

Appendix "A" - Marine Sediment Sampling Program

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**PWGSC PROJECT # R.076960.002  
MARINE SEDIMENT SAMPLING PROGRAM  
CAPE ST. MARYS SMALL CRAFT HARBOUR  
CAPE ST. MARYS, NOVA SCOTIA**

**FINAL REPORT**

Submitted to:

**Public Works and Government Services Canada**  
1713 Bedford Row  
Halifax, Nova Scotia  
B3J 1T3

Submitted by:

**GHD**  
45 Akerley Boulevard  
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MARCH 2016

11102262 (1)



March 28, 2016

Ms. Tamara McFarland  
Environmental Services  
Public Works and Government Services Canada  
1713 Bedford Row  
Halifax, Nova Scotia  
B3J 1T3

Dear Ms. McFarland:

**Re: Marine Sediment Sampling Program  
Cape St. Marys Small Craft Harbour  
Fisheries and Oceans Canada – Small Craft Harbours**

GHD is pleased to submit this report on the Marine Sediment Sampling Program conducted in June 2015 at the Cape St. Marys Small Craft Harbour in Cape St. Marys, Digby County, Nova Scotia. GHD welcomes the opportunity to discuss the program or answer any questions regarding this report.

Sincerely,

GHD

  
Peter Oram, P.Geol.

  
Amanda Facey, B.Sc.



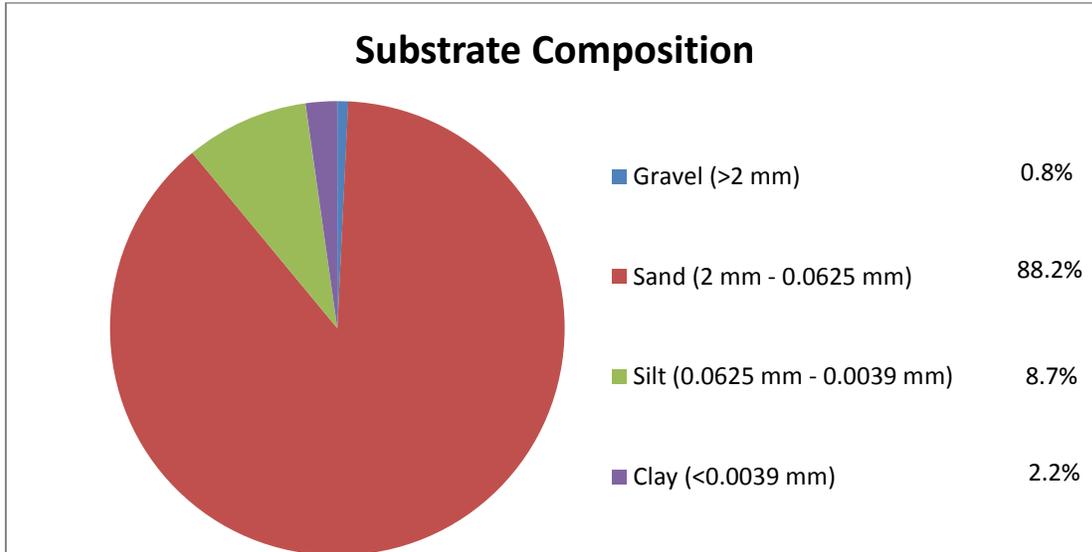
## EXECUTIVE SUMMARY

Six sediment samples were collected by a diver at the Cape St. Marys Small Craft Harbour. All samples were submitted to Maxxam for analyses. Results were compared to the Canadian Environmental Protection Act (CEPA) Disposal at Sea Regulations, Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the Protection of Environmental and Human Health in agricultural, residential/parkland, commercial, and industrial applications, Atlantic Risk-Based Corrective Action (RBCA) for Petroleum Impacted Sites in Atlantic Canada Version 3 Tier I Risk-Based Screening Levels (RBSLs) for Soil, the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills (NS Landfill Guidelines), and the Nova Scotia Tier 1 Environmental Quality Standards (NS EQSs) for Soil. Leachate results were compared to Health Canada's Guidelines for Canadian Drinking Water Quality, CCME Water Quality Guidelines, NS EQSs for Surface Water and Groundwater, and the NS Landfill guidelines. A summary of exceedances is presented in Table ES1.

**Table ES1 Exceedance Table**

Guideline /Parameter	Sample ID					
	SED1	SED2	SED3	SED4	SED5	SED6
CEPA						
CCME SQGs:	•	•		•		•
PAHs						
Metals	•	•		•		•
Metals Leachate (SPLP)	•	•				
BTEX						
PCBs						
Atlantic RBCA Tier 1 RBSLs						
NS Landfill Guidelines						
NS Tier I EQSs:	•	•	•	•	•	•
PAHs						
Metals	•	•	•	•	•	•
Metals Leachate (SPLP)	•	•				
BTEX/TPH						

• Indicates an exceedance



**Figure ES.1 Substrate Composition Averaged from Sample Locations within Proposed Dredging Area**



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## **1.0 INTRODUCTION**

At the request of Public Works and Government Services Canada (PWGSC), six locations were sampled within the footprint of the proposed dredging area at the Cape St. Marys Fisheries and Oceans Canada Small Craft Harbour (DFO SCH) on June 24, 2015.

## **2.0 SCOPE AND METHODOLOGY**

### **2.1 Site Plan**

A random approach was used to determine sample locations in the proposed dredging area of the SCH. The unstratified area was divided into 64 numbered square blocks that were spatially representative of the dredge area. The Excel RANDBETWEEN function was then used to generate numbers that represent the numbered cells and the sample locations within the proposed dredge area (Figure 2.1).

A detailed program design was prepared by GHD and submitted to PWGSC on May 7, 2015 for review and approval prior to field program implementation. The field program was scheduled upon acceptance of the design and scheduling the divers.

Sample collection, preparation, and analyses were conducted in accordance with Environment Canada's publication *Guidance Document on Collection and Preparation of Sediments for Physicochemical Characterization and Biological Testing*, December 1994. Connors Diving Services Limited was retained to collect the sediment samples. The sample collection field program was completed in accordance with guidelines defined by Nova Scotia's Workplace Health and Safety Regulations.

### **2.2 Sample Collection**

The marine sediment samples were collected by a diver as close as possible to the proposed sample locations. A handheld Topcon GMS-2 global positioning system (GPS) was used to georeference the sample location coordinates that were determined prior to field program initiation. All samples were able to be collected as planned. Sample location coordinates are listed in Table 2.1. Six samples were submitted to Maxxam Analytics in Bedford, Nova Scotia for analysis. Marine Sediment Sampling Program (MSSP) field notes that were completed in the field during the sampling program are provided in Appendix A.

On June 24, the weather was foggy with light wind, and the temperature was approximately 13°C. The water in the harbour where sampling occurred was relatively calm.

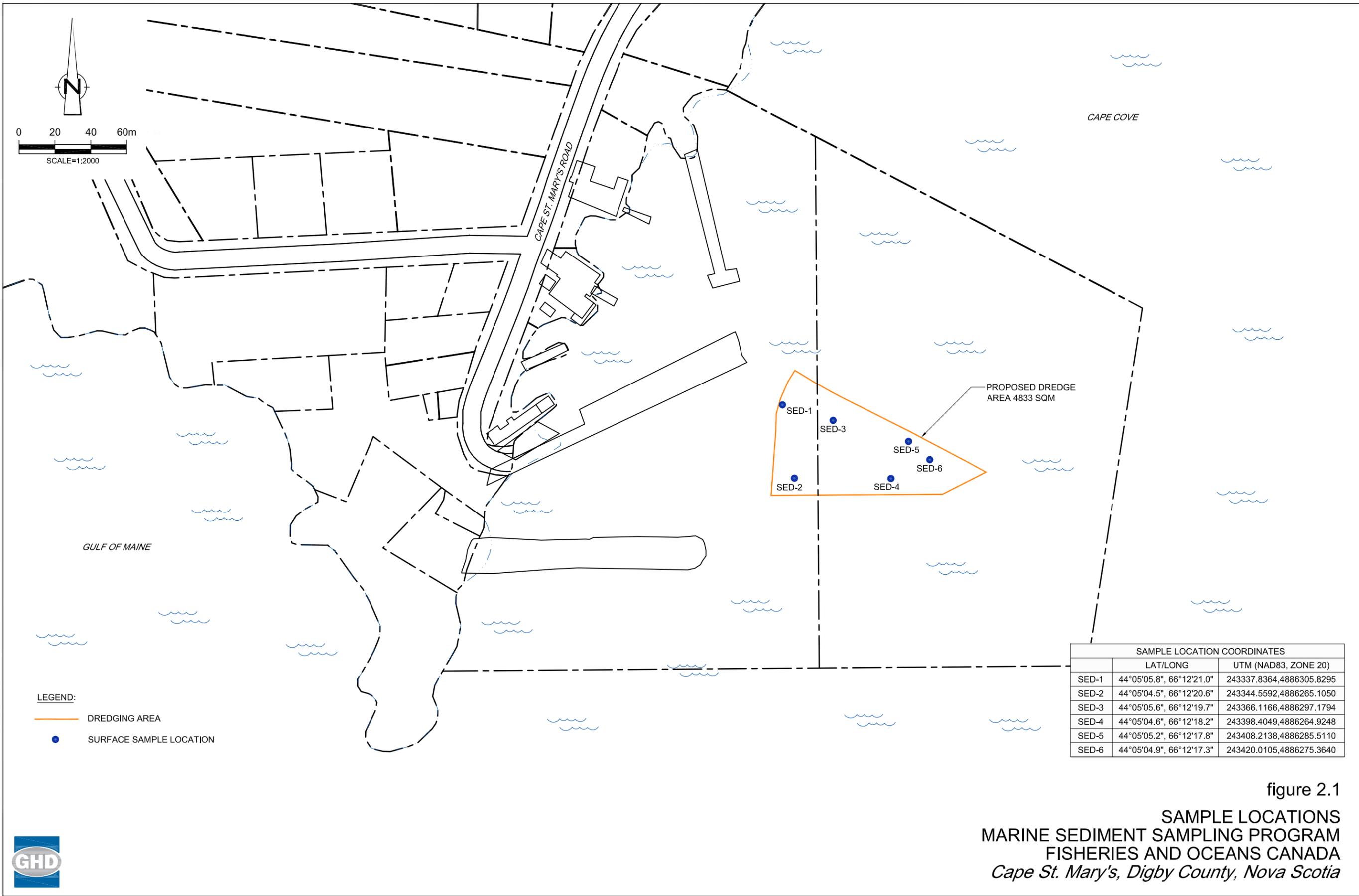


figure 2.1  
 SAMPLE LOCATIONS  
 MARINE SEDIMENT SAMPLING PROGRAM  
 FISHERIES AND OCEANS CANADA  
 Cape St. Mary's, Digby County, Nova Scotia





**Table 2.1 Sample Location Coordinates**

Sample Location	Sample Coordinates (decimal degrees, NAD 83)	
SED1	44.08494	-66.20583
SED2	44.08458	-66.20572
SED3	44.08487	-66.20547
SED4	44.08459	-66.20505
SED5	44.08478	-66.20494
SED6	44.08469	-66.20479

In order to facilitate the determination of all disposal options, the sample analytical results were compared to the following:

- Canadian Environmental Protection Act (CEPA) Disposal at Sea Regulations – Lower Level Screening Criteria;
- Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the Protection of Environmental and Human Health in agricultural, residential/parkland, commercial, and industrial applications;
- Atlantic Risk-Based Corrective Action (RBCA) for Petroleum Impacted Sites in Atlantic Canada Version 3 Tier I Risk-Based Screening Levels (RBSLs);
- Nova Scotia Guidelines for the Disposal of Contaminated Solids in Landfills (NS Landfill Guidelines); and
- Nova Scotia Tier 1 Environmental Quality Standards for Soil (NS EQSs).

Leachate results were compared to the following:

- Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ);
- CCME Water Quality Guidelines (WQGs);
- NS EQSs for Surface Water and Groundwater; and
- NS Landfill Guidelines

The following guidelines have been provided for reference in the analytical summary tables (Appendix B):

- CCME Sediment Quality Guidelines Interim Sediment Quality Guidelines;
- CCME Sediment Quality Guidelines Probable Effect Levels;
- Atlantic RBCA Tier 1 Sediment Ecological Screening Levels; and
- NS EQSs for Sediment

### **3.0 BENTHIC PHOTO INTERPRETATION**

On June 24, 2015, Connors Diving Services Limited took underwater video at six sediment sample locations in Cape St. Marys SCH, Digby County, Nova Scotia. The purpose of this survey was to broadly characterize the existing benthic habitat at the sediment sample locations. The sample locations were identified using a GPS, and conditions during the



underwater survey were relatively calm. Still images were taken from the video for each sample location. The substrate was mainly composed of sand. No macrofauna were visible on the photos for each sample location, and macroflora only appears to consist of floating debris. No anchored flora was observed. Underwater photographs are presented in Appendix A.

## **4.0 ANALYTICAL RESULTS**

The analytical results of the marine sediment samples collected and analyzed from Cape St. Marys SCH are summarized in Tables B.1 to B.7 (Appendix B) and discussed below.

Based on a review of the initial analytical results, it was decided through consultation with PWGSC that SED1 and SED4 should undergo leachate analyses. SED1 and SED4 were analyzed for metals (synthetic precipitation leaching procedure [SPLP]) for their exceedances of the CCME SQGs and NS EQSs. Results from these analyses were compared against Health Canada's GCDWQ, the CCME WQGs, the NS EQSs for Surface Water and Groundwater, and the NS Landfill Guidelines for leachate. SED2 was also analyzed for ethylene glycol due to all samples having a total organic carbon (TOC) concentration greater than 0.068 g/kg. SED2 was chosen because it had the highest TOC concentration.

For the polycyclic aromatic hydrocarbons (PAHs) and metals results, only those parameters for which there are established regulatory guidelines or those used in calculations are included in the tables. The complete set of analytical results, including laboratory quality assurance/quality control (QA/QC) and certificates of analyses for all parameters tested are provided in Appendix C.

### **4.1 PAH Concentrations**

Total PAH levels are regulated at a value of less than or equal to 2.5 milligrams per kilogram (mg/kg) under CEPA in order to meet Disposal at Sea Regulations. The CCME SQGs for the Protection of Environmental and Human Health stipulate guideline values for individual PAH compounds as well as the sum of individual PAH compounds for the calculation of index of additive cancer risk (IACR). PAH concentrations have also been compared to the NS Landfill Guidelines and the NS EQSs. A summary of the results compared to each of the referenced guidelines is provided in the following subsections:

#### CEPA Disposal at Sea Regulations

All 6 samples were below the CEPA lower level screening criterion for total PAHs (Table B.1a).

#### CCME SQGs – Human Health (Potable Water)

All 6 samples were below the CCME IACR (drinking water check) value of 1.0 mg/kg (Table B.1a).



#### CCME SQGs – Human Health (Direct Contact)

Guidance provided in the CCME SQGs for the Protection of Environmental and Human Health (2010) indicates that for soil contaminated by coal tar or creosote mixtures, the calculated benzo(a)pyrene total potency equivalent (B(a)P TPE) concentration for soil samples should be multiplied by an uncertainty factor of three prior to comparison with the SQGs for the Protection of Human Health (direct contact) to account for carcinogenic potential of alkylated and other PAHs present for which a potency equivalence factor does not currently exist, but which are likely to contribute to mixture carcinogenic potential.

Analytical results revealed that creosote was not detected in the six samples analyzed. Results of all six samples were below the CCME SQG for the Protection of Human Health (direct contact) for the agricultural, residential/parkland, commercial, and industrial value of 5.3 mg/kg (Table B.1a).

#### CCME SQGs – Environmental Health (Soil Contact, Soil and Food Ingestion, Freshwater Life, and Interim Soil Quality Criteria)

No samples exceeded the CCME SQGs for the Protection of Environmental Health - soil contact, soil and food ingestion, or freshwater life, for any land use scenarios (Table B.1a).

No samples exceeded the Interim Soil Quality Criteria for any land use (Table B.1a).

#### NS EQSs

No samples exceeded the NS EQSs (Table B.1b).

#### NS Landfill Guidelines

No samples exceeded the NS Landfill Guidelines (Table B.1b).

## **4.2 Metal Concentrations**

Sample results were compared to the established CEPA Disposal at Sea Regulations lower level screening criteria. The results were also compared to the CCME SQGs for agricultural, residential/parkland, commercial, and industrial applications for land disposal, the NS EQSs, and the NS Landfill Guidelines.

#### CEPA Disposal at Sea Regulations

No samples exceeded the CEPA lower level screening criteria (Table B.2).

#### CCME SQGs

SED1, SED2, SED4, and SED6 exceeded the CCME SQG for hot water soluble boron for agricultural land use (guideline – 2 mg/kg, concentrations ranged from 2.1 – 5.3 mg/kg) (Table B.2).



