May 12, 2017

**BDC1148**

**Ms. Marilyn Steinberg**
Property Owner - 22 Hawthorne Avenue
1425 Doctor Penfield Avenue,
Montreal, Quebec
H3G 2V1

**Mr. David Cutler**
Victor Ages Vallance LLP
112 Lisgar St.
Ottawa, Ontario
K1Y 0N1

Dear Ms. Steinberg and Mr. Cutler:

**Oil Spill Delineation**
**22 Hawthorne Avenue, Ottawa, Ontario**

## 1 INTRODUCTION

CM3 Environmental Inc. (CM3) was retained by Ms. Marilyn Steinberg (client) to provide environmental consulting services with respect to a fuel oil release at 22 Hawthorne Avenue, Ottawa, Ontario (site). CM3 was assigned the delineation assessment on March 1, 2017 and was requested to delineate the extent of impacts to soil and groundwater and provide recommendations for the remediation of the site to comply with orders in the Technical Standards and Safety Association (TSSA) inspection report 6460966, dated December 5, 2016. A copy of the TSSA report is provided in **Appendix A**.

### 1.1 Scope of Work

The environmental site assessment (ESA) was carried out in accordance with CM3's standard field procedures and industry protocol. All work was completed in general accordance with Ontario Regulation (O. Reg.) 153/04 and the TSSA Environmental Management Protocol for Fuel Handling Sites in Ontario. The work was completed as outlined in the CM3 Delineation proposal dated March 1, 2017. The general scope of work included:

- The advancement of 16 boreholes to assess the soil conditions at the site, 22 and 24 Hawthorne Avenue, including the submission of selected soil samples for laboratory analysis;
- The completion of 13 boreholes as monitoring wells to assess groundwater conditions at the site, 22 and 24 Hawthorne Avenue;
- The measurement of the depth to liquid phase hydrocarbons (LPH) and groundwater in all CM3 installed monitoring wells; and
- The collection of groundwater samples from all CM3 installed monitoring wells.

Soil and groundwater samples submitted for laboratory analysis were analysed for benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbons (PHCs) F1-F4 fractions. One soil sample was submitted per O.Reg. 558 for toxicity characteristic leaching procedure (TCLP) testing

for the analysis of leachable organics and inorganics, to classify the soil for off-site disposal. At the time of collection, all samples for laboratory analysis were placed in coolers with ice packs with an accompanying chain of custody, for shipment to Paracel Laboratories (Paracel) of Ottawa, Ontario.

## 2 BACKGROUND

CM3 understands that the release was discovered on December 1, 2016 in the immediate vicinity of a 909 liter exterior, above ground furnace oil tank (AST) when a technician was on-site to provide a quote for installation of a new fuel system. It was reported that 50 litres of fuel was delivered on November 18, 2016 and an additional 140 litres of fuel was delivered on November 24, 2016. It was also reported that the furnace ran out of fuel very shortly after each filling event. The TSSA inspected the property on December 2, 2016 and noted two holes in the tank, fuel (i.e. staining) on the ground near the tank, and staining on the interior basement wall nearest the AST, adjacent the fill and vent pipes.

CM3 first attended the site on December 15, 2016 to inspect the reported spill and the exterior of the property. The AST was removed prior to CM3's site visit and the area where the AST was located was covered with snow. The exterior of the property was photographed and it was noted that the location of the former AST was in very close proximity to the east property line. It appeared that a replacement tank had been installed in the basement of the residence based on the condition of the fill and vent pipes coming from the basement. CM3 recommended the installation of boreholes in the vicinity of the former tank to determine if the escaped fuel had penetrated the subsurface.

CM3 was retained by the client to conduct a limited assessment to determine if there was subsurface contamination from the fuel release in December 2016. Details of the limited assessment are provided in the CM3 report "*Oil Spill Investigation, 22 Hawthorne Avenue, Ottawa Ontario*" dated January 11, 2017. The CM3 report is provided in **Appendix B**. CM3 advanced two boreholes (MW1 and MW2), completed as monitoring wells, as part of the limited assessment. Soil screening showed strong evidence of contamination at borehole MW2, from surface to the maximum depth of the borehole. Soil laboratory analysis confirmed the presence of contamination, showing concentrations of BTEX and PHCs above the applicable Ontario Ministry of environment and Climate Change (MOECC) site condition standards (SCS). Groundwater contamination, primarily as LPH, was also present at MW2. Borehole/monitoring well MW1 did not show any evidence of soil or groundwater contamination. CM3 identified potential current or future off-site migration of fuel based on the presence of LPH in one of the two groundwater monitoring wells installed by CM3. CM3 recommended further delineation work and that the identified contamination should be remediated.

Kanellos Consulting Inc. (KCI) was retained by the insurer of the fuel supplier (Bruce Fuels) to conduct an assessment of the extent of contamination on the site in January of 2017. KCI's site investigation included the advancement of four interior boreholes in the basement of 22 Hawthorne Avenue, one exterior borehole and the collection of four shallow soil samples in the vicinity of the CM3 monitoring wells. All KCI boreholes were completed as monitoring wells. The results of the KCI assessment were provided to CM3 on January 30, 2017 (**Appendix C**). KCI submitted seven soil samples for laboratory analysis of BTEX and PHCs F1-F4 fractions. The analytical results showed the PHCs at

concentrations above the MOECC SCS in six of the samples. KCI groundwater sampling showed the presence of BTEX and/or PHCs at all five KCI monitoring well locations. CM3 understands that KCI was requested to stop their delineation work in February of 2017. CM3 reviewed the information completed by KCI and determined that KCI did not fully define the extents of soil and groundwater contamination prior to the stop work request.

CM3 developed a conceptual site model based on the results of CM3's limited assessment and KCI's site investigation. CM3 concluded that although the assessment work was not finalized, the results showed soil and groundwater contamination from the 2016 fuel release extended under 22 Hawthorne and was likely under 20 Hawthorne to the west. CM3 also concluded that off-site impacts to the east on the 24 Hawthorne Avenue property were likely due to the close proximity of the fuel release to the property line.

## 3 REGULATORY STANDARDS

The soil and groundwater analytical results were compared to the Ontario Ministry of Environment and Climate Change (MOECC) O.Reg. 153/04 "Soil, Ground Water and Sediment standards for Use Under Part XV.1 of the Environmental Protection Act", dated April 15, 2011. The following site conditions were used in the selection of the appropriate MOECC site condition standards (SCS) to assess the soil and groundwater analytical results:

- The site was not considered an environmentally sensitive site;
- There were no water bodies within 30 m of the site;
- Bedrock was not encountered at less than 2.0 m below grade during the investigation;
- The site and surrounding land use was considered to be residential and commercial;
- Potable water is supplied via a municipal network that does not rely on groundwater in the area of the site; and
- Soils at the site were considered coarse textured.

The MOECC Table 3: Full Depth Generic Site Condition Standards in a Non Potable Ground Water Condition for residential property use and coarse textured soils were used for the evaluation of the analytical results, based on the above. The Table 3 SCS for fine-textured soil may be used for the evaluation of the results, following the soil grain size analysis to confirm the soil texture. The SCS for coarse grained soils were used as a more conservative approach to the development of a remedial plan.

## 4 SITE ASSESSMENT

### 4.1 Site Description

The subject site is located at 22 Hawthorne Avenue, in an urban residential area located south of Highway 417 approximately 100 meters east of the Rideau Canal in Ottawa, Ontario. The site is located on the south side of Hawthorne Avenue and is the east side of a two story brick clad semi-detached residence. The west side of the residence is 20 Hawthorne Avenue. It is CM3's understanding that both 20 and 22 Hawthorne Avenue are owned by the client and are operated as

residential rental properties. The building has a stone block foundation with an un-finished basement. Ground cover at the site is primarily asphalt and/or concrete with grass and landscaping at the south part of the property. The ground surface in the area is relatively flat. Surface water drainage at the site is likely controlled by the local storm sewer towards the Rideau Canal. The residence is supplied potable water and sewer services by the City of Ottawa. The site location is illustrated on **Figure 1**. A site plan is provided as **Figure 2**. Site photographs are provided in **Appendix D**.

## 4.2 Soil Investigation

The soil investigation included the advancement of fourteen boreholes surrounding the footprint of the residence to assess soil conditions and delineate petroleum impacts related to the fuel oil spill. Soil samples collected during the soil investigation were split in the field for screening and/or possible laboratory analysis. Soil samples collected for field screening of combustible vapour analysis were placed in a polyethylene bag. Combustible vapour concentrations were measured from the bag sample headspace using an RKI Eagle combustible vapour meter calibrated to hexane. Soil samples collected for possible laboratory analysis were placed in one 40 mL vial (approximately 5 grams of soil) containing methanol preservative for BTEX and PHCs F1 analysis and one 120 mL glass jar for PHCs F2-F4 analysis. The vials and jarred samples were placed into an iced chilled cooler for shipment to the laboratory for analysis.

### *4.2.1 Boreholes*

Boreholes MW3 through MW13, BH14, BH15 and BH16 were completed from March 20 to April 5, 2017, under supervision of CM3 personnel. Boreholes MW3 through MW12 and BH16 were advanced surrounding the residence using an electric jackhammer and split spoon samplers supplied and operated by CCC Environmental and Geotechnical Drilling (CCC) from Ottawa, Ontario. Boreholes MW13, BH14 and BH15 were initially advanced on March 29, 2017 with a hydro-vacuum excavator, supplied and operated by Clean Water Works of Ottawa, Ontario. The hydro-vacuumed boreholes were extended by CCC on April 5, 2016 using an electric jackhammer and split spoon samplers. The borehole locations are provided on **Figure 3**.

Soil samples were collected continuously from grade to a maximum depth of 4.6 metres below grade (mbg) at each borehole using a 60 cm long, 5.1 cm diameter split spoon sampler. Soil samples were logged at the time of drilling for grain size, colour, moisture content, and visual or olfactory evidence of impacts. At the time of recovery from the split spoon, each soil sample was split for combustible vapour analysis and possible laboratory analysis, following the methodology described above. The split spoon sampling equipment was washed and rinsed between each sample interval and borehole location to prevent cross-contamination. All recovered soil samples were field screening of combustible vapours.

The site stratigraphy was determined based on the borehole logging. In general, concrete, asphalt or grass with topsoil was present at grade, underlain by 1.3 to 2.1 metres of brown laminated silty sand. Clay was present below the silty sand to the maximum depth of investigation at 4.6 m below grade (m bg). A thin veneer of construction debris was present at some borehole locations, below the

surface material and above the silty sand. The thickness of the clay unit was not determined but it was noted that the upper 1 m of the clay was fractured. The presence of fractures in the clay decrease with depth and increase moisture content. Bedrock was not encountered in any of the boreholes. The site stratigraphy is provided on the borehole logs (**Appendix E**).

In general, the boreholes showed relatively low combustible vapour concentrations of 0-15 parts per million (ppm). Borehole BH15 showed a vapour concentration of 160 ppm at 2.4 m bg. The vapour concentrations at boreholes MW8, MW9 and MW11 were 55- 80 ppm at depth of 2.7 to 4.6 m bg. The combustible vapour concentrations are provided on the borehole logs (**Appendix E**).

A total of 15 borehole soil samples were submitted for laboratory analysis of BTEX and PHCs F1-F4 fractions. Soil samples MW11 SA8 and BH15 SA2 showed concentrations of PHCs F1, F2 and/or F3 fraction above the MOECC Table 3 SCS. Samples MW3 SA8, MW5 SA6, Under Asphalt and MW13 SA1 showed PHCs F3 and/or F4 fraction concentrations below the MOECC Table 3 SCS. The borehole soil sample analytical results are summarized in **Table 1**. The CM3 soil sample results from December 2016 are included in **Table 1**. The borehole soil quality is provided on **Figure 4**. Laboratory reports are provided in **Appendix F**.

### 4.3 Monitoring Well Installation

Boreholes MW1 through MW13 were completed as monitoring wells. Monitoring well construction consisted of 32 mm outside diameter, flush-threaded schedule 40 PVC well screens and risers. At each borehole, a 10-slot well screen was placed to intercept the water table to allow for the detection of LPH. A silica sand pack was placed around the outside of the well screen in the annular space of the borehole to a minimum of 0.3 m above the screened interval. A bentonite seal was placed above the sand pack to approximately 0.3 m bg. Monitoring wells were either finished above grade and capped with lockable j-plugs or were finished below grade in protective flush mounted steel casings. Well completion details are provided on the borehole logs (**Appendix E**).

Following installation, CM3 personnel developed the monitoring wells using dedicated 5/8" outside diameter (O.D.) low density polyethylene (LDPE) tubing and foot valves. The wells were developed to ensure that subsequent groundwater samples collected were representative of overburden groundwater conditions. The wells were developed until the purge waters were relatively free of sediment or a minimum of three standing water volumes were removed from each well. Purge waters were stored on-site in a plastic drum.

### 4.4 Site Survey

The locations of all boreholes/monitoring wells referenced to existing site buildings and structures. The ground surface and monitoring well top of pipe elevations were referenced to an arbitrary site benchmark (basement window ledge at 18 Hawthorne) of 100 m above reference level (m arl) using a TopCon AT-B4 automatic level. The interior KCl monitoring wells were not included in the elevation surveys. The ground surface and top of pipe elevations are included in on the borehole logs in **Appendix E**.

## 4.5 Groundwater Monitoring

### *4.5.1 LPH and Water Level Measurements*

CM3 measured the depth to liquid phase hydrocarbons (LPH) and groundwater in all accessible monitoring wells April 12, 2017. A Solinst® electronic oil/water interface probe and/or water level meter was used for this task. The depth to LPH (if present) and water were measured the nearest millimetre from the highest point of the well riser. The interface probe and water level meter were cleaned and rinsed with distilled water between each well to prevent cross contamination. The LPH and water level measurements are provided in **Table 2**. The December 2016 LPH and water level measurements are included in **Table 2**.

Liquid phase hydrocarbon was present at monitoring well MW2 during the April 12, 2017 monitoring event at thicknesses of 0.5 cm. LPH was previously detected at monitoring well MW2 during the December 2016 monitoring event. No other monitoring wells showed the presence of LPH.

The average groundwater elevation was to 98.36 marl with a maximum difference of 1.16 m, based on the April 12, 2017 depth to water measurements. The groundwater elevation data shows that the net groundwater flow direction was to the north-west east with minor groundwater mounding and localized south-east flow near the former AST. Groundwater flow at the site may be influenced by fill and drainage tile surrounding the building and by buried utilities on the site and to the north along Hawthorne Avenue. Further groundwater monitoring is required to confirm the flow direction and local variations. The April 12, 2017 water level elevations and inferred flow direction are provided on **Figure 5**. The CM3 water level data from December 30, 2016 is also presented on **Table 2**. The April 2017 groundwater elevation was approximately 1.5 m higher than the December 2016 elevation, likely due to the spring thaw and precipitation in early April 2017.

### *4.5.2 Groundwater Sampling*

CM3 collected groundwater samples from all CM3 installed monitoring wells on April 12, 2017 (MW1 through MW13). Prior to sampling, each well was purged to remove stagnant water from within the well bore and surrounding annulus to obtain samples that were representative of formation groundwater. Groundwater purging and sampling was conducted using a low-flow peristaltic pump and dedicated sampling tubing. Water samples were collected directly from the pump outlet tubing into two 40 mL amber glass vial (with preservative) for laboratory analysis of BTEX and PHCs F1 fraction and one 500 mL amber glass bottle for PHCs F2-F4 analysis. Following collection, all samples were packed on ice in coolers for delivery to Paracel for analysis.

The analytical results showed the presence of BTEX and/or PHCs F1, F2 or F3 fractions at concentrations above the MOECC Table 3 SCS in samples MW1 (PHCs F2 and F3), MW2 (BTEX and PHCs F1, F2, F3), MW7 (PHCs F2) and MW11 (PHCs F2 and F3). All other samples returned either non-detect results or showed concentrations of BTEX and/or PHCs F1-F4 fractions below the MOECC SCS. The results of the groundwater analyses are summarized in **Table 3**. The December 2016 sample results are included in **Table 3**. Monitoring well locations and the April 12, 2017 groundwater quality provided on **Figure 6**. Laboratory reports are provided in **Appendix G**.

### 4.6 Extent of Impacts and Conceptual Site Model

CM3 developed a conceptual site model (CSM) based on the results of the CM3 site assessments and available information from KCI. The CSM was used to determine the soil types at the site, the extents of the contamination, how much contamination was present, the potential migration of the contamination and the potential exposure to the contaminant by humans or the environment. The CSM was updated as the project progressed and new information became available. The extent of petroleum hydrocarbon impacts was estimated based on the results of the site assessment activities completed from December 2016 to April 14, 2017.

Petroleum hydrocarbon impacts to soil were identified primarily as PHCs in the F2 fraction and/or F1 and F3 fractions. It was determined that the fuel oil contaminated soil was present underneath the majority of the 22 Hawthorne building, partially under the 20 Hawthorne building and off-site to east onto the 24 Hawthorne property, but were not likely present underneath the 24 Hawthorne building. The concrete foundation wall adjacent the former exterior fuel tank is also impacted. The area of contaminated soil was conservatively estimated to be 100 $m^2$ with most of it below the residences of 20 and 22 Hawthorne. The maximum depth of the contaminated soil was estimated to be 5.5 metres below grade and from grade to 5.5 m at the fuel release area and from 1.2 to 5.5 metres below grade underneath the residence based on the soil analyses and the water level fluctuations over the time of the assessments. The estimated volume of contaminated soil is 450 to 500 cubic meters or 900 to 1000 metric tonnes based on an estimated soil density of 2 tonnes per cubic metre. The volume estimate does not include soil (non-impacted) to be removed to remain safe side-slopes of the excavation (typically 1:1). The estimated extent of the impacted soil is shown on the Conceptual Site Model on **Figure 7** and **Figure 8**.

Petroleum hydrocarbon impacts to groundwater were identified as LPH and dissolved phase concentrations above the applicable MOECC SCS for BTEX and/or PHCs in the F2 and F3 ranges. LPH was observed in monitoring well MW2 located in the release area. Dissolved phase impacts were observed in the KCI monitoring wells located in the basement, off-site to the east in MW11 and to the north-west of 20 Hawthorne at MW7. The CM3 assessment did not identify any migration along utility pathways but it is very likely the released oil did migrate around the footings at 22 Hawthorne and possibly under the basement floor of 22 Hawthorne through the granular materials beneath the floor slab. Fuel oil contaminated groundwater was present over the same area as the soil contamination except the groundwater contamination extends past the soil contamination to the north-west, in the direction of groundwater flow, past MW7 and likely beneath Hawthorne Avenue. The estimated extent of the impacted groundwater is shown on the Conceptual Site Model on **Figure 7** and **Figure 8**.

## 5 RECOMMENDATIONS

The results of the delineation assessment has shown the presence of fuel oil contaminated soil and groundwater that can be attributed to the 2016 fuel release at 22 Hawthorne. The levels exceed the MOECC Table 3 SCS. CM3 recommends the following:

1. LPH recovery should be initiated at MW2 as soon as practical;

2. A remedial action plan with options should be prepared based on the CSM;
3. Further delineation and/or testing work should be conducted to support site remediation activities ; and
4. Remedial activities should be conducted as soon as practical to help limit further spread of the contaminants.

## 6 CLOSING

This report has been prepared and the work described in this report has been undertaken by CM3 Environmental Inc. (CM3) for Ms. Marilyn Steinberg. It is intended for the sole and exclusive use of Ms. Marilyn Steinberg and her authorized agents for the purpose(s) set out in this report. Any use of, reliance on, or decision made based on this report by any person other than Ms. Marilyn Steinberg for any purpose, or by Ms. Marilyn Steinberg for a purpose other than the purpose(s) set out in this report, is the sole responsibility of such person, or Ms. Marilyn Steinberg. CM3 and Ms. Marilyn Steinberg make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expense, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

Nothing in this report is intended to constitute or provide a legal opinion. In addition, revisions to the regulatory standards referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

The work undertaken by CM3 for this report and any conclusions or recommendations made in this report reflect CM3's judgement based on the site conditions observed at the time of the site inspection on the date(s) set out in this report, on information available at the time of preparation of this report, on the interpretation of data collected from the field investigation and on the results of laboratory analyses, which were limited to the quantification in select samples of those substances specifically identified in the report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site; substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken. CM3 expresses no warranty with respect to the accuracy of the analytical results by the laboratory. Actual concentrations of the substances identified in the samples submitted may vary according to the extraction and testing procedures used.

As the evaluation and conclusions reported herein do not preclude the existence of other chemical compounds and/or that variations of conditions within the site may be possible, this report should be used for informational purposes only and should absolutely not be construed as a comprehensive hydrogeological or chemical characterization of the site. If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

Other than by Ms. Marilyn Steinberg as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of CM3.

We trust that the above is satisfactory for your purposes at this time. Should you have any questions or concerns, please contact the undersigned.

Respectfully submitted,

**CM3 Environmental Inc.**

Karl Bilyj, P.Geo., QP
Geoscientist

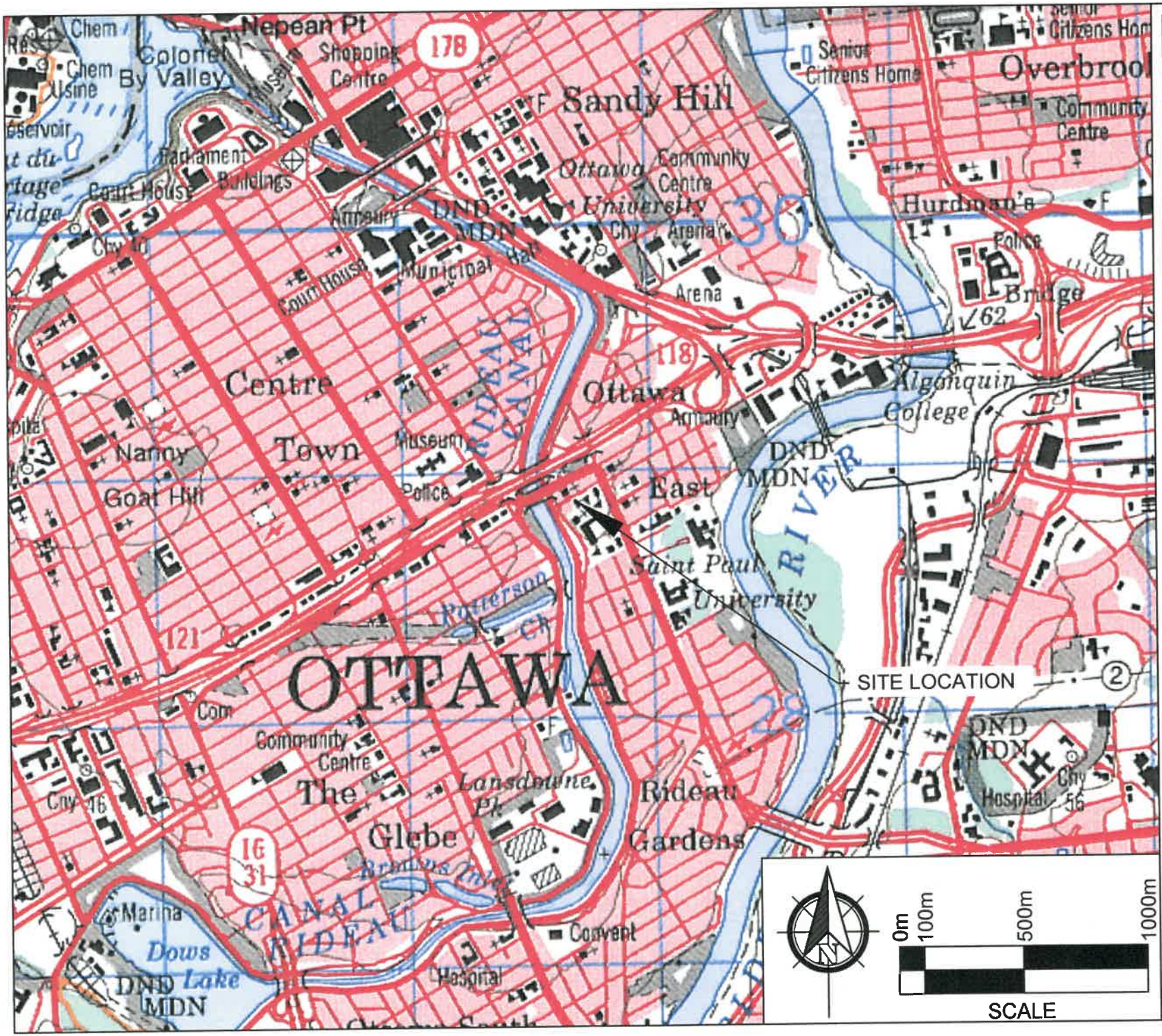
Bruce Cochrane, P.Geo., QP, EP
Principal

