Annual Groundwater and Surface Water Monitoring
Richmond Landing, Property Asset No. 96189
Ottawa, Ontario

Revision: 0 (Final)

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Reviewed by:	Glen Briscoe	
Approved by:	 Glen Briscoe	

EXECUTIVE SUMMARY

Geofirma Engineering Ltd. was retained by the National Capital Commission (NCC) to complete a third year of annual groundwater and surface water monitoring at Richmond Landing in Ottawa, Ontario (NCC Property Asset No. 96189). Richmond Landing is located on the Ottawa River, south of Victoria Island, east of the Portage Bridge and includes landscaped green space, recreational pathways, and is the location of the Royal Canadian Navy Monument.

Former land uses of concern on the site included a bulk fuel storage facility, rail sidings and fill placement, resulting in historical contamination of soil and groundwater with metals, petroleum hydrocarbons (PHCs), polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs). The site has been subject to several investigations of soil, groundwater and surface water quality, in addition to a partial groundwater and soil remediation and re-development completed in 2011. Following site remediation and re-development a five-year monitoring program in addition to a Screening Level Risk Assessment (SLRA) was recommended.

In 2013 following completion of the SLRA and first year of annual monitoring, Geofirma concluded that the only potential risk posed to human receptors on site or off site, was a potential risk associated with site workers excavating contaminated soil. On-site ecological receptors were found to be potentially at risk to metals and PHCs in the subsurface soil, while ecological receptors exposed to PAHs in the subsurface soils were found to be at a low to moderate potential for risk. Assessment of risk posed to off-site ecological receptors by way of site soil becoming sediment in the Ottawa River was low to negligible for metals and PAHs in soil or groundwater. Potential risks posed to aquatic receptors off-site by groundwater discharging to surface water was identified as negligible for metals, VOCs and PHCs, and low for PAH parameters.

Results of the third year of annual monitoring conducted in May and September 2015 indicate that PAH and PHC/BTEX parameters in excess of federal guidelines and provincial standards for residential/parkland land use are still present in groundwater at the site. Areas of low concentration PAH and PHC impacted groundwater remain along the northwest portion of the site. Concentrations of PAH and PHC parameters analysed in site groundwater in 2015 were consistent with those reported in 2014 and lower than those measured in 2013.

One of five surface water samples collected during the May 2015 monitoring program had detections of fluoranthene and pyrene however the low-level detections are not considered an environmental concern to the Ottawa River.

Following the completion of a third year of the annual groundwater and surface water monitoring program for Richmond Landing, the following recommendations are provided.

- The risk management strategies outlined in the SLRA (Geofirma, 2013) for Richmond Landing remain appropriate for the site and their implementation should continue; including annual groundwater and surface water monitoring and bi-annual natural attenuation evaluation.
- The approximate cost to complete the 2016 annual groundwater and surface water monitoring program including the bi-annual assessment of MNA parameters is [redacted] excluding taxes.

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1 INTRODUCTION

Geofirma Engineering Ltd. was retained by the National Capital Commission (NCC) to complete an annual groundwater and surface water monitoring program at Richmond Landing in Ottawa, Ontario (NCC Property Asset No. 96189) hereafter referred to as the site.

Richmond Landing is located on the Ottawa River, south of Victoria Island, east of the Portage Bridge in Ottawa, Ontario. The site includes landscaped green space, recreational pathways, and is the location of the Royal Canadian Navy Monument. The location of the Richmond Landing site is shown on Figure A.1, Appendix A.

The annual groundwater and surface water monitoring program was completed in accordance with Geofirma's proposal dated April 23, 2015, as approved by the NCC on May 6, 2015. Work was completed under Geofirma Standing Offer Agreement No. 586104 with the NCC.

1.1 Background and Previous Investigations

The site has been subject to various investigations since it was chosen for erection of a monument by the Royal Canadian Navy, including a partial soil and groundwater remediation and Screening Level Risk Assessment (SLRA). An initial Phase II investigation was completed by Trow in 2009, identifying soil contamination by way of metals, PAHs, VOCs, and PHCs in the subsurface, in addition to poor quality fill containing waste materials (Trow, 2009a). Additional work completed by Trow in 2009 found groundwater at the site to contain concentrations of PAH and PHC/BTEX parameters in excess of regulatory criteria at the time (Trow, 2009b).

In 2010 Geofirma (as Intera Engineering Ltd.) further investigated site groundwater and conducted an assessment of remedial options in preparation for monument construction. Results of the 2010 groundwater monitoring indicated contamination of groundwater by PHCs in sporadic locations across the site (Intera, 2010).

In 2011 Geofirma retained Vertex Environmental Inc., to undertake a limited scope insitu chemical oxidation program to partially remediate groundwater and soil at the site by way of sodium persulphate solution injections at select locations. Following the remediation program and site redevelopment in 2011 (including limited excavation and disposal of contaminated soil) Geofirma recommended re-instating a groundwater monitoring network at the site and monitoring for a minimum of five years to evaluate the effectives of the remedial actions and to conduct a SLRA (Geofirma, 2011). Eight groundwater monitoring wells were installed at the site in December 2012 to screen the static water table (Geofirma, 2013a).

In 2013 following completion of a SLRA, Geofirma concluded the groundwater remediation was effective at reducing high levels of PHCs, however, PAH and PHC contamination was still present in site groundwater (Geofirma, 2013b). Contaminants of concern in site soil and groundwater included: a limited number of VOCs, several metals parameters, PAHs and all fractions of PHC. Following completion of the SLRA, Geofirma concluded that the only potential risk posed to human receptors on site is the potential risk associated with site workers excavating contaminated soil. Risks to potential off-site human health based on VOCs in the subsurface were negligible. On-site ecological receptors were found to be potentially at risk due to metals and PHCs (low potential for risk) in the subsurface

soil, while ecological receptors exposed to PAHs in the subsurface soils were found to be at a low to moderate potential for risk. Assessment of risk posed to off-site ecological receptors by way of site soil becoming sediment in the Ottawa River was low to negligible for metals and PAHs in soil. Additionally for site groundwater discharging to the Ottawa River, off-site risk to ecological receptors from VOC and PHCs was negligible, and risk from PAH parameters was low.

In 2014 Geofirma completed the second year of the recommended five year monitoring plan proposed in 2011, including the first round of the bi-annual Monitored Natural Attenuation (MNA) assessment. Groundwater monitoring conducted in 2014 indicated that PAHs and PHCs were still present in site groundwater but at concentrations much lower than those recorded in 2013 and 2010. Results of the MNA assessment indicated that the assimilative capacity of groundwater was sufficient to continue to naturally biodegrade remnant hydrocarbon contamination in site groundwater (Geofirma, 2014).

Recommendations made following the 2014 groundwater and surface water monitoring report included the addition of a fall groundwater monitoring event in addition to the spring groundwater monitoring event. The recommendation was made to investigate if there are seasonal variations in PAH and PHC concentrations in site groundwater, possibly related to varying groundwater elevations.

1.2 Study Objectives and Scope of Work

The primary objectives of the 2015 groundwater and surface monitoring program at Richmond Landing are to assess current concentrations of PAH and PHC contamination in site groundwater under varying groundwater elevations and to assess current concentrations of PAHs in surface water proximate to the site.

To meet these objectives, the scope of work included the following general tasks/activities as outlined in the Geofirma proposal dated April 23, 2015:

- Review of previous work and finalization of the work plan;
- Spring sampling and analyses of groundwater and surface water for site contaminants of concern during higher groundwater conditions;
- Following two years of anomalous groundwater elevation data from monitoring well MW09-05, an elevation survey will be conducted to confirm the elevation of this historical monitoring location relative to the current site datum;
- Late summer or fall sampling and analyses of groundwater under low water table conditions for site contaminants of concern; and
- Preparation of a report summarizing findings and providing recommendations based on the risk management plan developed for the site in the 2013 SLRA.

2 METHODOLOGY

Field investigations in support of the 2015 annual groundwater and surface water monitoring program for Richmond Landing took place on May 13, 2015 and September 1, 2015. The site layout and sampling locations of the annual groundwater and surface water monitoring program are provided in Figure A.2. The work included the collection of groundwater depths, field chemistry measurements, low-flow groundwater sampling from accessible site wells for analysis of PAH and PHC parameters and collection of surface water samples adjacent to the site for analysis of PAH parameters.

2.1 Groundwater Elevation Monitoring and Sampling

Prior to spring and fall groundwater sampling, water levels were recorded in all existing site wells on May 13, 2015 and September 1, 2015, with the exception of MW09-15 which could not be located in either round. Water levels were measured relative to the top of the PVC riser using an electronic water level tape that was decontaminated between wells. The top of PVC riser elevation for MW09-05 was resurveyed in May 2015 to confirm the elevation of this historical monitoring location relative to the current site datum. The elevation was found to be 0.43 m higher than previously recorded. The new riser elevation is shown in Table B.1 and has been applied to the current and historical water levels presented.

Spring groundwater sampling was conducted under higher groundwater table conditions on May 13, 2015. Samples were collected from all existing site wells with the exception of MW09-19 due to a lack of groundwater volume, and MW09-15 which could not be located. Fall groundwater sampling was conducted under lower groundwater table conditions on September 1, 2015. Samples were collected from all existing site wells with the exception of MW09-5 and MW09-19 due to a lack of groundwater volume and MW09-15 which could not be located.

Groundwater samples were collected from monitoring wells using dedicated polyethylene tubing and a peristaltic pump (Spectra Field Pro II) using low-flow, parameter stabilization methods prior to sampling. Low-flow purging was carried out at approximately 0.3 litres per minute or less depending on observed draw down conditions, generally following guidance presented in the “Low Flow Purging and Sampling Procedure for the Collection of Groundwater Samplings from Monitoring Wells” (USEPA, 2010).

Nine groundwater samples were submitted for laboratory analysis following the May 2015, sample event while eight groundwater samples were submitted for laboratory analysis following the September 2015, monitoring event. All groundwater samples were analysed for PHC/BTEX and PAH parameters. Groundwater samples for laboratory analyses were collected directly into appropriate containers supplied by the analytical laboratory.

All groundwater samples were analysed by Maxxam Analytics (Maxxam) of Ottawa, Ontario. All samples were stored and shipped in coolers with ice packs and hand-delivered to the laboratory by local courier under chain-of-custody procedures, in accordance with Geofirma QA/QC procedures.

During low-flow groundwater sampling, field readings for temperature, pH, electrical conductivity, dissolved oxygen and oxygen reduction potential were recorded using a YSI 600QS handheld multimeter enclosed in a flow-through cell.

2.2 Surface Water Monitoring

Geofirma staff collected five surface water samples on May 13, 2015; surface water monitoring locations are also provided on Figure A.2. Locations for surface water monitoring were established in similar locations as those established by Trow in 2009, allowing for one background location on each side of the site, one downstream location per side, and one location on the tip of the site where both waters meet.

Surface water samples were collected via reaching pole extended from the shoreline. Samples were collected from approximately 5 cm below surface and as close to shore as possible without disturbing the substrate. All five surface water samples were submitted for analysis of PAH parameters only.

Surface water samples were analysed by Maxxam. All samples were stored and shipped in coolers with ice packs and hand-delivered to the laboratory by local courier under chain-of-custody procedures, in accordance with Geofirma QA/QC procedures.

The elevation of the Ottawa River proximate to the site was surveyed twice in 2015 using a Trimble laser survey level on May 13, 2015 and on September 1, 2015, the same days as groundwater elevations were recorded. The surface water elevation of the Ottawa River was surveyed next to monitoring well MW12-02.

2.3 Quality Assurance/Quality Control Program

A quality assurance/quality control (QA/QC) program was implemented during investigations at the site. The program consisted of standard field protocols in accordance with Geofirma's Quality Management System, use of field quality control samples and internal laboratory QC performed by Maxxam. Field QC samples included the collection of one blind duplicate sample during each monitoring event collected from groundwater and analysed for PAH and PHC/BTEX parameters.

Groundwater blind duplicates consisted of a duplicate sample collected from MW12-03 on May 13, 2015, and a duplicate sample collected from MW12-02 on September 1, 2015.

All samples were stored in coolers with ice packs and hand delivered to laboratories under chain-of-custody procedures, in accordance with Geofirma QA/QC procedures.

3 RESULTS

3.1 Regulatory Guidelines, Criteria and Standards

Groundwater and surface water analytical results are compared to the following federal guidelines and provincial standards:

- Environment Canada Federal Interim Groundwater Quality Guidelines (EC, 2012): Table 2 Generic Guidelines for Residential/Parkland Land Use, Tier 1, coarse grained soil.
- Canadian Council of Ministers of the Environment Canadian Environmental Quality Guidelines (CCME, 1999; updates to 2016) protection of freshwater aquatic life.
- Ontario Ministry of the Environment (MOE, 2011), *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act,* Table 3: Full Depth Generic Site Condition Standards in a Non-potable Ground Water Condition (Residential/Parkland/ Institutional Land Use, coarse grained soil).
- Ontario Ministry of the Environment (MOE, 2011), *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act,* Table 9: Generic Site Condition Standards for use within 30m of a water body in a Non-potable Ground Water Condition (Residential/Parkland/ Institutional Land Use, coarse grained soil).
- Ontario Ministry of the Environment (MOE, 1999), Water Management, Policies, Guidelines, *Provincial Water Quality Objectives* of the Ministry of Environment,

Application of residential/parkland land use guidelines and standards and non-potable water guidelines and standards to the site are based on the continued use of the site as a park and the fact that the site groundwater is not a source of drinking water.

3.2 Groundwater Elevations

Water level measurements were taken in all accessible wells during each site visit in 2015, as described in Section 2.1. Table B.1, Appendix B contains groundwater depths and corresponding groundwater elevations for May and September 2015 monitoring events as well as historical data since January 2013. The groundwater elevations recorded at MW09-5 correlate much better to the rest of the site now that the riser elevation has been corrected. Groundwater elevations from the May 13, 2015, monitoring event are presented on Figure A.3 in Appendix A, while Figure A.4 presents groundwater elevations from the September 1, 2015, monitoring event. The water levels collected May 13, 2015 were approximately one metre lower on average than April 29, 2014 and the water levels in September 2015 were approximately 0.8 m lower than May 2015.

As evident in both Figure A.3 and Figure A.4 the shallow groundwater table is strongly influenced by the elevation of the Ottawa River, which flows parallel to the site on both the south-east and north-west sides. Groundwater elevations calculated in May 2015, for MW12-02, -03, -04, -05, -06 and MW09-05 were within 0.01 m of each other and generally equal to the elevation of the Ottawa River, which is consistent with groundwater elevations recorded in three previous rounds in 2013 and 2014. Consistent with historical data, groundwater elevations are highest at MW12-08 at the top of the embankment and decreasing in correlation with the ground surface elevation and bedrock surface elevation towards MW12-06.

Groundwater elevations calculated in September were more variable than those historically presented for spring and summer months in 2013 and 2014. Elevations calculated for MW12-03, -04, -05, -06 and MW09-5 varied by 0.09 m in September 2015.

In contrast to May 2015 data, MW12-02 and MW12-01 were 0.8 to 1.0 m lower than those from MW12-03, -04, -05, -06 and MW09-5. Also notable from the September 2015 monitoring event is that for all wells located at the bottom of the embankment, the Ottawa River was higher in elevation than groundwater elevations measured in the wells adjacent to it. This is likely due to a relatively rapid increase in river elevation in the days leading up to the monitoring event, and the varied response of each well corresponding to the local hydraulic conductivity of the screened interval. The increase in river elevation is likely attributable to water level management by the upstream hydro dam.

Groundwater flow direction in both spring and fall monitoring events appeared to be generally consistent with that of the Ottawa River. Groundwater flow is directed to the northeast from the top of the embankment at MW12-08 to the toe of the slope at MW12-06, from this location to MW12-01 groundwater elevations are relatively flat.

Groundwater elevation data from May and September 2015, in conjunction with a review of historical data, indicates that the groundwater table at the site is connected to the Ottawa River. The bedrock surface which outcrops along the north side of the site, likely provides the source for surface water infiltration from the Ottawa River to site, while the fractured bedrock surface and overburden interface likely acts as a transmissive pathway for groundwater and surface water interaction. This scenario results in a discharge/recharge relationship between groundwater beneath the site and surface water adjacent to the site.

3.3 Groundwater Quality

Observations of contamination in site groundwater were recorded during each monitoring event. There was only one field observation of contamination in 2015 where a faint hydrocarbon odour was detected while sampling MW12-08 in September. During the sampling of all other monitoring wells in May and September 2015, no other observations of a hydrocarbon sheen or odour were noted.

3.3.1 Polycyclic Aromatic Hydrocarbons

Laboratory analytical results for PAH analysis for May 13 and September 1, 2015 groundwater sampling events are summarized in Table B.2 in Appendix B and presented alongside historical groundwater data. Complete laboratory analytical reports are included in Appendix C.

Review of the 2015 analytical results for PAH analysis in groundwater at the site indicates the following:

- Only one of nine monitoring wells (MW12-07) exceeded FIGQG in May 2015, while five of eight exceeded FIGQG in September 2015.
- One of four wells (MW12-04) located within 10 m of the Ottawa River exceeded CCME protection of Freshwater Aquatic Life (FAL) guidelines for PAH parameters in 2015.
- None of the 17 groundwater samples analysed for PAH parameters in 2015 exceeded MOE Table 3 or Table 9 standards for PAH parameters in May or September.

- With the exception of May 2015, MW12-05 contained the highest concentrations of PAH parameters in groundwater at the site. This is consistent with historical data from 2013 and 2014.
- Parameters exceeding FIGQGs in 2015 included: anthracene, benzo[a]anthracene, benzo[a]pyrene, chrysene, fluoranthene, naphthalene, phenanthrene and pyrene.
- Parameters exceeding CCME FAL guidelines in 2015 included only: anthracene and pyrene.
- In general, PAH concentrations measured in site groundwater in May and September 2015, were consistent with those presented in 2014 and lower than those presented in 2013.
- Concentrations of PAHs in site groundwater did not appear to show a strong correlation to groundwater elevations however more exceedences were recorded in September during lower groundwater conditions than in May under higher groundwater conditions.
- The following monitoring wells recorded no exceedences of CCME or MOE guidelines or standards for PAH parameters in either May or September 2015: MW09-5, MW12-01, MW12-02 and MW12-03. The same four wells did not record any PAH exceedences in 2014.

3.3.2 Petroleum Hydrocarbons

Laboratory analytical results for PHC/BTEX analysis for May 13 and September 1, 2015 groundwater sampling events are summarized in Table B.3 in Appendix B and presented alongside historical groundwater data. Complete laboratory analytical reports are included in Appendix C.

Review of the 2015 analytical results for PHC/BTEX analysis in groundwater at the site indicates the following:

- Four of nine monitoring wells exceeded MOE standards for PHCs in May and five of eight exceeded MOE standards in September.
- Only one well (MW12-08) had any BTEX parameters detected and only benzene exceeded any guidelines or standards, which is consistent with previous sampling events. MW12-08 exceeded MOE standards in both May and September 2015 as well as FIGQGs in May.
- Only one of the 17 groundwater samples analysed for PHC/BTEX parameters in 2015 exceeded FIGQGs. The concentrations of benzene and PHC F1 fraction measured at MW12-08 in May were the only parameters to exceed FIGQGs in 2015 for PHC/BTEX parameters.
- One of four wells (MW12-04) located within 10 m of the Ottawa River exceeded CCME protection of Freshwater Aquatic Life (FAL) guidelines for PAH parameters in 2015.
- PHC F2 exceeded MOE standards in May and September 2015 at monitoring wells MW12-03, MW12-04, and MW12-06 and MW12-05 exceeded in September only.
- PHC/BTEX concentrations measured in site groundwater in 2015 were consistent with those presented in 2014 and lower than those presented in 2013, with the exception of elevated PHC F2 concentrations measured at MW12-05 in September 2015.
- Concentrations of PHC F2 fraction in site groundwater appear to show some correlation to groundwater elevation. PHC F2 values were higher on average in September 2015 than those presented for May 2015 and May 2014 but lower than those presented for July 2013.