#### NS EQSs

SED1, SED2, SED4, and SED6 exceeded the NS EQS for hot water soluble boron for agricultural land use (guideline – 2 mg/kg, concentrations ranged from 2.1 – 5.3 mg/kg). All samples exceeded the NS EQS for iron for agricultural, residential/parkland, and commercial land uses (guideline – 11000 mg/kg, concentrations ranged from 12000 – 15000 mg/kg) (Table B2).

#### NS Landfill Guidelines

No samples exceeded the NS Landfill Guidelines; however, the RDL for total boron is greater than the NS Landfill Guideline (RDL – 50 mg/kg, guideline – 2 mg/kg), therefore, a comparison could not be made to the guideline (Table B.2).

### **4.2.1 Metals Leachate Analysis**

SED1 and SED4 were analyzed for metals leachate (SPLP).

#### CCME WQGs – Aquatic Life (Freshwater)

Both samples exceeded the CCME WQG for the Protection of Aquatic Life, freshwater, for aluminium, and SED1 exceeded this guideline for lead. The cadmium concentrations for both samples were not detected; however, the RDL for cadmium is greater than the CCME WQG, freshwater (RDL – 0.30 µg/L, guideline – 0.09 µg/L), therefore, a comparison could not be made to the guideline (Table B.2b).

#### Health Canada GCDWQ MAC and AO

Leachate analysis results of SED1 and SED4 did not exceed any Health Canada GCDWQ MAC or the AO (Tables B.2b).

#### NS EQSs for Surface Water and Groundwater

SED1 and SED4 exceeded the NS EQS for freshwater surface water for aluminium, and SED1 exceeded this guideline for lead (Table B.2b).

#### NS Landfill Guidelines

SED1 and SED4 did not exceed any of the NS Landfill Guidelines for leachate (Table B.2b).

### **4.3 Petroleum Hydrocarbon Concentrations**

Although no federal guidelines for petroleum hydrocarbons currently exist for marine sediment, the analytical benzene, toluene, ethylbenzene, and xylene (BTEX) results of the six samples were compared to the Atlantic RBCA Version 3 Tier 1 RBSLs, CCME SQGs for various land use applications, the NS Landfill Guidelines, and the NS EQSs. Silica gel clean-up was requested and completed prior to analysis.

Modified total petroleum hydrocarbon (TPH) values reflect the sum of the individual carbon fractions that resemble gasoline, fuel oil, and lube oil. The analytical results for modified TPH



were compared against the corresponding Atlantic RBCA Version 3 Tier 1 RBSLs and the NS EQSs.

There were no detectable concentrations of BTEX or hydrocarbon fractions, therefore, no guidelines were exceeded (Table B.3).

#### **4.4 PCB Concentrations**

Total PCB values are regulated at a value of less than or equal to 0.1 mg/kg under CEPA in order to meet Disposal at Sea Regulations. The CCME SQGs for PCBs in agricultural, residential/parkland, and commercial/industrial applications are regulated at values of 0.5, 1.3, and 33.0 mg/kg, respectively. PCB concentrations have also been compared to the NS Landfill Guidelines and the NS EQSs.

All samples had non-detectable concentrations of PCBs and, therefore, were below guidelines (Table B.4).

#### **4.5 Carbon Content**

Samples showed total carbon contents ranging from 2.3 to 8.6 grams per kilogram (g/kg). TOC and total inorganic carbon had similar ranges, 0.92 to 4.5 g/kg and 1.4 to 4.1 g/kg, respectively (Table B.5).

#### **4.6 Ethylene Glycol**

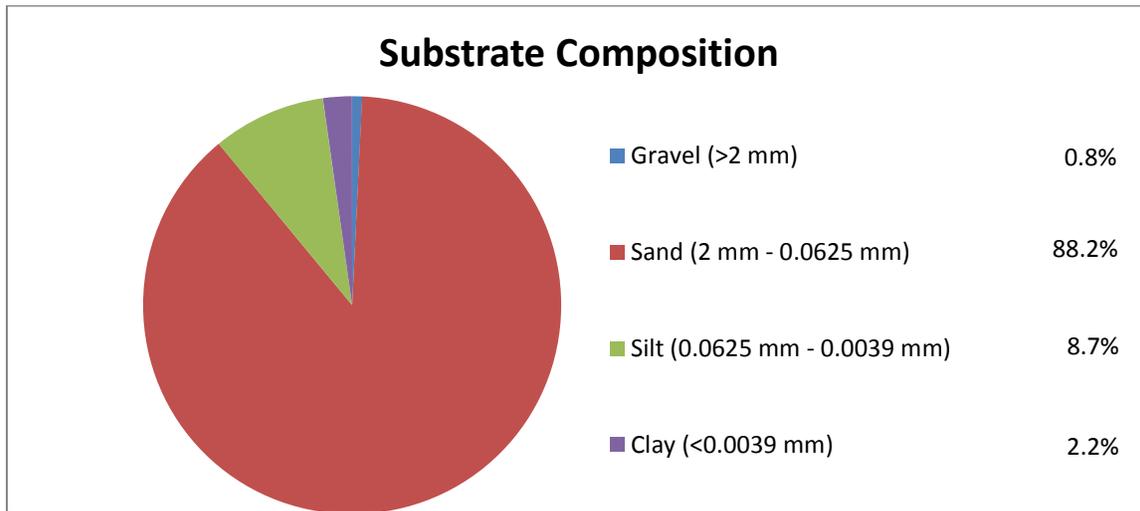
SED2 was analyzed for ethylene glycol due to all samples having a TOC concentration greater than 0.068 g/kg. SED2 was chosen for analysis because it had the highest TOC concentration. The concentration of ethylene glycol in SED2 was not detectable and, therefore, below applicable guidelines. The sample extraction for glycol analysis was completed past the 14 day hold time. (Table B.6).

#### **4.7 Pentachlorophenol**

All samples had non-detectable concentrations of pentachlorophenol and, therefore, were below guidelines (Table B.7).

#### **4.8 Grain Size Distribution**

Sediment composition is described in Figure 4.1.



**Figure 4.1 Substrate Composition Averaged from Sample Locations within Proposed Dredging Area**

Dominant sediment types in each sample are summarized in Table 4.1.

**Table 4.1 Dominant Sediment Types in Each Sample**

Sediment Distribution				
Sample ID	Primary Substrate	Secondary Substrate	Tertiary Substrate	Quaternary Substrate
SED1	Sand	Silt	Clay	Gravel
SED2	Sand	Silt	Clay	Gravel
SED3	Sand	Silt	Clay	Gravel
SED4	Sand	Gravel	Silt	Clay
SED5	Sand	Clay	Silt	Gravel
SED6	Sand	Silt	Clay	Gravel

## 5.0 QUALITY ASSURANCE/QUALITY CONTROL

All samples collected were labelled on-site using a waterproof marker with the date, site location, sample identification, and project number. The samples were wrapped in bubble wrap and placed upright on ice inside a cooler for safe storage and transport, and were delivered to the laboratory following program completion. A copy of the chain of custody that accompanied the samples is provided in Appendix C. Additional samples were collected to safeguard against loss or damage during transport, and will be stored and refrigerated until the final report is received by PWGSC.

Sample collection, preparation, and analyses followed guidance provided in the aforementioned Environment Canada document. Samples were analyzed by an accredited laboratory with CALA and/or ISO/IEC 17025 and that is certified by the Standards Council of Canada for each selected chemical analyses of this program. The complete set of analytical



results, including laboratory QA/QC and certificates of analyses for all parameters tested, are provided in Appendix C.

The laboratory undertakes internal duplicate analyses for QA/QC purposes. Laboratory duplicate analyses were performed for hot water soluble boron, PAHs, and MTBE, BTEX and the C<sub>6</sub>-C<sub>10</sub> fractions of petroleum hydrocarbons, to meet internal QA/QC objectives for the Cape St. Marys samples submitted. No discrepancies were noted by the laboratory for the laboratory initiated duplicates.

To assess the quality of the analytical data, a review of the internal laboratory QA/QC results was completed and included a review of laboratory duplicate analyses, method blanks, surrogates, spike samples, and QA/QC standards. The following information applicable to this MSSP report's findings was noted:

- Due to the sample matrix, SED2 required dilution for pentachlorophenol analysis. The RDL was adjusted accordingly. The adjusted RDL was not above any applicable guidelines.
- The method blank for leachable barium contained low-level lab contamination; however, the lab indicated that this would have minimal impact on data quality.
- Relative percent difference (RPD) for laboratory duplicates:
  - RPD for SED1 and SED1 laboratory duplicate for hot water soluble boron was 4%.

A senior GHD reviewer has reviewed this report prior to its release. The limitations of this document are provided in Appendix D.

## 6.0 CONCLUSION

The analytical results of the six sediment samples from the Cape St. Marys DFO SCH indicate that all of the samples exceeded various screening levels and/or guidelines. None of the samples exceeded any of the CEPA screening criteria. The CCME SQG for agricultural land use was exceeded by SED1, SED2, SED4, and SED6 for hot water soluble boron. The CCME WQGs for freshwater life were exceeded by SED1 and SED4 for leachable aluminium, and SED1 exceeded this guideline for leachable lead.

SED1, SED2, SED4, and SED6 exceeded the NS soil EQS for agricultural land use for hot water soluble boron. All samples exceeded the NS EQS for iron for agricultural, residential/parkland, and commercial land uses. SED1 and SED4 leachable aluminium concentrations exceeded the NS EQSs for freshwater, and SED1 exceeded this guideline for leachable lead.

There were no guideline exceedances for PAHs, BTEX/TPH, or PCBs. Boron, cyanide, pentachlorophenol, and ethylene glycol were all below their RDLs.

Carbon content was similar between organic and inorganic carbon. Sand made up the largest percentage of material in the sediment within the entire proposed dredge area with lower amounts of silt and clay.



## 7.0 CLOSING

This document has been prepared and reviewed by the following people:

**Reviewed by:**

**Prepared by:**

A handwritten signature in blue ink, appearing to read 'Peter Oram', written over a horizontal line.

**Peter Oram, P.Geol.**

A handwritten signature in blue ink, appearing to read 'Amanda Facey', written over a horizontal line.

**Amanda Facey, B.Sc.**



**APPENDIX A**  
**MSSP Field Report**

## MSSP FIELD REPORT

Site: Cape St. Marys SCH	Location: Cape St. Marys, Digby Co.	Date: 24 June 2015
Sample Collector: A Facey / Connors Diving		Time: 9:12 AM
Recorder: A Facey		Average Water Temperature (°C): -
Collection Device: Bucket	Type of Vessel: Zodiac	

Site Description		
Air Temperature: 13 °C □ °F	Weather: foggy, light breeze	Photographs Taken: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Site Conditions: calm		
Observations: Construction underway on southern breakwater. No impact on sample collection.		

Sample Data					
Sample ID	Sediment Description <sup>1</sup>	Odour <sup>2</sup>	Grab Depth (cm)	Flora/Fauna	Latitude and Longitude <sup>3</sup>
SED1	dk br, sand, coarse	none	10-15	-	44.08494 -66.20583
SED2	br/bl, sand, tr silt	none	10-15	floral debris	44.08458 -66.20572
SED3	br, sand, coarse	none	10-15	-	44.08487 -66.20547
SED4	br, sand, coarse	none	10-15	floral debris	44.08459 -66.20505
SED5	br, sand, coarse	none	10-15	floral debris	44.08478 -66.20494
SED6	br, sand, coarse	none	10-15	-	44.08469 -66.20479

Additional Comments
dk = dark
br = brown
bl = black
tr = trace

Notes:
1. Sediment colour, gradient type, sediment type, texture and consistency, colour, presence of biota
2. Degree of odour (strong, slight, none)
3. Decimal degrees (DDD.dddd)



Photo 1: SED1 – Macrofloral debris



Photo 2: SED2 – Macrofloral debris



Photo 3: SED3 – Macrofloral debris



Photo 4: SED4 – Macrofloral debris



Photo 5: SED5 – Macrofloral debris



Photo 6: SED6 – Macrofloral debris



**APPENDIX B**  
**Analytical Summary Tables**

Table B.1a PAH Results for Marine Sediments Compared to Federal Criteria - Cape St. Marys DFO-SCH, Cape St. Marys, Nova Scotia

Parameter	RDL	Units	Sample Identification and Date								CEPA Disposal at Sea Screening Criterion - Lower Level	CCME Sediment Quality Guidelines				CCME Soil Quality Guidelines								
			SED1	SED2	SED3	SED4	SED5	SED5 Lab-Dup	SED6	Interim Sediment Quality Guidelines		Probable Effects Levels		Human Health		Environmental Health			Interim Soil Quality Criteria					
			24-Jun-15									Freshwater	Marine	Freshwater	Marine	Potable Water	Direct Contact	Soil Contact		Soil and Food Ingestion	Freshwater Life	Agricultural Land Use	Residential/Parkland Land Use	Commercial and Industrial Land Uses
																Agricultural, Residential/Parkland, Commercial and Industrial Land Uses	Agricultural, Residential/Parkland, Commercial and Industrial Land Uses	Agricultural and Residential/Parkland Land Uses	Commercial and Industrial Land Uses	Agricultural and Residential/Parkland Land Uses	Agricultural, Residential/Parkland, Commercial/Industrial Land Uses			
<b>Polycyclic Aromatic Hydrocarbon (PAH) Results</b>																								
1-Methylnaphthalene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050															
2-Methylnaphthalene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.0202	0.0202	0.201	0.201										
Acenaphthene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.00671	0.00671	0.0889	0.0889				21.5	0.28					
Acenaphthylene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.00587	0.00587	0.128	0.128					320					
Anthracene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.0469	0.0469	0.245	0.245		2.5	32	61.5						
Benzo(a)anthracene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.0371	0.0748	0.385	0.693				6.2					10	
Benzo(a)pyrene	0.0050		<0.0050	0.0099	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.0319	0.0888	0.782	0.763		20	72	0.6	8800					
Benzo(b)fluoranthene	0.0050		<0.0050	0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050									6.2					10	
Benzo(g,h,i)perylene	0.0050	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050															
Benzo(j)fluoranthene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050															
Benzo(k)fluoranthene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050									6.2					10	
Chrysene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.0571	0.108	0.862	0.846				6.2						
Dibenz(a,h)anthracene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.00622	0.00622	0.135	0.135							0.1	1	10	
Fluoranthene	0.0050		<0.0050	0.017	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.111	0.113	2.355	1.494		50	180	15.4						
Fluorene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.0212	0.0212	0.144	0.144				15.4	0.25					
Indeno(1,2,3-cd)pyrene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050												0.1	1	10	
Naphthalene	0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.0346	0.0346	0.391	0.391				8.8	0.013					
Phenanthrene	0.0050		<0.0050	0.0098	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.0419	0.0867	0.515	0.544				43	0.046					
Pyrene	0.0050		<0.0050	0.013	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		0.053	0.153	0.875	1.398				7.7					100	
Total PAHs	Calculation		0.040	0.087	0.040	0.040	0.040	0.040	0.040	2.5														
Index of Additive Cancer Risk (IACR)	Calculation	None	0.075	0.141	0.075	0.075	0.075	0.075	0.075						1									
Benzo(a)pyrene TPE (10 <sup>-5</sup> )	Calculation	mg/kg	0.006	0.014	0.006	0.006	0.006	0.006	0.006															
Creosote or Coal Tar source suspected/known? *	Yes/No		No	No	No	No	No	No	No															
Uncertainty Factor Applied	Yes/No		No	No	No	No	No	No	No															
Benzo(a)pyrene TPE (10 <sup>-5</sup> ) with UF	Calculation	mg/kg	NA	NA	NA	NA	NA	NA	NA						5.3									

