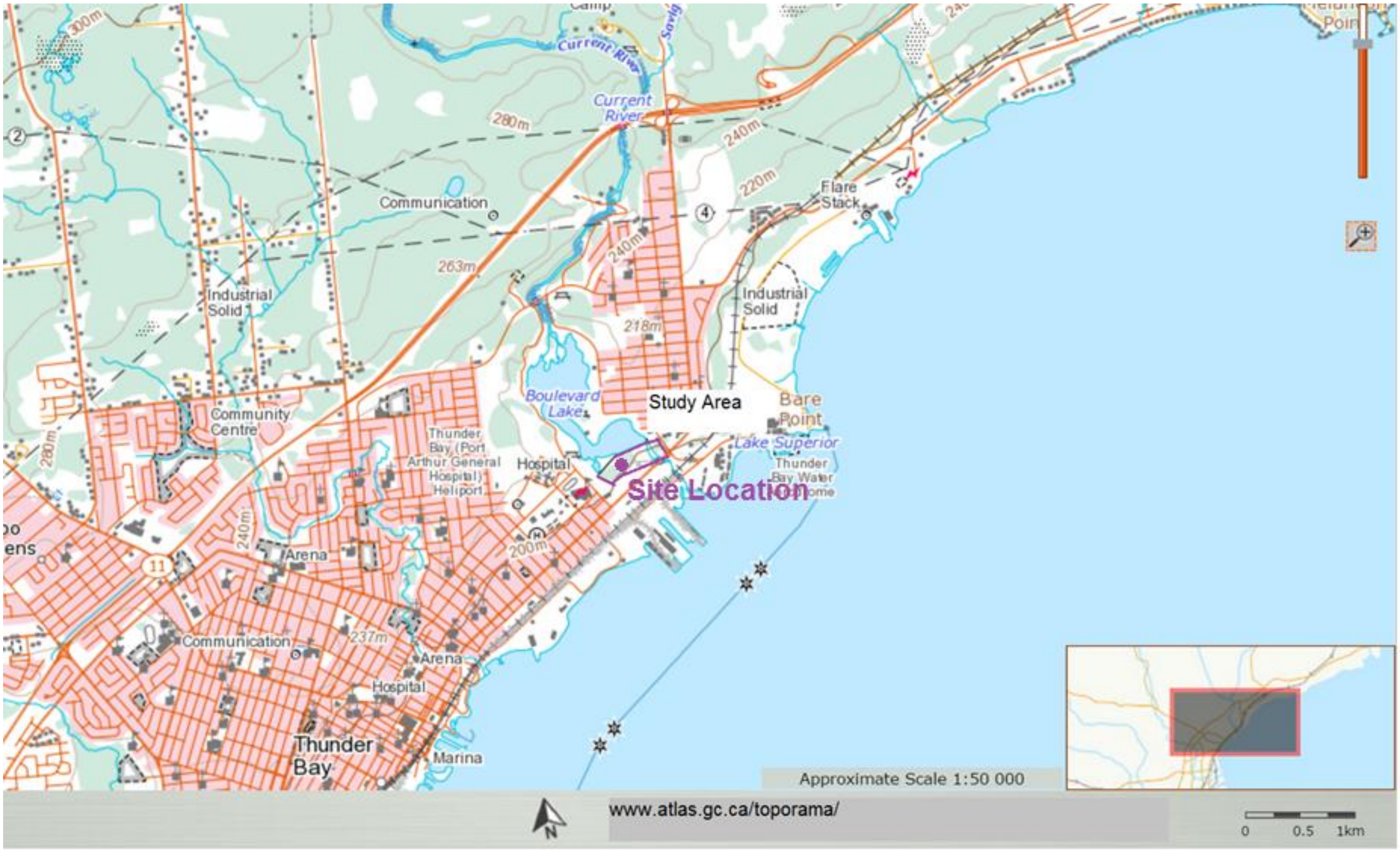
STAGE 1 AND 2 ARCHAEOLOGICAL ASSESSMENT
BOULEVARD LAKE DAM IMPROVEMENTS
CITY OF THUNDER BAY
DISTRICT OF THUNDER BAY
SUPPLEMENTARY DOCUMENTATION

Prepared for

Arcadis Canada Inc.
and
Ministry of Tourism, Culture and Sport

SCARLETT JANUSAS ARCHAEOLOGY INC.
269 Cameron Lake Road
Tobermory, Ontario N0H 2R0
phone 519-596-8243 cell 519-374-1119
jscarlett@amtelecom.net
www.actionarchaeology.ca

