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REPORT

Fall 2014
Semi-Annual Monitoring Report

Waste Management of Canada
Richmond Landfill
Town of Greater Napanee, Ontario

Submitted to:

WASTE MANAGEMENT OF CANADA
1271 Beechwood Road
Napanee, ON K7R 3L1

Submitted by:

WESA, a division of BluMetric Environmental Inc.
The Tower, The Woolen Mill
4 Cataraqui Street
Kingston, ON K7K 1Z7

January 2015
WESA Project No.: K-B12321-00-05

FINAL

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1 INTRODUCTION

The purpose of this document is to present results and to provide an interpretation of the data that were collected during the fall 2014 semi-annual monitoring event at the Waste Management of Canada Corporation (WM) Richmond Landfill. Groundwater elevations recorded in summer 2014 are also reported herein.

The WM Richmond Landfill is approved as a 16.2 hectare waste disposal (landfilling) facility within a total site area of 138 hectares, located on parts of Lots 1, 2 and 3, Concession IV of the former Township of Richmond, now in the Town of Greater Napanee, Ontario.

2 MONITORING PROGRAM

2.1 PROGRAM METHODOLOGY

The fall 2014 semi-annual monitoring event was conducted in accordance with Environmental Compliance Approval (ECA) number A371203, issued by MOE January 9, 2012 and amended May 3, 2013. The site layout and monitoring locations are shown on Figure 1. The monitoring programs for groundwater, surface water, and landfill gas are summarized in Table 1.

For the summer 2014 monitoring event, water levels were recorded on August 20, 2014 at groundwater monitoring wells (35 installed within the shallow groundwater flow zone and 32 from the intermediate bedrock flow zone), and at the three ponds located on site between the landfill and Beechwood Road. No water levels were recorded at monitoring wells M15, M18 and M39 (dry), M19, M29 and OW57 (damaged), or at M9-3 (inaccessible).

The fall monitoring event was conducted between October 20 and 23, 2014. The activities completed included the following:

- Water levels were recorded at groundwater monitoring wells on October 20, 2014 (36 installed within the shallow groundwater flow zone and 33 from the intermediate bedrock flow zone). No water levels were recorded at groundwater monitors M15 and M18 (dry), M19, M29 and OW57 (damaged);
- Pond water levels were measured on October 20, 2014 at the three ponds on the south side of the landfill;
- Liquid levels were measured in landfill leachate wells on October 20, 2014;

- Seven off-site domestic water supply wells were sampled on October 21, 2014[1]. Water samples from private supply wells were analyzed for groundwater inorganic and general parameters, and VOCs;
- A total of 43 groundwater monitors were sampled between October 21 and 23, 2014. Four groundwater monitoring wells could not be sampled because they (a) had insufficient recovery for sampling after purging (M39), (b) were damaged (M29 and M58-4) or (c) they were suspected to be contaminated by a damaged pipe casing which causes break-through of bentonite material to enter the well (M71). Samples were analyzed for the suite of groundwater inorganic and general parameters (Table 2);
- Surface water sampling was conducted on October 20, 2014 from locations S2, S3, S6, S7 and S8R. No sample was collected from locations S4R and S5 because they were dry. Surface water samples were analyzed for the surface water inorganic and general parameters;
- Landfill gas migration monitoring was conducted on October 20, 2014. Field measurements were made with a RKI Eagle probe calibrated to methane gas response at seven gas monitors (GM1, GM2, GM3, GM4-1, GM4-2, GM5 and GM6); and
- A total of 11 Quality Assurance/Quality Control (QA/QC) samples were collected during the fall sampling event, including six field duplicate samples, two field blanks, and three trip blanks. Deionised water for analysis of blank samples was supplied by the laboratory.

2.2 Water Sample Collection and Laboratory Analysis

Groundwater and surface water samples were collected in accordance with accepted industry protocols. Groundwater samples were collected using dedicated Waterra inertial lift pumps connected to dedicated polyethylene tubing. Three casing volumes of water were purged from each monitoring well prior to the collection of groundwater samples. During purging, readings for pH, conductivity and temperature were recorded on a regular basis. The stabilization of the parameters was used to assess when well purging was complete. Low producing wells were purged dry and allowed to recover prior to sampling. If the monitoring well had not recovered sufficiently for sampling within 24 hours, the monitor was considered dry and a sample was not collected.

Domestic supply wells were sampled at an access point before any treatment system. A typical sampling location was a tap or access located near the pressure tank or when access to the treatment system was not available, the sample was collected from the kitchen tap (with the aerator screen removed). Prior to collecting the water sample, the water was allowed to run for

[1] 1121 Beechwood Road was not sampled as it is now on whole-house supplied water, and the well head (sampling point) is no longer accessible.

a minimum of five but more typically closer to 10 minutes to ensure the volume of the pressure tank and supply line was purged and that the sample would be representative of well water conditions.

Surface water samples were collected using a clean bottle where water depth was sufficient; at sampling locations where water depth was an issue, a 50 cc syringe was used to carefully collect the surface water as not to disturb the bottom sediments. Surface water sampling locations were sampled from downstream to upstream to prevent any re-suspension of sediment impacting the downstream sampling locations. The pH, temperature, and conductivity of the surface water were obtained in the field at all surface water sampling points while minimizing disturbance of the bottom sediment.

All water samples were placed in bottles supplied and prepared by the laboratory. The samples were packed in coolers with ice and shipped by courier to the laboratory. All samples were analysed by Maxxam Analytics Inc. of Mississauga, ON, which is accredited by the *Canadian Association for Laboratory Accreditation Inc. (CALA).* Table 2 presents a summary of groundwater, surface water and leachate analytical parameters.