NOTES:  
 CEPA = Canadian Environmental Protection Act - Disposal at Sea Regulations, September 9, 2009  
 CCME = Canadian Council of Ministers of the Environment - Sediment Quality Guidelines for the Protection of Aquatic Life (provided for reference)  
 CCME - Soil Quality Guidelines for the Protection of Environmental and Human Health, Polycyclic Aromatic Hydrocarbons, 2010  
 Total PAH calculation based on the sum of 16 individual PAH compounds (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluorene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene) as per guidance from Environment Canada, 2009  
 Index of Additive Cancer Risk (potable water check) =  
 ((Benzo(a)anthracene)/0.33 mg·kg<sup>-1</sup>) + ((Chrysene)/2.1 mg·kg<sup>-1</sup>) + ((Benzo(b)+k)fluoranthene)/0.16 mg·kg<sup>-1</sup> + ((Benzo(a)pyrene)/0.37 mg·kg<sup>-1</sup>) + ((Indeno(1,2,3-cd)pyrene)/2.7 mg·kg<sup>-1</sup>) + ((Dibenz(a,h)anthracene)/0.23 mg·kg<sup>-1</sup>) + ((Benzo(g,h,i)perylene)/6.8 mg·kg<sup>-1</sup>)  
 Benzo(a)pyrene TPE (10<sup>-5</sup>) = Sum of PAH concentrations multiplied by their respective Benzo(a)pyrene Potency Equivalency Factors: ((Benzo(a)anthracene)\*0.1) + ((Benzo(a)pyrene)\*1) + ((Benzo(b)+k)fluoranthene)\*0.1 + ((Benzo(k)fluoranthene)\*0.1) + ((Benzo(g,h,i)perylene)\*0.01) + ((Chrysene)\*0.01) + ((Dibenz(a,h)anthracene)\*1) + ((Indeno(1,2,3-cd)pyrene)\*0.1)  
 Total Potency Equivalent (TPE) based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10<sup>-5</sup>)  
 Where parameter is not detected, IACR and B(a)P TPE calculations use 1/2 the detection limit  
 Benzo(a)pyrene TPE Uncertainty Factor = 3  
 \* Laboratory analysis indicated no presence of creosote  
 RDL = reportable detection limit  
 NA = not applicable  
**Exceedances are bolded with applicable guideline bolded - NO EXCEEDANCES**



Table B.2 Metal Results for Marine Sediments - Cape St. Marys DFO-SCH, Cape St. Marys, Nova Scotia

Parameter	RDL	Units	Sample Identification and Date							CEPA Disposal at Sea Screening Criteria - Lower Level	CCME Sediment Quality Guidelines				CCME Soil Quality Guidelines				Nova Scotia Environmental Quality Standards				NS Landfill Guidelines			
			SED1	SED1 Lab-Dup	SED2	SED3	SED4	SED5	SED6		Interim Sediment Quality Guidelines		Probable Effects Levels		Agricultural Land Use	Residential/Parkland Land Use	Commercial Land Use	Industrial Land Use	Potable and Non-Potable Sites with Coarse- and Fine-Grained Soils					Sediment Environment		
			24-Jun-15								Freshwater	Marine	Freshwater	Marine					Agricultural Land Use	Residential/Parkland Land Use	Commercial Land Use	Industrial Land Use		Agricultural Land Use	Residential/Parkland Land Use	Commercial Land Use
Aluminum	10	mg/kg	6500		6000	6300	7200	6100	6000									15400	15400	15400	198000					
Antimony	2.0		<2.0		<2.0	<2.0	<2.0	<2.0	<2.0					20	20	40	40	7.5	7.5	63	63	25		40		
Arsenic	2.0		2.9		2.7	3.1	2.6	3.2	2.5		5.9	7.24	17.0	41.6	12	12	40	12	17	31	31	31	17	41.6	50	
Barium	5.0		13		16	12	11	11	11						750	500	2000	2000	400	10000	15000	140000			2000	
Beryllium	2.0		<2.0		<2.0	<2.0	<2.0	<2.0	<2.0						4	4	8	8	5	38	320	320			8	
Boron (Total)	50		<50**		<50**	<50**	<50**	<50**	<50**										4300	4300	24000	24000			2	
Boron (Hot Water Soluble)	0.30		<b>2.5</b>	<b>2.6</b>	<b>5.3</b>	1.9	<b>2.1</b>	1.8	<b>2.1</b>						<b>2</b>				<b>2</b>							
Cadmium	0.30		<0.30		<0.30	<0.30	<0.30	<0.30	<0.30	0.6	0.6	0.7	3.5	4.2	1.4	10	22	22	1.4	14	49	192	3.5	4.2	20	
Chromium (Hexavalent)	0.20		<0.2		<0.2	<0.2	<0.2	<0.2	<0.2						0.4	0.4	1.4	1.4	0.4	160	1300	1300			8	
Chromium (Total)	2.0		14		13	14	15	13	13		37.3	52.3	90.0	160	64	64	87	87	52	220	630	2300	90	160	800	
Cobalt	1.0		3.5		3.5	3.6	4.0	3.5	3.4						40	50	300	300	20	22	250	250			300	
Copper	2.0		3.5		5.0	3.5	4.4	4.2	3.5		35.7	18.7	197	108	63	63	91	91	63	1100	4000	16000	197	108	500	
Cyanide (Total)	0.5		<0.50		<0.50	<0.50	<0.50	<0.50	<0.50																500	
Iron	50		<b>13000</b>		<b>12000</b>	<b>13000</b>	<b>15000</b>	<b>13000</b>	<b>13000</b>										<b>11000</b>	<b>11000</b>	<b>11000</b>	144000	43766			
Lead	0.50		2.8		6.0	3.0	4.1	3.0	2.9		35.0	30.2	91.3	112	70	140	260	600	70	140	260	740	91.3	112	1000	
Manganese	2.0		170		170	170	230	190	190														1100			
Mercury (Total)	0.10		<0.10		<0.10	<0.10	<0.10	<0.10	<0.10	0.75	0.17	0.13	0.486	0.7	6.6	6.6	24	50	6.6	6.6	24	99	0.486	0.7	10	
Molybdenum	2.0		<2.0		<2.0	<2.0	<2.0	<2.0	<2.0						5	10	40	40	40	110	1200	1200			40	
Nickel	2.0		9.1		8.6	9.0	10	8.6	8.9						50	50	50	50	50	330	2200	2200	75		500	
Selenium	1.0		<1.0		<1.0	<1.0	<1.0	<1.0	<1.0						1	1	2.9	2.9	1	80	125	1135	2		10	
Silver	0.50		<0.50		<0.50	<0.50	<0.50	<0.50	<0.50						20	20	40	40	20	77	490	490	1	2.2	40	
Strontium	5.0		18		54	20	23	17	16										9400	9400	9400	122000				
Thallium	0.10		<0.10		<0.10	<0.10	<0.10	<0.10	<0.10						1	1	1	1	1	1	1	1	1			1
Tin	1.0		<1.0		<1.0	<1.0	2.0	<1.0	<1.0						5	50	300	300	5	9400	9400	122000			300	
Uranium	0.10		0.26		0.51	0.27	0.30	0.31	0.39						23	23	33	300	23	23	33	300				
Vanadium	2.0		16		15	16	16	16	15						130	130	130	130	39	39	160	160			200	
Zinc	5.0		28		27	27	30	24	24		123	124	315	271	200	200	360	360	200	5600	47000	47000	315	271	1500	

NOTES:

CEPA = Canadian Environmental Protection Act - Disposal at Sea Regulations, September 9, 2009

CCME = Canadian Council of Ministers of the Environment - Sediment Quality Guidelines for the Protection of Aquatic Life (provided for reference)

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

Nova Scotia Tier 1 Environmental Quality Standards for Soil and Sediment, July 6, 2013

NS Landfill Guidelines = Nova Scotia Environment and Labour - Guidelines for Disposal of Contaminated Solids in Landfills, March 22, 1992

RDL = reportable detection limit

\*\* RDL for total boron greater than NS Landfill Guideline

Exceedances are bolded with applicable guideline bolded.

**Table B.2b Metal Results for Leachate Samples (SPLP) - Cape St. Marys DFO-SCH, Cape St. Marys, Nova Scotia**

Parameter	RDL	Units	Sample Identification and Date		CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life		Health Canada Guidelines for Canadian Drinking Water Quality		Nova Scotia Environmental Quality Standards				NS Landfill Guidelines	
			24-Jun-15		Freshwater	Marine	Maximum Acceptable Concentration	Aesthetic Objective	Surface Water		Groundwater			
			SED1	SED4					Freshwater	Marine	Potable with Fine- and Coarse-Grained Soils	Non-Potable with Fine- and Coarse-Grained Soils		
					Freshwater	Marine	Agricultural/Residential and Commercial/Industrial Land Uses							
<b>Leachable Metals</b>														
Aluminum	10	µg/L	<b>220</b>	<b>290</b>	<b>5-100</b>				<b>5</b>				500000	
Antimony	2.0		<2.0	<2.0			6		20	500	6			
Arsenic	2.0		2.6	2.0	5	12.5	10		5.0	12.5	10			5000
Barium	5.0		16	18			1000		1000	500	1000			100000
Beryllium	2.0		<2.0	<2.0					5.3	100	4			10000
Cadmium	0.30		<0.30*	<0.30*	0.09**	0.12	5		0.01	0.12	5			500
Chromium (Total)	2.0		<2.0	<2.0			50				50			5000
Cobalt	1.0		<1.0	<1.0					10		10			5000
Copper	2.0		<2.0	<2.0	2**			1000	2	2				100000
Iron	50		260	280	300			300	300					
Lead	0.50		<b>1.2</b>	0.68	<b>1**</b>		10		<b>1</b>	2	10			5000
Manganese	2.0		<2.0	3.0					50	820				
Molybdenum	2.0		<2.0	<2.0	73				73		70			5000
Nickel	2.0		<2.0	<2.0	25**				25	8.3	100			20000
Selenium	1.0		<1.0	<1.0	1		50		1.0	2	10			1000
Silver	0.50		<0.50*	<0.50*	0.1				0.1	1.5	100			5000
Strontium	5.0		100	97					21000		4400			
Thallium	0.10		<0.10	<0.10	0.8				0.8	21.3	2			
Tin	2.0		<2.0	<2.0							4400			
Uranium	0.10		<0.10	<0.10	15		20		300	100	20			2000
Vanadium	2.0	4.6	5.1					6	50	6.2			10000	
Zinc	5.0	<5.0	5.1	30				5000	30	10	5000		500000	

NOTES:

CCME = Canadian Council of Ministers of the Environment - Water Quality Guidelines for the Protection of Aquatic Life, long term

Health Canada - Guidelines for Canadian Drinking Water Quality, August 2012

Nova Scotia Tier 1 Environmental Quality Standards for Surface Water and Groundwater, July 6, 2013

NS Landfill Guidelines = Nova Scotia Environment and Labour - Guidelines for Disposal of Contaminated Solids in Landfills, March 22, 1992

Aluminum: CCME CWQG for the Protection of Freshwater Aquatic Life = pH < 6.5 = 5 ug/L; pH ≥ 6.5 = 100 ug/L.

\*\* Samples were not analyzed for hardness, therefore, the most stringent guidelines for cadmium, copper, lead, and nickel were used.

RDL = reportable detection limit

\* RDL greater than guideline.

**Exceedances are bolded with applicable guideline bolded.**

Table B.3 BTEX/TPH Results for Marine Sediments - Cape St. Marys DFO-SCH, Cape St. Marys, Nova Scotia

Sample ID	Date	Units	BTEX Concentrations				Petroleum Hydrocarbon Fraction Concentrations					MTBE	Reached Baseline at C <sub>32</sub>	Resemblance
			Benzene	Toluene	Ethylbenzene	Xylene	C <sub>6</sub> -C <sub>10</sub>	C <sub>10</sub> -C <sub>16</sub>	C <sub>16</sub> -C <sub>21</sub>	C <sub>21</sub> -C <sub>32</sub>	Modified TPH (Less BTEX)			
SED1	24-Jun-15	mg/kg	<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<10	<15	<15	<0.025	NA	NA
SED2			<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<10	<15	<15	<0.025	NA	NA
SED3			<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<10	<15	<15	<0.025	NA	NA
SED4			<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<10	<15	<15	<0.025	NA	NA
SED5			<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<10	<15	<15	<0.025	NA	NA
SED 5 Lab-Dup			<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<10	<15	<15	<0.025	NA	NA
SED6			<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<10	<15	<15	<0.025	NA	NA
RDL			0.0050	0.025	0.010	0.050	2.5	10	10	15	15	0.025		
<b>Guidelines</b>			<b>Benzene</b>	<b>Toluene</b>	<b>Ethylbenzene</b>	<b>Xylene</b>	<b>Gasoline</b>	<b>Diesel / No. 2 Fuel Oil</b>		<b>No. 6 Oil/ Lube Oil</b>	<b>Modified TPH (Less BTEX)</b>	<b>MTBE</b>		
<b>Atlantic RBCA Tier I Version 3.0</b>														
<b>Risk-Based Screening Levels for Soil</b>														
Agricultural/ Residential Land Use	Potable	Coarse-Grained Soil	0.042	0.35	0.043	0.73					74 (gas), 270 (fuel), 1100 (lube)			
		Fine-Grained Soil	0.094	0.74	0.089	1.5					1900 (gas), 4700 (fuel), 10000 (lube)			
	Non-Potable	Coarse-Grained Soil	0.099	77	30	8.8					74 (gas), 270 (fuel), 1100 (lube)			
		Fine-Grained Soil	2.3	10000	9300	210					2100 (gas), 8600 (fuel), 10000 (lube)			
Commercial/ Industrial Land Use	Potable	Coarse-Grained Soil	0.042	0.35	0.043	0.73					870 (gas), 1800 (fuel), 10000 (lube)			
		Fine-Grained Soil	0.094	0.74	0.089	1.5					1900 (gas), 4700 (fuel), 10000 (lube)			
	Non-Potable	Coarse-Grained Soil	2.5	10000	10000	110					870 (gas), 4000 (fuel), 10000 (lube)			
		Fine-Grained Soil	33	10000	10000	10000					10000 (gas), 10000 (fuel), 10000 (lube)			
Residential Saturation		Coarse-Grained Soil	890	450	240	340								
		Fine-Grained Soil	1000	480	250	360								
<b>Sediment Ecological Screening Levels for the Protection of Freshwater and Marine Aquatic Life</b>														
Sediment Type		Typical	1.2	1.4	1.2	1.3					15 (gas), 25 (fuel), 43 (lube)			
(based on standard FOC = 0.01)		Other	5.4	6.1	5	5.5					67 (gas), 110 (fuel), 190 (lube)			
Maximum Screening Level											500			
<b>CCME Soil Quality Guidelines</b>														
Agricultural, Residential/ Parkland, Commercial, and Industrial Land Uses	Surface	Coarse-Grained Soil	0.03	0.37	0.082	11.0								
		Fine-Grained Soil	0.0068	0.08	0.018	2.4								
	Subsoil	Coarse-Grained Soil	0.03	0.37	0.082	11.0								
		Fine-Grained Soil	0.0068	0.08	0.018	2.4								
<b>Nova Scotia Environmental Quality Standards</b>														
<b>Soils</b>														
Agricultural Land Use	Potable	Coarse-Grained Soil	0.042	0.35	0.065	8.8					74 (gas), 150 (fuel), 300 (lube)	0.05		
		Fine-Grained Soil	0.094	0.74	0.13	22					210 (gas), 150 (fuel), 1300 (lube)	0.05		
	Non-Potable	Coarse-Grained Soil	0.99	75	30	8.8					74 (gas), 150 (fuel), 300 (lube)	0.05		
		Fine-Grained Soil	2.3	10000	120	65					210 (gas), 150 (fuel), 1300 (lube)	1.1		
Residential/ Parkland Land Use	Potable	Coarse-Grained Soil	0.042	0.35	0.065	8.8					74 (gas), 270 (fuel), 1100 (lube)	0.05		
		Fine-Grained Soil	0.094	0.74	0.13	22					1900 (gas), 4700 (fuel), 10000 (lube)	0.05		
	Non-Potable	Coarse-Grained Soil	0.99	77	30	8.8					74 (gas), 270 (fuel), 1100 (lube)	0.05		
		Fine-Grained Soil	2.3	10000	9300	210					2100 (gas), 8600 (fuel), 10000 (lube)	1.1		
Commercial and Industrial Land Uses	Potable	Coarse-Grained Soil	0.042	0.35	0.065	11					870 (gas), 1800 (fuel), 10000 (lube)	0.062		
		Fine-Grained Soil	0.094	0.74	0.13	22					1900 (gas), 4700 (fuel), 10000 (lube)	0.05		
	Non-Potable	Coarse-Grained Soil	2.5	10000	10000	110					870 (gas), 4000 (fuel), 10000 (lube)	0.57		
		Fine-Grained Soil	33	10000	10000	10000					10000 (gas), 10000 (fuel), 10000 (lube)	7.4		
<b>Sediment</b>														
Sediment Environment		Freshwater	1.2	1.4	1.2	1.3					15 (gas), 25 (fuel), 43 (lube)			
		Marine	1.2	1.4	1.2	1.3					15 (gas), 25 (fuel), 43 (lube)			
Total TPH											500			
<b>NS Landfill Guidelines</b>														
			5	30	50	50								

NOTES:

CCME Soil Quality Guidelines for benzene based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10<sup>-6</sup>).

Silica gel clean-up performed prior to analysis.