License # P027, PIF #P027-0291-2016
February 17, 2017


Study Area
Site Location
Current River
Boulevard Lake
Communication
Industrial Solid
Community Centre
Thunder Bay (Port Arthur General Hospital) Heliport
Hospital
Flare Stack
Bare Point
Lake Superior
Thunder Bay Water
Arena
Communication
Hospital
Marina
Thunder Bay
280m
240m
220m
263m
218m
200m
237m
Approximate Scale 1:50 000
www.atlas.gc.ca/toporama/
0 0.5 1km

DcJh- 71


datum
DcJh-71
Break of slope
Negative test pits
1 m test units over positive test pits
19 m
© 2016 Google
Google earth


Orientation and
Location of Images for
Site DcJh-71
52,
53
50,51
79
© 2016 Google
91 m
Google earth

Avoidance measures
Monitoring of all construction activities in this area shall be conducted by a licensed archaeologist.

GPS CO-ORDINATES FOR DcJh-71 (NAD 83) (16U)
Accuracy 3 – 5 metres

Location	Easting	Northing	Elevation metres above sea level
Hydro pole #14007, datum	337966.79	5369167.46	206
Centre Test Unit 1	337967.38	5369161.28	206
Centre Test Unit 2	337972.66	5369157.23	206

Location Information for DcJH-21

The site is very confined – limited only by the two positive test pits which are approximately 3 m distant from one another. The site sits on a small plateau where break of slope occurs to the east and south of the site. On the east side, below break of slope, is an intermittent stream. The original path of the Current River (has widened since the construction of the dam to permit overflow and historically used for transportation of timber) lies approximately 256 metres to the east of the site. The intermittent stream lies approximately 10 metres to the east. The site is located at an elevation of 206 metres above sea level.

Avoidance

Reply Reply All Forward

Campbell, Paige (MTCS) <Paige.Campbell@ontario.ca> | Scarlett Janusas; Anneliese Grieve; Hember, Ian (MTCS); von Bitter, Robert (MTCS) | 9/23/2016

RE: Boulevard Lake

This message is part of a tracked conversation. Click here to find all related messages or to open the original flagged message.

Scarlett,

Yes, no fencing is recommended as that will just draw peoples' attention to the area and next thing you know, someone will be in there digging it up! Marked areas will be adequate.

I would say that yes, it is the same site, so maybe talk to Rob von B. about how to get it into DcJh-21.

Paige

From: Scarlett Janusas [mailto:jscarlett@amtelecom.net]
Sent: September-23-16 3:47 PM
To: Campbell, Paige (MTCS)
Cc: Anneliese Grieve; Hember, Ian (MTCS)
Subject: RE: Boulevard Lake

Report echoes our findings pretty much, although our site area is a tad smaller. Do you want me to cancel the one borden number then (to confirm), and just so that I understand – no fencing required – just marked areas? I've been in communication with Ian Hember, who is also wondering why Pastport didn't pick this one up. The vagaries of the system - .... Thanks for your input, Paige. For Ian - pif is **#P027-0291-2016**

Scarlett

Reply Reply All Forward

Campbell, Paige (MTCS) <Paige.Campbell@ontario.ca> Scarlett Janusas; Sherratt, Jim (MTCS) 5 9/23/2016

RE: Boulevard Lake

Follow up.

Message 007.JPG (1 MB) 008.JPG (1 MB) 002.JPG (2 MB) 003.JPG (2 MB) 004.JPG (2 MB)

Well, I think this will be like any other Stage 2 partial clearance. Ensure that all standards for a post-Stage 2 partial clearance are met in the report, including the additional required documentation, and submit it with an expedited review request. I would suggest providing a final map with the city's proposed work areas and the known site area, its 20m buffer zone and the 50m construction monitoring zone, to be provided to the client, and included in the SD for the report.

Also, there is not much to know about the site. I have included some shots of the artifacts and the documentation, and you can use what you like in the report. The PastPort ShowMap feature in the sites section does show the site clearly within the project area, even if it is not exactly in the correct spot, so it's not just a case of being 'within 1km' of the project area. There is no report from the finding of the site back in 1976, just a catalogue, description, and the 9 or 10 artifacts.

Paige

From: Scarlett Janusas [mailto:jscarlett@amtelecom.net]
Sent: September-23-16 9:26 AM
To: Campbell, Paige (MTCS)
Subject: Boulevard Lake
Importance: High

Morning – so client wants to know how we will be moving forward. I would like to obtain any information you have regarding this site (as it was not provided to me through standard means, i.e. pastport), and now that you know what we have done, the possibilities and mechanisms of avoidance and protection. We would like to move ahead with this project as soon as possible, as my client is on a tight time schedule (having taken longer with other studies).

