C.0463

ENVIRONMENTAL SITE ASSESSMENT
Red River Bank Adjacent to the Former Sutherland Avenue Manufactured Gas Plant Winnipeg, MB Manitoba Hydro/Centra Gas

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MORROW ENVIRONMENTAL CONSULTANTS

W1801B
2001 09 17

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EXECUTIVE SUMMARY

As requested by Manitoba Hydro/Centra Gas, Morrow Environmental Consultants Inc. (MECI) in association with Agassiz North Associates Limited (Agassiz North) has completed a Phase II Environmental Site Assessment (ESA) of the left (south) bank of the Red River adjacent to the Centra Gas Sutherland Operations Centre in Winnipeg, MB. The Centra Gas site is the location of a former Manufactured Gas Plant (MGP). The purpose of the assessment was to further investigate the extent of impacted soil beneath the Red River bank identified during investigations completed by CH2M Hill Engineering Limited (CH2M Hill) and AMEC Earth and Environmental Limited (AMEC) since 1993.

The Phase II ESA completed by MECI included excavating a test pit located at the base of an excavation for the construction of an outfall structure on the south bank of the Red River and drilling two boreholes on the west side of the outfall gate control structure to depths of 12.2 m below ground surface. Soil samples were collected from the test pit and boreholes for visual observation and laboratory analyses.

The stratigraphy beneath the river bank generally consisted of clay fill to a depth of approximately 1.5 m below ground surface. Clay or clay and silt were encountered to depths of 3.9 m to 6.1 m below grade, below which was a 0.9 m to 1.5 m thick layer of silt. Clay or clay and silt extended to depths of 7.6 m to 8.5 below grade. Sand was encountered to depths of 9.9 m to 11.0 m below grade, below which was clay to depths of 10.7 m to 11.6 m below grade. Silt till extended to the maximum depth of the investigation (12.2 m below grade).

Black and grey staining and a mothball odour were noted in the test pit, from 0.3 m to 1.0 m below the base of the excavation. Liquid coal tar was observed seeping from silty sand layers into the test pit. A slight mothball/hydrocarbon odour was noted in the clay fill in Borehole 01-47 at a depth of 1.2 m to 1.5 m below grade. Hydrocarbon sheen was not observed in either of the boreholes. Due to rising spring river levels at the time of the investigation, a borehole could not be installed to the west of the test pit.

Coal tar related hydrocarbons were detected at elevated concentrations in soil samples recovered from the test pit and from Borehole 01-47 located west of the outfall structure.

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1. INTRODUCTION

The current Manitoba Hydro/Centra Gas Sutherland Operations Centre is located at 35, 37 and 38 Sutherland Avenue in Winnipeg, MB. The site is bounded by the CPR tracks to the south, Annabella Street to the east, Rover Avenue to the north and Gladstone Street to the west. Surrounding land use includes commercial and residential to the east, commercial to the south, and the Disraeli Freeway to the west beyond which is recreational and residential. The Red River is located immediately north of Rover Avenue. The river flows northwest past the Centra Gas site. A Location Plan is presented as Drawing W1801B-001, Appendix I.

The Centra Gas site is the location of a former Manufactured Gas Plant (MGP). The plant produced manufactured gas from coal and oil during the period from the late 1800s to the mid 1900s. Previous studies undertaken by CH2M Hill Engineering Limited (1993 to 1995) and AMEC Earth and Environmental Limited (1995 to 2000) have determined that the soil and groundwater beneath the Centra Gas site, and off of the site immediately to the north and west, have been impacted by a number of constituents characteristic of products and raw materials associated with manufactured gas plant operations. The results of the most recent investigation are summarised in AMEC's report entitled: *Closure Report, Centra Gas Operations Facility, 35 Sutherland Avenue, Winnipeg, Manitoba*, November 2000.

In view of the nature and types of constituents found at the site, Manitoba Hydro/Centra Gas retained Agassiz North Associates Limited and Morrow Environmental Consultants Inc. (MECI) to assist them in completing the environmental site assessment (ESA) work to delineate the extent of impacted sediments in the Red River and along the south bank of the Red River. This report summarizes the results of the environmental site assessment work completed by MECI on the left bank of the Red River.

A separate investigation was undertaken by MECI on the Red River sediments adjacent to the former MGP. The results of the investigation were presented to Manitoba Hydro/Centra Gas in a separate report dated 2001 09 17.

1.1. Project Team

The Phase II Environmental Site Assessment (ESA) adjacent to Centra Gas's former Manufactured Gas Plant Site in Winnipeg, MB was carried out by a project team consisting of MECI representatives: Alex Man, M.Sc., P.Eng., Roberta Dyck, P.Eng., Andrew Eason, P.Eng.,

and Ron Typliski, P.Eng. Site investigation work and report preparation were conducted by Alex Man, Roberta Dyck and Andrew Eason with senior technical review provided by Ron Typliski. Doug Ramsey of Agassiz North Associates Limited provided liaison between MECI, Centra Gas and Manitoba Hydro, and shared his knowledge of the area of investigation.

Manitoba Hydro/Centra Gas representatives, who provided invaluable assistance to the project team, were Dennis Windsor and Bob Gill.

The City of Winnipeg, UMA Engineering Ltd. and Nelson River Construction assisted with the coordination of activities at the storm sewer outfall structure construction underway on the south riverbank immediately adjacent to MECI's area of investigation.

1.2. Phase II ESA Objectives and Scope of Investigation

The purpose of the limited Phase II ESA was as follows.

- Investigate horizontal and vertical extent of impacted soil identified during the excavation of the outfall structure;

The scope of work completed for the Phase II ESA is summarized below.

- One test pit and two boreholes were installed on the left riverbank immediately northwest of the former MGP site. Soil samples were recovered from the test pit and boreholes, and selected soil samples were submitted for laboratory analysis of organic parameters.
- This report was prepared summarizing the findings of the investigation.

Due to rising spring time water levels in the Red River at the time of the investigation, boreholes could not be installed immediately west of the test pit. As a result, delineation of the impacted soils were not established to the west of the test pit. Instead, the two boreholes were placed west of the gate control structure further up the south bank.

2. REGULATORY FRAMEWORK

Soil quality for the current field investigation has been reviewed within a regulatory framework of federal and provincial guidelines/criteria for the target parameters. The guidelines/criteria for soil quality are discussed below, with respect to their application and relevance to the investigation and the data obtained. The guidelines/criteria are for information purposes and are not presented as remediation objectives.

The document entitled *Guideline for Environmental Site Investigations in Manitoba*, Manitoba Environment, June 1998 outlines the evaluative process that applies a risk-based protocol to sites in Manitoba. The process consists of a Site Investigation, Site Classification and a three tier Evaluation component to establish target levels based on the risk to public health and safety and the physical environment. A Tier I Evaluation involves using available generic environmental quality guidelines (EQG). A Tier II Evaluation involves making limited modifications to the EQG based on site specific conditions. A Tier III Evaluation consists of conducting a site specific risk assessment to establish site specific EQG. For this investigation, a combination of a Tier I Evaluation and a Tier II Evaluation, was selected for the subject site. The EQG are presented in the documents entitled: *Canadian Environmental Quality Guidelines*, Canadian Council of Ministers of the Environment (CCME) 1999, *Guideline for Use at Contaminated Sites in Ontario,* Ontario Ministry of Environment and Energy (MOEE), 1996 (revised September 1998), and *Canada-Wide Standards (CWS) for Petroleum Hydrocarbons (PHC) in Soil,* CCME, April 2001.