Atlantic RBCA = Atlantic Risk-based Corrective Action for Petroleum Impacted Sites in Atlantic Canada - Version 3.0, User Guidance, Table 4a (Appendix 3) - Tier I Risk-Based Screening Levels for Soil, July 2012

CCME = Canadian Council of Ministers of the Environment - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

Nova Scotia Tier 1 Environmental Quality Standards for Soil and Sediment, July 6, 2013

NS Landfill Guidelines = Nova Scotia Environment and Labour - Guidelines for Disposal of Contaminated Solids in Landfills, March 22, 1992

RDL = reportable detection limit

NA = not applicable/not analyzed

Exceedances are bolded with applicable guideline bolded - NO EXCEEDANCES

Table B.4 PCB Results for Marine Sediments - Cape St. Marys DFO-SCH, Cape St. Marys, Nova Scotia

Parameter	RDL	Units	Sample Identification and Date						CEPA Disposal at Sea Screening Criteria - Lower Level	CCME Sediment Quality Guidelines				CCME Soil Quality Guidelines			Nova Scotia Environmental Quality Standards						NS Landfill Guidelines						
			SED1	SED2	SED3	SED4	SED5	SED6		Interim Sediment Quality Guidelines		Marine and Estuarine Probable Effects Levels		Agricultural Land Use	Residential/Parkland Land Use	Commercial/Industrial Land Use	Potable Site and Non-Potable				Sediment Environment								
										24-Jun-15							Freshwater	Marine	Freshwater	Marine	Fine-Grained and Coarse-Grained Soils				Freshwater	Marine			
																					Agricultural Land Use	Residential/Parkland Land Use		Commercial Land Use			Industrial Land Use	Agricultural Land Use	Residential/Parkland Land Use
<b>Polychlorinated Biphenyl (PCB) Results</b>																													
Aroclor 1016	0.050	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050																					
Aroclor 1221	0.050		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050																					
Aroclor 1232	0.050		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050																					
Aroclor 1248	0.050		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050																					
Aroclor 1242	0.050		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050																					
Aroclor 1254	0.050		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050		0.060	0.0633	0.340	0.709																
Aroclor 1260	0.050		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050																					
Calculated Total PCB	0.050		<0.050*	<0.050*	<0.050*	<0.050*	<0.050*	<0.050*	0.1	0.0341	0.0215	0.277	0.189	0.5	1.3	33	1.3	22	33	33	0.277	0.189	50						

**NOTES:**  
 CEPA = Canadian Environmental Protection Act - Disposal at Sea Regulations, September 9, 2009  
 CCME = Canadian Council of Ministers of the Environment - Sediment Quality Guidelines for the Protection of Aquatic Life (provided for reference)  
 CCME - Soil Quality Guidelines for the Protection of Environmental and Human Health  
 Nova Scotia Tier 1 Environmental Quality Standards for Soil and Sediment, July 6, 2013  
 NS Landfill Guidelines = Nova Scotia Environment and Labour - Guidelines for Disposal of Contaminated Solids in Landfills, March 22, 1992  
 RDL - reportable detection limit  
 \* RDL greater than Sediment Quality Guideline(s) for the Protection of Aquatic Life ISQGs (provided for reference)  
**Exceedances are bolded with applicable guideline bolded - NO EXCEEDANCES**

**Table B.5 TIC, TOC, and Grain Size Results for Marine Sediments - Cape St. Marys DFO-SCH, Cape St. Marys, Nova Scotia**

Parameter	RDL	Units	Sample Identification and Date					
			SED1	SED2	SED3	SED4	SED5	SED6
			24-Jun-15					
<b>Grain Size Results</b>								
< -1 Phi (2 mm)	0.10	%	100	100	100	96	100	100
< 0 Phi (1 mm)	0.10		100	100	100	95	99	100
< +1 Phi (0.5 mm)	0.10		100	99	99	91	98	98
< +2 Phi (0.25 mm)	0.10		98	98	97	85	95	95
< +3 Phi (0.12 mm)	0.10		16	68	20	27	30	34
< +4 Phi (0.062 mm)	0.10		3.9	44	5.7	5.0	2.0	4.9
< +5 Phi (0.031 mm)	0.10		2.1	26	3.3	2.9	2.7	2.3
< +6 Phi (0.016 mm)	0.10		1.8	9.7	1.9	2.0	1.7	1.7
< +7 Phi (0.0078 mm)	0.10		1.5	6.0	1.7	1.9	1.4	1.7
< +8 Phi (0.0039 mm)	0.10		1.6	5.3	1.7	1.8	1.4	1.7
< +9 Phi (0.0020 mm)	0.10		1.6	4.9	1.7	1.9	1.5	1.8
Gravel	0.10		<0.10	<0.10	0.31	3.8	0.31	0.22
Sand	0.10		96	56	94	91	98	95
Silt	0.10	2.4	39	4.1	3.2	0.62	3.2	
Clay	0.10	1.6	5.3	1.7	1.8	1.4	1.7	
<b>Other</b>								
Total Inorganic Carbon (C)	0.30	g/kg	1.4	4.1	1.4	2.7	1.4	1.4
Moisture	1.0	%	23	27	22	21	20	22
Organic Carbon (TOC)	0.20	g/kg	1.0	4.5	1.1	1.0	1.0	0.92
Total Carbon-combustion IR	0.30	g/kg	2.4	8.6	2.5	3.8	2.4	2.3

**Table B.6 Ethylene Glycol Results for Marine Sediments - Cape St. Marys DFO-SCH, Cape St. Marys, Nova Scotia**

Parameter	RDL	Units	Sample Identification and Date	CEPA Disposal at Sea Screening Criteria - Lower Level	CCME Sediment Quality Guidelines				CCME Soil Quality Guidelines	Nova Scotia Environmental Quality Standards								NS Landfill Guidelines
			SED2		Interim Sediment Quality Guidelines		Probable Effects Levels			Potable Sites with Fine-Grained Soils	Potable Sites with Coarse-Grained Soils	Non-Potable Sites with Fine- and Coarse-Grained Soils				Sediment Environment		
			24-Jun-15		Freshwater	Marine	Freshwater	Marine	Agricultural, Residential/Parkland, Commercial, Industrial Land Uses	Agricultural, Residential/Parkland, Commercial, Industrial Land Uses	Agricultural, Residential/Parkland, Commercial, Industrial Land Uses	Agricultural Land Use	Residential/Parkland Land Use	Commercial Land Use	Industrial Land Use	Freshwater	Marine	
Ethylene Glycol	10	mg/kg	<10						960	60	68	1100	73000	110000	110000			

**NOTES:**

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

Nova Scotia Tier 1 Environmental Quality Standards for Soil, July 6, 2013

NS Landfill Guidelines = Nova Scotia Environment and Labour - Guidelines for Disposal of Contaminated Solids in Landfills, March 22, 1992

**Table B.7 Pentachlorophenol Results for Marine Sediments - Cape St. Marys DFO-SCH, Cape St. Marys, Nova Scotia**

Parameter	RDL	Units	Sample Identification and Date						CEPA Disposal at Sea Screening Criterion - Lower Level	CCME Sediment Quality Guidelines				CCME Soil Quality Guidelines	Nova Scotia Environmental Quality Standards						NS Landfill Guidelines			
			SED1	SED2	SED3	SED4	SED5	SED6		Interim Sediment Quality Guidelines		Probable Effects Levels			Potable Site			Non-Potable Site				Sediment Environment		
			24-Jul-15							Freshwater	Marine	Freshwater	Marine		Fine- and Coarse-Grained Soil			Fine- and Coarse-Grained Soil				Freshwater	Marine	
Pentachlorophenol	0.5	µg/g	<0.05	<0.5	<0.05	<0.05	<0.05	<0.05						Agricultural, Residential/ Parkland, Commercial and Industrial Land Uses	7.6	7.6	7.6	7.6	11	93	340/1300	0.1**	0.1**	10

NOTES:

CEPA = Canadian Environmental Protection Act - Disposal at Sea Regulations, September 9, 2009

CCME = Canadian Council of Ministers of the Environment - Sediment Quality Guidelines for the Protection of Aquatic Life (provided for reference)

CCME - Soil Quality Guidelines for the Protection of Environmental and Human Health

Nova Scotia Tier 1 Environmental Quality Standards for Soil and Sediment, July 6, 2013

NS Landfill Guidelines = Nova Scotia Environment and Labour - Guidelines for Disposal of Contaminated Solids in Landfills, March 22, 1992

RDL = reportable detection limit

\* RDL greater than guideline

Exceedances are bolded: NO EXCEEDANCES



**APPENDIX C**  
**Laboratory Certificates of Analyses, QA/QC, and Chain of Custody**

Your Project #: 11102262  
 Site Location: CAPE ST.MARYS  
 Your C.O.C. #: B 165929

**Attention:Amanda Facey**

GHD Limited  
 45 Akerley Blvd  
 Dartmouth , NS  
 B3B 1J7

**Report Date: 2015/07/23**  
 Report #: R3593048  
 Version: 5 - Revision

**CERTIFICATE OF ANALYSIS – REVISED REPORT**

**MAXXAM JOB #: B5C4507**

**Received: 2015/06/25, 15:43**

Sample Matrix: Soil  
 # Samples Received: 6

Analyses	Quantity	Date	Date	Laboratory Method	Reference
		Extracted	Analyzed		
Boron Solid MS - Hot Water Soluble	1	2015/07/02	2015/07/02	ATL SOP 00058	EPA 6020A R1 m
Boron Solid MS - Hot Water Soluble	5	2015/07/02	2015/07/04	ATL SOP 00058	EPA 6020A R1 m
Acid Extractables by GC/MS (1)	6	2015/07/07	2015/07/08	CAM SOP-00332	EPA 8270D m
Hexavalent Chromium in Soil by IC (1, 2)	6	2015/07/06	2015/07/07	CAM SOP-00436	EPA 3060/7199 m
TEH in Soil (PIRI) (2)	1	2015/07/02	2015/07/02	ATL SOP 00111	Atl. PIRI v3 m
TEH in Soil (PIRI) (2)	5	2015/07/02	2015/07/03	ATL SOP 00111	Atl. PIRI v3 m
Metals Leach, SPLP Extraction	2	2015/07/21	2015/07/22	ATL SOP 00058	EPA 6020A R1 m
Metals Solids Acid Extr. ICPMS	6	2015/07/02	2015/07/03	ATL SOP 00058	EPA 6020A R1 m
Moisture	6	N/A	2015/06/30	ATL SOP 00001	OMOE Handbook 1983 m
PAH in sediment by GC/MS (Low Level) (2)	6	2015/07/06	2015/07/07	ATL SOP 00102	EPA 8270D 2007 m
PCBs in soil by GC/ECD (2)	6	2015/06/30	2015/07/02	ATL SOP 00106	EPA 8082 m
PCB Aroclor sum (soil)	6	N/A	2015/07/02		Auto Calc.
VPH in Soil - Low Level	6	2015/06/27	2015/07/05	ATL SOP 00119	Atl. PIRI v3 m
Particle size in solids (pipette&sieve) (3)	6	N/A	2015/07/08	ATL SOP 00012	MSAMS 1978 m
SPLP Inorganic extraction - pH	2	N/A	2015/07/21	ATL SOP 00036	EPA 1312 m
SPLP Inorganic extraction - Weight	2	N/A	2015/07/21	ATL SOP 00036	EPA 1312 m
Total Carbon in Solids by Ind.	6	2015/07/06	2015/07/06	ATL SOP 00044/00045	LECO 203-601-224 m
TIC in soil	6	2015/06/26	2015/07/07	ATL SOP 00044/00045	LECO 203-601-224 m
Total Organic Carbon in Soil	4	2015/07/02	2015/07/02	ATL SOP 00044/00045	LECO 203-601-224 m
Total Organic Carbon in Soil	2	2015/07/06	2015/07/07	ATL SOP 00044/00045	LECO 203-601-224 m
ModTPH (T1) Calc. for Soil	6	N/A	2015/07/06	N/A	Atl. PIRI v3 m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Analytics Mississauga

(2) Soils are reported on a dry weight basis unless otherwise specified.

(3) Note: Graphical representation of larger fractions (PHI-4, PHI -3 and PHI -2) not applicable unless these optional parameters are specifically requested.

Your Project #: 11102262  
Site Location: CAPE ST.MARYS  
Your C.O.C. #: B 165929

**Attention:Amanda Facey**

GHD Limited  
45 Akerley Blvd  
Dartmouth , NS  
B3B 1J7

**Report Date: 2015/07/23**  
Report #: R3593048  
Version: 5 - Revision

**CERTIFICATE OF ANALYSIS – REVISED REPORT**

**MAXXAM JOB #: B5C4507**  
**Received: 2015/06/25, 15:43**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Michelle Hill, Project Manager  
Email: MHill@maxxam.ca  
Phone# (902)420-0203 Ext:289

=====  
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

**RESULTS OF ANALYSES OF SOIL**

Maxxam ID		ANG414	ANG415	ANG416	ANG417		ANG418	ANG419		
Sampling Date		2015/06/24	2015/06/24	2015/06/24	2015/06/24		2015/06/24	2015/06/24		
COC Number		B 165929	B 165929	B 165929	B 165929		B 165929	B 165929		
	Units	SED1	SED2	SED3	SED4	QC Batch	SED5	SED6	RDL	QC Batch
<b>Charge/Prep Analysis</b>										
Sample Weight (as received)	g	50			50	4113056			N/A	4113056
Final pH	N/A	9.12			9.22	4113057			N/A	4113057
<b>Inorganics</b>										
Chromium (VI)	ug/g	<0.2	<0.2	<0.2	<0.2	4093129	<0.2	<0.2	0.2	4093129
Total Inorganic Carbon (C)	g/kg	1.4	4.1	1.4	2.7	4082551	1.4	1.4	0.30	4082551
Moisture	%	23	27	22	21	4085054	20	22	1.0	4085054
Organic Carbon (TOC)	g/kg	1.0	4.5	1.1	1.0	4088592	1.0	0.92	0.20	4093216
Total Carbon-combustion IR	g/kg	2.4	8.6	2.5	3.8	4092852	2.4	2.3	0.30	4092852
< -1 Phi (2 mm)	%	100	100	100	96	4084969	100	100	0.10	4084969
< 0 Phi (1 mm)	%	100	100	100	95	4084969	99	100	0.10	4084969
< +1 Phi (0.5 mm)	%	100	99	99	91	4084969	98	98	0.10	4084969
< +2 Phi (0.25 mm)	%	98	98	97	85	4084969	95	95	0.10	4084969
< +3 Phi (0.12 mm)	%	16	68	20	27	4084969	30	34	0.10	4084969
< +4 Phi (0.062 mm)	%	3.9	44	5.7	5.0	4084969	2.0	4.9	0.10	4084969
< +5 Phi (0.031 mm)	%	2.1	26	3.3	2.9	4084969	2.7	2.3	0.10	4084969
< +6 Phi (0.016 mm)	%	1.8	9.7	1.9	2.0	4084969	1.7	1.7	0.10	4084969
< +7 Phi (0.0078 mm)	%	1.5	6.0	1.7	1.9	4084969	1.4	1.7	0.10	4084969
< +8 Phi (0.0039 mm)	%	1.6	5.3	1.7	1.8	4084969	1.4	1.7	0.10	4084969
< +9 Phi (0.0020 mm)	%	1.6	4.9	1.7	1.9	4084969	1.5	1.8	0.10	4084969
Gravel	%	<0.10	<0.10	0.31	3.8	4084969	0.31	0.22	0.10	4084969
Sand	%	96	56	94	91	4084969	98	95	0.10	4084969
Silt	%	2.4	39	4.1	3.2	4084969	0.62	3.2	0.10	4084969
Clay	%	1.6	5.3	1.7	1.8	4084969	1.4	1.7	0.10	4084969
RDL = Reportable Detection Limit QC Batch = Quality Control Batch										

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

**ELEMENTS BY ICP/MS (SOIL)**

Maxxam ID		ANG414	ANG414		ANG415		ANG416	ANG417	ANG418		
Sampling Date		2015/06/24	2015/06/24		2015/06/24		2015/06/24	2015/06/24	2015/06/24		
COC Number		B 165929	B 165929		B 165929		B 165929	B 165929	B 165929		
	Units	SED1	SED1 Lab-Dup	RDL	SED2	RDL	SED3	SED4	SED5	RDL	QC Batch