3.3.3 Field Parameters

Field parameters collected from all sampled groundwater wells are presented along with PHC/BTEX results in Table B.3 in Appendix B.

- Groundwater pH was consistent with historical data in both May and September 2015, with values indicating a neutral pH. The pH values from MW12-02, -03, -04, -05 and -06 were slightly below CCME and MOE pH range values at least once in 2015.
- Dissolved Oxygen (DO) concentrations in site groundwater were generally low with the exception of data from MW09-05, MW12-02 and MW12-05 in May 2015 and MW12-07 in September 2015.
- Oxidation-Reduction Potential (ORP) values recorded during both sampling events in 2015 varied significantly with no spatial or temporal trends apparent.
- Electrical Conductivity (EC) values were generally comparable to historical values for each monitoring well in both May and September 2015.

3.4 Surface Water Quality

Geofirma collected five surface water samples on May 13, 2015 from the same locations sampled in April 2014. Surface water monitoring locations are illustrated on Figure A.2 and the results are tabulated in Table B.4 in Appendix B. Locations for surface water monitoring were established in similar locations as those established by Trow in 2009.

- No PAH parameters were detected above laboratory detection limits at four of the five surface water monitoring locations (SW14-1, SW14-3, SW14-4 and SW14-5).
- Fluoranthene exceeded the interim PWQO in May 2015 at surface water location SW14-2 but met the federal guideline. Aside from fluoranthene the only other PAH parameter detected above laboratory limits was pyrene, also from SW14-2. Both detections were just above the method detection limit and are not considered a significant environmental concern.

3.5 Quality Assurance/Quality Control Program

Laboratory analysis in 2015 were completed by Maxxam, a CALA (Canadian Association for Laboratory Accreditation) certified laboratory. Maxxam completed all analyses in accordance with internal laboratory QC programs that included referenceable, standardized analytical methods and procedures, and use of laboratory quality control samples. Certificates of quality controls were provided by Maxxam for all completed analysis. These certificates summarize standardized analytical methods, and the laboratory's results for laboratory QA/QC samples including replicate samples, process blanks, standard surrogate additions and matrix spikes. Complete laboratory analytical reports for the 2015 sampling program are provided in Appendix C. Laboratory method blank and duplicate analyses are not included on the summary analytical tables in Appendix B, but are available for review in Appendix C.

Geofirma review of Maxxam QA/QC certificates indicates that all analytical results fell within acceptable QA/QC limits for constituent recovery as defined by the protocols for the analytical methods.

Relative percent differences were calculated for blind duplicate groundwater samples collected from MW12-03 in May and MW12-02 in September for both PAH and PHC/BTEX analysis. The relative percent difference calculated for both PAH and PHC/BTEX analysis in May was 0%. The relative percent difference calculated for PHC/BTEX parameters from MW12-02 in September was also 0% and the RPD value for PAH analysis in September was 20%.

Based on a review of the laboratory and field QA/QC documentation, the groundwater and surface water analytical results from 2015 sampling are considered of acceptable quality and can be used in this report without qualification.

3.6 Discussion

3.6.1 Polycyclic Aromatic Hydrocarbons

Concentrations of low molecular weight PAHs in groundwater in the vicinity of MW12-03, -04, -05, -06, -07 and -08 indicate groundwater impacts remain from historical site usage. The source of low-level PAH contamination in site groundwater is likely due to remnant contamination in overburden material not removed during the 2011 partial remediation and re-development (Geofirma, 2012) or remnant PAH contamination entrained in the fracture network of shallow bedrock.

Fluoranthene exceeded PWQOs in surface water proximate to the site in May 2015 at surface water location SW14-2. This sole exceedence and the low concentration detection of pyrene were the only PAH parameters above laboratory method detection limits in surface water proximate to the site. The 2015 and 2014 data indicates that PAH-impacted groundwater is not significantly impacting surface water adjacent to the site. The source of fluoranthene in surface water from SW14-2 may also be the aqueduct discharging to the Ottawa River approximately 50 m upstream of this location.

Continued monitoring of PAHs in surface water adjacent to the site may not be necessary unless hydraulic conditions or contaminant concentrations in groundwater at the site change significantly.

3.6.2 Petroleum Hydrocarbons

PHC-impacted groundwater at the site is primarily by way of PHC F2 fraction. The F2 fraction consistently exceeds the MOE Table 3 and Table 9 standards for F2 components at MW12-03, -04, and -06 with sporadic exceedences at MW12-05. When groundwater elevations were lower in July 2013 and September 2015, PHC F2 concentrations were elevated in MW12-05. In May of 2014 and 2015 when the groundwater elevation was higher than the top of the screened interval in MW12-05, the F2 fraction was not detected.

PHC F1 and BTEX parameter contamination is confined to MW12-08. PHC-F1 fraction and BTEX have not been present in any other site wells since 2013, indicating an isolated area of light fraction PHC contamination.

4 CONCLUSIONS AND RECOMMENDATIONS

Following completion of a third year of annual groundwater and surface water monitoring for Richmond Landing, the following conclusions are provided:

- Contaminants exceeding applicable federal guidelines and provincial standards for residential/parkland land use, coarse-grained soil, in a non-potable groundwater condition were identified in groundwater at the site in both May and September 2015.
- In general, PAH concentrations measured in site groundwater in 2015 were consistent with those presented in 2014 and lower than those presented in 2013.
- PHC/BTEX concentrations measured in site groundwater in 2015 were generally consistent with those presented in 2014 and lower than those presented in 2013, with the exception of elevated PHC F2 concentrations measured at MW12-05 in September 2015.
- Fluoranthene was detected above PWQOs in one of five surface water samples collected adjacent to the site in May 2015. This low-level exceedence is not considered an environmental concern to the Ottawa River.

Based on the conclusions provided above, the following recommendations are provided:

- The risk management strategies outlined in the SLRA (Geofirma, 2013) for Richmond Landing remain appropriate for the site and their implementation should continue; including annual groundwater and surface water monitoring and bi-annual natural attenuation evaluation.
- The approximate cost to complete the 2016 annual monitoring program with an MNA assessment is [redacted] excluding taxes.

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6 CLOSURE

This report has been prepared for the exclusive use of the National Capital Commission (NCC) using a methodology for conducting groundwater and surface water monitoring that is acceptable within the profession. Data obtained from sampling investigations represent the conditions about a limited area surrounding the sampling location at the time of sampling and as such can be expected to be variable with respect to location and time.

Geofirma Engineering Ltd. has exercised professional judgment in collecting and analyzing the information and in formulating recommendations based on the results of the study. The mandate at Geofirma is to perform the given tasks within guidelines prescribed by the client and with the quality and due diligence expected within the profession. No other warranty or representation expressed or implied, as to the accuracy of the information or recommendations is included or intended in this report.

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Respectfully submitted,

Geofirma Engineering Ltd.

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Environmental Scientist

Glen Briscoe, P. Eng.
Senior Project Manager

APPENDIX A

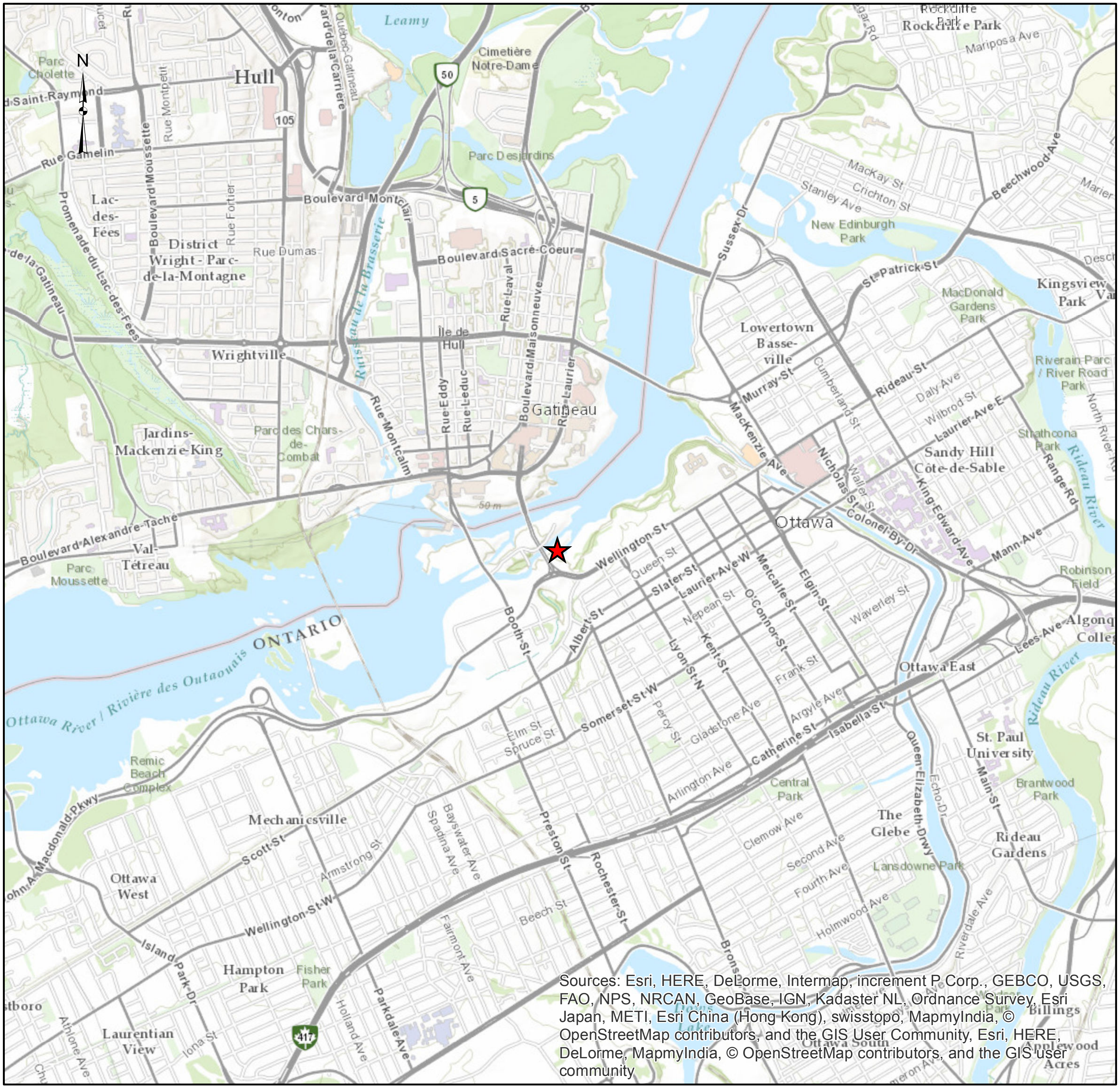
Site Figures

A.1 Site Location

A.2 Site Layout

A.3 May 2015, Groundwater Elevations and Flow Directions

A.4 September 2015, Groundwater Elevations and Flow Directions



LEGEND

★ Richmond Landing

Figure A.1
Site Location

Scale 1:35,000

Meters
0 250 500 1,000

Coordinate System: NAD 83 MTM Zone 9
Source: NCC, LIO, MNR

PROJECT No. 13-215-24

PROJECT
2015 Groundwater and Surface Water Monitoring Richmond Landing

DESIGN: NMP
CAD/GIS: ADG/NMP
CHECK: DMP
REV: 0

DATE: 11/18/2015

Geofirma Engineering Ltd

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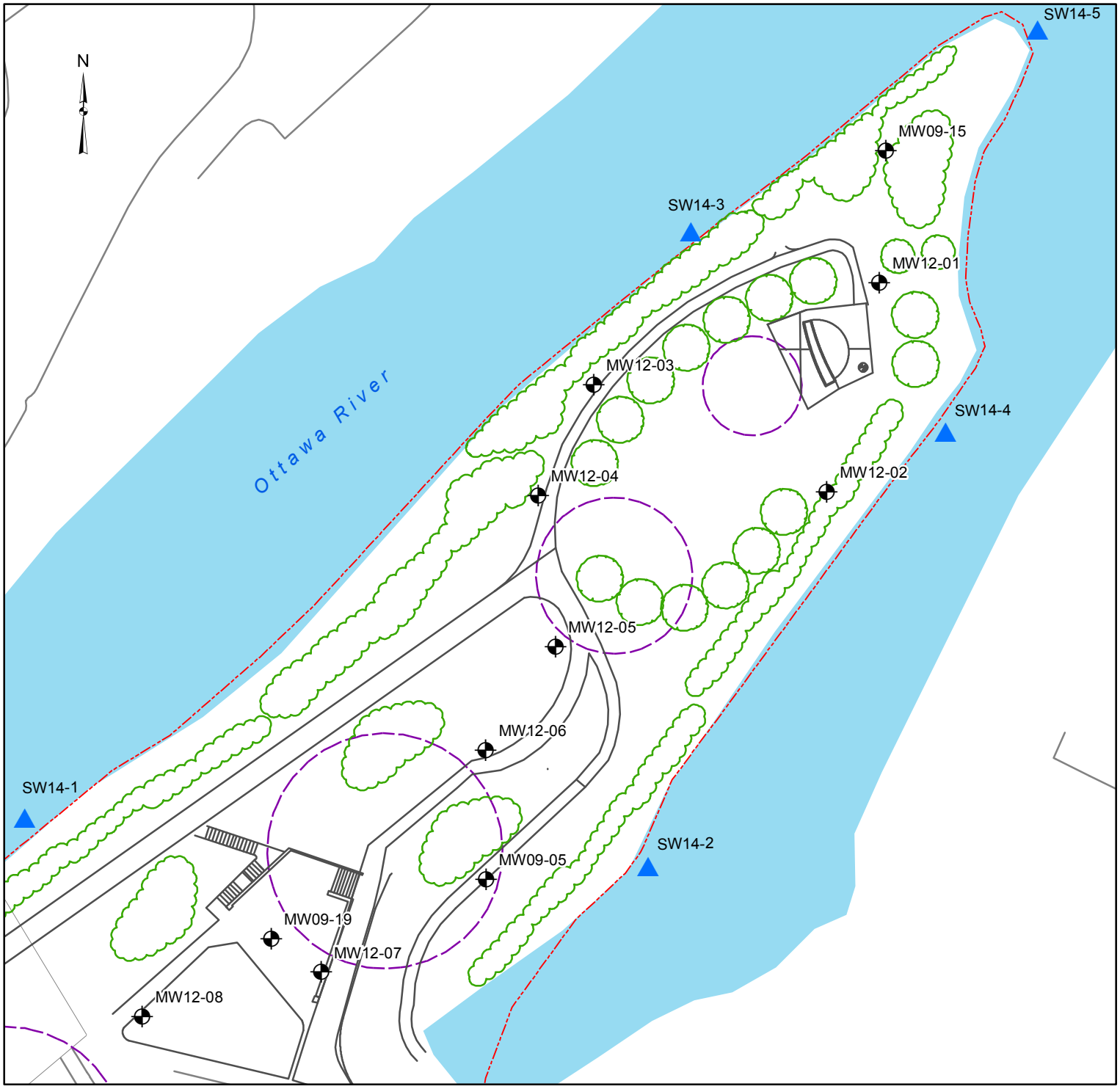

LEGEND

- Property Boundary
- Road
- Pathway
- Shrub/Tree
- Ottawa River
- Former Gas Holder Location
- Monitoring Well Location
- Surface Water Sampling Location

Figure A.2
Site Layout

Scale 1:900

Metres

0 10 20 40

Coordinate System: NAD 83 MTM Zone 9
Source: NCC, LIO, MNR

PROJECT No. 13-215-24

PROJECT

2015 Groundwater and Surface Water Monitoring
Richmond Landing

DESIGN: NMP
CAD/GIS: ADG/NMP
CHECK: DMP
REV: 0

DATE: 11/18/2015

Geofirma Engineering Ltd

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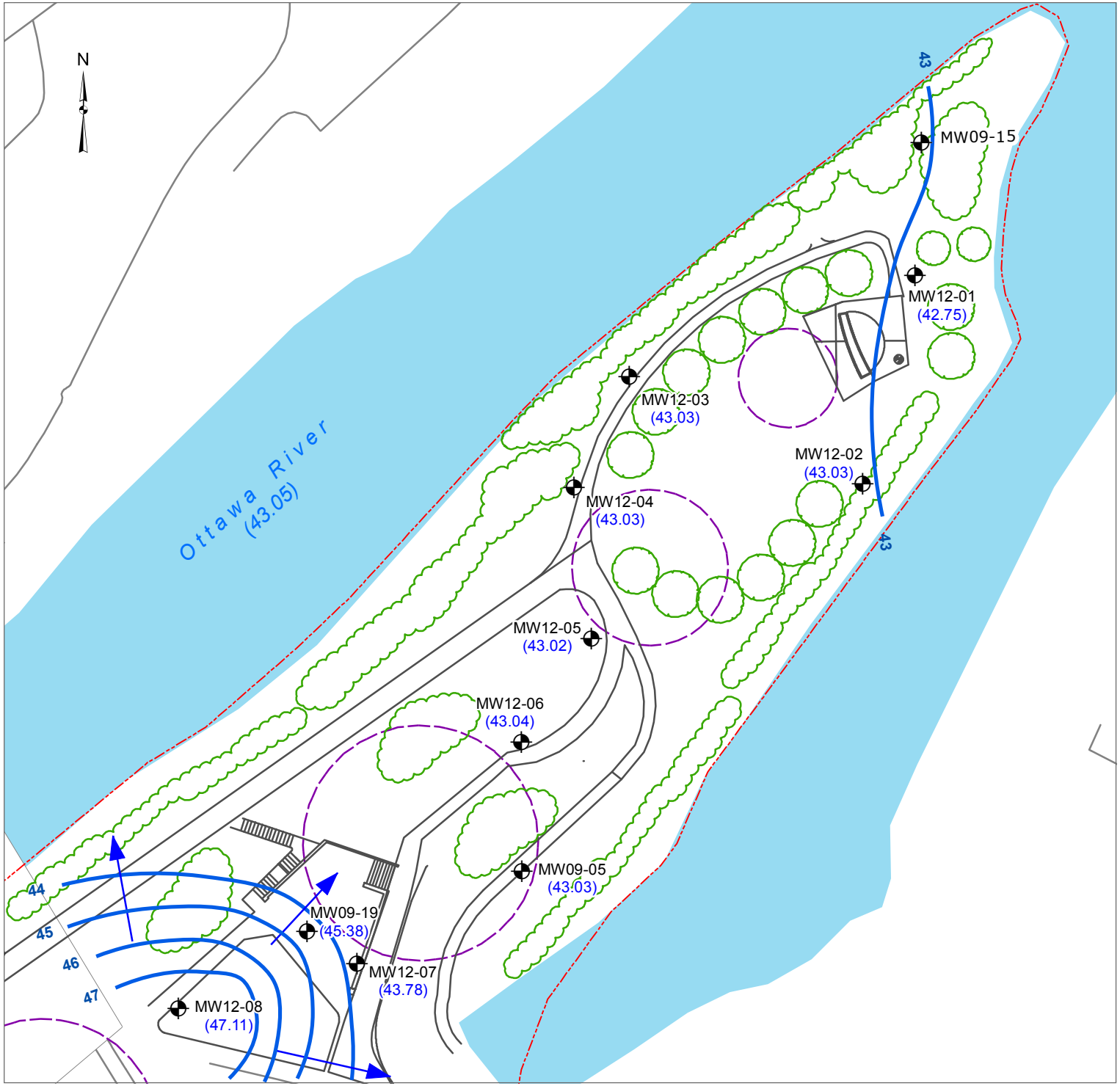