For consistency with previous studies, the CCME (1999) Commercial Land Use guidelines are presented for information. Residential/parkland EQG are also presented for information purposes. The generic EQG for benzene and toluene are based on a "limiting pathway" of ingestion of groundwater used for drinking water. Since shallow groundwater proximate to the site is not used as a source of drinking water, the pathway for ingestion of groundwater is not considered applicable for the subject site. Due to the adjacent Red River, the most probable "limiting pathway" for benzene and toluene is groundwater recharge to surface water. Accordingly, the CCME (1999) Residential/Parkland and Commercial Land Use Soil Quality Guidelines for Environmental Health (SQG_E) guidelines for toluene are presented. The generic EQG for xylenes is based on a "limiting pathway" of inhalation (human health). Inhalation of indoor air is not considered applicable for the subject portion of the site. The most probable

"limiting pathway" for xylenes is soil contact. Accordingly, the CCME (1999) Residential/Parkland and Commercial Land Use SQG_E guidelines for xylenes are presented. The generic EQG for ethylbenzene is based on the most probable "limiting pathway" of soil contact. As such, the CCME (1999) Residential/Parkland and Commercial Land Use SQG_E guidelines remain unchanged. The EQG for benzo(a)pyrene is based on the most sensitive "limiting pathway" of groundwater used for drinking water. Since shallow groundwater proximate to the site is not used as a source of drinking water, the pathway for ingestion of groundwater is not considered applicable for the subject site. The most probable "limiting pathway" for benzo(a)pyrene is soil contact. Accordingly, the CCME (1999) Residential/Parkland and Commercial Land Use SQG_E guidelines for benzo(a)pyrene are presented. The EQG for naphthalene is based on a "limiting pathway" of soil contact. The most probable and sensitive "limiting pathway" for naphthalene is groundwater recharge to surface water. Accordingly, the CCME (1999) Residential/Parkland and Commercial Land Use SQG_E guideline for naphthalene is presented.

For polycyclic aromatic hydrocarbon (PAH) components not referenced in the CCME (1999) guidelines, the MOEE (1996) criteria have been used for information purposes. The "surface soil criteria for Residential/Parkland and Commercial/Industrial land use for a non-potable groundwater condition" shown on Table B of the MOEE (1996) document are presented.

The guidelines presented in the CCME (2000) CWS PHC document have also been presented for information purposes. For consistency with previous studies, commercial land use EQG are presented. Additionally, residential EQG are presented for information. The standards that are protective of groundwater (GW) for aquatic life or eco soil contact have been presented for informational purposes. The native soil adjacent to the Red River includes clay and silt (fine grain soil) at depths less than 1.5 m below grade and sand layers (coarse grain soil) at depths greater than 1.5 m below grade. The CWS PHC document has not determined a fine-grained surface soil standard that is protective of groundwater for aquatic life. As such, for the shallow clay and silt, the Pathway-Specific Tier 1 Levels for PHC in Fine-Grained Surface Soil (<1.5 m depth), Commercial Land Use and Residential Land Use, Eco Soil Contact are presented. For the deep sand layers, the Generic Levels for PHC in Coarse-Grained Subsoil (>1.5 m depth), Commercial Land Use and Residential Land Use, Protection of GW for Aquatic Life are presented for fractions F1 and F2. Since there are no applicable standards for this pathway for

F3 and F4, the Generic Levels for PHC in Coarse-Grained Subsoil (>1.5 m depth), Commercial Land Use and Residential Land Use, Eco Soil Contact are presented.

The soil quality guidelines/criteria, as discussed above, are summarised in the table below.

Soil Quality Guidelines/Criteria

	Environmental Quality Guidelines			
Parameter	**Residential/Parkland Land Use**		**Commercial Land Use**	
BTEX				
Benzene	4[1,2]		4[1,2]	
Toluene	10[1,2]		10[1,2]	
Ethylbenzene	1.2[1]		20[1]	
Xylene(s)	1[1,2]		21[1,2]	
PAHs				
Acenaphthene	1,000[3]		1,300[3]	
Acenaphthylene	100[3]		840[3]	
Anthracene	28[3]		28[3]	
Benzo(a)anthracene	1[1]		10[1]	
Benzo(a)pyrene	0.7[1,2]		1.4[1,2]	
Benzo(b)flouranthene	1[1]		10[1]	
Benzo(k)flouranthene	1[1]		10[1]	
Benzo(g,h,I)perylene	40[3]		40[3]	
Chrysene	12[3]		19[3]	
Dibenzo(a,h)anthracene	1[1]		10[1]	
Fluoranthene	40[3]		40[3]	
Fluorene	350[3]		350[3]	
Indeno(1,2,3-cd)pyrene	1[1]		10[1]	
Naphthalene	2.2[1,2]		2.2[1,2]	
1-methyl naphthalene	280[3]		280[3]	
2-methyl naphthalene	280[3]		280[3]	
Phenanthrene	5[1]		50[1]	
Pyrene	10[1]		100[1]	
CWS for PHC	**Fine-grained surface soil**	**Coarse-grained subsoil**	**Fine-grained surface soil**	**Coarse-grained subsoil**
Fraction F1 (C_6 - C_{10})	260[4,6,7]	300[4,5,6]	660 [4,6,7]	300 [4,5,6]
Fraction F2 (>C_{10} – C_{16})	900[4,7]	90[4,5]	1,500 [4,7]	90 [4,5]
Fraction F3 (>C_{16} – C_{34})	800[4,7]	2,500[4,7]	2,500 [4,7]	3,500 [4,7]
Fraction F4 (>C_{34})	5,600[4,7]	10,000[4,7]	6,600 [4,7]	10,000 [4,7]

EQG are expressed in milligrams per dry kilogram
[1] - *Canadian Environmental Quality Guidelines*, CCME, 1999
[2] - Soil Quality Guideline for Environmental Health (SQG_E)
[3] - *Guideline for Use at Contaminated Sites in Ontario*, MOEE, 1996 (revised September 1998)
[4] - *Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil*, CCME, June 2000
[5] - Protection of GW for Aquatic Life
[6] - excludes the target compounds benzene, toluene, ethylbenzene, and xylenes (BTEX)
[7] - Eco-Soil Contact

3. FIELD INVESTIGATION

3.1. Outfall Structure Excavation Soil Sampling

At the time of MECI's investigation, the City of Winnipeg was constructing a storm sewer outfall structure on the left riverbank to the west of the Disraeli Bridge. The location of the outfall excavation is shown on Drawing W1801B-002, Appendix I. On 2001 02 20, MECI personnel visited the site to observe the subsurface conditions exposed by the outfall excavation. Nelson River Construction, the general contractor for the outfall construction, excavated Test Pit 01-01 in the base of the outfall excavation. MECI recovered soil samples from the Test Pit 01-01 for field screening and potential laboratory analysis. The samples were handled in accordance with the protocols described in the following section.

3.2. Red River Bank Drilling Investigation

The drilling investigation was conducted by MECI personnel on 2001 04 10 and included the supervision of the drilling of two boreholes and the collection of soil samples for field screening and potential laboratory analysis. Prior to initiating the drilling program, utilities that may be in the area of investigation including telecommunications, natural gas, power, and water and sewer lines were identified by representatives of the appropriate utilities and/or by drawings provided by the appropriate utility companies.

Boreholes 01-47 and 01-48 were drilled on the south bank of the Red River using a backhoe mounted drilling rig operated by Maple Leaf Drilling of Winnipeg, MB. The boreholes were both drilled to a depth of 12.2 m below grade using 125 mm diameter solid stem continuous flight augers. The area of investigation extended approximately 12 m west of the outfall gate control structure. The locations of the boreholes are presented on the Site Plan, Drawing W1801B-002, Appendix I.

Each borehole was advanced in 0.75 m to 1.5 m intervals to allow for the collection of soil samples. Representative grab soil samples were collected at various depth intervals for field screening of sample headspace vapour concentrations, visual observation and potential laboratory analysis. As the boreholes were advanced, the stratigraphic conditions were logged in detail with respect to soil composition, relative density, moisture content, and any visual and/or olfactory evidence of impact.

The soil samples were handled in accordance with the following protocols:

- Samples were collected and placed into a sealable polyethylene bag for field screening. Selected samples were collected in duplicate, with a portion of the sample being transferred to laboratory supplied sample containers. Prior to transferring the samples to the polyethylene bags and/or sampling containers, the samples were trimmed to remove any smeared or loose materials which may have contacted the sampling devices;

- The bagged portion of the sample was field screened for hydrocarbon vapour concentrations using a standardized headspace technique. The headspace analysis of samples involved allowing the bagged sample to warm to ambient air temperature. The bag was then punctured using the monitoring probe and screened for hydrocarbon vapours using a portable hydrocarbon vapour analyser (calibrated to a hexane standard) set for no methane response. The results were recorded in parts per million (ppm); and

- The samples collected for potential laboratory analyses were placed into laboratory supplied sample containers. The soil samples were stored in ice-chilled coolers, and shipped, via courier, to Philip Analytical Services Corp. (Philip) in Mississauga, ON within 48 hours of sample collection. Selection of samples for laboratory analyses was based on several factors including the location, depth, visual evidence of impact, and/or headspace screening results. A description of the analytical methodologies and procedures is included in the methodologies section of the Laboratory Reports presented in Appendix II.