# FIGURES

**Oil Spill Delineation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**BDC1148**




General Notes

cm3 environmental

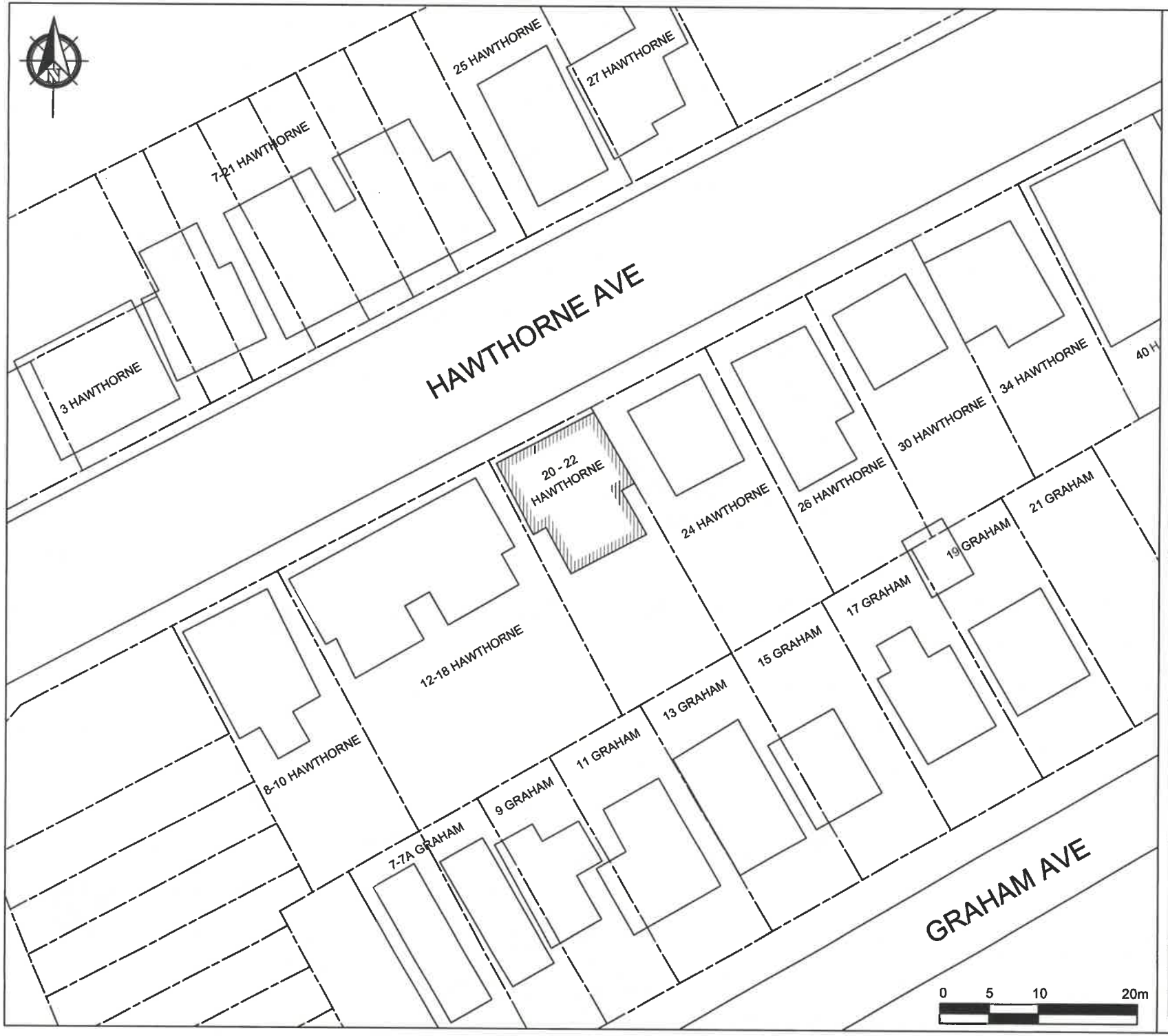
CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1

MARILYN STEINBERG

22 HAWTHORNE AVENUE
OTTAWA, ON

SITE LOCATION

| Project | Drawn by |
|---|---|
| BDC1148 | MWM |
| Date | Reviewed by |
| MAY 2017 | BDC |
| Scale | Figure |
| AS SHOWN | 1 |




**General Notes**

PROPERTY LINE


cm3 environmental

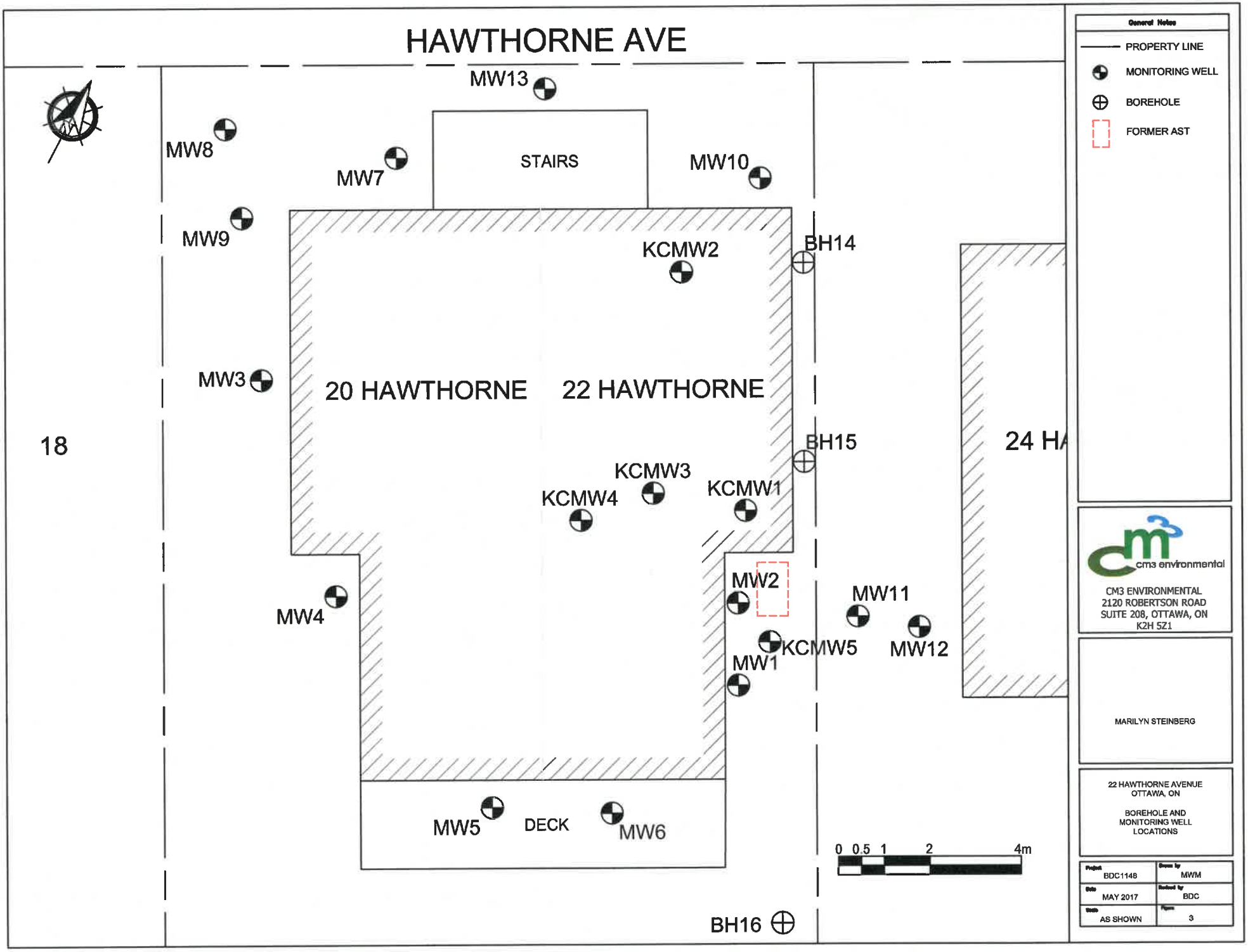
CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1

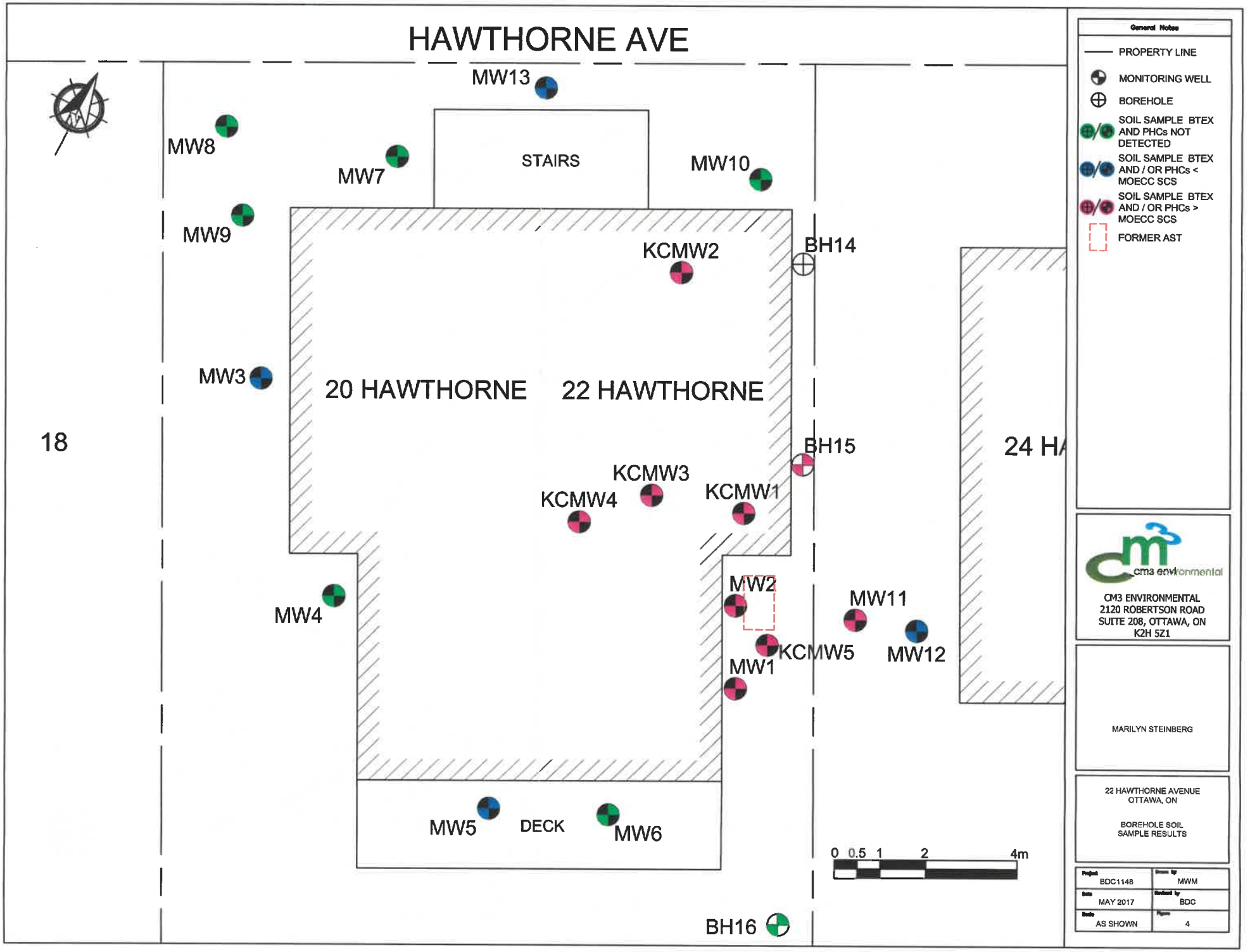

MARILYN STEINBERG

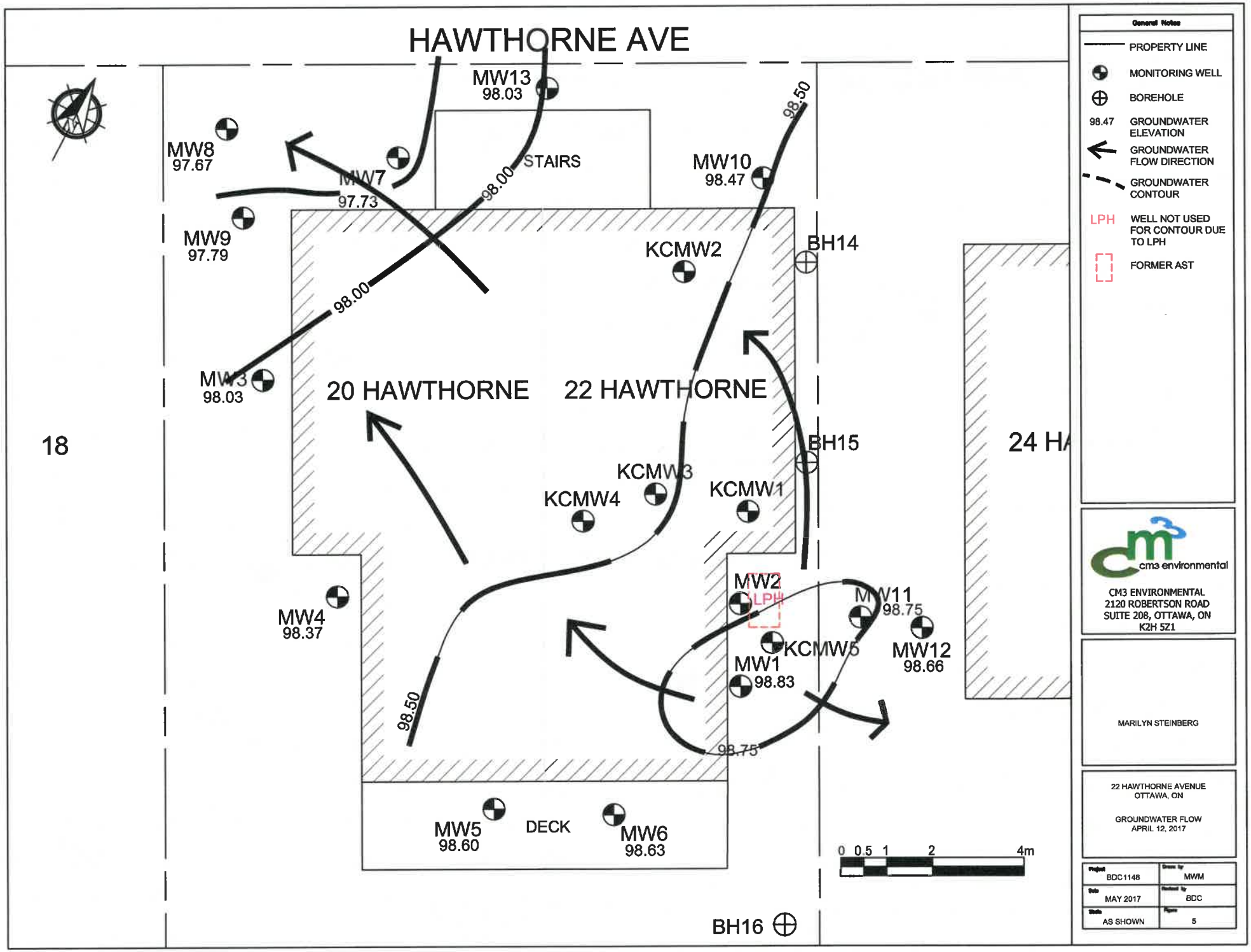
22 HAWTHORNE AVENUE
OTTAWA, ON

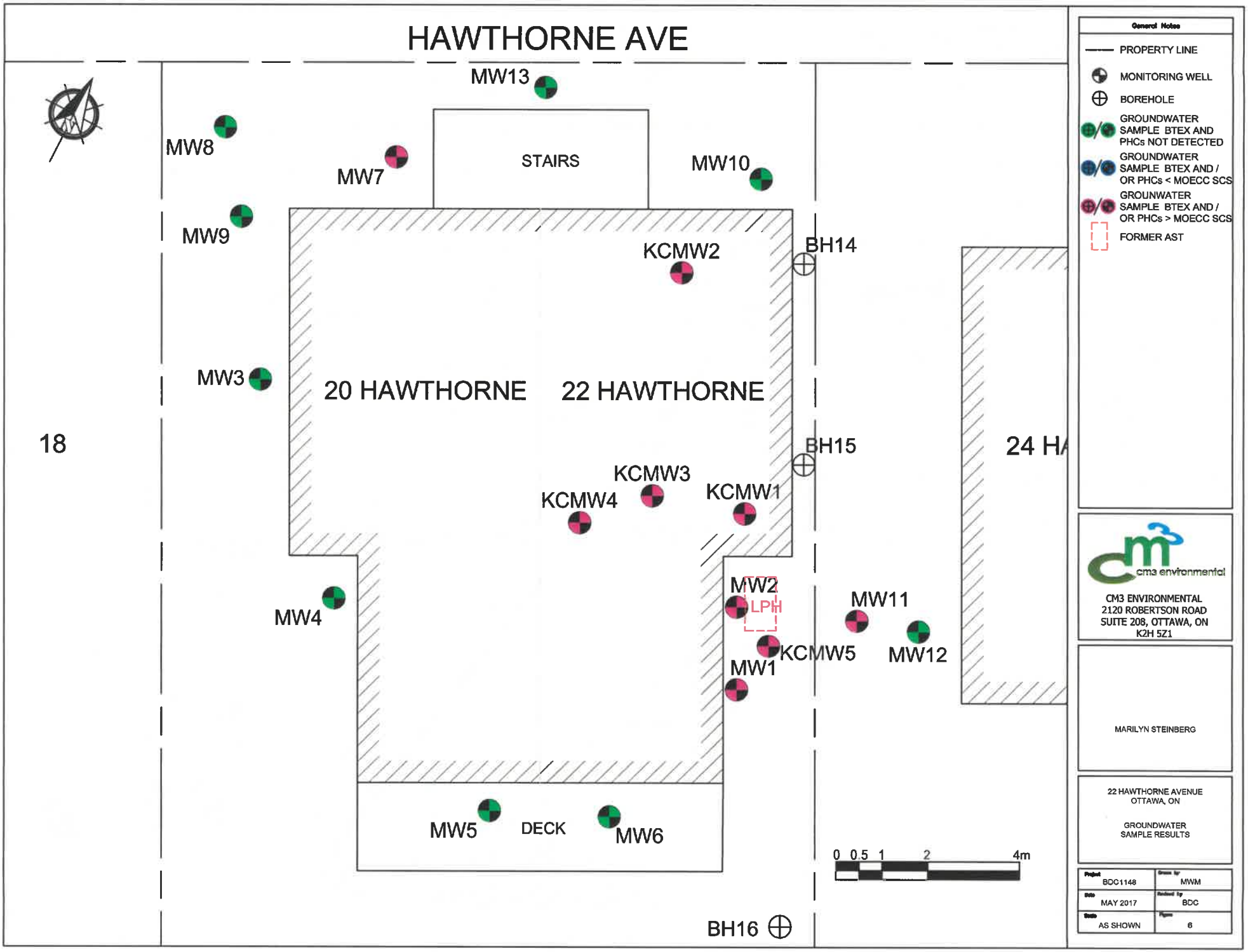
SITE PLAN

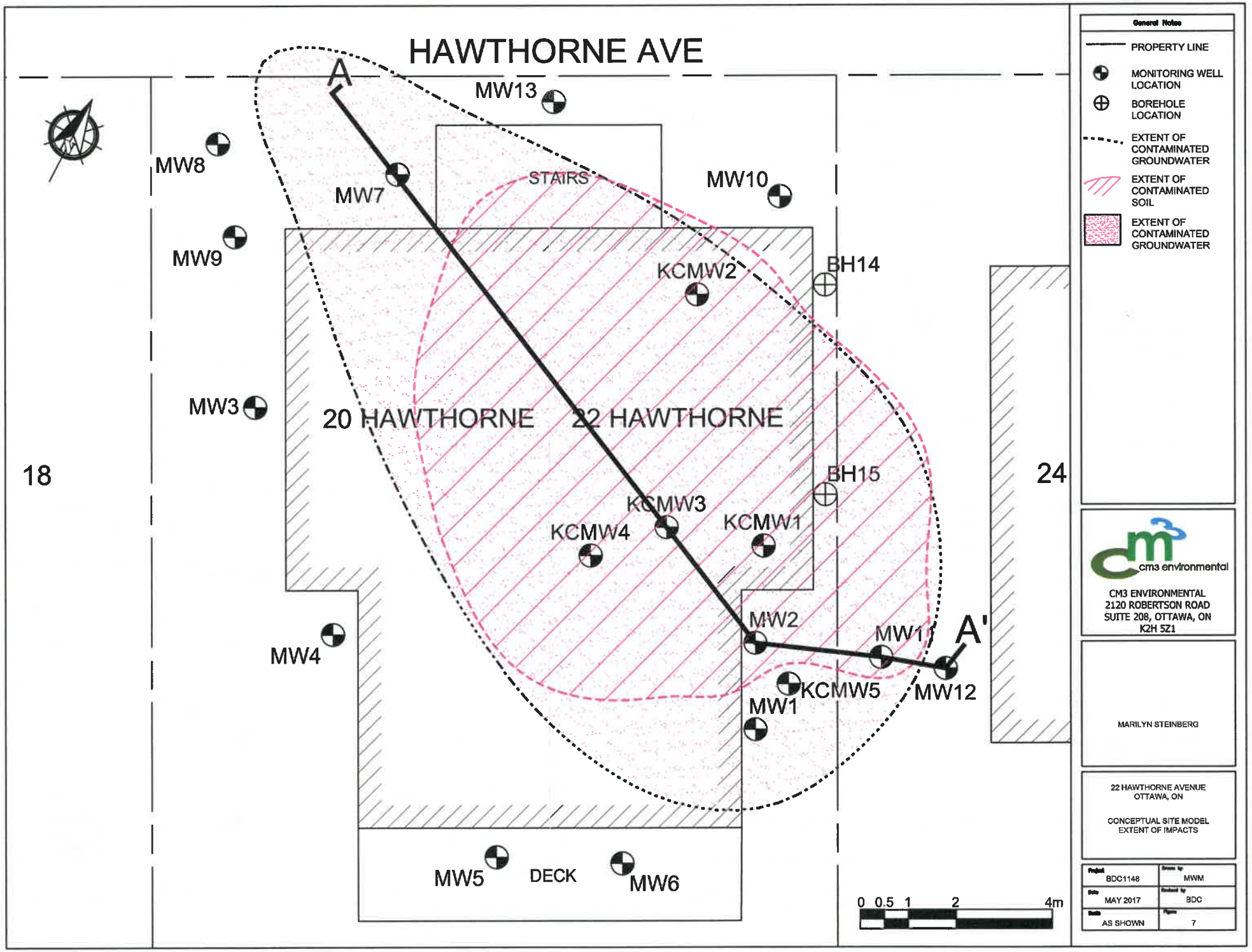
| Project | Drawn by |
|---|---|
| BDC1148 | MWM |
| Date | Reviewed by |
| MAY 2017 | BDC |
| Scale | Figure |
| AS SHOWN | 2 |

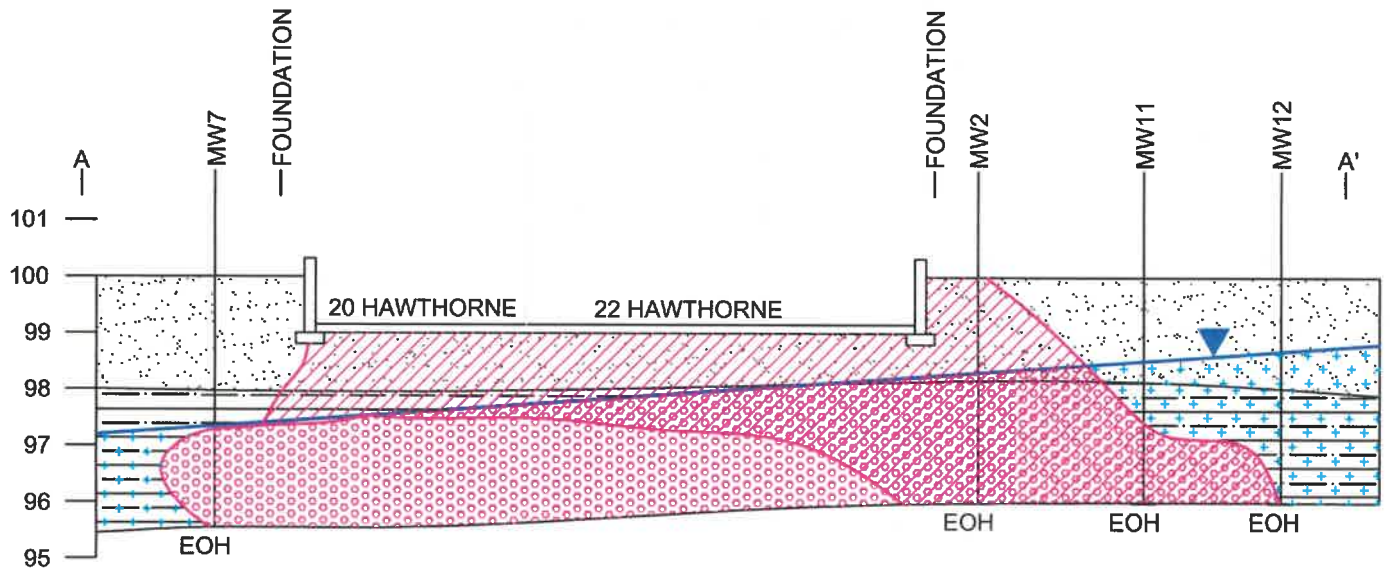

HAWTHORNE AVE
MW13
MW8
MW7
STAIRS
MW10
MW9
KCMW2
BH14
MW3
20 HAWTHORNE
22 HAWTHORNE
18
BH15
24 HA
KCMW3
KCMW4
KCMW1
MW2
MW4
MW11
KCMW5
MW12
MW1
MW5
DECK
MW6
BH16
0 0.5 1 2 4m
General Notes
PROPERTY LINE
MONITORING WELL
BOREHOLE
FORMER AST
cm3 environmental
CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1
MARILYN STEINBERG
22 HAWTHORNE AVENUE
OTTAWA, ON
BOREHOLE AND
MONITORING WELL
LOCATIONS
Project BDC1148
Drawn by MWM
Date MAY 2017
Revised by BDC
Scale AS SHOWN
Figure 3