2.3 GROUNDWATER ELEVATIONS

Prior to collecting groundwater samples, water levels were recorded to the nearest 0.01 m using an electronic water level meter. Table 3 presents groundwater elevation monitoring locations.

3 MONITORING RESULTS AND DISCUSSION

Background information concerning the site geology and hydrogeology was described in detail in the Site Conceptual Model (SCM) report[2], and is summarized here. The SCM report describes the groundwater flow conditions at the Richmond Landfill. Based on the results from extensive studies conducted previously at the site, the basic hydrogeological framework for the facility has been defined as follows:

- the active groundwater flow zone at the site extends to a depth of approximately 30 m below the top of bedrock;
- the shallow groundwater flow zone is conceptualized as the overburden, the overburden-bedrock contact and the upper one to two metres of bedrock;

[2] *Site Conceptual Model Report, WM Richmond Landfill*, prepared by Dr. B.H. Kueper and WESA Inc., October 2009

- the direction of groundwater flow in the shallow flow zone is strongly influenced by topography;
- the intermediate bedrock flow zone extends from one to two metres below top of bedrock to a depth of approximately 30 m below top of bedrock;
- groundwater flows through a well-connected network of fractures in the upper 30 m of bedrock;
- the dominant fracture orientation is horizontal to sub-horizontal; however, vertical to subvertical fractures are present providing hydraulic connection between horizontal fractures;
- hydraulic connection of fractures exists in the intermediate bedrock flow zone to the west, south and east of the site (horizontal and vertical connections);
- intermediate bedrock flownets show that groundwater generally flows to the west from the western edge of the landfill, to the southeast from the southern edge of the landfill, to the south along the eastern edge of the landfill, and north to northwest from the northern limit of the landfill;
- the hydraulic conductivity of the intermediate bedrock is lower to the north and east of the landfill compared to other areas of the site, implying that the rate of groundwater flow is lower than in areas south, southeast and west of the landfill; and
- groundwater flow directions in the intermediate bedrock zone are variable with season.

3.1 Liquid Levels in Leachate Wells

Liquid levels were measured in the two landfill leachate wells on October 20, 2014 and provided the following:

- The liquid level at LW-P1 was 147.45 m above sea level (masl); and
- The liquid level at LW-P2 was 157.41 masl.

3.2 Groundwater Results

3.2.1 Groundwater Elevations

Groundwater elevations from program monitoring wells listed in Table 3 were measured on August 20, 2014 and October 20, 2014 and are presented in Tables 4a and 4b, respectively. An inventory of monitoring well locations is provided in Appendix A. Groundwater elevation contours within the shallow groundwater flow zone are shown on Figures 2a (summer) and 2b (fall), while Figures 3a (summer) and 3b (fall) show the groundwater elevation contours for the intermediate bedrock flow zone. Groundwater flow directions were inferred by interpolating the

hydraulically responsive wells screened within the corresponding groundwater flow zone, and are consistent with historical results.

The summer and fall 2014 shallow groundwater contours (Figures 2a and 2b, respectively) are consistent with historical results and show that the Empey Hill drumlin southwest from the landfill creates a flow divide, with shallow groundwater being directed both to the north and the south towards areas of lower hydraulic heads. North of the landfill, shallow groundwater converges towards Marysville Creek in the area immediately east of County Road 10 (Deseronto Road), while shallow flow in the southern portion of the site converges on Beechwood Ditch and the southern pond system. Shallow groundwater east of the landfill is influenced by a local zone of higher water levels in the vicinity of monitoring well M96; shallow groundwater north of M96 flows to the north-northwest and ultimately Marysville Creek, while groundwater south of M96 flows to the south-southwest, towards Beechwood Ditch and the ponds.

The summer and fall 2014 intermediate bedrock zone contours are presented on Figures 3a and 3b, respectively. On the landfill property, groundwater in this hydrostratigraphic unit generally flows to the north, west, and south-southeast relative to the landfill. Water levels from intermediate bedrock monitors M49-1, M70-1, OW54-d and OW54-i, identified as "responsive" in the 2009 SCM report were not used to prepare the fall 2014 groundwater contours, as the water levels at these locations were not static, believed to be recovering from past sampling events. Groundwater monitoring wells M49-2 and M52-1 are non-responsive and were also excluded from the intermediate bedrock flow zone contouring.

3.2.2 Groundwater Analytical Results

Results from the groundwater monitoring wells sampled in fall 2014 are presented in Table 5a. Groundwater quality data for the fall 2014 monitoring event are similar to historical results, and discussed in this section.

Slightly elevated concentrations of a number of water quality parameters (e.g., alkalinity, barium, boron, chloride, conductivity, DOC, sodium and/or TDS) were observed in some shallow groundwater zone monitoring wells located in close proximity to the landfill footprint (M41 to the south; M101 and M103 to the northwest, and M66-2 to the northeast).

In other areas of the site, there is no evidence of groundwater impacts away from the landfill footprint in the shallow groundwater flow zone. Isolated occurrences of elevated concentrations of water quality parameters (i.e., one or two parameters per sample) are seen elsewhere on the Site. No indications of elevated concentrations related to impacts are identified at the property boundary in the shallow flow zone.

