Public Works
Government Services
Canada

Architectural and
Engineering Services

Ontario Region

Travaux publics
Services gouvernementaux
Canada

Services d'architecture
et de génie

Région de l'Ontario

MICHIPICOTEN ISLAND, ONTARIO

DEPARTMENT OF FISHERIES AND OCEANS CANADA

LEAD BASED PAINT ABATEMENT AND DEBRIS REMOVAL – MICHIPICOTEN ISLAND EAST END, LIGHT STATION

PWGSC Proj. No.: R.083149.31

Canada

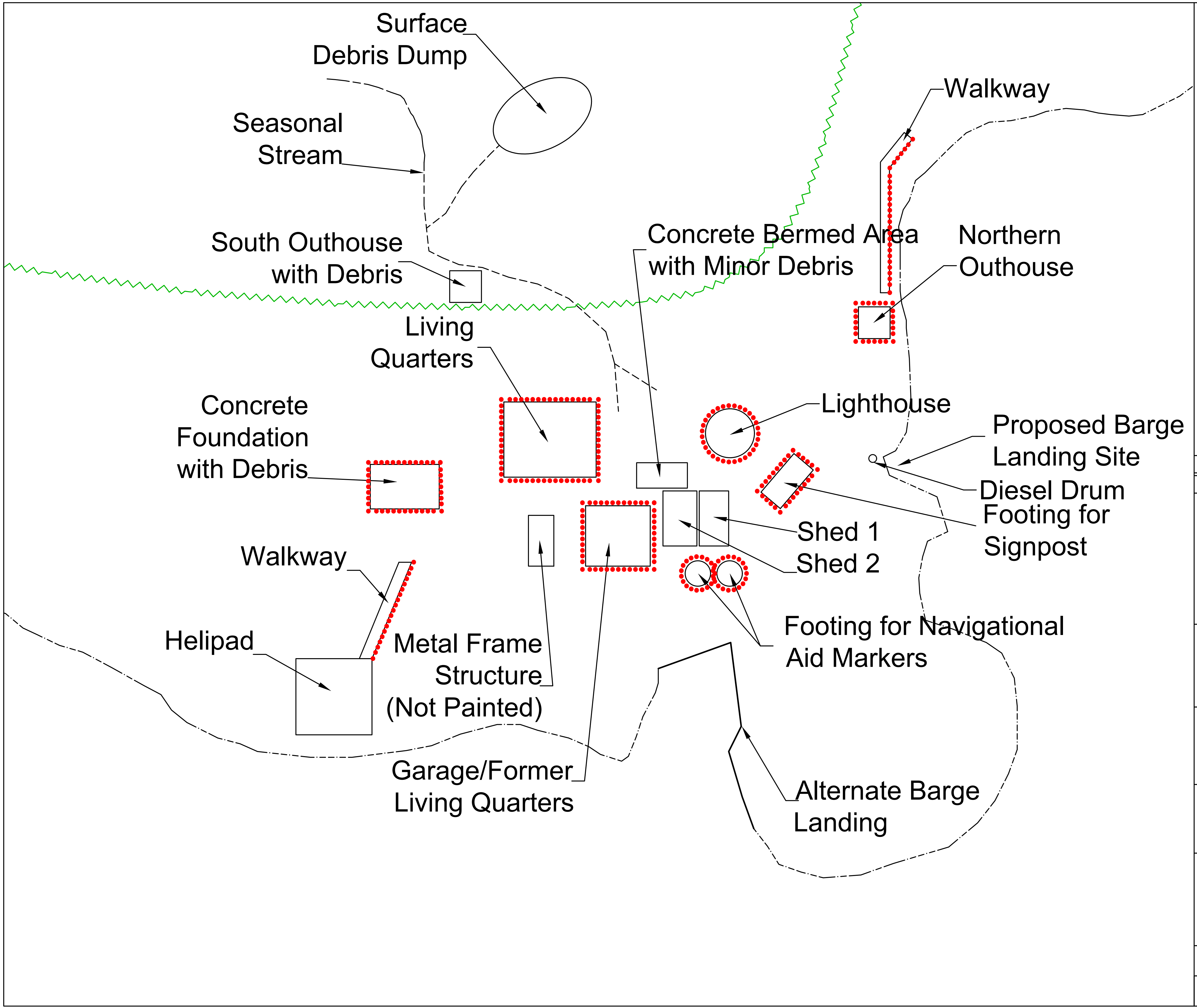
LIST OF DRAWINGS

SITE

Note: Refer to DSS Report for Specific Details on Lead Based and/or Asbestos to be Abated

BluMetric™ Environmental

The Tower – The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531–2725 FAX: (613) 531–1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca



LEGEND

——— Site Features

— — — Seasonal Stream

— - — Coastline

〰〰 Treeline

●●●●●● Structures That Require Exterior Paint to be Abated

Note: Refer to DSS Report for Specific Details on Lead Based Paint
and/or Asbestos to be Abated

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
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REFERENCES

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1:600 0 m 4 m 8 m 12 m 16 m 20 m

THIS SCALE TO BE USED TO OBTAIN
APPROXIMATE DIMENSIONS FOR INFORMATION

N

CLIENT

PUBLIC WORKS &
GOVERNMENT SERVICES
CANADA

PROJECT

LEAD BASED PAINT ABATEMENT
& DEBRIS REMOVAL, MICHIPICOTEN ISLAND
EAST END, LIGHT STATION

TITLE

OVERVIEW OF SITE
WORK AREA

BluMetric™ Environmental
3108 Carp Road PO Box 430
Ottawa, Ontario K0A 1L0
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PROJECT #	*DATE*
160528	2017-06-09

DRAWN	*CHECKED*	*DWG NO.*	*REV*
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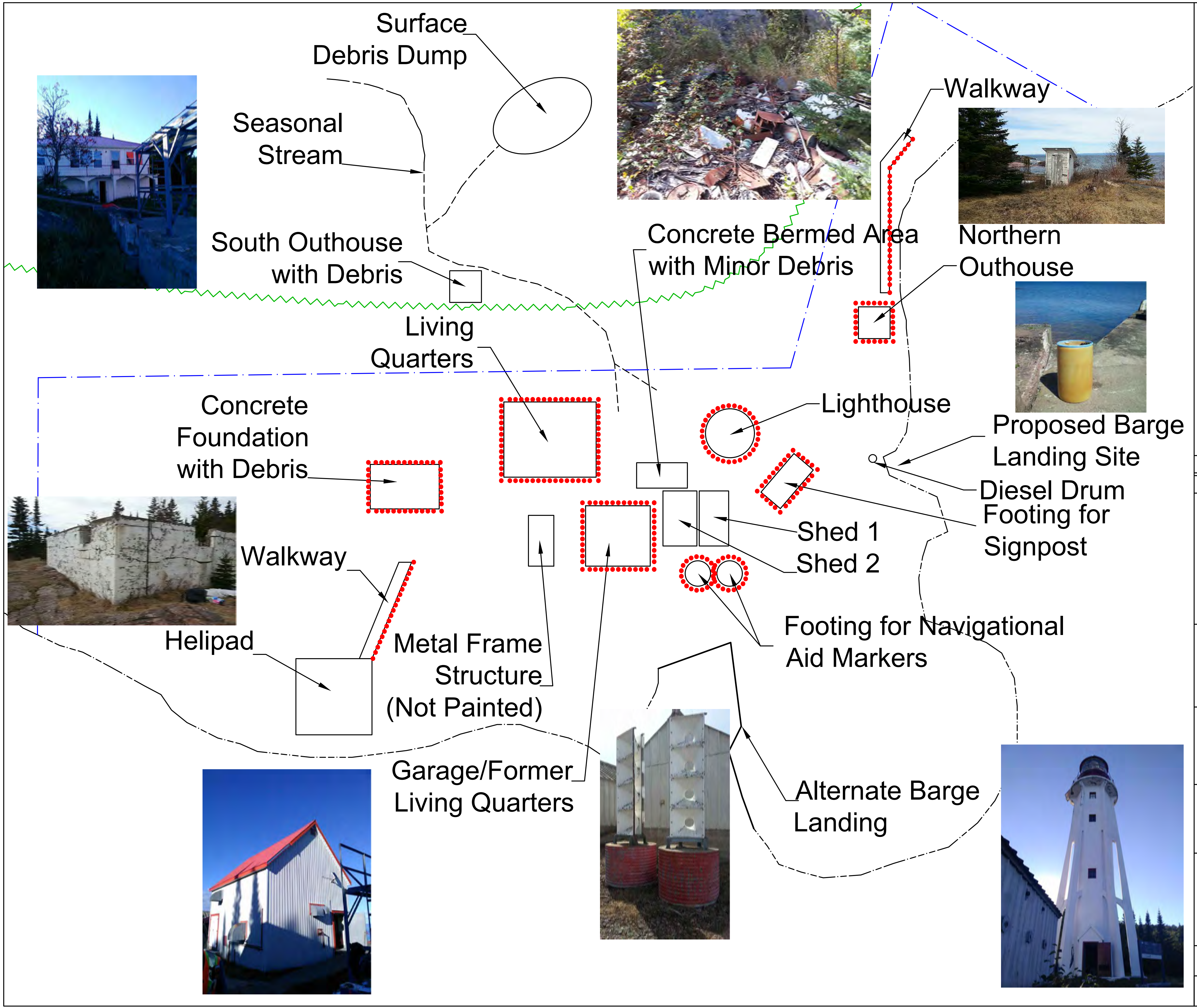

LEGEND

—	Site Features
– – –	Seasonal Stream
– – · –	Coastline
〰	Treeline
· · · · · ·	Structures That Require Exterior Paint to be Abated
–·–·–	Potential Pathway of Temporary Fenceline

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
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APPROXIMATE DIMENSIONS FOR INFORMATION

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PUBLIC WORKS &
GOVERNMENT SERVICES
CANADA

PROJECT

LEAD BASED PAINT ABATEMENT
& DEBRIS REMOVAL, MICHIPICOTEN ISLAND
EAST END, LIGHT STATION

TITLE

EXPLODED VIEW OF
WORK LOCATIONS

BluMetric™ Environmental
3108 Carp Road PO Box 430
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Web: http://www.blumetric.ca

PROJECT #	DATE
160528	2017-06-09

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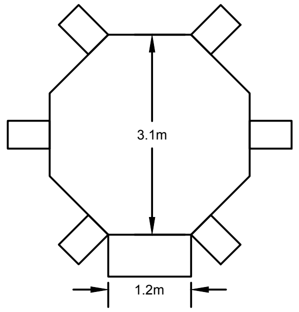
WC	VM	C-3	0

BASE FLOORING / PAD



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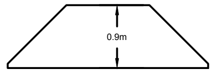

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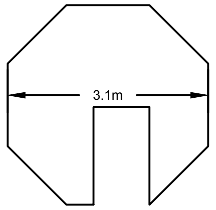

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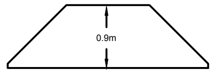

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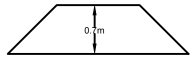

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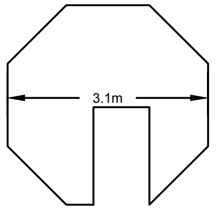

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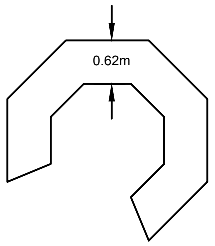

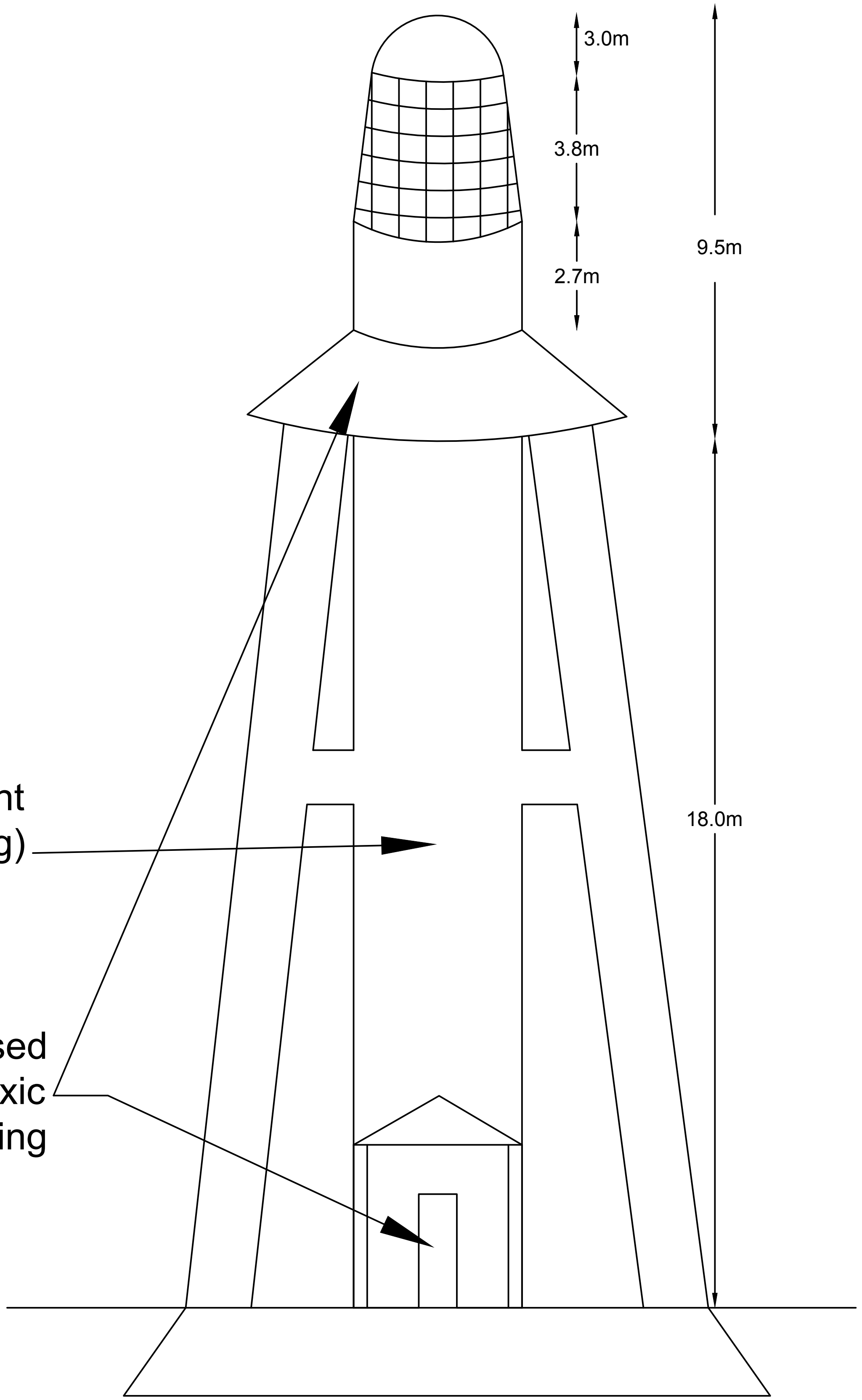

White Lead Based Paint
(Entire Exterior Building)

Red Lead Based
Painted Leachate Toxic
Door + Balcony Railing

LEGEND

Note: Refer to DSS Report for Specific Details on Lead Based Paint
and/or Asbestos to be Abated

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

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PUBLIC WORKS &
GOVERNMENT SERVICES
CANADA

PROJECT

LEAD BASED PAINT ABATEMENT
& DEBRIS REMOVAL, MICHIPICOTEN ISLAND
EAST END, LIGHT STATION

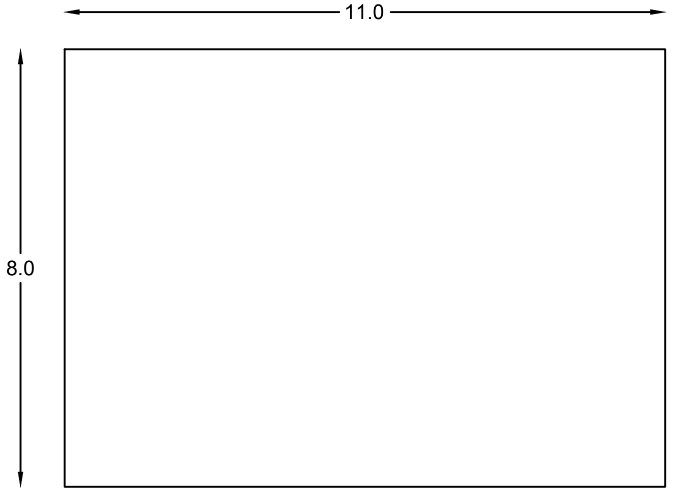
TITLE

LEAD BASED PAINT
ABATEMENT - LIGHTHOUSE

BluMetric™
Environmental
3108 Carp Road PO Box 430
Ottawa, Ontario K0A 1L0
TEL: (613) 839-3053 FAX: (613) 839-5376
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT # 160528
DATE 2017-06-05
DRAWN WC
CHECKED VM
DWG NO. C-4
REV 0

BASEMENT



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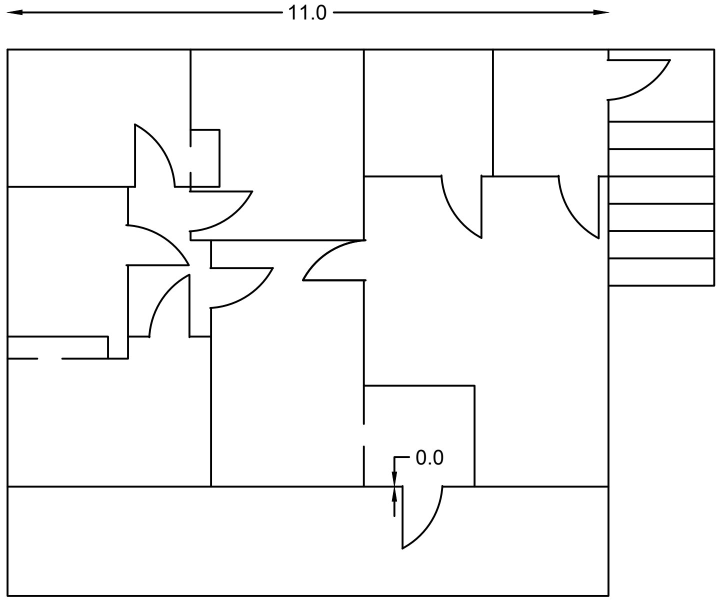
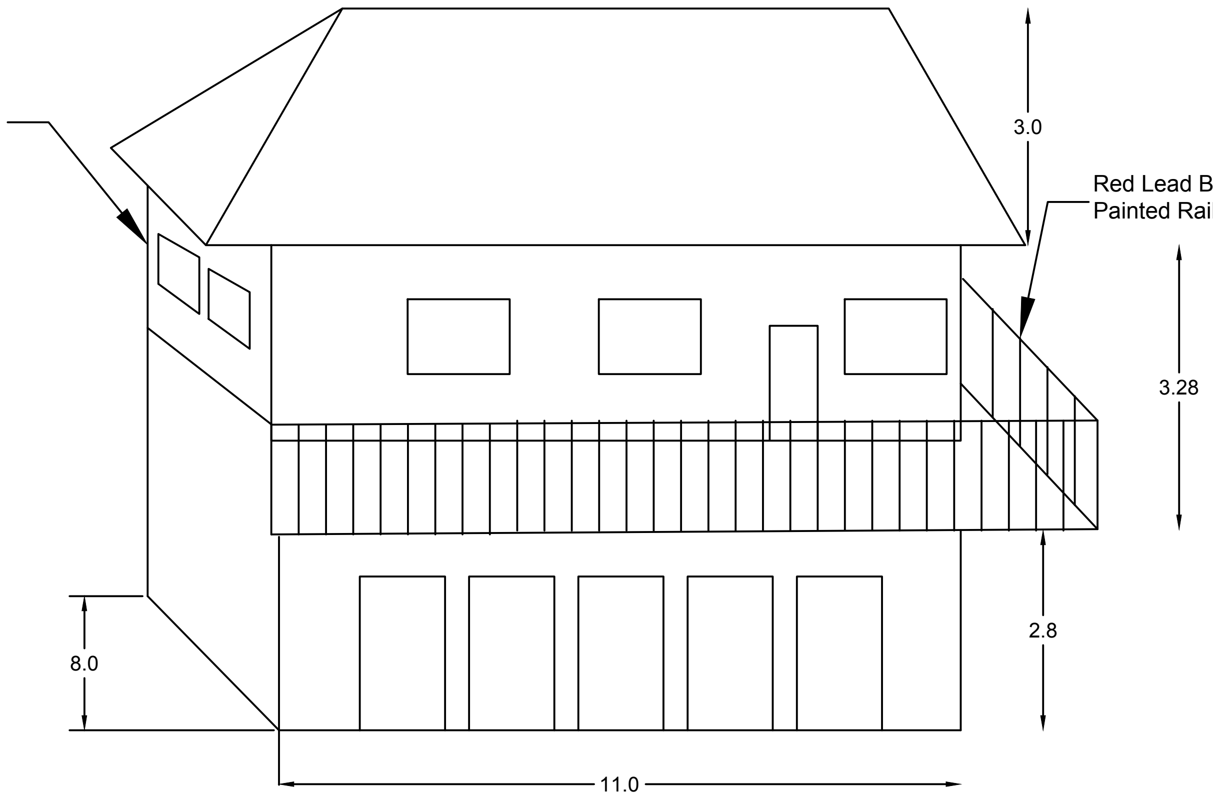


White Lead Based Painted
Asbestos Transite
Cladding Over Tarpaper
(Upper Level Only)



Red Lead Based
Painted Railing

LEGEND

Note: Refer to DSS Report for Specific Details on Lead Based Paint and/or Asbestos to be Abated

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

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PUBLIC WORKS &
GOVERNMENT SERVICES
CANADA

PROJECT

LEAD BASED PAINT ABATEMENT
& DEBRIS REMOVAL, MICHIPICOTEN ISLAND
EAST END, LIGHT STATION

TITLE

LEAD BASED PAINT
ABATEMENT - LIVING QUARTERS

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725 FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT # 160528		*DATE* 2017-06-05	
DRAWN WC	*CHECKED* VM	*DWG NO.* C-5	*REV* 0

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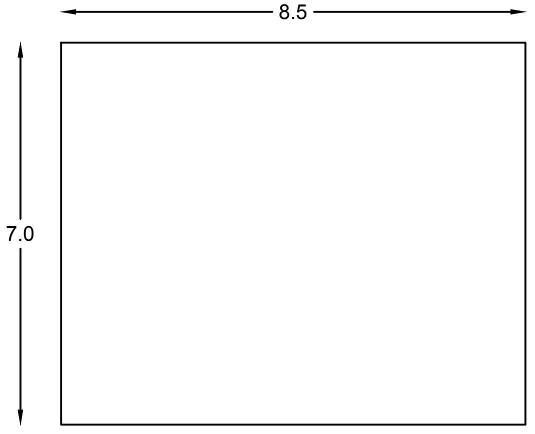

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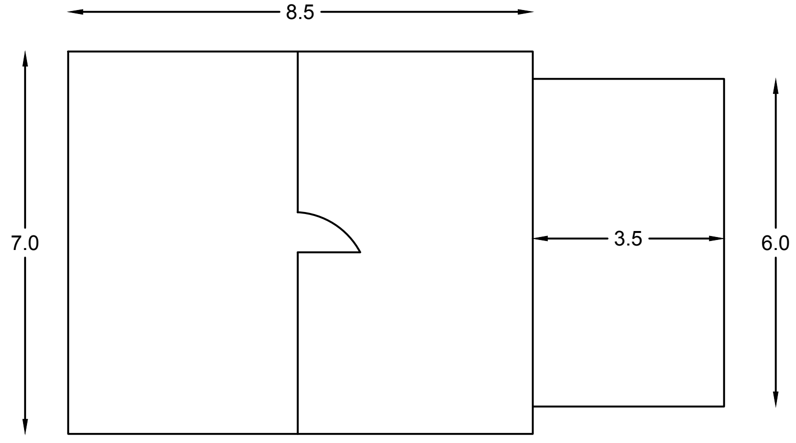

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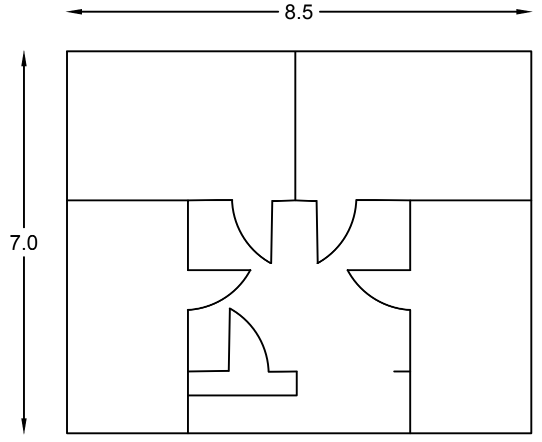

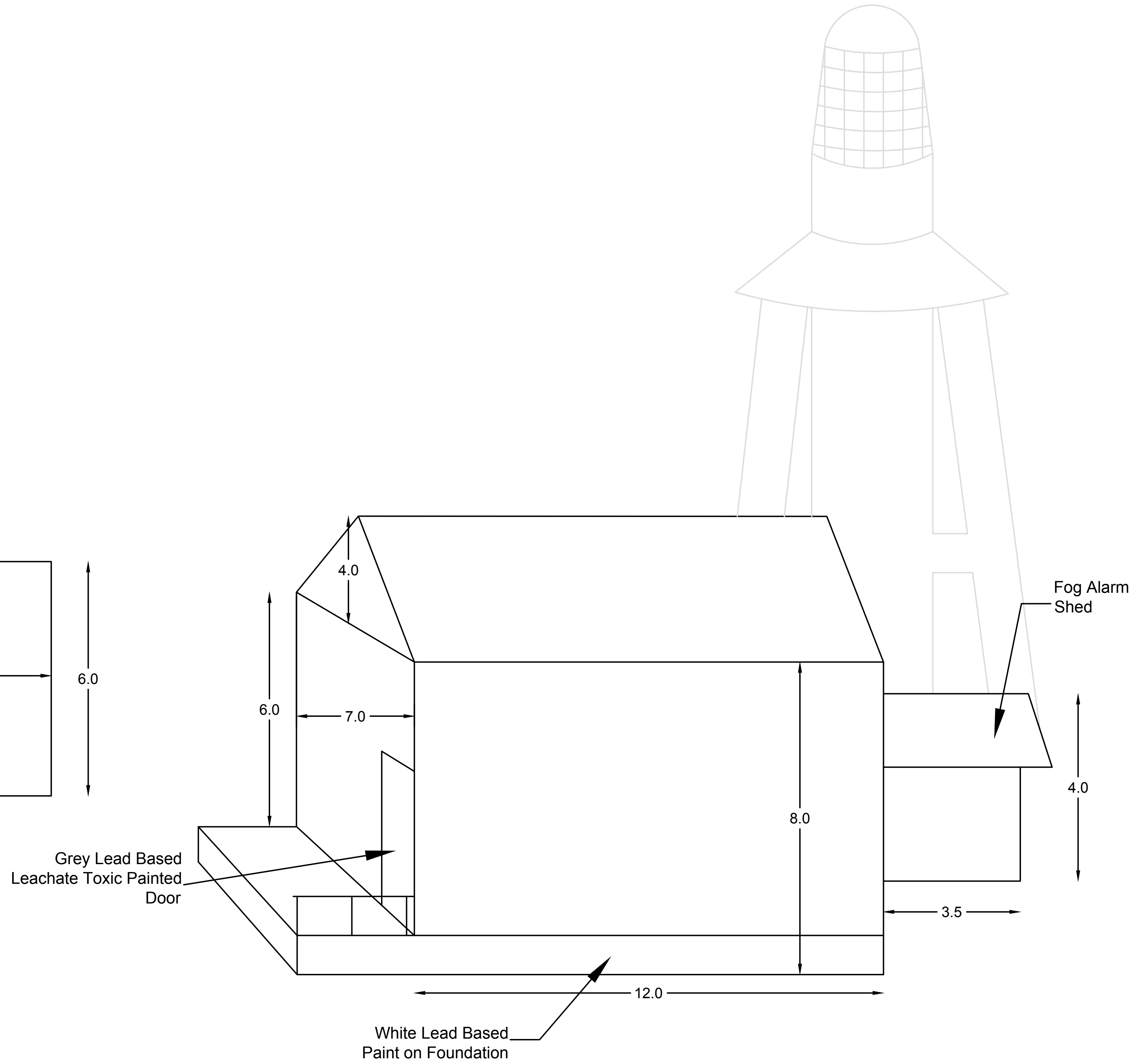

LEGEND

Note: Refer to DSS Report for Specific Details on Lead Based Paint
and/or Asbestos to be Abated

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PUBLIC WORKS &
GOVERNMENT SERVICES
CANADA

PROJECT

LEAD BASED PAINT ABATEMENT
& DEBRIS REMOVAL, MICHIPICOTEN ISLAND
EAST END, LIGHT STATION

TITLE

LEAD BASED PAINT
ABATEMENT - GARAGE/LIVING QUARTERS

BluMetric™ Environmental
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Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725 FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #
160528

DATE
2017-06-05

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DWG NO.
C-6

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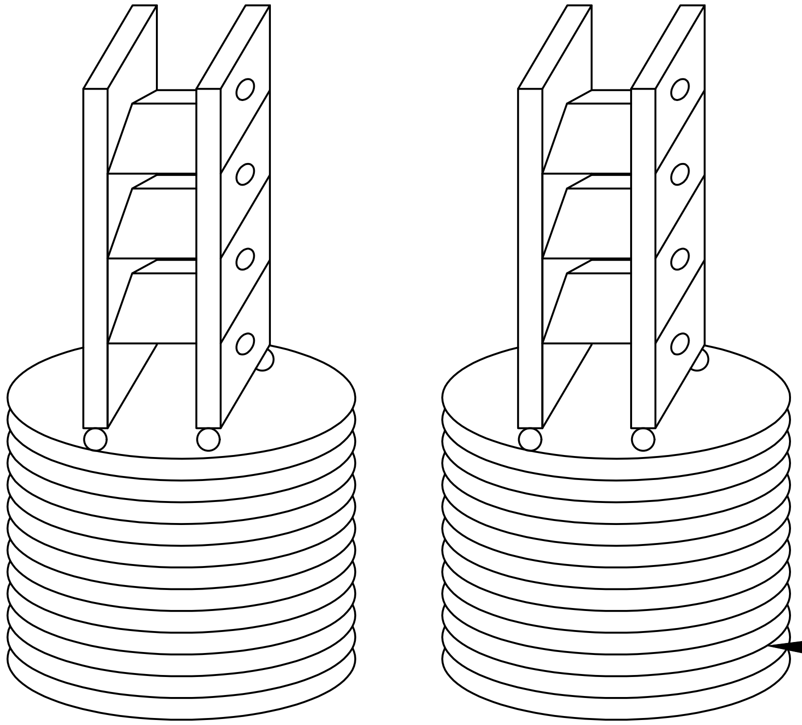
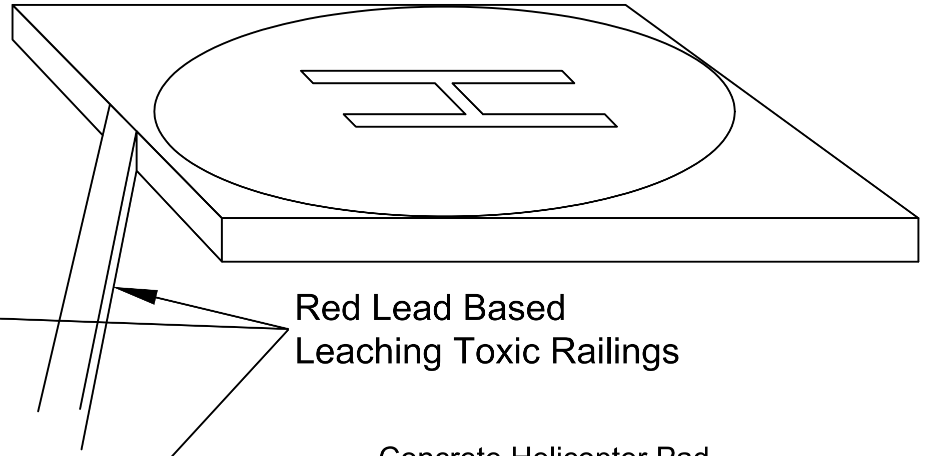
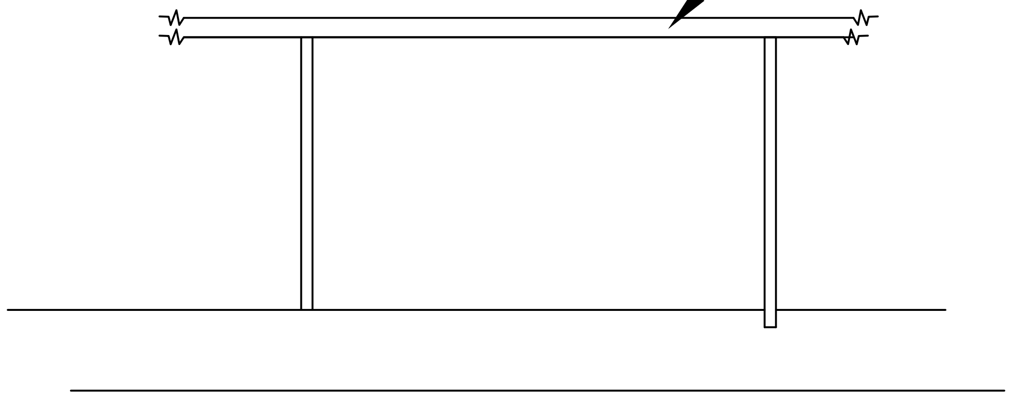


Communications Towers



Concrete Helicopter Pad

Red Lead Based
Leaching Toxic Railings



Example of Northern Walkway Construction

LEGEND

Note: Refer to DSS Report for Specific Details on Lead Based and/or Asbestos to be Abated

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
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REFERENCES

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PUBLIC WORKS &
GOVERNMENT SERVICES
CANADA

PROJECT

LEAD BASED PAINT ABATEMENT
& DEBRIS REMOVAL, MICHIPICOTEN ISLAND
EAST END, LIGHT STATION

TITLE

LEAD BASED PAINT
ABATEMENT - COMMUNICATIONS TOWERS
AND HELICOPTER PAD

BluMetric™ Environmental
3108 Carp Road PO Box 430
Ottawa, Ontario K0A 1L0
TEL: (613) 839-3053 FAX: (613) 839-5376
Email: info@blumetric.ca
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PROJECT #	DATE
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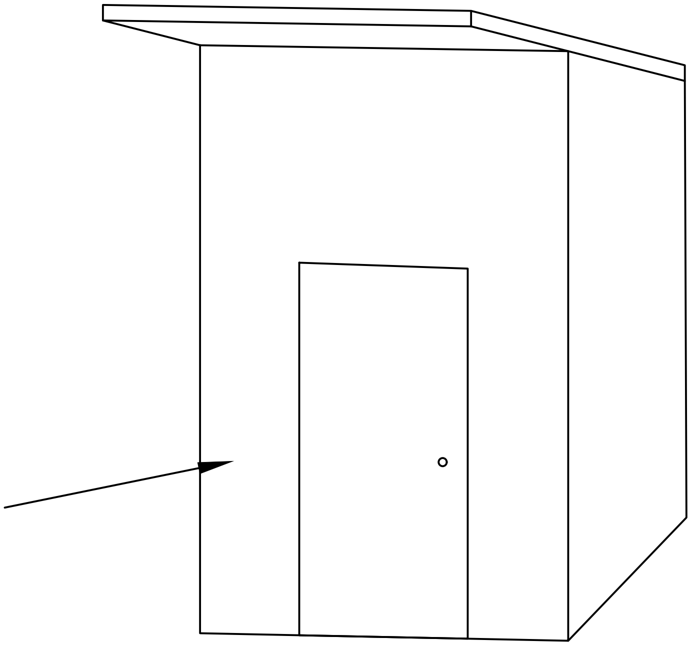
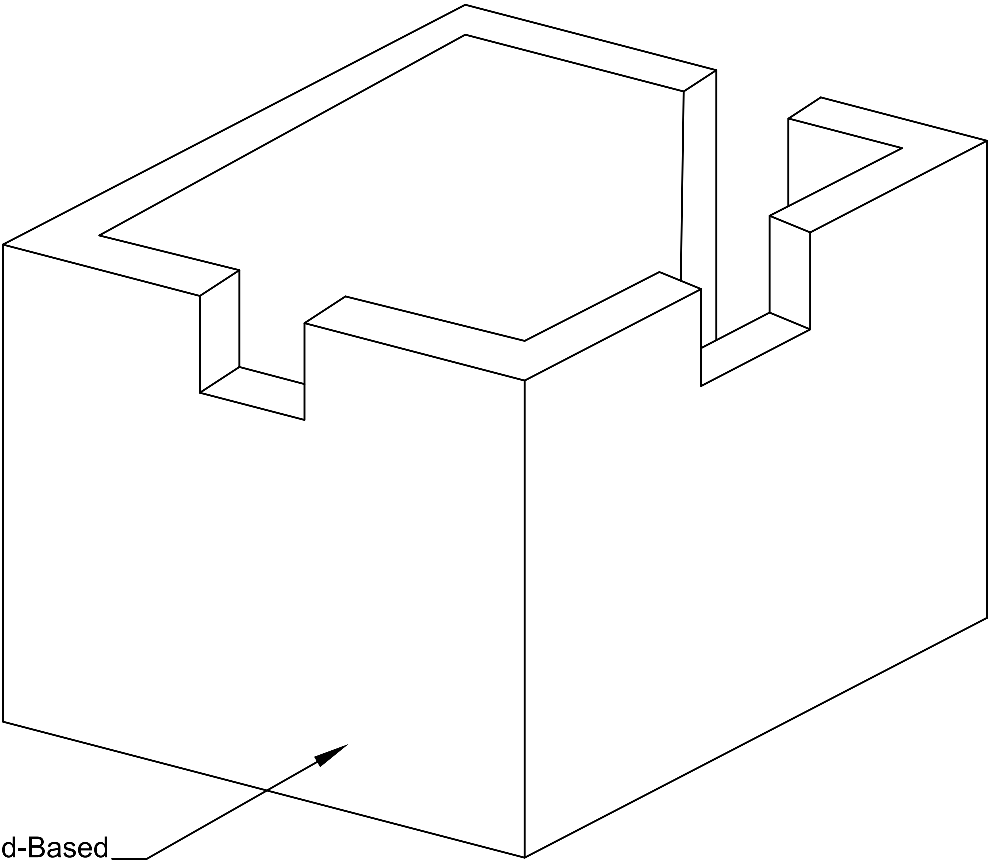
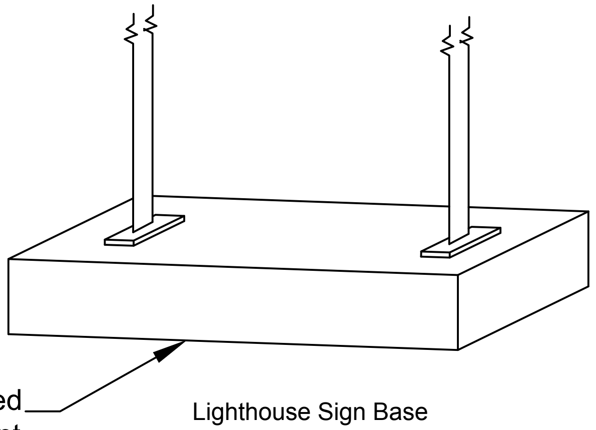


Northern Outhouse



Former Building Foundation



Lighthouse Sign Base

LEGEND

Note: Refer to DSS Report for Specific Details on Lead Based and/or
Asbestos to be Abated

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

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GOVERNMENT SERVICES
CANADA

PROJECT

LEAD BASED PAINT ABATEMENT
& DEBRIS REMOVAL, MICHIPICOTEN ISLAND
EAST END, LIGHT STATION

TITLE

LEAD BASED PAINT
MISCELLANEOUS

BluMetric™ Environmental

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PROJECT #	*DATE*
160528	2017-06-05

DRAWN	*CHECKED*	*DWG NO.*	*REV*
WC	VM	C-8	0

SUMMARY OF PROJECT
3RD PARTY REPORT

EAST END LIGHT STATION
MICHIPICOTEN ISLAND, ONTARIO
DFRP NO. 67652, PWGSC NO. R.083149.031
FCSI NO. 67652001 & 67652002

Submitted to:

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Public Works & Government Services Canada
Ontario Region
4900 Yonge Street
Toronto, ON M2N 6A6

Prepared by:

BluMetric Environmental Inc.
3108 Carp Road P.O. Box 430
Ottawa, ON K0A 1L0

Project Number: 160528

June 9, 2017

SUMMARY OF PROJECT
3RD PARTY REPORT

EAST END LIGHT STATION
MICHIPICOTEN ISLAND, ONTARIO
DFRP NO. 67652, PWGSC NO. R.083149.031
FCSI NO. 67652001 & 67652002

Submitted to:

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Public Works & Government Services Canada
Ontario Region
4900 Yonge Street
Toronto, ON M2N 6A6

Prepared by:

BluMetric Environmental Inc.
3108 Carp Road P.O. Box 430
Ottawa, ON K0A 1L0

Project Number: 160528

June 9, 2017

EXECUTIVE SUMMARY

IMPORTANT: *This executive summary provides an overview of the main findings of the study to which it pertains. This executive summary does not provide a comprehensive report, and its review should not be considered a substitute for reading the report in its entirety.*

BluMetric Environmental Inc. (BluMetric™) was retained by Public Works & Government Services Canada (PWGSC), on behalf of Fisheries and Oceans Canada (DFO), to conduct an Environmental Program on the East End Light Station Michipicoten Island, Ontario. The Environmental Program was to include; soil delineation, designated substances and hazardous materials assessment (DS/HMS); structural assessment; biological assessment to support an ecological risk assessment (ERA) and/or species at risk (SAR) assessment; marine engineering assessment; Environmental Effects Evaluation (EEE); and, the preparation of plans and specifications for abatement and debris removal.

The primary objective of the project was to be the abatement of lead based paint on the exterior of the lighthouse and appurtenant structures. No demolition of existing structures will be required. Additionally, a scrap metal dump located near the site will also be removed along with general site debris. All project activities would be constrained to the previously disturbed or developed areas of the subject property.

It has been surmised that lead based paints are potentially contributing to soil contamination at the site. Soils in the vicinity of locations where lead based paints were used were consistently found to exceed criteria for arsenic, lead and zinc in the samples collected at the site. All three metals are typical constituents of lead based paint. Additionally there are some asbestos containing materials on site that have been coated with lead based paint, and located in debris throughout the site. The presence of asbestos containing material (ACM) will impact lead based paint abatement, debris removal, and/or any future soil remediation activities at the site. Specific ACM abatement will be required where ACM material is underlying the lead based paint, located within the site debris, located in a soil remediation area, or will be disturbed during these activities.

Therefore, a secondary project objective is to address all other environmental contamination issues at the site via risk assessment (and subsequent soil remediation if determined to be necessary). The risk assessment evaluation will be completed separately and will be covered in a separate report.

A tertiary project objective is the safe removal and off-site of a 60 gallon plastic drum containing diesel fuel, located on the north dock.

A detailed summary of each of the individual reports that went into the Environmental Program is provided below.

Designated Substance and Hazardous Materials Survey – BluMetric completed a comprehensive survey of building construction materials to determine the presence and condition of designated substances and hazardous materials was conducted. The overall conclusion of the DS/HMS report (BluMetric June, 2017) was that in the instance that the structures are renovated or building materials need to be disturbed for maintenance purposes, any worker or contractor who performs work in the vicinity of materials known to contain asbestos, mercury, or lead should be informed and appropriate controls should be implemented to reduce exposures to regulated levels. Disturbance or damage to hazardous materials may create airborne concentrations of hazardous materials.

Structural Engineering Assessment - Novatech completed a structural engineering assessment of the site. Based on the findings of the assessment, there is a potential risk of injury to workers performing work in the vicinity of the lighthouse structure, as there is risk of debris falling from the exterior platform. Work on the lighthouse can still be performed if the proper precautions such as temporary fencing and erecting full height scaffolding are taken.

Marine Engineering Assessment - Shoreplan completed a marine engineering assessment of the site. Based on these access requirements and following review of the size and condition of existing dock and breakwater, Shoreplan recommended that site access be provided by way of a small landing craft launched from a barge and tug.

Biological Assessment - Bowfin conducted a biological assessment of the site. The report provided recommendations in order to avoid impacts to areas that could or do have significance from a natural heritage function.

Subsurface Investigations - Previous Phase II and Phase III Environmental Site Assessments (ESA) were conducted for the site in 2001 (XCG Consultants Limited) and in 2006 (Jacques Whitford), respectively. BluMetric was retained to conduct a shallow soils investigation at the site. The site investigation goal was to further characterize and delineate the current environmental conditions (horizontal and vertical) at the site. Based on the results of this shallow soil assessment, recommendations are provided for; removal and disposal of the waste metal debris; abatement of all potential lead-based paint; and, conduct a risk assessment of all areas of soil impact by various chemical species in order to reduce the volume of soil required to be removed as part of a future site remediation. In addition, remedial or risk management strategies should consider site-specific environmental risk factors. Note that PAH and PHC impacts have not been fully delineated.

Environmental Effects Evaluation - BluMetric was retained to complete and EEE on the site. The purpose of this project is to remediate heavy metal containing exterior paint and a metal and debris dump at the site. It determined that with effective and established mitigation in place and good work practices, environmental effects will be of short duration and the potential zone of influence will be confined to the immediate vicinity of the work site.

TABLE OF CONTENTS

LIST OF APPENDICES

1. INTRODUCTION

BluMetric Environmental Inc. (BluMetric™) was retained by Public Works & Government Services Canada (PWGSC), on behalf of Fisheries and Oceans Canada (DFO), to conduct an Environmental Program on the East End Light Station Michipicoten Island, Ontario. The Environmental Program was to include; soil delineation, designated substances and hazardous materials assessment (DS/HMS); structural assessment; biological assessment to support an ecological risk assessment (ERA) and/or species at risk (SAR) assessment; marine engineering assessment; Environmental Effects Evaluation (EEE); and, the preparation of plans and specifications for abatement and debris removal. The goal of the remediation will be the abatement of lead based paint and the removal of scrap metal and debris.

1.1 PROJECT OBJECTIVE

The Project objective was to provide remediation and risk management of environmental contaminates (affecting mainly soils) at the site. This was then divided into specific tasks to address the overall goal.

- A Designated Substances and Hazardous Materials Survey (DS/HMS) was to verify all lead based paint (mainly exterior lead based paint, but also interior lead based paint, asbestos, and other substances of concern) that might be a source of environmental contamination;
- A Structural Engineering Assessment was completed to verify the structural integrity of the site buildings with respect to remediation construction work to be performed on the site to remove environmental contamination sources from the site (can remediation construction work be completed safely on site buildings);
- A Marine Engineering Assessment was completed to provide site access recommendations to potential contractors conducting environmental remediation work at the site;
- An Ecological Assessment was completed to determine potential impacts/risks to the environment receptors as a result of the remediation construction activities;
- The Environmental Effect Evaluation (EEE) was completed to provide risk mitigation measures with respect to remediation construction activities;
- The safe removal and off-site of a 60 gallon plastic drum containing diesel fuel, located on the north dock;
- A Shallow Soil Delineation was completed to determine the extent of contaminated soils at the site and used for support of a Risk Assessment of the soil impacts; and,
- Finally, design drawings and specifications were completed to provide specific direction to contractors conducting lead based paint abatement (and other Hazardous materials abatement as appropriate) and debris removal at the site to eliminate potential sources of environmental contamination at the site.

Once sources of environmental contamination have been removed from the site, intended future work will include either risk management or remediation of contaminated site soils. The end objective of all this work is to risk manage/mitigate human health and ecological risks to the site with respect to environmental contamination.

1.2 BACKGROUND

The Michipicoten Island East End Light Station is a 39.3 hectare property located on the northeast end of Michipicoten Island in Lake Superior, and is found within Michipicoten Island Provincial Park. The project site itself consists of a roughly one hectare area that is improved with an unmanned lighthouse, fog alarm building, generator building, equipment shed, tank farm with a concrete dyke, and helicopter pad. There are also foundations from a former radio beacon building, former fuel storage shed, former boathouse, and former dwelling on the site. The site is unmanned and is currently owned by DFO.

The lighthouse itself, constructed in 1911, is a designated Classified Federal Heritage Building (Parks Canada, 2017) based on its design and the relatively unchanged and remote nature of the site. The main section of the tower is a six-sided reinforced concrete structure, approximately 18.7 metres high, braced by six tapered flying buttresses. The designation does not extend to the site itself or any of the other structures which are present.

Previous environmental assessments by others found soils impacted by petroleum hydrocarbons (PHC), Polycylic Aromatic Hydropcarbons (PAH) and metals (primarily lead) on-site, as well as dump sites/loose debris, and flaking lead based paints on structures. The presence of PHC and PAH was attributed to historic DFO operations at the site, while the lead impact was believed to be directly correlated to the flaking exterior paint. The site has been assigned Federal Contaminated Site Index Number 67652001 and 67652002, which correspond to the same GPS location.

2. REPORT SUMMARIES

As part of the overall project, the following summaries of assessments that have been conducted on the Michipicoten Lighthouse site are provided.

2.1 DESIGNATED SUBSTANCE AND HAZARDOUS MATERIALS SURVEY

BluMetric was retained to conduct a comprehensive Designated Substances and Hazardous Materials Survey (DS/HMS) for structures, as well as a small metal debris dump, found on the

Michipicoten Island East Lighthouse site, found in Lake Superior west of Wawa, Ontario. The purpose of this project was to conduct a comprehensive survey of interior building construction materials to determine the presence and condition of designated substances and hazardous materials. Full results and recommendations are provided in the report entitled; *Comprehensive Designated Substance and Hazardous Material Survey. BluMetric, June 6, 2017.*

BluMetric's Intermediate Occupational Hygiene / Environmental Technologist, Véronique Maynard, visited the Site on September 23, 2016 to complete the DSHMS. The findings of that assessment were as follows.

Asbestos

Three samples from sixteen (16) identified homogenized materials and five (5) samples from one homogenized materials were suspected to be an Asbestos Containing Material (ACM) and were submitted for laboratory analysis. Eight (8) of the seventeen (17) homogenized materials were confirmed as asbestos containing.

Note that there is lead based paint present on some of the ACM. Specific ACM abatement measures will be required when there is potential for the ACM to be disturbed during site activities such as lead based paint abatement, debris removal, soil remediation, building maintenance and works.

Lead

Thirty-six (36) samples of suspected lead based paint were submitted for analysis. Thirty (30) of the representative paint samples were found to be lead-based. A number of these paint coating were determined to be leachate toxic, as per the regulated criteria (General Waste Management R.R.O. 1990, Regulation 347).

Based on the age of the building, lead may also be present in other materials including solder used on plumbing lines and fixtures and in electrical equipment. These types of materials were not tested as part of this assessment. The amounts of lead present would be minimal and are physically bound into the solder and would not pose a significant concern during construction/demolition activities.

Mercury

Two (2) of the paint samples analysed have exceeded the Surface Coatings Materials Regulations mercury criteria of 10 μg/g. Note that these paints were also determined to be lead-based.

Based on the age of the building, mercury may be present in other materials including thermostats, fluorescent lights and potentially historical use of 'mercury bath' for lighthouse light. One mercury containing thermostat was found in the living quarters, and one mercury containing thermometer and one thermostat were found in the garage/former living quarters. Mercury was not visually observed in or around the device that holds the light bulb though paint samples collected in the upper most parts of the lighthouse (green painted light device and silver painted metal above the light bulb) were found to have the higher concentrations of mercury.

Mercury was historically used in lighthouses, specifically in the light bath. Paint samples collected in the upper most parts of the lighthouse (green painted light device and silver painted metal above the light bulb) were found to have the higher concentrations of mercury. Mercury was not visually observed in or around the device that holds the light bulb.

Arsenic

Although not specifically sampled, arsenic may be present in painted materials.

Silica

Although not specifically sampled, silica may be present in the following building materials observed during the site visit: poured concrete, stone and mortar.

PCB

Fluorescent light ballasts were not observed in any of the buildings. Accordingly it is unlikely that PCBs are present on the site.

ODS Containing Equipment

One refrigerator was noted in the living quarters and one in the upper area of the garage/former living quarters. Refrigerant must be inspected prior to disposal and must be disposed of accordingly. Removal of the refrigerator is not part of the proposed work plan.

Benzene

Benzene may be present in any area where fuel, oil and waste oil are stored.

Above ground or below ground storage tanks or other containers for fuel or waste oil were not observed on the site during the BluMetric visit. A boiler was found in the garage/former building and an engine is present up in the tower of the lighthouse. Benzene was present at the site in the form of a 60 gallon, plastic drum containing diesel fuel located on the north dock.

Any benzene containing material must be disposed of accordingly.

Identification of Mould

Due to the age of the buildings and the fact that they are unoccupied, thus not regularly maintained, some mould growth is possible in the buildings found on site. There was evidence of water intrusions in the garage/former living quarters.

Other Hazardous Materials

Based on observations made during the site visit and reported on-site activities, there is no reason to believe that the following designated substances or hazardous materials are present: acrylonitrile, coke oven emissions, ethylene oxide, isocyanates, vinyl chloride, and UFFI.

Conclusions

The overall conclusion of the DS/HMS report (BluMetric March, 2017) was that in the instance that the structures are renovated or building materials need to be disturbed for maintenance, remedial abatement purposes or any other activities, any worker or contractor who performs work in the vicinity of materials known to contain asbestos, mercury, or lead should be informed and appropriate controls should be implemented to reduce exposures to regulated levels. Disturbance or damage to hazardous materials may create airborne concentrations of hazardous materials.

2.2 STRUCTURAL ENGINEERING ASSESSMENT

BluMetric retained Novatech Engineers, Planners, and Landscape Architects (Novatech) to complete a structural engineering assessment of the site. The full report is titled; *Michipicoten Island - East End Light Station - Lighthouse and Other Buildings Structural Condition Evaluation, Noveatech, March 16, 2017.*

Mr. Peter James, P.Eng. of Novatech Engineers, Planners, and Landscape Architects visited the site on September 23, 2016 to complete a structural engineering assessment of the lighthouse and other appurtenant structures. The findings of that assessment were as follows.

- The primary structure of the lighthouse is generally in satisfactory condition. The deterioration (spalling, corrosion, etc.) of the top floor and exterior concrete platform is significant and should be removed/repaired;
- Other buildings are generally in good condition. Minor maintenance work is recommended to maintain the existing condition; and,
- With regular maintenance, there long-term deterioration will be minimized.

Safe work procedures to be followed during abatement work are to include:

- If any work is to be undertaken in the immediate vicinity of the lighthouse, there is a potential risk of injury to workers from debris falling from the exterior platform. Work on the lighthouse can still be performed if the proper precautions such as temporary fencing and full height scaffolding are taken;
- The exterior concrete platform of the lighthouse cannot be considered safe, alternate access must be provided to reach exterior surfaces (e.g. full height scaffolding). These costs should be fully examined and considered as part of the work plan for remediation work; and,
- No additional specific considerations/precautions are required for abatement work conducted on the appurtenant structures as the site.

2.3 MARINE ENGINEERING ASSESSMENT

BluMetric retained Shoreplan Engineering Limited (Shoreplan) to complete a marine engineering assessment of the site. The full report is titled; *Marine Assessment, Michipicoten Island, Lighthouse, Lake Superior. Shoreplan Engineering Limited. January 12, 2017.*

Shoreplan's Bruce Pinchin P.Eng visited the site on September 23, 2016, in order to assess conditions and to provide recommendations for site access during remediation activities. Marine access requirements were assumed to be limited to the equipment required for remediation (scaffolding, excavator, etc.), the transfer of personnel to and from the island as well as the removal of waste (paint, impacted soil, scrap metal, etc.).

Marine access alternatives were determined to be limited due to jagged rock shoreline, and the size of the existing dock and breakwall. The only practical marine access alternative for the site is by barge and tug boat. Site access can be provided by way of a small landing craft launched from a barge and tug. Equipment would be transferred between the barge and the island by a small landing craft with an approximate capacity of 4.5 tons. In the case of rough conditions, the barge and tug can shelter in Quebec Harbour nearby.

Given the remote nature of the site, it is likely that a helicopter will remain on standby in the event of an emergency.

2.4 BIOLOGICAL ASSESSMENT

BluMetric retained Bowfin Environmental Consulting Inc. (Bowfin) to conduct a biological assessment of the site. The full report is titled; *Michipicoten Island, Ecological Risk Assessment of East End Light House Station and Surrounding Area. Bowfin Environmental Consulting Inc. March 2017.*

Bowfin was on-site to conduct a biological assessment on September 23rd, 2017. A site specific habitat assessment was completed in order to identify potentially significant natural features as well as the potential for Species at Risk (SAR) or their habitats to occur within the study area. Also included was a vegetation survey representing the late September season and incidental recordings of mammals, birds, reptiles, amphibians, and insects. The timing of the surveys was late September, outside of the growing season which limited the amount and type of data that could be collected.

Ecological habitats at the site were fairly uniform and consisted primarily of coniferous forests with some marsh and bedrock inclusions. The study area is situated on the east tip of Michipicoten Island in an area referred to as Point Maurepas. This land is federal and does not form part of the Michipicoten Provincial Park. The surrounding lake habitat within 2.5 km of the island does form part of the provincial park.

The findings of that assessment were as follows:

- There are no provincially significant wetlands (PSW) in or near the study area;
- The entire study area consisted of, a very shallow (soil) dry to fresh (moisture regime) conifer forest. Included within this community were very small wetlands and bedrock outcrops or rock barrens;
- All bedrock and shoreline habitats could have the potential for species of conservation value and should be considered potential significant wildlife habitat (SWH) habitat until a survey is completed during the growing season;
- There were no watercourses found with the exception of a short channel created from what appeared to be a seep (no iron precipitate was observed). This channel was identified on the edge of the adjacent lands to the north of the study area;
- Evidence of wildlife species consisted of beaver, grey wolf and woodland caribou;
- Other species noted consisted of birds: bald eagle, American pipit, blackburnian warbler, black-capped chickadee, palm warbler, pine warbler and yellow-rumped warbler. All of

these but the bald eagle are considered to be common species. The bald eagle is listed as S2 (signifying that it is imperiled in Ontario). It is also a Special Concern Species (provincially);

- While no significant wildlife habitat was confirmed, vegetation and habitats encountered could be considered to provide candidate SWH for bat hibernacula, reptile hibernacula, woodland raptor nesting habitat, seeps and springs, denning sites and/or mast producing areas;
- A total of 64 plant species were identified of which 68% were native and all were ranked at a value higher than S4 with the exception of oval-leaved blueberry. This S2 (imperiled) ranked species was noted throughout the study area; and,
- The following species at risk are considered to have potential to be present within the project area: Lake Sturgeon, Shortjaw Cisco, Deepwater Sculpin, Whip-poor-will, barn swallow, Canada warbler, Little Brown myotis, Northern Myotis/Northern Long eared bat, tri-coloured bat and Woodland Caribou. Of these species Woodland caribou were confirmed to be present.

In order to avoid impacts to areas that could or do have significance from a natural heritage, the following steps should be adhered to:

- Minimize the clearing of any vegetation including trees (potential nesting for birds and raptors), shrubs (potential forage for wildlife) and plant communities on bedrock (potential for significant plant species or SWH communities to occur);
- Any clearing of vegetation should take place outside of the breeding bird window (April 15th to August 31st);
- Impacts to vegetation be minimized by pre-selecting routes onto and off the island and around the area;
- If disturbance to vegetation is required, complete a plant inventory during the growing season before hand;
- Avoid impacting the seeps and springs (including the north wetland);
- Avoid excavating into bedrock unless it is confirmed that there are no snakes or bat hibernacula on the island or surveys are completed to document their presence/absence;
- Avoid impacts to the aquatic habitat surrounding the island which may provide important fish habitat; and,
- Ensure that any workers brought on for the repairs/removal of the buildings are provided information on the potential wildlife encounters (i.e. caribou, wolves etc.) and that caribou are a protected species.

2.5 SUBSURFACE INVESTIGATIONS

Historical Information

Previous Phase II and Phase III Environmental Site Assessments (ESA) were conducted for the site in 2001 (XCG Consultants Limited) and in 2006 (Jacques Whitford), respectively.

Phase 1 - XCG Consultants Limited

The purpose of the Phase II ESA was to confirm the presence or absence of contamination at potential areas of concern identified during the previous Enhanced Phase I ESA.

The scope of work included the following:

- Seventeen (17) soil samples and two surface water samples were collected in November 2000;
- Soil samples were analyzed for metals. Selected samples were additionally analyzed for total petroleum hydrocarbons (TPH), PAH, and anions;
- Surface water samples were analyzed for metals and anions;
- Soil and surface water results were compared to applicable Federal guidelines and Provincial objectives. The federal guidelines were those from the Canadian Council of Ministers of the Environment (CCME). The provincial objectives were those from the Ontario Ministry of the Environment (MOE) with surface water; and,
- Results were additionally compared to Ontario Provincial Water Quality Standards.

The major findings included the following:

- Based on the analytical results, the subject site was divided into two sections or “contaminated sites” (CS-1 and CS-2). The main site area (or CS-1), comprises the eastern section of the Site containing the light house and main building group, while the landfill area (or CS-2) is found in the western section containing former double dwelling foundation;
- Soil results indicated that numerous metal, TPH and PAH parameters exceeded applicable guidelines in CS-1. No anion exceedances were noted. The quantity of soil impacted by metals and hydrocarbons in CS-1 was estimated to a “best guess” amount of approximate 245 m^3;
- Surface water results indicated that numerous metal parameters exceeded the applicable guidelines in CS-2. It was suggested that the west landfill area has potentially impacted the on-site surface water quality. There was insufficient information to calculate a quantitative estimate for contamination in CS-2; and,

- The Qualitative Risk Assessment (QRA) results indicated that there is a low to medium degree of risk associated with available pathways to potential receptors.

Recommendations in the report were as follows;

- *Given the identified metal and hydrocarbon contamination, XCG recommended a Site Specific Risk Assessment (SSRA)/Risk Management as the most suitable remedial alternative for CS-1, including groundwater and sediment sampling; and,*
- *In the absence of subsurface information, it was recommended that CS-2 be investigated further, including groundwater and sediment sampling.*

Phase III ESA – Jacques Whitford

The purpose of the Phase III ESA was to complete a detailed intrusive investigation of the site contamination and delineate the horizontal and vertical extent within the impacted media.

The scope of work included the following:

- Eighteen (18) soil samples were collected in August 2005 from ten boreholes advanced in CS-1 and four boreholes in CS-2;
- Soil samples were analyzed for PHCs (F1-F4), benzene, toluene, ethylbenzene, and xylenes (BTEX), PAHs, and selected metal parameters. Additionally, polychlorinated biphenyls (PCBs) were analyzed in CS-1 samples; and,
- Soil results were compared to applicable Federal and Provincial guidelines.

The major findings included the following:

- Soil results indicated that numerous metal parameters exceeded applicable guidelines in all CS-1 samples, along with PHC F3, xylene, and PAHs in select few samples;
- Soil results indicated that numerous metal parameters exceeded applicable guidelines in all CS-2 samples, along with PHC F3 and F4, toluene, xylene, and in select few samples.
- Five aboveground storage tanks (AST) of various construction and installations were observed to be in good condition;
- Federal Contaminated Sites Action Plan (FCSAP) National Classification System (NCS) classified the site as “1 - Action Required”; and,

- Approximately 420 cubic meters was the estimated impacted soil volume, suggested to be on the low-side given that a “clean-line” could not be attained due to high natural metal levels of the local geology and soil overburden. Depending on the findings of the Risk Assessment which is being addressed under a separate report, additional studies to determine background concentrations of metals at the site may be required before any potential physical soil remediation construction work can commence. Existing metal exceedances might be representative of background concentrations.

Recommendations in the report were as follows:

- *Jacques Whitford recommended that a Screening Level Risk Assessment (SLRA) be used to determine if human or ecological risk exists in association with the identified contamination concentrations.*

Current Investigation (Shallow Soil Investigation)

In order to update the understanding of impacts at the site from the 2006 Phase III ESA, BluMetric was retained to conduct a shallow soils investigation at the site. The site investigation goal was to further characterize and delineate the current environmental conditions (horizontal and vertical) at the site. The full report is titled; *East End Light Station Shallow Soils Investigation Michipicoten Island, Ontario. BluMetric Environmental Inc., June 8, 2017.*

BluMetric’s investigation began with a comprehensive review of available historical documentation, previous environmental reports and operational records including the previously completed Phase II and Phase III assessments. This information formed the basis of the sampling plan that was implemented during the site investigation.

The scope of work for the Shallow Soils Investigation was as follows, in accordance with the Terms of Reference (ToR):

- Complete delineation of COPCs at the Site that were not fully delineated during the previous Phase III ESA;
- Provide the necessary site sampling and analyses to determine the nature, quantity, location and extent of any material or substance that may be of environmental concern;
- Conduct sampling and analysis designed to quantify, in report form, the extent environmental impacts;
- Provide recommendations associated with potential risks of current site conditions while highlighting immediate concerns or actions;
- Display contamination plumes on maps as contours; and,

- Discuss with PWGSC whether a SSRA is required, which type (i.e. Preliminary Quantitative RA or Detailed Quantitative RA), and if soil remediation plans are to be included.

The environmental investigation identified impacts of metal, PHC and PAH in soils at the site. Analytical results indicated that metal impacted soil, including lead, is found across the site around all current and former structures. The site also shows pockets of soils impacted with PHC and PAH above the applicable criteria. The impacts were noted within the shallow overburden (0-0.3 m bsg). The overburden is found as a veneer over the bedrock with bedrock outcrops noted in some locations, though competency of the bedrock could not be determined.

It was noted that significant amounts of metal scrap and debris are distributed in the forest surrounding the site. Additionally, a scrap metal dump is present west of the site in a bedrock bounded, seasonal surface water feature with an estimated waste volume of 4 m^3. While not directly observed at the time of the site visit, it was apparent (observed soil erosion, shallow channelization and undercut vegetation, etc.) that this surface water feature results in periodic flowing stream which runs first south east and then to the east towards the site. This metal dump is a potential contributing source of metals impacts in surface soils for areas of the main site down gradient.

Based on the results from the 2016 sampling event as well as previous site assessments it was found that: 1) the volume of metals impacted soil across the site is estimated to be between 411 m^3 and 548 m^3; 2) the volume of PHC impacted soil across the site is estimated to be between 30 m^3 and 40 m^3; and, 3) The volume of PAH impacted soil across the site is estimated to be between 29 m^3 and 38 m^3. However, it should be noted that the metals, PHC and PAH impacts have not been fully delineated and further delineation activities may be required to conclusively quantify these impacts at the site. It should also be noted these areas of impacts tend to overlap and the entire extent of soil impact is assumed to be roughly 550 m^3.

The remedial or risk management strategies should consider site-specific environmental risk factors. That is, the source conditions, exposure pathways and the likelihood of exposure, and the sensitivity of receptors at or adjacent to the site. It was recommended that a site-specific ecological and human health risk assessment be performed prior to the development of a Remedial Action and Risk Management Plan, to ensure that rational decisions regarding site remediation are made, and the most appropriate remedial strategies are implemented.

2.6 ENVIRONMENTAL EFFECTS EVALUATION

BluMetric was retained to complete and EEE on the site. The report is titled; *Basic Project Evaluation Report for the Abatement and Debris Removal, Michipicoten Island East End Site,* *Ontario Pursuant to Sections 67 of the Canadian Environmental Assessment Act, 2012, BluMetric, March 31, 2017.*

It has been determined by PWGSC, that abatement activities at the East End Light Station Michipicoten Island, Ontario is subject to evaluation the Canadian Environmental Assessment Act 2012 (CEAA 2012). The evaluation non-designated projects (those not requiring a full environmental assessment) under Section 67 may take two forms, an environmental effects evaluation or a basic project assessment, based on whether or not there is uncertainty around the potential for environmental effects and where mitigation measures are not known to be effective and established (CEAA, 2016).

The purpose of this project is to remediate heavy metal containing exterior paint and a metal and debris dump at the East End Light Station (the Site) located at the east end of Michipicoten Island in Lake Superior in order to limit further lead impacts to the environment. Potential impacts of this project are associated with the removal of exterior paints, re-painting, removal of scrap metal/debris, transport of equipment and personnel to/from site, housing of personnel on site and waste management. It is reasonable to conclude that with effective and established mitigation in place and good work practices, environmental effects will be of short duration and the potential zone of influence will be confined to the immediate vicinity of the work site. Accordingly, the assessment categorized the project as a “basic project” and concluded that project impacts would be non-significant following the implementation of effective and established mitigation measures.

3. CLOSING

This document summarizes the results of a project evaluating the proposed abatement of the East End Light Station Michipicoten Island. This report provides an overview of the main findings of the individual studies to which it pertains. This report does not provide a comprehensive report, and its review should not be considered a substitute for reading the reports in their entirety.

BluMetric Environmental Inc. makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information. Nothing in this report is intended to constitute or provide a legal opinion. BluMetric Environmental Inc. makes no representation as to compliance with environmental laws, rules, regulations or policies established by regulatory agencies.

This report was prepared for Public Works and Government Services Canada, on behalf of the Transport Canada. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric Environmental Inc. in writing.

BluMetric Environmental Inc. accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

Should you have any questions regarding this report or require more information, please do not hesitate to contact the undersigned.

Respectfully submitted,
BluMetric Environmental Inc.

Carl Hentschel

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Environmental Scientist	Environmental Engineer

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APPENDIX A

Designated Substance and Hazardous Materials Survey

COMPREHENSIVE DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY

3rd PARTY

Environmental Services Stream 3 – Standing Offer Agreement EQ447-141528/A

Michipicoten Island East End Site
DFRP No. 67652, PWGSC No. R.083149.031
FCSI No. 67652001 & 67652002
Near Wawa, ON

Submitted to:

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Public Works & Government Services Canada – Ontario Region
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Project Number: 160528-00-00

June 6, 2017

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1.0 INTRODUCTION

Public Works and Government Services Canada (PWGSC), on behalf of the Department of Fisheries and Oceans Canada (DFO), retained BluMetric Environmental Inc. (BluMetric™), to conduct a comprehensive Designated Substances and Hazardous Materials Survey (DS/HMS) for structures, as well as a small metal debris dump, found on the Michipicoten Island East Lighthouse site, found in Lake Surperior west of Wawa, Ontario. The purpose of this project was to conduct a comprehensive survey of interior building construction materials to determine the presence and condition of designated substances and hazardous materials.

The DS/HMS at the buildings found on the East End Light Station complies with the Occupational Health and Safety Act of Ontario (OHSA) and its Regulations, including but not limited to O. Reg. 278/05 (Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations), O. Reg. 490/09 (Designated Substances). The site has been listed as DFRP No. 67652, and FCSI No. 67652001 & 67652002.

The site survey and sampling was performed by Veronique Maynard of BluMetric on September 23, 2016. She was unaccompanied by any DFO or PWGSC staff during the site visit. A follow-up visit was performed by Paul Bandler on April 21, 2017, accompanied by a PWGSC staff member.

Note that this report addresses all buildings found on the East End Light Station location.

1.1 OBJECTIVES, SCOPE AND ASSESSMENT CRITERIA

The overall objective of the building survey is to identify, quantify and assess the condition of asbestos-containing materials (ACM) and surface coatings (according to Surface Coating Materials Regulations (SOR/2005-109). This includes:

- A comprehensive DS/HMS of all suspect surface and building materials was conducted, by means of intrusive sampling methods in order to access hidden surfaces (or multiple layers of building materials) behind walls, floors, and ceilings. Intrusive sampling was conducted;
- The type, number, location, distribution, and analysis of the samples was assessed at BluMetric's discretion and was in compliance with Ontario's *Occupational Health and Safety Act* and the Regulations made pursuant to the Act in order to safely and accurately identify, locate, and quantify infrastructure-related Designated Substances and Hazardous Materials.

Prepare a summary of the observations from site, along with recommendations for the abatement procedures as per regulatory and/or Environmental Abatement Contractors of Ontario (EACO) guidelines. This summary is included in the main report.

This report provides, as per the requirements outlined in the Statement of Work:

- The type, location, and quantity of all infrastructure-related Designated Substances and Hazardous materials that will typically be disturbed as part of the upcoming fire and life safety project;
- Drawings indicating the sample locations and results of this;
- Representative results of leachate testing for painted surfaces requiring disposal; and,
- Recommended hazard mitigation measures and waste disposal measures;

1.2 SITE BUILDING AND DESCRIPTION

The Michipicoten Island East End Light Station is a 39.3 hectare property located on the northeast end of Michipicoten Island in Lake Superior, and is found within Michipicoten Island Provincial Park. The project site itself consists of a roughly 1 hectare area that is improved with an unmanned lighthouse built in 1911, living quarters built in the 1950s, garage/former livingquarters/fog alarm building built in 1950s, two (2) storage sheds built in the 1970s, and helicopter pad. There are also foundations from a former radio beacon building, former fuel storage shed, former boathouse, and former dwelling on the site. Environmental investigations were completed on the surficial soil at the site between 1997 and 2006, which identified soil impacts including concentrations of metals, petroleum hydrocarbons (PHCs), and polycyclic aromatic hydrocarbons (PAHs) in excess of current regulatory guidelines. Additionally, there is a concern that lead-based paint may be flaking off the existing structures and impacting the surrounding surficial soil. There has been no previous designated substance survey completed at the subject site.

2.0 METHODOLOGY

2.1 SITE SURVEY

BluMetric inspected all areas (including voids) in order to determine the presence, quantity and condition of hazardous material. BluMetric collected sufficient samples of building materials to assess the presence and type of asbestos-containing materials (ACM), as well as lead and mercury content of paint.

Proper PPE should be worn if lead containing surfaces are to be disturbed during any demolition or alteration.

Designated substances are defined by the Ontario Regulation respecting Designated Substances (O. Reg. 490/09). In this survey, the designated substances specifically evaluated and sampled were asbestos, and paint-containing lead, and/or mercury. Silica is anticipated to be present in all poured concrete and pre-fabricated concrete products. Arsenic is also possibly found in paint.

BluMetric staff used field notes, cameras and checklists to record observations and evidence. Relevant photos are included in the results tables in this report. Updated site plans/drawings with sample locations are included in Appendix B.

Samples that were collected were shipped to a CALA - (Canadian Associated for Laboratory Accreditation Inc.)/ NVLAP - (National Voluntary Laboratory Accreditation Program) accredited laboratory for analysis using strict chain-of-custody records/protocol. Full laboratory reports and chain of custody records are provided in Appendix C.

2.1.1 Asbestos Containing Materials

In Ontario, asbestos containing materials (ACMs) are defined as any material found to contain 0.5% or more asbestos by dry weight volume within one sample of a homogeneous material, as determined by the standard polarized light microscopy (PLM) method, as stipulated in Ontario Regulation 278/05 (O. Reg. 278/05), "*Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations".* O. Reg. 278/05 requires that a management program designed to prevent worker exposure to airborne asbestos fibres be established in buildings where asbestos is known to be present. This program includes training of workers who may disturb asbestos and routine inspection and maintenance of the materials. The regulations states that "Ongoing asbestos management in buildings applies to the… owner of a building that has been advised under Section 9 of the discovery of material that may be asbestos-containing material; and/or, an owner of a building knows or ought reasonably to know that asbestos-containing material has been used in a building for any purpose related to the building, including insulation, fireproofing and ceiling".

Although asbestos is not considered a hazardous waste, Ontario Regulation 347, revised by Reg. 558 - *made under the Ontario Environmental Protection Act*, does define specific requirements for the disposal of materials containing friable asbestos at landfills. These requirements include notification of the landfill site, proper labelling and containment of the material.

As part of this work program, representative samples of suspected ACMs observed at the Site were taken in accordance with the requirements set out in O. Reg. 278/05. The number of samples collected was considered representative based on observations pertaining to like building materials and the minimum sampling requirements, as described in Table 1 below.

Table 1: Minimum of Asbestos Bulk Material Sample Requirements

Item	Type of Material	Size of Area of Homogeneous Material	Minimum Number of ACM Samples to be Collected
1.	Surfacing material, including without limitation material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings and fireproofing materials on structural members	Less than 90 square metres	3
		90 or more square metres, but less than 450 square metres	5
		450 or more square metres	7
2.	Thermal insulation, except as described in item 3	Any size	3
3.	Thermal insulation patch	Less than 2 linear metres or 0.5 square metres	1
4.	Other material	Any size	3

Three (3) samples from (16) sixteen identified homogenized materials and five (5) samples from (1) one homogenized materials were suspected to be an ACM and were submitted for laboratory analysis. Samples were placed into individual sample bags labeled with a unique sample number. Sampling tools, utility knives and scrapers, were cleaned between samples. The samples collected were sent to Paracel Laboratories in Ottawa, Ontario and analyzed by polarized light microscopy (PLM) using EPA Method 600/R-93/116/NYS-DOH 198.1. The lab was instructed to perform a 'stop positive' analysis, so that if one (of three) samples was identified to be asbestos containing they were to assume all samples of the homogenized material were asbestos containing, as per O. Reg 278/05. Paracel is NVLAP-accredited for bulk asbestos analysis by PLM.

Sampling results are presented in section 3.2.1 below.

2.1.2 Lead Based Paints and Lead Material

Lead is a naturally occurring metal, although; when found in paint it may pose a potential health risk when the paint surface deteriorates with aging or is damaged and disturbed in such a manner that it creates dust and chips. Based on the age of the building, lead may also be present in other materials including solder used on plumbing lines and fixtures and in electrical equipment.

Lead containing paint is defined by the Canada Consumer Product Safety Act – Surface Coating Materials Regulations SOR/2005-109. This stipulates that the concentration of total lead present in a surface coating material must not be more than 90 µg/g. There was formerly a criterion under the Hazardous Products Act; however, it has been revoked with no replacement value.

It is important to note that this standard serves primarily to reduce potential exposure to lead by ingestion in residential settings where children may have access to lead contaminated surfaces or coated materials. In the absence of a published criterion to determine whether an existing paint coating contains potentially hazardous levels of lead with respect to a potential airborne exposure, it is reasonable to use the aforementioned legislation as a screening benchmark. Thus, paint samples confirmed with a concentration ≥90 µg/g of lead are considered to be lead containing respectively. The established limits for lead on surfaces are intended to protect children from adverse health effects, primarily in residential settings (housing), schools, childcare establishments, yards, etc.

The Environmental Abatement Council of Ontario (EACO) published a document titled "*Lead Guideline for Construction, Renovation, Maintenance or Repair*" (2014) that classifies lead containing paint according to the hazard it presents to abatement workers. Paints containing less than 1,000 µg/g lead are considered low-level lead paints, paints between 1,000 µg/g and 5,000 µg/g are considered to be lead-containing, and paints containing more than 5,000 µg/g are defined as lead-based paints.

Thirty-six (36) samples of suspected lead based paint or surface coatings were submitted for analysis. These were selected to reflect all painted surfaces of significant volume encountered, while treating paints of like colour as homogenous. Samples were placed into individual sample bags labeled with a unique sample number. Sampling tools, utility knives and scrapers, were cleaned between samples. The samples collected were sent to Paracel in Ottawa, Ontario for lead, mercury and leachate toxic lead analysis in accordance with EPA Method 6020-ICP-MS. Paracel is a CALA- and ISO-accredited laboratory for analysis of lead.

Sampling results are presented in section 3.2.2 below.

Other Lead Materials

Based on the age of the building, lead may also be present in other materials including solder used on plumbing lines and fixtures and in electrical equipment. These types of materials were not tested as part of this assessment. The amounts of lead present would be minimal and are physically bound into the solder and would not pose a significant concern during construction/demolition activities.

Any lead confirmed at the Site should be removed as hazardous waste following the requirements of O. Reg. 347 – Waste Management under the Ontario Environmental Protection Act.

2.1.3 Mercury Based Paints and Mercury Materials

Mercury Based Paints

Mercury containing paint is defined by the Canada Consumer Product Safety Act – Surface Coating Materials Regulations SOR/2005-109. This stipulates that the concentration of total mercury present in a surface coating material must not be more than 10 μg/g.

The thirty-five (35) paint samples collected were suspected to contain mercury and submitted for laboratory analysis. Sampling results are presented in section 3.2.3 below.

Mercury Materials

Based on the age of the building, mercury may be present in other materials including thermostats, fluorescent lights and potentially historical use of ‘mercury bath’ for lighthouse light. These types of materials were not tested as part of this assessment. When mercury is enclosed within a system (such as within a thermostat or fluorescent light), it is not in exposed form unless/until the encapsulation is broken. These materials must be disposed as mercury-containing waste. One (1) mercury containing thermostat was found in the living quarters, and one (1) mercury containing thermometer and one (1) thermostat were found in the garage/former living quarters.

Mercury was historically used in lighthouses, specifically in the light bath. Paint samples collected in the upper most parts of the lighthouse (green painted light device and silver painted metal above the light bulb) were found to have the higher concentrations of mercury. Mercury was not visually observed in or around the device that holds the lighthouse lamp.

Any mercury confirmed at the Site should be removed as hazardous waste following the requirements of O. Reg. 347 – Waste Management under the Ontario Environmental Protection Act.

2.1.4 Arsenic

Although not specifically sampled, arsenic may be present in painted materials. *During renovation or demolition any materials encountered not previously sampled, which could contain arsenic, should be sampled and sent to laboratory for analysis. Any mercury confirmed at the Site should be removed as hazardous waste following the requirements of O. Reg. 347 – Waste Management under the Ontario Environmental Protection Act.*

2.1.5 Silica

Although not specifically sampled, silica may be present in the following building materials observed during the Site visit: poured concrete, stone and mortar. Silica is expected to be present in all concrete products.

For silica containing materials precautions should be taken during construction activities such as coring through concrete slabs and demolition of masonry or concrete units to ensure that workers' exposure levels to respirable airborne crystalline silica do not exceed permissible exposure limits. Work which could disturb silica containing materials should follow the recommendations provided in the document entitled "Guideline: Silica on Construction Projects", issued by the Ontario Ministry of Labour, and include respiratory protection.

2.1.6 PCB Containing Equipment

PCBs are not regulated under the Ontario Designated Substances Regulation (O. Reg. 490/09) but are included in hazardous materials surveys because of their potentially hazardous nature and the specialized handling required when removing and disposing.

Fluorescent light ballasts were not observed in any of the buildings.

2.1.7 ODS Containing Equipment

Refrigeration equipment were inspected for the type and quantity of refrigerant, and compared to the Environment Canada code of practice entitled Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems (2003).

One refrigerator was noted in the living quarters and one in the upper area of the garage/former living quarters. The type refrigerant could not be determined. Refrigerant must be inspected prior to disposal and must be disposed of accordingly.

Many halocarbons, a group of ozone-depleting substances (ODS), are being phased out or have already been banned for production or consumption. The following ozone-depleting substances are already banned: R10, R11, R12, R13, R13b1, R40, R111, R112, R113, R114, R115, R140, R211, R212, R213, R214, R215, R216, and R217

All consumption/re-charging to be banned in 2020 (R21, R22, R31, R121, R122, R123, R123b, R124, 124a, R131, R132, R133, R141, R141b, R142, R142b, R143a, R151, R221, R222, R223, R224, R225, R225ca, R225cb, R226, R231, R232, R233, R234, R235, R241, R242, R243, R244, R251, R252, R253, R261, R262, R271.)

2.1.8 Benzene

Benzene may be present in any area where fuel, oil and waste oil are stored.

Benzene is present at the site in the form of a 60 gallon, plastic drum containing diesel fuel, located on the north dock.

Above ground or below ground storage tanks or other containers for fuel or waste oil were not observed on the site during BluMetric's visit. A boiler was found in the garage/former building and an engine is present up in the tower of the lighthouse. No fuel storage tanks were observed.

Any benzene containing material must be disposed of accordingly.

2.1.9 Mould

Due to the age of the buildings and the fact that they are unoccupied, thus not regularly maintained, some mould growth is possible in the buildings found on site. Room 6 in the garage/former living quarters was found to have evidence of water intrusion.

Fungal spores are ubiquitous in nature. For mould growth to occur, three conditions must be present: a medium to sustain growth, a temperature between 5°C to 40°C, and the presence of moisture. Indoors, the presence of moisture is the limiting factor.

2.1.10 Other Designated Substances and Hazardous Materials

Based on observations made during the Site visit and reported on-Site activities, there is no reason to believe that the following designated substances or hazardous materials are present: acrylonitrile, coke oven emissions, ethylene oxide, isocyanates, vinyl chloride, and UFFI.

3.0 RESULTS

BluMetric, visited the Site on September 23, 2016 and April 21, 2017 to complete the DSHMS. Observations made at the time of the Site visit include:

3.1 SITE OBSERVATIONS – SEPTEMBER 23, 2016

BluMetric's Occupational Hygiene / Environmental Technician, Ms. Véronique Maynard, visited the Site on September 23, 2016 to complete the DSHMS. Observations made at the time of the Site visits include:

- Full access to the Site (grounds and building) was given and available, apart from access to the **crawlspace area for the garage/former living quarters** due to confined space concerns;
- Exterior walls and roofing for the garage/former living quarters appears to be made of pre-fab painted tin siding and roofing. The tin roof of the living quarters appears to be made of the same material.
- The lighthouse is primarily constructed of concrete;
- The two sheds are constructed mostly out of unpainted transite board material;
- The living quarters building is constructed out of factory produced decorative transite board siding (upper exterior portion) and a concrete base;
- Various former structures are found onsite (mostly concrete or cinderblock bases). These bases are painted with a white paint, similar to and considered same as the paint on the lighthouse;
- Asbestos (namely transite) material is suspected to be found in the debris pile and southern outhouse;
- Additional debris found within former building foundation and north of former living questers/garage building;
- Two large propane tanks were found northeast of the living quarters; and,
- Mouse fecal matter is found in most buildings on site.

Sampling locations are detailed in Appendix B.

3.2 BUILDING MATERIALS TESTING

3.2.1 Asbestos Containing Materials

Three (3) samples from (16) sixteen identified homogenized materials and five (5) samples from (1) one homogenized materials were suspected to be an ACM and were submitted for laboratory analysis.

Eight (8) of the seventeen (17) homogenized materials were confirmed as asbestos containing (greater than 0.5% of total material weight). These include:

- A-02: Interior caulking on the Lighthouse lower floor with an approximate quantity of less than 1 m^3;
- A-03: Interior and exterior transite panels within Sheds 1 and 2, with an approximate surface area of 145 m^2. Also found in debris pile east of main compound and as debris in southern outhouse (less than 1 m^3);
- A-08: Exterior caulking on Shed 1 and 2 and Lighthouse, with an approximate quantity of less than 1 m^3;
- A-09: Interior Plaster/compound found along seams of plywood in room 6 of Garage/Former Living quarters building, with an approximate quantity of 1 m3;
- A-11: Exterior Transite cladding on 2nd level of Living Quarters building, with an approximate surface area of 123 m^2 and 2 cm thickness;
- A-13: Roofing shingles found on Outhouse roof, with an approximate surface area of 3 m^2. Also suspected to be found under existing roofing of the Garage/Former Living quarters building, Living Quarters Building, and in a small pile within Shed 2;
- A-14: Tar paper found on exterior of Living Quarters Building, with an approximate surface area of 235 m^2; and,
- A-16: Exterior pink caulking on Garage/Former Living quarters building with an approximate quantity of 1 m^3.

Photos, material descriptions, and laboratory results for all ACMs are found in **Appendix A, Table 4a**. Non-ACMs are presented in Table 4b.

During renovation or demolition any materials encountered not previously sampled, which could contain ACMs, should be sampled and sent to laboratory for analysis. Any ACMs confirmed at the Site should be removed by a qualified asbestos abatement contractor in accordance with the conditions as set out in O. Reg. 278/05.

3.2.2 Lead

Thirty-six (36) samples of suspected lead based paint or surface coatings were submitted for analysis. Thirty (30) of these representative paint samples were found to be lead-based. The results of the lead paint sampling are presented in Table 2 below. Photos, material descriptions, and laboratory results are found are found in **Appendix A, Table 5**. The laboratory report and chain of custody record is provided in Appendix C.

Table 2: Summary of Lead-Based Paints

Sample Identification	Sample Location	Lead (µg/g)	Comments
P-1 Interior Grey on orange/red	Lighthouse	**60800**	Poor Condition Interior concrete (50 m^2)
	Living Quarters		Poor Condition Upper storey floor (110 m^2)
P-2 Exterior White	Lighthouse	289	Fair Condition Exterior concrete (230 m^2) Interior concrete and wood (22 m^2)
	Living Quarters		Fair Condition Upper floor exterior, on transite cladding (210 m^2)
	Garage/Former Living Quarters		Poor condition Concrete base (24 m^2)
	Debris surrounding Lighthouse		Highest concentration within 5 m of Lighthouse Approximate surface area of 127 m^2
	Lighthouse Sign Base		Approximate surface area of 3 m^2
	Northern Outhouse		Approximate surface area of 10 m^2
	Painted material throughout site		Wood material (5 m^2) Concrete (30 m^2) Metal (8 m^2)
P-3 Exterior Red-orange	Lighthouse	**73300**	Fair Condition Exterior concrete (41 m^2) Interior Concrete and wood (22 m^2)
	Living Quarters		Good Condition Tin roof (80 m^2)
	Garage/Former Living Quarters		Good Condition Tin roof and trim (76 m^2)
P-4 Interior Green on red	Lighthouse	**46400**	Green on red Poor condition Interior beam holder, stairs, platform (16 m^2)
P-5 Interior Silver on white	Lighthouse	**22600**	Silver on white Fair to Good condition Upper window frame and wall panels (12 m^2)
P-6 Interior White	Lighthouse	124	Good Condition Walls and ceiling (75 m^2)
P-7 Interior Medium grey	Shed 1	871	Good Condition Floor (26 m^2)
P-11 Interior White on yellow, ochre,	Garage/Former Living Quarters	**87000**	Poor condition ceiling and door trim of room 1 (8.25 m^2)

Sample Identification	Sample Location	Lead (μg/g)	Comments
black, green, white			
P-12 Interior Mint green on yellow ochre, dark green, grey	Garage/Former Living Quarters	**63600**	Poor condition walls of room 1 (25 m^2)
P-13 Interior Dark army green on beige, silver	Garage/Former Living Quarters	**234000**	Poor condition walls of room 6 (31 m^2)
P-14 Interior Light cream on dark cream, grey	Garage/Former Living Quarters	4870	Poor condition ceiling of room 6 (8 m^2)
P-15 Interior Light rose on cream	Garage/Former Living Quarters	**193000**	Poor condition north wall of room 5 (8 m^2)
P-16 Interior Mint light green on cream	Garage/Former Living Quarters	**98400**	Poor condition south, east and west walls of room 5 (24 m^2)
P-17 Interior Dull yellow on light grey, cream	Garage/Former Living Quarters	**59500**	Poor condition walls of room 4 (35.5 m^2)
P-18 Interior Sky blue on cream	Garage/Former Living Quarters	**140000**	Poor condition walls and chimney of room 3 (30 m^2)
P-19 Interior Light cream on light blue, dark grey	Garage/Former Living Quarters	**113000**	Poor condition ceiling of room 3 (7.2 m^2)
P-20 Interior Medium cream on light cream, dark grey	Garage/Former Living Quarters	**130000**	Poor condition window trim of room 3 (2.5 m^2)
P-21 Interior Beige on lime green	Garage/Former Living Quarters	**117000**	Poor condition ceiling of room 7 (3.5 m^2)
P-22 Interior Light green/blue on yellow ochre, white	Garage/Former Living Quarters	**93100**	Poor condition outer walls of room 7 (12 m^2)
P-23 Interior Light grey/cream	Garage/Former Living Quarters	**169000**	Good condition inner walls of room 7 (23 m^2)
P-24 Interior Black, sky blue, white	Living Quarters	**46300**	Good condition kitchen wall moulding (1.55 m^2)

Sample Identification	Sample Location	Lead (μg/g)	Comments
P-25 Interior Beige, light blue	Living Quarters	**84800**	Good condition door trim (10 m^{2}) Fair condition ceiling above acoustic tile (78 m^{2}) Good condition cupboards in room 3 (4 m^{2})
P-26 Interior Light blue/green	Living Quarters	**48400**	Good condition kitchen cupboards (8 m^{2})
P-27 Interior Yellow	Living Quarters	**123000**	Good condition kitchen inner cupboards (8 m^{2}) bathroom (1.5 m^{2})
P-28 Interior Burgundy	Living Quarters	313	Good condition basement floor (40 m^{2})
P-30 (September 2016) same location as A-11a Exterior White	Living Quarters	280	Fair condition upper story on transite cladding (123 m^{2})
P-30 (April 2017) Exterior White	Old foundation wall south of lighthouse	1010	Poor condition concrete foundation (3 m^{2})
P-31 Exterior Red	Helipad Walkway	**7,210**	Poor to fair condition metal railings (2 m^{2})
	Northern Walkway		Poor to fair condition metal railings (2 m^{2})
	Navigation Aid Bases		Poor to fair condition metal (4 m^{2})
P-33 Exterior Red	Living Quarters	**9390**	Poor condition wooden staircase (10 m^{2})
P-35 Interior & Exterior Grey	Garage/Former Living Quarters	**68100**	Good condition 1st storey floor, walls, and exterior door (520 m^{2}) Good condition attached shed (108 m^{2})
Canada Consumer Product Safety Act – Surface Coating Materials Regulations SOR/2005-109		90	--
EACO 2014 Lead Guideline – Lead based paint		5,000	--

Any worker or contractor who performs work that would disturb paint identified as lead containing should be informed of the presence of lead in the paint and the workers should take precautionary measures. The Ontario Ministry of Labour (MOL) "Lead on Construction Projects Guidelines" or the EACO "Lead Guideline for Construction, Renovation, Maintenance or Repair, *October 2014" should be consulted for all work that may disturb the paint, and should include respiratory protection and work practices.*

Lead Leachate Toxic Paints

Six (6) of the representative paints that were found to be above the lead containing criteria were selected as representative samples for further analysed for leachable lead content. According to the General Waste Management R.R.O. 1990, Regulation 347 within Schedule 4, Leachate Quality Criteria, materials having a leachable lead content greater than 5 mg/L are considered leachate toxic and must be handling and disposed as hazardous waste. The results of the TCLP leachate toxic analysis is presented in **Appendix A, Table 5**. The laboratory report and chain of custody record is provided in Appendix C.

Waste material which includes leachable lead must be treated as hazardous waste following the requirements of O. Reg. 347 – Waste Management under the Ontario Environmental Protection Act.

3.2.3 Mercury

The thirty-five (35) paint samples collected were suspected to contain mercury and submitted for laboratory analysis. Two (2) of the thirty-five paint samples have exceeded the Surface Coatings Materials Regulations criteria of 10 µg/g, which corresponded to surface coatings within the lighthouse interior that were also found to be lead based. These positive results of the mercury paint analysis are presented in Table 3 below.

Table 3: Summary of Mercury-Based Paints

Sample Identification	Sample Location	Mercury (µg/g)	Comments
P-4 Green on Red	Lighthouse Interior	**64**	Poor condition Interior beam holder, stairs, platform (16 m^2)
P-5 Silver on white	Lighthouse Interior	**18**	Fair to Good condition Upper window frame and wall panels (12 m^2)
Canada Consumer Product Safety Act – Surface Coating Materials Regulations SOR/2005-109		10	--

The laboratory report and chain of custody record is provided in Appendix C. Photos, material descriptions, and laboratory results of the mercury paint sampling are presented in **Appendix A, Table 5**. Note both mercury-based paints were also found to be lead-based as well.

Any mercury confirmed at the Site should be removed as hazardous waste following the requirements of O. Reg. 347 – Waste Management under the Ontario Environmental Protection Act.

4.0 CONCLUSIONS

BluMetric Environmental Inc. was retained by Public works and Government Services Canada, on behalf of the Department of Fisheries and Oceans, to complete a visual designated substances survey of the lighthouse compound located on the east end of Michipicoten Island, in Lake Superior, Ontario.

Based on the completion this comprehensive designated substances and hazardous materials survey conducted in September 2016, the following suspected and potential designated substances and special handling materials were identified:

- Asbestos containing materials;
- Lead containing paints;
- Mercury containing paints;
- Silica containing materials;
- ODS containing equipment;
- Potential mould growth; and,
- Animal fecal matter; and,
- Benzene (in diesel fuel).

No other potential designated substances or special handling materials were identified.

In the instance that the structures are renovated or building materials need to be disturbed for maintenance purposes, any worker or contractor who performs work in the vicinity of materials known to contain asbestos, mercury, or lead should be informed and appropriate controls should be implemented to reduce exposures to regulated levels. Disturbance or damage to hazardous materials may create airborne concentrations of hazardous materials.

5.0 CLOSING

The conclusions presented in this report represent our professional opinion and are based upon the work described in this report and any limiting conditions in the terms of reference, scope of work, or conditions noted herein.

The findings presented in this report are based on conditions observed at the specified dates and locations, the analysis of samples for the specified parameters, and information obtained for this project. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, locations that were not investigated directly, or types of analysis not performed.

BluMetric makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information.

Nothing in this report is intended to constitute or provide a legal opinion. BluMetric makes no representation as to compliance with occupational health and safety laws, rules, regulations or policies established by regulatory agencies.

This report has been prepared for Public Works & Government Services Canada – Ontario Region. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric in writing. BluMetric accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

Respectfully submitted,
BluMetric Environmental Inc.

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APPENDIX A

Tables of Results

Table 4a: Confirmed asbestos results for Michipicoten Island East Lighthouse site

Confirmed or Suspected Asbestos Containing Material									
Photo	Sample No.	Material Type and Description	Sample Room #	Locations with Material - Room # (Quantity)	Total Quantity	Asbestos Content[1] and Type	Accessible[2]	Friable[3]	Condition[4]
	A-02a,b,c	Interior caulking	Lighthouse: lower floor	Interior Lighthouse window and door trims	~1 m^2	0.55% Chrysotile	A	No	Good
	A-03a,b,c	Transite interior walls, exterior walls, roof and ceiling	Sheds 1 and 2: exterior walls and interior walls	Sheds 1 & 2 (ceiling, interior and exterior walls, and roof)	145 m^2	25% Chrysotile	A	No but some debris is present	Good
	A-08a,b,c	Exterior caulking	Shed 1 & 2, Lighthouse: around pertrusions, window frames and door frames	Sheds 1 & 2 and lighthouse	~1 m^2	0.5% Chrysotile	A	No	Good
	A-09a,b,c	Plaster/compound found along seams of plywood	Garage/former living quarters: walls in room 6	Walls and ceilings of room 6 (possible to be present in other rooms of former quarters but it was not seen other than in room 6)	42 m^2	0.54% Chrysotile	C (ladder secured to wall, upper floor fully acceptable)	YES and debris present	Poor
	A-11a,b,c	Transite faux decorative wood panels	Living quarters: exterior upper walls	Exterior upper walls	123 m^2	30% Chrysotile	A	No but debris is present	Fair
	A-13a,b,c (roofing shingle only)	Roofing shingles	Outhouse: exterior roof	Outhouse roof	3 m^2	1.35% Chrysotile	A	No	Poor
				Roofing shingles suspected to be beneath roof for garage/former living quarters	72.5 m^2				
				Roofing shingles beneath roof for living quarters	100 m^2				
				Shed 2 (pile of shingles in room closest to water)	1 m^2				

Photo	Sample No.	Material Type and Description	Sample Room #	Locations with Material - Room # (Quantity)	Total Quantity	Asbestos Content[1] and Type	Accessible[2]	Friable[3]	Condition[4]
	A-14a,c,b	Tar paper	Living quarters: exterior walls, underbelly of patio	Exterior walls, suspected under roofing, behind transite decorative panels and underbelly of patio	235 m^2	0.79% Chrysotile	A	No	Good
	A-16a,b,c	Pink caulking	Garage/former living quarters: exterior walls	Exterior walls around windows, pertrusions and doors	~1 m^2	0.59% Chrysotile	A	No	Good
	*Same as A-03*	*Transite boards*	*N/A*	*Debris pile has possible transite materials, and some sheeting found in outhouse*	*Potentially ~250* m^2	*25% Chrysotile*	*A*	*Condition unknown*	*Poor (debris)*

[1] Asbestos-containing material is defined by the Ontario Regulation respecting Designated Substance - Asbestos On Construction Projects and In Buildings and Repair Operations (O. Reg. 278/05) as "material that contains 0.5 per cent or more asbestos by dry weight".

[2] A: easily accessible without destruction of barriers and less than 3m from the ground; B: found in a maintenance room; C: requires the use of a ladder, ≥ 3m from the ground D: requires the destruction of barriers.

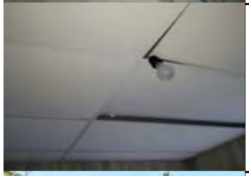
[3] Yes = material can be crumbled, pulverized or powdered under hand pressure. No = material cannot be crumbled, pulverized or powdered by hand pressure alone.

[4] Good = less than 1% of ACM damaged, deteriorated, abraded or delaminated; Fair = 1-10%; Poor = greater than 10% of ACM damaged, deteriorated, abraded or delaminated.

ND: Non-detect

N/A: Not applicable

Table 4b: Confirmed Non-Asbestos Results for Michipicoten Island East Lighthouse site

Confirmed Non-Asbestos Containing Material				
Photo	Sample No.	Material Type and Description	Building/area	Result[1]
	A-01a,b,c,d,e	Concrete skim coat found on most parts of exterior building	Exterior lighthouse	ND
	A-04a,b,c	Pink/white caulking tower windows and surrounding areas	Interior lighthouse,	ND
	A-05a,b,c	Pressboard	Interior of grey sheds, house and shop	ND
	A-06a,b,c	Concrete patch	Sporatically found in interior of tower	ND
	A-07a,b,c	Tar paper within the wall cavities of sheds	Grey sheds	ND
	A-10a,b,c	White powder	Garage/former living quarters building	ND
	A-12a,b,c	Plaster	Interior of building	ND
	A-13a,b,c	Mesh below shingles only (shingles contain asbestos)	Interior of building	ND
	A-15a,b,c	Speckeld brown 12" x 12" vinyl floor tile	Interior of building	ND

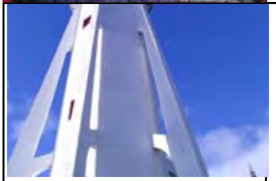
[1] Asbestos-containing material is defined by the Ontario Regulation respecting Designated Substance - Asbestos On Construction Projects and In Buildings and Repair Operations (O. Reg. 278/05) as "material that contains 0.5 per cent or more asbestos by dry weight".

ND: Non-detect N/A: Not applicable

Table 5: Surface Coating – Sample Summary

Table 5: Paint Results
Michipicoten Island East Lighthosue site
Designated Substance and Hazardous Materials Survey
BluMetric File Number: 160528

Analytical results: *** No current regulated amount, any concentration above detection limit highlighted. ^SOR/2005-109 Surface Coating Materials Regulations.

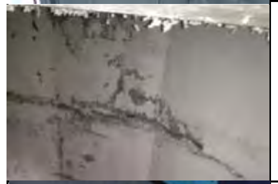
Photo/Reference**	Sample ID	Sample Location	Substrate Material	Sample Description	Other Locations with Surface Coating	Condition	Quantities (m^2)	Lead (90 µg/g)	Lead Leachate Results (5.0 mg/L)	Mercury (10 µg/g)
	P-1	Lighthouse	Concrete and some wood	Grey, orange, red	Interior of lighthouse (concrete) Floor of upper former living quarters (wood and concrete)	Poor	50 m^2 110 m^2	60800	Leachable	4
	P-2	Lighthouse: exterior wall	Concrete	White (exterior)	Exterior of lighthouse (concrete) Interior of lighthouse (concrete and wood)	Fair	230 m^2 20 m^2 and 2 m^2	**289**	Non-Leachable	<2
					Lighthouse sign base	Poor	3 m^2			
					Debris found surrounding lighthouse - highest concentration 5 m away	Poor - debris	127 m^2			
					Living quarters (upper floor & on transite)	Fair	210 m^2			
					Painted concrete material found throughout site	Poor	Approximately 30 m^2			
					Painted wood material found throughout site	Poor	Approximately 5 m^2			
					Painted metal material found throughout site	Poor	Approximately 8 m^2			
					Northern Outhouse	Poor	Approximately 10 m^2			
					Concrete base of garage/former living quarters	Poor	24 m^2			

Bolded areas indicate elevated levels of contaminants. Use Caution. Follow MOL Guideline for Lead, wet surfaces down before disturbing them. Notify Base Environmental Officer of the need to dispose of contaminated paint prior to disturbing it.

Table 5: Surface Coating – Sample Summary

Michipicoten Island East Lighthosue site
Designated Substance and Hazardous Materials Survey
BluMetric File Number: 160528

Analytical results: *** No current regulated amount, any concentration above detection limit highlighted. ^SOR/2005-109 Surface Coating Materials Regulations.

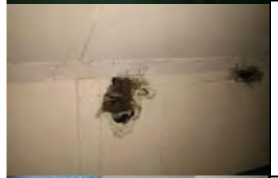
Photo/Reference**	Sample ID	Sample Location	Substrate Material	Sample Description	Other Locations with Surface Coating	Condition	Quantities (m^2)	Lead (90 µg/g)	Lead Leachate Results (5.0 mg/L)	Mercury (10 µg/g)
	P-3	Lighthouse: interior stairs and door	Metal	Red, orange	Interior of lighthouse (metal stairs)	Poor	15 m^2	73300	Leachable	7
					Exterior of lighthouse	Poor	40.5 m^2 (top metal), 1 m2 window frames wood), 2.3 m^2 metal door			
					Painted red tin roof for living quarters	Good	80 m^2			
					Painted red tin roof and trim for garage/ former living quarters	Good	76 m^2			
	P-4	Lighthouse: interior beam holder, stairs, platform	Metal	Green, red	-	Poor	16 m^2	46400	Leachable	64
	P-5	Lighthouse: interior upper tower window frame and upper most interior panels	Metal	Silver, white	-	Good-Fair	12 m^2	226000	Leachable	18
	P-6	Lightshouse: interior walls and ceilings	Various	Interior white	-	Good	75 m^2	124	Non-leachable	<2
	P-7	*Grey Shed 1: Floor	Concrete	Medium grey	-	Poor	26 m^2	871	Non-leachable	<2
	P-8	Grey Shed 1: Walls, beams and ceiling	Wood and plywood	Dark grey	Some sporatic panels areas in the lighthouse	Good	-	85	Non-leachable	<2

Bolded areas indicate elevated levels of contaminants. Use Caution. Follow MOL Guideline for Lead, wet surfaces down before disturbing them. Notify Base Environmental Officer of the need to dispose of contaminated paint prior to disturbing it.

Table 5: Surface Coating – Sample Summary

Michipicoten Island East Lighthosue site
Designated Substance and Hazardous Materials Survey
BluMetric File Number: 160528

Analytical results: *** No current regulated amount, any concentration above detection limit highlighted. ^SOR/2005-109 Surface Coating Materials Regulations.

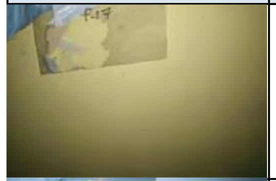
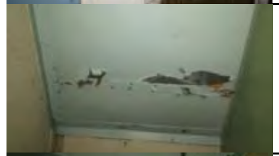
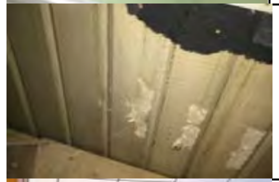
Photo/Reference**	Sample ID	Sample Location	Substrate Material	Sample Description	Other Locations with Surface Coating	Condition	Quantities (m^2)	Lead (90 µg/g)	Lead Leachate Results (5.0 mg/L)	Mercury (10 µg/g)
	P-9	Grey Shed 1: Walls, beams and ceiling	Wood and plywood	Cream, grey	-	Good	-	64	Non-leachable	3
	P-10	Shed attached to garage/former living quarters: walls and door	Plywood and metal	Light cream, lighter cream	-	Good	-	64	Non-leachable	<2
	P-11	Former living quarters (upper floor of garage): ceiling and door trim of room 1	Pressboard and wood	White, yellow ochre, black, green, white	-	Poor	8.25 m^2	87000	Leachable	<2
	P-12	Former living quarters (upper floor of garage): walls of room 1	Pressboard	Mint green, yellow ochre, dark green, grey	-	Poor	25 m^2	63600	Leachable	<2
	P-13	Former living quarters (upper floor of garage): walls of room 6	Pressboard	Dark army green, beige, silver	-	Poor	31 m^2	234000	12.8	<2
	P-14	Former living quarters (upper floor of garage): ceiling of room 6	Pressboard	Light cream, dark cream, grey	-	Poor	8 m^2	4870	2.6	<2
	P-15	Former living quarters (upper floor of garage): north wall of room 5	Pressboard	Light rose, cream	-	Poor	8 m^2	193000	Leachable	<2
	P-16	Former living quarters (upper floor of garage): east, west and south walls of room 5	Pressboard	Mint light green, cream	-	Poor	24 m^2	98400	Leachable	<2

Bolded areas indicate elevated levels of contaminants. Use Caution. Follow MOL Guideline for Lead, wet surfaces down before disturbing them. Notify Base Environmental Officer of the need to dispose of contaminated paint prior to disturbing it.

Table 5: Surface Coating – Sample Summary

Michipicoten Island East Lighthosue site
Designated Substance and Hazardous Materials Survey
BluMetric File Number: 160528

Analytical results: *** No current regulated amount, any concentration above detection limit highlighted. ^SOR/2005-109 Surface Coating Materials Regulations.

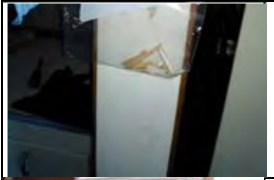
Photo/Reference**	Sample ID	Sample Location	Substrate Material	Sample Description	Other Locations with Surface Coating	Condition	Quantities (m^2)	Lead (90 µg/g)	Lead Leachate Results (5.0 mg/L)	Mercury (10 µg/g)
	P-17	Former living quarters (upper floor of garage): walls of room 4	Pressboard	Dull yellow, light grey, cream	-	Poor	35.5 m^2	59500	Leachable	<2
	P-18	Former living quarters (upper floor of garage): walls and chimney of room 3	Pressboard and brick	Sky blue, cream	-	Poor	30 m^2	140000	Leachable	<2
	P-19	Former living quarters (upper floor of garage): ceiling of room 3	Pressboard	Light cream, light blue, dark grey	-	Poor	7.2 m^2	113000	Leachable	<2
	P-20	Former living quarters (upper floor of garage): window trim of room 3	Wood	Medium cream, light cream, dark grey	-	Poor	2.5 m^2	130000	Leachable	<2
	P-21	Former living quarters (upper floor of garage): ceiling of room 7	Pressboard	Beige, lime green	-	Poor	3.5 m^2	117000	Leachable	<2
	P-22	Former living quarters (upper floor of garage): walls of room 7	Pressboard	Light green/blue, yellow ochre, white	-	Poor	12 m^2	93100	Leachable	<2
	P-23	Former living quarters (upper floor of garage): inner walls of room 7	Wood board walls	Light grey/cream	Garage/former living quarters (suspected to be behind white siding)	Good	23 m^2	169000	Leachable	<2
	P-24	Living quarters: kitchen wall moulding	Wood	Black, sky blue, white	Door trim	Good	1.55 m^2	46300	Leachable	6

Bolded areas indicate elevated levels of contaminants. Use Caution. Follow MOL Guideline for Lead, wet surfaces down before disturbing them. Notify Base Environmental Officer of the need to dispose of contaminated paint prior to disturbing it.

Table 5: Surface Coating – Sample Summary

Michipicoten Island East Lighthosue site
Designated Substance and Hazardous Materials Survey
BluMetric File Number: 160528

Analytical results: *** No current regulated amount, any concentration above detection limit highlighted. ^SOR/2005-109 Surface Coating Materials Regulations.

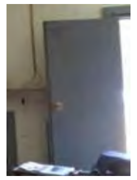
Photo/Reference**	Sample ID	Sample Location	Substrate Material	Sample Description	Other Locations with Surface Coating	Condition	Quantities (m^2)	Lead (90 µg/g)	Lead Leachate Results (5.0 mg/L)	Mercury (10 µg/g)
	P-25	Living quarters: door trim and cupboard	Wood	Beige, light blue	Door trim	Good	10 m^2	**84000**	Leachable	2
			Pressboard		Ceiling above acoustic tile	Fair	78 m^2			
			Wood		Cupboards in room 3	Good	4 m^2			
	P-26	Living quarters: kitchen cupboards	Wood	Light blue/green	Kitchen	Good	8 m^2	**48400**	Leachable	3
	P-27	Living quarters: kitchen inner cupboards	Wood	Yellow	Kitchen	Good	8 m^2	**123000**	Leachable	5
					Bathroom	Good	1.5 m^2			
	P-28	Living quarters: basement floor	Concrete	Burgundy	-	Good	40 m^2	**313**	Non-leachable	<2
	P-29	Living quarters: basement walls	Cinder blocks	Lime green	-	Good	-	<20	Non-leachable	<2
	P-30 (Sept 2016) same location as A-11a	Living quarters: exterior, upper storey	Transite cladding	White		Fair	123 m^2	**280**	Non-leachable	-
	P-30 (April 2017)	Exterior wall of old foundation found north-northwest of lighthouse	Concrete	White		Poor	3 m^2	**1010**	Non-detect	<2

Bolded areas indicate elevated levels of contaminants. Use Caution. Follow MOL Guideline for Lead, wet surfaces down before disturbing them. Notify Base Environmental Officer of the need to dispose of contaminated paint prior to disturbing it.

Table 5: Surface Coating – Sample Summary

Michipicoten Island East Lighthosue site
Designated Substance and Hazardous Materials Survey
BluMetric File Number: 160528

Analytical results: *** No current regulated amount, any concentration above detection limit highlighted. ^SOR/2005-109 Surface Coating Materials Regulations.

Photo/Reference**	Sample ID	Sample Location	Substrate Material	Sample Description	Other Locations with Surface Coating	Condition	Quantities (m^2)	Lead (90 µg/g)	Lead Leachate Results (5.0 mg/L)	Mercury (10 µg/g)
	P-31	Metal railings at helipad and northern walkway	Metal tubing	Red		Poor to Fair	4 m^2	14400	17.5	<2
		Corrugated metal base of navigation aids	Metal	Red		Poor	4m^2			
	P-32	Exterior walls of lower foundation of Living quarters	Concrete/parging	White		Poor to Fair	66 m^2	12	Non-leachable	<2
	P-33	Wood stairs on Living Quarters	Wood	Red		Poor	10 m^2	9390	0.69	<2
	P-34	Exterior wooden railing at Garage/Former Living Quarters	Wood	Red		Poor	6 m^2	17	Non-leachable	<2
 	P-35	Interior/Exterior of Garage/Former Living Quarters	Various	Grey	Exterior door, interior walls, and interior floor of Garage/Former Living Quarters	Good	520 m^2	68100	115	<2
			Various		Floor, walls, ceiling, and door trim of attached shed	Good	108 m^2			
Canada Consumer Product Safety Act – Surface Coating Materials Regulations SOR/2005-109								90 ug/g	-	10 ug/g+
EACO 2014 Lead Guideline – Lead based paint								5000 ug/g	-	-
General Waste Management R.R.O. 1990, Regulation 347 within Schedule 4, Leachate Quality Criteria									**5 mg/L**	-

* Grey shed 1 is the shed closest to the Lighthouse.
** Grey shed 2 is the shed closest to the Garage/former living quarters building.

Bolded areas indicate elevated levels of contaminants. Use Caution. Follow MOL Guideline for Lead, wet surfaces down before disturbing them. Notify Base Environmental Officer of the need to dispose of contaminated paint prior to disturbing it.