HAWTHORNE AVE
MW13
MW8
MW7
STAIRS
MW10
MW9
KCMW2
BH14
MW3
20 HAWTHORNE
22 HAWTHORNE
18
BH15
24 HA
KCMW3
KCMW4
KCMW1
MW2
MW11
MW4
KCMW5
MW12
MW1
MW5
DECK
MW6
BH16
0 0.5 1 2 4m
General Notes
PROPERTY LINE
MONITORING WELL
BOREHOLE
SOIL SAMPLE BTEX AND PHCs NOT DETECTED
SOIL SAMPLE BTEX AND / OR PHCs < MOECC SCS
SOIL SAMPLE BTEX AND / OR PHCs > MOECC SCS
FORMER AST
cm3 environmental
CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1
MARILYN STEINBERG
22 HAWTHORNE AVENUE
OTTAWA, ON
BOREHOLE SOIL SAMPLE RESULTS
Project BDC1148
Drawn by MWM
Date MAY 2017
Reviewed by BDC
Scale AS SHOWN
Figure 4


HAWTHORNE AVE
MW13
98.03
MW8
97.67
MW7
97.73
STAIRS
98.00
98.50
MW10
98.47
MW9
97.79
KCMW2
BH14
98.00
MW3
98.03
20 HAWTHORNE
22 HAWTHORNE
18
24 HA
BH15
KCMW3
KCMW4
KCMW1
MW2
LPH
MW11
98.75
MW4
98.37
KCMW5
MW12
98.66
MW1
98.83
98.50
98.75
MW5
98.60
DECK
MW6
98.63
0 0.5 1 2 4m
BH16
General Notes
PROPERTY LINE
MONITORING WELL
BOREHOLE
98.47 GROUNDWATER ELEVATION
GROUNDWATER FLOW DIRECTION
GROUNDWATER CONTOUR
LPH WELL NOT USED FOR CONTOUR DUE TO LPH
FORMER AST
cm3 environmental
CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1
MARILYN STEINBERG
22 HAWTHORNE AVENUE
OTTAWA, ON
GROUNDWATER FLOW
APRIL 12, 2017
Project BDC1148
Drawn by MWM
Date MAY 2017
Reviewed by BDC
Scale AS SHOWN
Figure 5


HAWTHORNE AVE
MW13
MW8
MW7
STAIRS
MW10
MW9
KCMW2
BH14
MW3
20 HAWTHORNE
22 HAWTHORNE
18
BH15
24 HA
KCMW3
KCMW4
KCMW1
MW2
LPH
MW4
MW11
KCMW5
MW12
MW1
MW5
DECK
MW6
BH16
0 0.5 1 2 4m
General Notes
PROPERTY LINE
MONITORING WELL
BOREHOLE
GROUNDWATER SAMPLE BTEX AND PHCs NOT DETECTED
GROUNDWATER SAMPLE BTEX AND / OR PHCs < MOECC SCS
GROUNWATER SAMPLE BTEX AND / OR PHCs > MOECC SCS
FORMER AST
cm3 environmental
CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1
MARILYN STEINBERG
22 HAWTHORNE AVENUE
OTTAWA, ON
GROUNDWATER SAMPLE RESULTS
Project BDC1148
Drawn by MWM
Date MAY 2017
Reviewed by BDC
Scale AS SHOWN
Figure 6


HAWTHORNE AVE
A
A'
MW13
MW8
MW7
STAIRS
MW10
MW9
KCMW2
BH14
MW3
20 HAWTHORNE
22 HAWTHORNE
18
24
BH15
KCMW3
KCMW4
KCMW1
MW2
MW1
MW4
KCMW5
MW12
MW1
MW5
DECK
MW6
0 0.5 1 2 4m
General Notes
PROPERTY LINE
MONITORING WELL LOCATION
BOREHOLE LOCATION
EXTENT OF CONTAMINATED GROUNDWATER
EXTENT OF CONTAMINATED SOIL
EXTENT OF CONTAMINATED GROUNDWATER
cm3 environmental
CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1
MARILYN STEINBERG
22 HAWTHORNE AVENUE
OTTAWA, ON
CONCEPTUAL SITE MODEL
EXTENT OF IMPACTS
Project BDC1148
Drawn by MWM
Date MAY 2017
Reviewed by BDC
Scale AS SHOWN
Figure 7




CONCEPTUAL SITE MODEL
CROSS SECTION A-A'

0 0.5 1 2 4m

General Notes

- SAND
- CLAY
- FUEL CONTAMINATED SOIL
- SATURATED SAND AND/OR CLAY (WATER TABLE)
- CONTAMINATED GROUNDWATER

cm3 environmental

CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1

MARILYN STEINBERG

22 HAWTHORNE AVENUE
OTTAWA, ON

CONCEPTUAL SITE MODEL
CROSS SECTION A-A'

| Project | Drawn by |
|---|---|
| BDC1148 | MWM |
| Date | Reviewed by |
| MAY 2017 | BDC |
| Scale | Figure |
| AS SHOWN | 8 |

# TABLES

**Oil Spill Delineation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**BDC1148**

**Table 1:**
**Summary of Soil Analytical Results**
**BTEX and Petroleum Hydrocarbons F1 to F4 Fractions (µg/g or ppm)**
**22 Hawthorne Avenue, Ottawa, Ontario**
**BDC1148**

| Sample ID | Date | Depth | Benzene | Ethyl Benzene | Toluene | m,p-Xylene | o-Xylene | Xylene (Total) | PHC F1 (C6-C10) | PHC F2 (C10-C16) | PHC F3 (C16-C34) | PHC F4 (>C34) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MDL > | 0.02 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 7 | 4 | 8 | 6 |
| | | MOECC Table 3 SCS > | 0.21 | 2 | 2.3 | NV | NV | 3.1 | 55 | 98 | 300 | 2800 |
| MW1 SA4 | 22-Dec-16 | 1.8 - 2.4 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| MW2 SA2 | 22-Dec-16 | 0.6 - 1.2 | *0.54* | *13.0* | *11.2* | 49.6 | 27.1 | *76.7* | *2,660* | *30,200* | *12,400* | <120 |
| MW2 SA6 | 22-Dec-16 | 3.1 - 3.7 | 0.02 | 0.73 | 0.63 | 2.84 | 1.62 | *4.46* | *259* | *14,100* | *5,810* | <60 |
| MW3 SA8 | 20-Mar-17 | 3.96 - 4.6 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | 24 | 12 |
| MW4 SA7 | 20-Mar-17 | 3.4 - 3.96 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| MW5 SA6 | 21-Mar-17 | 2.74 - 3.4 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | 40 | 33 |
| MW6 SA5 | 21-Mar-17 | 2.13 - 2.74 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| MW7 SA7 TOP | 21-Mar-17 | 3.4 - 3.7 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| MW7 SA7 BTM | 21-Mar-17 | 3.7 - 4 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| MW8 SA5 | 22-Mar-17 | 2.13 - 2.74 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| MW9 SA5 | 22-Mar-17 | 2.13 - 2.74 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| MW10 SA7 | 22-Mar-17 | 3.4 - 3.96 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| MW11 SA8 | 23-Mar-17 | 3.96 - 4.6 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 20 | *558* | 274 | <6 |
| MW12 SA5 | 23-Mar-17 | 2.13 - 2.74 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| Under Asphalt (MW11) | 23-Mar-17 | 0.0 - 0.3 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | 173 | 279 |
| MW13 SA1 | 5-Apr-17 | 1.8 - 2.4 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | 22 | <6 |
| BH15 SA2 | 5-Apr-17 | 2.4 - 3 | <0.02 | <0.05 | <0.05 | 0.27 | 0.05 | 0.32 | *253* | *1,980* | *966* | <6 |
| BH16 SA4 | 5-Apr-17 | 1.8 - 2.4 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |

**Notes:**

ppm - All concentrations provided in parts per million (micrograms per gram - µg/g)
Depth - Depth in m below grade
"<" - Less than detection limits indicated (refer to laboratory report)
NV - No standard listed
MOECC Table 3 SCS > - Standards from the Ontario Ministry of Environment and Climate Change (MOECC) Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the EPA (April 15, 2011) Reg 153/04 (2011)-Table 3 Non-Potable Groundwater, coarse
*Bold / Italics* - Indicates exceedance of MOECC Table Standards.

**Table 2:**
**Groundwater Level Measurements**
**22 Hawthorne Avenue, Ottawa, Ontario**
**BDC1148**

| Well ID | Date | TOC | Depth to | | Elevation | | LPH Thickness | Comments |
|---|---|---|---|---|---|---|---|---|
| | | (masl) | LPH (mbtoc) | GW (mbtoc) | LPH (masl) | GW (masl) | (m) | |
| MW1 | 30-Dec-16 | 100.847 | – | 3.466 | – | 97.381 | — | |
| | 12-Apr-17 | 100.847 | – | 2.015 | – | 98.832 | — | |
| MW2 | 30-Dec-16 | 100.835 | 3.768 | 3.769 | 97.067 | 97.066 | 0.001 | GW level not accurate, meter malfunction |
| | 12-Apr-17 | 100.835 | 2.120 | 2.125 | 98.715 | 98.710 | 0.005 | |
| MW3 | 12-Apr-17 | 99.957 | – | 1.928 | – | 98.029 | — | |
| MW4 | 12-Apr-17 | 100.827 | – | 2.459 | – | 98.368 | — | |
| MW5 | 12-Apr-17 | 100.636 | – | 2.033 | – | 98.603 | — | |
| MW6 | 12-Apr-17 | 100.697 | – | 2.068 | – | 98.629 | — | |
| MW7 | 12-Apr-17 | 100.887 | – | 3.158 | – | 97.729 | — | |
| MW8 | 12-Apr-17 | 99.943 | – | 2.270 | – | 97.673 | — | |
| MW9 | 12-Apr-17 | 99.988 | – | 2.202 | – | 97.786 | — | |
| MW10 | 12-Apr-17 | 101.055 | – | 2.581 | – | 98.474 | — | |
| MW11 | 12-Apr-17 | 100.303 | – | 1.558 | – | 98.745 | — | |
| MW12 | 12-Apr-17 | 101.307 | – | 2.650 | – | 98.657 | — | |
| MW13 | 12-Apr-17 | 99.908 | – | 1.883 | – | 98.025 | — | |
| KCI MW5 | 12-Apr-17 | 101.288 | – | 2.562 | – | 98.726 | — | |

**Notes:**
TOC - top of casing
masl - metres above arbitrary reference level
mbtoc - metres below top of casing
LPH - liquid phase hydrocarbons
GW - groundwater
NM - not measured
– - no value/LPH not present

**Table 3:**
**Summary of Groundwater Analytical Results**
**BTEX and Petroleum Hydrocarbons F1 to F4 Fractions (µg/L or ppb)**
**20 Hawthorne Avenue, Ottawa, Ontario**
**BDC1148**

| Sample ID | Date | Benzene | Ethyl Benzene | Toluene | m,p-Xylene | o-Xylene | Xylene (Total) | PHC F1 (C6-C10) | PHC F2 (C10-C16) | PHC F3 (C16-C34) | PHC F4 (>C34) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MDL > | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 25 | 100 | 100 | 100 |
| MOECC Table 3 SCS > | | 44 | 2300 | 18000 | NV | NV | 4200 | 750 | 150 | 500 | 500 |
| MW1 | 30-Dec-16 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |
| MW1 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | ***11,300*** | ***5,880*** | <100 |
| MW2 | 30-Dec-16 | ***LPH*** | ***LPH*** | ***LPH*** | ***LPH*** | ***LPH*** | ***LPH*** | ***6,750,000*** | ***6,750,000*** | ***2,670,000*** | ***<4,610,000*** |
| MW2 | 12-Apr-17 | ***68.4*** | ***113*** | ***170*** | ***411*** | ***186*** | ***597*** | ***805*** | ***4,270,000*** | ***2,240,000*** | <100 |
| MW3 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |
| MW4 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |
| MW5 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |
| MW6 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |
| MW7 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | ***475*** | 280 | <100 |
| MW8 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |
| MW9 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |
| MW10 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |
| MW11 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | ***4,570*** | ***2,460*** | <100 |
| MW12 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |
| MW13 | 12-Apr-17 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <25 | <100 | <100 | <100 |

**Notes:**

ppb - All concentrations provided in parts per billion (micrograms per litre - µg/L)
"<" - Less than detection limits indicated (refer to laboratory report)
NV - No standard listed
MOECC Table 3 SCS > - Standards from the Ontario Ministry of Environment and Climate Change (MOECC) Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the EPA (April 15, 2011) Reg 153/04 (2011)-Table 3 Non-Potable Groundwater, coarse
***Bold / Italics*** - Indicates exceedance of MOECC Table Standards.

# APPENDIX A

## TSSA REPORT

**Oil Spill Delineation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**BDC1148**

TECHNICAL STANDARDS and SAFETY AUTHORITY
345 Carlingview Drive
Toronto, Ontario M9W 6N9
Toll free 1-877-682-8772
www.tssa.org

**FS Inspection Report**

| | |
|---|---|
| Service Request # | 1987942 |
| Inspection Report # | 6460966 |

| | | |
|---|---|---|
| Inspection Address:<br>**22 Hawthorne Avenue**<br>**Ottawa;ON**<br>**CA K1S 0B1** | Reference Number(s): | Inspection Completion Date: |
| | Facility Type: | Equipment Type: |
| Customer Name and Address:<br>**Marilyn Steinberg**<br>**22 Hawthorne Avenue**<br>**Ottawa;ON**<br>**CA K1S 0B1** | Task Type:<br>FS-Enf Action Homeowner | |
| | The facility/equipment is inspected in accordance with Ontario's Technical Standards & Safety Act and the appropriate regulations and codes. When an inspector's order is issued, time limits for compliance reflect the severity of the violation and serve to avoid disruption of service. | |

**Orders Issued To:** Marilyn Steinberg

| Line | Reference and Order(s) | Compliance Date |
|---|---|---|
| 77832 7-1 | CAN/CSA-B139.1.0-15 Installation Code for Fuel Oil Burning Equipment - General requirements for large installations Clause M4.2 (Amended)<br>In the event of a spill, where a leak is confirmed, where there is discovery of a petroleum product that has escaped to the environment or inside a building, or where required by the Director, one or more of the responsible individuals identified in Clause 4.1, as applicable, shall notify the Director and the responsible individual(s) shall further:<br>(a) forthwith notify the Director in the event of a fire or explosion and remove any potential for fire or explosion hazard;<br>(b) provide all information to the Director or an inspector, as required;<br>(c) cease using and empty products from any leaking part of the tank system(s);<br>(d) repair, replace, or remove all defective underground or aboveground tank system(s) or equipment; and<br>(e) take all practical measures to comply with the Environmental Management Protocol for Operating Fuel Handling Facilities in Ontario.<br><br>Pursuant to ENVIRONMENTAL MANAGEMENT PROTOCOL You are hereby ordered to provide TSSA an assessment report, prepared by a qualified person as defined in Ontario Regulation 153/04 of the Environmental Protection Act which delineates the full extent of all petroleum impacts to both the soil and ground-water. The report must meet the criteria as set forth in the TSSA Environmental Management Protocol for Operating Fuel Handling Sites in Ontario.<br><br>The report must be sent to the following address on or before the compliance date:<br>Technical Standards and Safety Authority<br>Attn: Fuels Safety Engineering - Environmental<br>345 Carlingview Drive<br>Toronto, ON<br>M9W 6N9<br><br>Electronic submissions may be sent to the following email address fssubmissions@tssa.org ATTENTION Fuels Safety Engineering - Environmental<br><br>NOTE: All submissions MUST be accompanied by a completed Environmental Review Services Form. If the form is incomplete the report will not be reviewed and the file will not be closed. Copies of the form are available at http://www.tssa.org/regulated/fuels/fuelsForms.asp<br><br>TSSA does not consider the matter resolved and the file closed until written correspondence from the TSSA engineering department has been provided upon review of the report submission. | MAR 03, 2017 |

| | | | |
|---|---|---|---|
| **Customer Signature & Position / Date:** | | **Inspector Name:**<br>Barclay, David | **Inspector Contact Number:**<br>613-808-2727 |
| **Report Received By:**<br>Marilyn Steinberg via: meeze5050@gmail.com | **Customer Contact Number:**<br>(514) 945-3451 | **Inspector Email:**<br>dbarclay@tssa.org | **Inspector Fax:**<br>647-789-2129 |

As a not-for-profit regulatory authority, TSSA operates on a cost recovery basis. An Invoice will be issued for the Total Charges Incurred.
**(Note: This is not an invoice)**

**Putting Public Safety First**

TECHNICAL STANDARDS and SAFETY AUTHORITY

345 Carlingview Drive
Toronto, Ontario M9W 6N9
Toll free 1-877-682-8772
www.tssa.org

**FS Inspection Report**

| | |
|---|---|
| **Service Request #** | **1987942** |
| **Inspection Report #** | **6460966** |

| | | |
|---|---|---|
| Inspection Address:<br>**22 Hawthorne Avenue**<br>**Ottawa;ON**<br>**CA K1S 0B1** | Reference Number(s): | Inspection Completion Date: |
| | Facility Type: | Equipment Type: |
| Customer Name and Address:<br>**Marilyn Steinberg**<br>**22 Hawthorne Avenue**<br>**Ottawa;ON**<br>**CA K1S 0B1** | Task Type:<br>FS-Enf Action Homeowner<br>**The facility/equipment is inspected in accordance with Ontario's Technical Standards & Safety Act and the appropriate regulations and codes. When an Inspector's order is issued, time limits for compliance reflect the severity of the violation and serve to avoid disruption of service.** | |

| | | |
|---|---|---|
| 77832<br>7-2 | ONTARIO REGULATION 213/01. (FUEL OIL) 19 - Operation<br>No person shall operate or permit to be operated an appliance or tank system unless it is maintained in a safe operating condition and it complies with this Regulation. O. Reg. 213/01, s. 19.<br><br>The following Order is issued December 5th, 2016.<br><br>You are hereby Ordered to comply with ONTARIO REGULATION 213/01. (FUEL OIL) 19 forthwith. | DEC 05, 2016 |

**Task Notes**

TSSA Inspector David Barclay travelled to 22 Hawthorne Ave; Ottawa on December 2nd, 2016 after receiving a report from the Ministry of Environment that a discovery of petroleum leak had occurred on December 1st, 2016.

Mr.Helder Pacheco technician working for Bruce Fuels was on site and advised this Inspector that on November 18th, 2016 Boxall Heating Ltd; subcontractor to Bruce Fuels had conducted a fuel oil distributor comprehensive inspection and deliver 50 litres of fuel oil to the outside fuel oil storage tank. Boxall Heating Ltd; identified several deficiencies during their comprehensive inspection and left copies of the warning tags with a 30 day compliance date.

Bruce Fuels delivered 140 liters of fuel oil to this storage tank on November 24th, 2016. Mr. Pacheco was on site Dec. 1st, 2016 to give a quote on future installation work when it was discovered that fuel oil had leaked from the storage tank and a call was made to the Ministry of Environment.

This inspector noted the presence of fuel odours during the visual inspection of the fuel oil storage tank. The storage tank was found rusty all over, missing the fuel gauge, and with two pin holes and one larger hole approximately 1cm in diameter in the same proximity of each other near the fuel supply outlet at the bottom of the storage tank. Access to the house was given by Mr. John Morrison and fuel oil was discovered leaking through the wall from the outside down the inside wall of the basement with a stain 38"x45" on the wall.

Advised Mrs. Steinberg to contact her insurance company to make them aware of the fuel oil leak incident and that an Environmental Order will be issued to determine the extent of the leak. Discussed requirement for yearly maintenance of fuel oil and natural gas appliances.

Inspection complete.

The above Inspector's Order is a result of the Incident.

Pursuant to my Authority under Section 21 of the TSSAct, 2011, you are hereby Ordered to comply with the above Orders forthwith.

| | | | |
|---|---|---|---|
| **Customer Signature & Position / Date:** | | **Inspector Name:**<br>Barclay, David | **Inspector Contact Number:**<br>613-808-2727 |
| **Report Received By:**<br>Marilyn Steinberg via: meeze5050@gmail.com | **Customer Contact Number:**<br>(514) 945-3451 | **Inspector Email:**<br>dbarclay@tssa.org | **Inspector Fax:**<br>647-789-2129 |

As a not-for-profit regulatory authority, TSSA operates on a cost recovery basis. An Invoice will be issued for the Total Charges Incurred.
**(Note: This is not an invoice)**

TECHNICAL STANDARDS and SAFETY AUTHORITY

345 Carlingview Drive
Toronto, Ontario M9W 6N9
Toll free 1-877-682-8772
www.tssa.org

**FS Inspection Report**

| | |
|---|---|
| **Service Request #** | **1987942** |
| **Inspection Report #** | **6460966** |

| | | |
|---|---|---|
| Inspection Address:<br>**22 Hawthorne Avenue**<br>**Ottawa;ON**<br>**CA K1S 0B1** | Reference Number(s): | Inspection Completion Date: |
| | Facility Type: | Equipment Type: |
| Customer Name and Address:<br>**Marilyn Steinberg**<br>**22 Hawthorne Avenue**<br>**Ottawa;ON**<br>**CA K1S 0B1** | Task Type:<br>FS-Enf Action Homeowner | |
| | The facility/equipment is inspected in accordance with Ontario's Technical Standards & Safety Act and the appropriate regulations and codes. When an Inspector's order is issued, time limits for compliance reflect the severity of the violation and serve to avoid disruption of service. | |

| | | | |
|---|---|---|---|
| **Customer Signature & Position / Date:** | | **Inspector Name:**<br>Barclay, David | **Inspector Contact Number:**<br>613-808-2727 |
| **Report Received By:**<br>Marilyn Steinberg via: mecze5050@gmail.com | **Customer Contact Number:**<br>(514) 945-3451 | **Inspector Email:**<br>dbarclay@tssa.org | **Inspector Fax:**<br>647-789-2129 |

As a not-for-profit regulatory authority, TSSA operates on a cost recovery basis. An Invoice will be issued for the Total Charges Incurred.
**(Note: This is not an invoice)**

**Putting Public Safety First**

# APPENDIX B

## OIL SPILL INVESTIGATION, 22 HAWTHORNE AVENUE, OTTAWA, ONTARIO

**Oil Spill Delineation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**BDC1148**

January 11, 2017

**BDC1148**

Ms. Marilyn Steinberg
Property Owner -22 Hawthorne Avenue
1425 Doctor Penfield Avenue,
Montreal, Quebec
H3G 2V1

Dear Ms. Steinberg

**Oil Spill Investigation**
**22 Hawthorne Avenue, Ottawa Ontario**

---

## 1 INTRODUCTION

CM3 Environmental Inc. (CM3) was retained by Ms. Marilyn Steinberg (client) to provide environmental consulting services with respect to a fuel oil release at 22 Hawthorne Avenue, Ottawa, Ontario (site). CM3 was requested to determine the possible impact to soil and groundwater in the area of the release and provide recommendations for further work to comply with a Technical Standards and Safety Association (TSSA) Service Request and Inspection Report.

### 1.1 Scope of Work

The assessment was completed in accordance with CM3's standard field investigative procedures and industry protocol. The scope of work is provided as follows:

- A initial site inspection of the exterior of the residence and spill area;
- The advancement of two boreholes converted to monitoring wells to assess soil and groundwater conditions at the spill area;
- The collection and field analysis of soil samples from the two boreholes and the submission of selected soil samples for laboratory analysis;
- The measurement of the depth to liquid phase hydrocarbon (LPH), if present, and groundwater in all monitoring wells;
- The collection of groundwater samples from the monitoring wells for laboratory analysis;

- The evaluation of soil and groundwater analytical results with respect to the applicable Ontario Ministry of Environment and Climate Change (MOECC) site condition standards (SCS); and
- The documentation of the results and conclusions of the soil and groundwater assessment with recommendations presented in this report.

Soil and groundwater samples submitted for laboratory analysis were analysed for benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbons (PHCs) in the F1-F4 fractions. At the time of collection, all samples for laboratory analysis were placed in coolers with ice packs with an accompanying chain of custody, for shipment to Paracel Laboratories (Paracel) of Ottawa, Ontario.

## 2 BACKGROUND

The subject site is located at 22 Hawthorne Avenue, in an urban residential area located south of Highway 417 approximately 100 meters east of the Rideau Canal in Ottawa, Ontario (**Figure 1**). The site is located on the south side of Hawthorne Avenue and is the east side of a two story brick clad semi-detached residence. The west side of the residence is 20 Hawthorne Avenue. It is CM3's understanding that both 20 and 22 Hawthorne Avenue are owned by the client and are operated as residential rental properties. The footprint of the building appears to extend to both the east and west property line according to the City of Ottawa eMap web site. The building has a stone block foundation with a finished basement (CM3 has only inspected the 22 Hawthorne side of the residence). Ground cover at the site was mostly snow covered while CM3 was on-site but it appears the property is bounded to the north by the side walk along Hawthorne Avenue, two shared (likely asphalt) driveways to the east and west and a likely gravel parking area with minor landscaping at the south part of the property. The ground surface in the area is relatively flat. Surface water drainage at the site is likely controlled by the local storm sewer towards the Rideau Canal. The residence is supplied potable water and sewer services by the City of Ottawa.

The site location is illustrated on **Figure 1**. A site plan is provided as **Figure 2**.

It was reported to CM3 that the release was from an exterior 900 litre fuel oil above ground storage tank (AST) that was located along the east exterior wall of the building near the south corner, (photograph to the right). It is CM3's understanding that the spill was discovered in December 2016 after 40 litres and then 150 litres of fuel were delivered to the AST and the furnace ran out of fuel very shortly after each filling event. It is CM3's understanding that the TSSA inspected the spill and issued an order for delineation and remediation of the fuel release.