LEGEND

- Property Boundary
- Road
- Pathway
- Shrub/Tree
- Ottawa River
- Former Gas Holder Location
- Monitoring Well Location
- Interpretted Groundwater Contour (mASL)
- Interpretted Groundwater Flow Direction
- (44.11) Groundwater Elevation (mASL) 13-May-15

Figure A.3
May 2015
Groundwater Elevation and Flow Direction

Scale 1:900

Metres
0 10 20 40

Projection: NAD 83 MTM Zone 9
Source: NCC, Geogaphy Network Canada

PROJECT No. 13-215-24

PROJECT
2015 Groundwater and Surface Water Monitoring
Richmond Landing

DESIGN: NMP
CAD/GIS: NMP/ADG
CHECK: DMP
REV: 0

DATE: 3/9/2016

Geofirma Engineering Ltd

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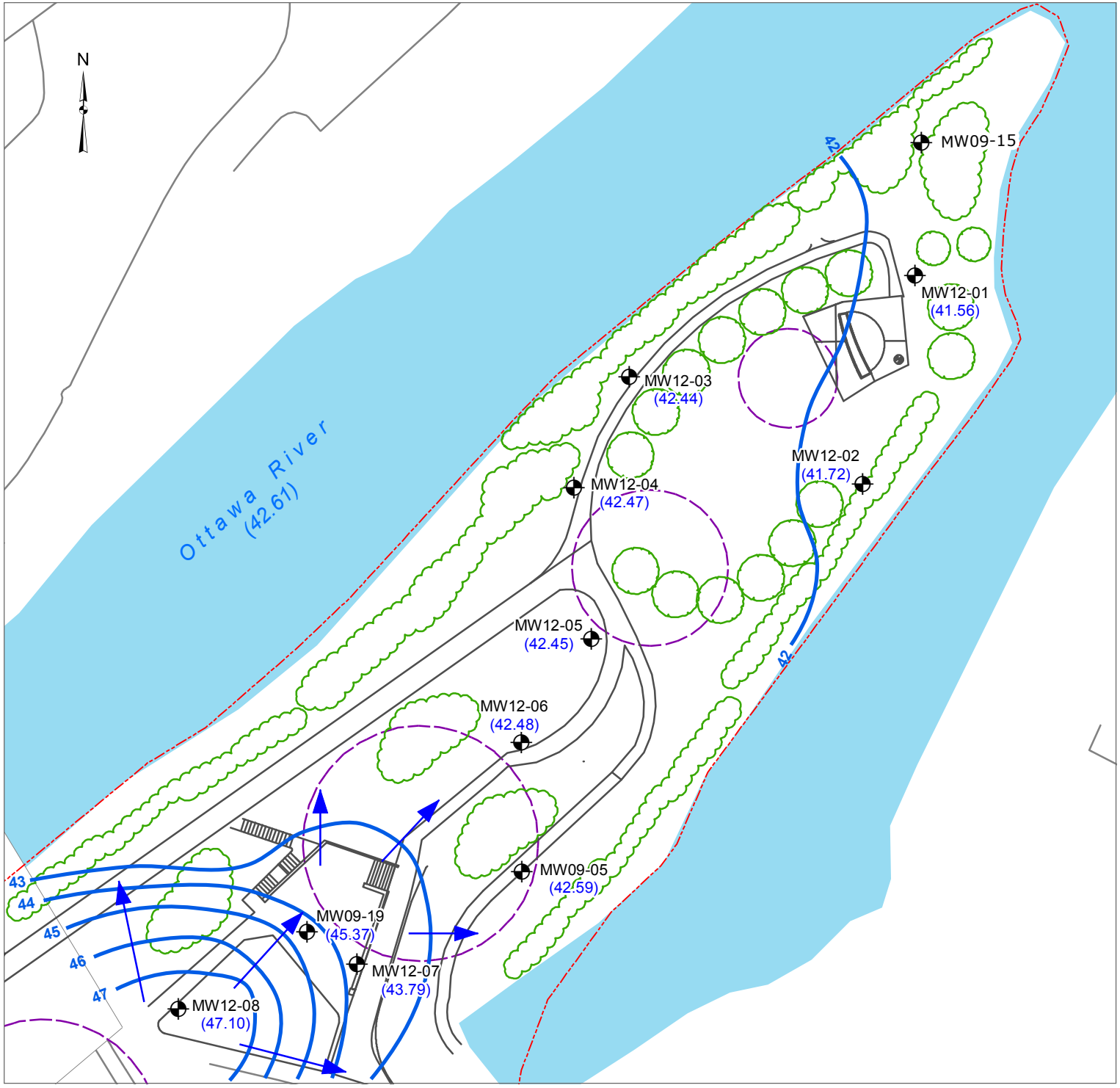

LEGEND

- Property Boundary
- Road
- Pathway
- Shrub/Tree
- Ottawa River
- Former Gas Holder Location
- Monitoring Well Location
- Interpretted Groundwater Contour (mASL)
- Interpretted Groundwater Flow Direction
- (44.11) Groundwater Elevation (mASL) 13-Sep-15

Figure A.4
September 2015 Groundwater Elevation and Flow Direction

Scale 1:900

Metres
0 10 20 40

Projection: NAD 83 MTM Zone 9
Source: NCC, Geogaphy Network Canada

PROJECT No. 13-215-24

PROJECT
2015 Groundwater and Surface Water Monitoring
Richmond Landing

DESIGN: NMP
CAD/GIS: NMP/ADG
CHECK: DMP
REV: 0

DATE: 3/9/2016

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APPENDIX B

Summary Data Tables

B.1 Groundwater Elevations

B.2 Groundwater Analytical Results – PAH

B.3 Groundwater Analytical Results – PHC & Field Parameters

B.4 Surface Water Analytical Results - PAH

Table B.1 - Groundwater Elevations

Monitoring Well ID & Zone	Ground Surface Elevation (mASL)	Top of Well PVC Riser Elevation (mASL)	8-Jan-13		6-Jul-13		29-Apr-14		13-May-15		1-Sep-15	
			Water Level Depth (mBTR)	Water Level Elevation (mASL)	Water Level Depth (mBTR)	Water Level Elevation (mASL)	Water Level Depth (mBTR)	Water Level Elevation (mASL)	Water Level Depth (mBTR)	Water Level Elevation (mASL)	Water Level Depth (mBTR)	Water Level Elevation (mASL)
MW09-05*	47.43	47.34	--	--	4.751	42.59	3.194	44.15	4.31	43.03	4.813	42.53
MW09-19	52.86	52.81	--	--	Dry (7.45)	<45.36	Dry (7.43)	<45.38	Dry (7.44)	<45.38	Dry (7.43)	<45.37
MW12-01	45.68	45.60	2.49	43.11	3.029	42.57	1.494	44.11	2.851	42.75	4.04	41.56
MW12-02	46.05	45.92	2.80	43.12	3.332	42.59	1.8	44.12	2.884	43.03	4.201	41.72
MW12-03	46.70	46.62	3.50	43.12	4.014	42.61	2.501	44.12	3.591	43.03	4.183	42.44
MW12-04	47.77	47.66	4.55	43.12	5.046	42.62	3.561	44.10	4.63	43.03	5.192	42.47
MW12-05	48.87	48.81	5.71	43.10	6.254	42.56	4.71	44.10	5.791	43.02	6.364	42.45
MW12-06	50.15	50.09	6.97	43.12	7.446	42.64	5.97	44.12	7.05	43.04	7.612	42.48
MW12-07	53.07	53.02	9.24	43.78	9.243	43.78	8.906	44.11	9.245	43.78	9.233	43.79
MW12-08	55.65	55.57	9.69	45.88	8.587	46.99	8.190	47.38	8.462	47.11	8.478	47.10
Ottawa River	nv	nv	--	43.14	--	42.60	--	44.13	--	43.05	--	42.61

Notes:

mASL = metres above sea level.

mBTR = metres below top of PVC riser

() = bottom of well measurement with water level tape when well was dry

* = Elevation of MW09-05 was resurveyed May 2015 and adjusted up by 0.43 m

Notes for Groundwater Analytical Results, Tables B.2-B.3

Notes:

All units are µg/L unless otherwise noted
MDL = Method Detection Limit
<0.05 = Not detected above MDL
NV = No Value
-- = Parameter not analysed
** = The methylnaphtalene standards are applicable to both 1-methylnaphtalene and 2-methylnaphtalene with provision that both are detected, the sum of the two not exceed the standard.
FIGQG = Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites, November 2015.
Table 2 Generic Guidelines for Residential/Parkland Land Use, Tier 1, coarse grained soil.
CCME FAL = Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life, 1999.
Updates to 2016. Applied only to groundwater monitoring wells within 10 m of the Ottawa River.
MOE = Soil, Groundwater and Sediment Standards for use under Part XV.1 of the Environmental Protection Act, April 2011
Table 3 = Full depth generic site condition standards in a non-potable ground water condition, coarse grained soil
Table 9 = Generic site condition standards for use within 30m of a water body in a non-potable groundwater condition
* = Guideline is dependent on Hardness as CaCO3, no historical or current hardness values exist, therefore the lowest presented value is used.

bold = indicates concentrations which exceed FIGQG guidelines
Underline = indicates concentrations which exceed CCME FAL guideliens
= indicates concentrations which exceed MOE Table 9
= indicates concentrations which exceed MOE Table 3 and Table 9 standards

Table B.2- Groundwater Analytical Results - Polycyclic Aromatic Hydrocarbons

Parameter	FIGQG Tier 1 - Table 2	CCME	MOE	MOE	MW09-5						MW12-01		
Date Sampled>	(µg/L)	FAL (ug/L)	Table 3 (µg/L)	Table 9 (µg/L)	21-Jan-09	11-Jun-09	13-Apr-10	Duplicate 13-Apr-10	2-May-14	13-May-15	2-May-14	13-May-15	1-Sep-15
Acenaphthene	5.8	5.8	600	600	0.4	<0.05	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	<0.010
Acenaphthylene	46	NV	1.8	1.4	0.17	0.08	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	<0.010
Anthracene	0.012	0.012	2.4	1	**0.05**	**0.05**	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[a]anthracene	0.018	0.018	4.7	1.8	**0.07**	**0.08**	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[a]pyrene	0.01	0.015	0.81	0.81	**0.03**	**0.06**	0.005	0.005	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[k]fluoranthene	0.48	NV	0.4	0.4	<0.05	<0.05	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[b]fluoranthene	NV	NV	0.75	0.75	0.05	0.09	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[ghi]perylene	0.17	NV	0.2	0.2	<0.05	0.1	<0.1	<0.1	<0.010	<0.010	<0.010	<0.010	<0.010
Biphenyl	NV	NV	1000	1700	<0.05	<0.05	--	--	--		--		
Chrysene	0.1	NV	1	0.7	0.05	0.08	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	<0.010
Dibenzo[a,h] anthracene	0.26	NV	0.52	0.4	<0.05	<0.05	<0.1	<0.1	<0.010	<0.010	<0.010	<0.010	<0.010
Fluoranthene	0.04	0.04	130	73	**0.17**	**0.29**	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	<0.010
Fluorene	3	3	400	290	0.43	0.21	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	0.011
Indeno[1,2,3-cd]pyrene	0.21	NV	0.2	0.2	<0.05	<0.05	<0.1	<0.1	<0.010	<0.010	<0.010	<0.010	<0.010
1-Methylnaphthalene	NV	NV	NV	NV	3.27	0.49	<0.05	<0.05	<0.010	0.052	<0.010	0.11	0.11
2-Methylnaphthalene	NV	NV	NV	NV	1.14	0.14	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	0.013
Methylnaphthalene, 2-(1-)-**	180	NV	1800	1500	4.41	0.63	<0.1	<0.1	<0.02	0.052	<0.02	0.11	0.123
Naphthalene	1.1	1.1	1400	1400	**1.12**	0.27	0.06	0.08	<0.010	<0.010	<0.010	0.012	0.023
Phenanthrene	0.4	0.4	580	380	0.38	0.3	<0.03	<0.03	<0.010	<0.010	<0.010	<0.010	<0.010
Pyrene	0.025	0.025	68	5.7	**0.17**	**0.4**	<0.05	<0.05	<0.010	<0.010	<0.010	<0.010	<0.010

Table B.2- Groundwater Analytical Results - Polycyclic Aromatic Hydrocarbons

Parameter	FIGQG Tier 1 - Table 2	CCME	MOE	MOE	MW12-02					MW12-03				
Date Sampled>	(µg/L)	FAL (ug/L)	Table 3 (µg/L)	Table 9 (µg/L)	11-Jul-13	2-May-14	13-May-15	1-Sep-15	MW-DUP 1-Sep-15	11-Jul-13	2-May-14	13-May-15	MW-DUP 13-May-15	1-Sep-15
Acenaphthene	5.8	5.8	600	600	<0.1	<0.010	<0.010	0.013	0.014	0.3	0.014	0.29	0.22	0.79
Acenaphthylene	46	NV	1.8	1.4	<0.1	<0.010	<0.010	<0.010	<0.010	<0.1	<0.010	<0.10	<0.10	0.04
Anthracene	0.012	0.012	2.4	1	<0.1	<0.010	<0.010	<0.010	<0.010	**0.2**	<0.010	<0.10	<0.10	0.01
Benzo[a]anthracene	0.018	0.018	4.7	1.8	<0.1	<0.010	<0.010	<0.010	<0.010	**0.5**	<0.010	<0.10	<0.10	<0.010
Benzo[a]pyrene	0.01	0.015	0.81	0.81	<0.1	<0.010	<0.010	<0.010	<0.010	**0.54**	<0.010	<0.10	<0.10	<0.010
Benzo[k]fluoranthene	0.48	NV	0.4	0.4	<0.05	<0.010	<0.010	<0.010	<0.010	0.46	<0.010	<0.10	<0.10	<0.010
Benzo[b]fluoranthene	NV	NV	0.75	0.75	<0.05	<0.010	<0.010	<0.010	<0.010	0.45	<0.010	<0.10	<0.10	<0.010
Benzo[ghi]perylene	0.17	NV	0.2	0.2	<0.1	<0.010	<0.010	<0.010	<0.010	**0.3**	<0.010	<0.10	<0.10	<0.010
Biphenyl	NV	NV	1000	1700	--	--				--	--			
Chrysene	0.1	NV	1	0.7	<0.05	<0.010	<0.010	<0.010	<0.010	**0.55**	<0.010	<0.10	<0.10	<0.010
Dibenzo[a,h] anthracene	0.26	NV	0.52	0.4	<0.1	<0.010	<0.010	<0.010	<0.010	0.1	<0.010	<0.10	<0.10	<0.010
Fluoranthene	0.04	0.04	130	73	<0.1	<0.010	<0.010	<0.010	<0.010	**1**	<0.010	<0.10	<0.10	0.017
Fluorene	3	3	400	290	<0.1	<0.010	<0.010	0.013	0.013	<0.1	0.034	0.6	0.48	1.8
Indeno[1,2,3-cd]pyrene	0.21	NV	0.2	0.2	<0.1	<0.010	<0.010	<0.010	<0.010	0.3	<0.010	<0.10	<0.10	<0.010
1-Methylnaphthalene	NV	NV	NV	NV	<0.1	<0.010	0.076	0.14	0.15	5.9	0.18	12	10	34
2-Methylnaphthalene	NV	NV	NV	NV	<0.1	<0.010	<0.010	0.011	0.012	<0.1	<0.010	<0.10	<0.10	<0.10 (1)
Methylnaphthalene, 2-(1-)-**	180	NV	1800	1500	<0.1	<0.02	0.076	0.151	0.162	5.9	0.18	12	10	34
Naphthalene	1.1	1.1	1400	1400	<0.1	<0.010	<0.010	0.023	0.022	<0.1	<0.020	<0.50 (1)	0.16	<0.50 (1)
Phenanthrene	0.4	0.4	580	380	<0.1	<0.010	<0.010	<0.010	<0.010	**0.8**	<0.010	<0.10	<0.10	0.33
Pyrene	0.025	0.025	68	5.7	<0.1	<0.010	<0.010	<0.010	<0.010	**0.9**	<0.010	<0.10	<0.10	0.013

Table B.2- Groundwater Analytical Results - Polycyclic Aromatic Hydrocarbons

Parameter	FIGQG Tier 1 - Table 2	CCME	MOE	MOE	MW12-04				MW12-05			
Date Sampled>	(µg/L)	FAL (ug/L)	Table 3 (µg/L)	Table 9 (µg/L)	11-Jul-13	2-May-14	13-May-15	1-Sep-15	11-Jul-13	2-May-14	13-May-15	1-Sep-15
Acenaphthene	5.8	5.8	600	600	0.2	0.43	0.36	0.9	0.2	0.015	<0.010	1
Acenaphthylene	46	NV	1.8	1.4	<0.1	0.016	<0.10	0.031	<0.1	<0.010	<0.010	<0.20 (1)
Anthracene	0.012	0.012	2.4	1	<0.1	<0.010	<0.10	**0.014**	**1**	**0.013**	<0.010	**0.22**
Benzo[a]anthracene	0.018	0.018	4.7	1.8	**0.2**	<0.010	<0.10	<0.010	**3.8**	**0.024**	<0.010	**0.19**
Benzo[a]pyrene	0.01	0.015	0.81	0.81	**0.18**	<0.010	<0.10	<0.010	**3.83**	**0.022**	<0.010	**0.087**
Benzo[k]fluoranthene	0.48	NV	0.4	0.4	0.19	<0.010	<0.10	<0.010	**2.92**	0.01	<0.010	0.044
Benzo[b]fluoranthene	NV	NV	0.75	0.75	0.17	0.01	<0.10	<0.010	3.12	0.026	<0.010	0.12
Benzo[ghi]perylene	0.17	NV	0.2	0.2	0.1	<0.010	<0.10	<0.010	**2.3**	0.01	<0.010	0.045
Biphenyl	NV	NV	1000	1700	--	--			--	--		
Chrysene	0.1	NV	1	0.7	**0.25**	0.01	<0.10	<0.010	**3.55**	0.02	<0.010	**0.15**
Dibenzo[a,h] anthracene	0.26	NV	0.52	0.4	<0.1	<0.010	<0.10	<0.010	**1**	<0.010	<0.010	0.011
Fluoranthene	0.04	0.04	130	73	**0.4**	0.03	<0.10	0.035	**5.8**	**0.057**	<0.010	**0.64**
Fluorene	3	3	400	290	0.5	0.7	0.53	1.3	<0.1	0.014	<0.010	0.87
Indeno[1,2,3-cd]pyrene	0.21	NV	0.2	0.2	0.1	<0.010	<0.10	<0.010	**2.1**	0.011	<0.010	0.046
1-Methylnaphthalene	NV	NV	NV	NV	1.8	1.9	2.3	7.3	<0.1	0.31	<0.010	34
2-Methylnaphthalene	NV	NV	NV	NV	<0.1	<0.010	<0.10	0.077	<0.1	0.016	<0.010	<0.50 (1)
Methylnaphthalene, 2-(1-)-**	180	NV	1800	1500	1.8	1.9	2.3	7.377	<0.1	0.326	<0.020	34
Naphthalene	1.1	1.1	1400	1400	<0.1	<0.050	<0.20 (1)	0.18	0.6	0.078	<0.010	**1.5**
Phenanthrene	0.4	0.4	580	380	**0.5**	0.079	<0.10	0.23	**3.1**	0.039	<0.010	**1.4**
Pyrene	0.025	0.025	68	5.7	**0.3**	0.025	<0.10	**0.027**	**5.6**	**0.049**	<0.010	**0.55**