Cuttings generated during drilling were screened for evidence of hydrocarbon impact (visible staining, sheen, combustible vapours identified using a hydrocarbon vapour analyser). Since no significant evidence of impact was observed, the cuttings were placed on the ground surface within the outfall construction area. The cuttings generated during the assessment were not used to backfill the annulus surrounding the monitoring wells. The boreholes were backfilled with bentonite.

On 2001 04 30, the horizontal location and elevation of each borehole was surveyed by MECI personnel. UTM (NAD83) coordinates for the boreholes and reference points in the area of investigation were obtained using a Trimble GPS Pathfinder Pro XRS.

4. RESULTS OF INVESTIGATION

4.1. Stratigraphy

Detailed stratigraphic information obtained during the investigation program can be found in the Test Pit and Borehole Logs in Appendix III.

4.1.1. Outfall Structure Excavation Soil Sampling

A test pit (TP01-01) was excavated at the base of an existing excavation for the installation of an outfall. The outfall excavation extended to native clay (to an approximate elevation 220.25 m), below which the test pit was excavated. Various clay and sand fill materials were noted on the base of the excavation. In general, the stratigraphy encountered in Test Pit 01-01, excavated in the base of the outfall structure excavation, consisted of clay to approximately 0.3 m below the base of the excavation. A silty sand layer approximately 0.1 m thick was encountered beneath the clay. Silt and sand extended from 0.4 m to 0.6 m below the base of the excavation and was underlain by a 0.05 m thick layer of sand. Sandy silt was encountered to approximately 1.0 m below the base of the excavation. Clay extended to the bottom of the test pit (2.0 m below the base of the excavation). Liquid coal tar was observed seeping from the silty sand layer at 0.3 m below the base of the outfall excavation. Black and grey staining and a mothball odour were noted from 0.3 m to 1.0 m below the base of the excavation. Photographs taken during the test pit program are provided in Appendix IV.

4.1.2. Red River Bank Drilling Investigation

In general, the stratigraphy encountered in Boreholes 01-47 and 01-48, located to the west of the outfall structure on the south riverbank, consisted of clay fill to a depth of approximately 1.5 m below ground surface. Clay or clay and silt were encountered to depths of 3.9 m to 6.1 m below grade, below which was a 0.9 m to 1.5 m thick layer of silt. Clay or clay and silt extended to depths of 7.6 m to 8.5 below grade. Sand was encountered to depths of 9.9 m to 11.0 m below grade, below which was clay to depths of 10.7 m to 11.6 m below grade. The sand lense was encountered at an elevation generally consistent with that observed in Test Pit 01-01. Silt till extended to the to the maximum depth of the investigation (12.2 m below grade).

A slight mothball odour was noted in the clay fill in Borehole 01-47 at a depth of 1.2 m to 1.5 m below grade. Some black staining with a slight natural organic odour was noted in the silt unit

encountered in Borehole 01-47. Trace black staining, with a slight natural organic odour, was observed in both boreholes in the clay from 5.8 m to 8.5 m below grade.

4.2. Analytical Results

Laboratory results for soil are summarized in Table 1. The detailed analytical reports are provided in Appendix II, which include information on the laboratory analytical methodology.

Soil samples were recovered from Test Pit 01-01 in the outfall excavation and from Boreholes 01-47 and 01-48 during the river bank drilling investigation. The samples were analysed for one or more of the following constituents: benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), and CWS hydrocarbon fractions F1 (C_6 - C_{10}), F2 (>C_{10} - C_{16}), F3 (>C_{16} – C_{34}), and F4 (>C_{34}).

Four samples recovered from Test Pit 01-01 were analysed for PAHs. Several PAH components were detected in all four samples at elevated concentrations.

Two samples recovered collected from Boreholes 01-47 and 01-48 were analysed for BTEX, PAHs, and hydrocarbon fractions F1 to F4. PAH compounds including benzo(a)pyrene and naphthalene were detected in the sample recovered from Borehole 01-47 at elevated concentrations. The remaining sample analysed from Borehole 01-48 contained hydrocarbons at relatively low concentrations.

5. CONCLUSIONS

Based on the results of this limited Phase II ESA, the following conclusions are made regarding the Red River bank to the west of the former MGP Site in Winnipeg, MB.

- The stratigraphy beneath the river bank generally consisted of clay fill to a depth of approximately 1.5 m below ground surface. Clay or clay and silt were encountered to depths of 3.9 m to 6.1 m below grade, below which was a 0.9 m to 1.5 m thick layer of silt. Clay or clay and silt extended to depths of 7.6 m to 8.5 below grade. Sand was encountered to depths of 9.9 m to 11.0 m below grade, below which was clay to depths of 10.7 m to 11.6 m below grade. Silt till extended to the to the maximum depth of the investigation (12.2 m below grade).

- Liquid coal tar was observed in a test pit excavated adjacent to of the outfall structure.

- PAHs were detected at elevated concentrations in soil samples recovered from the test pit in the outfall structure excavation and a borehole located west of the Disraeli Bridge on the left bank of the Red River.

6. CLOSURE

This report has been prepared by Morrow Environmental Consultants Inc. (MECI) for the exclusive use of Manitoba Hydro/Centra Gas, who has been party to the development of the scope of work for this project and understands its limitations.

This report is intended to provide information to Manitoba Hydro/Centra Gas to assist it in making business decisions. MECI is not a party to the various considerations underlying the business decisions, and does not make recommendations regarding such business decisions. In providing this report, MECI accepts no liability or responsibility in respect of the site described in this report or for any business decisions relating to the site, including decisions in respect of the purchase, sale or investment in the site.

Any use, reliance on, or decision made by a third party based on this report is the sole responsibility of such third party. MECI accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report.

The findings, conclusions and recommendations in this report have been developed in a manner consistent with the level of skill normally exercised by environmental professionals currently practising under similar conditions in the area. The findings contained in this report are based, in part, upon information provided by others. If any of the information is inaccurate, modifications to the findings, conclusions and recommendations may be necessary.

The findings, conclusions and recommendations presented by MECI in this report reflect MECI's best judgement based on the site conditions at the time of the site inspection on the date(s) set out in this report and on information available at the time of preparation of this report. They have been prepared for specific application to this site and are based, in part, upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific materials as described in this report during a specific time interval. The findings cannot be extended to previous or future site conditions or to portions of the site, which were unavailable for direct observation, subsurface locations which were not investigated directly, or materials or analysis which were not specified. Substances other than those described may exist within the site, reported substance parameters may exist in areas of

the site not investigated, and concentrations of substances greater than those reported may exist between sample locations.

If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations may be necessary.