APPENDIX B

Site Plans with Sample Locations

LEGEND

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

REFERENCES

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

1:600 0 m 4 m 8 m 12 m 16 m 20 m

THIS SCALE TO BE USED TO OBTAIN
APPROXIMATE DIMENSIONS FOR INFORMATION

CLIENT

PUBLIC WORKS &
GOVERNMENT SERVICES
CANADA

PROJECT

MICHIPICOTEN ISLAND
EAST END
LIGHTHOUSE

TITLE

SITE PLAN

BluMetric™ Environmental
3108 Carp Road PO Box 430
Ottawa, Ontario K0A 1L0
TEL: (613) 839–3053 FAX: (613) 839–5376
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #
160528

DATE
2017-06-09

DRAWN
WC

CHECKED
VM

DWG NO.
1

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0

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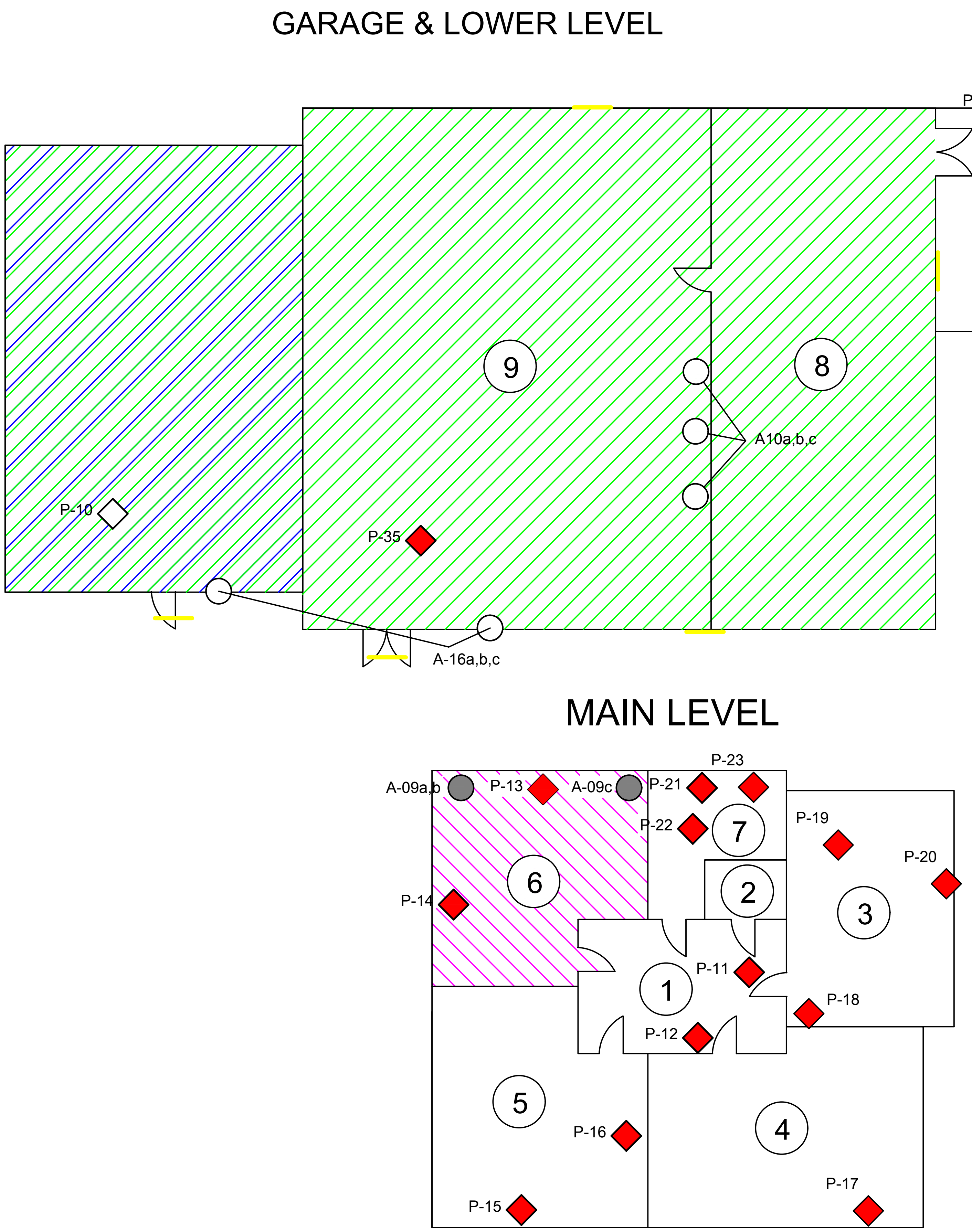

LEGEND

SAMPLE LOCATIONS LEGEND:

🟥	LEAD AND/OR MERCURY CONTAINING PAINT LOCATION
◇	NON- LEAD AND/OR MERCURY CONTAINING PAINT LOCATION
●	ASBESTOS CONTAINING MATERIAL
○	NON-ASBESTOS CONTAINING MATERIAL

ASBESTOS CONTAINING MATERIAL :

▨	JOINT COMPOUND ALONG PRESS BOARD SEAMS (POSSIBLY FOUND IN OTHER ROOMS
—	CAULKING (EXTERIOR PINK)
▨	LIGHT CREAM, LIGHTER CREAM INTERIOR WALLS AND FLOOR CONTAINS LEAD CONTAINING PAINT

NON LEAD/MERCURY CONTAINING PAINT (LEAD CRITERIA: 90µg/g, MERCURY 10µg/g) :

▨	PRE-FAB PAINTED TRIM WHITE AND ORANGE EXTERIOR ROOFING AND WALLS
#	ROOM NUMBER

NOTE: ALL SURFACES HAVE EXCEEDS LEAD CRITERIA (90µg/g) AND/OR MERCURY CRITERIA (10µg/g), UNLESS OTHER INDICATED

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

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CANADA

PROJECT

MICHIPICOTEN ISLAND
EAST END
LIGHTHOUSE

TITLE

GARAGE &
FORMER LIVING QUARTERS
SAMPLE LOCATIONS

BluMetric™ Environmental

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531–2725 FAX: (613) 531–1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #		DATE	
160528		2017-05-05	

DRAWN	CHECKED	DWG NO.	REV
IB	VM	2	0

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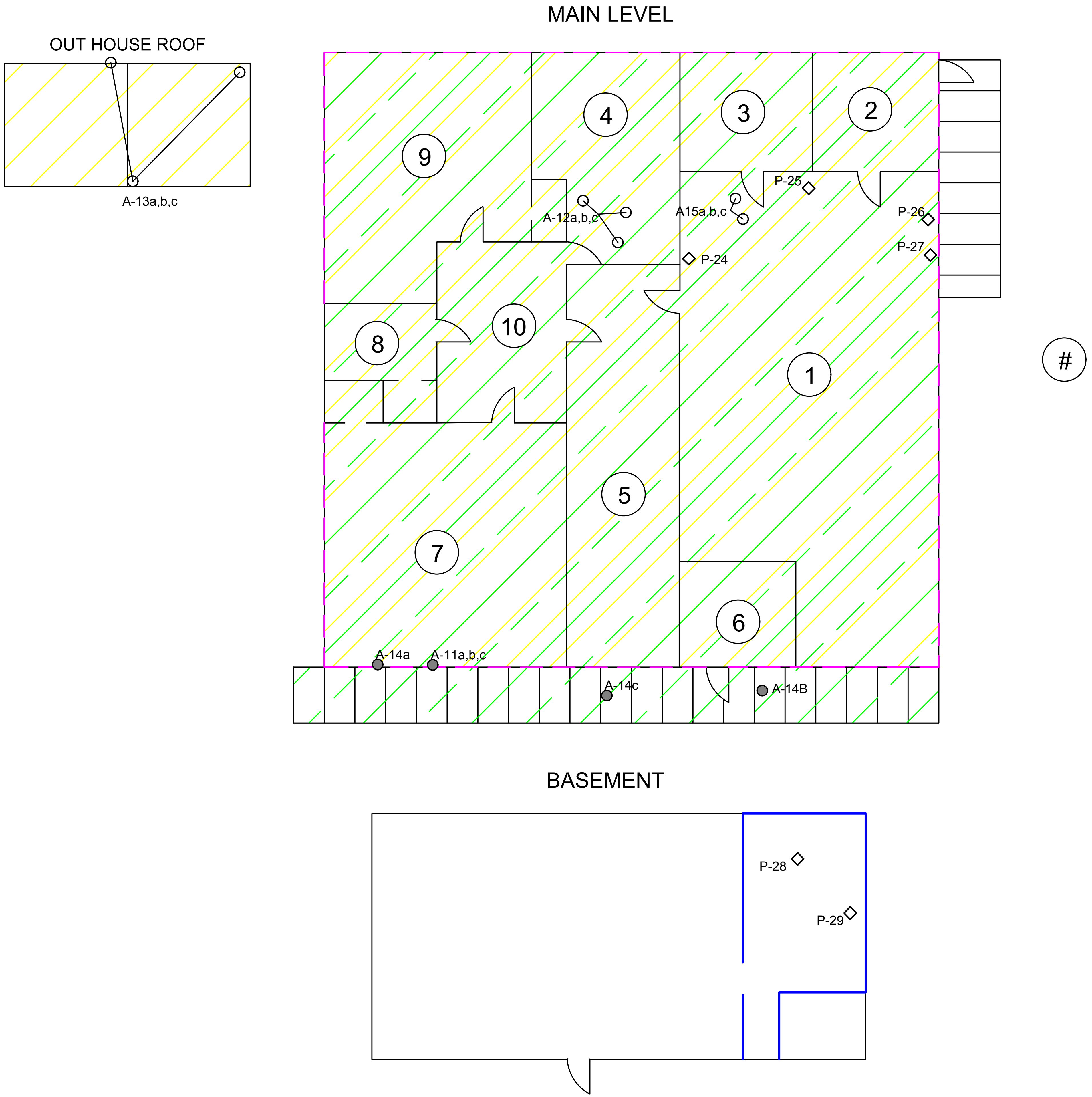

LEGEND

SAMPLE LOCATIONS LEGEND:

◇ NON- LEAD AND/OR MERCURY CONTAINING PAINT LOCATION

○ NON- ASBESTOS CONTAINING MATERIAL

ASBESTOS CONTAINING MATERIAL :

▭ TRANSIT DECORATIVE PANELS

▨ TAR PAPER

▨ ROOFING MATERIAL

NON LEAD/MERCURY CONTAINING PAINT (LEAD CRITERIA: 90Õg/g, MERCURY 10Õg/g) :

▭ LIME GREEN PAINT ALONG WALLS (ALL OTHER PAINTED SURFACES EXCEED LEAD AND/OR MERCURY CRITERIA)

\# ROOM NUMBER

NOTE: ALL SURFACES HAVE EXCEEDS LEAD CRITERIA (90µg/g) AND/OR MERCURY CRITERIA (10µg/g), UNLESS OTHER INDICATED

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

REFERENCES

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

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PROJECT

MICHIPICOTEN ISLAND
EAST END
LIGHTHOUSE

TITLE

LIVING QUARTERS
SAMPLE LOCATIONS

BluMetric™ Environmental

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725 FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT # 160528

DATE 2017-05-05

DRAWN IB

CHECKED VM

DWG NO. 3

REV 0

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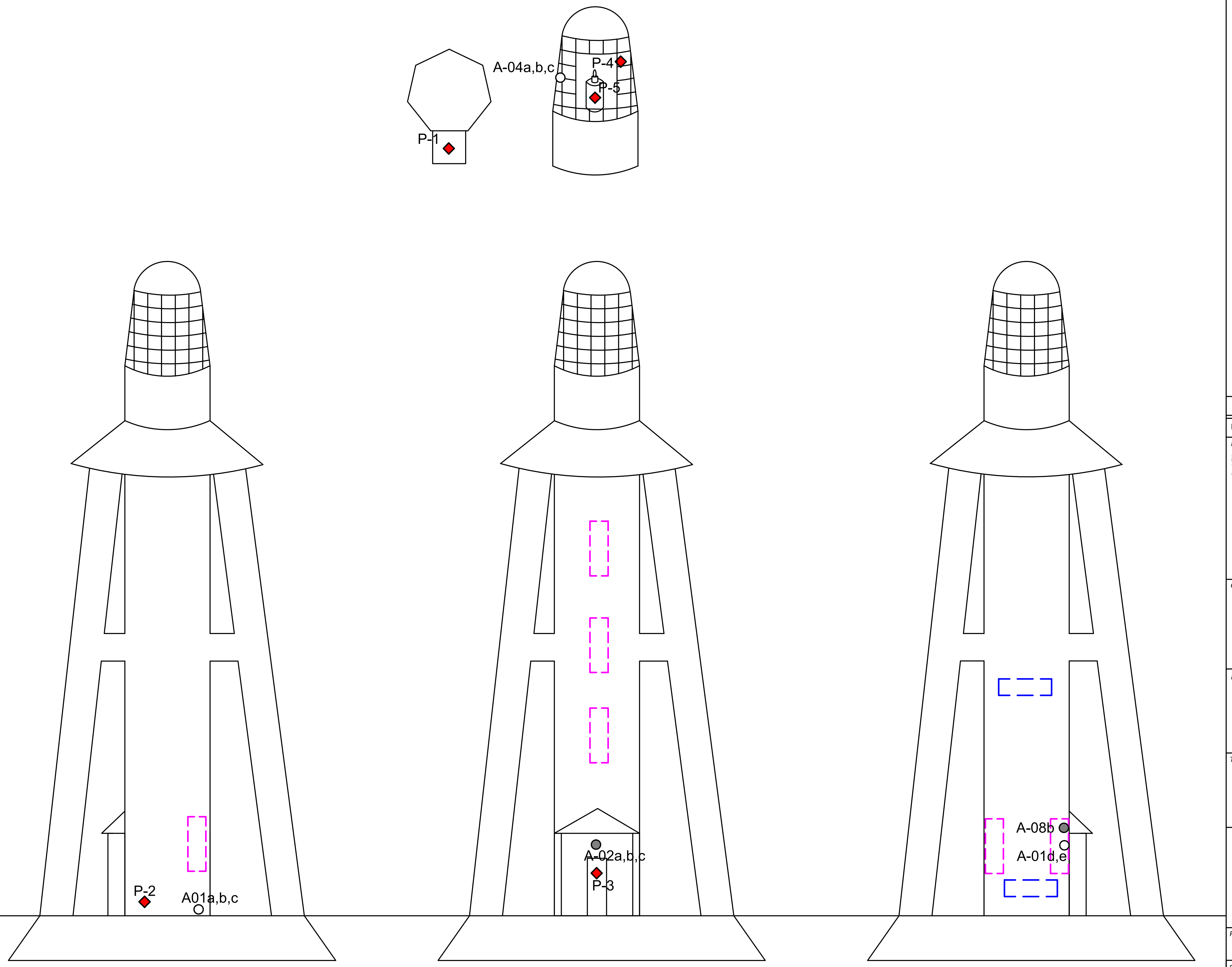

LEGEND

SAMPLE LOCATIONS LEGEND:

◆	LEAD AND/OR MERCURY CONTAINING PAINT LOCATION
◇	NON- LEAD AND/OR MERCURY CONTAINING PAINT LOCATION
●	ASBESTOS CONTAINING MATERIAL
○	NON- ASBESTOS CONTAINING MATERIAL

ASBESTOS CONTAINING MATERIAL :

⬚	ASBESTOS CONTAINING MATERIAL CAULKING

NON LEAD/MERCURY CONTAINING PAINT (LEAD CRITERIA: 90Õg/g, MERCURY 10Õg/g) :

⬚	SOME DARK GREEN WOOD PANELS

NOTE: ALL SURFACES HAVE EXCEEDS LEAD CRITERIA (90μg/g) AND/OR MERCURY CRITERIA (10μg/g), UNLESS OTHER INDICATED

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

REFERENCES

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

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CANADA

PROJECT

MICHIPICOTEN ISLAND
EAST END
LIGHTHOUSE

TITLE

LIGHTHOUSE
SAMPLE LOCATIONS

BluMetric™ Environmental
4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531–2725 FAX: (613) 531–1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #	*DATE*
160528	2016-10-27

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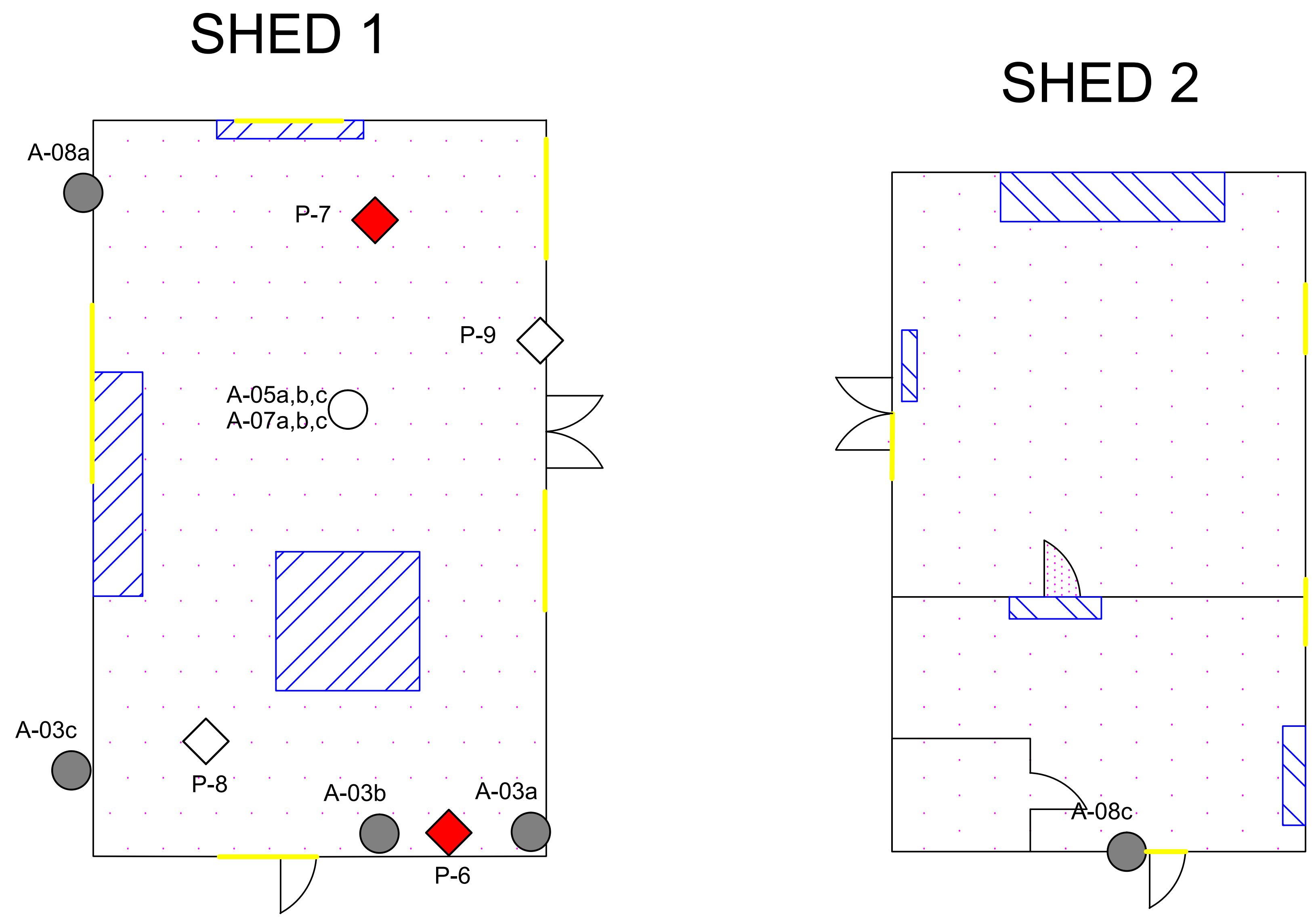

LEGEND

SAMPLE LOCATIONS LEGEND:

◆	LEAD AND/OR MERCURY CONTAINING PAINT LOCATION
◇	NON- LEAD AND/OR MERCURY CONTAINING PAINT LOCATION
●	ASBESTOS CONTAINING MATERIAL
○	NON- ASBESTOS CONTAINING MATERIAL

CONFIRMED ASBESTOS CONTAINING MATERIAL :

▨	TRANSIT (INTERIOR, EXTERIOR WALLS, CEILING AND ROOF)
—	CAULKING (MOSTLY, EXTERIOR, MAYBE INSIDE STRUCTURES AS WELL)

NON LEAD/MERCURY CONTAINING PAINT (LEAD CRITERIA: 90Õg/g, MERCURY 10Õg/g) :

▨	DARK GREY AND CREAM GREY PAINTED PLYWOOD AND WOOD. BEAMS ONLY HAVE LEAD AND/OR MERCURY CONCENTRATIONS BELOW CRITERIA. (ALL OTHER AREAS (FLOOR, CEILING, MOST WALLS) SHOULD BE CONSIDERED)

NOTE: ALL SURFACES HAVE EXCEEDS LEAD CRITERIA (90µg/g) AND/OR MERCURY CRITERIA (10µg/g), UNLESS OTHER INDICATED

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

REFERENCES

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

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CANADA

PROJECT

MICHIPICOTEN ISLAND
EAST END
LIGHTHOUSE

TITLE

SHED 1 & 2
SAMPLE LOCATIONS

BluMetric™ Environmental

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725 FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT # 160528		*DATE* 2016-10-27	
DRAWN IB	*CHECKED* VM	*DWG NO.* 5	*REV* 0

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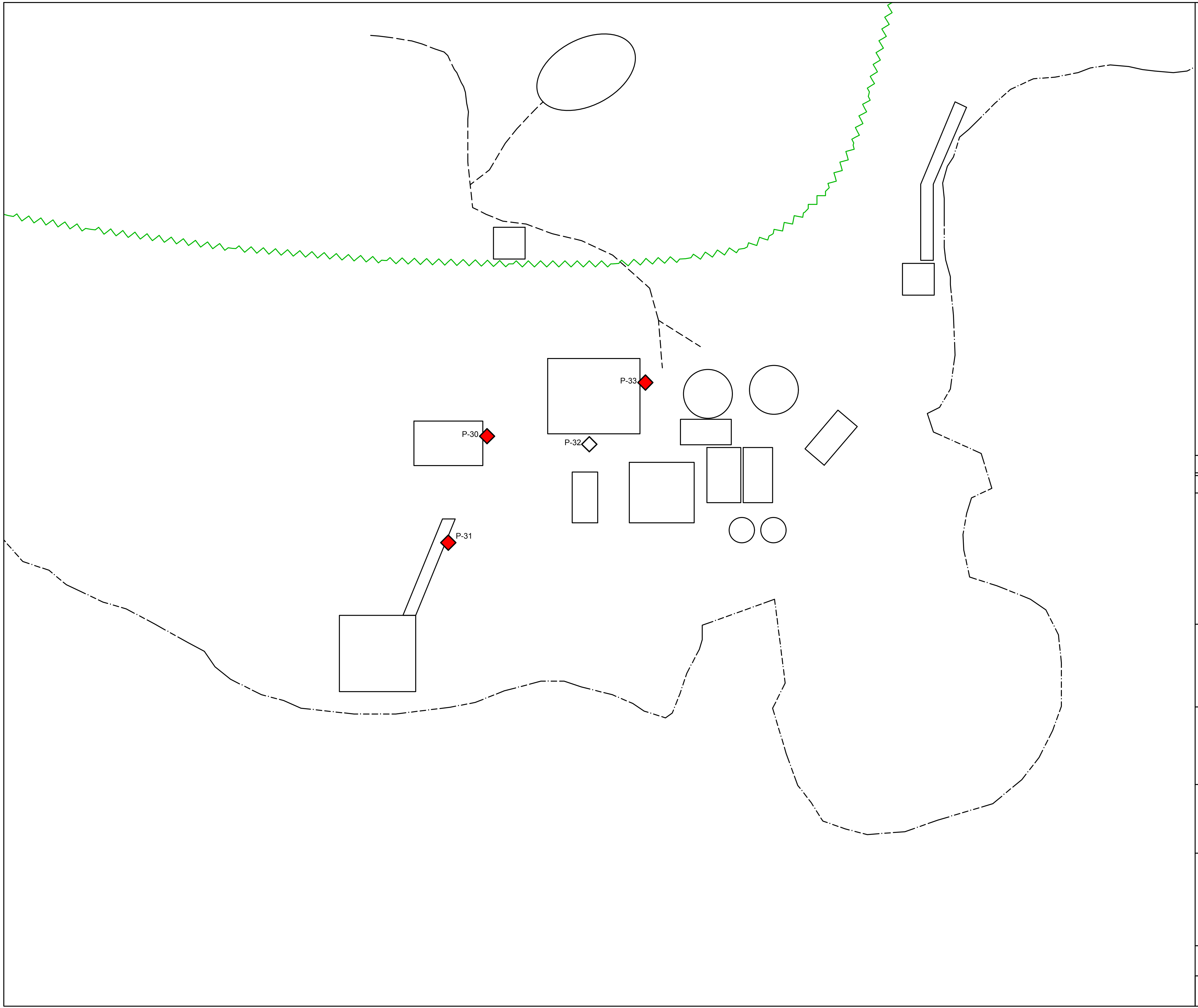

LEGEND

SAMPLE LOCATIONS LEGEND:

◆ LEAD AND/OR MERCURY CONTAINING PAINT LOCATION
◇ NON- LEAD AND/OR MERCURY CONTAINING PAINT LOCATION

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC. DO NOT SCALE DRAWING. THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

1:600 0 m 4 m 8 m 12 m 16 m 20 m

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CLIENT

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GOVERNMENT SERVICES
CANADA

PROJECT

MICHIPICOTEN ISLAND
EAST END
LIGHTHOUSE

TITLE

SAMPLE LOCATIONS

BluMetric™ Environmental

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531–2725 FAX: (613) 531–1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT # 160528
DATE 2017-05-05
DRAWN GM
CHECKED VM
DWG NO. 6
REV 0

APPENDIX C

Laboratory Reports, Certificates of Analysis, and Chain of Custody Records

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300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

BluMetric Environmental Inc. (Carp)

P.O. Box 430, 3108 Carp Rd.
Carp, ON K0A 1L0
Attn: Veronique Maynard

Client PO:
Project: 160528
Custody: 28958/28961/28959

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016

Order #: 1640097

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1640097-01	P-1, Grey, Orange, Red
1640097-02	P-2, White (exterior)
1640097-03	P-3, Red, Orange
1640097-04	P-4, Green, Red
1640097-05	P-5, Sliver, White
1640097-06	P-6, Interior White
1640097-07	P-7, Med Grey
1640097-08	P-8, Dark Grey
1640097-09	P-9, Cream, Grey
1640097-10	P-10, Light Cream, Lighter Cream
1640097-11	P-11, White, Yelllow Ocher, Black, Green, White
1640097-12	P-12, Mint Green, Yellow-Ochre, Dark Green Grey
1640097-13	P-13, Dark Army Green, Beige, Silver
1640097-14	P-14, Light Cream, Dark Cream, Grey
1640097-15	P-15, Light Rose, Cream
1640097-16	P-16, Mint Light Green, Cream
1640097-17	P-17, Dull Yellow, Light Grey, Cream
1640097-18	P-18, Sky Blue, Cream
1640097-19	P-19, Light Cream, Light Blue, Dark Grey
1640097-20	P-20, Med Cream, Light Cream, Dark Grey,
1640097-21	P-21, Beige, Lime Green
1640097-22	P-22, LIght Green/Blue, Yellow White Ochre
1640097-23	P-23, Light Grey/Cream
1640097-24	P-24, Black, Sky Blue, White
1640097-25	P-25, Beige, Light Blue
1640097-26	P-26, Light Blue/Green
1640097-27	P-27, Yellow
1640097-28	P-28, Burgendy
1640097-29	P-29, Lime Green

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 7471B - CVAA, digestion	29-Sep-16	29-Sep-16
Metals, ICP-OES	based on MOE E3470, ICP-OES	28-Sep-16	29-Sep-16

Certificate of Analysis

Client: BluMetric Environmental Inc. (Carp)

Client PO:

Report Date: 30-Sep-2016

Order Date: 26-Sep-2016

Project Description: 160528

	Client ID:	P-1, Grey, Orange, Red	P-2, White (exterior)	P-3, Red, Orange	P-4, Green, Red
	Sample Date:	23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
	Sample ID:	1640097-01	1640097-02	1640097-03	1640097-04
	MDL/Units	Paint	Paint	Paint	Paint
Metals					
Lead	20 ug/g	60800	289	73300	46400
Mercury	2 ug/g	4	<2	7	64
	Client ID:	P-5, Sliver, White	P-6, Interior White	P-7, Med Grey	P-8, Dark Grey
	Sample Date:	23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
	Sample ID:	1640097-05	1640097-06	1640097-07	1640097-08
	MDL/Units	Paint	Paint	Paint	Paint
Metals					
Lead	20 ug/g	226000	124	871	85 [1]
Mercury	2 ug/g	18	<2	<2	<2 [1]
	Client ID:	P-9, Cream, Grey	P-10, Light Cream, Lighter Cream	P-11, White, Yelllow Ocher, Black, Green, White	P-12, Mint Green, Yellow-Ochre, Dark Green Grey
	Sample Date:	23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
	Sample ID:	1640097-09	1640097-10	1640097-11	1640097-12
	MDL/Units	Paint	Paint	Paint	Paint
Metals					
Lead	20 ug/g	64 [1]	64	87000	63600
Mercury	2 ug/g	3 [1]	<2	<2	<2
	Client ID:	P-13, Dark Army Green, Beige, Silver	P-14, Light Cream, Dark Cream, Grey	P-15, Light Rose, Cream	P-16, Mint Light Green, Cream
	Sample Date:	23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
	Sample ID:	1640097-13	1640097-14	1640097-15	1640097-16
	MDL/Units	Paint	Paint	Paint	Paint
Metals					
Lead	20 ug/g	234000	4870	193000	98400
Mercury	2 ug/g	<2	<2	<2	<2
	Client ID:	P-17, Dull Yellow, Light Grey, Cream	P-18, Sky Blue, Cream	P-19, Light Cream, Light Blue, Dark Grey	P-20, Med Cream, Light Cream, Dark Grey,
	Sample Date:	23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
	Sample ID:	1640097-17	1640097-18	1640097-19	1640097-20
	MDL/Units	Paint	Paint	Paint	Paint
Metals					
Lead	20 ug/g	59500	140000	113000	130000
Mercury	2 ug/g	<2	<2	<2	<2

	Client ID:	P-21, Beige, Lime Green	P-22, LIght Green/Blue, Yellow White Ochre	P-23, Light Grey/Cream	P-24, Black, Sky Blue, White
	Sample Date:	23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
	Sample ID:	1640097-21	1640097-22	1640097-23	1640097-24
	MDL/Units	Paint	Paint	Paint	Paint
Metals					
Lead	20 ug/g	117000	93100	169000 [1]	46300
Mercury	2 ug/g	<2	<2	<2 [1]	6

	Client ID:	P-25, Beige, Light Blue	P-26, Light Blue/Green	P-27, Yellow	P-28, Burgendy
	Sample Date:	23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
	Sample ID:	1640097-25	1640097-26	1640097-27	1640097-28
	MDL/Units	Paint	Paint	Paint	Paint
Metals					
Lead	20 ug/g	84000	48400	123000	313
Mercury	2 ug/g	2	3	5	<2

	Client ID:	P-29, Lime Green	-	-	-
	Sample Date:	23-Sep-16	-	-	-
	Sample ID:	1640097-29	-	-	-
	MDL/Units	Paint	-	-	-
Metals					
Lead	20 ug/g	<20	-	-	-
Mercury	2 ug/g	<2	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Lead	ND	20	ug/g						
Mercury	ND	2	ug/g						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Lead	62300	20	ug/g	60800			2.3	30	
Mercury	5	2	ug/g	4			7.3	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Lead	224		ug/L		89.4	70-130			
Mercury	16	2	ug/g	4	79.8	70-130			

Qualifier Notes:

Sample Qualifiers :

1 : Complete separation of paint from substrate not possible for this sample and a small amount of substrate has been included in the paint digestion.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

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Chain of Custody
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№ 28958

Page 1 of 3

Client Name: BluMetric
Contact Name: V.Maynard / Ca Hertschel.
Address: 3108 Carp Rd, Carp, ON
Telephone: 613-839-3053

Project Reference: 160578
Quote #
PO #
Email Address: chertschel@blumetric.ca
Vmaynard@blumetric.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☒ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ____ ☐ Other: ____

Matrix Type: **S** (Soil/Sed.) **GW** (Ground Water) **SW** (Surface Water) **SS** (Storm/Sanitary Sewer) **P** (Paint) **A** (Air) **O** (Other)

Paracel Order Number:
1640097

Required Analyses

	Sample ID/Location Name		Matrix	Air Volume	# of Containers	Sample Taken		Bulk lead in paint	Bulk mercury in paint									
						Date	Time											
1	P-1 grey, orange, red		P	-	1	23Sept-16	—	X	X									
2	P-2 White (exterior)		P	-	1		—	X	X									
3	P-3 Red, orange.		P	-	1		—	X	X									
4	P4 Silver, white	/ colours	P	-	1		—	X	X	report as per colour								
5	P-5 Green, red.	/ are reversed	P	-	1		—	X	X	in bag per Carl. SC								
6	P-6 Interior white	in sample	P	-	1		—	X	X									
7	P-7 Med grey	bags.	P	-	1		—	X	X									
8	P-8 Dark grey		P	-	1		—	X	X									
9	P-9 Cream/grey		P	-	1		—	X	X									
10	P-10 light cream, lighter cream		P	-	1		—	X	X									

Comments: Keep some in case of leachate analysis.
Paint only

Method of Delivery: Walkin

Relinquished By (Sign):
Relinquished By (Print): CARL HERTSCHEL
Date/Time: SEP 26, 2016 16:23

Received by Driver/Depot:
Date/Time:
Temperature: ____ °C

Received at Lab: DONNA BROSNAN
Date/Time: Sept-26,16 4:23
Temperature: ____ °C

Verified By: Rachel Subject
Date/Time: Sep 27/16
pH Verified ☒ By: N/A 10:21

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Chain of Custody
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№ 28961

Page 2 of 3

Client Name: Blumetric
Contact Name: V. Maynard / C. Hentschel
Address: 3108 Carp Rd, Carp ON
Telephone: 613-839-3083

Project Reference: 160528
Quote #
PO #
Email Address: chentschel@blumetric.ca
vmaynard@blumetric.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☒ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1640097

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Bulk lead in paint	Bulk Mercury in Paint									
1	P-11 white, yellow ochre, black, green white	P	–	1	23 Sept-16	–	X	X									
2	P-12 Mint green, yellow-ochre, dark green grey	P	–	1		–	X	X									
3	P-13 Dark army green, beige, silver	P	–	1		–	X	X									
4	P-14 Light cream, dark cream, grey	P	–	1		–	X	X									
5	P-15 Light rose, cream	P	–	1		–	X	X									
6	P-16 Mint light green, cream.	P	–	1		–	X	X									
7	P-17 Dull yellow, light grey, cream	P	–	1		–	X	X									
8	P-18 Sky blue, cream	P	–	1		–	X	X									
9	P-19 Light ~~blue~~, cream, light blue, dark grey	P	–	1		–	X	X									
10	P-20-Med cream, light cream, dark grey	P	–	1		–	X	X									

Comments: Keep some sample material in case of leachate analysis.
Paint only

Method of Delivery: walk in

Relinquished By (Sign):
Relinquished By (Print): CARL HENTSCHEL
Date/Time: SEP 26, 2016 16:43

Received by Driver/Depot:
Date/Time:
Temperature: ______ °C

Received at Lab: [illegible] 23
Date/Time: Sept. 26, 16 4
Temperature: ______ °C

Verified By: Rachel Subject
Date/Time: Sep 27/16
pH Verified [X] By: N/A 10:21

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Chain of Custody
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№ 28959

Page 3 of 3

Client Name: Blumetric

Contact Name: V.Maynard, Carl Hentschel.

Address: 3108 Carp Rd, Carp, ON

Telephone: 613-839-3053

Project Reference: 160528

Quote #

PO #

Email Address: chentschel@blumetric.ca
Vmaynard@blumetric.ca

Turnaround Time:

☐ 1 Day ☐ 3 Day

☐ 2 Day ☒ Regular

Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1640097

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Bulk lead Paint	Bulk merc. Paint									
1	P-21 Beige, lime green.	P	–	1	23-Sept-16	–	X	X									
2	P-22 Light green/blue, yellow ochre, +white.	P	–	1		–	X	X									
3	P-23 Light grey/cream	P	–	1		–	X	X									
4	P-24 Black, sky blue, white	P	–	1		–	X	X									
5	P-25 Beige, light blue	P	–	1		–	X	X									
6	P-26 Light blue/green.	P	–	1		–	X	X									
7	P-27 Yellow.	P	–	1		–	X	X									
8	P-28 Burgundy	P	–	1		–	X	X									
9	P-29. Lime green	P	–	1		–	X	X									
10		P	–	1	↓	–	X	X									

Comments: Keep some sample material in case of leachate analysis Paint only.

Method of Delivery: Walk in

Relinquished By (Sign):

Relinquished By (Print): CARL HENTSCHEL

Date/Time: SEP 26, 2016 16:43

Received by Driver/Depot:

Date/Time:

Temperature: ______ °C

Received at Lab: D Bloom 23

Date/Time: Sept. 2016 4

Temperature: ______ °C

Verified By: Rachel Subject

Date/Time: Sep 27/16

pH Verified ☒ By N/A 10:21

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Certificate of Analysis

BluMetric Environmental Inc. (Carp)

P.O. Box 430, 3108 Carp Rd.
Carp, ON K0A 1L0
Attn: Veronique Maynard

Client PO:
Project: 160528
Custody: 12281

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016

Order #: 1640210

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1640210-01	A01a
1640210-02	A01b
1640210-03	A01c
1640210-04	A01d
1640210-05	A01e
1640210-06	A02a
1640210-07	A02b
1640210-08	A02c
1640210-09	A02d
1640210-10	A03a
1640210-11	A03b
1640210-12	A03c
1640210-13	A04a
1640210-14	A04b
1640210-15	A04c
1640210-16	A05a
1640210-17	A05b
1640210-18	A05c
1640210-19	A06a
1640210-20	A06b
1640210-21	A06c
1640210-22	A07a
1640210-23	A07b
1640210-24	A07c
1640210-25	A08a
1640210-26	A08b

Approved By:

Emma Diaz

Senior Analyst

1640210-27	A08c
1640210-28	A10a
1640210-29	A10b
1640210-30	A10c
1640210-31	A09a
1640210-32	A09b
1640210-33	A09c
1640210-34	A11a
1640210-35	A11b
1640210-36	A11c
1640210-37	A12a
1640210-38	A12b
1640210-39	A12c
1640210-40	A13a (Roofing Shingle)
1640210-41	A13b (Roofing Shingle)
1640210-42	A13c (Roofing Shingle)
1640210-43	A13a (Mesh)
1640210-44	A13b (Mesh)
1640210-45	A13c (Mesh)
1640210-46	A14a
1640210-47	A14b
1640210-48	A14c
1640210-49	A15a
1640210-50	A15b
1640210-51	A15c
1640210-52	A16a
1640210-53	A16b
1640210-54	A16c

Certificate of Analysis
Client: **BluMetric Environmental Inc. (Carp)**
Client PO:

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016
Project Description: 160528

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1640210-01	23-Sep-16	sample homogenized	White/Grey	Plaster	No	Client ID: A01a [ASLYR]	
						Non-Fibers	100
1640210-02	23-Sep-16	sample homogenized	White/Grey	Plaster	No	Client ID: A01b [ASLYR]	
						Non-Fibers	100
1640210-03	23-Sep-16	sample homogenized	White/Grey	Plaster	No	Client ID: A01c [ASLYR]	
						Non-Fibers	100
1640210-04	23-Sep-16	sample homogenized	White	Plaster	No	Client ID: A01d	
						Non-Fibers	100
1640210-05	23-Sep-16	sample homogenized	White	Plaster	No	Client ID: A01e	
						Non-Fibers	100
1640210-06	23-Sep-16	sample homogenized	Grey	Caulking	**Yes**	Client ID: A02a [AS-PRE]	
						Chrysotile	0.55
						Non-Fibers	99.45
1640210-07	23-Sep-16					Client ID: A02b	
						not analyzed	
1640210-08	23-Sep-16					Client ID: A02c	
						not analyzed	
1640210-09	23-Sep-16					Client ID: A02d [AS-PRE]	
						not analyzed	
1640210-10	23-Sep-16	sample homogenized	Grey	Transite	**Yes**	Client ID: A03a	
						Chrysotile	25
						Non-Fibers	75
1640210-11	23-Sep-16					Client ID: A03b	
						not analyzed	
1640210-12	23-Sep-16					Client ID: A03c	
						not analyzed	
1640210-13	23-Sep-16	sample homogenized	Pink/White	Caulking	No	Client ID: A04a [AS-PRE]	
						Non-Fibers	99
						Other fibers	1
1640210-14	23-Sep-16	sample homogenized	Pink/White	Caulking	No	Client ID: A04b [AS-PRE]	
						Non-Fibers	99
						Other fibers	1
1640210-15	23-Sep-16	sample homogenized	Pink/White	Caulking	No	Client ID: A04c [AS-PRE]	
						Non-Fibers	99
						Other fibers	1

Certificate of Analysis
Client: **BluMetric Environmental Inc. (Carp)**
Client PO:

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016
Project Description: 160528

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1640210-16	23-Sep-16	sample homogenized	Brown	Press Board	No	Client ID: A05a	[AS-PRE]
						Cellulose	95
						Non-Fibers	5
1640210-17	23-Sep-16	sample homogenized	Brown	Press Board	No	Client ID: A05b	[AS-PRE]
						Cellulose	95
						Non-Fibers	5
1640210-18	23-Sep-16	sample homogenized	Brown	Press Board	No	Client ID: A05c	[AS-PRE]
						Cellulose	95
						MMVF	1
						Non-Fibers	4
1640210-19	23-Sep-16	sample homogenized	Grey	Concrete	No	Client ID: A06a	
						Non-Fibers	100
1640210-20	23-Sep-16	sample homogenized	Grey	Concrete	No	Client ID: A06b	
						Non-Fibers	100
1640210-21	23-Sep-16	sample homogenized	Grey	Concrete	No	Client ID: A06c	
						Non-Fibers	100
1640210-22	23-Sep-16	sample homogenized	Black	Tar Paper	No	Client ID: A07a	[AS-PRE]
						Cellulose	60
						Non-Fibers	40
1640210-23	23-Sep-16	sample homogenized	Black	Tar Paper	No	Client ID: A07b	[AS-PRE]
						Cellulose	60
						Non-Fibers	40
1640210-24	23-Sep-16	sample homogenized	Black	Tar Paper	No	Client ID: A07c	[AS-PRE]
						Cellulose	60
						Non-Fibers	40
1640210-25	23-Sep-16	sample homogenized	Grey/White	Caulking	**Yes**	Client ID: A08a	[AS-PRE]
						Chrysotile	0.5
						Non-Fibers	99.5
1640210-26	23-Sep-16					Client ID: A08b	
						not analyzed	
1640210-27	23-Sep-16					Client ID: A08c	
						not analyzed	
1640210-28	23-Sep-16	sample homogenized	Grey	Powder	No	Client ID: A10a	[AS-PRE]
						Non-Fibers	100

Certificate of Analysis
Client: **BluMetric Environmental Inc. (Carp)**
Client PO:

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016
Project Description: 160528

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1640210-29	23-Sep-16	sample homogenized	Grey	Powder	No	Client ID: A10b [AS-PRE]	
						Non-Fibers	100
1640210-30	23-Sep-16	sample homogenized	Grey	Powder	No	Client ID: A10c [AS-PRE]	
						Non-Fibers	100
1640210-31	23-Sep-16	sample homogenized	e/Green/Grey/Br	Paint/Paper/Plaster/Wipe	**Yes**	Client ID: A09a [ASLYR, AS-PRE]	
						Chrysotile	0.54
						Cellulose	80
						Non-Fibers	19.46
1640210-32	23-Sep-16					Client ID: A09b [ASLYR]	
						not analyzed	
1640210-33	23-Sep-16					Client ID: A09c [ASLYR]	
						not analyzed	
1640210-34	23-Sep-16	sample homogenized	Grey	Transite	**Yes**	Client ID: A11a	
						Chrysotile	30
						Non-Fibers	70
1640210-35	23-Sep-16					Client ID: A11b	
						not analyzed	
1640210-36	23-Sep-16					Client ID: A11c	
						not analyzed	
1640210-37	23-Sep-16	sample homogenized	Beige/White	Ceiling Tile	No	Client ID: A12a [AS-PRE]	
						Cellulose	50
						MMVF	1
						Non-Fibers	49
1640210-38	23-Sep-16	sample homogenized	Beige/White	Ceiling Tile	No	Client ID: A12b [AS-PRE]	
						Cellulose	50
						MMVF	1
						Non-Fibers	49
1640210-39	23-Sep-16	sample homogenized	Beige/White	Ceiling Tile	No	Client ID: A12c [AS-PRE]	
						Cellulose	50
						MMVF	1
						Non-Fibers	49
1640210-40	23-Sep-16	sample homogenized	Brown	Roofing Shingle	**Yes**	Client ID: A13a (Roofing Shingle) [AS-PRE]	
						Chrysotile	1.35
						Cellulose	38.65
						Non-Fibers	60

Certificate of Analysis
Client: **BluMetric Environmental Inc. (Carp)**
Client PO:

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016
Project Description: 160528

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1640210-41	23-Sep-16					Client ID: A13b (Roofing Shingle)	
						not analyzed	
1640210-42	23-Sep-16					Client ID: A13c (Roofing Shingle)	
						not analyzed	
1640210-43	23-Sep-16	sample homogenized	White/Grey	Mesh	No	Client ID: A13a (Mesh)	[AS-PRE]
						Cellulose	60
						Non-Fibers	40
1640210-44	23-Sep-16	sample homogenized	White/Grey	Mesh	No	Client ID: A13b (Mesh)	[AS-PRE]
						Cellulose	60
						Non-Fibers	40
1640210-45	23-Sep-16	sample homogenized	White/Grey	Mesh	No	Client ID: A13c (Mesh)	[AS-PRE]
						Cellulose	60
						Non-Fibers	40
1640210-46	23-Sep-16	sample homogenized	Brown	Tar Paper	No	Client ID: A14a	[AS-PRE]
						Cellulose	40
						Non-Fibers	60
1640210-47	23-Sep-16	sample homogenized	Brown	Tar Paper	No	Client ID: A14b	[AS-PRE]
						Cellulose	40
						Non-Fibers	60
1640210-48	23-Sep-16	sample homogenized	Brown	Tar Paper	**Yes**	Client ID: A14c	[AS-PRE]
						Chrysotile	0.79
						Cellulose	40
						Non-Fibers	59.21
1640210-49	23-Sep-16	sample homogenized	Green/Brown	Vinyl Floor Tile/Backing	No	Client ID: A15a	[ASLYR, AS-PRE]
						Cellulose	30
						Non-Fibers	70
1640210-50	23-Sep-16	sample homogenized	Green/Brown	Vinyl Floor Tile/Backing	No	Client ID: A15b	[ASLYR, AS-PRE]
						Cellulose	30
						Non-Fibers	70
1640210-51	23-Sep-16	sample homogenized	Green/Brown	Vinyl Floor Tile/Backing	No	Client ID: A15c	[ASLYR, AS-PRE]
						Cellulose	30
						Non-Fibers	70

Certificate of Analysis
Client: **BluMetric Environmental Inc. (Carp)**
Client PO:

Report Date: 30-Sep-2016
Order Date: 26-Sep-2016
Project Description: 160528

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1640210-52	23-Sep-16	sample homogenized	Pink	Caulking	**Yes**	Client ID: A16a	[AS-PRE]
						Chrysotile	0.59
						Non-Fibers	96.46
						Other fibers	2.95
1640210-53	23-Sep-16					Client ID: A16b	
						not analyzed	
1640210-54	23-Sep-16					Client ID: A16c	
						not analyzed	

** MMVF: Man Made Vitreous Fibers: Fiberglass, Mineral Wool, Rockwool, Glasswool*

**** Analytes in bold indicate asbestos mineral content.**

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	2 - Ottawa West Lab	200812-0	30-Sep-16

** Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

Qualifier Notes

Sample Qualifiers :

ASLYR: Layers were noted for this sample, however, the entire sample was homogenized per client request.

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

Work Order Revisions / Comments

None

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№ 12281

Page 1 of 2

Client Name: BluMetric
Contact Name: V. Maynard / ~~E~~ C. Hentschel
Address: 3108 Carp Rd, Carp ON.
Telephone: 613 839 · 3053

Project Reference: 160528
Quote #:
PO #:
Email Address: chentschel@blumetric.ca
vmaynard@blumetric.ca

TAT: [✓ Regular] [ ] 3 Day
[ ] 2 Day [ ] 1 Day
[ ] Same Day
Date Required:

ASBESTOS ANALYSIS

Matrix: [ ] Air [✓ Other] **Regulatory Guideline:**

Required Analyses: [ ]PCM [✓ PLM] [ ]PLM 400PC [ ]PLM 1000PC [ ]Chatfield [ ]TEM

Paracel Order Number: 1640210

	Sample ID	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y / N)	Is the Sample Layered? (Y / N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	A01 a, b, c, d, e	White skim coat	23 Sept-16	–	Y	N	
2	A02 a, b, c, d.	Interior caulking	" "	–	Y	N	
3	A03 a, b, c	Transite board	" "	–	Y	N	
4	A04 a, b, c	Pink + white caulking	" "	–	Y	N	
5	A05 a, b, c	Press board	" "	–	Y	N	
6	A06 a, b, c	Patch material, (concrete)	" "	–	Y	N	
7	A07 a, b, c	Tar paper	" "	–	Y	N	
8	A08 a, b, c	Exterior grey / white caulking	" "	–	Y	N	
9	A10 a, b, c	White powder.	" "	–	Y	N	
10	A09 a, b, c	Skim coat on plaster	" "	–	Y	N	
11	A11 a, b, c	Decorative transite faux wood panels	" "	–	Y	N	
12	A12 a, b, c	White ceiling tiles	" "	–	Y	N	
13	A13 a, b, c	Roofing shingles + mesh	" "	–	Y	Y *	~~confirm *~~ SEP.
14	A14 a, b, c	Tar paper	" "	–	Y	N	
15	A15 a, b, c	Green 9x9 VFT with backing	" "	–	Y	Y *	to ~~confirm *~~ ~~SEP~~ Homog layers separately KW

* Each layer is charged as a separate analysis ** Homogenize = Sample is combined to a uniform mixture

Comments: VFT - Vinyl floor tile * Stop Positive * Homog A15 as per client KW

Method of Delivery: Walk in

Relinquished By (Sign):
Received at Depot: D. Bloom
Received at Lab:
Verified By:

Relinquished By (Print): V. Maynard
Date/Time: 23 Sept 2016
Date/Time: Sept. 26, 16 23
Date/Time: 09/27/16 9:42am
Date/Time: 09/28/16 1:15pm

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Page 2 of 2

Client Name: BluMetric	Project Reference: 160528	TAT: [X] Regular [ ] 3 Day
Contact Name: V. Maynard / C. Hentschel	Quote #:	[ ] 2 Day [ ] 1 Day
Address: 3108 Carp Rd, Carp ON	PO #:	[ ] Same Day
	Email Address: chentschel@blumetric.ca vmaynard@blumetric.ca,	
Telephone: 613-839-3053		Date Required:

ASBESTOS ANALYSIS

Matrix: [ ] Air [X] Other **Regulatory Guideline:** ____________

Required Analyses: [ ]PCM [X]PLM [ ]PLM 400PC [ ]PLM 1000PC [ ]Chatfield [ ]TEM

Paracel Order Number: 1640210

	Sample ID	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y / N)	Is the Sample Layered? (Y / N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	A16 a,b,c	Pink exterior caulking	23-sept-16	-	Y	N	
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

* Each layer is charged as a separate analysis ** Homogenize = Sample is combined to a uniform mixture

Comments: *Stop Positive*

Method of Delivery: Walk in

Relinquished By (Sign):	Received at Depot: D Poloon	Received at Lab:	Verified By:
Relinquished By (Print): V. Maynard			
Date/Time: 24 Sept 2016	Date/Time: Sept. 26,16 4 23	Date/Time: 09/27/16 9:42am	Date/Time: 09/28/16 1:15pm

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Certificate of Analysis

BluMetric Environmental Inc. (Carp)

P.O. Box 430, 3108 Carp Rd.
Carp, ON K0A 1L0
Attn: Veronique Maynard

Client PO:
Project: 160528
Custody: 28961

Report Date: 20-Oct-2016
Order Date: 18-Oct-2016

Order #: 1643145

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1643145-01	P-13, Dark Army Green, Beige, Silver
1643145-02	P-14, Light Cream, Dark Cream, Grey

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Metals, ICP-MS	EPA 6020 - Digestion - ICP-MS	20-Oct-16	20-Oct-16
Solids, %	Gravimetric, calculation	19-Oct-16	19-Oct-16

Certificate of Analysis

Client: BluMetric Environmental Inc. (Carp)

Client PO:

Report Date: 20-Oct-2016

Order Date: 18-Oct-2016

Project Description: 160528

	Client ID:	P-13, Dark Army Green, Beige, Silver	P-14, Light Cream, Dark Cream, Grey	-	-
	Sample Date:	23-Sep-16	23-Sep-16	-	-
	Sample ID:	1643145-01	1643145-02	-	-
	MDL/Units	Paint	Paint	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	100	100	-	-
EPA 1311 - TCLP Leachate Inorganics					
Lead	0.05 mg/L	12.8	2.60	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
EPA 1311 - TCLP Leachate Inorganics									
Lead	ND	0.05	mg/L						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
EPA 1311 - TCLP Leachate Inorganics									
Lead	0.060	0.05	mg/L	0.062			2.7	32	
Physical Characteristics									
% Solids	88.4	0.1	% by Wt.	89.0			0.6	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
EPA 1311 - TCLP Leachate Inorganics									
Lead	47.9		ug/L	6.16	83.5	77-126			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

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Page 2 of 3

Client Name: Blumetric
Contact Name: V. Maynard / C. Hentschel
Address: 3108 Carp Rd, Carp ON
Telephone: 613-839-3053
Project Reference: 160528
Quote #
PO #
Email Address: chentschel@blumetric.ca
vmaynard@blumetric.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☒ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ________ ☐ Other: ________

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1643145
~~1640097~~

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Bulk Lead in Paint	Bulk Mercury in Paint	Reg 558 Lead.								
1	P-11 white, yellow ochre, black, green white	P	–	1	28 Sept-16	—	X	X									
2	P-12 Mint green, yellow-ochre, dark green grey	P	–	1		—	X	X									
3	P-13 Dark army green, beige, silver	P	–	1		—	X	X	⊗								
4	P-14 light cream, dark cream, grey	P	–	1		—	X	X	⊗								
5	P-15 light rose, cream	P	–	1		—	X	X									
6	P-16 Mint light green, cream	P	–	1		—	X	X									
7	P-17 Dull yellow, light grey, cream	P	–	1		—	X	X									
8	P-18 Sky blue, cream	P	–	1		—	X	X									
9	P-19 light ~~blue~~ cream, light blue, dark grey	P	–	1		—	X	X									
10	P-20 Med cream, light cream, dark grey	P	–	1		—	X	X									

Required Analyses

Revised Oct 18/16 -RS

Comments: Keep some sample material in case of leachate analysis. Paint only

Method of Delivery: walk in

Relinquished By (Sign):
Relinquished By (Print): CARL HENTSCHEL
Date Time: SEP 26, 2016 16:43

Received by Driver/Depot:
Date/Time:
Temperature: °C

Received at Lab: DPaquin
Date/Time: Sept 26, 16 4:33
Temperature: °C

Verified By: Rachel Subject
Date/Time: Sep 27/
pH Verified [X] By: N/A

Rachel Subjet
Oct 18/16 1:33

Chain of Custody (Blank) - Rev 0.4 Feb 2016

Paracel Laboratories Ltd.	Client	BluMetric Environmental Inc. (Carp)					
Certificate of Analysis	Attention	Veronique Maynard					
Work Order: 1702008	Reference	Preferred Supplier Pricing- Tier 3					
Report Date: 1/12/2017 10:00:10 AM	Project Number	160528-00-00					
Note: This is not the original data. Please refer to PDF / Hardcopy report.							
	Parameter	Units	MRL				
LAB ID				1702008-01			
CLIENT ID				P-30 Exterior White (from paint on A11a, b, c)			
DATE SAMPLED				23-Sep-16			
DATE RECEIVED				06-Jan-17			
MATRIX				Paint			
	Lead	ug/g	20	280			

Certificate of Analysis

BluMetric Environmental Inc. (Kingston)

4 Cataraqui St.
Kingston, ON K7K 1Z7
Attn: Paul Bandler

Client PO:
Project: Michi Is
Custody: 86656

Report Date: 25-Apr-2017
Order Date: 24-Apr-2017

Order #: 1717004

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1717004-01	P30
1717004-02	P31
1717004-03	P32
1717004-04	P33
1717004-05	P34
1717004-06	P35

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 7471B - CVAA, digestion	25-Apr-17	25-Apr-17
Metals, ICP-MS	EPA 6020 - Digestion - ICP-MS	25-Apr-17	25-Apr-17
Metals, ICP-OES	based on MOE E3470, ICP-OES	25-Apr-17	25-Apr-17

Certificate of Analysis

Report Date: 25-Apr-2017

Client: BluMetric Environmental Inc. (Kingston)

Order Date: 24-Apr-2017

Client PO:

Project Description: Michi Is

Client ID:		P30	P31	P32	P33
Sample Date:		21-Apr-17	21-Apr-17	21-Apr-17	21-Apr-17
Sample ID:		1717004-01	1717004-02	1717004-03	1717004-04
	MDL/Units	Paint	Paint	Paint	Paint
Metals					
Lead	20 ug/g	1010	14400	-	9390
Lead	5 ug/g	-	-	12	-
Mercury	2 ug/g	<2	<2	<2	<2

Client ID:		P34	P35	-	-
Sample Date:		21-Apr-17	21-Apr-17	-	-
Sample ID:		1717004-05	1717004-06	-	-
	MDL/Units	Paint	Paint	-	-
Metals					
Lead	20 ug/g	-	68100	-	-
Lead	5 ug/g	17	-	-	-
Mercury	2 ug/g	<2	<2	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Lead	ND	5	ug/g						
Lead	ND	20	ug/g						
Mercury	ND	2	ug/g						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Lead	7560	50	ug/g	6400			16.6	50	
Lead	14700	20	ug/g	14400			2.2	30	
Mercury	ND	2	ug/g	ND			0.0	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Lead	46.6		ug/L		93.3	70-130			
Lead	207		ug/L		82.8	70-130			
Mercury	14	2	ug/g	ND	94.0	70-130			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Paracel ID: 1717004

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Client Name: Paul Bandler BluMetric
Contact Name:
Address: BluMetric Kingston
Telephone: 613 453 5496

Project Reference: Michi Is
Quote #
PO #
Email Address: pbandler@blumetric.ca

TAT: ☐ Regular
☐ 2 Day
☑ 1 Day
☐ Same Day
Date Required: Ap. 25/17; 3pm

Samples Submitted Under: ☐ O. Reg. 153/04 Table___ ☐ O. Reg 511/09 Table___ ☐ PWQO ☐ CCME ☐ Sewer Use (Storm) ☐ Sewer Use (Sanitary) ☐ Other:______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1717004

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Blank Pb	Blk Hg	
1	P30	P		1	Ap 21/17		✓	✓	ZIPLOCK BAG. ✓
2	P31	P		1			✓	✓	✓
3	P32	P		1			✓	✓	✓
4	P33	P		1			✓	✓	✓
5	P34	P		1			✓	✓	✓
6	P35	P		1			✓	✓	✓
7	~~P36~~	~~P~~		~~1~~					✓
8									
9									
10									

Comments: 24 hr Rush; results Tue Apr 25; 3pm

Method of Delivery: walk-in

Relinquished By (Print & Sign): PBandler
Date/Time: Apr 24/17

Received by Driver/Depot: Kaye Cooper
Date/Time: Apr. 24 0830
Temperature: ___ °C

Received at Lab: SUREEPORN DOKMAI
Date/Time: APR 24, 2017 03:26
Temperature: 8 °C

Verified By: Rachel Subject
Date/Time: Apr 24/17 3:32
pH Verified ☒ By: N/A

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Certificate of Analysis

BluMetric Environmental Inc. (Kingston)

4 Cataraqui St.
Kingston, ON K7K 1Z7
Attn: Paul Bandler

Client PO: 160528
Project: Michi Is
Custody: 86656

Report Date: 26-Apr-2017
Order Date: 25-Apr-2017

Order #: 1717214

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1717214-01	P30
1717214-02	P31
1717214-03	P33
1717214-04	P35

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Metals, ICP-MS	EPA 6020 - Digestion - ICP-MS	26-Apr-17	26-Apr-17
Solids, %	Gravimetric, calculation	26-Apr-17	26-Apr-17

	Client ID: **Sample Date:** **Sample ID:**	P30 21-Apr-17 1717214-01	P31 21-Apr-17 1717214-02	P33 21-Apr-17 1717214-03	P35 21-Apr-17 1717214-04
	MDL/Units	paint	paint	paint	paint
Physical Characteristics					
% Solids	0.1 % by Wt.	100	100	100	100
EPA 1311 - TCLP Leachate Inorganics					
Lead	0.05 mg/L	<0.05	17.5	0.69	115

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
EPA 1311 - TCLP Leachate Inorganics									
Lead	ND	0.05	mg/L						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
EPA 1311 - TCLP Leachate Inorganics									
Lead	ND	0.05	mg/L	ND			0.0	32	
Physical Characteristics									
% Solids	75.4	0.1	% by Wt.	76.4			1.3	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
EPA 1311 - TCLP Leachate Inorganics									
Lead	49.5		ug/L	1.43	96.1	77-126			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Revised Apr 25/17 -RS.

Paracel ID: 1717214

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Client Name: Paul Bandler BluMetric

Contact Name:

Address: BluMetric Kingston

Telephone: 613 453 5496

Project Reference: Michi Is

Quote #

PO #

Email Address: pbandler@blumetric.ca

TAT: ☐ Regular ☐ 2 Day [✓ 1 Day] ☐ Same Day

Date Required: Ap. 25/17 ; 3pm

Samples Submitted Under: ☐ O. Reg. 153/04 Table ___ ☐ O. Reg 511/09 Table ___ ☐ PWQO ☐ CCME ☐ Sewer Use (Storm) ☐ Sewer Use (Sanitary) ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: ~~1717004~~ 1717214.

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Bulk Pb	Blk Hg	TCLP Lead								
1	P30	P		1	Ap. 21/17		✓	✓	⊗			- ZIPLOCK BAG					/
2	P31	P		1			✓	✓	⊗								/
3	P32	P		1			✓	✓									/
4	P33	P		1			✓	✓	⊗								/
5	P34	P		1			✓	✓									/
6	P35	P		1			✓	✓	⊗								/
7	~~P36~~	~~P~~															
8																	
9																	
10																	

Comments: 24 hr Rush ; results Tue Apr 25 ; 3pm

Method of Delivery: walk-in

Relinquished By (Print & Sign): P Bandler
Date/Time: Apr 24/17

Received by Driver/Depot: Dave Cooper
Date/Time: Apr 24 0830
Temperature: ___ °C

Received at Lab: SUNEEPORN DOKMAI
Date/Time: APR 24, 2017 03:26
Temperature: 8 °

Verified By: Rachel Subject
Date/Time: Apr 24/17, 3:32
pH Verified [x] By: N/A

Chain of Custody (Env) - Rev 0.0 April 2011

Rachel Subject
Apr 25/17 5:04.

APPENDIX B

Structural Engineering Assessment

DFRP# 67652
FCSI# 67652001 & 67652002

Engineers, Planners & Landscape Architects

Structural Review

Michipicoten Island
East End
Light Station

December 2016

Novatech 116136

NOVATECH
Engineers, Planners & Landscape Architects

2017-03-16

BluMetric Environmental
3108 Carp Road
PO Box 430
Ottawa
K0A 1L0

Attention: **Karen Greer**

Reference: **Michipicoten Island - East End Light Station - Lighthouse and Other Buildings Structural Condition Evaluation**
DFRP: **67652**
Site ID:
FCSI: **67652001**
Our File: **116136**

1 Introduction

1.1 This report describes a visual evaluation of the structures at the Michipicoten Island East End Light Station Site.

1.2 The evaluation was undertaken for BluMetric Environmental in support of a Designated Substances and Hazardous Materials Survey, undertaken by BluMetric for PWGSC.

1.3 Recommendations are provided for repair and maintenance work to maintain the structural integrity of the lighthouse and the other buildings.

1.4 If the condition of the buildings might affect the proposed environmental abatement work, additional recommendations are provided, as required.

2 Methodology

2.1 No record documents were provided. Historical background information was obtained from selected Government and unofficial webpages. The lighthouse is a "Classified Federal Heritage Building", described in the FHBRO "Heritage Character Statement", included in Appendix A. The term "reportedly" relates to information obtained from one or more of these sources.

2.2 The site review was undertaken by Peter James, P.Eng, on September 23rd, 2016. Photographs of typical and notable features are included in Appendix B.

2.3 No invasive tests were undertaken. Existing construction details were identified by visual inspection of physical features, and, where necessary, inferred by reference to typical construction practices. The term "probably" describes conclusions developed by combining visible evidence with knowledge of typical construction practices.

2.4 Sometimes, original construction details may have been incomplete, or inadequate, or modified in an improper manner during the lifetime of a building. Some of these items could be hidden from view - and thus may not be accounted for in this report.

2.5 The term "railing" is used to describe all components that provide (in some manner) the function of guards and/or handrails.

3 General Description

3.1 The buildings at the site include a lighthouse; a house; a building that was originally a house, but was more recently used as a generator building; two small storage buildings; and several sets of footings or foundations previously used for either tanks or buildings.

3.2 None of the buildings is currently in use. All the buildings were locked (unlocked for the inspection). None of the buildings is heated.

4 Lighthouse

4.1 The lighthouse was reportedly constructed in 1911, using a standard design for flying buttress concrete lighthouses that was developed earlier in the 20th century.

4.2 The main section of the tower is a six-sided reinforced concrete structure, about 18.7 metres high, with each exterior face being about two metres wide. The tower is braced by six tapered flying buttresses, 300 mm wide, and 850 mm deep at grade, reducing to about half that depth where the buttress flares into the tower. The tower is capped with a circular concrete platform, with a diameter of about five metres (estimated). The tops of the buttresses flare out to support the platform. The tower has a hexagonal concrete base, each side about four metres wide. The base is locally extended by about 1.5 m by 1 m at each buttress. Details of the base below grade are not visible.

4.3 The inside of the tower has 12 faces, each about 830 mm wide. The interior width is about 3.1 metres for the full height of the tower (ie the tower is cylinder-like, not tapered). At six faces the walls are about 200 mm thick. The thickness of the walls at other six faces varies from about 200 mm to about 450 mm (estimated). The thickened sections of those faces align with the flying buttresses.

4.4 In addition to the top floor, there are two intermediate floors, and three intermediate landings, at varying spacings that average about 3.1 metres. The top floor extends outward, beyond the tower, to form the circular exterior platform. The intermediate floors and the top floor are concrete, 235 mm thick. The landings are concrete, 150 mm thick. Between the ground floor and the top floor there are six steel ladders, with either 11, 12 or 13 risers (varies with the floor to floor height), and steel pipe railings.

4.5 The lantern room is a two-storey circular metal and glass structure, about 5.9 m internal height, with an open-grate cast-iron upper floor at the glass level. The lantern room is vented. There is an exterior platform, also of open-grate cast-iron construction, at the glass level. Access to the upper floor is by a cast-iron spiral stair, with 10 risers. All the lantern room components are pre-fabricated. Both exterior platforms have railings around their outer edges, fabricated from iron or steel pipe, with threaded fittings at their connections.

4.6 There was no open access to either of the exterior platforms. It was not possible to inspect the top surface of the exterior concrete platform, nor to inspect the platform railings.

4.7 All the concrete components are painted. The paint is generally in satisfactory condition, except where the concrete has deteriorated (discussed below).

4.8 There is significant concrete deterioration at the outer edge and the underside of the exterior platform. There is a horizontal crack at about mid-depth of the edge of the platform that extends around at least 25% of the perimeter of the platform. There are several spalled areas, and some pieces of concrete have fallen. It can be expected that the top surface of the exterior platform will also have experienced some deterioration. At the ladder opening through the top floor there is significant horizontal cracking that is probably the inward extension of the horizontal crack observed at the edge of the exterior platform.

4.9 There is local spalling of the top-most sections of some of the buttresses, and at the top-most section of one face of the tower. There is also local cracking and spalling at the bases of some of the buttresses.

4.10 Internally, there is minor concrete deterioration of the intermediate floors and intermediate landings, including efflorescence, surface scaling, and local cracking.

4.11 All the metal components are painted. The paint on the ladders is in poor condition. The paint at the lantern room is generally in satisfactory condition.

4.12 There is localized corrosion of some metal components, mostly at the lower supports of the ladders, and at the railing supports.

5 House

5.1 The house is a single-storey wood-framed building with a basement, overall size about 10.5 m by 7.7 m. It is partly built-into a slope, and thus the basement is entered directly from the lower grade level. The primary entrance to the main floor is from the upper grade level via a concrete slab balcony structure. There is a secondary entrance to the main floor via an exterior wood staircase that leads to a small concrete landing.

5.2 The house was probably built in the 1950's. It has a steel-clad hipped roof, of recent vintage. The walls are finished with fibre-cement shingles, probably original. The windows are sealed sliding units, probably installed in the 1980's or 1990's. The windows are in good condition. There is evidence of a roof leak at one bedroom. With that exception, the building is otherwise weathertight, with no visible evidence of any structural deficiencies.

5.3 The foundation walls are concrete. The basement floor is partly concrete, partly soil, and partly rock. The balcony and the landing are supported on the foundation walls, and on seven concrete columns with substantial haunches.

5.4 All the exterior concrete components are painted. The foundation walls are in satisfactory condition. The balcony slab, the column haunches and the columns are in poor condition, including peeling paint, efflorescence, cracking, scaling and heavy local spalling.

5.5 The balcony has a painted metal pipe railing. The stairs and the landing have painted wood railings. The railings are not "sturdy", and they do not conform to current Code requirements for height or pickets / infill panels.

6 Generator Building

6.1 This building was originally a house. Its most-recent function was identified by the presence of a generator and an empty racking system of the type typically used for storage batteries.

6.2 The main section of this building has two storeys, with a basement, reportedly previously used as a boathouse. It is about 8.1 m by 6.5 m. There is an attached single-storey annex, supported on concrete piers, which is about 5.6 m by 3.7 m. Both the original house and the annex have pitched roofs.

6.3 Both sections of the building are wood-framed. The original building is probably of 1920's vintage. The annex is probably newer. The building is fully-clad with metal siding and metal roofing, of recent vintage. The cladding is generally in good condition, except that several pieces of fascia are missing. The interior faces of the ground floor walls are finished with painted plywood sheets.

6.4 The stairs have been removed. The upper floor was accessed by a ladder. The original windows remain in place, covered by plywood sheets, and the metal cladding. The original interior wall and ceiling finishes are in place. There was no visible evidence of any structural deficiencies.

7 Storage Buildings

7.1 The two small storage buildings are wood-framed, each about 6.4 m by 4 m. Each building is supported on a concrete slab, with the slab edges thickened to follow the ground contours. The pitched roofs and the walls are clad with corrugated fibre-cement cladding. The interior faces of the walls are finished with painted plywood sheets.

7.2 The storage buildings were probably built in the 1970's. They are in good condition.

8 Other Structures

8.1 These include:

.1 Concrete crawl space slab, plus one concrete block foundation wall, for another house. Concrete block debris from the demolition of the other foundation walls is lying on the slab.

.2 Footings and concrete foundation walls for a full-height basement of another building, purpose unknown.

.3 Concrete slab and containment walls for fuel tanks.

.4 Several concrete pads and piers, probably used to support either tanks or equipment.

8.2 None of the other structures was investigated in detail.

9 Comments - Lighthouse

9.1 Concrete spalling is generally the result of a combination of:

.1 Freeze-thaw action on wet exposed concrete, and

.2 Rebar corrosion, typically starting at cracks and/or at locations with insufficient concrete cover over the rebars.

9.2 The probable existence of horizontal cracking in the top floor / exterior platform slab, extending from the exterior edge of the slab to the ladder opening inside the tower, is potentially a significant problem. The spalling and the cracking are indicative of "top-of-slab concrete delaminations", which occur when expansive forces created by corrosion of the top layer of rebars cause the concrete to fail in tension (crack) in the plane of the rebars, resulting in the concrete above the corroded rebars becoming separated from the concrete below the rebars. When this occurs, the top rebars become debonded, and thus ineffective, resulting in the slab losing its capacity to resist cantilever action. Additionally, the now-separated upper and lower layers of concrete are at greater risk of cracking, and pieces of concrete may fall to the ground.

9.3 Rebar corrosion and concrete spalling at the exterior platform can be expected to continue, probably at a gradually increasing rate due to both the increasing exposure of fractured concrete to freeze-thaw action and the increasing exposure of the rebars to wet conditions. Accordingly, it can be expected that the amount of spalling and top-of-slab delamination will increase, and it can be expected that pieces of concrete will continue to fall. Additionally, the extension of the cracking into the interior section of the top floor slab, as already seen, provides a path for water to penetrate further into the slab, and thus to enter the tower itself, increasing the potential for corrosion and further deterioration.

9.4 At the present time, the primary risk is the risk of injury from falling debris to persons standing near the lighthouse. Deterioration of the top floor slab does not pose an immediate risk to the structural integrity of the lighthouse as a whole. Neither the exterior section of the top floor slab nor the outward flares of the buttresses that support the exterior section of the top floor slab are essential to the integrity of the lighthouse.

9.5 However, if the section of the top floor slab located directly above the walls of the tower, and which supports the lantern room structure, becomes badly fractured, it will eventually lose its capacity to support the loads imposed by the lantern room. Note that the most significant loads on the lantern room structure are wind loads, and to resist the wind loads the lantern room structure must be securely anchored to the tower structure.

9.6 With respect to the primary structure of the lighthouse, the tower and the flying buttresses are generally in satisfactory condition. The condition of the base, which does have some local cracking and spalling, and which is mostly hidden, should be further investigated.

9.7 The exterior concrete platform cannot be considered to be "safe" for access by personnel. The "sturdiness" of the railings has not been assessed. Access to both platforms would require safety harnesses, etc, and secure attachment points for safety lines would be required.

10 Recommendations - Lighthouse

Redacted

Redacted

11 Environmental Abatement Work - Lighthouse

11.1 If any work is to be undertaken in the immediate vicinity of the lighthouse, there is a potential risk of injury to workers from debris falling from the exterior platform.

11.2 If any work is to be undertaken outside the lantern tower, the exterior concrete platform cannot be considered to be safe. It will be necessary to establish alternative methods of access. Full-height scaffolding may be required.

11.3 The budget for external environmental abatement work at the lighthouse should include full allowances for access and protection costs. To develop this budget requires further study of means of access, methods of work, scope of other work that may be undertaken at the same time, etc.

12 Comments - Other Buildings

12.1 The cladding at all the other buildings is generally in good condition. With the exception of a possible leak at the house, all the other buildings appear to be generally weathertight.

12.2 The spalling of the concrete balcony and landing structures at the house has the same causes as the spalling at the lighthouse. Ongoing deterioration can be expected. Ongoing deterioration does not represent a threat to the primary structure of the house.

13 Recommendations - Other Buildings

Redacted

14 Environmental Abatement Work - Other Buildings

14.1 The condition of the other buildings will require no additional precautions other than those normally required for the type of work to be undertaken.

14.2 There should be no additional costs to the budget for the environmental abatement work on account of the structural condition of the other buildings.

15 Summary

15.1 Lighthouse:

.1 The primary structure of the tower is generally in satisfactory condition. The deterioration of the top floor / exterior concrete platform presents a significant present risk of falling debris, and a future risk to the stability of the lantern room.

.2 The top floor slab / exterior concrete platform should be removed. The exterior platform is not a primary structural element, and thus it does not have to be replaced in its present form.

.3 Additional repair and maintenance work should be undertaken to maintain the integrity of the primary structural system, and to minimize ongoing deterioration of other components.

.4 There may be significant costs for access and protection associated with undertaking the external environmental abatement work.

15.2 Other Buildings:

.1 The other buildings are generally in good condition. Minor maintenance work is recommended to maintain their existing condition.

.2 There should be no additional costs for the environmental abatement work on account of the structural condition of the other buildings.

Yours truly,

NOVATECH
Engineers, Planners & Landscape Architects

2017-03-27
PETER M. JAMES

Peter James, P.Eng
Senior Project Manager | Structural Engineering & Building Code

NOVATECH
Engineers, Planners & Landscape Architects

APPENDIX A

HISTORICAL INFORMATION

Michipicoten, Ontario
Michipicoten Lighttower

HERITAGE CHARACTER STATEMENT

The Michipicoten Lighttower was built in 1911 to designs by Lt. Col. Wm. Anderson of the Department of the Marine. It is the property of Transport Canada, Canadian Coast Guard. See FHBRO Building Report 88-145.

Reason for Designation

The lighttower was designated Classified for its historical, architectural and environmental significance.

Its architectural importance is of a high order. It is an advanced example of the reinforced concrete, flying buttress lighthouses developed early in the 20th century in locations requiring strong wind resistance. Its form is an adaptation of a prototype built in Belle Isle, Newfoundland in 1908. The resulting tapered elegance and height of the lighttower form, distinguish it from its predecessors.

The tower also embodies thematic significance. Its construction is associated with efforts to upgrade the quality of lighthouse construction in the early years of the 20th century, following a long period of restrained government spending.

The tower also enjoys significance for the relatively unchanged nature of the site on which it stands, and for its prominent role in establishing the character of the lightstation.

Character Defining Elements

The tower's architectural significance is primarily embodied in its six flying buttresses (each supported by double arches) flanking a tapered tower of particular elegance. Its formal power has been achieved by the use of reinforced concrete in the construction of buttresses, encircling shell and floor, permitting a fully integrated structural response to the increased weight of the improved lanterns and lighting apparatus of the period and the horizontally applied wind loads.

The design characteristics and materials of the original reinforced concrete elements would be important to maintain as repair work is carried out.

The lighttower has been altered little since its construction in 1911-12. To the fog plant an oil shed and boathouse of 1912 have been added, in 1928, the radio beacon building, a bungalow for the lighthouse keeper and a boat landing in 1953. The

.../2

buildings together provide a good example of the utilitarian additions and alterations typically experienced by such stations as they have adapted to changing circumstances. It would be important to give every consideration to ways of maintaining these buildings and the relationship between them in future planning of the site.

1992.01.16

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Engineers, Planners & Landscape Architects

APPENDIX B

PHOTOGRAPHS

Michipicoten Island - East End Light Station - Structural Review

Overall view of Light Station

Overall view of Lighthouse. Six flying buttresses. Top floor extends as exterior concrete platform.

Overall view of house. Concrete balcony, concrete landing at side door.
Roof, siding & windows in good condition.

Overall view of generator building, annex in shadow, and two small storage buildings beyond.
Metal cladding in good condition, one fascia piece missing.

Part-demolished concrete block foundations.

Abandoned concrete foundations.

Concrete spalling at exterior concrete platform. Note horizontal crack at edge of slab. See P8.

P6

Concrete spalling on wall face and at buttress flares.

Concrete cracking and spalling at base of buttress.

Ladder opening through top floor. Horizontal crack in slab is probably same crack visible at outside edge of exterior concrete platform. See P6.

Lantern room: Metal-plate wall, open-grate cast iron upper floor. Condition generally satisfactory.

Exterior platform: Open-grate cast-iron with steel pipe railing. Local corrosion.

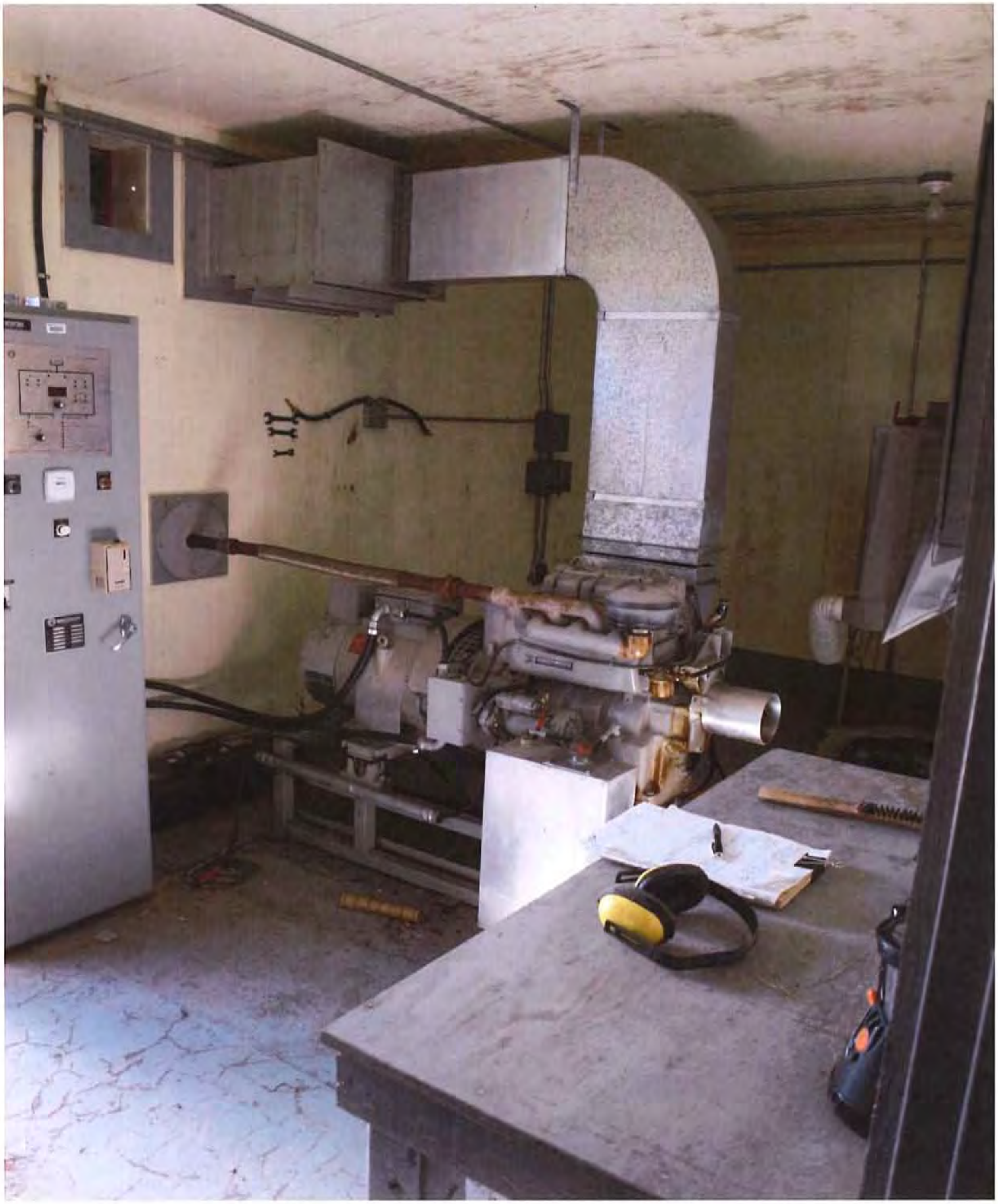
Typical ladders, pipe railings, concrete landing. Note walls generally in good condition.

Typical condition of ladders and railings at supports. Peeling paint, local corrosion.

Significant spalling of slab edge. Loss of integrity at base of railing post. Peeling paint on slab soffit.

Balcony slab. Cracking at column haunches. Paint fully peeled-off slab underside.

Generator Building & Annex. Metal cladding in good condition, several fascia pieces missing.



Generator.

Annex to Generator Building: Interior view.

Generator Building: Second floor - boarded-over window, original finishes.

Two small storage buildings. Generally good condition.

APPENDIX C

Marine Engineering Assessment

Shoreplan Engineering Limited
20 Holly Street, Suite 202
Toronto, ON Canada M4S 3B1
T) 416.487.4756 F) 416.487.5129
E) mail@shoreplan.com

FSCI # 67652001 and 67652002

SHOREPLAN

May 11, 2017

Carl Hentschel, P.Eng
BluMetric Environmental Inc.
3108 Carp Road
PO Box 430
Ottawa, Ontario, Canada
K0A 1L0

Dear Mr. Hentschel:

RE: Marine Assessment, Michipicoten Island Lightstation, Lake Superior
DFRP # 67652
Our file 16-2455

We have completed our review of the marine access aspects of the above noted project and offer the following comments. Shoreplan's role on this project was to evaluate options for site access options during remediation, and provide recommendations and cost estimates. Our cost estimates have been provided under separate cover. The undersigned participated in a site review on September 23, 2016, and the photographs presented below were taken at that time. The water level during our review was approximately 183.6m IGLD1985.

Coastal Setting

Physical Setting

Michipicoten Island is located in the north-east portion of Lake Superior, as shown in the Location Plan of Figure 1. It is approximately 70 km southwest of Wawa and 170 km northwest of Sault Ste. Marie. The lightstation is located on the northeast tip of the island.

Figure 2 is a site plan of the lightstation property. The shoreline is generally jagged rock that is not well suited for marine access. Photo 1 is a northerly looking view of the site. There is a concrete helicopter landing pad in the foreground and a concrete breakwall extending a short distance offshore in an easterly direction. Photo 2 shows a westerly looking view of the breakwall and a narrow channel adjacent to it that was dredged through the nearshore rock substrate. The shoreline on the south side of the breakwall is a cobble beach (Photo 3). There is also a short dock north of the lighthouse which does not extend offshore of the rock outcrop that abuts its eastern side (Photo 4).

The dock north of the lighthouse is approximately 10m long with water depths varying irregularly from 1.2 to 2.0m over that length. A shallow draft vessel could be berthed here during calm conditions, but there is a 2m long concrete base for a hoist (Photo 4) that limits access to the berth.

The breakwall east of the lighthouse is approximately 21.5m long in total, but there is a bend in it that effectively limits the area available for berthing to the innermost 13m. Depths over that 13m length range from approximately 0.25m at the shore to 0.75m at its mid-point and 1.1m at its outer end. The dredged access channel (Photo 2) was visually estimated to be approximately 3m wide and in the order of 1m deep.

Canadian Hydrographic Service navigation charts and field sheets were reviewed and they show deep water a relatively short distance offshore of the site, but the scale (1:96,000) is such that site details are not well defined.

Wind and Wave Conditions

The lighthouse station is on an exposed tip of the island and will experience frequent rough conditions under winds coming from the north through to the south. Figure 3 shows the monthly distribution of the mean and standard deviation of wind speed and wave heights for the NOAA buoy in East Superior. These plots were produced from data measured over an eighteen year period (1990-2008). Within one standard deviation wave heights exceeded 3m in each month.

Water Levels

Water levels on Lake Superior fluctuate on seasonal, short-term, and long-term bases. Briefly, seasonal fluctuations reflect the annual hydrologic cycle which is characterized by higher net basin supplies during the spring and early part of summer with lower supplies during the remainder of the year. Figure 4 is a hydrograph for Lake Superior showing long-term mean monthly water levels with respect to chart datum. It can be seen from Figure 4 that water levels generally peak in the late summer (August-September) with the lowest water levels generally occurring in the spring (March). The average annual water level fluctuation is approximately 0.35 metres.

Short-term fluctuations last from under an hour up to several days and are caused by local meteorological conditions. These fluctuations are most noticeable during storm events when barometric pressure differences and surface wind stresses cause temporary imbalances in water levels at different locations on the lake. MNR (1989) investigated storm surges throughout the Great Lakes as part of their analysis of extreme water levels for design conditions. They determined that storm surges in the order of 0.4m occur annually in the vicinity of Michipicoten Harbour. Surges will be noticeable at Michipicoten Island, but they will be smaller in magnitude than those at Michipicoten Harbour because of the island's location.

Long-term water level fluctuations on the Great Lakes are the result of persistently high or low net basin supplies. More than a century of water level records show that there is no consistent or predictable cycle to the long-term water level fluctuations. Figure 5 shows Lake Superior's mean monthly water levels from 1918 to 2013. Both long-term and seasonal fluctuations can be seen in Figure 5. Storm surges are not discernable in monthly mean data.

The water level during our site review was approximately 183.6m IGLD1985. There was an easterly wind which would not have caused any wind setup and may have caused a minor set-down at the eastern end of the lake. Figure 4 shows that water level to be above the average mean water level so it would be prudent to assume that the berth depths described above are maximum depths.

Marine Access Requirements

The marine access requirements were provided to us in general terms only; there was not a specific list of equipment that was required to be taken to the island and the material to be removed was not quantified. It is our understanding that at present only scaffolding is to be taken to the island. At a later date an excavator will be required and bagged soil will be removed.

The size of the excavator that can be taken to the island and the size of soil bags to be removed will be limited somewhat by access constraints, as described below.

Marine Access Alternatives

The marine access alternatives at this site are limited due to the jagged rock shoreline and the size of the existing dock and breakwall. It is our understanding that when this site was operational it was supplied and serviced by a small boat, described as a landing craft type vessel with an azimuth thruster propulsion system, with a shallow draft that could be berthed alongside the breakwall (Photos 2 and 3) or dock (Photo 4). It had a flat deck and was capable of carrying approximately 5 tons of cargo. The landing craft was carried aboard a coast guard ship and launched with a derrick once it was offshore of Michipicoten Island. The landing craft then shuttled people and material to and from the supply ship and the lighthouse station.

Using a similar operation is the only practical marine access alternative for this site. The landing craft vessel is too small to travel to Michipicoten Island on its own so it will need to be transported there by barge and tug. The tug size will be dictated by the risk of inclement sea conditions, which in turn is dependent upon the time of year the work is done. The closest port with suitable equipment to do this is Sault Ste. Marie. For a large project you might get competitive prices for marine equipment out of Thunder Bay or one of the lower lakes, but it is not certain to be the case here. Travel time from Sault Ste. Marie to Michipicoten Island is approximately 18 hours for a tug pulling a large barge. In case of rough seas the barge and tug can seek shelter in Quebec Harbour (Figure 1).

The landing craft can be assumed to have a cargo capacity in the order of 4.5 tonnes, based on the vessel previously used by the Coast Guard. That will limit the size of the excavator that that can be taken to the island to a class described as mini-excavators. The landing craft can be fitted with a ramp to allow access to the island via the cobble beach on the south side of the breakwall (Photos 2 and 3). Whether the landing craft uses the breakwall or the dock (Photo 4) will depend upon wave conditions at that time.

There are two reasonable methods of removing excavated soil from the island. One is to have the excavator place the soil in 1 or 2 cubic metre bags and transport the bag to the landing craft. The other is to place the excavated soil in small bags and hand-bomb them to the landing craft where they are then placed in larger bags. The bags (either option) will be shuttled out to the barge and placed on the barge with its crane.

For marine work at remote locations it is standard practice to have a faster safety boat on standby in case of an accident or medical emergency. Given the distance out to Michipicoten Island and the possibility of rough seas, it would be more appropriate to use a standby helicopter. Wilderness Helicopters in Wawa requires a minimum daily charge of 4 hours to keep a helicopter available for emergency service.

Project Timing

The best time of year to complete this work, in terms of marine access, is during the months of July and August when the annual water cycle is likely to be at its highest (maximize berthing depth) and wind speeds and wave heights are typically at their lowest. However, Figure 3 shows that inclement conditions can occur even during those months. Contractors will make their own estimate of the level of risk of downtime that they are willing to accept, and that will manifest itself in their tender prices. That risk, and hence tender prices, will increase for the non-summer months but their extent cannot be accurately estimated at the concept level of this analysis.

Closing Comments

We trust that this letter provides sufficient details about the coastal conditions and access alternatives for the Michipicoten Island lightstation. Please contact the undersigned if you have any questions or comments.

Yours truly,
Shoreplan Engineering Limited

Bruce Pinchin, P. Eng.

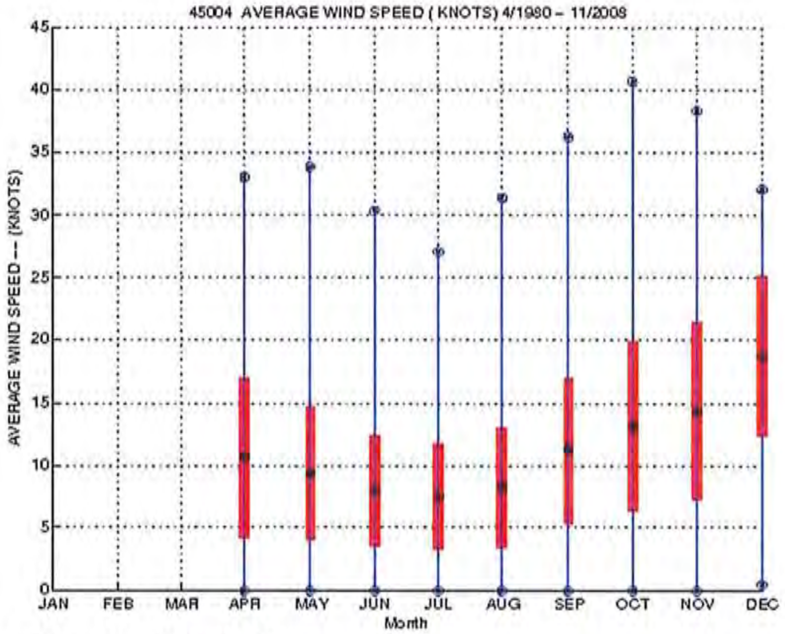
LICENSED PROFESSIONAL ENGINEER
B. M. PINCHIN
May 11, 2017
PROVINCE OF ONTARIO

Figure 1 **Location Plan, Michipicoten Island Lighthouse**

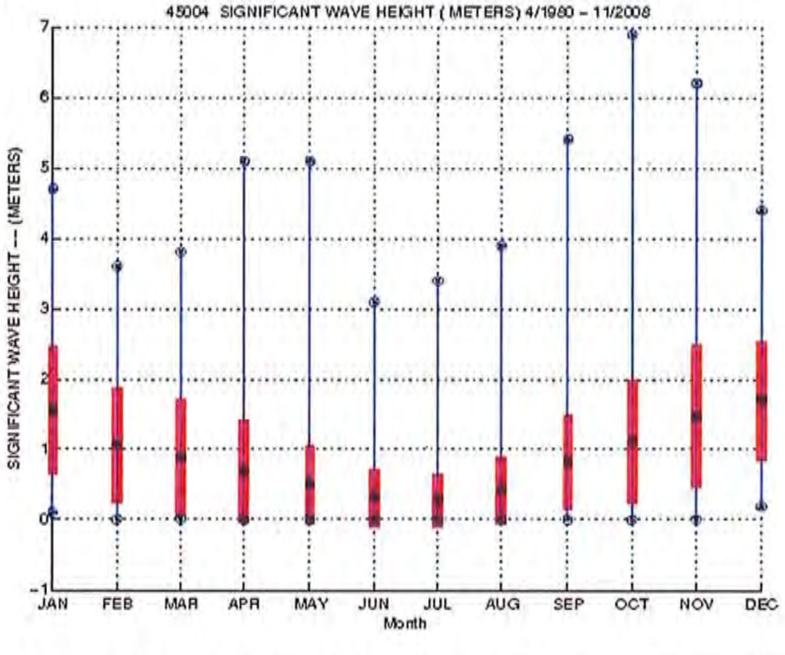
Figure 2 Site Plan

SHOREPLAN

Figure 3 Wind and Wave Climatic Summaries, East Superior



Mean and Standard Deviation Plots



from National Oceanic and Atmospheric Administration, U.S. Department of Commerce

Figure 4 Lake Superior Annual Hydrograph

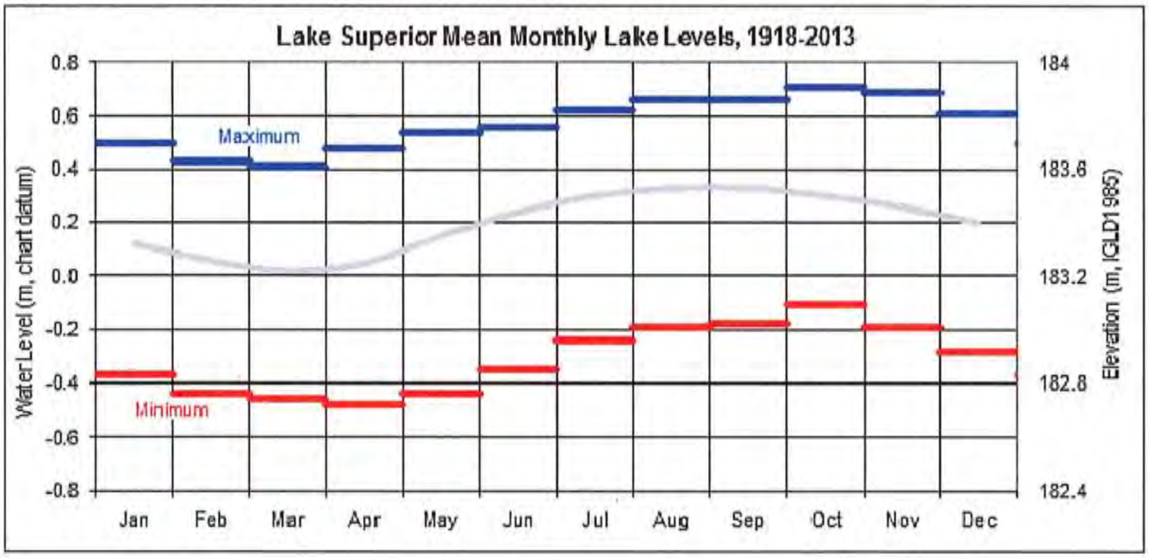


Figure 5 Long-Term Mean Monthly Water Levels

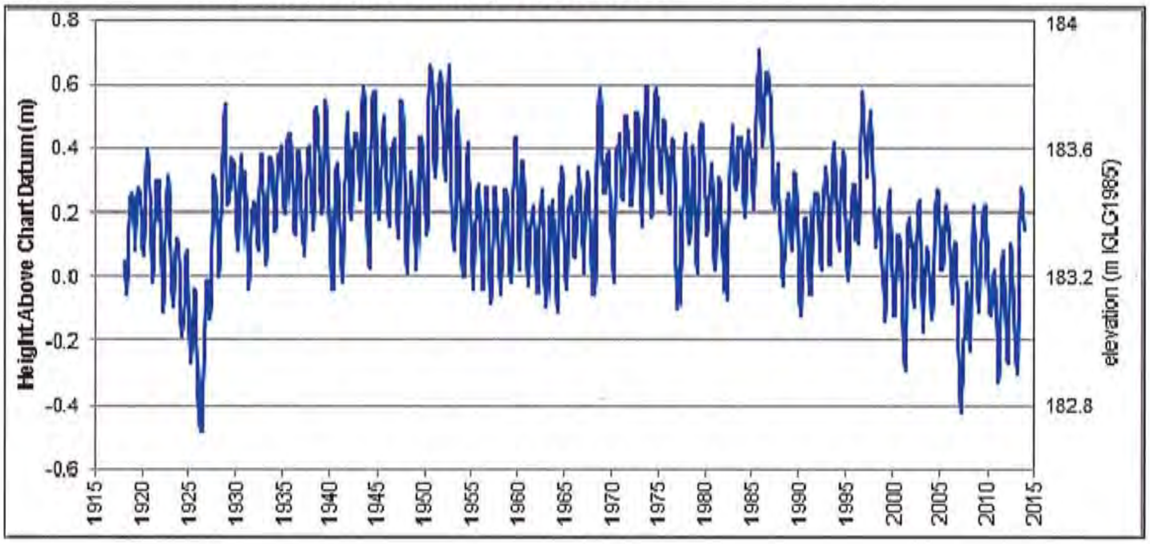


Photo 1 **Northerly Looking View of Lightstation**

Photo 2 **Westerly Looking View of Breakwall and Channel**

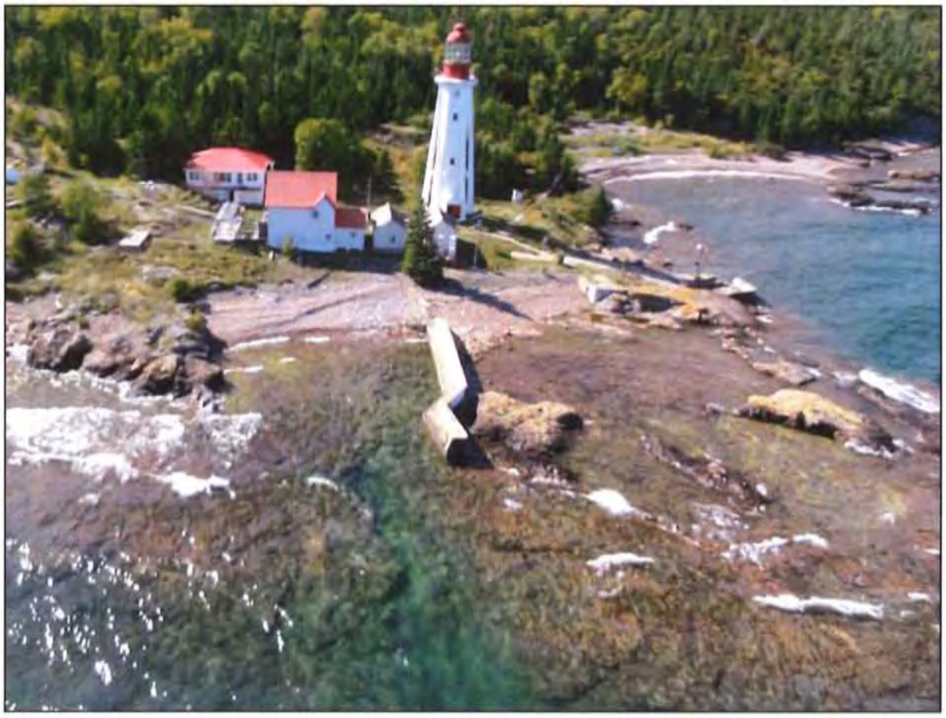
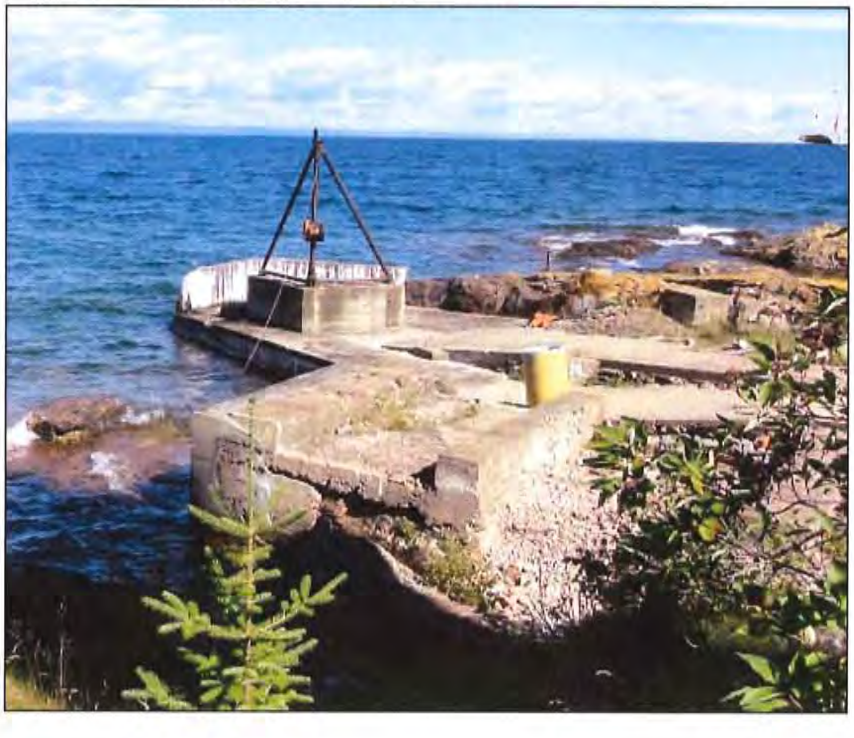


Photo 3 **Cobble Beach on South Side of Breakwall**

Photo 4 **Dock North of Lighthouse**



APPENDIX D

Ecological Assessment

DFRP# 67652
FCSI# 67652001 & 67652002

Michipicoten Island

Ecological Risk Assessment of East End Light Station and Surrounding Area

Prepared for:
BluMetric

Prepared by:
Bowfin Environmental Consulting Inc.
168 Montreal Road
Cornwall, ON
K6H 1B3

March 2017

List of Acronyms and Definitions

ABBO-Atlas of Breeding Birds of Ontario
CC- Co-Efficient of Conservation
COSEWIC- Committee on the Status of Endangered Wildlife in Canada
DBH- diameter-at-breast height
ELC- Ecological Land Classification
ERA- Ecological Risk Assessment
IBA-Important Bird Areas
LAMP-Lake Superior Lakewide Action and Management Plan
LIO- Land Information Ontario
MBCA- Migratory Bird Convention Act
MNRF- Ministry of Natural Resources and Forestry
NHRM- Natural Heritage Reference Manual
NWA- National Wildlife Areas
NHIC- Natural Heritage Information Centre
OMNR/MNRF - Ontario Ministry of Natural Resources (old name)
-Ministry of Natural Resources and Forestry (new name)
OWES-Ontario Wetland Evaluation System
PSW- Provincially Significant Wetlands
SAR- Species at Risk (provincial and federal listed endangered and threatened species)
SARA- Species at Risk Act
SARO – Species at Risk in Ontario
SWH- Significant Wildlife Habitat
SWHTG- Significant Wildlife Habitat Technical Guide
SWH4ECS- SWH 4E Criterion Schedule

SRANK DEFINITIONS

S1	Critically Imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2	Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3	Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	Apparently Secure; uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	Secure; Common, widespread, and abundant in the nation or state/province.
?	Inexact Numeric Rank—Denotes inexact numeric rank
SNA	Not Applicable, A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

S#B	Breeding
S#N	Non-Breeding

SARA STATUS DEFINITIONS

END	Endangered: a wildlife species facing imminent extirpation or extinction.
THR	Threatened: a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC	Special Concern, a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

SARO STATUS DEFINITIONS

END	Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.
THR	Threatened: A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC	Special concern: A species with characteristics that make it sensitive to human activities or natural events.

Coefficient of Conservatism Ranking Criteria

0	Obligate to ruderal areas.
1	Occurs more frequently in ruderal areas than natural areas.
2	Facultative to ruderal and natural areas.
3	Occurs less frequent in ruderal areas than natural areas.
4	Occurs much more frequently in natural areas than ruderal areas.
5	Obligate to natural areas (quality of area is low).
6	Weak affinity to high-quality natural areas.
7	Moderate affinity to high-quality natural areas.
8	High affinity to high-quality natural areas.
9	Very high affinity to high-quality natural areas.
10	Obligate to high-quality natural areas.

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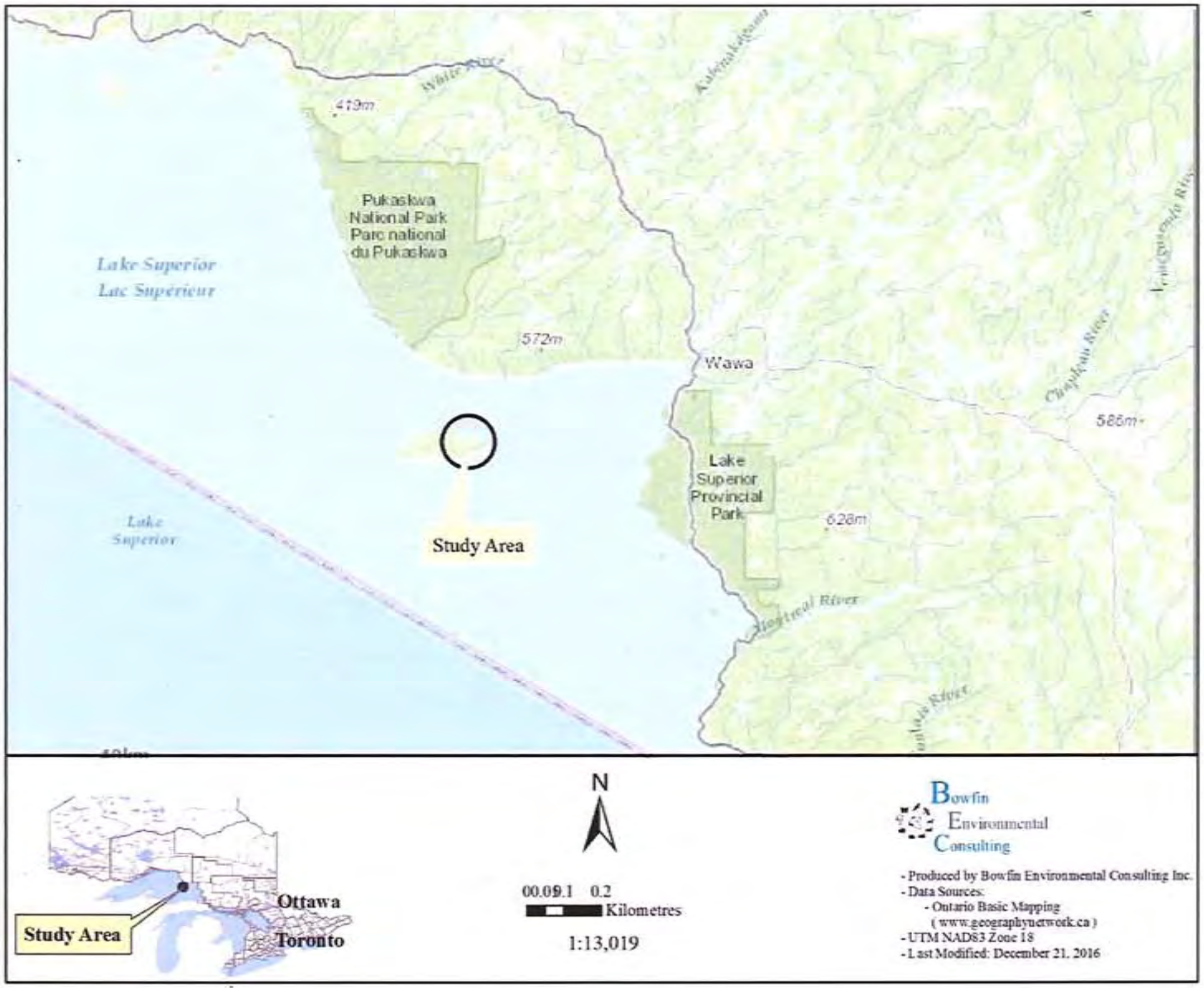
1.0 INTRODUCTION

Bowfin Environmental Consulting Inc. (Bowfin) was retained by BluMetric Environmental Ltd. (BluMetric) to prepare a biological assessment to support an Ecological Risk Assessment (ERA) for the East End Light Station on Michipicoten Island, located on Lake Superior approximately 66 km southwest of Wawa and 14 km south of the nearest shore (Figure 1).

To support the ERA, a site specific habitat assessment was completed. The purpose of this report is to identify potentially significant natural features as well as the potential for Species at Risk (SAR) or their habitats to occur within the study area (Figure 2). It is noted that the timing of the surveys was late September, outside of the growing season which limited the amount of data and type of data that could be collected. The discussion and conclusions reflect the time of year, erring on the side of caution when sufficient data could not be obtained. The following provides a summary of the methods, findings and a discussion with respect to natural features.

Note that the common names are used in this report. Scientific names for all species mentioned are found in Appendix A. Background information and communications are located in Appendix B and the status and ranking of species observed on-site is found in Appendix C.

Figure 1 Location of the Subject Area



2.0 METHODS

Work undertaken for the completion of this project included a background review of existing information and field investigations.

2.1 Background Review

The background review began with preliminary mapping of the vegetation communities as a desktop exercise. A search through available records and consulting reports was then made to gather information on the known natural heritage features within the study area. The following documents were reviewed:

- Jacques Whitford (2006). *Screening Level Risk Assessment.* Canadian Coast Guard Light Station L.L. 1097 Michipicoten Island, East End, Lake Superior, Ontario. Public Works and Government services Canada & The Department of Fisheries and Oceans.

- Lake Superior Lakewide Action and Management Plan (LAMP) (2015) *Lake Superior Biodiversity Conservation Assessment – Volume 2: Regional Unit Summaries – Michipicoten Island*

- Ontario Parks (2004). *Michipicoten Post and Michipicoten Island Provincial Parks Management Planning - Background Information.*

The web sources and their administrative authority were used during the background review:

- Atlas of Breeding Birds of Ontario (ABBO) (partnership between Bird Studies Canada, Ontario Field Ornithologists, Environment Canada and Climate Change, Ontario Nature and Ministry of Natural Resources and Forestry)

- Natural Heritage Information Centre (NHIC) (Ministry of Natural Resources and Forestry)

- Land Information Ontario (LIO) (Ministry of Natural Resources and Forestry)

- Important Bird Areas (IBA) (partnership between Bird Studies Canada and Nature Canada coordinated by BirdLife International)

- Migratory Bird Sanctuaries (MBS) (Environment Canada and Climate Change)

- National Wildlife Areas (NWA) (Environment Canada and Climate Change)

- Aquatic Species at Risk interactive maps (Fisheries and Oceans Canada)
- Species at Risk Public Registry (Government of Canada)
- Species at Risk Ontario (Ministry of Natural Resources and Forestry)

The Ministry of Natural Resources and Forestry (MNRF) Wawa District was contacted for information on SAR (Appendix B).

Discussions with the pilot from the helicopter also provided additional information from a local resident.

There are no official plan schedules or conservation authorities covering this island.

2.2 Field Studies

A single visit was made to the area on September 23, 2016 to look at the terrestrial and inland natural environment. Observations of the nearshore habitat was noted by air but the visit focused on identification of the habitats and collections of incidental observations of both flora and fauna. Information on the ambient conditions during the visit is provided in Table 1.

Table 1 Summary of Dates, Times and Location of Site Investigations

Date	Time (h)	Staff	Air Temperature (Min-Max) °C	Weather	Purpose
September 23, 2016	1015-1500	M. Lavictoire S. St. Pierre	11.0 (5.5-16.4)	35% cloud cover, gentle breeze	-Site Assessment

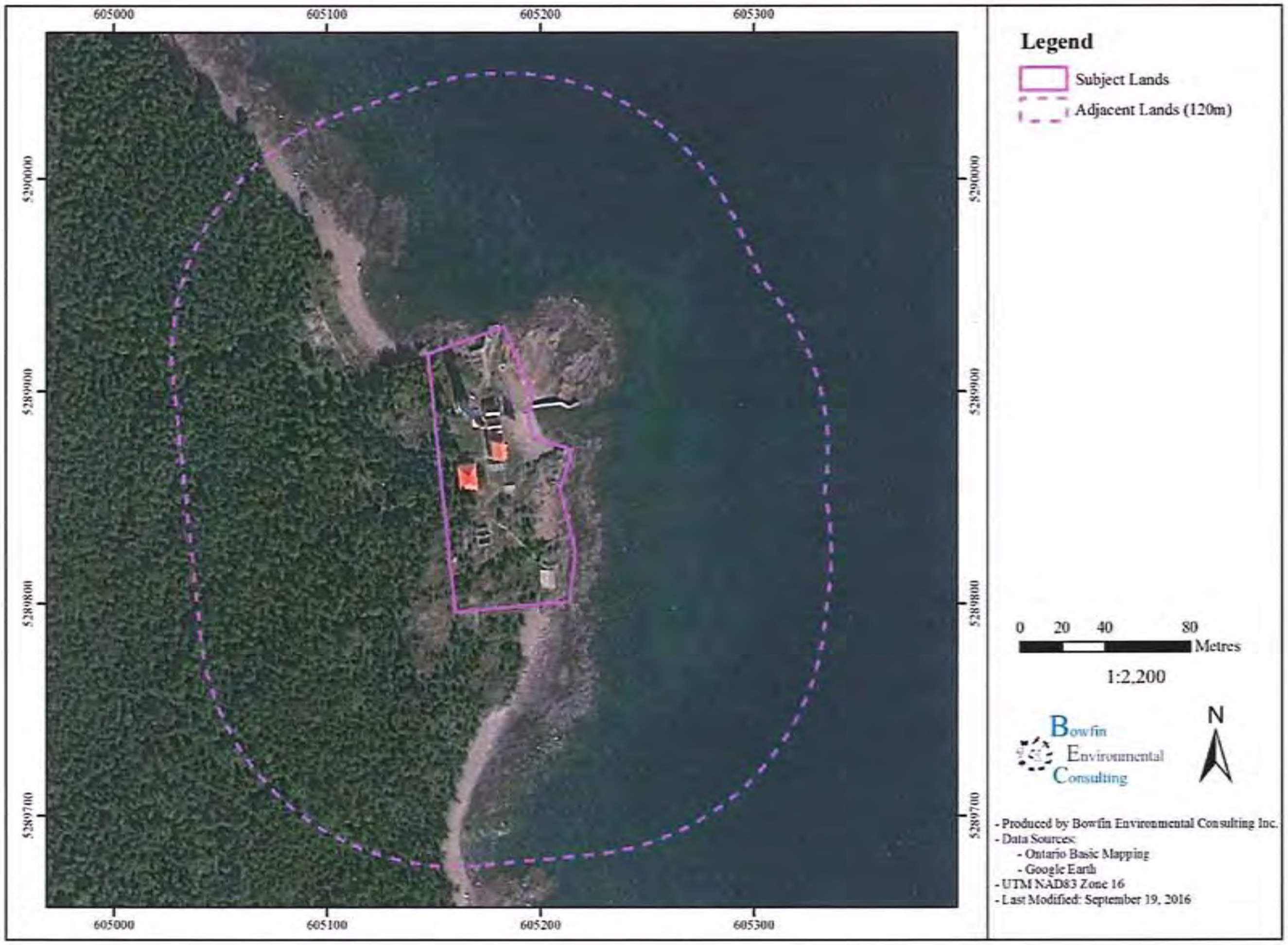
M. Lavictoire – Michelle (Nunas) Lavictoire – M.Sc. Natural Resources, B. Sc. Wildlife Biology
S. St. Pierre – Shaun St. Pierre – B. Sc. Biology and Fisheries and Wildlife Technologist

*Min-Max Temp Taken From: Environment Canada. National Climate Data and Information Archive. Wawa Available http://climate.weatheroffice.gc.ca/ [December 7, 2016]

2.2.1 Study Area

The study area was provided by BluMetric included the developed land. In addition, Bowfin also surveyed the adjacent lands. In this case these were those situated inland, within 120 m of the developed area (Figure 2). Potential to impact the lake environment was also considered through the background review. No field work was undertaken in the lake environment as the Marine Assessment (completed by Shoreplan Engineering Limited January 12, 2017) indicated that there were no proposed in-water works.

Figure 2 **Study Area**



2.2.1 Terrestrial and Wetland Habitat Descriptions and Flora Observations

The field studies were completed by systematically travelling through the study area. Specific habitat types identified during the preliminary mapping exercise were also targeted for community description. Habitat descriptions were based on the appropriate methodologies such as: *Ontario Wetland Evaluation System, Northern Manual* (OWES) for wetland habitats and Ecological Land Classification (ELC) Ecosite codes based on the *Operation Draft - Ecosites of Ontario* (ELCWG 2009) for terrestrial habitats. The Ecodistrict, Ecoregion and Geographic Range maps in the *Ecosites of Ontario* (ELCWG 2009) does not clearly define which areas Michipicoten Island belongs to. However the *Michipicoten Post and Michipicoten Island Background Information* (Ontario Parks 2004) indicates that the site is found in 4E-1 where the Boreal and Great Lakes - St. Lawrence (GLSL) Forest Regions overlap. As such the Ecosite Factsheets for the GLSL were used when describing the communities (versions dated February 25, 2015).

With respect to significant natural environment features, guidance was sought from the *Natural Heritage Reference Manual* (NHRM) and *Significant Wildlife Habitat Technical Guide* (SWHTG) and the *SWH 4E Criterion Schedule* (SWH4ECS). The SWH4ECS links the potential for candidate significant wildlife habitat (SWH) to the Ecosite Factsheets ELC community descriptions. The vegetation communities included in the SWH4ECS was cross-referenced with those observed during the site visit.

The minimum community size was 0.5 ha. A description of smaller habitats was provided only when they contained rare vegetation communities or significant functions.

The OWES definition of wetland habitat is:

> *"Lands that are seasonally or permanently flooded by shallow water as well as lands where the water table is close to the surface; in either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic or water tolerant plants".*

OWES defines the wetland boundary as the location where over 50% of the plant community consists of upland species with the woody vegetation layer (trees and shrubs) taking precedence over the herbaceous layer (MNRF 2013). Furthermore, the presence of large numbers of obligate upland species requires an upland classification. The minimum community size was 0.5 ha. Exceptions would be made if a smaller community with a special feature or function was found (none were).

Sufficient level of detail was collected in order to provide a general habitat description and identify the presence/absence of any of the natural environmental features (terrestrial, wetland or aquatic). The description of the habitats together with the results from the background review was utilized to identify potential SAR which may occur in the area.

As aforementioned, the timing of the surveys was late September, outside of the growing season which limited the amount of data and type of data that could be collected.

Plants that could not be identified in the field were collected for a more detailed examination in the laboratory. Nomenclature used in this report follows the Southern Ontario Plant List (Bradley, 2007) for both common and scientific names which are based on Newmaster *et al.* (1998). Authorities for scientific names are given in Newmaster *et al.* (1998). Specific attention was paid to locating SAR or species of conservation value (any S1-S3 or SH species) listed as potentially occurring within the study area.

2.2.3 Incidental Fauna Observations

Any wildlife observations were recorded. Incidental observations included observations of an individual, its tracks, burrows, feces and/or kill sights.

3.0 RESULTS

3.1 Setting

The study area is situated on the east tip of Michipicoten Island in an area referred to as Point Maurepas. This land is federal and does not form part of the Michipicoten Provincial Park. The surrounding lake habitat within 2.5 km of the island does form part of the provincial park. The habitats within the study area were fairly uniform and consisted primarily of coniferous forests with some marsh and bedrock inclusions.

3.1.1 Summary of Background Information

Michipicoten Post and Michipicoten Island Provincial Parks Management Planning – Background Information (Ontario Parks 2004) indicated the following information on the island:

- Park was established in 1985.
- Park boundary excludes Federal Lands
- Situated in the 4E-1 Ecodistrict on the northwest boundary of the Algoma Forest of the Great Lakes-St. Lawrence Forest Region.
- The precipitation on the island is strongly influenced by Lake Superior.
- There are no provincially significant breeding birds recorded in the park.

- There have been sightings of sandhill cranes and bald eagles (no breeding information).
- Woodland caribou are present on the island consisting of both naturally occurring and transplanted individuals.
- Amphibians in the park include the spotted salamander (regionally significant for Ecoregion 4E).
- The rocky shoreline is considered a potential provincially significant feature due to the possibility of significant plants.
- The shoreline of the park contains lake trout spawning beds and is fished for lake trout, Coho and Chinook salmon, herring and whitefish.
- The provincially rare pygmy whitefish has been documented on the eastern side.

The following information was found from a section of the *Lake Superior Biodiversity Conservation Assessment – Volume 2: Regional Unit Summaries – Michipicoten Island* (LAMP 2015). This report indicated the following:

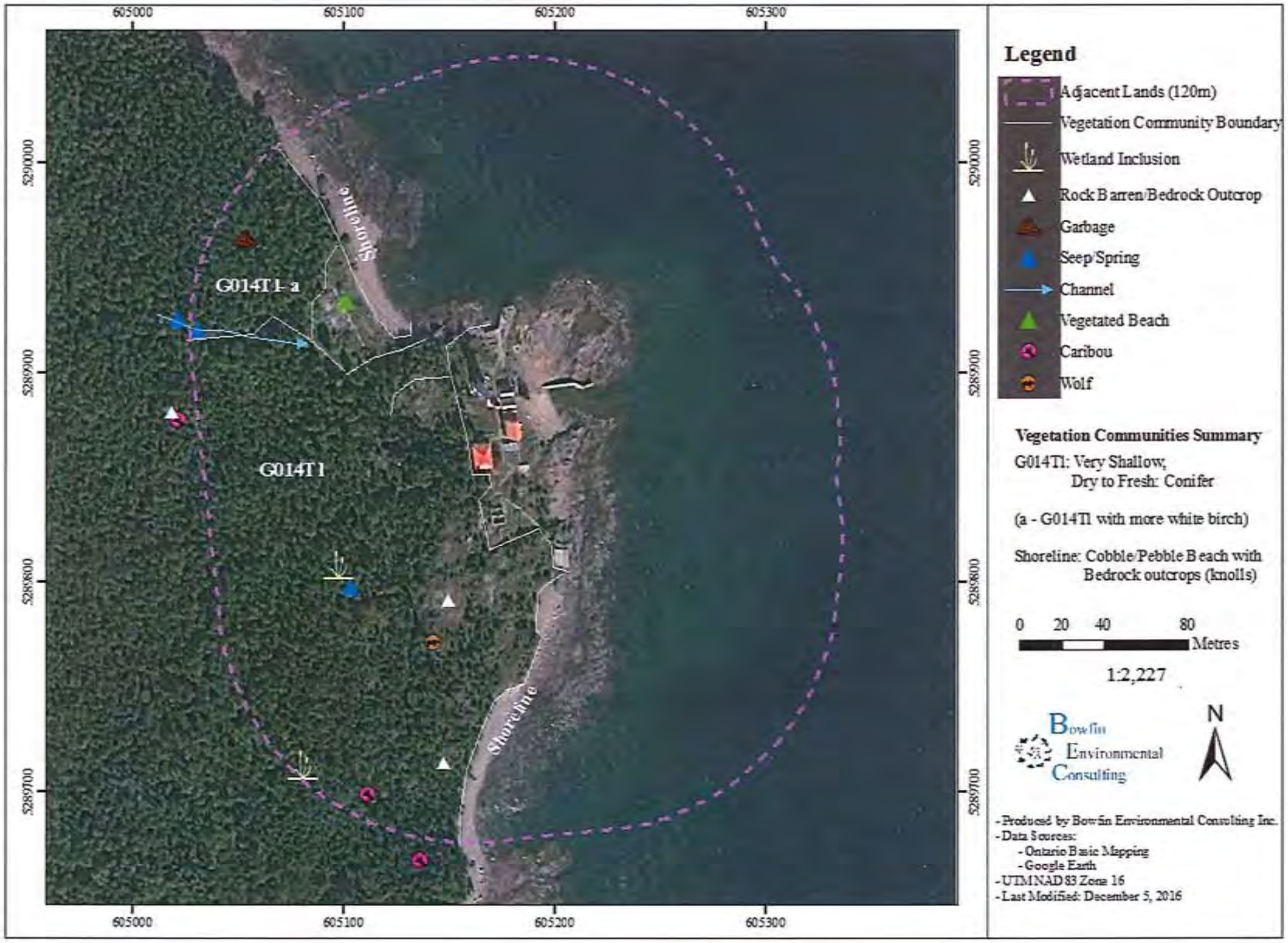
- Michipicoten Island shoreline consists of high cliffs and cobble beaches. The rocky shoreline is known to have provincially and regionally significant plants and communities.
- Lake trout spawning beds are present around the island.
- Fish community, which forms part of a sport fishery, includes: lake trout, Coho salmon, Chinook salmon, cisco and lake whitefish. Note that the prime areas for this fishing were not adjacent to the study area but rather along the south and southwestern shores.
- Pygmy whitefish is also found around the island.
- Lake whitefish spawning bed is noted in Quebec Harbour (south shoreline).
- The Lake Superior Binational Program Habitat Committee listed the island as an Important Habitat Area.
- Caribou population was extirpated in the 1800s. Since then it has become re-established from a naturally occurring male along with eight translocated individuals. In 2013, it was estimated that 400-500 individuals are present.
- 10 species and communities of conservation concern are present. Of these 3 are currently present: American Dun Grass-Beach Pea – Sand Cherry Dune Grassland Type, Alga Pondweed and Woodland Caribou. Only the Woodland Caribou was present within the study area. Historical records also identified: shortjaw cisco, blue wild rye, boreal bedstraw, deepwater sculpin, Braun's holly fern, oval-leaved blueberry and alpine woodsia.

LIO indicated that a small non-evaluated wetland was present but this was over 1.5 km from the study area and no provincially significant wetlands (PSW) in or near the study area. (Appendix B).

The Jacques Whitford (2006) report listed several potential flora that were ranked as S1-S3. These are called special concern and rare in the SWH4ECS which is misleading as they are not listed as a Special Concern under the *Endangered Species Act* rather this descriptor is related to the SRanking. They do not receive formal protection and are referred to herein as species of conservation value (Appendix A). Jacques Whitford's site visit took place during August 31, 2005. They did not find any SAR or species of conservation value within their study area.

Discussions with the helicopter pilot (a local resident) indicated that in some winters the island is connected to mainland by ice.

Figure 3 Vegetation Communities and Summary of Findings



3.1.2 Vegetation Communities

The following section provides a summary of the terrestrial and wetland habitats encountered in the primary study area. The community boundaries are based on satellite image interpretation; no on-site delineation was undertaken.

Photo 1 Overall view of habitats (September 23, 2016)

Very Shallow, Dry to Fresh: Conifer (G014Tl)

The entire study area consisted of the same type of community, a very shallow (soil) dry to fresh (moisture regime) and conifer forest. The topography consisted of bedrock hills with soil depth of <15 cm. The portion to the north (labelled as "a" on Figure 3) contained a higher percentage of deciduous tree species but the conifer species still comprised of 50% resulting in a conifer designation (using this ELC manual). This area had a canopy that was 8-10 m tall and provided 75-90% cover. The dominant species was balsam fir followed by white birch and the white spruce. The sub-canopy (4-6 m tall; 60% cover) contained the same species in the same order of dominance. The understory (0.5-2.0 m; 40% cover) included balsam fir, thimbleberry which were much more abundant than red-osier dogwood and bunchberry. The ground cover (30%) consisted mostly of moss with some lichen.

The remainder of the natural vegetation (labelled as b on Figure 3) was shorter (4-6 m tall) and more open (40-60% cover). This layer was strongly dominated by white spruce with the occasional white birch, and yellow birch. The understory (0.1 m-1.0 tall; 5-10% cover) was sparse and was vegetated mostly by low-sweet blueberry, purple flowering raspberry and regenerating spruce and white birch. The ground layer was dense (90%) and consisted mostly of moss, lichen with some bunchberry, starflower, large cranberry, low sweet blueberry and partridge berry.

Photo 2 Very Shallow, Dry-Fresh: Conifer (a) (September 23, 2016)

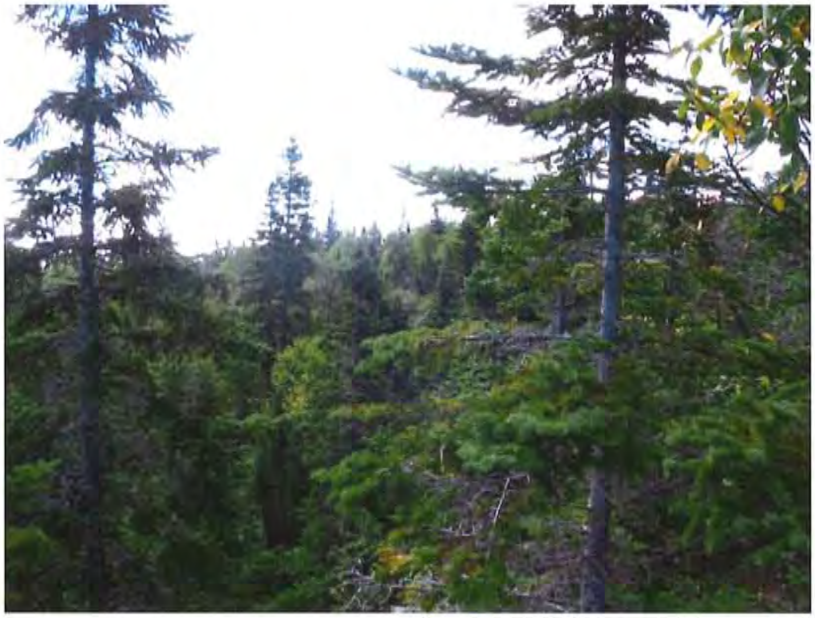


Photo 3 Very Shallow, Dry-Fresh: Conifer (b) (September 23, 2016)

Photo 4 Garbage pile near buildings in the Very Shallow, Dry-Fresh: Conifer community (September 23, 2016)

Included within this community were very small wetlands and bedrock outcrops or rock barrens. Their general locations are identified on Figure 3. The first wetland (north symbol) was a tall shrub swamp with four vegetation forms. The tall and low shrub forms consisted entirely of red-osier dogwood. The narrow emergents included reed canary grass, Canada blue-joint and fowl glyceria. The fourth layer was moss. There was water present (potentially from ground water but no iron precipitation was noted). Water temperature was 10°C. Beaver activity (stumps) was noted.

Photo 5 Tall Shrub Inclusion (north) (September 23, 2016)

The second wetland was even smaller (roughly 40 m^2) and consisted of a tall shrub swamp with two vegetation forms. The tall shrub layer included red osier dogwood and thimbleberry. The second layer was moss. While other species such as Canada blue-joint were present, they did not provide sufficient cover to be included in the description. Surface water was present but there were no channels and there was a lot of blowdown.

Photo 6 Tall Shrub Inclusion (south) (September 23, 2016)

Also present to varying sizes were several rock outcrops and an area that may meet the definition of a rock barren. The larger of these have been depicted on Figure 3. These contained exposed bedrock with lichen cover. The north site was only 5 m^2. Other species noted were bracken fern, starflower and bunchberry. Caribou feces were also found here. The south barren was similar in size and composition the one to the north. The bedrock feature in the middle was the largest and is discernable on the satellite imaging. Its size is likely due, at least in part, to human disturbances as remnant pieces of equipment and cables were found (clearing of vegetation associated with the light house compound). The exposed bedrock was covered by moss and lichen (40%). Also species included grasses, roses, low sweet blueberry. Wolf feces were noted here. The vegetation cover may be above 25% in which case this larger area would not meet the rock barren definition. Again, its presence is likely the result of human disturbances as opposed to naturally occurring.

