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Report

Rock Quarry and Borrow Pit Material Chemical Suitability Assessment

H346911-0000-07-124-0007

2015-11-03	**B**	**Client Review**	**N. Boucher**	**W. Hoyle**	**N. Boucher**
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Table of Contents

List of Tables

List of Figures

List of Appendices

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1. Introduction

Ontario Power Generation Inc. (OPG) is proposing to implement a shoreline stabilization project along a portion of the Gull Bay (Lake Nipigon) shoreline fronting the Kiashke Zaaging Anishinaabek (KZA) First Nation community (also known as Gull Bay First Nation).

Implementation of the Project will require that aggregate, including rip rap, rockfill, sand and gravel be obtained for use in the construction project. Accordingly, OPG has proposed to use (i) an existing rock quarry, previously used for rock extraction in the early 1970's, as the source for rip rap and rockfill and (ii) an existing borrow pit, under permit to the KZA Economic Development Corporation, as the source of sand and gravel for the Project.

OPG retained Hatch Ltd. (Hatch) to conduct a quality sampling program in 2015 to confirm that material from the two sources was suitable for use in the shoreline stabilization feature.

Hatch conducted preliminary chemical quality sampling at both proposed aggregate source locations in fall 2013, although results from the preliminary sampling and testing program were inconclusive and therefore further sampling was required.

The Ministry of Environment and Climate Change (MOECC) also reviewed the results of the preliminary 2013 sampling program and provided a memo dated November 25, 2014, which made recommendations regarding sampling requirements of the fill material for the stabilization project and adequacy of the materials for lake-filling purposes. These recommendations were addressed in the current 2015 sampling program.

This report summarizes the results of the 2015 sampling and analysis of rock from the proposed quarry and aggregate material from the borrow pit and assesses the suitability of these materials for use in the shoreline stabilization project, from a chemical quality perspective, based on the MOECC's *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* (Ministry of the Environment, 2011).

2. Background

Hatch carried out an initial site visit on November 12, 2013 to collect initial rock and granular samples from potential material source locations for the granular, rockfill and riprap materials.

These initial samples were tested for bulk chemical characteristics to assess fill quality at each location. The results were compared with the confined and unconfined fill quality guidelines in MOE's *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* (Ministry of the Environment, 2011). Results summary tables and the laboratory data sheets from this initial testing are provided in Appendix A.

It was found that there were exceedances for some metals compared to the above-noted guideline (MOE, 2011) for the rock and granular material analyzed for bulk chemical parameters.

These results were provided to MOECC for review. In a memo to OPG dated November 24, 2014, MOECC made recommendations regarding sampling and analysis of material proposed for use as source material for the shoreline stabilization project. These recommendations suggested that "the use of a suitable composite sampling protocol would be considered provided that it is consistent with existing MOECC guidelines" (Ministry of Environment and Climate Change, 2014). MOECC also recommended that Receiving Water Simulation Testing be undertaken due to exceedances for several metals as compared to guidelines for confined and unconfined fill identified during the bulk chemical testing.

Accordingly, supplementary laboratory testing of these 2013 samples from the quarry and pit was conducted in December 2014 in accordance with the Receiving Water Simulation Testing requirements. This testing was for reference purposes only, as the sample holding time had been exceeded for the majority of the chemical parameters. Although these results showed no exceedances of the criteria for the borrow pit sample, exceedances of the respective Provincial Water Quality Objectives (PWQO) for copper, Total Organic Carbon and Polychlorinated Biphenyls (PCBs) were found in the quarry sample. A results summary table and the laboratory data sheets from this supplementary testing are provided in Appendix A.

To confirm the results, the Receiving Water Simulation Test was re-run for the quarry rock sample. This sample was processed in Hatch's geotechnical laboratory to remove the face of the rock that was exposed to the elements, such that only fresh rock was tested to see if PCBs remained present. The laboratory procedure was also refined and samples were crushed to small pieces (approximately 1 cm^2 and leached in de-ionized water. The retested results showed there were no concentration exceedances for metals or PCBs when compared to the PWQOs (MOE, 2011). A results summary table and the laboratory data sheets from this supplementary testing are provided in Appendix A.

As a result of the criteria exceedances in the bulk chemical testing and Receiving Water Simulation testing and recommendations by MOECC for additional sampling, OPG directed

Hatch to conduct additional sampling and analysis of rock from the quarry and granular material from the borrow pit in May 2015 to confirm source material quality and suitability for use in the shoreline stabilization project. The remainder of this report deals with this additional 2015 sampling.

3. Methodology

3.1 Regulatory Guidance

The bulk and Receiving Water Simulation rock samples were assessed under MOE's *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* (Ministry of the Environment, 2011). The rock material collected from the quarry was assessed as an unconfined material as per the MOECC memo, since they will be exposed to the water of Lake Nipigon. The sand and gravel samples collected at the borrow pit were assessed under the guidelines as confined fill, since they will not come into direct contact with the water of Lake Nipigon.

3.2 Sampling Plan Rationale

The MOECC (2014) initially recommended a sampling frequency of one sample per 160 m^3 for the first 5000 m) of material and then one sample per 300 m^3 thereafter. However, due to the volume of material being considered for the project (25,800 m^3) MOECC indicated that consideration would be given to a suitable composite sampling protocol that was consistent with existing MOECC guidelines (MOECC, 2014).

Based on Hatch's experience conducting sampling programs for similar types of projects, it was recommended that 15 composite rock samples be collected from the quarry to characterize and confirm the chemical quality of the rock material. Two of the locations (GS-1 and GS-2) were previously sampled in November 2013, and were re-sampled in 2015. The remaining locations were chosen to provide a representative sample of the rock across the proposed quarry area. Sufficient sample volume was collected to allow for sub-sampling and retesting for parameters of interest or concern, if required.

Each sample from the quarry was collected as a localized composite sample, consisting of representative fragments of rock collected within a 1.5 m radius on a horizontal or vertical surface. A phased sampling approach was used as outlined in Table 3-1.

Five samples of the granular material from the borrow pit were collected and analysis three of these samples was considered sufficient to confirm the granular quality previously tested.

Table 3-1: Outline of Phased Approach for Laboratory Analysis of Collected Samples

Phase	Description	Criteria to Initiate Next Phase
Phase 1-A	Collect 15 representative samples at the quarry and 5 representative samples at the borrow pit. Submit 5 samples (including locations GS-1 and GS-2), to an accredited laboratory for bulk	Concentration exceedance – retest additional sample material. Concentration exceedance or highly

Phase	Description	Criteria to Initiate Next Phase
	chemical analysis and Receiving Water Simulation. Testing will be focused on the anticipated primary quarry development area.	inconsistent results for the quarry rock samples, proceed to Phase 1-B.
Phase 1-B	Submit 5 to10 additional samples to an accredited laboratory for bulk chemical analysis and Receiving Water Simulation Testing.	If there is an exceedance for PCBs or other parameters of concern, retest Phase 1-B with a fresh surface sample for a minimum of 3 samples. Concentration exceedance or highly inconsistent results for the total number of quarry rock samples, consider Phase 2.
Phase 2	Collect 3 sediment samples within 5 m of the Gull Bay shoreline in the area of the proposed stabilization project. Submit samples to an accredited laboratory for bulk chemical analysis and Receiving Water Simulation. Compare test results with the results from Phase 1.	

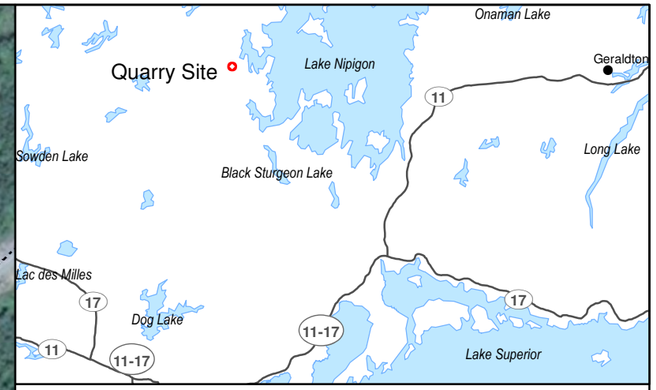
3.3 Sample Collection and Analysis Methodology

3.3.1 Rock Sample Collection at Former Quarry

Samples were collected at 15 selected locations within the proposed quarry (see Figure 3-1) on May 20, 2015 for assessment of rock quality for riprap and rock fill source material. The coordinates of the sampling locations in UTM NAD 83 Zone 16 are provided in Table 3-2.

Table 3-2: Coordinates of Rock Sample Collection Locations at the Rock Quarry

Sample ID	UTM Coordinates	
	Easting	Northing
GS-1	346002.8	5509867.1
GS-2	346009.4	5509884.7
GS-3	346014.9	5509880.8
GS-4	346010.8	5509864.6
GS-5	346023.0	5509862.4
GS-6	345962.0	5509894.6
GS-7	345913.5	5509862.1
GS-8	345903.0	5509857.6
GS-9	345879.3	5509881.4
GS-10	345811.6	5509860.5
GS-11	345831.4	5509789.9
GS-12	345825.7	5509732.8
GS-13	345905.8	5509727.6
GS-14	345942.9	5509764.5
GS-15	345966.4	5509783.3



LEGEND

- Rock Sampling Locations
- Access Road
- Topographic Contour (2m Interval)
- Permit Area (Proposed Quarry)
- Extraction Area (15m from Permit Area)

Notes:
1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2014.
2. Spatial referencing UTM NAD 83, Zone 16.
3. Imagery courtesy of Esri,Bing Maps.

0 20 40 80 Metres

1:2,000

NORTH

Figure 3 -1

Ontario Power Generation

Gull Bay Shoreline Stabilization Project

Quarry Rock Sampling Locations

HATCH™

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Sample collection was undertaken as follows:

- The pre-determined sampling location was located with a hand-held GPS.
- Using a blunt hand tool, fragments from the local outcrop were broken off, ensuring that approximately half of the sample was representative of the weathered surface and approximately half was representative of a fresh surface.
- A minimum of one localized-composite sample per location was collected with an amount of at least 2 kilograms (kg) of material in block form and size of approximately 0.1 m length by 0.1 m depth.
- Samples for rock components were logged and described and it was ensured that the sample was representative of the local rock mass in the area.
- Samples were placed in appropriately labeled, thick plastic bags with sealable tops and placed in a cooler with ice packs.
- Samples were collected, stored and transported as per Quality Assurance/Quality Control procedures outlined in Section 3.3.5.

3.3.2 Granular Fill Sample Collection at Borrow Pit

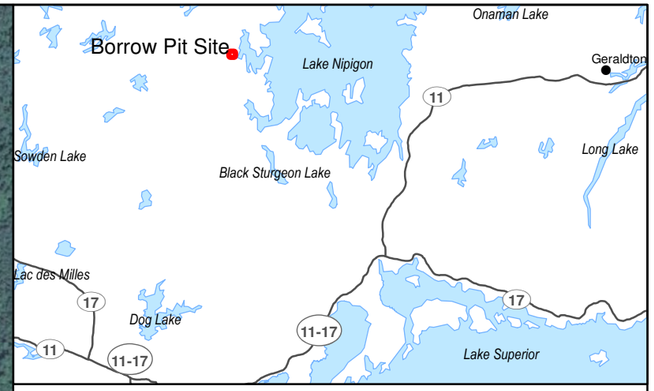
Samples were collected at five locations within the proposed borrow pit (see Figure 3-2) on May 20, 2015. The coordinates of the sampling locations in UTM NAD 83 Zone 16 are provided in Table 3-3.

Table 3-3: Coordinates of Granular Material Sample Collection Locations at the Borrow Pit

Sample ID	UTM Coordinates	
	Easting	Northing
GS-16	346836	5514865
GS-17	346738	5514958
GS-18	346759	5515096
GS-19	346873	5515010
GS-20	346799	5514996

Sample collection was undertaken as follows:

- The pre-determined sampling location was located with a hand-held GPS.
- A minimum of one localized-composite sample was collected by hand at each sampling location and placed in a thick plastic bag with sealable tops, and placed in a cooler with ice packs.
- Samples were logged for components and description (colour, texture, moisture content) and it was ensured that each sample was representative of the local borrow pit material in the area.



LEGEND

- Proposed Borrow Pit Samples
- Access Road

Notes:
1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2014.
2. Spatial referencing UTM NAD 83, Zone 16.
3. Imagery courtesy of Esri,Bing Maps.

0 50 100 200 Metres

1:5,000

NORTH

Figure 3 -2

Ontario Power Generation

Gull Bay Shoreline Stabilization Project

Borrow Pit Sampling Locations

HATCH

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- Samples were collected, stored and transported as per Quality Assurance/Quality Control procedures outlined in Section 3.3.5.

3.3.3 Sample Selection for Analysis

As per the phased sampling approach outlined in Table 3-1, five representative samples were selected from the 15 samples from the rock quarry and three samples were selected from the five borrow pit samples for bulk chemical analysis and Receiving Water Simulation to assess overall rock chemical quality (Phase 1-A in Table 3-1).

3.3.4 Laboratory Testing

Samples were sent to Paracel Laboratories Ltd., which is a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory and analyzed as described in the following sections. Paracel Laboratories Ltd. sub-contracted Testmark Laboratories Ltd. to complete the Total Organic Carbon analysis component of the bulk chemical testing and Pacific Rim Laboratories to complete the low-level PCB analysis component of the Receiving Water Test.

3.3.4.1 Quarry Rock Samples

The following tests were performed on the five rock samples from the quarry:

- Lakefill Quality Bulk Analysis as per MOE's *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* (Ministry of the Environment, 2011). The site is not considered contaminated and therefore the full list of parameters (Volatile Organic Compounds (VOCs) and Semi-volatile Organic Compounds) was not considered to be required for the analysis. Analysis included the following parameters: arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc, total phosphorous, total organic carbon and PCBs.
- Receiving Water Simulation analysis. The Receiving Water Simulation test was conducted as follows:
  - Sample crushed to small pieces (approximately 1 cm^2
  - The process did not include digestion of fine particulate.
  - Conduct testing according to Receiving Water Simulation in de-ionized water.
  - Allow leaching 24 hours.
  - The parameter list included: arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc, total phosphorous, total organic carbon and PCBs.
  - PCBs were analyzed using the HRGCMS method to achieve the low-level detection limit required to meet the PWQO criteria.

3.3.4.2 Borrow Pit Granular Samples

The following tests were performed on the three sand and gravel samples from the borrow pit:

- Lakefill Quality Bulk Analysis as per MOE's *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* (Ministry of the Environment, 2011).
- Receiving Water Simulation analysis - Conduct testing according to Receiving Water Simulation in de-ionized water and allow leaching for 24 hours.
- The samples were analyzed for the following parameters: arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc, total phosphorous, total organic carbon and PCBs.

3.3.5 Sample Collection and Analysis Quality Assurance/Quality Control

The following measures were taken to maintain sample integrity and prevent cross-contamination between samples:

- A dedicated pair of vinyl or nitrile gloves was used when sampling in the field and handling each sample in the Hatch laboratory to prepare for submission to Paracel Laboratories Ltd.
- Removal of debris and cleaning of instruments between collections of each sample in the field. Sampling equipment was washed with approved detergent and rinsed with distilled water between samples to prevent cross-contamination. Cleaning was completed with an additional rinsing of the equipment using spray bottles and wiping with a paper towel.
- Samples were collected according to the protocols applicable for the particular chemical analysis.
- A duplicate analysis was completed with the initial five samples from the proposed rock quarry.
- Sample containers were labeled with the sample number, sample date and project number.
- Samples were placed in a cooler with ice packs for shipment to the laboratory.
- The Chain of Custody was filled out with the analysis required and a copy of the form was maintained for verification with the laboratory.
- Samples were stored at approximately 4°C.
- Samples were handled and stored at all times with care to prevent cross-contamination between samples.

4. Results

The results of the laboratory analysis for the material samples from the rock quarry and borrow pit are summarized in the following sections, respectively. Laboratory analysis results are provided in Appendix B.

4.1 Rock Quarry Results

The results of the bulk chemical testing for the rock quarry samples are summarized in Table 4-1 and the Receiving Water Simulation test results for the rock quarry samples are summarized in Table 4-2.

4.1.1 Bulk Chemical Analysis

As shown in Table 4-1, there were a number of exceedances of the MOE Fill Quality Guidelines (2011) Table C-2 Lowest Effect Level criteria for unconfined fill, which is considered to be the appropriate criteria since the rock from the quarry will be used as rip rap and rockfill that will be exposed to the waters of Lake Nipigon. Exceedances were as follows:

- Total Phosphorus (3 of 5 samples)
- Chromium (4 of 5 samples)
- Copper (5 of 5 samples)
- Iron (5 of 5 samples)
- Manganese (1 of 5 samples)
- Nickel (5 of 5 samples).

None of the five samples exceeded the Lowest Effect Level PCB criteria (0.07 µg/g) for unconfined fill and PCBs were not detected at the Method Detection Limit (MDL) of 0.05 µg/g in any of the five samples from the rock quarry.

4.1.2 Receiving Water Simulation Test

As shown in Table 4-2, none of the samples had any exceedances of the respective PWQOs resulting from the Receiving Water Simulation Test.

PCBs were detected in one of the five samples from the rock quarry (GS-1) but the results (0.62 ng/L) were below the PWQO for PCBs (1.0 ng/L).

Table 4-1: **Summary of Quarry Rock Bulk Chemical Test Results**

Parameter	Units	MDL	Results						MOE Fill Quality Guidelines (2011) Table C-2: Unconfined Fill	
			GS-1	GS-1 (Duplicate)	GS-2	GS-3	GS-4	GS-5	No Effect Level	Lowest Effect Level
Arsenic	µg/g, dry	1	ND	ND	ND	ND	ND	ND	NV	6
Cadmium	µg/g, dry	0.5	ND	ND	ND	ND	ND	ND	NV	0.6
Chromium	µg/g, dry	5	22	25	33	35	28	33	NV	26
Copper	µg/g, dry	5	212	238	212	216	61	27	NV	16
Iron	µg/g, dry	200	35600	39300	41300	42200	43700	47900	NV	20000
Lead	µg/g, dry	1	1	1	5	1	20	1	NV	31
Manganese	µg/g, dry	0.1	346	394	349	517	238	249	NV	460
Mercury	µg/g, dry	5	ND	ND	ND	ND	ND	ND	NV	0.2
Nickel	µg/g, dry	5	34	38	41	41	31	27	NV	16
Zinc	µg/g, dry	20	56	63	42	52	64	32	NV	120
Phosphorus, Total	µg/g, dry	1	540	530	548	606	1280	1170	NV	600
Total Organic Carbon	%	0.1	ND	n/a	ND	ND (including duplicate)	ND	ND	NV	1
PCBs, Total	µg/g, dry	0.05	ND	ND	ND	ND	ND	ND	0.07	0.07

Notes

µg/g, dry	micrograms per gram, dry
MDL	Method Detection Limit
ND	No Detection of Parameter at MDL
NV	No value for parameter in MOE (2011)
	Indicates parameter concentration exceeds MOE Fill Quality Guidelines

Table 4-2: **Summary of Quarry Rock Receiving Water Simulation Test Results**

Parameter	Units	MDL	Results						Provincial Water Quality Objective
			GS-1	GS-1 (Duplicate)	GS-2	GS-3	GS-4	GS-5	
Arsenic	µg/L	1	ND	ND	ND	ND	ND	ND	**1000**
Cadmium	µg/L	0.1	ND	ND	ND	ND	ND	ND	**2**
Chromium	µg/L	1	ND	1	ND	ND	ND	1	**89**
Copper	µg/L	0.5	ND	1	ND	ND	ND	ND	**50**
Iron	µg/L	100	447	500	581	1380	1720	1840	**3000**
Lead	µg/L	0.1	ND	ND	0.2	1.2	1.5	0.2	5
Manganese	µg/L	5	7	8	8	37	22	25	NV
Mercury	µg/L	0.1	ND	ND	ND	ND	ND	ND	0.2
Nickel	µg/L	1	ND	ND	ND	1	1	2	**250**
Zinc	µg/L	5	ND	ND	ND	ND	7	8	**300**
Phosphorus, Total	mg/L	0.01	0.01	0.01	ND	0.02	0.03	0.06	100
Total Organic Carbon	mg/L	0.5	ND	ND	ND	ND	ND	2.7	NV
PCBs, Total	ng/L	0.05	0.62	n/a	ND	ND	ND	ND	1.0

Notes

µg/L Micrograms per Litre
mg/L Milligrams per Litre

ng/L Nanograms per Litre
MDL Method Detection Limit
ND No Detection of Parameter at MDL
NV No value for parameter in PWQO
BOLD Indicates PWQO Standard that has been multiplied by a factor of 10 (recommended best practice method from MOE 2011 for non-bioaccumulative parameters)
Indicates parameter concentration exceeds PWQO

4.2 Borrow Pit Results

The results of the bulk chemical testing for the borrow pit samples are summarized in Table 4-3 and the Receiving Water Simulation test results for the borrow pit samples are summarized in Table 4-4.

4.2.1 Bulk Chemical Analysis

The results of the bulk chemical analysis testing on the three samples of sand and gravel from the borrow pit are provided in Table 4-3. The results were compared to the MOE Fill Quality Guide (2011) Table C-1 criteria for confined fill (using the more restrictive of the criteria for fine/medium textured or coarse textured soils), which is considered to be the appropriate criteria for comparison since the sand and gravel material will be utilized as the bottom layer within the proposed shoreline stabilization toe berm and will be covered by rock fill and rip rap, and therefore, not exposed directly to the waters of Lake Nipigon.

As shown in Table 4-3, there were several exceedances of the Table C-1 criteria for fine/medium textured soils for copper, although the results for copper were below the criteria for coarse textured soils.

None of the three samples exceeded the PCB criteria for confined fill (0.07 µg/g) and PCBs were not detected at the MDL (0.05 µg/g) in any of the three samples.

4.2.2 Receiving Water Simulation Test

As shown in Table 4-4, there were several exceedances of the appropriate PWQO resulting from the Receiving Water Simulation Test on the borrow pit samples. This included:

- Iron (3 of 3 samples)
- Lead (1 of 3 samples).

However, none of those parameters exceeded the Bulk Chemical Test results criteria for confined fill in the MOE Fill Quality Guidelines (2011) as noted in Section 4.2.1. No exceedances of the PWQO standard for copper, which was the only parameter that exceeded the Table C-1 Criteria under the bulk testing analysis, were observed in the Receiving Water Simulation test results.