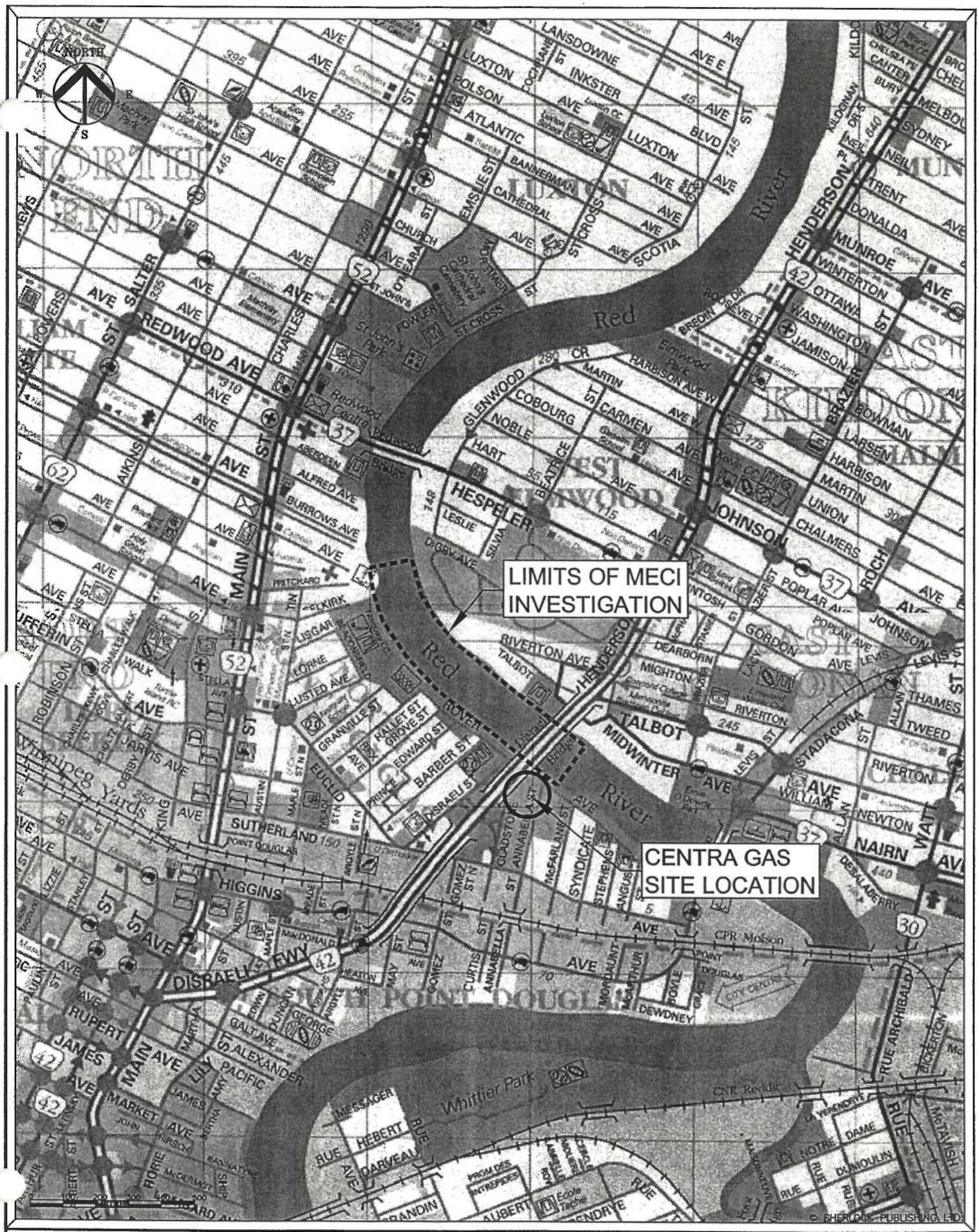
TABLE 1: Summary of Analytical Results for Hydrocarbons in Soil - Test Pit and Boreholes

Test Pit/Borehole No.:	TP01-01	TP01-01	TP01-01	TP01-01	BH01-47	BH01-48	
Sample No.:	Base CL-010220	TP01-1-0.3m-010220	TP01-1-0.4m-010220	TP01-1-0.6m-010220	BH01-47-3-010410	BH01-48-12-010410	
Depth below base of outfall excavation (m):	0	0.3	0.4	0.6	1.4	10.2	
Soil Vapour Concentration (ppm):	120	200	125	175	110	155	
Visual Soil Classification:	sand fill	silty sand	silt & sand	sand lense	clay	sand	
Visual Impact:	LPH & plastic coal tar	LPH coal tar	grey staining	LPH coal tar	slight PAH odour	none	
Parameter							**EQL**
Acenaphthene	1600	2820	27.9	1120	8.68	<0.05	0.05
Acenaphthylene	255	248	3.08	111	1.82	<0.05	0.05
Anthracene	1150	1180	11.0	1010	7.09	<0.05	0.05
Benzo(a)anthracene	874	688	6.28	332	3.13	0.05	0.05
Benzo(a)pyrene	628	671	6.18	346	3.41	0.08	0.05
Benzo(b)flouranthene	514	322	4.14	178	3.11	0.09	0.05
Benzo(k)flouranthene	511	404	2.68	190	1.13	<0.05	0.05
Benzo(g,h,i)perylene	211	314	3.11	164	2.06	0.14	0.05
Chrysene	674	642	5.71	369	3.55	0.06	0.05
Dibenzo(a,h)anthracene	60.6	60	0.65	26.3	0.34	<0.05	0.05
Fluoranthene	2560	1810	17.5	873	8.97	0.08	0.05
Fluorene	1300	1190	11.3	570	5.03	<0.05	0.05
Indeno(1,2,3-cd)pyrene	291	266	2.98	143	2.26	0.11	0.05
Naphthalene	8890	4970	46.4	1350	12.2	0.27	0.05
1-methyl naphthalene	1000	1200	12.5	377	4.37	<0.05	0.05
2-methyl naphthalene	1860	1780	18	552	6.40	<0.05	0.05
Phenanthrene	4890	4300	42.6	2160	20.6	0.09	0.05
Pyrene	2050	2320	22.5	1100	11.8	0.11	0.05
Total PAHs	29,319	25,185	244.51	10,971.3	106	1.08	-
Benzene	NA	NA	NA	NA	0.092	0.473	0.040
Toluene	NA	NA	NA	NA	0.621	<0.040	0.040
Ethylbenzene	NA	NA	NA	NA	1.55	<0.040	0.040
Xylene(s)	NA	NA	NA	NA	2.950	0.121	0.040
CWS F1 (C_6 - C_{10})	NA	NA	NA	NA	TR	<10	10.0
CWS F2 (>C_{10} - C_{16})	NA	NA	NA	NA	321	<10	10.0
CWS F3 (>C_{16} - C_{34})	NA	NA	NA	NA	762	23.6	10.0
CWS F4 (>C_{34})	NA	NA	NA	NA	190	16.4	10.0

Results expressed in milligrams per dry kilogram (mg/kg)
EQL - Estimated quantitation limit
TR - trace level less than EQL
NA - not analysed

APPENDIX I

Drawings



MORROW ENVIRONMENTAL CONSULTANTS INC.

KEY PLAN

DATE: 2001 09 17	DRAWN BY: CDC	CHECKED: AGM	CLIENT NAME: CENTRA GAS, SUTHERLAND OPERATIONS CENTRE	SITE ADDRESS: 35 SUTHERLAND AVENUE, WINNIPEG, MB	DRAWING NUMBER: W1801B-001

LEGEND

⊕ BOREHOLE LOCATION

TEST PIT LOCATION

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
–	–	–	–	–

MORROW ENVIRONMENTAL CONSULTANTS INC.

SCALE: 1:3000 | APPROVED BY: MEC: CLIENT: | DRAWN BY: CDC | CHECKED: AGM

DATE: 2001 09 17

CLIENT NAME: CENTRA GAS SUTHERLAND OPERATIONS CENTRE

PROJECT LOCATION: 35 SUTHERLAND AVENUE WINNIPEG, MANITOBA

SITE PLAN

CADFILE: W1801r00 | DRAWING NUMBER: W1801B-002 | REV.: 0

APPENDIX II

Laboratory Reports

PSC
ANALYTICAL SERVICES

Client:	Morrow Environmental Consultants Inc. Unit E, 1420 Clarence Ave Winnipeg, MB, CANADA R3T 1T6
Fax:	204-477-9194
Attn:	Alex Man

Date Received:	February 22/2001
Date Reported:	March 1/2001
Lab Ref#:	G210591
Lab Quote#:	DEB809-0991
Client Ref#:	W1801
Sampled By:	AM

Attached are your results for PAH's

If you have any questions, please call Elaine Grant,
your Service Manager at Philip Analytical Services Corp.