All bedrock habitats could have the potential for species of conservation value and should be considered potential SWH habitat until a survey is completed during the growing season.

Photo 7 Larger rock barren near helicopter pad (September 23, 2016)

Shoreline

The shoreline within the study area consisted of bedrock knolls or cobble/pebble beaches. The beach on the north side of the study area was the only area with a variety of vegetation types; transitioning from the rock beach to narrow strips of grass then to broad-leaf species and finally into the forest community. Some of the species observed included: grasses (could not be identified at this time of year), hawkweed, pearly everlasting, bunchberry, and tall buttercup. Given the potential for species of conservation value to occur this area should be considered potential SWH habitat until a survey is completed during the growing season.

Photo 8 **Rock shoreline (September 23, 2016)**

Photo 9 **Potential habitat for some Flora of conservation value (September 23, 2016)**

3.1.3 Watercourses

There were no watercourses found with the exception of a short channel created from what appeared to be a seep (no iron precipitate was observed). This channel was identified on the edge of the adjacent lands to the north of the study area. It did not reach the shoreline (Figure 3). The water temperature was 12°C. The wetted width was 31 cm and the average depth was 3 cm. The substrate and gradient created run and step morphological units.

The amount of water observed may have been the result of recent rainfall; there was 18.2 mm of rainfall in the week prior to the site investigations (Table 2). It is noted that the rainfall in much of Ontario was low during the summer of 2016. The nearest conservation authority is Sault Ste. Marie Region Conservation Authority and they indicated that water levels were seasonally low in their areas (Appendix B). While background information indicates that Michipicoten Island's precipitation is different from mainland due to the influence of the Lake (Ontario Parks 2004), it is reasonable to assume that water levels were lower than normal in which case the rainfall prior to the visit may have had less impacts on water levels then during more typical years.

Table 2 Summary of Rainfall from the nearest Rain Gage

Dates	Total Rainfall (mm)
September 16, 2016-September 23, 2016	18.2

Total Rainfall taken from: Environment Canada. 2016. National Climate Data and Information Archive – Sault Ste. Marie Airport (located 165 km to the south east of the project area). On-line (http://climate.weatheroffice.gc.ca)

Photo 10 Channel (September 23, 2016)

3.3 Wildlife Observations

A list of wildlife observations for the Study area is located in Appendix C. As indicated above evidence of caribou and wolf in the area was noted (feces) as were beaver (stumps). There were also some areas on the south side with heavier use by caribou where trails and more abundant feces were noted (Figure 3).

Other species noted consisted of birds: bald eagle, American pipit, blackburnian warbler, black-capped chickadee, palm warbler, pine warbler and yellow-rumped warbler. All of these but the bald eagle is considered to be common species (S4 to S5 ranking signifying that they are apparently secure to secure in Ontario) (Table 3). The bald eagle is listed as S2 (signifying that it is imperiled in Ontario). It is also a Special Concern species (provincially). Note that the background information indicates that there are no known significant breeding bird nesting or bald eagle nests on the island (Ontario Parks 2004).

While no significant wildlife habitat (SWH) listed under the SWH4ECS was confirmed, the vegetation and habitats encountered could be considered to provide candidate SWH for: bat hibernacula, reptile hibernacula, woodland raptor nesting habitat, seeps and springs, denning sites and/or mast producing areas. These are discussed under Section 4.0.

Table 3 Summary of Ranking and Status of Observed Wildlife

Common Name	*Scientific Name*	SRank[1]	Provincial Status (SARO)	Federal Status (SARA)
BIRDS				
Bald Eagle	*Haliaeetus leucocephalus*	S2N, S4B	SC	
Black-capped Chickadee	*Poecile atricapilla*	S5		
Red-breasted Nuthatch	*Sitta canadensis*	S5		
American Pipit	*Anthus rubescens*	S4		
Yellow-rumped Warbler	*Dendroica coronata*	S5B		
Blackburnian Warbler	*Dendroica fusca*	S5		
Pine Warbler	*Dendroica pinus*	S5		
Palm Warbler	*Dendroica palmarum*	S5		
Dark-eyed Junco	*Junco hyemalis*	S5B		
MAMMALS				
Beaver	*Castor canadensis*	S5		
Grey Wolf	*Canis lupus*	S4		
Woodland Caribou	*Rangifer tarandus caribou*	S4	THR	THR

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[1] See pages 2 & 3 for definitions of SRank, SARA and SARA status

3.4 Plant Observations

A total of 64 species were identified of which 68% were native and all were ranked at a value higher than S4[2] with the exception of oval-leaved blueberry (Table 4). This S2 ranked species was noted throughout the study area. S2 indicates that it is considered to be imperiled.

Other species that were observed include those that, according the SWH4ECS, indicate the potential of three SWHs: cliff and talus slopes, rock barrens and Great Lakes Arctic-Alpine Shoreline type. Of these indicator species for the first two were documented on-site (see list below). These three candidate SWHs are discussed in section 4.0.

- Cliff and Talus Slopes
    - Rock Polypodium Fern
    - Low Sweet Blueberry
    - Bearberry
    - Bush Honeysuckle
    - White Birch
    - Trembling Aspen

- Rock Barren
    - Wild Sarsaparilla
    - Eastern Bracken Fern
    - Low Sweet Blueberry
    - Wild Red Raspberry
    - Thimbleberry
    - Bush Honeysuckle
    - White Bird
    - Trembling Aspen
    - Bearberry

The number of non-native species is slightly high (33%) but this is reflective of the species recorded from the compound (sites with more than 70% native species are generally considered to be less disturbed). The Co-efficient of Conservatism (CC) of the species recorded provides information on the species' tolerance to disturbance; those species with a high CC (maximum of 10) are highly sensitive. The average CC for this site was 5.0 which would place it in the moderate side of the sensitivity. The majority of the species had a CC value of 6 or lower (74%). There were two species with a CC value of 9 or higher; large cranberry and Labrador tea. The cranberry was found on a bedrock knoll along the shoreline and the Labrador tea near the edge of the forested area.

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[2] SRanks is a method of classifying a species rarity within a jurisdiction. In Ontario those with a SRank of S1-S3 are considered extremely rare to uncommon and S4 – S5 are common to widespread. Additional information on pages 2 & 3.

Table 4 List of Plant Species Observed

Common Name	*Scientific Name*	SRank	Provincial Status (SARO)	Federal Status (SARA)	Coefficient of Conservatism
PLANTS					
Lichen sp.	*Lichen sp.*				
Mosses Sp.	*Bryophyta*				
Plume Moss	*Ptilium sp.*				
Peat Moss sp.	*Shagnum sp.*				
Eastern Bracken Fern	*Pteridium aquilinum var. latiusculum*	S5			2
Northern Lady Fern	*Athyrium filix-femina var. angustum*	S5			4
Rock Polypody Fern	*Polypodium virginianum*	S5			6
Common Juniper	*Juniperus communis*	S5			
Balsam Fir	*Abies balsamea*	S5			5
White Spruce	*Picea glauca*	S5			6
Black Spruce	*Picea mariana*				8
Red Maple	*Acer rubrum*	S5			4
Sugar Maple	*Acer saccharum*	S5			4
Staghorn Sumac	*Rhus typhina*	S5			1
Wild Sarsaparilla	*Aralia nudicaulis*	S5			4
Common Yarrow	*Achillea millefolium ssp. Millefolium*	SNA			0
Pearly Everlasting	*Anaphalis margaritacea*	S5			3
Large-leaved Aster	*Aster macrophyllus*	S5			5
Meadow Goat's-beard	*Tragopogon pratensis ssp. Pratensis*	SNA			
May-apple	*Podophyllum peltatum*	S5			5
Speckled Alder	*Alnus incana spp. rugosa*	S5			6
Yellow Birch	*Betula alleghaniensis*	S5			6
White Birch	*Betula papyrifera*	S5			
Harebell	*Campanula rotundifolia*	S5			7
Bush Honeysuckle	*Diervilla lonicera*	S5			5
Red-berried Elderberry	*Sambucus racemosa ssp. Pubens*	S5			5
Maple-leaved Viburnum	*Viburnum acerifolium*	S5			6
Mooseberry	*Viburnum edule*	S5			
Bunchberry	*Cornus canadensis*	S5			7
Red-osier Dogwood	*Cornus stolonifera*	S5			2
Bearberry	*Arctostaphylos uva-ursi*				8
Labrador-tea	*Ledum groenlandicum*				9
Low Sweet Blueberry	*Vaccinium angustifolium*	S5			6

Common Name	*Scientific Name*	SRank	Provincial Status (SARO)	Federal Status (SARA)	Coefficient of Conservatism
Large Cranberry	*Vaccinium macrocarpon*	S4S5			10
Velvet-leaf Blueberry	*Vaccinium myrtilloides*	S5			7
Oval-leaved Blueberry	*Vaccinium ovalifolium*	S2			
White Clover	*Trifolium repens*	SNA			
Wild Black Currant	*Ribes americanum*	S5			4
Common St. John's-wort	*Hypericum perforatum*	SNA			
Willow-herb sp.	*Epilobium*				
Swamp Candles	*Lysimachia terrestris*	S5			6
Starflower	*Trientalis borealis ssp. borealis*	S5			6
Canada Anemone	*Anemone canadensis*	S5			3
Tall Buttercup	*Ranunculus acris*	SNA			
Common Strawberry	*Fragaria virginiana ssp. virginiana*	S5			2
Three-toothed Cinquefoil	*Potentilla tridentata*	S5			
Cherry sp.	*Prunus sp.*				
Rose sp.	*Rosa sp.*				
Wild Red Raspberry	*Rubus idaeus ssp. strigosus*	S5			0
Thimbleberry	*Rubus parviflorus*	S4			7
Showy Mountain-ash	*Sorbus decora*	S5			8
Partridge Berry	*Mitchella repens*	S5			6
Trembling Aspen	*Populus tremuloides*	S5			
Willow sp.	*Salix sp.*				
Upland Willow	*Salix humilis*	S5			7
Common Mullein	*Verbascum thapsus*	SNA			
Chives sp.	*Allium sp.*				
Bluebead Lily	*Clintonia borealis*	S5			7
Wild Lily-of-the-valley	*Maianthemum canadense*	S5			5
Canada Blue-joint	*Calamagrostis canadensis*	S5			4
Fowl Glyceria	*Glyceria striata*	S4S5			3
Cut Grass sp.	*Leersia sp.*				
Reed Canary Grass	*Phalaris arundinacea*	S5			0
Timothy	*Phleum pratense*	SNA			

Updated December 19, 2016

4.0 Species at Risk

4.1 SAR Discussion

Species at Risk (SAR) can include both species listed as endangered or threated federally on Schedule 1 of the *Species at Risk Act* (SARA) or provincially on the *Endangered Species Act* (ESA). Federally protected species, other than fish, are only protected on Federal Lands. Note that nests of many birds species, including those listed under SARA, are protected under the *Migratory Bird Convention Act* (MBCA) on all lands. The provincially protected species are protected on provincial, private and in some cases on Federal Lands.

The following list of SAR was completed by analyzing the information available from federal and provincial databases as well as from the background information. The distribution ranges were determined using a variety of sources including: COSEWIC (Committee on the Status of Endangered Wildlife in Canada) reports, ABBO and the Species at Risk Ontario, Ontario Reptile and Amphibian Atlas and Aquatic species at risk websites. The provincial species added to this list included those identified by the Ministry of Natural Resources and Forestry (MNRF) as occurring within the area. Note that little information was present for the island itself as such if the distribution included the surrounding mainland then the species was included. It is noted that ice bridges to the island do periodically occur between mainland and the island providing access.

The resulting species list includes 20 species: 2 fish (lake sturgeon, and shortjaw cisco), 10 birds (American white pelican, golden eagle, whip-poor-will, common nighthawk, chimney sift, olive-sided flycatcher, bank swallow, barn swallow, Canada warbler and bobolink), 6 mammals (woodland caribou, wolverine, American badger, little brown myotis (bat), northern myotis (bat) and tri-coloured bay), 1 lichen (flooded jellyskin) and 1 plant (Pitcher's thistle) (Table 5).

Those species highlighted in red are those who have been documented on the island and those in orange in Table 4 are those whose habitat is present and may occur within the study area. Note that only the Woodland Caribou was confirmed to be present during the site investigations.

Fish

Lake Sturgeon (*Acipenser fulvescens*) Provincial Status - Threatened; Federal – No Status

Lake sturgeon does not receive any federal protection however it is listed as Threatened by the province and as such it is considered herein. Lake sturgeon spawn in fast flowing water such as rapids. The adults are typically captured on shoals in depths of 4.6-9.2 m and the young on gravelly or sandy shoals at the mouths of rivers (Scott and Crossman 1979). While the spawning habitat would not be present, there is a potential for adults to be present.

Shortjaw Cisco (*Coregonus zenithicus*) Provincial Status - Threatened; Federal - Threatened

The shortjaw cisco is a Threatened species protected by bot the provincial and federal legislations. This species is a lake dweller found mostly in the great lakes and in a few large lakes. It has been found on the west side of Michipicoten Island (MNRF). This species is considered present.

Birds

American White Pelican (*Pelecanus erythrorhynchos*) - Provincial Status - Threatened; Federal – No Status

The American white pelican is listed as a Threatened species provincially. In Ontario, its nesting sites tend to be located in areas that are isolated from the mainland and have ready access to prey. There is some question as to whether they prefer treed islands as the lack of trees on some sites may be the result of long-term use by colonial nesters. At this time, they have only been documented on islands far to the west of the study area (American White Pelican Recovery Team 2011). This species is considered absent from the study area.

Golden Eagle (*Aquila chrysaetos*) - Provincial Status - Endangered; Federal – No Status

The Golden Eagle is an Endangered species provincially. In Ontario, its breeding habitat is principally on the edge of the tundra and boreal forest and wet meadows. Its preferred habitat is open and semi open areas from meadows, tundra to barrens and woodlands. It tends to avoid heavily treed forests. The existing information on its population does not include the Michipicoten Island area; rather the nearest population is on the west side of Lake Superior (Wyshunski and Pulfer 2015). This species is not considered to occur here.

Whip-poor-Will (*Caprimulgus vociferus*) - Provincial Status - Threatened; Federal - Threatened

The whip-poor-will is protected both federally and provincially as a Threatened species. This well camouflaged species can be found in a multitude of forest types. Its requirements consist of areas that are semi-open forests or sites with a closed forest intermixed with other open habitats. It also needs some areas with little ground cover. Its minimum habitat size requirement is 10 ha (COSEWIC 2009a). There is sufficient woodland within the study area. It should be considered as a potential resident of the woodland habitats within the study area.

Common Nighthawk (*Chordeiles minor)* - Provincial Status - Special Concern; Federal - Threatened

The common nighthawk is protected federally as a Threatened species. It is listed as special concern provincially. This species can occupy a wide range of open habitats including rock barrens. While there are some appropriate habitats in the study area they are likely too small to support nesting of this species whose territory in natural areas is said to be 28 ha (COSEWIC 2007a). This species habitat is considered unlikely to occur.

Chimney Swift (*Chaetura pelagica)* - Provincial Status - Threatened; Federal - Threatened

The chimney swift is protected as a Threatened species both federally and provincially. This species can often be found in developed areas and prefers to utilize structures such as large (>50 cm diameter) trees or man-made structures such as chimneys for its nesting habitat (COSEWICb). This habitat is not present within the study area.

Olive-sided Flycatcher (*Contopus cooperi*) - Provincial Status - Special Concern; Federal - Threatened

The olive-sided flycatcher is protected federally as a Threatened species and is listed as special concern provincially. The preferred habitats for this species are open to semi-open areas including mature forests. In the boreal region the natural habitat is most often associated with wetlands (which provide the open habitat requirements) (COSEWIC 2007c). This habitat is not present within the study area. It is unlikely to be present.

Bank Swallow (*Riparia riparia)* - Provincial Status - Threatened; Federal - No Status

Bank swallows are known to nest in vertical banks including those along riverbanks, and sand pits. This habitat was lacking. This species is considered absent from the study area.

Barn Swallow (*Hirundo rustica)* - Provincial Status - Threatened; Federal - No Status

The barn swallow is not listed federally but is listed as Threatened provincially. It can often be found nesting on man-made structures including bridges. There is a potential for this species to utilize man-made structures for nesting. There is a potential for this species to be present on the buildings. None were noted during the visit.

Canada Warbler (*Wilsonia Canadensis)* - Provincial Status - Special Concern; Federal - Threatened

The Canada warbler is protected as a Threatened species federally and is listed as special concern provincially. The bird can be found in a wide range of forest types but typically prefers wetter, mixed forests with a dense shrub layer and is an area sensitive species requiring 30 ha [*Significant Wildlife Technical Guide Appendix G* – Ontario Ministry of Natural Resources (OMNR)]. There is a potential for this species to occur.

Bobolink (*Dolichonyx oryzivorus*) - Provincial Status - Threatened; Federal - No Status

The bobolink is a grassland breeding bird requiring a minimum of 4 ha of uncut meadow or field. This habitat is not present. This species is considered absent.

Mammals

Woodland Caribou (*Rangifer tarandus caribou*) - Provincial Status - Threatened; Federal - Threatened

The woodland caribou is a Threatened species both provincially and federally. As mentioned previously, there is a known population on Michipicoten Island and evidence of their use of the adjacent lands to the buildings was documented during the site visit. This species is present.

Wolverine (*Gulo gulo*) - Provincial Status - No Status; Federal - Threatened

The wolverine is a provincially listed Threatened species. It is found in forested and tundra habitat in remote areas. In Ontario, its known its historical range included all of Ontario however it is now restricted to the far north (Ontario Wolverine Recovery Team 2013). It is not anticipated to occur within the study area.

American Badger (*Taxidea taxus jacksoni*) - Provincial Status - Endangered; Federal - Endangered

The American Badger is an Endangered species both provincially and federally. It is typically found in grassland but may also occur in thickets and woodlots (Ontario American Badger Recovery Team 2010). Its current range is restricted to southern Ontario and west of Thunder Bay. It is considered absent from the study area.

Bats

Little Brown Myotis (*Myotis lucifugu*) - Provincial Status - Endangered; Federal – Endangered

Northern Myotis/Northern Long-eared Bat (*Myotis septentrionalis*) - Provincial Status - Endangered; Federal - Endangered

Tri-colored Bat (*Perimyotis subflavus*) – Provincial Status – Endangered; Federal – Endangered

The potential SAR bats within the general area are: little brown myotis, northern myotis, and tri-coloured bat. These species prefers to hibernate in caves or mines or buildings. While there are no known hibernation sites present, the island is said to have caves and the abundance of bedrock suggests that there is a potential for hibernacula to occur (Ontario Parks 2004).

Additional, species specific information, is available for the northern myotis. This species prefers large portions of older forests. The maternity sites tend to be in snags in the mid stage of decay. This species tends to prefer larger expanses of older forests (late successional or primary forests) with intact interior habitat and is shown to be negatively correlated with edge habitat (Menzel et al 2002, Broders et al. 2006, Yates et al. 2006, *SWH 4E Criterion Schedule*). The study area is situated on the edge of the forest and as such the northern myotis maternity sites are likely not present.

The *Significant Wildlife Habitat Criteria Schedules Draft 4E* indicated that consideration for maternity sites should be made when the vegetation community consists of a mature deciduous or mixed forest with >10 large trees/ha (>25 cm DBH). MRNF guidelines for bat maternity sites require a minimum of >10 snags (with a minimum DBH of 25 cm) / ha. The forest is coniferous (though it would be considered mixed under the southern ELC methods). That said the average tree diameter-at-breast height (DBH) is 10-15 cm. There is no potential for maternity sites.

The island contains lots of exposed bedrocks and reportedly caves (but none were found within the study area). There are also old mines on site. As such, there is a potential for bat hibernacula to occur on the island but no potential features were observed on-site during the site visit.

Lichen

Flooded Jellyskin (*Perimyotis subflavus*) - Provincial Status - No Status; Federal - Threatened

The Flooded Jellyskin is federally protected (threatened) lichen which is most often found inhabiting the bark of trees located in flood prone areas or along the edge of vernal pools. The COSEWIC report for this species lists red maple, silver maple, red ash and American elm as its preferred substrate (COSEWIC 2004). This species is unlikely to occur within the study area due to the absence of these tree species.

Plants

Pitcher's Thistle (*Cirsium pitcher)* - Provincial Status - Threatened; Federal - Endangered

This thistle is listed as Threatened provincially and Endangered federally. It is found on loose sandy habitats (Parks Canada Agency 2011). In Ontario its range is restricted to Lakes Huron and Superior (two beaches on Lake Superior west of Michipicoten Island on the mainland). There was no sandy habitat present. This species is considered absent.

Table 5 List of Potential Endangered or Threatened Species for the General Area

Common Name	Scientific Name	SRank	Provincial Status	Federal Status	Federal Schedule	Preferred Habitat	Reference
FISH							
Lake Sturgeon	*Acipenser fulvescens*	S2	THR	No Status	No schedule	Bottoms of lakes and large rivers.	COSEWIC 2000
Shortjaw Cisco	*Coregonus zenithicus*	S2	THR	THR	Schedule 2	Deep water species found mostly in great lakes but also in a few larger lakes.	Scott & Crossman 1998
BIRDS							
American White Pelican	*Pelecanus erythrorhynchos*		THR			In Ontario, this species nests on small (0.4-1.2 ha) low-lying bedrock islands far from mainland to protect it from predation. Islands may be unvegetated or with some trees. Known breeding pairs are located further west than Michipicoten Island.	Sandilands 2005
Golden Eagle	*Aquila chrysaetos*	S2B	END			Open country, near mountains and lakeshores.	Peterson 1980
Whip-poor-will	*Caprimulgus vociferus*	S4B	THR	THR	Schedule 1	Rock or sand barrens with scattered trees, savannahs, old burns or other disturbed sites in a state of early to mid-forest succession, or open conifer plantations	COSEWIC 2009a
Common Nighthawk	*Chordeiles minor*	S4B	SC	THR	Schedule 1	Open habitats, such as sand dunes, beaches, logged areas, burned-over areas, forest clearings, short-grass prairies, pastures, open forests, peatbogs, marshes, lakeshores, gravel roads, river banks, rocky outcrops, rock barrens, railways, mine tailings, quarries, urban parks, military bases, airports, mines and commercial blueberry fields, also present in mixed coniferous forest, and pine stands	COSEWIC 2007a
Chimney Swift	*Chaetura pelagica*	S4B, S4N	THR	THR	Schedule 1	Cities, towns, villages, rural, and wooded areas.	COSEWIC 2007b

Common Name	Scientific Name	SRank	Provincial Status	Federal Status	Federal Schedule	Preferred Habitat	Reference
Olive-sided Flycatcher	*Contopus cooperi*	S4B	SC	THR	Schedule 1	Open areas containing tall trees or snags for perching.	COSEWIC 2007c
Bank Swallow	*Riparia riparia*	S4B	THR	No Status		Variety of forest types, most common in wet, mixed deciduous-coniferous forest with a well-developed shrub layer. It is often found in shrub marshes, red maple stands, cedar stands, conifer swamps dominated by black spruce and larch and riparian woodlands along rivers and lakes. It is also associated with ravines and steep brushy slopes near these habitats	COSEWIC 2013
Barn Swallow	*Hirundo rustica*	S4B	THR	No Status	No schedule	Open or semi-open lands: farms, field, marshes.	Peterson 1980
Canada Warbler	*Wilsonia canadensis*	S4B	SC	THR	Schedule 1	Variety of forest types, most common in wet, mixed deciduous-coniferous forest with a well-developed shrub layer. It is often found in shrub marshes, red maple stands, cedar stands, conifer swamps dominated by black spruce and larch and riparian woodlands along rivers and lakes. It is also associated with ravines and steep brushy slopes near these habitats	COSEWIC 2008a
Bobolink	*Dolichonyx oryzivorus*	S4B	THR	No Status	No schedule	Primarily in forage crops, and grassland habitat.	COSEWIC 2010
MAMMALS							
Woodland Caribou	*Rangifer tarandus caribou*	S4	THR	THR	Schedule 1	Winter: Mature old-growth coniferous forest. Summer: Occasionally feed in young stands after fire or logging.	COSEWIC 2002
Wolverine	*Gulo gulo*		THR	No Status	No schedule	Large areas of remote wooded wilderness or tundra with an adequate year-round supply of food.	COSEWIC 2003

Common Name	Scientific Name	SRank	Provincial Status	Federal Status	Federal Schedule	Preferred Habitat	Reference
American Badger jacksoni subspecies	*Taxidea taxus jacksoni*		END	END	Schedule 1	Natural and undisturbed grasslands, shrubby areas, and woodlots.	Ontario American Badger Recovery Team 2009
Little Brown Myotis	*Myotis lucifugus*	S4	END	END	No schedule	Buildings, attics, roof crevices and loose bark on trees or under bridges. Always roost near waterbodies.	Eder 2002
Northern Myotis/Northern Long-eared Bat	*Myotis septentrionalis*	S3	END	END	No schedule	Older (late successional or primary forests) with large interior habitat.	Menzel et al. 2002, Broders et al. 2006, SWH 4E Criterion Schedule
Tri-colored Bat	*Perimyotis subflavus*	S3?	END	END	No schedule	Prefers shrub habitat or open woodland near water.	Eder 2002
LICHENS							
Flooded Jellyskin Lichen	*Leptogium rivulare*	S1		THR	Schedule 1	Periodically inundated bases of trees.	COSEWIC 2004
PLANTS							
Pitcher's Thistle	*Cirsium pitcheri*	S2	THR	END	Schedule 1	Optimal habitat is open, dry, loose sand with little other vegetation or duff	Parks Canada Agency 2011

Status Updated December 20, 2016

Those species highlighted in red are those who have been documented on the island and those in orange are those whose habitat is present and may occur within the study area.

SRANK DEFINITIONS

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

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

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

S4	Apparently Secure, Uncommon but not rare; some cause for long-term concern due to declines or other factors.
?	Inexact Numeric Rank—Denotes inexact numeric rank
S#B	Breeding
S#N	Non-Breeding

SARO STATUS DEFINITIONS

END	Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.
THR	Threatened: A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC	Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

END	Endangered, a wildlife species facing imminent extirpation or extinction.
THR	Threatened, a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC	Special Concern, a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

5.0 DISCUSSION OF NATURAL HERITAGE FEATURES

The study area consisted of a developed area with several structures. Surrounding this area was the rocky shoreline (cobble/pebble beach to bedrock knolls) on the east and conifer forests on bedrock hills to the west. The forest was fairly homogeneous with some area containing a higher portion of the deciduous trees but not sufficient to change the ELC code. Several areas of exposed bedrock were noted most were extremely small but there was one larger opening that can be distinguished on satellite imaging. This opening is on the south side of the buildings, near the helicopter pad, and in an area that was disturbed. Signs of disturbances included pieces of equipment and cables. The amount of vegetation was near the 25% cover range (and the survey was completed outside of the growing season) and as such it may not meet the rock barren designation. Further, since it is likely the result of clearing of vegetation for the development it would not be natural. There were also two small wetland inclusions. The one to the north offered the best habitat and included seep. The other was densely vegetated with shrubs and only about 25 m^2 in size. One other seep/spring was noted on the north side of the adjacent lands. This water formed a small channel but did not reach the beach. The forest, largely composed of balsam fir and white spruce with varying densities of white birch, contained several trails. Some were from humans leading to garbage piles but many were the result of caribou movements. The heavier use by caribou was noted on the south side of the adjacent lands. Wolf feces was also noted in the adjacent lands on the exposed bedrock to the south. Other wildlife included beaver activity and bald eagle (flying overhead).

As discussed in Section 3.0, the habitats encountered could provide SWH based on the criteria found in the SWH4ECS. The specific habitats and SWH are discussed in the paragraphs below. It could also provide habitat for Endangered and Threatened species (potential for bat hibernacula) and does provide habitat for the threatened species Woodland Caribou.

The various potential SWH associated with the habitats observed include: bat hibernacula, reptile hibernacula, cliff and talus slopes, rock barren, Great Lakes Arctic-Alpine shoreline type, woodland raptor nesting habitat, seeps and springs, denning sites and mast producing areas. The confirmation of these habitats would require surveys to determine if snakes, bats, or woodland raptors are even present on the island. Note that the background information indicated that there were no known bald eagle or osprey nests on the island (Ontario Parks 2004). No nests were observed but as the background information is somewhat dated and no surveys took place during the nesting season the potential use of the area by any raptors for nesting should not be ruled out. This edge habitat could provide suitable nest location for merlins. The presence of wolves indicates that there is a potential for denning sites but there are no known locations. Blueberries were found throughout the area and could provide food source to ruffed grouse should they occur (potential SWH Mast Producing Area under SWH4ECS). Note there were no signs of cliff swallow nests along the shoreline.

There were also a few wetland inclusions and a small channel with flowing water (assumed to originate from seepage). These features (especially the channel and the north wetland) could provide foraging and drinking habitat for wildlife during the winter months (SWH feature - Seep and Spring). These areas could also provide habitat for salamanders. Though none were observed, the background information indicated a potential for spotted salamanders to occur (Ontario Parks 2004). The spotted salamander would be considered regionally significant for ecoregion 4E (Ontario Parks 2004). The wetlands were too small to meet the SWH feature criteria for amphibian breeding habitats (which require a minimum area of 500 m^2).

There is also the potential for species of conservation value to occur, most notably the fish species upper great lakes kiyi, birds (bald eagle, peregrine falcon and wood thrush) and the plant (blue wild rye) (Appendix D).

Much of the shoreline was barren but the potential for flora with S1-S3, SH ranking or for the SWH Great Lakes Artic – Alpine Shoreline, cliff/talus slopes or rock barren communities to occur on the exposed bedrock. The only significant species documented was the oval-leaf blueberry (though identification was not confirmed with the characteristics available at this time of year). As mentioned in Section 3.0 some cliff and talus slope and rock barren indicator species were noted. No plant species of conservation value were found by the previous consultants and no other species were noted during this visit however both visits were conducted either at the end or after the growing season, respectively. Confirmation of the absence of other species or SWH would require vegetation surveys during the growing season.

While not part of the scope of the surveys it is noted that aquatic habitat surrounding the island forms part of the Michipicoten Provincial Park (2.5 km from shore). This area is noted for lake trout spawning beds (exact location was not provided), the presence of a fishery (coho and chinook salmon, herring and lake whitefish) and potential habitat for the species of special concern: deepwater sculpin and upper great lakes kiyi.

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Redacted

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- Important Bird Areas (IBA) (partnership between Bird Studies Canada and Nature Canada coordinated by BirdLife International) - http://www.ibacanada.com/

- Migratory Bird Sanctuaries (MBS) (Environment Canada and Climate Change) - https://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=EB3D54D1-1

- National Wildlife Areas (NWA) (Environment Canada and Climate Change) - https://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=2BD71B33-1

- Aquatic Species at Risk interactive maps (Fisheries and Oceans Canada) - http://www.dfo-mpo.gc.ca/species-especes/fpp-ppp/index-eng.htm

- Species at Risk Public Registry (Government of Canada) - http://www.sararegistry.gc.ca/sar/index/default_e.cfm

- Species at Risk Ontario (MNRF) - https://www.ontario.ca/environment-and-energy/species-risk-ontario-list

Appendix A – List of Common and Scientific Names of Species Mentioned in this report

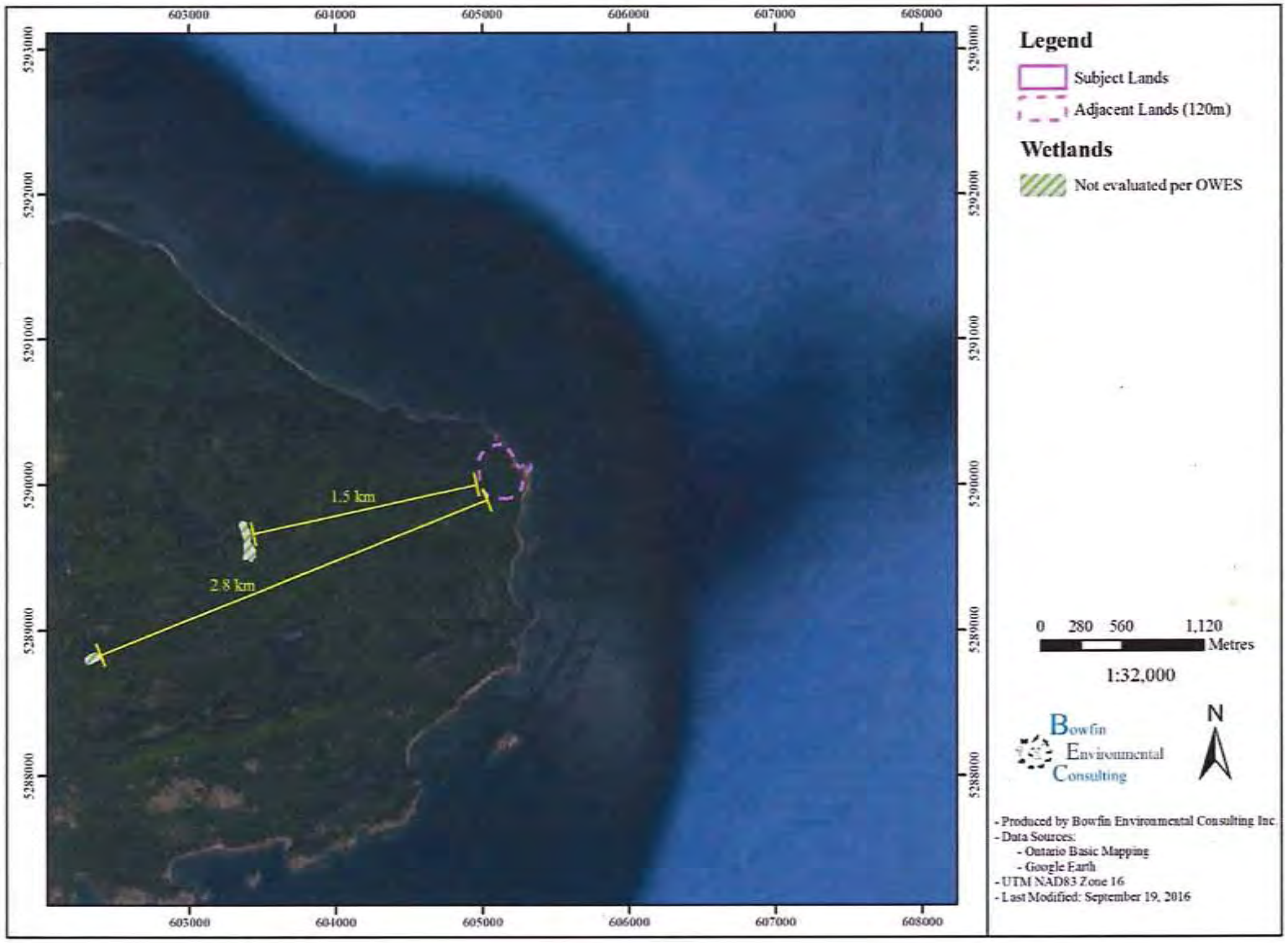
Common Name	Scientific Name
FISH	
Lake Sturgeon	*Acipenser fulvescens*
Shortjaw Cisco	*Coregonus zenithicus*
Northern Brook Lamprey	*Ichthyomyzon fossor*
Upper Great Lakes Kiyi	*Coregonus kiyi kiyi*
Lake Trout	*Salvelinus namaycush*
Coho Salmon	*Oncorhynchus kisutch*
Chinook Salmon	*Oncorhynchus tshawytscha*
Herring	*Clupea*
Lake Whitefish	*Coregonus clupeaformis*
Pygmy Whitefish	*Prosopium coulterii*
Deepwater Sculpin	*Myoxocephalus thompsonii*
REPTILES	
Snapping Turtle	*Chelydra serpentina*
AMPHIBIAN	
Spotted Salamander	*Ambystoma maculatum*
BIRDS	
Bald Eagle	*Haliaeetus leucocephalus*
Black-capped Chickadee	*Poecile atricapilla*
Red-breasted Nuthatch	*Sitta canadensis*
American Pipit	*Anthus rubescens*
Yellow-rumped Warbler	*Dendroica coronata*
Blackburnian Warbler	*Dendroica fusca*
Pine Warbler	*Dendroica pinus*
Palm Warbler	*Dendroica palmarum*
Dark-eyed Junco	*Junco hyemalis*
American White Pelican	*Pelecanus erythrorhynchos*
Golden Eagle	*Aquila chrysaetos*
Whip-poor-will	*Caprimulgus vociferus*
Common Nighthawk	*Chordeiles minor*
Chimney Swift	*Chaetura pelagica*
Olive-sided Flycatcher	*Contopus cooperi*
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirundo rustica*

Common Name	Scientific Name
Canada Warbler	*Wilsonia canadensis*
Bobolink	*Dolichonyx oryzivorus*
Peregrine Falcon	*Falco peregrinus*
Yellow Rail	*Coturnicops noveboracensis*
Black Tern	*Chlidonias niger*
Short-eared Owl	*Asio flammeus*
Wood Thrush	*Hylocichla mustelina*
Rusty Blackbird	*Euphagus carolinus*
Sandhill Crane	*Grus canadansis*
Osprey	*Pandion haliaetus*
Merlin	*Falco columbarius*
Cliff Swallow	*Hirundo pyrrhonota*
MAMMALS	
Beaver	*Castor canadensis*
Grey Wolf	*Canis lupus*
Woodland Caribou	*Rangifer tarandus caribou*
Wolverine	*Gulo gulo*
American Badger jacksoni subspecies	*Taxidea taxus jacksoni*
Little Brown Myotis	*Myotis lucifugus*
Northern Myotis/Northern Long-eared Bat	*Myotis septentrionalis*
Tri-colored Bat	*Perimyotis subflavus*
LICHENS	
Flooded Jellyskin Lichen	*Leptogium rivulare*
PLANTS	
Lichen sp.	*Lichen sp.*
Mosses Sp.	*Bryophyta*
Plume Moss	*Ptilium sp.*
Peat Moss sp.	*Shagnum sp.*
Eastern Bracken Fern	*Pteridium aquilinum var. latiusculum*
Northern Lady Fern	*Athyrium filix-femina var. angustum*
Rock Polypody Fern	*Polypodium virginianum*
Common Juniper	*Juniperus communis*
Balsam Fir	*Abies balsamea*
White Spruce	*Picea glauca*
Black Spruce	*Picea mariana*
Red Maple	*Acer rubrum*
Sugar Maple	*Acer saccharum*

Common Name	Scientific Name
Staghorn Sumac	*Rhus typhina*
Wild Sarsaparilla	*Aralia nudicaulis*
Common Yarrow	*Achillea millefolium ssp. Millefolium*
Pearly Everlasting	*Anaphalis margaritacea*
Large-leaved Aster	*Aster macrophyllus*
Meadow Goat's-beard	*Tragopogon pratensis ssp. Pratensis*
May-apple	*Podophyllum peltatum*
Speckled Alder	*Alnus incana spp. rugosa*
Yellow Birch	*Betula alleghaniensis*
White Birch	*Betula papyrifera*
Harebell	*Campanula rotundifolia*
Bush Honeysuckle	*Diervilla lonicera*
Red-berried Elderberry	*Sambucus racemosa ssp. Pubens*
Maple-leaved Viburnum	*Viburnum acerifolium*
Mooseberry	*Viburnum edule*
Bunchberry	*Cornus canadensis*
Red-osier Dogwood	*Cornus stolonifera*
Bearberry	*Arctostaphylos uva-ursi*
Labrador-tea	*Ledum groenlandicum*
Low Sweet Blueberry	*Vaccinium angustifolium*
Large Cranberry	*Vaccinium macrocarpon*
Velvet-leaf Blueberry	*Vaccinium myrtilloides*
White Clover	*Trifolium repens*
Wild Black Currant	*Ribes americanum*
Common St. John's-wort	*Hypericum perforatum*
Willow-herb sp.	*Epilobium*
Swamp Candles	*Lysimachia terrestris*
Starflower	*Trientalis borealis ssp. borealis*
Canada Anemone	*Anemone canadensis*
Tall Buttercup	*Ranunculus acris*
Common Strawberry	*Fragaria virginiana ssp. virginiana*
Three-toothed Cinquefoil	*Potentilla tridentata*
Cherry sp.	*Prunus sp.*
Rose sp.	*Rosa sp.*
Wild Red Raspberry	*Rubus idaeus ssp. strigosus*
Thimbleberry	*Rubus parviflorus*
Showy Mountain-ash	*Sorbus decora*

Common Name	Scientific Name
Partridge Berry	*Mitchella repens*
Trembling Aspen	*Populus tremuloides*
Willow sp.	*Salix sp.*
Upland Willow	*Salix humilis*
Common Mullein	*Verbascum thapsus*
Chives sp.	*Allium sp.*
Bluebead Lily	*Clintonia borealis*
Wild Lily-of-the-valley	*Maianthemum canadense*
Canada Blue-joint	*Calamagrostis canadensis*
Fowl Glyceria	*Glyceria striata*
Cut Grass sp.	*Leersia sp.*
Reed Canary Grass	*Phalaris arundinacea*
Timothy	*Phleum pratense*
Pitcher's Thistle	*Cirsium pitcheri*
Braun's Holly Fern	*Polystichum braunii*
Alpine Cliff Fern	*Woodsia alpina*
Smooth Woodsia	*Woodsia glabella*
Northern Fir-moss	*Huperzia selago*
Rand's Goldenrod	*Solidago simplex*
Woolly Beach-heath	*Hudsonia tomentosa*
Oval-leaved Blueberry	*Vaccinium ovalifolium*
Northern Wild Licorice	*Galium kamtschaticum*
Black Sedge	*Carex atratiformis*
Smooth Wild Rye	*Elymus glaucus*
Northern Woodsia	*Woodsia alpina*
Blue Bilberry	*Vaccinium ovalifolium*
Boreal Bedstraw	*Galium kamtscgaticum*
Blue Wild Rye	*Elymus Glaucus*
American Dune Grass	*Leymus mollis*
Alga Pondweed	*Potamogeton confervoides*
Beach Pea	*Lathyrus japonicus*
Sand Cherry	*Prunus pumila*
Purple Flowering Raspberry	*Rubus odoratus*
Hawkweed sp.	*Hieracium sp.*

Appendix B – Background Mapping and Communications



List of Potential Species with S1-S3 or SH Ranking from Background Information

Common Name	Scientific Name	SRANK	Provincial Status (SARO)	Federal Status (SARA)
Braun's Holly Fern	*Polystichum braunii*	S3		
Alpine Cliff Fern	*Woodsia alpina*	S2		
Smooth Woodsia	*Woodsia glabella*	S3		
Northern Fir-moss	*Huperzia selago*	S3S4		
Rand's Goldenrod	*Solidago simplex*	S3		
Woolly Beach-heath	*Hudsonia tomentosa*	S2S3		
Oval-leaved Blueberry	*Vaccinium ovalifolium*	S2		
Northern Wild Licorice	*Galium kamtschaticum*	S2		
Black Sedge	*Carex atratiformis*	S2		
Smooth Wild Rye	*Elymus glaucus*	S1		

*Status updated December 21, 2016

References

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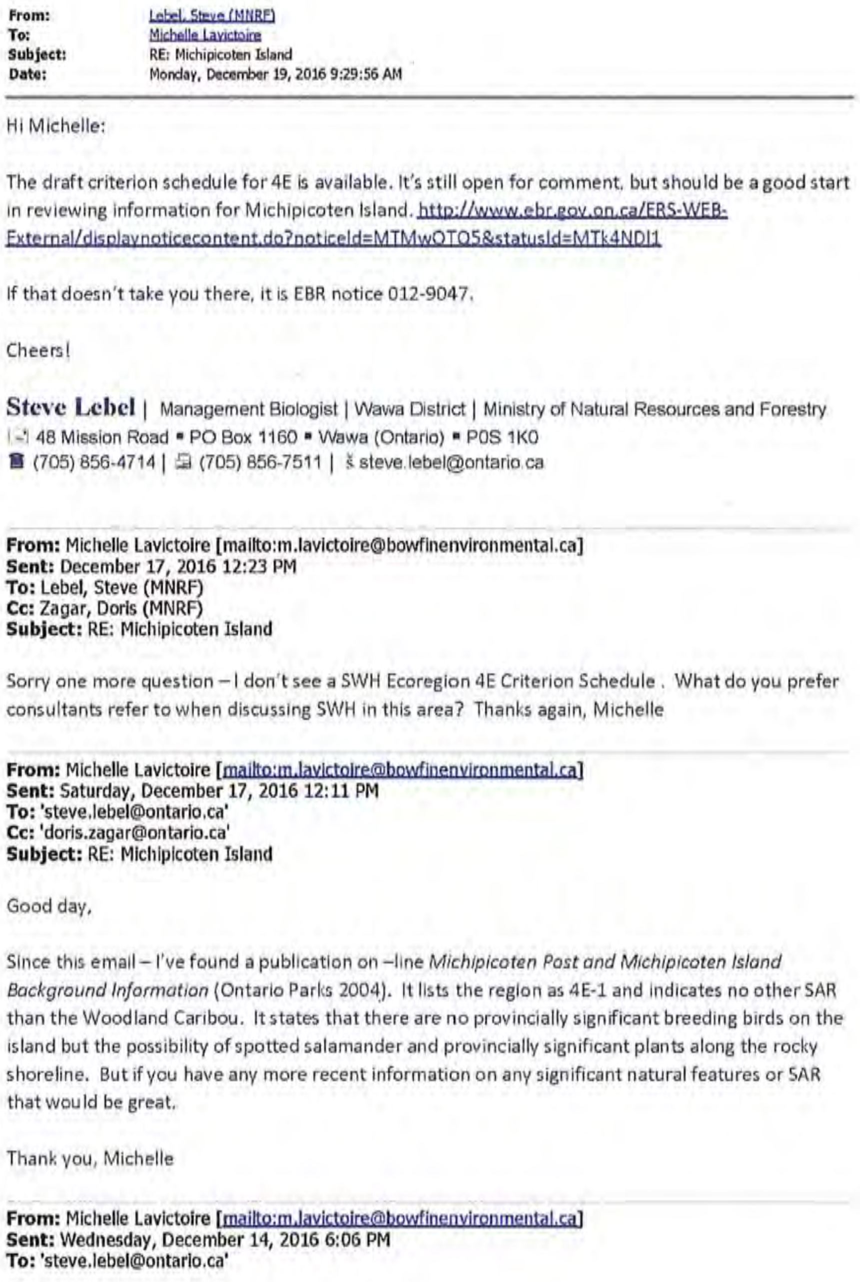
SRANK DEFINITIONS

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

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

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



From: Lebel, Steve (MNRF)
To: Michelle Lavictoire
Subject: RE: Michipicoten Island
Date: Monday, December 19, 2016 9:29:56 AM

Hi Michelle:

The draft criterion schedule for 4E is available. It's still open for comment, but should be a good start in reviewing information for Michipicoten Island. http://www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MTMwOTO5&statusId=MTk4NDI1

If that doesn't take you there, it is EBR notice 012-9047.

Cheers!

Steve Lebel | Management Biologist | Wawa District | Ministry of Natural Resources and Forestry
✉ 48 Mission Road ▪ PO Box 1160 ▪ Wawa (Ontario) ▪ P0S 1K0
☎ (705) 856-4714 | 📠 (705) 856-7511 | ✉ steve.lebel@ontario.ca

From: Michelle Lavictoire [mailto:m.lavictoire@bowfinenvironmental.ca]
Sent: December 17, 2016 12:23 PM
To: Lebel, Steve (MNRF)
Cc: Zagar, Doris (MNRF)
Subject: RE: Michipicoten Island

Sorry one more question – I don't see a SWH Ecoregion 4E Criterion Schedule . What do you prefer consultants refer to when discussing SWH in this area? Thanks again, Michelle

From: Michelle Lavictoire [mailto:m.lavictoire@bowfinenvironmental.ca]
Sent: Saturday, December 17, 2016 12:11 PM
To: 'steve.lebel@ontario.ca'
Cc: 'doris.zagar@ontario.ca'
Subject: RE: Michipicoten Island

Good day,

Since this email – I've found a publication on –line *Michipicoten Post and Michipicoten Island Background Information* (Ontario Parks 2004). It lists the region as 4E-1 and indicates no other SAR than the Woodland Caribou. It states that there are no provincially significant breeding birds on the island but the possibility of spotted salamander and provincially significant plants along the rocky shoreline. But if you have any more recent information on any significant natural features or SAR that would be great.

Thank you, Michelle

From: Michelle Lavictoire [mailto:m.lavictoire@bowfinenvironmental.ca]
Sent: Wednesday, December 14, 2016 6:06 PM
To: 'steve.lebel@ontario.ca'

1100 Fifth Line East
Sault Ste. Marie, ON P6A 6J8
Tel: (705) 946-8530
Fax: (705) 946-8533
Email: nature@ssmrca.ca
www.ssmrca.ca

Watershed Condition Statement – Flood Outlook

Issued September 6, 2016 @ 9:00 am

The Sault Ste. Marie Region Conservation Authority would like to issue a statement to residents in regard to current watershed conditions.

The weather forecast for today indicates the storm system moving through the area has rainfall with imbedded thunderstorms. The general precipitation amounts expected in Sault Ste. Marie and area in the next 24 hours are 10-15 mm. There is the potential of an additional 30-50 mm possible in localized thunderstorm activity.

Heavier precipitation activity is anticipated to continue north of Sault Ste. Marie.

There has been little precipitation in the area over the last few months and current streamflow conditions are seasonally low. Ground conditions are favourable to allow infiltration of precipitation. Runoff in to local streams and rivers will occur and increase water levels and flows. The localized thunderstorms expected may have the capacity to overwhelm areas of poor drainage and cause localized flooding.

The forecast for the following 24-hour period indicates another 10-15 mm of rainfall with the potential of thunderstorms.

The flood control channels owned and maintained by the Sault Ste. Marie Region Conservation Authority are flowing well. The Sault Ste. Marie Region Conservation Authority will be closely monitoring stream flows across the watershed.

The Sault Ste. Marie Region Conservation Authority would like to extend a warning to residents and visitors to use extreme caution when close to rivers, creeks and channels. Potential increases in water levels and flows can be especially dangerous and stream banks can be slippery. Please keep children and pets away from fast flowing rivers and streams.

This statement will be updated on Wednesday September 7, 2016.

-30-

For further information:
Rhonda Bateman, General Manager, SSMRCA
705-946-8530

Cc: 'doris.zagar@ontario.ca'
Subject: Michipicoten Island

Hello Mr. Lebel,

I spoke with Doris today and she suggested that I contact you with my questions.

I recently completed some work on Michipicoten Island at the East End Light for the Federal Government. As part of that project I wanted to request any background information you may have on Species at Risk on that area (terrestrial and aquatic species). I am also curious as to which ecodistrict the island falls under – I can't tell on any of the maps that I have.

Thank you very much.

Michelle Lavictoire

Bowfin Environmental Consulting
168 Montreal Road
Cornwall, Ontario K6H 1B3
Tel: 613.935.6139
Cell: 613.361.4154

Appendix C – List of All Observed Species

Common Name	*Scientific Name*	SRank	Provincial Status (SARO)	Federal Status (SARA)
BIRDS				
Bald Eagle	*Haliaeetus leucocephalus*	S2N, S4B	SC	
Black-capped Chickadee	*Poecile atricapilla*	S5		
Red-breasted Nuthatch	*Sitta canadensis*	S5		
American Pipit	*Anthus rubescens*	S4		
Yellow-rumped Warbler	*Dendroica coronata*	S5B		
Blackburnian Warbler	*Dendroica fusca*	S5		
Pine Warbler	*Dendroica pinus*	S5		
Palm Warbler	*Dendroica palmarum*	S5		
Dark-eyed Junco	*Junco hyemalis*	S5B		
MAMMALS				
Beaver	*Castor canadensis*	S5		
Grey Wolf	*Canis lupus*	S4		
Woodland Caribou	*Rangifer tarandus caribou*	S4	THR	THR

Common Name	*Scientific Name*	SRank	Provincial Status (SARO)	Federal Status (SARA)	Coefficient of Conservatism
PLANTS					
Lichen sp.	*Lichen sp.*				
Mosses Sp.	*Bryophyta*				
Plume Moss	*Ptilium sp.*				
Peat Moss sp.	*Shagnum sp.*				
Eastern Bracken Fern	*Pteridium aquilinum var. latiusculum*	S5			2
Northern Lady Fern	*Athyrium filix-femina var. angustum*	S5			4
Rock Polypody Fern	*Polypodium virginianum*	S5			6
Common Juniper	*Juniperus communis*	S5			
Balsam Fir	*Abies balsamea*	S5			5
White Spruce	*Picea glauca*	S5			6
Black Spruce	*Picea mariana*				8
Red Maple	*Acer rubrum*	S5			4
Sugar Maple	*Acer saccharum*	S5			4
Staghorn Sumac	*Rhus typhina*	S5			1
Wild Sarsaparilla	*Aralia nudicaulis*	S5			4
Common Yarrow	*Achillea millefolium ssp. Millefolium*	SNA			0
Pearly Everlasting	*Anaphalis margaritacea*	S5			3

Common Name	Scientific Name	SRank	Provincial Status (SARO)	Federal Status (SARA)	Coefficient of Conservatism
Large-leaved Aster	*Aster macrophyllus*	S5			5
Meadow Goat's-beard	*Tragopogon pratensis ssp. Pratensis*	SNA			
May-apple	*Podophyllum peltatum*	S5			5
Speckled Alder	*Alnus incana spp. rugosa*	S5			6
Yellow Birch	*Betula alleghaniensis*	S5			6
White Birch	*Betula papyrifera*	S5			
Harebell	*Campanula rotundifolia*	S5			7
Bush Honeysuckle	*Diervilla lonicera*	S5			5
Red-berried Elderberry	*Sambucus racemosa ssp. Pubens*	S5			5
Maple-leaved Viburnum	*Viburnum acerifolium*	S5			6
Mooseberry	*Viburnum edule*	S5			
Bunchberry	*Cornus canadensis*	S5			7
Red-osier Dogwood	*Cornus stolonifera*	S5			2
Bearberry	*Arctostaphylos uva-ursi*				8
Labrador-tea	*Ledum groenlandicum*				9
Low Sweet Blueberry	*Vaccinium angustifolium*	S5			6
Large Cranberry	*Vaccinium macrocarpon*	S4S5			10
Velvet-leaf Blueberry	*Vaccinium myrtilloides*	S5			7
Oval-leaved Blueberry *	*Vaccinium ovalifolium*	S2			
White Clover	*Trifolium repens*	SNA			
Wild Black Currant	*Ribes americanum*	S5			4
Common St. John's-wort	*Hypericum perforatum*	SNA			
Willow-herb sp.	*Epilobium*				
Swamp Candles	*Lysimachia terrestris*	S5			6
Starflower	*Trientalis borealis ssp. borealis*	S5			6
Canada Anemone	*Anemone canadensis*	S5			3
Tall Buttercup	*Ranunculus acris*	SNA			
Common Strawberry	*Fragaria virginiana ssp. virginiana*	S5			2
Three-toothed Cinquefoil	*Potentilla tridentata*	S5			
Cherry sp.	*Prunus sp.*				
Rose sp.	*Rosa sp.*				
Wild Red Raspberry	*Rubus idaeus ssp. strigosus*	S5			0
Thimbleberry	*Rubus parviflorus*	S4			7
Showy Mountain-ash	*Sorbus decora*	S5			8
Partridge Berry	*Mitchella repens*	S5			6
Trembling Aspen	*Populus tremuloides*	S5			
Willow sp.	*Salix sp.*				
Upland Willow	*Salix humilis*	S5			7

Common Name	*Scientific Name*	SRank	Provincial Status (SARO)	Federal Status (SARA)	Coefficient of Conservatism
Common Mullein	*Verbascum thapsus*	SNA			
Chives sp.	*Allium sp.*				
Bluebead Lily	*Clintonia borealis*	S5			7
Wild Lily-of-the-valley	*Maianthemum canadense*	S5			5
Canada Blue-joint	*Calamagrostis canadensis*	S5			4
Fowl Glyceria	*Glyceria striata*	S4S5			3
Cut Grass sp.	*Leersia sp.*				
Reed Canary Grass	*Phalaris arundinacea*	S5			0
Timothy	*Phleum pratense*	SNA			

Updated December 19, 2016

* Indicates that identification was not 100% however the species is known to occur on the Island (MNRF 2015)

SRANK DEFINITIONS

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

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

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

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

S#B Breeding

S#N Non-Breeding

SARO STATUS DEFINITIONS

END Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.

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

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

SARA STATUS DEFINITIONS

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

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

Coefficient of conservatism ranking criteria

0	Obligate to ruderal areas.
1	Occurs more frequently in ruderal areas than natural areas.
2	Facultative to ruderal and natural areas.
3	Occurs less frequent in ruderal areas than natural areas.
4	Occurs much more frequently in natural areas than ruderal areas.
5	Obligate to natural areas (quality of area is low).
6	Weak affinity to high-quality natural areas.
7	Moderate affinity to high-quality natural areas.
8	High affinity to high-quality natural areas.
9	Very high affinity to high-quality natural areas.
10	Obligate to high-quality natural areas.

Appendix D – List of Potential Species of Conservation Value

This list was created through the use of data on NHIC 10 km Squares (16FT08, 16FT 09, 16FT 18 & 16FT 19 and 16ET98 & 16ET 99) and from the Atlas of Breeding Bird of Ontario Region 36 East Superior Abundance Results. Note that most of the plant species with the exceptions of Boreal Bedstraw and Alga Pondweed were also on the list taken from the background information.

Those species highlighted in red are known to occur within the study area and those in orange could potentially occur based on available habitat.

Common Name	Scientific Name	Schedule	SRank	Provincial Status	Federal Status	Preferred Habitat	Reference
FISH							
Northern Brook Lamprey	*Ichthyomyzon fossor*	Schedule 1		SC	SC	Creeks and small rivers.	COSEWIC 2007d
Upper Great Lakes Kiyi	*Coregonus kiyi kiyi*	Schedule 1		SC	SC	Deep water fish known to occur in Lake Superior	COSEWIC 2005
REPTILES							
Snapping Turtle	*Chelydra serpentina*	Schedule 1	S3	SC	SC	Preferred habitat is slow-moving water with a soft mud bottom and dense aquatic vegetation.	COSEWIC 2008b
BIRDS							
Bald Eagle	*Haliaeetus leucocephalus*		S2N, S4B	SC		Associated with large lakes and rivers. Frequently observed on dead branches overlooking water.	Peterson 1980
Peregrine Falcon	*Falco peregrinus*	Schedule 1	S3B	SC	SC	Requires steep cliffs or high rises for nesting and open habitat for foraging.	COSEWIC 2007e
Yellow Rail	*Coturnicops noveboracensis*	Schedule 1	S4B	SC	SC	Grassy marshes and wet meadows.	COSEWIC 2009b

Common Name	Scientific Name	Schedule	SRank	Provincial Status	Federal Status	Preferred Habitat	Reference
Black Tern	*Chlidonias niger*		S3B	SC		Breed in freshwater marshes	Peterson 1980
Short-eared Owl	*Asio flammeus*	Schedule 1	S2N, S4B	SC	SC	Open areas.	COSEWIC 2008c
Wood Thrush	*Hylocichla mustelina*		S4B	SC	No Status	Found in moist, deciduous hardwood or mixed stands, often previously disturbed, with a dense deciduous undergrowth and with tall trees for singing perches	COSEWIC 2012
Rusty Blackbird	*Euphagus carolinus*	Schedule 1	S4B		SC	Generally characterized by conifer forest wetlands. In forested areas, the Rusty Blackbird is strictly riparian and rarely uses the forest interior. It occurs primarily in wetlands associated with recent burns, wooded heathland, and peat bogs with or without ponds, as well as in riparian scrub, open moss- and lichen-spruce woodlands, and areas dominated by conifer forest edges and lakes and bogs. The Rusty Blackbird also occurs in sedge meadows, marshes, muskegs, swamps and estuaries	COSEWIC 2006
PLANTS							
Braun's Holly Fern	*Polystichum brauni*		S3			Mesic to wet alluvial forests, coniferous forests, talus and lava flows in the lowland to subalpine zones	eFlora 2009
Northern Woodsia	*Woodsia alpina*		S2			Moist calcareous rocks in the montane and subalpine zones	eFlora 2009

Common Name	Scientific Name	Schedule	SRank	Provincial Status	Federal Status	Preferred Habitat	Reference
Blue Bilberry	*Vaccinium ovalifolium*		S3			Mesic to wet forests and openings, and bogs in the lowland to subalpine zones	eFlora 2009
Boreal Bedstraw	*Galium kamtscgaticum*		S2			Moist streambanks, thickets, forests and talus slopes in the lowland and montane zones	eFlora 2009
Blue Wild Rye	*Elymus Glaucus*		S1			Moist to dry slopes, meadows and open forests in the lowland and montane to subalpine zones	eFlora 2009
American Dune Grass	*Leymus mollis*		S4			Moist to mesic sandy or gravelly beaches and shoreline forests in the lowland zone	eFlora 2009
Alga Pondweed	*Potamogeton confervoides*		S2			Acid waters, often in bog ponds.	Crow & Hellquist 2000

Status Updated December 20, 2016

SRANK DEFINITIONS

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

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

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

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

? Inexact Numeric Rank—Denotes inexact numeric rank

S#B Breeding

S#N Non-Breeding

SARO STATUS DEFINITIONS

END Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.

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

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

SARA STATUS DEFINITIONS

END	Endangered, a wildlife species facing imminent extirpation or extinction.
THR	Threatened, a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC	Special Concern, a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

APPENDIX E

Environmental Site Investigations

reviewed

4350-3/C47-183

XCG

EXCELLENCE IN
ENVIRONMENTAL
CONSULTING
SERVICES

PHASE 2
ENVIRONMENTAL SITE ASSESSMENT CANADIAN COAST GUARD LIGHT STATION L.L. 1097 MICHIPICOTEN ISLAND, EAST END LAKE SUPERIOR, ONTARIO

Prepared for:

DEPARTMENT OF FISHERIES AND OCEANS
CENTRAL AND ARCTIC REGION

and

PUBLIC WORKS AND GOVERNMENT
SERVICES CANADA

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March 29, 2001
XCG File #1-336-60-01

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EXECUTIVE SUMMARY

XCG Consultants Ltd. (XCG) was retained by Public Works and Government Services Canada (PWGSC) on behalf of the Department of Fisheries and Oceans Canada (DFO), Central and Arctic Region, to carry out a Phase 2 Environmental Site Assessment (ESA) of the Michipicoten Island, East End Light Station on Lake Superior, Ontario. The Michipicoten Island, East End light station consists of a 39.3 hectare (97.1 acre) plot of land on the northeastern end of Michipicoten Island. The light station is located on the east end of Michipicoten Island Provincial Park and is approximately 38 nautical miles (70 km) southwest of Wawa. The subject site was established in 1912, and operated for over 70 years as an attended light station. Currently, the site operates as an unattended light station and consists of a lighthouse, a fog alarm building, a generator building, an equipment shed, an empty concrete dyked tank farm, and a residential dwelling. Foundations from a former radio beacon building, a former fuel storage shed, a former boathouse, and a former double dwelling remain on-site.

Seventeen soil samples and two surface water samples were collected and submitted to Entech Laboratories. Soil samples collected in the vicinity of the empty concrete dyked tank farm and in the vicinity of the generator building and were submitted for chemical analysis of total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), and metals. Samples collected from the vicinity of landfill site west of the lightkeeper's dwelling were submitted for metals and anions analysis. One surface water sample was collected south of the lightkeeper's dwelling, and one was collected from the landfill site on the northwestern portion of the site. The surface water samples were submitted for metal~~s~~ and anion~~s~~ analyses.

The applicable Environmental Quality criteria considered at this site were the Ontario Ministry of the Environment (MOE) Table F guidelines for all other land use, and the Canadian Council of Ministers of the Environment (CCME) guidelines for residential/parkland redevelopment. A comparison was also made to the MOE Table A guidelines, which are not strictly applicable given the shallow depth of overburden on the subject site, but which may still be considered to be protective of human health provided that contaminant leaching to groundwater can be eliminated as a pathway of concern. The surface water samples were compared to the CCME guidelines for water – aquatic life, the Ontario Provincial Water Quality Objectives (PWQO), and the MOE Table A potable groundwater criteria.

All seventeen of the soil samples submitted for metals analysis during the Phase 2 ESA, as well as two soil samples that were analyzed for metals during the enhanced Phase 1 ESA, indicated concentrations of metals above the CCME (residential/parkland) and MOE Table F criteria. The metals that exceeded the CCME criteria consisted of antimony, barium, cadmium, chromium, copper, lead, nickel, selenium, and zinc. Parameters in exceedance of the MOE Table F criteria were antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc.

Soil sampling from the Phase 2 ESA north of the generator building and in the vicinity of the concrete dyked tank farm indicated detectable concentrations of TPH (gas/diesel) and TPH (heavy oil) ranging from 30 ug/g to 6,200 ug/g. During the enhanced Phase 1 ESA, one soil sample from north of the generator building was analyzed for TPH (no specified range) and found to have a TPH concentration of 14,000 ug/g. There are no Table F values for TPH, as TPH is not naturally occurring in soil. Although Table A is not applicable to the subject property, the TPH values were compared to Table A to provide a general indication of the degree of impact. Six soil samples collected north of the generator building (including the one from the enhanced Phase 1 ESA), and two in the vicinity of the empty concrete dyked tank farm indicated concentrations of TPH (gas/diesel) or TPH (heavy oil), or both, in exceedance of MOE Table A criteria.

During the Phase 2 ESA, one soil sample collected north of the generator building and one collected west of the concrete dyked tank farm indicated concentrations of PAH in exceedance of the CCME (residential/parkland). These parameters consisted of benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene. Three of the soil samples collected north of the generator building or west of the concrete dyked tank farm indicated concentrations of PAH above MOE Table F values for one or more of the following parameters: acenaphthylene, anthracene, fluoranthene, benzo (a) anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. One soil sample collected from the area north of the generator building during the enhanced Phase 1 ESA contained an exceedance of MOE Table F value for pyrene.

Anions concentrations were analyzed in four soil samples collected on-site. No exceedances of the MOE Table F (background) values, or CCME (residential/parkland) criteria were noted.

Metals and anions concentrations were analyzed in two surface water samples collected on-site, one near the landfill site on the northwestern part of the site near the former double dwelling and one near the landfill site to the west of the lightkeeper's dwelling. Analytical results were compared to MOE Provincial Water Quality Objectives (PWQOs), the MOE Table A (Potable Groundwater Use), and the CCME Environmental Quality Guidelines (Water – Aquatic Life). Both surface water samples indicated concentrations of metals in exceedance of one or more of the applicable criteria. Parameters in exceedance of the CCME (Water – Aquatic Life) were aluminium, arsenic, chromium, and iron. Parameters in exceedance of the PWQOs or interim PWQOs included aluminium, arsenic, cobalt, copper, iron, and vanadium. Based on on-site observations and analytical surface water results, there is a potential that the two landfill areas (east and west) have impacted surface water on-site.

Based on the analytical results from the Conor Pacific 1997 Enhanced Phase 1 ESA, and the XCG 2000 Phase 2 ESA, two contaminated sites (CS-1 and CS-2) on the subject site were identified. CS-1 has been impacted by TPH (gas/diesel and heavy oil range), benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, antimony, barium, cadmium, chromium, copper, lead, nickel, selenium, and zinc exceeding CCME or MOE Table A criteria, and is comprised of the area north of the generator building, the area west of the concrete dyked tank farm, and the area west of the lightkeeper's dwelling. CS-2 has been impacted (in terms of surface water quality) by aluminium, arsenic, chromium, and iron in exceedance of the CCME (water – aquatic life) criteria, and consists of the landfill area on the northwest portion of the subject site.

During the 1997 Enhanced Phase 1 ESA, CCME National Classification System for Contaminated Sites (NCSCS) scores were calculated in for contamination at the waste disposal (west side), the waste disposal (east side), and the generator building. The scores were 51.7(± 3.5), 49.1 (± 3), and 57.2 (± 3), respectively. The first and last of these scores fall within the Class 2 designation (some action likely required). The score of 49.1 (± 3) falls with the Class 3 designation (some action may be required).

The NCSCS score calculated during the 2001 Phase 2 ESA for hydrocarbon and metals contamination at CS-1 is 62 with an estimated score of 4.5. This score is designated as Class 2 (some action likely required). The NCSCS score for metals contamination at CS-2 is 60 with an estimated score of 19.25. Since the estimated score for CS-2 is greater than15, CS-2 is designated as I (insufficient information to classify the site).

Based on the analytical data and visual observations, the quantity of soil impacted by metals and hydrocarbons in CS-1 is estimated to range between 163 and 326 cubic metres while the "best guess" amount is approximately 245 cubic metres. The quantity of soil impacted by metals at CS-2 has not been estimated, as there is currently insufficient information with which to classify this contaminated site. All minimum and maximum volume estimates are based on overburden depths of 0.2 metres and 0.4 metres, respectively.

Since the subject site is currently occupied, on a seasonal basis, by members of the general public, possibly including children, a qualitative risk assessment (QRA) has been performed to determine whether potential exposures to the contaminants found to be present at elevated concentrations at CS-1 and CS-2 are within acceptable limits, and thus whether any remedial action is required at this time. The results of the qualitative risk assessment indicate that there is a low to medium degree of risk associated with the receptors and pathways identified at both contaminated sites. Several remedial alternatives have been explored, and one has been recommended for CS-1. The site specific risk assessment (SSRA) / risk management plan is considered to be the most suitable and cost effective remedial alternative for CS-1 (approximate cost $95,000). As a component of this remedial option, the groundwater and sediment quality on the site would be investigated. This has not yet been carried out at this site. For CS-2, no remedial alternative has been recommended as there is insufficient subsurface sampling information. However, it is recommended that further sampling in this area, including groundwater and sediment quality sampling, be conducted (approximate cost $20,000).

The Treasury Board indicative estimates of liability and contingent liability associated with the contaminated sites identified on the subject property are as follows:

- CS-1: $95,000 (liability)
- CS-2: $20,000 (contingent liability)

The liability estimate associated with CS-1 represents the estimated cost of the recommended remedial alternative (SSRA/ risk management plan). In the case of CS-2, the contingent liability estimate represents the approximate cost for further sampling work, including a groundwater and sediment quality investigation in the area.

Recommendations regarding the Michipicoten Island, East End Light Station are outlined below.

1. An SSRA/ risk management plan should be implemented at CS-1. This remedial option will address the metals and hydrocarbon contamination at CS-1, and is the most cost effective of the feasible and acceptable remedial alternatives considered (approximately $95,000). As a component of this remedial option, the groundwater and sediment quality on the site would be investigated. This has not yet been carried out at this site.

2. Soil sampling, along with groundwater and sediment quality investigation should be conducted at CS-2, in order to further delineate the metals contamination at this contaminated site (approximately $20,000).

3. It is recommended that groundwater and sediment quality investigation be carried out at the site. The cost of this has been included in the liability estimates for CS-1 and CS-2.

CONTENTS

CONTENTS (cont'd)

TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

XCG Consultants Ltd. (XCG) was retained by Public Works and Government Services Canada (PWGSC) on behalf of the Department of Fisheries and Oceans Canada (DFO), Central and Arctic Region, to carry out a Phase 2 Environmental Site Assessment (ESA) of the Michipicoten Island, East End Light Station on Lake Superior, Ontario.

1.1 Scope and Assessment Objectives

In general, ESAs are completed in phases. An "Enhanced Phase 1" typically involves research, consultation, visual reconnaissance, limited sampling, and confirmatory testing. A Phase 1 report will indicate whether any remedial work is required, or if further (Phase 2) work is needed to achieve an adequate assessment of the property.

A Phase 2 ESA generally includes a more detailed field investigation (subsurface sampling, further analytical testing, etc.) in order to gain a better understanding of the environmental condition of the subject property.

The current assessment of the Michipicoten Island, East End light station follows the procedures of a Phase 2 ESA, including subsurface sampling and further analytical testing. The overall objective of the Phase 2 ESA was to investigate and delineate areas of potential environmental concern identified during the Enhanced Phase 1 ESA. The field work was conducted in general accordance with XCG's letter proposal entitled *"Proposal for Phase 2 Environmental Site Assessments, Canadian Coast Guard Navigational Sites, Near Sault Ste. Marie and Thunder Bay, Ontario," dated October 26, 2000.* PWGSC provided authorization to proceed with this Phase 2 investigation. Minor modifications were made in the field based on site observations. The final scope of work related to the Phase 2 ESA included the following:

- Collecting six soil samples at six locations north of the generator building (see Photo 1, Appendix B) to delineate subsurface metals, TPH (gas/ diesel and heavy oils), and PAH contamination. Soil samples were collected using a hand shovel;
- Collecting seven soil samples, including one QA/QC blind duplicate, at six locations west of the empty concrete dyked tank farm (see Photo 2, Appendix B) to delineate subsurface metals, TPH (gas/diesel and heavy oils) and PAH contamination. Soil samples were collected using a hand shovel;
- Collecting four soil samples at four locations in the vicinity of the east landfill site to delineate subsurface metals contamination. Soil samples were obtained using a hand shovel;
- Collecting two surface water samples at two locations; one south of the lightkeeper's dwelling, and one in the vicinity of the west landfill site (see Photo 3, Appendix B) to investigate metals and anions concentrations in surface water on-site;
- Field characterization of soil samples by screening with a field photoionization detector (i.e. MiniRae), which measures total organic vapours (TOVs) in the parts per million (ppm) range;
- Submitting seventeen soil samples (including one QA/QC blind duplicate) and two surface water samples for laboratory analyses of the parameters identified on the soil sample log, in Appendix G.;

- Reviewing and interpreting analytical results to identify exceedances of Federal and Provincial criteria;
- Delineating the impacted areas on the site plan and estimating the minimum, maximum, and "best guess" volumes of impacted soil on-site;
- Completing an updated National Classification System Site Summary;
- Completing the RPISCS information module,
- Preparing an indicative estimate of liability;
- Completing a qualitative risk assessment;
- Preparing a Remedial Action Plan; and
- Preparing a report documenting the findings of the above tasks.

1.2 Assessment Limitations

All information regarding the property description is based on the site visit observations and existing 1997 Enhanced Phase 1 ESA information, which is presumed to be accurate.

The intent of this report is to provide coverage of the entire area of the DFO property at Michipicoten Island, East End. The on-site subsurface investigation work, however, was limited to the core areas of the site (i.e. in the vicinity of previously identified areas of concern), since these are the areas where contamination, if present, would be expected.

This Phase 2 Subsurface Investigation focused on identifying any environmental damages as they relate to existing or potential future environmental liabilities relating specifically to the investigated areas of the Canadian Coast Guard property located at Michipicoten Island, East End, Lake Superior, Ontario. The conclusions drawn from the Phase 2 Subsurface Investigation work were based on information obtained at selected observation and sampling locations on November 7, 2000. In addition, the conclusions were based on the parameters that were chemically analyzed. Conditions between and beyond these locations may become apparent, during future investigations or on-site work, which could not be detected or anticipated at the time of this study. The sample locations were chosen based upon visual observations on-site and information provided in the 1997 Conor Pacific Enhanced Phase 1 ESA.

The scope of this report is limited to the matters expressly covered. This report is prepared for the sole benefit of the Department of Fisheries and Oceans and Public Works and Government Services Canada, and may not be relied upon by any other person or entity without written authorization of XCG Consultants Ltd. As such, the scope of services performed in the execution of this investigation may not be appropriate to satisfy needs of other users, and any use or reuse of this document or the findings, conclusions, or recommendations represented herein is at the sole risk of said users.

2.0 DESCRIPTION OF THE SITE

The Michipicoten Island, East End light station is comprised of a 39.3 hectare (97.1 acre) plot of land on the northeastern end of Michipicoten Island, in Lake Superior. The light station is also located at the east end of Michipicoten Island Provincial Park. Michipicoten Island is situated approximately 38 nautical miles (70 km) southeast of the Town of Wawa. The subject site was established in 1912 and operated for over 70 years as an attended light station. Currently, the light station is unattended and consists of a lighthouse, a fog alarm building, a generator building, an equipment shed, an empty concrete dyked tank farm, and a residential dwelling. Foundations from a former radio beacon building, a former fuel storage shed, a former boathouse, and a former double dwelling remain on-site. A site plan (Figure 1) and a site location plan (Figure 2) are included in Appendix A. Selected photographs taken during the site inspection are included as Appendix B.

2.1 Previous Environmental Reports

The following Enhanced Phase 1 ESA was reviewed:

- Conor Pacific Environmental Technologies Inc. *"Phase 1 Environmental Site Assessment, Michipicoten Island, East End Light Station, L.L. 1097, Lake Superior, Ontario, PWGSC Project #764661"* March 1997.

The conclusions of the 1997 Enhanced Phase 1 ESA report are summarized below:

- The site has been impacted by historical use as an attended lighthouse facility and residential area.

- Soil from BH-301, collected in the landfill area immediately west of the lightkeeper's dwelling, exceeded the MOE 1996 and CCME remediation guidelines for heavy metals (cadmium, copper, mercury, and zinc) and exceeded the CCME remediation guidelines for arsenic and conductivity.

- Soil from BH-302, collected in a fuel stained area immediately north of the diesel generator building, exceeded the MOE remediation guidelines for TPH (gas/diesel and heavy oil), PAH (pyrene), and exceeded the CCME remediation guidelines for beryllium, conductivity, and zinc.

- Two separate areas (each approximately 25 square metres in size) have been utilized as landfill facilities. Numerous batteries, paint cans, and solvents were catalogued during the Enhanced Phase 1 assessment. The depth of the material within each area is unknown.

- Lead-based paints were identified on painted surfaces at the lighthouse. The green high gloss paint used on the metal trim had a lead content of 59,147 parts per million (ppm). Paints were found to be deteriorating on the outside of the buildings; particularly the red paint on the window trim and doors. Based on analytical testing of typical CG paints (red, white, and grey) on painted surfaces at this site and other CG sites, other painted surfaces at this site may contain lead-based paint.

- Asbestos was identified within the radio beacon, the lightkeeper's dwelling, the equipment building, and the former double dwelling as a non-friable wall panel (transite board), and waste material (i.e. discarded wall boards etc.).

- PCB containing material may be present in minor quantities in the videograph capacitor, located in the fog alarm building.

- There are six aboveground storage tanks (ASTs) associated with the property. Three 9,000 litre diesel ASTs are situated in the concrete dyked tank farm west of the generator building. One 200 litre diesel tank is located inside the fog alarm building, and two 900 litre fuel oil tanks are situated adjacent to the southeast corner of the lightkeeper's dwelling. All ASTs appeared to be in good condition, with no leaks or staining noted.

- Although not mentioned in the report conclusions, a surface water sample SW-301, collected near the east landfill site (west of the lightkeeper's dwelling) indicated a concentration of chromium in exceedance of the CCME (water – aquatic life) criteria.

2.2 Land Use Profile

The following is a brief summary of the historic land use of Michipicoten Island, East End, as described in the Enhanced Phase 1 ESA (Conor Pacific, 1997). The current and future uses of the property are also stated.

DATE	LAND USE/NOTABLE EVENT
Jan.12, 1912	Department of Marine and Fisheries granted 100 acres at the northeast end of the Island for the development of a Lighthouse Reserve by the Province of Ontario
1911	The lighthouse was constructed.
1912	Fog Alarm building was constructed (initially a lightkeeper's dwelling).
1912	Oil shed and boathouse were constructed.
1928	The original radio beacon building was constructed.
1928-29	The radio beacon building was constructed.
1953	The fog alarm was installed.
1953	The lightkeeper's dwelling was constructed.
1963	Original double dwelling (duplex) was constructed.
1988	Final year station was staffed by lightkeepers.
1990	Original double dwelling (duplex) was demolished.
1994	Solar power system installed.
Present	• station operates as unattended navigation light only;
Future	• station to continue as unattended navigation light.

2.3 Site Reconnaissance

The site was visited by XCG field personnel on November 7, 2000. Access to the site was provided by Canadian Coast Guard (CCG) helicopter. Climatic conditions were cool and overcast, with moderate winds. General site characteristics were observed and documented, and a sampling program was conducted, as discussed in Section 1.1. A site plan (Figure 1) is provided in Appendix A. Selected photographs taken during the site visit are presented in Appendix B.

In conjunction with the Phase 2 ESA site visit, an inspection and documentation of all storage tanks on-site was conducted. The tank inspection was conducted as part of a tank audit that XCG is undertaking for PWGSC, on behalf of DFO. The results of the tank audit are to be provided in a separate report.

During the site inspection, it was noted that three 9,000 litre ASTs have been removed from the concrete dyked tank farm. No other significant changes to the site since the 1997 Phase 1 ESA were noted.

2.3.1 Health and Safety Plan

A health and safety plan was maintained throughout the field program. All field workers were instructed on the protocols of the plan and the proper use of personal protective equipment. Worker health and safety standards were assured by following stringent safety precautions in accordance with the applicable sections specified under the Canada Labour Code and the Canada Health and Safety Act.

Potential hazards for this project included exposure to contaminated soil and building materials containing designated substances during the site inspection and sampling program. Throughout the duration of the field activities, the following sections of the General Health and Safety Policy were adopted, as a minimum: site safety; Ontario Occupational Health and Safety Act (OHSA); first aid; Workplace Hazardous Materials Information System (WHMIS); and work over/around water.

Transportation to the subject site was via CCG helicopter. The pilot provided a briefing pertaining to safety measures for conduct while on the CCG helicopter. In addition, survival suits, including personal flotation devices, were supplied to field personnel.

2.4 QA/QC Analysis

A quality assurance and quality control (QA/QC) program was implemented to address the office and field programs. A blind field duplicate of soil sample MIC-AST-6 was analyzed for QA/QC purposes. The blind duplicate sample was identified as MIC-AST-AW6 and submitted for metals analysis. As part of these procedures, a lab blank and QC standards were analyzed during the testing of the samples. A minimum of 10% of the samples were to be submitted for QA/QC purposes. Only one soil sample of the seventeen collected at the Michipicoten Island site was submitted. However, approximately 10% of the total samples submitted (including samples from seven other CCG sites) were submitted as blind duplicates for QA/QC analysis by Entech.

The variance in concentrations between MIC-AST-6 and MIC-AST-AW6 for the individual (metals) parameters analyzed in the blind duplicate sample generally ranged from about 5 to 47%, which is considered representative. Entech laboratory also conducted laboratory duplicate analyses of soil samples MIC-LF-4 for anions, MIC-HFS-6 for PAHs, and surface water sample MIC-LF-SF1 for metals and anions. The analytical results of the laboratory duplicate samples did not significantly deviate from the original samples. Further, the results of Entech's internal QA/QC program (i.e. blanks and recoveries of QC standards) were considered representative and reproducible.

As a minimum, samplers were thoroughly cleaned before collecting subsequent samples to reduce the risk of cross-contamination between sampling. For all sampling locations, logs containing all pertinent information were prepared (see Appendix G) and collected samples were placed in appropriate containers immediately upon retrieval. Soil classification was completed in accordance with applicable sections of the Canadian Foundation Engineering Manual (CFEM). Field sampling and equipment decontamination was completed in accordance with applicable Environment Canada protocols and applicable industry practices. All laboratory chemical analyses were performed by an analytical laboratory that is accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL).

Soil samples were collected using a stainless steel hand trowel or shovel, placed in individual 250 mL glass jars or sealable plastic bags (as appropriate), identified, and logged for physical properties. Duplicate soil samples utilized for screening purposes were collected and placed in containers in the same manner. Soil samples were selected for laboratory analysis based on visual observations combined with screening results. Surface water samples were collected in 250 mL glass jars, identified, and logged.

A chain of custody form accompanied the samples at all points of handling. Samples were preserved until delivered to Entech Laboratory in Mississauga, Ontario, for analytical testing.

3.0 SUBSURFACE INVESTIGATION

The on-site field investigations were conducted on November 7, 2000. Sampling activities were conducted by Mr. Jonathon Ho and Ms. Andrea Wilson of XCG. A description of the field investigation methodology used is provided below.

3.1 Methodology

A hand shovel was used to collect soil samples in this investigation, and was cleaned between sampling locations to prevent cross-contamination. Soil samples were visually classified and logged for soil structure, and visual evidence of contamination. Surface water samples collected were classified for visual evidence of contamination. Headspace vapours in the soil sample bags were screened for TOV readings using a field photoionization detector (i.e. MiniRae meter).

Seventeen soil samples and two surface water samples were collected and submitted for laboratory analyses. The sampling locations, TOV readings, test soil parameters, and analytical program are summarized in Appendix G. The soil and surface water samples were stored in glass sample jars with teflon-lined lids, placed in coolers (containing ice/cooler packs), and delivered to Entech Laboratories in Mississauga, Ontario for analytical testing.

Figure 1 (Appendix A) contains a site plan that shows the Phase 1 and 2 ESA sampling locations.

3.2 Results

A total of seventeen soil samples including one duplicate (for QA/QC purposes) and two surface water samples were submitted to Entech for analyses. Seventeen soil samples, including one blind duplicate, were analyzed for metals. Twelve soil samples were analyzed for TPH (gas/diesel and heavy oil range). Four soil samples were analyzed for anions. PAHs were analyzed in twelve soil samples. Two surface water samples were analyzed for metals and anions. A summary of the analytical results for TPH are presented in Table 1, metals in Table 2, anions (soil) in Table 3, metals and anions (surface water) in Table 4, and PAHs in Table 5. Laboratory certificates of analyses are provided in Appendix C. A summary of sample location, test parameters, depth of sample, and exceedances of applicable criteria found in each soil sample is provided in Appendix G.

Table 1
Summary of Analytical Results for Petroleum Hydrocarbons in Soil
Michipicoten Island, L.L. 1097, Lake Superior, Ontario

PARAMETER (µg/g)	MDL	MIC-HFS-1	MIC-HFS-2	MIC-HFS-3	MIC-HFS-4	MIC-HFS-5	MIC-HFS-6	MIC-AST-1	MIC-AST-2	MIC-AST-3	CCME RES/PARK	MOE TABLE A RES/PARK	MOE TABLE F
TPH (gas/diesel)	10	**190**	**110**	**770**	**150**	**1,300**	**30**	<	**6,200**	<	NV	100	NV
TPH (Heavy Oils)	80	**1,600**	**1,200**	**110**	**1,100**	**1,700**	<	<	**790**	<	NV	1,000	NV

Table 1 (Cont'd)
Summary of Analytical Results for Petroleum Hydrocarbons in Soil
Michipicoten Island, L.L. 1097, Lake Superior, Ontario

PARAMETER (µg/g)	MDL	MIC-AST-4	MIC-AST-5	MIC-AST-6	CCME RES/PARK	MOE TABLE A RES/PARK	MOE TABLE F
TPH (gas/diesel)	10	<	**120**	<	NV	100	NV
TPH (Heavy Oils)	80	**110**	<	<	NV	1,000	NV

NOTES:

MDL	Laboratory Method Detection Limit	**Bold**	Value is detectable, but not in exceedance
NV	No guideline criteria for this parameter	**Bold**	Value exceeds one guideline

Table A	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table A surface soil criteria (coarse-grained) for residential/parkland land use in a potable groundwater situation
Table F	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table F Ontario Typical Range Soil Concentrations (Background). Although there is no Table F TPH (gas/diesel) background value for TPH, detectable TPH is considered to represent an exceedance of typical background values, and thus detectable TPH concentrations are shown in bold in the above table
CCME	Canadian Council of Ministers of the Environment, "Canadian Environmental Quality Guidelines," 1999.
<	None detected

Table 2
Summary of Analytical Results for Selected Metals in Soil
Michipicoten Island, L.L. 1097, Lake Superior, Ontario

PARAMETER (µg/g)	MDL	MIC-HFS-1	MIC-HFS-2	MIC-HFS-3	MIC-HFS-4	MIC-HFS-5	MIC-HFS-6	MIC-LF-1	MIC-LF-2	CCME RES/PARK	MOE TABLE A	MOE TABLE F
Aluminium	5	2,785	2,616	7,129	3,814	5,258	3,581	11,438	1,346	NV	NV	NV
Antimony	1	<1	**2.4**	**1.2**	**1.7**	**7.8**	**1.1**	**3.4**	$\boxed{151}$	20*	13	1.0
Arsenic	1	2.2	3.4	7.6	7.0	14.0	4.3	7.8	10.8	12	20	17
Barium	1	182	**351**	**391**	**478**	$\boxed{1,054}$	120	$\boxed{1,090}$	$\boxed{728}$	500*	750	210
Beryllium	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4*	1.2	1.2
Boron (HWE)	0.02	0.28	0.33	0.14	0.19	0.19	0.06	0.15	0.13	NV	1.5	NV
Cadmium	0.5	**2.3**	$\boxed{10.9}$	**2.8**	**2.4**	$\boxed{12.1}$	<0.5	<0.5	$\boxed{37.0}$	10	12	1.0
Chromium	1	18.5	$\boxed{101}$	13.6	$\boxed{74.3}$	61.1	$\boxed{114}$	54.3	$\boxed{266}$	64	750	71
Cobalt	1	2.1	2.2	3.5	<1	3.7	8.6	15.6	**33.7**	50*	40	21
Copper	1	41.4	47.1	82.5	71.5	$\boxed{168}$	$\boxed{213}$	$\boxed{85.8}$	$\boxed{378}$	63	225	85
Iron	10	9,291	7,860	13,673	8,426	11,976	21,314	19,183	319,805	NV	NV	NV
Lead	2	$\boxed{256}$	$\boxed{671}$	$\boxed{1,593}$	$\boxed{846}$	$\boxed{1,386}$	$\boxed{406}$	$\boxed{123,422}$	$\boxed{7,215}$	140	200	120
Manganese	1	378	827	670	600	361	272	455	1236	NV	NV	NV
Mercury	0.05	**0.44**	**0.64**	**1.58**	**1.13**	**3.09**	0.20	**0.24**	**2.46**	6.6	10	0.23
Molybdenum	2	<2	<2	<2	<2	<2	<2	<2	<2	10*	40	2.5
Nickel	1	9.6	$\boxed{245}$	6.1	22.5	17.1	$\boxed{52.7}$	42.0	$\boxed{84.1}$	50	150	43
Phosphorus	10	1,067	1,457	1,273	1,673	937	686	713	1,339	NV	NV	NV
Selenium	1	<1	$\boxed{3.9}$	<1	<1	<1	<1	**2.3**	<1	3*	10	1.9
Silver	0.5	<0.5	<0.5	1.8	<0.5	<0.5	<0.5	<0.5	<0.5	20*	20	0.42
Vanadium	1	6.4	2.7	19.9	4.0	10.2	15.9	68.8	10.9	130	200	91
Zinc	1	$\boxed{762}$	$\boxed{315}$	$\boxed{641}$	$\boxed{1,202}$	$\boxed{666}$	$\boxed{319}$	$\boxed{1,126}$	$\boxed{8,142}$	200	600	160

Table 2 cont'd
Summary of Analytical Results for Selected Metals in Soil
Michipicoten Island, L.L. 1097, Lake Superior, Ontario

PARAMETER (µg/g)	MDL	MIC-LF-3	MIC-LF-4	MIC-AST-1	MIC-AST-2	MIC-AST-3	MIC-AST-4	MIC-AST-5	MIC-AST-6	MIC-AST-AW6 (DUP of MIC-AST-6)	CCME RES/PARK	MOE TABLE A	MOE TABLE F
Aluminium	5	3,468	3,026	8,824	5,141	10,838	2,984	4,147	5,965	5,064	NV	NV	NV
Antimony	1	**2.5**	**1.2**	<1	**19.0**	**6.4**	**7.7**	**2.1**	**1.3**	**1.8**	20*	13	1.0
Arsenic	1	4.3	2.2	**14.7**	5.3	13.9	3.9	5.5	10.9	**14.4**	12	20	17
Barium	1	**303**	201	182	**401**	185	97.9	**512**	**573**	**475**	500*	750	210
Beryllium	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4*	1.2	1.2
Boron (HWE)	0.02	0.38	0.16	0.29	0.17	0.38	0.24	0.30	0.24	0.17	NV	1.5	NV
Cadmium	0.5	**11.9**	<0.5	0.8	1.1	<0.5	<0.5	1.7	<0.5	<0.5	10	12	1.0
Chromium	1	14.2	6.5	31.2	21.3	10.1	34.3	24.3	18.7	21.9	64	750	71
Cobalt	1	6.5	<1	3.0	1.5	7.3	2.3	3.9	4.0	4.5	50*	40	21
Copper	1	**138**	**73.4**	36.2	50.0	20.7	22.7	62.9	**121**	**199**	63	225	85
Iron	10	37,493	17,081	8,069	15,862	7,208	8,895	6,903	8,570	10,564	NV	NV	NV
Lead	2	**541**	**575**	**329**	**1,644**	56.3	**213**	**1,863**	**1,702**	**2,059**	140	200	120
Manganese	1	1221	380	326	548	1368	230	305	557	783	NV	NV	NV
Mercury	0.05	**0.66**	**0.24**	0.22	**3.51**	0.20	0.17	**1.42**	**0.29**	**0.55**	6.6	10	0.23
Molybdenum	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	10*	40	2.5
Nickel	1	**59.6**	14.8	10.2	7.0	8.5	13.9	4.1	7.2	8.5	50	150	43
Phosphorus	10	1,163	885	1,100	2,181	1,130	521	826	1,224	2,274	NV	NV	NV
Selenium	1	<1	<1	1.3	<1	<1	<1	1.3	1.3	<1	3*	10	1.9
Silver	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	20*	20	0.42
Vanadium	1	1.7	3.5	15.4	19.8	23.7	16.4	12.9	17.1	18.6	130	200	91
Zinc	1	**1,500**	**356**	**334**	**687**	**104**	**170**	**1,112**	**1,530**	**1,604**	200	600	160

NOTES:

MDL	Laboratory Method Detection Limit
NV	No Guideline concentration for this parameter
Bold	Value exceeds one guideline
Bold	Value exceeds two guidelines
Bold	Value exceeds three guidelines
Table A	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table A surface soil criteria (coarse-grained) for residential/parkland land use in a potable groundwater situation
Table F	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table F Ontario Typical Range Soil Concentrations (Background)
CCME	Canadian Council of Ministers of the Environment, "Canadian Environmental Quality Guidelines," 1999.
*CCME	Canadian Council of Ministers of the Environment, "Interim Canadian Environmental Quality Criteria for Contaminated Sites", September 1991.

Table 3
Summary of Analytical Results for Anions in Soil
Michipicoten Island, L.L. 1097, Lake Superior, Ontario

PARAMETER (µg/g)	MDL	MIC-LF-1	MIC-LF-2	MIC-LF-3	MIC-LF-4	MIC-LF-4 **DUP	CCME RES/PARK	MOE TABLE A	MOE TABLE F
Fluoride	0.25	<0.25	<0.25	0.35	0.34	0.34	*400	NV	NV
Chloride	0.25	14.5	18.0	15.9	11.8	11.9	NV	NV	330
Nitrate	0.25	0.98	0.99	1.71	0.92	0.660	NV	NV	61
Nitrite	0.25	<0.25	<0.25	<0.25	<0.25	<0.25	NV	NV	61
Bromide	0.25	<0.25	<0.25	<0.25	<0.25	<0.25	NV	NV	NV
Phosphate	0.5	1.75	<0.5	<0.5	<0.5	<0.5	NV	NV	NV
Sulphate	0.25	8.91	21.0	28.8	18.8	18.7	NV	NV	NV

NOTES:

MDL	Laboratory Method Detection Limit
NV	No Guideline concentration for this parameter

Bold	Value exceeds one guideline
$\boxed{\textbf{Bold}}$	Value exceeds two guidelines
$\boxed{\textbf{Bold}}$	Value exceeds three guidelines

Table A	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table A surface soil criteria (coarse-grained) for residential/parkland land use in a potable groundwater situation
Table F	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table F Ontario Typical Range Soil Concentrations (Background)
CCME	Canadian Council of Ministers of the Environment, "Canadian Environmental Quality Guidelines," 1999.
*CCME	Canadian Council of Ministers of the Environment, "Interim Canadian Environmental Quality Criteria for Contaminated Sites", September 1991.
**Dup	Indicates duplicate analysis of sample chosen by laboratory.

Table 4
Summary of Analytical Results for Metals and Anions in Surface Water
Michipicoten Island, L.L. 1097, Lake Superior, Ontario

PARAMETER (µg/L)	MDL	MIC-SW1	MIC-LF-SF1	MIC-LF-SF1**DUP	PWQO	CCME (WATER – AQUATIC LIFE)	MOE TABLE A (POTABLE GROUNDWATER) ALL LAND USE
Aluminium	50	$\boxed{701}$	$\boxed{110}$	$\boxed{114}$	15-75^{a,e}	5-100^{a}	NV
Antimony	1	1	1	1	7^{e}	NV	6.0
Arsenic	1	$\boxed{14}$	$\boxed{12}$	$\boxed{11}$	5^{e}	5	25
Barium	10	54	133	132	NV	NV	1,000
Beryllium	0.2	<0.2	<0.2	<0.2	11-1,100^{b}	NV	4.0
Boron (HWE)	10	<10	<10	<10	200^{e}	NV	5,000
Cadmium	0.8	<0.8	<0.8	<0.8	0.1-0.5^{b,e}	0.017	5.0
Calcium	500	3,473	13,483	13,583	NV	NV	NV
Chromium	10	**46**	**34**	**36**	100	1-8.9^{c}	50
Cobalt	10	**33**	**28**	**28**	0.4^{e}	NV	100
Copper	0.5	**1.3**	**1.4**	**1.3**	1-5^{b,e}	NV	23
Iron	100	$\boxed{978}$	<100	<100	300	300	NV
Lead	2	<2	<2	<2	1-5^{b,e}	1-7^{d}	10
Magnesium	100	544	836	851	NV	NV	NV
Manganese	10	792	186	186	NV	NV	NV
Mercury	0.05	<0.05	<0.05	<0.05	0.2^{f}	0.1	0.12
Molybdenum	20	<20	<20	<20	10^{e}	73	7,300
Nickel	10	10	<10	<10	25	25-150^{d}	100
Phosphorus	100	<100	<100	<100	10-30^{e}	NV	NV
Potassium	500	904	1139	1189	NV	NV	NV
Selenium	1	<1	<1	<1	100	1	10
Silver	0.8	<0.8	<0.8	<0.8	0.1	0.1	1.2
Sodium	100	1095	1505	1495	NV	NV	200,000
Vanadium	10	**17**	**16**	**19**	7^{e}	NV	200
Zinc	10	19	<10	<10	20^{e}	30	1,100
Sulphate	0.05	3,100	590	620	NV	NV	NV
Chloride	0.05	690	610	610	NV	NV	250,000
Nitrate-N	0.01	60	40	40	NV	NV	10,000
Nitrite-N	0.015	55	48	48	NV	60	1,000
Ortho Phosphate	0.1	<100	<100	<100	NV	NV	NV
Fluoride	0.05	70	70	<50	NV	NV	NV
Bromide	0.05	<50	<50	<50	NV	NV	NV

NOTES:

Bold	Value exceeds one guideline
$\boxed{\textbf{Bold}}$	Value exceeds two guidelines
$\boxed{\boxed{\textbf{Bold}}}$	Value exceeds three guidelines

MDL	Laboratory Method Detection Limit
NV	No Guideline concentration for this parameter
Table A	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table A surface soil criteria (coarse-grained) for residential/parkland land use in a potable groundwater situation
Table F	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table F Ontario Typical Range Soil Concentrations (Background)
CCME	Canadian Council of Ministers of the Environment, "Canadian Environmental Quality Guidelines," 1999.
*CCME	Canadian Council of Ministers of the Environment, "Interim Canadian Environmental Quality Criteria for Contaminated Sites", September 1991.
PWQO	Ministry of the Environment, "Provincial Water Quality Objectives," July 1994.
**Dup	Indicates duplicate analysis on sample chosen by laboratory.
a	Range of guidelines is based on pH of sample
b	Range of guidelines is based on hardness of sample
c	Indicates range for hexavalent chromium to trivalent chromium concentrations
d	Range of guidelines is based on alkalinity of sample
e	Indicates that the value is an Interim PWQO
f	In an unfiltered water sample

Table 5
Summary of Analytical Results for PAHs in Soil
Michipicoten Island, L.L. 1097, Lake Superior, Ontario

PARAMETER (µg/g)	MDL	MIC-HFS-1	MIC-HFS-2	MIC-HFS-3	MIC-HFS-4	MIC-HFS-5	MIC-HFS-6	MIC-HFS-6 **DUP	MIC-AST-1	MIC-AST-2	MIC-AST-3	MIC-AST-4	MIC-AST-5	MIC-AST-6	CCME RES/PARK	MOE TABLE A	MOE TABLE F
Naphthalene	0.007	<	0.02	<	<	<	<	<	<	<	<	0.11	0.05	<	0.6	4.6	0.09
Acenaphthylene	0.004	<	<	<	**0.41**	<	<	<	<	<	**0.13**	0.04	0.04	<	NV	100	0.08
Acenaphthene	0.004	<	<	<	<	<	<	<	<	<	<	<	<	<	NV	15	0.07
Fluorene	0.007	<	<	<	<	<	<	<	<	<	<	<	<	<	NV	340	0.12
Phenanthrene	0.006	<	0.40	0.32	0.57	<	<	<	<	<	0.03	0.06	0.09	<	5*	40	0.69
Anthracene	0.004	<	**0.21**	<	**0.35**	<	<	<	<	<	0.03	0.04	0.09	<	NV	28	0.16
Fluoranthene	0.003	<	0.37	<	**2.1**	0.13	<	<	0.01	<	<	0.13	0.33	<	NV	40	1.1
Pyrene	0.002	<	0.33	0.10	**2.0**	0.14	<	<	0.02	0.20	<	0.37	0.35	<	10*	250	1.0
Benzo (a) anthracene	0.006	0.25	0.27	0.15	$\boxed{\mathbf{1.6}}$	0.45	<	<	<	0.28	<	0.45	0.38	<	1*	6.6	0.74
Chrysene	0.005	0.04	0.05	0.03	0.28	0.08	<	<	0.01	0.06	<	0.12	0.20	<	NV	12	0.69
Benzo (b) fluoranthene	0.004	0.12	0.13	<	$\boxed{\mathbf{1.5}}$	0.10	<	<	0.01	<	<	0.14	0.16	<	1*	12	0.47
Benzo (k) fluoranthene	0.008	0.07	0.09	<	<	0.06	<	<	<	<	<	0.10	0.12	<	1*	12	0.48
Benzo (a) pyrene	0.003	0.35	<	<	$\boxed{\mathbf{1.1}}$	0.16	<	<	<	<	0.42	$\boxed{\mathbf{0.76}}$	0.29	<	0.7	1.2	0.49
Indeno (1,2,3-cd) pyrene	0.004	0.08	<	<	**0.70**	<	<	<	<	<	<	**0.95**	<	<	1*	12	0.38
Dibenzo (a,h) anthracene	0.003	<	<	<	**0.17**	<	<	<	<	<	<	$\boxed{\boxed{\mathbf{1.5}}}$	<	<	1*	1.2	0.16
Benzo (g,h,i) perylene	0.004	0.23	<	<	0.34	<	<	<	<	<	<	0.59	0.16	<	NV	40	0.68

NOTES:

MDL	Laboratory Method Detection Limit	**Bold**	Value exceeds one guideline
NV	No Guideline concentration for this parameter	$\boxed{\mathbf{Bold}}$	Value exceeds two guidelines
		$\boxed{\boxed{\mathbf{Bold}}}$	Value exceeds three guidelines

Table A	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table A surface soil criteria (coarse-grained) for residential/parkland land use in a potable groundwater situation
Table F	MOE, "Guideline for Use at Contaminated Sites in Ontario," Table F Ontario Typical Range Soil Concentrations (Background)
CCME	Canadian Council of Ministers of the Environment, "Canadian Environmental Quality Guidelines," 1999.
*CCME	Canadian Council of Ministers of the Environment, "Interim Canadian Environmental Quality Criteria for Contaminated Sites", September 1991.
**Dup	Indicates duplicate analysis on sample chosen by laboratory.
<	None detected

3.3 Interpretation of Results

Soil sample analytical results were compared to the following criteria:

- Table F criteria for all other land use published in the Ontario Ministry of the Environment (MOE) Guideline for Use at Contaminated Sites in Ontario (February 1997);
- MOE Table A criteria for residential/parkland use published in the Ontario Ministry of the Environment (MOE) Guideline for Use at Contaminated Sites in Ontario (February 1997);
- Criteria for residential/parkland land use in the Canadian Council of Ministers of the Environment (CCME) document entitled Canadian Environmental Quality Guidelines (1999);
- Criteria for residential/parkland use in the CCME document entitled Interim Canadian Environmental Quality Criteria for Contaminated Sites (September 1991);

Surface water analytical results were compared to the following criteria and objectives:

- Criteria for Water – Aquatic Life in the Canadian Council of Ministers of the Environment (CCME) document entitled Canadian Environmental Quality Guidelines (1999);
- MOE Provincial Water Quality Objectives (PWQO) (1994); and
- MOE Table A potable groundwater criteria published in the Ontario Ministry of the Environment (MOE) Guideline for Use at Contaminated Sites in Ontario (February 1997).

With respect to soil, the CCME 1991 criteria were only considered in cases of parameters that did not have more recent CCME criteria. Contaminated sites were identified based on exceedances of CCME (residential/parkland) criteria, and exceedances of MOE Table A in the case of TPH (gas/diesel and heavy oils).

A comparison of soil analytical results was made to the MOE Table A guidelines, which are not strictly applicable given the shallow depth of overburden on the subject site, but which may still be considered to be protective of human health provided that contaminant leaching to groundwater can be eliminated as a pathway of concern.

The CCME Water – Aquatic Life criteria and the MOE PWQO were used for comparison of the surface water results. A comparison was also made to the MOE Table A potable groundwater criteria because shallow groundwater is expected to exist near the surface of the bedrock on the site, which is within about 0.3 m of the ground surface. Consequently, the surface water quality is expected to be similar to the quality of the shallow groundwater on the property.

As indicated above, the Table F clean-up criteria in the MOE Guideline were used for comparison to the results of analysis of soil samples collected at the Michipicoten Island, East End site. Table A values generally apply to sites in a non-potable groundwater situation. However, Table A does not apply to sites which are considered to be potentially sensitive. Potentially sensitive sites include those which may contain unique, highly sensitive receptors which may not have been considered in the development of the generic criteria (ANSI's; wetlands; fish habitat; habitat of vulnerable, threatened or endangered species of birds, wildlife, fish or plants; for example), or those where site conditions are such that there is less than 2 metres of overburden and soil overlying the bedrock in the contaminated areas of the site. As Michipicoten Island, has an estimated maximum soil cover of approximately 0.3 metres, the site is considered to be potentially sensitive. Table F provides background soil criteria which may be used at any site, including potentially sensitive sites, and has thus been used as the provincial comparison criteria set for this site. There are no Table F values for TPH, as TPH is not naturally occurring in soil. Although Table A is not applicable to the subject property, the TPH values were compared to Table A to provide a general indication of the degree of impact.

3.4 Discussion

All seventeen of the soil samples submitted for metals analysis during the Phase 2 ESA, as well as the two soil samples that were analyzed for metals during the Enhanced Phase 1 ESA, indicated concentrations of metals above the CCME (residential/parkland) and MOE Table F criteria. The metals that exceeded the CCME criteria consisted of antimony, barium, cadmium, chromium, copper, lead, nickel, selenium, and zinc. Parameters in exceedance of the MOE Table F criteria were antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc.

Soil sampling from the Phase 2 ESA north of the generator building and in the vicinity of the concrete dyked tank farm indicated detectable concentrations of TPH (gas/diesel) and TPH (heavy oil) ranging from 30 ug/g to 6,200 ug/g. During the Enhanced Phase 1 ESA, one soil sample from north of the generator building was analyzed for TPH (no specified range) and found to have a TPH concentration of 14,000 ug/g. There are no Table F values for TPH, as TPH is not naturally occurring in soil. Although Table A is not applicable to the subject property, the TPH values were compared to Table A to provide a general indication of the degree of impact. Six soil samples collected north of the generator building (including the one from the Enhanced Phase 1 ESA), and two in the vicinity of the empty concrete dyked tank farm indicated concentrations of TPH (gas/diesel) or TPH (heavy oil), or both, in exceedance of MOE Table A criteria.

During the Phase 2 ESA, one soil sample collected north of the generator building and one collected west of the concrete dyked tank farm indicated concentrations of PAH in exceedance of the CCME (residential/parkland) criteria. These parameters consisted of benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene. Three of the soil samples collected north of the generator building or west of the concrete dyked tank farm indicated concentrations of PAH above MOE Table F values for one or more of the following parameters: acenaphthylene, anthracene, fluoranthene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. One soil sample collected from the area north of the generator building during the Enhanced Phase 1 ESA contained an exceedance of the MOE Table F value for pyrene.

Anions concentrations were analyzed in four soil samples collected on-site. No exceedances of the MOE Table F (background) values, or CCME (residential/parkland) criteria were noted.

Metals and anions concentrations were analyzed in two surface water samples collected on-site, one near the landfill site on the northwestern part of the site near the former double dwelling and one near the landfill site to the west of the lightkeeper's dwelling. Analytical results were compared to MOE Provincial Water Quality Objectives (PWQOs), MOE Table A (Potable Groundwater Use), and CCME Environmental Quality Guidelines (Water – Aquatic Life). Both surface water samples indicated concentrations of metals in exceedance of one or more of the applicable criteria. Parameters in exceedance of the CCME (Water – Aquatic Life) were aluminium, arsenic, chromium, and iron. Parameters in exceedance of the PWQOs or interim PWQOs included aluminium, arsenic, cobalt, copper, iron, and vanadium. Based on on-site observations and analytical surface water results, there is a potential that the two landfill areas (east and west) have impacted the surface water on-site.

Based on the analytical results from the Conor Pacific 1997 Enhanced Phase 1 ESA, and the XCG 2001 Phase 2 ESA, two contaminated sites (CS-1 and CS-2) on the subject site were identified. CS-1 has been impacted by TPH (gas/diesel and heavy oil range), benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, antimony, barium, cadmium, chromium, copper, lead, nickel, selenium, and zinc exceeding CCME or MOE Table A criteria, and is comprised of the area north of the generator building, the area west of the concrete dyked tank farm, and the area west of the lightkeeper's dwelling. CS-2 has been impacted (in terms of surface water quality) by aluminium, arsenic, chromium, and iron in exceedance of the CCME (water – aquatic life) criteria, and consists of the landfill area on the northwest portion of the subject site.

CCME National Classification System for Contaminated Sites (NCSCS) scores were calculated during the 1997 Enhanced Phase 1 ESA for contamination at the waste disposal (west side), the waste disposal (east side), and the generator building. The scores were 51.7(± 3.5), 49.1 (± 3), and 57.2 (± 3), respectively. The first and last of these scores fall within the Class 2 designation (some action likely required). The score of 49.1 (± 3) falls with the Class 3 designation (some action may be required).

The NCSCS score calculated during the 2001 Phase 2 ESA for hydrocarbon and metals contamination at CS-1 is 62 with an estimated score of 4.5. This score is designated as Class 2 (some action likely required). The NCSCS score for metals contamination at CS-2 is 60 with an estimated score of 19.25. Since the estimated score for CS-2 is greater than 15, CS-2 is designated as I (insufficient information to classify the site).

Based on the analytical data (from the Enhanced Phase 1, and Phase 2 ESAs) and visual observations, the quantity of soil impacted by metals and hydrocarbons in CS-1 is estimated to range between 163 and 326 cubic metres while the "best guess" amount is approximately 245 cubic metres. These quantity estimates are summarized in the table below. The quantity of soil impacted by metals at CS-2 has not been estimated, as there is currently insufficient information with which to classify this contaminated site. All minimum and maximum volume estimates are based on overburden depths of 0.2 metres and 0.4 metres, respectively.

LOCATION	AREA IMPACTED (m^2)	DEPTH OF IMPACT (m)	VOLUME OF IMPACT (m^3)	BEST GUESS VOLUME ESTIMATE (m^3)	CONTAMINANTS
CS-1 (a): Area north of generator building	265	0.2 to 0.4	53 to 106	80	Metals
	175	0.2 to 0.4	35 to 70	53	TPH
	265	0.2 to 0.4	53 to 106	80	TPH and Metals Combined
CS-1 (b): Area west of concrete dyked tank farm	100	0.2 to 0.4	20 to 40	30	Metals
	50	0.2 to 0.4	10 to 20	15	TPH
	120	0.2 to 0.4	24 to 48	36	TPH and Metals Combined
CS-1 (c): West of lightkeeper's dwelling	430	0.2 to 0.4	86 to 172	129	Metals
Total Volume of Impact in CS-1	**815**	**0.2 to 0.4**	**163 to 326**	**245**	**TPH and metals combined**
Total Volume of Impact in CS-2 (Northeast of Assistant's Dwelling)	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

NOTE: As there is currently insufficient information available to classify CS-2, a volume of impacted soil has not been estimated.

4.0 QUALITATIVE RISK ASSESSMENT (QRA)

4.1 Purpose of Qualitative Risk Assessment

The purpose of completing a qualitative risk assessment (QRA) is to provide a preliminary qualitative characterization of the risks posed by contaminants present on the subject site to human and ecological receptors. The QRA was completed using information collected on the subject property to date.

4.2 Findings of Qualitative Risk Assessment

A qualitative risk assessment was conducted for each of the areas considered to be a potential environmental concern. These areas of concern are:

Area 1:	Metals and Hydrocarbon Contamination (a) Area north of generator building (b) Former AST Location (west of concrete dyked tank farm) (c) Area west and southwest of lightkeeper's dwelling
Area 2:	Metals Contamination (a) Vicinity of west landfill site

The headings used in the risk assessment are described below.

Contaminants of Concern:	The substances which generate an adverse effect.
Receptor locations:	Locations where there is a potential for adverse effects from the areas of potential concern.
Exposure Pathways:	Transport media the contaminants could potentially use to migrate from the areas of potential concern to the receptor locations.
Receptor Exposure:	An assessment of the degree to which the receptor group could be potentially exposed to the contaminants of concern. This assessment considers the estimated concentrations of the contaminants of concern at the receptor locations.
Public Health Concern:	An assessment of whether or not the area of potential concern represents a risk to public health. The estimated concentrations of the contaminants of concern at the receptor locations are compared to those concentrations which could cause adverse effects.

Table 6 summarizes the risk assessment results for the four locations outlined above. The following were the significant receptors that were identified on, and in the vicinity of, the Michipicoten Island, East End light station property:

- a surface water body (Lake Superior), with its associated aquatic life and human recreational use,
- on-site or workers visiting the site to conduct maintenance, and
- wildlife (e.g. birds and mammals), and plants native to the site.

Ecological receptors such as animals and plants native to the lands were included because this site is considered to be potentially sensitive.

The following potential exposure pathways were identified:

(a) exposure of aquatic organisms and humans to contaminants transported into surface water bodies through groundwater movement and/or overland surface drainage;
(b) dermal contact by humans or terrestrial organisms with surficially contaminated soils and/or groundwater;
(c) ingestion by humans or terrestrial organisms of surficially contaminated soils; and
(d) inhalation by humans or terrestrial organisms of contaminated dust.

For each issue in Table 6 the above potential exposure pathways were considered and those judged to be most likely in the context of the issue being considered were listed in abbreviated form (using the above lettering system) in the "Exposure Pathways" column.

With respect to pathway (a) above, it is considered possible that receptor exposures may result from the movement of contaminants in the groundwater. No groundwater was encountered during the on-site investigations; however, two surface water samples were collected (one near each landfill area) and submitted for anions and metals analysis. Analytical results indicated that both surface water samples were in exceedance of the CCME (water – aquatic life) criteria. Based on site observations, it is considered likely that the areas the surface water samples were collected from receive surface runoff from the respective landfills. Therefore, there is the potential that both landfill areas have impacted surface water on-site. The contaminants present are considered to be in a weathered, relatively immobile condition, and would therefore not be expected to readily leach into the groundwater. Potential impacts on Lake Superior would be very minimal given its large assimilative capacity.

With respect to pathways (b) and (c), surficial sampling was not carried out; however, in the case that surficially contaminated soils are present, the likelihood of children potentially ingesting the soils is low. Since the site is currently only visited by maintenance workers on a seasonal basis, there is a very low possibility of children being present to ingest the soil, and also of significant dermal contact by humans with the soils. There is the potential for wildlife in the area to ingest grasses and small plants on-site, or to ingest or come into contact with small amounts of contaminated soil. However, due to the limited areal extent of the contamination present, and the relatively low contaminant concentrations observed in most areas, the exposure of wildlife via these pathways is not considered to be of significant concern. However, given one instance of a lead concentration of 123,422 ug/g found in a shallow soil sample from the landfill area east of the lightkeeper's dwelling, there is considered to be a somewhat higher risk (low to medium) of receptor exposure in this area.

Pathway (d) is not considered to be a significant concern, since the contaminants on-site are considered to be in a weathered, and relatively immobile condition. Most contaminants that are present in the soil are sufficiently contained by the vegetative cover on the island. Therefore, the potential for soil particles from the subsurface entering the air is low, and inhalation of dust is not considered to be a significant concern to humans or wildlife on-site.

For the reasons cited above, all of the areas are categorized as representing a low potential for receptor exposure, except for the landfill area west of the lightkeeper's dwelling, which has a low to medium potential for receptor exposure due to the elevated lead concentration that was found there. In all of the areas of potential environmental concern, no immediate public health concern is considered to exist, although the east landfill site is considered to pose some degree of potential risk (classified as low to medium) due the presence of several elevated metals concentrations in that area (e.g. the lead concentration mentioned above, which is about three orders of magnitude higher than the applicable criteria). Potential effects on wildlife are also considered to be minimal, although in the immediate area of the elevated lead concentration the risk to wildlife would be low to medium.

It is noted that this qualitative risk assessment provides a preliminary qualitative indication of the risk associated with the contamination on site. In order to assess the risk with greater certainty, a full quantitative site specific risk assessment (SSRA), completed in accordance with MOE guidelines, would be required. This is discussed further in Section 6.

TABLE 6
RISK ASSESSMENT OF AREAS OF POTENTIAL ENVIRONMENTAL CONCERN
Canadian Coast Guard L.L. 1097, Michipicoten Island, East End, Lake Superior, Ontario

AREA NO.	LOCATION	POTENTIAL ENVIRONMENTAL CONCERN	RISK ASSESSMENT				
			Contaminants of Concern	Receptor Locations	Exposure Pathways *	Receptor Exposure	Public Health Concern
1(a)	Area north of the generator building	Seven soil samples collected from the areas north and northeast of the generator building (six during the Phase 2 ESA and one during the Enhanced Phase 1 ESA) indicated concentrations of metals above MOE Table F and CCME (residential/parkland) criteria. Seven samples collected in this area (six during the Phase 2 ESA and one during the Enhanced Phase 1 ESA) indicated detectable levels of TPH (gas/diesel and heavy oils range). Six of these samples indicated concentrations of TPH (gas/diesel) or TPH (heavy oils), or both, in exceedance of MOE Table A criteria. Three of the samples collected during the Enhanced Phase 1 and Phase 2 ESAs indicated concentrations of PAHs above the CCME (residential/parkland) and/or MOE Table F criteria.	Metals (antimony, barium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, and zinc), TPH (gas/diesel and heavy oils), PAHs (pyrene, benzo (a) anthracene, benzo (b) fluoranthene, and benzo (a) pyrene)	Lake Superior located approximately 10 metres to the east, 30 metres to the north, maintenance workers, and wildlife.	(a), (b) (c), (d)	Low	Low
1(b)	Former AST Location (area west of concrete dyked tank farm)	Seven soil samples collected in six locations from the area west of the concrete dyked tank farm indicated elevated concentrations of metals above CCME (residential/parkland) criteria and MOE Table F criteria. Three soil samples collected from the area west of the equipment building indicated detectable levels of TPH (gas/diesel or heavy oil). Two of the samples indicated a concentration of TPH (gas/diesel) above the MOE Table A criterion. One soil samples collected from the area west of the equipment building indicated concentrations of PAHs above the CCME and MOE Table F criteria.	Metals (antimony, barium, copper, lead, nickel, and zinc), TPH (gas/diesel), benzo(a)pyrene, and dibenzo(a,h) anthracene.	Lake Superior located approximately 35 metres to the east, 25 metres to the north, maintenance workers, and wildlife.	(a), (b), (c), (d)	Low	Low
1(c)	Landfill area west and southwest of lightkeeper's dwelling	Four soil samples collected from the area south and southwest of the lightkeeper's dwelling indicated concentrations of metals above the CCME (residential/parkland) and MOE Table F criteria. A lead concentration of 123,422 ug/g was found in one of the samples. This is about three order s of magnitude greater than the applicable criteria for lead. One surface water sample indicated concentrations of metals in exceedance of CCME (water – aquatic life) criteria. One soil sample collected during the Enhanced Phase 1 ESA indicated concentrations of heavy metals in exceedance of CCME (residential/parkland) criteria.	Metals (aluminium, arsenic, antimony, barium, cadmium, chromium, copper, lead, iron, mercury, nickel, selenium, and zinc).	Lake Superior located approximately 50 metres to the east, 45 metres to the north; maintenance workers, and wildlife.	(a), (b), (c), (d)	Low to Medium	Low to Medium
2(a)	Vicinity of west landfill site	One surface water sample collected in the vicinity of the west landfill indicated concentrations of metals in exceedance of CCME (water – aquatic life) criteria.	Metals (aluminium, arsenic, chromium, and iron).	Lake Superior located approximately 55 metres to the east; maintenance workers and wildlife).	(a), (b), (c), (d)	Low	Low

*NOTE:
The exposure pathways are abbreviated according to the following lettering scheme:
(a) exposure of aquatic organisms and humans to contaminants transported into surface water bodies through groundwater movement and/or overland surface drainage,
(b) dermal contact with surficially contaminated soils and/or groundwater,
(c) ingestion of surficially contaminated soils; and
(d) inhalation of contaminated dust.

5.0 NCSCS CLASSIFICATION SUMMARY

5.1 Original NCSCS Scores

As part of the 1997 Enhanced Phase 1 ESA, the CCME National Classification System (NCSCS) for Contaminated Sites scores were calculated for three issues of concern on-site: the waste disposal area (west side), the waste disposal area (east side), and the diesel generator building (hydrocarbon contamination). These scores were 51.7± 3.5, 49.1 ± 3.0, and 57.2 ± 3.0, respectively. The west side waste disposal area (metals contamination) and the diesel generator building (hydrocarbon contamination) fall within the Class 2 designation (some action likely required). The east side disposal area (metals contamination) falls within the Class 3 designation (some action may be required).

5.2 Current NCSCS Scores

The current NCSCS score for hydrocarbon and metals contamination at CS-1 is 62 with an estimated score of 4.5. This score is designated as class 2 (some action likely required). The current NCSCS score for metals contamination at CS-2 is 60 with an estimated score of 19.25. Since the estimated score for CS-2 is greater than 15, CS-2 is designated as I (insufficient information to classify the site). The current NCSCS forms are included as Appendix D.

6.0 REMEDIAL ALTERNATIVES ASSESSMENT

For the purpose of the remedial alternatives assessment, CS-1 (metals and PAHs exceeding CCME criteria and TPH exceeding MOE Table A criteria) was considered as one area of concern. CS-2 (metals exceeding CCME criteria) is separate area of concern.

Based on analytical results and visual estimates, it is estimated that the amount of impacted soil (metals and TPH exceeding CCME or MOE Table A criteria) in CS-1 is estimated to range between 163 and 326 cubic metres, with a "best guess" estimate of 245 cubic metres. The total amount of impacted soil in CS-1 includes an estimated 45 to 90 cubic metres of TPH contamination ("best guess" estimate of 68 cubic metres). The amount of impacted soil in CS-2 has not been estimated, as it has been determined that further soil sampling is necessary to delineate this area of concern.

The remedial alternatives assessment considered the following five categories of remedial action:

A) No Action/ Monitoring (i.e. Natural Attenuation)
B) Isolation, Containment, and Control Technologies
C) Ex Situ Technologies
D) In Situ Technologies
E) Risk Management Alternatives

These five categories are discussed below (Section 6.1). Section 6.1 provides a review of remedial alternatives for the metals and hydrocarbon contaminated areas.

6.1 CS-1 (Hydrocarbon and Metals Contamination)

For the issue of metals and hydrocarbon contamination at CS-1, the feasibility (and discussion, if applicable) of each of the five remedial alternatives is outlined below.

Summary of the Issue:

There are an estimated 245 cubic metres of impacted soil (metals and TPH impacts) in CS-1. This includes approximately 68 cubic metres of TPH contaminated soil.

Remedial Action Objective:

To manage this issue such that the risk to human health and the environment is maintained at a negligible level.

Descriptions of the Potential Remedial Options Identified:

1. **(B and E) Site Specific Risk Assessment/Risk Management**: An SSRA could be completed and applied to the site on its own, in order to support a Level 2 risk management approach. In this case, most or all of the existing contamination would remain on-site and engineering control measures (i.e. containment) may be implemented to manage the risks associated with the contamination. If this approach were to be used, a Certificate of Prohibition may be required. A Certificate of Prohibition is a legal document that serves to notify anyone who deals with the property in the future that there is contamination on the site and that certain measures to adequately control the risks posed by the contamination must remain in place. The nature of the containment or control technologies required (if any are required) will be determined following completion of the full SSRA. As a component of this remedial option, the groundwater and sediment quality on-site would be investigated. This has not yet been carried out at this site.