<b>Metals</b>											
Soluble (Hot Water) Boron (B)	mg/kg	2.5	2.6	0.30	5.3	3.0	1.9	2.1	1.8	0.30	4087046
Leachable Aluminum (Al)	ug/L	220		10				290		10	4113281
Leachable Antimony (Sb)	ug/L	<2.0		2.0				<2.0		2.0	4113281
Leachable Arsenic (As)	ug/L	2.6		2.0				2.0		2.0	4113281
Leachable Barium (Ba)	ug/L	16		5.0				18		5.0	4113281
Leachable Beryllium (Be)	ug/L	<2.0		2.0				<2.0		2.0	4113281
Leachable Cadmium (Cd)	ug/L	<0.30		0.30				<0.30		0.30	4113281
Leachable Calcium (Ca)	ug/L	10000		100				11000		100	4113281
Leachable Chromium (Cr)	ug/L	<2.0		2.0				<2.0		2.0	4113281
Leachable Cobalt (Co)	ug/L	<1.0		1.0				<1.0		1.0	4113281
Leachable Copper (Cu)	ug/L	<2.0		2.0				<2.0		2.0	4113281
Leachable Iron (Fe)	ug/L	260		50				280		50	4113281
Leachable Lead (Pb)	ug/L	1.2		0.50				0.68		0.50	4113281
Leachable Lithium (Li)	ug/L	4.9		2.0				4.5		2.0	4113281
Leachable Magnesium (Mg)	ug/L	12000		100				11000		100	4113281
Leachable Manganese (Mn)	ug/L	<2.0		2.0				3.0		2.0	4113281
Leachable Molybdenum (Mo)	ug/L	<2.0		2.0				<2.0		2.0	4113281
Leachable Nickel (Ni)	ug/L	<2.0		2.0				<2.0		2.0	4113281
Leachable Potassium (K)	ug/L	5700		100				5300		100	4113281
Leachable Selenium (Se)	ug/L	<1.0		1.0				<1.0		1.0	4113281
Leachable Silver (Ag)	ug/L	<0.50		0.50				<0.50		0.50	4113281
Leachable Strontium (Sr)	ug/L	100		5.0				97		5.0	4113281
Leachable Thallium (Tl)	ug/L	<0.10		0.10				<0.10		0.10	4113281
Leachable Tin (Sn)	ug/L	<2.0		2.0				<2.0		2.0	4113281
Leachable Uranium (U)	ug/L	<0.10		0.10				<0.10		0.10	4113281
Leachable Vanadium (V)	ug/L	4.6		2.0				5.1		2.0	4113281
Leachable Zinc (Zn)	ug/L	<5.0		5.0				5.1		5.0	4113281

RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch  
Lab-Dup = Laboratory Initiated Duplicate

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

**ELEMENTS BY ICP/MS (SOIL)**

<b>Maxxam ID</b>		ANG419		
<b>Sampling Date</b>		2015/06/24		
<b>COC Number</b>		B 165929		
	<b>Units</b>	<b>SED6</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Metals</b>				
Soluble (Hot Water) Boron (B)	mg/kg	2.1	0.30	4087046
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

**ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)**

Maxxam ID		ANG414	ANG415	ANG416	ANG417	ANG418	ANG419		
Sampling Date		2015/06/24	2015/06/24	2015/06/24	2015/06/24	2015/06/24	2015/06/24		
COC Number		B 165929							
	Units	SED1	SED2	SED3	SED4	SED5	SED6	RDL	QC Batch
<b>Metals</b>									
Acid Extractable Aluminum (Al)	mg/kg	6500	6000	6300	7200	6100	6000	10	4088621
Acid Extractable Antimony (Sb)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4088621
Acid Extractable Arsenic (As)	mg/kg	2.9	2.7	3.1	2.6	3.2	2.5	2.0	4088621
Acid Extractable Barium (Ba)	mg/kg	13	16	12	11	11	11	5.0	4088621
Acid Extractable Beryllium (Be)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4088621
Acid Extractable Bismuth (Bi)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4088621
Acid Extractable Boron (B)	mg/kg	<50	<50	<50	<50	<50	<50	50	4088621
Acid Extractable Cadmium (Cd)	mg/kg	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	0.30	4088621
Acid Extractable Chromium (Cr)	mg/kg	14	13	14	15	13	13	2.0	4088621
Acid Extractable Cobalt (Co)	mg/kg	3.5	3.5	3.6	4.0	3.5	3.4	1.0	4088621
Acid Extractable Copper (Cu)	mg/kg	3.5	5.0	3.5	4.4	4.2	3.5	2.0	4088621
Acid Extractable Iron (Fe)	mg/kg	13000	12000	13000	15000	13000	13000	50	4088621
Acid Extractable Lead (Pb)	mg/kg	2.8	6.0	3.0	4.1	3.0	2.9	0.50	4088621
Acid Extractable Lithium (Li)	mg/kg	18	15	17	20	17	16	2.0	4088621
Acid Extractable Manganese (Mn)	mg/kg	170	170	170	230	190	190	2.0	4088621
Acid Extractable Mercury (Hg)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	4088621
Acid Extractable Molybdenum (Mo)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	4088621
Acid Extractable Nickel (Ni)	mg/kg	9.1	8.6	9.0	10	8.6	8.9	2.0	4088621
Acid Extractable Rubidium (Rb)	mg/kg	11	9.0	11	9.4	9.0	8.5	2.0	4088621
Acid Extractable Selenium (Se)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	4088621
Acid Extractable Silver (Ag)	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	4088621
Acid Extractable Strontium (Sr)	mg/kg	18	54	20	23	17	16	5.0	4088621
Acid Extractable Thallium (Tl)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	4088621
Acid Extractable Tin (Sn)	mg/kg	<1.0	<1.0	<1.0	2.0	<1.0	<1.0	1.0	4088621
Acid Extractable Uranium (U)	mg/kg	0.26	0.51	0.27	0.30	0.31	0.39	0.10	4088621
Acid Extractable Vanadium (V)	mg/kg	16	15	16	16	16	15	2.0	4088621
Acid Extractable Zinc (Zn)	mg/kg	28	27	27	30	24	24	5.0	4088621
RDL = Reportable Detection Limit									
QC Batch = Quality Control Batch									

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

**SEMI-VOLATILE ORGANICS BY GC-MS (SOIL)**

Maxxam ID		ANG414		ANG415		ANG416	ANG417	ANG418		
Sampling Date		2015/06/24		2015/06/24		2015/06/24	2015/06/24	2015/06/24		
COC Number		B 165929		B 165929		B 165929	B 165929	B 165929		
	Units	SED1	RDL	SED2	RDL	SED3	SED4	SED5	RDL	QC Batch
<b>Polyaromatic Hydrocarbons</b>										
1-Methylnaphthalene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
2-Methylnaphthalene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Acenaphthene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Acenaphthylene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Anthracene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Benzo(a)anthracene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Benzo(a)pyrene	mg/kg	<0.0050	0.0050	0.0099	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Benzo(b)fluoranthene	mg/kg	<0.0050	0.0050	0.010	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Benzo(g,h,i)perylene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Benzo(j)fluoranthene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Benzo(k)fluoranthene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Chrysene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Dibenz(a,h)anthracene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Fluoranthene	mg/kg	<0.0050	0.0050	0.017	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Fluorene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Indeno(1,2,3-cd)pyrene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Naphthalene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Perylene	mg/kg	<0.0050	0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Phenanthrene	mg/kg	<0.0050	0.0050	0.0098	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
Pyrene	mg/kg	<0.0050	0.0050	0.013	0.0050	<0.0050	<0.0050	<0.0050	0.0050	4092949
<b>Phenolics</b>										
Pentachlorophenol	ug/g	<0.05	0.05	<0.5	0.5	<0.05	<0.05	<0.05	0.05	4095238
<b>Surrogate Recovery (%)</b>										
2,4,6-Tribromophenol	%	101		100		90	91	89		4095238
2-Fluorophenol	%	97		100		96	107	105		4095238
D5-Phenol	%	69		72		67	73	75		4095238
D10-Anthracene	%	86		88		88	90	85		4092949
D14-Terphenyl	%	100		114		102	102	102		4092949
D8-Acenaphthylene	%	95		93		99	96	90		4092949
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

**SEMI-VOLATILE ORGANICS BY GC-MS (SOIL)**

Maxxam ID		ANG418	ANG419		
Sampling Date		2015/06/24	2015/06/24		
COC Number		B 165929	B 165929		
	Units	SED5 Lab-Dup	SED6	RDL	QC Batch
<b>Polyaromatic Hydrocarbons</b>					
1-Methylnaphthalene	mg/kg	<0.0050	<0.0050	0.0050	4092949
2-Methylnaphthalene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Acenaphthene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Acenaphthylene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Anthracene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Benzo(a)anthracene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Benzo(a)pyrene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Benzo(b)fluoranthene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Benzo(g,h,i)perylene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Benzo(j)fluoranthene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Benzo(k)fluoranthene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Chrysene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Dibenz(a,h)anthracene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Fluoranthene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Fluorene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Indeno(1,2,3-cd)pyrene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Naphthalene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Perylene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Phenanthrene	mg/kg	<0.0050	<0.0050	0.0050	4092949
Pyrene	mg/kg	<0.0050	<0.0050	0.0050	4092949
<b>Phenolics</b>					
Pentachlorophenol	ug/g		<0.05	0.05	4095238
<b>Surrogate Recovery (%)</b>					
2,4,6-Tribromophenol	%		100		4095238
2-Fluorophenol	%		76		4095238
D5-Phenol	%		66		4095238
D10-Anthracene	%	84	87		4092949
D14-Terphenyl	%	96	97		4092949
D8-Acenaphthylene	%	85	93		4092949
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate					

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

**ATLANTIC RBCA HYDROCARBONS (SOIL)**

Maxxam ID		ANG414	ANG415	ANG416	ANG417	ANG418	ANG418		
Sampling Date		2015/06/24	2015/06/24	2015/06/24	2015/06/24	2015/06/24	2015/06/24		
COC Number		B 165929							
	Units	SED1	SED2	SED3	SED4	SED5	SED5 Lab-Dup	RDL	QC Batch

Petroleum Hydrocarbons									
Methyl t-butyl ether (MTBE)	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.025	4090743
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	4090743
Toluene	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.025	4090743
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4090743
Total Xylenes	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	4090743
C6 - C10 (less BTEX)	mg/kg	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	2.5	4090743
>C10-C16 Hydrocarbons	mg/kg	<10	<10	<10	<10	<10		10	4088453
>C16-C21 Hydrocarbons	mg/kg	<10	<10	<10	<10	<10		10	4088453
>C21-<C32 Hydrocarbons	mg/kg	<15	<15	<15	<15	<15		15	4088453
Modified TPH (Tier1)	mg/kg	<15	<15	<15	<15	<15		15	4083347
Reached Baseline at C32	mg/kg	NA	NA	NA	NA	NA		N/A	4088453
Hydrocarbon Resemblance	mg/kg	NA	NA	NA	NA	NA		N/A	4088453
Surrogate Recovery (%)									
Isobutylbenzene - Extractable	%	82	90	86	84	91			4088453
n-Dotriacontane - Extractable	%	81	99	97	88	96			4088453
Isobutylbenzene - Volatile	%	100	100	101	98	100	102		4090743

RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch  
Lab-Dup = Laboratory Initiated Duplicate

Maxxam Job #: B5C4507  
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GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

**ATLANTIC RBCA HYDROCARBONS (SOIL)**

<b>Maxxam ID</b>		ANG419		
<b>Sampling Date</b>		2015/06/24		
<b>COC Number</b>		B 165929		
	<b>Units</b>	<b>SED6</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Petroleum Hydrocarbons</b>				
Methyl t-butyl ether (MTBE)	mg/kg	<0.025	0.025	4090743
Benzene	mg/kg	<0.0050	0.0050	4090743
Toluene	mg/kg	<0.025	0.025	4090743
Ethylbenzene	mg/kg	<0.010	0.010	4090743
Total Xylenes	mg/kg	<0.050	0.050	4090743
C6 - C10 (less BTEX)	mg/kg	<2.5	2.5	4090743
>C10-C16 Hydrocarbons	mg/kg	<10	10	4088453
>C16-C21 Hydrocarbons	mg/kg	<10	10	4088453
>C21-<C32 Hydrocarbons	mg/kg	<15	15	4088453
Modified TPH (Tier1)	mg/kg	<15	15	4083347
Reached Baseline at C32	mg/kg	NA	N/A	4088453
Hydrocarbon Resemblance	mg/kg	NA	N/A	4088453
<b>Surrogate Recovery (%)</b>				
Isobutylbenzene - Extractable	%	84		4088453
n-Dotriacontane - Extractable	%	93		4088453
Isobutylbenzene - Volatile	%	101		4090743
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable				

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

**POLYCHLORINATED BIPHENYLS BY GC-ECD (SOIL)**

Maxxam ID		ANG414	ANG415	ANG416	ANG417	ANG418	ANG419		
Sampling Date		2015/06/24	2015/06/24	2015/06/24	2015/06/24	2015/06/24	2015/06/24		
COC Number		B 165929							
	Units	SED1	SED2	SED3	SED4	SED5	SED6	RDL	QC Batch
<b>PCBs</b>									
Aroclor 1016	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	4086727
Aroclor 1221	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	4086727
Aroclor 1232	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	4086727
Aroclor 1248	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	4086727
Aroclor 1242	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	4086727
Aroclor 1254	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	4086727
Aroclor 1260	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	4086727
Calculated Total PCB	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	4083237
<b>Surrogate Recovery (%)</b>									
Decachlorobiphenyl	%	92	97	99	97	94	98		4086727
RDL = Reportable Detection Limit									
QC Batch = Quality Control Batch									

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

### GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C
Package 2	3.0°C
Package 3	3.0°C

TEH Analysis: Silica gel clean-up performed prior to analysis as per client request.

TEH Analysis: No creosote present.

Added glycol testing to sample SED-2 as requested by A. Facey.

Revised report: Reissued to report tin with an RDL of 1 mg/kg as requested on the COC at the time of submission. 2015/07/16 MHL

Revised report: Re-issued to include SPLP Leachate + Metals testing on SED1, SED2, SED3, and SED4 as requested by A. Facey 2015/07/17 MHL

Sample ANG415-01 : CPH Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

**Results relate only to the items tested.**

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

**QUALITY ASSURANCE REPORT**

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
4086727	Decachlorobiphenyl	2015/07/02	93	30 - 130	94	30 - 130	95	%				
4088453	Isobutylbenzene - Extractable	2015/07/02	89	30 - 130	90	30 - 130	85	%				
4088453	n-Dotriacontane - Extractable	2015/07/02	83	30 - 130	88	30 - 130	86	%				
4090743	Isobutylbenzene - Volatile	2015/07/05	101 (4)	60 - 130	87	60 - 130	89	%				
4092949	D10-Anthracene	2015/07/07	85 (4)	30 - 130	92	30 - 130	95	%				
4092949	D14-Terphenyl	2015/07/07	98 (4)	30 - 130	98	30 - 130	103	%				
4092949	D8-Acenaphthylene	2015/07/07	88 (4)	30 - 130	94	30 - 130	93	%				
4095238	2,4,6-Tribromophenol	2015/07/08	104	50 - 130	99	50 - 130	103	%				
4095238	2-Fluorophenol	2015/07/08	103	50 - 130	26 (6)	50 - 130	26 (6)					
4095238	D5-Phenol	2015/07/08	75	30 - 130	72	30 - 130	73	%				
4084969	Clay	2015/07/08							5.4 (1)	35		
4084969	Gravel	2015/07/08							9.9 (1)	35		
4084969	Sand	2015/07/08							9.1 (1)	35		
4084969	Silt	2015/07/08							8.5 (1)	35		
4086727	Aroclor 1016	2015/07/02					<0.050	ug/g	NC (1)	50		
4086727	Aroclor 1221	2015/07/02					<0.050	ug/g	NC (1)	50		
4086727	Aroclor 1232	2015/07/02					<0.050	ug/g	NC (1)	50		
4086727	Aroclor 1242	2015/07/02					<0.050	ug/g	NC (1)	50		
4086727	Aroclor 1248	2015/07/02					<0.050	ug/g	NC (1)	50		
4086727	Aroclor 1254	2015/07/02	122	30 - 130	120	30 - 130	<0.050	ug/g	NC (1)	50		
4086727	Aroclor 1260	2015/07/02					<0.050	ug/g	NC (1)	50		
4087046	Soluble (Hot Water) Boron (B)	2015/07/04	NC (2)	75 - 125	102	75 - 125	<0.30	mg/kg	5.9 (3)	35		
4088453	>C10-C16 Hydrocarbons	2015/07/02	73	30 - 130	75	30 - 130	<10	mg/kg	NC (1)	50		
4088453	>C16-C21 Hydrocarbons	2015/07/02	88	30 - 130	87	30 - 130	<10	mg/kg	NC (1)	50		
4088453	>C21-<C32 Hydrocarbons	2015/07/02	NC	30 - 130	89	30 - 130	<15	mg/kg	NC (1)	50		
4088592	Organic Carbon (TOC)	2015/07/02					<0.20	g/kg			97	75 - 125
4088621	Acid Extractable Aluminum (Al)	2015/07/03					<10	mg/kg	2.4 (1)	35		
4088621	Acid Extractable Antimony (Sb)	2015/07/03	96	75 - 125	97	75 - 125	<2.0	mg/kg	NC (1)	35		
4088621	Acid Extractable Arsenic (As)	2015/07/03	101	75 - 125	93	75 - 125	<2.0	mg/kg	NC (1)	35		
4088621	Acid Extractable Barium (Ba)	2015/07/03	NC	75 - 125	90	75 - 125	<5.0	mg/kg	3.4 (1)	35		
4088621	Acid Extractable Beryllium (Be)	2015/07/03	101	75 - 125	91	75 - 125	<2.0	mg/kg	NC (1)	35		