## 3 REGULATORY STANDARDS

The soil and groundwater analytical results were compared to the Ontario Ministry of Environment and Climate Change (MOECC) Ontario Regulation (O.Reg.) 153/04 "Soil, Ground Water and

Sediment standards for Use Under Part XV.1 of the Environmental Protection Act", dated April 15, 2011. The following site conditions were used in the selection of the appropriate MOECC site condition standards (SCS) to assess the soil and groundwater analytical results:

- The property is more than 30 meters from a body of water;
- Bedrock is more than 2 meters from grade;
- The site and surrounding land use is considered to be residential;
- Water is supplied from a municipal source; and,
- Soils at the site are considered coarse textured.

The MOECC Table 3: Generic Site Condition Standards (SCS) for in a Non Potable Ground Water Condition with coarse grained soil were used for the evaluation of the analytical results based on the above.

## 4 SITE ASSESSMENT

### 4.1 Initial Site Investigation

On December 15, 2016 CM3 attended the site to conduct an initial investigation of the fuel oil release. The inspection was limited to the exterior of the building and the property was snow covered.

The exterior of the property was photographed and it was noted that the location of the former AST was in very close proximity to the property line.


CM3 recommended that exterior boreholes be installed in the location of the former AST to determine if there had been any subsurface impact to the soil or groundwater from the fuel release.

### 4.2 Borehole Soil Sampling

A total of two boreholes (MW1 and MW2) were advanced on December 22, 2016 under supervision of CM3. The boreholes were advanced using portable drilling equipment supplied and operated by CCC Geotechnical and Environmental Drilling Ltd. (CCC) of Ottawa Ontario. The boreholes were advanced from grade a maximum depth of 4.3 meters below grade (m bg). Soil samples were collected continuously from grade to the maximum depth of each borehole location using a 60 cm long, 5.1 cm diameter split spoon sampler. Soil samples were logged at the time of drilling by the supervising CM3 personnel for soil classification and field screening evidence of impacts. Sampling equipment was washed and rinsed between each sample interval and borehole location to eliminate potential cross-contamination. Borehole locations are provided on **Figure 2**.

The soil profile was determined to be 0.1 meters of topsoil overlying 2.1 meters of fine grained laminated sand overlying a grey clay to a depth of 4.3 meters.

All soil samples were split in the field, with a portion being placed in the appropriate laboratory supplied 120 mL glass jars and 40 mL methanol preservation vials and stored on ice in a cooler pending laboratory analysis. The remainder of each sample was placed in a plastic bag for combustible vapour analysis using an RKI Eagle combustible gas detector, calibrated to hexane.

The combustible vapour concentrations were 0 parts per million (ppm) to 5 ppm for borehole MW1 soil samples and 110 ppm to 190 ppm for soil samples from borehole MW2. A total of three soil samples were submitted for analysis of BTEX and PHCs in the F1 to F4 Fractions, based on the results of the field screening. One soil sample was submitted from borehole MW1 (MW1 SA4) and two samples were submitted from borehole MW2 (MW2 SA2 and MW2 SA6).

The analytical results showed the presence of BTEX and/or PHCs in the F1 to F3 fractions in soil samples MW2 Sa2 and MW2 SA6, at concentrations above the MOECC Table 3 SCS. BTEX and PHCs in the F1 to F4 fractions were not detected in sample MW1 SA4, which met the applicable MOECC SCS. The soil analytical results are presented in **Table 1**. The laboratory reports are attached in **Appendix A** for reference.

### 4.3 Monitoring Well Installation

Boreholes MW1 and MW2 were completed as monitoring wells. Monitoring well construction consisted of 32 mm outside diameter, flush-threaded schedule 40 PVC well screens and risers. At each borehole, a 10-slot well screen was placed to intercept the water table to allow for the detection of liquid phase hydrocarbons (LPH). A silica sand pack was placed around the outside of the well screen in the annular space of the borehole, to a minimum of 0.3 m above the screened interval. A bentonite seal was placed above the sand pack to grade. All monitoring wells were capped with slip caps, and finished above grade. Monitoring well logs are provided in **Appendix B**.

### 4.4 Groundwater Sampling

Groundwater samples were collected from monitoring wells MW1 and MW2 on December 30, 2016. Prior to sampling, each well was purged to remove stagnant water from within the well bore and surrounding annulus to obtain samples that were representative of formation groundwater. Groundwater purging and sampling was conducted using dedicated low density polyethylene tubing installed at each well and a peristaltic pump. Water samples were collected into the appropriate

laboratory supplied sample containers (2 x 40 mL glass vials and 1 x 500 mL glass bottle) for analysis of BTEX and PHCs in the F1 to F4 fractions.

The analytical results showed the presence of PHCs F2 to F4 fractions in sample MW2, at concentrations above the MOECC Table 3 SCS. Liquid phase hydrocarbon was noted in the 40 mL sample vials for water sample MW2 and the laboratory did not conduct the BTEX and PHCs F1 fraction analysis for sample MW2. The presence of LPH is considered to exceed the MOECC Table 3 SCS. BTEX and PHCs in the F1 to F4 fractions were not detected in sample MW1, which met the applicable MOECC SCS. The Groundwater analytical results are summarized in **Table 2** and the laboratory reports are attached in **Appendix A** for reference.

## 5 SUMMARY AND CONCLUSIONS

CM3 Environmental Inc. was retained by Ms. Marilyn Steinberg to provide environmental consulting services with respect to a fuel oil release at 24 Hawthorne Avenue in Ottawa, Ontario. CM3 installed two monitoring wells in the immediate area of the release in December of 2016. The location of the first well (MW1) showed no impact to the soil or groundwater at that location. The location of the second well (MW2) showed the presence of LPH and soil/groundwater contamination in excess of the MOECC Standards. The presence of LPH in such a close proximity to the neighbouring property is a definite concern for current or future off-site migration of contamination. The presence of city services may also provide pathways for the off-site migration of LPH and/or contaminated water. Based on the above, CM3 is recommending the following:

- Further delineation is required. The current assessment did not fully delineate the extent of contamination. Contamination is expected off-site to the east and to the west underneath the on-site building, (based on the depth of contamination). Boreholes/monitoring wells should be installed at least on all four sides of the exterior of the residence and within the footprint of the residence. It would be prudent to inspect the backfill around all water/sewer lines that exit the building foundation as they may be preferred conduits for migration of the fuel;
- A remedial plan should be developed based on the fully delineated area of contamination; and
- Groundwater monitoring should be undertaken on a quarterly basis (four times a year) until the soil remediation is complete. Two groundwater monitoring events should be completed post remediation.

## 6 CLOSING

This report has been prepared and the work described in this report has been undertaken by CM3 Environmental Inc. (CM3) for Ms. Marilyn Steinberg. It is intended for the sole and exclusive use of Ms. Marilyn Steinberg and her authorized agents for the purpose(s) set out in this report. Any use of, reliance on, or decision made based on this report by any person other than Ms. Marilyn Steinberg for any purpose, or by Ms. Marilyn Steinberg for a purpose other than the purpose(s) set out in this report, is the sole responsibility of such person, or Ms. Marilyn Steinberg. CM3 and Ms. Marilyn Steinberg make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expense, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

Nothing in this report is intended to constitute or provide a legal opinion. In addition, revisions to the regulatory standards referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

The work undertaken by CM3 for this report and any conclusions or recommendations made in this report reflect CM3's judgement based on the site conditions observed at the time of the site inspection on the date(s) set out in this report, on information available at the time of preparation of this report, on the interpretation of data collected from the field investigation and on the results of laboratory analyses, which were limited to the quantification in select samples of those substances specifically identified in the report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site; substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken. CM3 expresses no warranty with respect to the accuracy of the analytical results by the laboratory. Actual concentrations of the substances identified in the samples submitted may vary according to the extraction and testing procedures used.

As the evaluation and conclusions reported herein do not preclude the existence of other chemical compounds and/or that variations of conditions within the site may be possible, this report should be used for informational purposes only and should absolutely not be construed as a comprehensive hydrogeological or chemical characterization of the site. If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

Other than by Ms. Marilyn Steinberg as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of CM3.

We trust that the above is satisfactory for your purposes at this time. Should you have any questions or concerns, please contact either of the undersigned.

Respectfully submitted,

CM3 Environmental Inc.

Karl Bilyj, P.Geo
Senior Geoscientist

Bruce Cochrane, P.Geo., QP, EP
Principal

PROFESSIONAL GEOSCIENTIST
BRUCE D. COCHRANE
PRACTISING MEMBER
0809
ONTARIO

# FIGURES

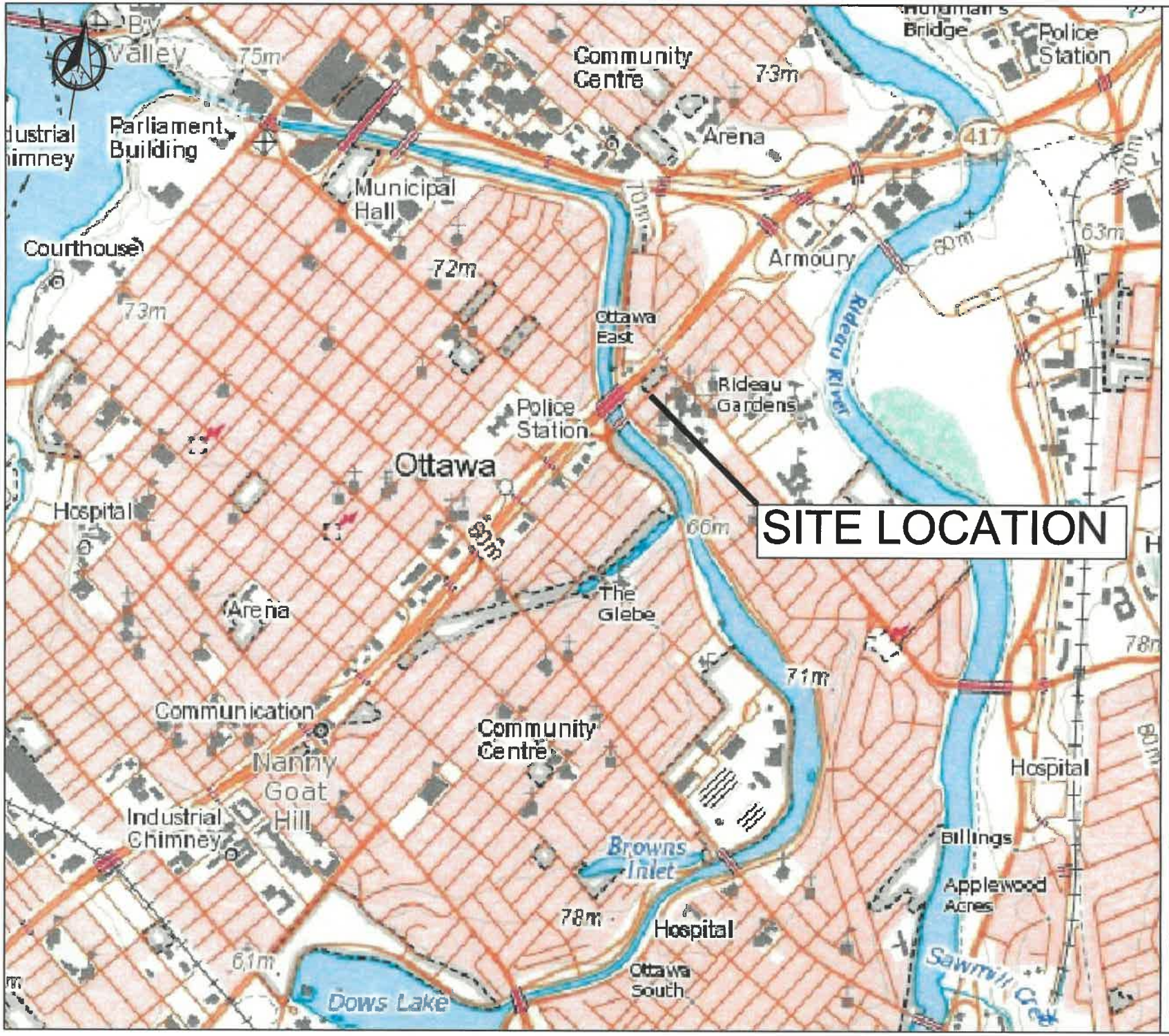
**Oil Spill Investigation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**Ms. Marilyn Steinberg**

**BDC1148**

**CM3 Environmental Inc.**
*2120 Robertson Road, Suite 208 Ottawa, Ontario, K2H 5Z1*




General Notes

cm3 environmental

CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1

MARILYN STEINBERG

22 HAWTHORNE AVENUE
OTTAWA, ON

SITE LOCATION

| | |
|---|---|
| Project: BDC1148 | Drawn by: MWM |
| Date: JANUARY 2017 | Reviewed by: BDC |
| Scale: AS SHOWN | Figure: 1 |


**General Notes**

PROPERTY LINE

MONITORING WELL LOCATION


cm3 environmental

CM3 ENVIRONMENTAL
2120 ROBERTSON ROAD
SUITE 208, OTTAWA, ON
K2H 5Z1


MARILYN STEINBERG

22 HAWTHORNE AVENUE
OTTAWA, ON

SITE LAYOUT

| | |
|---|---|
| Project: BDC1148 | Drawn by: MWM |
| Date: JANUARY 2017 | Revised by: BDC |
| Scale: AS SHOWN | Figure: 2 |

# TABLES

**Oil Spill Investigation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**Ms. Marilyn Steinberg**

**BDC1148**

**CM3 Environmental Inc.**
*2120 Robertson Road, Suite 208 Ottawa, Ontario, K2H 5Z1*

**Table 1:**
**Summary of Soil Analytical Results**
**BTEX and Petroleum Hydrocarbons F1 to F4 Fractions (ug/g or ppm)**
**22 Hawthorne Avenue, Ottawa**
**BDC1148**

| Sample ID | Date | Depth (m) | Benzene | Ethyl Benzene | Toluene | m,p-Xylene | o-Xylene | Xylene (Total) | PHC F1 (C6-C10) | PHC F2 (C10-C16) | PHC F3 (C16-C34) | PHC F4 (>C34) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MOECC Standards Table** | | **MDL (ug/g)** | 0.02 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 7 | 4 | 8 | 6 |
| Reg 153/04 (2011)-Table 3 Residential, coarse | | | 0.21 | 2 | 2.3 | nv | nv | 3.1 | 55 | 98 | 300 | 2800 |
| ***Borehole Samples*** | | | | | | | | | | | | |
| **MW1 SA4** | 22-Dec-16 | 1.8 to 2.4 | <0.02 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <7 | <4 | <8 | <6 |
| **MW2 SA2** | 22-Dec-16 | 0.6 to 1.2 | ***0.54*** | ***13.0*** | ***11.2*** | 49.6 | 27.1 | ***76.7*** | ***2,660*** | ***30,200*** | ***12,400*** | <120 |
| **MW2 SA6** | 22-Dec-16 | 3.1 to 3.7 | 0.02 | 0.73 | 0.63 | 2.84 | 1.62 | ***4.46*** | ***259*** | ***14,100*** | ***5,810*** | <60 |

**Notes:**

| | |
|---|---|
| ppm | - All concentrations provided in parts per million (micrograms per gram - ug/g) |
| "<" | - Less than detection limits indicated (refer to laboratory report) |
| nv | - No standard listed |
| MOECC Standards Table | - Standards from the Ontario Ministry of Environment and Climate Change (MOECC) Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the EPA (April 15, 2011) Reg 153/04 (2011)-Table 3 Residential, coarse |
| ***Bold / Italics*** | - Indicates exceedance of MOECC Table Standards. |

## Table 2:
## Summary of Groundwater Analytical Results
## BTEX and Petroleum Hydrocarbons F1 to F4 Fractions (ug/L or ppb)
## 22 Hawthorne Avenue, Ottawa
## BDC1148

| Sample ID | | Benzene | Ethyl Benzene | Toluene | m,p-Xylene | o-Xylene | Xylene (Total) | PHC F1 (C6-C10) | PHC F2 (C10-C16) | PHC F3 (C16-C34) | PHC F4 (>C34) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **MOECC Standards Table** | **MDL (ug/L)** | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 25 | 100 | 100 | 100 |
| Reg 153/04 (2011)-Table 3 Non-Potable Groundwater, coarse | **Date** | **44** | **2300** | **18000** | **nv** | **nv** | **4200** | **750** | **150** | **500** | **500** |
| ***Monitoring Well Samples*** | | | | | | | | | | | |
| **MW1** | 30-Dec-16 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <25 | <100 | <100 | <125 |
| **MW2** | 30-Dec-16 | *LPH* | *LPH* | *LPH* | *LPH* | *LPH* | *LPH* | ***6,750,000*** | ***2,670,000*** | <4610000 | - |

**Notes:**

| | |
|---|---|
| ppb | - All concentrations provided in parts per billion (micrograms per litre - µg/L) |
| "<" | - Less than detection limits indicated (refer to laboratory report) |
| nv | - No standard listed |
| MOECC Standards Table | - Standards from the Ontario Ministry of Environment and Climate Chnage (MOECC) Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the EPA Reg 153/04 (2011)-Table 3 Non-Potable Groundwater, coarse |
| ***Bold/italics*** | - Indicates exceedance of MOECC Table Standards. |

# APPENDIX A

**LABORATORY REPORTS**

**Oil Spill Investigation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**Ms. Marilyn Steinberg**

**BDC1148**

**CM3 Environmental Inc.**
*2120 Robertson Road, Suite 208 Ottawa, Ontario, K2H 5Z1*

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: 22 Hawthorne
Project: BDC1148
Custody: 31276

Report Date: 29-Dec-2016
Order Date: 22-Dec-2016

**Order #: 1652277**

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

| Paracel ID | Client ID |
|---|---|
| 1652277-01 | MW1 SA4 |
| 1652277-02 | MW2 SA2 |
| 1652277-03 | MW2 SA6 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 8260 - P&T GC-MS | 22-Dec-16 | 29-Dec-16 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 22-Dec-16 | 24-Dec-16 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 23-Dec-16 | 28-Dec-16 |
| Solids, % | Gravimetric, calculation | 28-Dec-16 | 28-Dec-16 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 29-Dec-2016
Order Date: 22-Dec-2016
**Project Description: BDC1148**

| | Client ID: | MW1 SA4 | MW2 SA2 | MW2 SA6 | - |
|---|---|---|---|---|---|
| | Sample Date: | 22-Dec-16 | 22-Dec-16 | 22-Dec-16 | - |
| | Sample ID: | 1652277-01 | 1652277-02 | 1652277-03 | - |
| | MDL/Units | Soil | Soil | Soil | - |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 67.8 | 91.1 | 69.9 | - |
| **Volatiles** | | | | | |
| Benzene | 0.02 ug/g dry | <0.02 | 0.54 | 0.02 | - |
| Ethylbenzene | 0.05 ug/g dry | <0.05 | 13.0 | 0.73 | - |
| Toluene | 0.05 ug/g dry | <0.05 | 11.2 | 0.63 | - |
| m,p-Xylenes | 0.05 ug/g dry | <0.05 | 49.6 | 2.84 | - |
| o-Xylene | 0.05 ug/g dry | <0.05 | 27.1 | 1.62 | - |
| Xylenes, total | 0.05 ug/g dry | <0.05 | 76.7 | 4.46 | - |
| Toluene-d8 | Surrogate | 119% | 110% | 104% | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 7 ug/g dry | <7 | 2660 | 259 | - |
| F2 PHCs (C10-C16) | 4 ug/g dry | <4 | 30200 | 14100 | - |
| F3 PHCs (C16-C34) | 8 ug/g dry | <8 | 12400 | 5810 | - |
| F4 PHCs (C34-C50) | 6 ug/g dry | <6 | <120 [1] | <60 [1] | - |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 29-Dec-2016
Order Date: 22-Dec-2016
**Project Description: BDC1148**

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g | | | | | | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g | | | | | | |
| F3 PHCs (C16-C34) | ND | 8 | ug/g | | | | | | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g | | | | | | |
| Ethylbenzene | ND | 0.05 | ug/g | | | | | | |
| Toluene | ND | 0.05 | ug/g | | | | | | |
| m,p-Xylenes | ND | 0.05 | ug/g | | | | | | |
| o-Xylene | ND | 0.05 | ug/g | | | | | | |
| Xylenes, total | ND | 0.05 | ug/g | | | | | | |
| *Surrogate: Toluene-d8* | *2.45* | | *ug/g* | | *76.6* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 29-Dec-2016
Order Date: 22-Dec-2016
**Project Description: BDC1148**

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g dry | ND | | | | 40 | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g dry | ND | | | | 30 | |
| F3 PHCs (C16-C34) | 33 | 8 | ug/g dry | 18 | | | 57.8 | 30 | QR-01 |
| F4 PHCs (C34-C50) | 34 | 6 | ug/g dry | 17 | | | 66.7 | 30 | QR-01 |
| **Physical Characteristics** | | | | | | | | | |
| % Solids | 64.8 | 0.1 | % by Wt. | 67.8 | | | 4.5 | 25 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g dry | ND | | | | 50 | |
| Ethylbenzene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| Toluene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| m,p-Xylenes | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| o-Xylene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| *Surrogate: Toluene-d8* | *2.27* | | *ug/g dry* | | *108* | *50-140* | | | |

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 216 | 7 | ug/g | | 108 | 80-120 | | | |
| F2 PHCs (C10-C16) | 131 | 4 | ug/g | ND | 130 | 60-140 | | | |
| F3 PHCs (C16-C34) | 330 | 8 | ug/g | 18 | 149 | 60-140 | | | QM-06 |
| F4 PHCs (C34-C50) | 224 | 6 | ug/g | 17 | 149 | 60-140 | | | QM-06 |
| **Volatiles** | | | | | | | | | |
| Benzene | 2.89 | 0.02 | ug/g | | 72.2 | 60-130 | | | |
| Ethylbenzene | 4.25 | 0.05 | ug/g | | 106 | 60-130 | | | |
| Toluene | 4.05 | 0.05 | ug/g | | 101 | 60-130 | | | |
| m,p-Xylenes | 8.11 | 0.05 | ug/g | | 101 | 60-130 | | | |
| o-Xylene | 4.18 | 0.05 | ug/g | | 105 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *2.68* | | *ug/g* | | *83.7* | *50-140* | | | |

## Qualifier Notes:

***Sample Qualifiers :***

1 : Elevated detection limit due to dilution required because of high target analyte concentration.

***QC Qualifiers :***

QM-06 : Due to noted non-homogeneity of the QC sample matrix, the spike recoveries were out side the accepted range. Batch data accepted based on other QC.

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

## Sample Data Revisions

None

## Work Order Revisions / Comments:

None

## Other Report Notes:

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

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD. | TRUSTED. RESPONSIVE. RELIABLE.

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com
www.paracellabs.com

**Chain of Custody** (Lab Use Only)
№ 31276

Page 1 of 1

| | | | |
|---|---|---|---|
| Client Name: CM3 | Project Reference: 22 Hawthorne | **Turnaround Time:** | |
| Contact Name: Bruce | Quote #: | ☐ 1 Day | ☐ 3 Day |
| Address: 2120 robertson rd | PO #: BDC 1148 | ☐ 2 Day | ☒ Regular |
| Telephone: 613 979 2093 | Email Address: Bruce@cm3environmental.com | Date Required: | |

Criteria: ☐ O. Reg. 153/04 (As Amended) Table 2 ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ☐ Other:

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

**Required Analyses**

**Paracel Order Number:** 1652277

| | Sample ID/Location Name | Matrix | Air Volume | # of Containers | Sample Taken: Date | Sample Taken: Time | BTEX PHC F1-F4 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | MW1 SA4 | S | | 2 | Dec 22 | | X | | 120mL + Meoh | | | | | | | |
| 2 | MW2 SA2 | S | | 2 | ↓ | | X | | ↓ | | | | | | | |
| 3 | MW2 SA6 | S | | 2 | ↓ | | X | | ↓ | | | | | | | |
| 4 | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | |

Comments:

Method of Delivery: Walk

| | | | |
|---|---|---|---|
| Relinquished By (Sign): | Received by Driver/Depot: | Received at Lab: SUNITOKEN DONNA | Verified By: Rachel Sinnett |
| Relinquished By (Print): Scenery Cochrane | Date/Time: Dec 22 12:05pm | Date/Time: DEC 22, 2016 04:34 | Date/Time: Dec 22/16 |
| Date/Time: Dec 22 2016 | Temperature: 4.5°C | Temperature: 10.9 °C | pH Verified ☐ By: N/A |

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: 22 Hawthorne
Project: BDC1048
Custody: 32030

Report Date: 4-Jan-2017
Order Date: 30-Dec-2016

**Order #: 1653103**

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

| Paracel ID | Client ID |
|---|---|
| 1653103-01 | MW1 |
| 1653103-02 | MW2 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 04-Jan-2017
Order Date: 30-Dec-2016
**Project Description: BDC1048**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 624 - P&T GC-MS | 30-Dec-16 | 30-Dec-16 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 30-Dec-16 | 30-Dec-16 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 3-Jan-17 | 3-Jan-17 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 04-Jan-2017
Order Date: 30-Dec-2016
**Project Description: BDC1048**

| | Client ID: | MW1 | MW2 | - | - |
|---|---|---|---|---|---|
| | Sample Date: | 30-Dec-16 | 30-Dec-16 | - | - |
| | Sample ID: | 1653103-01 | 1653103-02 | - | - |
| | MDL/Units | Ground Water | Ground Water | - | - |
| **Volatiles** | | | | | |
| Benzene | 0.5 ug/L | <0.5 | - | - | - |
| Ethylbenzene | 0.5 ug/L | <0.5 | - | - | - |
| Toluene | 0.5 ug/L | <0.5 | - | - | - |
| m,p-Xylenes | 0.5 ug/L | <0.5 | - | - | - |
| o-Xylene | 0.5 ug/L | <0.5 | - | - | - |
| Xylenes, total | 0.5 ug/L | <0.5 | - | - | - |
| Toluene-d8 | Surrogate | 99.1% | - | - | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 25 ug/L | <25 | - | - | - |
| F2 PHCs (C10-C16) | 100 ug/L | <100 | 67500000 [1] [3] | - | - |
| F3 PHCs (C16-C34) | 100 ug/L | <100 | 26700000 [1] [3] | - | - |
| F4 PHCs (C34-C50) | 100 ug/L | <100 | <4610000 [1] [2] [3] | - | - |
| F1 + F2 PHCs | 125 ug/L | <125 | - | - | - |
| F1 + F2 PHCs | 4610000 ug/L | - | 67500000 | - | - |
| F3 + F4 PHCs | 200 ug/L | <200 | - | - | - |
| F3 + F4 PHCs | 9230000 ug/L | - | 26700000 | - | - |

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 25 | ug/L | | | | | | |
| F2 PHCs (C10-C16) | ND | 100 | ug/L | | | | | | |
| F3 PHCs (C16-C34) | ND | 100 | ug/L | | | | | | |
| F4 PHCs (C34-C50) | ND | 100 | ug/L | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.5 | ug/L | | | | | | |
| Ethylbenzene | ND | 0.5 | ug/L | | | | | | |
| Toluene | ND | 0.5 | ug/L | | | | | | |
| m,p-Xylenes | ND | 0.5 | ug/L | | | | | | |
| o-Xylene | ND | 0.5 | ug/L | | | | | | |
| Xylenes, total | ND | 0.5 | ug/L | | | | | | |
| *Surrogate: Toluene-d8* | *79.0* | | *ug/L* | | *98.7* | *50-140* | | | |

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 25 | ug/L | ND | | | | 30 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.5 | ug/L | ND | | | | 30 | |
| Ethylbenzene | ND | 0.5 | ug/L | ND | | | | 30 | |
| Toluene | ND | 0.5 | ug/L | ND | | | | 30 | |
| m,p-Xylenes | ND | 0.5 | ug/L | ND | | | | 30 | |
| o-Xylene | ND | 0.5 | ug/L | ND | | | | 30 | |
| *Surrogate: Toluene-d8* | *79.9* | | *ug/L* | | *99.8* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 04-Jan-2017
Order Date: 30-Dec-2016
**Project Description: BDC1048**

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 1840 | 25 | ug/L | | 91.8 | 68-117 | | | |
| F2 PHCs (C10-C16) | 1310 | 100 | ug/L | | 72.8 | 60-140 | | | |
| F3 PHCs (C16-C34) | 2940 | 100 | ug/L | | 79.0 | 60-140 | | | |
| F4 PHCs (C34-C50) | 1810 | 100 | ug/L | | 73.1 | 60-140 | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 34.1 | 0.5 | ug/L | | 85.2 | 60-130 | | | |
| Ethylbenzene | 39.8 | 0.5 | ug/L | | 99.6 | 60-130 | | | |
| Toluene | 38.1 | 0.5 | ug/L | | 95.3 | 60-130 | | | |
| m,p-Xylenes | 77.7 | 0.5 | ug/L | | 97.1 | 60-130 | | | |
| o-Xylene | 39.9 | 0.5 | ug/L | | 99.8 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *74.6* | | *ug/L* | | *93.3* | *50-140* | | | |

**Qualifier Notes:**

***Sample Qualifiers :***

1 : Elevated Reporting Limits due to limited sample volume.