2. **(C) Excavation and Off-Site Disposal:** Approximately 163 to 326 cubic metres (approximately 326 to 652 tonnes) of metals and hydrocarbon impacted soil would be excavated to bedrock. Twelve verification samples would be taken in the vicinity of the excavations. The excavated soil would be disposed of at an MOE facility registered to receive contaminated waste. Following excavation, clean fill would be imported to the site and placed in the excavated areas. Due to the remoteness of the site, a barge with a crane, and a smaller boat, would be required to transport the backhoe and the soil on and off site. As a component of this remedial option, the groundwater and sediment quality on-site would be investigated. This has not yet been carried out at this site.
3. **(D) In-situ Bio-Remediation or Phyto-Remediation:** Bioremediation is a technique aimed at stimulating micro-organisms in the soil to grow and use the contaminants as food and energy. Generally, metals are not readily bioremediated, and phyto-remediation is an emerging technology that has a low likelihood of success given the various contaminants present. In situ remediation for CS-1 is therefore not considered to be a feasible option.
4. **(A) No Action/ Monitoring:** This option involves monitoring of the site, and allowing the contaminants to "naturally attenuate", and slowly degrade over time. The NCSCS score for CS-1 (metals and TPH contamination) indicates a class 2 designation (some action likely required). Therefore, natural attenuation/ monitoring is not considered to be a feasible option.

Remedial Option Evaluation:

OPTION NO.	*EFFECTIVENESS*	*RISK*	*EASE OF IMPLEMENTATION*	*COST*	*ACCEPTANCE*	*TIME*	*RANKING*
1 (B and E)	Medium	Low	Medium to High	$95,000	High	Two to three months	1
2 (C)	High	Low	Medium	$84,680 to $129,160	High	One month	2
3 (D)	Ineffective	Low to Medium	Low	Not estimated^2	Unacceptable	N/A	4
4 (A)	Low	Low to Medium	High	Not estimated^2	Unacceptable	Ongoing	3

Justification for Top Ranking Given to Preferred Remedial Option:

Based on the assessed level of risk associated with the metals and hydrocarbon contamination at CS-1, Remedial Option 1 is an acceptable and cost effective alternative. This option may be more practical than Option 2, given the remoteness of the site, and the difficulties which would probably be encountered in trying to scrape soil from bedrock.

Notes

1. A breakdown of the cost estimates given above is provided in Appendix F.
2. Remedial Options 3 and 4 were not costed because they are considered to be unacceptable alternatives.

6.2 CS-2 (Metals Contamination)

Based on the NCSCS score calculated for CS-2, it has been determined that there is currently insufficient information available (designated as Class "I") to recommend a remedial option for the metals contamination in this area of concern. It is therefore recommended that soil sampling be carried out at CS-2 to further delineate the metals contamination. As a component of this remedial option, the groundwater and sediment quality on-site would be investigated. This has not yet been carried out at this site. The estimated cost for additional investigations of CS-2 is $20,000. A breakdown of this estimate is provided in Appendix F.

6.3 Overall Preferred Remedial Option

Due to the remoteness of the site, and the low to medium risk to human health and the environment, the overall preferred remedial option for CS-1 is to conduct a site specific risk assessment (SSRA) and prepare and implement a risk management plan. This option can be applied to both types of contamination (hydrocarbon and metals), and it is the most cost effective and feasible of the acceptable alternatives (approximately $95,000). Although no remedial option has been recommended for the metals contamination at CS-2, it is recommended that soil sampling, along with a groundwater and sediment quality investigation, be carried out in this area to further delineate the impacts (approximate cost $20,000).

7.0 INDICATIVE ESTIMATE OF LIABILITY

As outlined in *Appendix G – Use of Estimates in Treasury Board Submissions*, previous classes of estimates (A,B,C, and D) have been replaced by two types of estimates, substantive and indicative. A substantive estimate is one of high quality and reliability, and it replaces the former A and B class estimates. An indicative estimate is an order-of-magnitude estimate that is not sufficiently reliable to warrant Treasury Board approval as a cost objective. An indicative estimate provides a rough cost projection used for budget planning purposes in the early stages of concept development of a project. It replaces the classes of estimates formerly referred to as Class C or D. For the purposes of estimating liability associated with the subject property, an indicative estimate will be used.

Treasury Board Liability Estimate

The draft Treasury Board Policy on Accounting for Costs and Liabilities related to Contaminated Sites states that, "it is the policy of the government to account for costs and liabilities related to the management and restoration of environmentally contaminated sites when contamination occurs if the government is obliged, or is likely to be obliged to incur such costs":

a) for reasons of public safety and health,
b) to be in compliance with an act or regulation issued by the government, (federal, provincial or municipal) in Canada or abroad, or
c) due to contractual arrangements.

As such, an estimate of the liability associated with the Michipicoten Island site was made based on the requirements of the Treasury Board. The estimate was made based on the procedures discussed in "*Appendix G* of *Chapter 2-1* of the *Treasury Board Manual, Information and Administration Management Component, Capital Plans, Projects and Procurement, 1994/07/08*".

An evaluation of remedial options for the contaminated sites (CS-1 and CS-2) identified on the subject property was conducted, and a preferred remedial option was selected for CS-1. Assumptions made in developing the cost estimates for the preferred remedial options are presented in Section 6.1. As discussed in Section 5.2, the current CCME NCSCS classifications for the CS-1 and CS-2 were determined to be Class 2 and Class I, respectively. On this basis it is believed that an *indicative* estimate of liability is required CS-1 and an indicative estimate of *contingent* liability is required for CS-2.

Based on analytical results and visual estimates, it is estimated that the amount of impacted soil (metals and TPH contamination) in CS-1 ranges between 163 and 326 cubic metres, with a "best guess" estimate of 245 cubic metres. The amount of impacted soil (metals contamination) in CS-2 has not been estimated, as there is currently insufficient information available to delineate the impacts in this area of concern.

XCG's recommended remedial alternative for CS-1 is the implementation of a site specific risk assessment (SSRA)/risk management plan (see Section 6). The estimated cost of this option is approximately $95,000. Although no remedial alternative has been recommended for CS-2, it is recommended that soil sampling, in conjunction with sediment and groundwater quality investigation be conducted at CS-2. The estimated cost of this is $20,000. Therefore, the indicative estimate of liability for CS-1 is $95,000 and the estimated contingent liability for CS-2 is $20,000. The remedial options are discussed further in Section 6, and the guidelines used to make these estimates are included in Appendix F.

8.0 REAL PROPERTY INFORMATION SYSTEM FOR CONTAMINATED SITES (RPISCS) MODULE

Site data for the RPISCS was compiled and entered into the module for CS-1 and CS-2. These RPISCS summary forms are included as Appendix E and contain a property description, summary of the environmental concerns on-site, CCME NCSCS score, and the respective Treasury Board Estimate of Liability (see Section 7.0).

9.0 SUMMARY

XCG Consultants Ltd. (XCG) was retained by Public Works and Government Services Canada (PWGSC) on behalf of the Department of Fisheries and Oceans Canada (DFO), Central and Arctic Region, to carry out a Phase 2 Environmental Site Assessment (ESA) of the Michipicoten Island, East End Light Station on Lake Superior, Ontario. The Michipicoten Island, East End light station consists of a 39.3 hectare (97.1 acre) plot of land on the northeastern end of Michipicoten Island. The light station is located on the east end of Michipicoten Island Provincial Park and is approximately 38 nautical miles (70 km) southwest of Wawa. The subject site was established in 1912, and operated for over 70 years as an attended light station. Currently, the site operates as an unattended light station and consists of a lighthouse, a fog alarm building, a generator building, an equipment shed, an empty concrete dyked tank farm, and a residential dwelling. Foundations from a former radio beacon building, a former fuel storage shed, a former boathouse, and a former double dwelling remain on-site.

Seventeen soil samples and two surface water samples were collected and submitted to Entech Laboratories. Soil samples collected in the vicinity of the empty concrete dyked tank farm and in the vicinity of the generator building and were submitted for chemical analysis of total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), and metals. Samples collected from the vicinity of landfill site west of the lightkeeper's dwelling were submitted for metals and anions analysis. One surface water sample was collected south of the lightkeeper's dwelling, and one was collected from the landfill site on the northwestern portion of the site. The surface water samples were submitted for metals and anions analyses.

The applicable Environmental Quality criteria considered at this site were the Ontario Ministry of the Environment (MOE) Table F guidelines for all other land use, and the Canadian Council of Ministers of the Environment (CCME) guidelines for residential/parkland redevelopment. A comparison was also made to the MOE Table A guidelines, which are not strictly applicable given the shallow depth of overburden on the subject site, but which may still be considered to be protective of human health provided that contaminant leaching to groundwater can be eliminated as a pathway of concern. The surface water samples were compared to the CCME guidelines for water – aquatic life, the Ontario Provincial Water Quality Objectives (PWQO), and the MOE Table A potable groundwater criteria.

Two contaminated sites were identified on the subject site. CS-1 is on the eastern portion of the site, in the area north of the generator building, west of the former tank farm dyke, and in the landfill area west of the lightkeeper's dwelling. CS-2 is on the northwestern portion of the site, in the area of a landfill west of the former double dwelling foundation.

CS-1 Findings

All seventeen of the soil samples submitted for metals analysis during the Phase 2 ESA, as well as two soil samples that were analyzed for metals during the Enhanced Phase 1 ESA, indicated concentrations of metals above CCME (residential/parkland) and MOE Table F criteria. The metals that exceeded the CCME criteria consisted of antimony, barium, cadmium, chromium, copper, lead, nickel, selenium, and zinc. Parameters in exceedance of the MOE Table F criteria were antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc.

Soil sampling from the Phase 2 ESA north of the generator building and in the vicinity of the concrete dyked tank farm indicated detectable concentrations of TPH (gas/diesel) and TPH (heavy oil) ranging from 30 ug/g to 6,200 ug/g. During the Enhanced Phase 1 ESA, one soil sample from north of the generator building was analyzed for TPH (no specified range) and found to have a TPH concentration of 14,000 ug/g. Although Table A is not applicable to the subject property, the TPH values were compared to Table A to provide a general indication of the degree of impact. Six soil samples collected north of the generator building (including the one from the Enhanced Phase 1 ESA), and two in the vicinity of the empty concrete dyked tank farm indicated concentrations of TPH (gas/diesel) or TPH (heavy oil), or both, in exceedance of MOE Table A criteria.

During the Phase 2 ESA, one soil sample collected north of the generator building and one collected west of the concrete dyked tank farm indicated concentrations of PAH in exceedance of CCME (residential/parkland) criteria. These parameters consisted of benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene. Three of the soil samples collected north of the generator building or west of the concrete dyked tank farm indicated concentrations of PAH above MOE Table F values for one or more of the following parameters: acenaphthylene, anthracene, fluoranthene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. One soil sample collected from the area north of the generator building during the Enhanced Phase 1 ESA contained an exceedance of the MOE Table F value for pyrene.

Anions concentrations were analyzed in four soil samples collected on-site. No exceedances of the MOE Table F (background) values, or CCME (residential/parkland) criteria were noted.

Metals and anions concentrations were analyzed in one surface water sample collected on-site near the landfill site to the west of the lightkeeper's dwelling. Analytical results were compared to MOE Provincial Water Quality Objectives (PWQOs), the MOE Table A (Potable Groundwater Use), and the CCME Environmental Quality Guidelines (Water – Aquatic Life). This surface water sample indicated concentrations of metals in exceedance of one or more of the applicable criteria. Parameters in exceedance of the CCME (Water – Aquatic Life) were aluminium, arsenic, and chromium. Parameters in exceedance of the PWQOs or interim PWQOs included aluminium, arsenic, cobalt, copper, and vanadium. Based on on-site observations and analytical surface water results, there is a potential that the east landfill area has impacted surface water on-site.

Based on the analytical data and visual observations, the quantity of soil impacted by metals and hydrocarbons in CS-1 is estimated to range between 163 and 326 cubic metres while the "best guess" amount is approximately 245 cubic metres. The quantity of soil impacted by metals at CS-2 has not been estimated, as there is currently insufficient information with which to classify this contaminated site. All minimum and maximum volume estimates are based on overburden depths of 0.2 metres and 0.4 metres, respectively.

CS-2 Findings

Metals and anions concentrations were analyzed in one surface water sample collected on-site near the landfill site on the northwestern part of the site near the former double dwelling. Analytical results were compared to MOE Provincial Water Quality Objectives (PWQOs), MOE Table A (Potable Groundwater Use), and CCME Environmental Quality Guidelines (Water – Aquatic Life). This surface water sample indicated concentrations of metals in exceedance of one or more of the applicable criteria. Parameters in exceedance of the CCME (Water – Aquatic Life) were aluminium, arsenic, chromium, and iron. Parameters in exceedance of the PWQOs or interim PWQOs included aluminium, arsenic, cobalt, copper, iron, and vanadium. .

Based on on-site observations and analytical surface water results, there is a potential that the west landfill area has impacted surface water on-site.

There is currently insufficient information to calculate a quantitative estimate for the contamination in CS-2.

CCME National Classification System for Contaminated Sites (NCSCS)

CCME National Classification System for Contaminated Sites (NCSCS) scores were calculated in the 1997 Enhanced Phase 1 ESA for contamination at the waste disposal (west side), the waste disposal (east side), and the generator building. The scores were 51.7(± 3.5), 49.1 (± 3), and 57.2 (± 3), respectively. The first and last of these scores fall within the Class 2 designation (some action likely required). The score of 49.1 (± 3) falls with the Class 3 designation (some action may be required).

The NCSCS score calculated during the 2001 Phase 2 ESA for hydrocarbon and metals contamination at CS-1 is 62 with an estimated score of 4.5. This score is designated as Class 2 (some action likely required). The NCSCS score for metals contamination at CS-2 is 60 with an estimated score of 19.25. Since the estimated score for CS-2 is greater than15, CS-2 is designated as I (insufficient information to classify the site).

Qualitative Risk Assessment and Treasury Board Liability Estimates

Since the subject site is currently occupied, on a seasonal basis, by members of the general public, possibly including children, a qualitative risk assessment (QRA) has been performed to determine whether potential exposures to the contaminants found to be present at elevated concentrations at CS-1 and CS-2 are within acceptable limits, and thus whether any remedial action is required at this time. The results of the qualitative risk assessment indicate that there is a low to medium degree of risk associated with the receptors and pathways identified at both contaminated sites. Several remedial alternatives have been explored, and one has been recommended for CS-1. The site specific risk assessment (SSRA) / risk management plan is considered to be the most suitable and cost effective remedial alternative for CS-1 (approximate cost $95,000). As a component of this remedial option, the groundwater and sediment quality on-site would be investigated. This has not yet been carried out at this site. For CS-2, no remedial alternative has been recommended as there is insufficient subsurface sampling information. However, it is recommended that further sampling in this area, including groundwater and sediment quality sampling, be conducted (approximate cost $20,000).

The Treasury Board *indicative* estimates of liability and contingent liability associated with the contaminated sites identified on the subject property are as follows:

- CS-1: $95,000 (liability)
- CS-2: $20,000 (contingent liability)

The liability estimate associated with CS-1 represents the estimated cost of the recommended remedial alternative (SSRA/ risk management plan). In the case of CS-2, the contingent liability estimate represents the approximate cost for further sampling work, including a groundwater and sediment quality investigation in the area.

10.0 RECOMMENDATIONS

1. An SSRA/ risk management plan (as described above) should be implemented at CS-1. This remedial option will address the metals and hydrocarbon contamination at CS-1, and is the most cost effective of the feasible and acceptable remedial alternatives considered (approximately $95,000). As a component of this remedial option, the groundwater and sediment quality on the site would be investigated. This has not yet been carried out at this site.

2. Soil sampling, along with groundwater and sediment quality investigation should be conducted at CS-2, in order to further delineate the metals contamination at this contaminated site (approximately $20,000).

3. It is recommended that groundwater and sediment quality investigation be carried out at the site. The cost of this has been included in the liability estimates for CS-1 and CS-2.

All of which is respectfully submitted,

XCG CONSULTANTS LTD.

Kevin Shipley, M.A.Sc., P.Eng., CEA
Associate, Senior Environmental Specialist

Basil Wong, M. Eng., P. Eng.
Project Manager

Andrea Wilson

Andrea Wilson, B.A.Sc., EIT
Environmental Site Assessor

11.0 REFERENCES

1. *Conor Pacific Environmental Technologies Inc.* "Phase 1 Environmental Site Assessment, Michipicoten Island, East End Light Station, L.L. 1097, Lake Superior, Ontario, PWGSC Project #764661" *March 1997.*

2. Ministry of the Environment, "*Guidelines for Use at Contaminated Sites in Ontario* " February 1997

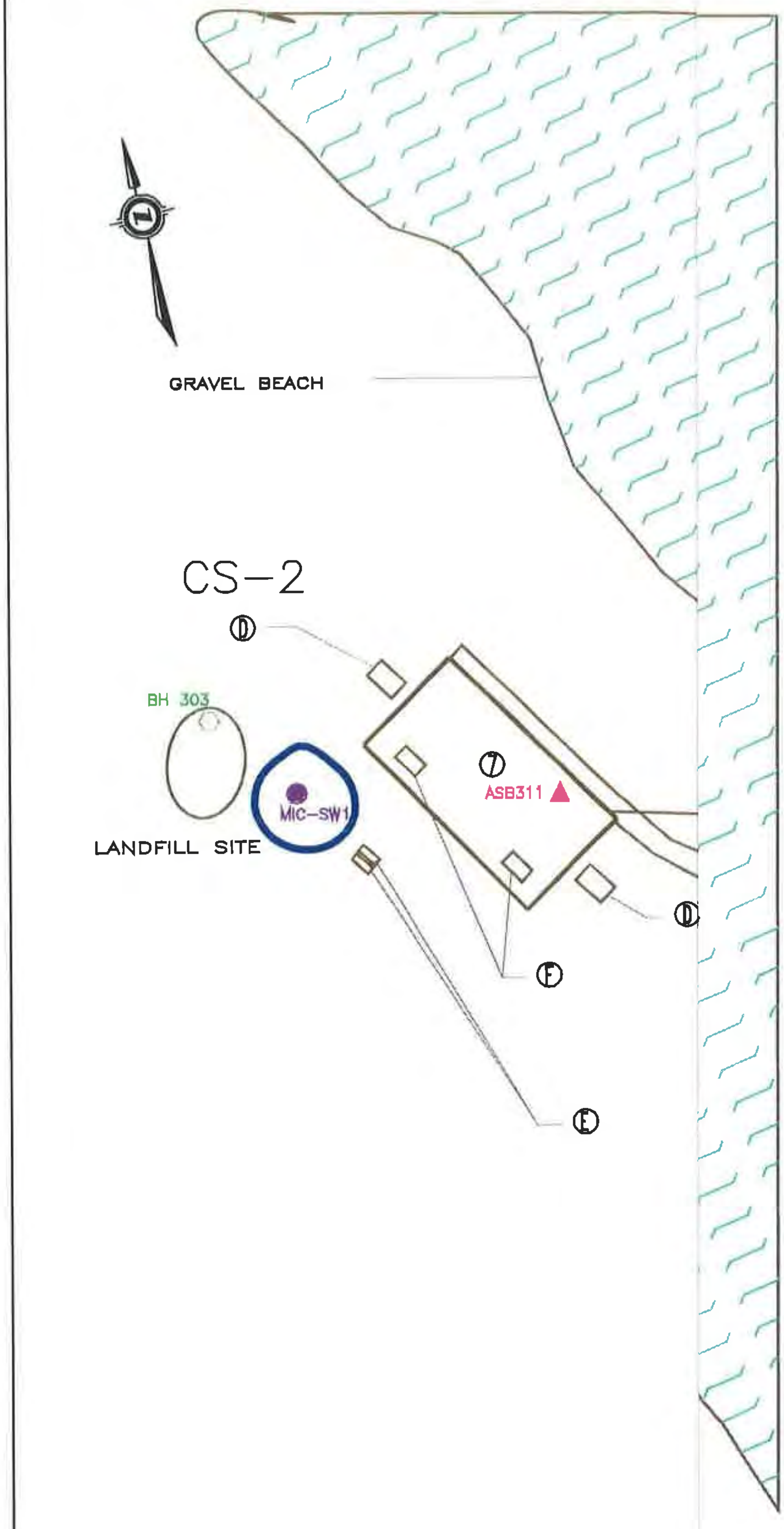
3. Ministry of the Environment, Provincial Water Quality Objectives, July 1994.

4. Canadian Council of Ministers of the Environment, "Canadian Environmental Quality Guidelines," 1999.

5. Canadian Council of Ministers of the Environment, "Interim Canadian Environmental Quality Criteria for Contaminated Sites", September 1991

APPENDIX A:

Figure 1 (Site Plan)
Figure 2 (Site Location Plan)



LEGEND:

APPROXIMATE DELINATION OF SOIL IMPACT –METALS

APPROXIMATE DELINATION OF SOIL IMPACT –TPH

MIC–SW1	●	XCG SURFACE WATER SAMPLE LOCATION
MIC–LF–SF–1	⬟	XCG SOIL SAMPLE LOCATION
CS–1		CONTAMINATED SITE

CONOR PACIFIC SAMPLE LOCATIONS:

BH 101	⬡	BOREHOLE LOCATION
PNT 101	■	PAINT SAMPLE LOCATION
ASB101	▲	ASBESTOS SAMPLE LOCATION
SW–401	⊗	SURFACE WATER SAMPLE LOCATION

BUILDING LEGEND:

① GENERATOR BUILDING
② EQUIPMENT BUILDING
③ FOG ALARM BUILDING
④ HELICOPTER PAD
⑤ LIGHT KEEPER'S DWELLING
⑥ LIGHT HOUSE
⑦ DOUBLE DWELLING FOUNDATION
⑧ FOUNDATION OF FORMER BOATHOUSE
⑨ FOUNDATION OF FORMER FUEL STORAGE SHED
⑩ FORMER GENERATOR HOUSE
⑪ FOUNDATION OF FORMER RADIO BEACON BUILDING

STORAGE TANK LEGEND

Ⓐ 900L DIESEL AST
Ⓑ 200L AST
Ⓒ 45kg PROPANE AST
Ⓓ SEPTIC TANK
Ⓔ FORMER 2,730L AST (CONCRETE SADDLE REMAINS)
Ⓕ FORMER 900L AST
Ⓖ FORMER 2,730L DIESEL AST (CONCRETE SADDLE REMAINS)
Ⓗ FORMER 2,275L DIESEL AST
Ⓘ FORMER 2,730L DIESEL AST
Ⓙ FORMER 9,000L DIESEL AST
Ⓚ FORMER 7,080–L AST (FORMERLY AIR TANKS)

AST – ABOVE GROUND STORAGE TANK

SITE PLAN
L.L. 1097

CANADIAN COAST GUARD LIGHTHOUSE
MICHIPICOTEN ISLAND, EAST END LIGHTHOUSE
LAKE SUPERIOR, ONTARIO

XCG CONSULTANTS LTD.

DATE	JOB NO.	FIGURE NO.
MARCH 2001	1–336–60–01	1

DRAWING REFERENCE: Base drawing supplied by Public Works Government Servic
NOTE: Locations of buildings, underground utilities, etc. are for reference only

MICHIPICOTEN ISLAND, EAST END LIGHT STATION – SITE LOCATION MAP

APPENDIX B:

Site Photographs

PHOTO 1 MICHIPICOTEN ISLAND, LAKE SUPERIOR.
AREA NORTHEAST OF GENERATOR BUILDING, LOOKING SOUTH.

PHOTO 2 SAMPLING LOCATIONS NEAR CONCRETE DYKED TANK FARM, LOOKING NORTH.

PHOTO 3 SAMPLING LOCATION NEAR WEST LANDFILL AREA. (LOOKING EAST).

APPENDIX C:

Laboratory Certificates of Analysis

(Including QA/QC Results)

Client:	**XCG-Mississauga**
Attention:	**J. HO**
Project:	**1336-51-MIC**
P.O.:	
Sample Type:	**Water**
Date Sampled:	**N/A**
Date Received:	**Nov 13/2000**
Date Analysed:	**Nov 14 to Nov 16/2000**
Date Reported:	**Nov 20/2000**

ENTECH
A Division of Agri-Service Lab Inc.
6820 Kitimat Rd., Unit #4,
Mississauga, ONT L5N 5M3
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FAX: (905) 821-2095

Certificate of Analysis
for
METAL SCAN

PARAMETER	MDL µg/L	TABLE A Potable Groundwater Criteria µg/L	CONTROL Expected µg/L	SAMPLE Found µg/L	SAMPLE DATA (µg/L) Blank	7655 MIC-SW1	7656 MIC-LF-SF1	7656 MIC-LF-SF1 Duplicate
Aluminum	50	-	10000	9240	<50	701	110	114
Antimony	1	6.0	210	213	<1	1	1	1
Arsenic	1	25	400	378	<1	14	12	11
Barium	10	1000	2010	2130	<10	54	133	132
Beryllium	0.2	4.0	16	15.8	<0.2	<0.2	<0.2	<0.2
Boron	10	5000	731	770	<10	<10	<10	<10
Cadmium	0.8	5.0	20	21.2	<0.8	<0.8	<0.8	<0.8
Calcium	500	-	22100	22600	<500	3473	13483	13583
Chromium	10	50	879	969	<10	46	34	36
Cobalt	10	100	95	86	<10	33	28	28
Copper	0.5	23	50	52.2	<0.5	1.3	1.4	1.3
Iron	100	-	148	156.00	<100	978	<100	<100
Lead	2	10	421	459	<2	<2	<2	<2
Magnesium	100	-	4830	4870	<100	544	836	851
Manganese	10	-	1000	1040	<10	792	186	186
Mercury	0.05	0.12	3.75	3.77	<0.05	<0.05	<0.05	<0.05
Molybdenum	20	7300	52	55	<20	<20	<20	<20
Nickel	10	100	1280	1290	<10	10	<10	<10
Phosphorus	100	-	42	42	<100	<100	<100	<100
Potassium	500	-	12800	13600	<500	904	1139	1189
Selenium	1	10	320	327	<1	<1	<1	<1
Silver	0.8	1.2	8	8.7	<0.8	<0.8	<0.8	<0.8
Sodium	100	200000	21600	21800	<100	1095	1505	1[illegible]95
Vanadium	10	200	990	1000	<10	17	16	19
Zinc	10	1100	501	523	<10	19	<10	<10

Sample Disposal: 90 Days from the Reporting Date.

Analyst(s):

Metals: ICP-AES(PN/USN)(EPA 3005/200.7/200.15)

Arsenic, Selenium & Antimony: HG-AAS/Digestion(EPA 3005A/7062/7742)

Mercury: CV-AAS(EPA 245.1)

S.K. Sanyal

Sam Sanyal, M. Sc.,C.Chem.
Manager, Inorganic Analysis.

Michipicoten

Client: XCG-Mississauga
Attention: J. HO
Project: 1336-51-MIC
P.O.:
Sample Type: Soil
Date Received: Nov 13/2000
Date Analysed: Nov 20 to 21, Dec 11 & 15/2000
Date Reported: Nov 24/2000
Date Revised: Dec 18/2000

Sam Sanyal, M.Sc.,C. Chem.
Manager, Inorganic Analysis.

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FAX: (905) 821-2095

Certificate of Analysis for

METAL SCAN (Soils)

PARAMETER	Method Detection Limit (µg/g)	CONTROL SAMPLE			SAMPLE DATA (µg/g)			
		Expected Conc. (µg/g)	Found Conc. (µg/g)	Recovery %	7645 MIC-HFS1	7646 MIC-HFS2	7647 MIC-HFS3	7648 MIC-HFS4
Aluminum	5	5370	5863	109	2785	2616	7129	3814
Antimony *	1	0.210	0.195	93	<1	2.4	1.2	1.7
Arsenic	1	75	73	97	2.2	3.4	7.6	7.0
Barium	1	102	106	104	182	351	391	478
Beryllium	0.5	41.6	38.9	94	<0.5	<0.5	<0.5	<0.5
Boron (HWE) *	0.02	1	0.986	99	0.28	0.33	0.14	0.19
Cadmium	0.5	71.1	72.0	101	2.3	10.9	2.8	2.4
Chromium	1	76.4	74.0	97	18.5	101	13.6	74.3
Cobalt	1	116	120.6	104	2.1	2.2	3.5	<1
Copper	1	63.9	70.6	110	41.4	47.1	82.5	71.5
Iron	10	20406	22000	108	9291	7860	13673	8426
Lead	2	233	235	101	256	671	1593	846
Manganese	1	425	451	106	378	827	670	600
Mercury	0.05	0.19	0.185	97	0.44	0.64	1.58	1.13
Molybdenum *	2	1	1.06	106	<2	<2	<2	<2
Nickel	1	120	119	99	9.6	245	6.1	22.5
Phosphorus *	10	10	10.6	106	1067	1457	1273	1673
Selenium	1	0.8	0.78	98	<1	3.9	<1	<1
Silver	0.5	1.9	2.0	105	<0.5	<0.5	1.8	<0.5
Vanadium	1	56.9	62.1	109	6.4	2.7	19.9	4.0
Zinc	1	6775	7140	105	762	315	641	1202

Sample data and MDL units are in µg/g unless otherwise specified
Sample Disposal: 90 Days from the Reporting Date.
Metals: Digestion/ICP-AES(EPA 3050A/200.7)
Arsenic, Antimony & Selenium: Digestion/HG-AAS(EPA 3050A/7062/7742)
Mercury: Digestion/CV-AAS(EPA 7471A/245.5)
** Control Sample Unit is µg/mL for the specified parameter instead of µg/g unless otherwise specified.*

HWE: Hot Water Extract
Analyst(s): AV, CP, EC

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FAX: (905) 821-2095

Client: **XCG-Mississauga**
Attention: **J. HO**
Project: **1336-51-MIC**
P.O.:
Sample Type: **Soil**
Date Received: **Nov 13/2000**
Date Analysed: **Nov 20 to 21, Dec 11 & 15/2000**
Date Reported: **Nov 24/2000**
Date Revised: **Dec 18/2000**

SKSanyal
Sam Sanyal, M.Sc.,C. Chem.
Manager, Inorganic Analysis.

Certificate of Analysis for

METAL SCAN (Soils)

PARAMETER	Method Detection Limit (µg/g)	CONTROL SAMPLE			SAMPLE DATA (µg/g)			
		Expected Conc. (µg/g)	Found Conc. (µg/g)	Recovery %	Blank	7649 MIC-HFS5	7650 MIC-HFS6	
Aluminum	5	5370	5863	109	<5	5258	3581	
Antimony *	1	0.210	0.195	93	<1	7.8	1.1	
Arsenic	1	75	73	97	<1	14.0	4.3	
Barium	1	102	106	104	<1	1054	120	
Beryllium	0.5	41.6	38.9	94	<0.5	<0.5	<0.5	
Boron (HWE) *	0.02	1	0.986	99	<0.02	0.19	0.06	
Cadmium	0.5	71.1	72.0	101	<0.5	12.1	<0.5	
Chromium	1	76.4	74.0	97	<1	61.1	114	
Cobalt	1	116	120.6	104	<1	3.7	8.6	
Copper	1	63.9	70.6	110	<1	168	213	
Iron	10	20406	22000	108	<10	11976	21314	
Lead	2	233	235	101	<2	1386	406	
Manganese	1	425	451	106	<1	361	272	
Mercury	0.05	0.19	0.185	97	<0.05	3.09	0.20	
Molybdenum *	2	1	1.06	106	<2	<2	<2	
Nickel	1	120	119	99	<1	17.1	52.7	
Phosphorus *	10	10	10.6	106	<10	937	686	
Selenium	1	0.8	0.78	98	<1	<1	<1	
Silver	0.5	1.9	2.0	105	<0.5	<0.5	<0.5	
Vanadium	1	56.9	62.1	109	<1	10.2	15.9	
Zinc	1	6775	7140	105	<1	666	319	

Sample data and MDL units are in µg/g unless otherwise specified

HWE: Hot Water Extract

Sample Disposal: 90 Days from the Reporting Date.

Analyst(s): AV, CP, EC

Metals: Digestion/ICP-AES(EPA 3050A/200.7)
Arsenic, Antimony & Selenium: Digestion/HG-AAS(EPA 3050A/7062/7742)
Mercury: Digestion/CV-AAS(EPA 7471A/245.5)

* *Control Sample Unit is µg/mL for the specified parameter instead of µg/g unless otherwise specified.*

Client: XCG-Mississauga
Attention: J. HO
Project: 1336-61-MIC
P.O.:
Sample Type: Soil
Date Received: Nov 13/2000
Date Analysed: Nov 20 to 22, Dec 11 & 15/2000
Date Reported: Nov 24/2000
Date Revised: Dec 18/2000

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Certificate of Analysis
for
METAL SCAN (Soils)

PARAMETER	Method Detection Limit (μg/g)	CONTROL SAMPLE			SAMPLE DATA (μg/g)			
		Expected Conc. (μg/g)	Found Conc. (μg/g)	Recovery %	Blank	7651 MIC-LF1	7652 MIC-LF2	7653 MIC-LF3
Aluminum	5	5370	5863	109	<5	11438	1346	3468
Antimony *	1	0.210	0.195	93	<1	3.4	151	2.5
Arsenic	1	75	73	97	<1	7.8	10.8	4.3
Barium	1	102	106	104	<1	1090	728	303
Beryllium	0.5	41.6	38.9	94	<0.5	<0.5	<0.5	<0.5
Boron (HWE) *	0.02	1	0.986	99	<0.02	0.15	0.13	0.38
Cadmium	0.5	71.1	72.0	101	<0.5	<0.5	37.0	11.9
Chromium	1	76.4	74.0	97	<1	54.3	266	14.2
Cobalt	1	116	120.6	104	<1	15.6	33.7	6.5
Copper	1	63.9	70.6	110	<1	85.8	378	138
Iron	10	20406	22000	108	<10	19183	319805	37493
Lead	2	233	235	101	<2	123422	7215	541
Manganese	1	425	451	106	<1	455	1236	1221
Mercury	0.05	0.19	0.185	97	<0.05	0.24	2.46	0.66
Molybdenum *	2	1	1.06	106	<2	<2	<2	<2
Nickel	1	120	119	99	<1	42.0	84.1	59.6
Phosphorus *	10	10	10.6	106	<10	713	1339	1163
Selenium	1	0.8	0.78	98	<1	2.3	<1	<1
Silver	0.5	1.9	2.0	105	<0.5	<0.5	<0.5	<0.5
Vanadium	1	56.9	62.1	109	<1	68.8	10.9	1.7
Zinc	1	6775	7140	105	<1	1126	8142	1500

Sample data and MDL units are in μg/g unless otherwise specified
Sample Disposal: 90 Days from the Reporting Date.
Metals: Digestion/ICP-AES(EPA 3050A/200.7)
Arsenic, Antimony & Selenium: Digestion/HG-AAS(EPA 3050A/7062/7742)
Mercury: Digestion/CV-AAS(EPA 7471A/245.5)
** Control Sample Unit is μg/mL for the specified parameter instead of μg/g unless otherwise specified.*

HWE: Hot Water Extract
Analyst(s): AV, CP, EC

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FAX: (905) 821-2095

Client: XCG-Mississauga
Attention: J. HO
Project: 1336-51-MIC
P.O.:
Sample Type: Soil
Date Received: Nov 13/2000
Date Analysed: Nov 20 to 22, Dec 11 & 15/2000
Date Reported: Nov 24/2000
Date Revised: Dec 18/2000

Sanyal
Sam Sanyal, M.Sc.,C. Chem.
Manager, Inorganic Analysis.

Certificate of Analysis
for
METAL SCAN (Soils)

PARAMETER	Method Detection Limit (µg/g)	CONTROL SAMPLE			SAMPLE DATA (µg/g)			
		Expected Conc. (µg/g)	Found Conc. (µg/g)	Recovery %	7654 MIC-LF4			
Aluminum	5	5370	5863	109	3026			
Antimony *	1	0.210	0.195	93	1.2			
Arsenic	1	75	73	97	2.2			
Barium	1	102	106	104	201			
Beryllium	0.5	41.6	38.9	94	<0.5			
Boron (HWE) *	0.02	1	0.986	99	0.16			
Cadmium	0.5	71.1	72.0	101	<0.5			
Chromium	1	76.4	74.0	97	6.5			
Cobalt	1	116	120.6	104	<1			
Copper	1	63.9	70.6	110	73.4			
Iron	10	20406	22000	108	17081			
Lead	2	233	235	101	575			
Manganese	1	425	451	106	380			
Mercury	0.05	0.19	0.185	97	0.24			
Molybdenum *	2	1	1.06	106	<2			
Nickel	1	120	119	99	14.8			
Phosphorus *	10	10	10.6	106	885			
Selenium	1	0.8	0.78	98	<1			
Silver	0.5	1.9	2.0	105	<0.5			
Vanadium	1	56.9	62.1	109	3.5			
Zinc	1	6775	7140	105	356			

Sample data and MDL units are in µg/g unless otherwise specified
Sample Disposal: 90 Days from the Reporting Date.
Metals: Digestion/ICP-AES(EPA 3050A/200.7)
Arsenic, Antimony & Selenium: Digestion/HG-AAS(EPA 3050A/7062/7742)
Mercury: Digestion/CV-AAS(EPA 7471A/245.5)
** Control Sample Unit is µg/mL for the specified parameter instead of µg/g unless otherwise specified.*

HWE: Hot Water Extract
Analyst(s): AV, CP, EC

ENTECH

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TEL: (905) 821-1112
FAX: (905) 821-2095

Client:	**XCG-Mississauga**
Attention:	**J. HO**
Project:	**1-336-51-MIC**
P.O.:	
Sample Type:	**Soil**
Date Received:	**Nov 14/2000**
Date Analysed:	**Nov 22, 23, 28 to Nov 30/2000**
Date Reported:	**Dec 01/2000**

f Sam Senyal, M.Sc.,C. Chem.
Manager, Inorganic Analysis.
(A. Viravong, B.Sc)

Certificate of Analysis
for
METAL SCAN (Soils)

PARAMETER	Method Detection Limit (µg/g)	CONTROL SAMPLE			SAMPLE DATA (µg/g)			
		Expected Conc. (µg/g)	Found Conc. (µg/g)	Recovery %	7723 MIC-AST1	7724 MIC-AST2	7725 MIC-AST3	7726 MIC-AST4
Aluminum	5	13265	13689	103	8824	5141	10838	2984
Antimony *	1	0.210	0.193	92	<1	19.0	6.4	7.7
Arsenic	1	75	77	103	14.7	5.3	13.9	3.9
Barium	1	215	218	101	182	401	185	97.9
Beryllium	0.5	41.6	39.2	94	<0.5	<0.5	<0.5	<0.5
Boron (HWE) *	0.02	1	1.01	101	0.29	0.17	0.38	0.24
Cadmium	0.5	71.1	72.0	101	0.8	1.1	<0.5	<0.5
Chromium	1	76.4	85.4	112	31.2	21.3	10.1	34.3
Cobalt	1	12	13.1	109	3.0	1.5	7.3	2.3
Copper	1	191	205	107	36.2	50.0	20.7	22.7
Iron	10	21046	20680	98	8069	15862	7208	8895
Lead	2	126	120	95	329	1644	56.3	213
Manganese	1	457	473	104	326	548	1368	230
Mercury	0.05	0.28	0.232	83	0.22	3.51	0.20	0.17
Molybdenum *	2	1	1.03	103	<2	<2	<2	<2
Nickel	1	54	50.1	93	10.2	7.0	8.5	13.9
Phosphorus	10	752	719	96	1100	2181	1130	521
Selenium	1	0.8	0.78	98	1.3	<1	<1	<1
Silver	0.5	131	122	93	<0.5	<0.5	<0.5	<0.5
Vanadium *	1	1	1.07	107	15.4	19.8	23.7	16.4
Zinc	1	467	461	99	334	687	104	170

Sample data and MDL units are in µg/g unless otherwise specified
Sample Disposal: 90 Days from the Reporting Date.
Metals: Digestion/ICP-AES(EPA 3050A/200.7)
Arsenic, Antimony & Selenium: Digestion/HG-AAS(EPA 3050A/7062/7742)
Mercury: Digestion/CV-AAS(EPA 7471A/245.5)
** Control Sample Unit is µg/mL for the specified parameter instead of µg/g unless otherwise specified.*

HWE: Hot Water Extract
Analyst(s): PS, CP, EC, JW, AV

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A Division of Agri-Service Lab Inc.
6820 Kitimat Rd., Unit #4
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TEL: (905) 821-1112
FAX: (905) 821-2095

Client: **XCG-Mississauga**
Attention:- **J. HO**
Project: **1-336-51-MIC**
P.O.:
Sample Type: **Soil**
Date Received: **Nov 14/2000**
Date Analysed: **Nov 22, 23, 28 to Nov 30/2000**
Date Reported: **Dec 01/2000**

Sam Sanyal, M.Sc.,C. Chem.
Manager, Inorganic Analysis.
(A. VIRAVONG, B.Sc)

Certificate of Analysis for

METAL SCAN (Soils)

PARAMETER	Method Detection Limit (µg/g)	CONTROL SAMPLE			SAMPLE DATA (µg/g)		
		Expected Conc. (µg/g)	Found Conc. (µg/g)	Recovery %	Blank	7727 MIC-AST5	7728 MIC-AST6
Aluminum	5	13265	13689	103	<5	4147	5965
Antimony *	1	0.210	0.193	92	<1	2.1	1.3
Arsenic	1	75	77	103	<1	5.5	10.9
Barium	1	215	218	101	<1	512	573
Beryllium	0.5	41.6	39.2	94	<0.5	<0.5	<0.5
Boron (HWE) *	0.02	1	1.01	101	<0.02	0.30	0.24
Cadmium	0.5	71.1	72.0	101	<0.5	1.7	<0.5
Chromium	1	76.4	85.4	112	<1	24.3	18.7
Cobalt	1	12	13.1	109	<1	3.9	4.0
Copper	1	191	205	107	<1	62.9	121
Iron	10	21046	20680	98	<10	6903	8570
Lead	2	126	120	95	<2	1863	1702
Manganese	1	457	473	104	<1	305	557
Mercury	0.05	0.28	0.232	83	<0.05	1.42	0.29
Molybdenum *	2	1	1.03	103	<2	<2	<2
Nickel	1	54	50.1	93	<1	4.1	7.2
Phosphorus	10	752	719	96	<10	828	1224
Selenium	1	0.8	0.78	98	<1	1.3	1.3
Silver	0.5	131	122	93	<0.5	<0.5	<0.5
Vanadium *	1	1	1.07	107	<1	12.9	17.1
Zinc	1	467	461	99	<1	1112	1530

Sample data and MDL units are in µg/g unless otherwise specified
Sample Disposal: 90 Days from the Reporting Date.
Metals: Digestion/ICP-AES(EPA 3050A/200.7)
Arsenic, Antimony & Selenium: Digestion/HG-AAS(EPA 3050A/7062/7742)
Mercury: Digestion/CV-AAS(EPA 7471A/245.5)
** Control Sample Unit is µg/mL for the specified parameter instead of µg/g unless otherwise specified.*

HWE: Hot Water Extract
Analyst(s): PS, CP, EC, JW, AV

Client: XCG-Mississauga
Attention: J. Ho
Project: 1336-51-MIC
P.O.:
Sample Type: Soil
Date Received: Dec 28/2000
Date Analysed: Jan 04, 05 & Jan 08/2001
Date Reported: Jan 09/2001

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TEL: (905) 821-1112
FAX: (905) 821-2095

for Sam Sanyal, M.Sc.,C. Chem.
Manager, Inorganic Analysis.
(A. VIRAVONG, B.Sc)

Certificate of Analysis
for
METAL SCAN (Soils)

PARAMETER	Method Detection Limit (µg/g)	CONTROL SAMPLE			SAMPLE DATA (µg/g)			
		Expected Conc. (µg/g)	Found Conc. (µg/g)	Recovery %	Blank	9834 MIC-AST-AW6		
Aluminum	5	9518	9762	103	<5	5084		
Antimony *	1	0.210	0.218	104	<1	1.8		
Arsenic	1	75	73	97	<1	14.4		
Barium	1	102	103	101	<1	475		
Beryllium *	0.5	1	0.994	99	<0.5	<0.5		
Boron (HWE) *	0.02	1	0.960	96	<0.02	0.17		
Cadmium	0.5	34	37.13	109	<0.5	<0.5		
Chromium	1	64	65.8	103	<1	21.9		
Cobalt	1	28	29.7	106	<1	4.5		
Copper	1	63.9	67.0	105	<1	199		
Iron	10	20406	19901	98	<10	10564		
Lead	2	233	219	94	<2	2059		
Manganese	1	425	416	98	<1	783		
Mercury	0.05	0.28	0.295	105	<0.05	0.55		
Molybdenum *	2	1	1.02	102	<2	<2		
Nickel	1	231	228	99	<1	8.5		
Phosphorus	10	1070	1089	102	<10	2274		
Selenium	1	0.8	0.78	98	<1	<1		
Silver *	0.5	0.20	0.193	97	<0.5	<0.5		
Vanadium	1	56.9	51.5	91	<1	18.6		
Zinc	1	6775	6802	100	<1	1604		

Sample data and MDL units are in µg/g unless otherwise specified
Sample Disposal: 90 Days from the Reporting Date.
Metals: Digestion/ICP-AES(EPA 3050A/200.7)
Arsenic, Antimony & Selenium: Digestion/HG-AAS(EPA 3050A/7062/7742)
Mercury: Digestion/CV-AAS(EPA 7471A/245.5)
** Control Sample Unit is µg/mL for the specified parameter instead of µg/g unless otherwise specified.*

HWE: Hot Water Extract
Analyst(s): AV, CP, EC

Client: XCG - Mississauga
Attention: J. HO
Client Reference: Proj: 1-336-51-MIC
Date Received: Nov. 14, 2000.
Date Analyzed: Nov. 16, 2000.
Date Reported: Nov. 21, 2000.
Sample Type: Soil

ENTECH

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CERTIFICATE OF ANALYSIS

Total Petroleum Hydrocarbons

ENTECH # Sample #	Concentration (ug/g)		
	gasoline range (C5-C10)	diesel range (>C10-C24)	heavy oil range (>C24-C50)
MDL	10	10	80
Lab Blank	<	<	<
7723 MIC-AST1	<	<	<
7724 MIC-AST2	<	6,200	790
7725 MIC-AST3	<	<	<
7726 MIC-AST4	<	<	110
7727 MIC-AST5	120	<	<
7728 MIC-AST6	<	<	<
7728* MIC-AST6	<	<	<
CRM spiked **(ug/g)**	620	685	2147
CRM recovered **(ug/g)**	554(89%)	653(95%)	2007(93%)

Comments:

* Means duplicate sample was analyzed

MDL = Method Detection Limit; < = Not detected (less than MDL); ug/g = ppm.

Ref. Method: EPA 3550B/EPA 3630C/EPA 8015A - Solvent Extraction GC/FID & HT-GC/FID

CRM (Certified Reference Material) Spike recovery control limits: 70%-130%.

Dr. Asit Raksit, Ph.D., C. Chem.
Manager, Organics

Analysts: Saima Johri, B. Sc.
Nigel Dewsbury, B. Sc.

Client: XCG - Mississauga
Attention: J. HO
Client Reference: Proj: 1336-51-MIC
Date Received: Nov. 13, 2000.
Date Analyzed: Nov. 16, 2000.
Date Reported: Nov. 20, 2000.
Sample Type: Soil

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CERTIFICATE OF ANALYSIS

Total Petroleum Hydrocarbons

ENTECH # Sample #	Concentration (ug/g)		
	gasoline range (C5-C10)	diesel range (>C10-C24)	heavy oil range (>C24-C50)
MDL	10	10	80
Lab Blank	<	<	<
7645 MIC-HFS1	<	190	1,600
7646 MIC-HFS2	<	110	1,200
7647 MIC-HFS3	<	770	110
7648 MIC-HFS4	<	150	1,100
7649 MIC-HFS5	<	1,300	1,700
7650 MIC-HFS6	<	30	<
7650* MIC-HFS6	<	40	<
CRM spiked (ug/g)	620	685	2147
CRM recovered (ug/g)	554(89%)	653(95%)	2007(93%)

Comments:

* Means duplicate sample was analyzed

MDL = Method Detection Limit; < = Not detected (less than MDL); ug/g = ppm.

Ref. Method: EPA 3550B/EPA 3630C/EPA 8015A - Solvent Extraction GC/FID & HT-GC/FID

CRM (Certified Reference Material) Spike recovery control limits: 70%-130%.

Dr. Asit Raksit, Ph.D., C. Chem.
Manager, Organics

Analysts: Saima Johri, B. Sc.
Nigel Dewsbury, B. Sc.

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Client: XCG-Kitchener
Attention: J. Ho
Project: 1336-51-MIC
P.O.:
Sample Type: Soil
Date Received: Nov 13/2000
Date Analysed: Nov 17/2000
Date Reported: Nov 21/2000

SKSanyal
Sam Sanyal, M.Sc., C. Chem
Manager, Inorganic Analysis.

Certificate of Analysis

PARAMETER	Units	Method Detection Limit (µg/g)	CONTROL SAMPLE			SAMPLE DATA (µg/g)							
			Expected Conc. (µg/mL)	Found Conc. (µg/mL)	Recovery %	Blank	7651 MIC-LF1	7652 MIC-LF2	7653 MIC-LF3	7654 MIC-LF4	7654 MIC-LF4 Duplicate		
Fluoride	µg/g	0.25	14.1	14	99	<0.25	<0.25	<0.25	0.35	0.34	0.34		
Chloride	µg/g	0.25	122	130.16	107	<0.25	14.5	18.0	15.9	11.8	11.9		
Nitrate	µg/g	0.25	13.47	13.7	102	<0.25	0.98	0.99	1.71	0.92	0.860		
Nitrite	µg/g	0.25	7.33	7.06	96	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25		
Bromide	µg/g	0.25	0.5	0.5	100	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25		
Phosphate	µg/g	0.5	12	13.12	109	<0.5	1.75	<0.5	<0.5	<0.5	<0.5		
Sulphate	µg/g	0.25	121	120.05	99	<0.25	8.91	21.0	28.8	18.8	16.7		

Sample Disposal: 90 Days from the Reporting Date.
***Analyst:* AV**

Method:
Anions - Extraction/Ion Chromatography (EPA 300.0)

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Client: **XCG-Mississauga**
Attention: **J. Ho**
Project: **1336-51-MIC**
P.O.:
Sample Type: **Water**
Date Sampled: **N/A**
Date Received: **Nov 13/2000**
Date Analysed: **Nov 16/2000**
Date Reported: **Nov 20/2000**

Certificate of Analysis

PARAMETER	Method Detection Limit (µg/mL)	CONTROL SAMPLE			SAMPLE DATA (µg/mL)			
		Expected Conc. (µg/mL)	Found Conc. (µg/mL)	Recovery %	Blank	7655 MIC-SW1	7656 MIC-LF-SF1	7656 MIC-LF-SF1 Duplicate
Sulphate	0.05	121	118.31	98	<0.05	3.10	0.59	0.62
Chloride	0.05	122	126.71	104	<0.05	0.69	0.61	0.61
Nitrate-N	0.01	3.04	3.08	101	<0.01	0.06	0.04	0.04
Nitrite-N	0.015	2.22	2.13	96	<0.015	0.055	0.048	0.048
Ortho Phosphate	0.1	12	12.42	104	<0.1	<0.1	<0.1	<0.1
Fluoride	0.05	14.1	13.53	96	<0.05	0.07	0.06	<0.05
Bromide	0.05	2.0	2.0	100	<0.05	<0.05	<0.05	<0.05

Sample Disposal: 90 Days from the Reporting Date.
***Analyst:* AV**
Method:
Anions - Ion Chromatography (EPA 300.0)

S.K. Sanyal
Sam Sanyal, M.Sc., C. Chem.
Manager, Inorganic Analysis.

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Tel: 905-821-1112
Fax: 905-821-2095

Client: XCG - Mississauga
Attention: J. HO
Client Reference: Proj: 1336-51-MIC
Date Received: Nov. 13, 2000.
Date Analyzed: Nov. 15, 200.
Date Reported: Nov. 20, 2000.
Sample Type: Soil

Certificate of Analysis

Polycyclic Aromatic Hydrocarbons (PAH's)

ENTECH # >> Sample # >> Units are ug/g (ppm)	MDL	Lab Blank	7645 MIC-HFS1	7646 MIC-HFS2	7647 MIC-HFS3	7648 MIC-HFS4	7649 MIC-HFS5	7650 MIC-HFS6	7650dup MIC-HFS6	HS-5 Spike Amount (ppm)	HS-5 Recovery (%)
Naphthalene	0.007	<	<	0.02	<	<	<	<	<	0.18	70
Acenaphthylene	0.004	<	<	<	<	0.41	<	<	<	0.15	130
Acenaphthene	0.004	<	<	<	<	<	<	<	<	0.13	70
Fluorene	0.007	<	<	<	<	<	<	<	<	0.30	70
Phenanthrene	0.006	<	<	0.40	0.32	0.57	<	<	<	4.2	114
Anthracene	0.004	<	<	0.21	<	0.35	<	<	<	0.53	130
Fluoranthene	0.003	<	<	0.37	<	2.1	0.13	<	<	5.8	70
Pyrene	0.002	<	<	0.33	0.10	2.0	0.14	<	<	4.0	95
Benzo (a) anthracene	0.006	<	0.25	0.27	0.15	1.6	0.45	<	<	1.7	88
Chrysene	0.005	<	0.04	0.05	0.03	0.28	0.08	<	<	1.9	79
Benzo (b) fluoranthene	0.004	<	0.12	0.13	<	1.5	0.10	<	<	1.0	82
Benzo (k) fluoranthene	0.008	<	0.07	0.09	<	<	0.06	<	<	0.60	110
Benzo (a) pyrene	0.003	<	0.35	<	<	1.1	0.16	<	<	0.90	70
Indeno (1,2,3-cd) pyrene	0.004	<	0.08	<	<	0.70	<	<	<	0.60	90
Dibenzo (a,h) anthracene	0.003	<	<	<	<	0.17	<	<	<	0.10	110
Benzo (g,h,i) perylene	0.004	<	0.23	<	<	0.34	<	<	<	1.0	98
TOTAL PAH			1.1	1.9	0.60	11	1.1	-	-	23	-
Surrogate Recoveries (%)											
Naphthalene-d8		88	128	104	128	116	126	128	120	100	80
Phenanthrene-d10		104	122	104	-108	94	106	110	88	100	114
Chrysene-d12		78	106	90	106	80	90	106	82	100	74

Comments:

MDL = Method Detection Limit; < = Not Detected (less than the MDL).
Ref. Method: EPA 3550B/8270C - Solvent Ext./GC/MS
Surrogate and Spike recovery control limits = 70% - 130%.
HS-5 = Certified Reference Material.

Dr. Asit Raksit, Ph.D., C. Chem.
Manager, Organics

Analysts: Saima Johri, B. Sc.
Agnes Tworek, B. Sc.

Client: XCG - Mississauga
Attention: J. HO
Client Reference: Proj: 1336-51-MIC
Date Received: Nov. 14, 2000.
Date Analyzed: Nov. 17, 2000.
Date Reported: Nov. 22, 2000.
Sample Type: Soil

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Certificate of Analysis

Polycyclic Aromatic Hydrocarbons (PAH's)

Units are ug/g (ppm)	ENTECH # >> Sample # >> MDL	Lab Blank	7723 MIC-AST1	7724 MIC-AST2	7725 MIC-AST3	7726 MIC-AST4	7727 MIC-AST5	7728 MIC-AST6	HS-5 pike Amoun (ppm)	HS-5 Recovery (%)
Naphthalene	0.007	<	<	<	<	0.11	0.05	<	0.18	70
Acenaphthylene	0.004	<	<	<	0.13	0.04	0.04	<	0.15	130
Acenaphthene	0.004	<	<	<	<	<	<	<	0.13	70
Fluorene	0.007	<	<	<	<	<	<	<	0.30	70
Phenanthrene	0.006	<	<	<	0.03	0.06	0.09	<	4.2	114
Anthracene	0.004	<	<	<	0.03	0.04	0.09	<	0.53	130
Fluoranthene	0.003	<	0.01	<	<	0.13	0.33	<	5.8	70
Pyrene	0.002	<	0.02	0.20	<	0.37	0.35	<	4.0	95
Benzo (a) anthracene	0.006	<	<	0.28	<	0.45	0.38	<	1.7	88
Chrysene	0.005	<	0.01	0.06	<	0.12	0.20	<	1.9	79
Benzo (b) fluoranthene	0.004	<	0.01	<	<	0.14	0.16	<	1.0	82
Benzo (k) fluoranthene	0.008	<	<	<	<	0.10	0.12	<	0.60	110
Benzo (a) pyrene	0.003	<	<	<	0.42	0.76	0.29	<	0.90	70
Indeno (1,2,3-cd) pyrene	0.004	<	<	<	<	0.95	<	<	0.60	90
Dibenzo (a,h) anthracene	0.003	<	<	<	<	1.5	<	<	0.10	110
Benzo (g,h,i) perylene	0.004	<	<	<	<	0.59	0.16	<	1.0	98
TOTAL PAH			**0.05**	**0.54**	**0.61**	**5.4**	**2.3**	**-**	**23**	**-**
Surrogate Recoveries (%)										
Naphthalene-d8		122	122	122	124	120	120	120	100	80
Phenanthrene-d10		70	120	122	126	124	122	118	100	114
Chrysene-d12		70	128	70	130	130	130	118	100	74

Comments:
MDL = Method Detection Limit; < = Not Detected (less than the MDL).
Ref. Method: EPA 3550B/8270C - Solvent Ext./GC/MS
Surrogate and Spike recovery control limits = 70% - 130%.
HS-5 = Certified Reference Material.

Dr. Asit Raksit, Ph.D., C. Chem.
Manager, Organics

Analysts: Saima Johri, B. Sc.
Agnes Tworek, B. Sc.

APPENDIX D

Current National Classification System for Contaminated Sites

Site Identification: Michipicoten Island, East End Light Station (CS-1)

L.L. 1097

62 ± 4.5

DETAILED EVALUATION FORM

* Update Jan 2001 *

Before completing this form, review instructions in text (Section 3.0).

I **CONTAMINANTS CHARACTERISTICS** (Maximum Total Score is 33)
Complete **Sections A, B, C,** and **Special Considerations**
If answer is an estimate, circle the question mark (?) beside your score;
if not an estimate circle the checkmark (✓)(see Subsection 3.7.1 in text).

Hydrocarbon Contamination and Metals (near generator building and equipment buildings)

ontam

Factors		Scoring Guideline	Site Score	Totals
A	**Degree of Hazard** (max. 14)			
	• High concern contaminants - high concentration	14		
	• High concern contaminants - low concentration	11		
	• Medium concern contaminants - high concentration	8		
	• Medium concern contaminants - low concentration	5		
	• Low concern contaminants	3	14 ? [✓ ✓]	14 Section A max. 14
B	**Contaminant Quantity** (area or volume of site contamination) (max. 10)			
	• >10 ha or 1000 m³ or drums of liquid	10		
	• 2 to 10 ha or 100 to 1000 m³	6		
	• <2 ha or 100 m³	2	2 ? [✓ ✓]	2 Section B max. 10
C	**Physical State of Contaminants** (max. 9)			
	• Liquid/gas	9		
	• Sludge	7		
	• Solid	3	3 ? [✓ ✓]	3 Section C max. 9
Special Considerations				
	Discretionary addition or subtraction to this category score (Contaminant Characteristics) by up to 6 points based on technical judgment of the user. (Special considerations scores must not cause total score for this category to exceed the maximum (33) or be lower than the minimum (0) allowable.)			
	DETAILED RATIONALE MUST BE DOCUMENTED	-6 to +6	0 ✓	0 max. 6

I **Total Site Score for CONTAMINANT CHARACTERISTICS** Add:

	Total "/"	Total "?"	Total "✓"+"?"
Section A	14	0	14
Section B	2	0	2
Section C	3	0	3
Special Considerations	0	0	0
TOTAL	19	0	19
			max. 33

Site Identification: ____________________

Site Identification:

DETAILED EVALUATION FORM (Cont'd.)

II **EXPOSURE PATHWAYS** (Maximum Total Score is 33)
Complete Sections A, B, and C.

A **Groundwater** (Maximum Score is 11)
Score **Section 1 (Known)** OR **2 (Potential)**, and **Section 3.**
If answer is an estimate, circle the question mark (?) beside your score;
if not an estimate circle the checkmark (✓).

Factors	Scoring Guideline	Site Score	Totals
1 **Known Contamination of Groundwater at or beyond the Property Boundary** (measured contamination of, or known contact with, groundwater (max. 11))			
• Groundwater significantly exceeds CDWG (by >2x) or known contact of contaminants with groundwater;	11		
• Between 1 and 2x CDWG or probable contact with groundwater	6		
• Meets Canadian Drinking Water Guidelines	0	___ ✓	___ Section 1 max. 11
If impact on groundwater is not known, complete 2			
OR 2 **Potential for Groundwater Contamination** (max. 11)			
a) Engineered subsurface containment (max. 4)			
• No containment	4		
• Partial containment	2		
• Full containment	0	4 ? [✓ ✓]	
b) Thickness of confining layer over aquifer (max. 1.5)			
• 3 m or less	1.5		
• 3 to 10 m	1		
• >10 m	0	1.5 ? ✓	
c) Hydraulic conductivity of the confining layer (max. 1.5)			
• $>10^{-4}$ cm/sec	1.5		
• 10^{-4} to 10^{-6} cm/sec	1		
• $<10^{-6}$ cm/sec	0.5	0.750 [✓ ?] ✓	
d) Annual rainfall (max. 1)			
• >1,000 mm	1		
• 600 mm	0.6		
• 400 mm	0.4		
• 200 mm	0.2	0.5 [✓ ?] ✓	
e) Hydraulic conductivity of aquifer(s) of concern (max. 3)			
• $>10^{-2}$ cm/sec	3		
• 10^{-2} to 10^{-4} cm/sec	1.5		
• $<10^{-4}$ cm/sec	0.5	1.5 [✓ ?] ✓	8.25 Section 2 max 11

3	**Special Considerations** Discretionary addition or subtraction to this sub category score (Groundwater Pathway) by up to 4 points based on technical judgment of the user. (Special considerations scores must not cause total score for this category to exceed the maximum (11) or be lower than the minimum (0) allowable.) DETAILED RATIONALE MUST BE DOCUMENTED	-4 to +4	0	✓	0 Section 3 max. 4

				Total "✓"	Total "?"	Total "✓"+"?"
A	**Groundwater Total**	Add:	Section 1 or 2	5.5	2.75	8.25
			Section 3	0	0	0
			TOTAL	5.5	2.75	8.25 max. 11

Site Identification: ______

Site Identification:

DETAILED EVALUATION FORM (Cont'd.)

II EXPOSURE PATHWAYS (Cont'd.)

B Surface Water (Maximum Score is 11)

Score Section 1 (Known) OR 2 (Potential), and Section 3.

Factors		Scoring Guideline	Site Score	Totals
1	**Observed or Measured Contamination of Water/Effluent Discharged from Site** (max. 11)			
	• Known or strongly suspected to exceed CWQG by >2x	11		
	• Known or strongly suspected to be between 1 and 2x CWQG	6		
	• Meets Canadian Water Quality Guidelines	0	___ ✓	Section 1 max. 11
	If impact on surface water is not known, complete 2			
OR 2	**Potential for Surface Water Contamination** (max. 11)			
	a) Surface containment (max. 5)		5 ? ✓	
	• No containment	5		
	• Partial containment	3		
	• Full containment	0.5		
	b) Distance to perennial surface water (max. 3)		3 ? ✓	
	• 0 to <100 m	3		
	• 100 - 300 m	2		
	• >300 m	0.5		
	c) Topography (max. 1.5)		1 ? ✓	
	• Contaminants above ground level and slope is steep	1.5		
	• Contaminants at or below ground level and slope is steep	1.2		
	• Contaminants above ground level and slope is flat	0.8		
	• Contaminants at or below ground level and slope is flat	0		
	d) Run off potential (see nomograph at end of Appendix D) (max. 1)		0.5 ① ✓	
	• >1000 mm rainfall and low permeability surface material	1		
	• 500-1000 mm rainfall and moderately permeable surface material	0.6		
	• <500 mm rainfall and highly permeable surface material	0.2		
	e) Flood potential (max. 0.5)		0.25 ① ✓	9.75
	• 1 in 2 years	0.5		Section 2 max. 11
	• 1 in 10 years	0.3		
	• 1 in 50 years	0.1		

3	**Special Considerations** Discretionary addition or subtraction to this sub-category score (Surface Water Pathway) by up to 4 points based on the technical judgment of the user. (Special considerations scores must not cause the total score for this sub category to exceed the maximum (11) or be lower than the minimum (0) allowable.) DETAILED RATIONALE MUST BE DOCUMENTED	-4 to +4	0 ✓	0 Section 3 max. 4

				Total "✓"	Total "?"	Total "✓"+"?"
B	**Surface Water Total**	Add:	Section 1 or 2	8	1.75	9.75
			Section 3	0	0	0
			TOTAL	8	1.75	9.75 max. 11

Site Identification:

Site Identification: ______________ DETAILED EVALUATION FORM (Cont'd.)

II EXPOSURE PATHWAYS (Cont'd.)

C **Direct Contact** (Maximum Score is 11)
Score **Section 1 (Known)** OR **2 (Potential)**, and **Section 3**

	Factors	Scoring Guideline	Site Score	Totals
1	**Known Contamination of Media Off-site** (max. 11)			
	• Known contamination of media (soil, sediment, air) off-site due to direct contact with contaminated soil, dust, air, etc. (vector transported should also be considered)	11		
	• Strongly suspected contamination of media (soil, sediment, air) off-site	6		
	• No contamination of media off-site	0	____ ✓	Section 1 max. 11
	If impact due to direct contact is not known, complete 2			
OR 2	**Potential for Direct Human and/or Animal Contact** (max. 11)			
	a) Airborne Emissions (gases, vapours, contaminated dust, etc.) (max. 5)			
	• Known or suspected airborne emissions impacting on neighbouring properties (see User's Guide)	5		
	• Airborne emissions generally restricted to site	3		
	• No airborne emissions	0	0 ?✓	
	b) Accessibility of Site (Ability to Contact Materials) (max. 4)			
	• Limited barriers to prevent site access; contaminants not covered	4		
	• Moderate accessibility or no intervening barriers; contaminants are covered	3	3 ?✓	
	• Controlled access or remote location and contaminants are covered	0		
	c) Hazardous soil gas migration from the site (max. 2)			
	• Contaminants are putrescible and soil permeability is high	2		
	• Site contaminants are putrescible but soil permeability is low, and/or groundwater is <2 m from surface	1		
	• No putrescible contaminants at the site	0	0 ?✓	3 Section 2 max. 11
3	**Special Considerations**			
	Discretionary addition or subtraction to this sub-category score (Direct Contact Pathway) by up to 4 points based on the technical judgment of the user. (Special consideration scores must not cause the total score for this sub-category to exceed the maximum (11) or be lower than the minimum (0) allowable.) DETAILED RATIONALE MUST BE DOCUMENTED	-4 to +4	0 ✓	0 Section 3 max. 4

				Total "✓"	Total "?"	Total "✓"+"?"
C	**Direct Contact Total**	Add:	Section 1 or 2	3	0	3
			Section 3	0	0	0
			TOTAL	3	0	3 max. 11

II	**Total Site Score for EXPOSURE PATHWAYS**	Add:	**A Groundwater**	5.5	2.75	8.25
			B Surface Water	8	1.75	9.75
			C Direct Contact	3	0	3
			TOTAL	16.5	4.5	21 max. 33

Site Identification:

Site Identification:

DETAILED EVALUATION FORM (Cont'd.)

III **RECEPTORS** (Maximum Total Score is 34)
Complete Sections A and B.

A **Human and Animal Uses** (Maximum score is 18)
Score **Section 1 (Known)** OR **2 (Potential)**, and **Section 3.**
If answer is an estimate, circle the question mark (?) beside your score; if not an estimate circle the checkmark (✓).

Factors		Scoring Guideline	Site Score	Totals
1	**Known Impact on Humans or Animals** (max. 18)			
	Known adverse impact on humans or domestic animals as a result of the contaminated site (see User's Guide)			
	• Known adverse effect on humans or domestic animals	18		
	• Strongly suspected adverse effect on humans or domestic animals	15	___ ✓	___ Section 1 max. 18 ↓ Class 1
	If adverse effect on humans is not known, complete 2			
OR 2	**Potential for Impact on Humans or Animals** (max. 18)			
a)	Drinking Water Supply (max. 9) (groundwater or surface water; private, commercial or municipal supply) Complete **Section i) (Known) OR ii) (Potential)**			
i)	Known impact on drinking water supply (max. 9) (see User's Guide) Drinking water supply is known to be adversely affected as a result of site contamination			
	• Known contamination of drinking water supply (to levels exceeding CDWG)	9		
	• Strongly suspected contamination of drinking water supply	7		
	• Drinking water supply is known not to be contaminated	0	___ ✓	
	If impact on drinking water is not known, complete **ii)**			
ii)	Potential for impact on drinking water supply (max. 9)			
	■ Proximity to drinking water supply (max. 6)			
	• 0 to <100 m	6		
	• 100 to <300 m	5		
	• 300 m to <1 km	4		
	• 1 to 5 km	3	6 ? [✓]	
	■ "Availability" of alternate drinking water supply (max. 3)			
	• Alternate drinking water supply is not available	3		
	• Alternate drinking water supply difficult to obtain	2		
	• Alternate drinking water supply available	0.5	0.5 ? [✓]	

Factors	Scoring Guideline	Site Score	Totals

b) Other Water Resources (max. 4)
(groundwater or surface water)

Complete **i) (Known) OR ii) (Potential)**

i) Known impact on water resources (max. 4) (see User's Guide)

- Water resources (used for recreational purposes, commercial food preparation, livestock watering, irrigation and other food chain uses) is known to be adversely affected as a result of site contamination

	Scoring Guideline	Site Score
• Water resource is known to be contaminated above CWQG	4	
• Water resource is strongly suspected to be contaminated above CWQG	3	
• Water resource is known not to be contaminated	0	—— ✓

If impact on water resource is not known, complete **ii)**

ii) Potential for impact on water resources (max. 4)

■ Proximity to water resources used for activities listed above (max. 2)

	Scoring Guideline	Site Score
• 0 to <100 m	2	
• 100 to <300 m	1.5	
• 300 m to <1 km	1	
• 1 to 5 km	0.5	2 ? ✓

■ Use of water resources (max. 2)
If multiple uses, give highest score automatically
(use following table)

Water Use	Frequency of Use Frequent	 Occasional	Site Score
Recreational (swimming, fishing, etc.)	2	1	
Commercial food preparation	1.5	0.8	
Livestock watering	1	0.5	
Irrigation	1	0.5	
Other domestic or food chain uses	0.5	0.3	
Not currently used but likely future use	0.5	0.2	1 ✓

Site Identification: ____________________

DETAILED EVALUATION FORM (Cont'd.)

III **RECEPTORS (Cont'd.)**

A **Human and Animal Use (Cont'd.)**

Factors	Scoring Guideline	Site Score	Totals

c) Direct Human Exposure (max. 5)

Complete i) (Known) OR ii) (Potential)

i) Known contamination of land used by humans (max. 5) (see User's Guide)

	Scoring Guideline	Site Score
• Known contamination of land used for agricultural or residential/parkland/school purposes above AG or R/P EQC values.	5	
• Known contamination of land used for commercial or industrial purposes above C/I EQC values.	3.5	5 ✓
• Land is known not be contaminated	0	

If impact on used land is not known, complete ii)

ii) Potential human exposure through land use (give highest score to worst case scenario) (max. 5)

■ Use of land at and surrounding site
Determine use(s) of land at and surrounding site and assign score using following table:

	Distance from Site				
Land Use	0-<300 m	300 m-<1 km	1 km-5 km	Site Score	Totals
Residential	5	4.5	3		
Agricultural	5	4	2.5		
Parkland/School	4	3	1.5		14.5
Commercial/Industrial	3	1	0.5	___ X(✓)	Section 2 max. 18

3 **Special Considerations**

Discretionary addition or subtraction to this sub-category (Impact on Human and Animal Receptors) by up to 5 points based on the technical judgment of the user. (Special considerations score must not cause the total score for this sub category to exceed the maximum (18) or be lower than the minimum (0) allowable.)

	Scoring Guideline	Site Score	Totals
DETAILED RATIONALE MUST BE DOCUMENTED	-5 to +5	-5 ✓	-5 Section 3 max 5

* Lake not used as drinking water supply* points
(removed from ai aii)
-> water supply intake pump no
longer connected

				Total "✓"	Total "?"	Total "✓"+ "?"
A	**Total Human and Animal Receptors**	Add:	Section 1 or 2	14,5	0	14.5
			Section 3	-5	0	-5
			TOTAL	9.5	0	9.5 max. 18

Site Identification:

Site Identification:

DETAILED EVALUATION FORM (Cont'd.)

III RECEPTORS (Cont'd.)

B Environmental Receptors (Maximum Score is 16)
Score **Section 1 (Known)** OR **2 (Potential)**, and Section 3

	Factors	Scoring Guideline	Site Score	Totals
1	**Known Adverse Impact on the Environment as a Result of the Contaminated Site** (max. 16)			
	• Known adverse impact on sensitive environment	16		
	• Evidence of stress on aquatic species, or vegetative stress on trees, crops or plant life located on properties neighbouring the site	14		
	• Strongly suspected adverse impact on sensitive environment	12	—— ✓	Section 1 max. 16
	If impact on the environment is not known, complete 2.			
OR 2	**Potential for Impact on Sensitive Environments** (max. 16)			
	a) Distance from the site to the nearest sensitive environment (max. 10) (e.g., sensitive aquatic environment, nature preserve, habitat for endangered species, sensitive forest reserves, national parks or forests, etc.)			
	• 0 to <500 m	10		
	• 500 m to <2 km	6		
	• 2 to <5 km	2		
	• 5 to 10 km	0.5	6 ? ✓	
	b) Groundwater (max. 6) Distance to an important or susceptible groundwater resource (e.g. recharge area)			
	• 0 to <500 m	6		
	• 500 m to <2 km	4		
	• 2 to <5 km	2		
	• 5 to 10 km	1	6 ? ✓	12 Section 2 max 16
3	**Special Considerations**			
	Discretionary addition or subtraction to this sub category (Environmental Receptors) by up to 5 points based on the technical judgment of the user. (Special considerations score must not cause total score for this sub-category to exceed the maximum (16) or be lower than the minimum (0) allowable.)			
	DETAILED RATIONALE MUST BE DOCUMENTED	-5 to +5	0 ✓	0 Section 3 max 5

				Total "✓"	Total "?"	Total "✓"+"?"
B	**Total Environmental Receptors**	Add:	Section 1 or 2	12	0	12
			Section 3	0	0	0
			TOTAL	12	0	12. max. 16

III	**Total Site Score for RECEPTORS**	Add:	A	**Human and Animal Use**	9.5	0	9.5
			B	**Environmental Receptors**	12	0	12
				TOTAL	21.5	0	21.5 max. 34

Site Identification: ______________________

Site Identification: ________ ____________ ________

DETAILED EVALUATION FORM (Cont'd.)

FINAL SCORE SHEET AND SITE CATEGORIES

Factor Categories	Category Score (CS) ("✓" + "?")	Estimated Score (ES) ("?" only)	Total Category Score (CS)	Total Estimated Score (ES)
I CONTAMINANT CHARACTERISTICS (33)	19	0	Total → 19	± 0
II EXPOSURE PATHWAYS (33)				
A Groundwater (11)	8.25	2.75		
B Surface Water (11)	9.75	1.75		
C Direct Contact (11)	3	0		
Total	21	4.5	Total → 21	± 4.5
III RECEPTORS (34)				
A Human and Animal (18)	9.5	0		
B Environment (16)	12	0		
Total	21.5	0	Total → 21.5	± 0
			61.5	± 4.5
			TOTAL SCORE FOR THE SITE (TS) (Sum of scores marked "✓" and "?", rounded to nearest whole number)	**ESTIMATED SCORE FOR SITE (ES)** (Sum of scores marked "?", i.e. score estimated or unkown)

CLASSIFICATION (1, 2, 3, or N)
If ES ≥15, then site is categorized as **I**
(insufficient information to classify site)

2

SITE SCORE	CLASS	RISK POTENTIAL	ACTION REQUIRED
70 - 100	Class 1	High	Yes
50 - 69	Class 2	Medium	Likely
38 - 49	Class 3	Medium Low	May Be
≤37	Class N	Low	Not Likely

Site Identification: Michipicoten Island, East End Light Station L.L.1017. (CS-2)

DETAILED EVALUATION FORM

* Update Jan 2001 *

Waste Disposal Site - West Side (Metals Contamination in Surface H_2O).

Before completing this form, review instructions in text (Section 3.0).

I **CONTAMINANTS CHARACTERISTICS** (Maximum Total Score is 33)
Complete **Sections A, B, C,** and **Special Considerations**
If answer is an estimate, circle the question mark (?) beside your score;
if **not** an estimate circle the checkmark (✓)(see Subsection 3.7.1 in text).

TOTAL 60 ± 19.25

I = insufficient info

(CS-04)

Factors	Scoring Guideline	Site Score	Totals
A **Degree of Hazard** (max. 14)			
• High concern contaminants - high concentration	14		
• High concern contaminants - low concentration	11		
• Medium concern contaminants - high concentration	8		
• Medium concern contaminants - low concentration	5		
• Low concern contaminants	3	7 [✓ ?] ✓	7 Section A max. 14
B **Contaminant Quantity** (area or volume of site contamination) (max. 10)			
• >10 ha or 1000 m³ or drums of liquid	10		
• 2 to 10 ha or 100 to 1000 m³	6		
• <2 ha or 100 m³	2	5 [✓ ?] ✓	5 Section B max. 10
C **Physical State of Contaminants** (max. 9)			
• Liquid/gas	9		
• Sludge	7		
• Solid	3	4.5 [✓ ?] ✓	4.5 Section C max. 9
Special Considerations			
Discretionary addition or subtraction to this category score (Contaminant Characteristics) by up to 6 points based on technical judgment of the user. (Special considerations scores must not cause total score for this category to exceed the maximum (33) or be lower than the minimum (0) allowable.)			
DETAILED RATIONALE MUST BE DOCUMENTED	-6 to +6	0 ✓	0 max. 6

* Parts A and B are classified as "?", as this contaminated site is based on one surface water sample only.

1 Total Site Score for CONTAMINANT CHARACTERISTICS Add:

	Total "✓"	Total "?"	Total "✓"+"?"
Section A	0	7	7
Section B	0	5	5
Section C	0	4.5	4.5
Special Considerations	0	0	0
TOTAL	0	16.5	16.5 max. 33

Site Identification:

Site Identification:

DETAILED EVALUATION FORM (Cont'd)

II **EXPOSURE PATHWAYS** (Maximum Total Score is 33)
Complete Sections A, B, and C.

A **Groundwater** (Maximum Score is 11)
Score **Section 1 (Known)** OR **2 (Potential)**, and **Section 3**.
If answer is an estimate, circle the question mark (?) beside your score;
if not an estimate circle the checkmark (✓).

Factors		Scoring Guideline	Site Score	Totals
1	**Known Contamination of Groundwater at or beyond the Property Boundary** (measured contamination of, or known contact with, groundwater (max. 11)			
	• Groundwater significantly exceeds CDWG (by ≥2x) or known contact of contaminants with groundwater;	11		
	• Between 1 and 2x CDWG or probable contact with groundwater	6		
	• Meets Canadian Drinking Water Guidelines	0	____ ✓	____ Section 1 max. 11
	If impact on groundwater is not known, complete 2			
OR 2	**Potential for Groundwater Contamination** (max. 11)			
	a) Engineered subsurface containment (max. 4)			
	• No containment	4		
	• Partial containment	2		
	• Full containment	0	4 ? [✓ ✓]	
	b) Thickness of confining layer over aquifer (max 1.5)			
	• 3 m or less	1.5		
	• 3 to 10 m	1		
	• >10 m	0	1.5 ? [✓ ✓]	
	c) Hydraulic conductivity of the confining layer (max. 1.5)			
	• $>10^{4}$ cm/sec	1.5		
	• 10^{4} to 10^{6} cm/sec	1		
	• $<10^{6}$ cm/sec	0.5	0.75 [✓ ?] ✓	
	d) Annual rainfall (max. 1)			
	• >1,000 mm	1		
	• 600 mm	0.6		
	• 400 mm	0.4		
	• 200 mm	0.2	0.5 [✓ ?] ✓	
	e) Hydraulic conductivity of aquifer(s) of concern (max. 3)			
	• $>10^{2}$ cm/sec	3		
	• 10^{2} to 10^{4} cm/sec	1.5		
	• $<10^{4}$ cm/sec	0.5	1.5 [✓ ?] ✓	8.25 Section 2 max 11

3 **Special Considerations**

Discretionary addition or subtraction to this sub-category score (Groundwater Pathway) by up to 4 points based on technical judgment of the user. (Special considerations scores must not cause total score for this category to exceed the maximum (11) or be lower than the minimum (0) allowable.)

DETAILED RATIONALE MUST BE DOCUMENTED

-4 to +4 0 ✓

0 Section 3 max. 4

A **Groundwater Total**

Add:

	Total "✓"	Total "?"	Total "✓"+"?"
Section 1 or 2	5.5	2.75	8.25
Section 3	0	0	0
TOTAL	5.5	2.75	8.25 max. 11

Site Identification:

Site Identification:

DETAILED EVALUATION FORM (Cont'd.)

II EXPOSURE PATHWAYS (Cont'd.)

B **Surface Water** (Maximum Score is 11)

Score **Section 1 (Known)** OR **2 (Potential)**, and Section 3.

	Factors	Scoring Guideline	Site Score	Totals
1	**Observed or Measured Contamination of Water/Effluent Discharged from Site** (max. 11)			
	• Known or strongly suspected to exceed CWQG by >2x	11	11 ✓	11
	• Known or strongly suspected to be between 1 and 2x CWQG	6		Section 1 max. 11
	• Meets Canadian Water Quality Guidelines	0		
	If impact on surface water is not known, complete 2			
OR 2	**Potential for Surface Water Contamination** (max. 11)			
	a) Surface containment (max. 5)			
	• No containment	5		
	• Partial containment	3		
	• Full containment	0.5	___ ? ✓	
	b) Distance to perennial surface water (max. 3)			
	• 0 to <100 m	3		
	• 100 - 300 m	2		
	• >300 m	0.5	___ ? ✓	
	c) Topography (max. 1.5)			
	• Contaminants above ground level and slope is steep	1.5		
	• Contaminants at or below ground level and slope is steep	1.2		
	• Contaminants above ground level and slope is flat	0.8		
	• Contaminants at or below ground level and slope is flat	0	___ ? ✓	
	d) Run-off potential (see nomograph at end of Appendix D) (max. 1)			
	• >1000 mm rainfall and low permeability surface material	1		
	• 500-1000 mm rainfall and moderately permeable surface material	0.6		
	• <500 mm rainfall and highly permeable surface material	0.2	___ ? ✓	
	e) Flood potential (max. 0.5)			
	• 1 in 2 years	0.5		
	• 1 in 10 years	0.3		
	• 1 in 50 years	0.1	___ ? ✓	___ Section 2 max. 11

3 **Special Considerations**

Discretionary addition or subtraction to this sub-category score (Surface Water Pathway) by up to 4 points based on the technical judgment of the user. (Special considerations scores must not cause the total score for this sub category to exceed the maximum (11) or be lower than the minimum (0) allowable.)

DETAILED RATIONALE MUST BE DOCUMENTED -4 to +4 0 ✓

0
Section 3
max 4

			Total "✓"	Total "?"	Total "✓"+"?"
B	**Surface Water Total**	Add: Section 1 or 2	11	0	11
		Section 3	0	0	0
		TOTAL	11	0	11 max. 11

Site Identification:

Site Identification: ______________________ **DETAILED EVALUATION FORM** (Cont'd.)

II EXPOSURE PATHWAYS (Cont'd.)

C **Direct Contact** (Maximum Score is 11)

Score **Section 1 (Known)** OR **2 (Potential)**, and **Section 3**

	Factors	Scoring Guideline	Site Score	Totals
1	**Known Contamination of Media Off-site** (max. 11)			
	• Known contamination of media (soil, sediment, air) off-site due to direct contact with contaminated soil, dust, air, etc. (vector transported should also be considered)	11		
	• Strongly suspected contamination of media (soil, sediment, air) off-site	6		
	• No contamination of media off-site	0	____ ✓	____ Section 1 max. 11
	If impact due to direct contact is not known, complete 2			
OR 2	**Potential for Direct Human and/or Animal Contact** (max. 11)			
	a) Airborne Emissions (gases, vapours, contaminated dust, etc.) (max. 5)			
	• Known or suspected airborne emissions impacting on neighbouring properties (see User's Guide)	5		
	• Airborne emissions generally restricted to site	3		
	• No airborne emissions	0	0 ? ✓	
	b) Accessibility of Site (Ability to Contact Materials) (max. 4)			
	• Limited barriers to prevent site access; contaminants not covered	4		
	• Moderate accessibility or no intervening barriers; contaminants are covered	3		
	• Controlled access or remote location and contaminants are covered	0	3 ? ✓	
	c) Hazardous soil gas migration from the site (max. 2)			
	• Contaminants are putrescible and soil permeability is high	2		
	• Site contaminants are putrescible but soil permeability is low, and/or groundwater is <2 m from surface	1		
	• No putrescible contaminants at the site	0	0 ? ✓	3 Section 2 max 11
3	**Special Considerations**			
	Discretionary addition or subtraction to this sub-category score (Direct Contact Pathway) by up to 4 points based on the technical judgment of the user. (Special consideration scores must not cause the total score for this sub-category to exceed the maximum (11) or be lower than the minimum (0) allowable.) DETAILED RATIONALE MUST BE DOCUMENTED	-4 to +4	0 ✓	0 Section 3 max 4

				Total "✓"	Total "?"	Total "✓"+"?"
C	**Direct Contact Total**	Add:	Section 1 or 2	3	0	3
			Section 3	0	0	0
			TOTAL	3	0	3 max. 11

					Total "✓"	Total "?"	Total "✓"+"?"
II	**Total Site Score for EXPOSURE PATHWAYS**	Add:	A	**Groundwater**	5.5	2.75	8.25
			B	**Surface Water**	11	0	11
			C	**Direct Contact**	3	0	3
				TOTAL	19.5	2.75	22.25 max. 33

Site Identification:

Site Identification: ______________

DETAILED EVALUATION FORM (Cont'd.)

III RECEPTORS (Maximum Total Score is 34)
Complete Sections A and B.

A Human and Animal Uses (Maximum score is 18)
Score **Section 1 (Known)** OR **2 (Potential)**, and **Section 3.**
If answer is an estimate, circle the question mark (?) beside your score; if **not** an estimate circle the checkmark (✓).

Factors	Scoring Guideline	Site Score	Totals
1 Known Impact on Humans or Animals (max. 18)			
Known adverse impact on humans or domestic animals as a result of the contaminated site (see User's Guide)			
• Known adverse effect on humans or domestic animals	18		
• Strongly suspected adverse effect on humans or domestic animals	15	___ ✓	___ Section 1 max. 18 ↓ Class 1
If adverse effect on humans is not known, complete 2			
OR 2 Potential for Impact on Humans or Animals (max. 18)			
a) Drinking Water Supply (max. 9) (groundwater or surface water; private, commercial or municipal supply) Complete **Section i) (Known) OR ii) (Potential)**			
i) Known impact on drinking water supply (max. 9) (see User's Guide) Drinking water supply is known to be adversely affected as a result of site contamination			
• Known contamination of drinking water supply (to levels exceeding CDWG)	9		
• Strongly suspected contamination of drinking water supply	7		
• Drinking water supply is known not to be contaminated	0	___ ✓	
If impact on drinking water is not known, complete **ii)**			
ii) Potential for impact on drinking water supply (max. 9)			
■ Proximity to drinking water supply (max. 6)			
• 0 to <100 m	6		
• 100 to <300 m	5		
• 300 m to <1 km	4		
• 1 to 5 km	3	6 ? [✓]	
■ "Availability" of alternate drinking water supply (max. 3)			
• Alternate drinking water supply is not available	3		
• Alternate drinking water supply difficult to obtain	2		
• Alternate drinking water supply available	0.5	0.5 ? [✓]	

Factors	Scoring Guideline	Site Score	Totals
b) Other Water Resources (max. 4) (groundwater or surface water)			
Complete **i) (Known) OR ii) (Potential)**			
i) Known impact on water resources (max. 4) (see User's Guide) Water resources (used for recreational purposes, commercial food preparation, livestock watering, irrigation and other food chain uses) is known to be adversely affected as a result of site contamination			
• Water resource is known to be contaminated above CWQG	4		
• Water resource is strongly suspected to be contaminated above CWQG	3		
• Water resource is known not to be contaminated	0	____ ✓	
If impact on water resource is not known, complete **ii)**			
ii) Potential for impact on water resources (max. 4)			
■ Proximity to water resources used for activities listed above (max. 2)			
• 0 to <100 m	2		
• 100 to <300 m	1.5		
• 300 m to <1 km	1		
• 1 to 5 km	0.5	2 ?✓	
■ Use of water resources (max. 2) If multiple uses, give highest score automatically (use following table)			

Water Use	Frequency of Use Frequent	Frequency of Use Occasional	Site Score
Recreational (swimming, fishing, etc.)	2	1	
Commercial food preparation	1.5	0.8	
Livestock watering	1	0.5	
Irrigation	1	0.5	
Other domestic or food chain uses	0.5	0.3	
Not currently used but likely future use	0.5	0.2	1 ?✓

Site Identification:

Site Identification:

DETAILED EVALUATION FORM (Cont'd.)

III **RECEPTORS** (Cont'd.)

A **Human and Animal Use** (Cont'd.)

Factors	Scoring Guideline	Site Score	Totals
c) Direct Human Exposure (max. 5)			
Complete **i) (Known) OR ii) (Potential)**			
i) Known contamination of land used by humans (max. 5) (see User's Guide)			
• Known contamination of land used for agricultural or residential/parkland/school purposes above AG or R/P EQC values.	5	5 ✓	
• Known contamination of land used for commercial or industrial purposes above C/I EQC values.	3.5		
• Land is known not be contaminated	0		
If impact on used land is not known, complete ii)			
ii) Potential human exposure through land use (give highest score to worst case scenario) (max. 5)			
■ Use of land at and surrounding site Determine use(s) of land at and surrounding site and assign score using following table:		✓	14.5 Section 2 max. 18

Land Use	Distance from Site 0-<300 m	 300 m-<1 km	 1 km-5 km
Residential	[✓ 5]	4.5	3
Agricultural	5	4	2.5
Parkland/School	4	3	1.5
Commercial/Industrial	3	1	0.5

Factors	Scoring Guideline	Site Score	Totals
3 **Special Considerations** Discretionary addition or subtraction to this sub-category (Impact on Human and Animal Receptors) by up to 5 points based on the technical judgment of the user. (Special considerations score must not cause the total score for this sub-category to exceed the maximum (18) or be lower than the minimum (0) allowable.) DETAILED RATIONALE MUST BE DOCUMENTED	-5 to +5	-5 ✓	-5 Section 3 max 5

−5 * Lake is no used as Water supply (points Removed from 2 a(ii))
or

Site Identification: ________ ________ ________

DETAILED EVALUATION FORM (Cont'd.)

FINAL SCORE SHEET AND SITE CATEGORIES

Factor Categories	Category Score (CS) ("✓" + "?")	Estimated Score (ES) ("?" only)	Total Category Score (CS)	Total Estimated Score (ES)
I CONTAMINANT CHARACTERISTICS (33)	16.5	16.5	Total → 16.5	± 16.5
II EXPOSURE PATHWAYS (33)				
A Groundwater (11)	8.25	2.75		
B Surface Water (11)	11	0		
C Direct Contact (11)	3	0		
Total	22.25	2.75	Total → 22.25	± 2.75
III RECEPTORS (34)				
A Human and Animal (18)	9.5	0		
B Environment (16)	12	0		
Total	21.5	0	Total → 21.5	± 0
			60.25	± 19.25
			TOTAL SCORE FOR THE SITE (TS) (Sum of scores marked "✓" and "?", rounded to nearest whole number)	**ESTIMATED SCORE FOR SITE (ES)** (Sum of scores marked "?", i.e. score estimated or unkown)

CLASSIFICATION (1, 2, 3, or N)
If ES ≥15, then site is categorized as I
(insufficient information to classify site)

I

SITE SCORE	CLASS	RISK POTENTIAL	ACTION REQUIRED
70 - 100	Class 1	High	Yes
50 - 69	Class 2	Medium	Likely
38 - 49	Class 3	Medium Low	May Be
≤37	Class N	Low	Not Likely

B	**Total Environmental Receptors**	Add:		**Total "✓"**	**Total "?"**	**Total "✓"+"?"**
			Section 1 or 2	12	0	12
			Section 3	0	0	0
			TOTAL	12	0	12
						max. 16

III	**Total Site Score for RECEPTORS**	Add:	**A** **Human and Animal Use**	9.5	0	9.5
			B **Environmental Receptors**	12	0	12
			TOTAL	21.5	0	21.5
						max. 34

Site Identification: ______________________

				Total "✓"	Total "?"	Total "✓"+ "?"
A	**Total Human and Animal Receptors**	Add:	Section 1 or 2	14.5	0	14.5
			Section 3	-5	0	-5
			TOTAL	9.5	0	9.5 max. 18

Site Identification: ____________________

Site Identification:

DETAILED EVALUATION FORM (Cont'd.)

III RECEPTORS (Cont'd.)

B Environmental Receptors (Maximum Score is 16)

Score **Section 1 (Known)** OR **2 (Potential)**, and **Section 3**

	Factors	Scoring Guideline	Site Score	Totals
1	**Known Adverse Impact on the Environment as a Result of the Contaminated Site** (max. 16)			
	• Known adverse impact on sensitive environment	16		
	• Evidence of stress on aquatic species, or vegetative stress on trees, crops or plant life located on properties neighbouring the site	14		
	• Strongly suspected adverse impact on sensitive environment	12	____ ✓	____ Section 1 max. 16
	If impact on the environment is not known, complete 2.			
OR 2	**Potential for Impact on Sensitive Environments** (max. 16)			
	a) Distance from the site to the nearest sensitive environment (max. 10) (e.g., sensitive aquatic environment, nature preserve, habitat for endangered species, sensitive forest reserves, national parks or forests, etc.)			
	• 0 to <500 m	10		
	• 500 m to <2 km	6		
	• 2 to <5 km	2		
	• 5 to 10 km	0.5	6 ? ✓	
	b) Groundwater (max. 6) Distance to an important or susceptible groundwater resource (e.g. recharge area)			
	• 0 to <500 m	6		
	• 500 m to <2 km	4		
	• 2 to <5 km	2		
	• 5 to 10 km	1	6 ? ✓	12 Section 2 max 16
3	**Special Considerations**			
	Discretionary addition or subtraction to this sub category (Environmental Receptors) by up to 5 points based on the technical judgment of the user. (Special considerations score must not cause total score for this sub-category to exceed the maximum (16) or be lower than the minimum (0) allowable.)			
	DETAILED RATIONALE MUST BE DOCUMENTED	-5 to +5	0 ✓	0 Section 3 max 5

APPENDIX E

Real Property Information System for Contaminated Sites (RPISCS) Module Information

Contaminated Sites Summary

Monday, April 09, 2001

RPIS
CS Module

Region: Central/Arctic

Site Name Michipicoten Island East End (LL#1097)

Site Number C F 50534

Site Descriptor Lightstation

List of Lights Number 1097

Province Ontario

Land Descriptor Unit 67652

Sector Canadian Coast Guard

Status Active

Custodian F&OCG

Site Location 39.3 hectare parcel of land, situated at the northeast end of Michipicoten Island, 70 kilometres southwest of the town of Wawa.

Street Address NE end of Michipicoten, 70 km

City

Postal Code

Latitude 47-45-15

Longitude 85-35-45

Contaminated Site Name East Landfill, Generator Building and Lighthouse

CS Number 001

Status Under Assessment

Regional File Number

National File Number

Description Michipicoten Island Light Station L.L 1097, Lake Superior, Ontario

Location of Contamination Area northeast of generator building,area south of lighthouse, in vicinity of concrete dyked tank farm and areas south and northwest of east landfill

Latitude 47 15 15

Longitude 0 0 0

Action Plan Phase 3 ESA to further delineate the metal and hydrocarbon impacts, to assess/investigate for metal and/or hydrocarbon impacts in the area of the other buildings (or foundations) and former AST areas. Estimated Cost: $25,000 (included as the indicative liability estimate).

Additional Information Results which were below method detection limits were taken to be half the method detection limit. In the imported sample data spreadsheet (see Documents) the results which were taken to be half the MDL are highlighted green. The federal and other criteria for surface water was chosen to be the lower end of the ranges specified as pH. hardness and alkalinity were not measured for the two water samples. In the sample data spreadsheet, the cases in which this occurred are highlighted yellow. PWGSC revised EA6 (under A-Description), EE4, EE5, EE7, and EE8 (under E-NCSCS Rating), and EF1, and EF4 (under F-Expenditures)

Total Assessment Cost $4,357.00

Total Remediation Cost

Contaminated Sites Summary

Monday, April 09, 2001

RPIS
CS Module

Region: Central/Arctic

Site Name Michipicoten Island East End (LL#1097)

Site Number C F 50534

Site Descriptor Lightstation

List of Lights Number 1097

Province Ontario

Land Descriptor Unit 67652

Sector Canadian Coast Guard

Status Active

Custodian F&OCG

Site Location 39.3 hectare parcel of land, situated at the northeast end of Michipicoten Island, 70 kilometres southwest of the town of Wawa.

Street Address NE end of Michipicoten, 70 km

City

Postal Code

Latitude 47-45-15

Longitude 85-35-45

Contaminated Site Name West Landfill

CS Number 002

Status Under Assessment

Regional File Number

National File Number

Description Michipicoten Island Light Station L.L 1097, Lake Superior, Ontario

Location of Contamination Area southeast and west of the landfill

Latitude 47 15 15

Longitude 0 0 0

Action Plan Phase 3 ESA to fully assess (with soil sampling) the west landfill area. Includes 1 water and sediment quality assessment on site. Also includes assessment of the former AST areas, septic tank, and the double dwelling foundation, in terms of metal and hydrocarbon impacts, etc. Estimated Cost: $10,000.

Additional Information Results which were below method detection limits were taken to be half the method detection limit. Longitude: 85 35' 45". PWGSC revised EA6 (under A-Description), EE4, EE5, EE7, and EE8 (under E-NCSCS Rating), and EF1, EF2, EF3 and EF4 (under F-Expenditures). March 29, 2001.

Total Assessment Cost $4,357.00

Total Remediation Cost

Contaminated Site Issues

Monday, April 09, 2001

RPIS
CS Module

Region: Central/Arctic

Site Name Michipicoten Island East End (LL#1097)

Site Number C F 50534

Site Descriptor Lightstation

Province Ontario

Contaminated Site Name East Landfill, Generator Building and Lighthouse

CS Number 001

Status Under Assessment

Description Michipicoten Island Light Station L.L 1097, Lake Superior, Ontario

Contaminant Category Heavy Metals

Specify

Impacts

Soil	☑	**Status**	Actual	**Ground Water**	☑	**Status**	Potential
Sediment	☑	**Status**	Potential	**Surface Water**	☑	**Status**	Actual
Air	☑	**Status**	None				

Sources

Batteries	☐	**Ash Dump**	☐	**Hazardous Const. Materials**	☑
Landfill	☑	**Storage Tank(s)**	☐	**Waste Storage Area**	☐
Dumping/Waste	☑	**Fuel Cache**	☐	**Chemical Storage Area**	☐
Unknown	☑	**Other (Specify)**	☑	Lead Based Paints	

Contaminated Site Issues

Monday, April 09, 2001

RPIS
CS Module

Region: Central/Arctic

Site Name Michipicoten Island East End (LL#1097)

Site Number C F 50534

Site Descriptor Lightstation

Province Ontario

Contaminated Site Name East Landfill, Generator Building and Lighthouse

CS Number 001

Status Under Assessment

Description Michipicoten Island Light Station L.L 1097, Lake Superior, Ontario

Contaminant Category Petroleum Hydrocarbons and PAHs

Specify

Impacts

Soil ☑ **Status** Actual

Sediment ☑ **Status** Potential

Air ☑ **Status** None

Ground Water ☑ **Status** Potential

Surface Water ☑ **Status** Potential

Sources

Batteries ☐

Landfill ☐

Dumping/Waste ☐

Unknown ☑

Ash Dump ☐

Storage Tank(s) ☑

Fuel Cache ☐

Other (Specify) ☐

Hazardous Const. Materials ☐

Waste Storage Area ☐

Chemical Storage Area ☐

Contaminated Site Issues

Monday, April 09, 2001

RPIS
CS Module

Region: Central/Arctic

Site Name Michipicoten Island East End (LL#1097)

Site Number C F 50534

Site Descriptor Lightstation

Province Ontario

Contaminated Site Name West Landfill

CS Number 002

Status Under Assessment

Description Michipicoten Island Light Station L.L 1097, Lake Superior, Ontario

Contaminant Category Heavy Metals

Specify

Impacts

Soil ☑ **Status** Potential

Sediment ☑ **Status** Potential

Air ☑ **Status** None

Ground Water ☑ **Status** Potential

Surface Water ☑ **Status** Actual

Sources

Batteries ☐

Landfill ☑

Dumping/Waste ☑

Unknown ☐

Ash Dump ☐

Storage Tank(s) ☐

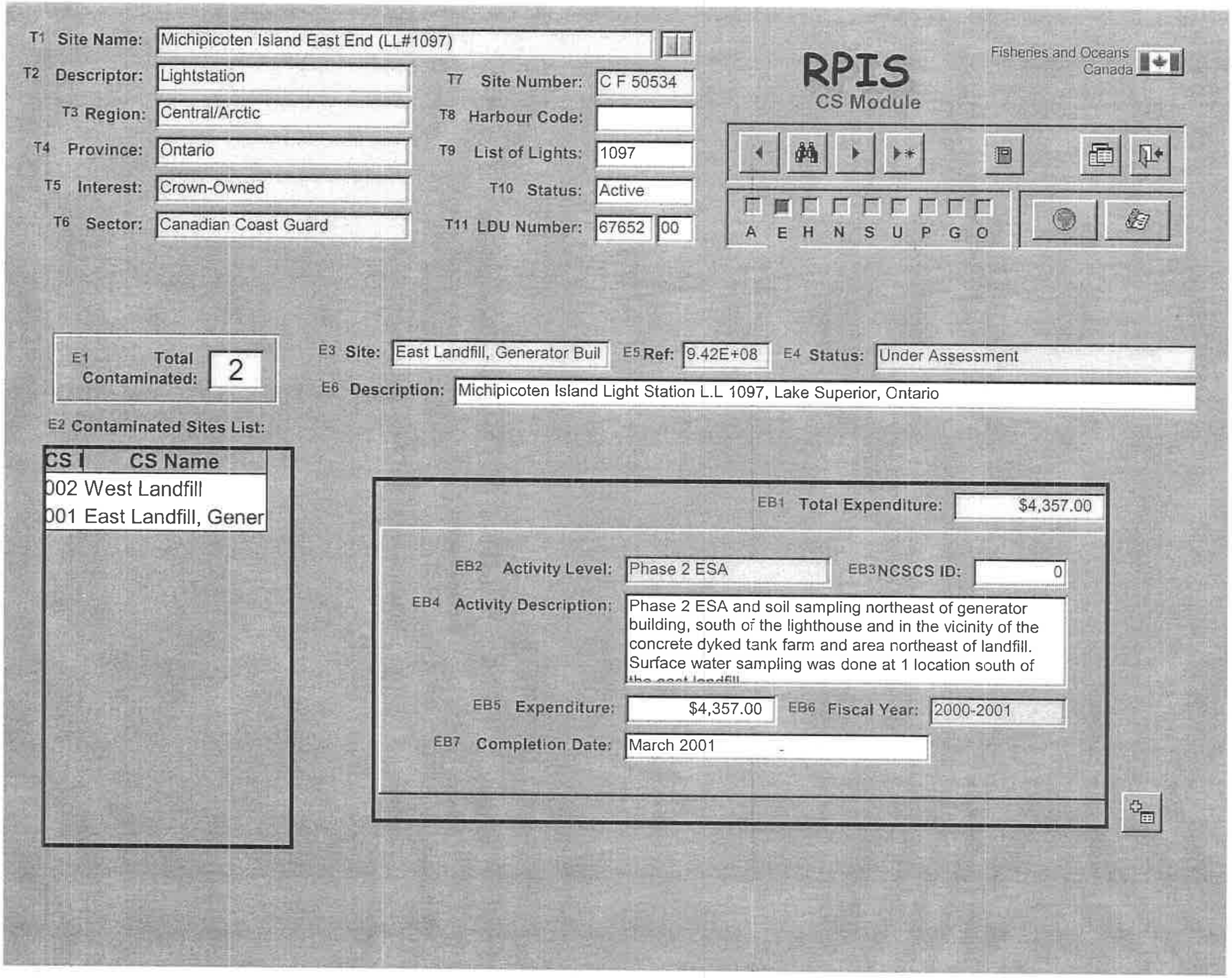
Fuel Cache ☐

Other (Specify) ☑ Lead based Paint

Hazardous Const. Materials ☐

Waste Storage Area ☐

Chemical Storage Area ☐



RPIS
CS Module

Fisheries and Oceans Canada

T1 **Site Name:** Michipicoten Island East End (LL#1097)

T2 **Descriptor:** Lightstation

T3 **Region:** Central/Arctic

T4 **Province:** Ontario

T5 **Interest:** Crown-Owned

T6 **Sector:** Canadian Coast Guard

T7 **Site Number:** C F 50534

T8 **Harbour Code:**

T9 **List of Lights:** 1097

T10 **Status:** Active

T11 **LDU Number:** 67652 00

☐ A ☒ E ☐ H ☐ N ☐ S ☐ U ☐ P ☐ G ☐ O

E1 **Total Contaminated:** 2

E3 **Site:** East Landfill, Generator Buil

E5 **Ref:** 9.42E+08

E4 **Status:** Under Assessment

E6 **Description:** Michipicoten Island Light Station L.L 1097, Lake Superior, Ontario

E2 **Contaminated Sites List:**

CS I	CS Name
002	West Landfill
001	East Landfill, Gener

EB1 **Total Expenditure:** $4,357.00

EB2 **Activity Level:** Phase 2 ESA

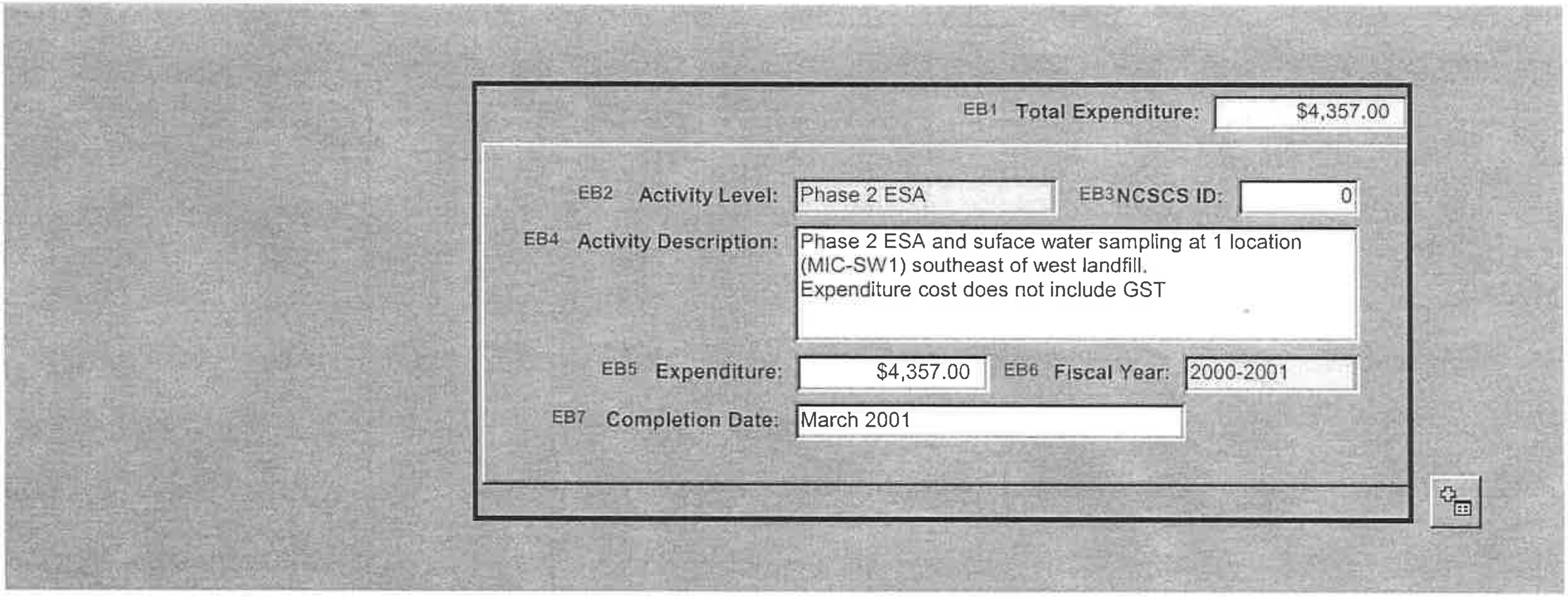
EB3 **NCSCS ID:** 0

EB4 **Activity Description:** Phase 2 ESA and soil sampling northeast of generator building, south of the lighthouse and in the vicinity of the concrete dyked tank farm and area northeast of landfill. Surface water sampling was done at 1 location south of the east landfill

EB5 **Expenditure:** $4,357.00

EB6 **Fiscal Year:** 2000-2001

EB7 **Completion Date:** March 2001



EB1 **Total Expenditure:** $4,357.00

EB2 **Activity Level:** Phase 2 ESA

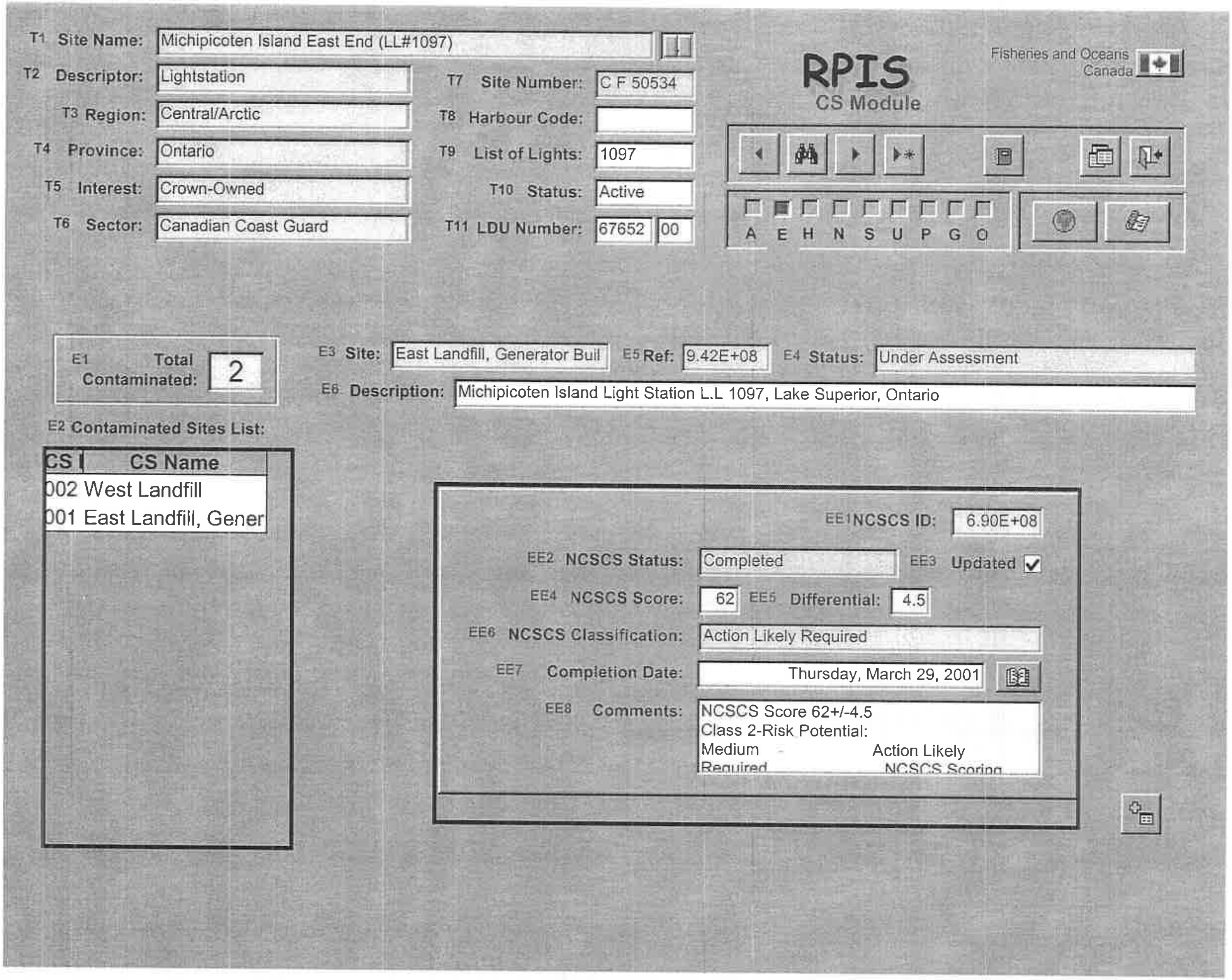
EB3 **NCSCS ID:** 0

EB4 **Activity Description:** Phase 2 ESA and suface water sampling at 1 location (MIC-SW1) southeast of west landfill.
Expenditure cost does not include GST

EB5 **Expenditure:** $4,357.00

EB6 **Fiscal Year:** 2000-2001

EB7 **Completion Date:** March 2001



T1 **Site Name:** Michipicoten Island East End (LL#1097)
T2 **Descriptor:** Lightstation
T3 **Region:** Central/Arctic
T4 **Province:** Ontario
T5 **Interest:** Crown-Owned
T6 **Sector:** Canadian Coast Guard
T7 **Site Number:** C F 50534
T8 **Harbour Code:**
T9 **List of Lights:** 1097
T10 **Status:** Active
T11 **LDU Number:** 67652 00

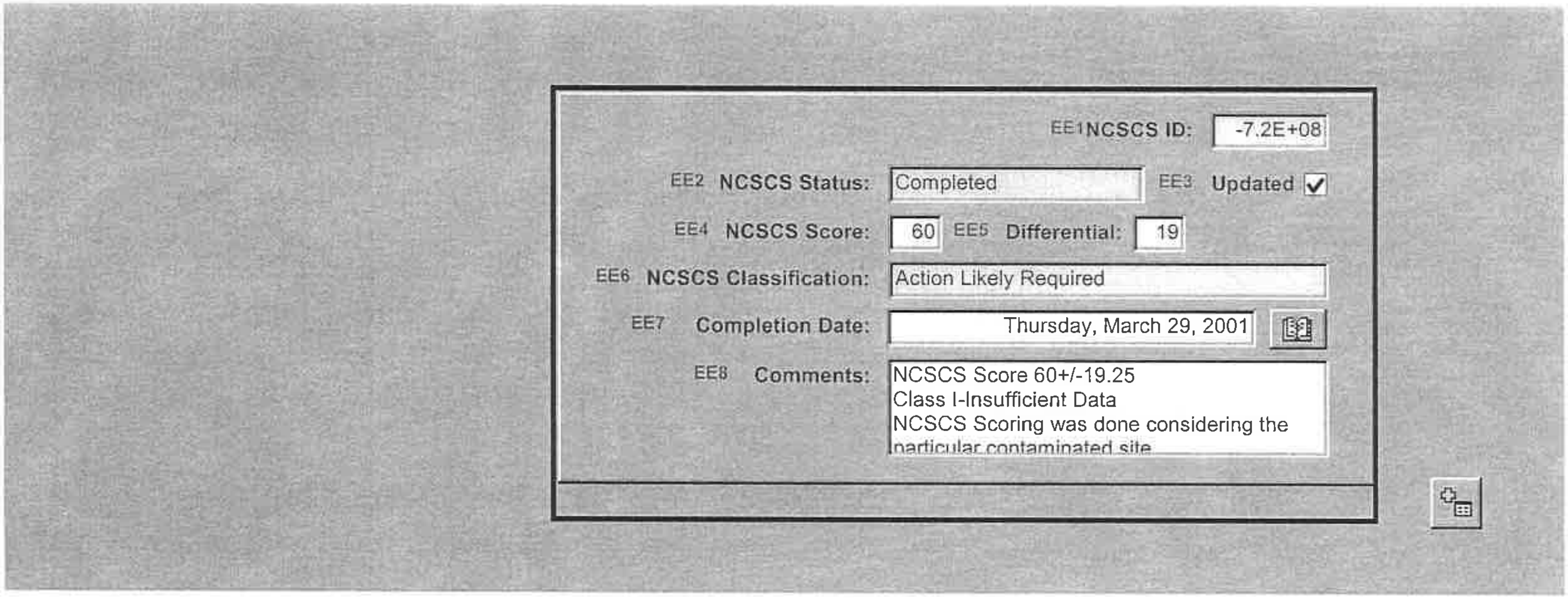
☐ A ☒ E ☐ H ☐ N ☐ S ☐ U ☐ P ☐ G ☐ O

E1 **Total Contaminated:** 2
E3 **Site:** East Landfill, Generator Buil
E5 **Ref:** 9.42E+08
E4 **Status:** Under Assessment
E6 **Description:** Michipicoten Island Light Station L.L 1097, Lake Superior, Ontario

E2 **Contaminated Sites List:**

CS	CS Name
002	West Landfill
001	East Landfill, Gener

EE1 **NCSCS ID:** 6.90E+08
EE2 **NCSCS Status:** Completed
EE3 **Updated** ☑
EE4 **NCSCS Score:** 62
EE5 **Differential:** 4.5
EE6 **NCSCS Classification:** Action Likely Required
EE7 **Completion Date:** Thursday, March 29, 2001
EE8 **Comments:** NCSCS Score 62+/-4.5
Class 2-Risk Potential:
Medium Action Likely
Required NCSCS Scoring



EE1 **NCSCS ID:** -7.2E+08

EE2 **NCSCS Status:** Completed

EE3 **Updated** ☑

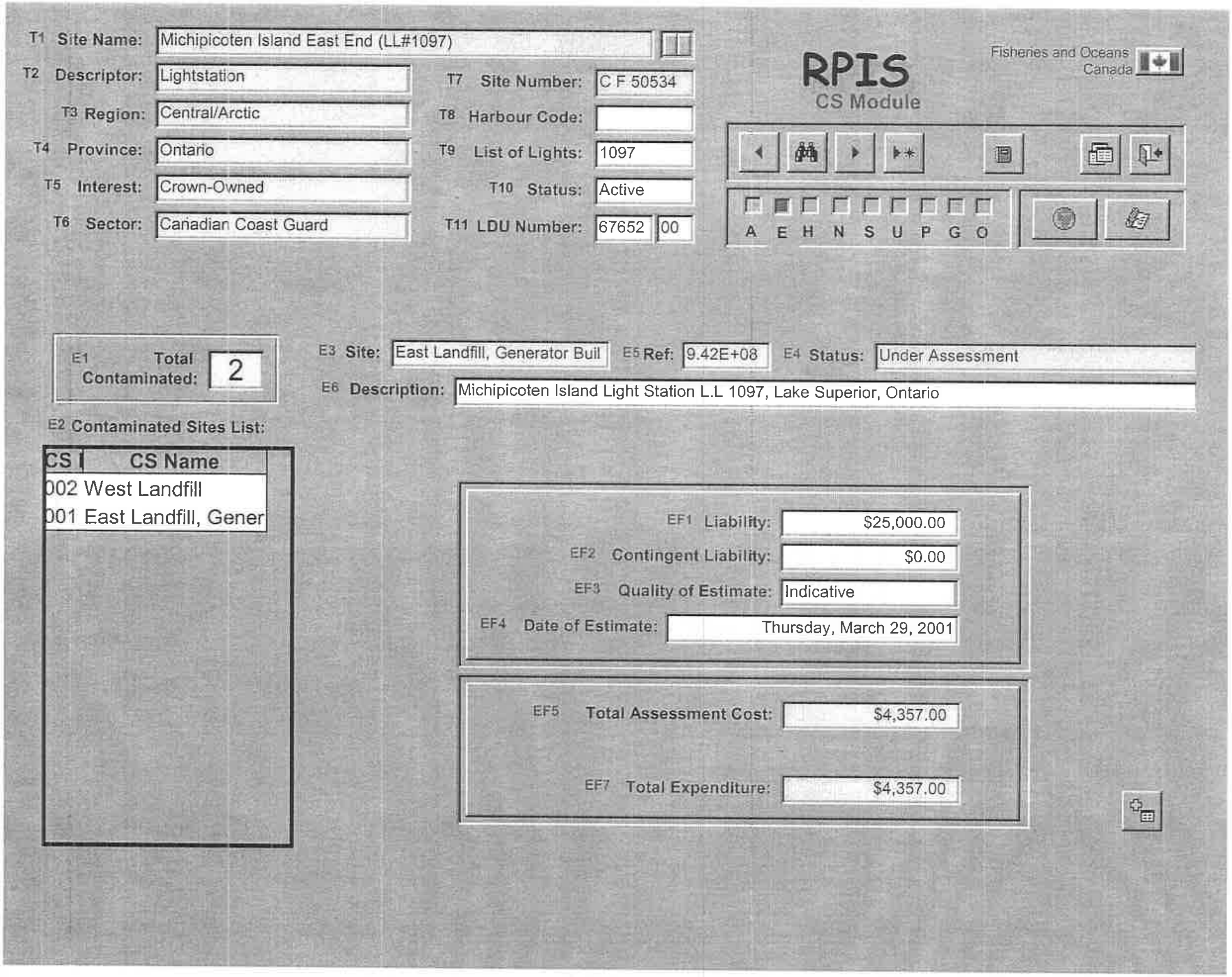
EE4 **NCSCS Score:** 60

EE5 **Differential:** 19

EE6 **NCSCS Classification:** Action Likely Required

EE7 **Completion Date:** Thursday, March 29, 2001

EE8 **Comments:**
NCSCS Score 60+/-19.25
Class I-Insufficient Data
NCSCS Scoring was done considering the
particular contaminated site



T1 **Site Name:** Michipicoten Island East End (LL#1097)

T2 **Descriptor:** Lightstation

T3 **Region:** Central/Arctic

T4 **Province:** Ontario

T5 **Interest:** Crown-Owned

T6 **Sector:** Canadian Coast Guard

T7 **Site Number:** C F 50534

T8 **Harbour Code:**

T9 **List of Lights:** 1097

T10 **Status:** Active

T11 **LDU Number:** 67652 00

☐ A ☒ E ☐ H ☐ N ☐ S ☐ U ☐ P ☐ G ☐ O

E1 **Total Contaminated:** 2

E3 **Site:** East Landfill, Generator Buil

E5 **Ref:** 9.42E+08

E4 **Status:** Under Assessment

E6 **Description:** Michipicoten Island Light Station L.L 1097, Lake Superior, Ontario

E2 **Contaminated Sites List:**

CS I	CS Name
002	West Landfill
001	East Landfill, Gener

EF1 **Liability:** $25,000.00

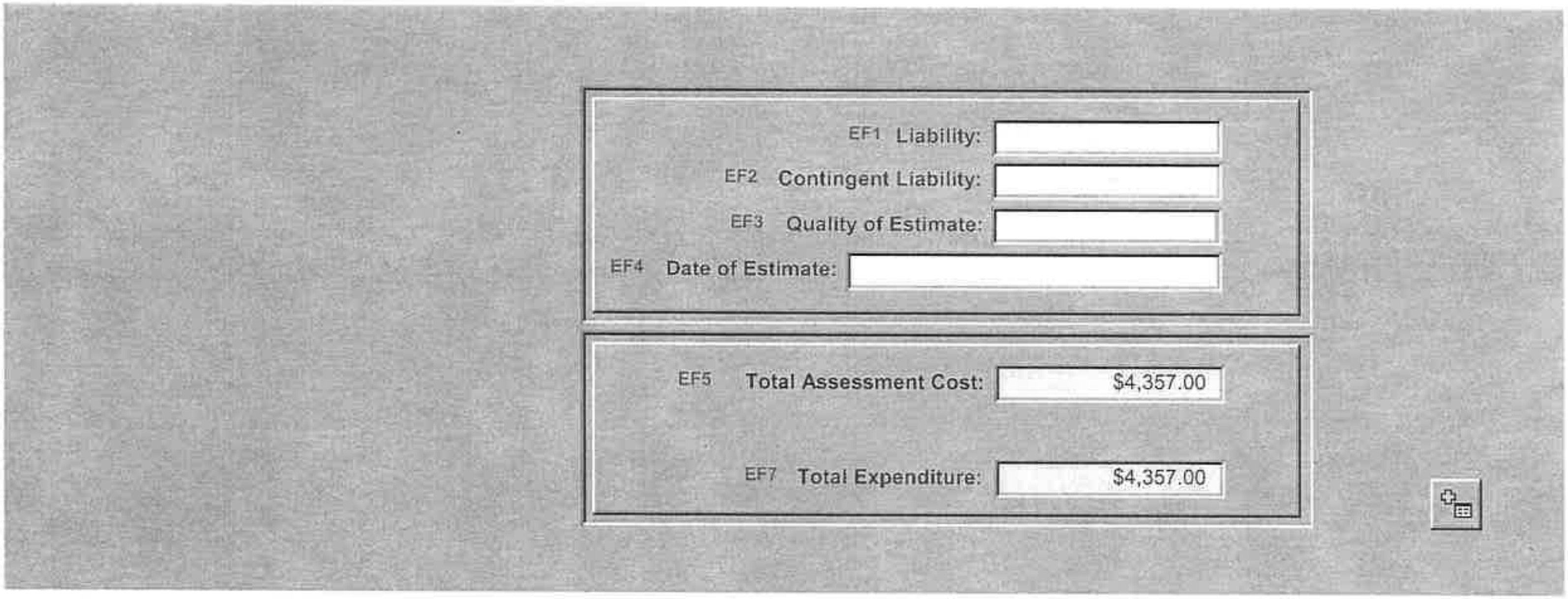
EF2 **Contingent Liability:** $0.00

EF3 **Quality of Estimate:** Indicative

EF4 **Date of Estimate:** Thursday, March 29, 2001

EF5 **Total Assessment Cost:** $4,357.00

EF7 **Total Expenditure:** $4,357.00



EF1 Liability:

EF2 Contingent Liability:

EF3 Quality of Estimate:

EF4 Date of Estimate:

EF5 Total Assessment Cost: $4,357.00

EF7 Total Expenditure: $4,357.00

APPENDIX F

Remedial Alternatives Cost Estimates

COST ESTIMATES FOR REMEDIAL OPTIONS
Michipicoten Island, East End Light Station, L.L. 1097

March 29, 2001

The remedial alternatives assessment considered the following five categories of remedial action:

A) No Action/ Monitoring (i.e. Natural Attenuation)
B) Isolation, Containment, and Control Technologies
C) Ex Situ Technologies
D) In Situ Technologies
E) Risk Management Alternatives

A brief description of each of these remedial options is provided in the following sections.