Table B.2- Groundwater Analytical Results - Polycyclic Aromatic Hydrocarbons

Parameter	FIGQG Tier 1 - Table 2	CCME	MOE	MOE	MW12-06				MW12-07			
Date Sampled>	(µg/L)	FAL (ug/L)	Table 3 (µg/L)	Table 9 (µg/L)	11-Jul-13	2-May-14	13-May-15	1-Sep-15	11-Jul-13	2-May-14	13-May-15	1-Sep-15
Acenaphthene	5.8	5.8	600	600	<0.1	0.13	0.1	0.92	<0.1	0.014	0.015	0.016
Acenaphthylene	46	NV	1.8	1.4	<0.1	0.016	<0.010	0.033	<0.1	0.017	<0.010	<0.010
Anthracene	0.012	0.012	2.4	1	<0.1	**0.018**	0.01	**0.023**	<0.1	**0.041**	**0.025**	**0.07**
Benzo[a]anthracene	0.018	0.018	4.7	1.8	**0.2**	<0.010	<0.010	<0.010	<0.1	**0.087**	**0.068**	<0.010
Benzo[a]pyrene	0.01	0.015	0.81	0.81	**0.3**	<0.010	<0.010	<0.010	**0.8**	**0.081**	**0.065**	<0.010
Benzo[k]fluoranthene	0.48	NV	0.4	0.4	0.23	<0.010	<0.010	<0.010	<0.05	0.03	0.077	<0.010
Benzo[b]fluoranthene	NV	NV	0.75	0.75	0.24	<0.010	<0.010	<0.010	<0.05	0.087	0.027	<0.010
Benzo[ghi]perylene	0.17	NV	0.2	0.2	**0.2**	<0.010	<0.010	<0.010	<0.1	0.048	0.036	<0.010
Biphenyl	NV	NV	1000	1700	--	--			--	--		
Chrysene	0.1	NV	1	0.7	**0.25**	<0.010	<0.010	<0.010	0.1	0.086	0.068	<0.010
Dibenzo[a,h] anthracene	0.26	NV	0.52	0.4	<0.1	<0.010	<0.010	<0.010	<0.1	0.01	<0.010	<0.010
Fluoranthene	0.04	0.04	130	73	**0.5**	0.021	<0.010	0.02	**0.2**	**0.16**	**0.14**	<0.010
Fluorene	3	3	400	290	<0.1	0.83	<0.10 (1)	1.9	<0.1	0.024	0.021	0.035
Indeno[1,2,3-cd]pyrene	0.21	NV	0.2	0.2	0.2	<0.010	<0.010	<0.010	<0.1	0.042	0.038	<0.010
1-Methylnaphthalene	NV	NV	NV	NV	7	1.2	<0.010	34	<0.1	0.012	0.062	0.62
2-Methylnaphthalene	NV	NV	NV	NV	<0.1	0.38	0.013	<0.10 (1)	<0.1	0.016	<0.010	0.017
Methylnaphthalene, 2-(1-)-**	180	NV	1800	1500	7	1.58	0.013	34	<0.1	0.028	0.062	0.637
Naphthalene	1.1	1.1	1400	1400	<0.1	0.32	<0.050 (1)	<0.50 (1)	<0.1	0.016	0.022	0.037
Phenanthrene	0.4	0.4	580	380	**1.3**	0.041	<0.010	0.29	0.2	0.15	0.089	0.014
Pyrene	0.025	0.025	68	5.7	**0.6**	0.025	0.013	0.019	**0.2**	**0.19**	**0.13**	<0.010

Table B.2- Groundwater Analytical Results - Polycyclic Aromatic Hydrocarbons

Parameter	FIGQG Tier 1 - Table 2	CCME FAL	MOE Table 3	MOE Table 9	MW12-08		
Date Sampled>	(µg/L)	(ug/L)	(µg/L)	(µg/L)	2-May-14	13-May-15	1-Sep-15
Acenaphthene	5.8	5.8	600	600	<0.010	0.19	0.29
Acenaphthylene	46	NV	1.8	1.4	<0.010	<0.10	0.022
Anthracene	0.012	0.012	2.4	1	<0.010	<0.10	**0.046**
Benzo[a]anthracene	0.018	0.018	4.7	1.8	<0.010	<0.10	**0.039**
Benzo[a]pyrene	0.01	0.015	0.81	0.81	<0.010	<0.10	**0.032**
Benzo[k]fluoranthene	0.48	NV	0.4	0.4	<0.010	<0.10	0.015
Benzo[b]fluoranthene	NV	NV	0.75	0.75	0.01	<0.10	0.041
Benzo[ghi]perylene	0.17	NV	0.2	0.2	<0.010	<0.10	0.018
Biphenyl	NV	NV	1000	1700	--		
Chrysene	0.1	NV	1	0.7	<0.010	<0.10	0.032
Dibenzo[a,h] anthracene	0.26	NV	0.52	0.4	<0.010	<0.10	<0.010
Fluoranthene	0.04	0.04	130	73	0.013	<0.10	**0.11**
Fluorene	3	3	400	290	<0.010	0.12	0.23
Indeno[1,2,3-cd]pyrene	0.21	NV	0.2	0.2	<0.010	<0.10	0.019
1-Methylnaphthalene	NV	NV	NV	NV	<0.010	0.19	0.83
2-Methylnaphthalene	NV	NV	NV	NV	<0.010	<0.10	0.051
Methylnaphthalene, 2-(1-)-**	180	NV	1800	1500	<0.020	0.19	0.881
Naphthalene	1.1	1.1	1400	1400	<0.010	0.13	0.17
Phenanthrene	0.4	0.4	580	380	<0.010	<0.10	0.14
Pyrene	0.025	0.025	68	5.7	0.019	<0.10	**0.1**

Table B.3 - Groundwater Analytical Results - PHC/BTEX and Field Readings

Parameter	FIGQG	CCME	MOE	MOE	MW09-5					MW12-01			
Date Sampled>	Tier 1 Table 2 (µg/L)	FAL (ug/L)	Table 3 (µg/L)	Table 9 (µg/L)	21-Jan-09	11-Jun-09	13-Apr-10	2-May-14	13-May-15	7-Jul-13	2-May-14	13-May-15	1-Sep-15
Petroleum Hydrocarbons (PHC)													
F1 PHCs (C6-C10)	810	NV	750	420	<200	<200	<100	<25	<25	<100	<25	<25	<25
F2 PHCs (C10-C16)	1300	NV	150	150	<100	101	<100	<100	<100	**1500**	<100	<100	<100
F3 PHCs (C16-C34)	NV	NV	500	500	<100	<100	<100	<200	<100	1300	<200	<100	<200
F4 PHCs (C34-C50)	NV	NV	500	500	<100	<100	<100	<200	<200	<200	<200	<200	<200
BTEX													
Benzene	140	370	44	44	<0.5	<0.5	--	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20
Ethylbenzene	11000	90	2300	1800	<0.5	<0.5	--	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20
Toluene	83	2	18000	14000	<0.5	1	--	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20
Xylenes, m,p-	NV	NV	NV	NV	<0.5	<0.5	--	<0.40	<0.40	<0.5	<0.40	<0.40	<0.20
Xylene, o-	NV	NV	NV	NV	<0.5	<0.5	--	<0.20	<0.20	<0.5	<0.20	<0.20	<0.40
Xylenes, Total	3900	NV	4200	3300	<1	<1	--	<0.40	<0.40	<1.0	<0.40	<0.40	<0.40
Field Data													
Conductivity (ms/cm)	NV	NV	NV	NV	--	--	0.537	--	0.386	0.47	0.227	0.122	0.334
Temperature (^{o}C)	NV	NV	NV	NV	--	--	9.91	--	7.51	15.32	3.86	6.66	16.17
Dissolved Oxygen (mg/L)	NV	6.0-9.5	NV	NV	--	--	8.71	--	7.85	1.31	5.35	4.9	1.19
ORP (mV)	NV	NV	NV	NV	--	--	149.3	--	72.3	200.6	251	21.9	-20.3
pH	6.5-9.0	NV	6.5-8.7	6.5-8.7	--	--	7.9	--	7.28	6.93	8.01	7.37	6.95

Table B.3 - Groundwater Analytical Results - PHC/BTEX and Field Readings

Parameter	FIGQG	CCME	MOE	MOE	MW12-02						MW12-03				
Date Sampled>	Tier 1 Table 2 (µg/L)	FAL (ug/L)	Table 3 (µg/L)	Table 9 (µg/L)	7-Jul-13	Duplicate 7-Jul-13	2-May-14	13-May-15	1-Sep-15	Duplicate 1-Sep-15	7-Jul-13	2-May-14	13-May-15	Duplicate 13-May-15	1-Sep-15
Petroleum Hydrocarbons (PHC)															
F1 PHCs (C6-C10)	810	NV	750	420	<100	<100	<25	<25	<25	<25	<100	<25	<25	<25	46
F2 PHCs (C10-C16)	1300	NV	150	150	<100	100	<100	<100	<100	<100	800	<100	290	300	640
F3 PHCs (C16-C34)	NV	NV	500	500	<200	<200	<200	<100	<200	<200	600	<200	<100	<100	<200
F4 PHCs (C34-C50)	NV	NV	500	500	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
BTEX															
Benzene	140	370	44	44	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20	<0.20
Ethylbenzene	11000	90	2300	1800	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20	0.22
Toluene	83	2	18000	14000	<0.5	<0.5	<0.20	<0.20	<0.20	<0.20	2	<0.20	<0.20	<0.20	<0.20
Xylenes, m,p-	NV	NV	NV	NV	<0.5	<0.5	<0.40	<0.40	<0.20	<0.20	0.9	<0.40	<0.40	<0.40	<0.20
Xylene, o-	NV	NV	NV	NV	<0.5	<0.5	<0.20	<0.20	<0.40	<0.40	<0.5	<0.20	<0.20	<0.20	<0.40
Xylenes, Total	3900	NV	4200	3300	<1.0	<1.0	<0.40	<0.40	<0.40	<0.40	<1.0	<0.40	<0.40	<0.40	<0.40
Field Data															
Conductivity (ms/cm)	NV	NV	NV	NV	0.39		0.138	0.118	0.618		1.25	0.928	0.526		0.916
Temperature (^{o}C)	NV	NV	NV	NV	15.98		3.57	6.93	14.05		13.74	5.73	5.77		11.21
Dissolved Oxygen (mg/L)	NV	6.0-9.5	NV	NV	2.24		7	6.13	0.7		0.74	3.3	2.4		0.74
ORP (mV)	NV	NV	NV	NV	168.8		237.8	71.7	691.2		108.3	221.7	-9.6		728.8
pH	6.5-9.0	NV	6.5-8.7	6.5-8.7	6.92		8.31	7.46	**6.45**		**6.13**	7.13	**6.41**		7.42

Table B.3 - Groundwater Analytical Results - PHC/BTEX and Field Readings

Parameter	FIGQG Tier 1 Table 2 (µg/L)	CCME FAL (ug/L)	MOE Table 3 (µg/L)	MOE Table 9 (µg/L)	MW12-04				MW12-05				
Date Sampled>					7-Jul-13	2-May-14	13-May-15	1-Sep-15	7-Jul-13	2-May-14	Duplicate 2-May-14	13-May-15	2-Sep-15
Petroleum Hydrocarbons (PHC)													
F1 PHCs (C6-C10)	810	NV	750	420	<100	<25	<25	<25	<100	<25	<25	<25	<25
F2 PHCs (C10-C16)	1300	NV	150	150	**2000**	190	190	340	300	<100	<100	<100	970
F3 PHCs (C16-C34)	NV	NV	500	500	1600	<200	<100	<200	<200	270	<200	<100	<200
F4 PHCs (C34-C50)	NV	NV	500	500	<200	<200	<200	<200	<200	<200	<200	<200	<200
BTEX													
Benzene	140	370	44	44	<0.5	<0.20	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20	<0.20
Ethylbenzene	11000	90	2300	1800	<0.5	<0.20	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20	<0.20
Toluene	83	2	18000	14000	4.2	<0.20	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20	<0.20
Xylenes, m,p-	NV	NV	NV	NV	2.1	<0.40	<0.40	<0.20	<0.5	<0.40	<0.40	<0.40	<0.20
Xylene, o-	NV	NV	NV	NV	0.9	<0.20	<0.20	<0.40	<0.5	<0.20	<0.20	<0.20	<0.40
Xylenes, Total	3900	NV	4200	3300	3	<0.40	<0.40	<0.40	<1.0	<0.40	<0.40	<0.40	<0.40
Field Data													
Conductivity (ms/cm)	NV	NV	NV	NV	1.11	0.493	0.61	0.776	0.69	0.134		0.144	1.609
Temperature (^{o}C)	NV	NV	NV	NV	16.08	7.48	6.42	10.58	16.28	7.05		8.3	14.18
Dissolved Oxygen (mg/L)	NV	6.0-9.5	NV	NV	1.95	3.19	2.73	1.08	2.4	--		6.14	2.08
ORP (mV)	NV	NV	NV	NV	199.5	71.5	-95.8	730.2	242	156.9		20.5	-63.8
pH	6.5-9.0	NV	6.5-8.7	6.5-8.7	**6.4**	6.69	**6.48**	7.32	**6.44**	6.99		**6.45**	**6.12**

Table B.3 - Groundwater Analytical Results - PHC/BTEX and Field Readings

Parameter	FIGQG Tier 1 Table 2 (µg/L)	CCME FAL (ug/L)	MOE Table 3 (µg/L)	MOE Table 9 (µg/L)	MW12-06				MW12-07			
Date Sampled>					7-Jul-13	2-May-14	13-May-15	1-Sep-15	7-Jul-13	2-May-14	13-May-15	1-Sep-15
Petroleum Hydrocarbons (PHC)												
F1 PHCs (C6-C10)	810	NV	750	420	<100	<25	<25	<25	<100	<25	<25	<25
F2 PHCs (C10-C16)	1300	NV	150	150	**2600**	580	210	590	<100	<100	<100	<100
F3 PHCs (C16-C34)	NV	NV	500	500	700	<200	160	<200	1100	<200	<100	<200
F4 PHCs (C34-C50)	NV	NV	500	500	<200	<200	<200	<200	<200	<200	<200	<200
BTEX												
Benzene	140	370	44	44	<0.5	<0.20	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20
Ethylbenzene	11000	90	2300	1800	<0.5	<0.20	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20
Toluene	83	2	18000	14000	<0.5	<0.20	<0.20	<0.20	<0.5	<0.20	<0.20	<0.20
Xylenes, m,p-	NV	NV	NV	NV	<0.5	<0.40	<0.40	<0.20	<0.5	<0.40	<0.40	<0.20
Xylene, o-	NV	NV	NV	NV	<0.5	<0.20	<0.20	<0.40	<0.5	<0.20	<0.20	<0.40
Xylenes, Total	3900	NV	4200	3300	<1.0	<0.40	<0.40	<0.40	<1.0	<0.40	<0.40	<0.40
Field Data												
Conductivity (ms/cm)	NV	NV	NV	NV	0.56	1.45	0.586	0.627	1.05	0.321	0.905	0.624
Temperature (^{o}C)	NV	NV	NV	NV	15.46	6.13	6.33	9.78	15.09	10.57	11	13.54
Dissolved Oxygen (mg/L)	NV	6.0-9.5	NV	NV	1.02	1.5	1.74	0.77	--	--	2.45	6.6
ORP (mV)	NV	NV	NV	NV	187.5	-25.9	-99.5	-41.7	240.1	179.1	-33.2	75.7
pH	6.5-9.0	NV	6.5-8.7	6.5-8.7	**6.21**	6.56	6.68	6.15	7.19	7.28	7.28	6.9

Table B.3 - Groundwater Analytical Results - PHC/BTEX and Field Readings

Parameter	FIGQG Tier 1 Table 2 (µg/L)	CCME FAL (ug/L)	MOE Table 3 (µg/L)	MOE Table 9 (µg/L)	MW12-08			
Date Sampled>					7-Jul-13	2-May-14	13-May-15	1-Sep-15
Petroleum Hydrocarbons (PHC)								
F1 PHCs (C6-C10)	810	NV	750	420	<100	710	**990**	550
F2 PHCs (C10-C16)	1300	NV	150	150	<100	130	140	<100
F3 PHCs (C16-C34)	NV	NV	500	500	660	<200	390	<200
F4 PHCs (C34-C50)	NV	NV	500	500	<200	<200	<200	<200
BTEX								
Benzene	140	370	44	44	<0.5	**150**	**150**	57
Ethylbenzene	11000	90	2300	1800	<0.5	11	14	5.7
Toluene	83	2	18000	14000	<0.5	4.2	3	1.3
Xylenes, m,p-	NV	NV	NV	NV	<0.5	41	9.2	1.3
Xylene, o-	NV	NV	NV	NV	<0.5	3.1	3.1	4.8
Xylenes, Total	3900	NV	4200	3300	<1.0	44	12	6.2
Field Data								
Conductivity (ms/cm)	NV	NV	NV	NV	3.31	2.313	1.388	0.924
Temperature (^{o}C)	NV	NV	NV	NV	18.66	11.25	10.42	11.97
Dissolved Oxygen (mg/L)	NV	6.0-9.5	NV	NV	--	3.76	1.08	0.75
ORP (mV)	NV	NV	NV	NV	297.4	228	-148.3	707.2
pH	6.5-9.0	NV	6.5-8.7	6.5-8.7	6.97	6.94	7.19	6.76

Notes for Surface Water Analytical Results, Table B.4

Notes:

All units are µg/L unless otherwise noted
NV = No value
-- = Parameter not analysed
<10 = Not detected above laboratory detection limit
CCME FAL = Canadian Council of Ministers of the Environment. Canadian Environment Quality Guidelines, 1999 (updates to 2016), Protection of Freshwater Aquatic Life
PWQO = Provincial Water Quality Objectives for Ontario, February 1999
** = Interim criteria
bold = Indicates concentrations which exceed CCME CEQG
= Indicates concentrations which exceed PWQO