Analytical results from intermediate bedrock groundwater monitors sampled in fall 2014 are generally consistent with historical results. North of the landfill, elevated concentrations of water quality parameters are noted at M6-3 and OW4, which are in close proximity to the footprint. These results indicate the presence of leachate impacts at these locations. However, the concentrations are lower and impacts from the landfill are not evident further north of the footprint and along Marysville Creek (e.g., at M5-3, M75, M82-1, M82-2 and OW1), as well as north of the creek at M59-2, M59-3 and M59-4.

South of the landfill, slightly elevated concentrations of alkalinity, DOC, chloride and TDS at M10-1 and M105 indicate groundwater impacts. Other locations south and southeast of the landfill with elevated concentrations (e.g., M49-1, M49-2 and M70-1) represent areas where the deeper saline groundwater is affecting the water quality. These pockets of more saline groundwater are isolated and do not reflect any widespread or significant upwelling of saline groundwater.

Elsewhere to the west (M58-3, M72, M74, M91-1 and M95-1), southwest (M56-2 and M80-1) and east (M52-1) of the landfill, the concentrations of water quality parameters are relatively low and continue to reflect background conditions.

Alkalinity and ammonia results are shown for the shallow and intermediate bedrock flow zones on Figures 4 and 5, respectively.

3.2.3 Guideline B-7 Reasonable Use Limits (RULs)

Selected monitoring wells within the low-head areas of the WM Richmond Landfill in both the Shallow and Intermediate Bedrock Groundwater Flow Zones are compared to the RULs derived from laboratory analytical results (Table 5b). Proposed RULs for leachate indicator parameters and trigger monitors were presented in the EMP dated June 29, 2010. These will be re-examined as part of ongoing investigations, but are used here on an interim basis.

Slightly elevated concentrations of a number of inorganic or general water quality parameters (e.g., DOC, iron, manganese, sodium and/or TDS) were observed in shallow groundwater zone monitoring wells (M41, M53-4, M54-4, M66-2, M67-2, M80-2, M87-2 and OW37-s).

Slightly elevated concentrations of a number of water quality parameters (e.g alkalinity, boron, chloride, DOC, iron, manganese, sodium, and/or TDS) were observed in some intermediate groundwater zone monitoring wells (M5-3, M6-3, M10-1, M49-1, M56-2, M70-1, M82-1, M107, OW1, OW4 and OW54-d).

3.2.4 Status of Monitoring Wells and Compliance with Ontario Regulation 903

During the fall 2014 monitoring event, the conditions of monitoring wells were inspected. Any repairs, such as new locks, labels or well caps, etc. were made as necessary. Watertight casings and seals remain in place at all monitors to ensure that surface water or foreign materials do not infiltrate the wells. The monitoring wells comply with the applicable sections of Ontario Regulation 903 relevant to "test holes" as defined in the regulation, as well as the overall intent of the regulation to protect groundwater supplies. With the exception of monitors M19, M29, M58-4 and OW57 (damaged) as well as M71 and M75 (integrity of the bentonite seals in monitors suspect due to the presence of bentonite in purge water), all of the monitoring wells included in the EMP are currently active. It is recommended that the damaged wells be decommissioned when a revised EMP is approved as they cannot be repaired.

3.2.5 Off-Site Domestic Water Supply Well Results

Results from off-site private water supply wells sampled in fall 2014 are presented in Table 6.

Comparison with Ontario Drinking Water Quality Objectives and Guidelines (ODWSOG, 2006) revealed all parameters were below their respective maximum acceptable concentrations (MAC) or interim maximum acceptable concentrations (IMAC) as specified in Table 2 of the ODWSOG, with the exception of lead at 1206 Beechwood Road. The supply wells at these residences are not in use, and the groundwater is not being consumed. The elevated lead concentrations may be related to a lack of water flushing through the systems since the groundwater supplies are no longer in use. Some inorganic parameters (alkalinity, chloride, DOC, hardness, iron, manganese, sodium and TDS) were measured at concentrations exceeding their respective aesthetic objective (AO) or operational guideline (OG) from Table 4 of the ODWSOG, at all locations. Figure 6 shows the alkalinity and ammonia results from the domestic well sampling program.

As was the case in previous sampling events, volatile organic compounds (VOCs) in off-site supply wells were generally reported below the laboratory reporting limit (RL) at all locations, with the exception of some VOCs detected in measurable quantities above the RL at 1097, 1144, 1181, 1250, 1252 and 1264 Beechwood Road. In all cases, VOC concentrations were below the MAC or AO.

3.2.6 Groundwater Chemistry Quality Assurance / Quality Control (QA/QC)

An evaluation of the QA/QC data (from duplicate and blank samples) is included in Appendix B, where analytical results are compared between regular samples and their corresponding field duplicate samples, submitted to the laboratory without identifying the location they were

collected from. A standard margin of error of 20% (relative percent difference (RPD) between regular sample and duplicate) was deemed acceptable for field duplicates. In general, the comparison between samples and duplicates shows very good correlation for the majority of analyzed constituents. All parameters for groundwater duplicate QA/QC sampling were well within the 20% margin of error with the three exceptions as summarized in Appendix B. All parameters that had RPD greater than 20% were measured at low concentrations (less than 5 times the RDL) and are therefore within acceptable margin of error. All parameters were near or below the RDL in equipment and field blanks.

3.3 SURFACE WATER RESULTS

3.3.1 Pond Elevations

Staff gauges are installed in the three ponds on the south side of the landfill labeled SG1, SG2 and SG3. Staff gauge locations and pond elevations measured on August 20, 2014 and October 20, 2014 are shown on Figures 2a and 2b.