1. B and E) Isolation, Containment, and Control Technologies combined with Risk Management Alternatives: **Site Specific Risk Assessment/ Risk Management**
2. C) Ex-Situ Technology: **Excavation and disposal at a licensed off-site disposal facility;**

CS-1 (METALS AND HYDROCARBON IMPACTS)

There are approximately 326 to 652 tonnes of metals and hydrocarbon-impacted soil at CS-1.

B and E) Isolation, Containment and Control Technologies combined with Risk Management Alternatives: Site Specific Risk Assessment/Risk Management:

An SSRA could be completed in order to support a Level 2 risk management approach. In this case, most or all of the existing hydrocarbon contamination would remain on-site and engineering control measures (i.e. containment) may be implemented to manage the risks associated with the contamination.

SSRA Labour Costs and Disbursements	$35,000
Allowance for containment and control technologies	$40,000
Groundwater and sediment quality investigation	$20,000
TOTAL ESTIMATED COST (excluding GST)	**$95,000**

The nature of the containment or control technologies required (if any are required) will be determined following completion of the full SSRA. XCG has included an allowance of $40,000 as part of the cost estimate. Also, $20,000 has been included to account for groundwater and sediment quality investigation.

C) Ex Situ Technologies: Excavation and Off-Site Disposal

The ex situ technology considered most applicable for this site is excavation and off-site disposal. This option would involve the removal of contaminated soil from the site. The contaminated soil would be disposed of at an MOE approved facility registered to receive contaminated waste. Following excavation, clean fill would be imported to the site and placed in the excavated areas. Due to the remoteness of the site, a barge with a crane, and a smaller boat, would be required to transport the backhoe and the soil on and off site.

Approximately 163 to 326 cubic metres (approximately 326 to 652 tonnes) of soil contaminated with metals and TPH would be excavated to bedrock. Twelve verification samples would be taken in the vicinity of the excavations. The excavated soil would be disposed of at an appropriate landfill, and the excavations would be backfilled with clean soil.

Equipment and Personnel Costs for excavation and haulage, of contaminated soil $2,000/day @ 3 –5 days	$6,000 to $10,000
Landfill Disposal of Contaminated Soil @$50/tonne	$16,300 to $32,600
Barge with crane, and tugboat rental to transport backhoe and soil on and off-site ($7,200 /day @ 3 – 5 days)	$21,600 to $36,000
Soil verification testing $250/set x 12 samples	$3,000
Backfill and compaction @ $30/tonne	$9,780 to $19,560
Clean-up supervision	$3,000
Disbursements	$2,000
Clean-up management and reporting	$3,000
Groundwater and sediment quality investigation	$20,000
TOTAL ESTIMATED COST (excluding GST)	**$84,680 to $129,160**

CS-2 (METALS AND HYDROCARBON IMPACTS)

The estimated component of the NCSCS score for CS-2 is 19.25, thus indicating insufficient information to classify the site. Therefore, further sampling at CS-2 is required to delineate the metals contamination. Groundwater and sediment quality at CS-2 would have to be assessed, if CS-2 was found to be impacted by metals. Therefore, $10,000 has been included in this estimate to allow for potential groundwater and sediment quality investigation and analysis.

Further sampling to delineate metals contamination	$10,000
Groundwater and sediment quality analysis	$10,000
TOTAL ESTIMATED COST (excluding GST)	**$20,000**

SUMMARY OF REMEDIAL OPTIONS

Cost of Remedial Options for CS-1 (Hydrocarbon and Metals Impacts)	
Isolation, Containment and Control Technologies, and Risk Management	**$95,000**
Excavation and Off-Site Disposal	**$84,680 to $129,160**
Cost of Remedial Options for CS-2 (Metals Impacts)	
Further Sampling, Groundwater and Sediment Quality Analysis	**$20,000**

INFORMATION SOURCES:

1. Pricing for transportation, and disposal was based on a quotation from Superior Petroleum Maintenance Ltd., Ontario.
2. Pricing for rental of barge and tugboat was based on a cost estimate from Purvis Marine, Sault Ste. Marie, Ontario.

APPENDIX G

Soil Sample Log Information

Sample ID	Location	TOV Reading (ppm)	Depth of Soil Sample (m)	Significant Observations	Test Soil Parameters	Exceedances **
MIC-HFS-1	North of generator building	ND	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• TPH (gas/diesel) – 190 ug/g • TPH (heavy oils) – 1,600 ug/g • cadmium – 2.3 ug/g • lead – 256 ug/g • mercury – 0.44 ug/g • zinc – 762 ug/g
MIC-HFS-2	North of generator building	ND	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• TPH (gas/diesel) – 110 ug/g • TPH (heavy oils) – 1,200 ug/g • antimony – 2.4 ug/g • barium – 351 ug/g • cadmium – 10.9 ug/g • chromium – 101 ug/g • lead – 671 ug/g • mercury – 0.64 ug/g • nickel – 245 ug/g • selenium – 3.9 ug/g • zinc – 315 ug/g • anthracene – 0.21 ug/g
MIC-HFS-3	Northeast of generator building	0.4	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• TPH (gas/diesel) – 770 ug/g • TPH (heavy oils) – 110 ug/g • antimony – 1.2 ug/g • barium – 391 ug/g • cadmium – 2.8 ug/g • lead – 1,593 ug/g • mercury – 1.58 ug/g • zinc – 641 ug/g

Sample ID	Location	TOV Reading (ppm)	Depth of Soil Sample (m)	Significant Observations	Test Soil Parameters	Exceedances **
MIC-HFS-4	East of generator building	0.2	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• TPH (gas/diesel) – 150 ug/g • TPH (heavy oils) – 1,100 ug/g • antimony – 1.7 ug/g • barium – 478 ug/g • cadmium – 2.4 ug/g • chromium – 74.3 ug/g • lead – 846 ug/g • mercury – 1.13 ug/g • zinc – 1,202 ug/g • acenaphthylene – 0.41 ug/g • anthracene – 0.35 ug/g • fluoranthene – 2.1 ug/g • pyrene – 2.0 ug/g • benzo (a) anthracene – 1.6 ug/g • benzo (b) fluoranthene – 1.5 ug/g • benzo (a) pyrene – 1.1 ug/g • indeno (1,2,3-cd) pyrene – 0.7 ug/g • dibenzo (a,h) anthracene – 0.17 ug/g
MIC-HFS-5	East of generator building	ND	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• TPH (gas/diesel) – 1,300 ug/g • TPH (heavy oils) – 1,700 ug/g • antimony – 7.8 ug/g • barium – 1,054 ug/g • cadmium – 12.2 ug/g • copper – 168 ug/g • lead – 1,386 ug/g • mercury – 3.09 ug/g • zinc – 666 ug/g
MIC-HFS-6	Northeast of generator building	ND	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• TPH (gas/diesel) – 30 ug/g • antimony – 1.1 ug/g • chromium – 114 ug/g • copper – 213 ug/g • lead – 406 ug/g • nickel – 52.7 ug/g • zinc – 319 ug/g

Sample ID	Location	TOV Reading (ppm)	Depth of Soil Sample (m)	Significant Observations	Test Soil Parameters	Exceedances **
MIC-AST-1	West of fog alarm building	ND	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• arsenic – 14.7 ug/g • lead – 329 ug/g • zinc – 334 ug/g
MIC-AST-2	West of fog alarm building	0.2	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• TPH (gas/diesel) – 6,200 ug/g • TPH (heavy oils) – 790 ug/g • antimony – 19 ug/g • barium – 401 ug/g • lead – 1,644 ug/g • mercury – 3.51 ug/g • zinc – 687 ug/g
MIC-AST-3	West of fog alarm building	0.3	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• acenaphthylene – 0.13 ug/g • antimony – 6.4 ug/g • zinc – 104 ug/g
MIC-AST-4	West of tank farm	0.2	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• TPH (heavy oils) – 110 ug/g • antimony – 7.7 ug/g • lead – 213 ug/g • zinc – 170 ug/g • benzo (a) pyrene – 0.76 ug/g • indeno (1,2,3-cd) pyrene – 0.95 ug/g • dibenzo (a,h) anthracene – 1.5 ug/g
MIC-AST-5	West of tank farm	0.3	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• TPH (gas/diesel) – 120 ug/g • antimony – 2.1 ug/g • barium – 512 ug/g • lead – 1,863 ug/g • mercury – 1.42 ug/g • zinc – 1,112 ug/g
MIC-AST-6	West of tank farm	0.3	0.3	Brown fill, sand and gravel. No odours or staining noted.	TPH (gas/diesel, heavy oil), PAH, Metals	• antimony – 1.3 ug/g • barium – 573 ug/g • copper – 121 ug/g • lead – 1,702 ug/g • mercury – 0.29 ug/g • zinc – 1,530 ug/g

Sample ID	Location	TOV Reading (ppm)	Depth of Soil Sample (m)	Significant Observations	Test Soil Parameters	Exceedances **
MIC-AST-AW6	Duplicate of MIC-AST-6	0.3	0.3	Brown fill, sand and gravel. No odours or staining noted.	Metals	• antimony – 1.8 ug/g • arsenic – 14.4 ug/g • barium – 475 ug/g • copper – 199 ug/g • lead – 2,059 ug/g • mercury – 0.55 ug/g • zinc – 1,604 ug/g
MIC-LF-1	Northwest of light keeper's dwelling	0.2	0.3	Black fill, sand and gravel. No odours or staining noted.	Metals, Anions	• antimony – 3.4 ug/g • barium – 1,090 ug/g • copper – 85.8 ug/g • lead – 123,422 ug/g • mercury – 0.24 ug/g • selenium – 2.3 ug/g • zinc – 1,126 ug/g
MIC-LF-2	Northwest of east landfill site	0.2	0.3	Black fill, sand and gravel. No odours or staining noted.	Metals, Anions	• antimony – 151 ug/g • barium – 728 ug/g • cadmium – 37 ug/g • chromium – 266 ug/g • cobalt – 33.7 ug/g • copper – 378 ug/g • lead – 7,215 ug/g • mercury – 2.46 ug/g • nickel – 84.1 ug/g • zinc – 8,142 ug/g
MIC-LF-3	North of west landfill site	0.4	0.3	Black fill, sand and gravel. No odours or staining noted.	Metals, Anions	• antimony – 2.5 ug/g • barium – 303 ug/g • cadmium – 11.9 ug/g • copper – 138 ug/g • lead – 541 ug/g • mercury – 0.66 ug/g • nickel – 59.6 ug/g • zinc – 1,500 ug/g
MIC-LF-4	West of west landfill site	0.4	0.3	Black fill, sand and gravel. No odours or staining noted.	Metals, Anions	• antimony – 1.2 ug/g • lead – 575 ug/g • mercury – 0.24 ug/g • zinc – 356 ug/g
MIC-SW1	East of west landfill site	N/A	surface water – not filtered	Clear, no oily sheen noted.	Metals, Anions	• aluminium – 701 ug/L • arsenic – 14 ug/L • chromium – 46 ug/L • cobalt – 33 ug/L • iron – 978 ug/L • vanadium – 17 ug/L.

Sample ID	Location	TOV Reading (ppm)	Depth of Soil Sample (m)	Significant Observations	Test Soil Parameters	Exceedances **
MIC-LF-SF1	Southwest of light keeper's dwelling	N/A	surface water – not filtered	Clear, no oily sheen noted.	Metals, Anions	• aluminium – 110 ug/L • arsenic – 12 ug/L • chromium – 34 ug/L • cobalt – 28 ug/L • copper – 1.4 ug/L • vanadium – 16 ug/L

NOTES:

TPH	total petroleum hydrocarbons
PAH	polycyclic aromatic hydrocarbons

Metals analysis includes hydrides: (As, Se, and Hg)

* Sample locations are presented on the site plan in Appendix A.
Analytical results are presented in Tables 1,2, and 3.
Laboratory reports are provided in Appendix C.

** Criteria for residential/parkland use specified by CCME *Environmental Quality Guidelines* (1999), for all other land use as specified by MOE *Guidelines for Use at Contaminated Sites in Ontario* (September 1998) – Table F, and for residential/parkland land use as specified by MOE *Guidelines for Use at Contaminated Sites in Ontario* (September 1998) – Table A.

Jacques
Whitford

REPORT

CCME Phase III Environmental Site Assessment

Department Of Fisheries And Oceans
And Public Works And Government
Services Canada

Canadian Coast Guard Light Station
L.L. 1097 Michipicoten Island, East End
Lake Superior, Ontario
DFRP #67652

PROJECT NO. 1004315.

PROJECT NO. 1004315

REPORT TO

Department of Fisheries and Oceans,
Central and Arctic Region
c/o
Public Works and Government Services
Canada, Ontario Region

FOR

CCME Phase III Environmental Site Assessment

ON

Canadian Coast Guard Light Station
L.L. 1097
Michipicoten Island, East End
Lake Superior, Ontario
DFRP #67652

April 6, 2006

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EXECUTIVE SUMMARY

Jacques Whitford Limited (Jacques Whitford) was retained by Public Works and Government Services Canada (PWGSC) on behalf of the Department of Fisheries and Oceans (DFO) Central and Arctic Region to conduct a Canadian Council of Ministers of the Environment (CCME) Phase III Environmental Site Assessment (CCME Phase III ESA) at the Michipicoten Island, East End, Light Station in Lake Superior, Ontario. The purpose of the CCME Phase III ESA is to delineate the horizontal and vertical extent of contamination as well as to provide applicable remedial recommendations. As a result, a subsurface investigation was conducted at the site, inclusive of two areas:

- CS-1 - Main Site Area (Investigated parameters of concern include BTEX, PHC Fractions (F1-F4), selected inorganic (metal) parameters, polycyclic aromatic hydrocarbons (PAH), and polychlorinated biphenyls (PCBs))
- CS-2 - Waste Dump Area (Investigated parameters of concern include BTEX, PHC Fractions (F1-F4), selected metal parameters, and PAHs)

The Michipicoten Island, East End Light Station consists of 39.3 hectares on the northeastern end of Michipicoten Island. The Light Station is located on the northeastern end of Michipicoten Island, at the eastern edge of Michipicoten Island Provincial Park and is approximately 70 km southeast of Wawa across Lake Superior in Ontario.

On August 31, 2005, Jacques Whitford Limited (Jacques Whitford) completed a CCME Phase III ESA at the Canadian Coast Guard Light Station L.L. 1097 Michipicoten Island, East End, in Lake Superior, Ontario, herein referred to as the Site. The site location and regional topography of the site is presented on **Drawing No.1** in **Appendix 1.**

The investigation included the collection of soil samples from various locations at both sites (CS1 and CS2). No surface water samples were able to be collected in the vicinity of the Site as no ponded water was present and no other surface water was accessible for sampling. Identified soil impacts in excess of the CCME guidelines are presented in the following table:

Summary Table of Findings

Contaminated Site	Source Description	Contaminants of Concern	Supporting Documentation	NCS Class
CS-1 Main Site Area CS#67652-001 GPS Coordinates: N 5289600 E 605100	Five existing aboveground storage tanks (ASTs) containing diesel and propane. Approximately twelve former ASTs containing diesel and/or fuel oil.	Arsenic, barium, copper, lead, selenium, zinc PHC fraction F_3 Benzo(a)pyrene, benzo (b) fluoranthene, benzo (a)anthracene	Lab samples CS1-1 to CS1-10	1
CS-2 Waste Dump Site Area CS#67652-002 GPS Coordinates: N 5289600 E 605100	Two former 900 L ASTs, various waste material	Arsenic, copper, selenium, zinc PHC fractions F_3 and F_4	Lab samples CS2-2 and CS2-4 to CS2-6	1

Delineation of Soil Impacts

Based on the analytical results from the previous and current ESAs, the volume of PHC impacted soil in CS1 is approximately 70 cubic metres and the volume of PHC impacted soil at CS2 is approximately 15 cubic metres.

Based on the analytical results from the previous and current ESAs, the volume of PAH impacted soil in CS1 is approximately 30 cubic metres. No PAH exceedances were identified in the previous and current soil samples recovered from CS2.

As discussed in Section 4.0, metal impacted soils were laterally delineated by XCG in 2001. Metal exceedances were identified in all soil sampling locations during the current investigation but as no vertical "clean line" could be established within the overburden, a metal impacted soil volume could not be accurately calculated. However, using the depth of bedrock at the Site as the maximum depth of soil contamination, along with the lateral extent of soil contamination determined from the XCG 2001 data and the current Jacques Whitford data, a volume of metal impacted soil was estimated at 305 cubic metres for both sites.

The estimated volume of PHC, metal and PAH impacted soils at the property, areas CS1 and CS2 inclusive, is approximately 420 cubic metres (850 metric tones).

Recommended Remedial Program and Estimated Costs:

Jacques Whitford, recommends the use of a SLRA to determine if a human or ecological risk exists associated with the presence of one or more concentrations of BTEX, PHC fraction F_1 to F_4, PAHs and selected metal parameters at both contaminated sites. Based on PWGSC's commitment to reduce the probability of an adverse effect, a SLRA should be completed in order to evaluate if a potential risk of human and ecological health exists at Michipicoten Island, East End. Further, this approach would give PWGSC and DFO a better assessment of the level of risk that would exist if the impacted soils were to remain on-site.

The combined financial liability associated with the contaminated sites considered as a whole is approximately $20,000.

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CCME PHASE III ENVIRONMENTAL SITE ASSESSMENT

1.0 INTRODUCTION

Jacques Whitford Limited (Jacques Whitford) was retained by Public Works and Government Services Canada (PWGSC) on behalf of the Department of Fisheries and Oceans (DFO) Central and Arctic Region to conduct a Canadian Council of Ministers of the Environment (CCME) Phase III Environmental Site Assessment (CCME Phase III ESA) at the Michipicoten Island, East End, Light Station in Lake Superior, Ontario (the "Site"), DFRP #67652.

1.1 Objectives

The purpose of the CCME Phase III ESA is to delineate the horizontal and vertical extent of contamination as well as to provide applicable remedial recommendations. The subsurface investigation conducted at the Site included the following two areas:

- CS1 - Main Site Area (investigated parameters include benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbon (PHC) fractions (F1-F4), selected inorganic (metal) parameters, polycyclic aromatic hydrocarbons (PAH), and polychlorinated biphenyls (PCBs)); and
- CS2 - Waste Dump Area (investigated parameters include BTEX, PHC Fractions (F1-F4), selected metal parameters, and PAHs).

1.2 Scope of Work

The scope of work for the CCME Phase III ESA was based on the Term of Reference (TOR), dated August 2005 and subsequent discussions with PWGSC c/o DFO.

Generally, the recommended process for conducting a CCME Phase III ESA consists of a sampling program at a known contaminated site where horizontal and vertical delineation is required to prepare a remedial action plan/risk management plan (RAP/RMP) with a liability cost estimate for implementation. The objectives of this ESA included the completion of the following five (5) activities:

1. Complete a detailed intrusive investigation to identify the source and nature of contamination on the property and delineate the horizontal and vertical extent of contamination in all impact media;
2. Ensure sufficient and updated data is gathered during the intrusive investigation to delineate the contamination and to enable completion of a Screening Level Risk Assessment (SLRA) for all contaminated sites present;
3. Provide a concise summary of all contaminated sites on the property based on the results of the intrusive investigation and update the National Classification System (NCS) for Contaminated Sites NCS ranking using the FCSAP worksheets detailed evaluation form;

4. Develop a Remedial Action Plan (RAP) for the remediation and/or risk management of known contamination sites on the property;

5. Meet the requirements of treasury board (TB) reporting by developing an indicative estimate of financial liability or contingent liability for all contaminated sites on the property.

Objectives 1 to 5 have been addressed under this cover. A SLRA has been conducted for this site in conjunction with the PHIII ESA under a separate report, entitled *Screening Level Risk Assessment, Canadian Coast Guard Light Station L.L 1097 Michipicoten Island, East End, Lake Superior, Ontario,* prepared by Jacques Whitford, dated February 2006.

2.0 SITE DESCRIPTION

The Site consists of a 39.3 hectare property located on the eastern edge of Michipicoten Island Provincial Park, approximately 70 km southeast of Wawa across Lake Superior in Ontario. This site does not include a water lot. The site location and regional topography of the site is presented on **Drawing No.1** in **Appendix 1.**

The scope of work for the subsurface investigation was established using the information provided from the previous environmental reports conducted at the Site, as follows:

- *Phase 2 Environmental Site Assessment, Canadian Coast Guard Light Station L.L 1097 Michipicoten Island, East End, Lake Superior, Ontario,* dated March 29, 2001, prepared by XCG Consultant Ltd.; and
- *Fuel Storage Tank Audit, Michipicoten Island, East End, Navigation AID L.L. 1997,* dated May 28, 2001 prepared by XCG Consultants Ltd.

Upon review of the previous reports, one or more concentrations of select inorganic (metal) parameters, benzene, toluene, ethylbenzene, xylenes (BTEX), petroleum hydrocarbons (PHC) (TPH gas/diesel and heavy oils under the former MOE Guideline applicable at the time of the XCG 2001 investigation) and polycyclic aromatic hydrocarbons (PAHs) exceeded the applicable CCME guidelines in the two subject areas; CS1 and CS2.

Based on the analytical results from the XCG Phase 2 ESA Report, the quantity of soil impacted by metals and hydrocarbons in CS1 was approximately 245 cubic metres. The quantity of soil impacted by metals at CS2 was not estimated, as there was insufficient information with which to classify the site.

Recommendations made by XCG in 2001 include:

- A Site Specific Risk Assessment (SSRA) / risk management plan was recommended at Site CS-1 to address the identified metals and hydrocarbon contamination. The estimated cost to complete the SSRA was $95,000, including a groundwater and sediment quality investigation.
- A soil, groundwater and sediment quality investigation was recommended at Site CS-2 to further delineate the metals contamination at the Site.

3.0 SELECTION OF APPROPRIATE ENVIRONMENTAL QUALITY GUIDELINES & STANDARDS

It is understood that the subject site is federally owned and operated by the Department of Fisheries and Oceans Central and Arctic Region. As a result, the federal guideline criteria for soil are the applicable guidelines for the subject site. All of the analytical data have been compared to the CCME *"Canadian Environmental Quality Guidelines"*, December 2004 and its subsidiary guideline document entitled *"Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil"*, May 2001. In addition, the analytical data has also been compared to the Province of Ontario's *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act,* March 9, 2004 of the Ontario Regulation 153/04 (Table 1) for Full Depth Background Site Conditions Standards. There are currently no PHC values for comparison to the Table 1 Standards, as such the Table 2 standards for PHC (F_1 to F_4) values have been chosen for comparison. It should be noted that the Province of Ontario's Table 1 and Table 2 Standards are shown for comparison purposes only and the identification of contaminated sites is based on the federal CCME Guidelines.

Based upon the current land-uses and the on-site soil texture (the Site is considered to have coarse textured soils), the following Federal and Provincial guidelines have been used for comparison purposes.

Federal Guidelines

- "Canadian Environmental Quality Guidelines", December 2004, Chapter 7, Soil for a residential/parkland land use, coarse textured surface soils with a 10^{-5} incremental risk based on a human health risk factor; and
- "Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil", May 2001, Tier 1 Level for a residential/parkland site with coarse textured soils.

Provincial Guidelines

- Province of Ontario's *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*, March 9, 2004 of the Ontario Regulation 153/04 (Table 1) for Full Depth Background Site Conditions Standards; and
- Province of Ontario's *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*, March 9, 2004 of the Ontario Regulation 153/04 Table 2 Standards in a potable groundwater condition with coarse textured soils.

4.0 SUBSURFACE INVESTIGATION

4.1 Methodology

The CCME Phase III ESA included a series of hand auger boreholes to investigate the conditions of the subsurface soils at the site. Hand auger equipment was used due to the remote location of the Site and the shallow bedrock conditions present. The subsurface investigation was conducted in accordance with the Ontario Ministry of the Environment (MOE) document entitled "*Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario*", February 1997, as well as the CCME "*Guidance Manual on Sampling Analysis and Data Management for Contaminated Sites – Volume I: Main Report*", 1993.

Due to the depth of the subsurface investigation at the selected sampling locations, clearing of underground utilities for the areas of investigation was not required.

For the purposes of this report two subject areas were designated as areas of investigation; (1) Main Site Area (CS1) and (2) Waste Dump Area (CS2).

CS1- Main Site Area

Ten (10) hand-auger locations (CS1-1 to CS1-10) were advanced on August 31, 2005, near the former Fuel Storage shed, the Generator building, the Light House, and the former 9000 L Diesel AST, all within the Main Site Area boundaries, (as indicated on **Drawing No. 2** in **Appendix 1**) to confirm and delineate the actual subsurface impacts identified in the XCG 2001 Report. Hand auger locations were advanced to a maximum depth of approximately 0.3 m below grade. The borehole logs are included in **Appendix 4**. Soil samples considered to be representative of subsurface conditions, based on volume of soil recovered, visual and/or olfactory observations, were selected for chemical analyses for concentrations of PHC (F_1-F_4), BTEX, PAHs, PCBs and selected metal parameters.

CS2- Waste Dump Area

Four (4) hand-auger locations (CS2-2, CS2-4 to CS2-6) were advanced on August 31, 2005, at predetermined locations within the Waste Dump Area boundaries, (as indicated on **Drawing No. 2** in **Appendix 1**) to confirm and delineate the actual subsurface impacts identified in the XCG 2001 Report. Hand auger locations were advanced to a maximum depth of approximately 0.3 m below grade. Due to shallow bedrock conditions and bedrock outcrops in several areas, five (5) hand-auger locations had been proposed but only four (4) samples were able to be recovered. The borehole logs are included in **Appendix 4**. Representative soil samples were selected for chemical analyses for concentrations of PHC (F_1-F_4), BTEX, PAHs, and selected metal parameters.

As per our CCME Phase III ESA and SLRA proposal dated August 11, 2005, groundwater sampling was not practical due to the shallow overburden at the Site and as a result, a surface water and sediment sampling program was recommended. However, at the time of the investigation, no ponded water was present and no other surface water was accessible for sampling in the vicinity of the Site. Therefore no surface water or sediment samples were able to be collected.

4.2 Collection and Handling of Soil Samples

On August 31, 2005 a total of eighteen (18) soil samples including four (4) field duplicate samples were recovered from the two subject areas. The sampling locations were advanced to a maximum depth of approximately 0.3 metre (m) below grade using a hand auger sampling device.

Soil samples were recovered from the overburden overlying a competent bedrock layer. Subsurface conditions encountered during the hand auger sampling were logged at the time of the investigation in order to identify the Site soil stratigraphy and moisture content, as well as any visual and olfactory evidence of impact.

Headspace vapour readings were measured and recorded for each soil sample from CS-1 using a Gastechtor^{TM} 1238ME portable hydrocarbon surveyor calibrated to hexane, and operated in methane elimination mode. Subsurface vapours were not able to be measured at CS-2 due to low sample recovery. As indicated above, representative soil samples were selected for chemical analyses on the basis based on volume of soil recovered, visual and/or olfactory observations and the locations relative to potential sources of impact. Soil vapour readings were recorded at the time of hand augering and are presented on the borehole logs in **Appendix 4**.

Soil samples selected for chemical analyses were delivered to the laboratory by courier within a cooler packed with ice, while soil samples not selected for analyses were temporarily archived at Jacques Whitford's Markham office.

4.3 Analytical Laboratory Program

The analytical laboratory program included the testing for different combinations of selected chemical parameters based on our understanding of the historical site operations, previous investigations and field observations. Soil samples were recovered from the Site and submitted for laboratory analysis of one or more of the following parameters: BTEX, PAHs, selected metal parameters, PCBs and PHC. The PHC analysis was further segregated into different petroleum hydrocarbon fractions (F_1, to F_4) as outlined in CCME, "Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil" May 2001.

In addition to comparison of data to the CCME December 2004 guidelines, the analytical data has been compared to the Province of Ontario's *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the environmental Protection Act,* March 9, 2004 of the Ontario Regulation 153/04 (Table 1) for Full Depth Background Site Conditions Standards. However, there are no PHC values for comparison to the Province of Ontario's Table 1 Standards and as such, the Province of Ontario's Table 2 standards for PHC (F_1 to F_4) values have been chosen as default values for comparison. As indicated in **Table I** in **Appendix 2**, the PHC (F_1 to F_4) values are identical.

Soil Analyses

A total of eighteen (18) soil samples, were collected from fourteen (14) sampling locations at the two subject areas and chemically analyzed for concentrations of the following parameters:

CS1- Main Site Area

- Thirteen (13) soil samples, including three (3) field duplicates (CS1-2dup, CS1-4dup and CS1-9dup), for quality assurance/quality control (QA/QC) purposes from test locations CS1-2, CS1-4 and CS1-9 were recovered and analysed for concentrations of BTEX and PHC fractions (F1-F4);
- Twelve (12) soil samples, including two (2) field duplicates (CS1-5dup, CS1-6dup and CS1-9dup) for QA/QC purposes from test locations CS1-5, CS1-6 and CS1-9 were recovered and analysed for concentrations of inorganic (metal) parameters and PAHs, and;
- Three (3) soil samples, including one (1) field duplicate (CS1-4dup) for QA/QC purposes from test location (CS1-4) was recovered and analysed for concentrations of PCBs.

CS2- Waste Dump Area

- Five (5) soil samples, including three (1) field duplicate (CS2-6dup) for QA/QC purposes from test location CS2-6 were recovered and analysed for concentrations of BTEX and PHC fractions (F1-F4); and,
- Six (6) soil samples, including two (2) field duplicates (CS2-5dup and CS2-6dup) for QA/QC purposes were recovered and analysed for concentrations of inorganic (metal) parameters and PAHs.

5.0 RESULTS OF THE INVESTIGATION

5.1 Regional Geology

Based on available maps, the surficial geology at the sites consists of undifferentiated igneous and metamorphic rock, exposed at surface or covered by a discontinuous, thin layer of drift. The native soils encountered during the current subsurface investigation identified sand, gravelly sand and gravel; nearshore and beach deposits. The characteristic permeability of the gravelly sand is high. The bedrock encountered exhibited a high level competency with little to no fractures.

5.2 Topography and Regional Drainage

The Sites are relatively flat depending on the location. Based on *Ministry of Northern Development of Mines,* Map 2555, Quaternary Geology of Ontario, East-Central Sheet and the observed site topography, regional surface drainage (anticipated groundwater flow direction) appears to be generally east towards Lake Superior.

5.3 Surface Water Drainage

The Site generally consists of overgrown vegetation or gravelly sand covered areas and competent bedrock exposed at surface. Storm water collected on the overgrown vegetative areas, sand/gravel and competent bedrock is anticipated to drain by infiltration and/or overland flow.

5.4 Site Stratigraphy

The stratigraphic information recorded during the investigation is presented on the borehole logs presented in **Appendix 4**.

The ground surface cover at the various borehole locations generally consisted of gravelly sand, bedrock and/or grass surface cover.

As indicated on the borehole records, the soil stratigraphy in the areas investigated generally consisted of organics i.e. (rootlets) gravelly sand overburden underlain by competent bedrock. The depth of the overburden encountered within the hand auger locations ranged from 0.1 metres (m) to 0.3 m below grade.

5.5 Soil Vapour Concentrations

There are no regulatory criteria for soil vapours; however, soil vapours are often used as a field screening tool to assist in identifying possible petroleum hydrocarbon impacted soils. Elevated soil vapour concentrations, typically expressed as a percentage of the Lower Explosive Limit, or %LEL range, generally indicate the presence of volatile petroleum products, such as gasoline and to a lesser extent diesel and fuel oil. Note that 1 % LEL is equivalent to 110 ppm based on a hexane calibration.

Combustible soil vapour concentrations measured in the soil samples recovered during the investigation are presented on the borehole logs in **Appendix 4**. The maximum measured combustible soil vapour concentrations at all locations were less than 5 ppm at depths ranging from approximately 0.1 to 0.3 m below grade.

5.6 Phase-Separated Petroleum Hydrocarbons

Phase separated liquid petroleum hydrocarbons were not detected in any of the soil samples. Furthermore, petroleum or solvent-like soil staining were not encountered.

5.7 Soil Analytical Results

A summary of the laboratory analytical results for the soil samples recovered from the hand-auger test locations, along with the applicable CCME guidelines, are presented in **Tables I to IV** in **Appendix 2**. For comparison purposes, the applicable Province of Ontario's Table 1 standards have also been included.

The following is a summary of the parameters, which exceed the applicable CCME and Province of Ontario's Table 1 standards:

CS1 - Main Site Area

- Concentrations of PHC (F_3) exceeded the applicable CCME guidelines in two soil samples (CS1-1 and CS1-3);
- Concentration of xylene exceeded the applicable Table 1 standard in one soil sample (CS1-3);
- Concentrations of antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, lead, mercury, molybdenum, selenium and zinc exceeded the applicable CCME guidelines and/or Table 1 Standards in all of the representative soil samples submitted for laboratory analysis (CS1-1 to CS1-10); and,
- Concentrations of acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene and pyrene exceeded the applicable CCME and/or Table 1 Standards in one soil sample (CS1-5).

CS2 – Waste Dump Area

- Concentrations of PHC (F_3 and F_4) exceeded the applicable CCME guidelines in one soil sample (CS2-4);
- Concentrations of toluene and xylenes exceeded the applicable Table 1 standards in one soil sample (CS2-2);
- Concentrations of antimony, arsenic, barium, cadmium, copper, mercury, silver, selenium and zinc exceeded the applicable CCME guidelines and/or MOE Table 1 Standards in all of the representative soil samples submitted for laboratory analysis.

A site plan showing approximate sampling locations, parameters exceeding the applicable soil criteria and delineation of soil impacts is presented in **Drawing No. 3** in **Appendix 1**. A copy of the Laboratory Certificate of Analyses is presented in **Appendix 5**.

5.8 Quality Assurance / Quality Control

Soil sampling and analyses were conducted under a strict quality assurance/quality control (QA/QC) program. The purpose of the QA/QC program was to ensure that representative samples were collected and analysed to assess interference from outside sources, and to quantify laboratory reproducibility. The QA/QC program used in this investigation specified sampling and analytical protocols. Sampling protocols included the use of dedicated, non-contaminating materials, equipment cleaning, sample preservation techniques and minimization of handling. The analytical protocols used during the investigation were developed by the analytical laboratory and are referenced to standard procedures.

The relative percent difference (RPD) between the analytical results of sample "CS1-2" and its field duplicate recovered simultaneously from the same location ranged from 3.8% to 5.8% for the PHC-CWS fractions F2 and F3 only, while the RPD for sample "CS1-4" and its field duplicate recovered simultaneously from the same location ranged from 1.8% to 12.5%. The RPD for sample "CS1-6" and its duplicate recovered simultaneously from the same location ranged from

9.4% to 16% for copper and lead, while the RPD for sample "CS1-9" and it's field duplicate recovered simultaneously from the same location ranged from 17.8% and 30% for selenium and barium. The RPD for sample "CS2-5" did not exhibited a concentration for any of the selected PAHs, therefore a RPD could not be calculated. However, the calculated RPD values for samples "CS1-2, CS1-4, CS1-6 and CS2-5" and their respective field duplicates indicate that the field sampling procedures were valid. The RPD is defined as the absolute value of the variation in concentration between a sample and its duplicate, when compared to the concentration of the original. RPD values at or below 30% are considered acceptable QA/QC values.

5.9 Aboveground Storage Tank Survey

At the time of the CCME Phase III ESA, Jacques Whitford conducted a storage tank survey at the sites. A total of five (5) aboveground storage tanks (ASTs) were located at the Main Site Area, on August 31, 2005, as follows:

- two (2) 900 Litre (L) capacity steel fuel oil ASTs;
- two (2) aboveground 45 Kilogram (kg) propane cylinders, and;
- one (1) 200 L capacity steel diesel AST.

No storage tanks were observed to be at the Waste Dump Area.

Based on the storage tank survey and a review of XCG *Storage Tank Audit, Michipicoten Island, East End, Navigation AID L.L. 1997,* dated May 28, 2001, two (2) 900 Litre (L) capacity steel fuel oil ASTs were installed outside on two concrete cradles along the south wall of the Lighthouse Keepers Dwelling. The fuel oil ASTs were observed to be in good condition. The two (2) 45 Kilogram (kg) propane tanks were located outside, along the Lighthouse Keepers Dwelling. The tanks appeared to be in good condition. Information obtained during the Storage Tank Survey showed no variance between the information reported in the 2001 report documented by XCG.

Jacques Whitford was unable to enter the Fog Alarm Building to inspect an interior tank. As such, based on a review of the XCG Tank Audit Report, dated May 28, 2001, one (1) 200 L capacity steel diesel AST was reported to be located inside the Fog Alarm Building. It was reported that the AST is a single walled steel tank and is located in a steel storage rack. There is no secondary contaminant; however, the floor of the building is concrete and there are no floor drains. A Form summarizing the Data for Fuel Storage Tanks is provided in **Appendix 6**.

6.0 INTERPRETATION OF RESULTS

Following the completion of the CCME Phase III ESA , those soil samples exceeding the applicable guidelines, which were recovered from the soil overburden at both sites (CS1 and CS2), have been delineated laterally as well as vertically by bedrock (the depth to bedrock is approximately 0.3 m below grade). Calculated areas and volumes of impacted soil per contaminant type (ie. PHC, metals and PAH) are provided in **Table 1** and discussed in Sections 4.1 and 4.2.

Table 1: Summary of Impacted Volumes

LOCATION	AREA IMPACTED (m^2)	DEPTH OF IMPACT (m)	VOLUME OF IMPACT (m^3)	PARAMETER
CS1 – Main Site Area	234	0.3	70	PHC
	830	0.3	250	Metals
	100	0.3	30	PAH
CS2 – Waste Dump Area	44	0.3	15	PHC
	187	0.3	55	Metals
Total Volume of Impact in CS1	**1164**	**0.3**	**350**	**PHC/ Metals/PAH**
Total volume of impact in CS2	**231**	**0.3**	**70**	**PHC/Metals**

Areas delineated by PHC, metal and PAH soil impacts in CS1 and CS2 are presented in **Drawing No.3** in **Appendix 1**.

6.1 CS1 – Main Site Area

Metal impacted soils were laterally delineated by XCG in 2001. Metal exceedances were identified in all soil sampling locations during the current investigation but as no vertical "clean line" could be established within the overburden, a metal impacted soil volume could not be accurately calculated. However, using the depth of bedrock at the Site as the maximum depth of soil contamination, along with the lateral extent of soil contamination determined from the XCG 2001 data and the current Jacques Whitford data, a volume of metal impacted soil was estimated at 305 cubic metres for both sites.

Two (2) soil samples (CS1-1 and CS1-3) recovered from the Main Site Area (CS1) by Jacques Whitford, were found to have concentrations (5500 ug/g and 890 ug/g, respectively) above the applicable CCME guidelines for PHC (F_3). XCG reported TPH soil exceedances in 2001 in this areas as well (as noted earlier, PHC (F_1 to F_4) fractions were not documented by XCG in 2001 as it was not a reporting requirement prior to October 2004. For purposes of this delineation exercise, it is assumed the TPH exceedances reported by XCG in 2001 would have also been above of the current criteria for PHC (F_1 to F_4). Thus, in conjunction with both the Jacques Whitford data and the TPH data by XCG in 2001, the quantity of soil impacted by PHC at CS1 is approximately 70 cubic metres.

One (1) soil sample (CS1-5) recovered from CS1 by Jacques Whitford, was found to have one or more concentrations of PAHs above the applicable CCME guidelines. Based on the previous analytical PAH results by XCG in 2001 of the known soil impacts, the quantity of soil impacted by one or more concentrations of PAHs is approximately 30 cubic metres.

6.2 CS2 –Waste Dump Area

One soil sample (CS2-4) recovered from the Waste Dump Area (CS2) by Jacques Whitford, was found to have concentrations of PHC (F_3 and F_4) above the CCME guidelines. Based on visual observations and laboratory analytical results, the quantity of soil impacted by PHC at CS2 is approximately 15 cubic metres.

Jacques Whitford has calculated approximately 55 cubic metres of metal-impacted soil exceeding the guidelines based on its 2005 data and the 2001 data by XCG.

7.0 CONTAMINATED SITES SUMMARY

Identified soil impacts in excess of the CCME guidelines are presented in the following table:

Summary Table of Findings

Contaminated Site	Source Description	Contaminants of Concern	Supporting Documentation	NCS Class
CS-1 Main Site Area CS#67652-001 GPS Coordinates: N 5289600 E 605100	Five existing aboveground storage tanks (ASTs) containing diesel and propane. Approximately twelve former ASTs containing diesel and/or fuel oil.	Arsenic, barium, copper, lead, selenium, zinc PHC fraction F_3 Benzo(a)pyrene, benzo (b) fluoranthene, benzo (a)anthracene	Lab samples CS1-1 to CS1-10	1
CS-2 Waste Dump Site Area CS#67652-002 GPS Coordinates: N 5289600 E 605100	Two former 900 L ASTs, various waste material	Arsenic, copper, selenium, zinc PHC fractions F_3 and F_4	Lab samples CS2-2 and CS2-4 to CS2-6	1

7.1 FCSAP Contaminated Sites Classification

Jacques Whitford has reviewed the available site information and has completed the site classification as presented in the FCSAP Contaminated Sites Guidance Document Version 1.6 dated September 16, 2005, and developed by Franz Environmental Inc.

All available data were considered and the light station property in its entirety was addressed during the completion of this National Classification System (NCS) classification. FCSAP worksheets are attached in **Appendix 3**.

Based on the available information for Site CS-1 (Main Site Area), the assessment indicated a total score of **72** with an estimated score based on speculation of 6. Based on the available information for Site CS-2 (Waste Dump Area), the assessment indicated a total score of **72** with an estimated score based on speculation of 6. Scores ranging from 70 to 100 are designated as a having a classification of **"1"** indicating that **"Action Required"**.

There is a high potential for off-site impacts, although the threat to human health and environment is generally not imminent. There is no indication of off-site contamination, however the potential for this was rated high and therefore some action is likely required.

7.2 Original NCS Scores

In comparison NCS scores calculated by XCG, during the 2001 Phase 2 ESA for site CS1 indicated a total score of 62 with an estimated score of 4.5. This score falls within a classification of "2".

Furthermore, the NCS total score for site CS2 was 60 with an estimated score of 19.25. Since the estimated score for CS2 was greater than 15, CS2 had been designated a classification of "I" (insufficient information to classify the site).

8.0 REMEDIAL ACTION PLAN / LIABILITY COST ESTIMATE

The estimated volume of impacted soils (PHC, metals and PAH) at the property, inclusive of CS1 and CS2 as shown on Table 1 is 420 cubic metres (850 metric tones). As discussed in Section 6.0, this volume estimate is on the low side as a 'clean line' for metal impacted soils could not be attained, probably due largely to naturally high metal levels in the soil overburden due to the geology of the area. Most of the island is a bedrock outcrop with very shallow overburden along its shoreline, ie. which is where the lightstation is located.

To address these impacted soils, a remedial action plan has been developed. The plan was formed after an evaluation of the following three possible remedial alternative categories:

1. Risk Management Alternatives
    - Isolation, Containment and Control Technologies
2. Ex Situ Treatment Technologies
    - Excavation and Disposal

3. In Situ Treatment Technologies
   - In Situ Bio Remediation

A comparison and feasibility of each of the three abovementioned remedial alternatives is discussed below:

Risk Management Alternatives

A Screening Level Risk Assessment (SLRA) could be completed to determine if a human or ecological risk exists associated with the presence of BTEX, PHC (F_1 to F_4) PAHs and inorganic (metal) parameters. In this case most or all of the impacted soils would remain on-site and engineering control measures (containment) may be used to manage the risks. The estimated cost for the SLRA (for a principally qualitative and semi-quantitative human and ecological assessment) would is approximately **$20,000** (not including engineering control measures and applicable taxes). If the SLRA is submitted to the Ministry of the Environment for review and comment, and if their preview recommends a qualitative risk assessment (RA), then the cost for a risk assessment may be in the range of $95,000.

Ex Situ Treatment Technologies

This option involves the excavation and offsite disposal of all impacted soils to the vertical extents of the bedrock. Due to the remote location of the site, an excavator, a barge, crane and smaller access boats would be required to transport equipment and dispose of soil, resulting in increased project costs. The estimated cost for the excavation and offsite disposal of all impacted soils (including metal impacts) as defined in Table 1 is approximately **$400,000** (not including applicable taxes), assuming both sites CS1 and CS2 are remediated concurrently. However, if the sites are remediated separately, additional mobilization charges would apply and the breakdown per site would be as follows: **$360,000** for site CS1 and **$90,000** for site CS2.

In Situ Treatment Technologies

Bioremediation is a technology that encourages growth and reproduction of indigenous micro-organisms to enhance biodegradation of organic constituents within the impacted soils. Representative soil samples would be taken over time to determine environmental soil conditions, however this option will have little to no effect on the metal impacts. This technology is also temperature dependant and thus its application to the Site would only be in the summer months. Phytoremediation is a technology that uses plant species to remediate metal impacts from soil and typically requires a the pH of the soil to be slightly acidic (in the range of 5.5 to 6.5). Additional analyses would be required to confirm the pH of the soil, the feasibility of the use of this technology at this Site, and the amount of time required to complete this type of remediation. The estimated cost for in-situ remediation is in the range of $500,000 to $750,000.

The following table provides a breakdown of the remedial alternatives:

Option	Effectiveness in Meeting Clean Up Criteria	Applicability to Site Conditions / Ease of Implementation	Cost	Approximate Time Required
Risk Management	Medium to High	High	$20,000 (SLRA) to $95,000 (RA)	Three to four months
Ex-Situ Soil Excavation and Disposal	High	Medium to low	$360,000 (Site CS1)	One to two months
			$90,000 (Site CS2)	One to two months
In-Situ Bio/Phyto remediation	Medium to low	Medium to low	$500,000 to $750,000	Two to three years

9.0 CONCLUSIONS AND RECOMMENDATIONS

Given the concentrations of BTEX, PHC (F_1 to F_4), PAHs and inorganic (metal) parameters and the shallow nature of the exceedances, the probability of a human or ecological risk, appears to be likely, but low. This evaluation is supported by the medium to low risk potential documented in the assessment of a FCSAP Score and Classification of the contaminated sites.

The purpose of the recommendation is to identify the most effective approach, from a cost, time and ease of implementation perspective, to manage the impacted soil at the Canadian Coast Guard Light Station L.L. 1097 Michipicoten Island, East End, Lake Superior, Ontario. The information obtained from the CCME Phase III ESA indicates soil impacts of one or more concentrations of BTEX, PHC (F_1 to F_4), PAHs and selected metal parameters are in excess of the applicable CCME and MOE Table 1 criterion at the Waste Dump Area and the Main Site Area.

Therefore, Jacques Whitford, recommends the use of a Screening Level Risk Assessment (SLRA) to determine if a human or ecological risk exists associated with the presence of one or more concentrations of BTEX, PHC (F_1 to F_4), PAHs and inorganic (metal) parameters. Based on PWGSC commitment to reduce the probability of an adverse effect, the development of SLRA should be considered as an option to evaluate if a potential risk on human and ecological health exists at Michipicoten Island, East End. Further, this approach would give PWGSC and DFO a better assessment of the level of risk that would exist if the impacted soils were to remain on-site.

Screening Level Risk Assessment

Site characterization has been conducted through previous work at this site and these reports have formed the basis for the SLRA. Current and future proposed land use will determine the appropriate human receptors that will be evaluated for potential risk.

Chemical characterization to date has included spatial (horizontal and vertical) distribution of chemicals within environmental media at the Site. Chemicals of concern (CoC) include metals whose concentrations exceed the appropriate guidelines, such as the Canadian Council Ministers of the Environment (CCME) guidelines and Ontario Ministry of the Environment (MOE) guidelines.

Human exposures via ingestion, inhalation and dermal absorption pathways for the SLRA will be calculated using equations specified in Health Canada guidance. Additional receptor characteristics will be selected from Canadian sources, and where such information is not available, scientifically defensible and referenced sources will be cited.

In all cases, recommended or readily available toxicity reference factors, intake rates, and other relevant exposure parameters (both human and ecological) will be used. A review of the most appropriate or site specific parameters or recent sources of literature or information will not be conducted, in accordance with the screening level of this assessment. Instead, the values recommended by Health Canada will be applied.

Based upon our current level of understanding of the site conditions, the SLRA cost associated with the Site is approximately $20,000.

10.0 CLOSURE

This report has been prepared for the sole benefit of Public Works and Government Services Canada (PWGSC) and Department of Fisheries and Oceans Central and Arctic Region (DFO). The report may not be relied upon by any other person or entity without the express written consent of Jacques Whitford, PWGSC and DFO.

Any use which a third party makes of this report, or any reliance on decisions made based on it, are the responsibility of such third parties. Jacques Whitford accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Some of the information presented in this report was provided through existing documents and interviews. Although attempts were made, whenever possible, to obtain a minimum of two confirmatory sources of information, Jacques Whitford in certain instances has been required to assume that the information provided is accurate.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. The conclusions and recommendations presented represent the best judgement of Jacques Whitford based on the data obtained from the work. Due to the nature of investigation and the limited data available, Jacques Whitford cannot warrant against undiscovered environmental liabilities. Conclusions and recommendations presented in this report should not be construed as legal advice.

The conclusions presented in the CCME Phase III ESA section of this report represent the best technical judgement of Jacques Whitford based on the data obtained from the work. The conclusions are based on the site conditions encountered by Jacques Whitford at the time the work was performed at the specific testing and/or sampling locations, and can only be extrapolated to an undefined limited area around these locations. The extent of the limited area depends on the soil conditions, as well as the history of the site reflecting natural, construction and other activities. In addition, analysis has been carried out for a limited number of chemical parameters, and it should not be inferred that other chemical species are not present. Due to the nature of the investigation and the limited data available, Jacques Whitford cannot warrant against undiscovered environmental liabilities.

Should additional information become available, Jacques Whitford requests that this information be brought to our attention so that we may re-assess the conclusions presented herein. This report was prepared by Ms. Krista Phillips, P.Eng. and reviewed by Eric Veska, PhD., P.Geo.

Respectfully submitted,

JACQUES WHITFORD LIMITED

Original Signed By:

Krista Phillips, P.Eng.
Report Author

Original Signed By:

Eric Veska, PhD., P.Geo., C.Chem.
Principal

Michipicoten_PHIII_draft report-April6'06

11.0 REFERENCES

CCME, 2001. Canada Wide Standards for Petroleum Hydrocarbons (PHCs) in Soil. Technical Supplement. Canadian Council of Ministers of the Environment (CCME). January, 2001.

CCME. 2004. Summary of Existing Canadian Environmental Quality Guidelines. Canadian Council of Ministers of the Environment, December 2004.

FEI, 2005. FCSAP Contaminated Sites Classification Guidance Document Version 1.6. Developed for Environment Canada. Franz Environmental Inc. September 16, 2005.

Jacques Whitford, 2006. Screening Level Risk Assessment, Canadian Coast Guard Light Station L.L. 1097 Michipicoten Island, East End, Lake Superior, Ontario. Jacques Whitford Limited. Report dated February 2006.

XCG, 2001. Phase II Environmental Site Assessment, Canadian Coast Guard Light Station L.L.1097, Michipicoten Island, East End, Lake Superior, Ontario, prepared by XCG Consultants Ltd., dated March 29, 2001.

XCG, 2001. Fuel Storage Tank Audit, Michipicoten, Island, East End Navigational Aid L.L. 1097 report prepared by XCG Consultants Ltd., dated May 28, 2001.

APPENDIX 1

Drawings

T:\10xxx\1004315\1004315-Topo Map.dwg (Model)

NOTE: LOCATIONS OF SITE FEATURES ARE APPROXIMATE AND MAY VARY FROM THAT SHOWN.

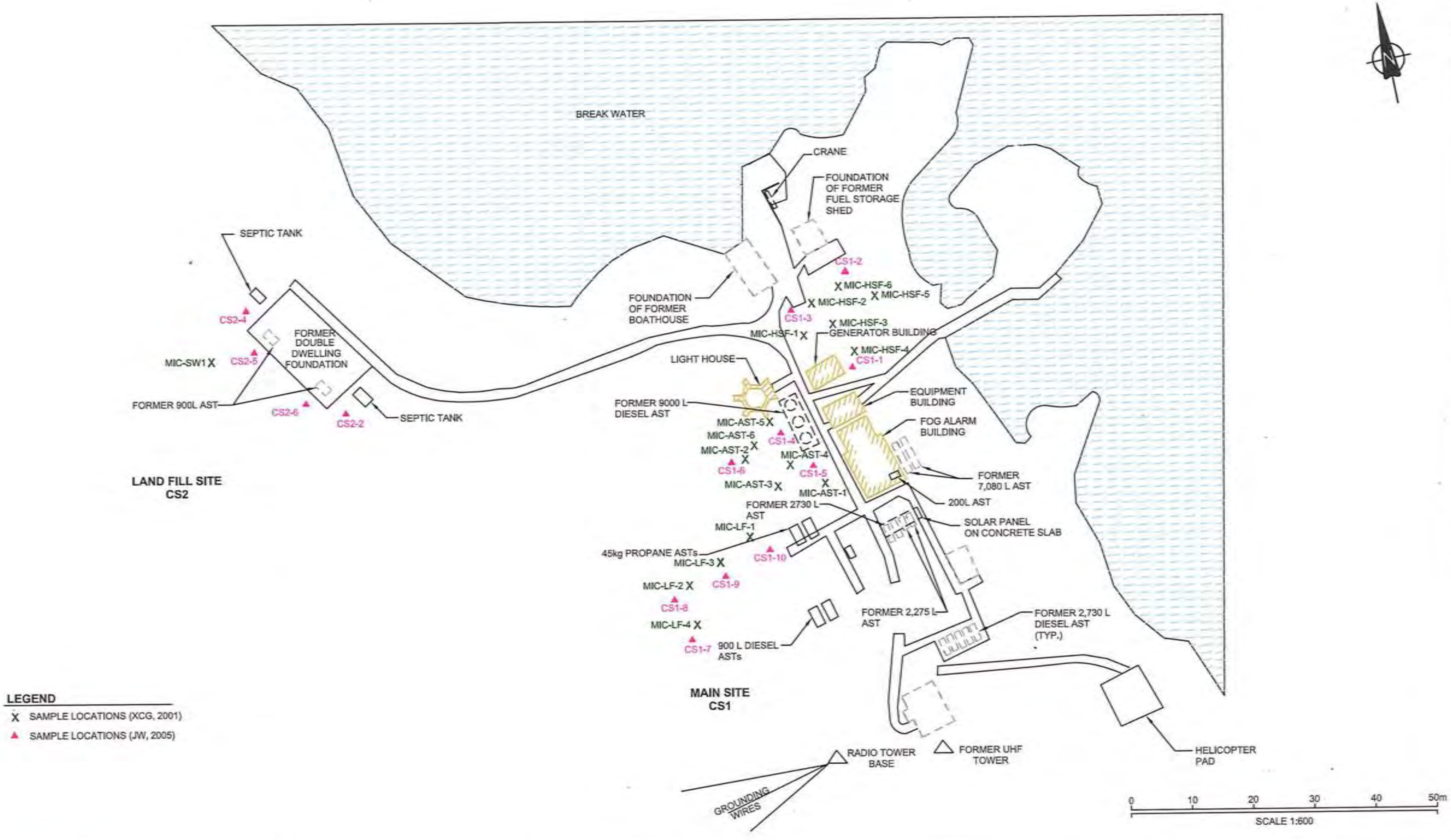
SITE LOCATION AND REGIONAL TOPOGRAPHY

MICHIPICOTEN ISLAND LIGHT STATION, LAKE SUPERIOR, ONTARIO

Job No.: 1004315
Dwg. No.: 1
Date: 05/10/14
Dwn. by: PC PC
Appd.: DF

Jacques Whitford

T:\10xxx\1004315\1004315PH2-03.dwg (Model)



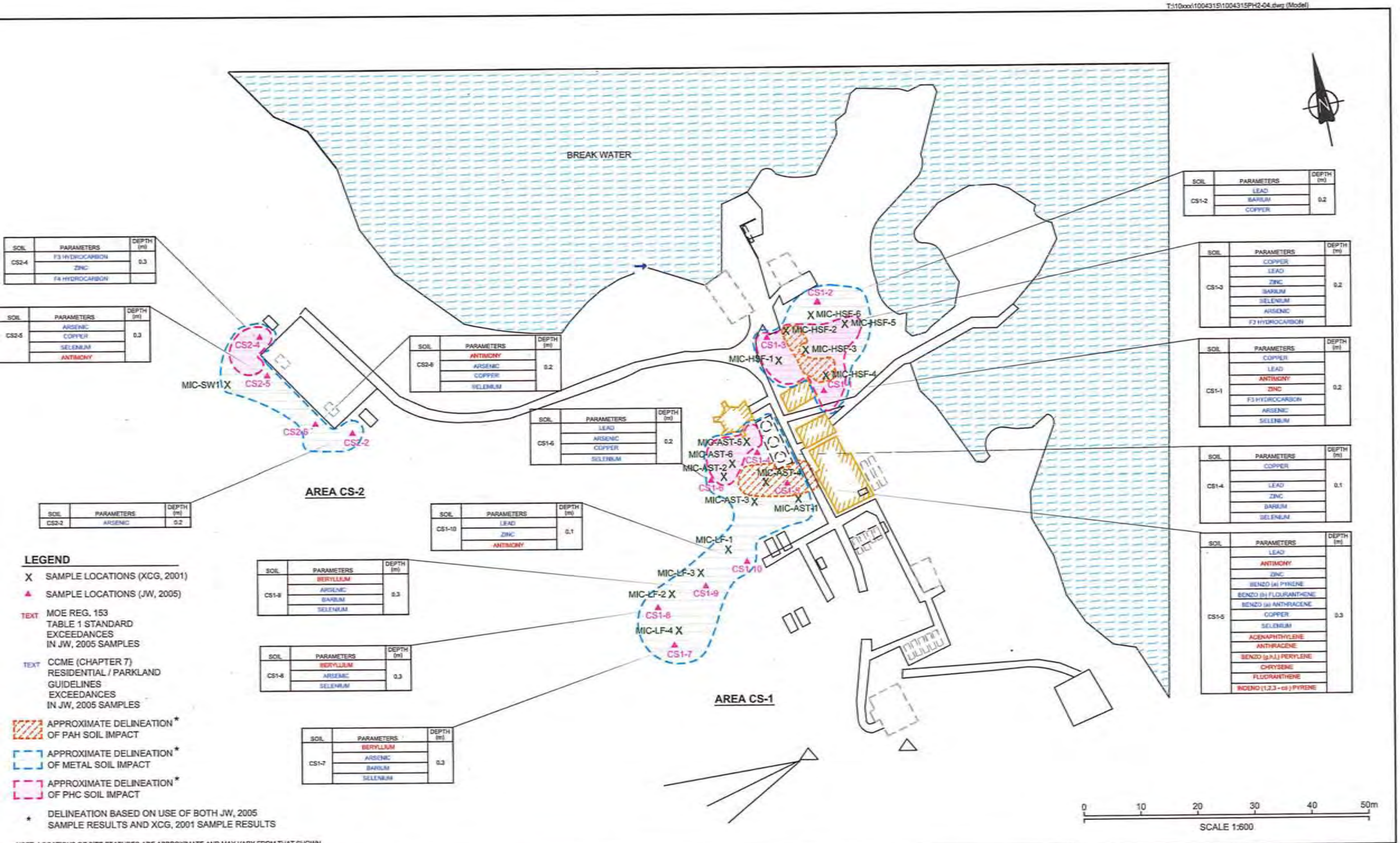
NOTE: LOCATIONS OF SITE FEATURES ARE APPROXIMATE AND MAY VARY FROM THAT SHOWN.

SITE PLAN SHOWING EXISTING AND FORMER SITE FEATURES AND APPROXIMATE SAMPLE LOCATIONS
CANADIAN COAST GUARD LIGHT HOUSE MICHIPCOTEN ISLAND, EAST END LIGHT HOUSE
LAKE SUPERIOR, ONTARIO

Job No.: 1004315
Dwg. No.: 2
Date: 06/03/10
Dwn. by: AA AA
Appd.: KP

Jacques Whitford

T:\10xxx\1004315\1004315PH2-04.dwg (Model)



SOIL	PARAMETERS	DEPTH (m)
CS2-4	F3 HYDROCARBON	0.3
	ZINC	
	F4 HYDROCARBON	

SOIL	PARAMETERS	DEPTH (m)
CS2-5	ARSENIC	0.3
	COPPER	
	SELENIUM	
	ANTIMONY	

SOIL	PARAMETERS	DEPTH (m)
CS2-6	ANTIMONY	0.2
	ARSENIC	
	COPPER	
	SELENIUM	

SOIL	PARAMETERS	DEPTH (m)
CS1-6	LEAD	0.2
	ARSENIC	
	COPPER	
	SELENIUM	

SOIL	PARAMETERS	DEPTH (m)
CS2-2	ARSENIC	0.2

SOIL	PARAMETERS	DEPTH (m)
CS1-10	LEAD	0.1
	ZINC	
	ANTIMONY	

SOIL	PARAMETERS	DEPTH (m)
CS1-9	BERYLLIUM	0.3
	ARSENIC	
	BARIUM	
	SELENIUM	

SOIL	PARAMETERS	DEPTH (m)
CS1-8	BERYLLIUM	0.3
	ARSENIC	
	SELENIUM	

SOIL	PARAMETERS	DEPTH (m)
CS1-7	BERYLLIUM	0.3
	ARSENIC	
	BARIUM	
	SELENIUM	

SOIL	PARAMETERS	DEPTH (m)
CS1-2	LEAD	0.2
	BARIUM	
	COPPER	

SOIL	PARAMETERS	DEPTH (m)
CS1-3	COPPER	0.2
	LEAD	
	ZINC	
	BARIUM	
	SELENIUM	
	ARSENIC	
	F3 HYDROCARBON	

SOIL	PARAMETERS	DEPTH (m)
CS1-1	COPPER	0.2
	LEAD	
	ANTIMONY	
	ZINC	
	F3 HYDROCARBON	
	ARSENIC	
	SELENIUM	

SOIL	PARAMETERS	DEPTH (m)
CS1-4	COPPER	0.1
	LEAD	
	ZINC	
	BARIUM	
	SELENIUM	

SOIL	PARAMETERS	DEPTH (m)
CS1-5	LEAD	0.3
	ANTIMONY	
	ZINC	
	BENZO (a) PYRENE	
	BENZO (b) FLOURANTHENE	
	BENZO (a) ANTHRACENE	
	COPPER	
	SELENIUM	
	ACENAPHTHYLENE	
	ANTHRACENE	
	BENZO (g,h,i,) PERYLENE	
	CHRYSENE	
	FLUORANTHENE	
	INDENO (1,2,3 - cd) PYRENE	

LEGEND

- X SAMPLE LOCATIONS (XCG, 2001)
- ▲ SAMPLE LOCATIONS (JW, 2005)
- TEXT MOE REG. 153 TABLE 1 STANDARD EXCEEDANCES IN JW, 2005 SAMPLES
- TEXT CCME (CHAPTER 7) RESIDENTIAL / PARKLAND GUIDELINES EXCEEDANCES IN JW, 2005 SAMPLES
- ▨ APPROXIMATE DELINEATION* OF PAH SOIL IMPACT
- ☐ APPROXIMATE DELINEATION* OF METAL SOIL IMPACT
- ☐ APPROXIMATE DELINEATION* OF PHC SOIL IMPACT
- * DELINEATION BASED ON USE OF BOTH JW, 2005 SAMPLE RESULTS AND XCG, 2001 SAMPLE RESULTS

NOTE: LOCATIONS OF SITE FEATURES ARE APPROXIMATE AND MAY VARY FROM THAT SHOWN.

SITE PLAN SHOWING APPROXIMATE SAMPLING LOCATIONS AND PARAMETERS EXCEEDING THE APPLICABLE SOIL CRITERIA
CANADIAN COAST GUARD LIGHT HOUSE MICHIPCOTEN ISLAND, EAST END LIGHT HOUSE
LAKE SUPERIOR, ONTARIO

Job No.:	Dwg. No.:	
1004315	3	

Date:	Dwn. by:	Appd.:
06/04/21	AA BC	KP

Jacques Whitford

APPENDIX 2

Soil Analytical Tables

Project No. 1004315.

TABLE I - Main Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
BTEX AND PHC FRACTIONS (F1 to F4)
(µg/g or ppm)

Parameter	CS1-1 (0.2)*	CS1-2 (0.2)*	CS1-2 Duplicate (0.2)*	CS1-3 (0.2)*	CS1-4 (0.1)*	CS1-4 Duplicate (0.1)*	CS1-5 (0.2)*	CCME Chapter 7 Guidelines[a]	MOE Table 1 Standards[b]	Laboratory Method Detection Limits
Benzene	<0.02	<0.02	na	<0.02	<0.02	<0.02	<0.02	0.03	0.002	0.020
Toluene	<0.02	<0.02	na	<0.02	<0.02	<0.02	<0.02	0.37	0.002	0.020
Ethylbenzene	<0.02	<0.02	na	<0.02	<0.02	<0.02	<0.02	0.032	0.002	0.020
Xylenes	<0.06	<0.06	na	0.04	<0.06	<0.06	<0.06	11	0.002	0.060
Petroleum Hydrocarbons F1 (C6-C10)	<10	<10	na	<10	<10	<10	<10	30	30!	10
Petroleum Hydrocarbons F2 (>C10-C16)	31	18	17	<10	<10	<10	<10	150	150!	10
Petroleum Hydrocarbons F3 (>C16-C34)	**5500**	26	27	**890**	55	56	180	400	400!	10
Petroleum Hydrocarbons F4 (>C34)	550	<10	<10	570	16	14	44	2800	2800!	10

Notes:

* Depth below grade from which the soil sample was recovered.

a Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised December 2004, Chapter 7 soil criteria for a residential/parkland land use and Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, May 2001, Tier 1 Level for a residential/parkland site with coarse textured soils.

b Province of Ontario's *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental Protection Act*, revised March 9, 2004, of the Ontario Regulation 153/04, Table 1 Standards, for Full Depth Background Site Conditions with coarse textured soils.

! Values indicate MOE Table 2 standards for coarse textured soils

BOLD Exceeds CCME Chapter 7 Guidelines

SHADED Exceeds MOE Table 1 Standards

NOTE: Laboratory detection limits exceed the MOE Table 1 Standards for the BTEX parameters

Project No. 1004315.

TABLE I - Main Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
BTEX AND PHC FRACTIONS (F1 to F4)
(µg/g or ppm)

Parameter	CS1-6 (0.2)*	CS1-7 (0.3)*	CS1-8 (0.3)*	CS1-9 (0.3)*	CS1-9 Duplicate (0.3)*	CS1-10 (0.1)*	CCME Chapter 7 Guidelines[a]	MOE Table 1 Standards[b]	Laboratory Method Detection Limits
Benzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.002	0.020
Toluene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.37	0.002	0.020
Ethylbenzene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.032	0.002	0.020
Xylenes	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	11	0.002	0.060
Petroleum Hydrocarbons F1 (C6-C10)	<10	<10	<10	<10	<10	<10	30	30!	10
Petroleum Hydrocarbons F2 (>C10-C16)	<10	<40	<40	<20	<10	16	150	150!	10
Petroleum Hydrocarbons F3 (>C16-C34)	66	<40	62	200	100	320	400	400!	10
Petroleum Hydrocarbons F4 (>C34)	55	<40	<40	52	<10	140	2800	2800!	10

Notes:

* Depth below grade from which the soil sample was recovered.

a Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised December 2004, Chapter 7 soil criteria for a residential/parkland land use and Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, May 2001, Tier 1 Level for a residential/parkland site with coarse textured soils.

b Province of Ontario's *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental Protection Act*, revised March 9, 2004, of the Ontario Regulation 153/04, Table 1 Standards, for Full Depth Background Site Conditions with coarse textured soils.

! Values indicate MOE Table 2 standards for coarse textured soils

NOTE: Laboratory detection limits exceed the MOE Table 1 Standards for the BTEX parameters

Project No. 1004315.

TABLE I - Landfill Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
BTEX AND PHC FRACTIONS (F1 to F4)
(µg/g or ppm)

Parameter	CS2-2 (0.2)*	CS2-4 (0.2)*	CS2-5 (0.2)*	CS2-6 (0.2)*	CS2-6 Duplicate (0.2)*	CCME Chapter 7 Guidelines[a]	MOE Table 1 Standards[b]	Laboratory Method Detection Limits
Benzene	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.002	0.020
Toluene	0.12	<0.02	<0.02	<0.02	<0.02	0.37	0.002	0.020
Ethylbenzene	<0.02	<0.02	<0.02	<0.02	<0.02	0.032	0.002	0.020
Xylenes	0.04	<0.06	<0.06	<0.06	<0.06	11	0.002	0.060
Petroleum Hydrocarbons F1 (C6-C10)	<10	<10	<10	<10	<10	30	30!	10
Petroleum Hydrocarbons F2 (>C10-C16)	<10	58	10	<10	<10	150	150!	10
Petroleum Hydrocarbons F3 (>C16-C34)	210	**2800**	92	48	12	400	400!	10
Petroleum Hydrocarbons F4 (>C34)	120	**5000**	23	<10	<10	2800	2800!	10

Notes:

* Depth below grade from which the soil sample was recovered.

a Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised December 2004, Chapter 7 soil criteria for a residential/parkland land use and Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, May 2001, Tier 1 Level for a residential/parkland site with coarse textured soils.

b Province of Ontario's *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental Protection Act*, revised March 9, 2004, of the Ontarion Regulation 153/04, Table 1 Standards, for Full Depth Background Site Conditions with coarse textured soils.

na Not analysed

! Values indicate MOE Table 2 standards for coarse textured soils

BOLD Exceeds CCME Chapter 7 Guidelines

SHADED Exceeds MOE Table 1 Standards

NOTE: Laboratory detection limits exceed the MOE Table 1 Standards for the BTEX parameters

Project No. 1004315.

TABLE II - Main Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
Inorganic (Metal) Parameters
(µg/g or ppm)

Parameter	CS1-1 (0.2)*	CS1-2 (0.2)*	CS1-3 (0.2)*	CS1-4 (0.1)*	CS1-5 (0.2)*	CS1-6 (0.2)*	CCME Chapter 7 Guidelines[a]	MOE Table 1 Standards[b]	Laboratory Method Detection Limits
Total Aluminum (Al)	15000	2300	4600	7500	5500	12000	nv	nv	50
Total Antimony (Sb)	1.1	<1.0	3.2	1.2	2.1	<1.0	nv	1	1
Total Arsenic	**12**	3.2	**18**	1.2	2.1	**12**	12	17	1
Total Barium (Ba)	350	**690**	**1200**	**610**	430	140	500	210	0.5
Total Beryllium (Be)	2.4	<0.5	<0.5	1.1	0.8	1.2	4	1.2	0.5
Total Cadmium (Cd)	4.4	<0.3	4.2	1.8	1.7	0.7	10	1	0.3
Total Calcium (Ca)	14000	2100	17000	14000	8700	3200	nv	nv	50
Total Chromium (Cr)	14	10	58	15	13	17	64	71	0.5
Total Cobalt (Co)	4	3.2	6.1	4.2	3.2	13	50	21	0.5
Total Copper (Cu)	**120**	**70**	**96**	**130**	**77**	**74**	63	85	0.5
Total Iron (Fe)	8000	15000	9200	11000	8600	14000	nv	nv	50
Total Lead (Pb)	**580**	**310**	**5800**	**1600**	**1100**	**250**	140	120	1
Total Magnesium (Mg)	1300	1500	1700	1800	740	640	nv	nv	50
Total Manganese (Mn)	510	110	560	880	360	310	nv	nv	1
Extractable Mercury (Hg)	0.48	0.08	1.88	1.02	1.66	0.14	6.6	0.23	0.05
Total Molybdenum (Mo)	1.1	<0.5	3.2	0.8	1.9	3.1	10	2.5	0.5
Total Nickel (Ni)	7.4	4.9	7.4	6	5.3	23	50	43	0.5
Total Phosphorus (P)	2100	310	990	1800	1100	890	nv	nv	20
Total Potassium (K)	310	<200	540	520	300	1100	nv	nv	200
Total Silver (Ag)	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	20	0.42	1
Total Sodium (Na)	<100	110	<100	<100	<100	470	nv	nv	0.3
Total Selenium	**1.3**	<1	**1.8**	**1.2**	**2.7**	**1.4**	1	1.9	100
Total Titanium (Ti)	210	600	240	240	140	130	nv	nv	5
Total Vanadium (V)	14	37	14	18	13	27	130	91	0.5
Total Zinc (Zn)	**820**	85	**3400**	**740**	**590**	150	200	160	3

Notes:

* Depth below grade from which the soil sample was recovered.

a Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised November 2002, Chapter 7 soil criteria for residential / parkland land use with coarse grained soil conditions

b Province of Ontario's *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental Protection Act*, revised March 9, 2004, of the Ontario Regulation153/04, Table 1 Standards for Full Depth Background Site Conditions with coarse textured soils.

nv No value specified in the applicable Guidelines/Standards.

BOLD Exceeds CCME Chapter 7 Guideline

SHADED Exceeds MOE Table 1 Standards

Project No. 1004315.

TABLE II - Main Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
Inorganic (Metal) Parameters
(µg/g or ppm)

Parameter	CS1-6 Duplicate (0.2)*	CS1-7 (0.3)*	CS1-8 (0.3)*	CS1-9 (0.3)*	CS1-9 Duplicate (0.3)*	CS1-10 (0.1)*	CCME Chapter 7 Guidelines[a]	MOE Table 1 Standards[b]	Laboratory Method Detection Limits
Total Aluminum (Al)	11000	20000	29000	21000	24000	16000	nv	nv	50
Total Antimony (Sb)	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	nv	1	1
Total Arsenic	<1.0	**37**	**99**	**57**	**57**	6.6	12	17	1
Total Barium (Ba)	140	**640**	320	**560**	**660**	260	500	210	0.5
Total Beryllium (Be)	1.1	**4.2**	**4.8**	**4.4**	**5.1**	0.8	4	1.2	0.5
Total Cadmium (Cd)	0.7	1.8	3	2.1	2.8	1	10	1	0.3
Total Calcium (Ca)	3200	13000	5900	9400	12000	17000	nv	nv	50
Total Chromium (Cr)	17	6.7	5.9	7.3	8	16	64	71	0.5
Total Cobalt (Co)	13	6.3	10	19	23	4.5	50	21	0.5
Total Copper (Cu)	**81**	30	25	49	58	57	63	85	0.5
Total Iron (Fe)	14000	9000	2200	15000	15000	13000	nv	nv	50
Total Lead (Pb)	**210**	64	48	97	110	**390**	140	120	1
Total Magnesium (Mg)	680	880	480	770	900	3700	nv	nv	50
Total Manganese (Mn)	300	6000	1300	5800	7500	570	nv	nv	1
Extractable Mercury (Hg)	<0.05	0.24	0.39	0.46	0.49	0.12	6.6	0.23	0.05
Total Molybdenum (Mo)	3.1	3.5	3.5	1.6	1.6	0.8	10	2.5	0.5
Total Nickel (Ni)	23	3.3	2.4	3.9	4.2	8.6	50	43	0.5
Total Phosphorus (P)	880	2100	1600	2000	2200	830	nv	nv	20
Total Potassium (K)	1100	500	250	440	570	2700	nv	nv	200
Total Silver (Ag)	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	20	0.42	1
Total Sodium (Na)	440	<100	<100	<100	<100	400	nv	nv	0.3
Total Selenium	<1.0	**4**	**1.9**	**3**	**3.9**	<1	1	1.9	100
Total Titanium (Ti)	130	120	140	180	180	400	nv	nv	5
Total Vanadium (V)	26	27	60	33	36	18	130	91	0.5
Total Zinc (Zn)	160	55	76	150	180	**220**	200	160	3

Notes:

* Depth below grade from which the soil sample was recovered.

a Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised November 2002, Chapter 7 soil criteria for residential / parkland land use with coarse grained soil conditions

b Province of Ontario's *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental Protection Act*, revised March 9, 2004, of the Ontario Regulation153/04, Table 1 Standards for Full Depth Background Site Conditions with coarse textured soils.

nv No value specified in the applicable Guidelines/Standards.

BOLD Exceeds CCME Chapter 7 Guideline

SHADED Exceeds MOE Table 1 Standards

TABLE II - Landfill Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
Inorganic (Metal) Parameters
(µg/g or ppm)

Parameter	CS2-2 (0.2)*	CS2-4 (0.2)*	CS2-5 (0.2)*	CS2-5 Duplicate (0.2)*	CS2-6 (0.2)*	CS2-6 Duplicate (0.2)*	CCME Chapter 7 Guidelines[a]	MOE Table 1 Standards[b]	Laboratory Method Detection Limits
Total Aluminum (Al)	7100	6400	10000	10000	9600	11000	nv	nv	50
Total Antimony (Sb)	<1.0	<1.0	1.2	na	1.1	<1.0	nv	1	1
Total Arsenic	**25**	5.2	**19**	na	**20**	**23**	12	17	1
Total Barium (Ba)	180	59	440	430	260	310	500	210	0.5
Total Beryllium (Be)	1	0.8	1.1	1.1	0.7	0.8	4	1.2	0.5
Total Cadmium (Cd)	0.8	1.4	3.7	3.6	2.4	3.3	10	1	0.3
Total Calcium (Ca)	1800	95000	4000	4100	2400	2400	nv	nv	50
Total Chromium (Cr)	3.7	16	10	10	12	13	64	71	0.5
Total Cobalt (Co)	2.9	4.8	3.9	3.8	3.7	4.8	50	21	0.5
Total Copper (Cu)	22	21	**76**	**72**	**82**	**76**	63	85	0.5
Total Iron (Fe)	13000	13000	15000	14000	15000	16000	nv	nv	50
Total Lead (Pb)	21	63	110	110	86	98	140	120	1
Total Magnesium (Mg)	1800	45000	1100	960	1000	1200	nv	nv	50
Total Manganese (Mn)	250	1000	820	810	430	730	nv	nv	1
Extractable Mercury (Hg)	0.08	0.21	0.26	<0.05	0.21	0.15	6.6	0.23	0.05
Total Molybdenum (Mo)	<0.5	0.6	1	1.6	1.7	1.9	10	2.5	0.5
Total Nickel (Ni)	3	37	9.1	9	8.6	11	50	43	0.5
Total Phosphorus (P)	800	460	1800	1700	1700	1500	nv	nv	20
Total Potassium (K)	740	850	830	820	1100	1100	nv	nv	200
Total Silver (Ag)	<0.3	<0.3	<0.3	<0.3	0.5	0.6	20	0.42	1
Total Sodium (Na)	<100	180	<100	<100	<100	<100	nv	nv	0.3
Total Selenium	<1	<1	**2.6**	na	**1.5**	**1.8**	1	1.9	100
Total Titanium (Ti)	230	170	200	170	290	380	nv	nv	5
Total Vanadium (V)	19	17	22	21	27	27	130	91	0.5
Total Zinc (Zn)	34	**360**	180	180	140	150	200	160	3

Notes:

* Depth below grade from which the soil sample was recovered.

a Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised November 2002, Chapter 7 soil criteria for residential / parkland land use with coarse grained soil conditions

b Province of Ontario's *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental Protection Act*, revised March 9, 2004, of the Ontario Regulation153/04, Table 1 Standards for Full Depth Background Site Conditions with coarse textured soils.

nv No value specified in the applicable Guidelines/Standards.

BOLD Exceeds CCME Chapter 7 Guideline

▨ SHADED Exceeds MOE Table 1 Standards

TABLE III - Main Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
Polycyclic Aromatic Hydrocarbons (PAH)
(μg/g or ppm)

Parameter	CS1-1 (0.2)*	Laboratory Method Detection Limit	CS1-2 (0.2)*	Laboratory Method Detection Limit	CS1-3 (0.2)*	Laboratory Method Detection Limit	CS1-4 (0.1)*	Laboratory Method Detection Limit	CS1-5 (0.2)*	Laboratory Method Detection Limit	CCME Chapter 7 Guidelines[a]	MOE Table 1 Standards[b]
Acenapthene	<0.05	0.05	<0.01	0.01	<0.05	0.05	<0.01	0.01	<0.05	0.05	nv	0.07
Acenaphthylene	<0.03	0.03	<0.005	0.005	0.05	0.03	0.021	0.005	0.27	0.03	nv	0.08
Anthracene	<0.03	0.03	<0.005	0.005	0.05	0.03	0.007	0.005	0.58	0.03	nv	0.05
Benzo (a) anthracene	<0.05	0.05	<0.01	0.01	0.41	0.05	0.04	0.01	**2.69**	0.05	1	0.74
Benzo (a) pyrene	<0.03	0.03	<0.005	0.005	0.28	0.03	0.043	0.005	**1.5**	0.03	0.7	0.49
Benzo (b) fluoranthene	<0.03	0.03	<0.005	0.005	0.41	0.03	0.05	0.005	**1.81**	0.03	1	0.47
Benzo(g,h,i)perylene	<0.1	0.1	<0.02	0.02	0.2	0.1	0.07	0.02	0.9	0.1	nv	0.68
Benzo(k)fluoranthene	<0.05	0.05	<0.01	0.01	0.19	0.05	0.02	0.01	0.74	0.05	1	0.48
Chrysene	<0.05	0.05	<0.01	0.01	0.35	0.05	0.04	0.01	2.29	0.05	nv	0.69
Dibenzo (a,h) anthracene	<0.01	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	0.3	0.1	1	0.16
Fluoranthene	0.4	0.03	<0.005	0.005	0.61	0.03	0.043	0.005	4.88	0.03	nv	1.1
Fluorene	<0.03	0.03	<0.005	0.005	<0.03	0.03	<0.005	0.005	<0.03	0.03	nv	0.12
Indeno (1,2,3-cd) pyrene	<0.1	0.1	<0.02	0.02	0.2	0.1	0.05	0.02	**1.2**	0.1	1	0.38
1-Methylnaphthalene	<0.03	0.03	<0.005	0.005	0.05	0.03	0.009	0.005	<0.03	0.03	nv	0.26
2-Methylnaphthalene	0.04	0.03	<0.005	0.005	0.06	0.03	0.011	0.005	<0.03	0.03	nv	0.29
Naphthalene	<0.03	0.03	<0.005	0.005	0.05	0.03	0.025	0.005	<0.03	0.03	0.6	0.09
Phenanthrene	<0.03	0.03	<0.005	0.005	0.2	0.03	0.018	0.005	1.77	0.03	5	0.69
Pyrene	0.13	0.03	<0.005	0.005	0.58	0.03	0.048	0.005	5.93	0.03	10	1

Notes:

*	Depth below grade from which the soil sample was recovered.
a	Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised November 2002, Chapter 7 soil criteria for residential / parkland land use with coarse grained soil
b	Province of Ontario's *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental Protection Act*, revised March 9, 2004, of the Ontario Regulation153/04, Table 1 Standards for Full Depth Background Site Conditions with coarse textured soils.
nv	No value specified in the applicable Guidelines
BOLD	Exceeds CCME Chapter 7 Guideline
SHADED	Exceeds MOE Table 1 Standards

TABLE III - Main Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
Polycyclic Aromatic Hydrocarbons (PAH)
(µg/g or ppm)

Parameter	CS1-6 (0.2)*	CS1-7 (0.3)*	CS1-8 (0.3)*	CS1-9 (0.3)*	CS1-9 Duplicate (0.3)*	Laboratory Method Detection Limit	CS1-10 (0.1)*	Laboratory Method Detection Limit	CCME Chapter 7 Guidlines^{a}	MOE Table 1 Standards^{b}
Acenapthene	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.05	0.05	nv	0.07
Acenaphthylene	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.03	0.03	nv	0.08
Anthracene	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.03	0.03	nv	0.05
Benzo (a) anthracene	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.34	0.05	1	0.74
Benzo (a) pyrene	<0.005	<0.005	<0.005	<0.005	0.015	0.005	0.24	0.03	0.7	0.49
Benzo (b) fluoranthene	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.33	0.03	1	0.47
Benzo(g,h,i)perylene	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.3	0.1	nv	0.68
Benzo(k)fluoranthene	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.13	0.05	1	0.48
Chrysene	<0.01	<0.01	<0.01	<0.01	0.02	0.01	0.25	0.05	nv	0.69
Dibenzo (a,h) anthracene	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.1	0.1	1	0.16
Fluoranthene	0.011	<0.005	<0.005	<0.005	0.035	0.005	0.34	0.03	nv	1.1
Fluorene	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.03	0.03	nv	0.12
Indeno (1,2,3-cd) pyrene	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.3	0.1	1	0.38
1-Methylnaphthalene	<0.005	0.117	<0.005	<0.005	<0.005	0.005	<0.03	0.03	nv	0.26
2-Methylnaphthalene	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.03	0.03	nv	0.29
Naphthalene	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.03	0.03	0.6	0.09
Phenanthrene	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.03	0.03	5	0.69
Pyrene	0.008	<0.005	<0.005	<0.005	0.045	0.005	<0.03	0.03	10	1

Notes:

* Depth below grade from which the soil sample was recovered.

a Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised November 2002, Chapter 7 soil criteria for residential / parkland land use with coarse grained soil

b Province of Ontario's *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental Protection Act*, revised March 9, 2004, of the Ontario Regulation153/04, Table 1 Standards for Full Depth Background Site Conditions with coarse textured soils.

nv No value specified in the applicable Guidelines

TABLE III - Landfill Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
Polycyclic Aromatic Hydrocarbons (PAH)
(µg/g or ppm)

Parameter	CS2-2 (0.3)*	Laboratory Method Detection Limit	CS2-4 (0.3)*	Laboratory Method Detection Limit	CS2-5 (0.3)*	CS2-5 Duplicate (0.2)*	CS2-6 (0.2)*	CS2-6 Duplicate (0.2)*	Laboratory Method Detection Limit	CCME Chapter 7 Guideline[a]	MOE Table 1 Standards[b]
Acenapthene	<0.01	0.01	<0.05	0.05	<0.01	<0.01	<0.01	<0.01	0.01	nv	0.07
Acenaphthylene	<0.005	0.005	<0.03	0.03	<0.005	<0.005	<0.005	<0.005	0.005	nv	0.08
Anthracene	<0.005	0.005	<0.03	0.03	<0.005	<0.005	<0.005	<0.005	0.005	nv	0.05
Benzo (a) anthracene	<0.01	0.01	0.07	0.05	0.03	<0.01	<0.01	0.02	0.01	1	0.74
Benzo (a) pyrene	<0.005	0.005	<0.03	0.03	<0.005	<0.005	<0.005	<0.005	0.005	0.7	0.49
Benzo (b) fluoranthene	<0.005	0.005	0.08	0.03	<0.005	<0.005	<0.005	<0.005	0.005	1	0.47
Benzo(g,h,i)perylene	<0.02	0.02	<0.1	0.1	<0.02	<0.02	<0.02	<0.02	0.02	nv	0.68
Benzo(k)fluoranthene	<0.01	0.01	<0.05	0.05	<0.01	<0.01	<0.01	<0.01	0.01	1	0.48
Chrysene	<0.01	0.01	0.06	0.05	<0.01	<0.01	<0.01	<0.01	0.01	nv	0.69
Dibenzo (a,h) anthracene	<0.02	0.02	<0.01	0.1	<0.02	<0.02	<0.02	<0.02	0.02	1	0.16
Fluoranthene	<0.005	0.005	0.06	0.03	<0.005	<0.005	<0.005	0.017	0.005	nv	1.1
Fluorene	<0.005	0.005	<0.03	0.03	<0.005	<0.005	<0.005	<0.005	0.005	nv	0.12
Indeno (1,2,3-cd) pyrene	<0.02	0.02	<0.1	0.1	<0.02	<0.02	<0.02	<0.02	0.02	1	0.38
1-Methylnaphthalene	<0.005	0.005	<0.03	0.03	0.008	<0.005	<0.005	<0.005	0.005	nv	0.26
2-Methylnaphthalene	<0.005	0.005	<0.03	0.03	0.019	<0.005	<0.005	<0.005	0.005	nv	0.29
Naphthalene	<0.005	0.005	<0.03	0.03	<0.005	<0.005	<0.005	<0.005	0.005	0.6	0.09
Phenanthrene	<0.005	0.005	0.03	0.03	<0.005	<0.005	<0.005	0.013	0.005	5	0.69
Pyrene	<0.005	0.005	0.05	0.03	0.01	<0.005	<0.005	0.013	0.005	10	1

Notes:

* Depth below grade from which the soil sample was recovered.

a Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised November 2002, Chapter 7 soil criteria for residential / parkland land use with coarse grained soil conditions

b Province of Ontario's *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental Protection Act*, revised March 9, 2004, of the Ontario Regulation 153/04, Table 1 Standards for Full Depth Background Site Conditions with coarse textured soils.

nv No value specified in the applicable Guidelines

Project No. 1004315.

TABLE IV - Main Site Area
SOIL ANALYTICAL RESULTS AND COMPARATIVE STANDARDS
Polychlorinated Biphenyls (PCBs)
(µg/g or ppm)

Parameter	CS1-4 (0.1)*	CS1-4 Duplicate (0.1)*	CS1-7 (0.3)*	CCME Chapter 7 Guidelines[a]	MOE Table 1 Standards[b]	Laboratory Method Detection Limit
Polychlorinated Biphenyls	<0.02	<0.02	<0.02	1.3	0.3	0.02

Notes:

* Depth below grade from which the soil sample was recovered.

[a] Canadian Council of Ministers of the Environment (CCME), "Canadian Environmental Quality Guidelines", revised November 2002, Chapter 7 soil criteria for residential / parkland land use with coarse grained soil conditions

[b] Ontario Ministry of the Environment's (MOE) *Soil, Ground Water and Sediment Standards* for Use Under Part XV.1 of the *Environmental* Protection Act, revised March 9, 2004, of the Ontario Regulation153/04, Table 1 Standards for Full Depth Background Site Conditions with coarse textured soils.

APPENDIX 3

National Classification System for Contaminated Sites

Jacques
Whitford

CS-1 Main Site Area

FCSAP Classification

Jacques
Whitford

I. Contaminant Characteristics (max. 33) **Complete A, B, C, and Special Considerations.**	**Scoring Guideline**	**Site Score**	**Information Source**
A. Degree of Hazard (max. 14)			
High concern contaminants - high concentrations	14		
High concern contaminants - low concentrations	11		
Medium concern contaminants - high concentrations	8		
Medium concern contaminants - low concentrations	5		
Low concern contaminants (high or low concentrations)	3		
A. Site Score		14	Data
B. Contaminant Quantity (max. 10)			
>10 ha or 5000 m^3	10		
2 to 10 ha or 1000 to 5000 m^3	6		
<2 ha or 1000 m^3	2		
B. Site Score		2	Speculation
C. Physical State (max. 9)			
Highly mobile contaminants or high potential for mobility by erosion	9		
Moderately mobile contaminants	7		
Low to immobile contaminants or low potential for mobility by erosion	3		
C. Site Score		3	Speculation
Special Considerations (max. 6)	-6 to +6		
Score Based on Data		14	
Score Based on Speculation		5	
Score from Special Considerations		0	
Total Site Score for Contaminant Characteristics		19	

Document relevant site information, the source of that information, and the rationale for selecting the site score.

XCG Consultants Inc. (2001) and/or Jacques Whitford (2005) report concentrations of antimony (high hazard ranking), arsenic (high hazard ranking), barium (low hazard ranking), cadmium (high hazard ranking), chromium (medium hazard ranking), copper (low hazard ranking), lead (high hazard ranking), nickel (high hazard ranking), selenium (medium hazard ranking), zinc (low hazard ranking), benzo(a)anthracene (high hazard ranking), benzo(a)pyrene (high hazard ranking) to be present in soil at the site in concentrations in excess of 2x the CCME Residential/Parkland criteria. Jacques Whitford (2005) report concentrations of petroleum hydrocarbons (PHCs) in the F3 fraction (low hazard ranking) at concentrations greater than 2x the Canada Wide Standard Criteria (CCME, 2001). Hazard rankings are based on information provided in the FCSAP Contaminated Sites Classification Guidance Document Table 1-1A (Franz Environmental Inc.(FEI), 2005). As indicated in the FCSAP Guidance Document (FEI, 2005) document, the chemical present at the site which is classified as the most hazardous is used for classification of the site.

Jacques Whitford (2005) indicates an estimated area of 350 m^3 of metal, PAH and PHC impacted soil at the site.

Chemical concentrations above the CCME Residential/Parkland concentrations (or CWS for PHCs) reported by Jacques Whitford (2005) at the site are from analysis of soil samples. No impact to ground water was reported and no liquid petroleum hydrocarbons (LPH) or other liquid or sludge contaminants have been reported at the site by XCG (2001) or Jacques Whitford (2005). As such, the mobility of the conmtaminants is considered to be low based on the FCSAP classification crteria.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
II. Exposure Pathways **A. Groundwater (max. 11)** **Complete 1 (Known) or 2 (Potential), and Special Considerations.**				
1. Known contamination and operable groundwater pathway within and/or beyond the property boundary (max. 11)				
For potable groundwater environments, 1) groundwater concentrations exceed background concentrations and the CCME Canadian Drinking Water Guidelines (CDWG) by 2X or 2) there is known contact of contaminants with groundwater, based on physical evidence of groundwater impacts. For nonpotable environments (typically urban environments with municipal services), 1) groundwater concentrations exceed 2X the appropriate nonpotable guidelines or modified generic guidelines (which excludes ingestion of drinking water pathway) or 2) there is known contact of contaminants with groundwater, based on physical evidence of groundwater impacts.	11			
For potable water environments, groundwater concentrations exceed background concentrations and the CDWG 1 to 2X. For nonpotable environments, groundwater concentrations exceed by 1 to 2X the appropriate nonpotable guidelines or modified generic guidelines (which excludes ingestion of drinking water pathway).	6			
Meets CDWG for potable environments; meets nonpotable criteria or modified generic (excludes ingestion of drinking water pathway) for nonpotable environments, or Absence of groundwater exposure pathway.	0			As reported by XCG (2001) ground water was not encountered at the site and is likely not used as a potable source at the site. As reported by XCG (2001) the majority of the soil at the site is equal to or less than 0.3 m in depth below the soil surface and the chemicals of potential concern are in a weathered condition and are not liely to leach from the soil. Ground water is not expected to be a pathway of exposure at the site.
A1. Site Score		0		
2. Potential for Groundwater Contamination. **Complete a, b, c, d, and e.**				
2a. Engineered Subsurface Containment (max. 4)				
No containment	4			
Partial containment	2			
Full containment or direct, monitored evidence of natural attenuation processes	0			Section 2 not completed due to availability of adequate site information for completion of Section 1.
A2a. Site Score				
2b. Thickness of confining layer over aquifer of concern or groundwater exposure pathway (max. 1.5)				
3 m or less including no or discontinuous confining layer or unknown	1.5			
3 to 10 m	1			
>10 m	0			
A2b. Site Score				

II. Exposure Pathways

A. Groundwater (max. 11)

Complete 1 (Known) or 2 (Potential), and Special Considerations.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
2c. Hydraulic conductivity of confining layer (max. 1.5)				
>10^{-4} cm/s or no confining layer or unknown	1.5			
10^{-4} to 10^{-6} cm/sec	1			
<10^{-6} cm/sec	0.5			
A2c. Site Score				
2d. Annual precipitation (max. 1)				
>1000 mm and moderately to highly permeable surface material	1			
600 mm and moderately to highly permeable surface material	0.6			
400 mm and low to moderately permeable surface material	0.4			
200 mm and low permeability surface material	0.2			
A2d. Site Score				
2e. Hydraulic conductivity of aquifer of concern (max. 3)				
>10^{-2} cm/sec	3			
10^{-2} to 10^{-4} cm/sec	1.5			
<10^{-4} cm/sec	0.5			
A2e. Site Score				
Special Considerations (max. 4)	-4 to +4			

Score Based on Data	0
Score Based on Speculation	0
Score from Special Considerations	0
Total Site Score for Exposure Pathways/ Groundwater	0

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
II. Exposure Pathways				
B. Surface Water (max. 11).				
Complete 1 (Known) or 2 (Potential), and Special Considerations.				
1. Observed or measured contamination, above background conditions of surface water/effluent near the site which is considered an operable exposure pathway (max. 11)				Surface water (Lake Superior) in the vicintiy of the site is remote and is not expected to be visited by members of the general public for recreational activities. As reported by XCG (2001), the contaminants at the site are considered to be in a weathered, relatively immobile condition, and would therefore not be expected to readily leach into the ground water or surface water. The potential impacts on Lake Superior would be very minimal due to its large assimilative capacity. As reported by XCG (2001) concentrations of aluminum, arsenic, chromium, and iron were above the CME water-aquatic life criteria for at least one of two water samples recovered from areas of surface ponded water at the site. Section 2 was also completed due to limited available data used in completion of Section 1.
Known concentrations of surface water: 1) Concentrations exceed background concentrations and exceed CCME CWQG - Protection of Aquatic Life Guidelines by 2X; or 2) There is known contact of contaminants with surface water based on physical evidence; or 3) In the absence of CWQG, chemicals have been proven to be toxic based on site specific testing (e.g. toxicity testing, bioassay testing or other indicator testing of exposure).	11			
Known concentrations of surface water which are above background and between 1 and 2X CWQG.	6			
Meets CWQG or absence of surface water exposure pathway	0			
B1. Site Score		11		
2. Potential for Surface Water Contamination. Complete a, b, c, d, and e.				
2a. Surface Containment (max. 5)				
No containment	5			
Partial containment	3			
Full containment	0.5			
B2a. Site Score		3	Speculation	Overburden soil is expected to provide a partial barrier to surface water contamination.
2b. Distance to Perennial Surface Water (max. 3)				
0 to <100 m	3			
100 to 300 m	2			
>300 m	0.5			
B2b. Site Score		3	Data	Light house property (CS-1) is in close proximity to the shoreline of Lake Superior
2c. Topography (max. 1.5)				
Contaminants above ground level and slope is steep	1.5			
Contaminants at or below ground level and slope is steep	1.2			
Contaminants above ground level and slope is flat	0.8			
Contaminants at or below ground level and slope is flat	0			
B2c. Site Score		0	Speculation	Soil analytical data for samples recovered by XCG (2001) and Jacques Whitford (2005) are considered representative of subsurface soil conditions. The slope of the site is not definitively known; however, due to the close proximity of the site to Lake Superior and the site visit conducted by a representative of Jacques Whitford the slope may be estimated as flat (<5%).
2d. Run-off Potential (max. 1)				
>1000 mm precipitation and low permeability surface material	1			
500 - 1000 mm precipitation and moderately permeable surface material	0.6			
<500 mm precipitation and highly permeable surface material	0.2			
B2d. Site Score		0.6	Speculation	Environment Canada Climate Normals for 1971-2000 indicate that the annual average precipitation in the area (data extrapolated from Wawa Weather Station A) of Michipicoten Island is approximately 1002 mm (available online at http://www.climate.weatheroffice.ec.gc.ca/climate_normals). The Ministry of Northern

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
II. Exposure Pathways				
B. Surface Water (max. 11).				
Complete 1 (Known) or 2 (Potential), and Special Considerations.				
2e. Flood Potential (max. 0.5)				The site is not considered to be located in a flood plain. No evidence of flooding is available for this area as indicated by NRC (2005) (Flood information map available online at http://atlas.gc.ca/site/english/maps/environment/naturalhazards/majorfloods)
1 in 2 years	0.5			
1 in 10 years	0.3			
1 in 50 years	0.1			
B2e. Site Score		0.1	Speculation	
Special Considerations (max. 4)	-4 to +4			
Score Based on Data		11		
Score Based on Speculation		0		
Score from Special Considerations		0		
Total Site Score for Exposure Pathways/ Surface Water		11		

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
II. Exposure Pathways **C. Direct Contact (max. 11).** **Complete 1 (Known) or 2 (Potential), and Special Considerations.**				
1. Known contamination of media by direct contact (max. 11) Known contamination of media (soil, sediments and air):				
1) Concentrations exceed background concentrations and exceed 2X applicable environmental quality criteria (EQC) for the appropriate land use on/near the site; or 2) There is known contact of contaminants with media based on physical evidence; or 3) There is known vapour migration into indoor air environment (building).	11			
Known contamination of media (soil, sediments, and air) with concentrations exceeding background and exceeding by 1 to 2 X applicable EQC for the appropriate land use on/near the site.	6			
No exceedance of applicable EQC for appropriate land use on/near the site; or no physical evidence of contamination of the media; or absence of direct contact exposure pathway.	0			
C1. Site Score		11		XCG Consultants Inc. (2001) and/or Jacques Whitford (2005) report concentrations of antimony, arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, zinc, benzo(a)anthracene, benzo(a)pyrene to be present in soil at the site in concentrations in excess of 2x the CCME Residential/Parkland criteria. Jacques Whitford (2005) report concentrations of petroleum hydrocarbons (PHCs) in the F3 fraction at concentrations greater than 2x the Canada Wide Standard Criteria (CCME, 2001).
2. Potential for Direct Human and/or Animal Contact. Complete a, b, and c. **2a. Vapour Emissions (gases, subsurface and surface generated vapours, contaminated dust; max. 5)**				
Suspected vapour migration with a potential for exposure to impact on an indoor air environment (building on-site or near site).	5			
Evidence of significant dust generated and impacting on-site and off-site potential or known receptors.	3			
No vapour emissions and/or no dust generated	0			
C2a. Site Score				Section 2 not completed due to availability of soil chemical concentration data.
2b. Accessibility of Site (ability to contact materials; max. 4)				
Limited barriers to prevent site access; contamination not covered	4			
Moderate access or no intervening barriers; contaminants are covered; remote locations in which contaminants are not covered	3			
Controlled access or remote location and contaminants are covered	0			
C2b. Site Score				

II. Exposure Pathways

C. Direct Contact (max. 11).

Complete 1 (Known) or 2 (Potential), and Special Considerations.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
2c. Hazardous Soil Gas Migration and Explosive Potential from the Site (max. 2)				
Contaminants are volatile, mobile in the gas/vapour phase and are a potential explosion hazard; soil permeability is high	2			
Contaminants are volatile, mobile in the gas/vapour phase and are a potential explosion hazard. Soil permeability is low and/or groundwater is <2 m from surface.	1			
Contaminants are neither volatile nor mobile in the gas/vapour phase. No risk of explosive hazard.	0			
C2c. Site Score				
Special Considerations (max. 4)	-4 to +4			
Score Based on Data		11		
Score Based on Speculation		0		
Score from Special Considerations		0		
Total Site Score for Exposure Pathways/ Direct Contact		11		

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
III. Receptors **A. Human and Animal Uses (max. 18).** **Complete 1 (Known) or 2 (Potential), and Special Considerations.**				
1. Known adverse impact on humans or animals (domestic or documented traditional food source) as a result of the contaminated site (max. 18)				
Documented adverse impact or high quantified exposure which has or will result in an adverse effect, injury or harm or impairment of the safety to humans or animals (domestic or documented traditional food source) as a result of the contaminated site.	18			
Suspected adverse impact or moderately high exposure which has or will result in an adverse effect, injury or harm or impairment of the safety to humans or animals (domestic or documented traditional food source) as a result of the contaminated site.	15			
No quantified or suspected exposures/impacts in humans or animals	0			
A1. Site Score		0		No documented evidence or suspected adverse effects, injury, harm, or impairment of human or animal health was reviewed during the completion of this classification exercise. Due to uncertainty of adverse effects and lack of documentation in this respect, Section 2 (Unknown) was completed.
2. Potential for impacts on humans and animals Complete a, b, and c. **a) Drinking water supply (max. 9). Complete i (Known) or ii (Potential).** **i) Known impact on drinking water supply (max. 9)**				
Known contamination of drinking water supply (groundwater or surface water) with (1) concentrations above background and CDWG, or (2) there is physical evidence of drinking water contamination.	9			
Measurable concentrations of contaminants in the drinking water supply (groundwater or surface water) but concentrations are less than the CDWG or there is a significant potential for CDWG exceedances of the water supply in the near future	7			
Drinking water supply is known not to be contaminated	0			
A2ai. Site Score		7		Alternative source of drinking water is supplied to maintenance workers at the site. It is possible that animals may come in contact with temporarily ponded water on site or may drink water from the lake, and that this water may contain contaminants as measured by XCG (2001).
ii) Potential for impact on drinking water supply (max. 9) Complete both sections.				
Proximity to drinking water supply (max. 6)				
0 to <100 m	6			
100 to <300 m	5			
300 m to <1 km	4			
1 to 5 km	3			
A2aii(Part1). Site Score		6	Data	Photographs of the site indicate that the Lighthouse property (CS-1) is located within 100 m of the Lake Superior Shoreline.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
III. Receptors				
A. Human and Animal Uses (max. 18).				
Complete 1 (Known) or 2 (Potential), and Special Considerations.				
Availability of alternative drinking water supply (max. 3)				
Alternative drinking water supply is not available	3			
Alternative drinking water supply difficult to obtain	2			
Alternative drinking water supply available	0.5			
A2aii(Part2). Site Score		0.5	Data	Similar to other light station sites in the area, it is likely that untreated lake water was historically used as a source of drinking water at the site. Via communication with a representative of the DFO (personal communication, Ron Walker, DFO, October 2005) it is reported that maintenance workers to the site have access to alternative potable water supply.
2a. Site Score Based on Data		7		
2a. Site Score Based on Speculation		0		
2a. Site Score		7		
b) Other water resources (max. 4). Complete i (Known) or ii (Potential)				
i) Water resources (i.e. recreational, commercial, livestock, irrigation or other food chain uses) known to be adversely affected as a result of site contamination (max. 4)				
Known contamination of water resource (1) to concentrations above background and above the appropriate environmental quality criteria (EQC) as required based on the water resources usage or (2) there is physical evidence of water resources contamination	4			
Chemical concentrations are currently below the appropriate EQC as required based on the water resources usage but strongly suspect potential for future EQC exceedances	3			
Water resource is not known to be contaminated	0			
A2bi. Site Score		0		No adverse effects from recreational use of water resources were identified during site document review.
ii) Potential for impact on water resources (max. 4). Complete both sections.				
Proximity to water resources (max. 2)				
0 to <100 m	2			
100 to <300 m	1.5			
300 m to <1 km	1			
1 to 5 km	0.5			
A2bii(Part1). Site Score		2	Data	Site is in close proximity to the shoreline

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.

III. Receptors

A. Human and Animal Uses (max. 18).

Complete 1 (Known) or 2 (Potential), and Special Considerations.

Use of water resources (max. 2). If multiple uses, give the highest score automatically (use following table)

Water Use	**Frequent Use**	**Occasional Use**
Recreational (swimming, fishing, etc.)	2	1
Commercial food preparation	1.5	0.8
Livestock watering	1	0.5
Irrigation	1	0.5
Other domestic or food chain uses	0.5	0.3
Not currently used but likely future use	0.5	0.2

	Site Score	Information Source	
A2bii(Part2). Site Score	1	Speculation	It is possible that that the waters surrounding this island are used as a recreational destination for members of the general public during the summer season

2b. Site Score Based on Data	2
2b. Site Score Based on Speculation	1
2b. Site Score	3

c) Direct human exposure (max. 5). Complete i (Known) or ii (Potential)

i) Known contamination of land used by humans (max. 5)

	Scoring Guideline	Site Score	Information Source	
Known contamination of land used for agricultural (AG) or residential/parkland/school purposes (R/P) above AG or R/P CCME Environmental Quality Criteria (EQC).	5			
Known contamination of land used for commercial or industrial (C/I) purposes above C/I CCME EQC.				
Land is known not to be contaminated above background concentrations	0			
A2ci. Site Score		5		**Property is reported to contain soil chemical concentrations above the applicable CCME Criteria.**

ii) Potential human exposure through land use (give highest score to worst case scenario; max. 5)

Determine use(s) of land at and surrounding site and assign score using following table:

Land Use	**Distance from Site**		
	0-<300 m	300 m-<1 km	1-5 km
residential	5	4.5	3
agricultural	5	4	2.5
parkland/school	4	3	1.5
commercial/industrial	3	1	0.5

	Site Score	Information Source	
A2cii. Site Score	3	Speculation	The site occupies and area of approximately 40 ha at the eastern end of Michipicoten Island. The majority of the island with the exception of the site and several small private properties is designated as Provincial Parkland. It is estimated that the Provincial Park boundary is approximately 300 m from the centre of the site.

III. Receptors

A. Human and Animal Uses (max. 18).

Complete 1 (Known) or 2 (Potential), and Special Considerations.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
2c. Site Score Based on Data		5		
2c. Site Score Based on Speculation		0		
2c. Site Score		5		
Special Considerations (max. 5)	-5 to +5			
Score Based on Data		14		
Score Based on Speculation		1		
Score from Special Considerations		0		
Total Site Score for Receptors/ Human and Animal Uses		15		

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
III. Receptors				
B. Environmental Receptors (max. 16)				
Complete 1 (Known) or 2 (Potential), and Special Considerations.				
1. Known impacts on the environment as a result of the contaminated site (max. 16)				
Known adverse effect on environmental receptors including fish habitat	16			
Visual physical evidence of stress on aquatic species or vegetative stress on trees, crops or plant life located on the site or off-site with impacts related to the contaminated site	12			
No known environmental receptors within 1 km of contaminated site and no known adverse effects.	0			
B1. Site Score		0		Due to uncertainty of adverse effects and lack of documentation in this respect, Section 2 (Unknown) was completed.
2. Potential for Impact on Environmental Receptors. Complete a and b.				
a) Distance from the site to the nearest environmental receptor (max. 10)				
0 to <300 m	10			
300 m to <1 km	6			
1 km to <5 km	2			
>5 km	0.5			
B2a. Site Score		10	Data	**Vegetation and local wildlife are assumed to be present at the site and therefore exposed to the impacted soils.**
b) Distance to an important or susceptible groundwater or surface water resource (max. 6)				
0 to <300 m	6			
300 m to <1 km	4			
1 km to <5 km	2			
>5 km	1			
B2b. Site Score		6	Data	**The site is located with 100 m of Lake Superior**
Special Considerations (max. 5)	-5 to +5			
Score Based on Data		16		
Score Based on Speculation		0		
Score from Special Considerations		0		
Total Site Score for Receptors/ Environmental Receptors		16		

Factor Categories	Known and Potential Scores Based on Data	Potential Scores Based on Speculation	Scores from Special Considerations	Total Category Scores
I. Contaminant Characteristics (max. 33)	14	5	0	19
II. Exposure Pathways (max. 33)				
A. Groundwater (max. 11)	0	0	0	0
B. Surface Water (max. 11)	11	0	0	11
C. Direct Contact (max. 11)	11	0	0	11
III. Receptors (max. 34)				
A. Human and Animal (max. 18)	14	1	0	15
B. Environment (max. 16)	16	0	0	16
Total Scores for the Site	66	6	0	72

Site Classification Class 1 - Action Required

Class 1 (Score 70 to 100): Action Required

Class 2 (Score 50 to 69.9): Action Likely Required

Class 3 (Score 37 to 49.9): Action May Be Required

Class N (Score <37): Action Not Likely Required

Class I (Speculation Score =15): Insufficient Information

Note: This worksheet can be copied for inclusion in site reports or other documents.

CS-2 Waste Dump Area

FCSAP Classification

Jacques Whitford

I. Contaminant Characteristics (max. 33) Complete A, B, C, and Special Considerations.	Scoring Guideline	Site Score	Information Source
A. Degree of Hazard (max. 14)			
High concern contaminants - high concentrations	14		
High concern contaminants - low concentrations	11		
Medium concern contaminants - high concentrations	8		
Medium concern contaminants - low concentrations	5		
Low concern contaminants (high or low concentrations)	3		
A. Site Score		14	Data
B. Contaminant Quantity (max. 10)			
>10 ha or 5000 m^3	10		
2 to 10 ha or 1000 to 5000 m^3	6		
<2 ha or 1000 m^3	2		
B. Site Score		2	Speculation
C. Physical State (max. 9)			
Highly mobile contaminants or high potential for mobility by erosion	9		
Moderately mobile contaminants	7		
Low to immobile contaminants or low potential for mobility by erosion	3		
C. Site Score		3	Speculation
Special Considerations (max. 6)	-6 to +6		
Score Based on Data		14	
Score Based on Speculation		5	
Score from Special Considerations		0	
Total Site Score for Contaminant Characteristics		19	

Document relevant site information, the source of that information, and the rationale for selecting the site score.

XCG Consultants Inc. (2001) and/or Jacques Whitford (2005) report concentrations of arsenic (high hazard ranking), chromium (medium hazard ranking), copper (low hazard ranking), selenium (medium hazard ranking) and zinc (low hazard ranking) to be present in soil at the site in concentrations in excess of 2x the CCME Residential/Parkland criteria. Jacques Whitford (2005) report concentrations of petroleum hydrocarbons (PHCs) in the F3 and F4 fractions (low hazard ranking) at concentrations greater than 2x the Canada Wide Standard Criteria (CCME, 2001). Hazard rankings are based on information provided in the FCSAP Contaminated Sites Classification Guidance Document Table 1-1A (Franz Environmental Inc.(FEI), 2005). As indicated in the FCSAP Guidance Document (FEI, 2005) document, the chemical present at the site which is classified as the most hazardous is used for classification of the site.

Jacques Whitford (2005) indicates an estimated area of 70 m^3 of metal, PAH and PHC impacted soil at the site.

Chemical concentrations above the CCME Residential/Parkland concentrations (or CWS for PHCs) reported by Jacques Whitford (2005) at the site are from analysis of soil samples. No impact to ground water was reported and no liquid petroleum hydrocarbons (LPH) or other liquid or sludge contaminants have been reported at the site by XCG (2001) or Jacques Whitford (2005). As such, the mobility of the conmtaminants is considered to be low based on the FCSAP classification crteria.

II. Exposure Pathways

A. Groundwater (max. 11)

Complete 1 (Known) or 2 (Potential), and Special Considerations.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
1. Known contamination and operable groundwater pathway within and/or beyond the property boundary (max. 11)				
For potable groundwater environments, 1) groundwater concentrations exceed background concentrations and the CCME Canadian Drinking Water Guidelines (CDWG) by 2X or 2) there is known contact of contaminants with groundwater, based on physical evidence of groundwater impacts. For nonpotable environments (typically urban environments with municipal services), 1) groundwater concentrations exceed 2X the appropriate nonpotable guidelines or modified generic guidelines (which excludes ingestion of drinking water pathway) or 2) there is known contact of contaminants with groundwater, based on physical evidence of groundwater impacts.	11			
For potable water environments, groundwater concentrations exceed background concentrations and the CDWG 1 to 2X. For nonpotable environments, groundwater concentrations exceed by 1 to 2X the appropriate nonpotable guidelines or modified generic guidelines (which excludes ingestion of drinking water pathway).	6			
Meets CDWG for potable environments; meets nonpotable criteria or modified generic (excludes ingestion of drinking water pathway) for nonpotable environments, or Absence of groundwater exposure pathway.	0			
A1. Site Score		0		As reported by XCG (2001) ground water was not encountered at the site and is likely not used as a potable source at the site. As reported by XCG (2001) the majority of the soil at the site is equal to or less than 0.3 m in depth below the soil surface and the chemicals of potential concern are in a weathered condition and are not liely to leach from the soil. Ground water is not expected to be a pathway of exposure at the site.

2. Potential for Groundwater Contamination. Complete a, b, c, d, and e.

	Scoring Guideline	Site Score	Information Source	
2a. Engineered Subsurface Containment (max. 4)				
No containment	4			
Partial containment	2			
Full containment or direct, monitored evidence of natural attenuation processes	0			
A2a. Site Score				Section 2 not completed due to availability of adequate site information for completion of Section 1.
2b. Thickness of confining layer over aquifer of concern or groundwater exposure pathway (max. 1.5)				
3 m or less including no or discontinuous confining layer or unknown	1.5			
3 to 10 m	1			
>10 m	0			
A2b. Site Score				

II. Exposure Pathways

A. Groundwater (max. 11)

Complete 1 (Known) or 2 (Potential), and Special Considerations.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
2c. Hydraulic conductivity of confining layer (max. 1.5)				
>10^{-4} cm/s or no confining layer or unknown	1.5			
10^{-4} to 10^{-6} cm/sec	1			
<10^{-6} cm/sec	0.5			
A2c. Site Score				
2d. Annual precipitation (max. 1)				
>1000 mm and moderately to highly permeable surface material	1			
600 mm and moderately to highly permeable surface material	0.6			
400 mm and low to moderately permeable surface material	0.4			
200 mm and low permeability surface material	0.2			
A2d. Site Score				
2e. Hydraulic conductivity of aquifer of concern (max. 3)				
>10^{-2} cm/sec	3			
10^{-2} to 10^{-4} cm/sec	1.5			
<10^{-4} cm/sec	0.5			
A2e. Site Score				
Special Considerations (max. 4)	-4 to +4			
Score Based on Data		0		
Score Based on Speculation		0		
Score from Special Considerations		0		
Total Site Score for Exposure Pathways/ Groundwater		0		

II. Exposure Pathways B. Surface Water (max. 11). Complete 1 (Known) or 2 (Potential), and Special Considerations.	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
1. Observed or measured contamination, above background conditions of surface water/effluent near the site which is considered an operable exposure pathway (max. 11)				Surface water (Lake Superior) in the vicintiy of the site is remote and is not expected to be visited by members of the general public for recreational activities. As reported by XCG (2001), the contaminants at the site are considered to be in a weathered, relatively immobile condition, and would therefore not be expected to readily leach into the ground water or surface water. The potential impacts on Lake Superior would be very minimal due to its large assimilative capacity. As reported by XCG (2001) concentrations of aluminum, arsenic, chromium, and iron were above the CME water-aquatic life criteria for at least one of two water samples recovered from areas of surface ponded water at the site. Section 2 was also completed due to limited available data used in completion of Section 1.
Known concentrations of surface water: 1) Concentrations exceed background concentrations and exceed CCME CWQG - Protection of Aquatic Life Guidelines by 2X; or 2) There is known contact of contaminants with surface water based on physical evidence; or 3) In the absence of CWQG, chemicals have been proven to be toxic based on site specific testing (e.g. toxicity testing, bioassay testing or other indicator testing of exposure).	11			
Known concentrations of surface water which are above background and between 1 and 2X CWQG.	6			
Meets CWQG or absence of surface water exposure pathway	0			
B1. Site Score		11		
2. Potential for Surface Water Contamination. Complete a, b, c, d, and e.				
2a. Surface Containment (max. 5)				Overburden soil is expected to provide a partial barrier to surface water contamination.
No containment	5			
Partial containment	3			
Full containment	0.5			
B2a. Site Score		3	Speculation	
2b. Distance to Perennial Surface Water (max. 3)				The Waste Dump Area (CS-2) is in close proximity to the shoreline of Lake Superior
0 to <100 m	3			
100 to 300 m	2			
>300 m	0.5			
B2b. Site Score		3	Data	
2c. Topography (max. 1.5)				Soil analytical data for samples recovered by XCG (2001) and Jacques Whitford (2005) are considered representative of subsurface soil conditions. The slope of the site is not definitively known; however, due to the close proximity of the site to Lake Superior and the site visit conducted by a representative of Jacques Whitford the slope may be estimated as flat (<5%).
Contaminants above ground level and slope is steep	1.5			
Contaminants at or below ground level and slope is steep	1.2			
Contaminants above ground level and slope is flat	0.8			
Contaminants at or below ground level and slope is flat	0			
B2c. Site Score		0	Speculation	
2d. Run-off Potential (max. 1)				Environment Canada Climate Normals for 1971-2000 indicate that the annual average precipitation in the area (data extrapolated from Wawa Weather Station A) of Michipicoten Island is approximately 1002 mm (available online at http://www.climate.weatheroffice.ec.gc.ca/climate_normals). The Ministry of Northern
>1000 mm precipitation and low permeability surface material	1			
500 - 1000 mm precipitation and moderately permeable surface material	0.6			
<500 mm precipitation and highly permeable surface material	0.2			
B2d. Site Score		0.6	Speculation	

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
II. Exposure Pathways **B. Surface Water (max. 11).** **Complete 1 (Known) or 2 (Potential), and Special Considerations.**				
2e. Flood Potential (max. 0.5)				The site is not considered to be located in a flood plain. No evidence of flooding is available for this area as indicated by NRC (2005) (Flood information map available online at http://atlas.gc.ca/site/english/maps/environment/naturalhazards/majorfloods)
1 in 2 years	0.5			
1 in 10 years	0.3			
1 in 50 years	0.1			
B2e. Site Score		0.1	Speculation	
Special Considerations (max. 4)	-4 to +4			
Score Based on Data		11		
Score Based on Speculation		0		
Score from Special Considerations		0		
Total Site Score for Exposure Pathways/ Surface Water		11		

II. Exposure Pathways

C. Direct Contact (max. 11).

Complete 1 (Known) or 2 (Potential), and Special Considerations.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
1. Known contamination of media by direct contact (max. 11)				
Known contamination of media (soil, sediments and air): 1) Concentrations exceed background concentrations and exceed 2X applicable environmental quality criteria (EQC) for the appropriate land use on/near the site; or 2) There is known contact of contaminants with media based on physical evidence; or 3) There is known vapour migration into indoor air environment (building).	11			
Known contamination of media (soil, sediments, and air) with concentrations exceeding background and exceeding by 1 to 2 X applicable EQC for the appropriate land use on/near the site.	6			
No exceedance of applicable EQC for appropriate land use on/near the site; or no physical evidence of contamination of the media; or absence of direct contact exposure pathway.	0			
C1. Site Score		11		XCG Consultants Inc. (2001) and/or Jacques Whitford (2005) report concentrations of arsenic, chromium, copper, selenium and zinc to be present in soil at the site in concentrations in excess of 2x the CCME Residential/Parkland criteria. Jacques Whitford (2005) report concentrations of petroleum hydrocarbons (PHCs) in the F3 and F4 fractions at concentrations greater than 2x the Canada Wide Standard Criteria (CCME, 2001).
2. Potential for Direct Human and/or Animal Contact. Complete a, b, and c.				
2a. Vapour Emissions (gases, subsurface and surface generated vapours, contaminated dust; max. 5)				
Suspected vapour migration with a potential for exposure to impact on an indoor air environment (building on-site or near site).	5			
Evidence of significant dust generated and impacting on-site and off-site potential or known receptors.	3			
No vapour emissions and/or no dust generated	0			
C2a. Site Score				Section 2 not completed due to availability of soil chemical concentration data.
2b. Accessibility of Site (ability to contact materials; max. 4)				
Limited barriers to prevent site access; contamination not covered	4			
Moderate access or no intervening barriers; contaminants are covered; remote locations in which contaminants are not covered	3			
Controlled access or remote location and contaminants are covered	0			
C2b. Site Score				

II. Exposure Pathways
C. Direct Contact (max. 11).
Complete 1 (Known) or 2 (Potential), and Special Considerations.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
2c. Hazardous Soil Gas Migration and Explosive Potential from the Site (max. 2)				
Contaminants are volatile, mobile in the gas/vapour phase and are a potential explosion hazard; soil permeability is high	2			
Contaminants are volatile, mobile in the gas/vapour phase and are a potential explosion hazard. Soil permeability is low and/or groundwater is <2 m from surface.	1			
Contaminants are neither volatile nor mobile in the gas/vapour phase. No risk of explosive hazard.	0			
C2c. Site Score				
Special Considerations (max. 4)	-4 to +4			
Score Based on Data		11		
Score Based on Speculation		0		
Score from Special Considerations		0		
Total Site Score for Exposure Pathways/ Direct Contact		11		

III. Receptors A. Human and Animal Uses (max. 18). Complete 1 (Known) or 2 (Potential), and Special Considerations.	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
1. Known adverse impact on humans or animals (domestic or documented traditional food source) as a result of the contaminated site (max. 18)				No documented evidence or suspected adverse effects, injury, harm, or impairement of human or animal health was reviewed during the completion of this classification exercise. Due to uncertainty of adverse effects and lack of documentation in this respect, Section 2 (Unknown) was completed.
Documented adverse impact or high quantified exposure which has or will result in an adverse effect, injury or harm or impairment of the safety to humans or animals (domestic or documented traditional food source) as a result of the contaminated site.	18			
Suspected adverse impact or moderately high exposure which has or will result in an adverse effect, injury or harm or impairment of the safety to humans or animals (domestic or documented traditional food source) as a result of the contaminated site.	15			
No quantified or suspected exposures/impacts in humans or animals	0			
A1. Site Score		0		
2. Potential for impacts on humans and animals Complete a, b, and c. **a) Drinking water supply (max. 9).** Complete i (Known) or ii (Potential). **i) Known impact on drinking water supply (max. 9)**				Alternative source of drinking water is supplied to maintenance workers at the site. It is possible that animals may come in contact with temporarily ponded water on site or may drink water from the lake, and that this water may contain contaminants as measured by XCG (2001) at Site CS-1.
Known contamination of drinking water supply (groundwater or surface water) with (1) concentrations above background and CDWG, or (2) there is physical evidence of drinking water contamination.	9			
Measurable concentrations of contaminants in the drinking water supply (groundwater or surface water) but concentrations are less than the CDWG or there is a significant potential for CDWG exceedances of the water supply in the near future	7			
Drinking water supply is known not to be contaminated	0			
A2ai. Site Score		7		
ii) Potential for impact on drinking water supply (max. 9) Complete both sections.				Photographs of the site indicate that the Waste Dump Area (CS-2) is located within 100 m of the Lake Superior Shoreline.
Proximity to drinking water supply (max. 6)				
0 to <100 m	6			
100 to <300 m	5			
300 m to <1 km	4			
1 to 5 km	3			
A2aii(Part1). Site Score		6	Data	

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
III. Receptors				
A. Human and Animal Uses (max. 18).				
Complete 1 (Known) or 2 (Potential), and Special Considerations.				
Availability of alternative drinking water supply (max. 3)				Similar to other light station sites in the area, it is likely that untreated lake water was historically used as a source of drinking water at the site. Via communication with a representative of the DFO (personal communication, Ron Walker, DFO, October 2005) it is reported that maintenance workers to the site have access to alternative potable water supply.
Alternative drinking water supply is not available	3			
Alternative drinking water supply difficult to obtain	2			
Alternative drinking water supply available	0.5			
A2aii(Part2). Site Score		0.5	Data	
2a. Site Score Based on Data		7		
2a. Site Score Based on Speculation		0		
2a. Site Score		7		
b) Other water resources (max. 4). Complete i (Known) or ii (Potential)				
i) Water resources (i.e. recreational, commercial, livestock, irrigation or other food chain uses) known to be adversely affected as a result of site contamination (max. 4)				
Known contamination of water resource (1) to concentrations above background and above the appropriate environmental quality criteria (EQC) as required based on the water resources usage or (2) there is physical evidence of water resources contamination	4			
Chemical concentrations are currently below the appropriate EQC as required based on the water resources usage but strongly suspect potential for future EQC exceedances	3			
Water resource is not known to be contaminated	0			No adverse effects from recreational use of water resources were identified during site document review.
A2bi. Site Score		0		
ii) Potential for impact on water resources (max. 4). Complete both sections.				
Proximity to water resources (max. 2)				
0 to <100 m	2			
100 to <300 m	1.5			
300 m to <1 km	1			
1 to 5 km	0.5			
A2bii(Part1). Site Score		2	Data	Site is in close proximity to the shoreline

III. Receptors

A. Human and Animal Uses (max. 18).

Complete 1 (Known) or 2 (Potential), and Special Considerations.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.