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**QUALITY ASSURANCE REPORT(CONT'D)**

GHD Limited  
Client Project #: 11102262  
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Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
4088621	Acid Extractable Bismuth (Bi)	2015/07/03	107	75 - 125	94	75 - 125	<2.0	mg/kg	NC (1)	35		
4088621	Acid Extractable Boron (B)	2015/07/03	88	75 - 125	93	75 - 125	<50	mg/kg	NC (1)	35		
4088621	Acid Extractable Cadmium (Cd)	2015/07/03	102	75 - 125	94	75 - 125	<0.30	mg/kg	NC (1)	35		
4088621	Acid Extractable Chromium (Cr)	2015/07/03	101	75 - 125	91	75 - 125	<2.0	mg/kg	1.9 (1)	35		
4088621	Acid Extractable Cobalt (Co)	2015/07/03	102	75 - 125	92	75 - 125	<1.0	mg/kg	2.2 (1)	35		
4088621	Acid Extractable Copper (Cu)	2015/07/03	105	75 - 125	93	75 - 125	<2.0	mg/kg	1.3 (1)	35		
4088621	Acid Extractable Iron (Fe)	2015/07/03					<50	mg/kg	4.4 (1)	35		
4088621	Acid Extractable Lead (Pb)	2015/07/03	NC	75 - 125	94	75 - 125	<0.50	mg/kg	3.2 (1)	35		
4088621	Acid Extractable Lithium (Li)	2015/07/03	NC	75 - 125	94	75 - 125	<2.0	mg/kg	1.6 (1)	35		
4088621	Acid Extractable Manganese (Mn)	2015/07/03	NC	75 - 125	94	75 - 125	<2.0	mg/kg	3.4 (1)	35		
4088621	Acid Extractable Mercury (Hg)	2015/07/03	97	75 - 125	92	75 - 125	<0.10	mg/kg	NC (1)	35		
4088621	Acid Extractable Molybdenum (Mo)	2015/07/03	100	75 - 125	96	75 - 125	<2.0	mg/kg	NC (1)	35		
4088621	Acid Extractable Nickel (Ni)	2015/07/03	101	75 - 125	95	75 - 125	<2.0	mg/kg	1.4 (1)	35		
4088621	Acid Extractable Rubidium (Rb)	2015/07/03	97	75 - 125	94	75 - 125	<2.0	mg/kg	NC (1)	35		
4088621	Acid Extractable Selenium (Se)	2015/07/03	99	75 - 125	96	75 - 125	<1.0	mg/kg	NC (1)	35		
4088621	Acid Extractable Silver (Ag)	2015/07/03	100	75 - 125	93	75 - 125	<0.50	mg/kg	NC (1)	35		
4088621	Acid Extractable Strontium (Sr)	2015/07/03	100	75 - 125	94	75 - 125	<5.0	mg/kg	NC (1)	35		
4088621	Acid Extractable Thallium (Tl)	2015/07/03	105	75 - 125	93	75 - 125	<0.10	mg/kg	NC (1)	35		
4088621	Acid Extractable Tin (Sn)	2015/07/03	105	75 - 125	88	75 - 125	<2.0	mg/kg	NC (1)	35		
4088621	Acid Extractable Uranium (U)	2015/07/03	104	75 - 125	95	75 - 125	<0.10	mg/kg	NC (1)	35		
4088621	Acid Extractable Vanadium (V)	2015/07/03	102	75 - 125	93	75 - 125	<2.0	mg/kg	1.3 (1)	35		
4088621	Acid Extractable Zinc (Zn)	2015/07/03	NC	75 - 125	97	75 - 125	<5.0	mg/kg	4.3 (1)	35		
4090743	Benzene	2015/07/05	66 (4)	60 - 130	77	60 - 140	<0.0050	mg/kg	NC (5)	50		
4090743	C6 - C10 (less BTEX)	2015/07/05					<2.5	mg/kg	NC (5)	50		
4090743	Ethylbenzene	2015/07/05	70 (4)	60 - 130	79	60 - 140	<0.010	mg/kg	NC (5)	50		
4090743	Methyl t-butyl ether (MTBE)	2015/07/05			79	60 - 140	<0.025	mg/kg	NC (5)	50		
4090743	Toluene	2015/07/05	81 (4)	60 - 130	79	60 - 140	<0.025	mg/kg	NC (5)	50		
4090743	Total Xylenes	2015/07/05	80 (4)	60 - 130	79	60 - 140	<0.050	mg/kg	NC (5)	50		
4092852	Total Carbon-combustion IR	2015/07/06					<0.20	g/kg	4.9 (1)	35	92	75 - 125
4092949	1-Methylnaphthalene	2015/07/07	74 (4)	30 - 130	80	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	2-Methylnaphthalene	2015/07/07	78 (4)	30 - 130	90	30 - 130	<0.0050	mg/kg	NC (5)	50		

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**QUALITY ASSURANCE REPORT(CONT'D)**

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
4092949	Acenaphthene	2015/07/07	89 (4)	30 - 130	93	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Acenaphthylene	2015/07/07	75 (4)	30 - 130	83	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Anthracene	2015/07/07	83 (4)	30 - 130	84	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Benzo(a)anthracene	2015/07/07	100 (4)	30 - 130	86	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Benzo(a)pyrene	2015/07/07	113 (4)	30 - 130	94	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Benzo(b)fluoranthene	2015/07/07	119 (4)	30 - 130	93	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Benzo(g,h,i)perylene	2015/07/07	104 (4)	30 - 130	81	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Benzo(j)fluoranthene	2015/07/07	110 (4)	30 - 130	100	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Benzo(k)fluoranthene	2015/07/07	113 (4)	30 - 130	97	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Chrysene	2015/07/07	108 (4)	30 - 130	93	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Dibenz(a,h)anthracene	2015/07/07	94 (4)	30 - 130	66	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Fluoranthene	2015/07/07	108 (4)	30 - 130	89	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Fluorene	2015/07/07	86 (4)	30 - 130	89	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Indeno(1,2,3-cd)pyrene	2015/07/07	97 (4)	30 - 130	70	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Naphthalene	2015/07/07	77 (4)	30 - 130	89	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Perylene	2015/07/07	102 (4)	30 - 130	94	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Phenanthrene	2015/07/07	106 (4)	30 - 130	86	30 - 130	<0.0050	mg/kg	NC (5)	50		
4092949	Pyrene	2015/07/07	100 (4)	30 - 130	88	30 - 130	<0.0050	mg/kg	NC (5)	50		
4093129	Chromium (VI)	2015/07/07	94	75 - 125	100	80 - 120	<0.2	ug/g	NC (1)	35	94	80 - 120
4093216	Organic Carbon (TOC)	2015/07/07					<0.20	g/kg	4.5 (1)	35	94	75 - 125
4095238	Pentachlorophenol	2015/07/08	90	50 - 130	97	50 - 130	<0.05	ug/g	NC (1)	50		
4113056	Sample Weight (as received)	2015/07/21					NA	g	0.014 (1)	N/A		
4113057	Final pH	2015/07/21					4.29	N/A	0.47 (1)	N/A		
4113281	Leachable Aluminum (Al)	2015/07/22	NC	80 - 120	103	80 - 120	<10	ug/L	26 (1)	35		
4113281	Leachable Antimony (Sb)	2015/07/22	104	80 - 120	104	80 - 120	<2.0	ug/L	NC (1)	35		
4113281	Leachable Arsenic (As)	2015/07/22	99	80 - 120	100	80 - 120	<2.0	ug/L	NC (1)	35		
4113281	Leachable Barium (Ba)	2015/07/22	NC	80 - 120	96	80 - 120	11, RDL=5.0 (7)	ug/L	21 (1)	35		
4113281	Leachable Beryllium (Be)	2015/07/22	99	80 - 120	99	80 - 120	<2.0	ug/L	NC (1)	35		
4113281	Leachable Cadmium (Cd)	2015/07/22	100	80 - 120	100	80 - 120	<0.30	ug/L	NC (1)	35		

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

**QUALITY ASSURANCE REPORT(CONT'D)**

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
4113281	Leachable Calcium (Ca)	2015/07/22	95	80 - 120	93	80 - 120	350, RDL=100 (7)	ug/L	4.6 (1)	35		
4113281	Leachable Chromium (Cr)	2015/07/22	98	80 - 120	98	80 - 120	<2.0	ug/L	NC (1)	35		
4113281	Leachable Cobalt (Co)	2015/07/22	98	80 - 120	99	80 - 120	<1.0	ug/L	NC (1)	35		
4113281	Leachable Copper (Cu)	2015/07/22	98	80 - 120	99	80 - 120	<2.0	ug/L	NC (1)	35		
4113281	Leachable Iron (Fe)	2015/07/22	NC	80 - 120	104	80 - 120	<50	ug/L	25 (1)	35		
4113281	Leachable Lead (Pb)	2015/07/22	98	80 - 120	99	80 - 120	<0.50	ug/L	NC (1)	35		
4113281	Leachable Lithium (Li)	2015/07/22	100	80 - 120	100	80 - 120	<2.0	ug/L	NC (1)	35		
4113281	Leachable Magnesium (Mg)	2015/07/22	102	80 - 120	103	80 - 120	<100	ug/L	24 (1)	35		
4113281	Leachable Manganese (Mn)	2015/07/22	NC	80 - 120	101	80 - 120	<2.0	ug/L	23 (1)	35		
4113281	Leachable Molybdenum (Mo)	2015/07/22	104	80 - 120	102	80 - 120	<2.0	ug/L	NC (1)	35		
4113281	Leachable Nickel (Ni)	2015/07/22	100	80 - 120	100	80 - 120	<2.0	ug/L	NC (1)	35		
4113281	Leachable Potassium (K)	2015/07/22	109	80 - 120	110	80 - 120	110, RDL=100	ug/L	22 (1)	35		
4113281	Leachable Selenium (Se)	2015/07/22	102	80 - 120	101	80 - 120	<1.0	ug/L	NC (1)	35		
4113281	Leachable Silver (Ag)	2015/07/22	103	80 - 120	104	80 - 120	<0.50	ug/L	NC (1)	35		
4113281	Leachable Strontium (Sr)	2015/07/22	104	80 - 120	103	80 - 120	<5.0	ug/L	NC (1)	35		
4113281	Leachable Thallium (Tl)	2015/07/22	100	80 - 120	101	80 - 120	<0.10	ug/L	NC (1)	35		
4113281	Leachable Tin (Sn)	2015/07/22	103	80 - 120	102	80 - 120	<2.0	ug/L	NC (1)	35		
4113281	Leachable Uranium (U)	2015/07/22	108	80 - 120	108	80 - 120	<0.10	ug/L	NC (1)	35		
4113281	Leachable Vanadium (V)	2015/07/22	99	80 - 120	99	80 - 120	<2.0	ug/L	14 (1)	35		

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

**QUALITY ASSURANCE REPORT(CONT'D)**

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
4113281	Leachable Zinc (Zn)	2015/07/22	98	80 - 120	99	80 - 120	<5.0	ug/L	NC (1)	35		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Duplicate Parent ID

(2) Matrix Spike Parent ID [ANG414-01]

(3) Duplicate Parent ID [ANG414-01]

(4) Matrix Spike Parent ID [ANG418-01]

(5) Duplicate Parent ID [ANG418-01]

(6) Surrogate recovery was below the lower control limit . This may represent a low bias in some results.

(7) Low level lab contamination. Minimal impact on data quality.

Maxxam Job #: B5C4507  
Report Date: 2015/07/23

GHD Limited  
Client Project #: 11102262  
Site Location: CAPE ST.MARYS  
Sampler Initials: AF

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Brad Newman, Scientific Specialist



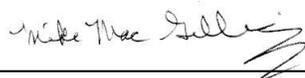
Colleen Acker, Supervisor, General Chemistry



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist



Kevin MacDonald, Inorganics Supervisor



Mike MacGillivray, Scientific Specialist (Inorganics)



Rose MacDonald, Scientific Specialist (Organics)

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This column for lab use only:

Client Code  
Maxxam Job #  
BSC4507

Cooler ID	Seal Present	Seal Intact	Temp 1	Temp 2	Temp 3	Average Temp
			55	55	52	
			33	33		
			32	24		

Integrity YES  NO   
Integrity / Checklist by *ADS*

Labelled by Location / Bin #

**INVOICE INFORMATION:**

Company Name: *CRA*  
 Contact Name: *Amanda Facey*  
 Address: *Dartmouth, NS*  
 Postal Code: *B3B 1J7*  
 Email: *afacey@croworld.com*  
 Ph: *468-1248* Fax: *468-2207*

**REPORT INFORMATION (if differs from invoice):**

Company Name:  
 Contact Name:  
 Address:  
 Postal Code:  
 Email:  
 Ph: Fax:

PO #  
 Project # / Phase # *11102262*  
 Project Name / Site Location *Cape St. Marys*  
 Quote *B37708*  
 Site #  
 Task Order #  
 Sampled by *AF*

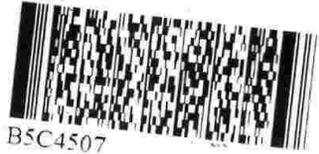
TURNAROUND TIME  
 Standard   
 10 day   
 If RUSH Specify Date:  
 Pre-schedule rush work  
 Charge for # Jars used but not submitted

**Guideline Requirements / Detection Limits / Special Instructions**

RDL 1mg/Kg for tin.  
 Low level BTEX (CCME SAG).  
 Low level PAHs (CCME), scan for creosote.  
 Silica gel cleanup for PAH.

\*Specify Matrix: Surface/Salt/Ground/Tapwater/Sewage/Effluent/  
 Potable/NonPotable/Tissue/Soil/Sludge/Metal/Seawater

Field Sample Identification	Matrix*	Date/Time Sampled	# & type of bottles	Field Filtered & Preserved	Lab Filtration Required	RCAP-30 Total or Diss Metals	RCAP-MS Total or Diss Metals	Total Digest (Default Method) for well water, surface water	Dissolved for ground water	Mercury	Metals & Mercury Default Available Digest Method	Metals Total Digest - for Ocean sediments (HNO3/HF/HClO4)	Mercury Low level by Cold Vapour AA	Selenium (low level) Req'd for CCME Residential, Parkslands, Agricultural	Hot Water soluble Boron (required for CCME Agricultural)	RBCA Hydrocarbons (BTEX, C6-C12)	Hydrocarbons Soil (Potable), NS Fuel Oil Soil Policy, Low Level BTEX, C6-C12	BTEX, VPH, Low level T.E.H.	PAHs	PAHs with Vertexine, Quinoline PCP	Cr VI	PCBs	Carbon (TC + TOC)	Grain Size Distribution	MTBE	
1 SED1	sediment	24 June 2015	3 X 500 ml								X					X	X			X	X	X	X	X	X	X
2 SED2											X					X	X			X	X	X	X	X	X	X
3 SED3											X					X	X			X	X	X	X	X	X	X
4 SED4											X					X	X			X	X	X	X	X	X	X
5 SED5											X					X	X			X	X	X	X	X	X	X
6 SED6											X					X	X			X	X	X	X	X	X	X
7																										
8																										
9																										



BSC4507

RELINQUISHED BY: (Signature/Print) <i>A Facey</i>	Date <i>25 June 15</i>	Time	RECEIVED BY: (Signature/Print) <i>SARA MASON</i>	Date <i>25 JUN 15</i>	Time <i>17:43</i>
--	---------------------------	------	---	--------------------------	----------------------

Your Project #: B5C4507  
Your C.O.C. #: n-a

**Attention:Bedford Client Svc (SubContr)**

Maxxam Analytics  
200 Bluewater road  
Bedford, NS  
CANADA B4B 1G9

**Report Date: 2015/07/09**  
Report #: R2021621  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**MAXXAM JOB #: B536436**

**Received: 2015/06/30, 08:30**

Sample Matrix: SOIL  
# Samples Received: 6

<b>Analyses</b>	<b>Quantity</b>	<b>Date Extracted</b>	<b>Date Analyzed</b>	<b>Laboratory Method</b>	<b>Primary Reference</b>
Total Cyanide*	6	2015/07/07	2015/07/09	STL SOP-00035	MA300-CN 1.2 R3 m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.  
Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

\* Maxxam is accredited as per the MDDELCC program.