2 : Elevated detection limit due to dilution required because of high target analyte concentration.

3 : Free product was observed in the sample container.

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

BTEX/PHC F1 could not be analyzed on sample MW-2 due to the nature of the matrix. Sample was submitted in a VOC vial which contained pure product.

**Other Report Notes:**

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD. | TRUSTED. RESPONSIVE. RELIABLE.

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com
www.paracellabs.com

# Chain of Custody
(Lab Use Only)
№ 32030

Page 1 of 1

| | | |
|---|---|---|
| Client Name: CM3 | Project Reference: 22 Hawthorne | **Turnaround Time:** |
| Contact Name: Bruce | Quote #: | ☐ 1 Day ☐ 3 Day |
| Address: 220 roberton | PO #: BOC1048 | ☐ 2 Day ☒ Regular |
| Telephone: 613 979 2693 | Email Address: bruce@cm3environmental.com | Date Required: |

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

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

**Required Analyses**

Paracel Order Number: 1653103

| | Sample ID/Location Name | Matrix | Air Volume | # of Containers | Sample Taken: Date | Sample Taken: Time | BTEX PHC-F | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | mw1 | GW | | 3 | Dec 30 | | X | | | | | | | | | | | X |
| 2 | mw2 | GW | | 3 | Dec 30 | | X | | | | | | | | | | | X |
| 3 | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | |

Comments: * ALL PHC = NON PRESERVE.

Method of Delivery: Walk in

| | | | |
|---|---|---|---|
| Relinquished By (Sign): | Received by Driver/Depot: | Received at Lab: | Verified By: Rachel Sibert |
| Relinquished By (Print): Spencer Cochrane | Date/Time: | Date/Time: Dec 30/16 | Date/Time: Dec 30/16 |
| Date/Time: Dec 30 2016 | Temperature: °C | Temperature: 9.2 °C 10:27a | pH Verified ☒ By: N/A 11:22 |

# APPENDIX B

**BOREHOLE LOGS**

**Oil Spill Investigation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**Ms. Marilyn Steinberg**

**BDC1148**

**CM3 Environmental Inc.**
*2120 Robertson Road, Suite 208 Ottawa, Ontario, K2H 5Z1*

# BOREHOLE LOG

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

BOREHOLE NO: MW1
SURFACE ELEVATION:

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000 | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | -1.0 |
| 0 | | | | | Ground Surface | | | | | 0.0 |
| | | | | | **Topsoil** silt clay sand orangic rich, black, moist | | | | | |
| | | MW1 SA1 | | | **Sand** silty sand, laminated, brown, dry | | | | bentonite seal | |
| | | | | | | | | | 32 mm solid PVC pipe | |
| 1 | | MW1 SA2 | | | | | | | | 1.0 |
| | | MW1 SA3 | | | moist | | | | | |
| 2 | | MW1 SA4 | | | **Clay** clay, grey, moist | | | | | 2.0 |
| | | | | | wet | | | | | |
| | | MW1 SA5 | | | | | | | (not surveyed) | |
| 3 | | | | | | | | | silica sand | 3.0 |
| | | MW1 SA6 | | | | | | | 32 mm 010 slot PVC pipe | |
| 4 | | MW1 SA7 | | | | | | | | 4.0 |
| | | | | | End of borehole at 4.2 m | | | | | |
| | | | | | Groundwater Information: Depth to groundwater from TOP = 3.47 m (12-30-16) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

Notes: SPLIT SPOON

DRILL DATE: December 22, 2016 LOGGED BY: SDC

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW2
SURFACE ELEVATION:

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1 10 100 1000 | | | | |
| -1 | | | | | | | | | stickup, jplug | -1.0 |
| 0 | | | | | Ground Surface | | | | | 0.0 |
| | | MW2 SA1 | | | **Topsoil** silt clay sand orangic rich, black, moist | 170 | | | bentonite seal | |
| | | | | | **Sand** silty sand, laminated, brown, dry | | | | 32 mm solid PVC pipe | |
| 1 | | MW2 SA2 | | | | 180 | | | | 1.0 |
| | | MW2 SA3 | | | | 110 | | | | |
| | | | | | moist | | | | | |
| 2 | | MW2 SA4 | | | | 110 | | | | 2.0 |
| | | | | | **Clay** clay, grey, moist wet | | | | | |
| | | MW2 SA5 | | | | 110 | | | | |
| 3 | | | | | | | | | silica sand | 3.0 |
| | | | | | | | | | (not surveyed) | |
| | | MW2 SA6 | | | | 190 | | | 32 mm 010 slot PVC pipe | |
| 4 | | MW2 SA7 | | | | 110 | | | | 4.0 |
| | | | | | End of borehole at 4.3 m | | | | | |
| | | | | | Groundwater Information: Depth to groundwater from TOP = 3.77 m (12-30-16) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

Notes: SPLIT SPOON

DRILL DATE: December 22, 2016 LOGGED BY: SDC

# APPENDIX C

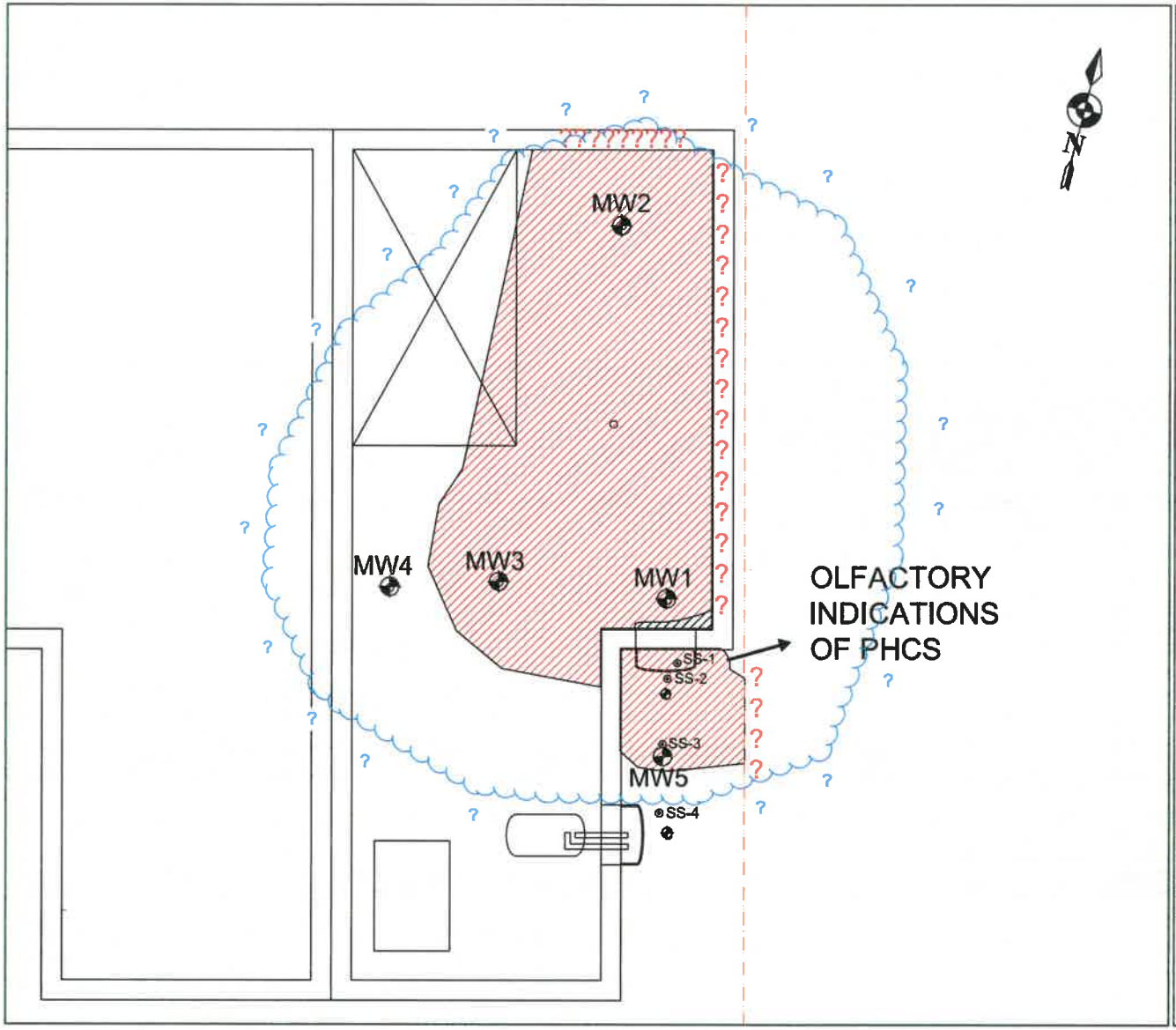
## KCI LIMITED SITE ASSESSMENT – DATA

**Oil Spill Delineation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**BDC1148**

| TABLE 1 | | CLIENT: Kanellos Consulting Inc. | | | | | |
|---|---|---|---|---|---|---|---|
| PARACEL LABORATORIES LTD. | | ATTENTION: Alex Fisher | | | | | |
| WORKORDER: 1653057 | | PROJECT: C1612083 | | | | | |
| REPORT DATE: 01/03/2017 | | REFERENCE: Preferred Rebate | | | | | |
| | | | | | | | |
| **Parameter** | **Units** | **MDL** | **Regulation** | **Sample** | | | |
| | | | | **SS-1 S.WINDOW WELL 1653057-01** | **SS-2 0.6m from SOUTH WALL 1653057-02** | **SS-3 1.5m from SOUTH WALL 1653057-03** | **SS-4 ADJACENT TO E. WINDOW WELL 1653057-04** |
| **Sample Date (m/d/y)** | | **Reg 153/04 (2011)-Table 3 Residentia** | | **12/28/2016** | **12/28/2016** | **12/28/2016** | **12/28/2016** |
| ***Physical Characteristics*** | | | | | | | |
| % Solids | % by Wt. | 0.1 | | 60.9 | 73.0 | 72.8 | 74.0 |
| ***Volatiles*** | | | | | | | |
| Benzene | ug/g dry | 0.02 | 0.21 ug/g dry | ND (0.02) | 0.10 | ND (0.02) | ND (0.02) |
| Ethylbenzene | ug/g dry | 0.05 | 2 ug/g dry | 0.20 | 1.92 | ND (0.05) | ND (0.05) |
| Toluene | ug/g dry | 0.05 | 2.3 ug/g dry | 0.20 | 1.49 | ND (0.05) | ND (0.05) |
| m/p-Xylene | ug/g dry | 0.05 | | ND (0.05) | 10.9 | 0.22 | ND (0.05) |
| o-Xylene | ug/g dry | 0.05 | | 1.75 | 11.8 | 0.55 | ND (0.05) |
| Xylenes, total | ug/g dry | 0.05 | 3.1 ug/g dry | 1.75 | 22.7 | 0.76 | ND (0.05) |
| ***Hydrocarbons*** | | | | | | | |
| F1 PHCs (C6-C10) | ug/g dry | 7 | 55 ug/g dry | 126 | 438 | 20 | ND (7) |
| F2 PHCs (C10-C16) | ug/g dry | 4 | 98 ug/g dry | 21600 | 14100 | 1030 | 14 |
| F3 PHCs (C16-C34) | ug/g dry | 8 | 300 ug/g dry | 9770 | 6570 | 928 | 397 |
| F4 PHCs (C34-C50) | ug/g dry | 6 | 2800 ug/g dry | ND (60) | ND (60) | 40 | 189 |




LEGEND

- EXTENT OF EXCAVATION
- MONITORING WELL
- SOIL SAMPLE WALL, ANALYZED
- SOIL SAMPLE FLOOR, ANALYZED
- SOIL SAMPLE IN EXCESS OF MOE REG 153/04 TABLE 3 CRITERIA
- VISUAL STAINING ON CONCRETE FLOOR SLAB
- PROPERTY LINE *(APPROX.)*
- CONFIRMED SUBSURFACE SOIL IMPACTS
- PRESENCE OF HYDROCARBONS ON GROUNDWATER

**UTILITIES**

- ELECTRICAL
- WATER
- GAS
- STORM SEWER

**NOTES:**

All UNITS ARE METRIC

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN

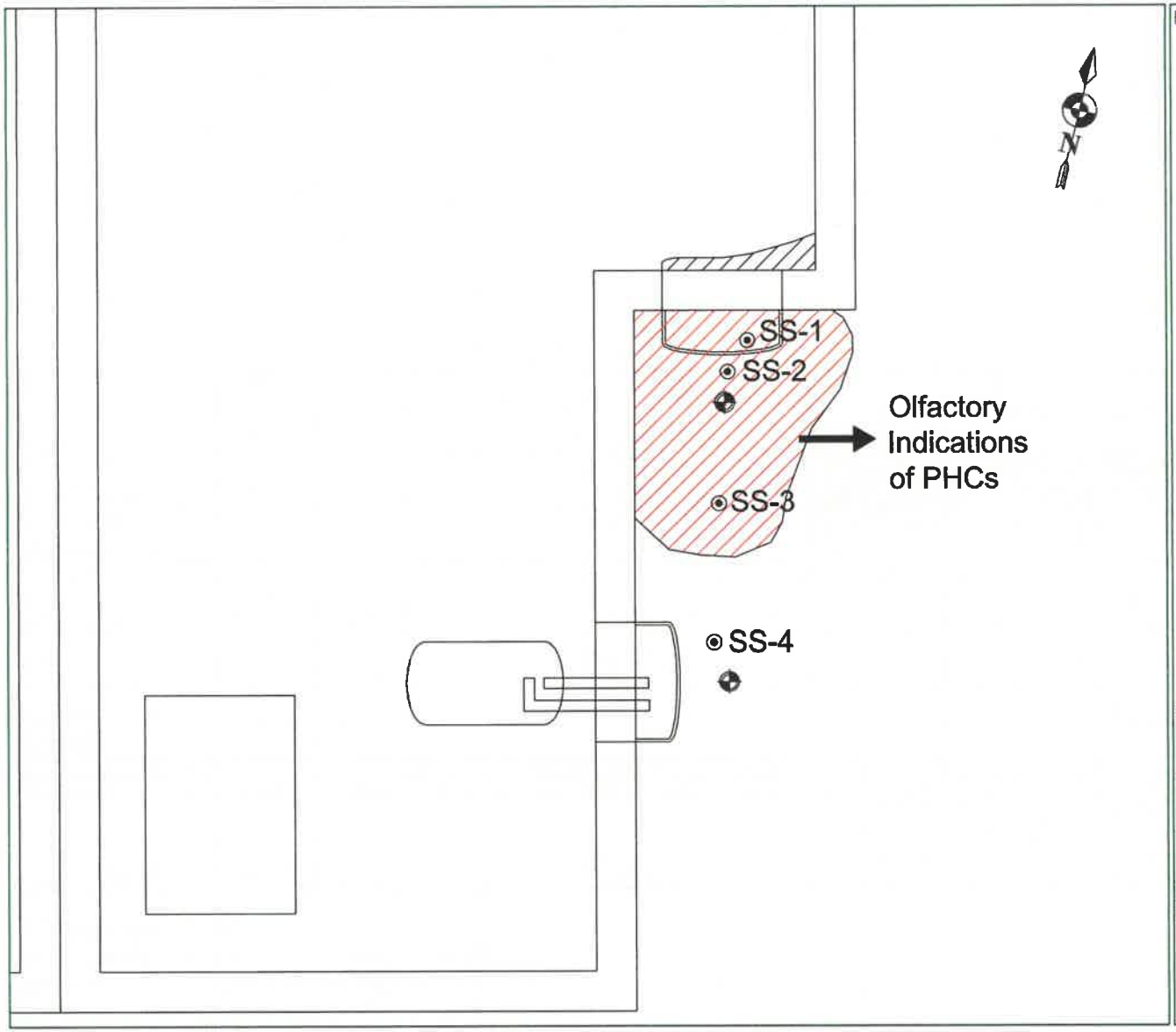
22 HAWTHORNE AVENUE, OTTAWA, ON

**FUEL OIL LEAK - REMEDIATION AND ASSESSMENT**

**SITE PLAN**

| | | | | | |
|---|---|---|---|---|---|
| DATE | 19/1/2017 | SCALE | AS SHOWN | DRAWING No. | 2 |
| FILE NAME | C1612083-2.DWG | JOB NO. | C1612083 | | |

KANELLOS CONSULTING INC




LEGEND

- EXTENT OF EXCAVATION
- MONITORING WELL
- SOIL SAMPLE WALL, ANALYZED
- SOIL SAMPLE FLOOR, ANALYZED
- SOIL SAMPLE IN EXCESS OF MOE REG 153/04 TABLE 3 CRITERIA
- VISUAL STAINING ON CONCRETE FLOOR SLAB
- PROPERTY LINE *(APPROX.)*
- TREES AND OR VEGETATION

**UTILITIES**

- ELECTRICAL
- WATER
- GAS
- STORM SEWER

**NOTES:**

All UNITS ARE METRIC

STORM SEWER LOCATION IS BASED ON PROVIDED LOCATES AND REPORTED DIAMETER

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN

22 HAWTHORNE AVENUE, OTTAWA, ON

# FUEL OIL LEAK - REMEDIATION AND ASSESSMENT

## SITE PLAN

| | | | | |
|---|---|---|---|---|
| DATE | 28/12/2018 | SCALE | AS SHOWN | DRAWING No. 1 |
| FILE NAME | C1812083-1.DWG | JOB NO. | C1812083 | |

KANELLOS CONSULTING INC
www.kanellosconsulting.com

| Groundwater Results CLIENT: Kanellos Consulting Inc. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PARACEL LABORATORIES LTD. | ATTENTION: Alex Fisher | | | | | | | |
| WORKORDER: 1703500 | PROJECT: C1612083 | | | | | | | |
| REPORT DATE: 01/24/2017 | | | | | | | | |
| | | | | | | | | |
| **Parameter** | **Units** | **MDL** | **Regulation** | **Sample** | | | | |
| | | | | **MW1 1703500-01** | **MW2 1703500-02** | **MW3 1703500-03** | **MW4 1703500-04** | **MW5 1703500-05** |
| **Sample Date (m/d/y)** | | | **Reg 153/04 (2011)-Table 3 Non-Potable Gr** | **01/19/2017** | **01/19/2017** | **01/19/2017** | **01/19/2017** | **01/19/2017** |
| ***Volatiles*** | | | | | | | | |
| Benzene | ug/L | 0.5 | 44 ug/L | 18.2 | ND (0.5) | 62.5 | 0.7 | ND (0.5) |
| Ethylbenzene | ug/L | 0.5 | 2300 ug/L | 33.1 | ND (0.5) | 79.2 | 2.3 | 0.6 |
| Toluene | ug/L | 0.5 | 18000 ug/L | 82.7 | 0.5 | 200 | 3.3 | ND (0.5) |
| m/p-Xylene | ug/L | 0.5 | | 236 | 11.1 | 286 | 10.9 | 28.6 |
| o-Xylene | ug/L | 0.5 | | 94.6 | 1.7 | 156 | 6.5 | 0.8 |
| Xylenes, total | ug/L | 0.5 | 4200 ug/L | 330 | 12.8 | 443 | 17.4 | 29.4 |
| ***Hydrocarbons*** | | | | | | | | |
| F1 PHCs (C6-C10) | ug/L | 25 | 750 ug/L | 756 | 60 | 803 | 95 | 121 |
| F2 PHCs (C10-C16) | ug/L | 100 | 150 ug/L | 195000 | 6080 | 994000 | 157000 | 10700 |
| F3 PHCs (C16-C34) | ug/L | 100 | 500 ug/L | 88500 | 3300 | 443000 | 70000 | 4680 |
| F4 PHCs (C34-C50) | ug/L | 100 | 500 ug/L | ND (1000) | ND (100) | ND (5000) | ND (1000) | ND (100) |
| F1 + F2 PHCs | ug/L | 1020 | | 196000 | 6140 | 995000 | 157000 | 10800 |
| F3 + F4 PHCs | ug/L | 10000 | | 88500 | 3300 | 443000 | 70000 | 4680 |

| Soil Results Jan 2017 | CLIENT: Kanellos Consulting Inc. |
|---|---|
| PARACEL LABORATORIES LTD. | ATTENTION: Alex Fisher |
| WORKORDER: 1702202 | PROJECT: C1612083 |
| REPORT DATE: 01/17/2017 | |

| Parameter | Units | MDL | Regulation | Sample | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BH1 SS1 1702202-01 | BH2 SS2 1702202-02 | BH3 SS2 1702202-03 | BH4 SS1 1702202-04 | BH5 SS2 1702202-05 | BH6 SS3 1702202-06 | BH6 SS6 1702202-07 |
| Sample Date (m/d/y) | | | Reg 153/04 (2011)- | 01/10/2017 | 01/10/2017 | 01/10/2017 | 01/11/2017 | 01/11/2017 | 01/11/2017 | 01/11/2017 |
| ***Physical Characteristics*** | | | | | | | | | | |
| % Solids | % by Wt. | 0.1 | | 70.4 | 66.1 | 59.2 | 72.7 | 59.4 | 86.7 | 63.6 |
| ***Volatiles*** | | | | | | | | | | |
| Benzene | ug/g dry | 0.02 | 0.21 ug/g dry | ND (0.02) | ND (0.02) | ND (0.02) | ND (0.02) | ND (0.02) | ND (0.02) | ND (0.02) |
| Ethylbenzene | ug/g dry | 0.05 | 2 ug/g dry | 0.25 | ND (0.05) | ND (0.05) | ND (0.05) | ND (0.05) | ND (0.05) | ND (0.05) |
| Toluene | ug/g dry | 0.05 | 2.3 ug/g dry | 0.28 | ND (0.05) | ND (0.05) | ND (0.05) | ND (0.05) | ND (0.05) | ND (0.05) |
| m/p-Xylene | ug/g dry | 0.05 | | 1.20 | ND (0.05) | 0.20 | ND (0.05) | ND (0.05) | ND (0.05) | ND (0.05) |
| o-Xylene | ug/g dry | 0.05 | | 0.60 | ND (0.05) | 0.11 | ND (0.05) | ND (0.05) | ND (0.05) | ND (0.05) |
| Xylenes, total | ug/g dry | 0.05 | 3.1 ug/g dry | 1.80 | ND (0.05) | 0.32 | ND (0.05) | ND (0.05) | 0.06 | ND (0.05) |
| ***Hydrocarbons*** | | | | | | | | | | |
| F1 PHCs (C6-C10) | ug/g dry | 7 | 55 ug/g dry | 168 | 11 | 33 | 23 | ND (7) | 76 | 33 |
| F2 PHCs (C10-C16) | ug/g dry | 4 | 98 ug/g dry | 2760 | 255 | 313 | 197 | 40 | 1410 | 364 |
| F3 PHCs (C16-C34) | ug/g dry | 8 | 300 ug/g dry | 1310 | 163 | 187 | 112 | 41 | 799 | 189 |
| F4 PHCs (C34-C50) | ug/g dry | 6 | 2800 ug/g dry | ND (6) | ND (6) | ND (6) | ND (6) | ND (6) | ND (6) | ND (6) |