Table B.4 - Surface Water Analytical Results - Polycyclic Aromatic Hydrocarbons

Parameter / Sample ID > / Sample Date >	CCME FAL (µg/L)	PWQO (µg/L)	SW1 10-Jun-09	SW2 10-Jun-09	SW3 10-Jun-09	SW4 10-Jun-09	SW40 Duplicate 10-Jun-09	SW5 10-Jun-09	SW6 10-Jun-09	SW7 10-Jun-09	SW8 10-Jun-09	SW9 10-Jun-09
Acenaphthene	5.8	NV	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	NV	NV	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	0.012	0.0008**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]anthracene	0.018	0.0004**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[a]pyrene	0.015	NV	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b]fluoranthene	NV	NV	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	NV	0.00002**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[k]fluoranthene	NV	0.0002**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chrysene	NV	0.0001**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenzo[a,h]anthracene	NV	0.002**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[1,2,3-cd]pyrene	NV	NV	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	0.04	0.0008**	<0.01	<0.01	<0.01	**0.09**	<0.01	**0.07**	**0.06**	<0.01	<0.01	<0.01
Fluorene	3.0	0.2**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1-Methylnaphthalene	NV	2.0**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	NV	2.0**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	1.1	7.0**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	0.4	0.03**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	0.025	NV	<0.01	<0.01	<0.01	**0.15**	<0.01	**0.11**	**0.1**	<0.01	<0.01	<0.01

Table B.4 - Surface Water Analytical Results - Polycyclic Aromatic Hydrocarbons

Parameter	CCME	PWQO	SW14-1		SW14-2		SW14-3		SW14-4		SW14-5	
Sample ID >	FAL											
Sample Date >	(µg/L)	(µg/L)	30-Apr-14	13-May-15	30-Apr-14	13-May-15	30-Apr-14	13-May-15	30-Apr-14	13-May-15	30-Apr-14	13-May-15
Acenaphthene	5.8	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Acenaphthylene	NV	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Anthracene	0.012	0.0008**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[a]anthracene	0.018	0.0004**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[a]pyrene	0.015	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[b]fluoranthene	NV	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[g,h,i]perylene	NV	0.00002**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[k]fluoranthene	NV	0.0002**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chrysene	NV	0.0001**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Dibenzo[a,h]anthracene	NV	0.002**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Indeno[1,2,3-cd]pyrene	NV	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Fluoranthene	0.04	0.0008**	<0.010	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Fluorene	3.0	0.2**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
1-Methylnaphthalene	NV	2.0**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2-Methylnaphthalene	NV	2.0**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Naphthalene	1.1	7.0**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phenanthrene	0.4	0.03**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Pyrene	0.025	NV	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010

APPENDIX C

Laboratory Analytical Reports

Your P.O. #: 1321524-001
Your Project #: Richmond Landling
Your C.O.C. #: 513329-01-01

Attention:Drew Paulusse

Geofirma Engineering Ltd
1 Raymond St
Suite 200
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Report Date: 2015/05/21
Report #: R3436351
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B590038
Received: 2015/05/14, 12:50

Sample Matrix: Water
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Petroleum Hydro. CCME F1 & BTEX in Water (1)	1	N/A	2015/05/20	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydro. CCME F1 & BTEX in Water (1)	9	N/A	2015/05/21	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water	10	2015/05/15	2015/05/15	OTT SOP-00001	CCME Hydrocarbons
PAH Compounds in Water by GC/MS (SIM) (1)	9	2015/05/16	2015/05/19	CAM SOP-00318	EPA 8270 m
PAH Compounds in Water by GC/MS (SIM) (1)	1	2015/05/20	2015/05/21	CAM SOP-00318	EPA 8270 m

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

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

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

(1) This test was performed by Maxxam Analytics Mississauga

Your P.O. #: 1321524-001
Your Project #: Richmond Landling
Your C.O.C. #: 513329-01-01

Attention:Drew Paulusse

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
K1R 1A2

Report Date: 2015/05/21
Report #: R3436351
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B590038
Received: 2015/05/14, 12:50

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Madison Bingley, Project Manager Assistant
Email: MBingley@maxxam.ca
Phone# (613) 274-0573

==========

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

Maxxam Job #: B590038
Report Date: 2015/05/21

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		AGU607	AGU608		AGU609		AGU610		
Sampling Date		2015/05/13	2015/05/13		2015/05/13		2015/05/13		
COC Number		513329-01-01	513329-01-01		513329-01-01		513329-01-01		
	Units	**MW12-01**	**MW12-02**	**RDL**	**MW12-03**	**RDL**	**MW12-04**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons									
Acenaphthene	ug/L	<0.010	<0.010	0.010	0.29	0.10	0.36	0.10	4026705
Acenaphthylene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Anthracene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Benzo(a)anthracene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Benzo(a)pyrene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Benzo(b/j)fluoranthene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Benzo(g,h,i)perylene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Benzo(k)fluoranthene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Chrysene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Dibenz(a,h)anthracene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Fluoranthene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Fluorene	ug/L	<0.010	<0.010	0.010	0.60	0.10	0.53	0.10	4026705
Indeno(1,2,3-cd)pyrene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
1-Methylnaphthalene	ug/L	0.11	0.076	0.010	12	0.10	2.3	0.10	4026705
2-Methylnaphthalene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Naphthalene	ug/L	0.012	<0.010	0.010	<0.50 (1)	0.50	<0.20 (1)	0.20	4026705
Phenanthrene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Pyrene	ug/L	<0.010	<0.010	0.010	<0.10	0.10	<0.10	0.10	4026705
Surrogate Recovery (%)									
D10-Anthracene	%	95	75		99		92		4026705
D14-Terphenyl (FS)	%	82	63		86		81		4026705
D8-Acenaphthylene	%	91	70		93		88		4026705

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) DL was raised due to matrix interference.

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Maxxam Job #: B590038
Report Date: 2015/05/21

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		AGU611			AGU612		AGU613		AGU614		
Sampling Date		2015/05/13			2015/05/13		2015/05/13		2015/05/13		
COC Number		513329-01-01			513329-01-01		513329-01-01		513329-01-01		
	Units	**MW12-05**	**RDL**	**QC Batch**	**MW12-06**	**RDL**	**MW12-07**	**RDL**	**MW12-08**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons											
Acenaphthene	ug/L	<0.010	0.010	4030000	0.10	0.010	0.015	0.010	0.19	0.10	4026705
Acenaphthylene	ug/L	<0.010	0.010	4030000	<0.010	0.010	<0.010	0.010	<0.10	0.10	4026705
Anthracene	ug/L	<0.010	0.010	4030000	0.010	0.010	0.025	0.010	<0.10	0.10	4026705
Benzo(a)anthracene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.068	0.010	<0.10	0.10	4026705
Benzo(a)pyrene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.065	0.010	<0.10	0.10	4026705
Benzo(b/j)fluoranthene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.077	0.010	<0.10	0.10	4026705
Benzo(g,h,i)perylene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.036	0.010	<0.10	0.10	4026705
Benzo(k)fluoranthene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.027	0.010	<0.10	0.10	4026705
Chrysene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.068	0.010	<0.10	0.10	4026705
Dibenz(a,h)anthracene	ug/L	<0.010	0.010	4030000	<0.010	0.010	<0.010	0.010	<0.10	0.10	4026705
Fluoranthene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.14	0.010	<0.10	0.10	4026705
Fluorene	ug/L	<0.010	0.010	4030000	<0.10 (1)	0.10	0.021	0.010	0.12	0.10	4026705
Indeno(1,2,3-cd)pyrene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.038	0.010	<0.10	0.10	4026705
1-Methylnaphthalene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.062	0.010	0.19	0.10	4026705
2-Methylnaphthalene	ug/L	<0.010	0.010	4030000	0.013	0.010	<0.010	0.010	<0.10	0.10	4026705
Naphthalene	ug/L	<0.010	0.010	4030000	<0.050 (1)	0.050	0.022	0.010	0.13	0.10	4026705
Phenanthrene	ug/L	<0.010	0.010	4030000	<0.010	0.010	0.089	0.010	<0.10	0.10	4026705
Pyrene	ug/L	<0.010	0.010	4030000	0.013	0.010	0.13	0.010	<0.10	0.10	4026705
Surrogate Recovery (%)											
D10-Anthracene	%	94		4030000	75		91		100		4026705
D14-Terphenyl (FS)	%	76		4030000	80		68		84		4026705
D8-Acenaphthylene	%	76		4030000	75		85		95		4026705

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) DL was raised due to matrix interference.

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Maxxam Job #: B590038
Report Date: 2015/05/21

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		AGU615		AGU616		
Sampling Date		2015/05/13		2015/05/13		
COC Number		513329-01-01		513329-01-01		
	Units	**MW09-5**	**RDL**	**MW-DUP**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons						
Acenaphthene	ug/L	<0.010	0.010	0.22	0.10	4026705
Acenaphthylene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Anthracene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Benzo(a)anthracene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Benzo(a)pyrene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Benzo(b/j)fluoranthene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Benzo(g,h,i)perylene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Benzo(k)fluoranthene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Chrysene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Dibenz(a,h)anthracene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Fluoranthene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Fluorene	ug/L	<0.010	0.010	0.48	0.10	4026705
Indeno(1,2,3-cd)pyrene	ug/L	<0.010	0.010	<0.10	0.10	4026705
1-Methylnaphthalene	ug/L	0.052	0.010	10	0.10	4026705
2-Methylnaphthalene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Naphthalene	ug/L	<0.010	0.010	0.16	0.10	4026705
Phenanthrene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Pyrene	ug/L	<0.010	0.010	<0.10	0.10	4026705
Surrogate Recovery (%)						
D10-Anthracene	%	97		82		4026705
D14-Terphenyl (FS)	%	81		70		4026705
D8-Acenaphthylene	%	92		78		4026705

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B590038
Report Date: 2015/05/21

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		AGU607	AGU607	AGU608	AGU609	AGU610	AGU611		
Sampling Date		2015/05/13	2015/05/13	2015/05/13	2015/05/13	2015/05/13	2015/05/13		
COC Number		513329-01-01	513329-01-01	513329-01-01	513329-01-01	513329-01-01	513329-01-01		
	Units	**MW12-01**	**MW12-01 Lab-Dup**	**MW12-02**	**MW12-03**	**MW12-04**	**MW12-05**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons									
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	4029347
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	4029347
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	4029347
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	4029347
p+m-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	4029347
Total Xylenes	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	4029347
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	<25	25	4029347
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	<25	<25	<25	25	4029347
F2-F4 Hydrocarbons									
F2 (C10-C16 Hydrocarbons)	ug/L	<100		<100	290	190	<100	100	4025353
F3 (C16-C34 Hydrocarbons)	ug/L	<100		<100	<100	<100	<100	100	4025353
F4 (C34-C50 Hydrocarbons)	ug/L	<200		<200	<200	<200	<200	200	4025353
Reached Baseline at C50	ug/L	Yes		Yes	Yes	Yes	Yes		4025353
Surrogate Recovery (%)									
1,4-Difluorobenzene	%	110	106	104	104	105	106		4029347
4-Bromofluorobenzene	%	103	101	105	105	102	104		4029347
D10-Ethylbenzene	%	114	112	119	116	115	114		4029347
D4-1,2-Dichloroethane	%	99	98	100	99	99	99		4029347
o-Terphenyl	%	93		96	92	93	94		4025353

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

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Report Date: 2015/05/21

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		AGU612	AGU613	AGU614	AGU615	AGU616		
Sampling Date		2015/05/13	2015/05/13	2015/05/13	2015/05/13	2015/05/13		
COC Number		513329-01-01	513329-01-01	513329-01-01	513329-01-01	513329-01-01		
	Units	**MW12-06**	**MW12-07**	**MW12-08**	**MW09-5**	**MW-DUP**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons								
Benzene	ug/L	<0.20	<0.20	150	<0.20	<0.20	0.20	4029347
Toluene	ug/L	<0.20	<0.20	3.0	<0.20	<0.20	0.20	4029347
Ethylbenzene	ug/L	<0.20	<0.20	14	<0.20	<0.20	0.20	4029347
o-Xylene	ug/L	<0.20	<0.20	3.1	<0.20	<0.20	0.20	4029347
p+m-Xylene	ug/L	<0.40	<0.40	9.2	<0.40	<0.40	0.40	4029347
Total Xylenes	ug/L	<0.40	<0.40	12	<0.40	<0.40	0.40	4029347
F1 (C6-C10)	ug/L	<25	<25	990	<25	<25	25	4029347
F1 (C6-C10) - BTEX	ug/L	<25	<25	800	<25	<25	25	4029347
F2-F4 Hydrocarbons								
F2 (C10-C16 Hydrocarbons)	ug/L	210	<100	140	<100	300	100	4025353
F3 (C16-C34 Hydrocarbons)	ug/L	160	<100	390	<100	<100	100	4025353
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	<200	200	4025353
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes	Yes		4025353
Surrogate Recovery (%)								
1,4-Difluorobenzene	%	106	106	105	105	109		4029347
4-Bromofluorobenzene	%	104	98	100	101	107		4029347
D10-Ethylbenzene	%	111	110	111	109	116		4029347
D4-1,2-Dichloroethane	%	99	98	96	98	101		4029347
o-Terphenyl	%	94	94	94	96	95		4025353

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B590038
Report Date: 2015/05/21

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

TEST SUMMARY

Maxxam ID: AGU607 **Collected:** 2015/05/13
Sample ID: MW12-01 **Shipped:**
Matrix: Water **Received:** 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/20	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU607 Dup **Collected:** 2015/05/13
Sample ID: MW12-01 **Shipped:**
Matrix: Water **Received:** 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/20	Lincoln Ramdahin

Maxxam ID: AGU608 **Collected:** 2015/05/13
Sample ID: MW12-02 **Shipped:**
Matrix: Water **Received:** 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/21	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU609 **Collected:** 2015/05/13
Sample ID: MW12-03 **Shipped:**
Matrix: Water **Received:** 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/21	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU610 **Collected:** 2015/05/13
Sample ID: MW12-04 **Shipped:**
Matrix: Water **Received:** 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/21	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU611 **Collected:** 2015/05/13
Sample ID: MW12-05 **Shipped:**
Matrix: Water **Received:** 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/21	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi

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Maxxam Job #: B590038
Report Date: 2015/05/21

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

TEST SUMMARY

Maxxam ID: AGU611
Sample ID: MW12-05
Matrix: Water

Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4030000	2015/05/20	2015/05/21	Darryl Tiller

Maxxam ID: AGU612
Sample ID: MW12-06
Matrix: Water

Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/21	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU613
Sample ID: MW12-07
Matrix: Water

Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/21	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU614
Sample ID: MW12-08
Matrix: Water

Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/21	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU615
Sample ID: MW09-5
Matrix: Water

Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/21	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU616
Sample ID: MW-DUP
Matrix: Water

Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4029347	N/A	2015/05/21	Lincoln Ramdahin
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4025353	2015/05/15	2015/05/15	Arezoo Habibagahi

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Report Date: 2015/05/21

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

TEST SUMMARY

Maxxam ID: AGU616
Sample ID: MW-DUP
Matrix: Water

Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

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GENERAL COMMENTS

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

Package 1	9.3°C
Package 2	9.0°C
Package 3	9.7°C

Sample AGU609-01 : PAH analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Sample AGU610-01 : PAH analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Sample AGU614-01 : PAH analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Sample AGU616-01 : PAH analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
4025353	AH1	Matrix Spike	o-Terphenyl	2015/05/15		111	%	30 - 130
			F2 (C10-C16 Hydrocarbons)	2015/05/15		89	%	50 - 130
			F3 (C16-C34 Hydrocarbons)	2015/05/15		89	%	50 - 130
			F4 (C34-C50 Hydrocarbons)	2015/05/15		89	%	50 - 130
4025353	AH1	Spiked Blank	o-Terphenyl	2015/05/15		96	%	30 - 130
			F2 (C10-C16 Hydrocarbons)	2015/05/15		83	%	60 - 130
			F3 (C16-C34 Hydrocarbons)	2015/05/15		83	%	60 - 130
			F4 (C34-C50 Hydrocarbons)	2015/05/15		83	%	60 - 130
4025353	AH1	Method Blank	o-Terphenyl	2015/05/15		93	%	30 - 130
			F2 (C10-C16 Hydrocarbons)	2015/05/15	<100		ug/L	
			F3 (C16-C34 Hydrocarbons)	2015/05/15	<200		ug/L	
			F4 (C34-C50 Hydrocarbons)	2015/05/15	<200		ug/L	
4025353	AH1	RPD	F2 (C10-C16 Hydrocarbons)	2015/05/15	NC		%	50
			F3 (C16-C34 Hydrocarbons)	2015/05/15	NC		%	50
			F4 (C34-C50 Hydrocarbons)	2015/05/15	NC		%	50
4026705	LFE	Matrix Spike	D10-Anthracene	2015/05/19		90	%	50 - 130
			D14-Terphenyl (FS)	2015/05/19		78	%	50 - 130
			D8-Acenaphthylene	2015/05/19		85	%	50 - 130
			Acenaphthene	2015/05/19		88	%	50 - 130
			Acenaphthylene	2015/05/19		89	%	50 - 130
			Anthracene	2015/05/19		86	%	50 - 130
			Benzo(a)anthracene	2015/05/19		98	%	50 - 130
			Benzo(a)pyrene	2015/05/19		96	%	50 - 130
			Benzo(b/j)fluoranthene	2015/05/19		88	%	50 - 130
			Benzo(g,h,i)perylene	2015/05/19		83	%	50 - 130
			Benzo(k)fluoranthene	2015/05/19		85	%	50 - 130
			Chrysene	2015/05/19		95	%	50 - 130
			Dibenz(a,h)anthracene	2015/05/19		79	%	50 - 130
			Fluoranthene	2015/05/19		92	%	50 - 130
			Fluorene	2015/05/19		86	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/05/19		96	%	50 - 130
			1-Methylnaphthalene	2015/05/19		89	%	50 - 130
			2-Methylnaphthalene	2015/05/19		86	%	50 - 130
			Naphthalene	2015/05/19		83	%	50 - 130
			Phenanthrene	2015/05/19		82	%	50 - 130
			Pyrene	2015/05/19		93	%	50 - 130
4026705	LFE	Spiked Blank	D10-Anthracene	2015/05/19		93	%	50 - 130
			D14-Terphenyl (FS)	2015/05/19		81	%	50 - 130
			D8-Acenaphthylene	2015/05/19		87	%	50 - 130
			Acenaphthene	2015/05/19		94	%	50 - 130
			Acenaphthylene	2015/05/19		92	%	50 - 130
			Anthracene	2015/05/19		90	%	50 - 130
			Benzo(a)anthracene	2015/05/19		102	%	50 - 130
			Benzo(a)pyrene	2015/05/19		99	%	50 - 130
			Benzo(b/j)fluoranthene	2015/05/19		86	%	50 - 130
			Benzo(g,h,i)perylene	2015/05/19		78	%	50 - 130
			Benzo(k)fluoranthene	2015/05/19		96	%	50 - 130
			Chrysene	2015/05/19		100	%	50 - 130
			Dibenz(a,h)anthracene	2015/05/19		64	%	50 - 130
			Fluoranthene	2015/05/19		97	%	50 - 130
			Fluorene	2015/05/19		91	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/05/19		96	%	50 - 130