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Lauriane Bernard, Project Manager  
Email: LBernard@maxxam.ca  
Phone# (514)448-9001

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B536436  
Report Date: 2015/07/09

Maxxam Analytics  
Client Project #: B5C4507

**CONVENTIONAL PARAMETERS (SOIL)**

Maxxam ID		BA8527	BA8528	BA8529	BA8530		
Sampling Date		2015/06/24	2015/06/24	2015/06/24	2015/06/24		
COC Number		n-a	n-a	n-a	n-a		
	<b>Units</b>	<b>ANG414-03R\ SED1</b>	<b>ANG415-03R\ SED2</b>	<b>ANG416-03R\ SED3</b>	<b>ANG417-03R\ SED4</b>	<b>RDL</b>	<b>QC Batch</b>
% MOISTURE	%	22	28	21	22	N/A	N/A
<b>CONVENTIONALS</b>							
Total Cyanide (CN)	mg/kg	<0.5	<0.5	<0.5	<0.5	0.5	1476055
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable							

Maxxam ID		BA8531	BA8532		
Sampling Date		2015/06/24	2015/06/24		
COC Number		n-a	n-a		
	<b>Units</b>	<b>ANG418-03R\ SED5</b>	<b>ANG419-03R\ SED6</b>	<b>RDL</b>	<b>QC Batch</b>
% MOISTURE	%	17	21	N/A	N/A
<b>CONVENTIONALS</b>					
Total Cyanide (CN)	mg/kg	<0.5	<0.5	0.5	1476055
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable					

Maxxam Job #: B536436  
Report Date: 2015/07/09

Maxxam Analytics  
Client Project #: B5C4507

### GENERAL COMMENTS

All results are calculated on a dry weight basis except where not applicable.

Condition of sample(s) upon receipt: GOOD

#### CONVENTIONAL PARAMETERS (SOIL)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

**Results relate only to the items tested.**

Maxxam Job #: B536436  
Report Date: 2015/07/09

Maxxam Analytics  
Client Project #: B5C4507

**QUALITY ASSURANCE REPORT**

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
1476055	MH1	QC Standard	Total Cyanide (CN)	2015/07/09		81	%	75 - 125
1476055	MH1	Spiked Blank	Total Cyanide (CN)	2015/07/09		91	%	75 - 125
1476055	MH1	Method Blank	Total Cyanide (CN)	2015/07/09	<0.5		mg/kg	

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

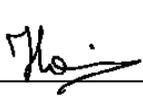
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Job #: B536436  
Report Date: 2015/07/09

Maxxam Analytics  
Client Project #: B5C4507

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Madina Hamrouni, B.Sc., Chemist

---

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MAXXAM ANALYTICS  
800 BLUEWATER ROAD  
BEDFORD, NS B4B1G9  
902-420-0203

E STING!

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ditions de service apply to  
de service publiées de P.  
www.purdata.com

**PIECES:**  
1 of 8



OR PIN: 609

603 901305257

Your Project #: DB5C4507  
Your C.O.C. #: B5C4507

**Attention: BEDFORD CLIENT SERVICE**

MAXXAM ANALYTICS  
200 BLUEWATER ROAD, SUITE 105  
BEDFORD, NS  
CANADA B4B 1G9

**Report Date: 2015/07/14**  
**Report #: R1996324**  
**Version: 1**

**CERTIFICATE OF ANALYSIS**

**MAXXAM JOB #: B558553**

**Received: 2015/07/10, 08:30**

Sample Matrix: Soil  
# Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Glycol in Soil by GC/FID	1	2015/07/13	2015/07/13	CAL SOP-00093	EPA 8015D R4 m
Moisture	1	N/A	2015/07/12	AB SOP-00002	CCME PHC-CWS

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.  
\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Curtis Templeton, Project Manager Assistant  
Email: CTempleton@maxxam.ca  
Phone# (403) 219-3662

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B558553  
Report Date: 2015/07/14

MAXXAM ANALYTICS  
Client Project #: DB5C4507

**RESULTS OF CHEMICAL ANALYSES OF SOIL**

Maxxam ID		MQ2310		
Sampling Date		2015/06/24		
COC Number		B5C4507		
	<b>UNITS</b>	<b>SED2 (ANG415-01R)</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Physical Properties</b>				
Moisture	%	28	0.30	7964015

RDL = Reportable Detection Limit

Maxxam Job #: B558553  
Report Date: 2015/07/14

MAXXAM ANALYTICS  
Client Project #: DB5C4507

**GLYCOLS BY GC-FID (SOIL)**

Maxxam ID		MQ2310		
Sampling Date		2015/06/24		
COC Number		B5C4507		
	<b>UNITS</b>	<b>SED2 (ANG415-01R)</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Glycols</b>				
Extractable (Water) Ethylene Glycol	mg/kg	<10	10	7964720
Extractable (Water) Diethylene Glycol	mg/kg	<10	10	7964720
Extractable (Water) Triethylene Glycol	mg/kg	<10	10	7964720
Extractable (Water) Tetraethylene Glycol	mg/kg	<10	10	7964720
Extractable (Water) Propylene Glycol	mg/kg	<10	10	7964720
<b>Surrogate Recovery (%)</b>				
Extractable (Water) Methyl Sulfone (sur.)	%	75	N/A	7964720

N/A = Not Applicable  
RDL = Reportable Detection Limit

Maxxam Job #: B558553  
Report Date: 2015/07/14

MAXXAM ANALYTICS  
Client Project #: DB5C4507

Package 1	5.3°C
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Each temperature is the average of up to three cooler temperatures taken at receipt

**General Comments**

Sample MQ2310-01: Sample extracted past 14 day hold time for GLYCOL-S.

**Results relate only to the items tested.**

MAXXAM ANALYTICS  
Attention: BEDFORD CLIENT SERVICE  
Client Project #: DB5C4507  
P.O. #:  
Site Location:

Quality Assurance Report  
Maxxam Job Number: CB558553

QA/QC Batch	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
7964015 SRB	Method Blank	Moisture	2015/07/12	<0.30		%	
	RPD	Moisture	2015/07/12	0		%	20
7964720 DO1	Matrix Spike	Extractable (Water) Methyl Sulfone (sur.)	2015/07/13		62	%	50 - 130
		Extractable (Water) Ethylene Glycol	2015/07/13		86	%	30 - 130
		Extractable (Water) Diethylene Glycol	2015/07/13		66	%	30 - 130
		Extractable (Water) Triethylene Glycol	2015/07/13		75	%	30 - 130
		Extractable (Water) Tetraethylene Glycol	2015/07/13		82	%	30 - 130
		Extractable (Water) Propylene Glycol	2015/07/13		46	%	30 - 130
	Spiked Blank	Extractable (Water) Methyl Sulfone (sur.)	2015/07/13		75	%	50 - 130
		Extractable (Water) Ethylene Glycol	2015/07/13		95	%	30 - 130
		Extractable (Water) Diethylene Glycol	2015/07/13		80	%	30 - 130
		Extractable (Water) Triethylene Glycol	2015/07/13		91	%	30 - 130
		Extractable (Water) Tetraethylene Glycol	2015/07/13		105	%	30 - 130
		Extractable (Water) Propylene Glycol	2015/07/13		64	%	30 - 130
	Method Blank	Extractable (Water) Methyl Sulfone (sur.)	2015/07/13		80	%	50 - 130
		Extractable (Water) Ethylene Glycol	2015/07/13	<10		mg/kg	
		Extractable (Water) Diethylene Glycol	2015/07/13	<10		mg/kg	
		Extractable (Water) Triethylene Glycol	2015/07/13	<10		mg/kg	
		Extractable (Water) Tetraethylene Glycol	2015/07/13	<10		mg/kg	
		Extractable (Water) Propylene Glycol	2015/07/13	<10		mg/kg	
	RPD	Extractable (Water) Ethylene Glycol	2015/07/13	NC		%	50
		Extractable (Water) Diethylene Glycol	2015/07/13	NC		%	50
		Extractable (Water) Triethylene Glycol	2015/07/13	NC		%	50
		Extractable (Water) Tetraethylene Glycol	2015/07/13	NC		%	50
		Extractable (Water) Propylene Glycol	2015/07/13	NC		%	50

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.  
 Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.  
 Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.  
 Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.  
 Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.  
 NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

**Validation Signature Page**

**Maxxam Job #: B558553**

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The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



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Dennis Ngundu, Organics – Supervisor



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Janet Gao, Supervisor

=====

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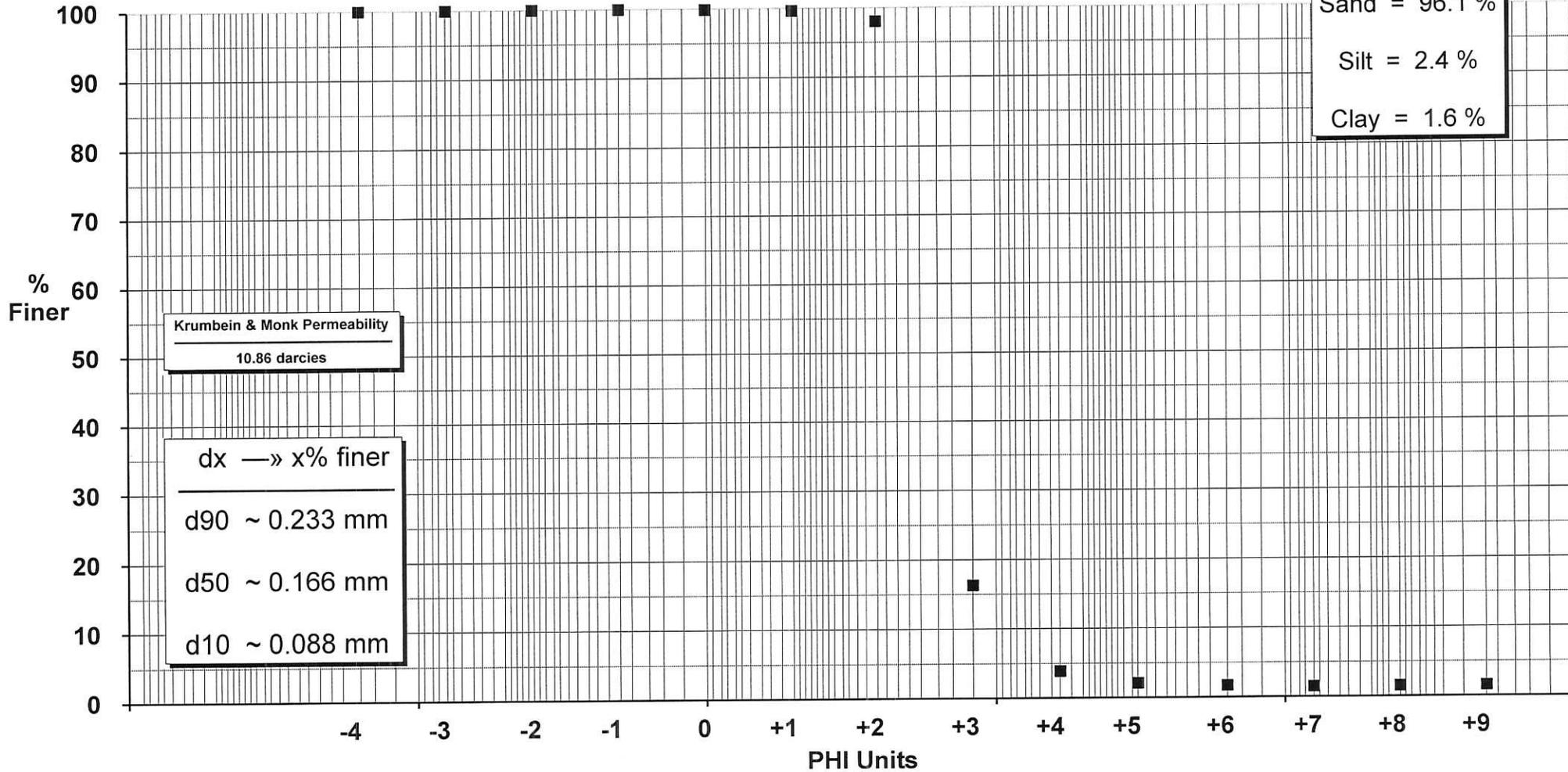


