

Appendix 'A'

Marine Sediment Sampling Program (MSSP) Report



**MARINE SEDIMENT SAMPLING PROGRAM
MURPHY'S POND SMALL CRAFT HARBOUR
PORT HOOD, NOVA SCOTIA**

FINAL REPORT

Submitted to:
Public Works and Government Services Canada
1713 Bedford Row
PO Box 2247
Halifax, Nova Scotia
B3J 3C9

Submitted by:
Conestoga-Rovers & Associates Ltd.
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March 2014

084369

March 12, 2014

Mr. Troy Young
Public Works and Government Services Canada
1713 Bedford Row
PO Box 2247
Halifax, Nova Scotia
B3J 3C9

Dear Mr Young:

Re: Marine Sediment Sampling Program
Murphy's Pond Small Craft Harbour
Fisheries and Oceans Canada – Small Craft Harbours Branch

Conestoga-Rovers & Associates Ltd. (CRA) is pleased to submit this report for the Marine Sediment Sampling Program conducted in November 2013 at the Murphy's Pond Small Craft Harbour in Port Hood, Inverness County, Nova Scotia. CRA welcomes the opportunity to discuss the above items or answer any questions regarding this report.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES



Peter Oram, P.Geo.



Amanda Facey, B.Sc.

EXECUTIVE SUMMARY

Three sediment samples were collected by divers from Murphy's Pond Small Craft Harbour. The samples were submitted to Maxxam Analytics for detailed analyses. Results were compared to the Canadian Environmental Protection Act (CEPA) Disposal at Sea Regulations (formerly the Ocean Dumping Control Act) – 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), Version 2.0 for Petroleum Impacted Sites in Atlantic Canada Tier I Risk-based Screening Levels (RBSLs), and the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills. Leachate results were compared to Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ), and CCME Water Quality Guidelines (WQGs).

Table ES1 Exceedance Table

Parameter/Guideline	Sample ID		
	SED-1	SED-2	SED-3
CEPA	-	•	-
CCME SQGs			
PAHs	•	•	•
Metals	•	•	•
PCBs	-	-	-
DDT	-	-	-
Atlantic RBCA Version 2.0 Tier 1 RBSLs	-	-	-
NS Guidelines for Disposal of Contaminated Solids in Landfills	•	•	-

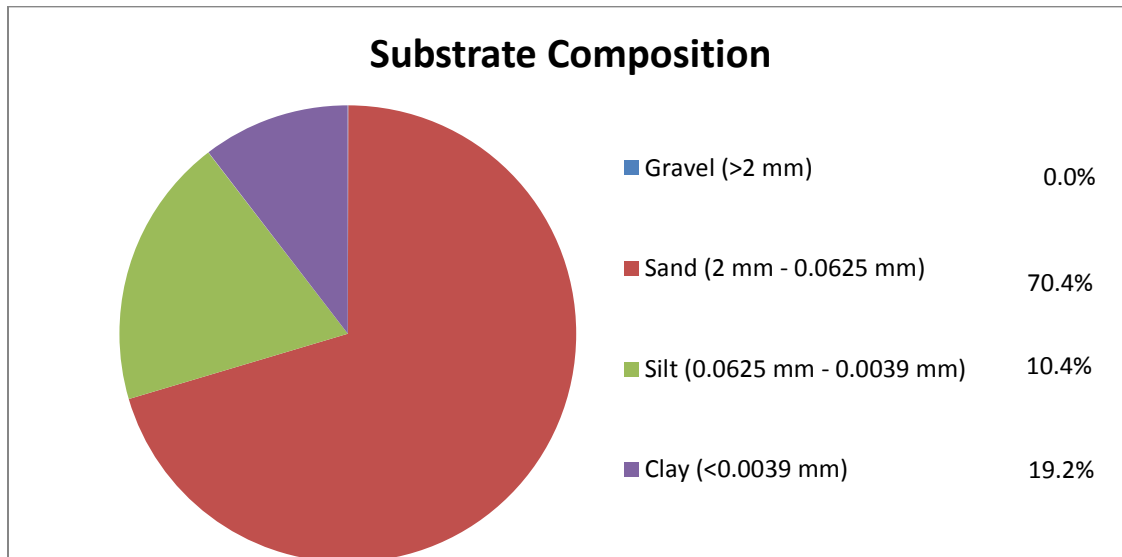


Figure ES1 Substrate Composition Averaged From Sampling Locations within Proposed Dredging Area

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1.0 INTRODUCTION

At the request of Public Works and Government Services Canada (PWGSC), three (3) stations were sampled within the footprint of the proposed dredging area at the Murphy's Pond Fisheries and Oceans Canada Small Craft Harbour (DFO SCH) on November 13, 2013.

2.0 SCOPE AND METHODOLOGY

2.1 Site Plan

The selection of sample stations followed guidance provided in the Environmental Protection Series: *Users Guide to the Application Form for Ocean Disposal* (Report EPS 1/MA/1 December 1995), whereby a random approach was implemented for the location of sampling stations in the proposed dredging area of the SCH. The unstratified area was divided into square blocks where at least five times as many blocks as the number of stations required was used. The Excel RANDBETWEEN function was then used to derive the sampling locations within the proposed dredge area (Figure 2.1).

A detailed program design was prepared by Conestoga-Rovers & Associates Ltd. (CRA) and submitted to PWGSC on October 22, 2013 for review and approval prior to field program implementation. The field program was scheduled upon acceptance of the design.

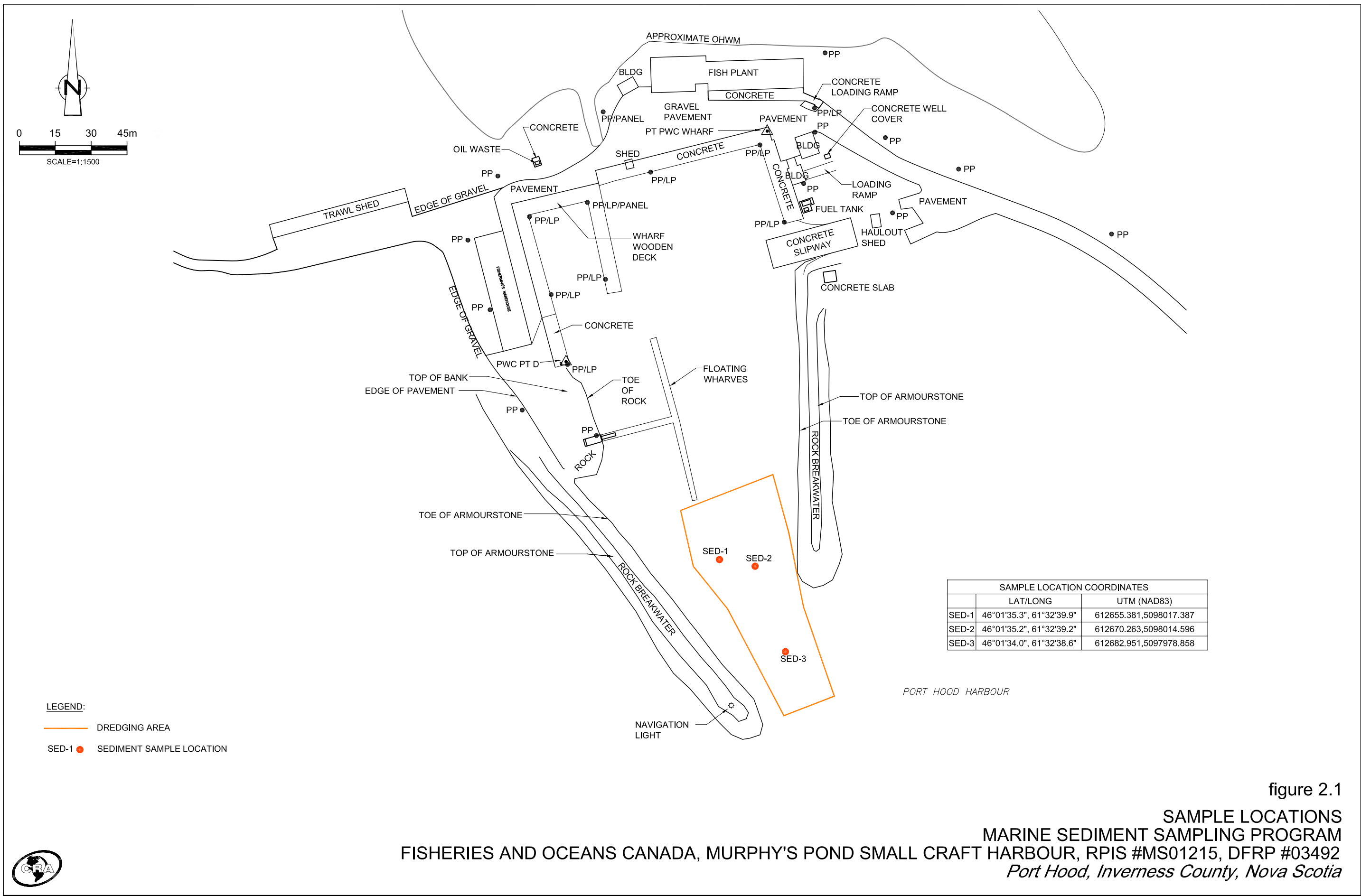
Sample collection, preparation, and analyses were conducted in accordance with Environment Canada's publication Guidance Document on *Collection and Preparation of Sediments for Physicochemical Characterization and Biological Testing*, December 1994. Connors Diving Services Ltd. (Connors) was retained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

Prior to collecting each sediment sample, Connors took close-up photographs of the sample location to allow the substrate to be seen and identification of flora and fauna at each sample location. A photo log is provided in Appendix A.

2.2 Sample Collection

The marine sediment samples were collected by a diver at the selected sampling stations. A handheld Topcon Global Positioning System (GPS) was used to georeference the sampling location coordinates that were derived prior to field program initiation. Sample station coordinates are listed in Table 2.1. Marine Sediment Sampling Program (MSSP) field notes that were completed in the field during the sampling program are provided in Appendix A.

The weather during the field program was cloudy and windy and the temperature was approximately 1°C. The water was rough in the harbour. Due to the presence of a buoy near the proposed location for sediment sample SED-3, the sample location had to be adjusted and was moved slightly north of the proposed location.



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 (formerly the Ocean Dumping Control Act) – 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), Version 2.0 for Petroleum Impacted Sites in Atlantic Canada Tier I Risk-based Screening Levels; and
- Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills.

Leachate results were compared to:

- Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ); and
- CCME Water Quality Guidelines (WQGs).

The following guidelines were provided for reference:

- CCME Sediment Quality Guidelines Interim Sediment Quality Guidelines; and
- CCME Sediment Quality Guidelines Probable Effect Levels for the Protection of Marine Aquatic Life.