Table 4-3: **Summary of Borrow Pit Material Bulk Chemical Test Results**

Parameter	Units	MDL	Results			MOE Fill Quality Guidelines (2011) Table C-1: Confined Fill	
			GS-16	GS-17	GS-18	Fine/Medium Textured Soils	Coarse Textured Soils
Arsenic	µg/g, dry	1	ND	ND	ND	11	11
Cadmium	µg/g, dry	0.5	ND	ND	ND	1	1
Chromium	µg/g, dry	5	21	21	22	160	160
Copper	µg/g, dry	5	151	144	134	140	180
Iron	µg/g, dry	200	34000	35800	34800	NV	NV
Lead	µg/g, dry	1	4	3	20	45	45
Manganese	µg/g, dry	0.1	400	464	365	NV	NV
Mercury	µg/g, dry	5	ND	ND	ND	1.8	0.25
Nickel	µg/g, dry	5	55	61	61	130	100
Zinc	µg/g, dry	20	39	40	43	340	340
Phosphorus, Total	µg/g, dry	1	562	569	573	NV	NV
Total Organic Carbon	%	0.1	0.38	0.4	0.17	NV	NV
PCBs, Total	µg/g, dry	0.05	ND	ND	ND	0.35	0.35

Notes

µg/g, dry	micrograms per gram, dry
MDL	Method Detection Limit
ND	No Detection of Parameter at MDL
NV	No value for parameter in MOE (2011)
	Indicates parameter concentration exceeds MOE Fill Quality Guidelines

Table 4-4: **Summary of Borrow Pit Material Receiving Water Simulation Test Results**

Parameter	Units	MDL	Results			Provincial Water Quality Objective
			GS-16	GS-17	GS-18	
Arsenic	µg/L	1	ND	ND	ND	**1000**
Cadmium	µg/L	0.1	ND	ND	ND	**2**
Chromium	µg/L	1	2	5	4	**89**
Copper	µg/L	0.5	20.4	40.0	39.4	**50**
Iron	µg/L	100	3390	6750	5070	**3000**
Lead	µg/L	0.1	1.8	2.0	10.0	5
Manganese	µg/L	5	77	150	123	NV
Mercury	µg/L	0.1	ND	ND	ND	0.2
Nickel	µg/L	1	5	11	8	**250**
Zinc	µg/L	5	16	34	18	**300**
Phosphorus, Total	mg/L	0.01	0.03	0.07	0.07	100
Total Organic Carbon	mg/L	0.5	ND	0.6	ND	NV
PCBs, Total	µg/L	0.05	ND	ND	ND	0.001

Notes

µg/L	micrograms per Litre
mg/L	milligrams per Litre
MDL	Method Detection Limit
ND	No Detection of Parameter at MDL
NV	No value for parameter in PWQO
BOLD	Indicates PWQO Standard that has been multiplied by a factor of 10 (recommended best practice method from MOE 2011 for non-bioaccumulative parameters)
	Indicates parameter concentration exceeds PWQO

5. Discussion

The following sections discuss the suitability of the tested quarry and borrow pit material for use in the proposed shoreline stabilization project, from a quality perspective as it relates to the guidance in the MOE Fill Quality Guidelines (2011).

It is important to note that the Fill Quality Guidelines (MOE, 2011) indicate that there is typically no need to chemically assess natural materials such as quarried rock, sand and gravel, unless there is some concern with respect to quality of the origin of the material. In this instance, there was no particular concern with the origin of the material, but OPG decided to proceed with the testing program as part of their overall due diligence to ensure that their activities associated with the proposed shoreline stabilization project did not cause undue negative effects on the environment.

Sampling of Lake Nipigon sediments for the purposes of comparison with the rock, sand and gravel results (per Phase 2 identified in Table 3-1) was not undertaken, given that none of the samples from the rock quarry exceeded the PWQO criteria for the Receiving Water Simulation Test and the sand and gravel materials will be confined and not directly exposed to Lake Nipigon water.

5.1 Rock Quarry

None of the samples from the rock quarry exceeded any of the PWQO criteria from the Receiving Water Simulation Test; therefore these sample results indicate that the material is considered to be suitable for use as unconfined fill for the shoreline stabilization project.

5.2 Borrow Pit

The Receiving Water Simulation Test results from the three samples from the borrow pit exceeded the PWQO criteria for iron. However, iron is a common constituent of aggregate material in northern Ontario.

Further, none of the samples exceeded the Table C-1 criteria for iron from the MOE Fill Quality Guidelines (MOE, 2011) for confined fill. This sand and gravel material is proposed for use as confined fill within the stabilization feature and will not come into direct contact with the waters of Lake Nipigon. Therefore, use of this material as confined fill along the shoreline is not expected to result in negative effects on water quality and biota in Lake Nipigon.

Measures will be taken by the Contractor during installation of the confined fill to prevent it from coming into contact with or escapement of the material into Lake Nipigon.

One of the samples from the borrow pit (located at the north end of the pit) did exceed the PWQO criteria for lead from the Receiving Water Simulation Test. This sample result was approximately 5 to 10 times higher than the lead results for the other two samples from the borrow pit, which were located along the southern and western walls of the pit. Therefore, it appears that this one sample may be an anomaly. Waste debris was observed at some

locations at the northern end of the pit and it is possible that this could have resulted in sample contamination. To mitigate this, the Technical Specifications for the project will require the Contractor to extract material from the southern and western walls of the pit and avoid the northern wall where the waste debris was observed.

Although the PCB MDL for the Receiving Water Simulation Test was above the PWQO criteria, PCBs were not detected in the borrow pit samples during the bulk chemical analysis, where the MDL was below the MOE Fill Quality Guidelines criteria for confined fill. Therefore, it was not retested to confirm the results.

Overall, this material is considered to be suitable for use as confined fill within the proposed shoreline stabilization feature on the Gull Bay shoreline.

6. Summary and Conclusions

As part of their due diligence on the Gull Bay Shoreline Stabilization Project, OPG retained Hatch to collect and analyze samples of rock from the proposed quarry and samples of sand and gravel from the proposed borrow pit to ensure they were chemically suitable for use as fill for the proposed shoreline stabilization feature. Sampling, analysis and conclusions were based on MOE's *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* (Ministry of the Environment, 2011).

Samples of rock from the proposed quarry exceeded the lowest effect level for use as unconfined fill for several parameters including chromium, copper, iron, manganese, nickel and total phosphorus. As a result, the Receiving Water Simulation Test was conducted on the samples to determine if these constituents would leach from the rock and have negative effects on the receiving environment in Lake Nipigon. The results of this testing showed that none of the samples exceeded the PWQOs. Therefore, the rock from the quarry is considered to be suitable for use as unconfined fill on the shoreline stabilization feature.

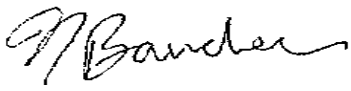
Samples of sand and gravel from the borrow pit exceeded the MOE (2011) guideline for copper for use as confined fill. Therefore, the Receiving Water Simulation Test was conducted on the samples to confirm how they would react in the presence of water. The results showed several exceedances of the PWQO for iron, although no exceedances for copper were observed. Iron is a common constituent of aggregate material in northern Ontario and the bulk chemical testing of iron showed no exceedances for the confined fill standards. Given that the sand and gravel will be used as confined fill within the erosion protection feature, no negative effects on the environment are anticipated as a result of use of this material.

One of the samples from the borrow pit did exceeding the PWQO criteria for lead from the Receiving Water Simulation Test. Waste debris was observed at some locations at the northern end of the pit and it is possible that this could have resulted in sample contamination. To mitigate this, the Technical Specifications for the project will require the

Contractor to extract material from the southern and western walls of the pit and avoid the northern wall where the waste debris was observed. Overall, this material is considered to be suitable for use as confined fill within the proposed shoreline stabilization feature on the Gull Bay shoreline.

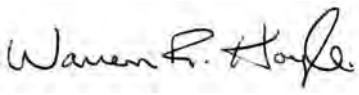
7. Qualifications of Authors

This report was prepared by Mr. Noel Boucher; an Environmental Scientist with Hatch Ltd. Mr. Boucher holds a Bachelor's degree in Environmental Science and has over 15 years experience conducting environmental studies.



Noel Boucher, B.Sc. (Env.)
Environmental Scientist
Environmental Services Group

This Report was prepared under the direction of Mr. Warren Hoyle (P.Geo.) of Hatch Ltd. Mr. Hoyle holds a degree in Earth Sciences, is a Registered Professional Geoscientist in Ontario, and has over 20 years of professional experience in geotechnical and environmental engineering projects. Mr. Hoyle is considered to be a Qualified Person for the purposes of this assessment.



Warren Hoyle, P. Geo
Geotechnical Lead – Niagara Falls, Project Delivery Group

8. References

Ministry of the Environment and Climate Change (MOECC). 2014. Memorandum, Rock Quality Comparison for Shoreline Erosion Protection Design for Kiashke Zaaging Anishinaabek (Gull Bay) First Nation Shoreline Erosion Project. November 25, 2014.

Ministry of the Environment. 2011. Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario. March 2011.

Appendix A
2013 Laboratory Analysis Results

A.1 2013 Bulk Chemical Analysis Results

A.1.1 Rock Quarry

Table A-1 provides a summary of the bulk chemical analysis results from the single rock sample collected from the proposed rock quarry in November 2013. Laboratory data sheets are provided in Attachment 1.

Table A-1: Summary of 2013 Quarry Rock Sample Bulk Chemical Test Results

Parameter	Units	Results	MOE Fill Quality Guidelines (2011) Table C-2: Unconfined Fill Lowest Effect Level
Mercury	µg/g, dry	<0.05	0.2
Aluminum	µg/g, dry	68000	NV
Antimony	µg/g, dry	<0.8	NV
Arsenic	µg/g, dry	1	6
Barium	µg/g, dry	180	NV
Beryllium	µg/g, dry	0.46	NV
Bismuth	µg/g, dry	<0.09	NV
Cadmium	µg/g, dry	0.79	0.6
Calcium	µg/g, dry	65000	NV
Chromium	µg/g, dry	60	26
Cobalt	µg/g, dry	39	NV
Copper	µg/g, dry	410	16
Iron	µg/g, dry	94000	20000
Lead	µg/g, dry	20	31
Magnesium	µg/g, dry	26000	NV
Manganese	µg/g, dry	1100	460
Molybdenum	µg/g, dry	1.7	0.2
Nickel	µg/g, dry	49	16
Lithium	µg/g, dry	11	NV
Potassium	µg/g, dry	4500	NV
Phosphorus	µg/g, dry	1100	600
Selenium	µg/g, dry	2	NV
Silver	µg/g, dry	0.78	NV
Sodium	µg/g, dry	18000	NV
Strontium	µg/g, dry	150	NV
Thallium	µg/g, dry	0.23	NV
Tin	µg/g, dry	1	NV
Titanium	µg/g, dry	10000	NV
Uranium	µg/g, dry	0.45	NV
Vanadium	µg/g, dry	300	NV
Yitrium	µg/g, dry	27	NV
Zinc	µg/g, dry	150	120

Notes

µg/g, dry	micrograms per gram, dry
ND	No Detection of Parameter at MDL
NV	No value for parameter in MOE (2011)
	Indicates parameter concentration exceeds 2011 Fill Quality Guidelines Lowest Effect Level for Unconfined Fill

A.1.2 Borrow Pit

Table A-2 provides a summary of the bulk chemical analysis results from the single granular material (sand and gravel) sample collected from the proposed borrow pit in November 2013. Laboratory data sheets are provided in Attachment A1.

Table A-2: **Summary of 2013 Borrow Pit Granular Sample Bulk Chemical Test Results**

Parameter	Units	Results	MOE Fill Quality Guidelines (2011) Table C-1: Confined Fill	
			Fine/Medium Textured Soils	Coarse Grained Soils
Mercury	µg/g, dry	<0.05	1.8	0.25
Aluminum	µg/g, dry	61000	NV	NV
Antimony	µg/g, dry	<0.8	7.5	7.5
Arsenic	µg/g, dry	0.8	11	11
Barium	µg/g, dry	220	390	390
Beryllium	µg/g, dry	0.94	5	4
Bismuth	µg/g, dry	<0.9	NV	NV
Cadmium	µg/g, dry	0.25	1	1
Calcium	µg/g, dry	43000	NV	NV
Chromium	µg/g, dry	77	160	160
Cobalt	µg/g, dry	29	22	22
Copper	µg/g, dry	290	180	140
Iron	µg/g, dry	58000	NV	NV
Lead	µg/g, dry	5.1	45	45
Magnesium	µg/g, dry	27000	NV	NV
Manganese	µg/g, dry	740	NV	NV
Molybdenum	µg/g, dry	0.9	6.9	6.9
Nickel	µg/g, dry	62	130	100
Lithium	µg/g, dry	21	NV	NV
Potassium	µg/g, dry	9600	NV	NV
Phosphorus	µg/g, dry	580	NV	NV
Selenium	µg/g, dry	1.1	2.4	2.4
Silver	µg/g, dry	0.62	25	20
Sodium	µg/g, dry	15000	NV	NV
Strontium	µg/g, dry	170	NV	NV
Thallium	µg/g, dry	0.14	1	1
Tin	µg/g, dry	1.4	NV	NV
Titanium	µg/g, dry	5900	NV	NV
Uranium	µg/g, dry	0.84	23	23
Vanadium	µg/g, dry	140	86	86
Yitrium	µg/g, dry	23	NV	NV
Zinc	µg/g, dry	39	340	340

Notes

µg/g, dry	micrograms per gram, dry
ND	No Detection of Parameter at MDL
NV	No value for parameter in MOE (2011)
	Indicates parameter concentration exceeds 2011 Fill Quality Guidelines for Confined Fill (based on the most restrictive grain size criteria)

A.2 2013 Receiving Water Simulation Test Results

Table A-3 summarizes the results of the Receiving Water Simulation testing completed in December 2014 on a sample of rock from the proposed rock quarry and a sample of granular material (sand and gravel) from the proposed borrow pit, both of which were collected in November 2013.

The Receiving Water Simulation Test was completed on two separate occasions, using different sub-samples, for the sample of rock from the quarry. On the first occasion (December 2014), results showed some exceedances of metals and PCBs for the respective PWQO as identified in Table A-3. For the December 2014 analysis, the laboratory crushed and pulverized the rock to a fine dust. That dust was then water-leached in de-ionized water and then ran through a glass filter. Due to the nature of the material after crushing and pulverizing, there remained a significant amount of fine particles in the supernatant, so the laboratory acid-digested the particles and analyzed the results of the digested particles within the liquid. This processing method may have contributed to the levels of metals observed in the results.

On the second occasion (February 2015), Hatch submitted a sub-sample of quarry rock that had been processed to remove the face of the rock that was exposed at the former quarry, to determine if the PCBs observed in the December 2014 test results may have only been present on the face of the rock instead of within the fresh unexposed rock. For this testing, the laboratory crushed the quarry rock sample into small pieces (approximately 1 cm^2) and then performed the de-ionized water leach. After the leaching period, the supernatant did not contain any fine material; therefore acid digestion was not necessary. The results of this test did not show any exceedances of the PWQOs, although it is noted that the method detection limit for PCBs (0.05 µg/L) was above the PWQO value (0.001 µg/L).

TableA-3: Summary of Quarry and Borrow Pit Material Receiving Water Simulation Test Results from Samples Collected in 2013

Parameter	Units	MDL	Results			Provincial Water Quality Objective
			Quarry (December 2014)	Quarry (February 2015)	Borrow Pit (December 2014)	
Arsenic	µg/L	1	<5	<1	<5	1000
Cadmium	µg/L	0.1	<0.5	<0.1	<0.5	2
Chromium	µg/L	1	<5	<1	<5	89
Copper	µg/L	0.5	15.4	<0.5	49.2	50
Lead	µg/L	0.1	5.5	<0.1	1.9	5
Mercury	µg/L	0.1	<0.1	<0.1	<0.1	0.2
Nickel	µg/L	1	6	<1	11	250
Zinc	µg/L	5	32	<5	<25	300
Phosphorus, Total	mg/L	0.01	0.11	<0.01	0.09	100
Total Organic Carbon	mg/L	0.5	1.3	1.5	0.9	NV
PCBs, Total	µg/L	0.05	0.80	<0.05	<0.05	0.001

Notes

µg/L micrograms per Litre
mg/L milligrams per Litre
MDL Method Detection Limit
NV No value for parameter in PWQO
BOLD Indicates PWQO Standard that has been multiplied by a factor of 10 (recommended best practice method from MOE 2011 for non-bioaccumulative parameters)
Indicates parameter concentration exceeds PWQO

SGS Canada Inc.
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Lakefield - Ontario - KOL 2HO
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17-December-2013

Hatch LTD
Attn : Shathli Shaif

4342 Queen St Suite500
Niagara Falls, ON
L2E 6W1,

Phone: 905-374-5200
Fax:905-374-0701

Date Rec. : 06 December 2013
LR Report: **CA13223-DEC13**

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Mine Waste Rock	6: Quarry Sample	7: Pit Sample
Sample Date & Time			NA	NA	NA
Mercury [µg/g]	11-Dec-13	13:05	< 0.05	< 0.05	< 0.05
Silver [µg/g]	12-Dec-13	14:49	0.39	0.78	0.62
Aluminum [µg/g]	12-Dec-13	14:13	69000	68000	61000
Arsenic [µg/g]	12-Dec-13	14:49	0.5	1.0	0.8
Barium [µg/g]	12-Dec-13	14:49	100	180	220
Beryllium [µg/g]	12-Dec-13	14:49	0.14	0.46	0.94
Bismuth [µg/g]	12-Dec-13	14:49	< 0.09	< 0.09	< 0.09
Calcium [µg/g]	12-Dec-13	14:13	69000	65000	43000
Cadmium [µg/g]	12-Dec-13	14:49	0.09	0.79	0.25
Cobalt [µg/g]	12-Dec-13	14:49	47	39	29
Chromium [µg/g]	16-Dec-13	08:56	87	60	77
Copper [µg/g]	12-Dec-13	14:49	120	410	290
Iron [µg/g]	12-Dec-13	14:14	53000	94000	58000
Potassium [µg/g]	12-Dec-13	14:14	3100	4500	9600
Lithium [µg/g]	12-Dec-13	14:49	10	11	21
Magnesium [µg/g]	12-Dec-13	14:14	42000	26000	27000
Manganese [µg/g]	12-Dec-13	14:49	770	1100	740
Molybdenum [µg/g]	12-Dec-13	14:49	1.7	1.7	0.9
Sodium [µg/g]	12-Dec-13	14:14	14000	18000	15000
Nickel [µg/g]	12-Dec-13	14:49	230	49	62
Phosphorus [µg/g]	12-Dec-13	14:14	24	1100	580
Lead [µg/g]	12-Dec-13	14:49	1.6	20	5.1
Antimony [µg/g]	12-Dec-13	14:49	< 0.8	< 0.8	< 0.8
Selenium [µg/g]	12-Dec-13	14:49	1.6	2.0	1.1
Tin [µg/g]	12-Dec-13	14:49	< 0.5	1.0	1.4
Strontium [µg/g]	12-Dec-13	14:49	180	150	170
Titanium [µg/g]	12-Dec-13	14:49	900	10000	5900

SGS Canada Inc.
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Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

LR Report : **CA13223-DEC13**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Mine Waste Rock	6: Quarry Sample	7: Pit Sample
Thallium [µg/g]	12-Dec-13	14:49	0.05	0.23	0.14
Uranium [µg/g]	12-Dec-13	14:49	0.11	0.45	0.84
Vanadium [µg/g]	12-Dec-13	14:49	97	300	140
Yttrium [µg/g]	12-Dec-13	14:49	2.8	27	23
Zinc [µg/g]	12-Dec-13	14:49	45	150	39

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0000078634

SGS Canada Inc.
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20-December-2013

Hatch LTD
Attn : Shathli Shaif

4342 Queen St Suite500
Niagara Falls, ON
L2E 6W1,

Phone: 905-374-5200
Fax:905-374-0701

Date Rec. : 06 December 2013
LR Report: **CA13222-DEC13**

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Mine Waste Rock	6: Quarry Sample	7: Pit Sample
Sample Date & Time			NA	NA	NA
Paste pH	20-Dec-13	16:04	9.44	9.07	8.30
Fizz Rate [---]	20-Dec-13	16:04	1	1	1
Sample weight [g]	20-Dec-13	16:04	2.01	1.97	2.02
HCl added [mL]	20-Dec-13	16:04	20.00	20.00	20.00
HCl [Normality]	20-Dec-13	16:04	0.10	0.10	0.10
NaOH [Normality]	20-Dec-13	16:04	0.10	0.10	0.10
NaOH to [pH=8.3 mL]	20-Dec-13	16:04	15.50	13.11	14.90
Final pH	20-Dec-13	16:04	1.19	1.80	1.59
NP [t CaCO3/1000 t]	20-Dec-13	16:04	11	18	13
AP [t CaCO3/1000 t]	---	---	4.06	0.94	0.31
Net NP [t CaCO3/1000 t]	---	---	7.14	16.6	12.3
NP/AP [ratio]	---	---	2.76	18.7	40.6
S [%]	13-Dec-13	10:41	0.195	0.066	0.014
Acid Leachable SO4-S [%]	---	---	0.06	0.04	0.01
Sulphide [%]	16-Dec-13	09:50	0.13	0.03	< 0.01
C [%]	13-Dec-13	10:41	0.049	0.049	0.075
CO3 [%]	16-Dec-13	09:56	0.120	0.045	0.020

SGS Canada Inc.
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*NP (Neutralization Potential)

$$= \frac{50 \times (\text{N of HCL} \times \text{Total HCL added} - \text{N NaOH} \times \text{NaOH added})}{\text{Weight of Sample}}$$

*AP (Acid Potential) = % Sulphide Sulphur x 31.25
*Net NP (Net Neutralization Potential) = NP-AP
NP/AP Ratio = NP/AP
*Results expressed as tonnes CaCO3 equivalent/1000 tonnes of material
Samples with a % Sulphide value of <0.01 will be calculated using a 0.01 value.

Sulphur analysis performed following BC ARD Guidelines (Price 1997)

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

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Certificate of Analysis

Hatch Ltd.
4342 Queen St., Suite 300
Niagara Falls, ON L2E 7J7
Attn: Shathli Shaif

Phone: (905) 374-0701
Fax: (905) 374-1157

Client PO:
Project: H3_ _911
Custody: 102018

Report Date: 19-Dec-2014
Order Date: 12-Dec-2014
Order #: 1451235

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

Paracel ID	Client ID
1451235-01	Gull Bay Quarry Sample
1451235-02	Gull Bay Pit Sample

Approved By: Mark Foto

Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 19-Dec-2014
Order Date:12-Dec-2014

Client: **Hatch Ltd.**
Client PO: Project Description: H3_ _911

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury	EPA 245.1 - Cold Vapour AA	19-Dec-14	19-Dec-14
Metals, ICP-MS	EPA 200.8 - ICP-MS	19-Dec-14	19-Dec-14
PCBs, total	EPA 608 - GC-ECD	19-Dec-14	19-Dec-14
Phosphorus, total	EPA 365.4 - Auto Colour, digestion	19-Dec-14	19-Dec-14
TOC	MOE 3247B - Combustion IR	19-Dec-14	19-Dec-14

PARACEL LABORATORIES LTD.