Use of water resources (max. 2). If multiple uses, give the highest score automatically (use following table)

Water Use	Frequent Use	Occasional Use
Recreational (swimming, fishing, etc.)	2	1
Commercial food preparation	1.5	0.8
Livestock watering	1	0.5
Irrigation	1	0.5
Other domestic or food chain uses	0.5	0.3
Not currently used but likely future use	0.5	0.2

	Site Score	Information Source	Document relevant site information
A2bii(Part2). Site Score	1	Speculation	It is possible that that the waters surrounding this island are used as a recreational destination for members of the general public during the summer season

2b. Site Score Based on Data	2
2b. Site Score Based on Speculation	1
2b. Site Score	3

c) Direct human exposure (max. 5). Complete i (Known) or ii (Potential)

i) Known contamination of land used by humans (max. 5)

	Scoring Guideline	Site Score	Information Source	Document relevant site information
Known contamination of land used for agricultural (AG) or residential/parkland/school purposes (R/P) above AG or R/P CCME Environmental Quality Criteria (EQC). Known contamination of land used for commercial or industrial (C/I) purposes above C/I CCME EQC.	5			
Land is known not to be contaminated above background concentrations	0			
A2ci. Site Score		5		**Property is reported to contain soil chemical concentrations above the applicable CCME Criteria.**

ii) Potential human exposure through land use (give highest score to worst case scenario; max. 5)

Determine use(s) of land at and surrounding site and assign score using following table:

Land Use	**Distance from Site**		
	0-<300 m	300 m-<1 km	1-5 km
residential	5	4.5	3
agricultural	5	4	2.5
parkland/school	4	3	1.5
commercial/industrial	3	1	0.5

	Site Score	Information Source	Document relevant site information
A2cii. Site Score	3	Speculation	The site occupies and area of approximately 40 ha at the eastern end of Michipicoten Island. The majority of the island with the exception of the site and several small private properties is designated as Provincial Parkland. It is estimated that the Provincial Park boundary is approximately 300 m from the centre of the site.

III. Receptors

A. Human and Animal Uses (max. 18).

Complete 1 (Known) or 2 (Potential), and Special Considerations.

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
2c. Site Score Based on Data		5		
2c. Site Score Based on Speculation		0		
2c. Site Score		5		
Special Considerations (max. 5)	-5 to +5			
Score Based on Data		14		
Score Based on Speculation		1		
Score from Special Considerations		0		
Total Site Score for Receptors/ Human and Animal Uses		15		

	Scoring Guideline	Site Score	Information Source	Document relevant site information, the source of that information, and the rationale for selecting the site score.
III. Receptors				
B. Environmental Receptors (max. 16)				
Complete 1 (Known) or 2 (Potential), and Special Considerations.				
1. Known impacts on the environment as a result of the contaminated site (max. 16)				
Known adverse effect on environmental receptors including fish habitat	16			
Visual physical evidence of stress on aquatic species or vegetative stress on trees, crops or plant life located on the site or off-site with impacts related to the contaminated site	12			
No known environmental receptors within 1 km of contaminated site and no known adverse effects.	0			
B1. Site Score		0		Due to uncertainty of adverse effects and lack of documentation in this respect, Section 2 (Unknown) was completed.
2. Potential for Impact on Environmental Receptors. **Complete a and b.**				
a) Distance from the site to the nearest environmental receptor (max. 10)				
0 to <300 m	10			
300 m to <1 km	6			
1 km to <5 km	2			
>5 km	0.5			
B2a. Site Score		10	Data	**Vegetation and local wildlife are assumed to be present at the site and therefore exposed to the impacted soils.**
b) Distance to an important or susceptible groundwater or surface water resource (max. 6)				
0 to <300 m	6			
300 m to <1 km	4			
1 km to <5 km	2			
>5 km	1			
B2b. Site Score		6	Data	**The site is located with 100 m of Lake Superior**
Special Considerations (max. 5)	-5 to +5			
Score Based on Data		16		
Score Based on Speculation		0		
Score from Special Considerations		0		
Total Site Score for Receptors/ Environmental Receptors		16		

Factor Categories	Known and Potential Scores Based on Data	Potential Scores Based on Speculation	Scores from Special Considerations	Total Category Scores
I. Contaminant Characteristics (max. 33)	14	5	0	19
II. Exposure Pathways (max. 33)				
A. Groundwater (max. 11)	0	0	0	0
B. Surface Water (max. 11)	11	0	0	11
C. Direct Contact (max. 11)	11	0	0	11
III. Receptors (max. 34)				
A. Human and Animal (max. 18)	14	1	0	15
B. Environment (max. 16)	16	0	0	16
Total Scores for the Site	66	6	0	72

Site Classification Class 1 - Action Required

Class 1 (Score 70 to 100): Action Required

Class 2 (Score 50 to 69.9): Action Likely Required

Class 3 (Score 37 to 49.9): Action May Be Required

Class N (Score <37): Action Not Likely Required

Class I (Speculation Score =15): Insufficient Information

Note: This worksheet can be copied for inclusion in site reports or other documents.

APPENDIX 4

Borehole Logs

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS1-4

CLIENT Public Works and Government Services Canada

PROJECT No. 1004315

LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON

DATUM --

DATES: BORING August 31, 2005

WATER LEVEL --

TPC ELEV. --

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm ● 20 40 60 80 ▲ 100 200 300 400	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0		SAND and GRAVEL, with organics			0		AS	1	--	
		END OF BOREHOLE at approximately 0.1 m								
					1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS1-4 submitted for BTEX, ICP25, PAHs, PCBs, and PHC (F1-F4) analyses

Jacques Whitford

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS1-5

CLIENT Public Works and Government Services Canada
LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON
DATES: BORING August 31, 2005
WATER LEVEL --
PROJECT No. 1004315
DATUM --
TPC ELEV. --

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
						● 20 40 60 80 ▲ 100 200 300 400				
0		SAND and GRAVEL, with organics			0		AS	1	--	
		END OF BOREHOLE at approximately 0.2 m			1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS1-5 submitted for BTEX, ICP25, PAHs, and PHC (F1-F4) analyses

Jacques Whitford

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS1-6

CLIENT Public Works and Government Services Canada
PROJECT No. 1004315
LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON
DATUM --
DATES: BORING August 31, 2005
WATER LEVEL --
TPC ELEV. --

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm ● 20 40 60 80 ▲ 100 200 300 400	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0		SAND and GRAVEL, with organics			0		AS	1	--	
		END OF BOREHOLE at approximately 0.2 m								
					1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS1-6 submitted for BTEX, ICP25, PAHs, and PHC (F1-F4) analyses

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS1-7

CLIENT Public Works and Government Services Canada

PROJECT No. 1004315

LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON

DATUM --

DATES: BORING August 31, 2005

WATER LEVEL --

TPC ELEV. --

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm ● 20 40 60 80 ▲ 100 200 300 400	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0		SAND			0		AS	1	--	
		END OF BOREHOLE at approximately 0.3 m			1					
					2					
					3					
1					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS1-7 submitted for BTEX, ICP25, PAHs, PCBs, and PHC (F1-F4) analyses

Jacques Whitford

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS1-8

CLIENT Public Works and Government Services Canada

LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON

DATES: BORING August 31, 2005

WATER LEVEL --

PROJECT No. 1004315

DATUM --

TPC ELEV. --

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm ● 20 40 60 80 ▲ 100 200 300 400	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0		SAND			0		AS	1	--	
		END OF BOREHOLE at approximately 0.3 m			1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS1-8 submitted for BTEX, ICP25, PAHs, and PHC (F1-F4) analyses

Jacques Whitford

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS1-9

CLIENT Public Works and Government Services Canada
PROJECT No. 1004315
LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON
DATUM --
DATES: BORING August 31, 2005
WATER LEVEL --
TPC ELEV. --

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm ● 20 40 60 80 ▲ 100 200 300 400	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0		SAND	⁘		0		AS	1	--	
		END OF BOREHOLE at approximately 0.3 m			1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS1-9 submitted for BTEX, ICP25, PAHs, and PHC (F1-F4) analyses

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS1-10

CLIENT Public Works and Government Services Canada

PROJECT No. 1004315

LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON

DATUM --

DATES: BORING August 31, 2005

WATER LEVEL --

TPC ELEV. --

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm ● 20 40 60 80 ▲ 100 200 300 400	SAMPLES			WELL CONSTRUCTION
							TYPE	NUMBER	N-VALUE	
0		GRAVEL, with organics			0		AS	1	--	
		END OF BOREHOLE at approximately 0.1 m			1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS1-10 submitted for BTEX, ICP25, PAHs, and PHC (F1-F4) analyses

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS2-2

CLIENT Public Works and Government Services Canada

LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON

DATES: BORING August 31, 2005

WATER LEVEL --

PROJECT No. 1004315

DATUM --

TPC ELEV. --

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm ● 20 40 60 80 ▲ 100 200 300 400	SAMPLES			WELL CONSTRUCTION
							TYPE	NUMBER	N-VALUE	
0		GRAVEL, with organics			0		AS	1	--	
		END OF BOREHOLE at approximately 0.2 m			1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS2-2 submitted for BTEX, ICP25, PAHs, and PHC (F1-F4) analyses

Jacques Whitford

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS2-4

CLIENT Public Works and Government Services Canada

LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON

DATES: BORING August 31, 2005

WATER LEVEL --

PROJECT No. 1004315

DATUM --

TPC ELEV. --

							SAMPLES			
DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm ● 20 40 60 80 ▲ 100 200 300 400	TYPE	NUMBER	N-VALUE	WELL CONSTRUCTION
0		GRAVEL, with organics			0		AS	1	--	
		END OF BOREHOLE at approximately 0.2 m			1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS2-4 submitted for BTEX, ICP25, PAHs, and PHC (F1-F4) analyses

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS2-5

CLIENT Public Works and Government Services Canada
PROJECT No. 1004315
LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON
DATUM --
DATES: BORING August 31, 2005
WATER LEVEL --
TPC ELEV. --

VAPOUR CONCENTRATIONS: ● %LEL ▲ ppm
● 20 40 60 80
▲ 100 200 300 400

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0		GRAVEL, with organics	●		0		AS	1	--	
		END OF BOREHOLE at approximately 0.2 m			1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS2-5 submitted for BTEX, ICP25, PAHs, and PHC (F1-F4) analyses

JACQUES WHITFORD LIMITED

BOREHOLE RECORD

CS2-6

CLIENT Public Works and Government Services Canada
PROJECT No. 1004315
LOCATION Canadian Coast Guard Light Station, Michipicoten Island, Lake Superior, ON
DATUM --
DATES: BORING August 31, 2005
WATER LEVEL --
TPC ELEV. --

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm ● 20 40 60 80 ▲ 100 200 300 400	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0		GRAVEL, with organics			0		AS	1	--	
		END OF BOREHOLE at approximately 0.2 m			1					
					2					
					3					
1										
					4					
					5					
					6					
2										

LABORATORY ANALYSES: Soil sample CS2-6 submitted for BTEX, ICP25, PAHs, and PHC (F1-F4) analyses

Jacques Whitford

APPENDIX 5

Laboratory Certificate of Analyses

Maxxam
Analytics Inc

Driven by service and Science
www.maxxamanalytics.com

Your P.O. #: NSD016300
Your Project #: ONT1004315/SUPERIOR
Site: SUPERIOR
Your C.O.C. #: 39085

RECEIVED
OCT 13 2005

Attention: Michael Farnsworth
Jacques Whitford Limited {R}
Markham - Standing Offer
7271 Warden Ave
Markham, ON
L3R 5X5

Report Date: 2005/10/04
This report dated: 2005/10/04 supersedes previous report dated: 2005/09/21

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A585922
Received: 2005/09/02, 13:51

Sample Matrix: SOLID
Samples Received: 16

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Petroleum Hydro. CCME FI& BTEX in Soil	16	2005/09/06	2005/09/09	Ont SOP-0816	CCME CWS
Petroleum Hydrocarbons F2-F4 in Soil	16	2005/09/06	2005/09/06	Ont SOP-0817	CCME CWS
Mercury in Soil by CVAA	15	2005/09/08	2005/09/08	Ont SOP 0112	EPA 7470
Mercury in Soil by CVAA	1	2005/09/13	2005/09/14	Ont SOP 0112	EPA 7470
Total Metals in Soil by Axial ICP-AES	15	2005/09/08	2005/09/14	SOP ING-101	EPA SW846-M6010B
Total Metals in Soil by Axial ICP-AES	1	2005/09/13	2005/09/15	SOP ING-101	EPA SW846-M6010B
MOISTURE	16	N/A	2005/09/07	Ont SOP-0114	MOE HANDBOOK(198
PAH Compounds in Soil by GC/MS (SIM)	1	2005/09/06	2005/09/07	EPA 8270	GC/MS
PAH Compounds in Soil by GC/MS (SIM)	12	2005/09/07	2005/09/08	EPA 8270	GC/MS
PAH Compounds in Soil by GC/MS (SIM)	3	2005/09/08	2005/09/13	EPA 8270	GC/MS
Polychlorinated Biphenyl in Soil	2	2005/09/07	2005/09/07	Ont SOP 0127	SW 846 3rd Edition

MAXXAM ANALYTICS INC.

Ewa Pranjic
CHEMIST

EWA PRANJIC, M.Sc., C.Chem
Senior Supervisor, Trace Organics, Pesticides

EP/fds
encl.

Total cover pages: 1

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

RESULTS OF ANALYSES OF SOLID

Maxxam ID		I00142	I00143	I00144	I00145	I00146	I00147		
Sampling Date		2005/08/31	2005/08/31	2005/08/31	2005/08/31	2005/08/31	2005/08/31		
COC Number		390851	390851	390851	390851	390851	390851		
	Units	**CS1-1**	**CS1-2**	**CS1-3**	**CS1-4**	**CS1-5**	**CS1-6**	**RDL**	**QC Batch**
INORGANICS									
Moisture	%	2.5	15	11	13	18	29	0.2	815611

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		I00148	I00149	I00150	I00151	I00152	I00153		
Sampling Date		2005/08/31	2005/08/31	2005/08/31	2005/08/31	2005/08/31	2005/08/31		
COC Number		390851	390851	390851	390851	390851	390851		
	Units	**CS1-7**	**CS1-8**	**CS1-9**	**CS1-10**	**CS1-66**	**CS2-2**	**RDL**	**QC Batch**
INORGANICS									
Moisture	%	78	71	59	33	60	8.7	0.2	815611

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		I00154	I00155	I00156		I00157		
Sampling Date		2005/08/31	2005/08/31	2005/08/31		2005/08/31		
COC Number		390851	390851	390851		390851		
	Units	**CS2-4**	**CS2-5**	**CS2-6**	**QC Batch**	**CS2-S5**	**RDL**	**QC Batch**
INORGANICS								
Moisture	%	16	4.0	16	815611	3.5	0.2	815619

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

ELEMENTS BY ATOMIC SPECTROSCOPY (SOLID)

Maxxam ID		I00142	I00143			I00144		
Sampling Date		2005/08/31	2005/08/31			2005/08/31		
COC Number		390851	390851			390851		
	Units	CS1-1	CS1-2	RDL	QC Batch	CS1-3	RDL	QC Batch
METALS								
Total Aluminum (Al)	ug/g	15000	2300	50	815837	4600	50	818983
Total Antimony (Sb)	ug/g	1	ND	1	815837	3	1	818983
Total Arsenic (As)	ug/g	12	3	1	815837	18	1	818983
Total Barium (Ba)	ug/g	350	690	0.5	815837	1200	0.5	818983
Total Beryllium (Be)	ug/g	2.4	ND	0.5	815837	ND	0.5	818983
Total Cadmium (Cd)	ug/g	4.4	ND	0.3	815837	4.2	0.3	818983
Total Calcium (Ca)	ug/g	14000	2100	50	815837	17000	50	818983
Total Chromium (Cr)	ug/g	14	10	0.5	815837	58	0.5	818983
Total Cobalt (Co)	ug/g	4.0	3.2	0.5	815837	6.1	0.5	818983
Total Copper (Cu)	ug/g	120	70	0.5	815837	96	0.5	818983
Total Iron (Fe)	ug/g	8000	15000	50	815837	9200	50	818983
Total Lead (Pb)	ug/g	580	310	1	815837	5800	1	818983
Total Magnesium (Mg)	ug/g	1300	1500	50	815837	1700	50	818983
Total Manganese (Mn)	ug/g	510	110	1	815837	560	1	818983
Acid Extractable Mercury (Hg)	ug/g	0.48	0.08	0.05	816099	1.88	0.25	819276
Total Molybdenum (Mo)	ug/g	1.1	ND	0.5	815837	3.2	0.5	818983
Total Nickel (Ni)	ug/g	7.4	4.9	0.5	815837	7.4	0.5	818983
Total Phosphorus (P)	ug/g	2100	310	20	815837	990	20	818983
Total Potassium (K)	ug/g	310	ND	200	815837	540	200	818983
Total Selenium (Se)	ug/g	1	ND	1	815837	2	1	818983
Total Silver (Ag)	ug/g	ND	ND	0.3	815837	ND	0.3	818983
Total Sodium (Na)	ug/g	ND	110	100	815837	ND	100	818983
Total Titanium (Ti)	ug/g	210	600	5	815837	240	5	818983
Total Vanadium (V)	ug/g	14	37	0.5	815837	14	0.5	818983
Total Zinc (Zn)	ug/g	820	85	3	815837	3400	3	818983

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

ELEMENTS BY ATOMIC SPECTROSCOPY (SOLID)

Maxxam ID		I00145			I00146		
Sampling Date		2005/08/31			2005/08/31		
COC Number		390851			390851		
	Units	**CS1-4**	**RDL**	**QC Batch**	**CS1-5**	**RDL**	**QC Batch**
METALS							
Total Aluminum (Al)	ug/g	7500	50	815837	5500	50	815828
Total Antimony (Sb)	ug/g	1	1	815837	2	1	815828
Total Arsenic (As)	ug/g	20	1	815837	11	1	815828
Total Barium (Ba)	ug/g	610	0.5	815837	430	0.5	815828
Total Beryllium (Be)	ug/g	1.1	0.5	815837	0.8	0.5	815828
Total Cadmium (Cd)	ug/g	1.8	0.3	815837	1.7	0.3	815828
Total Calcium (Ca)	ug/g	14000	50	815837	8700	50	815828
Total Chromium (Cr)	ug/g	15	0.5	815837	13	0.5	815828
Total Cobalt (Co)	ug/g	4.2	0.5	815837	3.2	0.5	815828
Total Copper (Cu)	ug/g	130	0.5	815837	77	0.5	815828
Total Iron (Fe)	ug/g	11000	50	815837	8600	50	815828
Total Lead (Pb)	ug/g	1600	1	815837	1100	1	815828
Total Magnesium (Mg)	ug/g	1800	50	815837	740	50	815828
Total Manganese (Mn)	ug/g	880	1	815837	360	1	815828
Acid Extractable Mercury (Hg)	ug/g	1.02	0.25	816099	1.66	0.05	816093
Total Molybdenum (Mo)	ug/g	0.8	0.5	815837	1.9	0.5	815828
Total Nickel (Ni)	ug/g	6.0	0.5	815837	5.3	0.5	815828
Total Phosphorus (P)	ug/g	1800	20	815837	1100	20	815828
Total Potassium (K)	ug/g	520	200	815837	300	200	815828
Total Selenium (Se)	ug/g	1	1	815837	3	1	815828
Total Silver (Ag)	ug/g	ND	0.3	815837	ND	0.3	815828
Total Sodium (Na)	ug/g	ND	100	815837	ND	100	815828
Total Titanium (Ti)	ug/g	240	5	815837	140	5	815828
Total Vanadium (V)	ug/g	18	0.5	815837	13	0.5	815828
Total Zinc (Zn)	ug/g	740	3	815837	590	3	815828

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

ELEMENTS BY ATOMIC SPECTROSCOPY (SOLID)

Maxxam ID		I00147	I00148	I00149		I00150		
Sampling Date		2005/08/31	2005/08/31	2005/08/31		2005/08/31		
COC Number		390851	390851	390851		390851		
	Units	**CS1-6**	**CS1-7**	**CS1-8**	**QC Batch**	**CS1-9**	**RDL**	**QC Batch**
METALS								
Total Aluminum (Al)	ug/g	12000	20000	29000	815837	21000	50	815837
Total Antimony (Sb)	ug/g	ND	ND	ND	815837	ND	1	815837
Total Arsenic (As)	ug/g	12	37	99	815837	57	1	815837
Total Barium (Ba)	ug/g	140	640	320	815837	560	0.5	815837
Total Beryllium (Be)	ug/g	1.2	4.2	4.8	815837	4.4	0.5	815837
Total Cadmium (Cd)	ug/g	0.7	1.8	3.0	815837	2.1	0.3	815837
Total Calcium (Ca)	ug/g	3200	13000	5900	815837	9400	50	815837
Total Chromium (Cr)	ug/g	17	6.7	5.9	815837	7.3	0.5	815837
Total Cobalt (Co)	ug/g	13	6.3	10	815837	19	0.5	815837
Total Copper (Cu)	ug/g	74	30	25	815837	49	0.5	815837
Total Iron (Fe)	ug/g	14000	9000	22000	815837	15000	50	815837
Total Lead (Pb)	ug/g	250	64	48	815837	97	1	815837
Total Magnesium (Mg)	ug/g	640	880	480	815837	770	50	815837
Total Manganese (Mn)	ug/g	310	6000	1300	815837	5800	1	815837
Acid Extractable Mercury (Hg)	ug/g	0.14	0.24	0.39	816099	0.46	0.05	816093
Total Molybdenum (Mo)	ug/g	3.1	3.5	3.5	815837	1.6	0.5	815837
Total Nickel (Ni)	ug/g	23	3.3	2.4	815837	3.9	0.5	815837
Total Phosphorus (P)	ug/g	890	2100	1600	815837	2000	20	815837
Total Potassium (K)	ug/g	1100	500	250	815837	440	200	815837
Total Selenium (Se)	ug/g	1	4	2	815837	3	1	815837
Total Silver (Ag)	ug/g	ND	ND	ND	815837	ND	0.3	815837
Total Sodium (Na)	ug/g	470	ND	ND	815837	ND	100	815837
Total Titanium (Ti)	ug/g	130	120	140	815837	180	5	815837
Total Vanadium (V)	ug/g	27	27	60	815837	33	0.5	815837
Total Zinc (Zn)	ug/g	150	55	76	815837	150	3	815837

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

ELEMENTS BY ATOMIC SPECTROSCOPY (SOLID)

Maxxam ID		I00151		I00152	I00153	I00154		
Sampling Date		2005/08/31		2005/08/31	2005/08/31	2005/08/31		
COC Number		390851		390851	390851	390851		
	Units	**CS1-10**	**QC Batch**	**CS1-66**	**CS2-2**	**CS2-4**	**RDL**	**QC Batch**
METALS								
Total Aluminum (Al)	ug/g	16000	815837	24000	7100	6400	50	815828
Total Antimony (Sb)	ug/g	1	815837	ND	ND	ND	1	815828
Total Arsenic (As)	ug/g	7	815837	57	25	5	1	815828
Total Barium (Ba)	ug/g	260	815837	660	180	59	0.5	815828
Total Beryllium (Be)	ug/g	0.8	815837	5.1	1.0	0.8	0.5	815828
Total Cadmium (Cd)	ug/g	1.0	815837	2.8	0.8	1.4	0.3	815828
Total Calcium (Ca)	ug/g	17000	815837	12000	1800	95000	50	815828
Total Chromium (Cr)	ug/g	16	815837	8.0	3.7	16	0.5	815828
Total Cobalt (Co)	ug/g	4.5	815837	23	2.9	4.8	0.5	815828
Total Copper (Cu)	ug/g	57	815837	58	22	21	0.5	815828
Total Iron (Fe)	ug/g	13000	815837	15000	13000	13000	50	815828
Total Lead (Pb)	ug/g	390	815837	110	21	63	1	815828
Total Magnesium (Mg)	ug/g	3700	815837	900	1800	45000	50	815828
Total Manganese (Mn)	ug/g	570	815837	7500	250	1000	1	815828
Acid Extractable Mercury (Hg)	ug/g	0.12	816099	0.49	0.08	0.21	0.05	816093
Total Molybdenum (Mo)	ug/g	0.8	815837	1.6	ND	0.6	0.5	815828
Total Nickel (Ni)	ug/g	8.6	815837	4.2	3.0	37	0.5	815828
Total Phosphorus (P)	ug/g	830	815837	2200	800	460	20	815828
Total Potassium (K)	ug/g	2700	815837	570	740	850	200	815828
Total Selenium (Se)	ug/g	ND	815837	4	ND	ND	1	815828
Total Silver (Ag)	ug/g	ND	815837	ND	ND	ND	0.3	815828
Total Sodium (Na)	ug/g	400	815837	ND	ND	180	100	815828
Total Titanium (Ti)	ug/g	400	815837	180	230	170	5	815828
Total Vanadium (V)	ug/g	18	815837	36	19	17	0.5	815828
Total Zinc (Zn)	ug/g	220	815837	180	34	360	3	815828

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

ELEMENTS BY ATOMIC SPECTROSCOPY (SOLID)

Maxxam ID		I00155		I00156	I00157		
Sampling Date		2005/08/31		2005/08/31	2005/08/31		
COC Number		390851		390851	390851		
	Units	**CS2-5**	**QC Batch**	**CS2-6**	**CS2-S5**	**RDL**	**QC Batch**
METALS							
Total Aluminum (Al)	ug/g	10000	815828	9600	11000	50	815837
Total Antimony (Sb)	ug/g	1	815828	1	ND	1	815837
Total Arsenic (As)	ug/g	19	815828	20	23	1	815837
Total Barium (Ba)	ug/g	440	815828	260	310	0.5	815837
Total Beryllium (Be)	ug/g	1.1	815828	0.7	0.8	0.5	815837
Total Cadmium (Cd)	ug/g	3.7	815828	2.4	3.3	0.3	815837
Total Calcium (Ca)	ug/g	4000	815828	2400	2400	50	815837
Total Chromium (Cr)	ug/g	10	815828	12	13	0.5	815837
Total Cobalt (Co)	ug/g	3.9	815828	3.7	4.8	0.5	815837
Total Copper (Cu)	ug/g	76	815828	82	76	0.5	815837
Total Iron (Fe)	ug/g	15000	815828	15000	16000	50	815837
Total Lead (Pb)	ug/g	110	815828	86	98	1	815837
Total Magnesium (Mg)	ug/g	1100	815828	1000	1200	50	815837
Total Manganese (Mn)	ug/g	820	815828	430	730	1	815837
Acid Extractable Mercury (Hg)	ug/g	0.26	816093	0.21	0.15	0.05	816099
Total Molybdenum (Mo)	ug/g	1.0	815828	1.7	1.9	0.5	815837
Total Nickel (Ni)	ug/g	9.1	815828	8.6	11	0.5	815837
Total Phosphorus (P)	ug/g	1800	815828	1700	1500	20	815837
Total Potassium (K)	ug/g	830	815828	1100	1100	200	815837
Total Selenium (Se)	ug/g	3	815828	1	2	1	815837
Total Silver (Ag)	ug/g	ND	815828	0.5	0.6	0.3	815837
Total Sodium (Na)	ug/g	ND	815828	ND	ND	100	815837
Total Titanium (Ti)	ug/g	200	815828	290	380	5	815837
Total Vanadium (V)	ug/g	22	815828	27	27	0.5	815837
Total Zinc (Zn)	ug/g	180	815828	140	150	3	815837

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

SEMI-VOLATILE ORGANICS BY GC-MS (SOLID)

Maxxam ID		I00142		I00143		I00144		
Sampling Date		2005/08/31		2005/08/31		2005/08/31		
COC Number		390851		390851		390851		
	Units	**CS1-1**	**RDL**	**CS1-2**	**RDL**	**CS1-3**	**RDL**	**QC Batch**

PAHs								
Acenaphthene	ug/g	ND	0.05	ND	0.01	ND	0.05	814773
Acenaphthylene	ug/g	ND	0.03	ND	0.005	0.05	0.03	814773
Anthracene	ug/g	ND	0.03	ND	0.005	0.05	0.03	814773
Benzo(a)anthracene	ug/g	ND	0.05	ND	0.01	0.41	0.05	814773
Benzo(a)pyrene	ug/g	ND	0.03	ND	0.005	0.28	0.03	814773
Benzo(b/j)fluoranthene	ug/g	ND	0.03	ND	0.005	0.41	0.03	814773
Benzo(g,h,i)perylene	ug/g	ND	0.1	ND	0.02	0.2	0.1	814773
Benzo(k)fluoranthene	ug/g	ND	0.05	ND	0.01	0.19	0.05	814773
Chrysene	ug/g	ND	0.05	ND	0.01	0.35	0.05	814773
Dibenzo(a,h)anthracene	ug/g	ND	0.1	ND	0.02	ND	0.1	814773
Fluoranthene	ug/g	0.04	0.03	ND	0.005	0.61	0.03	814773
Fluorene	ug/g	ND	0.03	ND	0.005	ND	0.03	814773
Indeno(1,2,3-cd)pyrene	ug/g	ND	0.1	ND	0.02	0.2	0.1	814773
1-Methylnaphthalene	ug/g	ND	0.03	ND	0.005	0.05	0.03	814773
2-Methylnaphthalene	ug/g	0.04	0.03	ND	0.005	0.06	0.03	814773
Naphthalene	ug/g	ND	0.03	ND	0.005	0.05	0.03	814773
Phenanthrene	ug/g	ND	0.03	ND	0.005	0.20	0.03	814773
Pyrene	ug/g	0.13	0.03	ND	0.005	0.58	0.03	814773
Surrogate Recovery (%)								
D10-Anthracene	%	100		72		114		814773
D14-Terphenyl (FS)	%	98		68		90		814773
D8-Acenaphthylene	%	90		64		94		814773

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited (R)
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

SEMI-VOLATILE ORGANICS BY GC-MS (SOLID)

Maxxam ID		I00145		I00146		I00147	I00148		
Sampling Date		2005/08/31		2005/08/31		2005/08/31	2005/08/31		
COC Number		390851		390851		390851	390851		
	Units	**CS1-4**	**RDL**	**CS1-5**	**RDL**	**CS1-6**	**CS1-7**	**RDL**	**QC Batch**
PAHs									
Acenaphthene	ug/g	ND	0.01	ND	0.05	ND	ND	0.01	814773
Acenaphthylene	ug/g	0.021	0.005	0.27	0.03	ND	ND	0.005	814773
Anthracene	ug/g	0.007	0.005	0.58	0.03	ND	ND	0.005	814773
Benzo(a)anthracene	ug/g	0.04	0.01	2.69	0.05	ND	ND	0.01	814773
Benzo(a)pyrene	ug/g	0.043	0.005	1.50	0.03	ND	ND	0.005	814773
Benzo(b/j)fluoranthene	ug/g	0.050	0.005	1.81	0.03	ND	ND	0.005	814773
Benzo(g,h,i)perylene	ug/g	0.07	0.02	0.9	0.1	ND	ND	0.02	814773
Benzo(k)fluoranthene	ug/g	0.02	0.01	0.74	0.05	ND	ND	0.01	814773
Chrysene	ug/g	0.04	0.01	2.29	0.05	ND	ND	0.01	814773
Dibenzo(a,h)anthracene	ug/g	ND	0.02	0.3	0.1	ND	ND	0.02	814773
Fluoranthene	ug/g	0.043	0.005	4.88	0.03	0.011	ND	0.005	814773
Fluorene	ug/g	ND	0.005	ND	0.03	ND	ND	0.005	814773
Indeno(1,2,3-cd)pyrene	ug/g	0.05	0.02	1.2	0.1	ND	ND	0.02	814773
1-Methylnaphthalene	ug/g	0.009	0.005	ND	0.03	ND	0.117	0.005	814773
2-Methylnaphthalene	ug/g	0.011	0.005	ND	0.03	ND	ND	0.005	814773
Naphthalene	ug/g	0.025	0.005	ND	0.03	ND	ND	0.005	814773
Phenanthrene	ug/g	0.018	0.005	1.77	0.03	ND	ND	0.005	814773
Pyrene	ug/g	0.048	0.005	5.93	0.03	0.008	ND	0.005	814773
Surrogate Recovery (%)									
D10-Anthracene	%	73		112		73	77		814773
D14-Terphenyl (FS)	%	124		95		73	78		814773
D8-Acenaphthylene	%	70		94		71	70		814773

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

SEMI-VOLATILE ORGANICS BY GC-MS (SOLID)

Maxxam ID		I00149	I00150		I00151		I00152		
Sampling Date		2005/08/31	2005/08/31		2005/08/31		2005/08/31		
COC Number		390851	390851		390851		390851		
	Units	CS1-8	CS1-9	RDL	CS1-10	RDL	CS1-66	RDL	QC Batch
PAHs									
Acenaphthene	ug/g	ND	ND	0.01	ND	0.05	ND	0.01	814773
Acenaphthylene	ug/g	ND	ND	0.005	ND	0.03	ND	0.005	814773
Anthracene	ug/g	ND	ND	0.005	ND	0.03	ND	0.005	814773
Benzo(a)anthracene	ug/g	ND	ND	0.01	0.34	0.05	ND	0.01	814773
Benzo(a)pyrene	ug/g	ND	ND	0.005	0.24	0.03	0.015	0.005	814773
Benzo(b/j)fluoranthene	ug/g	ND	ND	0.005	0.33	0.03	ND	0.005	814773
Benzo(g,h,i)perylene	ug/g	ND	ND	0.02	0.3	0.1	ND	0.02	814773
Benzo(k)fluoranthene	ug/g	ND	ND	0.01	0.13	0.05	ND	0.01	814773
Chrysene	ug/g	ND	ND	0.01	0.25	0.05	0.02	0.01	814773
Dibenzo(a,h)anthracene	ug/g	ND	ND	0.02	ND	0.1	ND	0.02	814773
Fluoranthene	ug/g	ND	ND	0.005	0.34	0.03	0.035	0.005	814773
Fluorene	ug/g	ND	ND	0.005	ND	0.03	ND	0.005	814773
Indeno(1,2,3-cd)pyrene	ug/g	ND	ND	0.02	0.3	0.1	ND	0.02	814773
1-Methylnaphthalene	ug/g	ND	ND	0.005	ND	0.03	ND	0.005	814773
2-Methylnaphthalene	ug/g	ND	ND	0.005	ND	0.03	ND	0.005	814773
Naphthalene	ug/g	ND	ND	0.005	ND	0.03	ND	0.005	814773
Phenanthrene	ug/g	ND	ND	0.005	0.15	0.03	ND	0.005	814773
Pyrene	ug/g	ND	ND	0.005	0.56	0.03	0.045	0.005	814773
Surrogate Recovery (%)									
D10-Anthracene	%	72	72		100		70		814773
D14-Terphenyl (FS)	%	76	81		86		73		814773
D8-Acenaphthylene	%	60	68		86		69		814773

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

SEMI-VOLATILE ORGANICS BY GC-MS (SOLID)

Maxxam ID		I00153			I00154		
Sampling Date		2005/08/31			2005/08/31		
COC Number		390851			390851		
	Units	CS2-2	RDL	QC Batch	CS2-4	RDL	QC Batch
PAHs							
Acenaphthene	ug/g	ND	0.01	814014	ND	0.05	815698
Acenaphthylene	ug/g	ND	0.005	814014	ND	0.03	815698
Anthracene	ug/g	ND	0.005	814014	ND	0.03	815698
Benzo(a)anthracene	ug/g	ND	0.01	814014	0.07	0.05	815698
Benzo(a)pyrene	ug/g	ND	0.005	814014	ND	0.03	815698
Benzo(b/j)fluoranthene	ug/g	ND	0.005	814014	0.08	0.03	815698
Benzo(g,h,i)perylene	ug/g	ND	0.02	814014	ND	0.1	815698
Benzo(k)fluoranthene	ug/g	ND	0.01	814014	ND	0.05	815698
Chrysene	ug/g	ND	0.01	814014	0.06	0.05	815698
Dibenzo(a,h)anthracene	ug/g	ND	0.02	814014	ND	0.1	815698
Fluoranthene	ug/g	ND	0.005	814014	0.06	0.03	815698
Fluorene	ug/g	ND	0.005	814014	ND	0.03	815698
Indeno(1,2,3-cd)pyrene	ug/g	ND	0.02	814014	ND	0.1	815698
1-Methylnaphthalene	ug/g	ND	0.005	814014	ND	0.03	815698
2-Methylnaphthalene	ug/g	ND	0.005	814014	ND	0.03	815698
Naphthalene	ug/g	ND	0.005	814014	ND	0.03	815698
Phenanthrene	ug/g	ND	0.005	814014	0.03	0.03	815698
Pyrene	ug/g	ND	0.005	814014	0.05	0.03	815698
Surrogate Recovery (%)							
2-Fluorobiphenyl	%	98		814014	92		815698
D10-Anthracene	%	126		814014	126		815698
D14-Terphenyl (FS)	%	114		814014	86		815698
D5-Nitrobenzene	%	98		814014	73		815698
D8-Acenaphthylene	%	115		814014	94		815698

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited (R)
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

SEMI-VOLATILE ORGANICS BY GC-MS (SOLID)

Maxxam ID		I00155		I00156	I00157		
Sampling Date		2005/08/31		2005/08/31	2005/08/31		
COC Number		390851		390851	390851		
	Units	CS2-5	QC Batch	CS2-6	CS2-S5	RDL	QC Batch
PAHs							
Acenaphthene	ug/g	ND	814770	ND	ND	0.01	815698
Acenaphthylene	ug/g	ND	814770	ND	ND	0.005	815698
Anthracene	ug/g	ND	814770	ND	ND	0.005	815698
Benzo(a)anthracene	ug/g	0.03	814770	ND	0.02	0.01	815698
Benzo(a)pyrene	ug/g	ND	814770	ND	ND	0.005	815698
Benzo(b/j)fluoranthene	ug/g	ND	814770	ND	ND	0.005	815698
Benzo(g,h,i)perylene	ug/g	ND	814770	ND	ND	0.02	815698
Benzo(k)fluoranthene	ug/g	ND	814770	ND	ND	0.01	815698
Chrysene	ug/g	ND	814770	ND	ND	0.01	815698
Dibenzo(a,h)anthracene	ug/g	ND	814770	ND	ND	0.02	815698
Fluoranthene	ug/g	ND	814770	ND	0.017	0.005	815698
Fluorene	ug/g	ND	814770	ND	ND	0.005	815698
Indeno(1,2,3-cd)pyrene	ug/g	ND	814770	ND	ND	0.02	815698
1-Methylnaphthalene	ug/g	0.008	814770	ND	ND	0.005	815698
2-Methylnaphthalene	ug/g	0.019	814770	ND	ND	0.005	815698
Naphthalene	ug/g	ND	814770	ND	ND	0.005	815698
Phenanthrene	ug/g	ND	814770	ND	0.013	0.005	815698
Pyrene	ug/g	0.010	814770	ND	0.013	0.005	815698
Surrogate Recovery (%)							
2-Fluorobiphenyl	%			88	65		815698
D10-Anthracene	%	71	814770	97	78		815698
D14-Terphenyl (FS)	%	69	814770	93	68		815698
D5-Nitrobenzene	%			81	58		815698
D8-Acenaphthylene	%	69	814770	88	69		815698

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		I00142	I00143	I00144	I00145	I00146		
Sampling Date		2005/08/31	2005/08/31	2005/08/31	2005/08/31	2005/08/31		
COC Number		390851	390851	390851	390851	390851		
	Units	**CS1-1**	**CS1-2**	**CS1-3**	**CS1-4**	**CS1-5**	**RDL**	**QC Batch**
F1 PHC and BTEX								
Benzene	ug/g	ND	ND	ND	ND	ND	0.020	814088
Toluene	ug/g	ND	ND	ND	ND	ND	0.020	814088
Ethylbenzene	ug/g	ND	ND	ND	ND	ND	0.020	814088
o-Xylene	ug/g	ND	ND	ND	ND	ND	0.020	814088
p+m-Xylene	ug/g	ND	ND	0.040	ND	ND	0.040	814088
Total Xylenes	ug/g	ND	ND	ND	ND	ND	0.040	814088
F1 (C6-C10)	ug/g	ND	ND	ND	ND	ND	10	814088
F1 (C6-C10) - BTEX	ug/g	ND	ND	ND	ND	ND	10	814088
F2-F4 PHC								
F2 (C10-C16 Hydrocarbons)	ug/g	31	18	ND	ND	ND	10	814328
F3 (C16-C34 Hydrocarbons)	ug/g	5500	26	890	55	180	10	814328
F4 (C34-C50 Hydrocarbons)	ug/g	550	ND	570	16	44	10	814328
Reached Baseline at C50	ug/g	NO	YES	YES	YES	YES		814328
Surrogate Recovery (%)								
1,4-Difluorobenzene	%	102	98	100	101	99		814088
4-Bromofluorobenzene	%	102	98	98	98	100		814088
D10-Ethylbenzene	%	86	81	82	87	83		814088
D4-1,2-Dichloroethane	%	100	102	105	105	104		814088
o-Terphenyl	%	88	101	97	92	94		814328

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited (R)
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		I00147		I00148	I00149		
Sampling Date		2005/08/31		2005/08/31	2005/08/31		
COC Number		390851		390851	390851		
	Units	**CS1-6**	**RDL**	**CS1-7**	**CS1-8**	**RDL**	**QC Batch**
F1 PHC and BTEX							
Benzene	ug/g	ND	0.020	ND	ND	0.020	814088
Toluene	ug/g	ND	0.020	ND	ND	0.020	814088
Ethylbenzene	ug/g	ND	0.020	ND	ND	0.020	814088
o-Xylene	ug/g	ND	0.020	ND	ND	0.020	814088
p+m-Xylene	ug/g	ND	0.040	ND	ND	0.040	814088
Total Xylenes	ug/g	ND	0.040	ND	ND	0.040	814088
F1 (C6-C10)	ug/g	ND	10	ND	ND	10	814088
F1 (C6-C10) - BTEX	ug/g	ND	10	ND	ND	10	814088
F2-F4 PHC							
F2 (C10-C16 Hydrocarbons)	ug/g	ND	10	ND	ND	40	814328
F3 (C16-C34 Hydrocarbons)	ug/g	99	10	ND	62	40	814328
F4 (C34-C50 Hydrocarbons)	ug/g	55	10	ND	ND	40	814328
Reached Baseline at C50	ug/g	YES		YES	YES		814328
Surrogate Recovery (%)							
1,4-Difluorobenzene	%	100		100	99		814088
4-Bromofluorobenzene	%	98		99	99		814088
D10-Ethylbenzene	%	81		83	87		814088
D4-1,2-Dichloroethane	%	103		102	103		814088
o-Terphenyl	%	101		89	88		814328

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		I00150		I00151		I00152		
Sampling Date		2005/08/31		2005/08/31		2005/08/31		
COC Number		390851		390851		390851		
	Units	CS1-9	RDL	CS1-10	RDL	CS1-66	RDL	QC Batch
F1 PHC and BTEX								
Benzene	ug/g	ND	0.020	ND	0.020	ND	0.020	814088
Toluene	ug/g	ND	0.020	ND	0.020	ND	0.020	814088
Ethylbenzene	ug/g	ND	0.020	ND	0.020	ND	0.020	814088
o-Xylene	ug/g	ND	0.020	ND	0.020	ND	0.020	814088
p+m-Xylene	ug/g	ND	0.040	ND	0.040	ND	0.040	814088
Total Xylenes	ug/g	ND	0.040	ND	0.040	ND	0.040	814088
F1 (C6-C10)	ug/g	ND	10	ND	10	ND	10	814088
F1 (C6-C10) - BTEX	ug/g	ND	10	ND	10	ND	10	814088
F2-F4 PHC								
F2 (C10-C16 Hydrocarbons)	ug/g	ND	20	16	10	ND	20	814328
F3 (C16-C34 Hydrocarbons)	ug/g	200	20	320	10	100	20	814328
F4 (C34-C50 Hydrocarbons)	ug/g	52	20	140	10	ND	20	814328
Reached Baseline at C50	ug/g	YES		YES		YES		814328
Surrogate Recovery (%)								
1,4-Difluorobenzene	%	99		99		98		814088
4-Bromofluorobenzene	%	99		100		98		814088
D10-Ethylbenzene	%	81		80		83		814088
D4-1,2-Dichloroethane	%	103		102		102		814088
o-Terphenyl	%	103		97		117		814328

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		I00153	I00154	I00155	I00156	I00157		
Sampling Date		2005/08/31	2005/08/31	2005/08/31	2005/08/31	2005/08/31		
COC Number		390851	390851	390851	390851	390851		
	Units	**CS2-2**	**CS2-4**	**CS2-5**	**CS2-6**	**CS2-S5**	**RDL**	**QC Batch**
F1 PHC and BTEX								
Benzene	ug/g	ND	ND	ND	ND	ND	0.020	814088
Toluene	ug/g	0.12	ND	ND	ND	ND	0.020	814088
Ethylbenzene	ug/g	ND	ND	ND	ND	ND	0.020	814088
o-Xylene	ug/g	ND	ND	ND	ND	ND	0.020	814088
p+m-Xylene	ug/g	0.040	ND	ND	ND	ND	0.040	814088
Total Xylenes	ug/g	0.040	ND	ND	ND	ND	0.040	814088
F1 (C6-C10)	ug/g	ND	ND	ND	ND	ND	10	814088
F1 (C6-C10) - BTEX	ug/g	ND	ND	ND	ND	ND	10	814088
F2-F4 PHC								
F2 (C10-C16 Hydrocarbons)	ug/g	ND	58	10	ND	ND	10	814328
F3 (C16-C34 Hydrocarbons)	ug/g	210	2800	92	48	12	10	814328
F4 (C34-C50 Hydrocarbons)	ug/g	120	5000	23	ND	ND	10	814328
Reached Baseline at C50	ug/g	YES	NO	YES	YES	YES		814328
Surrogate Recovery (%)								
1,4-Difluorobenzene	%	100	101	100	101	100		814088
4-Bromofluorobenzene	%	99	98	100	99	98		814088
D10-Ethylbenzene	%	81	81	85	83	83		814088
D4-1,2-Dichloroethane	%	98	102	103	102	102		814088
o-Terphenyl	%	94	83	85	84	92		814328

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

POLYCHLORINATED BIPHENYLS BY GC-ECD (SOLID)

Maxxam ID		I00145	I00148		
Sampling Date		2005/08/31	2005/08/31		
COC Number		390851	390851		
	Units	**CS1-4**	**CS1-7**	**RDL**	**QC Batch**
PCBs					
Aroclor 1262	ug/g	ND	ND	0.01	814718
Aroclor 1016	ug/g	ND	ND	0.01	814718
Aroclor 1221	ug/g	ND	ND	0.02	814718
Aroclor 1232	ug/g	ND	ND	0.01	814718
Aroclor 1242	ug/g	ND	ND	0.02	814718
Aroclor 1248	ug/g	ND	ND	0.01	814718
Aroclor 1254	ug/g	ND	ND	0.01	814718
Aroclor 1260	ug/g	ND	ND	0.01	814718
Aroclor 1268	ug/g	ND	ND	0.01	814718
Total PCB	ug/g	ND	ND	0.02	814718
Surrogate Recovery (%)					
2,4,5,6-Tetrachloro-m-xylene	%	88	97		814718
Decachlorobiphenyl	%	81	87		814718

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A585922
Report Date: 2005/10/04

Jacques Whitford Limited {R}
Client Project #: ONT1004315/SUPERIOR
Project name: SUPERIOR
Your P.O. #: NSD016300
Sampler Initials:

GENERAL COMMENTS

Sample 100148-01: F2-F4 analysis: DL was adjusted because of the high moisture content.

Sample 100149-01: F2-F4 analysis: DL was adjusted because of the high moisture content.

Sample 100150-01: F2-F4 analysis: DL was adjusted because of the high moisture content.

Sample 100152-01: F2-F4 analysis: DL was adjusted because of the high moisture content.

Sample 100154-01: PAH Analysis: Due to coloured interferences, sample required dilution. DLs were adjusted accordingly.

ELEMENTS BY ATOMIC SPECTROSCOPY (SOLID)

Total Metals in Soil by Axial ICP-AES: ICPAXA-S
(Mo) was detected in the blank above Maxxam's acceptance criteria. This may represent a high bias for this element at low concentration.

SEMI-VOLATILE ORGANICS BY GC-MS (SOLID)

PAH Compounds in Soil by GC/MS (SIM): N/A: Target analyte could not be reported due to matrix interference.

PAH Compounds in Soil by GC/MS (SIM): The recoveries for the surrogate compound terphenyl-14 in the matrix spike and spiked blank are above the upper control limit. The recoveries for some target analytes in the spiked blank are above the upper control limits.These may represent a high bias in some results for some target analytes. The recoveries for some surrogate compounds in the blank are above the upper control limits. This has been evaluated as having no significant impact on the data reported.

PAH Compounds in Soil by GC/MS (SIM): The recovery of Acenaphthylene from the spiked blank was above the upper QC limit. The results for this parameter may be biased high.

PAH Compounds in Soil by GC/MS (SIM): The RPD between sample and its dupplicate for batch 814770 was above the QC limit for some of the parameters. This is likely due to sample geterogeneity.

Results relate only to the items tested.

Jacques Whitford Limited (R)
Attention: Michael Farnsworth
Client Project #: ONT1004315/SUPERIOR
P.O. #: NSD016300
Project name: SUPERIOR

Quality Assurance Report

Maxxam Job Number: MA585922

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
814014 MWG	MATRIX SPIKE	2-Fluorobiphenyl	2005/09/07		102	%	30 - 130
		D10-Anthracene	2005/09/07		122	%	30 - 130
		D14-Terphenyl (FS)	2005/09/07		140(1)	%	30 - 130
		D5-Nitrobenzene	2005/09/07		90	%	30 - 130
		D8-Acenaphthylene	2005/09/07		116	%	30 - 130
		Acenaphthene	2005/09/07		110	%	30 - 130
		Acenaphthylene	2005/09/07		112	%	30 - 130
		Anthracene	2005/09/07		118	%	30 - 130
		Benzo(a)anthracene	2005/09/07		115	%	30 - 130
		Benzo(a)pyrene	2005/09/07		101	%	30 - 130
		Benzo(b/j)fluoranthene	2005/09/07		125	%	30 - 130
		Benzo(g,h,i)perylene	2005/09/07		97	%	30 - 130
		Benzo(k)fluoranthene	2005/09/07		112	%	30 - 130
		Chrysene	2005/09/07		110	%	30 - 130
		Dibenzo(a,h)anthracene	2005/09/07		96	%	30 - 130
		Fluoranthene	2005/09/07		111	%	30 - 130
		Fluorene	2005/09/07		116	%	30 - 130
		Indeno(1,2,3-cd)pyrene	2005/09/07		101	%	30 - 130
		1-Methylnaphthalene	2005/09/07		101	%	30 - 130
		2-Methylnaphthalene	2005/09/07		100	%	30 - 130
		Naphthalene	2005/09/07		92	%	30 - 130
		Phenanthrene	2005/09/07		100	%	30 - 130
		Pyrene	2005/09/07		117	%	30 - 130
	Spiked Blank	2-Fluorobiphenyl	2005/09/07		120	%	30 - 130
		D10-Anthracene	2005/09/07		122	%	30 - 130
		D14-Terphenyl (FS)	2005/09/07		137(1)	%	30 - 130
		D5-Nitrobenzene	2005/09/07		116	%	30 - 130
		D8-Acenaphthylene	2005/09/07		127	%	30 - 130
		Acenaphthene	2005/09/07		128	%	30 - 130
		Acenaphthylene	2005/09/07		140(1)	%	30 - 130
		Anthracene	2005/09/07		134(1)	%	30 - 130
		Benzo(a)anthracene	2005/09/07		131(1)	%	30 - 130
		Benzo(a)pyrene	2005/09/07		100	%	30 - 130
		Benzo(b/j)fluoranthene	2005/09/07		124	%	30 - 130
		Benzo(g,h,i)perylene	2005/09/07		97	%	30 - 130
		Benzo(k)fluoranthene	2005/09/07		135(1)	%	30 - 130
		Chrysene	2005/09/07		129	%	30 - 130
		Dibenzo(a,h)anthracene	2005/09/07		91	%	30 - 130
		Fluoranthene	2005/09/07		146(1)	%	30 - 130
		Fluorene	2005/09/07		140(1)	%	30 - 130
		Indeno(1,2,3-cd)pyrene	2005/09/07		95	%	30 - 130
		1-Methylnaphthalene	2005/09/07		122	%	30 - 130
		2-Methylnaphthalene	2005/09/07		121	%	30 - 130
		Naphthalene	2005/09/07		113	%	30 - 130
		Phenanthrene	2005/09/07		139(1)	%	30 - 130
		Pyrene	2005/09/07		145(1)	%	30 - 130
	Method Blank	2-Fluorobiphenyl	2005/09/07		120	%	30 - 130
		D10-Anthracene	2005/09/07		138(1)	%	30 - 130
		D14-Terphenyl (FS)	2005/09/07		143(1)	%	30 - 130
		D5-Nitrobenzene	2005/09/07		116	%	30 - 130
		D8-Acenaphthylene	2005/09/07		138(1)	%	30 - 130
		Acenaphthene	2005/09/07	ND, DL=0.01		ug/g	
		Acenaphthylene	2005/09/07	ND, DL=0.005		ug/g	
		Anthracene	2005/09/07	ND, DL=0.005		ug/g	
		Benzo(a)anthracene	2005/09/07	ND, DL=0.01		ug/g	
		Benzo(a)pyrene	2005/09/07	ND, DL=0.005		ug/g	

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814014 MWG	Method Blank	Benzo(b/j)fluoranthene	2005/09/07	ND, DL=0.005		ug/g	
		Benzo(g,h,i)perylene	2005/09/07	ND, DL=0.02		ug/g	
		Benzo(k)fluoranthene	2005/09/07	ND, DL=0.01		ug/g	
		Chrysene	2005/09/07	ND, DL=0.01		ug/g	
		Dibenzo(a,h)anthracene	2005/09/07	ND, DL=0.02		ug/g	
		Fluoranthene	2005/09/07	ND, DL=0.005		ug/g	
		Fluorene	2005/09/07	ND, DL=0.005		ug/g	
		Indeno(1,2,3-cd)pyrene	2005/09/07	ND, DL=0.02		ug/g	
		1-Methylnaphthalene	2005/09/07	ND, DL=0.005		ug/g	
		2-Methylnaphthalene	2005/09/07	ND, DL=0.005		ug/g	
		Naphthalene	2005/09/07	ND, DL=0.005		ug/g	
		Phenanthrene	2005/09/07	ND, DL=0.005		ug/g	
		Pyrene	2005/09/07	ND, DL=0.005		ug/g	
	RPD	D14-Terphenyl (FS)	2005/09/07	4.4		%	N/A
		Acenaphthene	2005/09/07	NC		%	50
		Acenaphthylene	2005/09/07	19.3		%	50
		Anthracene	2005/09/07	97.1(1)		%	50
		Benzo(a)anthracene	2005/09/07	62.5(1)		%	50
		Benzo(a)pyrene	2005/09/07	45.8		%	50
		Benzo(b/j)fluoranthene	2005/09/07	37.7		%	50
		Benzo(g,h,i)perylene	2005/09/07	23.9		%	50
		Benzo(k)fluoranthene	2005/09/07	47.2		%	50
		Chrysene	2005/09/07	56.0(1)		%	50
		Dibenzo(a,h)anthracene	2005/09/07	NC		%	50
		Fluoranthene	2005/09/07	59.7(1)		%	50
		Fluorene	2005/09/07	NC		%	50
		Indeno(1,2,3-cd)pyrene	2005/09/07	33.1		%	50
		1-Methylnaphthalene	2005/09/07	NC		%	50
		2-Methylnaphthalene	2005/09/07	NC		%	50
		Naphthalene	2005/09/07	NC		%	50
		Phenanthrene	2005/09/07	88.4(1)		%	50
		Pyrene	2005/09/07	53.2(1)		%	50
814088 ABD	MATRIX SPIKE [I00145-01]	1,4-Difluorobenzene	2005/09/09		100	%	60 - 140
		4-Bromofluorobenzene	2005/09/09		99	%	60 - 140
		D10-Ethylbenzene	2005/09/09		84	%	30 - 130
		D4-1,2-Dichloroethane	2005/09/09		102	%	60 - 140
		Benzene	2005/09/09		89	%	60 - 140
		Toluene	2005/09/09		87	%	60 - 140
		Ethylbenzene	2005/09/09		87	%	60 - 140
		o-Xylene	2005/09/09		89	%	60 - 140
		p+m-Xylene	2005/09/09		88	%	60 - 140
		F1 (C6-C10)	2005/09/09		69	%	60 - 140
	Spiked Blank	1,4-Difluorobenzene	2005/09/09		101	%	60 - 140
		4-Bromofluorobenzene	2005/09/09		98	%	60 - 140
		D10-Ethylbenzene	2005/09/09		86	%	30 - 130
		D4-1,2-Dichloroethane	2005/09/09		105	%	60 - 140
		Benzene	2005/09/09		90	%	60 - 140
		Toluene	2005/09/09		92	%	60 - 140
		Ethylbenzene	2005/09/09		92	%	60 - 140
		o-Xylene	2005/09/09		94	%	60 - 140
		p+m-Xylene	2005/09/09		91	%	60 - 140
		F1 (C6-C10)	2005/09/09		61	%	60 - 140
	Method Blank	1,4-Difluorobenzene	2005/09/09		100	%	60 - 140
		4-Bromofluorobenzene	2005/09/09		100	%	60 - 140
		D10-Ethylbenzene	2005/09/09		86	%	30 - 130

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814088 ABD	Method Blank	D4-1,2-Dichloroethane	2005/09/09		105	%	60 - 140
		Benzene	2005/09/09	ND, DL=0.02		ug/g	
		Toluene	2005/09/09	ND, DL=0.02		ug/g	
		Ethylbenzene	2005/09/09	ND, DL=0.02		ug/g	
		o-Xylene	2005/09/09	ND, DL=0.02		ug/g	
		p+m-Xylene	2005/09/09	ND, DL=0.04		ug/g	
		Total Xylenes	2005/09/09	ND, DL=0.04		ug/g	
		F1 (C6-C10)	2005/09/09	ND, DL=10		ug/g	
		F1 (C6-C10) - BTEX	2005/09/09	ND, DL=10		ug/g	
	RPD [100145-01]	Benzene	2005/09/09	NC		%	50
		Toluene	2005/09/09	NC		%	50
		Ethylbenzene	2005/09/09	NC		%	50
		o-Xylene	2005/09/09	NC		%	50
		p+m-Xylene	2005/09/09	NC		%	50
		Total Xylenes	2005/09/09	NC		%	50
		F1 (C6-C10)	2005/09/09	NC		%	50
		F1 (C6-C10) - BTEX	2005/09/09	NC		%	50
814328 NCI	MATRIX SPIKE [100143-01]	o-Terphenyl	2005/09/06		100	%	30 - 130
		F2 (C10-C16 Hydrocarbons)	2005/09/06		67	%	60 - 140
		F3 (C16-C34 Hydrocarbons)	2005/09/06		67	%	60 - 140
		F4 (C34-C50 Hydrocarbons)	2005/09/06		67	%	60 - 140
	Spiked Blank	o-Terphenyl	2005/09/06		85	%	30 - 130
		F2 (C10-C16 Hydrocarbons)	2005/09/06		80	%	60 - 140
		F3 (C16-C34 Hydrocarbons)	2005/09/06		80	%	60 - 140
		F4 (C34-C50 Hydrocarbons)	2005/09/06		80	%	60 - 140
	Method Blank	o-Terphenyl	2005/09/06		82	%	30 - 130
		F2 (C10-C16 Hydrocarbons)	2005/09/06	ND, DL=10		ug/g	
		F3 (C16-C34 Hydrocarbons)	2005/09/06	ND, DL=10		ug/g	
		F4 (C34-C50 Hydrocarbons)	2005/09/06	ND, DL=10		ug/g	
	RPD [100143-01]	F2 (C10-C16 Hydrocarbons)	2005/09/06	NC		%	50
		F3 (C16-C34 Hydrocarbons)	2005/09/06	NC		%	50
		F4 (C34-C50 Hydrocarbons)	2005/09/06	NC		%	50
814718 ANL	MATRIX SPIKE [100145-03]	2,4,5,6-Tetrachloro-m-xylene	2005/09/07		92	%	40 - 130
		Decachlorobiphenyl	2005/09/07		92	%	40 - 130
		Aroclor 1260	2005/09/07		101	%	8 - 127
	Spiked Blank	2,4,5,6-Tetrachloro-m-xylene	2005/09/07		91	%	40 - 130
		Decachlorobiphenyl	2005/09/07		85	%	40 - 130
		Aroclor 1260	2005/09/07		91	%	53 - 135
	Method Blank	2,4,5,6-Tetrachloro-m-xylene	2005/09/07		87	%	40 - 130
		Decachlorobiphenyl	2005/09/07		81	%	40 - 130
		Aroclor 1262	2005/09/07	ND, DL=0.01		ug/g	
		Aroclor 1016	2005/09/07	ND, DL=0.01		ug/g	
		Aroclor 1221	2005/09/07	ND, DL=0.02		ug/g	
		Aroclor 1232	2005/09/07	ND, DL=0.01		ug/g	
		Aroclor 1242	2005/09/07	ND, DL=0.02		ug/g	
		Aroclor 1248	2005/09/07	ND, DL=0.01		ug/g	
		Aroclor 1254	2005/09/07	ND, DL=0.01		ug/g	
		Aroclor 1260	2005/09/07	ND, DL=0.01		ug/g	
		Aroclor 1268	2005/09/07	ND, DL=0.01		ug/g	
		Total PCB	2005/09/07	ND, DL=0.02		ug/g	
	RPD [100145-03]	Aroclor 1262	2005/09/07	NC		%	50
		Aroclor 1016	2005/09/07	NC		%	50
		Aroclor 1221	2005/09/07	NC		%	50
		Aroclor 1232	2005/09/07	NC		%	50

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814718 ANL	RPD [I00145-03]	Aroclor 1242	2005/09/07	NC		%	50
		Aroclor 1248	2005/09/07	NC		%	50
		Aroclor 1254	2005/09/07	NC		%	50
		Aroclor 1260	2005/09/07	NC		%	50
		Aroclor 1268	2005/09/07	NC		%	50
		Total PCB	2005/09/07	NC		%	50
814770 NMO	MATRIX SPIKE	D10-Anthracene	2005/09/08		99	%	30 - 130
		D14-Terphenyl (FS)	2005/09/08		93	%	30 - 130
		D8-Acenaphthylene	2005/09/08		103	%	30 - 130
		Acenaphthene	2005/09/08		92	%	30 - 130
		Acenaphthylene	2005/09/08		103	%	30 - 130
		Anthracene	2005/09/08		86	%	30 - 130
		Benzo(a)anthracene	2005/09/08		92	%	30 - 130
		Benzo(a)pyrene	2005/09/08		74	%	30 - 130
		Benzo(b/j)fluoranthene	2005/09/08		83	%	30 - 130
		Benzo(g,h,i)perylene	2005/09/08		62	%	30 - 130
		Benzo(k)fluoranthene	2005/09/08		80	%	30 - 130
		Chrysene	2005/09/08		86	%	30 - 130
		Dibenzo(a,h)anthracene	2005/09/08		58	%	30 - 130
		Fluoranthene	2005/09/08		82	%	30 - 130
		Fluorene	2005/09/08		99	%	30 - 130
		Indeno(1,2,3-cd)pyrene	2005/09/08		57	%	30 - 130
		1-Methylnaphthalene	2005/09/08		81	%	30 - 130
		2-Methylnaphthalene	2005/09/08		79	%	30 - 130
		Naphthalene	2005/09/08		70	%	30 - 130
		Phenanthrene	2005/09/08		80	%	30 - 130
		Pyrene	2005/09/08		84	%	30 - 130
	Spiked Blank	D10-Anthracene	2005/09/08		80	%	30 - 130
		D14-Terphenyl (FS)	2005/09/08		91	%	30 - 130
		D8-Acenaphthylene	2005/09/08		81	%	30 - 130
		Acenaphthene	2005/09/08		81	%	30 - 130
		Acenaphthylene	2005/09/08		95	%	30 - 130
		Anthracene	2005/09/08		72	%	30 - 130
		Benzo(a)anthracene	2005/09/08		107	%	30 - 130
		Benzo(a)pyrene	2005/09/08		69	%	30 - 130
		Benzo(b/j)fluoranthene	2005/09/08		73	%	30 - 130
		Benzo(g,h,i)perylene	2005/09/08		79	%	30 - 130
		Benzo(k)fluoranthene	2005/09/08		87	%	30 - 130
		Chrysene	2005/09/08		89	%	30 - 130
		Dibenzo(a,h)anthracene	2005/09/08		87	%	30 - 130
		Fluoranthene	2005/09/08		100	%	30 - 130
		Fluorene	2005/09/08		103	%	30 - 130
		Indeno(1,2,3-cd)pyrene	2005/09/08		121	%	30 - 130
		1-Methylnaphthalene	2005/09/08		81	%	30 - 130
		2-Methylnaphthalene	2005/09/08		82	%	30 - 130
		Naphthalene	2005/09/08		83	%	30 - 130
		Phenanthrene	2005/09/08		91	%	30 - 130
		Pyrene	2005/09/08		95	%	30 - 130
	Method Blank	D10-Anthracene	2005/09/08		89	%	30 - 130
		D14-Terphenyl (FS)	2005/09/08		85	%	30 - 130
		D8-Acenaphthylene	2005/09/08		75	%	30 - 130
		Acenaphthene	2005/09/08	ND, DL=0.01		ug/g	
		Acenaphthylene	2005/09/08	ND, DL=0.005		ug/g	
		Anthracene	2005/09/08	ND, DL=0.005		ug/g	
		Benzo(a)anthracene	2005/09/08	ND, DL=0.01		ug/g	
		Benzo(a)pyrene	2005/09/08	ND, DL=0.005		ug/g	

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QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
814770 NMO	Method Blank	Benzo(b/j)fluoranthene	2005/09/08	ND, DL=0.005		ug/g	
		Benzo(g,h,i)perylene	2005/09/08	ND, DL=0.02		ug/g	
		Benzo(k)fluoranthene	2005/09/08	ND, DL=0.01		ug/g	
		Chrysene	2005/09/08	ND, DL=0.01		ug/g	
		Dibenzo(a,h)anthracene	2005/09/08	ND, DL=0.02		ug/g	
		Fluoranthene	2005/09/08	ND, DL=0.005		ug/g	
		Fluorene	2005/09/08	ND, DL=0.005		ug/g	
		Indeno(1,2,3-cd)pyrene	2005/09/08	ND, DL=0.02		ug/g	
		1-Methylnaphthalene	2005/09/08	ND, DL=0.005		ug/g	
		2-Methylnaphthalene	2005/09/08	ND, DL=0.005		ug/g	
		Naphthalene	2005/09/08	ND, DL=0.005		ug/g	
		Phenanthrene	2005/09/08	ND, DL=0.005		ug/g	
		Pyrene	2005/09/08	ND, DL=0.005		ug/g	
	RPD	D14-Terphenyl (FS)	2005/09/08	8.0		%	N/A
		Acenaphthene	2005/09/08	NC		%	50
		Acenaphthylene	2005/09/08	NC		%	50
		Anthracene	2005/09/08	NC		%	50
		Benzo(a)anthracene	2005/09/08	61.5(1)		%	50
		Benzo(a)pyrene	2005/09/08	33.0		%	50
		Benzo(b/j)fluoranthene	2005/09/08	46.5		%	50
		Benzo(g,h,i)perylene	2005/09/08	NC		%	50
		Benzo(k)fluoranthene	2005/09/08	8.6		%	50
		Chrysene	2005/09/08	56.6(1)		%	50
		Dibenzo(a,h)anthracene	2005/09/08	NC		%	50
		Fluoranthene	2005/09/08	81.6(1)		%	50
		Fluorene	2005/09/08	NC		%	50
		Indeno(1,2,3-cd)pyrene	2005/09/08	22.8		%	50
		1-Methylnaphthalene	2005/09/08	NC		%	50
		2-Methylnaphthalene	2005/09/08	NC		%	50
		Naphthalene	2005/09/08	NC		%	50
		Phenanthrene	2005/09/08	104(1)		%	50
		Pyrene	2005/09/08	74.9(1)		%	50
814773 NMO	MATRIX SPIKE	D10-Anthracene	2005/09/08		85	%	30 - 130
		D14-Terphenyl (FS)	2005/09/08		98	%	30 - 130
		D8-Acenaphthylene	2005/09/08		72	%	30 - 130
		Acenaphthene	2005/09/08		77	%	30 - 130
		Acenaphthylene	2005/09/08		80	%	30 - 130
		Anthracene	2005/09/08		74	%	30 - 130
		Benzo(b/j)fluoranthene	2005/09/08		115	%	30 - 130
		Benzo(k)fluoranthene	2005/09/08		127	%	30 - 130
		Dibenzo(a,h)anthracene	2005/09/08		89	%	30 - 130
		Fluorene	2005/09/08		100	%	30 - 130
		1-Methylnaphthalene	2005/09/08		71	%	30 - 130
		2-Methylnaphthalene	2005/09/08		71	%	30 - 130
		Naphthalene	2005/09/08		65	%	30 - 130
		Phenanthrene	2005/09/08		105	%	30 - 130
	Spiked Blank	D10-Anthracene	2005/09/08		86	%	30 - 130
		D14-Terphenyl (FS)	2005/09/08		90	%	30 - 130
		D8-Acenaphthylene	2005/09/08		82	%	30 - 130
		Acenaphthene	2005/09/08		82	%	30 - 130
	RPD	Acenaphthene	2005/09/08	0		%	50
	Spiked Blank	Acenaphthylene	2005/09/08		96	%	30 - 130
	RPD	Acenaphthylene	2005/09/08	0		%	50
	Spiked Blank	Anthracene	2005/09/08		70	%	30 - 130
	RPD	Anthracene	2005/09/08	0		%	50
	Spiked Blank	Benzo(a)anthracene	2005/09/08		105	%	30 - 130

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814773 NMO	RPD	Benzo(a)anthracene	2005/09/08	0		%	50
	Spiked Blank	Benzo(a)pyrene	2005/09/08		75	%	30 - 130
	RPD	Benzo(a)pyrene	2005/09/08	0		%	50
	Spiked Blank	Benzo(b/j)fluoranthene	2005/09/08		75	%	30 - 130
	RPD	Benzo(b/j)fluoranthene	2005/09/08	0		%	50
	Spiked Blank	Benzo(g,h,i)perylene	2005/09/08		87	%	30 - 130
	RPD	Benzo(g,h,i)perylene	2005/09/08	0		%	50
	Spiked Blank	Benzo(k)fluoranthene	2005/09/08		79	%	30 - 130
	RPD	Benzo(k)fluoranthene	2005/09/08	0		%	50
	Spiked Blank	Chrysene	2005/09/08		88	%	30 - 130
	RPD	Chrysene	2005/09/08	0		%	50
	Spiked Blank	Dibenzo(a,h)anthracene	2005/09/08		93	%	30 - 130
	RPD	Dibenzo(a,h)anthracene	2005/09/08	0		%	50
	Spiked Blank	Fluoranthene	2005/09/08		99	%	30 - 130
	RPD	Fluoranthene	2005/09/08	0		%	50
	Spiked Blank	Fluorene	2005/09/08		104	%	30 - 130
	RPD	Fluorene	2005/09/08	0		%	50
	Spiked Blank	Indeno(1,2,3-cd)pyrene	2005/09/08		122	%	30 - 130
	RPD	Indeno(1,2,3-cd)pyrene	2005/09/08	0		%	50
	Spiked Blank	1-Methylnaphthalene	2005/09/08		81	%	30 - 130
	RPD	1-Methylnaphthalene	2005/09/08	0		%	50
	Spiked Blank	2-Methylnaphthalene	2005/09/08		84	%	30 - 130
	RPD	2-Methylnaphthalene	2005/09/08	0		%	50
	Spiked Blank	Naphthalene	2005/09/08		85	%	30 - 130
	RPD	Naphthalene	2005/09/08	0		%	50
	Spiked Blank	Phenanthrene	2005/09/08		90	%	30 - 130
	RPD	Phenanthrene	2005/09/08	0		%	50
	Spiked Blank	Pyrene	2005/09/08		94	%	30 - 130
	RPD	Pyrene	2005/09/08	0		%	50
	Method Blank	D10-Anthracene	2005/09/08		88	%	30 - 130
		D14-Terphenyl (FS)	2005/09/08		86	%	30 - 130
		D8-Acenaphthylene	2005/09/08		76	%	30 - 130
		Acenaphthene	2005/09/08	ND, DL=0.01		ug/g	
		Acenaphthylene	2005/09/08	ND, DL=0.005		ug/g	
		Anthracene	2005/09/08	ND, DL=0.005		ug/g	
		Benzo(a)anthracene	2005/09/08	ND, DL=0.01		ug/g	
		Benzo(a)pyrene	2005/09/08	ND, DL=0.005		ug/g	
		Benzo(b/j)fluoranthene	2005/09/08	ND, DL=0.005		ug/g	
		Benzo(g,h,i)perylene	2005/09/08	ND, DL=0.02		ug/g	
		Benzo(k)fluoranthene	2005/09/08	ND, DL=0.01		ug/g	
		Chrysene	2005/09/08	ND, DL=0.01		ug/g	
		Dibenzo(a,h)anthracene	2005/09/08	ND, DL=0.02		ug/g	
		Fluoranthene	2005/09/08	ND, DL=0.005		ug/g	
		Fluorene	2005/09/08	ND, DL=0.005		ug/g	
		Indeno(1,2,3-cd)pyrene	2005/09/08	ND, DL=0.02		ug/g	
		1-Methylnaphthalene	2005/09/08	ND, DL=0.005		ug/g	
		2-Methylnaphthalene	2005/09/08	ND, DL=0.005		ug/g	
		Naphthalene	2005/09/08	ND, DL=0.005		ug/g	
		Phenanthrene	2005/09/08	ND, DL=0.005		ug/g	
		Pyrene	2005/09/08	ND, DL=0.005		ug/g	
	RPD	D14-Terphenyl (FS)	2005/09/08	2.5		%	N/A
815611 SPU	RPD [I00149-01]	Moisture	2005/09/07	0.7		%	50
815619 SPT	RPD	Moisture	2005/09/07	1.3		%	50
815698 MWG	MATRIX SPIKE [I00156-02]	2-Fluorobiphenyl	2005/09/13		81	%	30 - 130
		D10-Anthracene	2005/09/13		87	%	30 - 130

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QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
815698 MWG	MATRIX SPIKE [I00156-02]	D14-Terphenyl (FS)	2005/09/13		95	%	30 - 130
		D5-Nitrobenzene	2005/09/13		77	%	30 - 130
		D8-Acenaphthylene	2005/09/13		76	%	30 - 130
		Acenaphthene	2005/09/13		100	%	30 - 130
		Acenaphthylene	2005/09/13		122	%	30 - 130
		Anthracene	2005/09/13		83	%	30 - 130
		Benzo(a)anthracene	2005/09/13		115	%	30 - 130
		Benzo(a)pyrene	2005/09/13		100	%	30 - 130
		Benzo(b/j)fluoranthene	2005/09/13		97	%	30 - 130
		Benzo(g,h,i)perylene	2005/09/13		83	%	30 - 130
		Benzo(k)fluoranthene	2005/09/13		92	%	30 - 130
		Chrysene	2005/09/13		101	%	30 - 130
		Dibenzo(a,h)anthracene	2005/09/13		95	%	30 - 130
		Fluoranthene	2005/09/13		112	%	30 - 130
		Fluorene	2005/09/13		117	%	30 - 130
		Indeno(1,2,3-cd)pyrene	2005/09/13		91	%	30 - 130
		1-Methylnaphthalene	2005/09/13		89	%	30 - 130
		2-Methylnaphthalene	2005/09/13		89	%	30 - 130
		Naphthalene	2005/09/13		80	%	30 - 130
		Phenanthrene	2005/09/13		103	%	30 - 130
		Pyrene	2005/09/13		107	%	30 - 130
	Spiked Blank	2-Fluorobiphenyl	2005/09/13		96	%	30 - 130
		D10-Anthracene	2005/09/13		98	%	30 - 130
		D14-Terphenyl (FS)	2005/09/13		101	%	30 - 130
		D5-Nitrobenzene	2005/09/13		95	%	30 - 130
		D8-Acenaphthylene	2005/09/13		94	%	30 - 130
		Acenaphthene	2005/09/13		109	%	30 - 130
		Acenaphthylene	2005/09/13		134(1)	%	30 - 130
		Anthracene	2005/09/13		85	%	30 - 130
		Benzo(a)anthracene	2005/09/13		122	%	30 - 130
		Benzo(a)pyrene	2005/09/13		105	%	30 - 130
		Benzo(b/j)fluoranthene	2005/09/13		103	%	30 - 130
		Benzo(g,h,i)perylene	2005/09/13		96(2)	%	30 - 130
		Benzo(k)fluoranthene	2005/09/13		105	%	30 - 130
		Chrysene	2005/09/13		106	%	30 - 130
		Dibenzo(a,h)anthracene	2005/09/13		104	%	30 - 130
		Fluoranthene	2005/09/13		116	%	30 - 130
		Fluorene	2005/09/13		120	%	30 - 130
		Indeno(1,2,3-cd)pyrene	2005/09/13		100	%	30 - 130
		1-Methylnaphthalene	2005/09/13		106	%	30 - 130
		2-Methylnaphthalene	2005/09/13		107	%	30 - 130
		Naphthalene	2005/09/13		101	%	30 - 130
		Phenanthrene	2005/09/13		105	%	30 - 130
		Pyrene	2005/09/13		114	%	30 - 130
	Method Blank	2-Fluorobiphenyl	2005/09/13		90	%	30 - 130
		D10-Anthracene	2005/09/13		110	%	30 - 130
		D14-Terphenyl (FS)	2005/09/13		109	%	30 - 130
		D5-Nitrobenzene	2005/09/13		88	%	30 - 130
		D8-Acenaphthylene	2005/09/13		84	%	30 - 130
		Acenaphthene	2005/09/13	ND, DL=0.01		ug/g	
		Acenaphthylene	2005/09/13	ND, DL=0.005		ug/g	
		Anthracene	2005/09/13	ND, DL=0.005		ug/g	
		Benzo(a)anthracene	2005/09/13	ND, DL=0.01		ug/g	
		Benzo(a)pyrene	2005/09/13	ND, DL=0.005		ug/g	
		Benzo(b/j)fluoranthene	2005/09/13	ND, DL=0.005		ug/g	

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815698 MWG	Method Blank	Benzo(g,h,i)perylene	2005/09/13	ND, DL=0.02		ug/g	
		Benzo(k)fluoranthene	2005/09/13	ND, DL=0.01		ug/g	
		Chrysene	2005/09/13	ND, DL=0.01		ug/g	
		Dibenzo(a,h)anthracene	2005/09/13	ND, DL=0.02		ug/g	
		Fluoranthene	2005/09/13	ND, DL=0.005		ug/g	
		Fluorene	2005/09/13	ND, DL=0.005		ug/g	
		Indeno(1,2,3-cd)pyrene	2005/09/13	ND, DL=0.02		ug/g	
		1-Methylnaphthalene	2005/09/13	ND, DL=0.005		ug/g	
		2-Methylnaphthalene	2005/09/13	ND, DL=0.005		ug/g	
		Naphthalene	2005/09/13	ND, DL=0.005		ug/g	
		Phenanthrene	2005/09/13	ND, DL=0.005		ug/g	
		Pyrene	2005/09/13	ND, DL=0.005		ug/g	
	RPD [I00156-02]	Acenaphthene	2005/09/13	NC		%	50
		Acenaphthylene	2005/09/13	NC		%	50
		Anthracene	2005/09/13	NC		%	50
		Benzo(a)anthracene	2005/09/13	NC		%	50
		Benzo(a)pyrene	2005/09/13	NC		%	50
		Benzo(b/j)fluoranthene	2005/09/13	NC		%	50
		Benzo(g,h,i)perylene	2005/09/13	NC		%	50
		Benzo(k)fluoranthene	2005/09/13	NC		%	50
		Chrysene	2005/09/13	NC		%	50
		Dibenzo(a,h)anthracene	2005/09/13	NC		%	50
		Fluoranthene	2005/09/13	NC		%	50
		Fluorene	2005/09/13	NC		%	50
		Indeno(1,2,3-cd)pyrene	2005/09/13	NC		%	50
		1-Methylnaphthalene	2005/09/13	NC		%	50
		2-Methylnaphthalene	2005/09/13	NC		%	50
		Naphthalene	2005/09/13	NC		%	50
		Phenanthrene	2005/09/13	NC		%	50
		Pyrene	2005/09/13	NC		%	50
815828 GBU	MATRIX SPIKE [I00155-02]	Total Antimony (Sb)	2005/09/14		89	%	75 - 125
		Total Arsenic (As)	2005/09/14		96	%	75 - 125
		Total Beryllium (Be)	2005/09/14		100	%	75 - 125
		Total Cadmium (Cd)	2005/09/14		94	%	75 - 125
		Total Chromium (Cr)	2005/09/14		98	%	75 - 125
		Total Cobalt (Co)	2005/09/14		97	%	75 - 125
		Total Magnesium (Mg)	2005/09/14		108	%	75 - 125
		Total Molybdenum (Mo)	2005/09/14		101	%	75 - 125
		Total Nickel (Ni)	2005/09/14		94	%	75 - 125
		Total Potassium (K)	2005/09/14		116	%	75 - 125
		Total Selenium (Se)	2005/09/14		95	%	75 - 125
		Total Silver (Ag)	2005/09/14		96	%	75 - 125
		Total Sodium (Na)	2005/09/14		107	%	75 - 125
		Total Vanadium (V)	2005/09/14		99	%	75 - 125
	QC STANDARD	Total Aluminum (Al)	2005/09/14		85	%	50 - 150
		Total Arsenic (As)	2005/09/14		112	%	30 - 170
		Total Barium (Ba)	2005/09/14		106	%	70 - 130
		Total Calcium (Ca)	2005/09/14		89	%	77 - 123
		Total Chromium (Cr)	2005/09/14		88	%	40 - 160
		Total Cobalt (Co)	2005/09/14		99	%	75 - 125
		Total Copper (Cu)	2005/09/14		105	%	73 - 127
		Total Iron (Fe)	2005/09/14		105	%	61 - 139
		Total Lead (Pb)	2005/09/14		97	%	54 - 146
		Total Magnesium (Mg)	2005/09/14		100	%	69 - 131
		Total Manganese (Mn)	2005/09/14		104	%	71 - 129

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815828 GBU	QC STANDARD	Total Nickel (Ni)	2005/09/14		102	%	61 - 139
		Total Phosphorus (P)	2005/09/14		101	%	89 - 111
		Total Potassium (K)	2005/09/14		82	%	44 - 156
		Total Titanium (Ti)	2005/09/14		125	%	45 - 165
		Total Vanadium (V)	2005/09/14		104	%	50 - 150
		Total Zinc (Zn)	2005/09/14		102	%	72 - 128
	Method Blank	Total Aluminum (Al)	2005/09/14	ND, DL=50		ug/g	
		Total Antimony (Sb)	2005/09/14	ND, DL=1		ug/g	
		Total Arsenic (As)	2005/09/14	ND, DL=1		ug/g	
		Total Barium (Ba)	2005/09/14	ND, DL=0.5		ug/g	
		Total Beryllium (Be)	2005/09/14	ND, DL=0.5		ug/g	
		Total Cadmium (Cd)	2005/09/14	ND, DL=0.3		ug/g	
		Total Calcium (Ca)	2005/09/14	ND, DL=50		ug/g	
		Total Chromium (Cr)	2005/09/14	ND, DL=0.5		ug/g	
		Total Cobalt (Co)	2005/09/14	ND, DL=0.5		ug/g	
		Total Copper (Cu)	2005/09/14	ND, DL=0.5		ug/g	
		Total Iron (Fe)	2005/09/14	ND, DL=50		ug/g	
		Total Lead (Pb)	2005/09/14	ND, DL=1		ug/g	
		Total Magnesium (Mg)	2005/09/14	ND, DL=50		ug/g	
		Total Manganese (Mn)	2005/09/14	ND, DL=1		ug/g	
		Total Molybdenum (Mo)	2005/09/14	1.5, DL=0.5		ug/g	
		Total Nickel (Ni)	2005/09/14	ND, DL=0.5		ug/g	
		Total Phosphorus (P)	2005/09/14	ND, DL=20		ug/g	
		Total Potassium (K)	2005/09/14	ND, DL=200		ug/g	
		Total Selenium (Se)	2005/09/14	ND, DL=1		ug/g	
		Total Silver (Ag)	2005/09/14	ND, DL=0.3		ug/g	
		Total Sodium (Na)	2005/09/14	ND, DL=100		ug/g	
		Total Titanium (Ti)	2005/09/14	ND, DL=5		ug/g	
		Total Vanadium (V)	2005/09/14	ND, DL=0.5		ug/g	
		Total Zinc (Zn)	2005/09/14	ND, DL=3		ug/g	
	RPD [I00155-02]	Total Aluminum (Al)	2005/09/14	1.8		%	20
		Total Barium (Ba)	2005/09/14	1.4		%	20
		Total Beryllium (Be)	2005/09/14	NC		%	20
		Total Cadmium (Cd)	2005/09/14	1.6		%	20
		Total Calcium (Ca)	2005/09/14	1.1		%	20
		Total Chromium (Cr)	2005/09/14	0.1		%	20
		Total Cobalt (Co)	2005/09/14	2.6		%	20
		Total Copper (Cu)	2005/09/14	5.3		%	20
		Total Iron (Fe)	2005/09/14	4.1		%	20
		Total Lead (Pb)	2005/09/14	0		%	20
		Total Magnesium (Mg)	2005/09/14	8.8		%	20
		Total Manganese (Mn)	2005/09/14	0.7		%	20
		Total Molybdenum (Mo)	2005/09/14	NC		%	20
		Total Nickel (Ni)	2005/09/14	0.9		%	20
		Total Phosphorus (P)	2005/09/14	5.4		%	20
		Total Potassium (K)	2005/09/14	NC		%	20
		Total Silver (Ag)	2005/09/14	NC		%	20
		Total Sodium (Na)	2005/09/14	NC		%	20
		Total Titanium (Ti)	2005/09/14	15.6		%	20
		Total Vanadium (V)	2005/09/14	3.9		%	20
		Total Zinc (Zn)	2005/09/14	1.2		%	20
815837 GBU	MATRIX SPIKE [I00147-04]	Total Antimony (Sb)	2005/09/14		98	%	75 - 125
		Total Arsenic (As)	2005/09/14		107	%	75 - 125
		Total Beryllium (Be)	2005/09/14		105	%	75 - 125
		Total Cadmium (Cd)	2005/09/14		97	%	75 - 125

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QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
815837 GBU	MATRIX SPIKE [I00147-04]	Total Calcium (Ca)	2005/09/14		113	%	75 - 125
		Total Chromium (Cr)	2005/09/14		111	%	75 - 125
		Total Cobalt (Co)	2005/09/14		105	%	75 - 125
		Total Magnesium (Mg)	2005/09/14		123	%	75 - 125
		Total Molybdenum (Mo)	2005/09/14		106	%	75 - 125
		Total Nickel (Ni)	2005/09/14		112	%	75 - 125
		Total Potassium (K)	2005/09/14		124	%	75 - 125
		Total Selenium (Se)	2005/09/14		93	%	75 - 125
		Total Silver (Ag)	2005/09/14		103	%	75 - 125
		Total Vanadium (V)	2005/09/14		110	%	75 - 125
	QC STANDARD	Total Aluminum (Al)	2005/09/14		90	%	50 - 150
		Total Arsenic (As)	2005/09/14		115	%	30 - 170
		Total Barium (Ba)	2005/09/14		113	%	70 - 130
		Total Calcium (Ca)	2005/09/14		91	%	77 - 123
		Total Chromium (Cr)	2005/09/14		90	%	40 - 160
		Total Cobalt (Co)	2005/09/14		102	%	75 - 125
		Total Copper (Cu)	2005/09/14		116	%	73 - 127
		Total Iron (Fe)	2005/09/14		109	%	61 - 139
		Total Lead (Pb)	2005/09/14		99	%	54 - 146
		Total Magnesium (Mg)	2005/09/14		109	%	69 - 131
		Total Manganese (Mn)	2005/09/14		108	%	71 - 129
		Total Nickel (Ni)	2005/09/14		105	%	61 - 139
		Total Phosphorus (P)	2005/09/14		105	%	89 - 111
		Total Potassium (K)	2005/09/14		83	%	44 - 156
		Total Titanium (Ti)	2005/09/14		131	%	45 - 165
		Total Vanadium (V)	2005/09/14		109	%	50 - 150
		Total Zinc (Zn)	2005/09/14		104	%	72 - 128
	Method Blank	Total Aluminum (Al)	2005/09/14	ND, DL=50		ug/g	
		Total Antimony (Sb)	2005/09/14	ND, DL=1		ug/g	
		Total Arsenic (As)	2005/09/14	ND, DL=1		ug/g	
		Total Barium (Ba)	2005/09/14	ND, DL=0.5		ug/g	
		Total Beryllium (Be)	2005/09/14	ND, DL=0.5		ug/g	
		Total Cadmium (Cd)	2005/09/14	ND, DL=0.3		ug/g	
		Total Calcium (Ca)	2005/09/14	ND, DL=50		ug/g	
		Total Chromium (Cr)	2005/09/14	ND, DL=0.5		ug/g	
		Total Cobalt (Co)	2005/09/14	ND, DL=0.5		ug/g	
		Total Copper (Cu)	2005/09/14	ND, DL=0.5		ug/g	
		Total Iron (Fe)	2005/09/14	ND, DL=50		ug/g	
		Total Lead (Pb)	2005/09/14	ND, DL=1		ug/g	
		Total Magnesium (Mg)	2005/09/14	ND, DL=50		ug/g	
		Total Manganese (Mn)	2005/09/14	ND, DL=1		ug/g	
		Total Molybdenum (Mo)	2005/09/14	ND, DL=0.5		ug/g	
		Total Nickel (Ni)	2005/09/14	ND, DL=0.5		ug/g	
		Total Phosphorus (P)	2005/09/14	ND, DL=20		ug/g	
		Total Potassium (K)	2005/09/14	ND, DL=200		ug/g	
		Total Selenium (Se)	2005/09/14	ND, DL=1		ug/g	
		Total Silver (Ag)	2005/09/14	ND, DL=0.3		ug/g	
		Total Sodium (Na)	2005/09/14	ND, DL=100		ug/g	
		Total Titanium (Ti)	2005/09/14	ND, DL=5		ug/g	
		Total Vanadium (V)	2005/09/14	ND, DL=0.5		ug/g	
		Total Zinc (Zn)	2005/09/14	ND, DL=3		ug/g	
	RPD [I00147-04]	Total Aluminum (Al)	2005/09/14	2.7		%	20
		Total Barium (Ba)	2005/09/14	1.1		%	20
		Total Beryllium (Be)	2005/09/14	NC		%	20
		Total Cadmium (Cd)	2005/09/14	NC		%	20

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815837 GBU	RPD [I00147-04]	Total Calcium (Ca)	2005/09/14	0.2		%	20
		Total Chromium (Cr)	2005/09/14	0.3		%	20
		Total Cobalt (Co)	2005/09/14	3.0		%	20
		Total Copper (Cu)	2005/09/14	8.8		%	20
		Total Iron (Fe)	2005/09/14	0.6		%	20
		Total Lead (Pb)	2005/09/14	18.4		%	20
		Total Magnesium (Mg)	2005/09/14	5.5		%	20
		Total Manganese (Mn)	2005/09/14	2.8		%	20
		Total Molybdenum (Mo)	2005/09/14	1.6		%	20
		Total Nickel (Ni)	2005/09/14	1.7		%	20
		Total Phosphorus (P)	2005/09/14	1.1		%	20
		Total Potassium (K)	2005/09/14	1.4		%	20
		Total Silver (Ag)	2005/09/14	NC		%	20
		Total Sodium (Na)	2005/09/14	NC		%	20
		Total Titanium (Ti)	2005/09/14	2.8		%	20
		Total Vanadium (V)	2005/09/14	3.7		%	20
		Total Zinc (Zn)	2005/09/14	3.0		%	20
816093 MC	MATRIX SPIKE [I00152-04]	Acid Extractable Mercury (Hg)	2005/09/08		108	%	75 - 125
	QC STANDARD	Acid Extractable Mercury (Hg)	2005/09/08		106	%	85 - 115
	Spiked Blank	Acid Extractable Mercury (Hg)	2005/09/08		91	%	75 - 125
	Method Blank	Acid Extractable Mercury (Hg)	2005/09/08	ND, DL=0.05		ug/g	
	RPD [I00152-04]	Acid Extractable Mercury (Hg)	2005/09/08	2.0		%	35
816099 MC	MATRIX SPIKE	Acid Extractable Mercury (Hg)	2005/09/08		103	%	75 - 125
	QC STANDARD	Acid Extractable Mercury (Hg)	2005/09/08		101	%	85 - 115
	Spiked Blank	Acid Extractable Mercury (Hg)	2005/09/08		91	%	75 - 125
	Method Blank	Acid Extractable Mercury (Hg)	2005/09/08	ND, DL=0.05		ug/g	
	RPD	Acid Extractable Mercury (Hg)	2005/09/08	NC		%	35
818983 GBU	MATRIX SPIKE	Total Antimony (Sb)	2005/09/15		91	%	75 - 125
		Total Arsenic (As)	2005/09/15		94	%	75 - 125
		Total Barium (Ba)	2005/09/15		96	%	75 - 125
		Total Beryllium (Be)	2005/09/15		98	%	75 - 125
		Total Cadmium (Cd)	2005/09/15		87	%	75 - 125
		Total Chromium (Cr)	2005/09/15		98	%	75 - 125
		Total Cobalt (Co)	2005/09/15		91	%	75 - 125
		Total Copper (Cu)	2005/09/15		98	%	75 - 125
		Total Lead (Pb)	2005/09/15		92	%	75 - 125
		Total Magnesium (Mg)	2005/09/15		75	%	75 - 125
		Total Molybdenum (Mo)	2005/09/15		100	%	75 - 125
		Total Nickel (Ni)	2005/09/15		89	%	75 - 125
		Total Potassium (K)	2005/09/15		114	%	75 - 125
		Total Selenium (Se)	2005/09/15		92	%	75 - 125
		Total Silver (Ag)	2005/09/15		94	%	75 - 125
		Total Sodium (Na)	2005/09/15		97	%	75 - 125
		Total Vanadium (V)	2005/09/15		100	%	75 - 125
		Total Zinc (Zn)	2005/09/15		92	%	75 - 125
	QC STANDARD	Total Aluminum (Al)	2005/09/15		84	%	50 - 150
		Total Arsenic (As)	2005/09/15		111	%	30 - 170
		Total Barium (Ba)	2005/09/15		106	%	70 - 130
		Total Calcium (Ca)	2005/09/15		89	%	77 - 123
		Total Chromium (Cr)	2005/09/15		89	%	40 - 160
		Total Cobalt (Co)	2005/09/15		101	%	75 - 125
		Total Copper (Cu)	2005/09/15		105	%	73 - 127
		Total Iron (Fe)	2005/09/15		106	%	61 - 139
		Total Lead (Pb)	2005/09/15		97	%	54 - 146
		Total Magnesium (Mg)	2005/09/15		99	%	69 - 131

Jacques Whitford Limited (R)
Attention: Michael Farnsworth
Client Project #: ONT1004315/SUPERIOR
P.O. #: NSD016300
Project name: SUPERIOR

Quality Assurance Report (Continued)

Maxxam Job Number: MA585922

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
818983 GBU	QC STANDARD	Total Manganese (Mn)	2005/09/15		104	%	71 - 129
		Total Nickel (Ni)	2005/09/15		102	%	61 - 139
		Total Phosphorus (P)	2005/09/15		96	%	89 - 111
		Total Potassium (K)	2005/09/15		77	%	44 - 156
		Total Titanium (Ti)	2005/09/15		124	%	45 - 165
		Total Vanadium (V)	2005/09/15		106	%	50 - 150
		Total Zinc (Zn)	2005/09/15		100	%	72 - 128
	Method Blank	Total Aluminum (Al)	2005/09/15	ND, DL=50		ug/g	
		Total Antimony (Sb)	2005/09/15	ND, DL=1		ug/g	
		Total Arsenic (As)	2005/09/15	ND, DL=1		ug/g	
		Total Barium (Ba)	2005/09/15	ND, DL=0.5		ug/g	
		Total Beryllium (Be)	2005/09/15	ND, DL=0.5		ug/g	
		Total Cadmium (Cd)	2005/09/15	ND, DL=0.3		ug/g	
		Total Calcium (Ca)	2005/09/15	ND, DL=50		ug/g	
		Total Chromium (Cr)	2005/09/15	ND, DL=0.5		ug/g	
		Total Cobalt (Co)	2005/09/15	ND, DL=0.5		ug/g	
		Total Copper (Cu)	2005/09/15	ND, DL=0.5		ug/g	
		Total Iron (Fe)	2005/09/15	ND, DL=50		ug/g	
		Total Lead (Pb)	2005/09/15	ND, DL=1		ug/g	
		Total Magnesium (Mg)	2005/09/15	ND, DL=50		ug/g	
		Total Manganese (Mn)	2005/09/15	ND, DL=1		ug/g	
		Total Molybdenum (Mo)	2005/09/15	ND, DL=0.5		ug/g	
		Total Nickel (Ni)	2005/09/15	ND, DL=0.5		ug/g	
		Total Phosphorus (P)	2005/09/15	ND, DL=20		ug/g	
		Total Potassium (K)	2005/09/15	ND, DL=200		ug/g	
		Total Selenium (Se)	2005/09/15	ND, DL=1		ug/g	
		Total Silver (Ag)	2005/09/15	ND, DL=0.3		ug/g	
		Total Sodium (Na)	2005/09/15	ND, DL=100		ug/g	
		Total Titanium (Ti)	2005/09/15	ND, DL=5		ug/g	
		Total Vanadium (V)	2005/09/15	ND, DL=0.5		ug/g	
		Total Zinc (Zn)	2005/09/15	ND, DL=3		ug/g	
	RPD	Total Antimony (Sb)	2005/09/15	NC		%	20
		Total Arsenic (As)	2005/09/15	NC		%	20
		Total Barium (Ba)	2005/09/15	6.3		%	20
		Total Beryllium (Be)	2005/09/15	NC		%	20
		Total Cadmium (Cd)	2005/09/15	NC		%	20
		Total Chromium (Cr)	2005/09/15	1.9		%	20
		Total Cobalt (Co)	2005/09/15	4.6		%	20
		Total Copper (Cu)	2005/09/15	14.5		%	20
		Total Lead (Pb)	2005/09/15	7.3		%	20
		Total Molybdenum (Mo)	2005/09/15	NC		%	20
		Total Nickel (Ni)	2005/09/15	6.3		%	20
		Total Selenium (Se)	2005/09/15	NC		%	20
		Total Silver (Ag)	2005/09/15	NC		%	20
		Total Vanadium (V)	2005/09/15	5.3		%	20
		Total Zinc (Zn)	2005/09/15	1.6		%	20
819276 MC	MATRIX SPIKE	Acid Extractable Mercury (Hg)	2005/09/14		101	%	75 - 125
	QC STANDARD	Acid Extractable Mercury (Hg)	2005/09/14		103	%	85 - 115
	Spiked Blank	Acid Extractable Mercury (Hg)	2005/09/14		99	%	75 - 125
	Method Blank	Acid Extractable Mercury (Hg)	2005/09/14	ND, DL=0.05		ug/g	
	RPD	Acid Extractable Mercury (Hg)	2005/09/14	NC		%	35

ND = Not detected
N/A = Not Applicable
NC = Non-calculable
RPD = Relative Percent Difference
QC Standard = Quality Control Standard

Quality Assurance Report (Continued)

Maxxam Job Number: MA585922

SPIKE = Fortified sample

(1) Please note that the recovery of some compounds are outside control limits however the overall quality control for this analysis meets our acceptability criteria.

(2) The recovery for acenaphthylene in the spiked blank is above the upper control limit. This may represent a high bias in some results for this compound.

APPENDIX 6

Data for Storage Tanks

DATA FOR FUEL STORAGE TANKS

INFORMATION REQUIRED TO REGISTER A STORAGE TANK SYSTEM

1. Name of owner – *DFO*
2. Address of owner – *201N. Front Street 703, Sarnia, Ontario, N7T 8B1*
3. Name of operator, if different than storage tank owner – *Canadian Coast Guard*
4. Name of landowner, if different than storage tank owner
5. Type of facility - *Lighthouse*
6. Location of storage tank system, if different than address of owner, unless the system is intended to be in place for less than 60 days, whereupon the system may be registered as having one or multiple temporary unspecified locations – *Michipicoten Island, East End*
7. Capacity of storage tank, or combined capacity of storage tanks if there are more than one in the storage tank system – *2 x 900 L capacity tanks*
8. Type of petroleum product or allied petroleum product stored – *Heating Oil*
9. Year of installation of each storage tank in the system – *approximately 1969*
10. Type of storage tank material for each storage tank in the system – *Single wall without secondary containment.*
11. Type of piping material – *possibly copper and lead piping*
12. Corrosion protection provided, if applicable – *UG - Galvanized steel without cathodic protection. AG – Coated with rust resistant material.*
13. Type of pump or pumps – *Suction pump (at dispensing unit)*
14. Type of leak detection – *none*
15. Internal linings, if any – *none*
16. Type of secondary containment – *none*
17. Number and location of monitoring wells - *none*
18. Type of overfill protection – *none*
19. Type of volatile organic compound (VOC) emission control – *none*
20. Manufacturer of each storage tank in the system – *unknown*

Registrations for aboveground storage tank systems must also include:

21. Type of diking - *unknown*
22. Type of storage tank, whether horizontal or vertical - *vertical*

DATA FOR FUEL STORAGE TANKS

INFORMATION REQUIRED TO REGISTER A STORAGE TANK SYSTEM

1. Name of owner – *DFO*
2. Address of owner – *201N. Front Street 703, Sarnia, Ontario, N7T 8B1*
3. Name of operator, if different than storage tank owner – *Canadian Coast Guard*
4. Name of landowner, if different than storage tank owner
5. Type of facility - *Lighthouse*
6. Location of storage tank system, if different than address of owner, unless the system is intended to be in place for less than 60 days, whereupon the system may be registered as having one or multiple temporary unspecified locations – *Michipicoten Island, East End*
7. Capacity of storage tank, or combined capacity of storage tanks if there are more than one in the storage tank system – *2 x 45 kg tanks*
8. Type of petroleum product or allied petroleum product stored – *Propane*
9. Year of installation of each storage tank in the system – *approximately1980's*
10. Type of storage tank material for each storage tank in the system –
11. Type of piping material
12. Corrosion protection provided, if applicable
13. Type of pump or pumps – *none*
14. Type of leak detection – *none*
15. Internal linings, if any – *none*
16. Type of secondary containment – *none*
17. Number and location of monitoring wells - *none*
18. Type of overfill protection – *none*
19. Type of volatile organic compound (VOC) emission control – *none*
20. Manufacturer of each storage tank in the system – *unknown*

Registrations for aboveground storage tank systems must also include:

21. Type of diking
22. Type of storage tank, whether horizontal or vertical - *vertical*

DATA FOR FUEL STORAGE TANKS

INFORMATION REQUIRED TO REGISTER A STORAGE TANK SYSTEM

1. Name of owner – *DFO*
2. Address of owner – *201N. Front Street 703, Sarnia, Ontario, N7T 8B1*
3. Name of operator, if different than storage tank owner – *Canadian Coast Guard*
4. Name of landowner, if different than storage tank owner
5. Type of facility - *Lighthouse*
6. Location of storage tank system, if different than address of owner, unless the system is intended to be in place for less than 60 days, whereupon the system may be registered as having one or multiple temporary unspecified locations – *Michipicoten Island, East End*
7. Capacity of storage tank, or combined capacity of storage tanks if there are more than one in the storage tank system – *200 L tank*
8. Type of petroleum product or allied petroleum product stored – *Diesel*
9. Year of installation of each storage tank in the system – *Approximately 1969*
10. Type of storage tank material for each storage tank in the system – Single wall without secondary containment.
11. Type of piping material
12. Corrosion protection provided, if applicable – *UG - copper. AG – Coated with rust resistant material.*
13. Type of pump or pumps – Suction pump (at dispensing unit)
14. Type of leak detection – *none*
15. Internal linings, if any – *none*
16. Type of secondary containment – *none*
17. Number and location of monitoring wells
18. Type of overfill protection – *none*
19. Type of volatile organic compound (VOC) emission control – *none*
20. Manufacturer of each storage tank in the system – *unknown*

Registrations for aboveground storage tank systems must also include:

21. Type of diking
22. Type of storage tank, whether horizontal or vertical – *horizontal*

APPENDIX 7

Assessors Qualifications

Ian R. Cooper, B.A. Hons.

Environmental Scientist

PROFILE

Mr. Ian Cooper is an Environmental Scientist of Jacques Whitford's Environmental Site Assessment & Remediation Group in Sudbury, Ontario. Mr. Cooper has over 5 years experience in the assessment, management and remediation of properties for downstream petroleum operations. Mr. Cooper has conducted numerous environmental investigations utilizing such techniques as vertical drilling, rock coring, percussion drilling, test pitting and soil vapour sampling to characterize the subsurface soil and groundwater conditions. Mr. Cooper has been involved as a Project Manager for numerous soil and groundwater assessment and remediation programs.

EDUCATION

Niagara College, Niagara-on-the-Lake, Ontario, 2000
Environmental Assessment Post-Graduate Program

Wilfrid Laurier University, Waterloo, Ontario, 1998
B.A. Hons., Geography

PROFESSIONAL COURSES AND DESIGNATIONS

- Predictive Index Management Workshop, 2005
- Myers-Briggs Type Indicator Workshop, 2005

CAREER SUMMARY

2000-present	**Jacques Whitford Limited, Markham, Ontario** Environmental Field Supervisor (2000-2004) Team Leader (2004-2005) Environmental Scientist (2005)
1998	**Wilfrid Laurier University, Waterloo, Ontario** Teaching Assistant
1995-1999	**Ministry of Natural Resources, Killarney, Ontario** Backcountry Technician

TRAINING AND CERTIFICATES

- Fall Arrest
- Traffic Control Supervisor and Planner
- Standard First Aid
- Transportation of Dangerous Goods
- WHIMIS
- Project Manager in Training Program

RELEVANT EXPERIENCE

ENVIRONMENTAL SITE INVESTIGATIONS

Investigations of Soil and Groundwater
Shell Canada Products and Petro-Canada: Ontario

Investigation of petroleum storage and dispensing facilities.
Role: Project Manager and Field Supervisor

Phase I ESA
Various sites: Alberta

Assessment of current and historical environmental concerns based on the requirements of CSA Standard Z768-01 updated April 2003.
Role: Assistant Site Assessor

Assessment of Soil and Groundwater
Various sites: Ontario and Alberta

Assessment of soil and groundwater for a variety of parameters including petroleum hydrocarbons, metals, pesticides/herbicides, volatile organic compounds and semi- volatile organic compounds.
Role: Project Manager and Field Supervisor

ENVIRONMENTAL REMEDIATION

Soil Remedial Excavations
Shell Canada Products and Petro-Canada: Ontario

Regulatory and multiple stakeholder liaison, and groundwater and liquid product recovery for petroleum storage and dispensing facilities
Role: Project Manager and Field Supervisor

Monitored Natural Attenuation
Petro-Canada: Ontario

Monitored Natural Attenuation of hydrocarbon impacted groundwater
Role: Field Supervisor

Grant Lafontaine, B.Sc.

Project Biologist/Scientist

PROFILE

Grant Lafontaine is a Project Scientist/Biologist with Jacques Whitford. Grant has excellent knowledge of terrestrial systems and field skills, including knowledge of bird identification and ecology, vegetation communities and other aspects of the natural environment. Grant graduated from Trent University in 1995 with an Honours B.Sc., major in Biology. He has completed the Ontario Ministry of Natural Resources training for Ecological Land Classification (ELC). Prior to working at Jacques Whitford, Grant had spent a number of years working in the capacity of Environmental Inspector at TransCanada PipeLines and Alliance Pipeline. This work ranged from Northern Ontario to the Prairie Provinces and involved coordinating environmental aspects of pipeline construction such as permitting, watercourse crossings, mitigation measures and reclamation. More recently, Grant worked for the Greater Toronto Airports Authority Environment Department, where amongst his various duties he advised on wildlife control and monitored surface water quality. Since joining Jacques Whitford, Grant has been involved in a number of environmental assessments for energy projects.

EDUCATION

Trent University, Peterborough, ON, 1995
Bachelor of Science
Biology

PROFESSIONAL COURSES AND DESIGNATIONS

- Ecological Land Classification, ELC – Southern Ontario (2004)
- Environmental Legislation and Compliance Seminar (2003)
- Confined Space Training (2002)
- WHIMIS (2002)
- Transportation of Dangerous Goods, Clear Language (2002)
- Asbestos course (2002)
- ISO 14001 EMS Internal Auditor Course – QMI, Mississauga, 2001
- First Aid/CPR/Defibrillation Certificate (2002)

CAREER SUMMARY

2004-Present	**Jacques Whitford Limited** Markham ON Project Scientist/Biologist
Fall 2003	**Great Lakes Power Ltd**. Sault Ste. Marie ON Environmental Management Officer
2001 – 2004	**Greater Toronto Airports Authority** Toronto ON Environmental Technician

2001	**Jacques Whitford Environment Ltd**., Markham ON Environmental Scientist
1999 to 2000	**Alliance Pipeline Ltd**., Calgary AB Environmental Inspector
1997 to 1999	**TransCanada PipeLines Ltd.,** Calgary AB Environmental Inspector
1996 to 1997	**DMK Drilling Fluids Ltd**., Rycroft AB Lab Technician
1995	**Trent University**, Algonquin Park ON Field Researcher –

RELEVANT EXPERIENCE

Oil and Gas Sector

- Ensured that pipeline construction activities were in compliance with environmental policies and government approvals
- Reported environmental noncompliance incidents and required follow- up activities
- Supervised horizontal directional drilling of sensitive rivers; which involved sampling the drilling mud, determining the disposal method such as landspreading, obtaining regulatory approval, and overseeing the disposal
- Communicated with landowners and government representatives when environmental issues arose such as discrepancies over topsoil stripping procedures, and soil contamination
- Coordinated the environmental aspects of hydrostatic testing of pipe including obtaining approval for withdrawal of water from a natural source and discharge over land; and testing of the discharge water for a variety of contaminants
- Acted as a liaison between TransCanada Pipelines management and government agencies such as the MOE and MNR on environmental issues related to pipeline construction projects
- Advised on waste management including the removal and disposal of pipe coating containing asbestos and PCBs
- Conducted hydrostatic test water sampling, hydrocarbon spill sampling, PCB swabs and assessed groundwater contamination
- Prepared Environmental As-built reports for review by the National Energy Board
- Provided construction personnel with professional advice on topsoil conservation, watercourse crossings, wildlife issues, seeding and fertilizing
- Prepared samples of drilling waste from oil well sites and analyzed using the Microtox bioassay, Atomic Absorption Spectrometer, ion chromatography, titration and many other lab techniques
- Submitted lab results to regulatory agencies and oil companies

Biological Field Research

- Completed a detailed vegetation inventory of trees, shrubs, and ground cover and conducted bird surveys to assess the effects of forestry on the bird population in Algonquin Park
- Conducted a research project funded by a Northern Studies Research Grant to determine the breeding success of semipalmated plovers on the Hudson Bay Shoreline
- Monitored breeding pairs of chickadees and sampled biota as part of an investigation into the effects of acid precipitation on forest breeding birds
- Prepared and conducted guided walks and workshops to educate visitors on the native flora and fauna of Presqu'ile Provincial Park as well as gave evening natural science presentations at an amphitheater to large audiences

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Michael A. Farnsworth, B.Sc.

Project Scientist

PROFILE

Michael Farnsworth is a Project Scientist with the Jacques Whitford Environmental Site Assessment & Remediation Group. He has over 5 years experience in the assessment, management and remediation of industrial, commercial and undeveloped properties for clients including developers, property managers, industrial manufacturing operations, petrochemical companies and real estate organizations. Michael has conducted numerous environmental investigations utilizing techniques such as vertical drilling, rock coring, percussion drilling, test pitting and soil vapour sampling to characterize the subsurface soil and groundwater conditions. He has been involved as a Project Manager and Field Supervisor for soil and groundwater remediation programs including such activities as dewatering, contaminated groundwater storage and treatment, soldier pile, shoring walls, underpinning and helical piering. Michael has also assisted in the management of in-situ bioremediation and catalytic oxidation (ORC) technologies at various remedial sites in Ontario.

EDUCATION

Royal Roads University, 1999
B.Sc. (Environmental Science)

Georgian College of Applied Arts & Technology, 1996
Diploma (Environmental Engineering Technology)

PROFESSIONAL COURSES AND DESIGNATIONS

- Pollution Prevention: P2 Planning and Beyond. University of Toronto, 2001.

CAREER SUMMARY

2002-present	**Jacques Whitford Limited, Markham, ON** Project Scientist
2000-2002	**Central Project Group Inc., Markham, ON** Project Manager
1998	**GPEC Consulting Ltd., Edmonton, AB** Engineering Technologist
1997	**Kodiak Environmental Ltd., Oakville, ON** Field Technician
1994-1997	**Shiu and Associates Inc., Brampton, ON** Junior Party Chief

RELEVANT EXPERIENCE

CONSTRUCTION SURVEYING

- As Junior Party Chief, conducted preliminary surveys for numerous subdivisions in Alberta and Ontario including layout for storm and sanitary sewers, road grading and topographic details.
- Performed a minimum of 25 construction layouts including bridges, ramps and highways (Hwy 407), municipal roads, underground structures and subdivisions.

ENVIRONMENTAL SITE ASSESSMENTS

- Conducted Phase 1 ESAs on various properties ranging from rural/urban residential properties to multiple building industrial facilities to determine if evidence of potential or actual environmental contamination exists as a result of current or historic activities at the property(s). Responsible for proposal development, gathering of historical information, site visits, client liaison, invoice review and approval and report preparation.

ENVIRONMENTAL SITE INVESTIGATIONS

- Environmental Site Investigations of soil and groundwater utilizing boreholes, test pits and monitoring well installations to characterize the subsurface soil and groundwater conditions for over 25 petroleum storage and dispensing facilities on behalf of Shell Products Canada, Imperial Oil Limited, Petro-Canada Products, and other major petroleum producers at numerous sites throughout Northern and Southern Ontario.
- Environmental Site Investigations for a number of financial institutions, municipal, provincial and federal agencies and private sectors. Responsible for proposal development, regulatory and client liaison, posting sub-consulting work, invoice review and approval, interpretation of chemical analyses and report preparation.

ENVIRONMENTAL REMEDIATION

- Soil Remedial Excavations, UST/AST Removals, Building demolitions including regulatory liaison and approval, groundwater and liquid product recovery, for numerous petroleum storage and dispensing facilities throughout Ontario including Imperial Oil, Petro Canada, Shell and other major petroleum producers.
- Soil and Groundwater Remediation, including soil vapour sampling, dewatering and contaminated groundwater storage and treatment, and soldier pile shoring walls, in Toronto, for Imperial Oil Limited.
- Soil Remedial Pre Design Field Pilot Scale Study in conjunction with a Residential (Furnace Oil) Insurance Claim and numerous petroleum hydrocarbon contaminated sites, including underpinning, and exterior/interior structural bracing of the residential dwelling(s), in situ bioremediation and catalytic oxidation (ORC).
- Recommended remediation options at over 15 sites in conjunction with the preparation of Remedial Action Plans.

HUMAN HEATH AND ECOLOGICAL RISK ASSESSMENT

- Conducted a site specific qualitative and quantitative risk assessment to determine an appropriate remediation objective for Benzo-(a)-pyrene in groundwater at a Federal Site, by identifying and quantifying hazards and evaluating exposure pathways and chemical fate and transport in the environment.

Krista E. Phillips, P.Eng.

Project Manager

PROFILE

Krista Phillips is a project manager in the Environmental Site Assessment and Remediation Group with Jacques Whitford. Since joining the firm she has been involved with various site assessment and remediation projects (Phase I, II and III Environmental Site Investigations) as a field technician, project coordinator and project manager. Krista works with various clients in the Real Estate, Railway and Oil and Gas Industries as well as municipal and federal government organizations (i.e., City of Toronto and Public Works & Government Services Canada).

EDUCATION

University of New Brunswick,
Fredericton, New Brunswick, May 2000
B.Sc.Eng. in Civil Engineering

PROFESSIONAL COURSES AND DESIGNATIONS

- Fall Protection Training, Acute Environmental, February 2006
- First Aid Basic Rescuer (C), Canadian Ski Patrol System
- WHMIS certified, August 2002
- First National Workshop on Air Quality Forecasting and Applications (April 2001)
- New Brunswick Environment Industry Association Water Quality Conference (Sept 2000)
- Atomic Energy of Canada Limited Climate Change Workshop (Sept 2000)

CAREER SUMMARY

2005-present	**Jacques Whitford Limited, Markham, Ontario** Project Manager
2002-2005	**Jacques Whitford Limited, Markham, Ontario** Field Technician / Project Manager in Training
2001–2002	**DST Consulting Engineers, Mississauga, ON** Junior Engineer (Field Technician)
2000–2001	**New Brunswick Department of Environment & Local Government, Assessment and Approvals Branch, Fredericton, NB** Junior Engineer

MEMBERSHIPS/ASSOCIATIONS

- Registered Professional Engineer with PEO, 2005-2006
- Associate Member - Engineers Without Borders, 2006

RELEVANT EXPERIENCE

Project Management

- Preparation of technical proposals and cost estimates for Phase II and III Environmental Site Investigations;
- Preparation of technical reports;
- Knowledge of provincial and federal regulatory guidelines;
- Presentation of technical updates to senior staff and clients;
- Review and interpretation of laboratory analytical data;
- Project budget/cost management

Field Technician

- Use of technical instruments (Gastechtor$^{\mathrm{TM}}$, Photoionization Detector, water level tape, survey gear, etc.);
- Geotechnical and environmental drilling and test pitting supervision;
- Surveying – level surveys of boreholes, monitoring wells and other monuments;
- Groundwater monitoring and sampling;
- Conducting hydraulic conductivity bail tests; and
- Supervision and documentation of remedial excavation and underground storage tank removal activities as per regulatory guidelines;

Eric Veska, PhD., P.Geo., C.Chem., CEA, EMS(A).

Principal

EDUCATION

University of Waterloo, 1983
Ph.D. Chemistry and Hydrogeology.

Brock University, 1978
M.Sc. Geology (Geochemistry).

Brock University, 1976
B.Sc. Chemistry and Geology.
E3 Course on Human Health Risk Assessment, 1995

CAREER SUMMARY

2002-present	**Jacques Whitford Limited, Toronto, Ontario.** Senior Consultant
2000-2002	**Jacques Whitford Limited, Toronto, Ontario.** Manager, Brownfield Redevelopment Sector Group
1997-present	**Jacques Whitford Environment Limited, Toronto, Ontario** Certified Environmental Auditor, Canadian Environmental Auditing Association
1995 - 2000	**Jacques Whitford Environment Limited, Toronto, Ontario** Manager, Environmental Engineering Division
1991 - 1995	**Trow Consulting Engineers Limited, Toronto, Ontario** Manager, Environment Division and Technical Director
1986 - 1991	**Monenco Consultants Limited, Toronto, Ontario** Manager, Decommissioning and Site Clean-up Group
1983 - 1986	**Health and Welfare Canada, Ottawa, Ontario** Manager, Nuclear Fallout and Reactor Section, Environmental Radiation Hazards Division

MEMBERSHIPS/ASSOCIATIONS

- Association of Professional Geoscientists of Ontario (Professional Geo-scientist)
- Association of the Chemical Profession of Ontario (Chartered Chemist)
- Canadian Environmental Auditing Association (Certified Environmental Auditor)
- Canadian Environmental Auditing Association (Environmental Management System Auditor)

RELEVANT EXPERIENCE

As principal, with 20 years of experience, Dr. Veska provides senior technical input and management of risk assessment and remediation projects. Highlights of select experience include:

LANDMARK PROJECTS

Inco Limited, Port Colborne Community Based Risk Assessment, 2000 to present

COMMUNITY-BASED RISK ASSESSMENT AND CLEANUP CRITERIA DEVELOPMENT

- Project Manager, investigation and community-based risk assessment of the population of Port Colborne (12,000 people) exposed to elevated levels of nickel, cobalt, copper and arsenic in surficial soils from historical deposition of smoke stack dust from Inco's Refinery. Also includes development of safe, publicly-acceptable soil cleanup criteria.
- Project Manager, investigation and community-based risk assessment of the Town of Wawa and surrounding population (approx. 4,500 people) of elevated arsenic levels in soils over a 20 Ha study area, Wawa, Ontario.
- Project Manager in the development of radioactive tritium in groundwater remedial criteria to be applied for non-potable groundwater settings at nuclear power stations in Ontario and that would also be protective of residents in communities surrounding those stations. Assistance was also provided to Ontario Power Generation Nuclear in the management of their contaminated sites and their radiological environmental monitoring programs for each of their reactor sites.