Table 2.1 Sample Coordinates

Sample ID	Sample Coordinates (decimal degrees, NAD 83)	
SED-1	46.026460	-61.544412
SED-2	46.026432	-61.544220
SED-3	46.026109	-61.544065

3.0 ANALYTICAL RESULTS

The analytical results of the marine sediment samples collected and analyzed from Murphy's Pond SCH are summarized in Tables B.1 to B.5 (Appendix B) and discussed below.

Based on a review of the initial analytical results, it was decided through consultation with PWGSC that SED-1, SED-2, and SED-3 should undergo leachate analysis (Synthetic Precipitation Leaching Procedure [SPLP]; EPA Method 1312) for their exceedances of the CCME SQGs. Results from these analyses were compared against Health Canada's GCDWQ and CCME WQGs.

It is also of note that for the 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 QA/QC and Certificates of Analyses for all parameters tested, are provided in Appendix C.

3.1 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 ocean disposal criteria. The CCME SQGs for the Protection of Human and Environmental 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 Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills. A summary of the results compared to each of the referenced guidelines is provided in the following subsections:

CEPA Ocean Disposal Guideline

No samples exceeded the CEPA Ocean Disposal Guideline for Total PAHs (Table B.1).

CCME SQGs – Human Health (Potable Water)

No samples exceeded the CCME IACR (Drinking Water Check) value of 1 or the CCME SQGs for the Protection of Human Health (potable water) for all land use scenarios (Table B.1).

CCME SQGs – Human Health (Direct Contact)

Guidance provided in the CCME SQGs for the Protection of Environmental and Human Health (2008) indicates that for soil contaminated by coal tar or creosote mixtures, the calculated Benzo(a)pyrene total potency equivalent (TPE) concentration for soil samples should be multiplied by an uncertainty factor (UF) of 3 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 from the open flame ionization detector scan revealed that creosote was not detected in any of the three samples analyzed. Results of all three samples fell below the CCME SQGs for the Protection of Human Health (direct contact) for agricultural, residential/parkland, commercial, and industrial value of 5.3 mg/kg (Table B.1).

When creosote is detected a UF of 3 will be multiplied to the calculated Benzo(a)pyrene TPE concentration prior to comparison with the SQGs for the protection of human health.

CCME SQGs – Environmental Health (Soil Contact, Soil and Food Ingestion, and Freshwater Life)

No samples exceeded the CCME SQGs for the Protection of Environmental Health (soil contact and soil and food ingestion) (Table B.1).

Samples SED-1, SED-2, and SED-3 exceeded the CCME SQGs for the Protection of Environmental Health (freshwater life) for all land use scenarios. Samples SED-1 and SED-2 also exceeded the Interim Soil Quality Criteria for agricultural land use (Table B.1).

Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills

No samples exceeded the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills (Table B.1).

CCME WQGs – Aquatic Life (Freshwater and Marine)

Samples SED-1, SED-2, and SED-3 were analyzed for leachate. No samples exceeded CCME WQGs for the Protection of Aquatic Life in freshwater environments. No exceedances of the CCME WQGs for the Protection of Aquatic Life in marine environments were noted (Table B.1b).

Health Canada CGDWQ Maximum Acceptable Concentration (MAC) and Aesthetic Objective (AO)

Samples SED-1, SED-2, and SED-3 were analyzed for leachate. No samples exceeded Health Canada's GCDWQ MAC or AO (Table B.1b).

3.2 Metal Concentrations

Sample results were compared to the established CEPA Disposal at Sea Regulations guidelines. The results were also compared to the CCME SQGs for agricultural, residential/parkland, commercial, and industrial applications for land disposal and the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills.

Sample SED-2 exceeded a CEPA guideline (Table B.2).

Samples SED-1, SED-2, and SED-3 exceeded the CCME SQGs for agricultural, residential/parkland, commercial, and/or industrial applications (Table B.2).

Samples SED-1 and SED-2 exceeded the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills (Table B.2).

Metal scan leachate samples SED-1, SED-2, and SED-3 did not exceed the CCME WQG for the protection of aquatic life for boron (Table B.2b). The CCME WQGs, protection of aquatic life, freshwater and marine are 1 µg/L and 1.5 µg/L, respectively, for hexavalent chromium. Maxxam's leachate code for the Synthetic Precipitation Leaching Procedure has a reportable detection limit of 5 µg/L for hexavalent chromium. Therefore, it cannot be determined whether or not the guidelines have been exceeded (Table B.2b).

Metal scan leachate samples SED-1, SED-2, and SED-3 did not exceed the Health Canada GCDWQ MACs (Table B.2b).

3.3 Petroleum Hydrocarbon Concentrations

Although no guidelines for petroleum hydrocarbons currently exist for marine sediment, the analytical BTEX results of the three samples collected were compared to the Atlantic RBCA Tier 1 Version 2.0 RBSLs, CCME SQGs for various land use applications, and the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills. Silica gel clean-up was requested and completed prior to analysis.

Modified TPH values reflect the sum of the individual carbon fractions that resembles gasoline, diesel #2, and lube oil. Based on the resemblance results provided by the laboratory, the analytical results for Modified TPH were compared against the corresponding Atlantic RBCA Tier 1 Version 2.0 RBSLs.

Individual carbon fractions were reported below laboratory detection limits for all samples. "Reached baseline at C32" was reported as not applicable for all samples because the samples were not detected for hydrocarbons.

BTEX was not detected in any of the three samples collected (Table B.3).

The modified TPH values did not exceed the Atlantic RBCA Tier 1 Version 2.0 RBSLs.

3.4 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 ocean disposal criteria. The CCME SQGs for PCBs in agricultural, residential/parkland, and industrial/commercial applications are regulated at values of 0.5, 1.3, and 33.0 mg/kg, respectively. PCB concentrations have also been compared to the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills.

All sample results were non-detectable; however, due to high moisture content in sediment samples SED-1 and SED-2, the reportable detection limit was elevated above the CEPA value for Total PCBs. The sample chromatographs were reviewed and there are no PCB patterns identified in the noted samples (Table B.4).

No samples exceeded the CCME SQGs for any land use (Table B.4).

No samples exceeded the Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills (Table B.4).

3.5 DDT Concentrations

Total DDT which refers to the sum of DDE, DDD, and DDT concentrations is regulated under the CCME SQGs for agricultural, residential/parkland, and commercial/industrial applications at values of 0.7, 0.7, and 12 mg/kg, respectively.

No samples exceeded the CCME SQGs for any land use (Table B.4).

3.6 Carbon Content

Samples SED-1, SED-2, and SED-3 showed total carbon contents ranging from 11 to 98 grams per kilogram (g/kg). TIC was the predominant type, ranging from 3.9 to 51 g/kg, while TOC ranged from 7.1 to 47 g/kg (Table B.5).

3.7 Grain Size Distribution

Sediment composition is described in Figure 3.1 and Table 3.1 below. Figure 3.1 illustrates the overall substrate composition from all sampling locations expressed as percentages to show the average grain size distribution within the proposed dredge area. Table 3.1 breaks down the sediment composition at each sampling location.

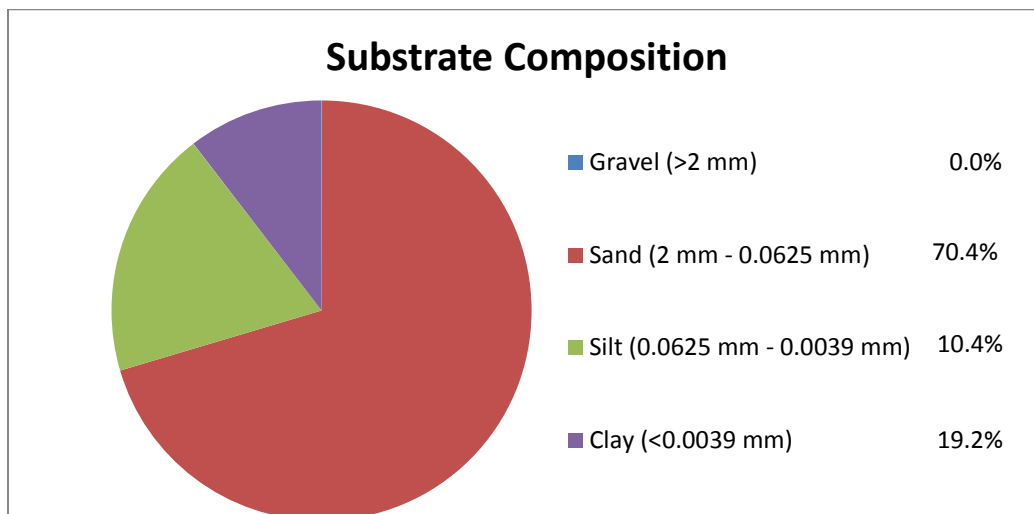


Figure 3.1 Substrate Composition Summarized From Sampling Locations within Proposed Dredging Area

Table 3.1 Dominant Sediment Types at Each Sample Location

Sediment Distribution				
Sample ID	Primary Substrate	Secondary Substrate	Tertiary Substrate	Quaternary Substrate
SED-1	Sand	Silt	Clay	Gravel
SED-2	Sand	Silt	Clay	Gravel
SED-3	Sand	Silt	Clay	Gravel

4.0 QUALITY ASSURANCE/QUALITY CONTROL

All samples collected were labeled on site using a waterproof marker with the date, sample site identifier, and sample number. The samples were placed upright on ice inside a cooler for safe storage and transport, and were hand-delivered to the laboratory following program completion. A copy of the chain of custody (COC) 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 afore-referenced Environment Canada document. Samples were analyzed by an accredited laboratory with CALA and/or ISO/IEC 17025 and 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 pH, total carbon, PAHs, soluble hot water boron, and leachable boron and leachable chromium VI to meet internal QA/QC objectives for the Murphy's Pond DFO SCH samples submitted. Two PAH parameters were outside of the acceptance criterion. However, this represents only two compounds from a multi-parameter list and all other parameters met the acceptance criteria. This data would be considered acceptable because less than 10% of compounds in the multi-component analysis were in violation.

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:

- Duplicate: < 10 % of compounds in multi-component analysis in violation – as explained above, two PAH parameters were outside of the acceptance criterion, but the data is considered acceptable.
- The matrix spike recovery for chromium VI was below the lower control limit. This may be due in part to the reducing environment of the sample.

- Due to the sample matrix, sediment samples SED-1 and SED-2 required dilution for Total PCB analysis. Detection limits were adjusted accordingly for high moisture content. The reportable detection limit was elevated above the CEPA value for Total PCBs. The sample chromatographs were reviewed and there are no PCB patterns identified in the noted samples

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


5.0 CONCLUSION

The analytical results of the three samples collected and analyzed from the Murphy's Pond DFO SCH indicate PAHs and metals exceedances of the CEPA Ocean Disposal Guideline, CCME SQGs, and Nova Scotia Guidelines for Disposal of Contaminated Solids in Landfills.