Order #: 1451235

Certificate of Analysis

Report Date: 19-Dec-2014
Order Date:12-Dec-2014

Client: **Hatch Ltd.**
Client PO:

Project Description: H3__911

	Client ID:	Gull Bay Quarry Sample	Gull Bay Pit Sample	-	-
	Sample Date:	01-Sep-13	01-Sep-13	-	-
	Sample ID:	1451235-01	1451235-02	-	-
	MDL/Units	Soil	Soil	-	-
General Inorganics					
Phosphorus, total	0.01 mg/L	0.11 [1]	0.09 [1]	-	-
Total Organic Carbon	0.5 mg/L	1.3 [1]	0.9 [1]	-	-
Metals					
Mercury	0.1 ug/L	<0.1	<0.1	-	-
Arsenic	1 ug/L	<5 [2]	<5 [2]	-	-
Cadmium	0.1 ug/L	<0.5 [2]	<0.5 [2]	-	-
Chromium	1 ug/L	<5 [2]	<5 [2]	-	-
Copper	0.5 ug/L	15.4	49.2	-	-
Lead	0.1 ug/L	5.5	1.9	-	-
Nickel	1 ug/L	6	11	-	-
Zinc	5 ug/L	32	<25 [2]	-	-
PCBs					
PCBs, total	0.05 ug/L	0.80 [1]	<0.05 [1]	-	-
Decachlorobiphenyl	Surrogate	68.3% [1]	86.8% [1]	-	-

Certificate of Analysis

Report Date: 19-Dec-2014
Order Date:12-Dec-2014

Client: **Hatch Ltd.**
Client PO: Project Description: H3_ _911

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	ND	0.01	mg/L						
Total Organic Carbon	ND	0.5	mg/L						
Metals									
Mercury	ND	0.1	ug/L						
Arsenic	ND	1	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium	ND	1	ug/L						
Copper	ND	0.5	ug/L						
Lead	ND	0.1	ug/L						
Nickel	ND	1	ug/L						
Zinc	ND	5	ug/L						

Certificate of Analysis

Report Date: 19-Dec-2014
Order Date:12-Dec-2014

Client: **Hatch Ltd.**
Client PO: Project Description: H3_ _911

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	ND	0.01	mg/L	ND			0.0	10	
Total Organic Carbon	0.6	0.5	mg/L	1.2			65.0	33	QR-01
Metals									
Mercury	ND	0.1	ug/L	ND			0.0	20	
Arsenic	ND	1	ug/L	ND			0.0	20	
Cadmium	ND	0.1	ug/L	ND			0.0	20	
Chromium	ND	1	ug/L	ND			0.0	20	
Copper	1.86	0.5	ug/L	1.83			1.7	20	
Lead	ND	0.1	ug/L	ND			0.0	20	
Nickel	55.9	1	ug/L	55.3			1.0	20	
Zinc	ND	5	ug/L	ND			0.0	20	

Certificate of Analysis

Report Date: 19-Dec-2014
Order Date:12-Dec-2014

Client: **Hatch Ltd.**
Client PO: Project Description: H3_ _911

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	0.511	0.01	mg/L	ND	102	80-120			
Total Organic Carbon	10.6	0.5	mg/L	1.2	94.3	61-128			
Metals									
Mercury	3.27	0.1	ug/L	ND	109	78-137			
Arsenic	49.1		ug/L	0.2	97.8	80-120			
Cadmium	48.0		ug/L	0.04	95.9	80-120			
Chromium	44.4		ug/L	0.3	88.1	80-120			
Copper	49.5		ug/L	1.83	95.4	80-120			
Lead	43.5		ug/L	0.08	86.9	80-120			
Nickel	98.9		ug/L	55.3	87.1	80-120			
Zinc	49		ug/L	0.8	95.5	80-120			

Certificate of Analysis

Report Date: 19-Dec-2014
Order Date:12-Dec-2014

Client: **Hatch Ltd.**
Client PO: Project Description: H3_ _911

Qualifier Notes:

Sample Qualifiers :

1 : Holding time had been exceeded upon sample receipt.

2 : Sediment and/or particulates in this liquid sample required digestion for Total metals analysis, which resulted in elevated detection limits.

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:

Please note that all results are based on an 18 hour DI Water leach at a 20:1 (Liquid:Solid) ratio.

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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Page 1 of 1

Client Name: HATCH
Contact Name: SHATHLI SHAIF / WARREN HOYLE
Address: 4342 QUEEN ST. NIAGARA FALLS, ON.
Telephone: 905 374 0701 x 5275 / x 5322

Project Reference: #3_911
Quote #
PO #
Email Address: sshaif@hatch.ca

TAT: [ ] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day
Date Required: DEC 18, 2014

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: 1450303

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	Receiving Water Simulation Test (Unclarified Fill)
1	GULLRAY QUARRY SAMPLE			1	Sept 2013	—								✓
2	" PIT SAMPLE			1	Sept 2013	—								✓
3														
4														
5														
6														
7														
8														
9														
10														

→ Sample date. Correct as per Dan B. 8:

Remove For Electrolyte To DEC 22nd

Comments: Proceed with analyses

Method of Delivery: drop box

Relinquished By (Sign):	Received by Driver/Depot: Niagara - BHomenier	Received at Lab: NMeers
Relinquished By (Print): SHATHLI SHAIF	Date/Time: 12 Dec 14 10:11	Date/Time: Dec 15/14 9:40
Date/Time: DEC 12, 2014	Temperature: ____ °C	Temperature: 3.6 °C 2.6

Verified By: DCF
Date/Time: Dec 15/14 8:03a
pH Verified [ ] By: ____

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Certificate of Analysis

Hatch Ltd.
4342 Queen St., Suite 300
Niagara Falls, ON L2E 7J7
Attn: Shathli Shaif

Phone: (905) 374-0701
Fax: (905) 374-1157

Client PO:
Project: H346911 Gull Bay
Custody: 20438

Report Date: 3-Feb-2015
Order Date: 22-Jan-2015
Order #: 1504225

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

Paracel ID	Client ID
1504225-01	Quarry (Trimmed)

Approved By: Mark Foto

Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 03-Feb-2015
Order Date:22-Jan-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911 Gull Bay

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury	EPA 245.1 - Cold Vapour AA	2-Feb-15	2-Feb-15
Metals, ICP-MS	EPA 200.8 - ICP-MS	3-Feb-15	3-Feb-15
PCBs, total	EPA 608 - GC-ECD	2-Feb-15	2-Feb-15
Phosphorus, total	EPA 365.4 - Auto Colour, digestion	3-Feb-15	3-Feb-15
Total Organic Carbon	MOE 3247B - Combustion IR	2-Feb-15	3-Feb-15

Certificate of Analysis

Report Date: 03-Feb-2015
Order Date:22-Jan-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911 Gull Bay

	Client ID:	Quarry (Trimmed)	-	-	-
	Sample Date:	01-Sep-13	-	-	-
	Sample ID:	1504225-01	-	-	-
	MDL/Units	Water	-	-	-
General Inorganics					
Phosphorus, total	0.01 mg/L	<0.01 [1]	-	-	-
Total Organic Carbon	0.5 mg/L	1.5 [1]	-	-	-
Metals					
Mercury	0.1 ug/L	<0.1 [1]	-	-	-
Arsenic	1 ug/L	<1 [1]	-	-	-
Cadmium	0.1 ug/L	<0.1 [1]	-	-	-
Chromium	1 ug/L	<1 [1]	-	-	-
Copper	0.5 ug/L	<0.5 [1]	-	-	-
Lead	0.1 ug/L	<0.1 [1]	-	-	-
Nickel	1 ug/L	<1 [1]	-	-	-
Zinc	5 ug/L	<5 [1]	-	-	-
PCBs					
PCBs, total	0.05 ug/L	<0.05 [1]	-	-	-
Decachlorobiphenyl	Surrogate	112% [1]	-	-	-

Certificate of Analysis

Report Date: 03-Feb-2015
Order Date:22-Jan-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911 Gull Bay

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	ND	0.01	mg/L						
Total Organic Carbon	ND	0.5	mg/L						
Metals									
Mercury	ND	0.1	ug/L						
Arsenic	ND	1	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium	ND	1	ug/L						
Copper	ND	0.5	ug/L						
Lead	ND	0.1	ug/L						
Nickel	ND	1	ug/L						
Zinc	ND	5	ug/L						
PCBs									
PCBs, total	ND	0.05	ug/L						
Surrogate: Decachlorobiphenyl	*0.452*		*ug/L*		*90.5*	*60-140*			

Certificate of Analysis

Report Date: 03-Feb-2015
Order Date:22-Jan-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911 Gull Bay

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	0.922	0.01	mg/L	0.916			0.7	10	
Total Organic Carbon	1.1	0.5	mg/L	1.1			3.2	33	
Metals									
Mercury	0.22	0.1	ug/L	0.23			7.3	20	
Arsenic	ND	1	ug/L	ND			0.0	20	
Cadmium	ND	0.1	ug/L	ND			0.0	20	
Chromium	9.5	1	ug/L	9.3			3.1	20	
Copper	3.35	0.5	ug/L	3.27			2.7	20	
Lead	ND	0.1	ug/L	ND			0.0	20	
Nickel	1.2	1	ug/L	1.2			0.2	20	
Zinc	10	5	ug/L	8			14.0	20	

Certificate of Analysis

Report Date: 03-Feb-2015
Order Date:22-Jan-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911 Gull Bay

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	1.35	0.01	mg/L	0.916	87.6	80-120			
Total Organic Carbon	11.5	0.5	mg/L	1.1	104	61-128			
Metals									
Mercury	3.26	0.1	ug/L	0.23	101	78-137			
Arsenic	54.0		ug/L	0.7	107	80-120			
Cadmium	46.1		ug/L	0.03	92.1	80-120			
Chromium	58.5		ug/L	9.3	98.4	80-120			
Copper	53.0		ug/L	3.27	99.5	80-120			
Lead	44.5		ug/L	0.07	88.9	80-120			
Nickel	51.5		ug/L	1.2	101	80-120			
Zinc	53		ug/L	8	89.2	80-120			
PCBs									
PCBs, total	1.14	0.05	ug/L	ND	114	60-140			
Surrogate: Decachlorobiphenyl	*0.499*		*ug/L*		*99.8*	*60-140*			

Certificate of Analysis

Report Date: 03-Feb-2015
Order Date:22-Jan-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911 Gull Bay

Qualifier Notes:

Sample Qualifiers :

1 : Holding time had been exceeded upon sample receipt.

Sample Data Revisions

None

Work Order Revisions / Comments:

Please note that all results are based on an 18 hour DI Water leach at a 20:1 (Liquid:Solid) ratio.

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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Nº 20438

Page 1 of 1

Client Name: HATCH LTD	Project Reference: H346911 GULL BAY	TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day
Contact Name: SHATHLI SHAIF	Quote #	
Address: 4342 QUEEN ST. NIAGARA FALLS, ON	PO #	Date Required:
Telephone: (905) 3740701 x5275	Email Address: ~~shathli.shaif~~ sshaif@hatch.ca	

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: 1504225

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	Required Analyses: RECEIVING WATER SIMULATION
1	QUARRY (TRIMMED)			1	Sept 2013		✓
2							
3							
4							
5							
6							
7							
8							
9							
10							

Comments: * Please talk w/ Dan w/ regards to procedure to be followed for test (different from last time).

Method of Delivery: drop box

Relinquished By (Sign):	Received by Driver/Depot: Niagara	Received at Lab:	Verified By:
Relinquished By (Print): SHATHLI SHAIF	Date/Time: 22 Jan 15 8:24	Date/Time: Jan 23/15	Date/Time: Jan 23/15
Date/Time: Jan 21, 2015 / 4:00 pm	Temperature: 5.0 °C	Temperature: 7.1 °C 8:34c	pH Verified [N] By: N/A

9:12a

Appendix B

2015 Laboratory Analysis Results

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Certificate of Analysis

Hatch Ltd.
4342 Queen Street, Suite 500
Niagara Falls, ON L2E 6W1
Attn: Warren Hoyle

Phone: (905) 374-0701
Fax: (905) 374-1157

Client PO:
Project: H346911
Custody:

Report Date: 2-Jun-2015
Order Date: 22-May-2015
Order #: 1522062

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

Paracel ID	Client ID
1522062-01	GS-1
1522062-02	GS-2
1522062-03	GS-3
1522062-04	GS-4
1522062-05	GS-5
1522062-06	GS-16
1522062-07	GS-17
1522062-08	GS-18

Approved By: Mark Foto

Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 7471B - CVAA, digestion	28-May-15	28-May-15
Metals, ICP-MS	EPA 6020 - Digestion - ICP-MS	28-May-15	28-May-15
PCBs, total	SW846 8082A - GC-ECD	26-May-15	27-May-15
Phosphorus, total	EPA 365.4 - Auto Colour, digestion	27-May-15	28-May-15
Solids, %	Gravimetric, calculation	27-May-15	27-May-15

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911

	Client ID:	GS-1	GS-2	GS-3	GS-4
	Sample Date:	22-May-15	22-May-15	22-May-15	22-May-15
	Sample ID:	1522062-01	1522062-02	1522062-03	1522062-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	100	100	100	100
General Inorganics					
Phosphorus, total	1.00 ug/g dry	540	548	606	1280
Metals					
Arsenic	1 ug/g dry	<1	<1	<1	<1
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	5 ug/g dry	22	33	35	28
Copper	5 ug/g dry	212	212	216	61
Iron	200 ug/g dry	35600	41300	42200	43700
Lead	1 ug/g dry	1	5	1	20
Manganese	5 ug/g dry	346	349	517	238
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	5 ug/g dry	34	41	41	31
Zinc	20 ug/g dry	56	42	52	64
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	96.6%	84.7%	70.7%	76.7%

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911

	Client ID:	GS-5	GS-16	GS-17	GS-18
	Sample Date:	22-May-15	22-May-15	22-May-15	22-May-15
	Sample ID:	1522062-05	1522062-06	1522062-07	1522062-08
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	100	94.4	95.1	95.5
General Inorganics					
Phosphorus, total	1.00 ug/g dry	1170	562	569	573
Metals					
Arsenic	1 ug/g dry	<1	<1	<1	<1
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	5 ug/g dry	33	21	21	22
Copper	5 ug/g dry	27	151	144	134
Iron	200 ug/g dry	47900	34000	35800	34800
Lead	1 ug/g dry	1	4	3	20
Manganese	5 ug/g dry	249	400	464	365
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	5 ug/g dry	27	55	61	61
Zinc	20 ug/g dry	32	39	40	43
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	48.3% [1]	109%	102%	101%

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO: Project Description: H346911

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	ND	1.00	ug/g						
Metals									
Arsenic	ND	1	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	5	ug/g						
Copper	ND	5	ug/g						
Iron	ND	200	ug/g						
Lead	ND	1	ug/g						
Mercury	ND	0.1	ug/g						
Manganese	ND	5	ug/g						
Nickel	ND	5	ug/g						
Zinc	ND	20	ug/g						
PCBs									
PCBs, total	ND	0.05	ug/g						
Surrogate: Decachlorobiphenyl	*0.108*		*ug/g*		*108*	*60-140*			

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO: Project Description: H346911

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	530	10.0	ug/g dry	540			1.9	10	
Metals									
Arsenic	ND	1	ug/g dry	ND			0.0	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium	25.0	5	ug/g dry	22.3			11.5	30	
Copper	238	5	ug/g dry	212			11.5	30	
Iron	39300	200	ug/g dry	35600			9.9	30	
Lead	1.4	1	ug/g dry	1.2			14.9	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	35	
Manganese	394	5	ug/g dry	346			13.0	30	
Nickel	38.4	5	ug/g dry	34.0			12.2	30	
Zinc	62.5	20	ug/g dry	56.0			10.9	30	
PCBs									
PCBs, total	ND	0.05	ug/g dry	ND				40	
Surrogate: Decachlorobiphenyl	*0.122*		*ug/g dry*	*ND*	*116*	*60-140*			
Physical Characteristics									
% Solids	69.7	0.1	% by Wt.	67.4			3.5	25	

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO: Project Description: H346911

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	60.5	1.00	ug/g	ND	96.8	57-139			
Metals									
Arsenic	47.1		ug/L	0.1	94.0	70-130			
Cadmium	42.4		ug/L	ND	85.0	70-130			
Chromium	60.6		ug/L	8.9	103	70-130			
Copper	137		ug/L	84.9	105	70-130			
Iron	15400		ug/L	14200	115	70-130			
Lead	50.0		ug/L	0.5	99.0	70-130			
Mercury	1.32	0.1	ug/g	ND	88.1	72-128			
Manganese	65.0		ug/L	ND	130	70-130			
Nickel	64.9		ug/L	13.6	103	70-130			
Zinc	69.6		ug/L	22.4	94.3	70-130			
PCBs									
PCBs, total	0.537	0.05	ug/g	ND	128	60-140			
Surrogate: Decachlorobiphenyl	*0.124*		*ug/g*		*118*	*60-140*			

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO: Project Description: H346911

Qualifier Notes:

Sample Qualifiers :

1 : The surrogate recovery for this sample is outside of established control limits due to a sample matrix effect.

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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Client Name:	Hatch	Project Reference: H346911	TAT: ☑ Regular ☐ 3 Day ☐ 2 Day ☐ 1 Day
Contact Name:	Noel Boucher / Warren Hoyle	Quote #	
Address:	4342 Queen St., Suite 500 Niagara Falls, ON L2E7J7	PO #	
		Email Address: nboucher@hatch.ca	Date Required:
Telephone:	905-374-5200		

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

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

Paracel Order Number: 1522062 - Bulk Soil, 1522063 - H20

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Metals	PCBs	Receiving water Simulation								
1	GS-1	s		1	May 20, 2015		✓	✓	✓								
2	GS-2	s		1	May 20, 2015		✓	✓	✓								
3	GS-3	s		1	May 20, 2015		✓	✓	✓								
4	GS-4	s		1	May 20, 2015		✓	✓	✓								
5	GS-5	s		1	May 20, 2015		✓	✓	✓								
6	GS-16	s		1	May 20, 2015		✓	✓	✓								
7	GS-17	s		1	May 20, 2015		✓	✓	✓								
8	GS-18	s		1	May 20, 15		✓	✓	✓								
9																	
10																	

Required Analyses

Comments: 1. Test for bulk testing according to Reg 153; 2. Recieving water simulation testing; 3. Hold S-1, S-2 and S-3 and GS-19 and GS-20 until further instruction provided by Hatch
4. See attachment regarding Recieving Water Simulation testing sample preparation and testing protocol , GS-18 added as per Warren.

Method of Delivery: drop off

Relinquished By (Sign):	Received by Driver/Depot: Niagara	Received at Lab:	Verified By:
Relinquished By (Print): Noel Boucher	Date/Time: 22 May 15 11:40	Date/Time: May 23/15 1:30	Date/Time: May 26/15
Date/Time: May 22/2015 11 am	Temperature: 7.0 °C	Temperature: 4.5 °C	pH Verified ☒ By: N/A

On Hold Samples held @ Niagara Depot.

1:24p

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www.paracellabs.com

Subcontracted Analysis

Hatch Ltd.
4342 Queen Street, Suite 500
Niagara Falls, ON L2E 6W1
Attn: Warren Hoyle

Tel: (905) 374-0701
Fax: (905) 374-1157

Paracel Report No.: **1522062**
Client Project(s): **H346911**
Client PO:
Reference:
CoC Number:

Order Date: 22-May-15
Report Date: 4-Jun-15

Sample(s) from this project were subcontracted for the listed parameters. A copy of the subcontractor's report is attached

Paracel ID	Client ID	Analysis
1522062-01	GS-1	Carbon- Total Organic, soil
1522062-02	GS-2	Carbon- Total Organic, soil
1522062-03	GS-3	Carbon- Total Organic, soil
1522062-04	GS-4	Carbon- Total Organic, soil
1522062-05	GS-5	Carbon- Total Organic, soil
1522062-06	GS-16	Carbon- Total Organic, soil
1522062-07	GS-17	Carbon- Total Organic, soil
1522062-08	GS-18	Carbon- Total Organic, soil

TESTMARK Laboratories Ltd.

Committed to Quality and Service

Analytical Report

Client:	Dale Robertson	**Work Order Number:**	**243015**
Company:	Paracel Laboratories Ltd.- Ottawa	**Date Order Received:**	5/28/2015
Address:	300-2319 St. Laurent Blvd.	**Regulation:**	None
	Ottawa, ON, K1G 4J8	**PO #:**	
Phone:	(613) 731-9577	**Project #:**	1522062
Fax:	(613) 731-9064		
Email:	drobertson@paracellabs.com		

Analyses were performed on the following samples submitted with your order.

The results relate only to the items tested.