Reply Reply All Forward

Campbell, Paige (MTCS) <Paige.Campbell@ontario.ca> jscarlett 9/22/2016

RE: Advice on Fencing and protection and avoidance

Well, I think it is the same site. I think DcJh-71 should be cancelled and the info transferred to DcJh-21. I wish I had known that you were going to be doing this project as I could have shared this map with you before you came.

As far as protection, I can see that the access road and laydown area are possibly within the construction monitoring zone, and so monitoring will be required, but as this is a very public place I wouldn't want snow fencing up for any length of time because of the risk of interference, if at all.

Is the work being done this year or next year?

Indigenous Engagement

Indigenous Community was initiated by JML Engineering in March of 2015. The following Indigenous Communities were contacted: Fort William First Nation, Métis Nation of Ontario, Red Sky Métis Independent Nation. At the time of the archaeological assessment, there had been no input from the Indigenous communities that would bear on the archaeological assessment.

Subsequent to the completion of the field assessment, a meeting was held with the City of Thunder Bay, SJAI, and representatives of Fort William First Nation. This meeting was held on November 17th, 2016.

Attending the meeting either in person or by phone were: Scarlett Janusas (SJAI), Mike Vogrig (City of Thunder Bay), Ed Collins and Kayla Dixon (Fort William First Nations). S. Janusas summarized the findings of the archaeological assessment, specifically the prehistoric chipping station, and the recommendation for monitoring during construction activities. Ed Collins indicated that they would have liked to have been contacted prior to the assessment (it was the understanding of SJAI that JML Engineering had contacted FWFN and that there was no response prior to the assessment), and that they would like to see the site area, and possible the Elders would like to conduct a ceremony at the site. He planned to return to FWFN and consult with the Elders regarding their wishes in this regard. S. Janusas indicated that a monitor would be invited to observe the “avoidance” of the site during construction should it occur within 20 m of the site area. S. Janusas indicated that the site materials had been given to Paige Campbell of the MTCS (her request) to consolidate the current materials with the previous materials at the site location. S. Janusas indicated that FWFN could view the collection and that she would arrange with Paige Campbell to ensure that such a viewing could be accommodated. S. Janusas followed up that same day with an email to Paige Campbell, copied to Ed Collins and the City of Thunder Bay (Mike Vogrig) requesting that the collection could be accessed. Paige Campbell emailed back indicating that this could be accommodated.

S. Janusas also indicated that she would be archaeologically assessing the area above the dam about mid-summer of 2017, when waters would be drawn down by a cofferdam. Ed Collins indicated that he would like to have a monitor present at the time. This was noted and the proponent informed of the same request.

A copy of the report will eventually be provided to FWFN – upon approval of the client releasing said report.

Reply Reply All Forward

Anneliese Grieve <grievea@rogers.com> 'Scarlett Janusas'; 'Bernard, Fred' 7/4/2016

RE: Boulevard Lake Dam - Evaluation of Alternative Solutions

This message is part of a tracked conversation. Click here to find all related messages or to open the original flagged message.

Hi Scarlett,

To date the City has had no response from the Indigenous communities so no indication on the need for monitors. The City is doing follow-up calls this week but I would suggest you start making plans for your field work so we can get things moving forward.

I hope you are enjoying the summer!
Anneliese

Reply Reply All Forward

Campbell, Paige (MTCS) <Paige.Campbell@ontario.ca> | Scarlett Janusas; 'Ed Collins'; Mike Vogrig; Anneliese Grieve; 'Kayla Dixon' | Fri 11/18

RE: DcJh-21

Absolutely. I am usually in the lab on Thursdays and Fridays, but can arrange to be there on other days as well. Just let me know.

Paige

From: Scarlett Janusas [mailto:jscarlett@amtelecom.net]
Sent: November-17-16 1:55 PM
To: Campbell, Paige (MTCS)
Cc: 'Ed Collins'; Mike Vogrig; Anneliese Grieve; 'Kayla Dixon'
Subject: DcJh-21

Hello Paige – Ed Collins from Fort William First Nations would greatly appreciate access to the site material from DcJh-21. I am copying Ed on this email so that the two of you can coordinate this.

Thanks
Scarlett

Scarlett Janusas, BA, MA
Member CAHP, APA, SHA
President, Scarlett Janusas Archaeology Inc.

Arcadis Canada Inc.

121 Granton Drive, Suite 12

Richmond Hill, ON L4B 3N4

Tel 905.764.9389

Arcadis.com