6.0 CLOSING

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

Prepared by:



Amanda Facey
Project Coordinator

Reviewed by:



Peter Oram
Project Manager



**CONESTOGA-ROVERS
& ASSOCIATES**

**APPENDIX A
Photo Log
and
MSSP Field Report**



Photo 1: SED-1 – Sediment at this sample location is 53% sand, 32% silt, and 15% clay. Plant litter is present.



Photo 2: SED-1 – Sediment at this sample location is 53% sand, 32% silt, and 15% clay. Serrated wrack and plant litter are present.



Photo 3: SED-1 – Sediment at this sample location is 53% sand, 32% silt, and 15% clay. Serrated wrack and plant litter are present.



Photo 4: SED-2 – Sediment at this sample location is 71% sand, 17% silt, and 12% clay. Plant litter is present.



Photo 5: SED-2 – Sediment at this sample location is 71% sand, 17% silt, and 12% clay. Plant litter is present.



Photo 6: SED-2 – Sediment at this sample location is 71% sand, 17% silt, and 12% clay. Plant litter is present.



Photo 7: SED-3 – Sediment at this sample location is 87% sand, 8.5% silt, and 4.3% clay.

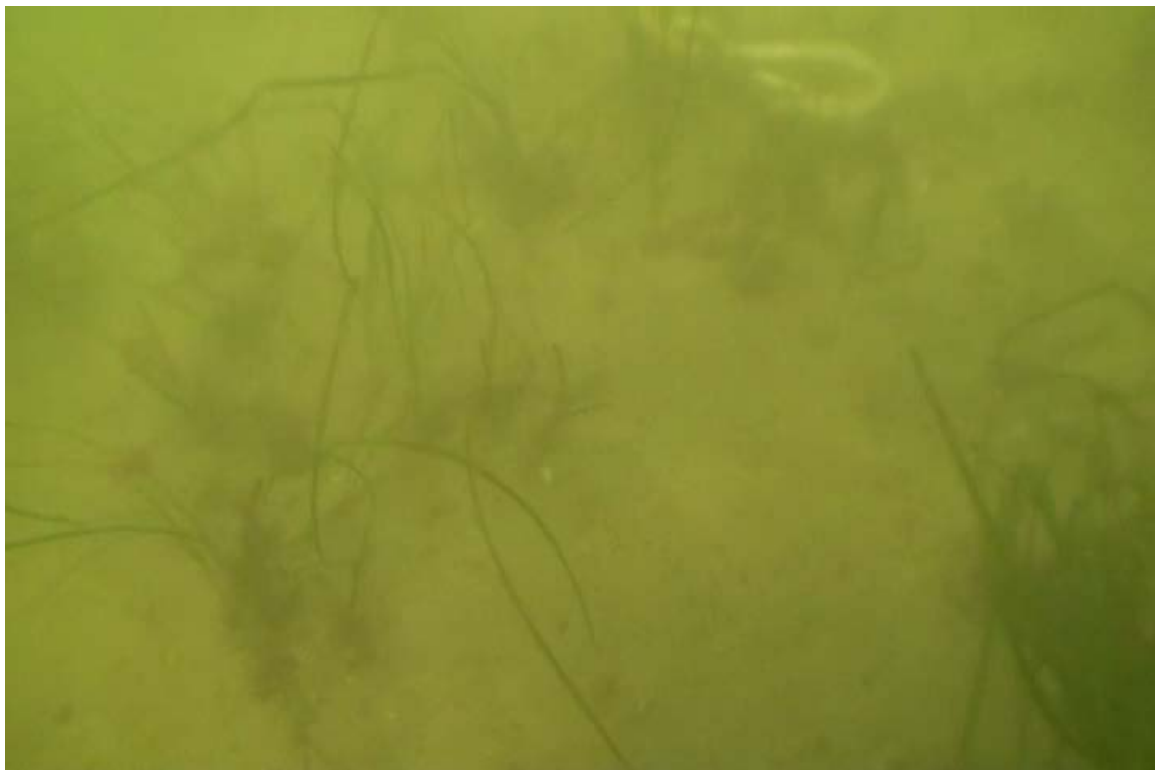


Photo 8: SED-3 – Sediment at this sample location is 87% sand, 8.5% silt, and 4.3% clay. Eelgrass is present.



Photo 9: SED-3 – Sediment at this sample location is 87% sand, 8.5% silt, and 4.3% clay. Eelgrass and a Jonah crab are present.

13 Nov 13 084369 A. Facey

p1/1

Murphy's Pond SCH MSSP, PWGSC

○ Connors Diving

Cloudy, windy, ~ 10°C; water is rough, may
impact photo quality

○ SED-1 612655.381 E 5098017.387 N

primarily sand w/ some silt
black / brown

plant material (minimal)

sulfur smell

SED-2 612670.263 E 5098014.596 N

primarily sand

black / brown

a lot of plant material

sulfur smell

SED-3 612682.951 E 5097978.858 N

primarily sand

black / brown

minimal plant material

sulfur smell

○ diver saw a crab

location moved north due to the presence
of a buoy very close to proposed location

LEVEL 1

APPENDIX B

Analytical Summary Tables

Table B.1. PAH Results for Marine Sediments - Murphy's Pond DFO-SCH, Inverness County, Nova Scotia

Parameter	RDL	B(a)P PEF	Units	Sample Identification and Date			CEPA Disposal at Sea Guidelines	CCME Sediment Quality Guidelines		CCME Soil Quality Guidelines										NS
				SED-1	SED-2	SED-3		Interim Sediment Quality Guidelines	Marine and Estuarine Probable Effects Levels	Human Health		Environmental Health				Interim Soil Quality Criteria				
										Potable Water	Direct Contact	Soil Contact		Soil and Food Ingestion	Freshwater Life					
										November 13, 2013			Agricultural, Residential/Parkland, Commercial and Industrial Land Uses	Agricultural, Residential/Parkland, Commercial and Industrial Land Uses	Agricultural, Residential/Parkland Land Uses	Commercial/ Industrial Land Uses	Agricultural, Residential/Parkland Land Uses	Agricultural, Residential/Parkland, Commercial and Industrial Land Uses	Agricultural Use	
Polycyclic Aromatic Hydrocarbon (PAH) Results																				
1-Methylnaphthalene	0.0050		mg/kg	0.10	0.12	0.071	-	-	-	-	-	-	-	-	-	-	-	-	10	
2-Methylnaphthalene	0.0050			0.12	0.15	0.083	-	0.0202	0.201	-	-	-	-	-	-	-	-	-	10	
Acenaphthene	0.0050			<0.0050	<0.0050	<0.0050	-	0.00671	0.0889	-	-	-	-	21.5	0.28	-	-	-	10	
Acenaphthylene	0.0050			<0.0050	<0.0050	<0.0050	-	0.00587	0.128	-	-	-	-	-	320	-	-	-	10	
Anthracene	0.0050			0.015	0.022	0.0074	-	0.0469	0.245	-	-	2.5	32	61.5	-	-	-	-	10	
Benzo(a)anthracene	0.0050	0.1		0.050	0.059	0.015	-	0.0748	0.693	-	-	-	-	6.2	-	0.1	1	10	10	
Benzo(a)pyrene	0.0050	1		0.030	0.030	0.010	-	0.0888	0.763	-	-	20	72	0.6	8800	0.7	0.7	1.4	10	
Benzo(b)fluoranthene	0.0050	0.1		0.048	0.039	0.012	-	-	-	-	-	-	-	6.2	-	0.1	1	10	10	
Benzo(g,h,i)perylene	0.0050	0.01		0.021	0.017	0.0092	-	-	-	-	-	-	-	-	-	-	-	-	10	
Benzo(j)fluoranthene	0.0050	0.1		0.023	0.021	<0.0050	-	-	-	-	-	-	-	-	-	-	-	10	10	
Benzo(k)fluoroanthene	0.0050	0.1		0.021	0.019	<0.0050	-	-	-	-	-	-	-	6.2	-	0.1	1	10	10	
Chrysene	0.0050	0.01		0.051	0.056	0.018	-	0.108	0.846	-	-	-	-	6.2	-	-	-	-	10	
Dibenz(a,h)anthracene	0.0050	1		<0.0050	<0.0050	<0.0050	-	0.00622	0.135	-	-	-	-	-	-	0.1	1	10	10	
Fluoranthene	0.0050			0.13	0.13	0.042	-	0.113	1.494	-	-	50	180	15.4	-	-	-	-	10	
Fluorene	0.0050			0.020	0.023	0.010	-	0.0212	0.144	-	-	-	-	15.4	0.25	-	-	-	10	
Indeno(1,2,3-cd)pyrene	0.0050	0.1		0.018	<0.0050	<0.0050	-	-	-	-	-	-	-	-	-	0.1	1	10	10	
Napthalene	0.0050			0.084 (7)	0.096 (7)	0.056 (7)	-	0.0346	0.391	-	-	-	-	8.8	0.013	0.6	0.6	22	10	
Perylene	0.0050			0.025	0.021	<0.0050	-	-	-	-	-	-	-	-	-	-	-	-	10	
Phenanthrene	0.0050			0.11 (7, 8)	0.13 (7, 8)	0.052 (7)	-	0.0867	0.544	-	-	-	-	43	0.046	0.1	5	50	10	
Pyrene	0.0050			0.095	0.11 (8)	0.041	-	0.153	1.398	-	-	-	-	7.7	-	0.1	10	100	10	
Total PAH				0.77	0.71	0.32	2.5	-	-	-	-	-	-	-	-	-	-	-	50	
Index of Additive Cancer Risk (IACR)				0.85	0.79	0.20	-	-	-	<1.0	-	-	-	-	-	-	-	-		
Benzo(a)pyrene TPE (10 ⁻⁵)			mg/kg	0.05	0.05	0.02	-	-	-	-	5.3	-	-	-	-	-	-	-		
Creosote or Coal Tar source suspected / known?				No	No	No	-	-	-	-	-	-	-	-	-	-	-	-		
Uncertainty Factor (UF) Applied				NA	NA	NA	-	-	-	-	-	-	-	-	-	-	-	-		
Benzo(a)pyrene TPE (10 ⁻⁵) with UF			mg/kg	NA	NA	NA	-	-	-	-	5.3	-	-	-	-	-	-	-		

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

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

IACR = Index of Additive Cancer Risk (potable water check) =

((Benz[a]anthracene)/0.33 mg·kg-1) + ((Chrysene)/2.1 mg·kg-1) + ((Benzo[b+j+k]fluoranthene)/0.16 mg·kg-1+ ((Benzo[a]pyrene)/0.37 mg·kg-1) + ((Indeno[1,2,3-c,d]pyrene)/2.7 mg·kg-1) + ((Dibenz[a,h]anthracene)/0.23 mg·kg-1) +((Benzo[g,h,i]perylene)/6.8 mg·kg-1)

Benzo(a)Pyrene TPE = Benzo(a) Pyrene Total Potency Equivalents - the sum of estimated cancer potency relative to all B(a)P for all potentially carcinogenic substituted PAHs. The B(a)P TPE for a soil sample is calculated by multiplying the concentration of each PAH in the sample by its B(a)P PEF (Potency Equivalence Factor), as indicated above, and summing the products.