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Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			1-Methylnaphthalene	2015/05/19		95	%	50 - 130
			2-Methylnaphthalene	2015/05/19		91	%	50 - 130
			Naphthalene	2015/05/19		89	%	50 - 130
			Phenanthrene	2015/05/19		87	%	50 - 130
			Pyrene	2015/05/19		99	%	50 - 130
4026705	LFE	Method Blank	D10-Anthracene	2015/05/19		99	%	50 - 130
			D14-Terphenyl (FS)	2015/05/19		83	%	50 - 130
			D8-Acenaphthylene	2015/05/19		92	%	50 - 130
			Acenaphthene	2015/05/19	<0.010		ug/L	
			Acenaphthylene	2015/05/19	<0.010		ug/L	
			Anthracene	2015/05/19	<0.010		ug/L	
			Benzo(a)anthracene	2015/05/19	<0.010		ug/L	
			Benzo(a)pyrene	2015/05/19	<0.010		ug/L	
			Benzo(b/j)fluoranthene	2015/05/19	<0.010		ug/L	
			Benzo(g,h,i)perylene	2015/05/19	<0.010		ug/L	
			Benzo(k)fluoranthene	2015/05/19	<0.010		ug/L	
			Chrysene	2015/05/19	<0.010		ug/L	
			Dibenz(a,h)anthracene	2015/05/19	<0.010		ug/L	
			Fluoranthene	2015/05/19	<0.010		ug/L	
			Fluorene	2015/05/19	<0.010		ug/L	
			Indeno(1,2,3-cd)pyrene	2015/05/19	<0.010		ug/L	
			1-Methylnaphthalene	2015/05/19	<0.010		ug/L	
			2-Methylnaphthalene	2015/05/19	<0.010		ug/L	
			Naphthalene	2015/05/19	<0.010		ug/L	
			Phenanthrene	2015/05/19	<0.010		ug/L	
			Pyrene	2015/05/19	<0.010		ug/L	
4026705	LFE	RPD	Acenaphthene	2015/05/19	NC		%	30
			Acenaphthylene	2015/05/19	NC		%	30
			Anthracene	2015/05/19	NC		%	30
			Benzo(a)anthracene	2015/05/19	NC		%	30
			Benzo(a)pyrene	2015/05/19	NC		%	30
			Benzo(b/j)fluoranthene	2015/05/19	NC		%	30
			Benzo(g,h,i)perylene	2015/05/19	NC		%	30
			Benzo(k)fluoranthene	2015/05/19	NC		%	30
			Chrysene	2015/05/19	NC		%	30
			Dibenz(a,h)anthracene	2015/05/19	NC		%	30
			Fluoranthene	2015/05/19	NC		%	30
			Fluorene	2015/05/19	NC		%	30
			Indeno(1,2,3-cd)pyrene	2015/05/19	NC		%	30
			1-Methylnaphthalene	2015/05/19	NC		%	30
			2-Methylnaphthalene	2015/05/19	NC		%	30
			Naphthalene	2015/05/19	NC		%	30
			Phenanthrene	2015/05/19	NC		%	30
			Pyrene	2015/05/19	NC		%	30
4029347	LRA	Matrix Spike [AGU607-02]	1,4-Difluorobenzene	2015/05/20		104	%	70 - 130
			4-Bromofluorobenzene	2015/05/20		103	%	70 - 130
			D10-Ethylbenzene	2015/05/20		111	%	70 - 130
			D4-1,2-Dichloroethane	2015/05/20		99	%	70 - 130
			Benzene	2015/05/20		106	%	70 - 130
			Toluene	2015/05/20		99	%	70 - 130
			Ethylbenzene	2015/05/20		108	%	70 - 130

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Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: DMP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			o-Xylene	2015/05/20		104	%	70 - 130
			p+m-Xylene	2015/05/20		95	%	70 - 130
			F1 (C6-C10)	2015/05/20		95	%	70 - 130
4029347	LRA	Spiked Blank	1,4-Difluorobenzene	2015/05/20		103	%	70 - 130
			4-Bromofluorobenzene	2015/05/20		103	%	70 - 130
			D10-Ethylbenzene	2015/05/20		94	%	70 - 130
			D4-1,2-Dichloroethane	2015/05/20		104	%	70 - 130
			Benzene	2015/05/20		95	%	70 - 130
			Toluene	2015/05/20		92	%	70 - 130
			Ethylbenzene	2015/05/20		95	%	70 - 130
			o-Xylene	2015/05/20		97	%	70 - 130
			p+m-Xylene	2015/05/20		87	%	70 - 130
			F1 (C6-C10)	2015/05/20		91	%	70 - 130
4029347	LRA	Method Blank	1,4-Difluorobenzene	2015/05/20		102	%	70 - 130
			4-Bromofluorobenzene	2015/05/20		102	%	70 - 130
			D10-Ethylbenzene	2015/05/20		108	%	70 - 130
			D4-1,2-Dichloroethane	2015/05/20		101	%	70 - 130
			Benzene	2015/05/20	<0.20		ug/L	
			Toluene	2015/05/20	<0.20		ug/L	
			Ethylbenzene	2015/05/20	<0.20		ug/L	
			o-Xylene	2015/05/20	<0.20		ug/L	
			p+m-Xylene	2015/05/20	<0.40		ug/L	
			Total Xylenes	2015/05/20	<0.40		ug/L	
			F1 (C6-C10)	2015/05/20	<25		ug/L	
			F1 (C6-C10) - BTEX	2015/05/20	<25		ug/L	
4029347	LRA	RPD [AGU607-02]	Benzene	2015/05/20	NC		%	30
			Toluene	2015/05/20	NC		%	30
			Ethylbenzene	2015/05/20	NC		%	30
			o-Xylene	2015/05/20	NC		%	30
			p+m-Xylene	2015/05/20	NC		%	30
			Total Xylenes	2015/05/20	NC		%	30
			F1 (C6-C10)	2015/05/20	NC		%	30
			F1 (C6-C10) - BTEX	2015/05/20	NC		%	30
4030000	DTI	Matrix Spike	D10-Anthracene	2015/05/21		91	%	50 - 130
			D14-Terphenyl (FS)	2015/05/21		78	%	50 - 130
			D8-Acenaphthylene	2015/05/21		83	%	50 - 130
			Acenaphthene	2015/05/21		96	%	50 - 130
			Acenaphthylene	2015/05/21		91	%	50 - 130
			Anthracene	2015/05/21		95	%	50 - 130
			Benzo(a)anthracene	2015/05/21		105	%	50 - 130
			Benzo(a)pyrene	2015/05/21		103	%	50 - 130
			Benzo(b/j)fluoranthene	2015/05/21		101	%	50 - 130
			Benzo(g,h,i)perylene	2015/05/21		89	%	50 - 130
			Benzo(k)fluoranthene	2015/05/21		96	%	50 - 130
			Chrysene	2015/05/21		104	%	50 - 130
			Dibenz(a,h)anthracene	2015/05/21		88	%	50 - 130
			Fluoranthene	2015/05/21		99	%	50 - 130
			Fluorene	2015/05/21		97	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/05/21		100	%	50 - 130
			1-Methylnaphthalene	2015/05/21		99	%	50 - 130
			2-Methylnaphthalene	2015/05/21		94	%	50 - 130
			Naphthalene	2015/05/21		88	%	50 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			Phenanthrene	2015/05/21		92	%	50 - 130
			Pyrene	2015/05/21		101	%	50 - 130
4030000	DTI	Spiked Blank	D10-Anthracene	2015/05/21		104	%	50 - 130
			D14-Terphenyl (FS)	2015/05/21		81	%	50 - 130
			D8-Acenaphthylene	2015/05/21		92	%	50 - 130
			Acenaphthene	2015/05/21		105	%	50 - 130
			Acenaphthylene	2015/05/21		99	%	50 - 130
			Anthracene	2015/05/21		103	%	50 - 130
			Benzo(a)anthracene	2015/05/21		110	%	50 - 130
			Benzo(a)pyrene	2015/05/21		104	%	50 - 130
			Benzo(b/j)fluoranthene	2015/05/21		104	%	50 - 130
			Benzo(g,h,i)perylene	2015/05/21		75	%	50 - 130
			Benzo(k)fluoranthene	2015/05/21		99	%	50 - 130
			Chrysene	2015/05/21		113	%	50 - 130
			Dibenz(a,h)anthracene	2015/05/21		58	%	50 - 130
			Fluoranthene	2015/05/21		106	%	50 - 130
			Fluorene	2015/05/21		105	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/05/21		92	%	50 - 130
			1-Methylnaphthalene	2015/05/21		105	%	50 - 130
			2-Methylnaphthalene	2015/05/21		101	%	50 - 130
			Naphthalene	2015/05/21		95	%	50 - 130
			Phenanthrene	2015/05/21		100	%	50 - 130
			Pyrene	2015/05/21		109	%	50 - 130
4030000	DTI	Method Blank	D10-Anthracene	2015/05/21		102	%	50 - 130
			D14-Terphenyl (FS)	2015/05/21		77	%	50 - 130
			D8-Acenaphthylene	2015/05/21		87	%	50 - 130
			Acenaphthene	2015/05/21	<0.010		ug/L	
			Acenaphthylene	2015/05/21	<0.010		ug/L	
			Anthracene	2015/05/21	<0.010		ug/L	
			Benzo(a)anthracene	2015/05/21	<0.010		ug/L	
			Benzo(a)pyrene	2015/05/21	<0.010		ug/L	
			Benzo(b/j)fluoranthene	2015/05/21	<0.010		ug/L	
			Benzo(g,h,i)perylene	2015/05/21	<0.010		ug/L	
			Benzo(k)fluoranthene	2015/05/21	<0.010		ug/L	
			Chrysene	2015/05/21	<0.010		ug/L	
			Dibenz(a,h)anthracene	2015/05/21	<0.010		ug/L	
			Fluoranthene	2015/05/21	<0.010		ug/L	
			Fluorene	2015/05/21	<0.010		ug/L	
			Indeno(1,2,3-cd)pyrene	2015/05/21	<0.010		ug/L	
			1-Methylnaphthalene	2015/05/21	<0.010		ug/L	
			2-Methylnaphthalene	2015/05/21	<0.010		ug/L	
			Naphthalene	2015/05/21	<0.010		ug/L	
			Phenanthrene	2015/05/21	<0.010		ug/L	
			Pyrene	2015/05/21	<0.010		ug/L	
4030000	DTI	RPD	Acenaphthene	2015/05/21	NC		%	30
			Acenaphthylene	2015/05/21	NC		%	30
			Anthracene	2015/05/21	NC		%	30
			Benzo(a)anthracene	2015/05/21	NC		%	30
			Benzo(a)pyrene	2015/05/21	NC		%	30
			Benzo(b/j)fluoranthene	2015/05/21	NC		%	30
			Benzo(g,h,i)perylene	2015/05/21	NC		%	30
			Benzo(k)fluoranthene	2015/05/21	NC		%	30

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Client Project #: Richmond Landling
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Sampler Initials: DMP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			Chrysene	2015/05/21	NC		%	30
			Dibenz(a,h)anthracene	2015/05/21	NC		%	30
			Fluoranthene	2015/05/21	NC		%	30
			Fluorene	2015/05/21	NC		%	30
			Indeno(1,2,3-cd)pyrene	2015/05/21	NC		%	30
			1-Methylnaphthalene	2015/05/21	NC		%	30
			2-Methylnaphthalene	2015/05/21	NC		%	30
			Naphthalene	2015/05/21	NC		%	30
			Phenanthrene	2015/05/21	NC		%	30
			Pyrene	2015/05/21	NC		%	30

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

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

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

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

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

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

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VALIDATION SIGNATURE PAGE

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

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

Paul Rubinato, Analyst, Maxxam Analytics

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

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6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-Free:800-563-6266 Fax:(905) 817-5777 www.maxxam.ca

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#12078 Geofirma Engineering Ltd	Company Name:	GEOFIRMA	Quotation #:	B42106	Maxxam Job #:	Bottle Order #: 513329
Attention:	Drew Paulusse	Attention:	Drew Paulusse	P.O. #:	1321524-001		
Address:	1 Raymond St Suite 200 Ottawa ON K1R 1A2	Address:		Project:	Richmond Landling	COC #: C#513329-01-01	Project Manager: Madison Bingley
Tel:	(613) 232-2525 Fax: (613) 232-7149	Tel:	Fax:	Project Name:			
Email:	dpaulusse@geofirma.ca, nrobertson@geofirma.ca	Email:	DPaulusse@geofirma.com	Site #:			
				Sampled By:	DMP		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☒ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☒ Coarse ☒ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___

Other Regulations: ☒ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558. ☐ Storm Sewer Bylaw ☐ MISA Municipality ☐ PWQO ☐ Other

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ____

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests..
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ____ Time Required: ____ ☐
Rush Confirmation Number: ____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Low Level PAH Compounds in Water by GC/MS (SIM)	CCME Petroleum Hydrocarbons	# of Bottles	Comments
1		MW12-01	13-MAY-15		GW		X	X	7	
2		MW12-02			GW					
3		MW12-03			GW					
4		MW12-04			GW					
5		MW12-05			GW					
6		MW12-06			GW					
7		MW12-07			GW					
8		MW12-08			GW					
9		MW09-5			GW					ON ICE PACK
10		MW-DUP			GW					

14-May-15 12:50
Madison Bingley
B590038
FHB OTT-001

RECEIVED IN OTTAWA

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
DREW PAULUSSE	14-May-15	930	Fatemeh H.A	15/05/14	12:50	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Receipt	Custody Seal	Yes	No
	9.9, 10 / 9, 10, 8	Present	✓	
		Intact	✓	

10, 9, 10

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

White: Maxxam Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

Your P.O. #: 1321524-001
Your Project #: Richmond Landling
Your C.O.C. #: 513330-01-01

Attention:Drew Paulusse

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
K1R 1A2

Report Date: 2015/05/20
Report #: R3435059
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B590106
Received: 2015/05/14, 12:50

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
PAH Compounds in Water by GC/MS (SIM) (1)	5	2015/05/16	2015/05/19	CAM SOP-00318	EPA 8270 m

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

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

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

(1) This test was performed by Maxxam Analytics Mississauga

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Madison Bingley, Project Manager Assistant
Email: MBingley@maxxam.ca
Phone# (613) 274-0573

==========

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

Maxxam Job #: B590106
Report Date: 2015/05/20

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: THG

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		AGU894	AGU895	AGU896	AGU897	AGU898		
Sampling Date		2015/05/13	2015/05/13	2015/05/13	2015/05/13	2015/05/13		
COC Number		513330-01-01	513330-01-01	513330-01-01	513330-01-01	513330-01-01		
	Units	**SW14-1**	**SW14-2**	**SW14-3**	**SW14-4**	**SW14-5**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons								
Acenaphthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Acenaphthylene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Benzo(a)anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Benzo(a)pyrene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Benzo(b/j)fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Benzo(g,h,i)perylene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Benzo(k)fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Chrysene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Dibenz(a,h)anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Fluoranthene	ug/L	<0.010	0.013	<0.010	<0.010	<0.010	0.010	4026705
Fluorene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Indeno(1,2,3-cd)pyrene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
1-Methylnaphthalene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
2-Methylnaphthalene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Naphthalene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Phenanthrene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	4026705
Pyrene	ug/L	<0.010	0.011	<0.010	<0.010	<0.010	0.010	4026705
Surrogate Recovery (%)								
D10-Anthracene	%	90	86	88	93	90		4026705
D14-Terphenyl (FS)	%	78	71	76	80	79		4026705
D8-Acenaphthylene	%	81	75	84	88	87		4026705

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B590106
Report Date: 2015/05/20

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: THG

TEST SUMMARY

Maxxam ID: AGU894
Sample ID: SW14-1
Matrix: Water
Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU895
Sample ID: SW14-2
Matrix: Water
Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU896
Sample ID: SW14-3
Matrix: Water
Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU897
Sample ID: SW14-4
Matrix: Water
Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

Maxxam ID: AGU898
Sample ID: SW14-5
Matrix: Water
Collected: 2015/05/13
Shipped:
Received: 2015/05/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4026705	2015/05/16	2015/05/19	Lingyun Feng

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Maxxam Job #: B590106
Report Date: 2015/05/20

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: THG

GENERAL COMMENTS

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

Package 1	9.3°C
Package 2	9.0°C
Package 3	9.7°C

POTENTIAL COAL TAR IMPACTS

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxam.ca

Maxxam Job #: B590106
Report Date: 2015/05/20

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: THG

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
4026705	LFE	Matrix Spike [AGU896-01]	D10-Anthracene	2015/05/19		90	%	50 - 130
			D14-Terphenyl (FS)	2015/05/19		78	%	50 - 130
			D8-Acenaphthylene	2015/05/19		85	%	50 - 130
			Acenaphthene	2015/05/19		88	%	50 - 130
			Acenaphthylene	2015/05/19		89	%	50 - 130
			Anthracene	2015/05/19		86	%	50 - 130
			Benzo(a)anthracene	2015/05/19		98	%	50 - 130
			Benzo(a)pyrene	2015/05/19		96	%	50 - 130
			Benzo(b/j)fluoranthene	2015/05/19		88	%	50 - 130
			Benzo(g,h,i)perylene	2015/05/19		83	%	50 - 130
			Benzo(k)fluoranthene	2015/05/19		85	%	50 - 130
			Chrysene	2015/05/19		95	%	50 - 130
			Dibenz(a,h)anthracene	2015/05/19		79	%	50 - 130
			Fluoranthene	2015/05/19		92	%	50 - 130
			Fluorene	2015/05/19		86	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/05/19		96	%	50 - 130
			1-Methylnaphthalene	2015/05/19		89	%	50 - 130
			2-Methylnaphthalene	2015/05/19		86	%	50 - 130
			Naphthalene	2015/05/19		83	%	50 - 130
			Phenanthrene	2015/05/19		82	%	50 - 130
			Pyrene	2015/05/19		93	%	50 - 130
4026705	LFE	Spiked Blank	D10-Anthracene	2015/05/19		93	%	50 - 130
			D14-Terphenyl (FS)	2015/05/19		81	%	50 - 130
			D8-Acenaphthylene	2015/05/19		87	%	50 - 130
			Acenaphthene	2015/05/19		94	%	50 - 130
			Acenaphthylene	2015/05/19		92	%	50 - 130
			Anthracene	2015/05/19		90	%	50 - 130
			Benzo(a)anthracene	2015/05/19		102	%	50 - 130
			Benzo(a)pyrene	2015/05/19		99	%	50 - 130
			Benzo(b/j)fluoranthene	2015/05/19		86	%	50 - 130
			Benzo(g,h,i)perylene	2015/05/19		78	%	50 - 130
			Benzo(k)fluoranthene	2015/05/19		96	%	50 - 130
			Chrysene	2015/05/19		100	%	50 - 130
			Dibenz(a,h)anthracene	2015/05/19		64	%	50 - 130
			Fluoranthene	2015/05/19		97	%	50 - 130
			Fluorene	2015/05/19		91	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/05/19		96	%	50 - 130
			1-Methylnaphthalene	2015/05/19		95	%	50 - 130
			2-Methylnaphthalene	2015/05/19		91	%	50 - 130
			Naphthalene	2015/05/19		89	%	50 - 130
			Phenanthrene	2015/05/19		87	%	50 - 130
			Pyrene	2015/05/19		99	%	50 - 130
4026705	LFE	Method Blank	D10-Anthracene	2015/05/19		99	%	50 - 130
			D14-Terphenyl (FS)	2015/05/19		83	%	50 - 130
			D8-Acenaphthylene	2015/05/19		92	%	50 - 130
			Acenaphthene	2015/05/19	<0.010		ug/L	
			Acenaphthylene	2015/05/19	<0.010		ug/L	
			Anthracene	2015/05/19	<0.010		ug/L	
			Benzo(a)anthracene	2015/05/19	<0.010		ug/L	
			Benzo(a)pyrene	2015/05/19	<0.010		ug/L	
			Benzo(b/j)fluoranthene	2015/05/19	<0.010		ug/L	

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Maxxam Job #: B590106
Report Date: 2015/05/20