# APPENDIX D

## SITE PHOTOGRAPHS

**Oil Spill Delineation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**BDC1148**

| **APPENDIX D**<br>PHOTOGRAPHIC RECORD | |
|---|---|
| **Client:** Marilyn Steinberg | **Job Number:** KB1017 |
| **Site Name:** 24 Hawthorne | **Location:** 24 Hawthorne Avenue, Ottawa |
| **Photographer:** BDC, SDC, KS | **Date:** December 15, 2016 to April 12, 2017 |

**Photograph 1:** View front of 20 and 22 Hawthorne on property looking south west.

**Photograph 2:** View of south east corner of 22 Hawthorn at location of AST.

| **APPENDIX D**<br>PHOTOGRAPHIC RECORD | |
|---|---|
| **Client:** Marilyn Steinberg | **Job Number:** KB1017 |
| **Site Name:** 24 Hawthorne | **Location:** 24 Hawthorne Avenue, Ottawa |
| **Photographer:** BDC, SDC, KS | **Date:** December 15, 2016 to April 12, 2017 |

**Photograph 3:** View of shared laneway and east side 22 Hawthorne and west side of 24 Hawthorne.

**Photograph 4:** Installation of MW1 by CM3 in December 2016.

| **APPENDIX D**<br>PHOTOGRAPHIC RECORD | |
|---|---|
| **Client:** Marilyn Steinberg | **Job Number:** KB1017 |
| **Site Name:** 24 Hawthorne | **Location:** 24 Hawthorne Avenue, Ottawa |
| **Photographer:** BDC, SDC, KS | **Date:** December 15, 2016 to April 12, 2017 |

**Photograph 5**: View of south east corner of 22 Hawthorne at MW1, MW2 and KCMW5.

**Photograph 6**: View of front (north side) of 20 and 22 Hawthorne during the installation of MW13.

| **APPENDIX D**<br>PHOTOGRAPHIC RECORD | |
|---|---|
| **Client:** Marilyn Steinberg | **Job Number:** KB1017 |
| **Site Name:** 24 Hawthorne | **Location:** 24 Hawthorne Avenue, Ottawa |
| **Photographer:** BDC, SDC, KS | **Date:** December 15, 2016 to April 12, 2017 |

**Photograph 7**: East side of 22 Hawthorne and hydro-vacuumed hole for BH14.

**Photograph 8**: View of east side of 22 Hawthorne at BH 14 and BH15.

| **APPENDIX D**<br>PHOTOGRAPHIC RECORD | |
|---|---|
| **Client:** Marilyn Steinberg | **Job Number:** KB1017 |
| **Site Name:** 24 Hawthorne | **Location:** 24 Hawthorne Avenue, Ottawa |
| **Photographer:** BDC, SDC, KS | **Date:** December 15, 2016 to April 12, 2017 |

**Photograph 9**: View inside 20 Hawthorne at shared sewer line exiting 20 Hawthorne.

**Photograph 10**: View of interior of basement 20 Hawthorne.

# APPENDIX E

## BOREHOLE LOGS

**Oil Spill Delineation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**BDC1148**

# BOREHOLE LOG

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

BOREHOLE NO: MW1
SURFACE ELEVATION: 100.35 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 / 10 / 100 / 1000 | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | MW1 SA1 | | | **Topsoil** silt clay sand orangic rich, black, moist | 0 | | | bentonite seal | |
| | | | | | **Sand** silty sand, laminated, brown, dry | | | | 32 mm solid PVC pipe | 100 |
| 1 | | MW1 SA2 | | | | 0 | | | | |
| | | MW1 SA3 | | | | 0 | | GW = 1.52 mbg (April 12, 2017) | | 99 |
| | | | | | moist | | | | | |
| 2 | | MW1 SA4 | | | **Clay** clay, grey, moist | | | | | 98 |
| | | | | | wet at 2.4m | | | | | |
| | | MW1 SA5 | | | | 0 | | | | |
| 3 | | | | | | | | | silica sand | |
| | | MW1 SA6 | | | | 0 | | | 32 mm 010 slot PVC pipe | 97 |
| | | MW1 SA7 | | | | 0 | | | | |
| 4 | | | | | End of borehole at 4.2 m | | | | | |

Groundwater Information:
Depth to groundwater from TOP = 2.02 m (April 12, 2017)

DRILLING METHOD: Pionjar Portable Drilling

Notes: SPLIT SPOON

DRILL DATE: 22 December 2016 LOGGED BY: SDC

# BOREHOLE LOG

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

BOREHOLE NO: MW2
SURFACE ELEVATION: 100.31 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | MW2 SA1 | | | **Topsoil**<br>silt clay sand orangic rich, black, moist<br>**Sand**<br>silty sand, laminated, brown, dry | 70 | | | bentonite seal<br>32 mm solid PVC pipe | 100 |
| 1 | | MW2 SA2 | | | | 180 | | | | |
| | | MW2 SA3 | | | | 110 | | ▼ | GW = 1.60 mbg (5mm LPH, April 12, 2017) | 99 |
| | | | | | moist | | | | | |
| 2 | | MW2 SA4 | | | | 110 | | | | 98 |
| | | | | | **Clay**<br>clay, grey, moist<br>wet at 2.4m | | | | | |
| | | MW2 SA5 | | | | 110 | | | | |
| 3 | | | | | | | | | silica sand | |
| | | MW2 SA6 | | | | 190 | | | | 97 |
| | | | | | | | | | 32 mm 010 slot PVC pipe | |
| 4 | | MW2 SA7 | | | | 110 | | | | |
| | | | | | End of borehole at 4.3 m<br><br>Groundwater Information:<br>Depth to groundwater from TOP = 2.13 m (5mm LPH, April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 22 December 2016 LOGGED BY: SDC

Notes: SPLIT SPOON

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW3
SURFACE ELEVATION: 100.03 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1 10 100 1000 | | | | |
| -1 | | | | | | | | | | 101 |
| | | | | | Ground Surface | | | | | |
| 0 | | MW3 SA1 | | | **Asphalt** | 0 | | | roadbox, jplug, cement bentonite seal | 100 |
| | | | | | **Gravel** gravel, some sand (fill), frost, grey and brown, dry | | | | | |
| | | MW3 SA2 | | | **Construction Debris** gravel and sand, pieces of brick and coal, black and red, dry | 0 | | | | |
| | | | | | **Sand** fine to medium sand, compact, laminated, brown, moist layers of light and dark brown | | | | | |
| 1 | | MW3 SA3 | | | iron staining (oxidation), heavy at transition from sand to clay | 0 | | | | 99 |
| | | MW3 SA4 | | | | 5 | | | silica sand | |
| 2 | | | | | | | | ▼ | GW = 2.00 mbg (April 12, 2017) | 98 |
| | | MW3 SA5 | | | **Clay** clay, some silt, firm, low to medium plasticity, grey, moist | 10 | | | | |
| | | MW3 SA6 | | | wet at 2.9m soft, high plasticity | 15 | | | 32 mm 010 slot PVC pipe | 97 |
| | | MW3 SA7 | | | | 10 | | | | |
| 4 | | MW3 SA8 | | | | 15 | | | | 96 |
| | | | | | End of borehole at 4.6 m | | | | | |
| | | | | | Groundwater Information: Depth to groundwater from TOP = 1.93 m (April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 20 March 2017 LOGGED BY: KS

Notes: GRAB SAMPLE
SPLIT SPOON

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW4
SURFACE ELEVATION: 100.08 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000 | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | MW4 SA1 | | | **Asphalt** | 0 | | | | |
| | | | | | **Gravel**<br>gravel, some sand (fill), frost, grey and brown, dry | | | | | |
| | | MW4 SA2 | | | **Construction Debris**<br>gravel and sand, pieces of brick and coal, black and red, dry | 0 | | | bentonite seal | 100 |
| | | | | | **Sand**<br>fine to medium sand, some silt, compact, laminated, brown, moist | | | | | |
| 1 | | MW4 SA3 | | | layers of light and dark brown | 0 | | | 32 mm solid PVC pipe | 99 |
| | | | | | iron staining (oxidation), heavy at transition from sand to clay | | | | | |
| | | MW4 SA4 | | | | 10 | | | GW = 1.71 mbg (April 12, 2017) | |
| 2 | | | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, grey, moist | | | | | 98 |
| | | MW4 SA5 | | | | 5 | | | | |
| | | MW4 SA6 | | | wet at 3.1m<br>soft, high plasticity | 5 | | | silica sand | 97 |
| 3 | | | | | | | | | | |
| | | MW4 SA7 | | | | 15 | | | | |
| 4 | | | | | | | | | 32 mm 010 slot PVC pipe | 96 |
| | | MW4 SA8 | | | | 15 | | | | |
| | | | | | End of borehole at 4.6 m | | | | | |
| | | | | | Groundwater Information:<br>Depth to groundwater from TOP = 2.46 m (April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 1 March 2009 LOGGED BY: KS

Notes: GRAB SAMPLE
SPLIT SPOON

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW5
SURFACE ELEVATION: 100.28 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 / 10 / 100 / 1000 | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | MW5 SA1 | | | **Topsoil**<br>topsoil and gravel, some sand (fill), frost, brown, dry | | | | | |
| | | MW5 SA2 | | | **Construction Debris**<br>gravel and sand, pieces of brick and coal, black and red, dry<br>**Sand**<br>fine to medium sand, some silt, loose to compact at depth, laminated, brown, moist | | | | bentonite seal | 100 |
| 1 | | MW5 SA3 | | | layers of light and dark brown<br><br>iron staining (oxidation), heavy at transition from sand to clay | | | | 32 mm solid PVC pipe<br><br>GW = 1.67 mbg (April 12, 2017) | 99 |
| | | MW5 SA4 | | | | | | | | |
| 2 | | | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, grey, moist | | | | | 98 |
| | | MW5 SA5 | | | | | | | | |
| 3 | | MW5 SA6 | | | wet at 3.1m<br>soft, high plasticity | | | | silica sand | 97 |
| | | MW5 SA7 | | | | | | | | |
| 4 | | MW5 SA8 | | | | | | | 32 mm 010 slot PVC pipe | 96 |
| | | | | | End of borehole at 4.6 m<br><br>Groundwater Information:<br>Depth to groundwater from TOP = 2.03 m (April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 21 March 2017 LOGGED BY: KS

Notes: GRAB SAMPLE
SPLIT SPOON

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW6
SURFACE ELEVATION: 100.31 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000 | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | MW6 SA1 | | | **Topsoil**<br>topsoil and gravel, some sand (fill), frost, brown, dry | | | | | |
| | | MW6 SA2 | | | **Construction Debris**<br>gravel and sand, pieces of brick and coal, black and red, dry<br>**Sand**<br>fine to medium sand, some silt, compact, laminated, brown, moist | | | | bentonite seal | 100 |
| 1 | | MW6 SA3 | | | layers of light and dark brown | | | | 32 mm solid PVC pipe | 99 |
| | | | | | iron staining (oxidation), heavy at transition from sand to clay | | | | GW = 1.68 mbg (April 12, 2017) | |
| | | MW6 SA4 | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist | | | | | |
| 2 | | MW6 SA5 | | | | | | | | 98 |
| 3 | | MW6 SA6 | | | | | | | silica sand | |
| | | | | | wet at 3.3m<br>soft, high plasticity | | | | | 97 |
| | | MW6 SA7 | | | | | | | | |
| 4 | | MW6 SA8 | | | | | | | 32 mm 010 slot PVC pipe | 96 |
| | | | | | End of borehole at 4.6 m | | | | | |
| | | | | | Groundwater Information:<br>Depth to groundwater from TOP = 2.07 m (April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 21 March 2017 LOGGED BY: KS

Notes: GRAB SAMPLE
SPLIT SPOON

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW7
SURFACE ELEVATION: 100.15 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 / 10 / 100 / 1000 | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | MW7 SA1 | | | **Topsoil** frost, brown, dry | | | | | |
| | | MW7 SA2 | | | **Construction Debris** gravel and sand, pieces of brick, black and red, dry | | | | bentonite seal | |
| 1 | | | | | **Sand** fine to medium sand, some silt, compact, laminated, brown, moist | | | | | 100 |
| | | MW7 SA3 | | | layers of light and dark brown | | | | 32 mm solid PVC pipe | 99 |
| | | | | | iron staining (oxidation), heavy at transition from sand to clay | | | | | |
| | | MW7 SA4 | | | | | | | | |
| 2 | | | | | **Clay** clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist | | | | | 98 |
| | | MW7 SA5 | | | | | | | GW = 2.42 mbg (April 12, 2017) | |
| 3 | | MW7 SA6 | | | | | | | silica sand | 97 |
| | | MW7 SA7 TOP | | | hydrocarbon odour at 3.35-4.57m | | | | | |
| | | MW7 SA7 BOT | | | wet at 3.75m soft, high plasticity | | | | | |
| 4 | | MW7 SA8 | | | | | | | 32 mm 010 slot PVC pipe | 96 |
| | | | | | End of borehole at 4.6 m | | | | | |
| | | | | | Groundwater Information: Depth to groundwater from TOP = 3.16 m (April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 21 March 2017 LOGGED BY: KS

Notes: GRAB SAMPLE
SPLIT SPOON

CM² JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW8
SURFACE ELEVATION: 99.97 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ground Surface | | | | | |
| 0 | | MW8 SA1 | | | **Asphalt**<br>**Gravel**<br>gravel, some sand (fill), grey and brown, dry | 0 | | | roadbox, jplug, cement bentonite seal | 100 |
| | | MW8 SA2 | | | **Sand**<br>fine to medium sand, some silt, compact, laminated, brown, moist | 0 | | | | |
| 1 | | MW8 SA3 | | | iron staining (oxidation) | 0 | | | | 99 |
| | | MW8 SA4 | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist | 15 | | | silica sand | |
| 2 | | MW8 SA5 | | | | 55 | | | GW = 2.30 mbg (April 12, 2017) | 98 |
| 3 | | MW8 SA6 | | | wet at 3.3m<br>soft, high plasticity | 25 | | | 32 mm 010 slot PVC pipe | 97 |
| | | MW8 SA7 | | | | 5 | | | | |
| 4 | | MW8 SA8 | | | | 15 | | | | 96 |
| | | | | | End of borehole at 4.6 m<br><br>Groundwater Information:<br>Depth to groundwater from TOP = 2.27 m (April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 23 March 2017 LOGGED BY: KS

Notes: GRAB SAMPLE
SPLIT SPOON

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW9
SURFACE ELEVATION: 100.05 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | 101 |
| 0 | | | | | Ground Surface | | | | | 100 |
| | | MW9 SA1 | | | **Asphalt**<br>**Gravel**<br>gravel, some sand (fill), grey and brown, dry | 0 | | | | |
| | | MW9 SA2 | | | **Sand**<br>fine to medium sand, some silt, compact, laminated, brown, moist | 0 | | | bentonite seal | |
| 1 | | MW9 SA3 | | | iron staining (oxidation) | 0 | | | 32 mm solid PVC pipe | 99 |
| | | MW9 SA4 | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist | 35 | | | | |
| 2 | | MW9 SA5 | | | | 80 | | | GW = 2.26 mbg (April 12, 2017) | 98 |
| 3 | | MW9 SA6 | | | wet at 3.4 m<br>soft, high plasticity | 10 | | | silica sand | 97 |
| | | MW9 SA7 | | | | 20 | | | | |
| 4 | | MW9 SA8 | | | | 5 | | | 32 mm 010 slot PVC pipe | 96 |
| | | | | | End of borehole at 4.6 m<br><br>Groundwater Information:<br>Depth to groundwater from TOP = 2.20 m (April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 23 March 2017 LOGGED BY: KS

Notes: GRAB SAMPLE
SPLIT SPOON

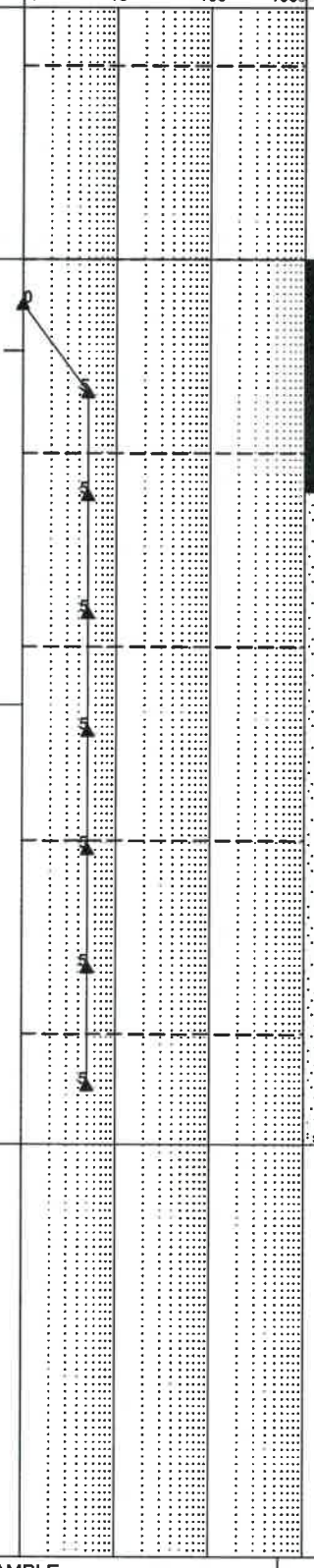
CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW10
SURFACE ELEVATION: 100.21 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | MW10 SA1 | | | **Topsoil**<br>some gravel, some sand, frost, brown, dry | | | | | 100 |
| | | MW10 SA2 | | | **Sand**<br>fine to medium sand, some silt, compact, laminated, brown, moist | | | | bentonite seal | |
| 1 | | MW10 SA3 | | | layers of light and dark brown<br>iron staining (oxidation), heavy at transition from sand to clay | | | | 32 mm solid PVC pipe | 99 |
| | | MW10 SA4 | | | | | | | GW = 1.78 mbg (April 12, 2017) | |
| 2 | | | | | | | | | | 98 |
| | | MW10 SA5 | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist | | | | | |
| 3 | | MW10 SA6 | | | | | | | silica sand | 97 |
| | | MW10 SA7 | | | | | | | | |
| 4 | | MW10 SA8 | | | wet at 3.85m<br>soft, high plasticity | | | | 32 mm 010 slot PVC pipe | 96 |
| | | | | | End of borehole at 4.6 m<br><br>Groundwater Information:<br>Depth to groundwater from TOP = 2.58 m (April 12, 2017) | | | | | |




DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 23 March 2017 LOGGED BY: KS

Notes: GRAB SAMPLE
SPLIT SPOON

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW11
SURFACE ELEVATION: 100.35 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000 | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | MW11 SA1 | | | **Asphalt** | | | | roadbox, jplug, cement bentonite seal | |
| | | | | | **Gravel**<br>gravel, some sand (fill), grey and brown, dry | 0 | | | | 100 |
| | | MW11 SA2 | | | **Sand**<br>fine to medium sand, some silt, compact, laminated, brown, moist | 0 | | | | |
| 1 | | MW11 SA3 | | | | 0 | | | | 99 |
| | | MW11 SA4 | | | | 0 | | | silica sand | |
| 2 | | | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist | 0 | | | | 98 |
| | | MW11 SA5 | | | hydrocarbon odour at 2.1-3.4m | | | | GW = 2.60 mbg (April 12, 2017) | |
| 3 | | MW11 SA6 | | | | | | | 32 mm 010 slot PVC pipe | |
| | | | | | wet at 3.3m<br>soft, high plasticity | 25 | | | | 97 |
| | | MW11 SA7 | | | | | | | | |
| 4 | | MW11 SA8 | | | | 65 | | | | 96 |
| | | | | | End of borehole at 4.6 m | | | | | |
| | | | | | Groundwater Information:<br>Depth to groundwater from TOP = 2.56 m (April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 23 March 1017 LOGGED BY: SDC

Notes: GRAB SAMPLE
SPLIT SPOON

CM² JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW12
SURFACE ELEVATION: 100.36 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000 | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | stickup, jplug | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | MW12 SA1 | | | **Asphalt** | | | | | |
| | | | | | **Gravel**<br>gravel, some sand (fill), grey and brown, dry | | | | | 100 |
| | | MW12 SA2 | | | **Sand**<br>medium to fine sand, some silt, compact, laminated, brown, moist | | | | bentonite seal | |
| 1 | | MW12 SA3 | | | | | | | 32 mm solid PVC pipe | 99 |
| | | MW12 SA4 | | | | | | ▼ | GW = 1.70 mbg (April 12, 2017) | |
| 2 | | | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist | | | | | 98 |
| | | MW12 SA5 | | | | | | | | |
| 3 | | MW12 SA6 | | | | | | | silica sand | |
| | | | | | wet at 3.3m<br>soft, high plasticity | | | | | 97 |
| | | MW12 SA7 | | | | | | | | |
| 4 | | | | | | | | | 32 mm 010 slot PVC pipe | |
| | | MW12 SA8 | | | | | | | | 96 |
| | | | | | End of borehole at 4.6 m | | | | | |
| | | | | | Groundwater Information:<br>Depth to groundwater from TOP = 2.65 m (April 12, 2017) | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 24 March 2017 LOGGED BY: SDC

Notes: ■ GRAB SAMPLE
⊠ SPLIT SPOON

CM³ JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: MW13
SURFACE ELEVATION: 99.97 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000 | WELL COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | | 101 |
| 0 | | | | | Ground Surface | | | | | 100 |
| | | | | | **Gravel**<br>gravel (fill), frost, brown, dry | | | | roadbox, jplug, cement bentonite seal | |
| | | | | | **Sand**<br>fine to medium sand, some silt, compact, laminated, brown, moist | | | | | |
| 1 | | | | | brown | | | | | 99 |
| | | | | | | | | | silica sand | |
| | | | | | | | | ▼ | GW = 1.94 mbg (April 12, 2017) | |
| 2 | | | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist | | | | | 98 |
| | | MW13 SA1 | | | | | | | | |
| 3 | | MW13 SA2 | | | | | | | 32 mm 010 slot PVC pipe | 97 |
| | | MW13 SA3 | | | | | | | | |
| | | | | | wet at 3.75m<br>soft, high plasticity | | | | | |
| 4 | | MW13 SA4 | | | | | | | | 96 |
| | | | | | End of borehole at 4.6 m | | | | | |
| | | | | | Groundwater Information:<br>Depth to groundwater from TOP = 1.88 m (April 12, 2017) | | | | | |
| | | | | | borehole advanced in hydro-excavation | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 5 April 2017 LOGGED BY: KS

Notes: NO RECOVERY
SPLIT SPOON

CM² JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: BH14
SURFACE ELEVATION: 100.30 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000 | BOREHOLE COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | | 101 |
| 0 | | | | | Ground Surface<br>**Asphalt**<br>**Gravel**<br>gravel, some sand (fill), grey and brown, dry | | | | | 100 |
| 1 | | | | | **Sand**<br>fine to medium sand, some silt, compact, laminated, brown, moist | | | | | 99 |
| 2 | | BH14 SA1 | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist | | | | | 98 |
| 3 | | BH14 SA2 | | | | | | | | |
| | | BH14 SA3 | | | wet at 3.3m<br>soft, high plasticity | | | | | 97 |
| | | | | | End of borehole at 3.7 m<br><br>borehole advanced in hydro-excavation | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 5 April 2017 LOGGED BY: KS

Notes: NO RECOVERY
SPLIT SPOON

CM² JOB NO: BDC1148

CLIENT: **Marilyn Steinberg**
PROJECT: **BDC1148**
**22 Hawthorne Avenue**
**Ottawa, Ontario**

# BOREHOLE LOG

BOREHOLE NO: BH15
SURFACE ELEVATION: 100.31 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000 | BOREHOLE COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | | 101 |
| 0 | | | | | Ground Surface<br>**Asphalt**<br>**Gravel**<br>gravel, some sand (fill), grey and brown, dry | | | | | 100 |
| 1 | | | | | **Sand**<br>fine to medium sand, some silt, compact, laminated, brown, moist | | | | | 99 |
| 2 | | BH15 SA1 | | | **Clay**<br>clay, some silt, firm, low to medium plasticity, minor iron staining, grey, moist<br>hydrocarbon odour at 2.4-3.05m | 0 | | | | 98 |
| | | BH15 SA2 | | | | 160 | | | | |
| 3 | | | | | End of borehole at 3.1 m<br><br>borehole advanced in hydro-excavation | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 5 April 2017 LOGGED BY: KS

Notes: NO RECOVERY
SPLIT SPOON

CM³ JOB NO: BDC1148

CLIENT: Marilyn Steinberg
PROJECT: BDC1148
22 Hawthorne Avenue
Ottawa, Ontario

# BOREHOLE LOG

BOREHOLE NO: BH16
SURFACE ELEVATION: 100.41 m

| DEPTH (m) | SAMPLE TYPE | SAMPLE ID | SPT COUNT | SOIL TYPE | SOIL DESCRIPTION | FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000 | BOREHOLE COMPLETION | WATER LEVEL | WELL COMPLETION NOTES | ELEVATION (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | | | | | | | | | 101 |
| 0 | | | | | Ground Surface | | | | | |
| | | SA1 | | | **Topsoil** gravel, sand (fill), frost, brown, dry | | | | | 100 |
| | | | | | **Construction Debris** gravel and sand, pieces of brick and coal, black and red, dry | | | | | |
| 1 | | SA2 | | | **Sand** fine to medium sand, some silt, loose to compact at depth, laminated, brown, moist | | | | | |
| | | | | | layers of light and dark brown | | | | | 99 |
| | | SA3 | | | iron staining (oxidation), heavy at transition from sand to clay | | | | | |
| 2 | | SA4 | | | **Clay** clay, some sit, firm, low to medium plasticity, grey, moist | | | | | 98 |
| | | SA5 | | | | | | | | |
| 3 | | SA6 | | | | | | | | 97 |
| | | | | | End of borehole at 3.7 m | | | | | |