Where parameter is not detected, IACR and TPE calculations use 1/2 the detection limit.

RDL - reportable detection limit

- = no guideline

NA = not applicable

Exceedances are bolded:

1 CEPA

2 CCME Potable Water

3 CCME Direct Contact

4 CCME Soil Contact - Agricultural, Residential/Parkland

5 CCME Soil Contact - Commercial, Industrial

6 CCME Soil and Food Ingestion

7 CCME Freshwater Life

8 Interim Soil Quality Criteria - Agricultural

9 Interim Soil Quality Criteria - Residential/Parkland

10 Interim Soil Quality Criteria - Commercial, Industrial

11 NS

Table B.1b. PAH Results for the Leachate Samples - Murphy's Pond DFO-SCH, Inverness County, 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	
			SED-1	SED-2	SED-3				
			November 13, 2013			Freshwater	Marine	Maximum Acceptable Concentration	Aesthetic Objective
Leachable Polycyclic Aromatic Hydrocarbons (PAHs)									
Leachable 1-Methylnaphthalene	0.01	ug/L	<0.010	<0.010	<0.010	-	-	-	-
Leachable 2-Methylnaphthalene	0.01		<0.010	<0.010	<0.010	-	-	-	-
Leachable Acenaphthene	0.005		<0.0050	<0.0050	<0.0050	5.8	-	-	-
Leachable Acenaphthylene	0.005		<0.0050	<0.0050	<0.0050	-	-	-	-
Leachable Anthracene	0.005		<0.0050	<0.0050	<0.0050	0.012	-	-	-
Leachable Benzo(a)anthracene	0.005		<0.0050	<0.0050	<0.0050	0.018	-	-	-
Leachable Benzo(a)pyrene	0.005		<0.0050	<0.0050	<0.0050	0.015	-	0.01	-
Leachable Benzo(b)fluoranthene	0.005		<0.0050	<0.0050	<0.0050	-	-	-	-
Leachable Benzo(g,h,i)perylene	0.005		<0.0050	<0.0050	<0.0050	-	-	-	-
Leachable Benzo(j)fluoranthene	0.005		<0.0050	<0.0050	<0.0050	-	-	-	-
Leachable Benzo(k)fluoranthene	0.005		<0.0050	<0.0050	<0.0050	-	-	-	-
Leachable Chrysene	0.005		<0.0050	<0.0050	<0.0050	-	-	-	-
Leachable Dibenz(a,h)anthracene	0.005		<0.0050	<0.0050	<0.0050	-	-	-	-
Leachable Fluoranthene	0.005		0.0068	0.007	<0.0050	0.04	-	-	-
Leachable Fluorene	0.005		<0.0050	<0.0050	<0.0050	3	-	-	-
Leachable Indeno(1,2,3-cd)pyrene	0.005		<0.0050	<0.0050	<0.0050	-	-	-	-
Leachable Naphthalene	0.02		<0.020	<0.020	<0.020	1.1	1.4	-	-
Leachable Perylene	0.005		<0.0050	<0.0050	<0.0050	-	-	-	-
Leachable Phenanthrene	0.005		0.011	0.01	0.0095	0.4	-	-	-
Leachable Pyrene	0.02		<0.020	<0.020	<0.020	0.025	-	-	-

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

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

RDL - reportable detection limit

- = no guideline

Exceedances are bolded:

1 CCME Freshwater

2 CCME Marine

3 Health Canada Maximum Acceptable Concentration

Table B.2. Metal Concentrations for Marine Sediments- Murphy's Pond DFO-SCH, Inverness County, Nova Scotia

Parameter	RDL	Units	Sample Identification and Date			CEPA Disposal at Sea Guidelines	CCME Sediment Quality Guidelines		CCME Soil Quality Guidelines				
			SED-1	SED-2	SED-3		Interim Sediment Quality Guidelines	Marine and Estuarine Probable Effects Levels	Agricultural	Residential/ Parkland	Commercial	Industrial	NS
			November 13, 2013										
Antimony (Sb)	2.0	mg/kg	<2.0	<2.0	<2.0	-	-	-	20	20	40	40	40
Arsenic (As)	2.0		8.3	6.5	4.0	-	7.24	41.6	12	12	12	12	50
Barium (Ba)	5.0		76	50	60	-	-	-	750	500	2000	2000	2000
Beryllium (Be)	2.0		<2.0	<2.0	<2.0	-	-	-	4	4	8	8	8
Boron (B)	50		55 (2, 6)	99 (2, 6)	<50*	-	-	-	2	-	-	-	2
Cadmium (Cd)	0.30		0.57	0.71 (1)	<0.30	0.6	0.7	4.2	1.4	10	22	22	20
Chromium +6	0.20		<0.2	12 (2, 3, 4, 5, 6)	4.3 (2, 3, 4, 5)	-	-	-	0.4	0.4	1.4	1.4	8
Chromium (Cr) (Total)	2.0		16	13	8.2	-	52.3	160	64	64	87	87	800
Cobalt (Co)	1.0		8.7	7.7	5.1	-	-	-	40	50	300	300	300
Copper (Cu)	2.0		27	22	15	-	18.7	108	63	63	91	91	500
Lead (Pb)	0.50		24	21	11	-	30.2	112	70	140	260	600	1000
Mercury (Hg)	0.10		<0.10	<0.10	<0.10	0.75	0.13	0.7	6.6	6.6	24	50	10
Molybdenum (Mo)	2.0		4.9	8.2 (2)	<2.0	-	-	-	5	10	40	40	40
Nickel (Ni)	2.0		21	18	10	-	-	-	50	50	50	50	500
Selenium (Se)	1.0		<1.0	<1.0	<1.0	-	-	-	1	1	2.9	2.9	10
Silver (Ag)	0.50		<0.50	<0.50	<0.50	-	-	-	20	20	40	40	40
Thallium (Tl)	0.10		0.18	0.18	<0.10	-	-	-	1	1	1	1	1
Tin (Sn)	2.0		<2.0	<2.0	<2.0	-	-	-	5	50	300	300	300
Uranium (U)	0.10		1.5	2.2	0.43	-	-	-	23	23	33	300	-
Vanadium (V)	2.0		27	24	14	-	-	-	130	130	130	130	200
Zinc (Zn)	5.0		92	87	54	-	124	271	200	200	360	360	1500

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
NS = Nova Scotia Environment and Labour - Guidelines for Disposal of Contaminated Solids in Landfills. March 22, 1992
RDL - reportable detection limit
- = no guideline available
* = CCME Agricultural, NS guidelines lower than RDL

Exceedances are bolded:

- 1 CEPA
- 2 CCME Agricultural
- 3 CCME Residential/Parkland
- 4 CCME Commercial
- 5 CCME Industrial
- 6 NS

Table B.2b. Metal Concentrations in the Leachate Samples - Murphy's Pond DFO-SCH, Inverness County, 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	
			SED-1	SED-2	SED-3				
			November 13, 2013			Freshwater	Marine	Maximum Acceptable Concentration	Aesthetic Objective
Background Data									
pH			8.44	7.89	8.70	6.5-9.0	7.0-8.7	-	-
Leachable Metals									
Leachable Boron (B)	500	ug/L	<500	600	<500	1500	-	5000	-
Leachable Chromium (VI)	5		-	<5*	-	1	1.5	50	-
Leachable Chromium (Cr)	2		-	<2.0	<2.0	-	-	-	-

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

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

RDL - reportable detection limit

- = no guideline

* RDL greater than the CCME Aquatic Life guidelines. See Section 3.2 of report.

Exceedances are bolded:

1 CCME Freshwater

2 CCME Marine

3 Health Canada Maximum Acceptable Concentration

Table B.3. BTEX/TPH Concentrations for Marine Sediments - Murphy's Pond DFO-SCH, Inverness County, Nova Scotia

Sample ID		Date	Units	BTEX Concentrations				Petroleum Hydrocarbon Fraction Concentrations				Resemblance
				Benzene	Toluene	Ethylbenzene	Xylenes	F1	F2	F3	Modified TPH (Less BTEX)	
SED-1		November 13, 2013	mg/kg	<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<18	<15	NA
SED-2				<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<18	<15	NA
SED-3				<0.0050	<0.025	<0.010	<0.050	<2.5	<10	<18	<15	NA
RDL				0.0050	0.025	0.010	0.050	2.5	10	18	15	NA
Reached Baseline at C32				NA								
Atlantic RBCA Tier I RBSLs for Soil												
Residential	Potable	Coarse-grained	0.03	0.38	0.08	11	-	-	-	Gas 39 / Diesel 140 / Oil 690	-	
		Fine-grained	0.01	0.08	0.02	2.3	-	-	-	Gas 140 / Diesel 220 / Oil 970	-	
	Non-potable	Coarse-grained	0.16	14	58	17	-	-	-	Gas 39 / Diesel 140 / Oil 690	-	
		Fine-grained	1.5	120	430	160	-	-	-	Gas 330 / Diesel 4400 / Oil 8300	-	
Commercial	Potable	Coarse-grained	0.03	0.38	0.08	11	-	-	-	Gas 450 / Diesel 7400 / Oil 10000	-	
		Fine-grained	0.03	0.08	0.02	2.3	-	-	-	Gas 520 / Diesel 840 / Oil 4700	-	
	Non-potable	Coarse-grained	1.8	160	430	200	-	-	-	Gas 450 / Diesel 7400 / Oil 10000	-	
		Fine-grained	11	680	430	650	-	-	-	Gas 10000 / Diesel 7700 / Oil 10000	-	
CCME Soil Quality Guidelines												
Agricultural Land Use	Surface	Coarse Soil	0.03	0.37	0.082	11	-	-	-	-	-	
		Fine Soil	0.0068	0.08	0.018	2.4	-	-	-	-	-	
	Subsoil	Coarse Soil	0.03	0.37	0.082	11	-	-	-	-	-	
		Fine Soil	0.0068	0.08	0.018	2.4	-	-	-	-	-	
Residential/ Parkland Use	Surface	Coarse Soil	0.03	0.37	0.082	11	-	-	-	-	-	
		Fine Soil	0.0068	0.08	0.018	2.4	-	-	-	-	-	
	Subsoil	Coarse Soil	0.03	0.37	0.082	11	-	-	-	-	-	
		Fine Soil	0.0068	0.08	0.018	2.4	-	-	-	-	-	
Commercial/ Industrial Land Use	Surface	Coarse Soil	0.03	0.37	0.082	11	-	-	-	-	-	
		Fine Soil	0.0068	0.08	0.018	2.4	-	-	-	-	-	
	Subsoil	Coarse Soil	0.03	0.37	0.082	11	-	-	-	-	-	
		Fine Soil	0.0068	0.08	0.018	2.4	-	-	-	-	-	
NS				5	30	50	50	-	-	-	-	-

Silica gel clean-up performed prior to analysis.