3.3.2 Surface Water Monitoring Locations

The two water courses that may receive surface water/storm water runoff from the Richmond Landfill are Marysville Creek to the north of the waste mound and Beechwood Ditch to the south (Figure 1). The Beechwood Ditch is a man-made surface water course that flows from the east onto WM property. It then flows west across a portion of the site before again crossing Beechwood Road and travelling southwest to cross County Road 10, and joins Marysville Creek east of Highway 49 and north of Highway 401. Both the Beechwood Ditch and Marysville Creek flow intermittently in the vicinity of the landfill. Marysville Creek has some base flow locally, and flows on a continuous basis west of County Road 10 (Deseronto Road). Marysville Creek eventually discharges into the Bay of Quinte at Hungry Bay.

All surface water monitoring locations are shown on Figure 1. Sampling locations S4R and S5 were not sampled in fall 2014 because they were dry.

3.3.3 Surface Water Flow Rates

Visual observations of surface water flow and general water characteristics for the fall sampling program are summarized in Table 7. Flow rates were either not measurable or not present at any of the sampling locations.

3.3.4 Surface Water Analytical Results

The results from the surface water locations sampled in fall 2014 are presented in Table 8, and are similar to historical results.

Surface water quality from samples collected in fall 2014 was compared to the Provincial Water Quality Objectives (PWQO) (see Table 8). Background surface water quality was monitored from upstream station S2 for Marysville Creek. Storm water runoff from the existing landfill area flows to one of three storm water sedimentation retention ponds, located to the northeast, northwest and south of the landfill footprint.

Constituents analysed in surface water samples were below their respective PWQO, with the exception of phenols and phosphorous at location S2, iron and phosphorous at location S3, cobalt, copper, phosphorous, iron and zinc at location S6, phosphorous at location S7 and phenols at location S8R. Concentrations at location S6 (north of the landfill) were generally higher than background concentrations at location S2 and further downstream concentrations at locations S7 and S3. At the point of surface water discharge from the site (location S3), PWQO exceedances were noted for iron and phosphorus.

Results from fall 2014 indicate that the landfill is not causing adverse impacts to surface water quality.

3.3.5 Surface Water Quality Assurance / Quality Control (QA/QC)

An evaluation of the QA/QC data (from duplicate and blank samples) is included in Appendix B, where analytical results are compared between regular samples and their corresponding field duplicate samples, submitted to the laboratory without identifying the location they were collected from. A standard margin of error of 20% was deemed acceptable for field duplicates. In general, the comparison between samples and duplicates shows very good correlation for the majority of analyzed constituents. All parameters for the surface water duplicate QA/QC sample (location S2) were well within the 20% margin of error, with the exception of potassium which was measured at low concentrations (less than 5 times the RDL) and is therefore within acceptable margin of error.

3.4 Subsurface Gas Sampling

On October 20, 2014, WESA inspected the subsurface gas monitoring probes and obtained measurements at all locations. The location of the gas monitors and the measurement results are shown in Table 9. Measurements of all gas wells were 0 ppm, well below the LEL for methane of 5% by volume in air, or 50,000 ppm.

3.5 ANNUAL SUMMARY

A comparative review of groundwater quality results between this and previous sampling events indicates that constituent concentrations vary over time but for the most part have remained relatively consistent over the current calendar year and over the past 10 years or more. Depending on which monitoring point and more importantly the time scale considered, conflicting trends in concentrations can occur sporadically. However since implementing the revised EMP dated June 29, 2010, the majority of the patterns have been observed to be seasonally variable but relatively similar.

Alkalinity, chloride, iron, manganese, and total dissolved solids (TDS) concentration data were reviewed for shallow monitoring wells M41, M66-2, M101, M102, M103 and OW37-s, as well as for intermediate monitoring wells M6-3, M10-1, M49-1, M49-2, M52-1, M59-2, M70-1, M105, M106, M107, OW1 and OW4 from the spring of 2011 to the fall of 2014. Over this time period the vast majority of the intervals show stabilized and/or variable/oscillating concentrations for almost all parameters analyzed. Exceptions to this generalization include:

- For the shallow groundwater monitors:
  - M66-2 for TDS (downward trend);
  - M101 for alkalinity (increasing trend) and chloride (downward trend);
  - M102 for alkalinity, chloride and TDS (decreasing);
  - M103 for alkalinity, chloride, manganese and TDS (downward trend); and
  - OW37-s for TDS (downward trend).

- For the intermediate bedrock groundwater monitors:
  - M6-3 for alkalinity and TDS (downward trend) and chloride (increasing);
  - M49-2 for alkalinity (increasing trend);
  - M70-1 for alkalinity (increasing trend) and chloride (downward trend);
  - M105 for chloride and alkalinity (increasing trend);
  - M106 for alkalinity (downward trend) and TDS (increasing trend);
  - M107 for chloride, iron and manganese (increasing trend); and
  - OW1 for alkalinity and TDS (increasing trend), and manganese (downward trend).

The observed trends in groundwater geochemistry outlined here are not necessarily indicative of landfill leachate impacts, and should be interpreted with caution. For the purpose of assessing potential landfill leachate impacts on off-site groundwater quality, an updated list of groundwater monitors and leachate indicator parameters has been proposed in a revised EMP (submitted in draft in October 2014). The proposed EMP is currently under review by the MOE and other stakeholders; once adopted, the new EMP will replace the current groundwater

monitoring program, and will be used to assess potential impacts to groundwater from landfill leachate.

3.6 ADDITIONAL INVESTIGATIONS

Work outside of the scope of the EMP program was performed throughout the year at the Richmond Landfill Site. Table 10 describes activities performed in 2014.