**SED1**

Percent Coarser than 75  $\mu\text{m}$   
(PHI = 3.737)  
—  
92.8 %

Percent Coarser than 50  $\mu\text{m}$   
(PHI = 4.322)  
—  
96.6 %

Wentworth  
Gravel = 0.0 %  
Sand = 96.1 %  
Silt = 2.4 %  
Clay = 1.6 %



*[Signature]*  
Approved

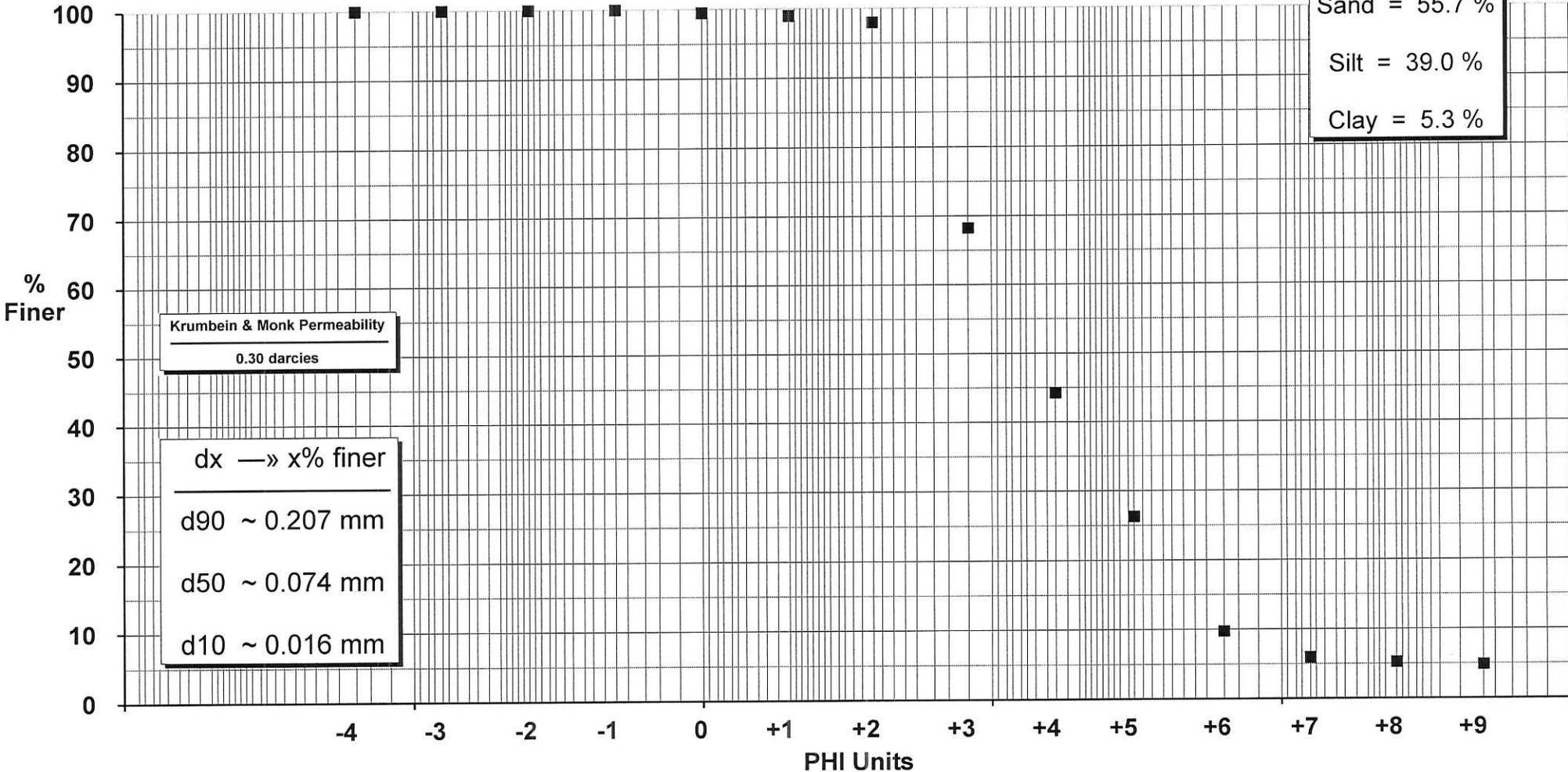


**SED2**

Percent Coarser than 75 µm  
(PHI = 3.737)  
—  
49.4 %

Percent Coarser than 50 µm  
(PHI = 4.322)  
—  
61.5 %

Wentworth  
—  
Gravel = 0.0 %  
Sand = 55.7 %  
Silt = 39.0 %  
Clay = 5.3 %



*[Signature]*  
Approved

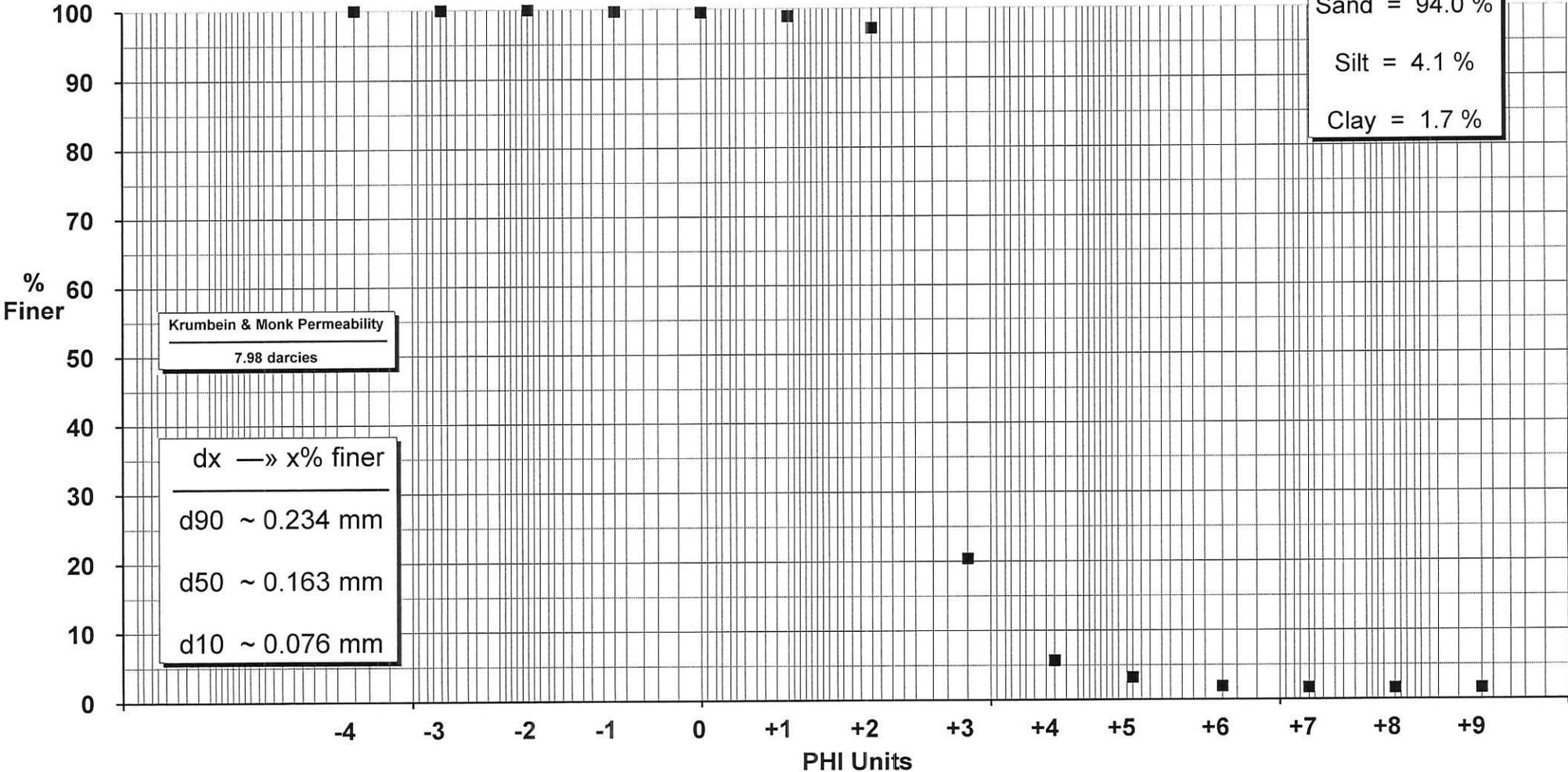


**SED3**

Percent Coarser than 75 µm  
(PHI = 3.737)  
—  
90.4 %

Percent Coarser than 50 µm  
(PHI = 4.322)  
—  
95.1 %

Wentworth  
—  
Gravel = 0.3 %  
Sand = 94.0 %  
Silt = 4.1 %  
Clay = 1.7 %



*[Signature]*  
Approved

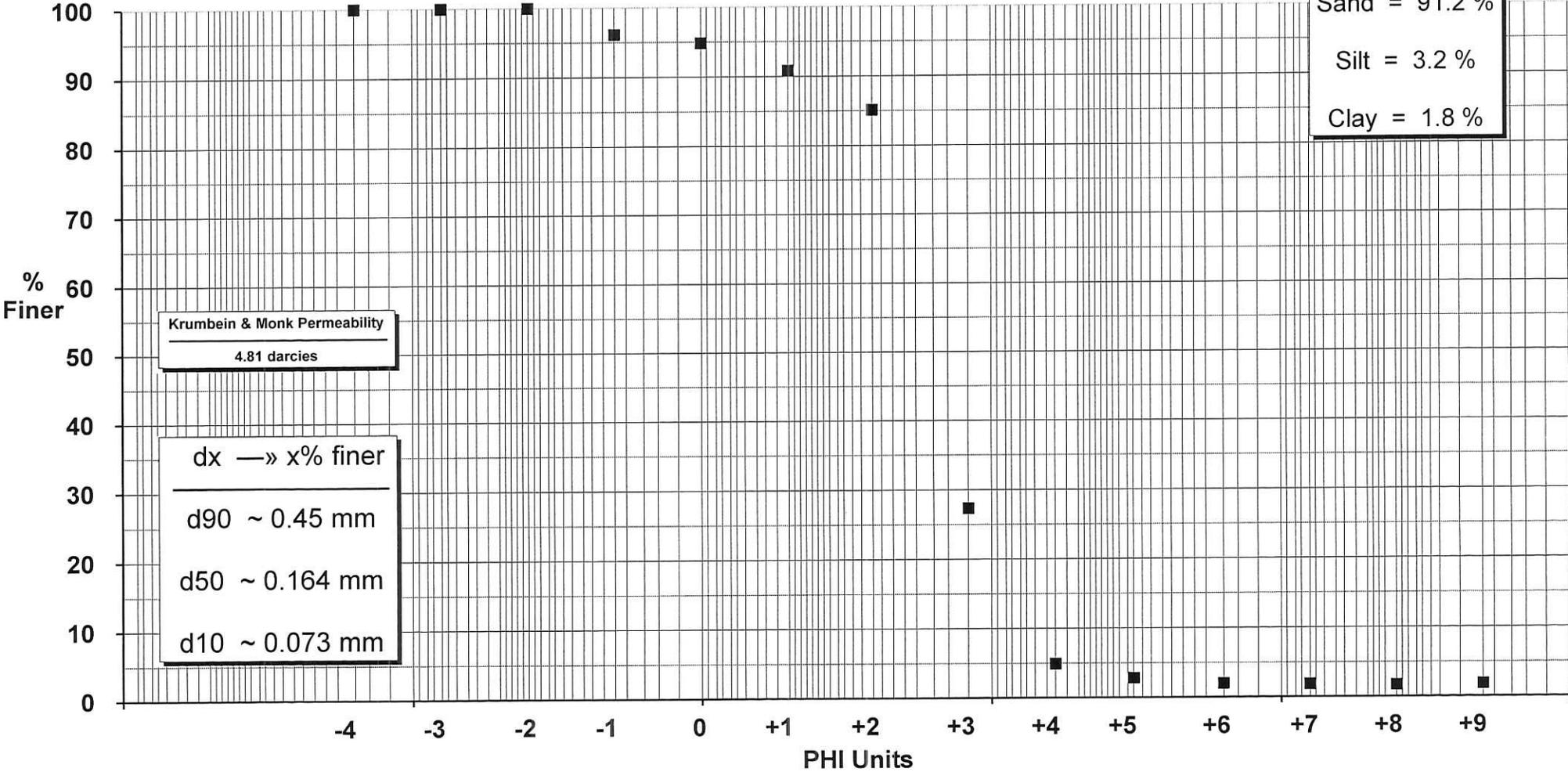


**SED4**

Percent Coarser than 75 µm (PHI = 3.737)
—
89.1 %

Percent Coarser than 50 µm (PHI = 4.322)
—
95.7 %

Wentworth
Gravel = 3.8 %
Sand = 91.2 %
Silt = 3.2 %
Clay = 1.8 %



*W.M.G.*  
Approved

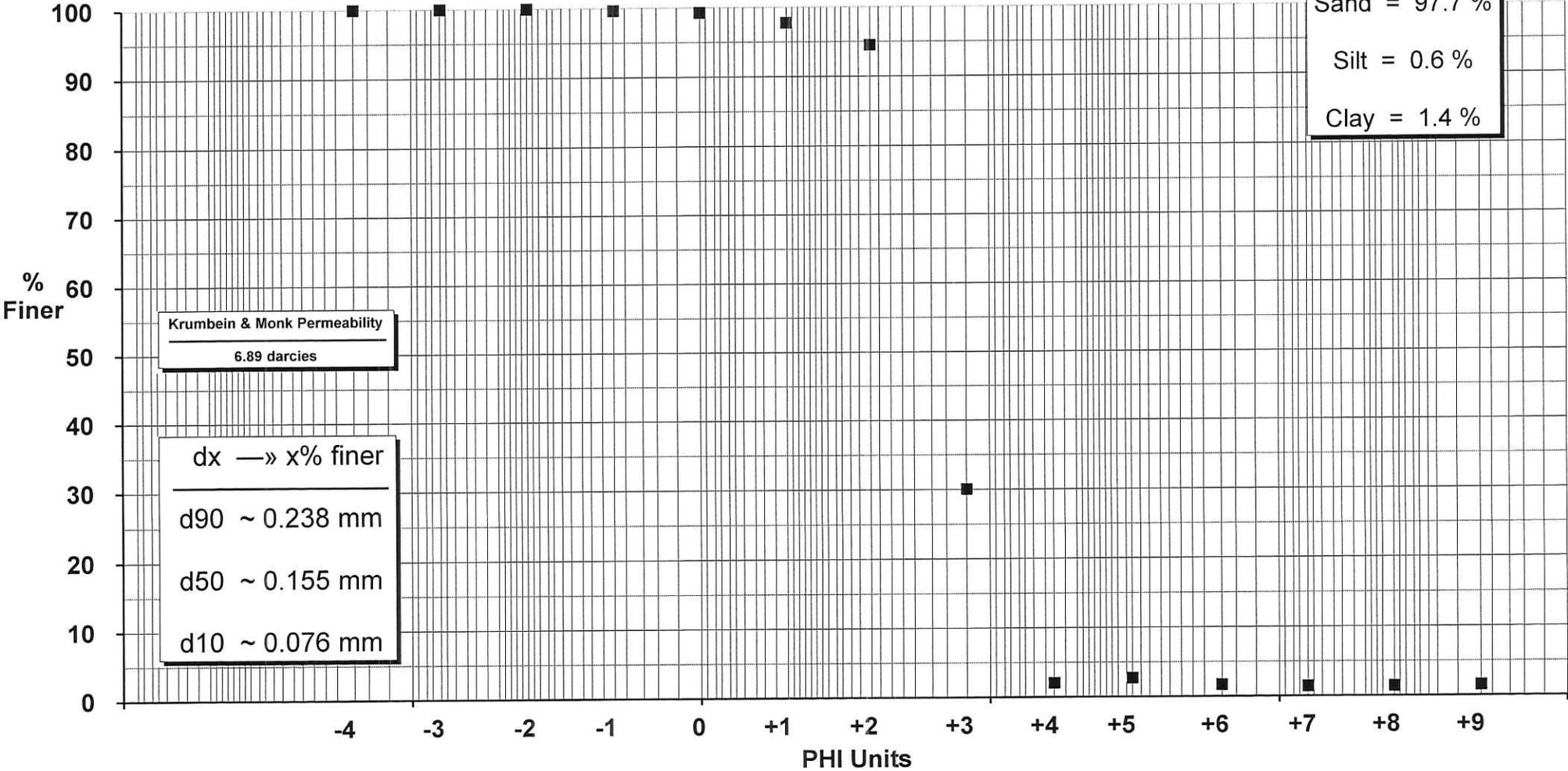


**SED5**

Percent Coarser than 75 $\mu$ m (PHI = 3.737)
—
90.6 %

Percent Coarser than 50 $\mu$ m (PHI = 4.322)
—
97.7 %

Wentworth
Gravel = 0.3 %
Sand = 97.7 %
Silt = 0.6 %
Clay = 1.4 %



*[Signature]*  
Approved

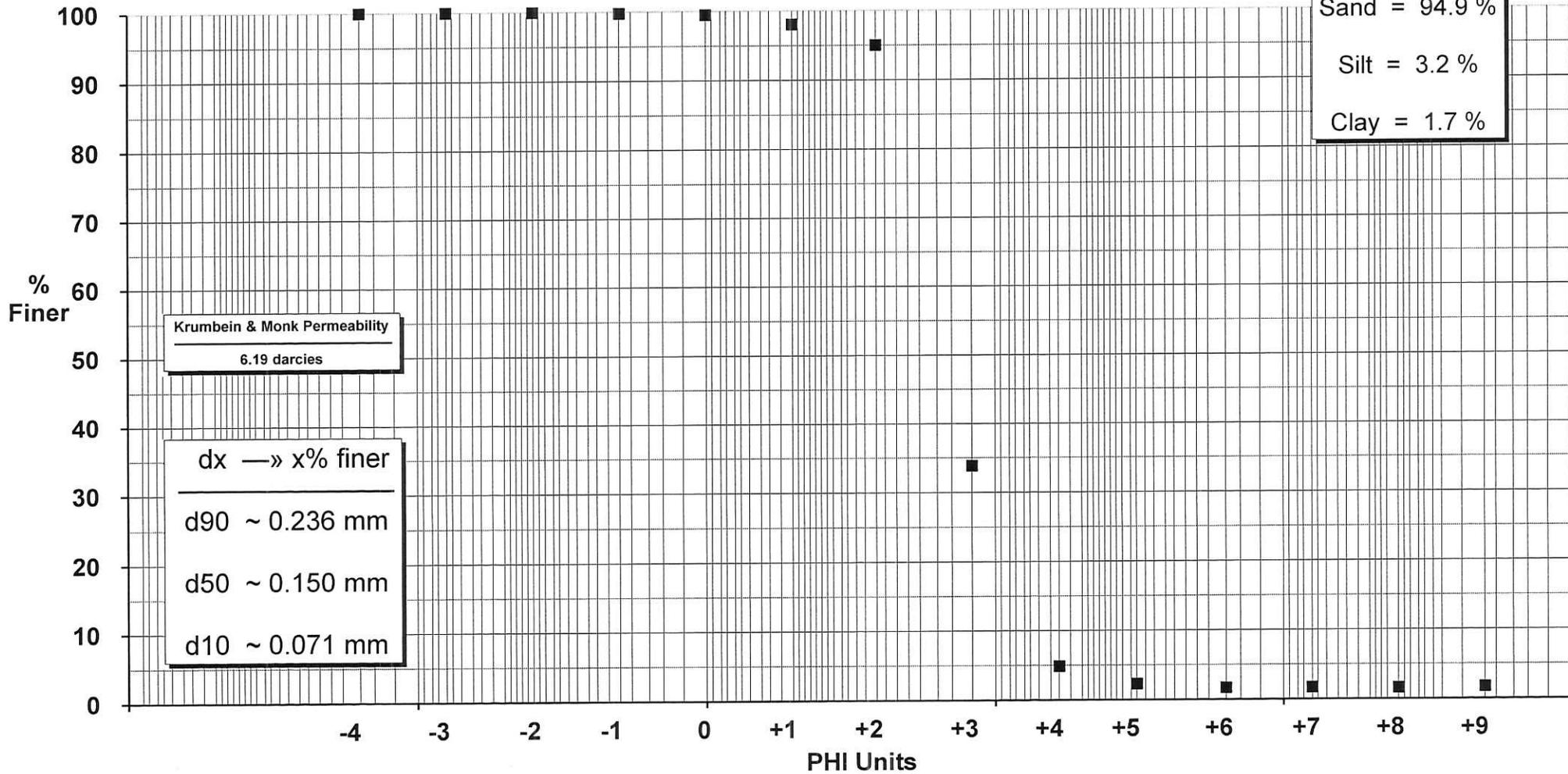


### SED6

Percent Coarser than 75  $\mu\text{m}$   
(PHI = 3.737)  
—  
87.5 %

Percent Coarser than 50  $\mu\text{m}$   
(PHI = 4.322)  
—  
95.9 %

Wentworth  
—  
Gravel = 0.2 %  
Sand = 94.9 %  
Silt = 3.2 %  
Clay = 1.7 %



*[Signature]*  
Approved



**APPENDIX D**  
**Statement of Limitations**



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