Atlantic RBCA = Atlantic Risk-based Corrective Action - Version 2.0 for Petroleum Impacted Sites in Atlantic Canada, User Guidance, Table 7 (Appendix 3)Tier I Risk-Based Screening Levels for Soil. March 2007

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

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

RDL - reportable detection limit

- = no guideline

NA = not applicable

Exceedances are bolded:

No Atlantic RBCA exceedances

No CCME exceedances

No NS exceedances

Table B.4. PCB and DDT Analytical Results for Marine Sediments - Murphy's Pond DFO-SCH, Inverness County, Nova Scotia

Parameter	RDL	Units	Sample Identification and Date			CEPA Disposal at Sea Guidelines	CCME Sediment Quality Guidelines		CCME Soil Quality Guidelines			
			SED-1	SED-2	SED-3		Interim Sediment Quality Guidelines	Marine and Estuarine Probable Effects Levels	Agricultural	Residential/ Parkland	Commercial/ Industrial	NS
			November 13, 2013									
Polychlorinated Biphenyl (PCB) Results												
Total PCB Concentration	0.015	mg/kg	<0.25*	<0.25*	<0.015	0.1	0.02150	0.01890	0.5	1.3	33	50
Dichloro-Diphenyl-Trichloroethane (DDT) Results												
DDT+ Metabolites	0.002	mg/kg	<0.030	<0.030	<0.0020	-	-	-	-	-	-	-
o,p-DDD + p,p-DDD	0.002		<0.030	<0.030	<0.0020	-	-	-	-	-	-	-
o,p-DDE + p,p-DDE	0.002		<0.030	<0.030	<0.0020	-	-	-	-	-	-	-
o,p-DDT + p,p-DDT	0.002		<0.030	<0.030	<0.0020	-	-	-	-	-	-	-
o,p-DDD	0.002		<0.030	<0.030	<0.0020	-	0.00122	0.00781	-	-	-	-
p,p-DDD	0.002		<0.030	<0.030	<0.0020	-	0.00122	0.00781	-	-	-	-
o,p-DDE	0.002		<0.030	<0.030	<0.0020	-	0.00207	0.37400	-	-	-	-
p,p-DDE	0.002		<0.030	<0.030	<0.0020	-	0.00207	0.37400	-	-	-	-
o,p-DDT	0.002		<0.030	<0.030	<0.0020	-	-	-	-	-	-	-
p,p-DDT	0.002		<0.030	<0.030	<0.0020	-	-	-	-	-	-	-
Total DDT (calculated)	0.07			0	0	0	-	0.00119	0.00477	0.7	0.7	12

*Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly with some being above the CEPA guideline. See Section 3.4 of report.

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

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

RDL - reportable detection limit

- = no guideline available

Total DDT = sum of op-DDD + pp-DDD + op-DDE + pp-DDE + op-DDT + pp-DDT (DDT + metabolites). Non-detected component parameters treated as zero for total DDT calculation. RDL = square root of the sum of the squares of the component parameters. Calculation methods provided by Maxxam Analytics.

Exceedances are bolded:

No CEPA exceedances

No CCME exceedances

Table B.5. TIC,TOC and Grain Size Analytical Results for Marine Sediments - Murphy's Pond DFO-SCH, Inverness County, Nova Scotia

Parameter	RDL	Units	Sample Identification and Date		
			SED-1	SED-2	SED-3
			November 13, 2013		
Grain Size Results					
< PHI -4 (16 mm)	-	%	-	-	-
< PHI -3 (8 mm)	-		-	-	-
< PHI -2 (4 mm)	-		-	-	-
< PHI -1 (2 mm)	0.10		100	100	100
< PHI 0 (1/2 mm)	0.10		96	98	99
< PHI +1 (1/4 mm)	0.10		91	93	98
< PHI +2 (1/8 mm)	0.10		85	86	80
< PHI +3 (1/16 mm)	0.10		68	57	43
< PHI +4 (1/32 mm)	0.10		47	29	13
< PHI +5 (1/32 mm)	0.10		36	23	9.7
< PHI +6 (1/64 mm)	0.10		25	18	6.2
< PHI +7 (1/128 mm)	0.10		18	13	5.0
< PHI +8 (1/256 mm)	0.10		15	12	4.3
< PHI +9 (1/512 mm)	0.10		12	9.9	3.9
Gravel	0.10		<0.10	<0.10	0.23
Sand	0.10		53	71	87
Silt	0.10		32	17	8.5
Clay	0.10		15	12	4.3
Other					
Total Organic Carbon (TOC)	0.20	g/kg	44	47	7.1
Total Inorganic Caron (TIC)	0.30	g/kg	13	51	3.9
Total Carbon (TC)	0.30	g/kg	56	98	11
Moisture	1	%	64	64	28

- = not analyzed

APPENDIX C

QA/QC, COC, and Laboratory Certificates of Analyses

Your Project #: 084369
 Site Location: MURPHY'S POND SCH
 Your C.O.C. #: B 121038

Attention: Amanda Facey

Conestoga-Rovers and Associates Ltd
 Dartmouth
 45 Akerley Blvd
 Dartmouth, NS
 B3B 1J7

Report Date: 2014/02/18
 Report #: R2874696
 Version: 5R

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B3J7350
Received: 2013/11/14, 16:46

Sample Matrix: Soil
 # Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Boron Solid MS - Hot Water Soluble	3	2013/11/19	2013/11/19	ATL SOP-00058	Based on EPA 6020A
Hexavalent Chromium in Soil by IC (1,2)	3	2013/11/22	2013/11/22	CAM SOP-00436	EPA SW846-3060/7199
Chromium (VI) in Leachate (1)	1	N/A	2013/12/12	CAM SOP-00436	EPA 7199
TEH in Soil (PIRI) (2)	3	2013/11/19	2013/11/19	ATL SOP 00111	Based on Atl. PIRI
Metals Leach, SPLP Extraction	3	2013/12/11	2013/12/12	ATL SOP 00058	Based on EPA6020A
Metals Solids Acid Extr. ICPMS	3	2013/11/18	2013/11/19	ATL SOP 00058	Based on EPA6020A
Moisture	3	N/A	2013/11/16	ATL SOP 00001	MOE Handbook 1983
OC Pesticides (Selected) & PCB (1,3)	3	2013/11/20	2013/11/20	CAM SOP-00307	SW846 8081, 8082
OC Pesticides Summed Parameters (1)	3	N/A	2013/11/16	CAM SOP-00307	SW846 8081, 8082
PAH in sediment by GC/MS (Low Level)	1	2013/11/15	2013/11/25	ATL SOP 00102	based on EPA8270C
PAH in sediment by GC/MS (Low Level)	2	2013/11/21	2013/11/25	ATL SOP 00102	based on EPA8270C
VPH in Soil - Low Level	3	2013/11/15	2013/11/18	ATL SOP 00119	Based on Atl. PIRI
Particle size in solids (pipette&sieve) (4)	3	N/A	2013/11/21	ATL SOP 00012	based on MSAMS-1978
SPLP Inorganic extraction - pH	3	N/A	2013/12/11	ATL SOP 00036	Based on EPA1312
SPLP Inorganic extraction - Weight	3	N/A	2013/12/11	ATL SOP 00036	Based on EPA1312
Total Carbon in Solids by Ind.	3	2013/11/21	2013/11/22	ATL SOP 00044/00045	LECO 203-601-224
TIC in soil	3	2013/11/15	2013/11/22	ATL SOP 00044/00045	LECO 203-601-224
Total Organic Carbon in Soil	3	2013/11/21	2013/11/21	ATL SOP 00044/00045	LECO 203-601-224
ModTPH (T1) Calc. for Soil (5)	3	N/A	2013/11/20	N/A	Based on Atl. PIRI

Remarks:

Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

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

* Results relate only to the items tested.

(1) This test was performed by Maxxam Analytics Mississauga

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

(3) Chlordane (Total) = Alpha Chlordane + Gamma Chlordane

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

(5) New RDLs in effect due to release of NS Contaminated Sites Regulations. Reduced RDL based on MDL study performance. Low level analytical run checks being implemented.

Maxxam Job #: B3J7350
Report Date: 2014/02/18

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

-2-

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.

Total cover pages: 2

Maxxam Job #: B3J7350
Report Date: 2014/02/18

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

RESULTS OF ANALYSES OF SOIL

Maxxam ID		TX3184	TX3184		TX3185		TX3186	TX3186		
Sampling Date		2013/11/13	2013/11/13		2013/11/13		2013/11/13	2013/11/13		
	Units	SED-1	SED-1 Lab-Dup	RDL	SED-2	RDL	SED-3	SED-3 Lab-Dup	RDL	QC Batch
Charge/Prep Analysis										
Sample Weight (as received)	g	50	50	N/A	50	N/A	50		N/A	3455025
Final pH	N/A	8.44	8.34	N/A	7.89	N/A	8.70		N/A	3455028
Inorganics										
Chromium (VI)	ug/g	<0.2		0.2	<0.2	0.2	<0.2		0.2	3432317
Total Inorganic Carbon (C)	g/kg	13		0.60	51	0.70	3.9		0.30	3424316
Moisture	%	64		1	64	1	28		1	3424041
Organic Carbon (TOC)	g/kg	44		0.60	47	0.70	7.1		0.20	3430367
Total Carbon-combustion IR	g/kg	56		0.30	98	0.60	11	11	0.30	3431126
< -1 Phi (2 mm)	%	100		0.10	100	0.10	100		0.10	3426101
< 0 Phi (1 mm)	%	96		0.10	98	0.10	99		0.10	3426101
< +1 Phi (0.5 mm)	%	91		0.10	93	0.10	98		0.10	3426101
< +2 Phi (0.25 mm)	%	85		0.10	86	0.10	80		0.10	3426101
< +3 Phi (0.12 mm)	%	68		0.10	57	0.10	43		0.10	3426101
< +4 Phi (0.062 mm)	%	47		0.10	29	0.10	13		0.10	3426101
< +5 Phi (0.031 mm)	%	36		0.10	23	0.10	9.7		0.10	3426101
< +6 Phi (0.016 mm)	%	25		0.10	18	0.10	6.2		0.10	3426101
< +7 Phi (0.0078 mm)	%	18		0.10	13	0.10	5.0		0.10	3426101
< +8 Phi (0.0039 mm)	%	15		0.10	12	0.10	4.3		0.10	3426101
< +9 Phi (0.0020 mm)	%	12		0.10	9.9	0.10	3.9		0.10	3426101
Gravel	%	<0.10		0.10	<0.10	0.10	0.23		0.10	3426101
Sand	%	53		0.10	71	0.10	87		0.10	3426101
Silt	%	32		0.10	17	0.10	8.5		0.10	3426101
Clay	%	15		0.10	12	0.10	4.3		0.10	3426101