4 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The fall 2014 monitoring program included the collection of groundwater and surface water samples, as well as landfill gas monitoring, in accordance with the site groundwater monitoring requirements outlined in the revised EMP dated June 29, 2010, as specified in the Environmental Compliance Approval (ECA) issued on January 9, 2012 and amended May 3, 2013. Per the settlement agreement with CCCTE and the ERT Order issued April 26, 2013, the EMP is to be revised upon completion of the investigation that is currently underway at the site.

Water levels were recorded on August 20, 2014 at 67 groundwater monitoring wells (35 installed within the shallow groundwater flow zone and 32 from the intermediate bedrock flow zone), and at the three ponds located on site between the landfill and Beechwood Road. The following were completed between October 20 and 23, 2014:

- Water levels were measured from 69 groundwater monitoring wells: 36 in the shallow groundwater flow zone and 33 in the intermediate bedrock flow zone.
- 43 groundwater monitors (17 completed in the shallow zone and 26 in the intermediate bedrock) were sampled for analytical testing.
- Seven off-site domestic water supply wells located along Beechwood Road were sampled for analytical testing.
- Five surface water locations were sampled for analytical testing.
- A total of 11 Quality Assurance/Quality Control (QA/QC) samples were collected (six field duplicates, two field blanks and three trip blanks).
- Subsurface gas concentrations were recorded from seven on-site gas monitoring wells.

4.1 GROUNDWATER

- Groundwater flow directions interpreted from monitors known to be hydraulically active were consistent with historical flownets:

  - Shallow groundwater flow is influenced by local topographic highs in the southwestern (Empey Hill Drumlin) and eastern (groundwater monitor M96 area) portions of the site, and is characterized by a flow divide with shallow groundwater being directed both to the north (toward Marysville Creek) and the south (toward Beechwood Ditch).
  - Groundwater in the intermediate bedrock flow zone generally flows to the north, west, and south-southeast relative to the landfill.
- Groundwater quality data from fall 2014 are generally consistent with historical results.
- Slightly elevated concentrations of a number of water quality parameters are seen in the shallow groundwater zone northwest and north of the Phase 1 landfill footprint. In other areas of the site, there is no evidence of groundwater impact away from the landfill footprint in the shallow groundwater flow zone.
- The geochemical results for the intermediate bedrock groundwater flow zone indicate higher concentrations of water quality parameters south and immediately north of the landfill relative to the concentrations west and east of the landfill. The higher concentrations are downgradient from the landfill footprint and occur in monitoring wells that are known to be hydraulically connected to each other.
- A comparative review of groundwater quality results between this and previous sampling events indicates that constituent concentrations vary over time but for the most part have remained relatively consistent over the current calendar year and over the past 10 years or more.
- Further investigation of the groundwater conditions south of the landfill is underway in order to better define and delineate impacts from the landfill and to define the extent of a contaminant attenuation zone.
- Continued groundwater monitoring within the shallow and intermediate bedrock groundwater flow zones between the landfill footprint and the low-head areas is warranted in order to further examine groundwater quality and any trends over time.
- It is recommended that the following groundwater monitoring wells be replaced, upgraded or removed from the monitoring program for the reasons stated below, as these wells have become unreliable for water level and/or quality monitoring as a result of these issues:
  - M29 and M39: low recovery small diameter (2.54 cm) overburden monitors that are often dry and/or cannot be sampled after being purged dry;
  - M71 and M75: integrity concerns with the bentonite seal (presence of bentonite in purge water); and
  - M19, M29, M58-4 and OW57: damaged monitors.

Repair, upgrade or replacement of these wells will be subject to the outcome from the ongoing investigation, and will be documented in the revised EMP (as per Condition 8.5(b) of the Amended ECA.

4.2 SURFACE WATER

- The concentrations observed are within the range of historical monitoring results except for location S6, which appears to be slightly higher than previous years. Continued evaluation of further results is required to validate whether this is a one-time occurrence;
- The concentrations of phenols and phosphorous at location S2, iron and phosphorous at location S3, cobalt, copper, phosphorous and iron at location S6, phosphorous at location S7 and phenols at location S8R were above PWQO.

4.3 SUBSURFACE GAS

- Measurements for methane gas were all non-detect (0 ppm), well below the LEL of 5% by volume in air, or 50,000 ppm.

5 LIMITING CONDITIONS

The fall 2014 monitoring program involved the collection of groundwater (from on-site monitoring wells and off-site domestic supply wells) and surface water for analyses at the site monitoring locations. The data collected during this investigation represent the conditions at the sampled locations only.

The conclusions presented in this report represent our professional opinion and are based on the conditions observed on the dates set out in the report, the information available at the time this report was prepared, the scope of work, and any limiting conditions noted herein.

BluMetric Environmental Inc. provides no assurances regarding changes to conditions subsequent to the time of the assessment. BluMetric Environmental Inc. makes no warranty as to the accuracy or completeness of the information provided by others or of the conclusions and recommendations predicated on the accuracy of that information.