RISK ASSESSMENT AND MANAGEMENT

- Manager (at Health and Welfare Canada) in conducting field investigations and radiological dose risk assessments on unscheduled releases of tritium to surface water and air from Canadian nuclear generating stations and on the presence of elevated uranium levels at abandoned uranium mine sites in Canada.
- Project Manager, investigation, risk assessment and remedial action plan for PAH and VOC subsurface contamination at a former coal gasification site, City of Hamilton, Ontario.
- Senior Scientist, investigation and risk assessment of a trichloroethylene and vinyl chloride groundwater plume at a former tannery, Toronto, Ontario.
- Senior Scientist, investigation, risk assessment and remedial action plan of the heavy metal contamination in surficial soils at a former chemical and pigment factory, Milton, Ontario.

ENVIRONMENTAL MANAGEMENT SYSTEMS DEVELOPMENT

- Lead Auditor, ISO 14001 Gap Analyses of Cogema Resources Inc. Environmental Management System on their McClean Lake Open Pit Uranium Mine and Mill Operation, Saskatchewan.
- Lead Auditor, ISO 14001 Gap Analyses and Environmental Aspects Review of DeBeers Diamond Environmental Management System on their Drilling Exploration Operation at Kennady Lake (Yellowknife), NorthWest Territories.
- Lead Auditor, ISO 14001 Gap Analyses and Environmental Aspects Review of DeBeers Environmental Management System on their Reconnaissance Exploration Operation at Oxford House (Thompson), Manitoba.
- Auditor ISO 14001 Gap Analyses of the Ontario Hydro Darlington Nuclear Generating Station.
- Auditor, ISO 14001 Environmental Management System Registration of the Waterloo Landfill Operation, Waterloo, Ontario.
- Quality Team Member, responsible in part for acquiring and maintaining ISO9000 accreditation (1998 – 2000) of the Jacques Whitford Toronto office, in particular those activities related to the Environmental Engineering Division. Responsible for preparation and maintenance of Procedures Manual and Work Instructions for the Division as part of the overall Jacques Whitford Quality Management System and dealing with non-conformances by staff.

ENVIRONMENTAL AUDITING

- Lead Auditor, Due diligence audit, including regulatory compliance and operational risk, for one of Denison's uranium mine operations, Elliot Lake, Ontario
- Auditor, Environment, Health & Safety Audit of Inco Central Tailings Area, Copper Cliff, Ontario;
- Auditor, Due Diligence/Compliance Audit of Toronto Port Authority Lands.
- Auditor, Due Diligence/Compliance Audit of Confidential Industrial Facility in Ontario for Novartis Corporation.
- Auditor, Due Diligence/Compliance Audit of ICI Chloralkali Facilities at Dalhousie, New Brunswick .
- Auditor, Due Diligence/Compliance Audit of ICI Chloralkali Research Facility, Sheridan Park, Mississauga, Ontario.
- Auditor, Compliance Audit of 3 Transport Canada-operated airports in Ontario, namely Earlton Airport, Kapuskasing Airport, and Sarnia Airport.
- Lead Auditor, Compliance Audit of the Algoma Central Railway Lands, including diesel fuel dispatch areas, maintenance buildings, terminals, switching yards, railway tie preserving operations and landfills, Northern Ontario.
- Auditor, Due Diligence/Compliance Audit of former Canadian Pacific Railway Lands from Guelph to Goderich, Ontario.

- Lead Auditor, Compliance Audit of the Canada Malting Operations in Thunder Bay, Montreal and Calgary.
- Lead Auditor, Compliance Audit of Leaver Mushroom Operations in Ontario, P.E.I. and Alberta.
- Lead Auditor, Due Diligence/Compliance Audit of Gerdau Courtice Steel Mill, Cambridge, Ontario.
- Lead Auditor, Compliance Audit of the Vytec Plastic Operation, London, Ontario.
- Lead Auditor, Due Diligence/Compliance Audit of heat exchanger manufacturing plants at Cambridge, Mississauga and Oakville, Ontario locations.
- Lead Auditor, Due Diligence/Compliance Audit of Alcan's Aluminum Extrusion Plants at Aurora and Pickering, Ontario locations.
- Lead Auditor, Waste Audit of the Lever Brothers Ltd. Facility, Toronto, Ontario.
- Auditor on various other industrial plant sites, including but not limited to, foundries, a tractor manufacturing facility, a postal station complex, a pesticide manufacturing facility, plastic manufacturing plants, electroplating facilities, and lead acid battery plants.

ENVIRONMENTAL SITE ASSESSMENTS/INVESTIGATIONS AND MONITORING

- Project Manager, Phase I Environmental Site Assessments (ESA) of 61 Ontario Hydro Services Company Inc. (OHSC) properties conducted throughout Northern and Southern Ontario from October through to December 1998.
- Project Manager, Phase II ESA of 65 OHSC Service Centre and Operation Centres throughout Northern and Southern Ontario from October 1998 through to January 1999. The work included detailed investigations, delineation, estimation of remedial actions and costs, where appropriate.
- Senior Advisor/Reviewer, Phase II ESAs of Ontario Power Generation (Hydro-Electric) generating sites at the Lakefield, Chats Falls, Mountain Chute, and Abitibi Canyon locations, Ontario.
- Senior Advisor/Reviewer, Phase II ESA of Ontario Power Technologies research facilities at 800 Kipling, Toronto, Ontario.
- Project Manager, Phase I and II ESAs on Ontario Ministry of Transportation-owned service centres in Gormley, Kettleby, Manchester, Newcastle, Newtonville, Ontario.
- Project Manager, Phase I and II ESAs on Bell Canada service centres at various sites in Ontario (1996-1999).
- Project Manager, Phase I and II ESAs on various Canadian National Railway real estate sites in Ontario.
- Project Manager, Phase II ESA on a Canadian Pacific Railway site - CP Schreiber yard in Ontario.

- Senior Reviewer, Phase I and II ESAs - Transport Canada Air Navigation System properties - 375 sites across Canada , 1997/98.
- Project Manager, Phase I and II ESAs - MetLife portfolio- completed for Hudson Advisors Canada, Inc. on numerous properties across Canada, 1999.
- Senior Reviewer, Phase I and II ESAs and Asbestos Surveys - completed for Cadillac Fairview on numerous properties across Canada .
- Project Manager, long term (10 year) monitoring of the natural attenuation of the BTEX groundwater plume at Earlton Airport, Earlton, Ontario.
- Project Manager, monitoring of offsite impact of a TCE/vinyl chloride groundwater plume from a tannery operation, Toronto, Ontario.
- Project Manager, subsurface investigation of Bell Canada's wood pole yards at ten sites in Southern Ontario to determine the effects of natural weathering of wood preservative chemicals.
- Project Manager, investigation of VOC and PAH contamination in soils and groundwater at Eka Nobel's chemical manufacturing site, Toronto, Ontario.
- Project Manager, investigation of soil and groundwater at the Gerdau Courtice Steel Plant, Cambridge, Ontario.
- Project Manager, audit and subsurface investigation of VOC subsurface contamination at the Spar Aerospace Gear Plant, Toronto, Ontario.
- Project Manager, subsurface investigation of two of Alcan Aluminum's extrusion and casting plants, Aurora and Pickering, Ontario.
- Project Manager, subsurface investigation of a tank farm at the Van Water and Rogers chemical solvent plant, Downsview, Ontario.

ENVIRONMENTAL INVESTIGATION AND REMEDIATION

- Project Manager, investigation and insitu oxidation of groundwater containing trichloroethylene and its daughter products using potassium permanganate at a former tannery site, Toronto, Ontario.
- Project Manager, investigation and insitu bioremediation of petroleum hydrocarbon contaminated soils at a former bus depot/garage, City of Scarborough, Ontario.
- Project Manager, landfarming of varsol-contaminated soils, John Deere, Welland, Ontario.
- Senior Scientist, landfarming of Texaco Refinery Wastes, Nanticoke, Ontario.
- Project Manager, investigation and clean-up of lead- and zinc-contaminated soils at the Windsor Ceramics (1989) Inc. manufacturing plant, Windsor, Ontario.

- Project Manager, clean-up of various gasoline stations and bulk plant properties, containing soil and groundwater contaminated with gasoline, diesel, varsol, fuel oil and other petroleum hydrocarbons. Clean-up technologies have included pump and treat, vapour extraction, insitu bioremediation and offsite disposal.

MINE AND MILL RELATED EXPERIENCE

- Lead Auditor, Environmental Audit of Several Uranium Mine and Tailings Sites, Elliot Lake, Ontario.
- Lead Auditor, ISO 14001 Gap Analyses of Cogema Resources Inc. Environmental Management System on their McClean Lake Uranium Mine and Mill Operation, Saskatchewan.
- Senior Scientist, Feasibility Analyses on the Decommissioning of Gypsum Stacks and Phosphate Ponds at the IMC Global Inc. Port Maitland (phosphate fertilizer) facility using a wetlands approach, Port Maitland, Ontario.
- Project Manager, environmental investigation on acid mine drainage from waste rock, Greyrock Uranium Mine, Bancroft, Ontario.
- Project Manager, environmental and radiological assessment of uranium mill tailings, Rayrock Uranium Mine, Yellowknife, NorthWest Territories.
- Project Manager, design of waste water treatment system involving a series of holding ponds and chemical precipitation technology to increase removal efficiency of zinc and other metals from mine effluent discharge, Kidd Creek (Base Metals) Mine, Timmins, Ontario.

LANDFILL INVESTIGATIONS

- Auditor, ISO 14001 Environmental Management System Registration of the Waterloo Landfill Operation, Waterloo, Ontario
- Project Manager, Peer Reviewer of technical reports on the operation of Keele Valley Landfill, Maple, Ontario. Client: Ontario Ministry of Environment.
- Project Manager, Peer Reviewer of technical reports on the operation of Britannia Road Landfill, Mississauga, Ontario. Client: Ontario Ministry of Environment.
- Project Manager, closure of the Baltimore Landfill north of Cobourg, Ontario.
- Project Manager, investigation of the Ancaster Landfill for the Highway 403 Right of Way Extension, Ministry of Transportation.
- Project Manager, investigation of a former landfill and preparation of a clean-up plan to allow for the construction of the proposed York City Centre condominium development at the corner of Black Creek and Eglinton in Toronto, Ontario. Proposed clean-up plan included landfill mining and screening.

- Project Manager, investigation of a landfill containing sodium cyanide, John Deere, Welland, Ontario.

HAZARDOUS WASTE MANAGEMENT

- Project Manager, investigation and cleanup of arsenic- and chromium-contaminated soils at a former wood preserving operation by excavation and onsite securement within an engineered system, Hawk Junction, Ontario.
- Project Manager, clean-up of a waste dump site in Cobourg, Ontario involving geophysical identification of drums containing volatile organics (mainly methyl ethyl ketone, acrylonitrile, styrene and toluene) and transfer of these drums offsite to a secure licenced hazardous waste facility.
- Project Manager, insitu fixation of a lagoon (approx 2 Ha and 6 m deep) which had been operated by Borg Warner Chemicals in Cobourg, Ontario. The lagoon contained sludge and wastewater with elevated levels of cumene and styrene. This lagoon had been a former MOE-licenced liquid waste disposal site.
- Project Manager, investigation and clean up of demolition remains and mercury-contaminated soil at a former James River Marathon chloralkali plant by excavation and onsite securement within an engineered system, Marathon, Ontario.
- Senior Scientist, insitu containment of PCB-contaminated soils, Federal Pioneer, Toronto, Ontario.
- Senior Scientist, insitu containment of PCB-contaminated soils, Ferranti Packard, St. Catharines, Ontario.

INDUSTRIAL DECOMMISSIONING AND RECLAMATION

- Senior Scientist, Feasibility Analyses on the Decommissioning of Gypsum Stacks and Phosphate Ponds at the IMC Global Inc. Port Maitland (phosphate fertilizer) facility using a wetlands approach, Port Maitland, Ontario.
- Project Manager, investigation and decommissioning of the former Toronto Lead Refinery and Smelters operation and former Consumers Gas Coal Gasification site at 28 Bathurst Street, Toronto, Ontario. Principal contaminants in soils and groundwater included lead, arsenic, mercury, PAHs and dioxins.
- Project Manager, decommissioning of the former Dominion Bridge Steel Plant, Toronto, Ontario.
- Project Manager, decommissioning of the former Canada Post complex and former National Defence Munitions factory in Mississauga, Ontario.
- Project Manager, decommissioning of the Cleanol Dry Cleaning operation, including cleanup of chlorinated contaminated soils, North York, Ontario.

- Project Manager, feasibility studies and decommissioning of various other industrial sites and facilities in North America, including Varta Battery Plants in Scarborough (Ontario), Richmond (British Columbia), Toledo (Ohio); Zoecon Pesticide Plant, Port Perry, Ontario; Paperboard Industries, Holland Landing, Ontario; Canadian Forces Base Summerside, P.E.I.; Montcalm Coast Guard Ice Breaker, Cape Breton, N.S.; Ontario Stockyards, Toronto, Ontario; Former Leather Tannery, Brampton, Ontario; and Blackwood Hodge Tractor Facility, North York, Ontario

UNDERGROUND STORAGE TANK MANAGEMENT

- Project Manager, design and management of underground storage tank programs at Walmart (various sites across Canada), Bell Canada (various sites across Ontario), John Deere (Welland), Navistar International (Chatham) and Norton Advanced Ceramics (Niagara Falls).

WASTE WATER MONITORING/TREATMENT

- Project Manager, regulatory MISA effluent monitoring of discharge water at outfalls at the following plants in Ontario: Norton Advanced Ceramics, Washington Mills, Exolon ESK, Electro Minerals Canada and St. Mary's Cement.
- Project Manager, dewatering a lagoon containing spent ink liquid waste, Paperboard Industries, Holland Landing, Ontario.
- Project Manager, design of a waste water treatment system at Leaver's Mushroom Plant, Campbellville.
- Senior Scientist, monitoring and maintenance of a treatment system to collect and remediate coal tar contaminants at a site in the Toronto Industrial Port (Client Confidential). This site was a former coal gasification operation.
- Project Manager, stream and sediment survey at the outfall of the Exolon-ESK plant in Thorold, Ontario, following an unscheduled release of chromium-containing process water.
- Project Manager, design of waste water treatment system involving a series of holding ponds and chemical precipitation technology to increase removal efficiency of zinc and other metals from mine effluent discharge, Kidd Creek (Base Metals) Mine, Timmins, Ontario.

EMERGENCY RESPONSE AND PREPAREDNESS

- Response Team Member, assist NavCanada on any potential environmental emergency situation at any of their facilities in Ontario (1999-2000 contract).
- Project Manager, preparation of an emergency response plan for the Ontario Waste Management Corporation (OWMC) on the proposed hazardous waste facility in Smithville, Ontario.

- Manager (Health and Welfare Canada), participated in design and implementation of nuclear emergency planning exercise. Internal responsibility included the preparation of a policy and procedures manual on environmental monitoring to be followed by Health and Welfare Canada in case of a major atmospheric nuclear event in Canada.

DEVELOPMENT OF GUIDELINES

- Senior Scientist, co-author in the writing of guidelines for the Canadian Council of Ministers of the Environment 1991 "National Guidelines for Decommissioning Industrial Sites" CCME-TS/WM-TRE013E, which included the process train to decommission an industrial facility as well as the preparation of an occupational health and safety plan.

PUBLICATIONS AND PRESENTATIONS

Veska, E. (1996) Leak Detection, Repair and Remediation: Advantages and Limitations of Various Methods. Canadian Institute Conference on Aboveground and Underground Storage Tanks. Toronto, Ontario,

Veska, E., and Stiebel, W.H. and Geddes, B.R. (1991) Decommissioning of a Sour Gas Plant in Alberta. Journal of Environmental Science & Engineering. 4(3) pp. 30-31.

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Ostry, R. and Veska, E. (1989) Site Characterization Needs for Groundwater Remediation. Hazardous Materials Management Conference, Toronto, Ontario.

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Chiu, N.W., Dean, J.R., Veska, E. and Vu, L.(1988) Transfer of Radionuclides to Human Milk - Phase 2 (Feasibility Study). Atomic Energy Control Board. DSS 55SS.87055-6-4155.

Trotter, D.M., Veska, E. and Neame, P.A. (1986) Radionuclide Movement through the Biosphere. National Uranium Tailings Program. Energy Mines and Resources Canada. DSS 15Sq.23317-6-1724

Veska, E. and Tracy, B.L. (1986) Migration of Reactor Water Released into Lake Huron in September 1983. Journal of Environmental Radioactivity. 3(4)

Eaton, R.S., McGregor, R.G., Quinn, J.M., Tracy, B.L. and Veska, E. (1986). Environmental Radioactivity in Canada - 1983. Health Protection Branch, Health and Welfare Canada 84-EHD0112.40.

Veska, E., Cherry, J.A. and Sharma, H.D. (1983) Origin and Subsurface Migration of Radionuclides from Waste Rock at an Abandoned Uranium Mine near Bancroft, Ontario. Atomic Energy Control Board, INFO-0105 (295 pp).

Veska, E., Fortescue, J.A.C. and Peach, P.A. (1977). Geochemistry and Hydrogeology of Agricultural Watershed No. 10. International Joint Commission on Great Lakes Water Quality. (119 pp).

Eric Veska

APPENDIX F

Shallow Soils Investigation

EAST END LIGHT STATION
SHALLOW SOILS INVESTIGATION
MICHIPICOTEN ISLAND, ONTARIO
3rd Party

DFRP: 67652

FCSI: 67652001 AND 67652002

Submitted to:

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Public Works and Government Services Canada
4900 Yonge Street
Toronto, ON M2N 6A6

Prepared by:

BluMetric Environmental Inc.
The Woolen Mill, The Tower
4 Cataraqui Street
Kingston, ON K7K 1Z7

PWGSC Project Number: R.083149.031
SOA# EQ447-141528/A

Project Number: 160528-00-00
8 June 2017

SOILS INVESTIGATION AND FURTHER DELINEATION
EAST END LIGHT STATION
MICHIPICOTEN ISLAND, ONTARIO

3rd PARTY REPORT

DFRP: 67652
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8 June 2017

EXECUTIVE SUMMARY

BluMetric Environmental Inc. (BluMetric ™) was retained by Public Works and Government Services Canada (PWGSC), on behalf of Fisheries and Oceans Canada (DFO), to complete a range of assessments at the East End Light Station on Michipicoten Island on Lake Superior, Ontario. Assessments included soil delineation, designated substances and hazardous materials assessment (DS/HMS), structural assessment, biological assessment to support an ecological risk assessment (ERA) and/or species at risk (SAR) assessment and marine assessment, as well as prepare plans and specifications for abatement and debris removal at the site and an environmental evaluation under under Section 67 of CEAA 2012. This report documents the impacted soils delineation investigation, while other assessments are documented in separate covers.

The Michipicoten Island East End Light Station is located on a 39.3 hectare property on the northeast end of Michipicoten Island in Lake Superior, and is found within Michipicoten Island Provincial Park (DFRP: 67652, FCSI: 67652001 and 67652002). The project site itself consists of a roughly 1 hectare area improved with an unmanned lighthouse, fog alarm building, generator building, equipment shed, tank farm with a concrete dyke, and helicopter pad. There are also foundations from a former radio beacon building, former fuel storage shed, former boathouse, and former dwelling on the site. No source of potable water was noted during site investigations; however, previous assessments have considered the site under a potable water condition. Environmental investigations were completed at the site between 1997 and 2006, which identified soil impacts including concentrations of metals, petroleum hydrocarbons (PHCs), and polycyclic aromatic hydrocarbons (PAHs) in excess of current regulatory guidelines. Additionally, there is a concern that lead-based paint may potentially be flaking off the existing structures and impacting the surrounding surficial soil.

To achieve the objectives of the investigation BluMetric completed an on-site sampling program on September 23, 2016. Thirty six (36) soil samples, including three blind (3) duplicates, were collected from thirty-three (33) test pits and were submitted for metals, petroleum hydrocarbons (PHCs) and polycyclic aromatic hydrocarbons (PAHs). During the site visit, a scrap metal dump with an estimated waste volume of 4 m^3 was also identified to the west of the site and scattered scrap metal and debris was also noted in the forest surrounding the site. The results were compared to the applicable site criteria, including CCME and MOECC 2011 Reg 153/04 criteria (Table 6: Generic Site Condition Standards for Shallow Soils in a Potable Groundwater Condition, Residential/ Parkland/ Institutional (Coarse), and Table 8: Generic Site Condition Standards for use within 30m of a Waterbody in a Potable Groundwater Condition, Residential/ Parkland/ Institutional/ and Industrial/ Commercial/ Community Property Use).

Of the thirty three (33) soil samples taken, thirty one (31) of the samples had measured metal concentrations with concentrations in excess of CCME SQGs, thirty (30) had metal concentrations in excess of MOECC Table 6 and thirty one (31) had metal concentrations in excess of MOECC Table 8.

Eight (8) samples had measured PHC concentrations in excess of CCME SQGs/CWS, eight (8) samples had measured PHC concentrations in excess MOECC Table 6 and eleven (11) samples had measured PHC concentrations in excess of MOECC Table 8;

Three (3) samples had measured PAH concentrations in excess of CCME SQGs, three (3) samples had measured PAH concentrations in excess of MOECC Table 6 and five (5) samples had measured PAH concentrations in excess MOECC Table 8 criteria;

Based on the results from the 2016 sampling event, with previous site assessment results taken into account, the average depth to bedrock, as well as visual observations from the site an estimated volume of between 411 m^3 and 548 m^3 of metal impacted soil is present at the site.

Based on the results from the 2016 sampling event, with previous site assessment results taken into account, the volume of PHC impacted soil across the site is estimated to be between 30 m^3 and 40 m^3.

Based on the results from the 2016 sampling event, with previous site assessment results taken into account, the volume of PAH impacted soil across the site is estimated to be between 29 m^3 and 38 m^3.

Metals impacts are widely distributed across the site and identified PHC and PAH impacts occur in overlapping pockets. However, it should be noted that metals, PHC and PAH impacts have not been fully delineated and further delineation activities are required to conclusively quantify impacts at the site.

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1. INTRODUCTION

BluMetric Environmental Inc. (BluMetric ™) was retained by Public Works and Government Services Canada (PWGSC), on behalf of Fisheries and Oceans Canada (DFO), to complete a range of assessments at the East End Light Station on Michipicoten Island on Lake Superior, Ontario. Assessments included soil delineation, designated substances and hazardous materials survey (DS/HMS), structural assessment, biological assessment to support an ecological risk assessment (ERA) and/or species at risk (SAR) assessment and marine assessment, as well as prepare plans and specifications for abatement and debris removal at the site and an Environmental Effects Evaluation (EEE). This report documents the impacted soils delineation investigation, while other assessments are documented in separate covers.

The Michipicoten Island East End Light Station is located on a 39.3 hectare property on the northeast end of Michipicoten Island in Lake Superior, and is found within Michipicoten Island Provincial Park (DFRP: 67652, FCSI: 67652001 and 67652002). A site location map is provided as Figure 1. The project site itself consists of a roughly 1 hectare area improved with an unmanned lighthouse, fog alarm building, generator building, equipment shed, tank farm with a concrete dyke, and helicopter pad. There are also foundations from a former radio beacon building, former fuel storage shed, former boathouse, and former dwelling on the site. Environmental investigations were completed at the site between 1997 and 2006, which identified soil impacts including concentrations of metals, petroleum hydrocarbons (PHCs), and polycyclic aromatic hydrocarbons in excess of current regulatory guidelines. Additionally, there is a concern that lead-based paint may potentially be flaking off the existing structures and impacting the surrounding surficial soil.

1.1 PROJECT SCOPE AND OBJECTIVES

The goals of the BluMetric 2016 assessment work were to further delineate previously identified soil impacts in support of risk assessment decision in regards to surficial soil impacts, as well as concurrently supporting the project objective of the abatement of exterior lead containing paint and asbestos containing materials (ACMs) at the Michipicoten Lighthouse site which is to be completed to remove the source of metals impact.

1.2 BACKGROUND

BluMetric Environmental Inc. (BluMetric™) was retained by Public Works and Government Services Canada (PWGSC), on behalf of Fisheries and Oceans Canada (DFO), to complete a range of assessments at the East End Light Station on Michipicoten Island on Lake Superior, Ontario.

Site Description

The Michipicoten Island East Lighthouse site consists of two areas separated by a long concrete walkway. The main site itself is where the majority of the existing structures are situated including the lighthouse itself as well as an abandoned two story residential dwelling, fog alarm building, generator building, equipment sheds, and an empty concrete dyked tank farm. Foundations for a former fuel storage building, former boathouse, and former radio building are also located in this area. To the northwest of the main site, the foundations of a former double dwelling are present.

In addition to these two areas, a small scrap metal dump was located approximately 100 m to the west of the main site.

A general layout of the project site is shown as **Figure 2**.

Previous Assessments

Environmental impacts to the surficial soils at the site have been previously documented by others.

XCG Consultants Ltd. 2001. Phase II Environmental Site Assessment, Canadian Coast Guard Light Station L.L. 1097. Michipicoten Island, East End, Lake Superior, Ontario. XCG File #1-336-60-01.

XCG Consultants conducted a Phase II Environmental Site Assessment (ESA) in 2001. The assessment included both soil and groundwater sampling and analysis for metals, petroleum hydrocarbons (PHC) and anions in order to delineate impacts at the site. A screening level risk assessment was also completed for the site by Jacques Whitford. Overall, the report identified metals and PHC impacts associated with the main site and the former double dwelling. While approximate estimates of the amount of impacted soils were provided for the main site, insufficient data was available to define volumes for the area around the double dwelling.

The XCG Consultants report also mentions that an enhanced Phase 1 ESA titled "Phase 1 Environmental Site Assessment Michipicoten Island, East End Light Station, L.L. 1097, Lake Superior Ontario, PWGSC Project #764661" was conducted by Conor Pacific Environmental Technologies Inc. in March of 1997. A copy of this report was not available for review.

Jacques Whitford. 2006. CCME Phase III Environmental Site Assessment, Canadian Coast Guard Light Station L.L. 1097. Michipicoten Island, East End, Lake Superior, Ontario. Project No. 1004315.

In 2005 Jacques Whitford conducted a CCME Phase III site assessment. The assessment was focused on the further delineation of soil impacts at the site beyond what was previously completed by XCG. A survey of above ground storage tanks (ASTs) was also completed. Further delineation was only partially successful as no vertical delineation could be established within the overburden meaning metal impacted soil volumes could not be accurately calculated. However, further resolution was obtained. The report concluded that both metal and PHC impacts were present over a larger area than estimated by XCG. Furthermore, the report recommended the use of a screening level risk assessment as the most cost effective method of determining if a human health or ecological risk exists associated with the presence of impacted soils.

Jacques Whitford. 2006. Screening Level Risk Assessment, Canadian Coast Guard Light Station L.L. 1097. Michipicoten Island, East End, Lake Superior, Ontario. Project No. 1004315.01.

Subsequent to the Phase III site assessment, Jacques Whitford also conducted a Screening Level Risk Assessment in 2006. The objective of the assessment was to determine if concentrations of potential contaminants of concern identified at the site pose any health risk to human or ecological receptors at the site under current property use conditions and if a site specific risk assessment was warranted. Jacques Whitford concluded that no elevated risk is posed to human health at this site based on the current property use; however, the report recommended that a site specific risk assessment be conducted in order to further assess the bioavailability of metals for uptake to plants and animals as well as a more detailed assessment of home ranges of species of interest.

Government of Canada 2016. Michipicoten Island – DFRP 67652, Geomatics Report, DFO Environmental Remediation Program of Works.

The geomatics report documents site ownership for the DFO property on Michipicoten Island as well as providing contact information for the adjacent property owner (Ontario Parks). A map showing property location as well as survey information is also provided.

2. CONTAMINANTS OF CONCERN

The on-site contaminants of potential concern (COPCs) in soil were determined through a review of previously completed work at the site. No information collected as part of site work indicated that changes to the list of COPCs was warranted. It should also be noted that insufficient information is available to link particular COPCs with specific areas of the site or sources. The COPCs are listed in Table 1.

Table 1: Contaminants of Potential Environmental Concern in Soil

Metals	PAHs	Hydrocarbons
Mercury	Acenaphthene	F1 PHCs (C6-C10)
Antimony	Acenaphthylene	F2 PHCs (C10-C16)
Arsenic	Anthracene	F3 PHCs (C16-C34)
Barium	Benzo[a]anthracene	F4 PHCs (C34-C50)
Beryllium	Benzo[a]pyrene	
Boron	Benzo[b]fluoranthene	
Cadmium	Benzo[g,h,i]perylene	
Chromium	Benzo[k]fluoranthene	
Cobalt	1,1-Biphenyl	
Copper	Chrysene	
Lead	Dibenzo[a,h]anthracene	
Molybdenum	Fluoranthene	
Nickel	Fluorene	
Selenium	Indeno[1,2,3-cd]pyrene	
Silver	1-Methylnaphthalene	
Thallium	2-Methylnaphthalene	
Tin	Methylnaphthalene (1&2)	
Uranium	Naphthalene	
Vanadium	Phenanthrene	
Zinc	Pyrene	
	Quinoline	

3. ASSESSMENT CRITERIA

3.1 SOIL ON-SITE

Analytical results in soil media will be compared to the regulatory criteria as outlined in Table 2. The rational for the selection of the criteria are as follows

- MOECC well records do not show wells within 2km of the site and no source of potable water was noted during site investigations; however, previous assessments have considered the site under a potable water condition;
- Grain size is considered course based on assessments conducted by others;
- Exact depth to bedrock was not confirmed during site work in 2016 due to soil conditions however are expected to be between 0.3 and 2m below ground surface based on field observations and assessments completed by others;
- Land use is considered Residential/Parkland and the site is located immediately adjacent to a Provincial Park;
- The majority of the site is located within 30m of the shoreline of a watercourse (Lake Superior).

For comparison purposes both Federal and Provincial criteria are applied with the most conservative standard being considered for exceedances.

Table 2: Regulatory Criteria for Comparison of Analytical results in Soil Media

Contaminant(s) of Potential Concern	Federal Guidelines	Provincial Guidelines
Metals	Canadian Council of Ministers of the Environment, Canadian Soil Quality Guidelines (SQGs) for the Protection of Environmental and Human Health (Soil Quality Guidelines Residential, coarse), 1999 (Updated in 2007).	Ontario Ministry of Environment (MOE, 2011). Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act., Ontario Reg 153/04 (2011) - Table 6: Generic Site Condition Standards for Shallow Soils in a Potable Groundwater Condition, Residential/Parkland/Institutional (Coarse), O.Reg 153/04 (2011) - Table 8: Generic Site Condition Standards for use within 30m of a Waterbody in a Potable Groundwater Condition Residential/Parkland/Institutional/and Industrial/Commercial/Community Property use

Contaminant(s) of Potential Concern	Federal Guidelines	Provincial Guidelines
PHCs	Canadian Council of Ministers of the Environment, Canadian Soil Quality Guidelines (SQGs) for the Protection of Environmental and Human Health (Soil Quality Guidelines Residential, coarse), 1999 (Updated in 2007). Canadian Council of Ministers of the Environment, Canada Wide Standards (CWS) for Petroleum Hydrocarbons in Soil (2008)	Ontario Ministry of Environment (MOE, 2011). Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act., Ontario Reg 153/04 (2011) - Table 6: Generic Site Condition Standards for Shallow Soils in a Potable Groundwater Condition, Residential/Parkland/Institutional (Coarse), O.Reg 153/04 (2011) - Table 8: Generic Site Condition Standards for use within 30m of a Waterbody in a Potable Groundwater Condition Residential/Parkland/Institutional/and Industrial/Commercial/Community Property use
PAHs	Canadian Council of Ministers of the Environment, Canadian Soil Quality Guidelines (SQGs) for the Protection of Environmental and Human Health (Soil Quality Guidelines Residential, coarse), 1999 (Updated in 2010).	Ontario Ministry of Environment (MOE, 2011). Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act., Ontario Reg 153/04 (2011) - Table 6: Generic Site Condition Standards for Shallow Soils in a Potable Groundwater Condition, Residential/Parkland/Institutional (Coarse), O.Reg 153/04 (2011) - Table 8: Generic Site Condition Standards for use within 30m of a Waterbody in a Potable Groundwater Condition Residential/Parkland/Institutional/and Industrial/Commercial/Community Property use

When considering these criteria and potential sample exceedances, is standard practice to consider both federal and provincial criteria as applicable and where these criteria differ to conservatively compare against the higher standard.

4. INVESTIGATION METHOD

4.1 SOIL SAMPLING

Thirty six (36) soil samples, including three (3) duplicates were collected from thirty-three (33) test pits and were submitted for metals, petroleum hydrocarbons (PHCs) and poly-aromatic hydrocarbons.

Test pits were excavated using clean stainless steel shovels. Shovels were decontaminated between the excavation of each test pit to eliminate cross-contamination. Soil samples were taken using new disposable gloves to transfer samples to disposable Ziploc bags and glass jars. In accordance with applicable sampling protocols, soil samples collected for potential chemical analysis of organic parameters were placed directly into laboratory supplied jars at the time of sampling and packed with minimal headspace to reduce the volatilization of organic compounds.

Additionally, owing to the specific concern that lead based paints may potentially be flaking into the soil surrounding site structures, four surficial surface soil samples (16TP22, 16TP31, 16TP32, 16TP33) were taken and analyzed specifically for lead content.

Jarred soil samples were placed into containers provided by the laboratory and stored until they were submitted Paracel in Ottawa, Ontario for chemical analysis. Samples were kept as cool as possible while on site and placed on ice for transport upon return to the mainland. The soil samples were submitted to the laboratory under chain of custody protocols.

Soils were examined in the field for lithology as well as for aesthetic evidence of impacts (i.e. debris, staining and odours). An RKI Eagle 2 Gas Monitor (with the methane elimination switch turned “on”) was used to scan soil cores in the field. The same monitor also was used to measure headspace vapours produced by samples placed in sealed plastic bags. This model measures multiple parameters including combustible volatile organic compounds in the range of BTEX. The accuracy of the RKI Eagle-2 is described as +/- 5% when in the LEL range, and +/- 10% in the parts per million (ppm) range. Before using the meter in the field, calibration was checked using hexane gas. The samples placed in sealed plastic bags were stored out of direct sunlight. Headspace measurements were made after at least an hour had elapsed since the sample was collected. The headspace monitoring was done on the samples as a preliminary screening for hydrocarbons.

All samples were submitted to Paracel for analysis of metals, PHCs and PAHs. Four samples were submitted for analysis of soil pH. As discussed in Section 5.2 below, three blind duplicate samples (i.e. DUP01, DUP02, and DUP03) were collected during sampling activities.

Samples were not submitted for TCLP analysis as the removal of soil from the site is not being considered at this time. TOC/FOC analysis was not conducted as it is considered out of scope of the assessment.

Soil analytical results for this soil sampling program can be found in **Appendix A, Table A-1**. Laboratory Certificates of Analysis are provided in **Appendix B**. Sample GPS locations are presented in **Appendix C**. Test pit photo logs and field notes are presented in **Appendix D**.

4.2 QUALITY ASSURANCE AND QUALITY CONTROL MEASURES

Various QA/QC measures were taken during the soil and groundwater sampling activities:

- All sampling containers were provided by the laboratory and were pre-charged by the laboratory with preservatives as necessary;
- All samples were assigned unique identifiers;
- Proper chain-of-custody forms accompanied all shipments of samples to the laboratory;
- All samples were delivered to the laboratory well before maximum holding times had been reached; and,
- The sample handling precautions described in Sections 4.1 were taken whenever collecting samples.

4.3 ANALYTICAL TESTING

All analytical testing was performed by Paracel Laboratories Inc. at 300-2319 St. Laurent Boulevard in Ottawa, Ontario. Paracel is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for all of the analysis conducted as part of this investigation.

5. RESULTS

Soil samples were taken during a site visit conducted on September 16, 2016. The weather conditions at the site visit were sunny and breezy with an approximate temperature of 12 °C. Soil sampling was conducted by two BluMetric staff, Jenna Findley and Kai Markvorsen.

5.1 SOIL QUALITY ON-SITE

Thirty six (36) soil samples, including three (3) duplicates were collected from thirty-three (33) test pits. Samples were collected between 0 and 0.3 m below ground surface and select samples were submitted for metals, PHCs, and PAHs analysis following the completion of the test pitting activities. Four (4) samples were also submitted for analysis of pH in soil. Sampling below 0.3 m was not feasible due to rocky soil conditions, sampling tools available and time available on site. Test pit locations are illustrated in **Figure 3**. Sample GPS locations are presented in **Appendix C**.

Headspace monitoring was done on the samples as a preliminary screening for hydrocarbons. However, the maximum recorded headspace reading for hexane was in a negligible range (0-10 ppm) for all samples. No groundwater was noted in any of the test pits and no background samples were taken. All sample locations showed similar soil conditions (highly organic, medium to dark, dry to damp brown soil and beach rock) with the exception of 16TP25 which consisted of black wet loam and organics. Sample locations were selected to avoid the inclusion of visible pain flakes in soil (i.e. to sample soil, not paint). A photo log showing test pits is presented in **Appendix D**.

Of the thirty three (33) soil samples taken, thirty one (31) of the samples had measured metal concentrations with concentrations in excess of CCME SQGs, thirty (30) had metal concentrations in excess of MOECC Table 6 and thirty one (31) had metal concentrations in excess of MOECC Table 8;

Eight (8) samples had measured PHC concentrations in excess of CCME SQGs/CWS, eight (8) samples had measured PHC concentrations in excess MOECC Table 6 and eleven (11) samples had measured PHC concentrations in excess of MOECC Table 8;

Three (3) samples had measured PAH concentrations in excess of CCME SQGs, three (3) samples had measured PAH concentrations in excess of MOECC Table 6 and five (5) samples had measured PAH concentrations in excess MOECC Table 8 criteria;

Soil pH ranged between 4.21 and 7.18.

Soil analytical results for this soil sampling program can be found in **Appendix A, Table A-1**. Laboratory Certificates of Analysis are provided in **Appendix B**. Sample GPS locations are presented in **Appendix C**. Testpit photologs and field notes are presented in **Appendix D**.

A summary of soil samples that have measured concentrations of one or more parameters over the CCME SQGs/CWS and/or MOECC Table 6 and/or MOECC Table 8 are shown in **Table 3** below. Associated site location (main site or double dwelling area to the northwest) is also documented.

Table 3: Summary of Samples Exceeding Regulatory Criteria

Sample	CCME	MOECC Table 6	MOECC Table 8	Sample Location
16TP1	Metals, PAHs	Metals, PAHs	Metals, PAHs	Double Dwelling
16TP2	Metals, PHCs	Metals, PHCs	Metals, PHCs	Double Dwelling
16TP3	Metals	Metals	Metals	Double Dwelling
16TP4	PHCs	PHCs	Metals, PHCs	Double Dwelling
16TP5	Metals	Metals	Metals	Double Dwelling
16TP6	PHCs	PHCs	PHCs	Double Dwelling
16TP7	Metals	Metals	Metals	Double Dwelling
16TP8	Metals, PHCs	PHCs	Metals, PHCs	Double Dwelling
16TP9	Metals	Metals	Metals, PHCs	Double Dwelling
16TP10	Metals, PHCs	PHCs	PHCs	Double Dwelling
DUP1 (16TP10)	Metals	-	-	Double Dwelling
16TP11	Metals	Metals	Metals, PHCs	Double Dwelling
16TP12	Metals	Metals	Metals	Double Dwelling
16TP13	Metals	Metals	Metals, PHCs	Main Site
16TP14	Metals	Metals	Metals	Main Site
16TP15	Metals, PHCs, PAHs	Metals, PHCs	Metals, PHCs, PAHs	Main Site
16TP16	Metals	Metals, PAHs	Metals, PAHs	Main Site
16TP17	Metals	Metals	Metals	Main Site
16TP18	Metals	Metals	Metals	Main Site
16TP19	Metals, PHCs	Metals, PHCs	Metals, PHCs	Main Site
16TP20	Metals	Metals	Metals	Main Site
DUP2 (16TP20)	Metals	Metals	Metals	Main Site
16TP21	Metals, PHCs, PAHs	Metals, PHCs, PAHs	Metals, PHCs, PAHs	Main Site
16TP22	Metals	Metals	Metals	Main Site
16TP23	Metals	Metals	Metals	Main Site
16TP24	Metals	Metals	Metals	Main Site

16TP25	Metals	Metals	Metals	Main Site
16TP26	Metals	Metals	Metals	Main Site
16TP27	Metals	Metals	Metals, PAHs	Main Site
16TP28	Metals	Metals	Metals	Main Site
16TP29	Metals	Metals	Metals	Main Site
DUP3 (16TP29)	Metals	Metals	Metals	Main Site
16TP30	Metals	Metals	Metals	Main Site
16TP31	Metals	Metals	Metals	Main Site
16TP32	Metals	Metals	Metals	Main Site
16TP33	Metals	Metals	Metals	Main Site

For reference, the highest concentrations detected for each parameter are presented in Table 4.

Table 4: Highest Concentrations by Parameter, September 16, 2016

Parameter	Concentration (ug/g dry)	Sample
Lead	3880.00	16TP30
Mercury	9.50	16TP21
Antimony	-	-
Arsenic	101.00	16TP14
Barium	2350.00	16TP15
Beryllium	4.10	16TP20 (DUP3)
Boron	29.50	16TP14
Cadmium	6.80	16TP13
Chromium	62.50	16TP14
Cobalt	11.20	16TP20 (DUP3)
Copper	211.00	16TP19
Lead	4370.00	16TP16
Molybdenum	-	-
Nickel	31.10	16TP1
Selenium	-	-
Silver	18.20	16TP1
Thallium	-	-
Tin	55.50	16TP19
Uranium	-	-
Vanadium	37.90	16TP17
Zinc	2850.00	16TP15
Hydrocarbons		
F1 PHCs (C6-C10)	-	-
F2 PHCs (C10-C16)	-	-
F3 PHCs (C16-C34)	2730.00	16TP15
F4 PHCs (C34-C50)	1440.00	16TP15
Semi-Volatiles		
Acenaphthene	0.02	16TP21
Acenaphthylene	2.20	16TP21
Anthracene	1.07	16TP21
Benzo[a]anthracene	3.84	16TP21
Benzo[a]pyrene	5.26	16TP21
Benzo[b]fluoranthene	15.60	16TP21
Benzo[g,h,i]perylene	7.21	16TP21

Parameter	Concentration (ug/g dry)	Sample
Benzo[k]fluoranthene	6.73	16TP21
1,1-Biphenyl	0.12	16TP27
Chrysene	4.79	16TP21
Dibenzo[a,h]anthracene	1.82	16TP21
Fluoranthene	3.03	16TP21
Fluorene	0.03	16TP21
Indeno[1,2,3-cd]pyrene	7.67	16TP21
1-Methylnaphthalene	0.20	16TP15
2-Methylnaphthalene	0.35	16TP15
Methylnaphthalene (1&2)	0.55	16TP15
Naphthalene	0.33	16TP21
Phenanthrene	0.41	16TP21
Pyrene	3.47	16TP21
Quinoline	-	-

Sample exceedances of regulatory criteria are shown in **Figure 4**.

5.2 QUALITY ASSURANCE AND QUALITY CONTROL RESULTS

All of the samples were handled in accordance with the Analytical Protocol with respect to the holding time, preservation method, storage requirements, and container type. BluMetric received a certificate of analysis for each sample submitted to the laboratory.

Duplicate Samples

"Blind" duplicates are samples labelled in such a way that it is not obvious to the laboratory that the sample is a duplicate.

Three blind duplicate soil samples were submitted to the laboratory as follows:

Duplicate ID	Duplicate of	Analysis
DUP1	16TP10	Metals, PHCs, PAHs
DUP2	16TP20	Metals, PHCs, PAHs
DUP3	16TP29	Metals, PHCs, PAHs

"Laboratory" duplicates are samples that the laboratory analyzes twice. The laboratory duplicates are not listed in this report but are provided in the Certificate of Analysis from the laboratory.

The concentrations in a sample and its duplicate can be used to calculate certain statistics. Precision is a measure of the reproducibility of analytical results and can be expressed quantitatively by the relative percent difference (RPD) between the original sample and the duplicate sample. Common standards for evaluating the repeatability of duplicate samples are described in CCME, 1993 and MOE, 2004. These guidance documents suggest the use of 40% RPD as acceptable for solids. RPD is calculated as follows:

$$\mathrm{RPD} = \frac{|(\mathrm{S}-\mathrm{D})|}{(\frac{(\mathrm{S}+\mathrm{D})}{2})} \times 100\%$$

Where: *S = concentration of in the original sample*
D = concentration in the duplicate

RPDs were only calculated where both the sample result "S" and the duplicate result "D" were above the analytical reportable detection limits.

The blind field duplicate sample DUP1 (duplicate of 16TP10) showed similar concentrations of all parameters detected in both samples excepting PHC F3 (RPD: 51.16%). The blind field duplicate sample DUP2 (duplicate of 16TP20) showed similar concentrations of all parameters detected in both samples excepting mercury (RPD 40%), boron (RPD 42.98%) and cadmium (122.22%). The blind field duplicate sample DUP3 (duplicate of 16TP29) showed similar concentrations of all parameters detected in both samples excepting zinc (164%). These exceptions are likely due to sample heterogeneity.

Procedures Used in the Laboratory

Laboratories implement additional QA/QC procedures. These include analyzing selected samples twice (as described above), but also include analyzing surrogate chemicals or "spiked blanks" (to show that the analytical equipment is operating within the desired tolerances of accuracy, and analyzing method blanks (to show that analytical equipment is not contaminated).

Situations occur when the measured results reported by the laboratory are less than a detection limit but the detection limit is higher than the federal guidelines or MOECC SCS. This can occur if the laboratory needs to dilute a sample to quantify a chemical present at an elevated concentration. This raises detection limits for other chemicals, even those not detectable in the sample. The factors considered in this case, when evaluating the data include the percentage of samples with elevated detection limits, how much higher the detection limits are than the federal guidelines or MOECC SCS, how frequently the chemical is measured in samples from other environmental media, and how frequently related chemicals are measured in samples.

The quality of the data produced by the soil quality investigation is adequate to meet the objectives and there are no aspects of the data that have restricted decision-making.

6. DISCUSSION

A shallow soils investigation was completed to attempt to further delineate on-site soil impacts above the applicable criteria. Previous assessments conducted at the site by both XCG and Jacques Whitford partially delineated impacts at both site areas. In order to provide the best available estimates of impacts at the site, the results of previous consultants were reviewed alongside samples taken by BluMetric (see Appendix A, Tables A-2 and A-3). Analytical results indicated that metal impacted soil, including lead, is found across the site around all current and former structures. The site also shows pockets of soils impacted with PHCs and PAHs above the applicable criteria. The impacts were noted within the shallow overburden (0-0.3 m bgs). As noted by previous investigations, vertical delineation could not be defined as there was no “clean line” which could be identified.

Figure 5 shows the approximate locations of samples taken by XCG and Jacques Whitford. As specific sample coordinates were not available, sample locations were approximated based on their relationship to site structures. The analytical results of previous sampling efforts were compared against current regulatory criteria where possible. PHC analyses reported by XCG from 2001 cannot be directly compared to current criteria due to differences in analytical and reporting methodology.

Analytical results from XCG and Jacques Whitford compared to CCME SQGs/CWS and/or MOECC Table 6 and/or MOECC Table 8 criteria (as applicable) is shown in Appendix C.

The approximate delineation of metals, PHC and PAH impacts to the surficial soils exceeding CCME and MOECC Table 6/Table 8 Criteria are presented as **Figures 6, 7** and **8** respectively. While the impacts for metals, PHCs and PAHs are distributed across the site areas impacted by PAHs and PHCs fall within the estimated area of metals impacts, shown in **Figure 9.**

As in previous assessments, metals impacts have been identified at all sample locations across an approximate area of 1370 m^2. Based on the average depth to bedrock, as well as visual observations from the site an estimated volume of between 411 m^3 and 548 m^3 of metal impacted soil is present at the site. However, it should be noted that metals impacts have not been fully delineated and further delineation activities are required to conclusively quantify metals impacts at the site.

It was noted that significant amounts of metal scrap and debris are distributed in the forest surrounding the site. Additionally, a scrap metal dump is present west of the site in a bedrock bounded, seasonal surface water feature with an estimated waste volume of 4 m^3 (**Appendix D**). While not directly observed at the time of the site visit, it was apparent (observed soil erosion, shallow channelization and undercut vegetation, etc.) that this surface water feature results in periodic flowing stream which runs first south east and then to the east towards the site. This metal dump was identified by XCG Consultants in 2001. This metal dump is a potential contributing source of metals impacts in surface soils for areas of the main site down gradient from the metal dump. This estimate is based on the assumption that the metal scrap dump is acting as a source for metal impacts for downgradient areas between the dump and the main site as a result of seasonal surface water runoff.

Based on the results from the 2016 sampling event as well as previous site assessments the volume of PHC impacted soil across the site is estimated to be between 30 m^3 and 40 m^3. However, it should be noted that PHC impacts have not been fully delineated and further delineation activities are required to conclusively quantify PHC impacts at the site.

Based on the results from the 2016 sampling event as well as previous site assessments the volume of PAH impacted soil across the site is estimated to be between 29 m^3 and 38 m^3. However, it should be noted that PAH impacts have not been fully delineated and further delineation activities are required to conclusively quantify PAH impacts at the site.

It should be noted that two FCSI entries exist for the Michipicoten site:

- FCSI 67552001 Lighthouse and Generator Building; and,
- FCSI 67652002 West Landfill

The assessment work, COPCs and partial delineation work discussed above is related to FCSI 6755001. No work has been completed in relation to FCSI 67652002.

7. SUMMARY AND CONCLUSIONS

Based on the results of the investigation the following summary and conclusions are provided;

Summary of 2016 On-Site Soil Sampling Results

- Of the thirty three (33) soil samples taken, thirty one (31) of the samples had measured metal concentrations with concentrations in excess of CCME SQGs, thirty (30) had concentrations in excess of MOECC Table 6 and thirty one (31) had concentrations in excess of MOECC Table 8;
- Eight (8) samples had measured PHC concentrations in excess of CCME SQGs/CWS, eight (8) samples had measured PHC concentrations in excess MOECC Table 6 and eleven (11) samples had measured PHC concentrations in excess of MOECC Table 8;
- Three (3) samples had measured PAH concentrations in excess of CCME SQGs, three (3) samples had measured PAH concentrations in excess of MOECC Table 6 and five (5) samples had measured PAH concentrations in excess MOECC Table 8 criteria;
- Based on the results from the 2016 sampling event as well as previous site assessments the volume of metals impacted soil across the site is estimated to be between 411 m^3 and 548 m^3. However, it should be noted that metals impacts have not been fully delineated and further delineation activities are required to conclusively quantify metals impacts at the site;
- Based on the results from the 2016 sampling event as well as previous site assessments the volume of PHC impacted soil across the site is estimated to be between 30 m^3 and 40 m^3. However, it should be noted that PHC impacts have not been fully delineated and further delineation activities are required to conclusively quantify PHC impacts at the site;
- Based on the results from the 2016 sampling event as well as previous site assessments the volume of PAH impacted soil across the site is estimated to be between 29 m^3 and 38 m^3. However, it should be noted that PAH impacts have not been fully delineated and further delineation activities are required to conclusively quantify PAH impacts at the site; and
- Based on observations, the estimated volume of metal waste in the metal scarp dump west of the main site is 4m^3. This metal dump has the potential to be a contributing source of metals impacts in surface soils for down gradient areas of the main site as described in Section 6.

8. LIMITING CONDITIONS

The conclusions presented in this report represent our professional opinion and are based upon the work described in this report and any limiting conditions in the terms of reference, scope of work, or conditions noted herein.

The findings presented in this report are based on conditions observed at the specified dates and locations, and on the analysis of samples for the specified parameters. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site that were not investigated directly, or types of analysis not performed.

BluMetric Environmental Inc. makes no warranty as to the accuracy or completeness of the information provided by others, or of conclusions and recommendations predicated on the accuracy of that information. Nothing in this report is intended to constitute or provide a legal opinion. BluMetric Environmental Inc. makes no representation as to compliance with environmental laws, rules, regulations or policies established by regulatory agencies.

This report was prepared for Public Works and Government Services Canada, on behalf of Fisheries and Oceans Canada. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric Environmental Inc. in writing. BluMetric Environmental Inc. accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

Should you have any questions regarding this report or require more information, please do not hesitate to contact the undersigned.

Respectfully submitted,
BluMetric Environmental Inc.

Carl Hentschel

Kai Markvorsen, B.Sc.
Environmental Scientist

Carl Hentschel, P.Eng.
Environmental Engineer

9. REFERENCES

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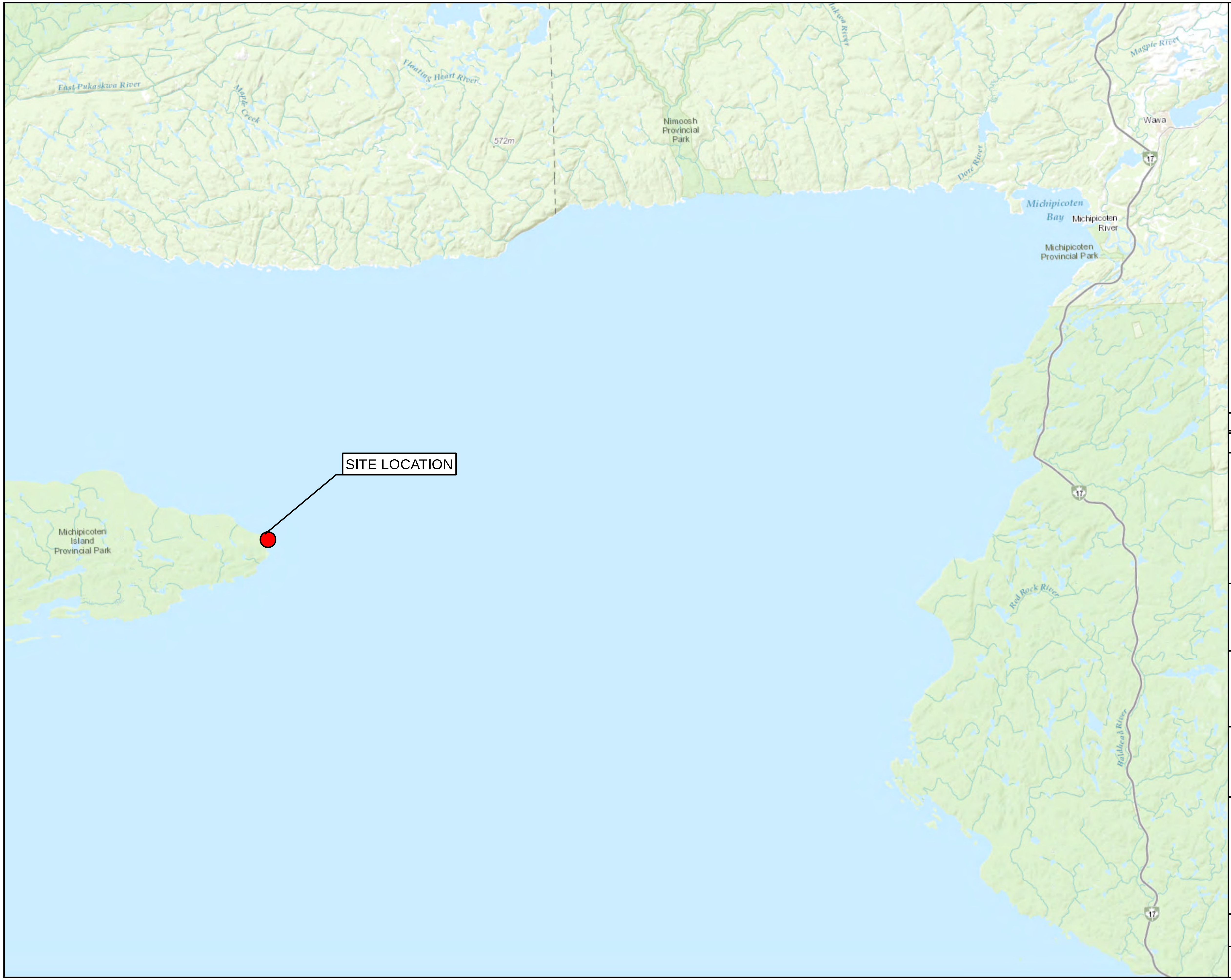
FIGURES



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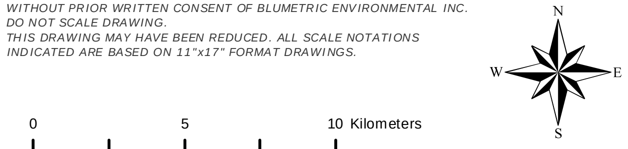

CLIENT

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

SITE LOCATION

BluMetric™ Environmental

The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725
FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #
160528

DATE
May 02, 2017

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LEGEND

▭ Approximate Building Footprint

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REFERENCES

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CLIENT

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

SITE LAYOUT

BluMetric™ Environmental

The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725
FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT # 160528	*DATE* May 02, 2017

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LEGEND

🟥 Test Pit Locations

☐ Approximate Building Footprint

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REFERENCES

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CLIENT

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

TEST PIT LOCATIONS

BluMetric™ Environmental

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PROJECT #	*DATE*
160528	May 02, 2017

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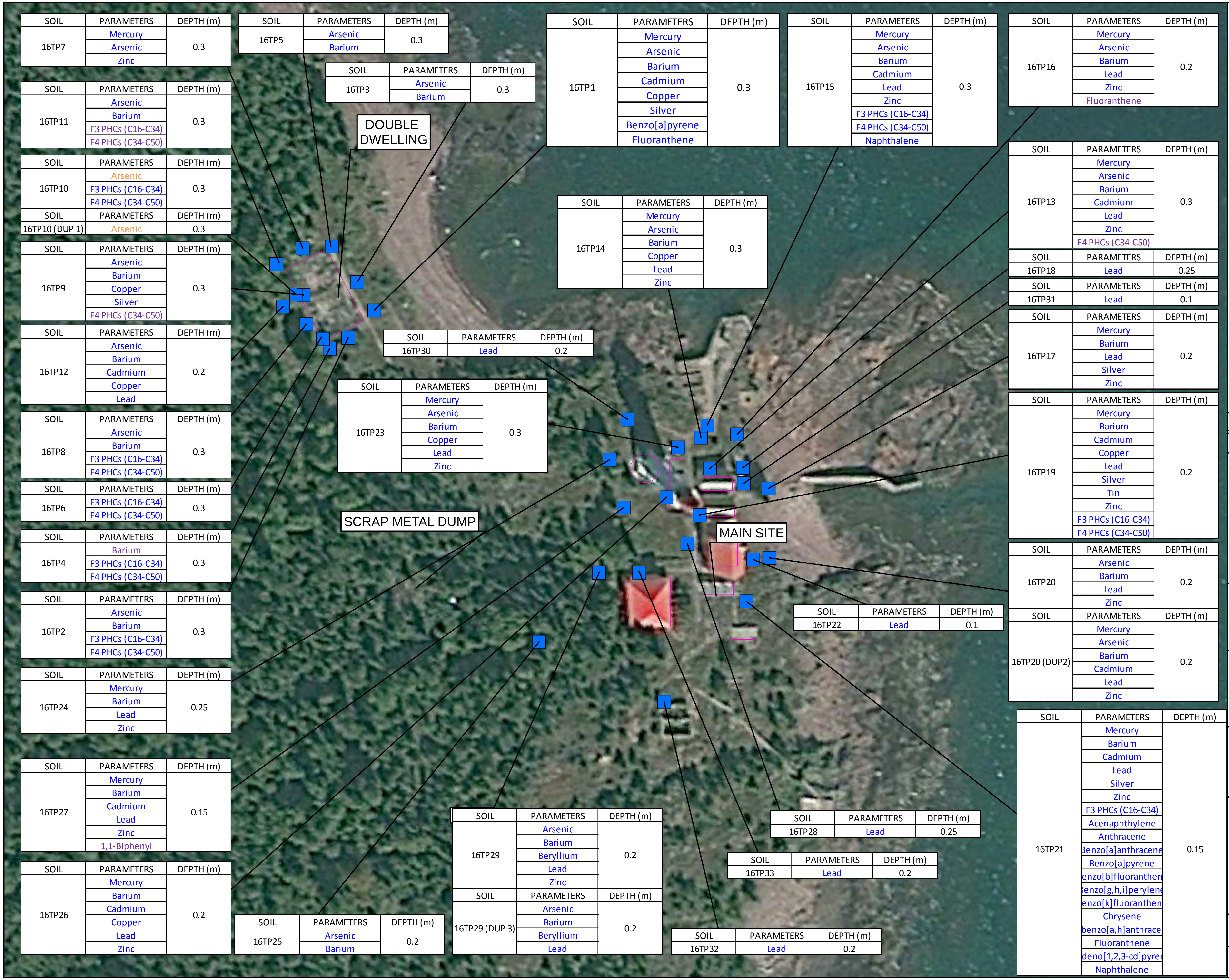

SOIL	PARAMETERS	DEPTH (m)
16TP7	Mercury	0.3
	Arsenic	
	Zinc	

SOIL	PARAMETERS	DEPTH (m)
16TP11	Arsenic	0.3
	Barium	
	F3 PHCs (C16-C34)	
	F4 PHCs (C34-C50)	

SOIL	PARAMETERS	DEPTH (m)
16TP10	Arsenic	0.3
	F3 PHCs (C16-C34)	
	F4 PHCs (C34-C50)	

SOIL	PARAMETERS	DEPTH (m)
16TP10 (DUP 1)	Arsenic	0.3

SOIL	PARAMETERS	DEPTH (m)
16TP9	Arsenic	0.3
	Barium	
	Copper	
	Silver	
	F4 PHCs (C34-C50)	

SOIL	PARAMETERS	DEPTH (m)
16TP12	Arsenic	0.2
	Barium	
	Cadmium	
	Copper	
	Lead	

SOIL	PARAMETERS	DEPTH (m)
16TP8	Arsenic	0.3
	Barium	
	F3 PHCs (C16-C34)	
	F4 PHCs (C34-C50)	

SOIL	PARAMETERS	DEPTH (m)
16TP6	F3 PHCs (C16-C34)	0.3
	F4 PHCs (C34-C50)	

SOIL	PARAMETERS	DEPTH (m)
16TP4	Barium	0.3
	F3 PHCs (C16-C34)	
	F4 PHCs (C34-C50)	

SOIL	PARAMETERS	DEPTH (m)
16TP2	Arsenic	0.3
	Barium	
	F3 PHCs (C16-C34)	
	F4 PHCs (C34-C50)	

SOIL	PARAMETERS	DEPTH (m)
16TP24	Mercury	0.25
	Barium	
	Lead	
	Zinc	

SOIL	PARAMETERS	DEPTH (m)
16TP27	Mercury	0.15
	Barium	
	Cadmium	
	Lead	
	Zinc	
	1,1-Biphenyl	

SOIL	PARAMETERS	DEPTH (m)
16TP26	Mercury	0.2
	Barium	
	Cadmium	
	Copper	
	Lead	
	Zinc	

SOIL	PARAMETERS	DEPTH (m)
16TP5	Arsenic	0.3
	Barium	

SOIL	PARAMETERS	DEPTH (m)
16TP3	Arsenic	0.3
	Barium	

SOIL	PARAMETERS	DEPTH (m)
16TP1	Mercury	0.3
	Arsenic	
	Barium	
	Cadmium	
	Copper	
	Silver	
	Benzo[a]pyrene	
	Fluoranthene	

SOIL	PARAMETERS	DEPTH (m)
16TP14	Mercury	0.3
	Arsenic	
	Barium	
	Copper	
	Lead	
	Zinc	

SOIL	PARAMETERS	DEPTH (m)
16TP30	Lead	0.2

SOIL	PARAMETERS	DEPTH (m)
16TP23	Mercury	0.3
	Arsenic	
	Barium	
	Copper	
	Lead	
	Zinc	

SOIL	PARAMETERS	DEPTH (m)
16TP15	Mercury	0.3
	Arsenic	
	Barium	
	Cadmium	
	Lead	
	Zinc	
	F3 PHCs (C16-C34)	
	F4 PHCs (C34-C50)	
	Naphthalene	

SOIL	PARAMETERS	DEPTH (m)
16TP25	Arsenic	0.2
	Barium	

SOIL	PARAMETERS	DEPTH (m)
16TP29	Arsenic	0.2
	Barium	
	Beryllium	
	Lead	
	Zinc	

SOIL	PARAMETERS	DEPTH (m)
16TP29 (DUP 3)	Arsenic	0.2
	Barium	
	Beryllium	
	Lead	

SOIL	PARAMETERS	DEPTH (m)
16TP28	Lead	0.25

SOIL	PARAMETERS	DEPTH (m)
16TP33	Lead	0.2

SOIL	PARAMETERS	DEPTH (m)
16TP32	Lead	0.2

SOIL	PARAMETERS	DEPTH (m)
16TP22	Lead	0.1

SOIL	PARAMETERS	DEPTH (m)
16TP16	Mercury	0.2
	Arsenic	
	Barium	
	Lead	
	Zinc	
	Fluoranthene	

SOIL	PARAMETERS	DEPTH (m)
16TP13	Mercury	0.3
	Arsenic	
	Barium	
	Cadmium	
	Lead	
	Zinc	
	F4 PHCs (C34-C50)	

SOIL	PARAMETERS	DEPTH (m)
16TP18	Lead	0.25

SOIL	PARAMETERS	DEPTH (m)
16TP31	Lead	0.1

SOIL	PARAMETERS	DEPTH (m)
16TP17	Mercury	0.2
	Barium	
	Lead	
	Silver	
	Zinc	

SOIL	PARAMETERS	DEPTH (m)
16TP19	Mercury	0.2
	Barium	
	Cadmium	
	Copper	
	Lead	
	Silver	
	Tin	
	Zinc	
	F3 PHCs (C16-C34)	
	F4 PHCs (C34-C50)	

SOIL	PARAMETERS	DEPTH (m)
16TP20	Arsenic	0.2
	Barium	
	Lead	
	Zinc	

SOIL	PARAMETERS	DEPTH (m)
16TP20 (DUP2)	Mercury	0.2
	Arsenic	
	Barium	
	Cadmium	
	Lead	
	Zinc	

SOIL	PARAMETERS	DEPTH (m)
16TP21	Mercury	0.15
	Barium	
	Cadmium	
	Lead	
	Silver	
	Zinc	
	F3 PHCs (C16-C34)	
	Acenaphthylene	
	Anthracene	
	Benzo[a]anthracene	
	Benzo[a]pyrene	
	enzo[b]fluoranthen	
	Benzo[g,h,i]perylene	
	enzo[k]fluoranthen	
	Chrysene	
	benzo[a,h]anthrace	
	Fluoranthene	
	deno[1,2,3-cd]pyrer	
	Naphthalene	

LEGEND

🟦	Sample Location Exceeding (BluMetric, 2016)
▭	Approximate Building Footprint

Exceeded CCME, MOECC Table 6 and/or MOECC Table 8

Exceeded CCME

Exceeded MOECC Table 6 and/or MOECC Table 8

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

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0 10 20 Meters

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PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

SAMPLE EXCEEDANCES

BluMetric™ Environmental

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Kingston, Ontario K7K 1Z7
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Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #	DATE
160528	June 12, 2017

DRAWN	CHECKED	FIG NO.	REV
WC	KM	4	0

LEGEND

◆ Sample Location (XCG, 2001)

▲ Sample Location (JW, 2005)

☐ Approximate Building Footprint

NOTE: Sample locations from previous report are approximated and not based on GPS coordinates.

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

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PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

APPROXIMATE SAMPLE LOCATIONS FROM PREVIOUS ASSESSMENTS

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PROJECT # 160528	*DATE* May 02, 2017

DRAWN IB	*CHECKED* KM	*FIG NO.* 5	*REV* 0

LEGEND

- ■ Sample Location Exceeding (BluMetric, 2016)
- ▲ Sample Location Exceeding (JW, 2005)
- ▭ Approximate Building Footprint
- ▭ Contamination Plume (BluMetric, 2016)

Metal impacts have not been fully delineated.
The plumes presented represent an approximation of the extent of site impacts

NOTE: Sample locations from previous report are approximated and not based on GPS coordinates.

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC.
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0 5 10 Meters

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PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

DELINEATION OF METAL EXCEEDANCES

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PROJECT #	DATE
160528	May 02, 2017

DRAWN	CHECKED	FIG NO.	REV
IB	KM	6	0

LEGEND

🟥 Sample Location Exceeding (BluMetric, 2016)

▲ Sample Location Excceding (JW,2005)

▭ Approximate Building Footprint

▭ Contamination Plume (BluMetric, 2016)

PHC impacts have not been fully delineated.
The plumes presented represent an approximation of the extent of site impacts

NOTE: Sample locations from previous report are approximated and not based on GPS coordinates.

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

REFERENCES

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0 5 10 Meters

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PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

DELINEATION OF PHC EXCEEDANCES

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PROJECT # 160528	*DATE* May 02, 2017

DRAWN IB	*CHECKED* KM	*FIG NO.* 7	*REV* 0

LEGEND

🟩	Sample Location Exceeding (BluMetric, 2016)
▲	Sample Location Exceeding (JW, 2005)
▭	Approximate Building Footprint
▭	Contamination Plume (BluMetric, 2016)

PAH impacts have not been fully delineated.
The plumes presented represent an approximation of the extent of site impacts

NOTE: Sample locations from previous report are approximated and not based on GPS coordinates.

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

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0 5 10 Meters

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PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

DELINEATION OF PAH EXCEEDANCES

BluMetric™ Environmental

The Tower - The Woolen Mill,
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Kingston, Ontario K7K 1Z7
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Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #	DATE
160528	May 02, 2017

DRAWN	CHECKED	FIG NO.	REV
IB	KM	8	0

LEGEND

■	Sample Locations (BluMetric, 2016)
▲	Previous Assessment Sample Locations (JW, 2015)
🟦	Metals Contamination Plume (BluMetric, 2016)
🟥	PHC Contamination Plume (BluMetric, 2016)
🟩	PAH Contamination Plume (BluMetric, 2016)
⬛	Approximate Building Footprint

Metal, PAH and PHC impacts have not been fully delineated.
The plumes presented represent an approximation of the extent of site impacts

NOTE: Sample locations from previous report are approximated and not based on GPS coordinates.

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

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0 5 10 Meters

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PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

COMBINED DELINEATION OF EXCEEDANCES (METAL, PHC, PAH)

BluMetric™ Environmental

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PROJECT #	DATE
160528	May 02, 2017

DRAWN	CHECKED	FIG NO.	REV
IB	KM	9	0

APPENDIX A

Soil Analytical Results

Table A-1: Soil Analytical Results (BluMetric Sep 2016)

Sample Name						16TP1	16TP2	16TP3	16TP4	16TP5	16TP6	16TP7	16TP8	16TP9	16TP10	16TP11	16TP12	16TP13	16TP14	16TP15	16TP16
Date						09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016
Area of Potential Environmental Concern						Area 1	Area 1	Area 1	Area 1	Area 1	Area 1	Area 1	Area 1	Area 1	Area 1	Area 1	Area 1	Area 2	Area 2	Area 2	Area 2
Sample depth (metres below ground surface)						0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2
Parameter	Units	MDL	Criteria																		
			Table 6[1]	Table 8[2]	CCME[3]																
General Inorganics																					
pH	pH Units	0.05				N/A	4.21	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.18	N/A	N/A
Metals																					
Mercury	ug/g	0.1	0.27 ug/g	0.27 ug/g	6.6 ug/g	*0.3*	0.1	0.1	< 0.1	< 0.1	< 0.1	*1.6*	0.1	0.2	0.1	0.2	0.1	*1.0*	*4.4*	*1.7*	*0.5*
Antimony	ug/g	1.0	7.5 ug/g	1.3 ug/g	20 ug/g	< 1.0	< 1.3	< 1.4	< 1.7	< 2.0	< 1.7	< 2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/g	1.0	18 ug/g	18 ug/g	12 ug/g	*36.3*	*50.8*	*53.8*	8.3	*49.4*	9.6	*30.6*	16.5	*45.2*	15.0	*69.8*	*22.7*	*25.4*	*101*	15.6	15.2
Barium	ug/g	1.0	390 ug/g	220 ug/g	500 ug/g	*326*	*244*	*302*	*253*	*328*	156	179	*387*	*377*	136	*318*	*573*	*608*	*859*	*2350*	*844*
Beryllium	ug/g	1.0	4 ug/g	2.5 ug/g	4 ug/g	2.4	< 1.3	2.0	< 1.7	< 2.0	< 1.7	< 2.1	< 1.0	1.3	< 1.0	1.6	2.1	1.2	< 1.0	1.1	1.5
Boron	ug/g	1.0	120 ug/g	36 ug/g		10.2	8.3	10.7	10.7	6.4	10.7	6.1	8.2	7.0	6.4	8.3	7.4	7.5	29.5	7.5	5.7
Cadmium	ug/g	0.5	1.2 ug/g	1.2 ug/g	10 ug/g	*5.3*	< 0.7	< 0.7	< 0.8	< 1.0	< 0.8	< 1.0	< 0.5	< 0.5	< 0.5	< 0.5	*2.9*	*6.8*	< 0.5	*2.3*	5.3
Chromium	ug/g	1.0	160 ug/g	70 ug/g	64 ug/g	13.4	11.3	13.0	6.3	12.2	10.0	10.5	10.4	10.5	11.2	9.8	6.9	12.8	62.5	23.9	25.2
Cobalt	ug/g	1.0	22 ug/g	22 ug/g	50 ug/g	3.7	3.2	4.7	< 1.7	3.7	1.8	2.9	3.6	3.0	2.1	3.1	3.7	3.2	4.0	5.3	5.3
Copper	ug/g	1.0	140 ug/g	92 ug/g	63 ug/g	*111*	39.7	22.5	24.7	32.7	13.0	24.4	24.0	87.9	18.0	32.5	69.3	32.6	*187*	62.8	56.2
Lead	ug/g	1.0	120 ug/g	120 ug/g	140 ug/g	76.0	67.8	41.9	49.7	67.2	87.7	92.8	63.3	58.1	36.7	57.3	*371*	*478*	*1090*	*1400*	*4370*
Molybdenum	ug/g	1.0	6.9 ug/g	2 ug/g	10 ug/g	< 1.0	< 1.3	< 1.4	< 1.7	< 2.0	< 1.7	< 2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nickel	ug/g	1.0	100 ug/g	82 ug/g	45 ug/g	31.1	6.8	7.8	5.3	10.3	4.8	8.4	8.1	8.9	6.4	6.2	4.9	4.8	9.9	7.9	9.6
Selenium	ug/g	1.0	2.4 ug/g	1.5 ug/g	1 ug/g	< 1.0	< 1.3	< 1.4	< 1.7	< 2.0	< 1.7	< 2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Silver	ug/g	0.5	20 ug/g	0.5 ug/g	20 ug/g	*18.2*	< 0.7	< 0.7	< 0.8	< 1.0	< 0.8	< 1.0	< 0.5	*1.8*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Thallium	ug/g	1.0	1 ug/g	1 ug/g	1 ug/g	< 1.0	< 1.3	< 1.4	< 1.7	< 2.0	< 1.7	< 2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tin	ug/g	5.0			50 ug/g	< 5.0	8.6	< 7.1	< 8.3	< 10.0	< 8.3	< 10.4	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	7.8	< 5.0	13.5
Uranium	ug/g	1.0	23 ug/g	2.5 ug/g	23 ug/g	< 1.0	< 1.3	< 1.4	< 1.7	< 2.0	< 1.7	< 2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium	ug/g	1.0	86 ug/g	86 ug/g	130 ug/g	23.2	17.7	26.5	11.6	26.2	14.9	25.0	29.3	20.5	25.0	22.7	10.9	12.3	16.4	11.0	15.4
Zinc	ug/g	1.0	340 ug/g	290 ug/g	200 ug/g	80.2	64.7	51.1	75.7	58.1	119	*381*	152	77.0	58.0	58.9	136	289	*534*	*2850*	*988*
Hydrocarbons																					
F1 PHCs (C6-C10)	ug/g	7	55 ug/g	25 ug/g	30 ug/g	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7
F2 PHCs (C10-C16)	ug/g	4	98 ug/g	10 ug/g	150 ug/g	< 4	< 4	< 4	< 4	< 4	< 4	N/A	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
F3 PHCs (C16-C34)	ug/g	8	300 ug/g	240 ug/g	300 ug/g	213	*359*	102	*676*	37	*601*	N/A	*589*	215	*388*	*254*	118	224	91	*2730*	< 8
F4 PHCs (C34-C50)	ug/g	6	2800 ug/g	120 ug/g	2800 ug/g	65	*169*	107	*248*	43	*266*	N/A	*180*	*135*	*253*	*237*	115	*173*	108	*1440*	< 6
Semi-Volatiles																					
Acenaphthene	ug/g	0.02	7.9 ug/g	0.072 ug/g	0.28 ug/g	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Acenaphthylene	ug/g	0.02	0.15 ug/g	0.093 ug/g	320 ug/g	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.02	< 0.02	0.09
Anthracene	ug/g	0.02	0.67 ug/g	0.22 ug/g	2.5 ug/g	0.11	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.08
Benzo[a]anthracene	ug/g	0.02	0.5 ug/g	0.36 ug/g	1 ug/g	0.36	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.12	0.04	0.24
Benzo[a]pyrene	ug/g	0.02	0.3 ug/g	0.3 ug/g	20 ug/g	*0.34*	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.13	0.04	0.25
Benzo[b]fluoranthene	ug/g	0.02	0.78 ug/g	0.47 ug/g	1 ug/g	0.40	< 0.02	< 0.02	< 0.02	< 0.02	0.05	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.20	0.11	0.33
Benzo[g,h,i]perylene	ug/g	0.02	6.6 ug/g	0.68 ug/g		0.20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.10	0.02	0.17
Benzo[k]fluoranthene	ug/g	0.02	0.78 ug/g	0.48 ug/g	1 ug/g	0.22	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.09	0.04	0.18
1,1-Biphenyl	ug/g	0.02	0.31 ug/g	0.05 ug/g		< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.03	< 0.02
Chrysene	ug/g	0.02	7 ug/g	2.8 ug/g	6.2 ug/g	0.32	< 0.02	< 0.02	< 0.02	< 0.02	0.05	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.15	0.05	0.26
Dibenzo[a,h]anthracene	ug/g	0.02	0.1 ug/g	0.1 ug/g	1 ug/g	0.06	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.03	< 0.02	0.06
Fluoranthene	ug/g	0.02	0.69 ug/g	0.69 ug/g	50 ug/g	*0.76*	< 0.02	< 0.02	< 0.02	< 0.02	0.05	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.35	0.07	*0.77*
Fluorene	ug/g	0.02	62 ug/g	0.19 ug/g	0.25 ug/g	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Indeno[1,2,3-cd]pyrene	ug/g	0.02	0.38 ug/g	0.23 ug/g	1 ug/g	0.22	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.11	< 0.02	0.18
1-Methylnaphthalene	ug/g	0.02	0.99 ug/g	0.59 ug/g		< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.20	< 0.02
2-Methylnaphthalene	ug/g	0.02	0.99 ug/g	0.59 ug/g		< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.35	< 0.02
Methylnaphthalene (1&2)	ug/g	0.04	0.99 ug/g	0.59 ug/g		< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	N/A	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.55	< 0.04
Naphthalene	ug/g	0.01	0.6 ug/g	0.09 ug/g	0.013 ug/g	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	N/A	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	*0.19*	0.03
Phenanthrene	ug/g	0.02	6.2 ug/g	0.69 ug/g	0.046 ug/g	0.38	< 0.02	< 0.02	< 0.02	< 0.02	0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.04	0.12	0.19
Pyrene	ug/g	0.02	78 ug/g	1 ug/g	10 ug/g	0.59	< 0.02	< 0.02	< 0.02	< 0.02	0.03	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.22	0.07	0.73
Quinoline	ug/g	0.10				< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	N/A	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Criteria:

1. Reg 153/04 (2011) - Table 6: Generic Site Condition Standards for Shallow Soils in a Pottable Groundwater Condition, Residential/Parkland/Institutional (Coarse)
2. Reg 153/04 (2011) - Table 8: Generic Site Condition Standards for use within 30m of a Waterbody in a Pottable Groundwater Condition Residential/Parkland/Institutional/Industrial/Commercial/Community Property use
3. CCME Soil Quality Guidelines Residential, coarse

Notes:

MDL - Method Detection Limit
N/A - Not Analysed

Screening:

☐ - Exceeds MOECC Table 6
0.08 - Exceeds MOECC Table 8
🟥 - Exceeds CCME

16TP17	16TP18	16TP19	16TP20	16TP21	16TP22	16TP23	16TP24	16TP25	16TP26	16TP27	16TP28	16TP29	16TP30	16TP31	16TP32	16TP33	DUP1 (16TP10)	DUP2 16TP20	DUP3 (16TP29)
09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016	09/23/2016
Area 2	Area 2	Area 2	Area 2	Area 2	Area 2	Area 3	Area 3	Area 3	Area 3	Area 3	Area 3	Area 3	Area 3	Area 2	Area 3	Area 3	Area 1	Area 2	Area 3
0.2	0.25	0.2	0.2	0.15	0.1	0.3	0.25	0.2	0.2	0.15	0.25	0.2	0.2	0.1	0.2		0.3	0.2	0.2
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.17	N/A	N/A	5.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.4	0.1	*6.6*	0.2	*9.5*	N/A	*0.6*	*0.3*	0.2	*0.5*	*0.6*	0.2	0.2	N/A	N/A	N/A	N/A	< 0.1	*0.3*	0.2
< 1.0	< 1.0	< 1.0	< 1.3	< 1.0	N/A	< 1.7	< 1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	N/A	N/A	N/A	N/A	< 1.2	< 1.0	< 1.0
8.5	5.5	8.5	*19.2*	12.0	N/A	14.6	7.2	*30.4*	10.5	7.3	4.2	*47.5*	N/A	N/A	N/A	N/A	16.2	16.3	*43.8*
226	65.0	*849*	*555*	*607*	N/A	*410*	*343*	*306*	*835*	*452*	85.9	*485*	N/A	N/A	N/A	N/A	142	*688*	*589*
< 1.0	< 1.0	< 1.0	2.4	< 1.0	N/A	< 1.7	< 1.4	2.2	< 1.0	< 1.0	< 1.0	*3.9*	N/A	N/A	N/A	N/A	< 1.2	2.1	*4.1*
5.3	2.1	11.3	14.7	7.9	N/A	10.0	12.5	6.6	10.8	9.0	3.9	8.9	N/A	N/A	N/A	N/A	10.8	9.5	9.3
< 0.5	< 0.5	*3.0*	< 0.7	*6.6*	N/A	< 0.8	< 0.7	< 0.5	*3.2*	*2.7*	< 0.5	< 0.5	N/A	N/A	N/A	N/A	< 0.6	*2.9*	< 0.5
15.8	11.4	36.1	16.5	26.0	N/A	10.6	17.2	4.2	14.6	6.7	16.1	20.6	N/A	N/A	N/A	N/A	15.9	14.0	18.0
5.2	5.6	4.8	4.9	5.9	N/A	2.9	3.5	9.1	2.9	1.6	5.1	10.2	N/A	N/A	N/A	N/A	2.6	4.3	11.2
50.5	52.8	*211*	58.9	53.2	N/A	63.9	46.7	13.8	*161*	42.7	15.1	44.0	N/A	N/A	N/A	N/A	20.8	57.1	46.9
847	*282*	*2270*	*827*	*2670*	*3000*	*927*	*468*	51.4	*1850*	*639*	*208*	*1200*	*3880*	*587*	*3310*	*700*	49.1	*708*	*1420*
< 1.0	< 1.0	< 1.0	< 1.3	< 1.0	N/A	< 1.7	< 1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	N/A	N/A	N/A	N/A	< 1.2	< 1.0	< 1.0
17.4	8.2	9.8	10.5	20.1	N/A	6.6	8.4	2.8	5.5	4.4	7.8	10.9	N/A	N/A	N/A	N/A	8.7	8.8	10.0
< 1.0	< 1.0	< 1.0	< 1.3	< 1.0	N/A	< 1.7	< 1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	N/A	N/A	N/A	N/A	< 1.2	< 1.0	< 1.0
0.6	< 0.5	*0.7*	< 0.7	*4.4*	N/A	< 0.8	< 0.7	< 0.5	*0.7*	< 0.5	< 0.5	< 0.5	N/A	N/A	N/A	N/A	< 0.6	< 0.5	< 0.5
< 1.0	< 1.0	< 1.0	< 1.3	< 1.0	N/A	< 1.7	< 1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	N/A	N/A	N/A	N/A	< 1.2	< 1.0	< 1.0
28.6	5.9	55.5	7.2	11.6	N/A	< 8.3	< 7.1	< 5.0	24.7	32.4	< 5.0	10.8	N/A	N/A	N/A	N/A	< 6.2	< 5.0	11.1
< 1.0	< 1.0	< 1.0	< 1.3	< 1.0	N/A	< 1.7	< 1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	N/A	N/A	N/A	N/A	< 1.2	< 1.0	< 1.0
37.9	27.2	17.5	29.2	16.9	N/A	14.0	15.9	16.9	12.4	6.9	35.5	31.0	N/A	N/A	N/A	N/A	33.2	24.6	32.4
399	119	*620*	*323*	*1110*	N/A	*300*	224	85.5	*1110*	*376*	104	265	N/A	N/A	N/A	N/A	72.0	272	26.6
< 7	< 7	< 7	< 7	< 7	N/A	< 7	< 7	< 7	< 7	< 7	< 7	< 7	N/A	N/A	N/A	N/A	< 7	< 7	< 7
< 4	< 4	< 4	< 4	< 4	N/A	< 4	< 4	< 4	< 4	< 4	< 4	< 4	N/A	N/A	N/A	N/A	< 4	< 4	< 4
< 8	< 8	*381*	20	*344*	N/A	< 8	48	< 8	41	188	50	< 8	N/A	N/A	N/A	N/A	114	< 8	42
< 6	< 6	*141*	< 6	57	N/A	< 6	32	< 6	< 6	25	< 6	< 6	N/A	N/A	N/A	N/A	< 6	< 6	< 6
< 0.02	< 0.02	< 0.02	< 0.02	0.02	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	0.02	< 0.02	< 0.02	*2.20*	N/A	< 0.02	< 0.02	< 0.02	< 0.02	0.06	< 0.02	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	*1.07*	N/A	< 0.02	< 0.02	< 0.02	< 0.02	0.04	0.04	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	0.10	< 0.02	< 0.02	*3.84*	N/A	< 0.02	0.04	< 0.02	0.05	0.24	0.06	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	0.12	< 0.02	< 0.02	*5.26*	N/A	< 0.02	0.04	< 0.02	0.06	0.26	0.06	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	0.18	0.02	< 0.02	*15.6*	N/A	< 0.02	0.06	< 0.02	0.11	0.37	0.08	< 0.02	N/A	N/A	N/A	N/A	< 0.02	0.03	0.02
< 0.02	0.10	0.04	< 0.02	*7.21*	N/A	< 0.02	0.04	< 0.02	0.05	0.20	0.04	< 0.02	N/A	N/A	N/A	N/A	< 0.02	0.03	< 0.02
< 0.02	0.09	< 0.02	< 0.02	*6.73*	N/A	< 0.02	0.03	< 0.02	0.05	0.15	0.05	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	0.03	N/A	< 0.02	< 0.02	< 0.02	< 0.02	*0.12*	< 0.02	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	0.13	< 0.02	< 0.02	*4.79*	N/A	< 0.02	0.04	< 0.02	0.05	0.27	0.06	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	0.02
< 0.02	0.03	< 0.02	< 0.02	*1.82*	N/A	< 0.02	< 0.02	< 0.02	< 0.02	0.09	< 0.02	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	0.20	< 0.02	< 0.02	*3.03*	N/A	< 0.02	0.09	< 0.02	0.09	0.37	0.17	< 0.02	N/A	N/A	N/A	N/A	< 0.02	0.02	0.03
< 0.02	< 0.02	< 0.02	< 0.02	0.03	N/A	< 0.02	< 0.02	< 0.02	< 0.02	0.02	< 0.02	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	0.11	0.03	< 0.02	*7.67*	N/A	< 0.02	0.04	< 0.02	0.06	0.18	0.05	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	< 0.02
< 0.02	< 0.02	0.02	< 0.02	0.13	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	0.15
< 0.02	< 0.02	0.05	< 0.02	0.25	N/A	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	0.17
< 0.04	< 0.04	0.07	< 0.04	0.38	N/A	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	N/A	N/A	N/A	N/A	< 0.04	< 0.04	0.32
< 0.01	0.01	0.02	< 0.01	*0.33*	N/A	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	N/A	N/A	N/A	N/A	< 0.01	0.01	0.09
< 0.02	0.03	< 0.02	< 0.02	0.41	N/A	< 0.02	< 0.02	< 0.02	< 0.02	0.06	0.12	< 0.02	N/A	N/A	N/A	N/A	< 0.02	< 0.02	0.14
< 0.02	0.19	< 0.02	< 0.02	*3.47*	N/A	< 0.02	0.07	< 0.02	0.07	0.33	0.13	< 0.02	N/A	N/A	N/A	N/A	< 0.02	0.02	0.03
< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	N/A	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	N/A	N/A	N/A	N/A	< 0.10	< 0.10	< 0.10

Table A-2: Soil Analytical Results (Jacques Whitford)

Sample Name						CS1-1*	CS1-3*	CS1-4 Duplicate	CS1-5*	CS1-6	CS1-6 Duplicate	CS1-7	CS1-8	CS1-9	CS1-9 Duplicate*	CS1-10*	CS2-2*	CS2-4*	CS2-5	CS2-5 Duplicate	CS2-6	CS2-6 Duplicate*
Date																						
Area of Potential Environmental Concern																						
Sample depth (metres below ground surface)						0.2	0.2	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.1	0.2	0.2	0.2		0.2	0.2
Parameter	Units	MDL	Criteria																			
			Table 6 [1]	Table 8 [2]	CCME [3]																	
General Inorganics																						
pH	pH Units	0.05																				
Metals																						
Mercury	ug/g	0.1	0.27 ug/g	0.27 ug/g	6.6 ug/g	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	ug/g	1.0	7.5 ug/g	1.3 ug/g	20 ug/g	1.1	**3.2**		**2.1**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**1.4**	<1.0	<1.0	1.2	N/A	1.1	<1.0
Arsenic	ug/g	1.0	18 ug/g	18 ug/g	12 ug/g	12	18		2.1	12	<1.0	**37**	**99**	**57**	**57**	6.6	**25**	5.2	**19**	N/A	**20**	**23**
Barium	ug/g	1.0	390 ug/g	220 ug/g	500 ug/g	**350**	**1200**		**430**	140	140	**640**	**320**	**560**	**660**	**260**	180	59	**440**	**430**	**260**	**310**
Beryllium	ug/g	1.0	4 ug/g	2.5 ug/g	4 ug/g	2.4	<0.5		0.8	1.2	1.1	**4.2**	**4.8**	**4.4**	**5.1**	0.8	1	0.8	1.1	1.1	0.7	0.8
Boron	ug/g	1.0	120 ug/g	36 ug/g																		
Cadmium	ug/g	0.5	1.2 ug/g	1.2 ug/g	10 ug/g	**4.4**	**4.2**		**1.7**	0.7	0.7	**1.8**	**3**	**2.1**	**2.8**	1	0.8	**1.4**	**3.7**	**3.6**	**2.4**	**3.3**
Chromium	ug/g	1.0	160 ug/g	70 ug/g	64 ug/g	14	58		13	17	17	6.7	5.9	7.3	8	16	3.7	16	10	10	12	13
Cobalt	ug/g	1.0	22 ug/g	22 ug/g	50 ug/g	4	6.1		3.2	13	13	6.3	10	19	**23**	4.5	2.9	4.8	3.9	3.8	3.7	4.8
Copper	ug/g	1.0	140 ug/g	92 ug/g	63 ug/g	120	96		77	74	81	30	25	49	58	57	22	21	76	72	82	76
Lead	ug/g	1.0	120 ug/g	120 ug/g	140 ug/g	**580**	**5800**		**1100**	**250**	**210**	64	48	97	110	**390**	21	63	110	110	86	98
Molybdenum	ug/g	1.0	6.9 ug/g	2 ug/g	10 ug/g	1.1	**3.2**		1.9	**3.1**	**3.1**	**3.5**	**3.5**	1.6	1.6	0.8	<0.5	0.6	1	1.6	1.7	1.9
Nickel	ug/g	1.0	100 ug/g	82 ug/g	45 ug/g	7.4	7.4		5.3	23	23	3.3	2.4	3.9	4.2	8.6	3	37	9.1	9	8.6	11
Selenium	ug/g	1.0	2.4 ug/g	1.5 ug/g	1 ug/g	1.3	**1.8**		**2.7**	1.4	<1.0	**4**	**1.9**	**3**	**3.9**	<1	<1	<1	**2.6**	N/A	1.5	**1.8**
Silver	ug/g	0.5	20 ug/g	0.5 ug/g	20 ug/g	<0.3	<0.3		<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.5	0.6
Thallium	ug/g	1.0	1 ug/g	1 ug/g	1 ug/g																	
Tin	ug/g	5.0			50 ug/g																	
Uranium	ug/g	1.0	23 ug/g	2.5 ug/g	23 ug/g																	
Vanadium	ug/g	1.0	86 ug/g	86 ug/g	130 ug/g	14	14		13	27	26	27	60	33	36	18	19	17	22	21	27	27
Zinc	ug/g	1.0	340 ug/g	290 ug/g	200 ug/g	**820**	**3400**		**590**	150	160	55	76	150	180	220	34	**360**	180	180	140	150
Hydrocarbons																						
F1 PHCs (C6-C10)	ug/g	7	55 ug/g	25 ug/g	30 ug/g	<10	<10	<10	<10	<10		<10	<10	<10	<10	<10	<10	<10	<10		<10	<10
F2 PHCs (C10-C16)	ug/g	4	98 ug/g	10 ug/g	150 ug/g	**31**	<10	<10	<10	<10		<40	<40	<20	<10	16	<10	**58**	10		<10	<10
F3 PHCs (C16-C34)	ug/g	8	300 ug/g	240 ug/g	300 ug/g	**5500**	**890**	56	180	66		<40	62	200	100	**320**	210	**2800**	92		48	12
F4 PHCs (C34-C50)	ug/g	6	2800 ug/g	120 ug/g	2800 ug/g	**550**	**570**	14	44	55		<40	<40	52	<10	**140**	120	**5000**	23		<10	<10
Semi-Volatiles																						
Acenaphthene	ug/g	<0.05	7.9 ug/g	0.072 ug/g	0.28 ug/g	<0.05	<0.05		<0.05	<0.01		<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	ug/g	<0.03	0.15 ug/g	0.093 ug/g	320 ug/g	<0.03	0.05		**0.27**	<0.005		<0.005	<0.005	<0.005	<0.005	<0.03	<0.005	<0.03	<0.005	<0.005	<0.005	<0.005
Anthracene	ug/g	<0.03	0.67 ug/g	0.22 ug/g	2.5 ug/g	<0.03	0.05		**0.58**	<0.005		<0.005	<0.005	<0.005	<0.005	<0.03	<0.005	<0.03	<0.005	<0.005	<0.005	<0.005
Benzo[a]anthracene	ug/g	<0.05	0.5 ug/g	0.36 ug/g	1 ug/g	<0.05	**0.41**		**2.69**	<0.01		<0.01	<0.01	<0.01	<0.01	0.34	<0.01	0.07	0.03	<0.01	<0.01	0.02
Benzo[a]pyrene	ug/g	<0.03	0.3 ug/g	0.3 ug/g	20 ug/g	<0.03	0.28		**1.5**	<0.005		<0.005	<0.005	<0.005	0.015	0.24	<0.005	<0.03	<0.005	<0.005	<0.005	<0.005
Benzo[b]fluoranthene	ug/g	<0.03	0.78 ug/g	0.47 ug/g	1 ug/g	<0.03	0.41		**1.81**	<0.005		<0.005	<0.005	<0.005	<0.005	0.33	<0.005	0.08	<0.005	<0.005	<0.005	<0.005
Benzo[g,h,i]perylene	ug/g	<0.1	6.6 ug/g	0.68 ug/g		<0.1	0.2		**0.9**	<0.02		<0.02	<0.02	<0.02	<0.02	0.3	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02
Benzo[k]fluoranthene	ug/g	<0.05	0.78 ug/g	0.48 ug/g	1 ug/g	<0.05	0.19		**0.74**	<0.01		<0.01	<0.01	<0.01	<0.01	0.13	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01
1,1-Biphenyl	ug/g		0.31 ug/g	0.05 ug/g				<0.02				<0.02										
Chrysene	ug/g	<0.05	7 ug/g	2.8 ug/g	6.2 ug/g	<0.05	0.35		**2.29**	<0.01		<0.01	<0.01	<0.01	0.02	0.25	<0.01	0.06	<0.01	<0.01	<0.01	<0.01
Dibenzo[a,h]anthracene	ug/g	<0.01	0.1 ug/g	0.1 ug/g	1 ug/g	<0.01	<0.1		**0.3**	<0.02		<0.02	<0.02	<0.02	<0.02	<0.1	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02
Fluoranthene	ug/g	0.4	0.69 ug/g	0.69 ug/g	50 ug/g	0.4	0.61		**4.88**	0.011		<0.005	<0.005	<0.005	0.035	0.34	<0.005	0.06	<0.005	<0.005	<0.005	0.017
Fluorene	ug/g	<0.03	62 ug/g	0.19 ug/g	0.25 ug/g	<0.03	<0.03		<0.03	<0.005		<0.005	<0.005	<0.005	<0.005	<0.03	<0.005	<0.03	<0.005	<0.005	<0.005	<0.005
Indeno[1,2,3-cd]pyrene	ug/g	<0.1	0.38 ug/g	0.23 ug/g	1 ug/g	<0.1	0.2		**1.2**	<0.02		<0.02	<0.02	<0.02	<0.02	**0.3**	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02
1-Methylnaphthalene	ug/g	<0.03	0.99 ug/g	0.59 ug/g		<0.03	0.05		<0.03	<0.005		<0.117	<0.005	<0.005	<0.005	<0.03	<0.005	<0.03	0.008	<0.005	<0.005	<0.005
2-Methylnaphthalene	ug/g	0.04	0.99 ug/g	0.59 ug/g		0.04	0.06		<0.03	<0.005		<0.005	<0.005	<0.005	<0.005	<0.03	<0.005	<0.03	0.019	<0.005	<0.005	<0.005
Methylnaphthalene (1&2)	ug/g		0.99 ug/g	0.59 ug/g		0.04	0.11		<0.06	<0.010		<.122	<0.010	<0.010	<0.010	<0.06	<0.010	<0.06	0.027	<0.010	<0.010	<0.010
Naphthalene	ug/g	<0.03	0.6 ug/g	0.09 ug/g	0.013 ug/g	<0.03	0.05		<0.03	<0.005		<0.005	<0.005	<0.005	<0.005	<0.03	<0.005	<0.03	<0.005	<0.005	<0.005	<0.005
Phenanthrene	ug/g	<0.03	6.2 ug/g	0.69 ug/g	0.046 ug/g	<0.03	0.2		**1.77**	<0.005		<0.005	<0.005	<0.005	<0.005	<0.03	<0.005	0.03	<0.005	<0.005	<0.005	0.013
Pyrene	ug/g	0.13	78 ug/g	1 ug/g	10 ug/g	0.13	0.58		**5.93**	0.008		<0.005	<0.005	<0.005	0.045	<0.03	<0.005	0.05	0.01	<0.005	<0.005	0.013
Quinoline	ug/g																					

Criteria:

1. Reg 153/04 (2011) - Table 6: Generic Site Condition Standards for Shallow Soils in a Pottable Groundwater Condition, Residential/Parkland/Institutional (Coarse)
2. Reg 153/04 (2011) - Table 8: Generic Site Condition Standards for use within 30m of a Waterbody in a Pottable Groundwater Condition Residential/Parkland/Institutional/Industrial/Commercial/Community Property use
3. CCME Soil Quality Guidelines Residential, coarse

Notes:

MDL - Method Detection Limit
N/A - Not Analysed
* - MDL specific to sample PAH analysis, see Table III JW Report

Screening:

☐ - Exceeds MOECC Table 6
0.08 - Exceeds MOECC Table 8
🟥 - Exceeds CCME

Table A-3: Soil Analytical Results (XCG)

Sample Name						MIC-HFS-1	MIC-HFS-2	MIC-HFS-3	MIC-HFS-4	MIC-HFS-5	MIC-HFS-6	MIC-HFS-6 DUP	MIC-LF-1	MIC-LF-2	MIC-LF-3	MIC-LF-4	MIC-LF-4 DUP	MIC-AST-1	MIC-AST-2	MIC-AST-3	MIC-AST-4	MIC-AST-5	MIC-AST-6	MIC-AST-AW6 DUP
Date						07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000
Area of Potential Environmental Concern						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sample depth (metres below ground surface)						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parameter	Units	MDL	Criteria																					
			Table 6 [1]	Table 8 [2]	CCME [3]																			
General Inorganics																								
pH	pH Units	0.05																						
Metals																								
Mercury	ug/g	0.05	0.27 ug/g	0.27 ug/g	6.6 ug/g	**0.44**	**0.64**	**1.58**	**1.13**	**3.09**	0.2	-	0.24	**2.46**	**0.66**	0.24	-	0.22	**3.51**	0.2	0.17	**1.42**	**0.29**	**0.55**
Antimony	ug/g	1.0	7.5 ug/g	1.3 ug/g	20 ug/g	<1	**2.4**	1.2	**1.7**	**7.8**	1.1	-	**3.4**	**151**	**2.5**	1.2	-	<1	**19**	**6.4**	**7.7**	**2.1**	1.3	**1.8**
Arsenic	ug/g	1.0	18 ug/g	18 ug/g	12 ug/g	2.2	3.4	7.6	7	14	4.3	-	7.8	10.8	4.3	2.2	-	14.7	5.3	13.9	3.9	5.5	10.9	14.4
Barium	ug/g	1.0	390 ug/g	220 ug/g	500 ug/g	182	**351**	**391**	**478**	**1054**	120	-	**1090**	**728**	**303**	201	-	182	**401**	185	97.9	**512**	**573**	47.5
Beryllium	ug/g	0.5	4 ug/g	2.5 ug/g	4 ug/g	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	ug/g	0.02	120 ug/g	36 ug/g		0.28	0.33	0.14	0.19	0.19	0.06	-	0.15	0.13	0.38	0.16	-	0.29	0.17	0.38	0.24	0.3	0.24	0.17
Cadmium	ug/g	0.5	1.2 ug/g	1.2 ug/g	10 ug/g	**2.3**	**10.9**	**2.8**	**2.4**	**12.1**	<0.5	-	<0.5	**37**	**11.9**	<0.5	-	0.8	1.1	<0.5	<0.5	**1.7**	<0.5	<0.5
Chromium	ug/g	1.0	160 ug/g	70 ug/g	64 ug/g	18.5	**101**	13.6	**74.3**	61.1	**114**	-	54.3	**266**	14.2	6.5	-	31.2	21.3	10.1	34.3	24.3	18.7	21.9
Cobalt	ug/g	1.0	22 ug/g	22 ug/g	50 ug/g	2.1	2.2	3.5	<1	3.7	8.6	-	15.6	**33.7**	6.5	<1	-	3	1.5	7.3	2.3	3.9	4	4.5
Copper	ug/g	1.0	140 ug/g	92 ug/g	63 ug/g	41.4	47.1	82.5	71.5	**168**	**213**	-	85.8	**378**	**138**	73.4	-	36.2	50	20.7	22.7	62.9	**121**	**199**
Lead	ug/g	2	120 ug/g	120 ug/g	140 ug/g	**256**	**671**	**1593**	**846**	**1386**	**406**	-	**123,422**	**7215**	**541**	**575**	-	**329**	**1644**	56.3	**213**	**1863**	**1702**	**2059**
Molybdenum	ug/g	1.0	6.9 ug/g	2 ug/g	10 ug/g	<2	<2	<2	<2	<2	<2	-	<2	<2	<2	<2	-	<2	<2	<2	<2	<2	<2	>2
Nickel	ug/g	1.0	100 ug/g	82 ug/g	45 ug/g	9.6	**245**	6.1	22.5	17.1	52.7	-	42	**84.1**	59.6	14.8	-	10.2	7	8.5	13.9	4.1	7.2	8.5
Selenium	ug/g	1.0	2.4 ug/g	1.5 ug/g	1 ug/g	<1	**3.9**	<1	<1	<1	<1	-	**2.3**	<1	<1	<1	-	1.3	<1	<1	<1	1.3	1.3	<1
Silver	ug/g	0.5	20 ug/g	0.5 ug/g	20 ug/g	<0.5	<0.5	**1.8**	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	ug/g	1.0	1 ug/g	1 ug/g	1 ug/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	ug/g	5.0			50 ug/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	ug/g	1.0	23 ug/g	2.5 ug/g	23 ug/g	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	ug/g	1.0	86 ug/g	86 ug/g	130 ug/g	6.4	2.7	19.9	4	10.2	15.9	-	68.8	10.9	1.7	3.5	-	15.4	19.8	23.7	16.4	12.9	17.1	18.6
Zinc	ug/g	1.0	340 ug/g	290 ug/g	200 ug/g	**762**	**315**	**641**	**1202**	**666**	**319**	-	**1126**	**8142**	**1500**	**356**	-	**334**	**687**	104	170	**1112**	**1530**	**1604**
Hydrocarbons																								
TPH (gas/diesel)						190	110	770	150	1300	30	-	-	-	-	-	-	<	6200	<	<	120	<	-
TPH (Heavy Oils)						1600	1200	110	1100	1700	<	-	-	-	-	-	-	<	790	<	110	<	<	-
Anions																								
Fluoride	ug/g	0.25	-	-	-	-	-	-	-	-	-	-	<0.25	<0.25	0.35	0.34	0.34	-	-	-	-	-	-	-
Chloride	ug/g	0.25	-	-	-	-	-	-	-	-	-	-	14.5	18	15.9	11.8	11.9	-	-	-	-	-	-	-
Nitrate	ug/g	0.25	-	-	-	-	-	-	-	-	-	-	0.98	0.99	1.71	0.92	0.66	-	-	-	-	-	-	-
Nitrite	ug/g	0.25	-	-	-	-	-	-	-	-	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	-	-	-	-	-	-	-
Bromide	ug/g	0.25	-	-	-	-	-	-	-	-	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	-	-	-	-	-	-	-
Phosphate	ug/g	0.5	-	-	-	-	-	-	-	-	-	-	1.75	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-	-
Sulphate	ug/g	0.25	-	-	-	-	-	-	-	-	-	-	8.91	21	28.8	18.8	18.7	-	-	-	-	-	-	-
Semi-Volatiles																								
Acenaphthene	ug/g	<0.05	7.9 ug/g	0.072 ug/g	0.28 ug/g	<	<	<	<	<	<	<	-	-	-	-	-	<	<	<	<	<	<	-
Acenaphthylene	ug/g	<0.03	0.15 ug/g	0.093 ug/g	320 ug/g	<	<	<	**0.41**	<	<	<	-	-	-	-	-	<	<	**0.13**	0.04	0.04	<	-
Anthracene	ug/g	<0.03	0.67 ug/g	0.22 ug/g	2.5 ug/g	<	0.21	<	**0.35**	<	<	<	-	-	-	-	-	<	<	0.03	0.04	0.09	<	-
Benzo[a]anthracene	ug/g	<0.05	0.5 ug/g	0.36 ug/g	1 ug/g	0.25	0.27	0.15	**1.6**	**0.45**	<	<	-	-	-	-	-	<	0.28	<	**0.45**	**0.38**	<	-
Benzo[a]pyrene	ug/g	<0.03	0.3 ug/g	0.3 ug/g	20 ug/g	**0.35**	<	<	**1.1**	0.16	<	<	-	-	-	-	-	<	<	**0.42**	**0.76**	0.29	<	-
Benzo[b]fluoranthene	ug/g	<0.03	0.78 ug/g	0.47 ug/g	1 ug/g	0.12	0.13	<	**1.5**	0.1	<	<	-	-	-	-	-	0.01	<	<	0.14	0.16	<	-
Benzo[g,h,i]perylene	ug/g	<0.1	6.6 ug/g	0.68 ug/g		0.23	<	<	0.34	<	<	<	-	-	-	-	-	<	<	<	0.59	0.16	<	-
Benzo[k]fluoranthene	ug/g	<0.05	0.78 ug/g	0.48 ug/g	1 ug/g	0.07	0.09	<	<	0.06	<	<	-	-	-	-	-	<	<	<	0.1	0.12	<	-
1,1-Biphenyl	ug/g		0.31 ug/g	0.05 ug/g									-	-	-	-	-							-
Chrysene	ug/g	<0.05	7 ug/g	2.8 ug/g	6.2 ug/g	0.04	0.05	0.03	0.28	0.08	<	<	-	-	-	-	-	0.01	0.06	<	0.12	0.2	<	-
Dibenzo[a,h]anthracene	ug/g	<0.01	0.1 ug/g	0.1 ug/g	1 ug/g	<	<	<	**0.17**	<	<	<	-	-	-	-	-	<	<	<	**1.5**	<	<	-
Fluoranthene	ug/g	0.4	0.69 ug/g	0.69 ug/g	50 ug/g	<	0.37	<	**2.1**	0.13	<	<	-	-	-	-	-	0.01	<	<	0.13	0.33	<	-
Fluorene	ug/g	<0.03	62 ug/g	0.19 ug/g	0.25 ug/g	<	<	<	<	<	<	<	-	-	-	-	-	<	<	<	<	<	<	-
Indeno[1,2,3-cd]pyrene	ug/g	<0.1	0.38 ug/g	0.23 ug/g	1 ug/g	0.08	<	<	**0.7**	<	<	<	-	-	-	-	-	<	<	<	**0.95**	<	<	-
1-Methylnaphthalene	ug/g	<0.03	0.99 ug/g	0.59 ug/g		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	ug/g	0.04	0.99 ug/g	0.59 ug/g		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene (1&2)	ug/g		0.99 ug/g	0.59 ug/g		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	ug/g	<0.03	0.6 ug/g	0.09 ug/g	0.013 ug/g	<	0.02	<	<	<	<	<	-	-	-	-	-	<	<	<	0.11	0.05	<	-
Phenanthrene	ug/g	<0.03	6.2 ug/g	0.69 ug/g	0.046 ug/g	<	0.4	0.32	0.57	<	<	<	-	-	-	-	-	<	<	0.03	0.06	0.09	<	-
Pyrene	ug/g	0.13	78 ug/g	1 ug/g	10 ug/g	<	0.33	0.1	**2**	0.14	<	<	-	-	-	-	-	0.02	0.2	<	0.37	0.35	<	-
Quinoline	ug/g																							

Criteria:

1. Reg 153/04 (2011) - Table 6: Generic Site Condition Standards for Shallow Soils in a Pottable Groundwater Condition, Residential/Parkland/Institutional (Coarse)
2. Reg 153/04 (2011) - Table 8: Generic Site Condition Standards for use within 30m of a Waterbody in a Pottable Groundwater Condition Residential/Parkland/Institutional/Industrial/Commercial/Community Property use
3. CCME Soil Quality Guidelines Residential, coarse

Notes:
MDL - Method Detection Limit
N/A - Not Analysed
* - MDL specific to sample PAH analysis, see Table III JW Report

Screening:

☐ - Exceeds MOECC Table 6
0.08 - Exceeds MOECC Table 8
▨ - Exceeds CCME

APPENDIX B

Laboratory Certificates of Analysis

PARACEL LABORATORIES LTD. | TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

BluMetric Environmental Inc. (Carp)

P.O. Box 430, 3108 Carp Rd.
Carp, ON K0A 1L0
Attn: Carl Hentschel

Client PO:
Project: 160528-00
Custody: 31378/79/86/85

Report Date: 4-Oct-2016
Order Date: 27-Sep-2016

Order #: 1640189

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1640189-01	16TP1
1640189-02	16TP2
1640189-03	16TP3
1640189-04	16TP4
1640189-05	16TP5
1640189-06	16TP6
1640189-07	16TP7
1640189-08	16TP8
1640189-09	16TP9
1640189-10	16TP10
1640189-11	16TP11
1640189-12	16TP12
1640189-13	16TP13
1640189-14	16TP14
1640189-15	16TP15
1640189-16	16TP16
1640189-17	16TP17
1640189-18	16TP18
1640189-19	16TP19
1640189-20	DUP2
1640189-21	16TP21
1640189-22	16TP22
1640189-23	16TP23
1640189-24	16TP24
1640189-25	16TP25
1640189-26	16TP26
1640189-27	16TP27
1640189-28	16TP28
1640189-29	16TP29
1640189-30	16TP30

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

1640189-31	16TP31
1640189-32	16TP32
1640189-33	16TP33
1640189-34	DUP1
1640189-35	16TP20
1640189-36	DUP3

Certificate of Analysis
Client: BluMetric Environmental Inc. (Carp)
Client PO:

Report Date: 04-Oct-2016
Order Date: 27-Sep-2016
Project Description: 160528-00

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
CCME-SQG: Metals by ICP-OES	based on MOE E3470, ICP-OES	30-Sep-16	30-Sep-16
Mercury by CVAA	EPA 7471B - CVAA, digestion	30-Sep-16	30-Sep-16
Metals, ICP-OES	based on MOE E3470, ICP-OES	30-Sep-16	30-Sep-16
PAHs by GC-MS	EPA 8270 - GC-MS, extraction	27-Sep-16	2-Oct-16
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	30-Sep-16	30-Sep-16
PHC F1	CWS Tier 1 - P&T GC-FID	1-Oct-16	3-Oct-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	30-Sep-16	2-Oct-16
Solids, %	Gravimetric, calculation	30-Sep-16	30-Sep-16

Certificate of Analysis
Client: BluMetric Environmental Inc. (Carp)
Client PO:

Report Date: 04-Oct-2016
Order Date: 27-Sep-2016
Project Description: 160528-00

	Client ID:	16TP1	16TP2	16TP3	16TP4
	Sample Date:	23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
	Sample ID:	1640189-01	1640189-02	1640189-03	1640189-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	75.7	76.2	84.0	39.5
General Inorganics					
pH	0.05 pH Units	-	4.21	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.3 [1]	<1.4 [1]	<1.7 [1]
Arsenic	1.0 ug/g dry	36.3	50.8	53.8	8.3
Barium	1.0 ug/g dry	326	244	302	253
Beryllium	1.0 ug/g dry	2.4	<1.3 [1]	2.0	<1.7 [1]
Boron	1.0 ug/g dry	10.2	8.3	10.7	10.7
Cadmium	0.5 ug/g dry	5.3	<0.7 [1]	<0.7 [1]	<0.8 [1]
Chromium	1.0 ug/g dry	13.4	11.3	13.0	6.3
Cobalt	1.0 ug/g dry	3.7	3.2	4.7	<1.7 [1]
Copper	1.0 ug/g dry	111	39.7	22.5	24.7
Lead	1.0 ug/g dry	76.0	67.8	41.9	49.7
Mercury	0.1 ug/g dry	0.3	0.1	0.1	<0.1
Molybdenum	1.0 ug/g dry	<1.0	<1.3 [1]	<1.4 [1]	<1.7 [1]
Nickel	1.0 ug/g dry	31.1	6.8	7.8	5.3
Selenium	1.0 ug/g dry	<1.0	<1.3 [1]	<1.4 [1]	<1.7 [1]
Silver	0.5 ug/g dry	18.2	<0.7 [1]	<0.7 [1]	<0.8 [1]
Thallium	1.0 ug/g dry	<1.0	<1.3 [1]	<1.4 [1]	<1.7 [1]
Tin	5.0 ug/g dry	<5.0	8.6	<7.1 [1]	<8.3 [1]
Uranium	1.0 ug/g dry	<1.0	<1.3 [1]	<1.4 [1]	<1.7 [1]
Vanadium	1.0 ug/g dry	23.2	17.7	26.5	11.6
Zinc	1.0 ug/g dry	80.2	64.7	51.1	75.7
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	213	359	102	676
F4 PHCs (C34-C50)	6 ug/g dry	65	169	107	248
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	0.02	<0.02	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Anthracene	0.02 ug/g dry	0.11	<0.02	<0.02	<0.02
Benzo [a] anthracene	0.02 ug/g dry	0.36	<0.02	<0.02	<0.02
Benzo [a] pyrene	0.02 ug/g dry	0.34	<0.02	<0.02	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	0.40	<0.02	<0.02	<0.02

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	16TP1 23-Sep-16 1640189-01 Soil	16TP2 23-Sep-16 1640189-02 Soil	16TP3 23-Sep-16 1640189-03 Soil	16TP4 23-Sep-16 1640189-04 Soil
Benzo [g,h,i] perylene	0.02 ug/g dry	0.20	<0.02	<0.02	<0.02
Benzo [k] fluoranthene	0.02 ug/g dry	0.22	<0.02	<0.02	<0.02
Biphenyl	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Chrysene	0.02 ug/g dry	0.32	<0.02	<0.02	<0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	0.06	<0.02	<0.02	<0.02
Fluoranthene	0.02 ug/g dry	0.76	<0.02	<0.02	<0.02
Fluorene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.22	<0.02	<0.02	<0.02
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	<0.04	<0.04
Naphthalene	0.01 ug/g dry	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.02 ug/g dry	0.38	<0.02	<0.02	<0.02
Pyrene	0.02 ug/g dry	0.59	<0.02	<0.02	<0.02
Quinoline	0.10 ug/g dry	<0.10	<0.10	<0.10	<0.10
2-Fluorobiphenyl	Surrogate	109%	94.6%	110%	79.7%
Terphenyl-d14	Surrogate	109%	89.9%	131%	66.9%

Certificate of Analysis

Client: BluMetric Environmental Inc. (Carp)

Client PO:

Report Date: 04-Oct-2016

Order Date: 27-Sep-2016

Project Description: 160528-00

Client ID: **Sample Date:** **Sample ID:**		16TP5 23-Sep-16 1640189-05	16TP6 23-Sep-16 1640189-06	16TP7 23-Sep-16 1640189-07	16TP8 23-Sep-16 1640189-08
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	88.1	52.4	61.2	58.3
Metals					
Antimony	1.0 ug/g dry	<2.0 [1]	<1.7 [1]	<2.1 [1]	<1.0
Arsenic	1.0 ug/g dry	49.4	9.6	30.6	16.5
Barium	1.0 ug/g dry	328	156	179	387
Beryllium	1.0 ug/g dry	<2.0 [1]	<1.7 [1]	<2.1 [1]	<1.0
Boron	1.0 ug/g dry	6.4	10.7	6.1	8.2
Cadmium	0.5 ug/g dry	<1.0 [1]	<0.8 [1]	<1.0 [1]	<0.5
Chromium	1.0 ug/g dry	12.2	10.0	10.5	10.4
Cobalt	1.0 ug/g dry	3.7	1.8	2.9	3.6
Copper	1.0 ug/g dry	32.7	13.0	24.4	24.0
Lead	1.0 ug/g dry	67.2	87.7	92.8	63.3
Mercury	0.1 ug/g dry	<0.1	<0.1	1.6	0.1
Molybdenum	1.0 ug/g dry	<2.0 [1]	<1.7 [1]	<2.1 [1]	<1.0
Nickel	1.0 ug/g dry	10.3	4.8	8.4	8.1
Selenium	1.0 ug/g dry	<2.0 [1]	<1.7 [1]	<2.1 [1]	<1.0
Silver	0.5 ug/g dry	<1.0 [1]	<0.8 [1]	<1.0 [1]	<0.5
Thallium	1.0 ug/g dry	<2.0 [1]	<1.7 [1]	<2.1 [1]	<1.0
Tin	5.0 ug/g dry	<10.0 [1]	<8.3 [1]	<10.4 [1]	<5.0
Uranium	1.0 ug/g dry	<2.0 [1]	<1.7 [1]	<2.1 [1]	<1.0
Vanadium	1.0 ug/g dry	26.2	14.9	25.0	29.3
Zinc	1.0 ug/g dry	58.1	119	381	152
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	-	<4
F3 PHCs (C16-C34)	8 ug/g dry	37	601	-	589
F4 PHCs (C34-C50)	6 ug/g dry	43	266	-	180
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Anthracene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Benzo [a] anthracene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Benzo [a] pyrene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	0.05	-	<0.02
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	<0.02	-	<0.02

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	16TP5 23-Sep-16 1640189-05 Soil	16TP6 23-Sep-16 1640189-06 Soil	16TP7 23-Sep-16 1640189-07 Soil	16TP8 23-Sep-16 1640189-08 Soil
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Biphenyl	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Chrysene	0.02 ug/g dry	<0.02	0.05	-	<0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Fluoranthene	0.02 ug/g dry	<0.02	0.05	-	<0.02
Fluorene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	-	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	-	<0.04
Naphthalene	0.01 ug/g dry	<0.01	<0.01	-	<0.01
Phenanthrene	0.02 ug/g dry	<0.02	0.02	-	<0.02
Pyrene	0.02 ug/g dry	<0.02	0.03	-	<0.02
Quinoline	0.10 ug/g dry	<0.10	<0.10	-	<0.10
2-Fluorobiphenyl	Surrogate	117%	110%	-	82.2%
Terphenyl-d14	Surrogate	121%	81.6%	-	117%

Certificate of Analysis

Client: BluMetric Environmental Inc. (Carp)

Client PO:

Report Date: 04-Oct-2016

Order Date: 27-Sep-2016

Project Description: 160528-00

Client ID:		16TP9	16TP10	16TP11	16TP12
Sample Date:		23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
Sample ID:		1640189-09	1640189-10	1640189-11	1640189-12
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	87.6	78.0	65.1	62.7
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Arsenic	1.0 ug/g dry	45.2	15.0	69.8	22.7
Barium	1.0 ug/g dry	377	136	318	573
Beryllium	1.0 ug/g dry	1.3	<1.0	1.6	2.1
Boron	1.0 ug/g dry	7.0	6.4	8.3	7.4
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	2.9
Chromium	1.0 ug/g dry	10.5	11.2	9.8	6.9
Cobalt	1.0 ug/g dry	3.0	2.1	3.1	3.7
Copper	1.0 ug/g dry	87.9	18.0	32.5	69.3
Lead	1.0 ug/g dry	58.1	36.7	57.3	371
Mercury	0.1 ug/g dry	0.2	0.1	0.2	0.1
Molybdenum	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Nickel	1.0 ug/g dry	8.9	6.4	6.2	4.9
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Silver	0.5 ug/g dry	1.8	<0.5	<0.5	<0.5
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Tin	5.0 ug/g dry	<5.0	<5.0	<5.0	<5.0
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Vanadium	1.0 ug/g dry	20.5	25.0	22.7	10.9
Zinc	1.0 ug/g dry	77.0	58.0	58.9	136
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	215	388	254	118
F4 PHCs (C34-C50)	6 ug/g dry	135	253	237	115
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [a] anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [a] pyrene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02

Certificate of Analysis

Client: BluMetric Environmental Inc. (Carp)

Client PO:

Report Date: 04-Oct-2016

Order Date: 27-Sep-2016

Project Description: 160528-00

	Client ID: **Sample Date:** **Sample ID:**	16TP9 23-Sep-16 1640189-09 Soil	16TP10 23-Sep-16 1640189-10 Soil	16TP11 23-Sep-16 1640189-11 Soil	16TP12 23-Sep-16 1640189-12 Soil
	MDL/Units				
Biphenyl	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Chrysene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Fluoranthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Fluorene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	<0.04	<0.04
Naphthalene	0.01 ug/g dry	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Pyrene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Quinoline	0.10 ug/g dry	<0.10	<0.10	<0.10	<0.10
2-Fluorobiphenyl	Surrogate	103%	101%	90.1%	81.7%
Terphenyl-d14	Surrogate	97.2%	86.0%	92.6%	70.8%