N/A = Not Applicable

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Maxxam Job #: B3J7350
Report Date: 2014/02/18

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

ELEMENTS BY ICP/MS (SOIL)

Maxxam ID		TX3184	TX3184	TX3185	TX3186		TX3186		
Sampling Date		2013/11/13	2013/11/13	2013/11/13	2013/11/13		2013/11/13		
	Units	SED-1	SED-1 Lab-Dup	SED-2	SED-3	RDL	SED-3 Lab-Dup	RDL	QC Batch
Metals									
Soluble (Hot Water) Boron (B)	mg/kg	27		26	4.4	3.0	5.0	0.30	3427328
Leachable Boron (B)	ug/L	<500	<500	600	<500	500			3453999
Leachable Chromium (Cr)	ug/L			<2.0	<2.0	2.0			3453999

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B3J7350
Report Date: 2014/02/18

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Maxxam ID		TX3184	TX3185	TX3185	TX3186		
Sampling Date		2013/11/13	2013/11/13	2013/11/13	2013/11/13		
	Units	SED-1	SED-2	SED-2 Lab-Dup	SED-3	RDL	QC Batch
Metals							
Leachable Chromium (VI)	ug/L		<5	<5		5	3455987
Acid Extractable Aluminum (Al)	mg/kg	7500	6400		4300	10	3426073
Acid Extractable Antimony (Sb)	mg/kg	<2.0	<2.0		<2.0	2.0	3426073
Acid Extractable Arsenic (As)	mg/kg	8.3	6.5		4.0	2.0	3426073
Acid Extractable Barium (Ba)	mg/kg	76	50		60	5.0	3426073
Acid Extractable Beryllium (Be)	mg/kg	<2.0	<2.0		<2.0	2.0	3426073
Acid Extractable Bismuth (Bi)	mg/kg	<2.0	<2.0		<2.0	2.0	3426073
Acid Extractable Boron (B)	mg/kg	55	99		<50	50	3426073
Acid Extractable Cadmium (Cd)	mg/kg	0.57	0.71		<0.30	0.30	3426073
Acid Extractable Chromium (Cr)	mg/kg	16	13		8.2	2.0	3426073
Acid Extractable Cobalt (Co)	mg/kg	8.7	7.7		5.1	1.0	3426073
Acid Extractable Copper (Cu)	mg/kg	27	22		15	2.0	3426073
Acid Extractable Iron (Fe)	mg/kg	22000	19000		14000	50	3426073
Acid Extractable Lead (Pb)	mg/kg	24	21		11	0.50	3426073
Acid Extractable Lithium (Li)	mg/kg	18	15		10	2.0	3426073
Acid Extractable Manganese (Mn)	mg/kg	300	250		280	2.0	3426073
Acid Extractable Mercury (Hg)	mg/kg	<0.10	<0.10		<0.10	0.10	3426073
Acid Extractable Molybdenum (Mo)	mg/kg	4.9	8.2		<2.0	2.0	3426073
Acid Extractable Nickel (Ni)	mg/kg	21	18		10	2.0	3426073
Acid Extractable Rubidium (Rb)	mg/kg	8.0	6.9		4.3	2.0	3426073
Acid Extractable Selenium (Se)	mg/kg	<1.0	<1.0		<1.0	1.0	3426073
Acid Extractable Silver (Ag)	mg/kg	<0.50	<0.50		<0.50	0.50	3426073
Acid Extractable Strontium (Sr)	mg/kg	60	71		26	5.0	3426073
Acid Extractable Thallium (Tl)	mg/kg	0.18	0.18		<0.10	0.10	3426073
Acid Extractable Tin (Sn)	mg/kg	<2.0	<2.0		<2.0	2.0	3426073
Acid Extractable Uranium (U)	mg/kg	1.5	2.2		0.43	0.10	3426073
Acid Extractable Vanadium (V)	mg/kg	27	24		14	2.0	3426073
Acid Extractable Zinc (Zn)	mg/kg	92	87		54	5.0	3426073

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

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Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

SEMI-VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		TX3184	TX3184	TX3185	TX3186		
Sampling Date		2013/11/13	2013/11/13	2013/11/13	2013/11/13		
	Units	SED-1	SED-1 Lab-Dup	SED-2	SED-3	RDL	QC Batch
Polyaromatic Hydrocarbons							
1-Methylnaphthalene	mg/kg	0.10	0.096	0.12	0.071	0.0050	3430616
2-Methylnaphthalene	mg/kg	0.12	0.11	0.15	0.083	0.0050	3430616
Acenaphthene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3430616
Acenaphthylene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3430616
Anthracene	mg/kg	0.015	0.023	0.022	0.0074	0.0050	3430616
Benzo(a)anthracene	mg/kg	0.050	0.12 (1)	0.059	0.015	0.0050	3430616
Benzo(a)pyrene	mg/kg	0.030	0.044	0.030	0.010	0.0050	3430616
Benzo(b)fluoranthene	mg/kg	0.048	0.055	0.039	0.012	0.0050	3430616
Benzo(g,h,i)perylene	mg/kg	0.021	0.022	0.017	0.0092	0.0050	3430616
Benzo(j)fluoranthene	mg/kg	0.023	0.030	0.021	<0.0050	0.0050	3430616
Benzo(k)fluoranthene	mg/kg	0.021	0.044	0.019	<0.0050	0.0050	3430616
Chrysene	mg/kg	0.051	0.12 (1)	0.056	0.018	0.0050	3430616
Dibenz(a,h)anthracene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3430616
Fluoranthene	mg/kg	0.13	0.15	0.13	0.042	0.0050	3430616
Fluorene	mg/kg	0.020	0.020	0.023	0.010	0.0050	3430616
Indeno(1,2,3-cd)pyrene	mg/kg	0.018	0.020	<0.0050	<0.0050	0.0050	3430616
Naphthalene	mg/kg	0.084	0.077	0.096	0.056	0.0050	3430616
Perylene	mg/kg	0.025	0.028	0.021	<0.0050	0.0050	3430616
Phenanthrene	mg/kg	0.11	0.12	0.13	0.052	0.0050	3430616
Pyrene	mg/kg	0.095	0.10	0.11	0.041	0.0050	3430616
Surrogate Recovery (%)							
D10-Anthracene	%	98	97	105	101		3430616
D14-Terphenyl	%	114	110	112	112		3430616
D8-Acenaphthylene	%	94	98	100	99		3430616

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

(1) - Duplicate: < 10 % of compounds in multi-component analysis in violation.

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Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
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ATLANTIC RBCA HYDROCARBONS (SOIL)

Maxxam ID		TX3184	TX3185	TX3186		
Sampling Date		2013/11/13	2013/11/13	2013/11/13		
	Units	SED-1	SED-2	SED-3	RDL	QC Batch
Petroleum Hydrocarbons						
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	0.0050	3426100
Toluene	mg/kg	<0.025	<0.025	<0.025	0.025	3426100
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	0.010	3426100
Xylene (Total)	mg/kg	<0.050	<0.050	<0.050	0.050	3426100
C6 - C10 (less BTEX)	mg/kg	<2.5	<2.5	<2.5	2.5	3426100
>C10-C16 Hydrocarbons	mg/kg	<10	<10	<10	10	3427238
>C16-C21 Hydrocarbons	mg/kg	<10	<10	<10	10	3427238
>C21-<C32 Hydrocarbons	mg/kg	<15	<15	<15	15	3427238
Modified TPH (Tier1)	mg/kg	<15	<15	<15	15	3423853
Reached Baseline at C32	mg/kg	NA	NA	NA	N/A	3427238
Hydrocarbon Resemblance	mg/kg	NA	NA	NA	N/A	3427238
Surrogate Recovery (%)						
Isobutylbenzene - Extractable	%	102	101	95		3427238
Isobutylbenzene - Volatile	%	96	101	99		3426100
n-Dotriacontane - Extractable	%	127 ⁽¹⁾	125 ⁽¹⁾	116 ⁽¹⁾		3427238

N/A = Not Applicable

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

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

Maxxam Job #: B3J7350
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Conestoga-Rovers and Associates Ltd
Client Project #: 084369
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Sampler Initials: AF

ORGANOCHLORINATED PESTICIDES BY GC-ECD (SOIL)

Maxxam ID		TX3184	TX3185		TX3186		
Sampling Date		2013/11/13	2013/11/13		2013/11/13		
	Units	SED-1	SED-2	RDL	SED-3	RDL	QC Batch
Calculated Parameters							
DDT+ Metabolites	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3424248
o,p-DDD + p,p-DDD	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3424248
o,p-DDE + p,p-DDE	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3424248
o,p-DDT + p,p-DDT	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3424248
Total PCB	ug/g	<0.25	<0.25	0.25	<0.015	0.015	3424248
Pesticides & Herbicides							
o,p-DDD	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3428999
p,p-DDD	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3428999
o,p-DDE	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3428999
p,p-DDE	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3428999
o,p-DDT	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3428999
p,p-DDT	ug/g	<0.030	<0.030	0.030	<0.0020	0.0020	3428999
Surrogate Recovery (%)							
2,4,5,6-Tetrachloro-m-xylene	%	108	95		79		3428999
Decachlorobiphenyl	%	76	82		76		3428999

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

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Package 1	6.3°C
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Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

TEH Analysis: No presence of creosote.

Revised report: Added SPLP Leachate plus boron analysis to all samples and SPLP Leachate plus chromium to sample SED-2 as requested by Amanda Facey 2013/12/05

Revised report: Revised to report SPLP Leachate chromium results for samples SED-2 and SED-3 as requested by Amanada Facey. 2014/02/18 MHL

Sample TX3184-01: OC Pesticide Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly. Detection limits were adjusted for high moisture content.

Sample TX3185-01: OC Pesticide Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly. Detection limits were adjusted for high moisture content.