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Respectfully submitted,
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TABLES

Table 1: Summary of Environmental Monitoring Program

Monitoring Locations		Parameter Suite	Monitoring Frequency
Shallow Groundwater Flow Zone Monitors			
M12, M14, M15, M16, M18, M19, M23, M27, M28, M29, M30, M31, M35, M38, M39, M41, M47-3, M53-4, M54-4, M58-4, M60-4, M66-2, M67-2, M68-4, M70-3, M77, M80-2, M81, M87-2, M88-2, M89-2, M96, M97, M98, M99-2, M100, M101, M102, M103, OW37-s, OW57		Groundwater Elevations	Spring, Summer and Fall
M29, M39, M41, M53-4, M54-4, M58-4, M66-2, M67-2, M68-4, M70-3, M80-2, M81, M87-2, M96, M97, M99-2, M101, M102, M103, OW37-s		Groundwater Inorganic & General	Semi-annual: Spring and Fall
M41, M58-4, M96, M97, M53-4, M54-4, M66-2, M67-2, M70-3, M80-2, M87-2, M101, M102, M103, OW37-s		VOCs	Annual: Spring
Intermediate Bedrock Groundwater Flow Zone Monitors			
M3A-3, M9-3, M10-1, M49-1, M49-2, M50-3, M52-1, M56-2, M58-3, M59-2, M59-3, M59-4, M60-1, M63-2, M64-2, M70-1, M71, M72, M73, M74, M80-1, M82-1, M82-2, M91-1, M95-1, M105, M106, M107*, M108, OW1, OW4, OW54-i, OW54-d		Groundwater Elevations	Spring, Summer and Fall
M5-3, M6-3, M9-3, M10-1, M49-1, M49-2, M52-1, M56-2, M58-3, M59-2, M59-3, M59-4, M70-1, M71, M72, M74, M75, M80-1, M82-1, M82-2, M91-1, M95-1, M105, M107*, OW1, OW4, OW54-d		Groundwater Inorganic & General	Semi-annual: Spring and Fall
M5-3, M6-3, M9-3, M10-1, M49-1, M49-2, M52-1, M56-2, M59-3, M70-1, M74, M75, M80-1, M82-1, M82-2, M91-1, M95-1, OW1, OW4		VOCs	Annual: Spring
Surface Water Sampling Locations			
Beechwood Ditch	S4R, S5 and S8R	Surface Water Inorganic and General	Semi-annual: Spring and Fall
Marysville Creek	S2, S3, S6 and S7	Surface Water Inorganic and General	Semi-annual: Spring and Fall
Leachate Monitoring Locations			
North Chamber, South Chamber, LW-P1 and LW-P2		Leachate Inorganic & General VOCs, NDMA	Annual: Spring
Landfill Gas Monitoring Wells			
GM1, GM3, GM4-1, GM4-2, GM5, GM6		% methane by volume	Semi-annual: Spring and Fall
Off-site Domestic Water Supply Wells			
1097 Beechwood Road 1121 Beechwood Road 1144 Beechwood Road 1181 Beechwood Road	1206 Beechwood Road 1250 Beechwood Road 1252 Beechwood Road 1264 Beechwood Road	Groundwater Inorganic & General, VOCs	Semi-annual: Spring and Fall

* M107: Originally labelled as M106 in EMP dated June 29, 2010

Table 2. Analytical Parameters for Water and Leachate Samples

Groundwater Inorganic and General Parameters		
Alkalinity	Conductivity	Nitrite
Ammonia (total)	Copper	pH
Arsenic	Dissolved organic carbon	Phenols
Barium	Hardness	Phosphorus (total)
Biological oxygen demand	Iron	Potassium
Boron	Lead	Sodium
Cadmium	Magnesium	Sulphate
Calcium	Manganese	Total dissolved solids
Chemical oxygen demand	Mercury	Total Kjeldahl Nitrogen
Chloride	Naphthalene	Zinc
Chromium (total)	Nitrate	
Surface Water Inorganic and General Parameters		
Alkalinity	Copper	Total dissolved solids
Ammonia (total)	Cyanide (free)	Total Kjeldahl nitrogen
Arsenic	Hardness	Total phosphorus
Barium	Iron	Total suspended solids
Biological oxygen demand	Lead	Un-ionized ammonia
Boron	Magnesium	Zinc
Cadmium	Mercury	
Calcium	Naphthalene	
Chemical oxygen demand	Nickel	*Field measured:*
Chloride	Nitrate	conductivity
Chromium (total)	Nitrite	dissolved oxygen
Chromium (III)	Phenols	estimated flow rate
Chromium (VI)	Potassium	pH
Cobalt	Sodium	temperature
Conductivity	Sulphate	
Leachate Inorganic and General Parameters		
Alkalinity	Conductivity	Nitrite
Ammonia (total)	Copper	pH
Arsenic	Dissolved organic carbon	Phenols
Barium	Hardness	Phosphorus (total)
Biological oxygen demand	Iron	Potassium
Boron	Lead	Sodium
Cadmium	Magnesium	Sulphate
Calcium	Manganese	Total dissolved solids
Chemical oxygen demand	Mercury	Total Kjeldahl Nitrogen
Chloride	Naphthalene	Zinc
Chromium (total)	Nickel	
Cobalt	Nitrate	
Volatile Organic Compounds (VOCs)		
1,1,1,2-Tetrachloroethane	Benzene	Ethylbenzene
1,1,1-Trichloroethane	Bromodichloromethane	m&p-Xylene
1,1,2,2-Tetrachloroethane	Bromoform	o-Xylene
1,1,2-Trichloroethane	Bromomethane	Styrene
1,1-Dichloroethane	Carbon tetrachloride	Toluene
1,1-Dichloroethylene	Chlorobenzene	Trans-1,2-Dichloroethylene
1,2-Dibromoethane	Chloroethane	Trans-1,3-Dichloropropylene
1,2-Dichlorobenzene	Chloroform	Tetrachloroethylene
1,2-Dichloroethane	Chloromethane	Trichloroethylene
1,2-Dichloropropane	Cis-1,2-Dichloroethylene	Trichlorofluoromethane
1,3,5-Trimethylbenzene	Cis-1,3-Dichloropropylene	Vinyl chloride
1,3-Dichlorobenzene	Dibromochloromethane	
1,4-Dichlorobenzene	Dichloromethane (methylene chloride)	