DRILLING METHOD: Pionjar Portable Drilling

DRILL DATE: 5 April 2017 LOGGED BY: KS

Notes: SPLIT SPOON
NO RECOVERY

# APPENDIX F

## LABORATORY REPORTS – SOIL

**Oil Spill Delineation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**BDC1148**

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: 22 Hawthorne
Project: BDC1148
Custody: 31276

Report Date: 29-Dec-2016
Order Date: 22-Dec-2016

**Order #: 1652277**

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

| Paracel ID | Client ID |
|---|---|
| 1652277-01 | MW1 SA4 |
| 1652277-02 | MW2 SA2 |
| 1652277-03 | MW2 SA6 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 8260 - P&T GC-MS | 22-Dec-16 | 29-Dec-16 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 22-Dec-16 | 24-Dec-16 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 23-Dec-16 | 28-Dec-16 |
| Solids, % | Gravimetric, calculation | 28-Dec-16 | 28-Dec-16 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 29-Dec-2016
Order Date: 22-Dec-2016
**Project Description: BDC1148**

| | Client ID: | MW1 SA4 | MW2 SA2 | MW2 SA6 | - |
|---|---|---|---|---|---|
| | Sample Date: | 22-Dec-16 | 22-Dec-16 | 22-Dec-16 | - |
| | Sample ID: | 1652277-01 | 1652277-02 | 1652277-03 | - |
| | MDL/Units | Soil | Soil | Soil | - |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 67.8 | 91.1 | 69.9 | - |
| **Volatiles** | | | | | |
| Benzene | 0.02 ug/g dry | <0.02 | 0.54 | 0.02 | - |
| Ethylbenzene | 0.05 ug/g dry | <0.05 | 13.0 | 0.73 | - |
| Toluene | 0.05 ug/g dry | <0.05 | 11.2 | 0.63 | - |
| m,p-Xylenes | 0.05 ug/g dry | <0.05 | 49.6 | 2.84 | - |
| o-Xylene | 0.05 ug/g dry | <0.05 | 27.1 | 1.62 | - |
| Xylenes, total | 0.05 ug/g dry | <0.05 | 76.7 | 4.46 | - |
| Toluene-d8 | Surrogate | 119% | 110% | 104% | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 7 ug/g dry | <7 | 2660 | 259 | - |
| F2 PHCs (C10-C16) | 4 ug/g dry | <4 | 30200 | 14100 | - |
| F3 PHCs (C16-C34) | 8 ug/g dry | <8 | 12400 | 5810 | - |
| F4 PHCs (C34-C50) | 6 ug/g dry | <6 | <120 [1] | <60 [1] | - |

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g | | | | | | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g | | | | | | |
| F3 PHCs (C16-C34) | ND | 8 | ug/g | | | | | | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g | | | | | | |
| Ethylbenzene | ND | 0.05 | ug/g | | | | | | |
| Toluene | ND | 0.05 | ug/g | | | | | | |
| m,p-Xylenes | ND | 0.05 | ug/g | | | | | | |
| o-Xylene | ND | 0.05 | ug/g | | | | | | |
| Xylenes, total | ND | 0.05 | ug/g | | | | | | |
| *Surrogate: Toluene-d8* | *2.45* | | *ug/g* | | *76.6* | *50-140* | | | |

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g dry | ND | | | | 40 | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g dry | ND | | | | 30 | |
| F3 PHCs (C16-C34) | 33 | 8 | ug/g dry | 18 | | | 57.8 | 30 | QR-01 |
| F4 PHCs (C34-C50) | 34 | 6 | ug/g dry | 17 | | | 66.7 | 30 | QR-01 |
| **Physical Characteristics** | | | | | | | | | |
| % Solids | 64.8 | 0.1 | % by Wt. | 67.8 | | | 4.5 | 25 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g dry | ND | | | | 50 | |
| Ethylbenzene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| Toluene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| m,p-Xylenes | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| o-Xylene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| *Surrogate: Toluene-d8* | *2.27* | | *ug/g dry* | | *108* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 29-Dec-2016
Order Date: 22-Dec-2016
**Project Description: BDC1148**

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 216 | 7 | ug/g | | 108 | 80-120 | | | |
| F2 PHCs (C10-C16) | 131 | 4 | ug/g | ND | 130 | 60-140 | | | |
| F3 PHCs (C16-C34) | 330 | 8 | ug/g | 18 | 149 | 60-140 | | | QM-06 |
| F4 PHCs (C34-C50) | 224 | 6 | ug/g | 17 | 149 | 60-140 | | | QM-06 |
| **Volatiles** | | | | | | | | | |
| Benzene | 2.89 | 0.02 | ug/g | | 72.2 | 60-130 | | | |
| Ethylbenzene | 4.25 | 0.05 | ug/g | | 106 | 60-130 | | | |
| Toluene | 4.05 | 0.05 | ug/g | | 101 | 60-130 | | | |
| m,p-Xylenes | 8.11 | 0.05 | ug/g | | 101 | 60-130 | | | |
| o-Xylene | 4.18 | 0.05 | ug/g | | 105 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *2.68* | | *ug/g* | | *83.7* | *50-140* | | | |

## Qualifier Notes:

***Sample Qualifiers :***

1 : Elevated detection limit due to dilution required because of high target analyte concentration.

***QC Qualifiers :***

QM-06 : Due to noted non-homogeneity of the QC sample matrix, the spike recoveries were out side the accepted range. Batch data accepted based on other QC.

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

## Sample Data Revisions

None

## Work Order Revisions / Comments:

None

## Other Report Notes:

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

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: BDC1148
Project: BDC1148
Custody: 36190

Report Date: 22-Mar-2017
Order Date: 20-Mar-2017

**Order #: 1712054**

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

| Paracel ID | Client ID |
|---|---|
| 1712054-01 | MW3 SA8 |
| 1712054-02 | MW4 SA7 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 22-Mar-2017
Order Date: 20-Mar-2017
**Project Description: BDC1148**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 8260 - P&T GC-MS | 21-Mar-17 | 22-Mar-17 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 21-Mar-17 | 22-Mar-17 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 21-Mar-17 | 21-Mar-17 |
| Solids, % | Gravimetric, calculation | 21-Mar-17 | 21-Mar-17 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 22-Mar-2017
Order Date: 20-Mar-2017
**Project Description: BDC1148**

| | Client ID: | MW3 SA8 | MW4 SA7 | - | - |
|---|---|---|---|---|---|
| | Sample Date: | 20-Mar-17 | 20-Mar-17 | - | - |
| | Sample ID: | 1712054-01 | 1712054-02 | - | - |
| | MDL/Units | Soil | Soil | - | - |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 58.9 | 60.6 | - | - |
| **Volatiles** | | | | | |
| Benzene | 0.02 ug/g dry | <0.02 | <0.02 | - | - |
| Ethylbenzene | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| Toluene | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| m,p-Xylenes | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| o-Xylene | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| Xylenes, total | 0.05 ug/g dry | <0.05 | <0.05 | - | - |
| Toluene-d8 | Surrogate | 92.6% | 90.8% | - | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 7 ug/g dry | <7 | <7 | - | - |
| F2 PHCs (C10-C16) | 4 ug/g dry | <4 | <4 | - | - |
| F3 PHCs (C16-C34) | 8 ug/g dry | 24 | <8 | - | - |
| F4 PHCs (C34-C50) | 6 ug/g dry | 12 | <6 | - | - |

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g | | | | | | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g | | | | | | |
| F3 PHCs (C16-C34) | ND | 8 | ug/g | | | | | | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g | | | | | | |
| Ethylbenzene | ND | 0.05 | ug/g | | | | | | |
| Toluene | ND | 0.05 | ug/g | | | | | | |
| m,p-Xylenes | ND | 0.05 | ug/g | | | | | | |
| o-Xylene | ND | 0.05 | ug/g | | | | | | |
| Xylenes, total | ND | 0.05 | ug/g | | | | | | |
| *Surrogate: Toluene-d8* | *2.96* | | *ug/g* | | *92.6* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 22-Mar-2017
Order Date: 20-Mar-2017
**Project Description: BDC1148**

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g dry | ND | | | | 40 | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g dry | ND | | | | 30 | |
| F3 PHCs (C16-C34) | 19 | 8 | ug/g dry | 24 | | | 24.0 | 30 | |
| F4 PHCs (C34-C50) | 6 | 6 | ug/g dry | 12 | | | 59.3 | 30 | QR-01 |
| **Physical Characteristics** | | | | | | | | | |
| % Solids | 78.1 | 0.1 | % by Wt. | 78.6 | | | 0.7 | 25 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g dry | ND | | | | 50 | |
| Ethylbenzene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| Toluene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| m,p-Xylenes | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| o-Xylene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| *Surrogate: Toluene-d8* | *1.95* | | *ug/g dry* | | *93.4* | *50-140* | | | |

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 212 | 7 | ug/g | | 106 | 80-120 | | | |
| F2 PHCs (C10-C16) | 146 | 4 | ug/g | ND | 95.5 | 60-140 | | | |
| F3 PHCs (C16-C34) | 317 | 8 | ug/g | 24 | 92.8 | 60-140 | | | |
| F4 PHCs (C34-C50) | 220 | 6 | ug/g | 12 | 98.8 | 60-140 | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 4.04 | 0.02 | ug/g | | 101 | 60-130 | | | |
| Ethylbenzene | 4.53 | 0.05 | ug/g | | 113 | 60-130 | | | |
| Toluene | 4.48 | 0.05 | ug/g | | 112 | 60-130 | | | |
| m,p-Xylenes | 9.54 | 0.05 | ug/g | | 119 | 60-130 | | | |
| o-Xylene | 4.83 | 0.05 | ug/g | | 121 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *2.81* | | *ug/g* | | *87.7* | *50-140* | | | |

**Qualifier Notes:**

***QC Qualifiers :***

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

None

**Other Report Notes:**

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

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: BDC1148
Project: BDC1148
Custody: 111512

Report Date: 27-Mar-2017
Order Date: 21-Mar-2017

**Order #: 1712215**

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

| Paracel ID | Client ID |
|---|---|
| 1712215-01 | MW5 SA6 |
| 1712215-02 | MW6 SA5 |
| 1712215-03 | MW7 SA7 TOP |
| 1712215-04 | MW7 SA7 BTM |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 27-Mar-2017
Order Date: 21-Mar-2017
**Project Description: BDC1148**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 8260 - P&T GC-MS | 22-Mar-17 | 24-Mar-17 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 22-Mar-17 | 24-Mar-17 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 23-Mar-17 | 25-Mar-17 |
| Solids, % | Gravimetric, calculation | 25-Mar-17 | 25-Mar-17 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 27-Mar-2017
Order Date: 21-Mar-2017
**Project Description: BDC1148**

| | Client ID: | MW5 SA6 | MW6 SA5 | MW7 SA7 TOP | MW7 SA7 BTM |
|---|---|---|---|---|---|
| | Sample Date: | 21-Mar-17 | 21-Mar-17 | 21-Mar-17 | 21-Mar-17 |
| | Sample ID: | 1712215-01 | 1712215-02 | 1712215-03 | 1712215-04 |
| | MDL/Units | Soil | Soil | Soil | Soil |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 67.4 | 68.4 | 61.9 | 61.4 |
| **Volatiles** | | | | | |
| Benzene | 0.02 ug/g dry | <0.02 | <0.02 | <0.02 | <0.02 |
| Ethylbenzene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | <0.05 |
| Toluene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | <0.05 |
| m,p-Xylenes | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | <0.05 |
| o-Xylene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | <0.05 |
| Xylenes, total | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | <0.05 |
| Toluene-d8 | Surrogate | 115% | 114% | 116% | 112% |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 7 ug/g dry | <7 | <7 | <7 | <7 |
| F2 PHCs (C10-C16) | 4 ug/g dry | <4 | <4 | <4 | <4 |
| F3 PHCs (C16-C34) | 8 ug/g dry | 40 | <8 | <8 | <8 |
| F4 PHCs (C34-C50) | 6 ug/g dry | 33 | <6 | <6 | <6 |

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g | | | | | | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g | | | | | | |
| F3 PHCs (C16-C34) | ND | 8 | ug/g | | | | | | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g | | | | | | |
| Ethylbenzene | ND | 0.05 | ug/g | | | | | | |
| Toluene | ND | 0.05 | ug/g | | | | | | |
| m,p-Xylenes | ND | 0.05 | ug/g | | | | | | |
| o-Xylene | ND | 0.05 | ug/g | | | | | | |
| Xylenes, total | ND | 0.05 | ug/g | | | | | | |
| *Surrogate: Toluene-d8* | *8.59* | | *ug/g* | | *107* | *50-140* | | | |

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g dry | ND | | | | 40 | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g dry | ND | | | | 30 | |
| F3 PHCs (C16-C34) | 33 | 8 | ug/g dry | 40 | | | 20.3 | 30 | |
| F4 PHCs (C34-C50) | 33 | 6 | ug/g dry | 33 | | | 2.2 | 30 | |
| **Physical Characteristics** | | | | | | | | | |
| % Solids | 88.1 | 0.1 | % by Wt. | 85.6 | | | 2.9 | 25 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g dry | ND | | | | 50 | |
| Ethylbenzene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| Toluene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| m,p-Xylenes | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| o-Xylene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| *Surrogate: Toluene-d8* | *10.7* | | *ug/g dry* | | *114* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 27-Mar-2017
Order Date: 21-Mar-2017
**Project Description: BDC1148**

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 175 | 7 | ug/g | | 87.7 | 80-120 | | | |
| F2 PHCs (C10-C16) | 110 | 4 | ug/g | ND | 82.6 | 60-140 | | | |
| F3 PHCs (C16-C34) | 291 | 8 | ug/g | 40 | 91.2 | 60-140 | | | |
| F4 PHCs (C34-C50) | 250 | 6 | ug/g | 33 | 118 | 60-140 | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 4.78 | 0.02 | ug/g | | 120 | 60-130 | | | |
| Ethylbenzene | 3.69 | 0.05 | ug/g | | 92.3 | 60-130 | | | |
| Toluene | 3.65 | 0.05 | ug/g | | 91.2 | 60-130 | | | |
| m,p-Xylenes | 7.89 | 0.05 | ug/g | | 98.6 | 60-130 | | | |
| o-Xylene | 3.91 | 0.05 | ug/g | | 97.8 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *7.45* | | *ug/g* | | *93.2* | *50-140* | | | |

**Qualifier Notes:**

None

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

None

**Other Report Notes:**

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

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: Hawthorne
Project: BDC1148
Custody: 111517

Report Date: 29-Mar-2017
Order Date: 23-Mar-2017

**Order #: 1712411**

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

| Paracel ID | Client ID |
|---|---|
| 1712411-01 | MW10 SA7 |
| 1712411-02 | MW8 SA5 |
| 1712411-03 | MW9 SA5 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 29-Mar-2017
Order Date: 23-Mar-2017
**Project Description: BDC1148**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 8260 - P&T GC-MS | 28-Mar-17 | 29-Mar-17 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 28-Mar-17 | 29-Mar-17 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 24-Mar-17 | 25-Mar-17 |
| Solids, % | Gravimetric, calculation | 25-Mar-17 | 25-Mar-17 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 29-Mar-2017
Order Date: 23-Mar-2017
**Project Description: BDC1148**

| | Client ID: | MW10 SA7 | MW8 SA5 | MW9 SA5 | - |
|---|---|---|---|---|---|
| | Sample Date: | 23-Mar-17 | 23-Mar-17 | 23-Mar-17 | - |
| | Sample ID: | 1712411-01 | 1712411-02 | 1712411-03 | - |
| | MDL/Units | Soil | Soil | Soil | - |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 70.2 | 68.7 | 70.1 | - |
| **Volatiles** | | | | | |
| Benzene | 0.02 ug/g dry | <0.02 | <0.02 | <0.02 | - |
| Ethylbenzene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| Toluene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| m,p-Xylenes | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| o-Xylene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| Xylenes, total | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| Toluene-d8 | Surrogate | 117% | 117% | 116% | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 7 ug/g dry | <7 | <7 | <7 | - |
| F2 PHCs (C10-C16) | 4 ug/g dry | <4 | <4 | <4 | - |
| F3 PHCs (C16-C34) | 8 ug/g dry | <8 | <8 | <8 | - |
| F4 PHCs (C34-C50) | 6 ug/g dry | <6 | <6 | <6 | - |

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g | | | | | | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g | | | | | | |
| F3 PHCs (C16-C34) | ND | 8 | ug/g | | | | | | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g | | | | | | |
| Ethylbenzene | ND | 0.05 | ug/g | | | | | | |
| Toluene | ND | 0.05 | ug/g | | | | | | |
| m,p-Xylenes | ND | 0.05 | ug/g | | | | | | |
| o-Xylene | ND | 0.05 | ug/g | | | | | | |
| Xylenes, total | ND | 0.05 | ug/g | | | | | | |
| *Surrogate: Toluene-d8* | *8.86* | | *ug/g* | | *111* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 29-Mar-2017
Order Date: 23-Mar-2017
**Project Description: BDC1148**

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g dry | ND | | | | 40 | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g dry | ND | | | | 30 | |
| F3 PHCs (C16-C34) | 33 | 8 | ug/g dry | 55 | | | 49.4 | 30 | QR-01 |
| F4 PHCs (C34-C50) | 89 | 6 | ug/g dry | 86 | | | 3.9 | 30 | |
| **Physical Characteristics** | | | | | | | | | |
| % Solids | 87.8 | 0.1 | % by Wt. | 85.8 | | | 2.3 | 25 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g dry | ND | | | | 50 | |
| Ethylbenzene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| Toluene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| m,p-Xylenes | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| o-Xylene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| *Surrogate: Toluene-d8* | *8.98* | | *ug/g dry* | | *117* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 29-Mar-2017
Order Date: 23-Mar-2017
**Project Description: BDC1148**

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 171 | 7 | ug/g | | 85.4 | 80-120 | | | |
| F2 PHCs (C10-C16) | 89 | 4 | ug/g | ND | 86.7 | 60-140 | | | |
| F3 PHCs (C16-C34) | 230 | 8 | ug/g | 55 | 82.3 | 60-140 | | | |
| F4 PHCs (C34-C50) | 248 | 6 | ug/g | 86 | 115 | 60-140 | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 4.14 | 0.02 | ug/g | | 104 | 60-130 | | | |
| Ethylbenzene | 3.93 | 0.05 | ug/g | | 98.3 | 60-130 | | | |
| Toluene | 3.97 | 0.05 | ug/g | | 99.2 | 60-130 | | | |
| m,p-Xylenes | 8.63 | 0.05 | ug/g | | 108 | 60-130 | | | |
| o-Xylene | 4.21 | 0.05 | ug/g | | 105 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *7.98* | | *ug/g* | | *99.7* | *50-140* | | | |

**Qualifier Notes:**

***QC Qualifiers :***

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

None

**Other Report Notes:**

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

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: Hawthorne
Project: BDC1148
Custody: 36198

Report Date: 29-Mar-2017
Order Date: 24-Mar-2017

**Order #: 1712421**

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

| Paracel ID | Client ID |
|---|---|
| 1712421-01 | MW12 SA5 |
| 1712421-02 | Under Asphalt |
| 1712421-03 | MW11 SA8 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 29-Mar-2017
Order Date: 24-Mar-2017
**Project Description: BDC1148**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 8260 - P&T GC-MS | 28-Mar-17 | 29-Mar-17 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 28-Mar-17 | 29-Mar-17 |
| PHC F4G (gravimetric) | CWS Tier 1 - Extraction Gravimetric | 27-Mar-17 | 27-Mar-17 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 24-Mar-17 | 26-Mar-17 |
| Solids, % | Gravimetric, calculation | 25-Mar-17 | 25-Mar-17 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 29-Mar-2017
Order Date: 24-Mar-2017
**Project Description: BDC1148**

| | Client ID: | MW12 SA5 | Under Asphalt | MW11 SA8 | - |
|---|---|---|---|---|---|
| | Sample Date: | 24-Mar-17 | 24-Mar-17 | 24-Mar-17 | - |
| | Sample ID: | 1712421-01 | 1712421-02 | 1712421-03 | - |
| | MDL/Units | Soil | Soil | Soil | - |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 67.4 | 88.2 | 72.9 | - |
| **Volatiles** | | | | | |
| Benzene | 0.02 ug/g dry | <0.02 | <0.02 | <0.02 | - |
| Ethylbenzene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| Toluene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| m,p-Xylenes | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| o-Xylene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| Xylenes, total | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| Toluene-d8 | Surrogate | 118% | 117% | 111% | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 7 ug/g dry | <7 | <7 | 20 | - |
| F2 PHCs (C10-C16) | 4 ug/g dry | <4 | <4 | 558 | - |
| F3 PHCs (C16-C34) | 8 ug/g dry | <8 | 173 | 274 | - |
| F4 PHCs (C34-C50) | 6 ug/g dry | <6 | 279 [1] | <6 | - |
| F4G PHCs (gravimetric) | 50 ug/g dry | - | 1330 | - | - |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 29-Mar-2017
Order Date: 24-Mar-2017
**Project Description: BDC1148**

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g | | | | | | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g | | | | | | |
| F3 PHCs (C16-C34) | ND | 8 | ug/g | | | | | | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g | | | | | | |
| F4G PHCs (gravimetric) | ND | 50 | ug/g | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g | | | | | | |
| Ethylbenzene | ND | 0.05 | ug/g | | | | | | |
| Toluene | ND | 0.05 | ug/g | | | | | | |
| m,p-Xylenes | ND | 0.05 | ug/g | | | | | | |
| o-Xylene | ND | 0.05 | ug/g | | | | | | |
| Xylenes, total | ND | 0.05 | ug/g | | | | | | |
| *Surrogate: Toluene-d8* | *8.86* | | *ug/g* | | *111* | *50-140* | | | |

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g dry | ND | | | | 40 | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g dry | ND | | | | 30 | |
| F3 PHCs (C16-C34) | 33 | 8 | ug/g dry | 55 | | | 49.4 | 30 | QR-01 |
| F4 PHCs (C34-C50) | 89 | 6 | ug/g dry | 86 | | | 3.9 | 30 | |
| **Physical Characteristics** | | | | | | | | | |
| % Solids | 87.8 | 0.1 | % by Wt. | 85.8 | | | 2.3 | 25 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g dry | ND | | | | 50 | |
| Ethylbenzene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| Toluene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| m,p-Xylenes | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| o-Xylene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| *Surrogate: Toluene-d8* | *8.98* | | *ug/g dry* | | *117* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 29-Mar-2017
Order Date: 24-Mar-2017
**Project Description: BDC1148**

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 171 | 7 | ug/g | | 85.4 | 80-120 | | | |
| F2 PHCs (C10-C16) | 89 | 4 | ug/g | ND | 86.7 | 60-140 | | | |
| F3 PHCs (C16-C34) | 230 | 8 | ug/g | 55 | 82.3 | 60-140 | | | |
| F4 PHCs (C34-C50) | 248 | 6 | ug/g | 86 | 115 | 60-140 | | | |
| F4G PHCs (gravimetric) | 830 | 50 | ug/g | | 83.0 | 80-120 | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 4.14 | 0.02 | ug/g | | 104 | 60-130 | | | |
| Ethylbenzene | 3.93 | 0.05 | ug/g | | 98.3 | 60-130 | | | |
| Toluene | 3.97 | 0.05 | ug/g | | 99.2 | 60-130 | | | |
| m,p-Xylenes | 8.63 | 0.05 | ug/g | | 108 | 60-130 | | | |
| o-Xylene | 4.21 | 0.05 | ug/g | | 105 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *7.98* | | *ug/g* | | *99.7* | *50-140* | | | |

**Qualifier Notes:**

***Sample Qualifiers :***

1 : GC-FID signal did not return to baseline by C50

***QC Qualifiers :***

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

None

**Other Report Notes:**

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

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: BDC1148
Project: BDC1148
Custody: 36531

Report Date: 10-Apr-2017
Order Date: 5-Apr-2017

**Order #: 1714281**

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

| Paracel ID | Client ID |
|---|---|
| 1714281-01 | MW13SA1 |
| 1714281-02 | BH15 SA2 |
| 1714281-03 | BH16 SA4 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 10-Apr-2017
Order Date: 5-Apr-2017
**Project Description: BDC1148**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 8260 - P&T GC-MS | 6-Apr-17 | 7-Apr-17 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 6-Apr-17 | 7-Apr-17 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 7-Apr-17 | 8-Apr-17 |
| Solids, % | Gravimetric, calculation | 8-Apr-17 | 8-Apr-17 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 10-Apr-2017
Order Date: 5-Apr-2017
**Project Description: BDC1148**

| | Client ID: | MW13SA1 | BH15 SA2 | BH16 SA4 | - |
|---|---|---|---|---|---|
| | Sample Date: | 05-Apr-17 | 05-Apr-17 | 05-Apr-17 | - |
| | Sample ID: | 1714281-01 | 1714281-02 | 1714281-03 | - |
| | MDL/Units | Soil | Soil | Soil | - |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 65.1 | 68.7 | 67.6 | - |
| **Volatiles** | | | | | |
| Benzene | 0.02 ug/g dry | <0.02 | <0.02 | <0.02 | - |
| Ethylbenzene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| Toluene | 0.05 ug/g dry | <0.05 | <0.05 | <0.05 | - |
| m,p-Xylenes | 0.05 ug/g dry | <0.05 | 0.27 | <0.05 | - |
| o-Xylene | 0.05 ug/g dry | <0.05 | 0.05 | <0.05 | - |
| Xylenes, total | 0.05 ug/g dry | <0.05 | 0.32 | <0.05 | - |
| Toluene-d8 | Surrogate | 107% | 77.5% | 106% | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 7 ug/g dry | <7 | 253 | <7 | - |
| F2 PHCs (C10-C16) | 4 ug/g dry | <4 | 1980 | <4 | - |
| F3 PHCs (C16-C34) | 8 ug/g dry | 22 | 966 | <8 | - |
| F4 PHCs (C34-C50) | 6 ug/g dry | <6 | <6 | <6 | - |