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: THG

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			Benzo(g,h,i)perylene	2015/05/19	<0.010		ug/L	
			Benzo(k)fluoranthene	2015/05/19	<0.010		ug/L	
			Chrysene	2015/05/19	<0.010		ug/L	
			Dibenz(a,h)anthracene	2015/05/19	<0.010		ug/L	
			Fluoranthene	2015/05/19	<0.010		ug/L	
			Fluorene	2015/05/19	<0.010		ug/L	
			Indeno(1,2,3-cd)pyrene	2015/05/19	<0.010		ug/L	
			1-Methylnaphthalene	2015/05/19	<0.010		ug/L	
			2-Methylnaphthalene	2015/05/19	<0.010		ug/L	
			Naphthalene	2015/05/19	<0.010		ug/L	
			Phenanthrene	2015/05/19	<0.010		ug/L	
			Pyrene	2015/05/19	<0.010		ug/L	
4026705	LFE	RPD	Acenaphthene	2015/05/19	NC		%	30
			Acenaphthylene	2015/05/19	NC		%	30
			Anthracene	2015/05/19	NC		%	30
			Benzo(a)anthracene	2015/05/19	NC		%	30
			Benzo(a)pyrene	2015/05/19	NC		%	30
			Benzo(b/j)fluoranthene	2015/05/19	NC		%	30
			Benzo(g,h,i)perylene	2015/05/19	NC		%	30
			Benzo(k)fluoranthene	2015/05/19	NC		%	30
			Chrysene	2015/05/19	NC		%	30
			Dibenz(a,h)anthracene	2015/05/19	NC		%	30
			Fluoranthene	2015/05/19	NC		%	30
			Fluorene	2015/05/19	NC		%	30
			Indeno(1,2,3-cd)pyrene	2015/05/19	NC		%	30
			1-Methylnaphthalene	2015/05/19	NC		%	30
			2-Methylnaphthalene	2015/05/19	NC		%	30
			Naphthalene	2015/05/19	NC		%	30
			Phenanthrene	2015/05/19	NC		%	30
			Pyrene	2015/05/19	NC		%	30

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

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

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

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

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

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

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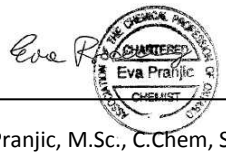
Maxxam Job #: B590106
Report Date: 2015/05/20

Geofirma Engineering Ltd
Client Project #: Richmond Landling
Your P.O. #: 1321524-001
Sampler Initials: THG

VALIDATION SIGNATURE PAGE

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



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

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Maxxam Analytics International Corporation o/a Maxxam Analytics
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-Free:800-563-6266 Fax:(905) 817-5777 www.maxxam.ca

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#12078 Geofirma Engineering Ltd	Company Name:	GEOFIRMA	Quotation #:	B42106	Maxxam Job #:	Bottle Order #: 513330
Attention:	Drew Paulusse	Attention:	Drew Paulusse	P.O. #:	1321524-001		
Address:	1 Raymond St Suite 200 Ottawa ON K1R 1A2	Address:		Project:	Richmond Landling	COC #: C#513330-01-01	Project Manager: Madison Bingley
Tel:	(613) 232-2525 Fax: (613) 232-7149	Tel:	Fax:	Project Name:			
Email:	dpaulusse@geofirma.ca, nrobertson@geofirma.ca	Email:	DPaulusse@geofirma.com	Site #:			
				Sampled By:	THG		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)
- [ ] Table 1 [X] Res/Park [ ] Medium/Fine
- [ ] Table 2 [ ] Ind/Comm [ ] Coarse
- [X] Table 3 [ ] Agri/Other [ ] For RSC
- [ ] Table ___

Other Regulations
- [X] CCME [ ] Sanitary Sewer Bylaw
- [ ] Reg 558. [ ] Storm Sewer Bylaw
- [ ] MISA Municipality ___
- [ ] PWQO
- [ ] Other ___

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: [X]
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests..
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ [ ]
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Low Level PAH Compounds in Water by GC/MS (SIM)	# of Bottles	Comments
1		SW14-1	13-MAY-15		SW		X	2	CCME REGS
2		SW14-2	"		SW		"	"	
3		SW14-3	"		SW		"	"	
4		SW14-4	"		SW		"	"	
5		SW14-5	"		SW		"	"	
6									
7									
8									
9									ON ICE PACKS.
10									

14-May-15 12:50
Madison Bingley
B590106
FHB OTT-001

RECEIVED IN OTTAWA

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Tim Galt	13-MAY-15	14:00	FHA Fatemeh H-A	15/05/14	12:50	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Receipt	Custody Seal	Yes	No
	9,9,10 / 9,10,8	Present	✓	
	10,9,10	Intact	✓	

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

White: Maxxam Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

Your P.O. #: 1321524-001
Your Project #: Richmond Landing
Your C.O.C. #: 527311-01-01

Attention:Drew Paulusse

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
K1R 1A2

Report Date: 2015/09/11
Report #: R3658288
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B5H8076
Received: 2015/09/03, 14:15

Sample Matrix: Water
Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Petroleum Hydro. CCME F1 & BTEX in Water	9	N/A	2015/09/04	OTT SOP-00002	CCME CWS
Petroleum Hydrocarbons F2-F4 in Water (2)	7	2015/09/08	2015/09/08	OTT SOP-00001	CCME Hydrocarbons
Petroleum Hydrocarbons F2-F4 in Water (2)	2	2015/09/08	2015/09/09	OTT SOP-00001	CCME Hydrocarbons
PAH Compounds in Water by GC/MS (SIM) (1)	7	2015/09/09	2015/09/10	CAM SOP-00318	EPA 8270 m
PAH Compounds in Water by GC/MS (SIM) (1)	2	2015/09/10	2015/09/11	CAM SOP-00318	EPA 8270 m

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

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

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

(1) This test was performed by Maxxam Analytics Mississauga
(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Madison Bingley, Project Manager Assistant
Email: MBingley@maxxam.ca
Phone# (613) 274-0573

==========

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

Maxxam Job #: B5H8076
Report Date: 2015/09/11

Geofirma Engineering Ltd
Client Project #: Richmond Landing
Your P.O. #: 1321524-001
Sampler Initials: DP

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		AXQ916	AXQ917	AXQ917		AXQ918		AXQ919		
Sampling Date		2015/09/01	2015/09/01	2015/09/01		2015/09/01		2015/09/01		
COC Number		527311-01-01	527311-01-01	527311-01-01		527311-01-01		527311-01-01		
	UNITS	**MW12-01**	**MW12-02**	**MW12-02 Lab-Dup**	**RDL**	**MW12-03**	**RDL**	**MW12-04**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons										
Acenaphthene	ug/L	<0.010	0.013	0.014	0.010	0.79	0.010	0.90	0.010	4183118
Acenaphthylene	ug/L	<0.010	<0.010	<0.010	0.010	0.040	0.010	0.031	0.010	4183118
Anthracene	ug/L	<0.010	<0.010	<0.010	0.010	0.010	0.010	0.014	0.010	4183118
Benzo(a)anthracene	ug/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	4183118
Benzo(a)pyrene	ug/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	4183118
Benzo(b/j)fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	4183118
Benzo(g,h,i)perylene	ug/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	4183118
Benzo(k)fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	4183118
Chrysene	ug/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	4183118
Dibenz(a,h)anthracene	ug/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	4183118
Fluoranthene	ug/L	<0.010	<0.010	<0.010	0.010	0.017	0.010	0.035	0.010	4183118
Fluorene	ug/L	0.011	0.013	0.013	0.010	1.8	0.010	1.3	0.010	4183118
Indeno(1,2,3-cd)pyrene	ug/L	<0.010	<0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	4183118
1-Methylnaphthalene	ug/L	0.11	0.14	0.14	0.010	34	0.010	7.3	0.010	4183118
2-Methylnaphthalene	ug/L	0.013	0.011	0.012	0.010	<0.10 (1)	0.10	0.077	0.010	4183118
Naphthalene	ug/L	0.023	0.023	0.023	0.010	<0.50 (1)	0.50	0.18	0.010	4183118
Phenanthrene	ug/L	<0.010	<0.010	<0.010	0.010	0.33	0.010	0.23	0.010	4183118
Pyrene	ug/L	<0.010	<0.010	<0.010	0.010	0.013	0.010	0.027	0.010	4183118
Surrogate Recovery (%)										
D10-Anthracene	%	92	91	93		87		92		4183118
D14-Terphenyl (FS)	%	93	95	98		93		97		4183118
D8-Acenaphthylene	%	92	94	95		90		91		4183118

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) DL was raised due to matrix interference.

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Maxxam Job #: B5H8076
Report Date: 2015/09/11

Geofirma Engineering Ltd
Client Project #: Richmond Landing
Your P.O. #: 1321524-001
Sampler Initials: DP

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		AXQ920		AXQ921			AXQ922		AXQ923		
Sampling Date		2015/09/02		2015/09/01			2015/09/01		2015/09/01		
COC Number		527311-01-01		527311-01-01			527311-01-01		527311-01-01		
	UNITS	**MW12-05**	**RDL**	**MW12-06**	**RDL**	**QC Batch**	**MW12-07**	**QC Batch**	**MW12-08**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons											
Acenaphthene	ug/L	1.0	0.010	0.92	0.010	4183118	0.016	4184987	0.29	0.010	4183118
Acenaphthylene	ug/L	<0.20 (1)	0.20	0.033	0.010	4183118	<0.010	4184987	0.022	0.010	4183118
Anthracene	ug/L	0.22	0.010	0.023	0.010	4183118	0.070	4184987	0.046	0.010	4183118
Benzo(a)anthracene	ug/L	0.19	0.010	<0.010	0.010	4183118	<0.010	4184987	0.039	0.010	4183118
Benzo(a)pyrene	ug/L	0.087	0.010	<0.010	0.010	4183118	<0.010	4184987	0.032	0.010	4183118
Benzo(b/j)fluoranthene	ug/L	0.12	0.010	<0.010	0.010	4183118	<0.010	4184987	0.041	0.010	4183118
Benzo(g,h,i)perylene	ug/L	0.045	0.010	<0.010	0.010	4183118	<0.010	4184987	0.018	0.010	4183118
Benzo(k)fluoranthene	ug/L	0.044	0.010	<0.010	0.010	4183118	<0.010	4184987	0.015	0.010	4183118
Chrysene	ug/L	0.15	0.010	<0.010	0.010	4183118	<0.010	4184987	0.032	0.010	4183118
Dibenz(a,h)anthracene	ug/L	0.011	0.010	<0.010	0.010	4183118	<0.010	4184987	<0.010	0.010	4183118
Fluoranthene	ug/L	0.64	0.010	0.020	0.010	4183118	<0.010	4184987	0.11	0.010	4183118
Fluorene	ug/L	0.87	0.010	1.9	0.010	4183118	0.035	4184987	0.23	0.010	4183118
Indeno(1,2,3-cd)pyrene	ug/L	0.046	0.010	<0.010	0.010	4183118	<0.010	4184987	0.019	0.010	4183118
1-Methylnaphthalene	ug/L	34	0.010	34	0.010	4183118	0.62	4184987	0.83	0.010	4183118
2-Methylnaphthalene	ug/L	<0.50 (1)	0.50	<0.10 (1)	0.10	4183118	0.017	4184987	0.051	0.010	4183118
Naphthalene	ug/L	1.5	0.010	<0.50 (1)	0.50	4183118	0.037	4184987	0.17	0.010	4183118
Phenanthrene	ug/L	1.4	0.010	0.29	0.010	4183118	0.014	4184987	0.14	0.010	4183118
Pyrene	ug/L	0.55	0.010	0.019	0.010	4183118	<0.010	4184987	0.10	0.010	4183118
Surrogate Recovery (%)											
D10-Anthracene	%	89		92		4183118	93	4184987	89		4183118
D14-Terphenyl (FS)	%	58		93		4183118	99	4184987	87		4183118
D8-Acenaphthylene	%	83		93		4183118	89	4184987	89		4183118

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) DL was raised due to matrix interference.

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Maxxam Job #: B5H8076
Report Date: 2015/09/11

Geofirma Engineering Ltd
Client Project #: Richmond Landing
Your P.O. #: 1321524-001
Sampler Initials: DP

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		AXQ924		
Sampling Date		2015/09/01		
COC Number		527311-01-01		
	UNITS	**MW-DUP**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons				
Acenaphthene	ug/L	0.014	0.010	4184987
Acenaphthylene	ug/L	<0.010	0.010	4184987
Anthracene	ug/L	<0.010	0.010	4184987
Benzo(a)anthracene	ug/L	<0.010	0.010	4184987
Benzo(a)pyrene	ug/L	<0.010	0.010	4184987
Benzo(b/j)fluoranthene	ug/L	<0.010	0.010	4184987
Benzo(g,h,i)perylene	ug/L	<0.010	0.010	4184987
Benzo(k)fluoranthene	ug/L	<0.010	0.010	4184987
Chrysene	ug/L	<0.010	0.010	4184987
Dibenz(a,h)anthracene	ug/L	<0.010	0.010	4184987
Fluoranthene	ug/L	<0.010	0.010	4184987
Fluorene	ug/L	0.013	0.010	4184987
Indeno(1,2,3-cd)pyrene	ug/L	<0.010	0.010	4184987
1-Methylnaphthalene	ug/L	0.15	0.010	4184987
2-Methylnaphthalene	ug/L	0.012	0.010	4184987
Naphthalene	ug/L	0.022	0.010	4184987
Phenanthrene	ug/L	<0.010	0.010	4184987
Pyrene	ug/L	<0.010	0.010	4184987
Surrogate Recovery (%)				
D10-Anthracene	%	97		4184987
D14-Terphenyl (FS)	%	105		4184987
D8-Acenaphthylene	%	98		4184987

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Report Date: 2015/09/11

Geofirma Engineering Ltd
Client Project #: Richmond Landing
Your P.O. #: 1321524-001
Sampler Initials: DP

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		AXQ916	AXQ916	AXQ917	AXQ918	AXQ919	AXQ920		
Sampling Date		2015/09/01	2015/09/01	2015/09/01	2015/09/01	2015/09/01	2015/09/02		
COC Number		527311-01-01	527311-01-01	527311-01-01	527311-01-01	527311-01-01	527311-01-01		
	UNITS	**MW12-01**	**MW12-01 Lab-Dup**	**MW12-02**	**MW12-03**	**MW12-04**	**MW12-05**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons									
Benzene	ug/L	<0.20		<0.20	<0.20	<0.20	<0.20	0.20	4178270
Toluene	ug/L	<0.20		<0.20	<0.20	<0.20	<0.20	0.20	4178270
Ethylbenzene	ug/L	<0.20		<0.20	0.22	<0.20	<0.20	0.20	4178270
o-Xylene	ug/L	<0.20		<0.20	<0.20	<0.20	<0.20	0.20	4178270
p+m-Xylene	ug/L	<0.40		<0.40	<0.40	<0.40	<0.40	0.40	4178270
Total Xylenes	ug/L	<0.40		<0.40	<0.40	<0.40	<0.40	0.40	4178270
F1 (C6-C10)	ug/L	<25		<25	46	<25	<25	25	4178270
F1 (C6-C10) - BTEX	ug/L	<25		<25	45	<25	<25	25	4178270
F2-F4 Hydrocarbons									
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	640	340	970	100	4180905
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	<200	<200	<200	<200	200	4180905
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	<200	<200	200	4180905
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes	Yes	Yes		4180905
Surrogate Recovery (%)									
1,4-Difluorobenzene	%	99		93	95	97	92		4178270
4-Bromofluorobenzene	%	115		104	102	104	102		4178270
D10-Ethylbenzene	%	91		93	101	95	85		4178270
D4-1,2-Dichloroethane	%	78		71	78	99	77		4178270
o-Terphenyl	%	96	92	94	93	93	95		4180905

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

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Report Date: 2015/09/11

Geofirma Engineering Ltd
Client Project #: Richmond Landing
Your P.O. #: 1321524-001
Sampler Initials: DP

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		AXQ921	AXQ922	AXQ923	AXQ924		
Sampling Date		2015/09/01	2015/09/01	2015/09/01	2015/09/01		
COC Number		527311-01-01	527311-01-01	527311-01-01	527311-01-01		
	UNITS	**MW12-06**	**MW12-07**	**MW12-08**	**MW-DUP**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons							
Benzene	ug/L	<0.20	<0.20	57	<0.20	0.20	4178270
Toluene	ug/L	<0.20	<0.20	1.3	<0.20	0.20	4178270
Ethylbenzene	ug/L	<0.20	<0.20	5.7	<0.20	0.20	4178270
o-Xylene	ug/L	<0.20	<0.20	1.3	<0.20	0.20	4178270
p+m-Xylene	ug/L	<0.40	<0.40	4.8	<0.40	0.40	4178270
Total Xylenes	ug/L	<0.40	<0.40	6.2	<0.40	0.40	4178270
F1 (C6-C10)	ug/L	<25	<25	550	<25	25	4178270
F1 (C6-C10) - BTEX	ug/L	<25	<25	480	<25	25	4178270
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	ug/L	590	<100	<100	<100	100	4180905
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	4180905
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	4180905
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes		4180905
Surrogate Recovery (%)							
1,4-Difluorobenzene	%	100	99	95	100		4178270
4-Bromofluorobenzene	%	118	105	97	105		4178270
D10-Ethylbenzene	%	101	103	100	88		4178270
D4-1,2-Dichloroethane	%	77	73	70	70		4178270
o-Terphenyl	%	101	99	101	93		4180905

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B5H8076
Report Date: 2015/09/11

Geofirma Engineering Ltd
Client Project #: Richmond Landing
Your P.O. #: 1321524-001
Sampler Initials: DP

TEST SUMMARY

Maxxam ID: AXQ916 **Collected:** 2015/09/01
Sample ID: MW12-01 **Shipped:**
Matrix: Water **Received:** 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4178270	N/A	2015/09/04	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/08	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4183118	2015/09/09	2015/09/10	Peggy Mclaren

Maxxam ID: AXQ916 Dup **Collected:** 2015/09/01
Sample ID: MW12-01 **Shipped:**
Matrix: Water **Received:** 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/08	Arezoo Habibagahi

Maxxam ID: AXQ917 **Collected:** 2015/09/01
Sample ID: MW12-02 **Shipped:**
Matrix: Water **Received:** 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4178270	N/A	2015/09/04	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/08	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4183118	2015/09/09	2015/09/10	Peggy Mclaren

Maxxam ID: AXQ917 Dup **Collected:** 2015/09/01
Sample ID: MW12-02 **Shipped:**
Matrix: Water **Received:** 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4183118	2015/09/09	2015/09/10	Peggy Mclaren

Maxxam ID: AXQ918 **Collected:** 2015/09/01
Sample ID: MW12-03 **Shipped:**
Matrix: Water **Received:** 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4178270	N/A	2015/09/04	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/08	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4183118	2015/09/09	2015/09/10	Peggy Mclaren

Maxxam ID: AXQ919 **Collected:** 2015/09/01
Sample ID: MW12-04 **Shipped:**
Matrix: Water **Received:** 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4178270	N/A	2015/09/04	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/08	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4183118	2015/09/09	2015/09/10	Peggy Mclaren

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Maxxam Job #: B5H8076
Report Date: 2015/09/11

Geofirma Engineering Ltd
Client Project #: Richmond Landing
Your P.O. #: 1321524-001
Sampler Initials: DP

TEST SUMMARY

Maxxam ID: AXQ920
Sample ID: MW12-05
Matrix: Water

Collected: 2015/09/02
Shipped:
Received: 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4178270	N/A	2015/09/04	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/08	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4183118	2015/09/09	2015/09/10	Peggy Mclaren