477-1849

PSC
ANALYTICAL SERVICES

Client: Morrow Environmental Consultants Inc.
Project Reference: W1801
Work Order Number: G210591B
Matrix: Soil

Polynuclear Aromatic Hydrocarbons (PAH's)

Units: Micrograms/gram (µg/g) dry weight

Date: 01-Mar-01

Compound	Industrial	EQL µg/g	Base-CL 010220 DF=500	EQL µg/g	TP01-1-0.3m 010220 DF=2500	EQL µg/g	TP01-1-0.4m 010220	TP01-1-0.4m 010220 Dup.
Naphthalene	22	25.0	8890	125	4970	0.05	46.4	37.6
2-Methylnaphthalene	-	25.0	1860	125	1780	0.05	18.0	14.4
1-Methylnaphthalene	-	25.0	1000	125	1200	0.05	12.5	9.78
Acenaphthylene	-	25.0	255	125	248	0.05	3.08	2.4
Acenaphthene	-	25.0	1600	125	2820	0.05	27.9	2[illegible]
Fluorene	-	25.0	1300	125	1190	0.05	11.3	9.00
Phenanthrene	50	25.0	4890	125	4300	0.05	42.6	34.2
Anthracene	-	25.0	1150	125	1180	0.05	11.0	8.45
Fluoranthene	-	25.0	2560	125	1810	0.05	17.5	13.7
Pyrene	100	25.0	2050	125	2320	0.05	22.5	18.1
Benzo(a)anthracene	10	25.0	874	125	688	0.05	6.28	4.91
Chrysene	-	25.0	674	125	642	0.05	5.71	4.51
Benzo(b)fluoranthene	10	25.0	514	125	322	0.05	4.14	3.41
Benzo(k)fluoranthene	10	25.0	511	125	404	0.05	2.68	2.04
Benzo(a)pyrene	1.4	25.0	628	125	671	0.05	6.18	4.82
Indeno(1,2,3-cd)pyrene	10	25.0	291	125	266	0.05	2.98	2.28
Dibenzo(a,h)anthracene	10	25.0	60.6	125	*60.0	0.05	0.65	0.50
Benzo(ghi)perylene	-	25.0	211	125	314	0.05	3.11	2.43
Surrogate Standard Recoveries (Control Limits)								
Acenaphthene-d10 (19-121%)			N/A		N/A		77%	73%
Anthracene-d10 (27-126%)			N/A		N/A		70%	70%
Benzo(a)pyrene-d12 (44-136%)			N/A		N/A		68%	69%

PSC
ANALYTICAL SERVICES

Client: Morrow Environmental Consultants Inc.
Project Reference: W1801
Work Order Number: G210591B
Matrix: Soil

Polynuclear Aromatic Hydrocarbons (PAH's)

Units: Micrograms/gram (µg/g) dry weight

Date: 01-Mar-01

Compound	EQL µg/g	TP01-1-0.6m 010220 DF=500
Naphthalene	25.0	1350
2-Methylnaphthalene	25.0	552
1-Methylnaphthalene	25.0	377
Acenaphthylene	25.0	111
Acenaphthene	25.0	1120
Fluorene	25.0	570
Phenanthrene	25.0	2160
Anthracene	25.0	1010
Fluoranthene	25.0	873
Pyrene	25.0	1100
Benzo(a)anthracene	25.0	332
Chrysene	25.0	369
Benzo(b)fluoranthene	25.0	178
Benzo(k)fluoranthene	25.0	190
Benzo(a)pyrene	25.0	346
Indeno(1,2,3-cd)pyrene	25.0	143
Dibenzo(a,h)anthracene	25.0	26.3
Benzo(ghi)perylene	25.0	164
Surrogate Standard Recoveries (Control Limits)		
Acenaphthene-d10 (19-121%)		N/A
Anthracene-d10 (27-126%)		N/A
Benzo(a)pyrene-d12 (44-136%)		N/A

PSC
ANALYTICAL SERVICES

Client: Morrow Environmental Consultants Inc.
Project Reference: W1801
Work Order Number: G210591B
Matrix: Soil

Polynuclear Aromatic Hydrocarbons (PAH's)

Units: Micrograms/gram (µg/g) dry weight

Date: 01-Mar-01

		Method Blank			Spiked Method Blank			
Compound	EQL µg/g	Result	Upper Limit	Accept	% Recovery	Lower Limit	Upper Limit	Accept
Naphthalene	0.05	nd	0.05	yes	51	42	107	yes
2-Methylnaphthalene	0.05	nd	0.05	yes	56	44	114	yes
1-Methylnaphthalene	0.05	nd	0.05	yes	61	46	119	yes
Acenaphthylene	0.05	nd	0.05	yes	60	39	114	yes
Acenaphthene	0.05	nd	0.05	yes	57	34	113	yes
Fluorene	0.05	nd	0.05	yes	63	36	120	ye
Phenanthrene	0.05	nd	0.05	yes	67	40	120	yes
Anthracene	0.05	nd	0.05	yes	70	42	124	yes
Fluoranthene	0.05	nd	0.05	yes	73	47	126	yes
Pyrene	0.05	nd	0.05	yes	71	46	125	yes
Benzo(a)anthracene	0.05	nd	0.05	yes	71	45	142	yes
Chrysene	0.05	nd	0.05	yes	69	46	148	yes
Benzo(b)fluoranthene	0.05	nd	0.05	yes	79	40	135	yes
Benzo(k)fluoranthene	0.05	nd	0.05	yes	71	40	129	yes
Benzo(a)pyrene	0.05	nd	0.05	yes	70	41	128	yes
Indeno(1,2,3-cd)pyrene	0.05	nd	0.05	yes	70	35	132	yes
Dibenzo(a,h)anthracene	0.05	nd	0.05	yes	71	34	137	yes
Benzo(ghi)perylene	0.05	nd	0.05	yes	66	38	130	yes
Surrogate Standard Recoveries (Control Limits)								
Acenaphthene-d10		59%			57	19	121	yes
Anthracene-d10		75%			78	27	126	yes
Benzo(a)pyrene-d12		68%			71	44	136	yes

PSC
ANALYTICAL SERVICES

Client: Morrow Environmental Consultants Inc.
Project Reference: W1601
Work Order Number: G210591B
Matrix: Soil

Polynuclear Aromatic Hydrocarbons (PAH's)

Date: 01-Mar-01

Legend: EQL = Estimated Quantitation Limit
nd = Not detected above EQL
Dup. = Duplicate
DF = Dilution Factor
N/A = Surrogate recovery could not be determined due to high dilution
* = Detected below EQL but passed compound identification criteria

Date received: February 22, 2001
Date extracted: February 27, 2001
Date analysed: February 27-28 & March 1, 2001

ANALYTICAL METHOD:

The soil samples (10 grams wet weight) were mixed with sodium sulfate and extracted with a 1:1 mixture of stone:dichloromethane. The extracts were cleaned up using alumina column chromatography. Analysis was performed by gas chromatography/mass spectrometry using U.S. EPA Method 8270C (modified).

REPORT DISCUSSION:

Some of the samples were run at a dilution factor due to elevated levels of target and nontarget compounds present which would exceed the calibration range of the instrument and cause contamination of the equipment if run undiluted. The quantitation limits for these samples are higher than the EQL's for undiluted samples as indicated above. The amounts reported have been corrected for the dilution factors that were used.

Note: Estimated quantitation limit is the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

NOTE: All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies and QA/QC procedures. Philip Analytical is limited in liability to the actual cost of the pertinent analysis done. Your samples will be retained by PASC for a period of 30 days following reporting or as per specific contractual arrangement.

JOB APPROVED BY:

Kathy Horvat

Kathy Horvat, B.Sc.
Chemist

Philip Analytical Services Corp

Report of Analysis

Client : Morrow Environmental Consultants Inc.
Contact: Alex Man

Report Date: April 20/2001
Lab Ref # : G211309
Lab Quote #: VG804 0490

Analysis of Soil, expressed on a dry weight basis

Client Ref#: W1801B

Paramotor	EQL	Units	BH01-47-3-010410 2001/04/10	BH01-47-3-010410 Replicate	BH01-48-12-010410 2001/04/10		
F2, C10-C16 Hydrocarbons	10.0	ug/g	321	290	nd		
F3, C16-C34 Hydrocarbons	10.0	ug/g	762	670	23.6		
F4A, C34-C50 Hydrocarbons	10.0	ug/g	190	148	16.4		
Resemblance	na	na	EGDMO?	EGDMO?	EMO?		
Benzene	0.040	mg/kg	0.092	0.115	0.473		
Ethylbenzene	0.040	mg/kg	1.55	2.06	nd		
F1, C6-C10 Hydrocarbons	10.0	mg/kg	TR	10.3	nd		
mp-Xylenes	0.080	mg/kg	1.70	2.44	0.121		
o-Xylene	0.040	mg/kg	1.25	1.59	nd		
Toluene	0.040	mg/kg	0.621	0.715	nd		

EQL Estimated Quantitation Limit = lowest level of the parameter that can be quantified with confidence.
EGDMO? Contaminant elutes across the gasoline/diesel/motor oil range but does not match our reference standards.
EMO? Contaminant elutes in the motor oil range but does not match reference standard.
na Not Applicable
nd parameter not detected ! = EQL higher than listed due to dilution ( ) Adjusted EQL
TR trace level less than EQL ! = EQL higher than listed due to dilution ( ) Adjusted EQL

Client: Morrow Environmental Consultants Inc.
Unit E, 1420 Clarence Ave
Winnipeg, MB, CANADA
R3T 1T6

Fax: 204-477-9194

Attn: Alex Man

Date Received:	April 12/2001
Date Reported:	April 20/2001
Lab Ref#:	G211309
Lab Quote#:	VG804 0490
Client Ref#:	W1801B
Sampled By:	AM

Certificate of Analysis

Additional Comments:

Hydrocarbons analysis (CWS, F1 and F4) of soils:
Please note that the chromatographic profile came close to baseline at C50 for all samples. The F1 results reported are excluded of BTEX results. The difference between the sample and replicate results for BH101-47-3-010410 is possibly due to non-homogeniety of the sample containing high level (27 %) moisture.