Table 3. Groundwater Elevation Monitoring Locations

Location	Shallow Groundwater Flow Zone			Intermediate Groundwater Flow Zone		
West of landfill footprint	M27	M58-4	M98	M3A-3	M59-4	M82-1
	M28	M67-2	M99-2	M56-2	M72	M82-2
	M29	M87-2	M100	M58-3	M73	M91-1
	M30	M88-2	M101	M59-2	M74	M95-1
	M31	M89-2	M102	M59-3		
	M38	M97	OW37-s			
North of landfill footprint	M35	M66-2		M60-1		
	M39	M103		OW1		
	M60-4			OW4		
South of landfill footprint	M12	M18	M80-2	M9-3	M64-2	M105
	M14	M41	M81	M10-1	M71	M106
	M15	M53-4	OW57	M49-1	M80-1	M107*
	M16	M54-4		M49-2	OW54-i	M108
				M63-2	OW54-d	
East of landfill footprint	M19	M68-4	M96	M50-3		
	M23	M70-3		M52-1		
	M47-3	M77		M70-1		

* M107: Originally labelled as M106 in EMP dated June 29, 2010

Table 4a: Groundwater Elevations - August 20, 2014

Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)
Shallow Groundwater Flow Zone							
M12	125.00	M31	123.17	M67-2	122.47	M98	129.39
M14	125.83	M35	124.20	M68-4	123.81	M99-2	129.43
M15	dry	M38	124.19	M70-3	126.08	M100	124.15
M16	124.26	M39	dry	M77	125.18	M101	123.30
M18	dry	M41	124.90	M80-2	123.32	M102	123.32
M19	damaged	M47-3	124.27	M81	124.34	M103	122.97
M23	126.14	M53-4	124.43	M87-2	123.63	OW37-s	121.88
M27	126.02	M54-4	124.10	M88-2	127.52	OW57	damaged
M28	125.33	M58-4	123.52	M89-2	128.64		
M29	damaged	M60-4	124.00	M96	127.81		
M30	123.40	M66-2	122.81	M97	124.47		
Intermediate Bedrock Groundwater Flow Zone							
M3A-3	124.70	M58-3	122.82	M72	122.60	M105	117.31
M9-3	inaccessible	M59-2	122.84	M73	122.67	M106	122.76
M10-1	117.69	M59-3	122.80	M74	123.47	M107	117.29
M49-1	116.87	M59-4	122.80	M80-1	122.86	M108	116.96
M49-2	117.56	M60-1	122.65	M82-1	122.73	OW1	122.67
M50-3	124.36	M63-2	121.05	M82-2	122.50	OW4	123.05
M52-1	112.36	M64-2	118.74	M91-1	122.81	OW54-d	117.13
M56-2	122.80	M70-1	116.93	M95-1	122.67	OW54-i	117.15
		M71	123.60				

Table 4b: Groundwater Elevations - October 20, 2014

Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)	Monitoring Well	Water Level (masl)
Shallow Groundwater Flow Zone							
M12	124.86	M31	123.23	M67-2	122.18	M98	129.38
M14	125.38	M35	124.17	M68-4	124.02	M99-2	129.34
M15	dry	M38	124.28	M70-3	126.34	M100	124.23
M16	124.25	M39	122.85	M77	124.69	M101	123.50
M18	dry	M41	124.71	M80-2	123.34	M102	123.97
M19	damaged	M47-3	124.40	M81	124.39	M103	123.17
M23	125.72	M53-4	124.44	M87-2	123.45	OW37-*s*	121.89
M27	126.23	M54-4	124.09	M88-2	127.07	OW57	damaged
M28	126.13	M58-4	123.41	M89-2	128.41		
M29	damaged	M60-4	124.04	M96	127.41		
M30	123.48	M66-2	122.93	M97	123.91		
Intermediate Bedrock Groundwater Flow Zone							
M3A-3	124.61	M58-3	122.81	M72	122.58	M105	119.29
M9-3	119.72	M59-2	122.82	M73	122.63	M106	122.73
M10-1	119.26	M59-3	122.79	M74	123.45	M107	119.28
M49-1	118.89	M59-4	122.78	M80-1	122.84	M108	119.11
M49-2	118.34	M60-1	122.48	M82-1	122.70	OW1	122.76
M50-3	124.38	M63-2	120.97	M82-2	122.50	OW4	123.20
M52-1	113.68	M64-2	118.58	M91-1	122.73	OW54-d	119.10
M56-2	122.77	M70-1	119.05	M95-1	122.66	OW54-i	119.11
		M71	123.60				