Maxxam Job #: B3J7350
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Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
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QUALITY ASSURANCE REPORT

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
3426073	Acid Extractable Antimony (Sb)	2013/11/19	NC	75 - 125	110	75 - 125	<2.0	mg/kg	NC	35		
3426073	Acid Extractable Arsenic (As)	2013/11/19	NC	75 - 125	101	75 - 125	<2.0	mg/kg	13.2	35		
3426073	Acid Extractable Barium (Ba)	2013/11/19	NC	75 - 125	98	75 - 125	<5.0	mg/kg	1.9	35		
3426073	Acid Extractable Beryllium (Be)	2013/11/19	101	75 - 125	99	75 - 125	<2.0	mg/kg	NC	35		
3426073	Acid Extractable Bismuth (Bi)	2013/11/19	102	75 - 125	104	75 - 125	<2.0	mg/kg	NC	35		
3426073	Acid Extractable Boron (B)	2013/11/19	93	75 - 125	104	75 - 125	<50	mg/kg	NC	35		
3426073	Acid Extractable Cadmium (Cd)	2013/11/19	97	75 - 125	98	75 - 125	<0.30	mg/kg	14.6	35		
3426073	Acid Extractable Chromium (Cr)	2013/11/19	NC	75 - 125	101	75 - 125	<2.0	mg/kg	1.2	35		
3426073	Acid Extractable Cobalt (Co)	2013/11/19	NC	75 - 125	100	75 - 125	<1.0	mg/kg	6.3	35		
3426073	Acid Extractable Copper (Cu)	2013/11/19	NC	75 - 125	99	75 - 125	<2.0	mg/kg	6.3	35		
3426073	Acid Extractable Lead (Pb)	2013/11/19	NC	75 - 125	98	75 - 125	<0.50	mg/kg	5.6	35		
3426073	Acid Extractable Lithium (Li)	2013/11/19	NC	75 - 125	107	75 - 125	<2.0	mg/kg	2.9	35		
3426073	Acid Extractable Manganese (Mn)	2013/11/19	NC	75 - 125	101	75 - 125	<2.0	mg/kg	3.8	35		
3426073	Acid Extractable Mercury (Hg)	2013/11/19	95	75 - 125	99	75 - 125	<0.10	mg/kg	NC	35		
3426073	Acid Extractable Molybdenum (Mo)	2013/11/19	NC	75 - 125	105	75 - 125	<2.0	mg/kg	NC	35		
3426073	Acid Extractable Nickel (Ni)	2013/11/19	NC	75 - 125	99	75 - 125	<2.0	mg/kg	9.0	35		
3426073	Acid Extractable Rubidium (Rb)	2013/11/19	101	75 - 125	101	75 - 125	<2.0	mg/kg	NC	35		
3426073	Acid Extractable Selenium (Se)	2013/11/19	101	75 - 125	102	75 - 125	<1.0	mg/kg	NC	35		
3426073	Acid Extractable Silver (Ag)	2013/11/19	104	75 - 125	104	75 - 125	<0.50	mg/kg	NC	35		
3426073	Acid Extractable Strontium (Sr)	2013/11/19	98	75 - 125	99	75 - 125	<5.0	mg/kg	NC	35		
3426073	Acid Extractable Thallium (Tl)	2013/11/19	103	75 - 125	103	75 - 125	<0.10	mg/kg	NC	35		
3426073	Acid Extractable Tin (Sn)	2013/11/19	107	75 - 125	106	75 - 125	<2.0	mg/kg	NC	35		
3426073	Acid Extractable Uranium (U)	2013/11/19	107	75 - 125	106	75 - 125	<0.10	mg/kg	2.8	35		
3426073	Acid Extractable Vanadium (V)	2013/11/19	NC	75 - 125	102	75 - 125	<2.0	mg/kg	0.8	35		
3426073	Acid Extractable Zinc (Zn)	2013/11/19	NC	75 - 125	103	75 - 125	<5.0	mg/kg	0.9	35		
3426073	Acid Extractable Aluminum (Al)	2013/11/19					<10	mg/kg	4.5	35		
3426073	Acid Extractable Iron (Fe)	2013/11/19					<50	mg/kg	1.7	35		
3426100	Isobutylbenzene - Volatile	2013/11/18	87	60 - 140	89	60 - 140	97	%				
3426100	Benzene	2013/11/18	70	60 - 140	62	60 - 140	<0.0050	mg/kg	NC	50		
3426100	Toluene	2013/11/18	107	60 - 140	67	60 - 140	<0.025	mg/kg	NC	50		
3426100	Ethylbenzene	2013/11/18	82	60 - 140	68	60 - 140	<0.010	mg/kg	NC	50		
3426100	Xylene (Total)	2013/11/18	104	60 - 140	70	60 - 140	<0.050	mg/kg	NC	50		
3426100	C6 - C10 (less BTEX)	2013/11/18					<2.5	mg/kg	NC	50		
3426101	Gravel	2013/11/21							NC	35		
3426101	Sand	2013/11/21							20.9	35		
3426101	Silt	2013/11/21							4.5	35		
3426101	Clay	2013/11/21							4.6	35		
3427238	Isobutylbenzene - Extractable	2013/11/19	85	30 - 130	91	30 - 130	95	%				
3427238	n-Dotriacontane - Extractable	2013/11/19	92	30 - 130	89	30 - 130	90	%				
3427238	>C10-C16Hydrocarbons	2013/11/19	78	30 - 130	74	30 - 130	<10	mg/kg	NC	50		

Maxxam Job #: B3J7350
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Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

QUALITY ASSURANCE REPORT

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
3427238	>C16-C21 Hydrocarbons	2013/11/19	82	30 - 130	88	30 - 130	<10	mg/kg	NC	50		
3427238	>C21-<C32 Hydrocarbons	2013/11/19	66	30 - 130	99	30 - 130	<15	mg/kg	NC	50		
3427328	Soluble (Hot Water) Boron (B)	2013/11/19	NC(1)	75 - 125	94	75 - 125	<0.30	mg/kg	NC(2)	35		
3428999	2,4,5,6-Tetrachloro-m-xylene	2013/11/20	78	50 - 130	85	50 - 130	87	%				
3428999	Decachlorobiphenyl	2013/11/20	50	50 - 130	69	50 - 130	83	%				
3428999	o,p-DDD	2013/11/20	101	50 - 130	102	50 - 130	<0.0020	ug/g	NC	40		
3428999	p,p-DDD	2013/11/20	100	50 - 130	102	50 - 130	<0.0020	ug/g	NC	40		
3428999	o,p-DDE	2013/11/20	86	50 - 130	86	50 - 130	<0.0020	ug/g	NC	40		
3428999	p,p-DDE	2013/11/20	106	50 - 130	92	50 - 130	<0.0020	ug/g	NC	40		
3428999	o,p-DDT	2013/11/20	95	50 - 130	97	50 - 130	<0.0020	ug/g	NC	40		
3428999	p,p-DDT	2013/11/20	102	50 - 130	104	50 - 130	<0.0020	ug/g	NC	40		
3430367	Organic Carbon (TOC)	2013/11/21					<0.20	g/kg	6.8	35	98	75 - 125
3430616	D10-Anthracene	2013/11/25	87	30 - 130	102	30 - 130	121	%				
3430616	D14-Terphenyl	2013/11/25	101	30 - 130	113	30 - 130	128	%				
3430616	D8-Acenaphthylene	2013/11/25	93	30 - 130	99	30 - 130	107	%				
3430616	1-Methylnaphthalene	2013/11/25	NC(3)	30 - 130	94	30 - 130	<0.0050	mg/kg	5.6(4)	50		
3430616	2-Methylnaphthalene	2013/11/25	NC(3)	30 - 130	103	30 - 130	<0.0050	mg/kg	9.7(4)	50		
3430616	Acenaphthene	2013/11/25	90(3)	30 - 130	106	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Acenaphthylene	2013/11/25	86(3)	30 - 130	94	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Anthracene	2013/11/25	82(3)	30 - 130	101	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Benzo(a)anthracene	2013/11/25	91(3)	30 - 130	114	30 - 130	<0.0050	mg/kg	83.1(5, 6, 4)	50		
3430616	Benzo(a)pyrene	2013/11/25	103(3)	30 - 130	115	30 - 130	<0.0050	mg/kg	35.8(4)	50		
3430616	Benzo(b)fluoranthene	2013/11/25	97(3)	30 - 130	105	30 - 130	<0.0050	mg/kg	13.8(4)	50		
3430616	Benzo(g,h,i)perylene	2013/11/25	94(3)	30 - 130	110	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Benzo(j)fluoranthene	2013/11/25	103(3)	30 - 130	110	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Benzo(k)fluoranthene	2013/11/25	101(3)	30 - 130	106	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Chrysene	2013/11/25	86(3)	30 - 130	106	30 - 130	<0.0050	mg/kg	79.3(5, 6, 4)	50		
3430616	Dibenz(a,h)anthracene	2013/11/25	92(3)	30 - 130	103	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Fluoranthene	2013/11/25	NC(3)	30 - 130	107	30 - 130	<0.0050	mg/kg	10.1(4)	50		
3430616	Fluorene	2013/11/25	88(3)	30 - 130	102	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Indeno(1,2,3-cd)pyrene	2013/11/25	92(3)	30 - 130	109	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Naphthalene	2013/11/25	NC(3)	30 - 130	103	30 - 130	<0.0050	mg/kg	8.5(4)	50		
3430616	Perylene	2013/11/25	97(3)	30 - 130	114	30 - 130	<0.0050	mg/kg	NC(4)	50		
3430616	Phenanthrene	2013/11/25	NC(3)	30 - 130	108	30 - 130	<0.0050	mg/kg	9.4(4)	50		
3430616	Pyrene	2013/11/25	NC(3)	30 - 130	105	30 - 130	<0.0050	mg/kg	9.1(4)	50		
3431126	Total Carbon-combustion IR	2013/11/22					<0.20	g/kg	0.09(2)	35	99	75 - 125
3432317	Chromium (VI)	2013/11/22	13(5, 7)	80 - 120	93	80 - 120	<0.2	ug/g	NC	35	93	80 - 120
3453999	Leachable Boron (B)	2013/12/12	NC(3)	80 - 120	97	80 - 120	<500	ug/L	NC(4)	35		
3453999	Leachable Chromium (Cr)	2013/12/12	95(3)	80 - 120	97	80 - 120	<2.0	ug/L				
3455025	Sample Weight (as received)	2013/12/11							0(4)	N/A		

Maxxam Job #: B3J7350
Report Date: 2014/02/18

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

QUALITY ASSURANCE REPORT

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
3455028	Final pH	2013/12/11					4.30, RDL=N/A	N/A	1.2 ⁽⁴⁾	N/A		
3455987	Leachable Chromium (VI)	2013/12/12	89 ⁽⁸⁾	80 - 120	95	80 - 120	<5	ug/L	NC ⁽⁹⁾	35		

Maxxam Job #: B3J7350
Report Date: 2014/02/18

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Leachate Blank	
			Value	Units
3455987	Leachable Chromium (VI)	2013/12/12	<5	ug/L

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

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.

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

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 not sufficiently significant to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

(1) - Matrix Spike Parent ID [TX3186-02]

(2) - Duplicate Parent ID [TX3186-02]

(3) - Matrix Spike Parent ID [TX3184-02]

(4) - Duplicate Parent ID [TX3184-02]

(5) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(6) - Duplicate: < 10 % of compounds in multi-component analysis in violation.

(7) - The matrix spike recovery was below the lower control limit. This may be due in part to the reducing environment of the sample.