Sample Name	Lab #	Matrix	Type	Comments	Date Collected	Time Collected
GS-1	641278	Soil	None		5/22/2015	
GS-2	641279	Soil	None		5/22/2015	
GS-3	641280	Soil	None		5/22/2015	
GS-4	641281	Soil	None		5/22/2015	
GS-5	641282	Soil	None		5/22/2015	
GS-16	641283	Soil	None		5/22/2015	
GS-17	641284	Soil	None		5/22/2015	
GS-18	641285	Soil	None		5/22/2015	

The following instrumentation and reference methods were used for your sample(s)

Method Name	Description	Reference
TOC Soil	Determination of Total Organic Carbon in Soil **Instrument group:** Carbon Sulphur Analyzer	Based on ASTM E1915-13

This report has been approved by:

Khaled Omari, Ph.D.
Laboratory Director

Sample Data:

Sample Name: GS-1 **Date: 5/22/2015** **Matrix: Soil** **Lab #: 641278**

TOC Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Organic Carbon	0.1	<0.1	%	20150604.R55A

Sample Name: GS-2 **Date: 5/22/2015** **Matrix: Soil** **Lab #: 641279**

TOC Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Organic Carbon	0.1	<0.1	%	20150604.R55A

Sample Name: GS-3 **Date: 5/22/2015** **Matrix: Soil** **Lab #: 641280**

TOC Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Organic Carbon	0.1	<0.1	%	20150604.R55A
Total Organic Carbon (Dup)	0.1	<0.1	%	20150604.R55A

Sample Name: GS-4 **Date: 5/22/2015** **Matrix: Soil** **Lab #: 641281**

TOC Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Organic Carbon	0.1	<0.1	%	20150604.R55A

Sample Name: GS-5 **Date: 5/22/2015** **Matrix: Soil** **Lab #: 641282**

TOC Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Organic Carbon	0.1	<0.1	%	20150604.R55A

Sample Name: GS-16 **Date: 5/22/2015** **Matrix: Soil** **Lab #: 641283**

TOC Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Organic Carbon	0.1	0.38	%	20150604.R55A

Sample Name: GS-17 **Date: 5/22/2015** **Matrix: Soil** **Lab #: 641284**

TOC Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Organic Carbon	0.1	0.4	%	20150604.R55A

Sample Name: GS-18 **Date: 5/22/2015** **Matrix: Soil** **Lab #: 641285**

TOC Soil				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Organic Carbon	0.1	0.17	%	20150604.R55A

MDL Method detection limit or minimum reporting limit.
% Rec Surrogate compounds are added to the sample in some cases and the recovery is reported as a percent recovered.
QAQCID This is a unique reference to the quality control data set used to generate the reported value.
Data reported for organic analysis in soil samples are corrected for moisture content
Matrix If the matrix is a leachate, the sample was extracted according to regulation 558.
INT Interferences
TNTC Too numerous to count
ND Not detected
NDOGN No Data, Overgrown with Non-Target
NDOGT No Data, Overgrown with Target
NDOGHPC No Data, Overgrown HPC

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Certificate of Analysis

Hatch Ltd.
4342 Queen Street, Suite 500
Niagara Falls, ON L2E 6W1
Attn: Warren Hoyle

Phone: (905) 374-0701
Fax: (905) 374-1157

Client PO:
Project: H346911
Custody:

Report Date: 2-Jun-2015
Order Date: 22-May-2015
Order #: 1522063

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

Paracel ID	Client ID
1522063-01	GS-1
1522063-02	GS-2
1522063-03	GS-3
1522063-04	GS-4
1522063-05	GS-5
1522063-06	GS-16
1522063-07	GS-17
1522063-08	GS-18

Approved By: Mark Foto

Mark Foto, M.Sc. For Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 245.1 - Cold Vapour AA	26-May-15	28-May-15
Metals, ICP-MS	EPA 200.8 - ICP-MS	27-May-15	28-May-15
PCBs, total	EPA 608 - GC-ECD	28-May-15	28-May-15
Phosphorus, total	EPA 365.4 - Auto Colour, digestion	28-May-15	28-May-15
Total Organic Carbon	MOE 3247B - Combustion IR	28-May-15	28-May-15

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Order #: 1522063

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911

	Client ID:	GS-1	GS-2	GS-3	GS-4
	Sample Date:	20-May-15	20-May-15	20-May-15	20-May-15
	Sample ID:	1522063-01	1522063-02	1522063-03	1522063-04
	MDL/Units	Solid	Solid	Solid	Solid
General Inorganics					
Phosphorus, total	0.01 mg/L	0.01	<0.01	0.02	0.03
Total Organic Carbon	0.5 mg/L	<0.5	<0.5	<0.5	<0.5
Metals					
Mercury	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Arsenic	1 ug/L	<1	<1	<1	<1
Cadmium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Chromium	1 ug/L	<1	<1	<1	<1
Copper	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Iron	100 ug/L	447	581	1380	1720
Lead	0.1 ug/L	<0.1	0.2	1.2	1.5
Manganese	5 ug/L	7	8	37	22
Nickel	1 ug/L	<1	<1	1	1
Zinc	5 ug/L	<5	<5	<5	7
PCBs					
PCBs, total	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	95.0%	48.9% [1]	54.0% [1]	51.4% [1]

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO:

Project Description: H346911

	Client ID:	GS-5	GS-16	GS-17	GS-18
	Sample Date:	20-May-15	20-May-15	20-May-15	20-May-15
	Sample ID:	1522063-05	1522063-06	1522063-07	1522063-08
	MDL/Units	Solid	Solid	Solid	Solid
General Inorganics					
Phosphorus, total	0.01 mg/L	0.06	0.03	0.07	0.07
Total Organic Carbon	0.5 mg/L	2.7	<0.5	0.6	<0.5
Metals					
Mercury	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Arsenic	1 ug/L	<1	<1	<1	<1
Cadmium	0.1 ug/L	<0.1	<0.1	<0.1	<0.1
Chromium	1 ug/L	1	2	5	4
Copper	0.5 ug/L	<0.5	20.4	40.0	39.4
Iron	100 ug/L	1840	3390	6750	5070
Lead	0.1 ug/L	0.2	1.8	2.0	10.0
Manganese	5 ug/L	25	77	150	123
Nickel	1 ug/L	2	5	11	8
Zinc	5 ug/L	8	16	34	18
PCBs					
PCBs, total	0.05 ug/L	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	64.0%	88.0%	61.0%	42.5% [1]

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO: Project Description: H346911

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	ND	0.01	mg/L						
Total Organic Carbon	ND	0.5	mg/L						
Metals									
Mercury	ND	0.1	ug/L						
Arsenic	ND	1	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium	ND	1	ug/L						
Copper	ND	0.5	ug/L						
Iron	ND	100	ug/L						
Lead	ND	0.1	ug/L						
Manganese	ND	5	ug/L						
Nickel	ND	1	ug/L						
Zinc	ND	5	ug/L						
PCBs									
PCBs, total	ND	0.05	ug/L						
Surrogate: Decachlorobiphenyl	*0.345*		*ug/L*		*69.0*	*60-140*			

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO: Project Description: H346911

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	0.014	0.01	mg/L	0.015			5.5	10	
Total Organic Carbon	6.1	0.5	mg/L	5.6			9.2	33	
Metals									
Mercury	ND	0.1	ug/L	ND			0.0	20	
Arsenic	ND	1	ug/L	ND			0.0	20	
Cadmium	ND	0.1	ug/L	ND			0.0	20	
Chromium	ND	1	ug/L	ND			0.0	20	
Copper	ND	0.5	ug/L	ND				20	
Iron	ND	100	ug/L	ND			0.0	20	
Lead	ND	0.1	ug/L	0.38			0.0	20	
Manganese	26.2	5	ug/L	25.6			2.6	20	
Nickel	ND	1	ug/L	ND			0.0	20	
Zinc	6	5	ug/L	6			0.1	20	

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO: Project Description: H346911

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	524		ug/L	15.3	102	80-120			
Total Organic Carbon	17.4	0.5	mg/L	5.6	118	61-128			
Metals									
Mercury	3.01	0.1	ug/L	ND	100	78-137			
Arsenic	47.0		ug/L	0.06	93.9	80-120			
Cadmium	43.2		ug/L	0.02	86.5	80-120			
Chromium	44.2		ug/L	0.5	87.5	80-120			
Copper	42.6		ug/L	ND	85.1	80-120			
Iron	890		ug/L	8	88.2	80-120			
Lead	50.2		ug/L	0.38	99.6	80-120			
Manganese	67.5		ug/L	25.6	83.8	80-120			
Nickel	41.6		ug/L	0.04	83.2	80-120			
Zinc	49		ug/L	6	85.2	80-120			
PCBs									
PCBs, total	0.815	0.05	ug/L	ND	81.5	60-140			
Surrogate: Decachlorobiphenyl	*0.444*		*ug/L*		*88.8*	*60-140*			

Certificate of Analysis

Report Date: 02-Jun-2015
Order Date:22-May-2015

Client: **Hatch Ltd.**
Client PO: Project Description: H346911

Qualifier Notes:

Sample Qualifiers :

1 : Low surrogate, difficulties during extraction.

Sample Data Revisions

None

Work Order Revisions / Comments:

Please note that the submitted sample was crushed to approximately 1 cm2. The crushed sample was then leached for 24 hours in DI water.

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
(Lab Use Only)

Client Name:	Hatch	Project Reference: H346911	TAT: ✓ Regular ☐ 3 Day ☐ 2 Day ☐ 1 Day
Contact Name:	Noel Boucher / Warren Hoyle	Quote #	
Address:	4342 Queen St., Suite 500 Niagara Falls, ON L2E7J7	PO #	
		Email Address: nboucher@hatch.ca	Date Required:
Telephone:	905-374-5200		

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

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

Paracel Order Number: 1522062 - Bulk Soil 1522063 - H2O

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Metals	PCBs	Receiving water Simulation								
							Required Analyses										
1	GS-1	s		1	May 20, 2015		✓	✓	✓								
2	GS-2	s		1	May 20, 2015		✓	✓	✓								
3	GS-3	s		1	May 20, 2015		✓	✓	✓								
4	GS-4	s		1	May 20, 2015		✓	✓	✓								
5	GS-5	s		1	May 20, 2015		✓	✓	✓								
6	GS-16	s		1	May 20, 2015		✓	✓	✓								
7	GS-17	s		1	May 20, 2015		✓	✓	✓								
8	GS-18	s		1	May 20, 15		✓	✓	✓								
9																	
10																	

Comments: 1. Test for bulk testing according to Reg 153; 2. Recieving water simulation testing; 3. Hold S-1, S-2 and S-3 and GS-19 and GS-20 until further instruction provided by Hatch
4. See attachment regarding Recieving Water Simulation testing sample preparation and testing protocol, GS-18 added as per Warren.

Method of Delivery: drop off

Relinquished By (Sign):	Received by Driver/Depot: Niagara	Received at Lab:	Verified By:
Relinquished By (Print): Noel Boucher	Date/Time: 22 May 15 1140	Date/Time: May 25/15 1:30	Date/Time: May 26/15
Date/Time: May 22/2015 11am	Temperature: 17.0 °C	Temperature: 4.5 °C	pH Verified ☐ By: N/A

On Hold Samples to refer to Report

1-24/2

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Certificate of Analysis

Hatch Ltd.

4342 Queen Street, Suite 500
Niagara Falls, ON L2E 6W1
Attn: Warren Hoyle

Client PO:
Project: H346911
Custody:

Report Date: 2-Nov-2015
Order Date: 26-Oct-2015

Order #: 1544047

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

Paracel ID	Client ID
1544047-01	GS-1

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: **Hatch Ltd.**
Client PO:

Report Date: 02-Nov-2015
Order Date:26-Oct-2015
Project Description: H346911

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 245.1 - Cold Vapour AA	29-Oct-15	29-Oct-15
Metals, ICP-MS	EPA 200.8 - ICP-MS	28-Oct-15	29-Oct-15
Phosphorus, total, water	EPA 365.4 - Auto Colour, digestion	29-Oct-15	2-Nov-15
Total Organic Carbon	MOE 3247B - Combustion IR	28-Oct-15	29-Oct-15

Certificate of Analysis

Report Date: 02-Nov-2015

Client: **Hatch Ltd.**

Order Date:26-Oct-2015

Client PO:

Project Description: H346911

	Client ID:	GS-1	-	-	-
	Sample Date:	20-May-15	-	-	-
	Sample ID:	1544047-01	-	-	-
	MDL/Units	Solid	-	-	-
General Inorganics					
Phosphorus, total	0.01 mg/L	0.01 [2]	-	-	-
Total Organic Carbon	0.5 mg/L	<0.5 [1]	-	-	-
Metals					
Mercury	0.1 ug/L	<0.1 [2]	-	-	-
Arsenic	1 ug/L	<1 [2]	-	-	-
Cadmium	0.1 ug/L	<0.1 [2]	-	-	-
Chromium	1 ug/L	1 [2]	-	-	-
Copper	0.5 ug/L	1.0 [2]	-	-	-
Iron	100 ug/L	500 [2]	-	-	-
Lead	0.1 ug/L	<0.1 [2]	-	-	-
Manganese	5 ug/L	8 [2]	-	-	-
Nickel	1 ug/L	<1 [2]	-	-	-
Zinc	5 ug/L	<5 [2]	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	ND	0.01	mg/L						
Total Organic Carbon	ND	0.5	mg/L						
Metals									
Mercury	ND	0.1	ug/L						
Arsenic	ND	1	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium	ND	1	ug/L						
Copper	ND	0.5	ug/L						
Iron	ND	100	ug/L						
Lead	ND	0.1	ug/L						
Manganese	ND	5	ug/L						
Nickel	ND	1	ug/L						
Zinc	ND	5	ug/L						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	7.11	0.10	mg/L	7.18			1.1	10	
Total Organic Carbon	4.1	0.5	mg/L	3.6			11.7	33	
Metals									
Mercury	ND	0.1	ug/L	ND			0.0	20	
Arsenic	ND	1	ug/L	ND			0.0	20	
Cadmium	ND	0.1	ug/L	ND			0.0	20	
Chromium	ND	1	ug/L	ND			0.0	20	
Copper	ND	0.5	ug/L	ND				20	
Iron	103	100	ug/L	104			1.2	20	
Lead	ND	0.1	ug/L	ND			0.0	20	
Manganese	394	5	ug/L	399			1.3	20	
Nickel	2.5	1	ug/L	2.7			7.9	20	
Zinc	5	5	ug/L	5			0.5	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Phosphorus, total	0.470	0.01	mg/L	ND	94.0	80-120			
Total Organic Carbon	13.7	0.5	mg/L	3.6	101	61-128			
Metals									
Mercury	3.03	0.1	ug/L	ND	101	78-137			
Arsenic	48.1		ug/L	0.4	95.5	80-120			
Cadmium	42.4		ug/L	0.05	84.6	80-120			
Chromium	44.9		ug/L	0.1	89.5	80-120			
Copper	41.1		ug/L	ND	82.2	80-120			
Iron	752		ug/L	ND	75.2	80-120			QM-07
Lead	41.0		ug/L	0.07	81.9	80-120			
Manganese	44.2		ug/L	0.02	88.4	80-120			
Nickel	44.6		ug/L	2.7	83.9	80-120			
Zinc	47		ug/L	5	84.5	80-120			

Qualifier Notes:

Sample Qualifiers :

1 : Holding time had been exceeded upon sample receipt.

2 : This analysis was conducted after the accepted holding time had been exceeded.

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

Please note that the submitted sample was crushed to approximately 1 cm2. The crushed sample was then leached for 24 hours in DI water.

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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Page 1 of 2

Client Name: Hatch	Project Reference: H346911	TAT: ✓ Regular	3 Day
Contact Name: Noel Boucher / Warren Hoyle	Quote #:	2 Day	1 Day
Address: 4342 Queen St. Suite 500 Niagara Falls, ON L2E7J7	PO #:	Date Required:	
Telephone: 905-374-5200	Email Address: nboucher@hatch.ca		

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

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

Paracel Order Number: 1544047

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	Metals	PCBs	Receiving Water Simulation							
1	GS-1	S		1	May 20, 2015		✓	✓	✓							
2	GS-2	S		1	May 20, 2015		✓	✓	✓							
3	GS-3	S		1	May 20, 2015		✓	✓	✓							
4	GS-4	S		1	May 20, 2015		✓	✓	✓							
5	GS-5	S		1	May 20, 2015		✓	✓	✓							
6	GS-16	S		1	May 20, 2015		✓	✓	✓							
7	GS-17	S		1	May 20, 2015		✓	✓	✓							
8	[illegible]	S		1	[illegible]		✓	✓	✓							
9																
10																

Re-analyze per Warren.

Comments: 1. Test for bulk testing according to Reg 153. 2. Recieving water simulation testing. 3. Hold S-1, S-2 and S-3 and GS-16 and GS-20 until further instruction provided by Hatch
4. See attachment regarding Receiving Water Simulation testing sample preparation and testing protocol. [illegible]

Method of Delivery: drop off

Relinquished By (Sign):	Received by Driver/Depot: Niagara	Received at Lab:	Verified By:
Relinquished By (Print): Noel Boucher	Date/Time: [illegible]	Date/Time: [illegible]	Date/Time: Oct 20/15 12:35pm
Date/Time:	Temperature: 7.0 °C	Temperature: 6.9 °C	pH Verified [illegible] By:

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Subcontracted Analysis

Hatch Ltd.
4342 Queen St., Suite 300
Niagara Falls, ON L2E 7J7
Attn: Noel Boucher

Tel: (905) 374-0701
Fax: (905) 374-1157

Paracel Report No **1537040**
Client Project(s): **H346911**
Client PO:
Reference: **#15-433- Hatch- Receiving Water Test- PCB HRGCMS**
CoC Number: **23458**

Order Date: 08-Sep-15
Report Date: 21-Oct-15

Sample(s) from this project were subcontracted for the listed parameters. A copy of the subcontractor's report is attached

Paracel ID	Client ID	Analysis
1537040-07	GS-1	PCBs by HRGC/MS- low level, no congener speciation
1537040-08	GS-2	PCBs by HRGC/MS- low level, no congener speciation
1537040-09	GS-3	PCBs by HRGC/MS- low level, no congener speciation
1537040-10	GS-4	PCBs by HRGC/MS- low level, no congener speciation
1537040-11	GS-5	PCBs by HRGC/MS- low level, no congener speciation
1537040-12	GS-2 Duplicate	PCBs by HRGC/MS- low level, no congener speciation

SAMPLE RECEIPT FORM / CHEMICAL ANALYSIS FORM

FILE #: PR153333

CLIENT: Paracel Laboratories
300-2319 St. Laurent Blvd.
Ottawa, ON
K1G 4J8

Phone: (613) 731-9577
Email: bhomeniek@paracellabs.com

RECEIVED BY: R. Chang
CONDITION: okay, 18.8°C

DATE/TIME: September 17, 2015 (11:58 a.m.)

# of Containers	Sample Type	Sample (Client Codes)	Lab Codes	Test Requested
		Project Number 1537040		
1	Water	GS-1	PR153333	PCB
1	Water	GS-2	PR153334	PCB
1	Water	GS-3	PR153335	PCB
1	Water	GS-4	PR153336	PCB
1	Water	GS-5	PR153337	PCB
1	Water	GS-2 Duplicate	PR153334D	PCB

STORAGE: Stored at 4°C.

ANALYTES: HRGC/HRMS analysis for polychlorinated biphenyls (PCB).

SPECIAL INSTRUCTIONS: none

METHODOLOGY

Reference Method: PCB: SOP LAB02; EPA Method 1668C

Data summarized in Data Report Attached

Report sent to: Beverly Homeniek Date: October 20, 2015

Comments: Results relate only to items tested.

_____

David Hope PChem, CEO

DATA REPORT

Client:	Paracel Labs	Contact:	Beverly Homeniek
Client ID:	GS-1	Date Extracted:	08-Oct-15
PRL ID:	PR153333	Date Analysed:	19-Oct-15

Dioxin-like PCBs				Surrogate	WHO-TEQs	
			DL	Recoveries	(ND=0)	(ND=DL)
Chemical Name	IUPAC #	ng/L	ng/L	%	ng/L	ng/L
3,4,4',5-TeCB	PCB 81	ND	0.02	60	ND	2.00E-06
3,3',4,4'-TeCB	PCB 77	ND	0.02	59	ND	2.00E-06
2,3',4,4',5'-PeCB	PCB 123	ND	0.02	26	ND	2.00E-06
2,3',4,4',5-PeCB	PCB 118	ND	0.02	26	ND	2.00E-06
2,3,4,4',5-PeCB	PCB 114	ND	0.02	27	ND	1.00E-05
2,3,3',4,4'-PeCB	PCB 105	ND	0.02	26	ND	2.00E-06
3,3',4,4',5-PeCB	PCB 126	ND	0.02	30	ND	2.00E-03
2,3',4,4',5,5'-HxCB	PCB 167	ND	0.02	48	ND	2.00E-07
2,3,3',4,4',5-HxCB	PCB 156	ND	0.02	42	ND	1.00E-05
2,3,3',4,4',5'-HxCB	PCB 157	ND	0.02	43	ND	1.00E-05
3,3',4,4',5,5'-HxCB	PCB 169	ND	0.02	39	ND	2.00E-04
2,3,3',4,4',5,5'-HpCB	PCB 189	ND	0.02	49	ND	2.00E-06
		Toxic Equivalent (WHO-TEQ)			0.00E+00	2.24E-03

Total PCB		
		DL
Homologs	ng/L	ng/L
Monochlorobiphenyls	ND	0.05
Dichlorobiphenyls	0.063	0.05
Trichlorobiphenyls	ND	0.05
Tetrachlorobiphenyls	0.56	0.05
Pentachlorobiphenyls	ND	0.05
Hexachlorobiphenyls	ND	0.05
Heptachlorobiphenyls	ND	0.05
Octachlorobiphenyls	ND	0.05
Nonachlorobiphenyls	ND	0.05
Decachlorobiphenyl	ND	0.05
Total PCB	0.62	

ND - none detected

Surrogate Recoveries		
Chemical Name	IUPAC #	%
$^{13}C_{12}$-2-MoCB	1L	14
$^{13}C_{12}$-4,4'-DiCB	15L	42
$^{13}C_{12}$-2,2',6'-TrCB	19L	43
$^{13}C_{12}$-3,4,4'-TrCB	37L	29
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	26
$^{13}C_{12}$-2,2',4,6,6'-PeCB	104L	31
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	31
$^{13}C_{12}$-2,2',3,4',5,6,6'-HpCB	188L	39
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-OcCB	202L	41
$^{13}C_{12}$-2,3,3',4,4',5,5',6-OcCB	205L	48
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	44
$^{13}C_{12}$-DeCB	209L	39

DATA REPORT

Client:	Paracel Labs	Contact:	Beverly Homeniek
Client ID:	GS-2	Date Extracted:	08-Oct-15
PRL ID:	PR153334	Date Analysed:	19-Oct-15

Dioxin-like PCBs				Surrogate	WHO-TEQs	
			DL	Recoveries	(ND=0)	(ND=DL)
Chemical Name	IUPAC #	ng/L	ng/L	%	ng/L	ng/L
3,4,4',5-TeCB	PCB 81	ND	0.02	101	ND	2.00E-06
3,3',4,4'-TeCB	PCB 77	ND	0.02	102	ND	2.00E-06
2,3',4,4',5'-PeCB	PCB 123	ND	0.02	45	ND	2.00E-06
2,3',4,4',5-PeCB	PCB 118	ND	0.02	45	ND	2.00E-06
2,3,4,4',5-PeCB	PCB 114	ND	0.02	57	ND	1.00E-05
2,3,3',4,4'-PeCB	PCB 105	ND	0.02	55	ND	2.00E-06
3,3',4,4',5-PeCB	PCB 126	ND	0.02	52	ND	2.00E-03
2,3',4,4',5,5'-HxCB	PCB 167	ND	0.02	91	ND	2.00E-07
2,3,3',4,4',5-HxCB	PCB 156	ND	0.02	84	ND	1.00E-05
2,3,3',4,4',5'-HxCB	PCB 157	ND	0.02	88	ND	1.00E-05
3,3',4,4',5,5'-HxCB	PCB 169	ND	0.02	98	ND	2.00E-04
2,3,3',4,4',5,5'-HpCB	PCB 189	ND	0.02	72	ND	2.00E-06
		Toxic Equivalent (WHO-TEQ)			0.00E+00	2.24E-03

Total PCB		
		DL
Homologs	ng/L	ng/L
Monochlorobiphenyls	ND	0.05
Dichlorobiphenyls	ND	0.05
Trichlorobiphenyls	ND	0.05
Tetrachlorobiphenyls	ND	0.05
Pentachlorobiphenyls	ND	0.05
Hexachlorobiphenyls	ND	0.05
Heptachlorobiphenyls	ND	0.05
Octachlorobiphenyls	ND	0.05
Nonachlorobiphenyls	ND	0.05
Decachlorobiphenyl	ND	0.05
Total PCB	ND	

ND - none detected

Surrogate Recoveries		
Chemical Name	IUPAC #	%
$^{13}C_{12}$-2-MoCB	1L	28
$^{13}C_{12}$-4,4'-DiCB	15L	56
$^{13}C_{12}$-2,2',6'-TrCB	19L	61
$^{13}C_{12}$-3,4,4'-TrCB	37L	47
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	41
$^{13}C_{12}$-2,2',4,6,6'-PeCB	104L	46
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	48
$^{13}C_{12}$-2,2',3,4',5,6,6'-HpCB	188L	67
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-OcCB	202L	76
$^{13}C_{12}$-2,3,3',4,4',5,5',6-OcCB	205L	87
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	82
$^{13}C_{12}$-DeCB	209L	66

DATA REPORT

Client:	Paracel Labs	Contact:	Beverly Homeniek
Client ID:	GS-2 Duplicate	Date Extracted:	08-Oct-15
PRL ID:	PR153334D	Date Analysed:	19-Oct-15