PSC

ANALYTICAL SERVICES

Client: Morrow Environmental Consultants Inc.
Unit E, 1420 Clarence Ave
Winnipeg, MB, CANADA
R3T 1T6

Fax: 204-477-9194

Attn: Alex Man

Date Received: April 12/2001
Date Reported: April 19/2001
Lab Ref#: G211309
Lab Quote#: VG804 0490

Client Ref#: W1801B
Sampled By: AM

Attached are your results for PAHs

If you have any questions, please call Elaine Grant,
your Service Manager at Philip Analytical Services Corp.

PSC
ANALYTICAL SERVICES

Client: Morrow Environmental
Project Reference: W1801B
Work Order Number: G211309B
Matrix: Soil

Polynuclear Aromatic Hydrocarbons (PAH's)

Units: Micrograms/gram (µg/g) dry weight

Date: 19-Apr-01

Compound	EQL µg/g	BH01-47-3 010410 DF=10	EQL µg/g	BH01-48-12 010410
Naphthalene	0.50	12.2	0.05	0.27
2-Methylnaphthalene	0.50	6.40	0.05	nd
1-Methylnaphthalene	0.50	4.37	0.05	nd
Acenaphthylene	0.50	1.82	0.05	nd
Acenaphthene	0.50	8.68	0.05	nd
Fluorene	0.50	5.03	0.05	nd
Phenanthrene	0.50	20.6	0.05	0.09
Anthracene	0.50	7.09	0.05	nd
Fluoranthene	0.50	8.97	0.05	0.08
Pyrene	0.50	11.8	0.05	0.11
Benzo(a)anthracene	0.50	3.13	0.05	0.05
Chrysene	0.50	3.55	0.05	0.06
Benzo(b)fluoranthene	0.50	3.11	0.05	0.09
Benzo(k)fluoranthene	0.50	1.13	0.05	nd
Benzo(a)pyrene	0.50	3.41	0.05	0.08
Indeno(1,2,3-cd)pyrene	0.50	2.26	0.05	0.11
Dibenzo(a,h)anthracene	0.50	*0.34	0.05	nd
Benzo(ghi)perylene	0.50	2.06	0.05	0.14
Surrogate Standard Recoveries (Control Limits)				
Acenaphthene-d10 (19-121%)		102%		80%
Anthracene-d10 (27-126%)		89%		74%
Benzo(a)pyrene-d12 (44-136%)		103%		96%

PSC
ANALYTICAL SERVICES

Client: Morrow Environmental
Project Reference: W1801B
Work Order Number: G211309B
Matrix: Soil

Polynuclear Aromatic Hydrocarbons (PAH's)

Units: Micrograms/gram (µg/g) dry weight

Date: 19-Apr-01

		Method Blank			Spiked Method Blank			
Compound	EQL µg/g	Result	Upper Limit	Accept	% Recovery	Lower Limit	Upper Limit	Accept
Naphthalene	0.05	nd	0.05	yes	85	42	107	yes
2-Methylnaphthalene	0.05	nd	0.05	yes	88	44	114	yes
1-Methylnaphthalene	0.05	nd	0.05	yes	90	46	119	yes
Acenaphthylene	0.05	nd	0.05	yes	87	39	114	yes
Acenaphthene	0.05	nd	0.05	yes	85	34	113	yes
Fluorene	0.05	nd	0.05	yes	90	36	120	yes
Phenanthrene	0.05	nd	0.05	yes	95	40	120	yes
Anthracene	0.05	nd	0.05	yes	97	42	124	yes
Fluoranthene	0.05	nd	0.05	yes	97	47	126	yes
Pyrene	0.05	nd	0.05	yes	97	46	125	yes
Benzo(a)anthracene	0.05	nd	0.05	yes	92	45	142	yes
Chrysene	0.05	nd	0.05	yes	92	46	148	yes
Benzo(b)fluoranthene	0.05	nd	0.05	yes	104	40	135	yes
Benzo(k)fluoranthene	0.05	nd	0.05	yes	103	40	129	yes
Benzo(a)pyrene	0.05	nd	0.05	yes	98	41	128	yes
Indeno(1,2,3-cd)pyrene	0.05	nd	0.05	yes	107	35	132	yes
Dibenzo(a,h)anthracene	0.05	nd	0.05	yes	110	34	137	yes
Benzo(ghi)perylene	0.05	nd	0.05	yes	109	38	130	yes
Surrogate Standard Recoveries (Control Limits)								
Acenaphthene-d10		93%			94	19	121	yes
Anthracene-d10		83%			77	27	126	yes
Benzo(a)pyrene-d12		106%			100	44	136	yes

PSC
ANALYTICAL SERVICES

Client: Morrow Environmental
Project Reference: W1801B
Work Order Number: G211309B
Matrix: Soil

Polynuclear Aromatic Hydrocarbons (PAH's)

Date: 19-Apr-01

Legend: EQL = Estimated Quantitation Limit
nd = Not detected above EQL
DF = Dilution Factor
* = Detected below EQL but passed compound identification criteria

Date received: April 12, 2001
Date extracted: April 18, 2001
Date analysed: April 19, 2001

ANALYTICAL METHOD:

The soil samples (10 grams wet weight) were mixed with sodium sulfate and extracted with a 1:1 mixture of acetone:dichloromethane. The extracts were cleaned up using alumina column chromatography. Analysis was performed by gas chromatography/mass spectrometry using U.S. EPA Method 8270C (modified).

REPORT DISCUSSION:

Since some target compounds present were at a level above the calibration range of the instrument, the sample BH01-47-3-010110 was run at a dilution factor to avoid exceeding the calibration range and to reduce the contamination to the equipment. The quantitation limits for this sample are higher than the EQL's for undiluted samples as indicated above. The amounts reported have been corrected for the dilution factor that was used.

Note: Estimated quantitation limit is the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

NOTE: All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies and QA/QC procedures. Philip Analytical is limited in liability to the actual cost of the pertinent analysis done. Your samples will be retained by PASC for a period of 30 days following reporting or as per specific contractual arrangement.

JOB APPROVED BY:

Mihai Bilanin, M.Sc.
Chemist

Philip Analytical Services Corp

5735 McAdam Road
Mississauga, Ontario, L4Z 1N9
tel:(905) 890-8566 fax:(905) 890-8575
Toll Free: 1-800-263-9040

Fax Cover Sheet

Pages: 2 (including cover sheet)

Please Deliver to: "Alex Man"

Morrow Environmental Consultants Inc.
Unit E, 1420 Clarence Ave
Winnipeg MB
R3T 1T6

Fax #: 1-204-477-9194

Service Manager: Elaine Grant

Fax #: (905) 890-8575
Phone:

Please review the following Project Opening Notice (PON) and contact indicated Service Manager regarding any errors or omissions.

PON210591

NOTE: The following information is confidential. If you receive this Fa transmission in error, please fax it back, to Nick Boulton's attention, a destroy the original. Thank you!

** REVISED ** PROJECT OPENING NOTICE

Client: Morrow Environmental Consultants Inc.

ddress: Unit E, 1420 Clarence Ave

City/Province: Winnipeg MB CANADA

Postal Code: R3T 1T6

Contact: Alex Man

Telephone #: 204-475-4133 Fax #: 204-477-9194

Invoice to: Contact [ ] Accounting [ ] Other [Y]

Company: Agassiz North Associates Ltd.