(8) - Matrix Spike Parent ID [TX3185-02]

(9) - Duplicate Parent ID [TX3185-02]

Validation Signature Page

Maxxam Job #: B3J7350

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



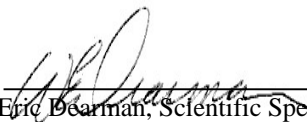
Brad Newman, Scientific Specialist



Colleen Acker, Supervisor, General Chemistry



Cristina Carriere, Scientific Services

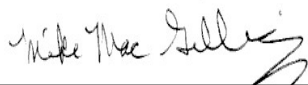


Eric Dearman, Scientific Specialist

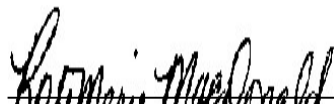
Validation Signature Page

Maxxam Job #: B3J7350

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



Mike MacGillivray, Scientific Specialist (Inorganics)



Robert MacDonald, Scientific Specialist (Organics)

=====

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Column for lab use only:

Lab Code 16276

Maxxam Job #

B3J7350

Cooler ID	Seal Present	Seal Intact	Temp 1	Temp 2	Temp 3	Average Temp

Integrity YES <u>NO</u>	Integrity / Checklist by <u>AF</u>
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 #

Project Name / Site Location

Quote

Site #

Task Order #

Sampled by

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

Low level BTEX (CCME SQG)/TPH
Silica gel clean up
Low level PAH (2010 CCME)
Scan for creosote
Metals include hexavalent chromium

*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
1 SED-1	sediment	13 Nov 13	4 x 250 ml
2 SED-2	sediment	13 Nov 13	4 x 250 ml
3 SED-3	sediment	13 Nov 13	4 x 250 ml
4			
5			
6			
7			
8			
9			
10			

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) Rec'd for CCME Residential, Parks, Agriculture	Hot Water soluble Boron (required for CCME Agriculture)	RBCA Hydrocarbons (BTEX, C6-C12)	Hydrocarbons Soil (Potable), NS Fuel Oil Soil Policy Low Level BTEX, C6-C12	TPH Fractionation	PAH's	PAH's with Acridine, Quinoline	PCBs and ODT suite	Carbon content (TIC/TOC)	Grain size distribution
							X				X	X			X	X	X		
							X				X	X			X	X	X		
							X				X	X			X	X	X		

2013 NOV 15 11:49

RELINQUISHED BY: (Signature/Print)

Date

Time

A Facey A Facey

14 Nov 2013

RECEIVED BY: (Signature/Print)

Date

Time

Joe Doyle

NOV 14 PM 4:45

Erin Fraser ERIN FRASER

Your Project #: 084369
 Site Location: MURPHY'S POND SCH
 Your C.O.C. #: B 121038

Attention: Amanda Facey

Conestoga-Rovers and Associates Ltd
 Dartmouth
 45 Akerley Blvd
 Dartmouth, NS
 B3B 1J7

Report Date: 2014/02/28
Report #: R2895261
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B427173

Received: 2014/02/19, 11:59

Sample Matrix: Soil
 # Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
PAH in Leachates GC/MS (Low Level)	2	2014/02/26	2014/02/27	ATL SOP 00103 R3	Based on EPA 8270C
PAH in Leachates GC/MS (Low Level)	1	2014/02/26	2014/02/28	ATL SOP 00103 R3	Based on EPA 8270C
SPLP Inorganic extraction - pH	3	N/A	2014/02/25	ATL SOP 00036	Based on EPA1312
SPLP Inorganic extraction - Weight	3	N/A	2014/02/25	ATL SOP 00036	Based on EPA1312

Remarks:

Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

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

* Results relate only to the items tested.

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.

Total cover pages: 1

Maxxam Job #: B427173
Report Date: 2014/02/28

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

RESULTS OF ANALYSES OF SOIL

Maxxam ID		UY4115	UY4116	UY4117	UY4117		
Sampling Date		2013/11/13	2013/11/13	2013/11/13	2013/11/13		
	Units	SED-1 (P#TX3184-01)	SED-2 (P#TX3185-01)	SED-3 (P#TX3186-01)	SED-3 (P#TX3186-01) Lab-Dup	RDL	QC Batch
Charge/Prep Analysis							
Sample Weight (as received)	g	50	50	50	50	N/A	3522225
Final pH	N/A	7.79	7.81	8.67	8.59	N/A	3522226

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B427173
Report Date: 2014/02/28

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

SEMI-VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		UY4115	UY4116	UY4117	UY4117		
Sampling Date		2013/11/13	2013/11/13	2013/11/13	2013/11/13		
	Units	SED-1 (P#TX3184-01)	SED-2 (P#TX3185-01)	SED-3 (P#TX3186-01)	SED-3 (P#TX3186-01) Lab-Dup	RDL	QC Batch
Polyaromatic Hydrocarbons							
Leachable 1-Methylnaphthalene	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	3523651
Leachable 2-Methylnaphthalene	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	3523651
Leachable Acenaphthene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Acenaphthylene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Anthracene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Benzo(a)anthracene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Benzo(a)pyrene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Benzo(b)fluoranthene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Benzo(g,h,i)perylene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Benzo(j)fluoranthene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Benzo(k)fluoranthene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Chrysene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Dibenz(a,h)anthracene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Fluoranthene	ug/L	0.0068	0.0070	<0.0050	0.0060	0.0050	3523651
Leachable Fluorene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Indeno(1,2,3-cd)pyrene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Naphthalene	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	3523651
Leachable Perylene	ug/L	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	3523651
Leachable Phenanthrene	ug/L	0.011	0.010	0.0095	0.011	0.0050	3523651
Leachable Pyrene	ug/L	<0.020 ⁽¹⁾	<0.020 ⁽¹⁾	<0.020 ⁽¹⁾	<0.020 ⁽¹⁾	0.020	3523651
Surrogate Recovery (%)							
Leachable D10-Anthracene	%	82	80	86	93		3523651
Leachable D14-Terphenyl	%	89	85	94	101		3523651
Leachable D8-Acenaphthylene	%	83	79	85	90		3523651

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

(1) - Elevated RDL(s) due to detected levels in the method blank.

Maxxam Job #: B427173
Report Date: 2014/02/28

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

Package 1	6.3°C
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Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Maxxam Job #: B427173
Report Date: 2014/02/28

Conestoga-Rovers and Associates Ltd
Client Project #: 084369
Site Location: MURPHY'S POND SCH
Sampler Initials: AF

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Spiked Blank		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	Value	Units
3522225	Sample Weight (as received)	2014/02/25			NA, RDL=N/A	g	0 ⁽¹⁾	N/A		
3522226	Final pH	2014/02/25			4.31, RDL=N/A	N/A	0.9 ⁽¹⁾	N/A		
3523651	Leachable D10-Anthracene	2014/02/27	99	30 - 130	94	%			93	%
3523651	Leachable D14-Terphenyl	2014/02/27	105	30 - 130	101	%			100	%
3523651	Leachable D8-Acenaphthylene	2014/02/27	97	30 - 130	95	%			89	%
3523651	Leachable 1-Methylnaphthalene	2014/02/28	91	30 - 130	<0.010	ug/L	NC ⁽¹⁾	40	<0.010	ug/L
3523651	Leachable 2-Methylnaphthalene	2014/02/28	100	30 - 130	<0.010	ug/L	NC ⁽¹⁾	40	<0.010	ug/L
3523651	Leachable Acenaphthene	2014/02/28	95	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Acenaphthylene	2014/02/28	88	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Anthracene	2014/02/28	83	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Benzo(a)anthracene	2014/02/28	88	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Benzo(a)pyrene	2014/02/28	86	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Benzo(b)fluoranthene	2014/02/28	83	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Benzo(g,h,i)perylene	2014/02/28	86	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Benzo(j)fluoranthene	2014/02/28	87	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Benzo(k)fluoranthene	2014/02/28	86	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Chrysene	2014/02/28	96	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Dibenz(a,h)anthracene	2014/02/28	75	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Fluoranthene	2014/02/28	87	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Fluorene	2014/02/28	93	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Indeno(1,2,3-cd)pyrene	2014/02/28	83	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Naphthalene	2014/02/28	96	30 - 130	<0.020	ug/L	NC ⁽¹⁾	40	<0.020	ug/L
3523651	Leachable Perylene	2014/02/28	88	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Phenanthrene	2014/02/28	91	30 - 130	<0.0050	ug/L	NC ⁽¹⁾	40	<0.0050	ug/L
3523651	Leachable Pyrene	2014/02/28	88	30 - 130	0.016, RDL=0.0050	ug/L	NC ^(2, 1)	40	<0.0050	ug/L

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

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

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

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 (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

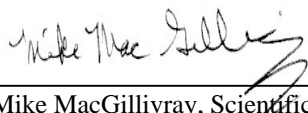
(1) - Duplicate Parent ID [UY4117-01]

(2) - Elevated RDL(s) due to detected levels in the method blank.

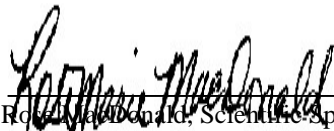
Validation Signature Page

Maxxam Job #: B427173

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



Mike MacGillivray, Scientific Specialist (Inorganics)



Robert MacDonald, Scientific Specialist (Organics)

=====

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Column for lab use only:

Lab Code 16276

Maxxam Job #

B3J7350

Cooler ID	Seal Present	Seal Intact	Temp 1	Temp 2	Temp 3	Average Temp

Integrity YES <u>NO</u>	Integrity / Checklist by <u>AF</u>
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 #

Project Name / Site Location

Quote

Site #

Task Order #

Sampled by

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

Low level BTEX (CCME SQG)/TPH
Silica gel clean up
Low level PAH (2010 CCME)
Scan for creosote
Metals include hexavalent chromium

*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
1 SED-1	sediment	13 Nov 13	4 x 250 ml
2 SED-2	sediment	13 Nov 13	4 x 250 ml
3 SED-3	sediment	13 Nov 13	4 x 250 ml
4			
5			
6			
7			
8			
9			
10			

Field Filtered & Preserved	Lab Filtration Required	Choose Total or Diss Metals	Choose 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, Parks, Agriculture	Hot Water soluble Boron (required for CCME Agriculture)	RBCA Hydrocarbons (BTEX, C6-C12)	Hydrocarbons Soil (Potable), NS Fuel Oil Spill Policy Low Level BTEX, C6-C12	NS Potable Water BTEX, VPH, Low level T.E.H.	TPH Fractionation	PAH's	PAH's with Acridine, Quinoline	PCBs and ODT suite	Carbon content (TIC, TOC)	Grain size distribution
							X				X	X				X	X	X		
							X				X	X				X	X	X		
							X				X	X				X	X	X		

2013 NOV 15 11:49

RELINQUISHED BY: (Signature/Print)

A Facey A Facey

Date

14 Nov 2013

Time

RECEIVED BY: (Signature/Print)

Joe Doyle
Erin Fraser ERIN FRASER

Date

NOV 14 PM 4:45

Time

APPENDIX D

Limitations

Public Works & Government Services Canada
Marine Sediment Sampling Program
Murphy's Pond Small Craft Harbour
March 11, 2014



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