Dioxin-like PCBs				Surrogate	WHO-TEQs	
			DL	Recoveries	(ND=0)	(ND=DL)
Chemical Name	IUPAC #	ng/L	ng/L	%	ng/L	ng/L
3,4,4',5-TeCB	PCB 81	ND	0.02	86	ND	2.00E-06
3,3',4,4'-TeCB	PCB 77	ND	0.02	89	ND	2.00E-06
2,3',4,4',5'-PeCB	PCB 123	ND	0.02	47	ND	2.00E-06
2,3',4,4',5-PeCB	PCB 118	ND	0.02	46	ND	2.00E-06
2,3,4,4',5-PeCB	PCB 114	ND	0.02	57	ND	1.00E-05
2,3,3',4,4'-PeCB	PCB 105	ND	0.02	48	ND	2.00E-06
3,3',4,4',5-PeCB	PCB 126	ND	0.02	51	ND	2.00E-03
2,3',4,4',5,5'-HxCB	PCB 167	ND	0.02	80	ND	2.00E-07
2,3,3',4,4',5-HxCB	PCB 156	ND	0.02	79	ND	1.00E-05
2,3,3',4,4',5'-HxCB	PCB 157	ND	0.02	80	ND	1.00E-05
3,3',4,4',5,5'-HxCB	PCB 169	ND	0.02	85	ND	2.00E-04
2,3,3',4,4',5,5'-HpCB	PCB 189	ND	0.02	74	ND	2.00E-06
		Toxic Equivalent (WHO-TEQ)			0.00E+00	2.24E-03

Total PCB		
		DL
Homologs	ng/L	ng/L
Monochlorobiphenyls	ND	0.05
Dichlorobiphenyls	ND	0.05
Trichlorobiphenyls	ND	0.05
Tetrachlorobiphenyls	ND	0.05
Pentachlorobiphenyls	ND	0.05
Hexachlorobiphenyls	ND	0.05
Heptachlorobiphenyls	ND	0.05
Octachlorobiphenyls	ND	0.05
Nonachlorobiphenyls	ND	0.05
Decachlorobiphenyl	ND	0.05
Total PCB	ND	

ND - none detected

Surrogate Recoveries		
Chemical Name	IUPAC #	%
$^{13}C_{12}$-2-MoCB	1L	35
$^{13}C_{12}$-4,4'-DiCB	15L	55
$^{13}C_{12}$-2,2',6'-TrCB	19L	57
$^{13}C_{12}$-3,4,4'-TrCB	37L	51
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	43
$^{13}C_{12}$-2,2',4,6,6'-PeCB	104L	45
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	43
$^{13}C_{12}$-2,2',3,4',5,6,6'-HpCB	188L	62
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-OcCB	202L	69
$^{13}C_{12}$-2,3,3',4,4',5,5',6-OcCB	205L	75
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	67
$^{13}C_{12}$-DeCB	209L	54

DATA REPORT

Client:	Paracel Labs	Contact:	Beverly Homeniek
Client ID:	GS-3	Date Extracted:	08-Oct-15
PRL ID:	PR153335	Date Analysed:	19-Oct-15

Dioxin-like PCBs				Surrogate	WHO-TEQs	
			DL	Recoveries	(ND=0)	(ND=DL)
Chemical Name	IUPAC #	ng/L	ng/L	%	ng/L	ng/L
3,4,4',5-TeCB	PCB 81	ND	0.02	86	ND	2.00E-06
3,3',4,4'-TeCB	PCB 77	ND	0.02	90	ND	2.00E-06
2,3',4,4',5'-PeCB	PCB 123	ND	0.02	43	ND	2.00E-06
2,3',4,4',5-PeCB	PCB 118	ND	0.02	42	ND	2.00E-06
2,3,4,4',5-PeCB	PCB 114	ND	0.02	50	ND	1.00E-05
2,3,3',4,4'-PeCB	PCB 105	ND	0.02	44	ND	2.00E-06
3,3',4,4',5-PeCB	PCB 126	ND	0.02	46	ND	2.00E-03
2,3',4,4',5,5'-HxCB	PCB 167	ND	0.02	100	ND	2.00E-07
2,3,3',4,4',5-HxCB	PCB 156	ND	0.02	84	ND	1.00E-05
2,3,3',4,4',5'-HxCB	PCB 157	ND	0.02	88	ND	1.00E-05
3,3',4,4',5,5'-HxCB	PCB 169	ND	0.02	95	ND	2.00E-04
2,3,3',4,4',5,5'-HpCB	PCB 189	ND	0.02	69	ND	2.00E-06
		Toxic Equivalent (WHO-TEQ)			0.00E+00	2.24E-03

Total PCB		
		DL
Homologs	ng/L	ng/L
Monochlorobiphenyls	ND	0.05
Dichlorobiphenyls	ND	0.05
Trichlorobiphenyls	ND	0.05
Tetrachlorobiphenyls	ND	0.05
Pentachlorobiphenyls	ND	0.05
Hexachlorobiphenyls	ND	0.05
Heptachlorobiphenyls	ND	0.05
Octachlorobiphenyls	ND	0.05
Nonachlorobiphenyls	ND	0.05
Decachlorobiphenyl	ND	0.05
Total PCB	ND	

ND - none detected

Surrogate Recoveries		
Chemical Name	IUPAC #	%
$^{13}C_{12}$-2-MoCB	1L	34
$^{13}C_{12}$-4,4'-DiCB	15L	56
$^{13}C_{12}$-2,2',6'-TrCB	19L	61
$^{13}C_{12}$-3,4,4'-TrCB	37L	44
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	42
$^{13}C_{12}$-2,2',4,6,6'-PeCB	104L	48
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	52
$^{13}C_{12}$-2,2',3,4',5,6,6'-HpCB	188L	66
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-OcCB	202L	76
$^{13}C_{12}$-2,3,3',4,4',5,5',6-OcCB	205L	77
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	75
$^{13}C_{12}$-DeCB	209L	58

DATA REPORT

Client:	Paracel Labs	Contact:	Beverly Homeniek
Client ID:	GS-4	Date Extracted:	08-Oct-15
PRL ID:	PR153336	Date Analysed:	19-Oct-15

Dioxin-like PCBs				Surrogate	WHO-TEQs	
			DL	Recoveries	(ND=0)	(ND=DL)
Chemical Name	IUPAC #	ng/L	ng/L	%	ng/L	ng/L
3,4,4',5-TeCB	PCB 81	ND	0.02	79	ND	2.00E-06
3,3',4,4'-TeCB	PCB 77	ND	0.02	81	ND	2.00E-06
2,3',4,4',5'-PeCB	PCB 123	ND	0.02	41	ND	2.00E-06
2,3',4,4',5-PeCB	PCB 118	ND	0.02	39	ND	2.00E-06
2,3,4,4',5-PeCB	PCB 114	ND	0.02	52	ND	1.00E-05
2,3,3',4,4'-PeCB	PCB 105	ND	0.02	46	ND	2.00E-06
3,3',4,4',5-PeCB	PCB 126	ND	0.02	46	ND	2.00E-03
2,3',4,4',5,5'-HxCB	PCB 167	ND	0.02	80	ND	2.00E-07
2,3,3',4,4',5-HxCB	PCB 156	ND	0.02	75	ND	1.00E-05
2,3,3',4,4',5'-HxCB	PCB 157	ND	0.02	76	ND	1.00E-05
3,3',4,4',5,5'-HxCB	PCB 169	ND	0.02	81	ND	2.00E-04
2,3,3',4,4',5,5'-HpCB	PCB 189	ND	0.02	72	ND	2.00E-06
		Toxic Equivalent (WHO-TEQ)			0.00E+00	2.24E-03

Total PCB		
		DL
Homologs	ng/L	ng/L
Monochlorobiphenyls	ND	0.05
Dichlorobiphenyls	ND	0.05
Trichlorobiphenyls	ND	0.05
Tetrachlorobiphenyls	ND	0.05
Pentachlorobiphenyls	ND	0.05
Hexachlorobiphenyls	ND	0.05
Heptachlorobiphenyls	ND	0.05
Octachlorobiphenyls	ND	0.05
Nonachlorobiphenyls	ND	0.05
Decachlorobiphenyl	ND	0.05
Total PCB	ND	

ND - none detected

Surrogate Recoveries		
Chemical Name	IUPAC #	%
$^{13}C_{12}$-2-MoCB	1L	35
$^{13}C_{12}$-4,4'-DiCB	15L	53
$^{13}C_{12}$-2,2',6'-TrCB	19L	65
$^{13}C_{12}$-3,4,4'-TrCB	37L	43
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	43
$^{13}C_{12}$-2,2',4,6,6'-PeCB	104L	49
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	48
$^{13}C_{12}$-2,2',3,4',5,6,6'-HpCB	188L	61
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-OcCB	202L	66
$^{13}C_{12}$-2,3,3',4,4',5,5',6-OcCB	205L	73
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	70
$^{13}C_{12}$-DeCB	209L	57

DATA REPORT

Client:	Paracel Labs	Contact:	Beverly Homeniek
Client ID:	GS-5	Date Extracted:	08-Oct-15
PRL ID:	PR153337	Date Analysed:	18-Oct-15

Dioxin-like PCBs				Surrogate	WHO-TEQs	
			DL	Recoveries	(ND=0)	(ND=DL)
Chemical Name	IUPAC #	ng/L	ng/L	%	ng/L	ng/L
3,4,4',5-TeCB	PCB 81	ND	0.02	94	ND	2.00E-06
3,3',4,4'-TeCB	PCB 77	ND	0.02	102	ND	2.00E-06
2,3',4,4',5'-PeCB	PCB 123	ND	0.02	41	ND	2.00E-06
2,3',4,4',5-PeCB	PCB 118	ND	0.02	40	ND	2.00E-06
2,3,4,4',5-PeCB	PCB 114	ND	0.02	49	ND	1.00E-05
2,3,3',4,4'-PeCB	PCB 105	ND	0.02	43	ND	2.00E-06
3,3',4,4',5-PeCB	PCB 126	ND	0.02	46	ND	2.00E-03
2,3',4,4',5,5'-HxCB	PCB 167	ND	0.02	86	ND	2.00E-07
2,3,3',4,4',5-HxCB	PCB 156	ND	0.02	81	ND	1.00E-05
2,3,3',4,4',5'-HxCB	PCB 157	ND	0.02	86	ND	1.00E-05
3,3',4,4',5,5'-HxCB	PCB 169	ND	0.02	89	ND	2.00E-04
2,3,3',4,4',5,5'-HpCB	PCB 189	ND	0.02	71	ND	2.00E-06
		Toxic Equivalent (WHO-TEQ)			0.00E+00	2.24E-03

Total PCB		
		DL
Homologs	ng/L	ng/L
Monochlorobiphenyls	ND	0.05
Dichlorobiphenyls	ND	0.05
Trichlorobiphenyls	ND	0.05
Tetrachlorobiphenyls	ND	0.05
Pentachlorobiphenyls	ND	0.05
Hexachlorobiphenyls	ND	0.05
Heptachlorobiphenyls	ND	0.05
Octachlorobiphenyls	ND	0.05
Nonachlorobiphenyls	ND	0.05
Decachlorobiphenyl	ND	0.05
Total PCB	ND	

ND - none detected

Surrogate Recoveries		
Chemical Name	IUPAC #	%
$^{13}C_{12}$-2-MoCB	1L	29
$^{13}C_{12}$-4,4'-DiCB	15L	58
$^{13}C_{12}$-2,2',6'-TrCB	19L	66
$^{13}C_{12}$-3,4,4'-TrCB	37L	40
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	43
$^{13}C_{12}$-2,2',4,6,6'-PeCB	104L	46
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	53
$^{13}C_{12}$-2,2',3,4',5,6,6'-HpCB	188L	74
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-OcCB	202L	82
$^{13}C_{12}$-2,3,3',4,4',5,5',6-OcCB	205L	83
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	82
$^{13}C_{12}$-DeCB	209L	71

QC REPORT - BLANK

Client:	Paracel Labs	Contact:	Beverly Homeniek
Client ID:	BLANK	Date Extracted:	08-Oct-15
PRL ID:	PC151063B	Date Analysed:	17-Oct-15

Dioxin-like PCBs				Surrogate	WHO-TEQs	
			DL	Recoveries	(ND=0)	(ND=DL)
Chemical Name	IUPAC #	ng/L	ng/L	%	ng/L	ng/L
3,4,4',5-TeCB	PCB 81	ND	0.02	87	ND	2.00E-06
3,3',4,4'-TeCB	PCB 77	ND	0.02	88	ND	2.00E-06
2,3',4,4',5'-PeCB	PCB 123	ND	0.02	41	ND	2.00E-06
2,3',4,4',5-PeCB	PCB 118	ND	0.02	45	ND	2.00E-06
2,3,4,4',5-PeCB	PCB 114	ND	0.02	61	ND	1.00E-05
2,3,3',4,4'-PeCB	PCB 105	ND	0.02	44	ND	2.00E-06
3,3',4,4',5-PeCB	PCB 126	ND	0.02	49	ND	2.00E-03
2,3',4,4',5,5'-HxCB	PCB 167	ND	0.02	94	ND	2.00E-07
2,3,3',4,4',5-HxCB	PCB 156	ND	0.02	87	ND	1.00E-05
2,3,3',4,4',5'-HxCB	PCB 157	ND	0.02	90	ND	1.00E-05
3,3',4,4',5,5'-HxCB	PCB 169	ND	0.02	97	ND	2.00E-04
2,3,3',4,4',5,5'-HpCB	PCB 189	ND	0.02	95	ND	2.00E-06
		Toxic Equivalent (WHO-TEQ)			0.00E+00	2.24E-03

Total PCB		
		DL
Homologs	ng/L	ng/L
Monochlorobiphenyls	ND	0.05
Dichlorobiphenyls	ND	0.05
Trichlorobiphenyls	ND	0.05
Tetrachlorobiphenyls	ND	0.05
Pentachlorobiphenyls	ND	0.05
Hexachlorobiphenyls	ND	0.05
Heptachlorobiphenyls	ND	0.05
Octachlorobiphenyls	ND	0.05
Nonachlorobiphenyls	ND	0.05
Decachlorobiphenyl	ND	0.05
Total PCB	ND	

ND - none detected

Surrogate Recoveries		
Chemical Name	IUPAC #	%
$^{13}C_{12}$-2-MoCB	1L	25
$^{13}C_{12}$-4,4'-DiCB	15L	51
$^{13}C_{12}$-2,2',6'-TrCB	19L	41
$^{13}C_{12}$-3,4,4'-TrCB	37L	38
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	44
$^{13}C_{12}$-2,2',4,6,6'-PeCB	104L	46
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	46
$^{13}C_{12}$-2,2',3,4',5,6,6'-HpCB	188L	53
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-OcCB	202L	49
$^{13}C_{12}$-2,3,3',4,4',5,5',6-OcCB	205L	84
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	69
$^{13}C_{12}$-DeCB	209L	61

Acronyms used in reporting Polychlorinated Biphenyls (PCBs)

MoCB = Monochlorobiphenyl
DiCB = Dichlorobiphenyl
TrCB = Trichlorobiphenyl
TeCB = Tetrachlorobiphenyl
PeCB = Pentachlorobiphenyl
HxCB = Hexachlorobiphenyl
HpCB = Heptachlorobiphenyl
OcCB = Octachlorobiphenyl
NoCB = Nonachlorobiphenyl
DeCB = Decachlorobiphenyl

Acceptable recoveries for PCB Internal Standards - EPA 1668C

Chemical Name	IUPAC #	Min	Max
$^{13}C_{12}$-2-MoCB	1L	5	145
$^{13}C_{12}$-4-MoCB	3L	5	145
$^{13}C_{12}$-2,2'-DiCB	4L	5	145
$^{13}C_{12}$-4,4'-DiCB	15L	5	145
$^{13}C_{12}$-2,2',6'-TrCB	19L	5	145
$^{13}C_{12}$-3,4,4'-TrCB	37L	5	145
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	5	145
$^{13}C_{12}$-3,4,4',5-TeCB	81L	10	145
$^{13}C_{12}$-3,3',4,4'-TeCB	77L	10	145
$^{13}C_{12}$-2,2',4,6,6'-PeCB	104L	10	145
$^{13}C_{12}$-2',3,4,4',5-PeCB	123L	10	145
$^{13}C_{12}$-2,3',4,4',5-PeCB	118L	10	145
$^{13}C_{12}$-2,3,4,4',5-PeCB	114L	10	145
$^{13}C_{12}$-2,3,3',4,4'-PeCB	105L	10	145
$^{13}C_{12}$-3,3',4,4',5-PeCB	126L	10	145
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	10	145
$^{13}C_{12}$-2,3',4,4',5,5'-HxCB	167L	10	145
$^{13}C_{12}$-2,3,3',4,4',5-HxCB	156L	10	145
$^{13}C_{12}$-2,3,3',4,4',5'-HxCB	157L	10	145
$^{13}C_{12}$-3,3',4,4',5,5'-HxCB	169L	10	145
$^{13}C_{12}$-2,2',3,4',5,6,6'-HpCB	188L	10	145
$^{13}C_{12}$-2,3,3',4,4',5,5'-HpCB	189L	10	145
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-OcCB	202L	10	145
$^{13}C_{12}$-2,3,3',4,4',5,5',6-OcCB	205L	10	145
$^{13}C_{12}$-2,2',3,3',4',5,5',6,6'-NoCB	208L	10	145
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	10	145
$^{13}C_{12}$-DeCB	209L	10	145
$^{13}C_{12}$-2,4,4'-TrCB	28L	5	145
$^{13}C_{12}$-2,3,3',5,5'-PeCB	111L	10	145
$^{13}C_{12}$-2,2',3,3',5,5',6-HpCB	178L	10	145

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December 9, 2015

Jerry Klymenko
Senior Plant Engineer - Northwest Operations
Ontario Power Generation
167 Burwood Road
Thunder Bay, ON P7B 6T7

Dear Mr. Klymenko:

Subject: Assessment Work Completed on Mining Claim No. TB 4276033

Hatch Ltd. (Hatch) was retained by Ontario Power Generation (OPG) to provide engineering and environmental services for the proposed Gull Bay Shoreline Stabilization Project. A component of those services involved the completion of assessment work within the area of Mining Claim No. TB 4276033 to verify that rock from the area is physically and chemically suitable for use as unconfined fill in the proposed shoreline stabilization feature. In addition, a Stage 1 Archaeological Assessment was completed within the proposed quarry area.

This letter summarizes the work that has been completed to date to assess the chemical and physical characteristics of the rock within the claim area, as well as the associated costs for each assessment component.

Physical Testing

OPG staff collected approximately 30 kg of rock from the claim area and shipped it to Hatch's Niagara Falls office in August 2015. Hatch submitted this rock to the AMEC Foster Wheeler Geotechnical Laboratory for testing of a number of parameters as outlined in Table 1. This testing was required to ensure the rock has sufficient durability and other physical characteristics to meet the design criteria for use as rock fill within the stabilization structure and rip rap on the outer shell of the stabilization structure. Material not meeting the design criteria may not be suitable for use in the shoreline stabilization structure, since it could degrade, erode, break-down or move which could cause failure of the stabilization feature. Failure of the feature could potentially result in significant negative social and environmental effects.

Table 1 Physical Tests Completed on Rock from the Claim Area

Test	Purpose of Test
Micro-Deval Abrasion Loss (Coarse)	• To determine loss of material due to abrasion in the presence of water and an abrasive charge • Rock with high abrasion loss would not be suitable for long-term placement within a shoreline stabilization

Test	Purpose of Test
	feature
Magnesium Sulfate Soundness	• To determine a material's resistance to disintegration by weathering and in particular, freeze-thaw cycles. • Rocks must be sufficiently resistant to weathering to avoid premature degradation which would decrease the useful life of the stabilization structure.
Relative Density	• To test the density of the rock compared to water to ensure it is a sufficient mass for the intended purpose (i.e. must be sufficient mass to resist movement due to wave and ice forces).
Absorption	• To test the absorption of the rock material (i.e. the increase in mass due to water in the pores) • High absorption can be indicative of non-durable rock.
Unconfined Freeze-Thaw Loss	• To test the resistance to loss upon freeze-thaw cycles, which is particularly important for durability of rocks in northern Ontario.

The testing (submitted to Hatch by Amec Foster Wheeler as File No. TB152049, dated October 16, 2015) confirmed that the rock was within the material specifications and therefore suitable for use in the shoreline stabilization feature.

The laboratory costs of the testing were $665 and the Hatch labour cost associated with preparation of the rock for testing, follow up with the laboratory and review of the results was $500, for a total cost of $1,165.

Chemical Testing

Hatch completed a chemical testing program on rock from the claim area in spring and summer 2015. The testing was completed to ensure that the rocks from the area comply with the requirements of the Ministry of the Environment and Climate Change (MOECC) *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* (2011). This guide is used to determine the chemical properties of fill material to assess if the material has the potential to cause negative effects to the environment (e.g. water quality, sediment quality, aquatic biota) when used as lake filling material, such as for the proposed shoreline stabilization feature.

A total of 15 samples of rock were collected from locations throughout the claim area in May 2015. A total of 5 of these samples were submitted to an accredited laboratory (Paracel Laboratories) to complete the following tests:

- Bulk Chemical Analysis
  - Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Zinc, Total Phosphorus and PCBs
- Receiving Water Simulation Test
  - Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Zinc, Total Phosphorus and PCBs (low level to meet Provincial Water Quality Objectives)

None of the samples from the rock quarry exceeded any of the PWQO criteria from the Receiving Water Simulation Test; therefore these sample results indicate that the material is considered to be suitable for use as unconfined fill for the shoreline stabilization project. A report (Hatch Report No. H346911-0000-07-124-0007) was prepared documenting the results of the assessment.

The costs for the collection, analysis and reporting of chemical quality of rocks from the claim area was $15,750, broken down as follows:

- Collection Costs - $3,000
- Laboratory Analysis Costs
  - Bulk Chemical Analysis $1,400
  - Receiving Water Simulation - $1,150
  - PCB Testing - $5,600
- Report Preparation - $4,600

Preliminary chemical testing was also completed by Hatch in the claim area in 2013. This involved collection of a sample of rock from the quarry and testing for bulk chemical analysis and the receiving water simulation test to provide a preliminary understanding of the potential suitability of the material for use as unconfined lake fill. The estimated cost for this preliminary testing, including collection, laboratory and analysis of results was $6,000.

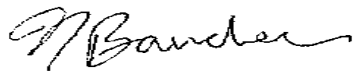
Stage 1 Archaeological Assessment

Hatch Ltd. retained Northwest Archaeological Assessments (NAA) on behalf of OPG to complete a Stage 1 Archaeological Assessment of the proposed quarry area for inclusion as part of the application for an Aggregate Permit from the Ontario of Ministry of Natural Resources and Forestry (MNRF). The report prepared by NAA (Stage 1 archaeological assessment: Proposed Category 11 Quarry for Gull Bay First Nation Shoreline Stabilisation, Unorganised Township, District of Thunder Bay), dated January 30, 2014, concluded that there were no areas of archaeological potential within the proposed quarry area and as such, no further archaeological assessment was recommended. This report was reviewed and entered into the Ontario Public Register of Archaeological Reports by the Ontario Ministry of Tourism, Culture and Sport (under Project Information Form Number P236-0021-2013). The cost for the Stage 1 Archaeological Assessment work was $2,950.

Jerry Klymenko
Senior Plant Engineer - Northwest Operations
Ontario Power Generation
December 9, 2015

I trust this provides the information you require regarding the physical and chemical assessment work completed on rock from within the claim area, as well as the Stage 1 Archaeological Assessment.