Address: 1214-B Chevrier Boulevard

City/Province: Winnipeg MB CANADA

Postal Code: R3T 1Y3

Attn of: Doug Ramsey

Project Number: G210591 Priority: Normal

Sample Arrival Date: 2001/02/22

Received: 2001/02/22 15:19:55

Defined: 2001/02/23 08:56:01

Defined By: GLM

Service Manager: EFG Sales Manager: VGE

Due Date: 2001/03/01

Last revised by: GLM Revised Date: 2001/02/23

Sampled by: AM

Sampling dates: 2001/02/20

Client PO #:

Client Reference #: W1801

Lab Quote #: DEB809-0991

PON Generated: 2001/02/23 14:53:01

# of samp	# to bill	Test	Test Description	Due Date	Revised Date	List Cost Per	List Total	Adjusted Cost Per	Adjusted Total
4	4	DISP-FE-SO	Environmental Sample Disposal Fee	2001/03/01					
4	4	PAH-001-SO	Polynuclear Aromatic Hydrocarbons(	2001/03/01					

Comments: OSA 114

Project Discount: or Analysis Discount: or

Analysis Total:

Containers:	
Sub-contracting:	
Courier:	
Other:	
Professional Time:	

Elaine Grant

Service Mgr:

Customer:

Prices to be reconciled to quote prior to invoicing. Please ensure quote number is properly referenced.

PROJECT OPENING NOTICE W1

Client: Morrow Environmental Consultants Inc.

Address: Unit E, 1420 Clarence Ave

City/Province: Winnipeg MB CANADA

Postal Code: R3T 1T6

Contact: Alex Man

Telephone #: 204-475-4133 Fax #: 204-477-9194

Project Number: G211309 Priority: P

Sample Arrival Date: 2001/04/12

Received: 2001/04/12 13:37:03

Defined: 2001/04/16 10:40:52

Defined By: DHA

Service Manager: EFG Sales Manager: VGE

Due Date: 2001/04/19

Last revised by: Revised Date:

Invoice to: Contact [Y] Accounting [ ] Other [ ]

Company:

Address:

City/Province:

Postal Code:

Attn of:

Sampled by: AM

Sampling dates: 2001/04/10

Client PO #:

Client Reference #: W1801B

Lab Quote #: VG804 0490

PON Generated: 2001/04/16 10:43:38

# of samp	# to bill	Test	Test Description	Due Date	Revised Date	List Cost Per	List Total	Adjusted Cost Per	Adjusted Total
2	2	DISP-FE-SO	Environmental Sample Disposal Fee	2001/04/19		$1.20	$2.40	$1.20	$2.
2	2	EHB-CCM-SO	Extractable Hydrocarbons, C10-C50(	2001/04/19		$85.00	$170.00	$85.00	$170.00
7	7	HOLD-01-SO	Hold Status	2001/04/19		$5.00	$35.00	$5.00	$35
2	2	PAH-CME-SO	Polynuclear Aromatic Hydrocarbons(	2001/04/19		$350.00	$700.00	$350.00	$700.00
2	2	VGC-CCM-SO	BTEX and Total Purgeable Hydrocarb	2001/04/19		$140.00	$280.00	$140.00	$
							$1,187.40		$1,187.

Comments: OSA 254.
CWS

Project Discount: 0.00% or $0.00

Analysis Discount: 0.00% or $0.

Analysis Total: $1,187.40

Containers:	
Sub-contracting:	
Courier:	
Other:	
Professional Time:	

Elaine Grant

Service Mgr:

Customer:

Page 1 of 1

Project Total: $1,187

Prices to be reconciled to quote prior to invoicing. Please ensure quote number is properly referenced.

PHILIP SERVICES

PHILIP ANALYTICAL SERVICES CORPORATION

5735 McAdam Road
Mississauga, Ontario L4Z 1N9

Tel: (905) 890-8566
Fax: (905) 890-8575
Wats: 1-800-263-9040

LABORATORY USE ONLY

Work Order: _____

Comments: _____

CHAIN OF CUSTODY RECORD

Client: Arcadis for Agassiz North

PASC Quote # : DEB809-0991

Page 1 of 1

Client P.O. # : _____

Client Project # : W1801

Contact: Al. Tam @ TEC1

Sampled by: AT.

Phone: [illegible] 4133 Fax: 477-9141

Please specify Guideline (if applicable) _____

Invoice to (if other than above):
Agassiz North

Analysis Required:

TAT (Turnaround Time)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

*some exceptions apply, please contact Lab

STD 5-7 Business Days ☐

RUSH Specify Date _____

Time _____

Sample #	Client Sample I.D.	Date Sampled	Time Sampled	PAHs	Sample Matrix	No.of Containers	Comments/Contamination/ Site History
1	Bore-CL-010220	01/02/20		X	Soil	1	1 jar only
2	TP01-1-0.3m-010220	010220		X	"	1	1 jar only
3	TP01-1-0.45m-010220	010220		X	"	3	
4	TP01-1-0.6m-010220	010220		X	"	3	
5							
6							
7							
8							
9							
10							
11							
12							

Samples Relinquished to PASC by (Client Signature)		Date: 01 02 21	Time: 3:30	Method of Shipment: HAND
Samples Received in lab by:		Date: 1-21-01	Time: 15:30	Condition of samples upon receipt at lab: OK

PHILIP SERVICES

PHILIP ANALYTICAL SERVICES

5735 McAdam Road
Mississauga, Ontario L4Z 1N9

Tel: (905) 890-8566
Fax: (905) 890-8575
Wats: 1-800-263-9040

LABORATORY USE ONLY

Work Order: ______

Comments: ______

CHAIN OF CUSTODY RECORD

Client: [illegible] Environmental

PAS Quote # : [illegible]

Page 1 of 1

Client P.O. # :

Client Project # : [illegible]

Contact: [illegible]

Sampled by: AH

Phone: [illegible]

Fax:

Please specify Guideline (if applicable) [illegible]

Invoice to (if other than above):

Analysis Required:

TAT (Turnaround Time)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

*some exceptions apply, please contact Lab

STD 5-7 Business Days

RUSH Specify Date ______

Time ______

Sample #	Client Sample I.D.	Date Sampled	Time Sampled	[illegible]	[illegible]	[illegible]	Sample Matrix	No.of Containers	Comments/Contamination/ Site History
1	[illegible]	[illegible]		X	X	X	Soil	2	
2	[illegible]							2	
3	[illegible]							2	
4	[illegible]							2	
5	[illegible]							2	
6	[illegible]							2	
7	[illegible]							2	
8	[illegible]			X	X	X		1	[illegible]
9	[illegible]							2	
10									
11									
12									

Samples Relinquished to PAS by (Client Signature) [signature] Date: [illegible] Time: 4:20

Method of Shipment

Samples Recei[ved at] lab by: Time:

Condition of samples upon receipt at l[ab]

APPENDIX III

Test Pit and Borehole Logs

CLIENT: AGASSIZ NORTH ASSOCIATES LIMITED	EXCAVATION CONTRACTOR: NELSON RIVER BACKHOE	PROJECT No.: W1801B
LOCATION: CENTRA GAS, RED RIVER, WINNIPEG, MANITOBA	EXCAVATION METHOD: BACKHOE	TEST PIT No.: TP01-01

TEST PIT LOG

PLOTTED:
CAD FILE No.:

SAMPLE TYPE: CORE | SPLIT SPOON | SHELBY | DISTURBED | NO RECOVERY

DEPTH (m)	SOIL DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE TYPE	SAMPLE NUMBER	SOIL VAPOUR CONCENTRATION (ppm) 100 1000 10000	WATER LEVEL	TEST PIT DETAIL
0	**CLAY** – silty, brown, firm, high plasticity, moist			TP01-01-0.3m -010220			
	SAND – coarse to fine grained, silty, trace gravel, well graded, black, saturated with LPH, mothball odour			TP01-01 -0.4m-010220			
0.5	**SILT AND SAND** – fine grained sand, poorly graded, grey (stained), loose/soft, moist, hydrocarbon sheen, mothball odour – 50mm sand lense, fine to coarse grained, silty, well graded, dark grey-black stained, visible LPH, mothball odour at 0.6m			TP01-01-0.6m -010220			
1	**SILT** – sandy, grey stained, soft, no plasticity, moist						
	CLAY – silty, brown, light brown, firm, high plasticity, moist						
1.5							
2	End of test pit at 2.0m						
2.5							
3							
3.5							
4							
4.5							

LEGEND
cuttings

MORROW ENVIRONMENTAL CONSULTANTS INC.