Maxxam ID: AXQ921
Sample ID: MW12-06
Matrix: Water

Collected: 2015/09/01
Shipped:
Received: 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4178270	N/A	2015/09/04	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/08	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4183118	2015/09/09	2015/09/10	Peggy Mclaren

Maxxam ID: AXQ922
Sample ID: MW12-07
Matrix: Water

Collected: 2015/09/01
Shipped:
Received: 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4178270	N/A	2015/09/04	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/08	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4184987	2015/09/10	2015/09/11	Lingyun Feng

Maxxam ID: AXQ923
Sample ID: MW12-08
Matrix: Water

Collected: 2015/09/01
Shipped:
Received: 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4178270	N/A	2015/09/04	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/09	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4183118	2015/09/09	2015/09/10	Peggy Mclaren

Maxxam ID: AXQ924
Sample ID: MW-DUP
Matrix: Water

Collected: 2015/09/01
Shipped:
Received: 2015/09/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	4178270	N/A	2015/09/04	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	4180905	2015/09/08	2015/09/09	Arezoo Habibagahi
PAH Compounds in Water by GC/MS (SIM)	GC/MS	4184987	2015/09/10	2015/09/11	Lingyun Feng

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Your P.O. #: 1321524-001
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GENERAL COMMENTS

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

Package 1	6.3°C

cooler custody seal was present and intact.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
4178270	LHR	Matrix Spike	1,4-Difluorobenzene	2015/09/04		93	%	70 - 130
			4-Bromofluorobenzene	2015/09/04		95	%	70 - 130
			D10-Ethylbenzene	2015/09/04		100	%	70 - 130
			D4-1,2-Dichloroethane	2015/09/04		75	%	70 - 130
			Benzene	2015/09/04		78	%	70 - 130
			Toluene	2015/09/04		80	%	70 - 130
			Ethylbenzene	2015/09/04		90	%	70 - 130
			o-Xylene	2015/09/04		85	%	70 - 130
			p+m-Xylene	2015/09/04		92	%	70 - 130
			F1 (C6-C10)	2015/09/04		79	%	70 - 130
4178270	LHR	Spiked Blank	1,4-Difluorobenzene	2015/09/04		97	%	70 - 130
			4-Bromofluorobenzene	2015/09/04		108	%	70 - 130
			D10-Ethylbenzene	2015/09/04		99	%	70 - 130
			D4-1,2-Dichloroethane	2015/09/04		75	%	70 - 130
			Benzene	2015/09/04		84	%	70 - 130
			Toluene	2015/09/04		79	%	70 - 130
			Ethylbenzene	2015/09/04		94	%	70 - 130
			o-Xylene	2015/09/04		89	%	70 - 130
			p+m-Xylene	2015/09/04		95	%	70 - 130
			F1 (C6-C10)	2015/09/04		99	%	70 - 130
4178270	LHR	Method Blank	1,4-Difluorobenzene	2015/09/04		92	%	70 - 130
			4-Bromofluorobenzene	2015/09/04		106	%	70 - 130
			D10-Ethylbenzene	2015/09/04		94	%	70 - 130
			D4-1,2-Dichloroethane	2015/09/04		74	%	70 - 130
			Benzene	2015/09/04	<0.20		ug/L	
			Toluene	2015/09/04	<0.20		ug/L	
			Ethylbenzene	2015/09/04	<0.20		ug/L	
			o-Xylene	2015/09/04	<0.20		ug/L	
			p+m-Xylene	2015/09/04	<0.40		ug/L	
			Total Xylenes	2015/09/04	<0.40		ug/L	
			F1 (C6-C10)	2015/09/04	<25		ug/L	
			F1 (C6-C10) - BTEX	2015/09/04	<25		ug/L	
4178270	LHR	RPD	F1 (C6-C10)	2015/09/04	NC		%	40
			F1 (C6-C10) - BTEX	2015/09/04	NC		%	40
4180905	AH1	Matrix Spike [AXQ918-02]	o-Terphenyl	2015/09/08		99	%	30 - 130
			F2 (C10-C16 Hydrocarbons)	2015/09/08		NC	%	50 - 130
			F3 (C16-C34 Hydrocarbons)	2015/09/08		96	%	50 - 130
			F4 (C34-C50 Hydrocarbons)	2015/09/08		96	%	50 - 130
4180905	AH1	Spiked Blank	o-Terphenyl	2015/09/08		94	%	30 - 130
			F2 (C10-C16 Hydrocarbons)	2015/09/08		86	%	80 - 120
			F3 (C16-C34 Hydrocarbons)	2015/09/08		86	%	80 - 120
			F4 (C34-C50 Hydrocarbons)	2015/09/08		86	%	80 - 120
4180905	AH1	Method Blank	o-Terphenyl	2015/09/08		95	%	30 - 130
			F2 (C10-C16 Hydrocarbons)	2015/09/08	<100		ug/L	
			F3 (C16-C34 Hydrocarbons)	2015/09/08	<200		ug/L	
			F4 (C34-C50 Hydrocarbons)	2015/09/08	<200		ug/L	
4180905	AH1	RPD [AXQ916-02]	F2 (C10-C16 Hydrocarbons)	2015/09/08	NC		%	50
			F3 (C16-C34 Hydrocarbons)	2015/09/08	NC		%	50
			F4 (C34-C50 Hydrocarbons)	2015/09/08	NC		%	50
4183118	PMC	Matrix Spike [AXQ916-01]	D10-Anthracene	2015/09/10		97	%	50 - 130
			D14-Terphenyl (FS)	2015/09/10		99	%	50 - 130
			D8-Acenaphthylene	2015/09/10		98	%	50 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Acenaphthene	2015/09/10		102	%	50 - 130
			Acenaphthylene	2015/09/10		105	%	50 - 130
			Anthracene	2015/09/10		102	%	50 - 130
			Benzo(a)anthracene	2015/09/10		119	%	50 - 130
			Benzo(a)pyrene	2015/09/10		115	%	50 - 130
			Benzo(b/j)fluoranthene	2015/09/10		110	%	50 - 130
			Benzo(g,h,i)perylene	2015/09/10		108	%	50 - 130
			Benzo(k)fluoranthene	2015/09/10		110	%	50 - 130
			Chrysene	2015/09/10		112	%	50 - 130
			Dibenz(a,h)anthracene	2015/09/10		108	%	50 - 130
			Fluoranthene	2015/09/10		115	%	50 - 130
			Fluorene	2015/09/10		107	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/09/10		117	%	50 - 130
			1-Methylnaphthalene	2015/09/10		99	%	50 - 130
			2-Methylnaphthalene	2015/09/10		96	%	50 - 130
			Naphthalene	2015/09/10		93	%	50 - 130
			Phenanthrene	2015/09/10		106	%	50 - 130
			Pyrene	2015/09/10		114	%	50 - 130
4183118	PMC	Spiked Blank	D10-Anthracene	2015/09/10		98	%	50 - 130
			D14-Terphenyl (FS)	2015/09/10		100	%	50 - 130
			D8-Acenaphthylene	2015/09/10		100	%	50 - 130
			Acenaphthene	2015/09/10		106	%	50 - 130
			Acenaphthylene	2015/09/10		108	%	50 - 130
			Anthracene	2015/09/10		105	%	50 - 130
			Benzo(a)anthracene	2015/09/10		119	%	50 - 130
			Benzo(a)pyrene	2015/09/10		119	%	50 - 130
			Benzo(b/j)fluoranthene	2015/09/10		112	%	50 - 130
			Benzo(g,h,i)perylene	2015/09/10		113	%	50 - 130
			Benzo(k)fluoranthene	2015/09/10		119	%	50 - 130
			Chrysene	2015/09/10		115	%	50 - 130
			Dibenz(a,h)anthracene	2015/09/10		89	%	50 - 130
			Fluoranthene	2015/09/10		118	%	50 - 130
			Fluorene	2015/09/10		109	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/09/10		127	%	50 - 130
			1-Methylnaphthalene	2015/09/10		101	%	50 - 130
			2-Methylnaphthalene	2015/09/10		98	%	50 - 130
			Naphthalene	2015/09/10		99	%	50 - 130
			Phenanthrene	2015/09/10		109	%	50 - 130
			Pyrene	2015/09/10		117	%	50 - 130
4183118	PMC	Method Blank	D10-Anthracene	2015/09/10		101	%	50 - 130
			D14-Terphenyl (FS)	2015/09/10		100	%	50 - 130
			D8-Acenaphthylene	2015/09/10		103	%	50 - 130
			Acenaphthene	2015/09/10	<0.010		ug/L	
			Acenaphthylene	2015/09/10	<0.010		ug/L	
			Anthracene	2015/09/10	<0.010		ug/L	
			Benzo(a)anthracene	2015/09/10	<0.010		ug/L	
			Benzo(a)pyrene	2015/09/10	<0.010		ug/L	
			Benzo(b/j)fluoranthene	2015/09/10	<0.010		ug/L	
			Benzo(g,h,i)perylene	2015/09/10	<0.010		ug/L	
			Benzo(k)fluoranthene	2015/09/10	<0.010		ug/L	
			Chrysene	2015/09/10	<0.010		ug/L	
			Dibenz(a,h)anthracene	2015/09/10	<0.010		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Fluoranthene	2015/09/10	<0.010		ug/L	
			Fluorene	2015/09/10	<0.010		ug/L	
			Indeno(1,2,3-cd)pyrene	2015/09/10	<0.010		ug/L	
			1-Methylnaphthalene	2015/09/10	<0.010		ug/L	
			2-Methylnaphthalene	2015/09/10	<0.010		ug/L	
			Naphthalene	2015/09/10	0.030, RDL=0.010 (1)		ug/L	
			Phenanthrene	2015/09/10	<0.010		ug/L	
			Pyrene	2015/09/10	<0.010		ug/L	
4183118	PMC	RPD [AXQ917-01]	Acenaphthene	2015/09/10	NC		%	30
			Acenaphthylene	2015/09/10	NC		%	30
			Anthracene	2015/09/10	NC		%	30
			Benzo(a)anthracene	2015/09/10	NC		%	30
			Benzo(a)pyrene	2015/09/10	NC		%	30
			Benzo(b/j)fluoranthene	2015/09/10	NC		%	30
			Benzo(g,h,i)perylene	2015/09/10	NC		%	30
			Benzo(k)fluoranthene	2015/09/10	NC		%	30
			Chrysene	2015/09/10	NC		%	30
			Dibenz(a,h)anthracene	2015/09/10	NC		%	30
			Fluoranthene	2015/09/10	NC		%	30
			Fluorene	2015/09/10	NC		%	30
			Indeno(1,2,3-cd)pyrene	2015/09/10	NC		%	30
			1-Methylnaphthalene	2015/09/10	2.4		%	30
			2-Methylnaphthalene	2015/09/10	NC		%	30
			Naphthalene	2015/09/10	NC		%	30
			Phenanthrene	2015/09/10	NC		%	30
			Pyrene	2015/09/10	NC		%	30
4184987	LFE	Matrix Spike	D10-Anthracene	2015/09/11		95	%	50 - 130
			D14-Terphenyl (FS)	2015/09/11		92	%	50 - 130
			D8-Acenaphthylene	2015/09/11		97	%	50 - 130
			Acenaphthene	2015/09/11		100	%	50 - 130
			Acenaphthylene	2015/09/11		98	%	50 - 130
			Anthracene	2015/09/11		97	%	50 - 130
			Benzo(a)anthracene	2015/09/11		104	%	50 - 130
			Benzo(a)pyrene	2015/09/11		70	%	50 - 130
			Benzo(b/j)fluoranthene	2015/09/11		77	%	50 - 130
			Benzo(g,h,i)perylene	2015/09/11		28 (2)	%	50 - 130
			Benzo(k)fluoranthene	2015/09/11		77	%	50 - 130
			Chrysene	2015/09/11		100	%	50 - 130
			Dibenz(a,h)anthracene	2015/09/11		25 (2)	%	50 - 130
			Fluoranthene	2015/09/11		112	%	50 - 130
			Fluorene	2015/09/11		106	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/09/11		30 (2)	%	50 - 130
			1-Methylnaphthalene	2015/09/11		104	%	50 - 130
			2-Methylnaphthalene	2015/09/11		99	%	50 - 130
			Naphthalene	2015/09/11		91	%	50 - 130
			Phenanthrene	2015/09/11		100	%	50 - 130
			Pyrene	2015/09/11		111	%	50 - 130
4184987	LFE	Spiked Blank	D10-Anthracene	2015/09/11		102	%	50 - 130
			D14-Terphenyl (FS)	2015/09/11		107	%	50 - 130
			D8-Acenaphthylene	2015/09/11		101	%	50 - 130
			Acenaphthene	2015/09/11		103	%	50 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Acenaphthylene	2015/09/11		101	%	50 - 130
			Anthracene	2015/09/11		103	%	50 - 130
			Benzo(a)anthracene	2015/09/11		109	%	50 - 130
			Benzo(a)pyrene	2015/09/11		110	%	50 - 130
			Benzo(b/j)fluoranthene	2015/09/11		110	%	50 - 130
			Benzo(g,h,i)perylene	2015/09/11		87	%	50 - 130
			Benzo(k)fluoranthene	2015/09/11		113	%	50 - 130
			Chrysene	2015/09/11		105	%	50 - 130
			Dibenz(a,h)anthracene	2015/09/11		54	%	50 - 130
			Fluoranthene	2015/09/11		115	%	50 - 130
			Fluorene	2015/09/11		109	%	50 - 130
			Indeno(1,2,3-cd)pyrene	2015/09/11		116	%	50 - 130
			1-Methylnaphthalene	2015/09/11		107	%	50 - 130
			2-Methylnaphthalene	2015/09/11		102	%	50 - 130
			Naphthalene	2015/09/11		106	%	50 - 130
			Phenanthrene	2015/09/11		102	%	50 - 130
			Pyrene	2015/09/11		116	%	50 - 130
4184987	LFE	Method Blank	D10-Anthracene	2015/09/11		100	%	50 - 130
			D14-Terphenyl (FS)	2015/09/11		103	%	50 - 130
			D8-Acenaphthylene	2015/09/11		98	%	50 - 130
			Acenaphthene	2015/09/11	<0.010		ug/L	
			Acenaphthylene	2015/09/11	<0.010		ug/L	
			Anthracene	2015/09/11	<0.010		ug/L	
			Benzo(a)anthracene	2015/09/11	<0.010		ug/L	
			Benzo(a)pyrene	2015/09/11	<0.010		ug/L	
			Benzo(b/j)fluoranthene	2015/09/11	<0.010		ug/L	
			Benzo(g,h,i)perylene	2015/09/11	<0.010		ug/L	
			Benzo(k)fluoranthene	2015/09/11	<0.010		ug/L	
			Chrysene	2015/09/11	<0.010		ug/L	
			Dibenz(a,h)anthracene	2015/09/11	<0.010		ug/L	
			Fluoranthene	2015/09/11	<0.010		ug/L	
			Fluorene	2015/09/11	<0.010		ug/L	
			Indeno(1,2,3-cd)pyrene	2015/09/11	<0.010		ug/L	
			1-Methylnaphthalene	2015/09/11	<0.010		ug/L	
			2-Methylnaphthalene	2015/09/11	<0.010		ug/L	
			Naphthalene	2015/09/11	0.025, RDL=0.010 (3)		ug/L	
			Phenanthrene	2015/09/11	<0.010		ug/L	
			Pyrene	2015/09/11	<0.010		ug/L	
4184987	LFE	RPD	Acenaphthene	2015/09/11	NC		%	30
			Acenaphthylene	2015/09/11	NC		%	30
			Anthracene	2015/09/11	NC		%	30
			Benzo(a)anthracene	2015/09/11	NC		%	30
			Benzo(a)pyrene	2015/09/11	NC		%	30
			Benzo(b/j)fluoranthene	2015/09/11	NC		%	30
			Benzo(g,h,i)perylene	2015/09/11	NC		%	30
			Benzo(k)fluoranthene	2015/09/11	NC		%	30
			Chrysene	2015/09/11	NC		%	30
			Dibenz(a,h)anthracene	2015/09/11	NC		%	30
			Fluoranthene	2015/09/11	NC		%	30
			Fluorene	2015/09/11	NC		%	30
			Indeno(1,2,3-cd)pyrene	2015/09/11	NC		%	30

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			1-Methylnaphthalene	2015/09/11	NC		%	30
			2-Methylnaphthalene	2015/09/11	NC		%	30
			Naphthalene	2015/09/11	NC		%	30
			Phenanthrene	2015/09/11	NC		%	30
			Pyrene	2015/09/11	NC		%	30

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

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

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

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

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

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

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

(1) Analyte was detected in the method blank at a level above the detection limit. Sample results have not been blank corrected. Those results at or near the detection limit may be biased high.

(2) The recovery was below the lower control limit due to matrix interference. This may represent a low bias in some results for flagged analytes.

(3) Analyte was detected in the method blank at a level above the detection limit. Sample results have not been blank corrected. Those results at or near the detection limit may be biased high..

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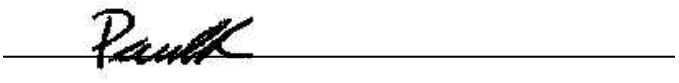
VALIDATION SIGNATURE PAGE

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

Brad Newman, Scientific Specialist



Paul Rubinato, Analyst, Maxxam Analytics

Steve Roberts, Ottawa Lab Manager

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

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CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#12078 Geofirma Engineering Ltd	Company Name:		Quotation #:	B42106	Maxxam Job #:	Bottle Order #: 527311
Attention:	Accounts Payable	Attention:	Drew Paulusse	P.O. #:	1321524-001		
Address:	1 Raymond St Suite 200 Ottawa ON K1R 1A2	Address:		Project:	Richmond Landing	COC #: C#527311-01-01	Project Manager: Madison Bingley
Tel:	(613) 232-2525 Fax: (613) 232-7149	Tel:	Fax:	Project Name:			
Email:	accountspayable@geofirma.com	Email:	DPaulusse@geofirma.com	Site #:			
				Sampled By:	DMP		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)
☐ Table 1 ☐ Res/Park ☐ Medium/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ For RSC
☐ Table ___

Other Regulations
☒ CCME ☐ Sanitary Sewer Bylaw
☐ Reg 558 ☐ Storm Sewer Bylaw
☐ MISA Municipality ___
☐ PWQO
☐ Other ___

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests..
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	CCME Petroleum Hydrocarbons	CCME PAH Compounds in Water by GC/MS (SIM)	# of Bottles	Comments
1		MW12-01	1-SEP-15		GW	NA	X	X	6	
2		MW12-02	"		GW	"	"	"	"	
3		MW12-03	"		GW	"	"	"	"	
4		MW12-04	"		GW	"	"	"	"	
5		MW12-05	2-SEP-15		GW	"	"	"	"	
6		MW12-06	1-SEP-15		GW	"	"	"	"	
7		MW12-07	"		GW	"	"	"	"	
8		MW12-08	"		GW	"	"	"	"	
9		MW-DUP	"		GW	"	"	"	"	
10					GW					

3-Sep-15 14:15
Madison Bingley
B5H8076
FHB OTT-001

RECEIVED IN OTTAWA
ON ICE pack.

RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Drew Paulusse	3-SEP-15	11:00	Fatemeh H.A	15/09/03	14:15	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Receipt	Custody Seal	Yes	No
	6, 6, 7	Present	✓	
		Intact	✓	

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

White: Maxxam Yellow: Client

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