Yours faithfully,



Noel Boucher

NB:nb

cc: M. de Prophetis, OPG
S. Kaszuba, OPG

16 October 2015
File: TB152049

Hatch Ltd.
4342 Queen St., Suite 500
Niagara Falls, ON
L2E 7J7 Canada

Attention: Mr. Warren R. Hoyle, P.Geo.

RE: PHYSICAL TESTING OF QUARRY ROCK FOR USE AS RIP RAP AND ROCK-FILL ONTARIO POWER GENERATION, GULL BAY SHORELINE STABILIZATION PROJECT (H346911)

1.0 INTRODUCTION

We are pleased to present the results of our Amec Foster Wheeler Hamilton laboratory testing conducted on rock lump samples provided by HATCH Limited (HATCH).It is understood the rock lump samples were sampled by a representative of Hatch and were received in our laboratory on 2 October 2015.

2.0 METHODLOGY

A total of 30.4kg of rock grab samples (4-5 inch) were provided for physical durability testing. The aggregate was crushed using a laboratory crusher at Amec Foster Wheeler Hamilton Laboratory. The material was crushed to produce a 19mm coarse aggregate to be tested. The following tests were conducted on the 19mm stone sample:

Micro-Deval Abrasion Loss (Coarse)	(ASTM C-535)
Magnesium Sulfate Soundness	(ASTM C-88)
Relative Density and Absorption	(ASTM C-127)
Unconfined Freeze-Thaw Loss	(LS 614)

The results of testing are summarized in Table 1.

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a Division of Amec Foster Wheeler Americas Limited
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Hamilton, Ontario
Canada L8H 6N6
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Hatch Ltd.
4342 Queen St., Suite 500
Niagara Falls, ON
L2E 7J7 Canada

3.0 RESULTS

Table 1. Results of the Physical Testing Crushed Aggregate Sample

Test Required	Test Method	Laboratory Test Results	Required Results
Relative Density (Specific Gravity)	ASTM C127	**3.025**	2.65 Minimum
Absorption (%)	ASTM C127	**0.37**	2% Maximum
Magnesium Sulfate Soundness (% loss)	ASTM C88	**0.6**	10% loss Maximum
Micro-Deval Abrasion (% loss)	ASTM D6928	**7.1**	40% loss
Unconfined Freeze-Thaw (% loss)	MTO LS614	**1.3**	10% loss Maximum

4.0 CONCLUSION

Based on the physical testing completed on the crushed rock lump sample the material meets the specifications provided to our office from the client, Hatch.

Please contact us if you have any questions, or if we can be of further service evaluating aggregate sources.

Regards,

Amec Foster Wheeler Environment & Infrastructure
Division of Amec Foster Wheeler Americas Limited

Reviewed by,

for Graeme Lowry
Soils & Aggregate Laboratory Supervisor

Little Martin
Senior Geoscientist

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Ontario Power Generation Inc.

Rock Quality Comparison for Shoreline Erosion Protection Design

For

Gull Bay First Nation

Shoreline Erosion Project

H345586-0000-07-124-0001
Rev. A
May 1, 2014

Report

Rock Quality Comparison for Shoreline Erosion Protection Design

H345586-0000-07-124-0001

2014-05-01	**A**	**Client Review**	**D. Oram**	**W. Hoyle**	**N. Boucher**	**As Required**
DATE	**REV.**	**STATUS**	**PREPARED BY**	**CHECKED BY**	**APPROVED BY**	**APPROVED BY**
				Discipline Lead	**Functional Manager**	**Choose Approver**

Disclaimer

This report has been prepared by Hatch Ltd. (Hatch) for the sole and exclusive use of Ontario Power Generation Inc. (the “Client”) for the purpose of assisting the Client to manage and make decisions with respect to the Gull Bay Shoreline Erosion Protection Project at the Kiashke Zaaging Anishinaabek First Nation (KZA) community, Gull Bay, Ontario, and shall not be (a) used for any other purpose, or (b) provided to, relied upon or used by any third party.

This report contains opinions and recommendations made by Hatch, using its professional judgment and reasonable care. Use of or reliance upon this report by Client is subject to the following conditions:

1. The report being read in the context of and subject to the terms of the agreement between Hatch and the Client dated October 17, 2013 (the “Agreement”), including any methodologies, procedures, techniques, assumptions and other relevant terms or conditions that were specified or agreed therein.
2. The report being read as a whole, with sections or parts hereof read or relied upon in context.
3. The conditions of the site may change over time or may have already changed due to natural forces or human intervention and Hatch takes no responsibility for the impact that such changes may have on the accuracy or validity or the observations, conclusions and recommendations set out in this report.
4. The report is based on information made available to Hatch by the Client or by certain third parties and unless stated otherwise in the Agreement, Hatch has not verified the accuracy, completeness or validity of such information, makes no representation regarding its accuracy and hereby disclaims any liability in connection therewith.

Table of Contents

List of Tables

List of Figures

List of Appendices

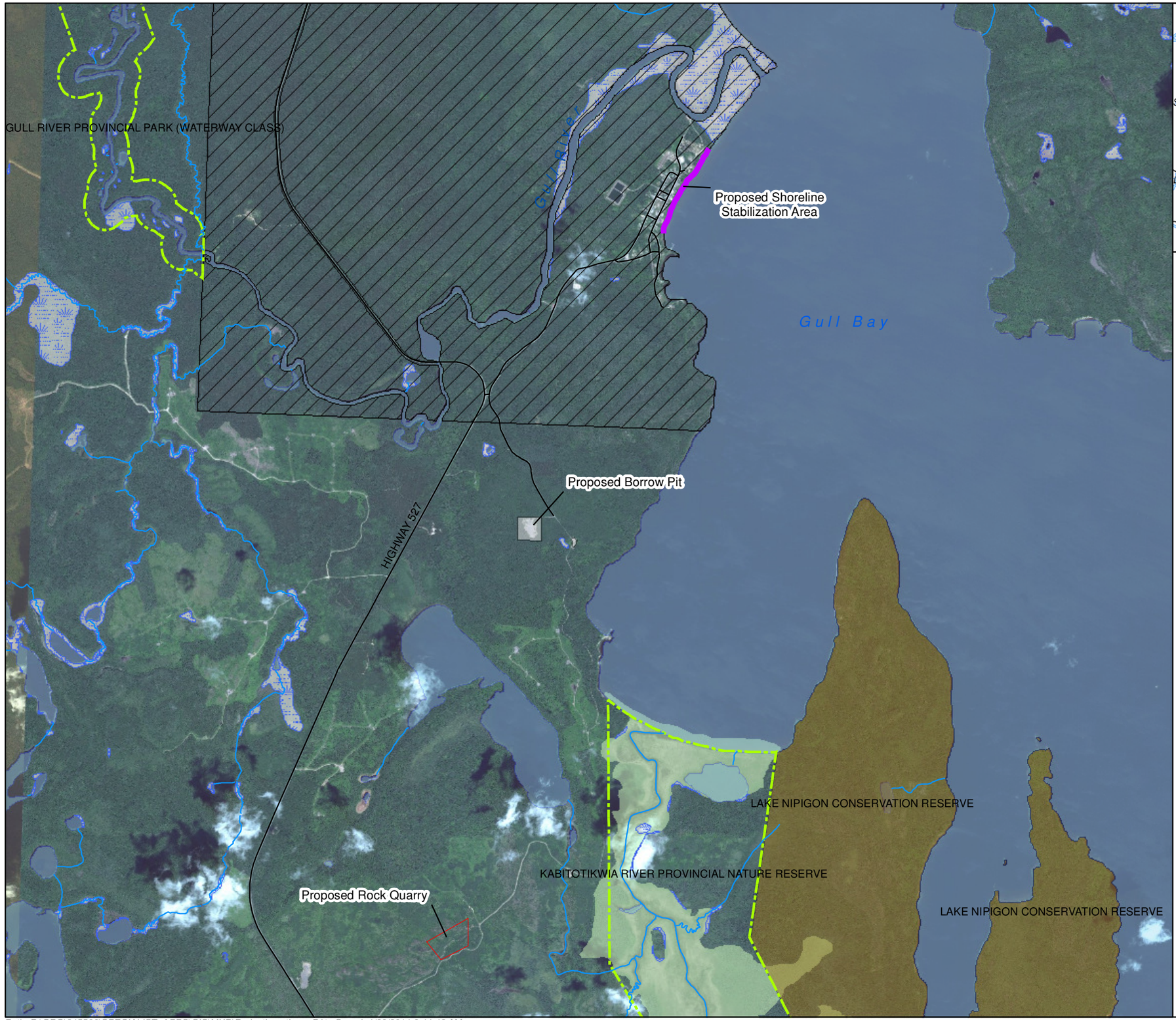
1. Introduction

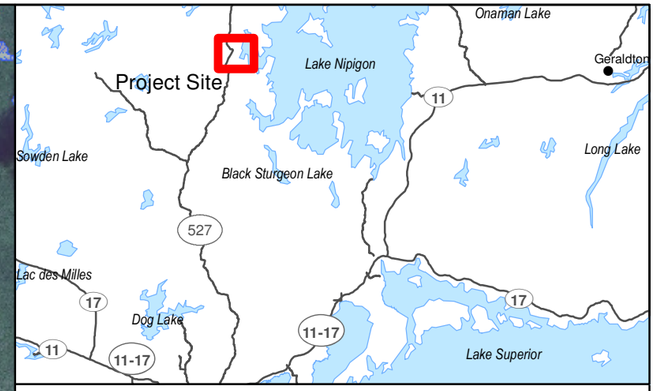
1.1 Terms of Reference

On behalf of Ontario Power Generation Inc. (OPG), Hatch Ltd. (Hatch) conducted an independent study as part of the Shoreline Erosion Protection Upgrade Project at Gull Bay, Ontario (Figure 1-1). The area under investigation is on the shores of Gull Bay (Lake Nipigon) at the Kiashke Zaaging Anishinaabek (KZA) First Nation community where previously installed riprap is in poor condition and provides limited shoreline erosion protection. OPG has entered into an agreement with KZA to implement shoreline erosion protection measures to prevent further erosion of the community shoreline. As part of this study, Hatch carried out an investigation on November 12, 2013 at three potential material source locations for the granular and riprap materials.

1.2 Scope of Work

The purpose of the site visit was to obtain samples of material at these three locations and conduct laboratory testing on them to determine the environmental suitability of the material as a source for the shoreline erosion protection works. This report summarizes the findings from the laboratory testing program with respect to the Ministry of Environment's (MOE)'s *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* (Ministry of the Environment, 2011).





LEGEND

- Road
- Shoreline Stabilization Area
- Watercourse
- Authorized Aggregate Site
- Conservation Reserve
- First Nation Reserve
- Provincial Park
- Waterbody
- Wetland - Unevaluated
- Wetland - Provincially Significant

Notes:
1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2014.
2. Spatial referencing UTM NAD 83, Zone 16.
3. Imagery courtesy of Esri, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

0 0.5 1 2 3 Km

NORTH

1:50,000

Figure 1-1
Ontario Power Generation
Gull Bay First Nation
Shoreline Stabilization Project
Project Location

HATCH™

2. Site and Project Description

The project is located at the western end of Lake Nipigon, approximately 187 km north of Thunder Bay, Ontario. The project includes the remediation of an approximately 1200-m long section of the Lake Nipigon shoreline adjacent to the KZA community.

Samples were obtained from two potential riprap source material locations and one potential granular source material location. These potential source material locations are as follows. A map showing these potential source locations as well as the project location is provided in Figure 2-1.

- Potential Riprap Sources:
  - waste rock from an existing mine site (Lac des Iles) located 96 km SW of Gull Bay
  - rock samples from an existing quarry site located 10 km SW of Gull Bay.
- Potential Granular Source:
  - rock samples from an existing borrow pit located 5 km SW of Gull Bay.

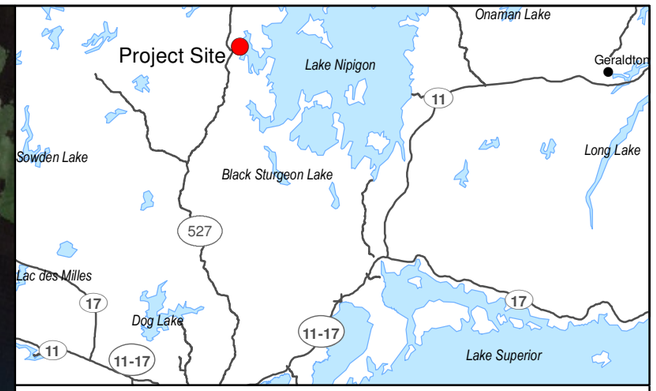
2.1 Physiography and Geology

2.1.1 Topography

The overburden in the project area forms a terraced shoreline with a height ranging from approximately 3 to 10 m above Lake Nipigon. At the edge of the terrace, a scarp exists and extends down to a beach. The inclination of the scarp varies from approximately 30 deg to 43 deg from the horizontal and the height varies from 3 to 10 m. The beach at the bottom of the scarp is flat, extending to the wetted zone along the edge of the lake. The width of the beach varies according to the water level of Lake Nipigon. At the shoreline, the water is shallow and the shallow depth is reported to extend to a considerable distance from the toe of the slope. Inspection of summer time air photos indicates a band of cloudy water of approximately 100 m wide, suggesting a wide extent of sand substrate. Shallow depth and sandy substrate were confirmed during the fall 2013 fisheries investigations.

2.1.2 Bedrock Geology

Based on Ontario Geological Survey (OGS) preliminary maps P3537 (MacDonal, TerMeer, Lepage, Préfontaine, & Tremblay, 2004) and P3559 (MacDonald, Tremblay, & TerMeer, 2005), the bedrock in the area comprises various granitic types of igneous rock. This includes granite, diorite, monzonite and syenite. This rock may be locally metamorphosed and foliated, resulting in gneissic rock masses.



LEGEND

- Road - Minor
- Road - Major
- Shoreline Stabilization Area
- Proposed Source Material

Notes:
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2. Spatial referencing UTM NAD 83, Zone 16.
3. Imagery courtesy of Esri, DigitalGlobe, GeoEye, i-cubed, USDA, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

0 5 10 20 Km

NORTH

1:350,000

Figure 2-1
Ontario Power Generation
Gull Bay First Nation
Shoreline Stabilization Project
Potential Source Material Locations

HATCH™

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2.1.3 Overburden Geology

The uppermost overburden consists of glaciolacustrine deposits, which cover extensive areas bordering Lake Nipigon (Mollard & Mollard, 1983). To the west, areas of thin overburden, possibly glacial till and also bedrock outcrops exist throughout. However, only a few local areas of glacial till and/or bedrock outcrops exist along the Lake Nipigon shoreline and for 2 to 3 km inland, which suggests relatively thick glaciolacustrine deposits. Locally, there are glacial fluvial deposits, which are at times in close proximity to the lake shoreline.

3. Investigative Procedures

The investigation was conducted on November 12, 2013 by Hatch and OPG and consisted of visiting two locations to obtain rock samples to determine their suitability as a riprap source material and one location to obtain a sample of granular material for use in the shoreline erosion protection project. Hand-sized samples of the rock materials were selected for testing. These samples were fresh in appearance and representative of the rock mass at each of the proposed riprap sources. A composite of material from several locations at the granular source location were selected to prepare a bulk sample for testing. The samples were sent to SGS Canada Inc. (SGS) in Lakefield, Ontario for laboratory testing. The following tests were executed:

- Fill Quality
- Acid/Base Accounting (ABA) (ASTM E1915-07A).

4. Investigation Program Results

4.1 General Site Assessment

The rock and granular sources were assessed at each of the sites and general summaries of the findings are described as follows. Photographs of the investigated sites are provided in Appendix A.

4.1.1 Lac des Iles Mine Site

There was approximately 55 000 tonnes of waste rock material in storage at the mine site, typically consisting of Gabbro. Approximately 10 to 15% of the material was greater than 1 m in diameter.

4.1.2 Quarry Site

The rock type in the quarry is a diabase dyke rock that forms a low ridge about 15 m above the country rock. The spacing of the joints is often variable throughout the rock mass with joint spacing typically consisting of moderate to widely spaced joints.

4.1.3 Borrow Pit

The borrow pit size was approximately 150 m to 200 m extending in both directions. The granular material was generally medium to coarse sand with fine gravel and trace coarse gravel.

4.2 Fill Quality Results

The rock samples were tested for chemical characteristics to assess fill quality at each location. The results were compared with the confined and unconfined fill quality guidelines in MOE's *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* (Ministry of the Environment, 2011). The results are summarized in Table 4-1. The total concentrations of metals in the whole sample were analyzed in order to determine the total potential availability of metals. The laboratory reports can be found in Appendix B.

According to MOE's *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario*, confined fill criteria guidelines may be used for quality assessment when fill is placed within the confines of a structure, such as a dyke, which is capable of withstanding waves of a 1-in-100-yr storm. The intent of confinement is to prevent the fill from coming into contact with the open water and, in the event of a storm or high waves, being washed away. For the confined fill parameters, soils are divided into three textural categories – coarse grained and medium and fine grained. Unconfined fill may be placed directly into open water (Ministry of the Environment, 2011).

Table 4-1: Summary of Fill Quality Results and Comparison with the MOE Guidelines for Confined and Unconfined Fill Parameters

Metals	Units	Sample			MOE Guidelines		
					Confined Fill		
		Mine Waste Rock	Quarry	Borrow Pit	Fine and Medium Grained	Coarse Grained	Unconfined Fill*
Mercury	µg/g dry	< 0.05	< 0.05	< 0.05	1.8	0.25	0.2
Aluminum	µg/g dry	69000	68000	61000	NV	NV	NV
Antimony	µg/g dry	< 0.8	< 0.8	< 0.8	7.5	7.5	NV
Arsenic	µg/g dry	0.5	1	0.8	11	11	6
Barium	µg/g dry	100	180	220	390	390	NV
Beryllium	µg/g dry	0.14	0.46	0.94	5	4	NV
Bismuth	µg/g dry	< 0.09	< 0.09	< 0.09	NV	NV	NV
Cadmium	µg/g dry	0.09	0.79	0.25	1	1	0.6
Calcium	µg/g dry	69000	65000	43000	NV	NV	NV
Chromium	µg/g dry	87	60	77	160	160	26
Cobalt	µg/g dry	47	39	29	22	22	NV
Copper	µg/g dry	120	410	290	180	140	16
Iron	µg/g dry	53000	94000	58000	NV	NV	NV
Lead	µg/g dry	1.6	20	5.1	45	45	31
Magnesium	µg/g dry	42000	26000	27000	NV	NV	NV
Manganese	µg/g dry	770	1100	740	NV	NV	460
Molybdenum	µg/g dry	1.7	1.7	0.9	6.9	6.9	NV
Nickel	µg/g dry	230	49	62	130	100	16
Lithium	µg/g dry	10	11	21	NV	NV	NV
Potassium	µg/g dry	3100	4500	9600	NV	NV	NV
Phosphorus	µg/g dry	24	1100	580	NV	NV	600
Selenium	µg/g dry	1.6	2	1.1	2.4	2.4	NV
Silver	µg/g dry	0.39	0.78	0.62	25	20	NV
Sodium	µg/g dry	14000	18000	15000	NV	NV	NV
Strontium	µg/g dry	180	150	170	NV	NV	NV
Thallium	µg/g dry	0.05	0.23	0.14	1	1	NV
Tin	µg/g dry	< 0.5	1	1.4	NV	NV	NV
Titanium	µg/g dry	900	10000	5900	NV	NV	NV
Uranium	µg/g dry	0.11	0.45	0.84	23	23	NV
Vanadium	µg/g dry	97	300	140	86	86	NV
Yttrium	µg/g dry	2.8	27	23	NV	NV	NV
Zinc	µg/g dry	45	150	39	340	340	120

* The Unconfined Fill results were taken for the lowest effect level from the Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario

NOTES:

MDL Method Detection Limit
N/A Not Assessed
ND Not Detected at Method Detection Limit (MDL)
NV No Value
µg/g micrograms per gram
mg/L milligrams per litre
Ohm.m Ohm metre
Concentration in exceedance of MOE Guidelines for Unconfined Fill
Concentration in exceedance of MOE Guidelines for Confined Fill
Concentration in exceedance of MOE Guidelines for both Confined and Unconfined Fill

By crushing the samples and analyzing the entire mass similar to soil material, the results could be compared to the lakefill criteria. The results of the fill quality testing indicated the following for the three samples obtained:

- **Mine Waste Rock:**
  - Metals with concentrations that exceeded the MOE Guidelines for Unconfined Fill were: Chromium, Copper and Manganese.
  - Metals with concentrations that exceeded the MOE Guidelines for Confined Fill were: Cobalt and Vanadium.
  - Metals with concentrations that exceeded the MOE Guidelines for both Confined and Unconfined Fill were: Nickel.
- **Quarry:**
  - Metals with concentrations that exceeded the MOE Guidelines for Unconfined Fill were: Cadmium, Chromium, Manganese, Nickel, Phosphorus and Zinc.
  - Metals with concentrations that exceeded the MOE Guidelines for Confined Fill were: Cobalt and Vanadium.
  - Metals with concentrations that exceeded the MOE Guidelines for both Confined and Unconfined Fill were: Copper.
- **Borrow Pit:**
  - Metals with concentrations that exceeded the MOE Guidelines for Unconfined Fill were: Chromium, Manganese and Nickel.
  - Metals with concentrations that exceeded the MOE Guidelines for Confined Fill were: Cobalt and Vanadium.
  - Metals with concentrations that exceeded the MOE Guidelines for both Confined and Unconfined Fill were: Copper.

4.3 ABA Test

Acid rock drainage (ARD) occurs when minerals containing sulphide and elemental sulphur are exposed to the weathering effects of oxygen and water. Acidity is generated from the oxidation of sulphur and precipitation of ferric iron. ARD occurs when the resulting acidity is entrained by water. High metal solubility and sulphide weathering occur under acidic conditions. Metal leaching (ML) is typically associated with acid rock drainage. Although a neutral pH does not necessarily prevent metal leaching, in many environments, metal leaching will only be significant if the drainage pH is less than 5.5 or 6 (Price & Errington, 1998) (Price and Errington 1998).

SGS Canada Inc. was retained by Hatch to carry out the ABA test for the three potential source locations. The testing was performed using the Modified Sobek method and followed the ASTM E1915-07A and British Columbia Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage. The individual results from the ABA testing can be found in Appendix B.

The results of the ABA testing are summarized in Table 4-2. The ABA test includes several components that provide an indicator of the acid-generating potential of the materials sampled, including paste pH, the sulphide sulphur component (%), neutralization potential (NP): acid potential (AP) ratio and net neutralization potential (NP-AP) (tonnes $CaCO_3$/1000 tonnes). The AP is calculated based on the sulphide sulphur concentration, and the NP is measurement of the amount of neutralizing base minerals, including carbonate in the samples. The neutralizing potential ratio (NPR) is the NP divided by the AP.