Client ID:		16TP13	16TP14	16TP15	16TP16
Sample Date:		23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
Sample ID:		1640189-13	1640189-14	1640189-15	1640189-16
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	77.5	76.6	90.0	65.8
General Inorganics					
pH	0.05 pH Units	-	7.18	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Arsenic	1.0 ug/g dry	25.4	101	15.6	15.2
Barium	1.0 ug/g dry	608	859	2350	844
Beryllium	1.0 ug/g dry	1.2	<1.0	1.1	1.5
Boron	1.0 ug/g dry	7.5	29.5	7.5	5.7
Cadmium	0.5 ug/g dry	6.8	<0.5	2.3	5.3
Chromium	1.0 ug/g dry	12.8	62.5	23.9	25.2
Cobalt	1.0 ug/g dry	3.2	4.0	5.3	5.3
Copper	1.0 ug/g dry	32.6	187	62.8	56.2
Lead	1.0 ug/g dry	478	1090	1400	4370
Mercury	0.1 ug/g dry	1.0	4.4	1.7	0.5
Molybdenum	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Nickel	1.0 ug/g dry	4.8	9.9	7.9	9.6
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Silver	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Tin	5.0 ug/g dry	<5.0	7.8	<5.0	13.5
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Vanadium	1.0 ug/g dry	12.3	16.4	11.0	15.4
Zinc	1.0 ug/g dry	289	534	2850	988
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	224	91	2730	<8
F4 PHCs (C34-C50)	6 ug/g dry	173	108	1440 [2]	<6
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	0.02	<0.02	0.09
Anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	0.08
Benzo [a] anthracene	0.02 ug/g dry	<0.02	0.12	0.04	0.24
Benzo [a] pyrene	0.02 ug/g dry	<0.02	0.13	0.04	0.25
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	0.20	0.11	0.33

Certificate of Analysis
Client: BluMetric Environmental Inc. (Carp)
Client PO:

Report Date: 04-Oct-2016
Order Date: 27-Sep-2016
Project Description: 160528-00

Client ID: **Sample Date:** **Sample ID:**		16TP13 23-Sep-16 1640189-13	16TP14 23-Sep-16 1640189-14	16TP15 23-Sep-16 1640189-15	16TP16 23-Sep-16 1640189-16
	MDL/Units	Soil	Soil	Soil	Soil
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	0.10	0.02	0.17
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	0.09	0.04	0.18
Biphenyl	0.02 ug/g dry	<0.02	<0.02	0.03	<0.02
Chrysene	0.02 ug/g dry	<0.02	0.15	0.05	0.26
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	0.03	<0.02	0.06
Fluoranthene	0.02 ug/g dry	<0.02	0.35	0.07	0.77
Fluorene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	0.11	<0.02	0.18
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	0.20	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	0.35	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	0.55	<0.04
Naphthalene	0.01 ug/g dry	<0.01	0.02	0.19	0.03
Phenanthrene	0.02 ug/g dry	<0.02	0.04	0.12	0.19
Pyrene	0.02 ug/g dry	<0.02	0.22	0.07	0.73
Quinoline	0.10 ug/g dry	<0.10	<0.10	<0.10	<0.10
2-Fluorobiphenyl	Surrogate	55.8%	85.6%	88.4%	52.7%
Terphenyl-d14	Surrogate	51.6%	86.7%	75.0%	130%

Certificate of Analysis
Client: BluMetric Environmental Inc. (Carp)
Client PO:

Report Date: 04-Oct-2016
Order Date: 27-Sep-2016
Project Description: 160528-00

Client ID:		16TP17	16TP18	16TP19	DUP2
Sample Date:		23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
Sample ID:		1640189-17	1640189-18	1640189-19	1640189-20
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	88.8	83.6	75.1	58.6
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Arsenic	1.0 ug/g dry	8.5	5.5	8.5	16.3
Barium	1.0 ug/g dry	226	65.0	849	688
Beryllium	1.0 ug/g dry	<1.0	<1.0	<1.0	2.1
Boron	1.0 ug/g dry	5.3	2.1	11.3	9.5
Cadmium	0.5 ug/g dry	<0.5	<0.5	3.0	2.9
Chromium	1.0 ug/g dry	15.8	11.4	36.1	14.0
Cobalt	1.0 ug/g dry	5.2	5.6	4.8	4.3
Copper	1.0 ug/g dry	50.5	52.8	211	57.1
Lead	1.0 ug/g dry	847	282	2270	708
Mercury	0.1 ug/g dry	0.4	0.1	6.6	0.3
Molybdenum	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Nickel	1.0 ug/g dry	17.4	8.2	9.8	8.8
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Silver	0.5 ug/g dry	0.6	<0.5	0.7	<0.5
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Tin	5.0 ug/g dry	28.6	5.9	55.5	<5.0
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Vanadium	1.0 ug/g dry	37.9	27.2	17.5	24.6
Zinc	1.0 ug/g dry	399	119	620	272
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	381	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	141	<6
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	0.02	<0.02	<0.02
Anthracene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Benzo [a] anthracene	0.02 ug/g dry	<0.02	0.10	<0.02	<0.02
Benzo [a] pyrene	0.02 ug/g dry	<0.02	0.12	<0.02	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	0.18	0.02	0.03
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	0.10	0.04	0.03

Certificate of Analysis

Client: BluMetric Environmental Inc. (Carp)

Client PO:

Report Date: 04-Oct-2016

Order Date: 27-Sep-2016

Project Description: 160528-00

Client ID:		16TP17	16TP18	16TP19	DUP2
Sample Date:		23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
Sample ID:		1640189-17	1640189-18	1640189-19	1640189-20
	MDL/Units	Soil	Soil	Soil	Soil
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	0.09	<0.02	<0.02
Biphenyl	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Chrysene	0.02 ug/g dry	<0.02	0.13	<0.02	<0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	0.03	<0.02	<0.02
Fluoranthene	0.02 ug/g dry	<0.02	0.20	<0.02	0.02
Fluorene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	0.11	0.03	<0.02
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	0.02	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	0.05	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	0.07	<0.04
Naphthalene	0.01 ug/g dry	<0.01	0.01	0.02	0.01
Phenanthrene	0.02 ug/g dry	<0.02	0.03	<0.02	<0.02
Pyrene	0.02 ug/g dry	<0.02	0.19	<0.02	0.02
Quinoline	0.10 ug/g dry	<0.10	<0.10	<0.10	<0.10
2-Fluorobiphenyl	Surrogate	51.7%	83.5%	93.0%	81.1%
Terphenyl-d14	Surrogate	60.3%	94.0%	97.0%	94.2%

Certificate of Analysis
Client: BluMetric Environmental Inc. (Carp)
Client PO:

Report Date: 04-Oct-2016
Order Date: 27-Sep-2016
Project Description: 160528-00

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	16TP21 23-Sep-16 1640189-21 Soil	16TP22 23-Sep-16 1640189-22 Soil	16TP23 23-Sep-16 1640189-23 Soil	16TP24 23-Sep-16 1640189-24 Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	55.8	87.0	81.1	62.4
Metals					
Antimony	1.0 ug/g dry	<1.0	-	<1.7 [1]	<1.4 [1]
Arsenic	1.0 ug/g dry	12.0	-	14.6	7.2
Barium	1.0 ug/g dry	607	-	410	343
Beryllium	1.0 ug/g dry	<1.0	-	<1.7 [1]	<1.4 [1]
Boron	1.0 ug/g dry	7.9	-	10.0	12.5
Cadmium	0.5 ug/g dry	6.6	-	<0.8 [1]	<0.7 [1]
Chromium	1.0 ug/g dry	26.0	-	10.6	17.2
Cobalt	1.0 ug/g dry	5.9	-	2.9	3.5
Copper	1.0 ug/g dry	53.2	-	63.9	46.7
Lead	1.0 ug/g dry	2670	-	927	468
Lead	1.0 ug/g dry	-	3000	-	-
Mercury	0.1 ug/g dry	9.5	-	0.6	0.3
Molybdenum	1.0 ug/g dry	<1.0	-	<1.7 [1]	<1.4 [1]
Nickel	1.0 ug/g dry	20.1	-	6.6	8.4
Selenium	1.0 ug/g dry	<1.0	-	<1.7 [1]	<1.4 [1]
Silver	0.5 ug/g dry	4.4	-	<0.8 [1]	<0.7 [1]
Thallium	1.0 ug/g dry	<1.0	-	<1.7 [1]	<1.4 [1]
Tin	5.0 ug/g dry	11.6	-	<8.3 [1]	<7.1 [1]
Uranium	1.0 ug/g dry	<1.0	-	<1.7 [1]	<1.4 [1]
Vanadium	1.0 ug/g dry	16.9	-	14.0	15.9
Zinc	1.0 ug/g dry	1110	-	300	224
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	-	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	344	-	<8	48
F4 PHCs (C34-C50)	6 ug/g dry	57	-	<6	32
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	0.02	-	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	2.20	-	<0.02	<0.02
Anthracene	0.02 ug/g dry	1.07	-	<0.02	<0.02
Benzo [a] anthracene	0.02 ug/g dry	3.84	-	<0.02	0.04
Benzo [a] pyrene	0.02 ug/g dry	5.26	-	<0.02	0.04
Benzo [b] fluoranthene	0.02 ug/g dry	15.6	-	<0.02	0.06

Certificate of Analysis

Client: BluMetric Environmental Inc. (Carp)

Client PO:

Report Date: 04-Oct-2016

Order Date: 27-Sep-2016

Project Description: 160528-00

Client ID: **Sample Date:** **Sample ID:**		16TP21 23-Sep-16 1640189-21 Soil	16TP22 23-Sep-16 1640189-22 Soil	16TP23 23-Sep-16 1640189-23 Soil	16TP24 23-Sep-16 1640189-24 Soil
	MDL/Units				
Benzo [g,h,i] perylene	0.02 ug/g dry	7.21	-	<0.02	0.04
Benzo [k] fluoranthene	0.02 ug/g dry	6.73	-	<0.02	0.03
Biphenyl	0.02 ug/g dry	0.03	-	<0.02	<0.02
Chrysene	0.02 ug/g dry	4.79	-	<0.02	0.04
Dibenzo [a,h] anthracene	0.02 ug/g dry	1.82	-	<0.02	<0.02
Fluoranthene	0.02 ug/g dry	3.03	-	<0.02	0.09
Fluorene	0.02 ug/g dry	0.03	-	<0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	7.67	-	<0.02	0.04
1-Methylnaphthalene	0.02 ug/g dry	0.13	-	<0.02	<0.02
2-Methylnaphthalene	0.02 ug/g dry	0.25	-	<0.02	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	0.38	-	<0.04	<0.04
Naphthalene	0.01 ug/g dry	0.33	-	<0.01	<0.01
Phenanthrene	0.02 ug/g dry	0.41	-	<0.02	<0.02
Pyrene	0.02 ug/g dry	3.47	-	<0.02	0.07
Quinoline	0.10 ug/g dry	<0.10	-	<0.10	<0.10
2-Fluorobiphenyl	Surrogate	64.6%	-	72.1%	54.2%
Terphenyl-d14	Surrogate	68.3%	-	93.9%	80.8%

Certificate of Analysis
Client: BluMetric Environmental Inc. (Carp)
Client PO:

Report Date: 04-Oct-2016
Order Date: 27-Sep-2016
Project Description: 160528-00

	Client ID:	16TP25	16TP26	16TP27	16TP28
	Sample Date:	23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
	Sample ID:	1640189-25	1640189-26	1640189-27	1640189-28
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	29.3	78.2	39.3	67.9
General Inorganics					
pH	0.05 pH Units	-	6.17	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Arsenic	1.0 ug/g dry	30.4	10.5	7.3	4.2
Barium	1.0 ug/g dry	306	835	452	85.9
Beryllium	1.0 ug/g dry	2.2	<1.0	<1.0	<1.0
Boron	1.0 ug/g dry	6.6	10.8	9.0	3.9
Cadmium	0.5 ug/g dry	<0.5	3.2	2.7	<0.5
Chromium	1.0 ug/g dry	4.2	14.6	6.7	16.1
Cobalt	1.0 ug/g dry	9.1	2.9	1.6	5.1
Copper	1.0 ug/g dry	13.8	161	42.7	15.1
Lead	1.0 ug/g dry	51.4	1850	639	208
Mercury	0.1 ug/g dry	0.2	0.5	0.6	0.2
Molybdenum	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Nickel	1.0 ug/g dry	2.8	5.5	4.4	7.8
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Silver	0.5 ug/g dry	<0.5	0.7	<0.5	<0.5
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Tin	5.0 ug/g dry	<5.0	24.7	32.4	<5.0
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Vanadium	1.0 ug/g dry	16.9	12.4	6.9	35.5
Zinc	1.0 ug/g dry	85.5	1110	376	104
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	41	188	50
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	25	<6
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	<0.02	0.06	<0.02
Anthracene	0.02 ug/g dry	<0.02	<0.02	0.04	0.04
Benzo [a] anthracene	0.02 ug/g dry	<0.02	0.05	0.24	0.06
Benzo [a] pyrene	0.02 ug/g dry	<0.02	0.06	0.26	0.06
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	0.11	0.37	0.08

Client ID:		16TP25	16TP26	16TP27	16TP28
Sample Date:		23-Sep-16	23-Sep-16	23-Sep-16	23-Sep-16
Sample ID:		1640189-25	1640189-26	1640189-27	1640189-28
	MDL/Units	Soil	Soil	Soil	Soil
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	0.05	0.20	0.04
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	0.05	0.15	0.05
Biphenyl	0.02 ug/g dry	<0.02	<0.02	0.12	<0.02
Chrysene	0.02 ug/g dry	<0.02	0.05	0.27	0.06
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	<0.02	0.09	<0.02
Fluoranthene	0.02 ug/g dry	<0.02	0.09	0.37	0.17
Fluorene	0.02 ug/g dry	<0.02	<0.02	0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	0.06	0.18	0.05
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	<0.04	<0.04
Naphthalene	0.01 ug/g dry	<0.01	<0.01	0.02	<0.01
Phenanthrene	0.02 ug/g dry	<0.02	<0.02	0.06	0.12
Pyrene	0.02 ug/g dry	<0.02	0.07	0.33	0.13
Quinoline	0.10 ug/g dry	<0.10	<0.10	<0.10	<0.10
2-Fluorobiphenyl	Surrogate	59.6%	79.7%	107%	77.5%
Terphenyl-d14	Surrogate	88.6%	89.8%	77.6%	93.5%

Certificate of Analysis

Client: BluMetric Environmental Inc. (Carp)

Client PO:

Report Date: 04-Oct-2016

Order Date: 27-Sep-2016

Project Description: 160528-00

	Client ID: **Sample Date:** **Sample ID:** **MDL/Units**	16TP29 23-Sep-16 1640189-29 Soil	16TP30 23-Sep-16 1640189-30 Soil	16TP31 23-Sep-16 1640189-31 Soil	16TP32 23-Sep-16 1640189-32 Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	37.4	82.9	78.8	70.7
General Inorganics					
pH	0.05 pH Units	5.39	-	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	-	-	-
Arsenic	1.0 ug/g dry	47.5	-	-	-
Barium	1.0 ug/g dry	485	-	-	-
Beryllium	1.0 ug/g dry	3.9	-	-	-
Boron	1.0 ug/g dry	8.9	-	-	-
Cadmium	0.5 ug/g dry	<0.5	-	-	-
Chromium	1.0 ug/g dry	20.6	-	-	-
Cobalt	1.0 ug/g dry	10.2	-	-	-
Copper	1.0 ug/g dry	44.0	-	-	-
Lead	1.0 ug/g dry	1200	-	-	-
Lead	1.0 ug/g dry	-	3880	587	3310
Mercury	0.1 ug/g dry	0.2	-	-	-
Molybdenum	1.0 ug/g dry	<1.0	-	-	-
Nickel	1.0 ug/g dry	10.9	-	-	-
Selenium	1.0 ug/g dry	<1.0	-	-	-
Silver	0.5 ug/g dry	<0.5	-	-	-
Thallium	1.0 ug/g dry	<1.0	-	-	-
Tin	5.0 ug/g dry	10.8	-	-	-
Uranium	1.0 ug/g dry	<1.0	-	-	-
Vanadium	1.0 ug/g dry	31.0	-	-	-
Zinc	1.0 ug/g dry	265	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	-	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	-	-	-
Acenaphthylene	0.02 ug/g dry	<0.02	-	-	-
Anthracene	0.02 ug/g dry	<0.02	-	-	-
Benzo [a] anthracene	0.02 ug/g dry	<0.02	-	-	-
Benzo [a] pyrene	0.02 ug/g dry	<0.02	-	-	-

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	16TP29 23-Sep-16 1640189-29 Soil	16TP30 23-Sep-16 1640189-30 Soil	16TP31 23-Sep-16 1640189-31 Soil	16TP32 23-Sep-16 1640189-32 Soil
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	-	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	-	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	-	-	-
Biphenyl	0.02 ug/g dry	<0.02	-	-	-
Chrysene	0.02 ug/g dry	<0.02	-	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	-	-	-
Fluoranthene	0.02 ug/g dry	<0.02	-	-	-
Fluorene	0.02 ug/g dry	<0.02	-	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	-	-	-
1-Methylnaphthalene	0.02 ug/g dry	<0.02	-	-	-
2-Methylnaphthalene	0.02 ug/g dry	<0.02	-	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	-	-	-
Naphthalene	0.01 ug/g dry	<0.01	-	-	-
Phenanthrene	0.02 ug/g dry	<0.02	-	-	-
Pyrene	0.02 ug/g dry	<0.02	-	-	-
Quinoline	0.10 ug/g dry	<0.10	-	-	-
2-Fluorobiphenyl	Surrogate	61.7%	-	-	-
Terphenyl-d14	Surrogate	91.7%	-	-	-

Certificate of Analysis

Client: BluMetric Environmental Inc. (Carp)

Client PO:

Report Date: 04-Oct-2016

Order Date: 27-Sep-2016

Project Description: 160528-00

	Client ID: **Sample Date:** **Sample ID:**	16TP33 23-Sep-16 1640189-33	DUP1 23-Sep-16 1640189-34	16TP20 23-Sep-16 1640189-35	DUP3 23-Sep-16 1640189-36
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	59.7	80.5	96.1	37.0
Metals					
Antimony	1.0 ug/g dry	-	<1.2 [1]	<1.3 [1]	<1.0
Arsenic	1.0 ug/g dry	-	16.2	19.2	43.8
Barium	1.0 ug/g dry	-	142	555	589
Beryllium	1.0 ug/g dry	-	<1.2 [1]	2.4	4.1
Boron	1.0 ug/g dry	-	10.8	14.7	9.3
Cadmium	0.5 ug/g dry	-	<0.6 [1]	<0.7 [1]	<0.5
Chromium	1.0 ug/g dry	-	15.9	16.5	18.0
Cobalt	1.0 ug/g dry	-	2.6	4.9	11.2
Copper	1.0 ug/g dry	-	20.8	58.9	46.9
Lead	1.0 ug/g dry	-	49.1	827	1420
Lead	1.0 ug/g dry	700	-	-	-
Mercury	0.1 ug/g dry	-	<0.1	0.2	0.2
Molybdenum	1.0 ug/g dry	-	<1.2 [1]	<1.3 [1]	<1.0
Nickel	1.0 ug/g dry	-	8.7	10.5	10.0
Selenium	1.0 ug/g dry	-	<1.2 [1]	<1.3 [1]	<1.0
Silver	0.5 ug/g dry	-	<0.6 [1]	<0.7 [1]	<0.5
Thallium	1.0 ug/g dry	-	<1.2 [1]	<1.3 [1]	<1.0
Tin	5.0 ug/g dry	-	<6.2 [1]	7.2	11.1
Uranium	1.0 ug/g dry	-	<1.2 [1]	<1.3 [1]	<1.0
Vanadium	1.0 ug/g dry	-	33.2	29.2	32.4
Zinc	1.0 ug/g dry	-	72.0	323	26.6
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	-	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	-	114	20	42
F4 PHCs (C34-C50)	6 ug/g dry	-	<6	<6	<6
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Anthracene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Benzo [a] anthracene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Benzo [a] pyrene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	-	<0.02	<0.02	0.02
Benzo [g,h,i] perylene	0.02 ug/g dry	-	<0.02	<0.02	<0.02

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	16TP33 23-Sep-16 1640189-33 Soil	DUP1 23-Sep-16 1640189-34 Soil	16TP20 23-Sep-16 1640189-35 Soil	DUP3 23-Sep-16 1640189-36 Soil
Benzo [k] fluoranthene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Biphenyl	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Chrysene	0.02 ug/g dry	-	<0.02	<0.02	0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Fluoranthene	0.02 ug/g dry	-	<0.02	<0.02	0.03
Fluorene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	<0.02	<0.02	<0.02
1-Methylnaphthalene	0.02 ug/g dry	-	<0.02	<0.02	0.15
2-Methylnaphthalene	0.02 ug/g dry	-	<0.02	<0.02	0.17
Methylnaphthalene (1&2)	0.04 ug/g dry	-	<0.04	<0.04	0.32
Naphthalene	0.01 ug/g dry	-	<0.01	<0.01	0.09
Phenanthrene	0.02 ug/g dry	-	<0.02	<0.02	0.14
Pyrene	0.02 ug/g dry	-	<0.02	<0.02	0.03
Quinoline	0.10 ug/g dry	-	<0.10	<0.10	<0.10
2-Fluorobiphenyl	Surrogate	-	63.8%	67.4%	62.5%
Terphenyl-d14	Surrogate	-	97.5%	127%	80.1%

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	1.0	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Tin	ND	5.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Biphenyl	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Quinoline	ND	0.10	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.33*		*ug/g*		*99.8*	*50-140*			
Surrogate: Terphenyl-d14	*1.33*		*ug/g*		*99.6*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
pH	7.80	0.05	pH Units	7.80			0.0	10	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	367	8	ug/g dry	388			5.8	30	
F4 PHCs (C34-C50)	265	6	ug/g dry	253			4.6	30	
Metals									
Antimony	ND	1.0	ug/g dry	ND			0.0	30	
Arsenic	ND	1.0	ug/g dry	ND			0.0	30	
Barium	81.1	1.0	ug/g dry	84.3			3.8	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron	5.93	1.0	ug/g dry	7.63			25.0	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium	14.5	1.0	ug/g dry	16.2			11.1	30	
Cobalt	5.59	1.0	ug/g dry	5.58			0.2	30	
Copper	13.2	1.0	ug/g dry	13.5			2.0	30	
Lead	7.60	1.0	ug/g dry	9.31			20.2	30	
Lead	7.60	1.0	ug/g dry	9.31			20.2	30	
Mercury	0.192	0.1	ug/g dry	0.223			14.8	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	9.68	1.0	ug/g dry	9.53			1.6	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Tin	ND	5.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	25.0	1.0	ug/g dry	27.8			10.5	30	
Zinc	18.9	1.0	ug/g dry	22.2			15.8	30	
Physical Characteristics									
% Solids	62.8	0.1	% by Wt.	59.8			5.0	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND			0.0	40	
Anthracene	0.027	0.02	ug/g dry	ND			0.0	40	
Benzo [a] anthracene	0.053	0.02	ug/g dry	0.037			36.0	40	
Benzo [a] pyrene	0.060	0.02	ug/g dry	0.044			31.7	40	
Benzo [b] fluoranthene	0.098	0.02	ug/g dry	0.065			40.6	40	QR-01
Benzo [g,h,i] perylene	0.056	0.02	ug/g dry	0.042			29.5	40	
Benzo [k] fluoranthene	0.049	0.02	ug/g dry	0.030			46.3	40	QR-01
Biphenyl	ND	0.02	ug/g dry	ND				40	
Chrysene	0.060	0.02	ug/g dry	0.043			32.6	40	
Dibenzo [a,h] anthracene	0.021	0.02	ug/g dry	ND			0.0	40	
Fluoranthene	0.076	0.02	ug/g dry	0.093			20.2	40	
Fluorene	ND	0.02	ug/g dry	ND			0.0	40	
Indeno [1,2,3-cd] pyrene	0.057	0.02	ug/g dry	0.043			27.3	40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND			0.0	40	
Naphthalene	0.013	0.01	ug/g dry	ND			0.0	40	
Phenanthrene	0.028	0.02	ug/g dry	ND			0.0	40	
Pyrene	0.063	0.02	ug/g dry	0.075			16.6	40	
Quinoline	ND	0.10	ug/g dry	ND				40	
Surrogate: 2-Fluorobiphenyl	*1.30*		*ug/g dry*		*60.9*	*50-140*			
Surrogate: Terphenyl-d14	*1.88*		*ug/g dry*		*88.0*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	162	7	ug/g		80.8	80-120			
F2 PHCs (C10-C16)	92	4	ug/g	ND	90.6	60-140			
F3 PHCs (C16-C34)	279	8	ug/g	ND	133	60-140			
F4 PHCs (C34-C50)	157	6	ug/g	ND	113	60-140			
Metals									
Antimony	289		ug/L	18.3	108	70-130			
Arsenic	321		ug/L	ND	129	70-130			
Barium	1900		ug/L	1720	71.9	70-130			
Beryllium	243		ug/L	1.00	96.9	70-130			
Boron	325		ug/L	78.5	98.5	70-130			
Cadmium	241		ug/L	1.74	95.7	70-130			
Chromium	552		ug/L	323	91.7	70-130			
Cobalt	374		ug/L	112	105	70-130			
Copper	563		ug/L	270	117	70-130			
Lead	215		ug/L		86.1	70-130			
Lead	215		ug/L		86.1	70-130			
Mercury	1.50	0.1	ug/g	0.223	84.9	70-130			
Molybdenum	224		ug/L	8.09	86.5	70-130			
Nickel	227		ug/L		90.8	70-130			
Selenium	223		ug/L	ND	89.3	70-130			
Silver	188		ug/L	ND	75.0	70-130			
Thallium	208		ug/L	16.8	76.4	70-130			
Tin	262		ug/L	22.7	95.8	70-130			
Uranium	276		ug/L	ND	110	70-130			
Vanadium	922		ug/L	709	85.2	70-130			
Zinc	2270		ug/L	2080	72.6	70-130			
Semi-Volatiles									
Acenaphthene	0.206	0.02	ug/g	ND	76.9	50-140			
Acenaphthylene	0.198	0.02	ug/g	ND	74.2	50-140			
Anthracene	0.215	0.02	ug/g	ND	80.4	50-140			
Benzo [a] anthracene	0.231	0.02	ug/g	0.037	72.6	50-140			
Benzo [a] pyrene	0.245	0.02	ug/g	0.044	75.3	50-140			
Benzo [b] fluoranthene	0.364	0.02	ug/g	0.065	112	50-140			
Benzo [g,h,i] perylene	0.260	0.02	ug/g	0.042	81.8	50-140			
Benzo [k] fluoranthene	0.335	0.02	ug/g	0.030	114	50-140			
Chrysene	0.245	0.02	ug/g	0.043	75.7	50-140			
Dibenzo [a,h] anthracene	0.238	0.02	ug/g	ND	89.0	50-140			
Fluoranthene	0.308	0.02	ug/g	0.093	80.5	50-140			
Fluorene	0.191	0.02	ug/g	ND	71.3	50-140			
Indeno [1,2,3-cd] pyrene	0.268	0.02	ug/g	0.043	84.3	50-140			
1-Methylnaphthalene	0.190	0.02	ug/g	ND	71.2	50-140			
2-Methylnaphthalene	0.197	0.02	ug/g	ND	73.7	50-140			
Naphthalene	0.174	0.01	ug/g	ND	65.0	50-140			
Phenanthrene	0.216	0.02	ug/g	ND	80.7	50-140			
Pyrene	0.293	0.02	ug/g	0.075	81.6	50-140			
Surrogate: 2-Fluorobiphenyl	*1.53*		*ug/g*		*71.4*	*50-140*			

Qualifier Notes:

Sample Qualifiers :

1 : Elevated Reporting Limits due to limited sample volume.

2 : GC-FID signal did not return to baseline by C50

QC Qualifiers :

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

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№ 31378

Page 1 of 4

Client Name: BluMetric Environmental
Contact Name: Carl Hentschel
Address: PO Box 430 3108 Carp rd, Carp ON K0A 1L0
Telephone: 613 839 3053

Project Reference: 160528-00
Quote #
PO #
Email Address: chentschel@blumetric.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☒ Regular
Date Required:

Criteria: ☒ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1640189

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHC F1-F4	metals	PAH	pH							
1	16TP1	S		2	23/09/16		X	X	X				250 mL + 1 vial				
2	16TP2	S		2			X	X	X	X							
3	16TP3	S		2			X	X	X								
4	16TP4	S		2			X	X	X								
5	16TP5	S		2			X	X	X								
6	16TP6	S		2			X	X	X								
7	16TP7	S		2			X	X	X								
8	16TP8	S		2			X	X	X								
9	16TP9	S		2			X	X	X								
10	16TP10	S		2			X	X	X								

Comments: ICP + Hg Metals per Jenna. Comparing to CCME as per Carl - BS.

Method of Delivery: Paracel

Relinquished By (Sign): Jenna Findlay
Relinquished By (Print):
Date/Time: 26/09/16 5:00pm

Received by Driver/Depot: Rouse
Date/Time: 27/09/16 10.20 AM.
Temperature: / °C

Received at Lab: Sumeporn Dokmai
Date/Time: SEP 27, 2016 11.20
Temperature: 16.8 °C

Verified By: Rachel Subject
Date/Time: Sep 28/16 12:37
pH Verified ☒ By: N/A

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№ 31379

Page 2 of 4

Client Name: BluMetric Environmental	Project Reference: 160528-00		
Contact Name: Carl Hentschel	Quote #		
Address: PO Box 430 3108 Carp rd, Ottawa ON K0A1L0	PO #		
Telephone: 613 839 3053	Email Address: chentschel@blumetric.ca		

Turnaround Time:

☐ 1 Day ☐ 3 Day

☐ 2 Day ☒ Regular

Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1640189

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHC F1-F4	metals	PAH	PH							
1	16TP11	S		2	23/09/16		X	X	X				250mL+1 vial				
2	16TP12	S		2			X	X	X								
3	16TP13	S		2			X	X	X								
4	16TP14	S		2			X	X	X	X							
5	16TP15	S		2			X	X	X								
6	16TP16	S		2			X	X	X								
7	16TP17	S		2			X	X	X								
8	16TP18	S		2			X	X	X								
9	16TP19	S		2			X	X	X								
10	16TP20	S		2			X	X	X								

Comments: lid reads Dup2 → report as DUP-2 on lid. per Carl. SC

Method of Delivery: Paracel

Relinquished By (Sign): J Findlay	Received by Driver/Depot: T. Krause	Received at Lab: SUPPORN DONMAI	Verified By: Rachel Subject
Relinquished By (Print): Jenna Finelley	Date/Time: 27/09/16 10 20 AM	Date/Time: SEP 27, 2016 11:20	Date/Time: Sep 28/16
Date/Time: 26/09/16 5:00pm	Temperature: ___ °C	Temperature: 16.8 °C	pH Verified ☒ By: N/A 12:37

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Page 3 of 4

Client Name: Blumetric Environmental
Contact Name: Carl Hentschel
Address: PO Box 430 3108 Carp rd Ottawa ON K0A 1L0
Telephone: 613 839 3053

Project Reference: 160528-00
Quote #
PO #
Email Address: chentschel@blumetric.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☒ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table__ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality:______ ☐ Other:______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1640189

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHC F1-F4	metals	PAH	Lead	pH		
1	16TP21	S		2	23/09/16		X	X	X				-250ml+1vial-
2	16TP22	S		1						X			- 250ml-
3	16TP23	S		2			X	X	X				- 250ml+1vial-
4	16TP24	S		2			X	X	X				
5	16TP25	S		2			X	X	X				
6	16TP26	S		2			X	X	X		X		
7	16TP27	S		2			X	X	X				
8	16TP28	S		2			X	X	X				
9	16TP29	S		2			X	X	X		X		
10	16TP30	S		~~2~~ 1						X			- 250ml-

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): J Findlay
Relinquished By (Print): Jenna Findlay
Date/Time: 26/09/16 5:00pm

Received by Driver/Depot: T. Rouse
Date/Time: 27/09/16 10:20 AM
Temperature: ____ °C

Received at Lab: Sumreporn Dokmai
Date/Time: SEP 27, 2016 11:20
Temperature: 16.8 °C

Verified By: Rachel Subject
Date/Time: Sep 28/16 12:37
pH Verified [✓] By: N/A

Chain of Custody (Blank) - Rev 0.4 Feb 2016

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№ 31385

Page 4 of 4

Client Name: BluMetric Environmental
Contact Name: Carl Hentschel
Address: PO Box 430 3108 Carp road Ottawa ON K0A 1L0
Telephone: 613 839 3053

Project Reference: 160528-00
Quote #
PO #
Email Address: chentschel@blumetric.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☒ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1640189

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHC F1-F4	metals	PAH	lead							
1	16TP31	S		1	23/09/16					X				- 250ml -			
2	16TP32	S		1						X							
3	16TP33	S		1						X							
4	DUP1	S		2			X	X	X					- 250ml + 1 vial -			
5	DUP2 / lid reads 16TP20.	S		2			X	X	X								
6	DUP3	S		2			X	X	X								
7	~~16TPC1~~	~~S~~		~~1~~													
8	~~16TPC2~~	~~S~~		~~1~~													
9	~~16TPC3~~	~~S~~		~~1~~													
10																	

Comments: Report as 16TP20 on lid per Carl. SC

Method of Delivery: Paracel

Relinquished By (Sign): JFindlay	Received by Driver/Depot: M. Trouse	Received at Lab: Sumetporn Dokmai	Verified By: Rachel Subject
Relinquished By (Print): Jenna Findlay	Date/Time: 27/09/16 10:20 AM	Date/Time: SEP 27, 2016 11:20	Date/Time: Sep 28/16 12:37
Date/Time: 26/09/16 5:00pm	Temperature: ___ °C	Temperature: 16.8 °C	pH Verified ☒ By: N/A

APPENDIX C

GPS Coordinates for Soil Sample Locations

Table 4: Sample GPS Locations

Sample #	Datum	Northing	Easting	Duplicate
16TP1	16T	605106	5289924	
16TP2	16T	605106	5289913	
16TP3	16T	605101	5289930	
16TP4	16T	605097	5289907	
16TP5	16T	605096	5289956	
16TP6	16T	605082	5289901	
16TP7	16T	605086	5289939	
16TP8	16T	605088	5289910	
16TP9	16T	605085	5289926	
16TP10	16T	605084	5289918	DUP1
16TP11	16T	605079	5289930	
16TP12	16T	605077	5289918	
16TP13	16T	605173	5289890	
16TP14	16T	605172	5289895	
16TP15	16T	605179	5289905	
16TP16	16T	605181	5289897	
16TP17	16T	605181	5289886	
16TP18	16T	605184	5289889	
16TP19	16T	605176	5289877	
16TP20	16T	605189	5289872	DUP2
16TP21	16T	605186	5289860	
16TP22	16T	605184	5289873	
16TP23	16T	605165	5289896	
16TP24	16T	605155	5289893	
16TP25	16T	605137	5289846	
16TP26	16T	605164	5289887	
16TP27	16T	605153	5289878	
16TP28	16T	605167	5289880	
16TP29	16T	605150	5289861	DUP3
16TP30	16T	605155	5289900	
16TP31	16T	605182	5289889	
16TP32	16T	605174	5289832	

* GPS accuracy ± 5m

APPENDIX D

Sample Location Photo Log and Field Notes

16TP1

16TP2

16TP3

16TP4

16TP5

16TP6

16TP7

16TP8

16TP9

16TP10

16TP11

16TP12

16TP13

16TP14

16TP15

16TP16

16TP17

16TP18

16TP19

16TP20

PHOTO LOG – Michipicoten Island, Ontario
160528-00-00

16TP21

16TP22

16TP23

16TP24

16TP25

16TP26

16TP28

16TP30

16TP31

16TP32

16TP33

Scrap Metal Dump

BluMetric™

Project M. Independence
Designed by KM
Date 2016. 09. 23
Project No.
Checked by
Date
Sheet 1 of

16TP X - # **Area 1** - building pad covered in smashed cinder blocks + outhouse cistern

16TP1 · 0605106 5289924
· gravel · organics
medium moist brown soil · very little by volume
· 30 cm deep.. no odour

16TP3 0605101 5289930
· gravel + organics 5 cm max beach stone
· medium moist brown soil
· 30 cm, no odour

16TP5 · 0605096 528 9956
· gravel (5 cm max) + organics (beach stone)
· medium moist brown soil + coarse sand
· 30 cm, no odour

16TP7 · 0605086 528 9939
· gravel (5 cm) + organics
· medium dry brown soil
· 30 cm, no odour

16TP9 0605085 5289926
· gravel (5 cm) + organics
· medium moist brown soil
· 30 cm, no odour

16TP11 0605079 5289930
· gravel (5 cm) + organics
· medium moist brown soil
· 30 cm no odour

BluMetric™

Project ____________ Project No. ____________
Designed by ____________ Checked by ____________
Date ____________ Date ____________
Sheet ______ of ______

AREA 2

16TP13 0605173 5289890
- gravel + rock + organics
- medium, dark brown moist soil
- 30 cm, no odour

16TP15 0605179 5289905
- gravel + rock + organics
- medium, dark brown dry soil
- 30 cm, no odour

16TP17 0605181 5289886
- gravel + rock + organics (tree roots)
- medium dark brown dry soil
- 20 cm, no odour

16TP19 0605176 5289877
- gravel + rock + organics
- medium dark brown, moist soil
- 30 cm, no odour

16TP22 0605184 5289813 Lead
- gravel + rock + organics + broken brick near building
- medium dark brown, moist soil +
- 10 cm, no odour

~~16TP23~~

16TP25 0605~~8~~37 / 5289846
- black, moist wet soil loam + org.
- 20 cm

16TP27 . 0605153 5289878
- black, moist wet soil + organics
- 10-15 cm

Project ____________ Project No. ____________

Designed by ____________ Checked by ____________

Date ____________ Date ____________

Sheet ______ of ______

16 TP30 $

- 0605155 5289900 by light house out house
- gravel + rock + organic
- dark brown, medium soil, moist
- 20 cm

16 TP31

- 0605182 5289889 by speakers
- gravel + sand (coarse) + organics
- brown sandy soil, dry
- 10 cm

16TP32

- 0605174 5289832 by "ruin" by helipad
- dark brown moist soil + grey coarse gravel
- 20 cm

BluMetric™

Project ____________________ Project No. ____________________

Designed by ____________________ Checked by ____________________

Date 2016-09-23 Date ____________________

Sheet 2 of ______

EAGLE

16TP1	<20 ppm	
16TP2	<20 ppm	
16TP3	<20 ppm	
16TP4	<20 ppm	
16TP5	<20 ppm	
16TP6	<20 ppm	
16TP7	<20 ppm	
16TP8	<20 ppm	
16TP9	<20 ppm	
16TP10	<20 ppm	
16TP11	<20 ppm	
16TP12	<20 ppm	
16TP13	<20 ppm	
16TP14	<20 ppm	
16TP15	<20 ppm	
16TP16	<20 ppm	
16TP17	25 ppm	
16TP18	<20 ppm	
16TP19	<20 ppm	
16TP20	30 ppm	
16TP21	<20 ppm	
16TP22	lead	
16TP23	<20 ppm	
16TP24	<20 ppm	
16TP25	—	metal/stream sample/out <20 ppm
16TP26	<20 ppm	
16TP27	<20 ppm	
16TP28	<20 ppm	
16TP29	<20 ppm	
16TP30		

Project ____________ Project No. ____________

Designed by ____________ Checked by ____________

Date ____________ Date ____________

Sheet ______ of ______

West Foundation N of Helipad
735 × 614 between 2.5 and 1.5 m tall (varies due to bedrock)

Sign Pad by lighthouse
240 × 65 × 30

Outhouse by Lighthouse
130 × 130 × 200

Guard Rail to Areal
approx 32 m long, 23 posts, double 2-4 rail

Guard Rail to Helepad
approx 215 m long, single 2-4 rail

"Speakers"
approx 4 m tall white speakers + red painted corrugated metal base filled with concrete

Sleeping Building 1940's 11 × 8 m

JOB 160528
DATE Sept 23 PAGE 1

JF KM VM on site
9:30 am East end lighthouse
Michipicoten Island

Soil sample test pit naming
convention 16TPX-# multiple
↑ test pit #

Area 1
East corner of building
16T 0605106
5289913

16TP2 medium brown highly
organic soil and beach
rock (avg. 5cm x 5cm), 30 cm deep
16T 0605103
5289912

6TP4 dark brown, organic soil,
damp, rocky (as above).
30 cm deep. Mostly rocks.
16T 0605097
5289907

PARTY CHIEF

WEATHER

JOB

DATE PAGE

16TP6 rocky dark brown moist organic soil (as above) 30cm deep. Mostly rocks
Test pit far side of building footprint and small (1m) concrete pads. Edge of tree line.
16T 0605082
5289901

16TP8 dark brown soil, organic, damp. Mostly small gravel (1cm x 1cm). 30 cm deep.
16T 0605088
5289910

16TP10 16T 0605084
5289918
med brown organic soil. dry below 5cm. Mostly small gravel (as above). 30cm deep
* DUP 1 *

PARTY CHIEF

WEATHER

JOB

DATE PAGE

16TP12 dark brow damp organic Soil. Med-fine sand + silt. Some gravel (minimal). test pit within tree line.
20 cm deep
16T 0605077
5289918

Jarred all for area
1 250ml Jar + 1 F1 vial
per sample
+ 1 composite = 16TPC1

PARTY CHIEF

WEATHER

JOB ....

DATE .... PAGE ....

Area 2

North corners of buildings

northern shed 16T 0605178/5289890

Middle shed 16T 0605 177/5289881

big new building 16T 0605178/5289885

~~light house door 16T 0605168/5289896~~

16TP14 dark brown moist organic soil. Med sand and cobbles. 30cm deep, 1m from corner of cement walkway.
16T 0605172
5289895

16TP16 med brown, dry organic soil, scarce soil between large cobbles (5cm x 10cm and bigger). 20cm deep
16T 0605181
5289897

PARTY CHIEF ....

WEATHER ....

JOB ....

DATE .... PAGE ....

16TP18 med brown med sand, slightly damp, organics between cobbles (5x10cm). On ridge sloping to beach. ~ 4m from North building. 25cm deep. 16T 0605184
5289889

16TP20 Gravel and cobbles, some med. brown med sand and organics. Bricks + concrete chuncks.
20 cm deep 16T 0605189
*DUP2 5289872

16TP21 organic soils med brown with cobbles and brick fragments. 15cm deep
16T 0605186
5289860

PARTY CHIEF ....

WEATHER ....

JOB

DATE PAGE

Jar all (1 250 ml) + 1 F1 vial)
+ composite (1 250 ml)
↳ 16TPC2

16TP22 for lead
1 x 250ml

~~16TP23 for lead~~
~~1 x 250ml~~

PARTY CHIEF

WEATHER

JOB

DATE PAGE

Area 3

Lighthouse door 16T0605168/5289896
north corner of concrete 16T0605166
basin 5289884
north corner of 2 storey residential
building 16T0605165
5289877

16TP23 Med brown, med sand +
organics. Cobbles and
gravel. 30cm deep.
North of lighthouse 16T 0605165
5289896

16TP24 Same as TP23
25cm deep, NW of
light house
16T 0605155
5289893

16TP26 Med brown med sand and
organics. Dry. Cobbles,
brick fragments, glass.
20 cm deep
16T0605164
5289887

PARTY CHIEF

WEATHER

JOB

DATE PAGE

16TP28 med brown med sand organics, cobbles and gravel damp. 25cm deep
16T0605167
5289880

16TP29 dark brown med sand & silt. Moist. Trace travel. Brick fragments. In outflow area behind 2 storey building.
20cm deep
16T0605150
5289861
& DUP3

Jar all (4 250ml + 1 F1 vial)

+ composite 16TPC3
(1 250ml)

PARTY CHIEF

WEATHER

JOB

DATE PAGE

PARTY CHIEF

WEATHER

Test Pit Data Sheet

Sample	Depth (cm)	Description
16TP1	30	Medium moist brown soil with organics and gravel.
16TP2	30	Medium brown highly organic soil and beach stone Average particle size 5 cm by 5 cm.
16TP3	30	Medium moist brown soil with organics, gravel and beach stone. Maximum beach stone particle size of 5 cm.
16TP4	30	Dark brown damp organic soil. Mostly beach stone with average particle size of 5 cm by 5cm.
16TP5	30	Medium moist brown soil and coarse sand. Some gravel and organics with beach stone. Maximum gravel particle size of 5 cm.
16TP6	30	Dark brown moist organic soil. Mostly rock.
16TP7		Medium dry brown soil with gravel and organics. Average gravel particle size of 5 cm.
16TP8	30	Dark brown, damp organic soil. Mostly small gravel with average particle size of 1 cm by 1 cm.
16TP9	30	Medium moist brown soil with gravel and organics. Average gravel particle size of 5 cm.
16TP10	30	Medium brown organic soil, dry below top soil (top 5 cm). Mostly small gravel with average particle size of 1 cm by 1 cm.
16TP11	30	Medium moist brown soil with gravel and organics. Average gravel particle size of 5 cm.
16TP12	20	Dark brown, damp organic soil. Medium fine sand and silt with minimal gravel.
16TP13	30	Medium dark brown moist soil with gravel, rock and organics present.
16TP14	30	Dark brown, moist organic soil. Medium sand and cobbles.
16TP15	30	Medium dark brown dry soil with gravel, rock and organics present.
16TP16	20	Medium brown, dry organic soil. Scarce soil between large cobbles (average size of 5 cm by 10 cm).
16TP17	20	Medium dark brown dry soil with gravel, rock and organics present.
16TP18	25	Medium brown sand with cobbles. Slightly damp organic soil between cobbles. Average cobble size of 5 cm by 10 cm.
16TP19	30	Medium dark brown, moist soil with gravel, rock and organics present.
16TP20	20	Mostly gravel and cobbles, some medium brown medium sand and organic soil. Bricks and concrete pieces are present.
16TP21	15	Medium brown organic soil with brick and cobble fragments.
16TP22	10	Medium dark brown moist soil with gravel, rock, organics and brick fragments present.
16TP23	30	Medium brown, medium sand and organic soil. Some cobbles and gravel.
16TP24	25	Medium brown, medium sand and organic soil. Some cobbles and gravel.
16TP25	30	Black wet loam with organics present.

16TP26	20	Medium brown, dry medium fine and and organic soil. Some cobbles and brick fragments. Glass pieces are present.
16TP27	10 - 15	Black wet soil with organics present.
16TP28	25	Medium brown, damp medium sand and organics. Some cobbles and gravel.
16TP29	20	Dark brown, moist medium sand and silt. Trace gravel and some brick fragments.
16TP30	20	Medium dark brown moist soil with gravel, rock, and organics present.
16TP31	10	Brown sandy coarse dry soil with gravel and organics present.
16TP32	20	Dark brown moist soil with grey coarse gravel particles.

APPENDIX G

Environmental Effects Evaluation

Basic Project Evaluation Report

for the

Abatement and Debris Removal, Michipicoten Island East End Site, Ontario

Pursuant to Sections 67 of the
Canadian Environmental Assessment Act, 2012

East End Light Station
Michipicoten Island, Ontario
PSPC Project No. R.083149.03

Prepared for
Public Services and Procurement Canada –
Environmental Remediation Services, ESCS, Ontario Region
Government of Canada

March 31, 2017

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Basic Project Evaluation Report

PART A: PROJECT INFORMATION

Project Title:	Remediation of East End Light Station Michipicoten Island
Project Location:	East End Light Station Michipicoten Island, Ontario
Lead Federal Authority:	Department of Fisheries and Oceans
Lead Authority Contact:	Jennifer Sifton
Title	Environmental Officer
Telephone Number	905-315-5287
Email Address	Jennifer.Sifton@dfo-mpo.gc.ca

Other Federal Authorities	Public Services and Procurement Canada – Ontario Region
Contact Name:	Martin Bouwma
Title	Senior Environmental Engineer
Telephone Number	416.512.5721
Email Address	Martin.Bouwma@pwgsc-tpsgc.gc.ca
PSPC Project No.	R.083149.03

PART B: SCOPE OF PROJECT

B.1 Project Description

The purpose of this project is to remediate lead paint and metal/debris dump at the East End Light Station (the Site) located at the east end of Michipicoten Island in Lake Superior in order to limit further lead impacts to the environment at the East End Light Station Michipicoten Island, Ontario. The two main phases of this project are:

- Abatement of paint on the exterior of the lighthouse and appurtenant structures (lighthouse, 2 buildings, building foundations and railings) as well as repainting of all structures.
- Removal of scrap metal (by hand) and debris from dump located to the west of the site.

No demolition of the existing structure or new construction is required. Other than exterior paint and scrap metal, no other remedial activities are proposed as part of this project and excavation of surface soils or vegetation removal will not be required.

Marine access to the site is limited due to the rock shoreline and the side of the existing dock and break walls which limit the size of craft which may safely dock at the site. Accordingly, equipment and materials required for the remediation as well as waste materials will be brought to and from the island by barge and then ferried to the site by small boat. The main equipment that will be required will consist of temporary scaffolding but it is possible that a small excavator will be required to move equipment and debris. Workers will either travel to and from the site via boat or be flown in by helicopter. While work is underway, workers will likely be housed on the island either in temporary shelters (tents) or in the structures present on the site. Other than the transport of personnel, equipment and waste materials, all project activities will be constrained to the subject property.

All work will be conducted by licensed qualified contractors and supervised by an environmental consultant.

B.2 Scheduling

The project is scheduled to be undertaken during the summer of 2017.

B.3 Regulatory

At minimum, the contractor must be cognizant and abide the following regulations during this project:

- Rules and regulations of authorities having jurisdiction.
- Occupational Health and Safety Act and Regulations for Construction Projects, Revised Statutes of Ontario 1990, Chapter O.1 as amended, Workplace Safety and Insurance Act and municipal statutes and authorities.
- Environmental Protection Act, Revised Statutes of Ontario 1990, Chapter E19 as amended, O. Reg. 102/94, Waste Audits and Waste Reduction Work Plans, and O. Reg. 103/94, Industrial, Commercial and Institutional Source Separation Programs.
- CCME (Canadian Council of Ministers of the Environment) Contaminated Sites, Contaminated Soil and Groundwater, and Remediation of Contaminated Sites most current publications.
- Canadian Environmental Assessment Act.
- Canadian Environmental Protection Act (New Substance Notification Regulations).
- Canada Consumers Product Act (Sc. 2010, c.21) as amended
- Surface Coating Materials regulations SOR 2016/123.
- Transportation of Dangerous Goods Act.
- Fisheries Act.
- Migratory Birds Convention Act.
- Migratory Birds Regulations.

The project site is also located within the Mitchipicoten Provincial Park and the Lighthouse itself is a designated as a Classified Federal Heritage Building by Parks Canada. Accordingly, the contractor should give due consideration for the environmental and heritage value of the site and surrounding area.

As part as the PWGSC mandated Health and Safety requirements for this project, the contractor must be cognizant and aware of the following additional regulations:

- .Canadian Standards Association (CSA): Canada
    - CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- National Building Code 2010 (NBC):
    - NBC 2010, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- National Fire Code 2010 (NFC):
    - NFC 2010, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.
- Ontario
    - O. Reg. 490/09, Designated Substances.
    - O. Reg. 278/05 Designated Substances.
- Treasury Board of Canada Secretariat (TBS):
    - Treasury Board, Fire Protection Standard April 1, 2010

As part of the lead-based paint abatement portion of this project, the contractor must be cognizant and aware of the following additional regulations:

- Department of Justice Canada
    - Canadian Environmental Protection Act, 1999 (CEPA).
- Health Canada
    - Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).
- Human Resources and Social Development Canada
    - Canada Labour Code Part II, SOR 86-304 – Occupational Health And Safety Regulations.

- Ontario Ministry of Labour
    - Health and Safety Guideline "Lead on Construction Projects", April 2011.
- Ontario Ministry of the Environment and Climate Change
    - O. Reg, 347/90 General – Waste Management as amended by O. Reg. 304/14.
    - Environmental Protection Act.
- U.S. Environmental Protection Agency (EPA)
    - EPA 747-R-95-007-1995 (as amended), Sampling House Dust for Lead.
- U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)
    - NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).
- Underwriters' Laboratories of Canada (ULC)
- U.S. Department of Labour – Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances
    - Lead in Construction Regulation - 29 CFR 1926.62-1993.

For the Living Quarters building, it will be required to remove lead-based paint from a transite cladding on the second floor exterior façade. As such, the contractor must be cognizant and aware of the following additional regulations concerning working with asbestos containing materials:

- Ontario Ministry of Labour
    - Buildings and Repair Operations released in November 2007, http://www.labour.gov.on.ca/english/hs/ asbestos/index.html.
    - Ontario Occupational Health and Safety Act.
- Public Works and Government Services Canada.
    - Annex C - Appendix 6 - Work Procedures of PWGSC DM Directive 057 Asbestos Management.
- Canadian General Standards Board (CGSB)
    - CAN/CGSB-1.205-2003, Sealer for Application to Asbestos-Fibre-Releasing Materials.
- U.S. Department of Labour - Occupational Safety and Health Administration - Toxic and Hazardous Substances
    - 29 CFR 1910.1001-2010, Asbestos Regulations.

During the debris removal portion of the project, the contractor must be cognizant and aware of the following additional regulations:

- Canadian General Standards Board (CGSB)
    - CGSB 51-GP-51M-81, Polyethylene Sheet for Use in Building Construction.
- Ontario
    - O.Reg 153/04 Record of Site Condition

For the repainting portion of this project, the contractor must be cognizant and aware of the following additional regulations:

- The Master Painters Institute (MPI)
    - Maintenance Repainting Manual 2004, Master Painters Institute (MPI), including Identifiers, Evaluation, Systems, Preparation and Approved Product List.
- Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

It should also be noted that, as a result of the heritage designation there may be recommendations from the Federal Heritage Review Office which will be taken into consideration in order to preserve the heritage aspects of the lighthouse.

PART C: SCOPE OF EVALUATION

PWGSC has determined that the abatement of lead paint at the East End Light Station Michipicoten Island, Ontario is subject to evaluation the Canadian Environmental Assessment Act 2012 (CEAA 2012). The project is not a designated project under CEAA 2012 and is therefore not subject to an environmental assessment. However, CEAA 2012 still requires an evaluation of potential project effects under Section 67. The evaluation non-designated projects under Section 67 may take two forms, an environmental effects evaluation or a basic project evaluation, based on whether or not there is uncertainty around the potential for environmental effects and where mitigation measures are not known to be effective and established (CEAA, 2016).

The primary objective of the project will be the abatement of lead based paint on the lighthouse and the removal of debris and scrap metal from a dump location identified to the west of the site. No demolition of the existing structure is required and no construction will be required beyond temporary scaffolding and possibly lodging for workers. As a result, all project activities will be constrained to the subject property and all potential environmental effects are not considered significant after the implementation of mitigative measures. Additionally, mitigative measures which will be employed are effective and established techniques for lead paint abatement. In the context of an evaluation under Section 67 of CEAA 2012, mitigation measures are considered “effective and established” if they meet all of the following criteria:

- Have been implemented before in similar situations;
- Are well understood and considered reliable; and
- Are ‘Avoid' or ‘Reduce' type mitigation measures.

Accordingly, based on the scope of the project and the results of the assessment, the project has been classified as a basic project according to the assessment requirements described under Section 67 of the CEAA 2012.

C.1 Environmental Setting

The Michipicoten Island East End Light Station is a 39.3 hectare property located on the northeast end of Michipicoten Island in Lake Superior, and is found within Michipicoten Island Provincial Park. The Site is situated in an area referred to as Point Maurepas. The Island is located approximately 70 km southeast of Wawa and 14 km from the nearest point of mainland (Figure 1). The project site itself consists of a roughly 1 hectare area that is developed with an unmanned lighthouse, fog alarm building, generator building, equipment shed, tank farm with a concrete dyke, and helicopter pad. There are also foundations from a former radio beacon building, former fuel storage shed, former boathouse, and former dwelling on the site (Figure 2).

The Site is unmanned and is currently owned by the Department of Fisheries and Oceans Canada (DFO). Excluding the site, Michipicoten island as well as a aquatic habitat within a 2.5 km buffer extending into Lake Superior is administered as Michipicoten Provincial Park.

C.2 Physical Environment

Climate

The nearest weather station to the Site is located in Wawa, ON approximately 70 km southeast of Wawa. It experiences average daily temperatures between -14˚C in January and 15˚C in July Daily average temperatures are above 0˚C during seven months of the year (April to October). The region typically experiences rainfall between April and November, with monthly averages ranging from 47 mm to 107 mm. The water equivalent of the average annual precipitation in this area is 970 mm (Environment Canada 2010). .

Topography

Generally, the Site is relatively flat with a moderate slope towards the shoreline of Lake Superior. The shoreline variably consists of bedrock outcroppings and sloped gravel beaches. Outlying structures (former radio building, helipad, etc.) away from the main site are also constructed on bedrock outcroppings. Regional surface drainage appears to be generally east towards Lake Superior.

The Site generally consists of overgrown vegetation or gravelly sand covered areas and competent bedrock exposed at surface. Storm water collected on the overgrown vegetative areas, sand/gravel and competent bedrock is anticipated to drain by infiltration and/or overland flow (JW 2006a). BluMetric (2016) noted an ephemeral stream that was dry during the assessment. It was apparent (observed soil erosion, shallow channelization and undercut vegetation, etc.) that this surface water feature results in a periodic flowing stream which runs first southeast and then to the east towards the Site. The habitat assessment conducted by Bowfin (2016) also noted a small channel created from what appeared to be a seep on the northern edge of the Site. The wetted width was 31 cm and the average depth was 3 cm. The substrate and gradient created run and step morphological units. This channel flowed east towards Lake Superior, but it did not reach the shoreline and ended just west of the double dwelling.

Geology and Soils

The surficial soils at the Site consist of glaciolacustrine deposits including sand, gravely sand and gravel, and near-shore beach deposits. Bedrock consisting of igneous and metamorphic rock is exposed at surface or covered by a discontinuous, thin layer of soil. The characteristic permeability of the gravelly sand is high. The bedrock encountered exhibited a high level competency with little to no fractures (JW 2006a and JW 2006b). Along the shoreline, the geology consists of deposits of lacustrine sand and gravel, including pebble and cobble materials (JW 2006b).

The ground surface cover at the various borehole locations in previous investigations generally consisted of gravelly sand, bedrock and/or grass surface cover. As indicated on the borehole records, the soil stratigraphy in the areas investigated generally consisted of organics covering gravelly sand overburden and underlain by competent bedrock. The depth of the overburden encountered within the hand auger locations ranged from 0.1 m to 0.3 m bgs (JW 2006a and BluMetric 2016).

According to JW (2006b) the natural bedrock contour in the vicinity of the site delineates overburden soils in both vertical and horizontal directions.

Contaminated Soils

Multiple assessments have occurred at the site in 2001, 2006 and 2016 (XCG 2001, Jacques Whitford 2006, BluMetric 2016) in order to document the extent of impacted soils at the site. Assessments have identified elevated levels of petroleum hydrocarbons (PHCs), metals and Polycyclic aromatic hydrocarbons (PAHs) distributed across the site. These impacts are associated with historical activities occurring over the long operational history of the site. Delineation of these impacts have been partially successful in estimating the volume of impacted soils present at the site, however exact delineation has not been achieved due to the remote location of the site and environmental conditions at the site.

It was also noted that elevated metal concentrations in site soils may be attributed to metal scrap and debris are distributed in the forest surrounding the site. A scrap metal dump was also identified to the west of the site in a seasonal surface water feature. This metal dump is a potential contributing source of metals impacts in surface soils for areas of the main site down gradient.

Description of Structures

Development at the light station consists of an unmanned lighthouse, fog alarm building, abandoned dwelling, generator building, equipment shed, and decommissioned tank farm with a concrete dyke, and helicopter pad. There are also foundations from a former radio beacon building, former fuel storage shed, former boathouse on the Site.

The lighthouse itself is a six-sided reinforced concrete structure, approximately 18.7 metres high, braced by six tapered flying buttresses. A structural assessment conducted in 2016 (Novatech, 2016) found that the lighthouse, while in generally satisfactory condition, is experiencing significant concrete deterioration (spalling and corrosion) especially around the exterior platform surrounding the top floor. It is noted that this deterioration presents a potential risk to workers working around the exterior of the lighthouse as a result of falling concrete.

The assessment also notes that the appurtenant structures at the site are generally in good condition.

A designated substances survey (DSS) conducted in 2016 (BluMetric, 2016) confirmed the presence of lead and mercury containing paint on the lighthouse and the surrounding structures. The DSS also identified asbestos containing materials as well as a thermostat containing mercury in the former living quarters.

Access

The Site is currently unmanned and personal and equipment are ferried by helicopter from the main land as required. The shoreline at the site is developed with a breakwater and small concrete wharf and historically the site was accessed by boat. Historically the site was accessed by way of a small craft launched from a larger vessel due to the exposed and shallow nature of the landing site

Marine access requirements for the proposed project are assumed to be limited to the equipment required for remediation (scaffolding, excavator, etc.), the transfer of personnel to and from the island as well as the removal of waste (paint, impacted soil, scrap metal, etc.). Based on these access requirements and following review of the size and condition of existing dock and breakwater a marine engineering assessment of the site (Shoreplan Engineering, 2016) recommended that site access be provided by way of a small landing craft launched from a barge and tug. Equipment would be transferred between the barge and the island by a small landing craft with an approximate capacity of 4.5 tons. In the case of rough conditions, the barge and tug can shelter in Quebec Harbour nearby. Given the remote nature of the site, it is likely that a helicopter will remain on standby in the event of an emergency.

C.3 Biological Environment

Ecological habitats at the Site and surrounding area are fairly uniform and consist primarily of coniferous forests with some marsh and bedrock inclusions. The forest is dominated by white birch and the white spruce with an understory consisting of balsam fir, thimbleberry, red-osier dogwood and bunchberry. The ground cover consisted mostly of moss with some lichen.

Very small wetlands and bedrock outcrops or rock barrens were found west and south of the Site. The small wetlands (some roughly 10 m x 4 m; too small to be considered as suitable amphibian breeding habitat) consisted of tall shrub swamp with two vegetation forms, dogwood and thimbleberry.

Bowfin (2016) provided a list of wildlife observations for the Site and surrounding area. Evidence of caribou and wolf in the area was noted (feces), as well as beaver (stumps). Other notable species included: bald eagle, American pipit, blackburnian warbler, black-capped chickadee, palm warbler, pine warbler and yellow-rumped warbler.

The only water bodies reported on the Site during recent investigations include ephemeral channels/streams and small areas of ponded water insufficient to support aquatic life (BluMetric 2016 and Bowfin 2016). The wetlands likely support aquatic life but are located up gradient from the light station and outside the project area.

The Site is bounded on the east by Lake Superior. Shoreline habitat consists of bedrock knolls or cobble/pebble beaches. Only one area on the north side contains vegetation, and generally transitions from rock beach to narrow strips of grass to broad-leaf species and finally into the forest community. Some of the species observed included: grasses, hawkweed, pearly everlasting, bunchberry, and tall buttercup. This area is noted for lake trout spawning beds, the presence of a fishery (i.e. coho and chinook salmon, herring and lake whitefish), and potential habitat for the species of special concern, which include the deepwater sculpin and the upper great lakes kiyi.

Although no significant wildlife habitats (SWH) were confirmed, Bowfin suggested that the vegetation and habitats encountered could be considered to provide candidate SWH for: bat hibernacula, reptile hibernacula, woodland raptor nesting habitat, seeps and springs, denning sites and/or mast producing areas, cliff and talus slopes, rock barren, and Great Lakes Arctic-Alpine Shoreline type.

Bowfin (2016) identified no Areas of Scientific Interest or Provincially Significant Wetlands on or in the vicinity of the Site.

Bowfin (2016) completed a SAR assessment for the Site. Provincial and federal databases were searched to obtain data on threatened or endangered species on or in the vicinity of the Site. SAR includes the following: Lake Sturgeon, Shortjaw Cisco, Deepwater Sculpin, Whip-poor-will, Barn Swallow, Canada Warbler, Little Brown Myotis, Northern Myotis/Northern Long-eared Bat and Tri-colored Bat. SAR whose habitat is present or may occur in the study area are summarized in Table X. Those species highlighted in red are those who have been documented on the island and those in orange in Table 2 are that whose habitat is present and may occur within the study area. Note that only the Woodland Caribou was confirmed to be present during the site investigations (Bowfin 2016).

Table 1 List of Potential Endangered or Threatened Species for the General Area

Common Name	Scientific Name	Schedule	SRank	Provincial Status	Federal Status	Preferred Habitat	Reference
FISH							
Lake Sturgeon	*Acipenser fulvescens*	No schedule	S2	THR	No Status	Bottoms of lakes and large rivers.	COSEWIC 2000
Shortjaw Cisco	*Coregonus zenithicus*	Schedule 2	S2	THR	THR	Deep water species found mostly in great lakes but also in a few larger lakes.	Scott & Crossman 1998
Deepwater Sculpin	*Myoxocephalus thompsonii*	Schedule 2	S3?		THR	Cold bottom waters of the hypolimnion, on soft sediments in deep lakes.	COSEWIC 2006
BIRDS							
American White Pelican	*Pelecanus erythrorhynchos*			THR		In Ontario this species nests on small (0.4-1.2 ha) low-lying bedrock islands far from mainland to protect it from predation. Islands may be unvegetated or with some trees. Known breeding pairs are located further west than Michipicoten Island.	Sandilands 2005
Golden Eagle	*Aquila chrysaetos*		S2B	END		Open country, near mountains and lakeshores.	Peterson 1980
Whip-poor-will	*Caprimulgus vociferus*	Schedule 1	S4B	THR	THR	Rock or sand barrens with scattered trees, savannahs, old burns or other disturbed sites in a state of early to mid-forest succession, or open conifer plantations	COSEWIC 2009
Common Nighthawk	*Chordeiles minor*	Schedule 1	S4B	SC	THR	Open habitats, such as sand dunes, beaches, logged areas, burned-over areas, forest clearings, short-grass prairies, pastures, open forests, peatbogs, marshes, lakeshores, gravel roads, river banks, rocky outcrops, rock barrens, railways, mine tailings, quarries, urban parks, military bases, airports, mines and commercial blueberry fields, also present in mixed coniferous forest, and pine stands	COSEWIC 2007
Chimney Swift	*Chaetura pelagica*	Schedule 1	S4B, S4N	THR	THR	Cities, towns, villages, rural, and wooded areas.	COSEWIC 2007

Common Name	Scientific Name	Schedule	SRank	Provincial Status	Federal Status	Preferred Habitat	Reference
Olive-sided Flycatcher	*Contopus cooperi*	Schedule 1	S4B	SC	THR	Open areas containing tall trees or snags for perching.	COSEWIC 2007
Bank Swallow	*Riparia riparia*		S4B	THR	No Status	Variety of forest types, most common in wet, mixed deciduous-coniferous forest with a well-developed shrub layer. It is often found in shrub marshes, red maple stands, cedar stands, conifer swamps dominated by black spruce and larch and riparian woodlands along rivers and lakes. It is also associated with ravines and steep brushy slopes near these habitats	COSEWIC 2013
Barn Swallow	*Hirundo rustica*	No schedule	S4B	THR	No Status	Open or semi-open lands: farms, field, marshes.	Peterson 1980
Canada Warbler	*Wilsonia canadensis*	Schedule 1	S4B	SC	THR	Variety of forest types, most common in wet, mixed deciduous-coniferous forest with a well-developed shrub layer. It is often found in shrub marshes, red maple stands, cedar stands, conifer swamps dominated by black spruce and larch and riparian woodlands along rivers and lakes. It is also associated with ravines and steep brushy slopes near these habitats	COSEWIC 2008
Bobolink	*Dolichonyx oryzivorus*	No schedule	S4B	THR	No Status	Primarily in forage crops, and grassland habitat.	COSEWIC 2010
MAMMALS							
Woodland Caribou	*Rangifer tarandus caribou*	Schedule 1	S4	THR	THR	Winter: Mature old-growth coniferous forest. Summer: Occasionally feed in young stands after fire or logging.	COSEWIC 2002
Wolverine	*Gulo gulo*	No schedule		THR	No Status	Large areas of remote wooded wilderness or tundra with an adequate year-round supply of food.	COSEWIC 2003

Common Name	Scientific Name	Schedule	SRank	Provincial Status	Federal Status	Preferred Habitat	Reference
American Badger jacksoni subspecies	*Taxidea taxus jacksoni*	Schedule 1		END	END	Natural and undisturbed grasslands, shrubby areas, and woodlots.	Ontario American Badger Recovery Team 2009
Little Brown Myotis	*Myotis lucifugus*	No schedule	S4	END	END	Buildings, attics, roof crevices and loose bark on trees or under bridges. Always roost near waterbodies.	Eder 2002
Northern Myotis/Northern Long-eared Bat	*Myotis septentrionalis*	No schedule	S3	END	END	Older (late successional or primary forests) with large interior habitat.	Menzel et al. 2002, Broders et al. 2006, SWH 4E Criterion Schedule
Tri-colored Bat	*Perimyotis subflavus*	No schedule	S3?	END	END	Prefers shrub habitat or open woodland near water.	Eder 2002
LICHENS							
Flooded Jellyskin Lichen	*Leptogium rivulare*	Schedule 1	S1		THR	Periodically inundated bases of trees.	COSEWIC 2004
PLANTS							
Pitcher's Thistle	*Cirsium pitcheri*	Schedule 1	S2	THR	END	Optimal habitat is open, dry, loose sand with little other vegetation or duff	Parks Canada Agency 2011

Status Updated December 20, 2016

SRANK DEFINITIONS

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

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

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

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

? Inexact Numeric Rank—Denotes inexact numeric rank

S#B Breeding

S#N Non-Breeding

SARO STATUS DEFINITIONS

END	Endangered: A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA.
THR	Threatened: A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
SC	Special Concern: A species with characteristics that make it sensitive to human activities or natural events.

SARA STATUS DEFINITIONS

END	Endangered, a wildlife species facing imminent extirpation or extinction.
THR	Threatened, a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC	Special Concern, a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

C.4 Socio-economic Environment

The Site is unmanned and is currently owned by the Department of Fisheries and Oceans Canada (DFO). The entirety of Michipicoten island as well as a 2.5 km buffer extending into Lake Superior is administered as Michipicoten Provincial Park. Park use is relatively low since access to the island is limited to tour operators, commercial fishing vessels, float planes, recreational watercraft, and helicopters. Past activities on the Island included small-scale copper mining, commercial fishing, trapping and operation of the lighthouse (Ontario Parks 2004). There are no permanent residents on the island.

The light station was built in 1911 and began operations in 1912. It operated for 70 years as an attended light station. In 1982 the light station was automated and is now unmanned. However, the lighthouse is a focal point for tourism promotion of the Island. Recreational activities known to occur at the island include boating and sea kayaking tours (Naturally Superior Adventures 2017).

C.5 Scoping

This basic project evaluation considers the full range of project / environment interactions and the environmental factors that could be affected by the project as defined above and the significance of related effects after mitigation. The environmental effects of a project to be considered include at a minimum, but are not limited to those described under subsection 5(1) and 5(2) of CEAA 2012. The environmental effects considered in this report include:

- Fish as defined under the *Fisheries Act*
- Aquatic Species as defined under the Species at Risk Act
- Migratory Birds as defined under the Migratory Birds Convention Act
- Aboriginal Interests as defined under Section 5(1) of CEAA 2012
- Health and Socioeconomic interests as defined under Section 5(1) of CEAA 2012 Section 5(2)

As well as a number of due diligence concerns including

- Water (ground and surface water)
- Wildlife
- Soil Quality
- Air Quality

The scope of the assessment is restricted to the immediate area of the Site (i.e. federal land) around the site and the associated remediation works. A summary of potential project and environmental effects is provided in Table 2.

Table 2: Potential Project / Environment Interactions Matrix

P = Potential Effect of Project on Environment;' - ' = No Interaction

	As per Section 5(1)			*Section 5(1c)* *Aboriginal Interest*				*Section 5(2)*			*Due Diligence*			
Project Phase / Physical Work/Activity	*Fish (Fisheries Act)*	*Aquatic Species (SARA)*	*Birds (MBCA)*	*Health and Socio economic*	*Physical and cultural heritage*	*Land use*	**HAPA Significance*	*Health and Socio economic (tourism)*	*Health and Socio economic (health and safety)*	*Physical and cultural heritage, HAPA Significance*	*Surface and Ground Water*	*Birds / Wildlife*	*Soil*	*Air Quality*
Remediation Activities														
Removal of exterior paints	-	-	-	-	-	-	-	*P*	*P*	*P*	*P*	-	*P*	*P*
Re-painting	-	-	-	-	-	-	-	*P*	*P*	*P*	*P*	-	*P*	*P*
Removal of scrap metal/debris	-	-	P	-	-	-	-	-	-	-	*P*	-	*P*	-
Supporting Activities														
Transport of equipment and personnel to/from site	P	P	-	-	-	-	-	-	-	-	P	-	-	P
Housing of personnel on site	-	-	P	-	-	-	-	P	-	-	P	P	-	-
Waste Management	P	P	P	-	-	-	-	P	-	-	P	P	P	-

*HAPA *–structure, site or thing that is of historical, archaeological, paleontological or architectural significant*

Table 3: Potential Project / Valued Ecosystem Interactions and Mitigation Measures

<table>
<tr><td colspan="5">Table 3.1 Valued Ecosystem Component - <i>Fish (Fisheries Act)</i></td></tr>
<tr><td colspan="5">Potential Effect: <i>Harmful effects to fish.</i></td></tr>
<tr><td colspan="2">Potential Interaction</td><td colspan="3">Mitigation</td></tr>
<tr><td colspan="2">• Transport of equipment and personnel may result in debris/material entering surface water (Lake Superior)
• Contamination of surface water from stored/transported waste material during remediation activities.</td><td colspan="3">• Potential impacts to fish and other aquatic species will be limited to the possibility for spills of deleterious substances (fuels, lubricants, removed paints, etc.) and the associated impacts to surface water. The assessment of the potential impacts to surface water and the associated avoidance measures are described below in Table 3.8</td></tr>
<tr><td>Magnitude</td><td>Reversibility</td><td>Geographic Extent</td><td>Duration</td><td>Frequency</td></tr>
<tr><td><i>Small</i></td><td><i>Reversible</i></td><td><i>Immediate</i></td><td><i>Short-term</i></td><td><i>Once</i></td></tr>
<tr><td>Residual Effects:</td><td colspan="4"><i>Insignificant</i></td></tr>
<tr><td>Monitoring:</td><td colspan="4"><i>None required</i></td></tr>
<tr><td colspan="5">Comments: The proposed work plan does not require the construction or modification to any shoreline structures (breakwater/warf) as existing facilities should be sufficient to facilitate site access. The project does not involve the excavation/disturbance of soils no potential for erosion is anticipated and as such the requirement for a Sediment and Erosion control plan is not anticipated. Should disturbance to surface soils or erosion be noted during remedial activities a Sediment and Erosion control plan should be developed and implemented.</td></tr>
</table>

<table>
<tr><td colspan="5">**Table 3.2 Valued Ecosystem Component –** *Aquatic Species (SARA)*</td></tr>
<tr><td colspan="5">**Potential Effect:** *Harmful effects on aquatic species at risk*</td></tr>
<tr><td colspan="2">**Potential Interaction**</td><td colspan="3">**Mitigation**</td></tr>
<tr><td colspan="2">• Transport of equipment and personnel may result in debris/material entering surface water (Lake Superior)
• Contamination of surface water from stored/transported waste material during remediation activities.</td><td colspan="3">• Potential impacts to SAR fish and other aquatic SAR will be limited to the possibility for spills of deleterious substances (fuels, lubricants, removed paints, etc.) and the associated impacts to surface water. The assessment of the potential impacts to surface water and the associated avoidance measures are described below in Table 3.8</td></tr>
<tr><td>**Magnitude**</td><td>**Reversibility**</td><td>**Geographic Extent**</td><td>**Duration**</td><td>**Frequency**</td></tr>
<tr><td>***Small***</td><td>***Reversible***</td><td>***Immediate***</td><td>***Short-term***</td><td>***Once***</td></tr>
<tr><td>**Residual Effects:**</td><td colspan="4">***Insignificant***</td></tr>
<tr><td>**Monitoring:**</td><td colspan="4">***None required***</td></tr>
<tr><td colspan="5">**Comments:** The proposed work plan does not require the construction or modification to any shoreline structures (breakwater/warf) as existing facilities should be sufficient to facilitate site access. The project does not involve the excavation/disturbance of soils no potential for erosion is anticipated and as such the requirement for a Sediment and Erosion control plan is not anticipated. Should disturbance to surface soils or erosion be noted during remedial activities a Sediment and Erosion control plan should be developed and implemented.</td></tr>
</table>

Table 3.3 Valued Ecosystem Component – *Birds (MBCA)*

Potential Effect: *Harmful effects on migratory birds or their habitat*

Potential Interaction	Mitigation
• Removal of waste metal and debris may result in possible disturbance to birds and their habitats • Housing of project personnel on site may result in possible disturbance to birds and their habitats • The improper handling and disposal of waste materials may result in disturbance of birds and their habitat	• No vegetation clearing is anticipated to be required; however, should it be required minimizing the clearing of any vegetation including trees (potential nesting for birds and raptors), shrubs (potential forage for wildlife). If required, any clearing of vegetation should take place outside of the breeding bird window (April 15th to August 31st). If this is not possible due to the scheduling of the work, a biologist should be present to identify any birds or nests that may be present, the nest area should be clearly staked or flagged and Environment Canada contacted to determine the appropriate buffer area based on the species encountered prior to vegetation removal. The proponent should contact Environment Canada if they are proposing work during the breeding season to ensure compliance with the Migratory Bird Convention Act. • Impacts to vegetation can also be minimized by pre-selecting routes onto and off the island and around the area. The site is crossed by numerous concrete walkways. • Avoid impacting the seeps and springs (including the north wetland). • In the event that workers need to be temporarily housed on the site during the remediation they should be housed in existing structures or temporary structures erected within the previously disturbed boundaries of the site. • When possible work will be completed during daylight. If nighttime lights are used they will be installed so as to illuminate the work area only to minimize impacts to nighttime activities of wildlife. • Organic/food waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site or incinerated on-site according to project permitting standards • Appropriate disposal containers will be available for the prompt disposal of waste. • Full disposal containers will be removed to the appropriate waste disposal facility on a regular basis. • A temporary waste storage area will be designated that meets the requirements of the *Environmental Protection Act*, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), *Fire Protection and Prevention Act* (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a watercourse and has no direct drainage leading to a watercourse. • All heavy mechanical equipment must be fitted with standard and well-maintained noise suppression devices.

Magnitude	Reversibility	Geographic Extent	Duration	Frequency
Small	*Reversible*	*Immediate*	*Short Term*	*Once*

Residual Effects:	***Insignificant***
Monitoring:	***None required***
Comments: The majority of project activities will be limited to the area immediately around site structures. The removal of the waste metal dump will be accomplished by hand and should not require the removal of vegetation or the disturbance of soils.	

<table>
<tr><td colspan="5">Table 3.4 Valued Ecosystem Component – <i>Aboriginal Interests as defined under Section 5(1) of CEAA 2012</i></td></tr>
<tr><td colspan="5">Potential Effect: <i>Effects on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological or architectural (HAPA) significance.</i></td></tr>
<tr><td colspan="2">Potential Interaction</td><td colspan="3">Mitigation</td></tr>
<tr><td colspan="2">• No interactions identified.</td><td colspan="3">• Consultation with First Nations to confirm lack of interest will be undertaken by DFO prior to the initiation of work</td></tr>
<tr><td>Magnitude</td><td>Reversibility</td><td>Geographic Extent</td><td>Duration</td><td>Frequency</td></tr>
<tr><td><i>N/A</i></td><td><i>N/A</i></td><td><i>N/A</i></td><td><i>N/A</i></td><td><i>N/A</i></td></tr>
<tr><td colspan="2">Residual Effects:</td><td colspan="3"><i>Insignificant – No Interactions Identified to Date</i></td></tr>
<tr><td colspan="2">Monitoring:</td><td colspan="3"><i>Confirmation by DFO</i></td></tr>
<tr><td colspan="5">Comments: N/A</td></tr>
</table>

<table>
<tr><td colspan="5">Table 3.5 Valued Ecosystem Component – <i>Health and Socioeconomics as defined under Section 5(1) of CEAA 2012 Section 5(2) - Tourism</i></td></tr>
<tr><td colspan="5">Potential Effect: <i>Potential effects on the tourism value of the site</i></td></tr>
<tr><td colspan="2">Potential Interaction</td><td colspan="3">Mitigation</td></tr>
<tr><td colspan="2">• Project activities and the housing of project personnel on site have the potential to affect the aesthetics and tourism value of the site during remedial activities</td><td colspan="3">• Park use is relatively low since access to the island is limited to tour operators, commercial fishing vessels, float planes, recreational watercraft, and helicopters.
• Following lead paint abatement, the lighthouse and appurtenant structures will be repainted in the same colour and style to maintain site aesthetics.
• Work site will be maintained in a clean and orderly manner free of garbage/litter.
• Work will be scheduled and conducted as quickly as possible to minimize the period of disturbance</td></tr>
<tr><td>Magnitude</td><td>Reversibility</td><td>Geographic Extent</td><td>Duration</td><td>Frequency</td></tr>
<tr><td><i>Small</i></td><td><i>Reversible</i></td><td><i>Immediate</i></td><td><i>Short Term</i></td><td><i>Once</i></td></tr>
<tr><td>Residual Effects:</td><td colspan="4"><i>Insignificant</i></td></tr>
<tr><td>Monitoring:</td><td colspan="4"><i>None required</i></td></tr>
<tr><td colspan="5">Comments: It should also be noted that, as a result of the heritage designation there may be recommendations from the Federal Heritage Review Office which will be taken into consideration in order to preserve the heritage aspects of the lighthouse.</td></tr>
</table>

Table 3.6 Valued Ecosystem Component – *Health and Socioeconomics as defined under Section 5(1) of CEAA 2012 Section 5(2) - Health and Safety*

Potential Effect: *Potential effects on the health and safety of project personnel and visitors to the site*

Potential Interaction	Mitigation
• Remediation and supporting activities may result in increased risk to worker and public health and safety as a result of site conditions during remediation and improper management of wastes and materials.	• Park use is relatively low since access to the island is limited to tour operators, commercial fishing vessels, float planes, recreational watercraft, and helicopters. • Work site will be maintained in a clean and orderly manner free of garbage/litter. • Work will be scheduled and conducted as quickly as possible to minimize the period of disturbance • Access to the site will be limited to construction personnel during remediation activities. • Identification/labelling, recording, and reporting will be done of any regulated wastes, products and substances, together with hazardous material through a Workplace Hazardous Material Information System assessment (WHMIS). • A temporary stockpiling and waste storage area(s) will be designated that meets the requirements of the *Environmental Protection Act*, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), *Fire Protection and Prevention Act* (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a watercourse and has no direct drainage leading to a watercourse. • Appropriate disposal containers will be available for the prompt disposal of waste. • Full disposal containers will be removed to the appropriate waste disposal facility on a regular basis. • Wastes that require special handling requirements will be handled in accordance with the appropriate local, provincial and federal legislation. • Organic/food waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site or incinerated on-site according to project permitting standards • Power tools utilized for the removal of loose or rough lead-containing coatings or materials will be fitted with an effective dust collection system equipped with a HEPA filters. • Exterior scaffolding erected to facilitate paint removal will be fitted with a dust screen/netting in order to prevent the migration of dust and potential for injury resulting from dislodged concrete. • The contractor will be required to develop a health and safety plan prior to commencement of any works, and to meet or exceed the requirements of all applicable federal and/or provincial health and safety legislation, regulations, and permits

Magnitude	Reversibility	Geographic Extent	Duration	Frequency
Small	***Reversible***	***Immediate***	***Short Term***	***Once***

Residual Effects:	***Insignificant***
Monitoring:	***None required***
Comments:	

<table>
<tr><td colspan="5">Table 3.7 Valued Ecosystem Component – <i>Health and Socioeconomics as defined under Section 5(1) of CEAA 2012 Section 5(2) – Heritage and HAPA Significance</i></td></tr>
<tr><td colspan="5">Potential Effect: <i>Effects on physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural (HAPA) significance.</i></td></tr>
<tr><td colspan="2">Potential Interaction</td><td colspan="3">Mitigation</td></tr>
<tr><td colspan="2">• Project activities and the housing of project personnel on site have the potential to affect the aesthetics and heritage value of the site
• Remediation activities may have the potential to impact previously undocumented archaeological or heritage resources</td><td colspan="3">• No excavation or disturbance of soils is anticipated as part of the proposed work plan. The areas around the lighthouse and appurtenant structures consist of bedrock and/or previously disturbed areas. As such, undiscovered archaeological resources are unlikely to be present.
• If human remains are discovered the local police, the coroner's office, and the Registrar of Cemeteries will be notified immediately.
• The lighthouse is a designated Classified Federal Heritage Building based on its design and the relatively unchanged and remote nature of the site. The proposed abatement work will not impact the design of the lighthouse. The heritage designation does not extend to the site or the other structures.
• Following paint abatement, the lighthouse structure will be repainted in the same colour style to maintain site aesthetics.
• Work will be scheduled and conducted as quickly as possible to minimize the period of disturbance
• In the event that previously undocumented archaeological resources are discovered during remediation work will cease work immediately and a licensed archaeologist will be contacted to complete an archaeological review or assessment</td></tr>
<tr><td>Magnitude</td><td>Reversibility</td><td>Geographic Extent</td><td>Duration</td><td>Frequency</td></tr>
<tr><td><i>Small</i></td><td><i>Reversible</i></td><td><i>Immediate/</i></td><td><i>Short-term</i></td><td><i>Once</i></td></tr>
<tr><td>Residual Effects:</td><td colspan="4"><i>Insignificant</i></td></tr>
<tr><td>Monitoring:</td><td colspan="4"><i>None required</i></td></tr>
<tr><td colspan="5">Comments: It should also be noted that, as a result of the heritage designation there may be recommendations from the Federal Heritage Review Office which will be taken into consideration in order to preserve the heritage aspects of the lighthouse.</td></tr>
</table>

Table 3.8 Valued Ecosystem Component – *Due Diligence (Water)*				
Potential Effect: *Potential impacts to surface and groundwater*				
Potential Interaction	**Mitigation**			
• Contamination of surface and ground water from temporarily stored materials (scraped paint, stored fuel, etc.) during remediation activities. • Potential for impacts to surface water (Lake Superior) and groundwater under accidental spill or product-loss scenarios.	• All work will be conducted by qualified, licensed contractors. Applicable legislation and regulations will be referenced and adhered to. • Work must be scheduled to avoid periods of heavy precipitation. • Machinery (e.g. generator) must be checked for leakage of lubricants or fuel and must be in good working order (clean, free of leaks, etc). • A temporary stockpiling and waste storage area(s) will be designated that meets the requirements of the *Environmental Protection Act*, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), *Fire Protection and Prevention Act* (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a watercourse and has no direct drainage leading to a watercourse. • Refueling must be done at least 30 m from any water body and on an impermeable surface. existing ground surface will be protected by the placement of tarps/plywood sheeting to prevent discolouration or contamination of surfaces • Basic petroleum spill clean-up equipment must be on-site. • All spills or leaks must be promptly contained, cleaned up and reported to the 24-hour environmental emergencies reporting system 1-800-268-6060). • Fuel levels in equipment and / or on-site fuel storage tanks must be inspected on a daily basis to ensure there is no leakage to the surrounding environment. • Workers must be qualified to respond to accidental spills on site. • Waste materials will be handled in accordance with the requirements of O.Reg. 347, O.Reg. 558 and the Transportation to Dangerous Goods Act. • Waste containing waste paint/metals will be transported within sealed containers for disposal at a licensed facility.			
Magnitude	**Reversibility**	**Geographic Extent**	**Duration**	**Frequency**
Small	***Reversible***	***Immediate***	***Long-Term***	***Once/***
Residual Effects:	***Insignificant***			
Monitoring:	*The contractor will be required to provide a spills monitoring and response plan.*			

Comments: The mitigation measures above will also be required to mitigate water quality effects on fish and other aquatic species as noted in Tables 3.1 and 3.2. The proposed work plan does not require the construction or modification to any shoreline structures (breakwater/warf) as existing facilities should be sufficient to facilitate site access. The project does not involve the excavation/disturbance of soils no potential for erosion is anticipated and as such the requirement for a Sediment and Erosion control plan is not anticipated. Should disturbance to surface soils or erosion be noted during remedial activities a Sediment and Erosion control plan should be developed and implemented.

Table 3.9 Valued Ecosystem Component – *Due Diligence (Terrestrial Wildlife)*	
Potential Effect: *Disturbance of terrestrial wildlife and their habitats*	
Potential Interaction	**Mitigation**
• Persons present on or surrounding project site may be exposed to hazards. • Operation of the site may cause exposure to hazardous materials.	• No vegetation clearing is anticipated to be required; however, should it be required minimizing the clearing of any vegetation including trees (potential nesting for birds and raptors), shrubs (potential forage for wildlife). If required, any clearing of vegetation should take place outside of the breeding bird window (April 15th to August 31st). If this is not possible due to the scheduling of the work, a biologist should be present to identify any birds or nests that may be present prior to vegetation removal and to document nesting success. • Impacts to vegetation can also be minimized by pre-selecting routes onto and off the island and around the area. The site is crossed by numerous concrete walkways. • In the event that disturbance to vegetation is required complete a plant inventory during the growing season before hand. A revegetation plan should be developed using local species. • Avoid impacting the seeps and springs (including the north wetland.) • Avoid excavating into bedrock unless it is confirmed that there are no snakes or bat hibernacula on the island or surveys are completed to document their presence/absence. At this time, no excavations are anticipated to be required. • In the event that workers need to be temporarily housed on the site during the remediation they should be housed in existing structures or temporary structures erected within the previously disturbed boundaries of the site. • Ensure that any workers brought on for the repairs/removal of the buildings are provided information on the potential wildlife encounters (i.e. caribou, wolves etc.) and that caribou are a protected species. • When possible work will be completed during daylight. If nighttime lights are used they will be installed so as to illuminate the work area only to minimize impacts to nighttime activities of wildlife. • Organic/food waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site or incinerated on-site according to project permitting standards • Appropriate disposal containers will be available for the prompt disposal of waste. • Full disposal containers will be removed to the appropriate waste disposal facility and disposed of according to regulations on a regular basis. • A temporary waste storage area will be designated that meets the requirements of the *Environmental Protection Act*, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), *Fire Protection and Prevention Act* (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a

	watercourse and has no direct drainage leading to a watercourse. All heavy mechanical equipment must be fitted with standard and well-maintained noise suppression devices.			
Magnitude	**Reversibility**	**Geographic Extent**	**Duration**	**Frequency**
Small	***Reversible***	***Immediate***	***Short-term***	***Once***
Residual Effects:	***Insignificant***			
Monitoring:	*None required.*			
Comments: The majority of project activities will be limited to the area immediately around site structures. The removal of the waste metal dump will be accomplished by hand and should not require the removal of vegetation or the disturbance of soils.				

Table 3.10 Valued Ecosystem Component – *Due Diligence (Soil)*	
Potential Effect: *Disturbance or impacts to site soils*	
Potential Interaction	**Mitigation**
Project activities have the potential to affect surface soils or soil quality at the project site as a result of • Disturbance to soil from equipment use. • Contamination of soil due to temporarily stored material during soil remediation activities. • Contamination of existing soils due to accidents, spills, or leaks from equipment.	• All work will be conducted by licensed and qualified contractors. • Work must be scheduled to avoid periods of heavy precipitation. • Existing ground surface will be protected by the placement of tarps/plywood sheeting to prevent discolouration or contamination of surfaces • All work will be conducted by qualified, licensed contractors. Applicable legislation and regulations will be referenced and adhered to. • Work must be scheduled to avoid periods of heavy precipitation. • Machinery (e.g. generator) must be checked for leakage of lubricants or fuel and must be in good working order. • A temporary waste storage area will be designated that meets the requirements of the *Environmental Protection Act*, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), *Fire Protection and Prevention Act* (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a watercourse and has no direct drainage leading to a watercourse. • Refueling must be done at least 30 m from any water body and on an impermeable surface. existing ground surface will be protected by the placement of tarps/plywood sheeting to prevent discolouration or contamination of surfaces • Basic petroleum spill clean-up equipment must be on-site. • All spills or leaks must be promptly contained, cleaned up and reported to the 24-hour environmental emergencies reporting system 1-800-268-6060). • Fuel levels in equipment and / or on-site fuel storage tanks must be inspected on a daily basis to ensure there is no leakage to the surrounding environment. • Workers must be qualified to respond to accidental spills on site. • Exterior scaffolding erected to facilitate paint removal will be fitted with a dust screen/netting in order to prevent the migration of dust. • Waste materials will be handled in accordance with the requirements of O.Reg. 347, O.Reg. 558 and the Transportation to Dangerous Goods Act. • Waste containing waste paint/metals will be transported within sealed containers for disposal at a licensed facility

Magnitude	**Reversibility**	**Geographic Extent**	**Duration**	**Frequency**
Small	***Reversible***	***Immediate***	***Short-term***	***Once***
Residual Effects:	***Insignificant***			
Monitoring:	*None required.*			
Comments: The majority of project activities will be limited to the area immediately around site structures. The removal of the waste metal dump will be accomplished by hand and should not require the removal of vegetation or the disturbance of soils.				

<table>
<tr><td colspan="5">Table 3.11 Valued Ecosystem Component – <i>Due Diligence (Air)</i></td></tr>
<tr><td colspan="5">Potential Effect: <i>Potential impacts to air quality</i></td></tr>
<tr><td colspan="2">Potential Interaction</td><td colspan="3">Mitigation</td></tr>
<tr><td colspan="2">• Use of machinery may cause short-term elevated noise levels and green-house gas emissions at the site, along the transportation route
• Remediation activities may cause very slight increase in fugitive dust emissions on site.</td><td colspan="3">• All heavy mechanical equipment must be fitted with standard and well-maintained noise suppression devices.
• All construction equipment must be in good working order prior to arriving on site. Excessive noise from machinery will not be permitted.
• Appropriate dust suppression methods must be employed when required.
• Engines must not be allowed to idle between work periods.
• All loads on haul trucks will be covered.
• Power tools utilized for the removal of loose or rough lead-containing coatings or materials will be fitted with an effective dust collection system equipped with a HEPA filters.
• Exterior scaffolding erected to facilitate paint removal will be fitted with a dust screen/netting in order to prevent the migration of dust.</td></tr>
<tr><td>Magnitude</td><td>Reversibility</td><td>Geographic Extent</td><td>Duration</td><td>Frequency</td></tr>
<tr><td><i>Small</i></td><td><i>Reversible</i></td><td><i>Immediate</i></td><td><i>Short-term</i></td><td><i>Once</i></td></tr>
<tr><td>Residual Effects:</td><td colspan="4"><i>Insignificant</i></td></tr>
<tr><td>Monitoring:</td><td colspan="4"></td></tr>
<tr><td colspan="5">Comments:</td></tr>
</table>

PART D: COMMUNICATIONS

D.1 Consideration of Public Concerns

The potential for public concern is possible due to the importance of the lighthouse local tourism and recreation. The lighthouse is also a designated heritage structure. Public consultation was not completed as part of this screening. The Federal Heritage Review Office may have recommendations which will be taken into consideration in order to preserve the heritage aspects of the lighthouse. DFO will be responsible for any consultation deemed to be necessary prior to the imitation of remediation work.

D.2 Aboriginal Interest

The potential for Aboriginal interest is possible due to the location of the site. Aboriginal consultation was not) completed as part of this screening. DFO will be responsible for any consultation deemed to be necessary prior to the imitation of remediation work.

D.3 Government Co-ordination

Federal and provincial authorities likely to have an interest in the project will contacted by DFO prior to the initiation of work.

Departments and/or provincial ministries will be contacted and asked to identify any concerns they have with respect to the proposed remediation plan.

PART E: BASIC PROJECT EVALUATION CONCLUSION

Potential impacts of this project are associated with

- Removal of exterior paints
- Re-painting
- Removal of scrap metal/debris
- Transport of equipment and personnel to/from site
- Housing of personnel on site
- Waste Management

It is reasonable to conclude that with appropriate mitigation in place and good work practices, environmental effects will be of short duration and the potential zone of influence will be confined to the immediate vicinity of the work site.

PART F: ACCURACY AND COMPLIANCE MONITORING

Site accuracy and compliance monitoring for this project won't be completed. All work will be conducted by licensed and qualified contractors overseen by an environmental consultant

PART G: DETERMINATION

The federal authority is required to provide a determination of the significance of environmental effects as a result of this project. The decision outlined below is based on the interpretation of environmental effects and mitigation measures described in Part D of this report.

Project Name:	Remediation of East End Light Station
PSPC Project No.:	R.083149.03
Location:	Michipicoten Island, Lake Superior, Ontario

The Federal Authority has evaluated the project for significant adverse environmental effects as required under Section 67 of *Canadian Environmental Assessment Act (CEAA), 2012*. On the basis of this evaluation, the department has determined that the decision opposite the "X" applies to the proposed project.

___ Project not likely to cause significant adverse environmental effects - proceed.

_X_ Project not likely to cause significant adverse environmental effects with mitigation - proceed using mitigative measures as determined.

___ Inadequate information available - further study and assessment is required.

___ Project likely to cause significant adverse environmental effects that cannot be justified in the circumstances - project will not proceed.

___ Project likely to cause significant adverse environmental effects that may be justified in the circumstances - refer to the Governor in Council for decision.

H: SIGNATURE

This document summarizes the results of an basic project evaluation related to the above project that has been performed and completed by the Federal Authority in accordance with the *Canadian Environmental Assessment Act, 2012.*

Environmental Specialist: ________________________________ Date: _________________________
(Title, Directorate)

The above has completed this basic project evaluation report to the best of their ability and knowledge, and ensures that it meets the requirement of the Canadian Environmental Assessment Act, 2012.

Project Manager: ______________________________________ Date: _________________________
(Title, Directorate)

The above has read and understood this basic project evaluation report and acknowledges responsibility for ensuring the implementation of mitigation measures and for ensuring the design and implementation of 'accuracy and compliance monitoring', if any, identified in this report.

PART I: REFERENCES

XCG Consultants Ltd. 2001. *Phase II Environmental Site Assessment, Canadian Coast Guard Light Station L.L. 1097*. Michipicoten Island, East End, Lake Superior, Ontario.
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Jacques Whitford. 2006. *CCME Phase III Environmental Site Assessment, Canadian Coast Guard Light Station L.L. 1097.* Michipicoten Island, East End, Lake Superior, Ontario. Project No. 1004315.

Jacques Whitford. 2006. *Screening Level Risk Assessment, Canadian Coast Guard Light Station L.L. 1097.* Michipicoten Island, East End, Lake Superior, Ontario. Project No. 1004315.01.

BluMetric Environmental Inc. 2016. *Shallow Soils Investigation, East End Light Station. Michipicoten Island, Lake Superior, Ontario*. Project Number: 160528-00-00.

Bowfin Environmental Inc., 2016. *Ecological Risk Assessment of East End Light Station and Surrounding Area, 2016*

Shoreplan Engineering, 2017. *Marine Assessment, Michipicoten Island Light Station, Lake Superior. File # 16-2455.*

Novatech Engineering, 2017. *Structural Review, Michipicoten Island East End Light Station. File # 116136*

BluMetric Environmental Inc. 2016. *Problem formulation East End Light Station, Michipicoten Island, Lake Superior, Ontario*. Project Number: 160528-00-00

Department of Justice Canada
Canadian Environmental Protection Act, 1999 (CEPA).

Health Canada
Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).

Ontario Ministry of Labour
O. Reg. 490/09, Designated Substances as amended by O. Reg. 148/12 and O. Reg. 149/12.
Health and Safety Guideline “Lead on Construction Projects”, April 2011.

Ontario Ministry of the Environment and Climate Change
O. Reg. 347/90 General – Waste Management as amended by O. Reg. 304/14.
Environmental Protection Act.

Transport Canada (TC)
Transportation of Dangerous Goods Act, 1992 (TDGA).

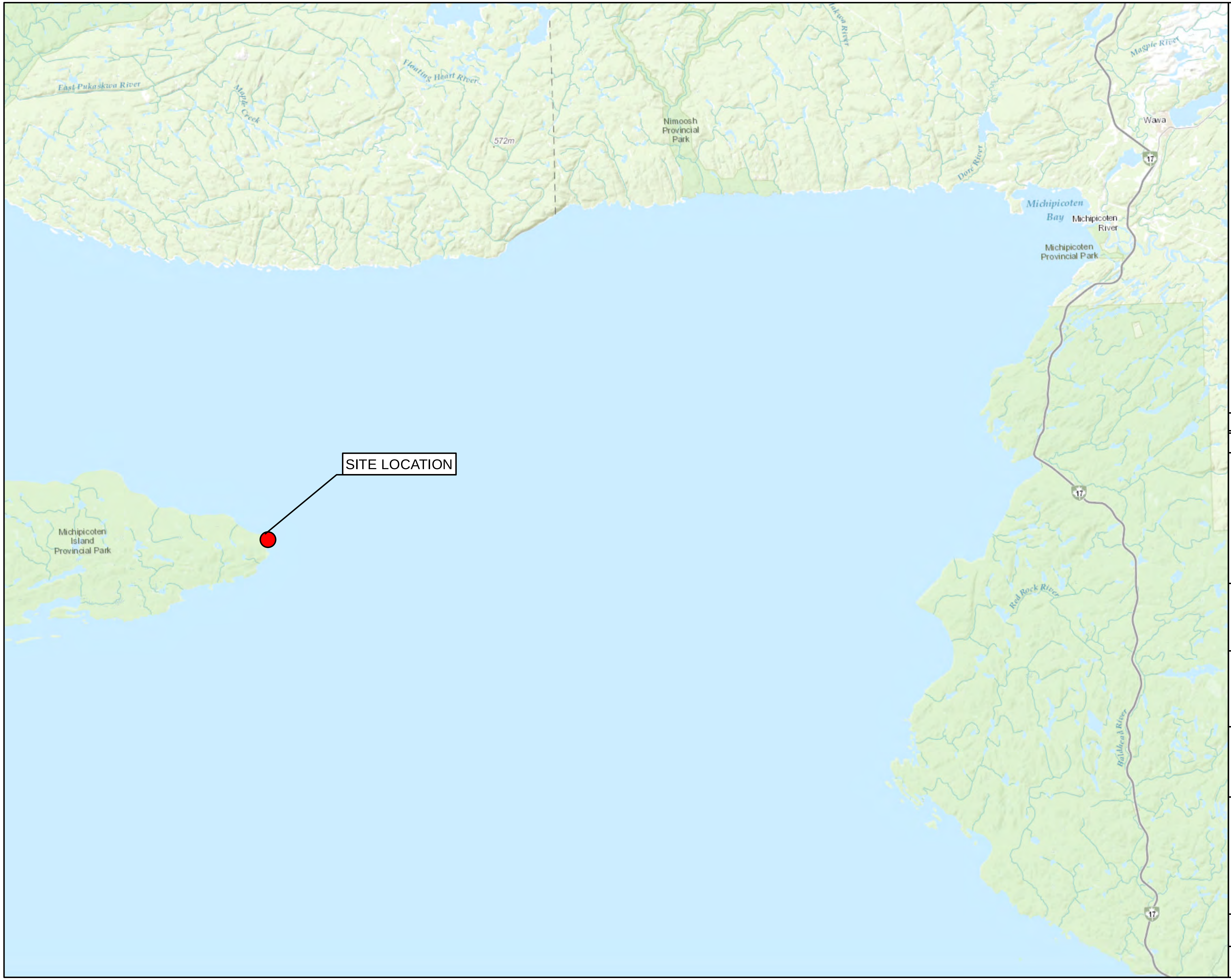
Canadian Environmental Assessment Agency, Projects on Federal Lands: Making Determination under Section 67 of the Canadian Environmental Assessment Act, 2012, July 2016

Parks Canada, Directory of Federal Heritage Designations, 2017.
http://www.pc.gc.ca/apps/dfhd/page_fhbro_eng.aspx?id=3440

Naturally Superior Advnetures, 2017. Mitchipicoten Island: The Mysterious Floating Island off of Lake Superior. Accessed online 24 March 2017: https://www.naturallysuperior.com/superior-destinations/michipicoten-island/

APPENDIX A

FIGURES



LEGEND

REV.	DESCRIPTION	YY/MM/DD	BY	CHK
1				

REFERENCES

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC.

DO NOT SCALE DRAWING.

THIS DRAWING MAY HAVE BEEN REDUCED. ALL SCALE NOTATIONS INDICATED ARE BASED ON 11"x17" FORMAT DRAWINGS.

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CLIENT

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

SITE LOCATION

BluMetric™ Environmental

The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725
FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT #	DATE
160528	November 28, 2016

DRAWN	CHECKED	FIG NO.	REV
IB	KM	1	0

LEGEND

▭ Approximate Building Footprint

1				
REV.	DESCRIPTION	YY/MM/DD	BY	CHK

REFERENCES

PROPRIETARY INFORMATION MAY NOT BE REPRODUCED OR DIVULGED WITHOUT PRIOR WRITTEN CONSENT OF BLUMETRIC ENVIRONMENTAL INC.
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CLIENT

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

PROJECT

MICHIPICOTEN ISLAND EAST END LIGHTHOUSE

TITLE

SITE LAYOUT

BluMetric™ Environmental

The Tower - The Woolen Mill,
4 Cataraqui St.,
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725
FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca

PROJECT # 160528
DATE November 28, 2016
DRAWN IB
CHECKED KM
FIG NO. 2
REV 0

APPENDIX B

RECORD OF PUBLIC PARTICIPATION DETERMINATION

Record of Public Participation Determination

Stage of work plan: Early planning phase of screening (pre-scoping)

Is there an indication that…	**Describe potential indication and issues**	**Consider public participation?**	
there is an existing or likely public interest in the type, location or potential effects of the project?	The site is located within a Provincial Park	X Yes	☐ No
There are members of the public with a history of being involved in past proposed projects in the area?	It is understood that there is an interest group concerned with the preservation of Ontario Lighthouses with an interest in the site	X Yes	☐ No
the project has the potential to generate conflict between environmental and social or economic values of concern to the public?	Remedial work may temporarily affect the tourism value (aesthetics, etc) of the site during work	X Yes	☐ No
the project may be <u>perceived</u> as having the potential for significant adverse environmental effects? [1]	Without consultation, stakeholders may not understand the scope of the project, mitigation measures or the significance of environmental effects	X Yes	☐ No
there is potential to learn from community ecological? knowledge or Aboriginal traditional knowledge?	It is likely that the public and or aboriginal community could provide further information on the socio-economic and historical value of the site.	X Yes	☐ No
there is uncertainty about potential direct and indirect environmental effects or the significance of identified effects?	Environmental effects and the associated mitigation measures are well understood	☐ Yes	X No
the project has been or will be subject to other public participation processes that would meet the objectives of the Ministerial Guideline *http://www.ceaa.gc.ca/013/006/ministerial_guideline_e.htm*	The project has not been subject to other public participation processes	☐ Yes	X No
there is any other reason why public participation is or is not appropriate?	The project is unlikely to result in negative environmental impacts	☐ Yes	X No

As a result of the scan above, is public participation under CEAA appropriate in the circumstances?

X Yes ☐ No

Additional comments to support determination:

---

[1] *Environmental Effect as per the definition in CEAA (2012) is*

- *Changes to the environment to components of the environment that are within the legislative authority of Parliament (fish as defined by the Fisheries Act, aquatic species under the Species at Risk Act, and migratory birds as defined in the Migratory Birds Convention Act (1994)*
- *Changes to the environment that occur on federal lands, or inter-provincially or outside of Canada.*
- *The effect of any change on health and socio-economic condition, physical and cultural heritage, use of resources for traditional purposes and structures of historical significance are limited with respect to Aboriginal peoples.*

APPENDIX C

DEFINITIONS AND METHODOLOGIES

Environment (defined in *S.2(1)*) – the components of the Earth, and includes land, water and air, including all layers of the atmosphere; and all organic and inorganic matter and living organisms (and the interacting natural systems of those).

Environmental Effects (defined in *S.5(1)* – 5.(1) For the purposes of this Act, the environmental effects that are to be taken into account in relation to an act or thing, a physical activity, a designated project or a project are

(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:
(i) fish as defined in section 2 of the Fisheries Act and fish habitat as defined in subsection 34(1) of that Act,
(ii) aquatic species as defined in subsection 2(1) of the Species at Risk Act,
(iii) migratory birds as defined in subsection 2(1) of the Migratory Birds Convention Act, 1994, and
(iv) any other component of the environment that is set out in Schedule 2;
(b) a change that may be caused to the environment that would occur:
(i) on federal lands,
(ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or
(iii) outside Canada; and
(c) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on
(i) health and socio-economic conditions,
(ii) physical and cultural heritage,
(iii) the current use of lands and resources for traditional purposes, or
(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

(2) However, if the carrying out of the physical activity, the designated project or the project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than this Act, the following environmental effects are also to be taken into account:
(a) a change, other than those referred to in paragraphs (1)(a) and (b), that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the project; and
(b) an effect, other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on
(i) health and socio-economic conditions,
(ii) physical and cultural heritage, or
(iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Schedule 2 (3) The Governor in Council may, by order, amend Schedule 2 to add or remove a component of the environment.

Federal Authority (defined in *S.2(1)*) – a Minister of the Crown in right of Canada; an agency of the Government of Canada or a parent Crown corporation, as defined in subsection 83(1) of the *Financial Administration Act (FAA);* or any department or departmental corporation that is set out in Schedule I or II to the FAA.

Federal lands (defined in *S.2(1)*) – defined as follows:

- lands that belong to Her Majesty in right of Canada, or that Canada has power to dispose of, and all waters on and airspace above those lands, other than lands under the administration and control of the Commissioner of Yukon, the Northwest Territories or Nunavut;
- the internal waters of Canada, in any area of the sea not within a province;
- the territorial sea of Canada in any area of the sea not within a province;
- the exclusive economic zone of Canada, and the continental shelf of Canada; and
- reserves, surrendered lands and any other lands that are set apart for the use and benefit of a band and that are subject to the *Indian Act*, and all waters on and airspace above those reserves or lands.

Mitigation measures (defined in *S. 2(1)*) – measures for the elimination, reduction or control of the adverse environmental effects of a designated project, and includes restitution for any damage to the environment cause by those effects through replacement, restoration, compensation or any other means.

Project (defined in *S. 66*) – a physical activity that is carried out in relation to a physical work and is not a designated project.

Valued Ecosystem Component (defined on Agency - www.ceaa.gc.ca/default.asp?lang=En&n= B7CA71391&offset=3#v) - The environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance.

The value of an ecosystem component may be determined on the basis of cultural ideals or scientific concern. Valued ecosystem components that have the potential to interact with project components should be included in the assessment of environmental effects.

Methodology

The environmental effects evaluation methodology used in this report focuses the evaluation on those environmental components of greatest concern. The Valued Ecological Components (VECs) most likely to be affected by the project as described are indicated in **Table 1.** VECs were selected based on ecological importance to the existing environment (above), the relative sensitivity of environmental components to project influences and their relative social, cultural or economic importance. The potential impacts resulting from these interactions are described below.

Evaluation of Environmental Effects

The VECs selected in Table 1 are addressed in Tables 2.1 through 2.16* in the EEE. The residual effects of the project on the environment are defined. Similarly, the physical works/activities and required mitigation measures are detailed and the significance of residual (post-mitigation) effects is estimated.

The following ratings are based on:

- **information provided by the proponent;**
- **a review of project related activities;**
- **an appraisal of the environmental setting, and identification of resources at risk;**
- **the identification of potential impacts within the temporal and spatial bounds; and**
- **personal knowledge and professional judgment of the assessor.**

The significance of project related impacts was determined in consideration of their frequency, the duration and geographical extent of the effects, magnitude relative to natural or background levels, and whether the effects are reversible or are positive or negative in nature. These criteria are indicated in Table 2.

Table 4. Assessment Criteria for Determination of Significance.

Magnitude	Magnitude, in general terms, may vary among Issues, but is a factor that accounts for size, intensity, concentration, importance, volume and social or monetary value. It is rated as compared with background conditions, protective standards or normal variability.	
	Small	Relative to natural or background levels
	Moderate	Relative to natural or background levels
	Large	Relative to natural or background levels
Reversibility	Reversible	Effect can be reversed
	Irreversible	Effects are permanent
Geographic Extent	Immediate	Confined to project site
	Local	Effects beyond immediate project site but not regional in scale
	Regional	Effects on a wide scale
Duration	Short Term	Between 0 and 6 months in duration
	Medium Term	Between 6 months and 2 years
	Long Term	Beyond 2 years
Frequency	Once	Occurs only once
	Intermittent	Occurs occasionally at irregular intervals
	Continuous	Occurs on a regular basis and regular intervals

APPENDIX D

MITIGATION TABLE

Environmental Component	**Reference**	**Mitigation Measures**	**Phase**	**Responsibility**
Fish (Fisheries Act)	Table 3.1	• Potential impacts to fish and other aquatic species will be limited to the possibility for spills of deleterious substances (fuels, lubricants, removed paints, etc.) and the associated impacts to surface water. The assessment of the potential impacts to surface water and the associated avoidance measures are described below. (Table 3.8)	Abatement & Debris Removal	Contractor
Aquatic Species (SARA)	Table 3.2	• Potential impacts to fish and other aquatic species will be limited to the possibility for spills of deleterious substances (fuels, lubricants, removed paints, etc.) and the associated impacts to surface water. The assessment of the potential impacts to surface water and the associated avoidance measures are described below. (Table 3.8)	Abatement & Debris Removal	Contractor
Birds (MBCA)	Table 3.3	• No vegetation clearing is anticipated to be required; however, should it be required minimizing the clearing of any vegetation including trees (potential nesting for birds and raptors), shrubs (potential forage for wildlife). If required, any clearing of vegetation should take place outside of the breeding bird window (April 15th to August 31st). If this is not possible due to the scheduling of the work, a biologist should be present to identify any birds or nests that may be present, the nest area should be clearly staked or flagged and Environment Canada contacted to determine the appropriate buffer area based on the species encountered prior to vegetation removal. The proponent should contact Environment Canada if they are proposing work during the breeding season to ensure compliance with the Migratory Bird Convention Act. • Impacts to vegetation can also be minimized by pre-selecting routes onto and off the island and around the area. The site is crossed by numerous concrete walkways. • Avoid impacting the seeps and springs (including the north wetland). • In the event that workers need to be temporarily housed on the site during the remediation they should be housed in existing structures or temporary structures erected within the previously disturbed boundaries of the site. • When possible work will be completed during daylight. If nighttime lights are used they will be installed so as to illuminate the work area only to minimize impacts to nighttime activities of wildlife. • Organic/food waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site or incinerated on-site according to project permitting standards • Appropriate disposal containers will be available for the prompt disposal of waste. • Full disposal containers will be removed to the appropriate waste disposal facility on a regular basis.	Abatement & Debris Removal	Contractor

Environmental Component	Reference	Mitigation Measures	Phase	Responsibility
		• A temporary waste storage area will be designated that meets the requirements of the Environmental Protection Act, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), Fire Protection and Prevention Act (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a watercourse and has no direct drainage leading to a watercourse. • All heavy mechanical equipment must be fitted with standard and well-maintained noise suppression devices.		
Aboriginal Interests as defined under Section 5(1) of CEAA 2012	Table 3.4	• Consultation with First Nations to confirm lack of interest will be undertaken by DFO prior to the initiation of work	Abatement & Debris Removal	DFO
Health and Socioeconomics as defined under Section 5(1) of CEAA 2012 Section 5(2) - Tourism	Table 3.5	• Park use is relatively low since access to the island is limited to tour operators, commercial fishing vessels, float planes, recreational watercraft, and helicopters. • Following lead paint abatement, the lighthouse and appurtenant structures will be repainted in the same colour and style to maintain site aesthetics. • Work site will be maintained in a clean and orderly manner free of garbage/litter. • Work will be scheduled and conducted as quickly as possible to minimize the period of disturbance	Abatement & Debris Removal	Contractor/DFO
Health and Socioeconomics as defined under Section 5(1) of CEAA 2012 Section 5(2) - Health and Safety	Table 3.6	• Park use is relatively low since access to the island is limited to tour operators, commercial fishing vessels, float planes, recreational watercraft, and helicopters. • Work site will be maintained in a clean and orderly manner free of garbage/litter. • Work will be scheduled and conducted as quickly as possible to minimize the period of disturbance • Access to the site will be limited to construction personnel during remediation activities. • Identification/labelling, recording, and reporting will be done of any regulated wastes, products and substances, together with hazardous material	Abatement & Debris Removal	Contractor

Environmental Component	Reference	Mitigation Measures	Phase	Responsibility
		through a Workplace Hazardous Material Information System assessment (WHMIS). • A temporary stockpiling and waste storage area(s) will be designated that meets the requirements of the Environmental Protection Act, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), Fire Protection and Prevention Act (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a watercourse and has no direct drainage leading to a watercourse. • Appropriate disposal containers will be available for the prompt disposal of waste. • Full disposal containers will be removed to the appropriate waste disposal facility on a regular basis. • Wastes that require special handling requirements will be handled in accordance with the appropriate local, provincial and federal legislation. • Organic/food waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site or incinerated on-site according to project permitting standards • Power tools utilized for the removal of loose or rough lead-containing coatings or materials will be fitted with an effective dust collection system equipped with a HEPA filters. • Exterior scaffolding erected to facilitate paint removal will be fitted with a dust screen/netting in order to prevent the migration of dust and potential for injury resulting from dislodged concrete. • The contractor will be required to develop a health and safety plan prior to commencement of any works, and to meet or exceed the requirements of all applicable federal and/or provincial health and safety legislation, regulations, and permits		
Health and Socioeconomics as defined under Section 5(1) of CEAA 2012	3.7	• No excavation or disturbance of soils is anticipated as part of the proposed work plan. The areas around the lighthouse and appurtenant structures consist of bedrock and/or previously disturbed areas. As such, undiscovered archaeological resources are unlikely to be present.	Abatement & Debris Removal	Contractor/DFO

Environmental Component	Reference	Mitigation Measures	Phase	Responsibility
Section 5(2) – Heritage and HAPA Significance		• If human remains are discovered the local police, the coroner's office, and the Registrar of Cemeteries will be notified immediately. • The lighthouse is a designated Classified Federal Heritage Building based on its design and the relatively unchanged and remote nature of the site. The proposed abatement work will not impact the design of the lighthouse. The heritage designation does not extend to the site or the other structures. • Following paint abatement, the lighthouse structure will be repainted in the same colour style to maintain site aesthetics. • Work will be scheduled and conducted as quickly as possible to minimize the period of disturbance • Recommendations from the Federal Heritage Buildings Review Office will be considered • In the event that previously undocumented archaeological resources are discovered during remediation work will cease work immediately and a licensed archaeologist will be contacted to complete an archaeological review or assessment		
Due Diligence (Water)	Table 3.8	• All work will be conducted by qualified, licensed contractors. Applicable legislation and regulations will be referenced and adhered to. • Work must be scheduled to avoid periods of heavy precipitation. • Machinery (e.g. generator) must be checked for leakage of lubricants or fuel and must be in good working order (clean, free of leaks, etc.). • A temporary stockpiling and waste storage area(s) will be designated that meets the requirements of the Environmental Protection Act, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), Fire Protection and Prevention Act (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a watercourse and has no direct drainage leading to a watercourse. • Refueling must be done at least 30 m from any water body and on an impermeable surface. existing ground surface will be protected by the placement of tarps/plywood sheeting to prevent discolouration or contamination of surfaces	Abatement & Debris Removal	Contractor

Environmental Component	Reference	Mitigation Measures	Phase	Responsibility
		• Basic petroleum spill clean-up equipment must be on-site. • All spills or leaks must be promptly contained, cleaned up and reported to the 24-hour environmental emergencies reporting system 1-800-268-6060). • Fuel levels in equipment and / or on-site fuel storage tanks must be inspected on a daily basis to ensure there is no leakage to the surrounding environment. • Workers must be qualified to respond to accidental spills on site. • Waste materials will be handled in accordance with the requirements of O.Reg. 347, O.Reg. 558 and the Transportation to Dangerous Goods Act. • Waste containing waste paint/metals will be transported within sealed containers for disposal at a licensed facility.		
Due Diligence (Terrestrial Wildlife)	Table 3.9	• No vegetation clearing is anticipated to be required; however, should it be required minimizing the clearing of any vegetation including trees (potential nesting for birds and raptors), shrubs (potential forage for wildlife). If required, any clearing of vegetation should take place outside of the breeding bird window (April 15th to August 31st). If this is not possible due to the scheduling of the work, a biologist should be present to identify any birds or nests that may be present, the nest area should be clearly staked or flagged and Environment Canada contacted to determine the appropriate buffer area based on the species encountered prior to vegetation removal. The proponent should contact Environment Canada if they are proposing work during the breeding season to ensure compliance with the Migratory Bird Convention Act. • Impacts to vegetation can also be minimized by pre-selecting routes onto and off the island and around the area. The site is crossed by numerous concrete walkways. • In the event that disturbance to vegetation is required complete a plant inventory during the growing season before hand. A revegetation plan should be developed using local species. • Avoid impacting the seeps and springs (including the north wetland.) • Avoid excavating into bedrock unless it is confirmed that there are no snakes or bat hibernacula on the island or surveys are completed to document their presence/absence. At this time, no excavations are anticipated to be required. • In the event that workers need to be temporarily housed on the site during	Abatement & Debris Removal	Contractor

Environmental Component	Reference	Mitigation Measures	Phase	Responsibility
		the remediation they should be housed in existing structures or temporary structures erected within the previously disturbed boundaries of the site. • Ensure that any workers brought on for the repairs/removal of the buildings are provided information on the potential wildlife encounters (i.e. caribou, wolves etc.) and that caribou are a protected species. • When possible work will be completed during daylight. If nighttime lights are used they will be installed so as to illuminate the work area only to minimize impacts to nighttime activities of wildlife. • Organic/food waste will be collected daily and stored in closed, animal resistant containers until disposed of at an approved waste disposal site or incinerated on-site according to project permitting standards • Appropriate disposal containers will be available for the prompt disposal of waste. • Full disposal containers will be removed to the appropriate waste disposal facility and disposed of according to regulations on a regular basis. • A temporary waste storage area will be designated that meets the requirements of the Environmental Protection Act, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), Fire Protection and Prevention Act (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a watercourse and has no direct drainage leading to a watercourse. All heavy mechanical equipment must be fitted with standard and well-maintained noise suppression devices.		
Due Diligence (Soil)	Table 3.10	• All work will be conducted by licensed and qualified contractors. • Work must be scheduled to avoid periods of heavy precipitation. • Existing ground surface will be protected by the placement of tarps/plywood sheeting to prevent discolouration or contamination of surfaces • All work will be conducted by qualified, licensed contractors. Applicable legislation and regulations will be referenced and adhered to. • Work must be scheduled to avoid periods of heavy precipitation. • Machinery (e.g. generator) must be checked for leakage of lubricants or fuel and must be in good working order.	Abatement & Debris Removal	Contractor

Environmental Component	Reference	Mitigation Measures	Phase	Responsibility
		• A temporary waste storage area will be designated that meets the requirements of the Environmental Protection Act, Guidelines for Environmental Protection Measures at Chemical and Waste Storage Facilities (2007), Fire Protection and Prevention Act (Fire Code) and Ontario Regulation 347. The area will be maintained so as to prevent leaks, spills or damage/deterioration to waste containers, has adequate containment, is secure, is protected from weather and is not located in an area within 30 m of a watercourse and has no direct drainage leading to a watercourse. • Refueling must be done at least 30 m from any water body and on an impermeable surface. existing ground surface will be protected by the placement of tarps/plywood sheeting to prevent discolouration or contamination of surfaces • Basic petroleum spill clean-up equipment must be on-site. • All spills or leaks must be promptly contained, cleaned up and reported to the 24-hour environmental emergencies reporting system 1-800-268-6060). • Fuel levels in equipment and / or on-site fuel storage tanks must be inspected on a daily basis to ensure there is no leakage to the surrounding environment. • Workers must be qualified to respond to accidental spills on site. • Exterior scaffolding erected to facilitate paint removal will be fitted with a dust screen/netting in order to prevent the migration of dust. • Waste materials will be handled in accordance with the requirements of O.Reg. 347, O.Reg. 558 and the Transportation to Dangerous Goods Act. • Waste containing waste paint/metals will be transported within sealed containers for disposal at a licensed facility		
Due Diligence (Air)	Table 3.11	• All heavy mechanical equipment must be fitted with standard and well-maintained noise suppression devices. • All construction equipment must be in good working order prior to arriving on site. Excessive noise from machinery will not be permitted. • Appropriate dust suppression methods must be employed when required. • Engines must not be allowed to idle between work periods. • All loads on haul trucks will be covered. • Power tools utilized for the removal of loose or rough lead-containing	Abatement & Debris Removal	Contractor

Environmental Component	Reference	Mitigation Measures	Phase	Responsibility
		coatings or materials will be fitted with an effective dust collection system equipped with a HEPA filters. • Exterior scaffolding erected to facilitate paint removal will be fitted with a dust screen/netting in order to prevent the migration of dust.		

Site monitoring (accuracy and compliance monitoring) may be conducted to verify whether required mitigation measures were implemented. The proponent must provide site access to Responsible Authority officials and/or its agents upon request