TOP OF TEST PIT ELEVATION (m): 220.25	DATE EXCAVATED: 2001 02 20
	OBSERVED WATER LEVEL: N/A
TOP OF CASING ELEVATION (m): N/A	LOGGED BY: AGM

SHEET 1 OF 1

CLIENT:		DRILLING CONTRACTOR:		PROJECT No.:
AGASSIZ NORTH ASSOCIATES LIMITED		MAPLE LEAF DRILLING		W1801B
LOCATION:		DRILLING METHOD:	DIAMETER:	BOREHOLE No.:
CENTRA GAS, RED RIVER, WINNIPEG, MANITOBA		SOLID STEM AUGER	125 mm	01–47
BOREHOLE LOG	PLOTTED: / CAD FILE No.:	SAMPLE TYPE: CORE / SPLIT SPOON / SHELBY / DISTURBED / NO RECOVERY		

DEPTH (m)	SOIL DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE TYPE	SAMPLE NUMBER	SOIL VAPOUR CONCENTRATION (ppm) 100 1000 10000	WATER LEVEL	MONITORING WELL INSTALLATION
0	**CLAY (FILL)** – silty, trace sand, trace sand, trace gravel, brown, firm, high plasticity, moist, glass fragments			01-47-1			
1	**CLAY** – silty, trace to some fine grained sand, trace organics, brown, firm to soft, high plasticity, moist, slight mothball odour from 1.2m to 1.5m			*01-47-3			
2	– some sand below 2.1m			01-47-2			
				01-47-4			
3	– greyish brown, orange–stained pockets below 3.7m			01-47-5			
4	**SILT** – clayey, some fine grained sand, laminated, grey, soft, low plasticity, moist, some black staining, slight natural organic odour			01-47-6			
5				01-47-8			
6	**CLAY** – silty, some fine grained sand pockets, trace organics, well graded, grey, firm, medium plasticity, moist, trace black staining, slight natural organic odour			01-47-8			
				01-47-9			
7				01-47-10			
	– increased sand below 7.9m						
8				01-47-11			
	SAND – fine to medium grained, poorly graded, grey, loose, wet						
9				01-47-12			
	CLAY						

LEGEND: bentonite seal

MORROW ENVIRONMENTAL CONSULTANTS INC.	GROUND SURFACE ELEVATION (m): 228.679	DATE DRILLED: 2001 04 10	
		OBSERVED WATER LEVEL: N/A	
	TOP OF CASING ELEVATION (m): N/A	LOGGED BY: AGM	SHEET 1 OF 2

CLIENT: AGASSIZ NORTH ASSOCIATES LIMITED	DRILLING CONTRACTOR: MAPLE LEAF DRILLING		PROJECT No.: W1801B
LOCATION: CENTRA GAS, RED RIVER, WINNIPEG, MANITOBA	DRILLING METHOD: SOLID STEM AUGER	DIAMETER: 125 mm	BOREHOLE No.: 01-47
BOREHOLE LOG — PLOTTED: / CAD FILE No.:	SAMPLE TYPE: CORE / SPLIT SPOON / SHELBY / DISTURBED / NO RECOVERY		

DEPTH (m)	SOIL DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE TYPE	SAMPLE NUMBER	SOIL VAPOUR CONCENTRATION (ppm) 100 1000 10000	WATER LEVEL	MONITORING WELL INSTALLATION
10	**CLAY** – silty, brown, firm, high plasticity, moist – some gravelly/silty till pockets below 10.4m						
	SILT (TILL) – gravelly, some sand, trace to some clay, light brown, stiff, low plasticity, moist			01-47-13			
11							
	– very stiff below 11.9m			01-47-14			
12	End of borehole at 12.2m.						
13							
14							
15							
16							
17							
18							
19							

LEGEND: bentonite seal

* submitted for laboratory analysis

MORROW ENVIRONMENTAL CONSULTANTS INC.	GROUND SURFACE ELEVATION (m): 228.679	DATE DRILLED: 2001 04 10
		OBSERVED WATER LEVEL: N/A
	TOP OF CASING ELEVATION (m): N/A	LOGGED BY: AGM
		SHEET 2 OF 2

CLIENT:	DRILLING CONTRACTOR:		PROJECT No.:
AGASSIZ NORTH ASSOCIATES LIMITED	MAPLE LEAF DRILLING		W1801B
LOCATION:	**DRILLING METHOD:**	**DIAMETER:**	**BOREHOLE No.:**
CENTRA GAS, RED RIVER, WINNIPEG, MANITOBA	SOLID STEM AUGER	125 mm	01-48

BOREHOLE LOG

PLOTTED:
CAD FILE No.:

SAMPLE TYPE: CORE / SPLIT SPOON / SHELBY / DISTURBED / NO RECOVERY

DEPTH (m)	SOIL DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE TYPE	SAMPLE NUMBER	SOIL VAPOUR CONCENTRATION (ppm) 100 1000 10000	WATER LEVEL	MONITORING WELL INSTALLATION
0	**CLAY (FILL)** - silty, some sand, some gravel, brown, firm, high plasticity, moist			01-48-1			
1							
	CLAY - silty, trace to some fine grained sand, trace organics, brown, firm to soft, high plasticity, moist			01-48-2			
2				01-48-3			
3				01-48-4			
	- and silt, grey, soft below 4.0m			01-48-5			
4				01-48-6			
5	**SILT AND CLAY** - some to trace fine grained sand, grey, soft, low plasicity, moist			01-48-7			
	- clayey, sandy below 6.1m			01-48-7B			
6							
7	**CLAY** - silty, some fine grained sand pockets, grey, firm, moist, trace black staining, slight natural organic odour - silty below 7.6m			01-48-8			
				01-48-9			
8				01-48-10			
9				01-48-11			
	SAND						

LEGEND
bentonite seal

MORROW ENVIRONMENTAL CONSULTANTS INC.

GROUND SURFACE ELEVATION (m):	DATE DRILLED: 2001 04 10
228.161	OBSERVED WATER LEVEL: N/A
TOP OF CASING ELEVATION (m):	LOGGED BY:
N/A	AGM

CLIENT: AGASSIZ NORTH ASSOCIATES LIMITED	DRILLING CONTRACTOR: MAPLE LEAF DRILLING		PROJECT No.: W1801B
LOCATION: CENTRA GAS, RED RIVER, WINNIPEG, MANITOBA	DRILLING METHOD: SOLID STEM AUGER	DIAMETER: 125 mm	BOREHOLE No.: 01-48
BOREHOLE LOG — PLOTTED: — CAD FILE No.:	SAMPLE TYPE: CORE / SPLIT SPOON / SHELBY / DISTURBED / NO RECOVERY		

DEPTH (m)	SOIL DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE TYPE	SAMPLE NUMBER	SOIL VAPOUR CONCENTRATION (ppm) 100 1000 10000	WATER LEVEL	MONITORING WELL INSTALLATION
10	**SAND** – fine to medium grained, trace coarse grained sand, trace fine grained gravel, poorly graded, grey, loose, wet			01-48-12	▲		
				01-48-13	▲		
11	**CLAY** – silty, trace gravel, brown, firm, moist			01-48-14	▲		
	SILT (TILL) – gravelly, some sand, trace clay, light brown, stiff, low plasticity, moist			01-48-15	▲		
12	End of borehole at 12.2m.						
13							
14							
15							
16							
17							
18							
19							

LEGEND: bentonite seal

* submitted for laboratory analysis

MORROW ENVIRONMENTAL CONSULTANTS INC.

GROUND SURFACE ELEVATION (m): 228.161	DATE DRILLED: 2001 04 10
	OBSERVED WATER LEVEL: N/A
TOP OF CASING ELEVATION (m): N/A	LOGGED BY: AGM

APPENDIX IV

Photographs

PHOTOGRAPH 1: OUTFALL EXCAVATION BASE SAMPLE LOCATION (TP01-01-BASE-CL-010220) AT AN APPROXIMATE ELEVATION OF 221m. NOTE BLACK COAL TAR STAINING IN SAND FILL.

PHOTOGRAPH 2: VIEW OF TP01-01 LOOKING NORTHWEST. NOTE COAL TAR SEEPING FROM NW CORNER OF TEST PIT FROM A SAND LENSE AT APPROXIMATELY 0.6m DEPTH, AND GREY STAINING IN SILT BELOW THE SAND LENSE.

PHOTOGRAPH 3: VIEW OF THE DRILL RIG WHILE DRILLING BH01-47. GATE CONTROL STRUCTURE IS IN THE BACKGROUND (BEHIND BACKHOE).

PHOTOGRAPH 4: VIEW OF DRILL RIG WHILE DRILLING BH01-48.