Table 4-2: Results of ABA Testing

Sample ID	Paste pH	NP/AP Ratio	Net NP (tonnes $CaCO_3$/1000 tonnes)	Sulphur (%)	Sulphide Sulphur (%)
Mine Waste Rock	9.44	2.76	7.14	0.195	0.13
Quarry	9.07	18.7	16.6	0.066	0.03
Borrow Pit	8.30	40.6	12.3	0.014	<0.01

The majority of the sulphur in all of the samples is sulphide sulphur. All of the samples had a paste pH over 9 except for the Borrow Pit, which indicates that neutralization potential will be available immediately under leaching conditions for the Quarry and the Mine Waste Rock. Based on results from ARD studies in the Appalachian coal mines (Brady, Perry, Beam, Bisko, Gardner, & Tarantino, 1994), a net NP value that exceeds 15 tonnes $CaCO_3$/tonne was considered to be non-acid generating, a net NP value less than or equal to 0 tonnes $CaCO_3$/tonne was considered to be acid generating, and a net NP value between 0 and 15 tonnes $CaCO_3$/tonne represented a grey zone that was potentially acid generating, but for which prediction was difficult. The ABA screening criteria developed by the BC Ministry of Energy and Mines (Price, 1997) are described in Table 4-3. The Neutralization Potential Ratio (NPR) is the ratio of NP/AP.

Table 4-3: Acid-Base Accounting Screening Criteria (Price 1997)

Potential for ARD	Initial Screening Criteria	Comments
Likely	NPR < 1	Likely ARD-generating unless sulphide minerals are non-reactive.
Possible	1 < NPR < 2	Possibly ARD-generating if NP is insufficiently reactive or is depleted at a faster rate than sulphides.
Low	2 < NPR < 4	Not potentially ARD-generating unless there is significant preferential exposure of sulphides along fracture planes or extremely reactive sulphides in combination with an insufficiently reactive NP.
None	NPR > 4	

The results of the ABA testing indicated the following for the three samples obtained:

- **Mine Waste Rock:**
  - The Net NP did not exceed 15 tonnes $CaCO_3$ resulting in being potentially acid generating.
  - The NP/AP ratio was between 2 and 4 resulting in low potential for ARD.
  - The paste pH was greater than 6 resulting in insignificant leaching potential.
- **Quarry:**
  - The Net NP exceeded 15 tonnes $CaCO_3$ and is considered to be non-acid generating.
  - The NP/AP ratio was greater than 4 resulting in no potential for ARD.
  - The paste pH was greater than 6 resulting in insignificant leaching potential.
- **Borrow Pit:**
  - The Net NP did not exceed 15 tonnes $CaCO_3$ resulting in being potentially acid generating.
  - The NP/AP ratio was greater than 4 resulting in no potential for ARD.
  - The paste pH was greater than 6 resulting in insignificant leaching potential.

5. Summary and Recommendations

This report is based on a geotechnical evaluation of (i) rock samples at a mine site and a quarry, and (ii) a borrow pit granular source for the purpose of determining the environmental suitability of the rock and granular material as shoreline erosion protection material.

The assessment of fill quality found the source tested rocks (2 sites) and granular material (1 site) contain metals with concentrations in excess of the MOE guidelines for both Confined and Unconfined Fill (Ministry of the Environment, 2011). Since most granular materials will be covered and not exposed for the shoreline erosion protection plan, the fill quality results for Confined Fill would be a suitable assessment for a soil-like material. Considering this reduces the number of metals which exceed the MOE guidelines for all three site locations. However, all three sites are in excess of the guidelines for Cobalt and Vanadium and the mine site is in excess for Nickel whereas the quarry and borrow pit are in excess for Copper.

This assessment assumes the tested materials are similar to soil where the surface area would be high and metals would likely be more available than in rock and granular materials. Therefore it would appear that by assessing the total bulk concentration of metals in the samples, the results are very conservative.

It is evident from the ABA testing that the most suitable materials to use as a source from an environmental perspective would be the quarry and borrow pit material as the NPR is greater than 4 in both cases and there is no potential for ARD. The mine site however has a NPR between 2 and 4 indicating there is potential for ARD. Therefore, the mine rock is not recommended as a source for the shoreline erosion protection. The most suitable material for a rock source location would be the quarry.

MOE's *Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario* states that typically, quarried rock, sand, gravel and excavated soils do not need chemical assessment except where there may be a concern regarding the origin of the material. It also states that where there may be locally high occurrences of some metals, the rock may be subjected to a *Receiving Water Simulation test* to assess whether these metals can rapidly leach into water (Ministry of the Environment, 2011). Since both materials from the quarry site as well as the borrow pit had low NPR, it indicates that leachability of the rock is likely low. Should the mine site rock be further considered a specific Receiving Water Simulation test would be needed.

It should be noted that in the process of permitting this project, regulatory agencies might ask that a confirmatory testing program be implemented during construction if the materials appear to differ from those tested to verify that bedrock does not contain potentially acid-generating rock or leachable metals.

6. Bibliography

Brady, K. B., Perry, E. F., Beam, R. L., Bisko, D. C., Gardner, M. D., & Tarantino, J. M. (1994). Evaluation of Acid-Base Accounting to Predict the Quality of Drainage at Surface Coal Mines in Pennsylvania, USA. *International Land Reclamation and Mine Drainage Conference and 3rd International Conference on the Abatement of Acidic Drainage , 1* , 138-146. Pittsburgh, PA, USA: USBM SP 06A-94.

MacDonal, C. A., TerMeer, M., Lepage, L., Préfontaine, S., & Tremblay, E. (2004). Precambrian geology of the English Bay-Havoc Lake area, western Nipigon Embayment, north-western Ontario. *Preliminary Map P.3537, scale 1:50 000* . Ontario Geological Survey.

MacDonald, C. A., Tremblay, E., & TerMeer, M. (2005). Precambrian geology of the Kabitotikwia Lake area, west-central Nipigon Embayment, northwestern Ontario. *Preliminary Map P.3559, scale 1:50 000* . Ontario Geological Survey.

Ministry of the Environment. (2011, March). Fill Quality Guide and Good Management Practices for Shore Infilling in Ontario.

Mollard, D. G., & Mollard, J. D. (1983). Gull River Area (NTS 52H/NW), District of Thunder Bay. *Northern Ontario Engineering Geology Terrain Study 25, 34 p. Accompanied by Maps 5049, 5053 and 5054, scale 1:100 000* . Ontario Geological Survey.

Price, W. A. (1997). Draft Guidelines and Recommended Methods for the Prediction of Metal LEaching and Acid Rock Drainage at Minesites in British Columbia. *British Columbia Ministry of Employment and Investment* .

Price, W. A., & Errington, J. C. (1998). Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia.

Appendix A
Site Investigation Photos

Photo 1: Lac des Iles Mine Site Waste Rock Stockpiles

Photo 2: Lac des Iles Mine Site Waste Rock Stockpiles – Typical Rock Dimensions

Photo 3: Quarry Site - Typical

Photo 4: Quarry Site – Variable Jointing from Moderately to Widely Spaced

Photo 5: Borrow Pit with Sidewalls Approximately 6 m in Height

Photo 6: Borrow Pit Sample Containing Medium to Coarse Grained Sand and Fine Gravel with Trace Coarse Gravel

Appendix B
Certificate of Analysis

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
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Phone: 705-652-2000 FAX: 705-652-6365

17-December-2013

Hatch LTD
Attn : Shathli Shaif

4342 Queen St Suite500
Niagara Falls, ON
L2E 6W1,

Phone: 905-374-5200
Fax:905-374-0701

Date Rec. : 06 December 2013
LR Report: **CA13223-DEC13**

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Mine Waste Rock	6: Quarry Sample	7: Pit Sample
Sample Date & Time			NA	NA	NA
Mercury [µg/g]	11-Dec-13	13:05	< 0.05	< 0.05	< 0.05
Silver [µg/g]	12-Dec-13	14:49	0.39	0.78	0.62
Aluminum [µg/g]	12-Dec-13	14:13	69000	68000	61000
Arsenic [µg/g]	12-Dec-13	14:49	0.5	1.0	0.8
Barium [µg/g]	12-Dec-13	14:49	100	180	220
Beryllium [µg/g]	12-Dec-13	14:49	0.14	0.46	0.94
Bismuth [µg/g]	12-Dec-13	14:49	< 0.09	< 0.09	< 0.09
Calcium [µg/g]	12-Dec-13	14:13	69000	65000	43000
Cadmium [µg/g]	12-Dec-13	14:49	0.09	0.79	0.25
Cobalt [µg/g]	12-Dec-13	14:49	47	39	29
Chromium [µg/g]	16-Dec-13	08:56	87	60	77
Copper [µg/g]	12-Dec-13	14:49	120	410	290
Iron [µg/g]	12-Dec-13	14:14	53000	94000	58000
Potassium [µg/g]	12-Dec-13	14:14	3100	4500	9600
Lithium [µg/g]	12-Dec-13	14:49	10	11	21
Magnesium [µg/g]	12-Dec-13	14:14	42000	26000	27000
Manganese [µg/g]	12-Dec-13	14:49	770	1100	740
Molybdenum [µg/g]	12-Dec-13	14:49	1.7	1.7	0.9
Sodium [µg/g]	12-Dec-13	14:14	14000	18000	15000
Nickel [µg/g]	12-Dec-13	14:49	230	49	62
Phosphorus [µg/g]	12-Dec-13	14:14	24	1100	580
Lead [µg/g]	12-Dec-13	14:49	1.6	20	5.1
Antimony [µg/g]	12-Dec-13	14:49	< 0.8	< 0.8	< 0.8
Selenium [µg/g]	12-Dec-13	14:49	1.6	2.0	1.1
Tin [µg/g]	12-Dec-13	14:49	< 0.5	1.0	1.4
Strontium [µg/g]	12-Dec-13	14:49	180	150	170
Titanium [µg/g]	12-Dec-13	14:49	900	10000	5900

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LR Report : **CA13223-DEC13**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Mine Waste Rock	6: Quarry Sample	7: Pit Sample
Thallium [µg/g]	12-Dec-13	14:49	0.05	0.23	0.14
Uranium [µg/g]	12-Dec-13	14:49	0.11	0.45	0.84
Vanadium [µg/g]	12-Dec-13	14:49	97	300	140
Yttrium [µg/g]	12-Dec-13	14:49	2.8	27	23
Zinc [µg/g]	12-Dec-13	14:49	45	150	39

Brian Graham B.Sc.
Project Specialist
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Date Rec. : 06 December 2013
LR Report: **CA13222-DEC13**

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Mine Waste Rock	6: Quarry Sample	7: Pit Sample
Sample Date & Time			NA	NA	NA
Paste pH	20-Dec-13	16:04	9.44	9.07	8.30
Fizz Rate [---]	20-Dec-13	16:04	1	1	1
Sample weight [g]	20-Dec-13	16:04	2.01	1.97	2.02
HCl added [mL]	20-Dec-13	16:04	20.00	20.00	20.00
HCl [Normality]	20-Dec-13	16:04	0.10	0.10	0.10
NaOH [Normality]	20-Dec-13	16:04	0.10	0.10	0.10
NaOH to [pH=8.3 mL]	20-Dec-13	16:04	15.50	13.11	14.90
Final pH	20-Dec-13	16:04	1.19	1.80	1.59
NP [t CaCO3/1000 t]	20-Dec-13	16:04	11	18	13
AP [t CaCO3/1000 t]	---	---	4.06	0.94	0.31
Net NP [t CaCO3/1000 t]	---	---	7.14	16.6	12.3
NP/AP [ratio]	---	---	2.76	18.7	40.6
S [%]	13-Dec-13	10:41	0.195	0.066	0.014
Acid Leachable SO4-S [%]	---	---	0.06	0.04	0.01
Sulphide [%]	16-Dec-13	09:50	0.13	0.03	< 0.01
C [%]	13-Dec-13	10:41	0.049	0.049	0.075
CO3 [%]	16-Dec-13	09:56	0.120	0.045	0.020

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LR Report : **CA13222-DEC13**

*NP (Neutralization Potential)

$$= \frac{50 \times (\text{N of HCL} \times \text{Total HCL added} - \text{N NaOH} \times \text{NaOH added})}{\text{Weight of Sample}}$$

*AP (Acid Potential) = % Sulphide Sulphur x 31.25
*Net NP (Net Neutralization Potential) = NP-AP
NP/AP Ratio = NP/AP
*Results expressed as tonnes CaCO3 equivalent/1000 tonnes of material
Samples with a % Sulphide value of <0.01 will be calculated using a 0.01 value.

Sulphur analysis performed following BC ARD Guidelines (Price 1997)

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Archaeological Assessment Report
Prepared by Andrew Hinshelwood
Archaeological Licence P-236
PIF **P236-0021-2013**

Stage 1
Original Report
January 30, 2014

Stage 1 archaeological assessment: Proposed Category 11 Quarry for Gull Bay First Nation Shoreline Stabilisation, Unorganised Township, District of Thunder Bay.

Prepared for:

Hatch Ltd.
4342 Queen Street, Suite 500
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Executive Summary

TBT Engineering Limited (TBTE) was commissioned to provide cultural heritage (archaeology) consultant services in support of Ontario Power Generation's (OPG) feasibility assessment of a rock quarry for use in the stabilisation of the shoreline at Gull Bay First Nation (Kiashke Za-agaiigan Anishinabe – KZA). The proposed location includes an area previously used as a quarry located south of the Gull Bay community.

The Stage 1 archaeological assessment of the proposed Category 11 quarry (Map 1 and Map 2) was completed as required under the **Aggregate Resources Act** (R.S.O. 1990, c. A.8). The assessment was completed by Northwest Archaeological Assessments on behalf of TBT Engineering (TBTE). The proponent for this development is Hatch, Ltd., on behalf of Ontario Power Generation (OPG). Noel Boucher is the contact for Hatch, Ltd.. The approval authority is the Ministry of Natural Resources (MNR), Northwest Region. The MNR contact is Colin Hovi, Aggregate Technical Specialist, Thunder Bay District**.**

The archaeological assessment reported here includes a Stage 1 Background Study, including a property inspection. The Stage 1 property inspection was completed for the entire proposed area of impact. The subject property was noted as containing a combination of moderately to steeply sloping elevated rock knob/ridge, the primary focus of the quarry, situated in a flat, poorly drained glaciolacustrine plain. The subject property lies between an esker ridge to the west, and the Nipigon Moraine to the east. The rock knob/ridge includes an earlier quarry development, and is not suitable for habitation, due to steep slopes and irregular surfaces. The subject property has previously burned in a forest fire, evidenced by a number of stumps, and regeneration of spruce, poplar, fir and birch. Forest cover is sparse, with a shrub level of mountain maple, hawthorn and alder, over *Ledum*, *Sphagnum* and *Vaccinium* ground cover, with other species present. Local relief is such that no areas where relict beaches associated with Lake Kelvin in the Nipigon basin are apparent. In light of the location and terrain of the property, and the lack of any previous archaeological resources in the local vicinity, archaeological potential is low.

As a result of the archaeological assessment one recommendation was made.

> There are no areas of archaeological potential on the subject property, and as such, it is recommended that no further archaeological assessment is required.

Table of Contents

Project Personnel

Personnel involved in this project included the licensee (Andrew Hinshelwood, P236). Mr. Hugh King, band council member from Kiashke Zaagaiigan Anishinabe (Gull Bay First Nation) provided guidance and transportation to and from the subject property. Heather Hopkins (NAA) acted as project manager, and assisted in the preparation of this report.

Project Context

TBT Engineering Limited (TBTE) was engaged to provide cultural heritage (archaeology) consultant services in support of the feasibility assessment and permitting of a Category 11 rock quarry for the production of suitable materials for the stabilisation of the shoreline at Gull Bay First Nation (Kiashke Zaagaiigan Anishinabe – KZA). The proposed location for the quarry is in an area previously used for quarry materials, south of the Gull Bay community (Maps 1 and 2).

Development Context

The Stage 1 archaeological assessment of the proposed Category 11 quarry (Map 1 and Map 2) was completed as required under the **Aggregate Resources Act** (R.S.O. 1990, c. A.8). The assessment was completed by Northwest Archaeological Assessments on behalf of TBT Engineering (TBTE). The proponent for this development is Hatch, Ltd., on behalf of Ontario Power Generation (OPG). Noel Boucher is the contact for Hatch, Ltd.. The approval authority is the Ministry of Natural Resources (MNR), Northwest Region. The MNR contact is Colin Hovi, Aggregate Technical Specialist, Thunder Bay District**.**

Fieldwork was undertaken on October 29, 2013 under clear, sunny and cool conditions.

Permission to enter onto the property was assumed, as the property lies on Crown Land.

Historic Context

The subject property lies on Crown land near Gull Bay on the west side of Lake Nipigon. Lake Nipigon, one of the largest inland lakes in Ontario, remains relatively undeveloped. Early euro-canadian settlement by-passed the area on the railways that run north and south of the lake in pursuit of fertile agricultural lands to the west. The lake was a minor focus in the early fur trade as again, exploration and market development sought out lands to the west. The construction of road access along the west side of the lake began with forest access, and over time the road between the Trans-Canada highway and the railway at Armstrong was developed into a provincial highway.

Currently, the subject property is accessible from Highway 527, by way of an unpaved road running northwest toward Gull Bay First Nation (Map 1). This unpaved road is the former route to Armstrong prior to the development of Highway 800 (now Hwy 527: Figure 4). Previous aggregate production at the subject property saw the unpaved road used for hauling quarry material. The subject property lies on Crown land.

The project area lies within the Robinson Superior 1850 treaty area. Of Aboriginal communities, Kiashke Zaaging Anishinaabek (Gull Bay First Nation) is located nearby, approximately 10 kilometres northeast, and accessible via Hwy 527 or the unpaved road mentioned above.

Archaeological Context

The pre-contact settlement of the region is well understood from archaeological survey work in the region. The typical archaeological sequence is defined in relation to material culture. From existing archaeological reports, and the author's own knowledge of the collections, it is understood that all pre-contact cultures are present. These include:

Late Palaeo-Indian (from 9,500 to 7,000 years before present)
Archaic (7,500 to 2,000 years B.P.)
Middle Woodland (2,500 to 1,000 years B.P.)
Late Woodland (1,500 to 400 years B.P.)

The post-contact period includes the fur trade, which began in the Lake Nipigon area with DuLhut's entry into the northwest *circa* 1684 (Zoltvany 1969; Heidenreich and Noel 1987), and continues to the present, albeit in a markedly different form. Logging, mining and commercial fishing on Lake Nipigon emerged following the construction of the railways in the post-Treaty period. More recently hydro-electric power generation and recreation have been added to the suite of commercial practices in the region. Archaeological survey of Lake Nipigon has been limited, relative to the size of this lake, but several interesting sites and artifacts have been reported. Dawson (1976) completed a major survey of the lake, resulting in a significant increase in the inventory of sites, especially middle and late woodland period sites. Subsequently, Dawson excavated at the middle woodland period Wabinosh River, approximately 37 kilometres to the north of the subject property (Dawson 1981). Arthurs also contributed a number of site reports to the inventory (1981), as well as reports on two important early artifacts: a Jesuit "IHS" ring (1982), and a kaolin (white clay) pipe dating to the late 17th century (1983). The pipe represents perhaps the only unequivocal artifact dating to the pre-1696 trade into Lake Nipigon.

No archaeological sites are recorded in the vicinity of the subject property. There have been no previous archaeological surveys or assessments of the subject property, and no recommendations made regarding such resources as may be present. Archaeological assessment of a property three kilometres west (P236-0009-2013: Map 1) found no archaeological potential on the property. There is no indication that post-contact commercial activities other than quarrying, although commercial forestry may have been carried out in the vicinity of the subject property.

The surficial geology of the subject property is comprised of complex post-glacial landforms (Mollard and Mollard 1983). To the west of the subject property, a north-south trending esker ridge is mapped, while to the east an end moraine feature runs nearly parallel. The subject property itself is within an end moraine landform, while soils are sand and gravel derived primarily from glaciolacustrine sediments: the subject property is mapped at the boundary between a raised beach and a glaciolacustrine plain (**Map 3**). The end moraine is the Nipigon Moraine, dated by Zoltai (1965) to around 9,500 years BP. As the moraine marks a stable front to the glacial mass, the moraine would almost certainly predate human occupation of the area by at least several hundred years. Earlier,

around 10,300 years BP, and possibly when the southern portions of the Nipigon moraine were forming (Prest 1970), pro-glacial Lake Kelvin, was present in the area. This lake, and the subsequent post-glacial Lake Kelvin, which occupied the entire Nipigon basin between around 9,500 and 8,400 years BP (Prest 1970) would be responsible for the lacustrine deposits mapped by Mollard and Mollard (1983). Thus, the evidence of the quaternary geology suggest that the earliest possible date for human settlement in the area of the subject property was some time after *circa* 9,000 years BP.

The mapped glaciolacustrine deposits are deceptive in terms of the actual ground conditions at the subject property. The subject property is a distinct rock knob/ridge feature standing out from the surrounding level glaciolacustrine plain now occupied primarily by poplar and alder. East of the ground moraine, the Kabitotikwia River, which drains the lake of the same name, is a low energy and highly meandering stream. Although the material in this adjacent area is indicated as originating in glaciolacustrine depositional environments, examination of the property did not identify any features suggestive of relict beaches.

The subject property is typical of the glaciated Canadian Shield, and lies within northern Ontario.

Stage 1
Background study

No archaeological sites are recorded in the vicinity of the subject property. There have been no previous archaeological surveys or assessments of the subject property, and no recommendations made regarding such resources as may be present. The property does not lie on or adjacent to any early trade or travel routes. Highway 527 was not built in this area until *circa* 1950. Prior to this, in both contact and pre-contact times, it is reasonable to suggest that the subject property was only used sporadically for hunting (game and migratory birds), trapping and later, for logging.

The subject property has previously seen use as a quarry, and quarry disturbance, including the operational face, and an area used for crushing, loading and equipment storage, have created disturbance within the proposed permit area (Figures 1 and 2).

The highway is relatively recent. A 1974 map shows the road, then designated as Highway 800, running north only as far as the Poshkohogan River, some 60 miles (100 km) from Armstrong and south of the subject property. Highway 800 provided access to a number of logging roads and camps (Map 4). The original route of the road followed the unpaved road that lies adjacent to the subject property, and this route would have been used as necessary for forest access and travel to Gull Bay and Armstrong.

The project area is within the general boundaries of the Black Spruce Forest Management Unit (035). The forest management plan for the Black Spruce FMU began in 2011. Publically available mapping for forest values in the unit includes mapping of cultural

heritage values.[1] These values represent the output of the heritage assessment tool (HAT) confirmed and verified through a process of automated modelling using assigned weights and values, followed by a review of the initial output against other information sources such as aerial photography and local knowledge of forestry crews. The mapping available shows that the nearest area of potential is along the shores of Johnspine Lake to the north. The shoreline configuration of this lake is partially defined by an esker, and doubtless, the shoreline and esker, combined, form the principle basis for the evaluation of potential.

The forest cover of the subject property has previously burned in a forest fire, evidenced by a number of charred stumps (Figure 3). Councillor King suggested that this fire may have occurred in the 1980s or 1990s, which would appear supported by the state of forest regeneration (Figure 4). Current conditions are a sparse, young tree cover of poplar, with spruce, birch and fir over a shrub level of mountain maple, hawthorn and alder, with *Ledum, Sphagnum* and *Vaccinium* ground cover, with other species present. Areas of bare rock show lichen and moss cover, as would be expected. The subject property is well drained, as a result of the soil texture and elevation. Below the rock knob/ridge, the ground is level and supports a dense growth of alder and poplar with some balsam fir and larch present. There are no water bodies within the subject property, and as noted previously, the Kabibotikwia River lies approximately 3 kilometres to the east, beyond the Nipigon Moraine. The location of the property in relation to larger water bodies or streams and the lack of any previous archaeological resources in the local vicinity, these factors suggest that archaeological potential is low.