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g | | | | | | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g | | | | | | |
| F3 PHCs (C16-C34) | ND | 8 | ug/g | | | | | | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g | | | | | | |
| Ethylbenzene | ND | 0.05 | ug/g | | | | | | |
| Toluene | ND | 0.05 | ug/g | | | | | | |
| m,p-Xylenes | ND | 0.05 | ug/g | | | | | | |
| o-Xylene | ND | 0.05 | ug/g | | | | | | |
| Xylenes, total | ND | 0.05 | ug/g | | | | | | |
| *Surrogate: Toluene-d8* | *3.04* | | *ug/g* | | *95.1* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 10-Apr-2017
Order Date: 5-Apr-2017
**Project Description: BDC1148**

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 21 | 7 | ug/g dry | 21 | | | 2.0 | 40 | |
| F2 PHCs (C10-C16) | 5 | 4 | ug/g dry | ND | | | 0.0 | 30 | |
| F3 PHCs (C16-C34) | 26 | 8 | ug/g dry | 22 | | | 16.3 | 30 | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g dry | ND | | | | 30 | |
| **Physical Characteristics** | | | | | | | | | |
| % Solids | 92.3 | 0.1 | % by Wt. | 92.5 | | | 0.2 | 25 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.02 | ug/g dry | ND | | | | 50 | |
| Ethylbenzene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| Toluene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| m,p-Xylenes | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| o-Xylene | ND | 0.05 | ug/g dry | ND | | | | 50 | |
| *Surrogate: Toluene-d8* | *2.05* | | *ug/g dry* | | *82.6* | *50-140* | | | |

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 208 | 7 | ug/g | | 104 | 80-120 | | | |
| F2 PHCs (C10-C16) | 155 | 4 | ug/g | ND | 112 | 60-140 | | | |
| F3 PHCs (C16-C34) | 389 | 8 | ug/g | 22 | 128 | 60-140 | | | |
| F4 PHCs (C34-C50) | 243 | 6 | ug/g | ND | 127 | 60-140 | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 4.94 | 0.02 | ug/g | | 123 | 60-130 | | | |
| Ethylbenzene | 4.58 | 0.05 | ug/g | | 115 | 60-130 | | | |
| Toluene | 4.34 | 0.05 | ug/g | | 108 | 60-130 | | | |
| m,p-Xylenes | 9.25 | 0.05 | ug/g | | 116 | 60-130 | | | |
| o-Xylene | 4.87 | 0.05 | ug/g | | 122 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *2.94* | | *ug/g* | | *92.0* | *50-140* | | | |

**Qualifier Notes:**

None

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

None

**Other Report Notes:**

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

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: BDC1148
Project: BDC1148
Custody: 36532

Report Date: 10-Apr-2017
Order Date: 5-Apr-2017

**Order #: 1714282**

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

| Paracel ID | Client ID |
|---|---|
| 1714282-01 | Reg 558 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 10-Apr-2017
Order Date: 5-Apr-2017
**Project Description: BDC1148**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| PHC F1 | CWS Tier 1 - P&T GC-FID | 6-Apr-17 | 7-Apr-17 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 7-Apr-17 | 8-Apr-17 |
| REG 558 - Mercury by CVAA | EPA 7470A - Cold Vapour AA | 7-Apr-17 | 7-Apr-17 |
| REG 558 - Metals, ICP-MS | EPA 6020 - Digestion - ICP-MS | 7-Apr-17 | 7-Apr-17 |
| Solids, % | Gravimetric, calculation | 8-Apr-17 | 8-Apr-17 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 10-Apr-2017
Order Date: 5-Apr-2017
**Project Description: BDC1148**

| | Client ID: | Reg 558 | - | - | - |
|---|---|---|---|---|---|
| | Sample Date: | 05-Apr-17 | - | - | - |
| | Sample ID: | 1714282-01 | - | - | - |
| | MDL/Units | Soil | - | - | - |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 73.6 | - | - | - |
| **EPA 1311 - TCLP Leachate Inorganics** | | | | | |
| Arsenic | 0.05 mg/L | <0.05 | - | - | - |
| Barium | 0.05 mg/L | 0.42 | - | - | - |
| Boron | 0.05 mg/L | 0.06 | - | - | - |
| Cadmium | 0.01 mg/L | <0.01 | - | - | - |
| Chromium | 0.05 mg/L | <0.05 | - | - | - |
| Lead | 0.05 mg/L | 0.05 | - | - | - |
| Mercury | 0.005 mg/L | <0.005 | - | - | - |
| Selenium | 0.05 mg/L | <0.05 | - | - | - |
| Silver | 0.05 mg/L | <0.05 | - | - | - |
| Uranium | 0.05 mg/L | <0.05 | - | - | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 7 ug/g dry | <7 | - | - | - |
| F2 PHCs (C10-C16) | 4 ug/g dry | 719 | - | - | - |
| F3 PHCs (C16-C34) | 8 ug/g dry | 631 | - | - | - |
| F4 PHCs (C34-C50) | 6 ug/g dry | 61 | - | - | - |

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **EPA 1311 - TCLP Leachate Inorganics** | | | | | | | | | |
| Arsenic | ND | 0.05 | mg/L | | | | | | |
| Barium | ND | 0.05 | mg/L | | | | | | |
| Boron | ND | 0.05 | mg/L | | | | | | |
| Cadmium | ND | 0.01 | mg/L | | | | | | |
| Chromium | ND | 0.05 | mg/L | | | | | | |
| Lead | ND | 0.05 | mg/L | | | | | | |
| Mercury | ND | 0.005 | mg/L | | | | | | |
| Selenium | ND | 0.05 | mg/L | | | | | | |
| Silver | ND | 0.05 | mg/L | | | | | | |
| Uranium | ND | 0.05 | mg/L | | | | | | |
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 7 | ug/g | | | | | | |
| F2 PHCs (C10-C16) | ND | 4 | ug/g | | | | | | |
| F3 PHCs (C16-C34) | ND | 8 | ug/g | | | | | | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g | | | | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: BDC1148**

Report Date: 10-Apr-2017
Order Date: 5-Apr-2017
**Project Description: BDC1148**

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **EPA 1311 - TCLP Leachate Inorganics** | | | | | | | | | |
| Arsenic | ND | 0.05 | mg/L | ND | | | 0.0 | 29 | |
| Barium | 0.388 | 0.05 | mg/L | 0.425 | | | 9.0 | 34 | |
| Boron | ND | 0.05 | mg/L | 0.060 | | | 0.0 | 33 | |
| Cadmium | ND | 0.01 | mg/L | ND | | | 0.0 | 33 | |
| Chromium | ND | 0.05 | mg/L | ND | | | 0.0 | 32 | |
| Lead | 0.051 | 0.05 | mg/L | 0.054 | | | 7.4 | 32 | |
| Mercury | ND | 0.005 | mg/L | ND | | | 0.0 | 30 | |
| Selenium | ND | 0.05 | mg/L | ND | | | 0.0 | 28 | |
| Silver | ND | 0.05 | mg/L | ND | | | 0.0 | 28 | |
| Uranium | ND | 0.05 | mg/L | ND | | | 0.0 | 27 | |
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 21 | 7 | ug/g dry | 21 | | | 2.0 | 40 | |
| F2 PHCs (C10-C16) | 5 | 4 | ug/g dry | ND | | | 0.0 | 30 | |
| F3 PHCs (C16-C34) | 26 | 8 | ug/g dry | 22 | | | 16.3 | 30 | |
| F4 PHCs (C34-C50) | ND | 6 | ug/g dry | ND | | | | 30 | |
| **Physical Characteristics** | | | | | | | | | |
| % Solids | 92.3 | 0.1 | % by Wt. | 92.5 | | | 0.2 | 25 | |

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **EPA 1311 - TCLP Leachate Inorganics** | | | | | | | | | |
| Arsenic | 53.8 | | ug/L | 0.324 | 107 | 83-119 | | | |
| Barium | 95.2 | | ug/L | 42.5 | 106 | 83-116 | | | |
| Boron | 49.1 | | ug/L | 6.05 | 86.0 | 71-128 | | | |
| Cadmium | 48.7 | | ug/L | ND | 97.4 | 78-119 | | | |
| Chromium | 52.6 | | ug/L | 1.71 | 102 | 80-124 | | | |
| Lead | 54.5 | | ug/L | 5.45 | 98.1 | 77-126 | | | |
| Mercury | 0.0267 | 0.005 | mg/L | ND | 89.1 | 70-130 | | | |
| Selenium | 51.5 | | ug/L | 0.924 | 101 | 81-125 | | | |
| Silver | 48.5 | | ug/L | 0.064 | 96.9 | 70-128 | | | |
| Uranium | 42.7 | | ug/L | ND | 85.3 | 70-131 | | | |
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 208 | 7 | ug/g | | 104 | 80-120 | | | |
| F2 PHCs (C10-C16) | 155 | 4 | ug/g | ND | 112 | 60-140 | | | |
| F3 PHCs (C16-C34) | 389 | 8 | ug/g | 22 | 128 | 60-140 | | | |
| F4 PHCs (C34-C50) | 243 | 6 | ug/g | ND | 127 | 60-140 | | | |

**Qualifier Notes:**

None

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

None

**Other Report Notes:**

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

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

# APPENDIX G

## LABORATORY REPORTS – GROUNDWATER

**Oil Spill Delineation**

**22 Hawthorne Avenue, Ottawa, Ontario**

**BDC1148**

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: 22 Hawthorne
Project: BDC1048
Custody: 32030

Report Date: 4-Jan-2017
Order Date: 30-Dec-2016

**Order #: 1653103**

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

| Paracel ID | Client ID |
|---|---|
| 1653103-01 | MW1 |
| 1653103-02 | MW2 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 04-Jan-2017
Order Date: 30-Dec-2016
**Project Description: BDC1048**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 624 - P&T GC-MS | 30-Dec-16 | 30-Dec-16 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 30-Dec-16 | 30-Dec-16 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 3-Jan-17 | 3-Jan-17 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 04-Jan-2017
Order Date: 30-Dec-2016
**Project Description: BDC1048**

| | Client ID: | MW1 | MW2 | - | - |
|---|---|---|---|---|---|
| | Sample Date: | 30-Dec-16 | 30-Dec-16 | - | - |
| | Sample ID: | 1653103-01 | 1653103-02 | - | - |
| | **MDL/Units** | Ground Water | Ground Water | - | - |
| **Volatiles** | | | | | |
| Benzene | 0.5 ug/L | <0.5 | - | - | - |
| Ethylbenzene | 0.5 ug/L | <0.5 | - | - | - |
| Toluene | 0.5 ug/L | <0.5 | - | - | - |
| m,p-Xylenes | 0.5 ug/L | <0.5 | - | - | - |
| o-Xylene | 0.5 ug/L | <0.5 | - | - | - |
| Xylenes, total | 0.5 ug/L | <0.5 | - | - | - |
| Toluene-d8 | Surrogate | 99.1% | - | - | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 25 ug/L | <25 | - | - | - |
| F2 PHCs (C10-C16) | 100 ug/L | <100 | 67500000 [1] [3] | - | - |
| F3 PHCs (C16-C34) | 100 ug/L | <100 | 26700000 [1] [3] | - | - |
| F4 PHCs (C34-C50) | 100 ug/L | <100 | <4610000 [1] [2] [3] | - | - |
| F1 + F2 PHCs | 125 ug/L | <125 | - | - | - |
| F1 + F2 PHCs | 4610000 ug/L | - | 67500000 | - | - |
| F3 + F4 PHCs | 200 ug/L | <200 | - | - | - |
| F3 + F4 PHCs | 9230000 ug/L | - | 26700000 | - | - |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 04-Jan-2017
Order Date: 30-Dec-2016
**Project Description: BDC1048**

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 25 | ug/L | | | | | | |
| F2 PHCs (C10-C16) | ND | 100 | ug/L | | | | | | |
| F3 PHCs (C16-C34) | ND | 100 | ug/L | | | | | | |
| F4 PHCs (C34-C50) | ND | 100 | ug/L | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.5 | ug/L | | | | | | |
| Ethylbenzene | ND | 0.5 | ug/L | | | | | | |
| Toluene | ND | 0.5 | ug/L | | | | | | |
| m,p-Xylenes | ND | 0.5 | ug/L | | | | | | |
| o-Xylene | ND | 0.5 | ug/L | | | | | | |
| Xylenes, total | ND | 0.5 | ug/L | | | | | | |
| *Surrogate: Toluene-d8* | *79.0* | | *ug/L* | | *98.7* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: 22 Hawthorne**

Report Date: 04-Jan-2017
Order Date: 30-Dec-2016
**Project Description: BDC1048**

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 25 | ug/L | ND | | | | 30 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.5 | ug/L | ND | | | | 30 | |
| Ethylbenzene | ND | 0.5 | ug/L | ND | | | | 30 | |
| Toluene | ND | 0.5 | ug/L | ND | | | | 30 | |
| m,p-Xylenes | ND | 0.5 | ug/L | ND | | | | 30 | |
| o-Xylene | ND | 0.5 | ug/L | ND | | | | 30 | |
| *Surrogate: Toluene-d8* | *79.9* | | *ug/L* | | *99.8* | *50-140* | | | |

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 1840 | 25 | ug/L | | 91.8 | 68-117 | | | |
| F2 PHCs (C10-C16) | 1310 | 100 | ug/L | | 72.8 | 60-140 | | | |
| F3 PHCs (C16-C34) | 2940 | 100 | ug/L | | 79.0 | 60-140 | | | |
| F4 PHCs (C34-C50) | 1810 | 100 | ug/L | | 73.1 | 60-140 | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 34.1 | 0.5 | ug/L | | 85.2 | 60-130 | | | |
| Ethylbenzene | 39.8 | 0.5 | ug/L | | 99.6 | 60-130 | | | |
| Toluene | 38.1 | 0.5 | ug/L | | 95.3 | 60-130 | | | |
| m,p-Xylenes | 77.7 | 0.5 | ug/L | | 97.1 | 60-130 | | | |
| o-Xylene | 39.9 | 0.5 | ug/L | | 99.8 | 60-130 | | | |
| *Surrogate: Toluene-d8* | *74.6* | | *ug/L* | | *93.3* | *50-140* | | | |

**Qualifier Notes:**

***Sample Qualifiers :***

1 : Elevated Reporting Limits due to limited sample volume.

2 : Elevated detection limit due to dilution required because of high target analyte concentration.

3 : Free product was observed in the sample container.

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

BTEX/PHC F1 could not be analyzed on sample MW-2 due to the nature of the matrix. Sample was submitted in a VOC vial which contained pure product.

**Other Report Notes:**

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

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

# Certificate of Analysis

**CM3 Environmental Inc.**

2120 Robertson Road, Suite 208
Ottawa, ON K2H 5Z1
Attn: Bruce Cochrane

Client PO: Hawthorne
Project: BDC1148
Custody: 113126

Report Date: 19-Apr-2017
Order Date: 12-Apr-2017

**Order #: 1715291**

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

| Paracel ID | Client ID |
|---|---|
| 1715291-01 | MW1 |
| 1715291-02 | MW2 |
| 1715291-03 | MW3 |
| 1715291-04 | MW4 |
| 1715291-05 | MW5 |
| 1715291-06 | MW6 |
| 1715291-07 | MW7 |
| 1715291-08 | MW8 |
| 1715291-09 | MW9 |
| 1715291-10 | MW10 |
| 1715291-11 | MW11 |
| 1715291-12 | MW12 |
| 1715291-13 | MW13 |

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 19-Apr-2017
Order Date: 12-Apr-2017
**Project Description: BDC1148**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| BTEX by P&T GC-MS | EPA 624 - P&T GC-MS | 17-Apr-17 | 17-Apr-17 |
| PHC F1 | CWS Tier 1 - P&T GC-FID | 13-Apr-17 | 17-Apr-17 |
| PHCs F2 to F4 | CWS Tier 1 - GC-FID, extraction | 13-Apr-17 | 17-Apr-17 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 19-Apr-2017
Order Date: 12-Apr-2017
**Project Description: BDC1148**

| | Client ID: | MW1 | MW2 | MW3 | MW4 |
|---|---|---|---|---|---|
| | Sample Date: | 12-Apr-17 | 12-Apr-17 | 12-Apr-17 | 12-Apr-17 |
| | Sample ID: | 1715291-01 | 1715291-02 | 1715291-03 | 1715291-04 |
| | MDL/Units | Water | Water | Water | Water |
| **Volatiles** | | | | | |
| Benzene | 0.5 ug/L | <0.5 | 68.4 | <0.5 | <0.5 |
| Ethylbenzene | 0.5 ug/L | <0.5 | 113 | <0.5 | <0.5 |
| Toluene | 0.5 ug/L | <0.5 | 170 | <0.5 | <0.5 |
| m,p-Xylenes | 0.5 ug/L | <0.5 | 411 | <0.5 | <0.5 |
| o-Xylene | 0.5 ug/L | <0.5 | 186 | <0.5 | <0.5 |
| Xylenes, total | 0.5 ug/L | <0.5 | 597 | <0.5 | <0.5 |
| Toluene-d8 | Surrogate | 104% | 112% | 107% | 111% |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 25 ug/L | <25 | 805 | <25 | <25 |
| F2 PHCs (C10-C16) | 100 ug/L | 11300 | 4270000 | <100 | <100 |
| F3 PHCs (C16-C34) | 100 ug/L | 5880 | 2240000 | <100 | <100 |
| F4 PHCs (C34-C50) | 100 ug/L | <100 | <10000 [1] | <100 | <100 |
| F1 + F2 PHCs | 10000 ug/L | - | 4270000 | - | - |
| F1 + F2 PHCs | 125 ug/L | 11300 | - | <125 | <125 |
| F3 + F4 PHCs | 200 ug/L | 5880 | - | <200 | <200 |
| F3 + F4 PHCs | 20000 ug/L | - | 2240000 | - | - |

| | Client ID: | MW5 | MW6 | MW7 | MW8 |
|---|---|---|---|---|---|
| | Sample Date: | 12-Apr-17 | 12-Apr-17 | 12-Apr-17 | 12-Apr-17 |
| | Sample ID: | 1715291-05 | 1715291-06 | 1715291-07 | 1715291-08 |
| | MDL/Units | Water | Water | Water | Water |
| **Volatiles** | | | | | |
| Benzene | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| Ethylbenzene | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| Toluene | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| m,p-Xylenes | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| o-Xylene | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| Xylenes, total | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| Toluene-d8 | Surrogate | 101% | 102% | 101% | 103% |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 25 ug/L | <25 | <25 | <25 | <25 |
| F2 PHCs (C10-C16) | 100 ug/L | <100 | <100 | 475 | <100 |
| F3 PHCs (C16-C34) | 100 ug/L | <100 | <100 | 280 | <100 |
| F4 PHCs (C34-C50) | 100 ug/L | <100 | <100 | <100 | <100 |
| F1 + F2 PHCs | 125 ug/L | <125 | <125 | 475 | <125 |
| F3 + F4 PHCs | 200 ug/L | <200 | <200 | 280 | <200 |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 19-Apr-2017
Order Date: 12-Apr-2017
**Project Description: BDC1148**

| | Client ID: | MW9 | MW10 | MW11 | MW12 |
|---|---|---|---|---|---|
| | Sample Date: | 12-Apr-17 | 12-Apr-17 | 12-Apr-17 | 12-Apr-17 |
| | Sample ID: | 1715291-09 | 1715291-10 | 1715291-11 | 1715291-12 |
| | MDL/Units | Water | Water | Water | Water |
| **Volatiles** | | | | | |
| Benzene | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| Ethylbenzene | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| Toluene | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| m,p-Xylenes | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| o-Xylene | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| Xylenes, total | 0.5 ug/L | <0.5 | <0.5 | <0.5 | <0.5 |
| Toluene-d8 | Surrogate | 102% | 102% | 116% | 102% |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 25 ug/L | <25 | <25 | <25 | <25 |
| F2 PHCs (C10-C16) | 100 ug/L | <100 | <100 | 4570 | <100 |
| F3 PHCs (C16-C34) | 100 ug/L | <100 | <100 | 2460 | <100 |
| F4 PHCs (C34-C50) | 100 ug/L | <100 | <100 | <100 | <100 |
| F1 + F2 PHCs | 125 ug/L | <125 | <125 | 4570 | <125 |
| F3 + F4 PHCs | 200 ug/L | <200 | <200 | 2460 | <200 |

| | Client ID: | MW13 | - | - | - |
|---|---|---|---|---|---|
| | Sample Date: | 12-Apr-17 | - | - | - |
| | Sample ID: | 1715291-13 | - | - | - |
| | MDL/Units | Water | - | - | - |
| **Volatiles** | | | | | |
| Benzene | 0.5 ug/L | <0.5 | - | - | - |
| Ethylbenzene | 0.5 ug/L | <0.5 | - | - | - |
| Toluene | 0.5 ug/L | <0.5 | - | - | - |
| m,p-Xylenes | 0.5 ug/L | <0.5 | - | - | - |
| o-Xylene | 0.5 ug/L | <0.5 | - | - | - |
| Xylenes, total | 0.5 ug/L | <0.5 | - | - | - |
| Toluene-d8 | Surrogate | 104% | - | - | - |
| **Hydrocarbons** | | | | | |
| F1 PHCs (C6-C10) | 25 ug/L | <25 | - | - | - |
| F2 PHCs (C10-C16) | 100 ug/L | <100 | - | - | - |
| F3 PHCs (C16-C34) | 100 ug/L | <100 | - | - | - |
| F4 PHCs (C34-C50) | 100 ug/L | <100 | - | - | - |
| F1 + F2 PHCs | 125 ug/L | <125 | - | - | - |
| F3 + F4 PHCs | 200 ug/L | <200 | - | - | - |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 19-Apr-2017
Order Date: 12-Apr-2017
**Project Description: BDC1148**

## *Method Quality Control: Blank*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 25 | ug/L | | | | | | |
| F2 PHCs (C10-C16) | ND | 100 | ug/L | | | | | | |
| F3 PHCs (C16-C34) | ND | 100 | ug/L | | | | | | |
| F4 PHCs (C34-C50) | ND | 100 | ug/L | | | | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.5 | ug/L | | | | | | |
| Ethylbenzene | ND | 0.5 | ug/L | | | | | | |
| Toluene | ND | 0.5 | ug/L | | | | | | |
| m,p-Xylenes | ND | 0.5 | ug/L | | | | | | |
| o-Xylene | ND | 0.5 | ug/L | | | | | | |
| Xylenes, total | ND | 0.5 | ug/L | | | | | | |
| *Surrogate: Toluene-d8* | *95.0* | | *ug/L* | | *119* | *50-140* | | | |

## *Method Quality Control: Duplicate*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | ND | 25 | ug/L | ND | | | | 30 | |
| **Volatiles** | | | | | | | | | |
| Benzene | ND | 0.5 | ug/L | ND | | | | 30 | |
| Ethylbenzene | ND | 0.5 | ug/L | ND | | | | 30 | |
| Toluene | ND | 0.5 | ug/L | ND | | | | 30 | |
| m,p-Xylenes | ND | 0.5 | ug/L | ND | | | | 30 | |
| o-Xylene | ND | 0.5 | ug/L | ND | | | | 30 | |
| *Surrogate: Toluene-d8* | *99.6* | | *ug/L* | | *124* | *50-140* | | | |

Certificate of Analysis
**Client: CM3 Environmental Inc.**
**Client PO: Hawthorne**

Report Date: 19-Apr-2017
Order Date: 12-Apr-2017
**Project Description: BDC1148**

## *Method Quality Control: Spike*

| Analyte | Result | Reporting Limit | Units | Source Result | %REC | %REC Limit | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|
| **Hydrocarbons** | | | | | | | | | |
| F1 PHCs (C6-C10) | 1810 | 25 | ug/L | | 90.6 | 68-117 | | | |
| F2 PHCs (C10-C16) | 1440 | 100 | ug/L | | 80.2 | 60-140 | | | |
| F3 PHCs (C16-C34) | 3300 | 100 | ug/L | | 88.7 | 60-140 | | | |
| F4 PHCs (C34-C50) | 2490 | 100 | ug/L | | 100 | 60-140 | | | |
| **Volatiles** | | | | | | | | | |
| Benzene | 42.4 | 0.5 | ug/L | ND | 106 | 50-140 | | | |
| Ethylbenzene | 37.6 | 0.5 | ug/L | ND | 94.0 | 50-140 | | | |
| Toluene | 36.2 | 0.5 | ug/L | ND | 90.6 | 50-140 | | | |
| m,p-Xylenes | 73.5 | 0.5 | ug/L | ND | 91.9 | 50-140 | | | |
| o-Xylene | 37.5 | 0.5 | ug/L | ND | 93.6 | 50-140 | | | |
| *Surrogate: Toluene-d8* | *79.7* | | *ug/L* | | *99.6* | *50-140* | | | |

**Qualifier Notes:**

***Login Qualifiers :***

Sample - Received with >5% sediment, instructed to decant and analyze without sediment
*Applies to samples: MW5*

***Sample Qualifiers :***

1 : Elevated detection limit due to dilution required because of high target analyte concentration.

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

None

**Other Report Notes:**

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

*CCME PHC additional information:*

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.