There are no commemorative plaques local to the subject property.

Property inspection

The entire subject property was inspected was completed on October 29, 2013. The inspection was sufficient to delineate areas of prior disturbance, and other features affecting archaeological potential such as the areas of surface stripping or bare rock, steep slopes and low, wet areas. The property inspection covered the entire property and confirmed that the subject property was part of a marked bedrock knob/ridge landform (Figure 5). Property inspection further identified that the area below the rock knob was level, moist terrain primarily supporting stands of alder, and that no distinct features resembling relict shoreline features were present.

Access to the property was from Highway 527 by way of Gull Bay First Nation along the unpaved road discussed previously. Property inspection proceeded on foot to visually examine all parts of the property. As part of the inspection, photographs were taken of site conditions in support of observations made **(Map 5)**.

The former quarry remains visible from the level area formerly used for crushing, loading and equipment storage. The former operational face (facing northeast) is approximately

[1] http://www.efmp.lrc.gov.on.ca/eFMP/viewFmuPlan.do?fmu=035&fid=100105&type=CURRENT&pid=100105&sid=8071&pn=FP&ppyf=2011&ppyt=2021&ptyf=2011&ptyt=2016&phase=P1

15 metres in height, with a quantity of fractured rock lying within (Figure 1). Above the quarry, thin soils cover the bedrock, and in many places, no soil is present (Figure 6). Thin soil development is due to limited parent material and the erosion resulting from frequent, recurring forest fires. The surface at the top of the rock knob/ridge is irregular (Figure 7). Below, the surface is level, and poplar and alder are the dominant forest cover (Figure 8). This extensive plain is evident in contrast to the rock knob/ridge (Figures 9 and 10). The subject property includes a steep slope, near vertical along the east face, which precludes the formation of beaches at this elevation. While Mollard and Mollard (1983) mark the subject property as bounded by lacustrine deposits, examination of the lower parts of the subject property did not reveal any distinct features resembling relict shoreline features.

Special Conditions

The subject property is located in northern Ontario and on the Canadian Shield. The S&Gs (Section 1.3.3, s. 1) allow for alternate strategies to be recommended. As noted in the S&Gs, Section 1.4.1, s. 1, no areas within 300 metres of water, or within 100 metres of early historic transportation routes can be recommended for exemption from further assessment. The strategies recommended include test pitting at a five metre interval only within 50 metres of a modern water course (Section 2.1.5, s. 1). The recommendation in Stage 1 includes consideration of these alternate strategies.

Record of Finds

As a result of the Stage 1 property inspection, no artifacts or cultural features were recovered. Consequently, no GPS readings were taken of artifacts, and no artifacts collected. As there were no finds, an artifact catalogue was not prepared; however, documentary records for this project include the following:

Documentation	***N***	***Description***	***Location***
Photographs	12	digital images	digital storage
GPS readings	11	property, context	digital storage
Field notes	1	page of notes	digital storage
Report	1	copy (.pdf)	digital storage

Analysis

The Stage 1 archaeological assessment of the proposed Category 11 quarry (Map 1 and Map 2) was completed as required under the **Aggregate Resources Act** (R.S.O. 1990, c. A.8). The assessment was completed by Northwest Archaeological Assessments on behalf of TBT Engineering (TBTE). The proponent for this development is Hatch, Ltd., on behalf of Ontario Power Generation (OPG). Noel Boucher is the contact for Hatch, Ltd.. The approval authority is the Ministry of Natural Resources (MNR), Northwest Region. The MNR contact is Colin Hovi, Aggregate Technical Specialist, Thunder Bay District**.**

A Stage 1 archaeological assessment was completed on behalf of the proponent on October 29, 2013 under PIF P236-0021-2013 by the report author. The Stage 1 background study did not identify any archaeological sites in proximity to the subject property. Prior to the development of road access, the primary land use in the area would have been traditional resource procurement practices.

The topography of the subject property is a relatively simple rock knob/ridge formation emerging from a glaciolacustrine plain; however, available surficial geology mapping (Mollard and Mollard 1983) shows the area as a complex interface between post-glacial landforms. The property lies within a unit defined as comprising glaciolacustrine shoreline sediments and or glaciolacustrine plain positioned between a north-south trending esker and the Nipigon moraine. The esker is contemporary to active glaciation, while the moraine has been dated to around 9,500 years BP (Zoltai 1965). The glaciolacustrine sediments may date to the pro-glacial Lake Kelvin, dated at 10.300 (Prest 1970), which was essentially a widening in an outlet to Lake Agassiz, or post-glacial Lake Kelvin, dated to between 9,500 and 8,400 years BP (Prest 1970). While the dating of the lake is important in regional archaeological studies, the fact remains that within the subject property the bedrock knob/ridge rises directly from relatively flat terrain, suggesting that the shoreline of Lake Kelvin, had it been at the level of the subject property, would have been washing the rocks, rather than depositing sands to form inhabitable beaches.

Conclusions

As a result of the Stage 1 background study, the subject property was evaluated as holding low archaeological potential. The resulting recommendations note that that there are no further concerns for the proposed development as regards the protection of archaeological resources.

Recommendations

As a result of the archaeological assessment, including background study and property inspection, the following recommendation is made:

> There are no areas of archaeological potential on the subject property, and as such, it is recommended that no further archaeological assessment is required.

Advice on compliance with legislation

Advice on compliance with legislation is not part of the archaeological record. However, for the benefit of the proponent and approval authority in the land use planning and development process, the report must include the following standard statements:

This report is submitted to the Minister of Tourism, Culture and Sport as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Tourism, Culture and Sport, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.

The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

Bibliography and Sources

Arthurs, D. 1981. Archaeological activities on western Lake Nipigon. Conservation Archaeology Report, Northwest Region Report 7. Ministry of Culture and Recreation, Thunder Bay.

Arthurs, D. 1982. An IHS finger ring from Lake Nipigon. Wanikan 83(3): 5-9.

Arthurs, D. 1983. An early historic pipe from Lake Nipigon. Wanikan 83(9): 5-9.

Dawson, K.C.A. 1976. Algonkians of Lake Nipigon: An archaeological survey. Archaeological Survey of Canada, Paper 48. National Museum of Man, Ottawa.

Dawson, K.C.A. 1981 The Wabinosh River site and the Laurel tradition. Ontario Archaeology 36: 3-46.

Heidenreich, C.E. and F. Noel. 1987. Trade and Empire, 1697 – 1739. Plate 39 *in* R.C. Harris and G.J. Matthews, eds, Historical Atlas of Canada, Volume 1: From the Beginning. University of Toronto Press, Toronto.

Mollard, D.G., and J.D. Mollard. 1983. Gull River Area (NTS 52H/NW), District of Thunder Bay; Ontario. Geological Survey, Northern Ontario Engineering Geology Terrain Study 25. Accompanied by Maps 5049, 5053, and 5054, scale 1:100000. Ontario Geological Survey, Toronto.

Prest, V.K. 1970. Quaternary Geology of Canada. Chapter XII *in* R.J.W. Douglas, editor, Geology and Economic Minerals of Canada. Geological Survey of Canada, Ottawa.

Zoltai, S.C. 1965. Glacial Features of the Quetico-Nipigon Area, Ontario. Canadian Journal of Earth Sciences, 2(4): 247-269.

Zoltvany, Y.F. 1969. Greysolon DuLuht. pp. 261-264 *in* D.M. Hayne, editor, Dictionary of Canadian Biography Volume II: 1701-1740.

Images

Figure 1: View southwest showing the existing quarry face.

Figure 2: View of quarry showing former processing, loading area in foreground.

Figure 3: View west showing lower area, burned trees and poplar regeneration.

Figure 4: View north showing upper area, burned trees and spruce, birch regeneration.

Figure 5: View southwest along near vertical face of rock knob/ridge.

Figure 6: View east showing bare rock interspersed with areas of thin soil.

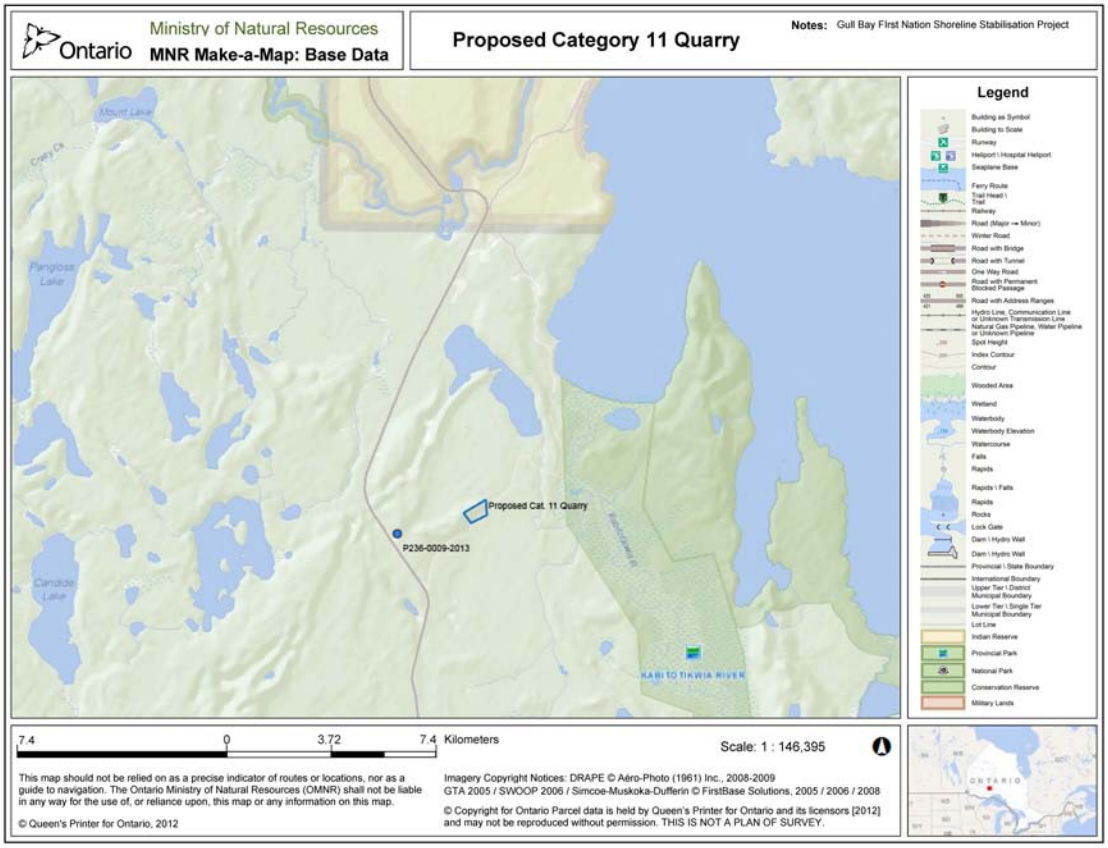
Figure 7: View north showing irregular surface typical or upper area.

Figure 8: View west in glaciolacustrine plain showing moist soils supporting alder.

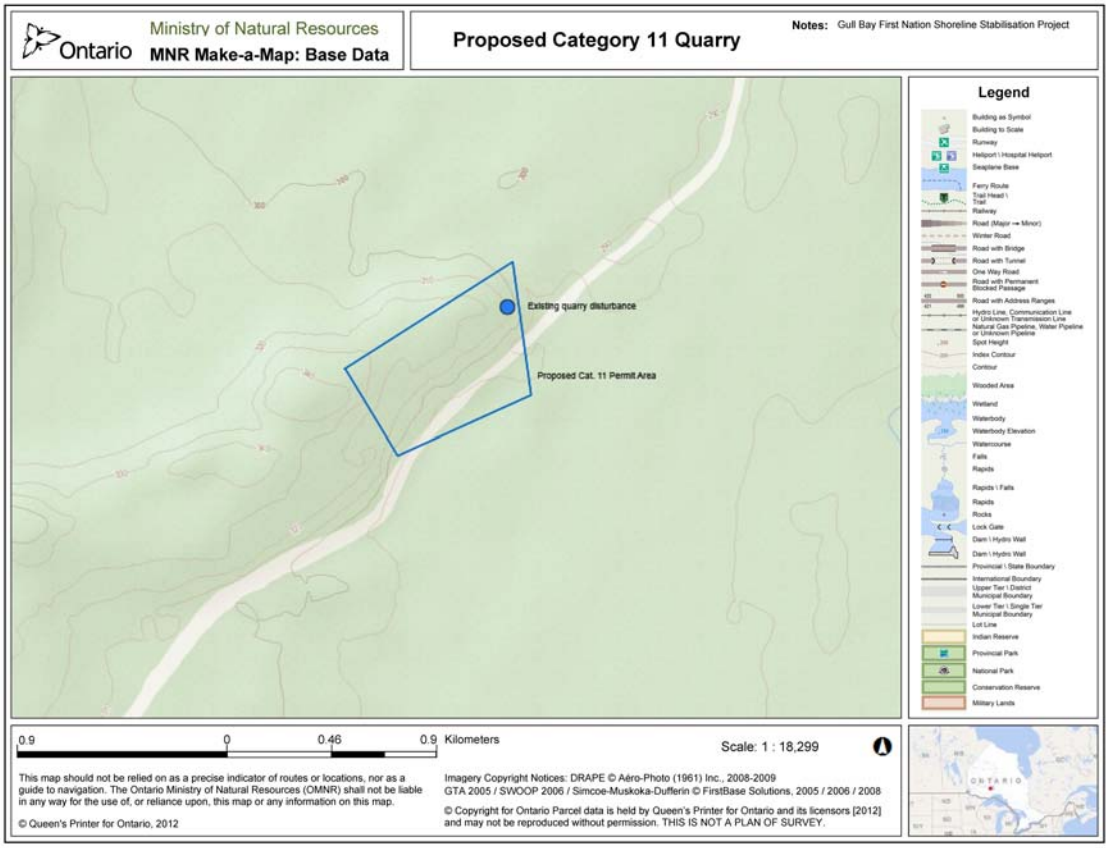
Figure 9: View east. Glaciolacustrine plain in foreground, Nipigon Moraine in distance.

Figure 10: View southwest showing level terrain and rock knob/ridge.

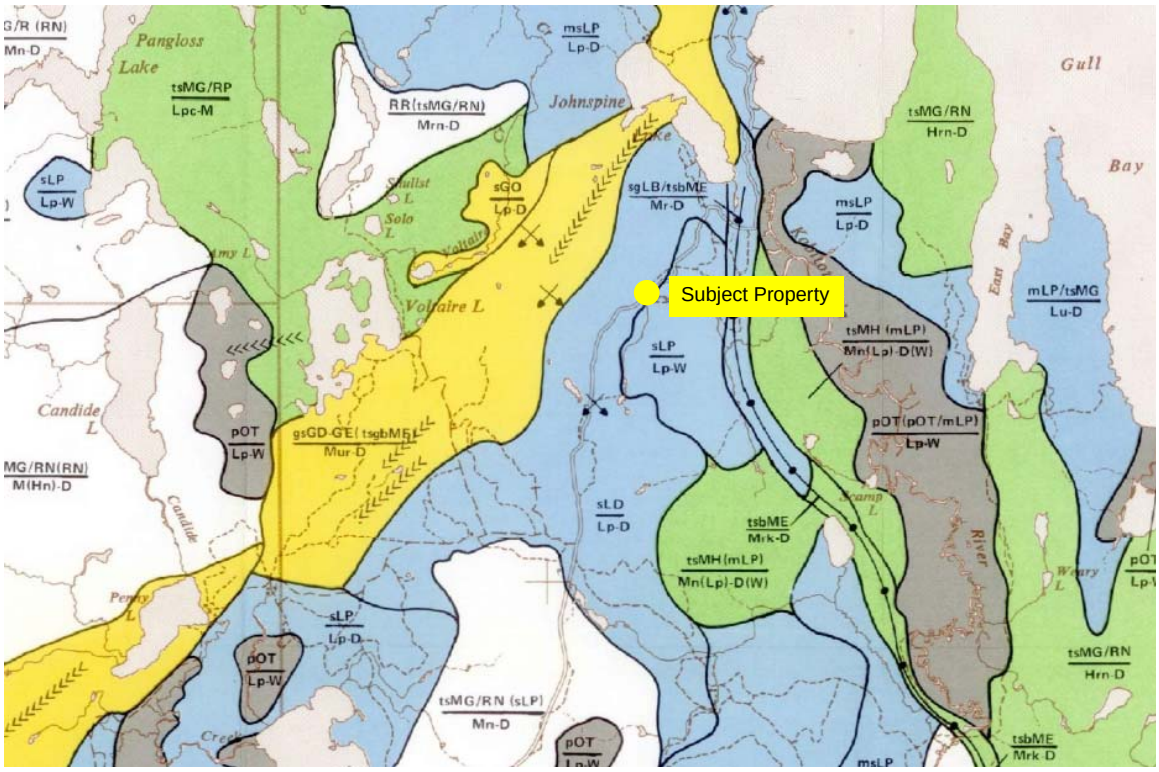
Maps



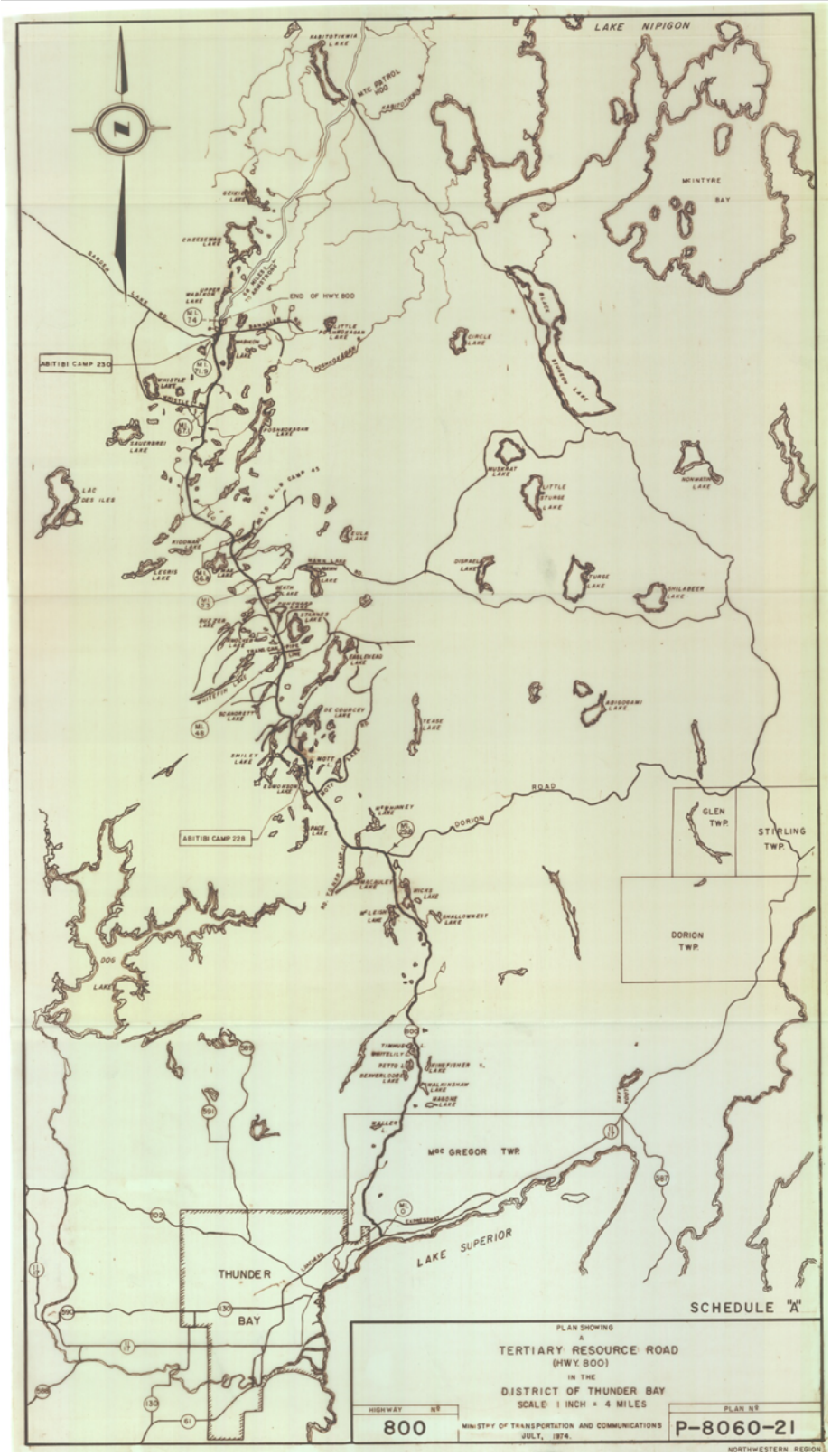
Map 1: Regional location of proposed development.



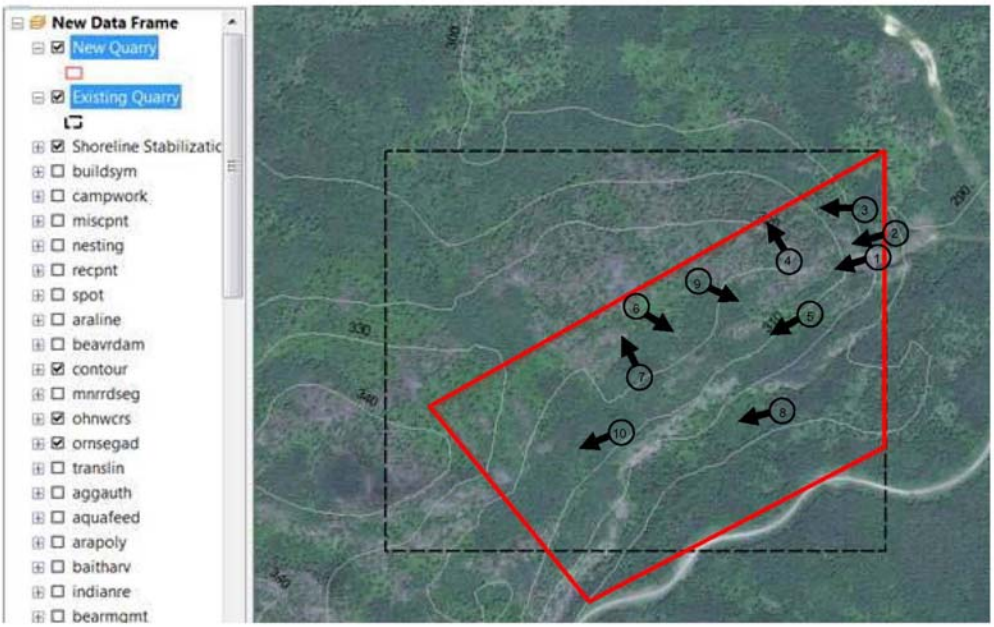
Map 2: Detail view of local environment of project area.



Map 3: Surficial Geology of the subject property and surrounding area.



Map 4: 1974 MTO plan showing Highway 800 (now Hwy 527) alignment.



Map 5: Location and direction of photographs included in report.