Table 5a: Groundwater Quality Results - October 21 - 23, 2014

Name	Date	Alkalinity	Ammonia	Arsenic	Barium	Biochemical Oxygen Demand	Boron	Cadmium	Calcium	Chemical Oxygen Demand	Chloride	Chromium	Cobalt	Conductivity	Copper	Dissolved Organic Carbon	Hardness	Iron	Lead	Magnesium	Manganese	Mercury	Naphthalene	Nickel	Nitrate	Nitrite	pH (Lab)	Phenols	Phosphorus (total)	Potassium	Sodium	Sulphate	Total Dissolved Solids	Total Kjeldahl Nitrogen	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	unitless	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Shallow Groundwater Flow Zone [1]																																			
M41	10/21/2014	470	< 0.15	< 0.001	0.085	< 2	0.06	< 0.0001	160	5.8	190	< 0.005	< 0.0005	1650	0.0016	3.7	730	< 0.1	< 0.0005	80	0.024	< 0.0002	< 0.0005	0.0043	0.16	< 0.01	7.75	< 0.001	0.03	14	49	89	940	< 0.7	< 0.005
M53-4	10/21/2014	440	< 0.15	< 0.001	0.06	< 2	0.019	< 0.0001	140	5.8	2	< 0.005	< 0.0005	997	< 0.001	2.9	460	< 0.1	< 0.0005	27	0.0088	< 0.0002	< 0.0005	< 0.001	0.34	< 0.01	7.83	< 0.001	0.04	0.28	47	110	608	< 0.7	< 0.005
M54-4	10/22/2014	380	< 0.15	< 0.001	0.19	< 2	0.034	< 0.0001	140	< 4	77	0.0082	< 0.0005	1010	< 0.001	4.3	480	< 0.1	< 0.0005	28	0.01	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	7.78	< 0.001	0.52	1.5	45	55	624	< 0.7	0.0062
M66-2	10/22/2014	340	< 0.15	0.0013	0.032	2	0.47	< 0.0001	130	8.7	100	< 0.005	0.00072	1380	< 0.001	3.9	500	2.7	< 0.0005	43	0.042	< 0.0002	< 0.0005	0.0028	< 0.1	< 0.01	7.86	< 0.001	0.03	4.3	110	240	860	< 0.7	< 0.005
M67-2	10/22/2014	360	0.57	0.0021	0.32	2	1	< 0.0001	56	6.1	5	< 0.005	< 0.0005	767	< 0.001	2.9	270	0.99	< 0.0005	32	0.05	< 0.0002	< 0.0005	< 0.001	< 0.1	0.011	8.02	0.001	0.07	9.8	59	54	428	< 0.7	< 0.005
M68-4	10/22/2014	430	0.21	< 0.001	0.32	< 2	< 0.01	< 0.0001	140	21	13	0.024	0.0005	844	< 0.001	3.5	430	2.8	< 0.0005	22	0.27	< 0.0002	< 0.0005	0.0017	< 0.1	< 0.01	7.72	< 0.001	2.2	0.45	23	33	466	3	< 0.005
M70-3	10/23/2014	350	< 0.15	< 0.001	0.043	< 2	0.014	< 0.0001	140	5.8	43	< 0.005	< 0.0005	1040	< 0.001	5.7	530	< 0.1	< 0.0005	42	0.017	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	7.77	< 0.001	0.07	0.86	24	160	682	< 0.7	< 0.005
M80-2	10/22/2014	340	< 0.15	< 0.001	0.12	< 2	0.049	< 0.0001	98	< 4	78	< 0.005	< 0.0005	902	< 0.001	2.7	460	< 0.1	< 0.0005	53	0.021	< 0.0002	< 0.0005	0.0016	< 0.1	0.021	8	< 0.001	0.16	4	15	37	518	< 0.7	< 0.005
M81	10/22/2014	360	< 0.15	< 0.001	0.23	< 2	0.032	< 0.0001	110	< 4	73	< 0.005	< 0.0005	942	< 0.001	1.9	480	< 0.1	< 0.0005	53	0.024	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	7.85	< 0.001	0.06	2.4	12	40	416	1.4	< 0.005
M87-2	10/23/2014	230	< 0.15	0.0012	0.057	< 2	0.037	< 0.0001	54	< 4	28	0.012	< 0.0005	596	< 0.001	1.6	290	< 0.1	< 0.0005	37	0.13	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8.06	< 0.001	0.48	2.1	14	50	308	1.4	< 0.005
M96	10/23/2014	300	< 0.15	< 0.001	0.11	< 2	0.069	< 0.0001	65	< 4	6	< 0.005	< 0.0005	636	< 0.001	2.1	310	< 0.1	< 0.0005	35	0.0044	< 0.0002	< 0.0005	< 0.001	2.12	< 0.01	7.97	< 0.001	0.05	4.5	17	37	346	< 0.7	< 0.005
M97	10/23/2014	220	< 0.15	0.0011	0.076	< 2	0.061	< 0.0001	31	< 4	6	< 0.005	< 0.0005	517	< 0.001	1.7	210	< 0.1	< 0.0005	31	0.004	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8.14	< 0.001	0.1	1.9	29	49	296	< 0.7	< 0.005
M99-2	10/23/2014	300	0.16	0.0017	0.043	< 2	0.072	< 0.0001	65	8.7	27	0.016	< 0.0005	839	< 0.001	2.8	420	0.57	< 0.0005	63	0.016	< 0.0002	< 0.0005	< 0.001	< 0.1	0.035	8	< 0.001	4.2	2.4	18	120	528	0.7	< 0.005
M101	10/22/2014	490	< 0.15	< 0.001	0.17	< 2	0.069	< 0.0001	170	8.2	83	0.011	0.00056	1220	< 0.001	3.3	640	< 0.1	< 0.0005	55	0.021	< 0.0002	< 0.0005	0.0012	< 0.1	0.013	7.68	< 0.001	0.23	4.2	17	65	746	0.7	< 0.005
M102	10/22/2014	430	< 0.15	< 0.001	0.13	< 2	0.045	< 0.0001	140	5.5	28	< 0.005	0.0013	939	< 0.001	3.1	480	0.56	< 0.0005	28	0.19	< 0.0002	< 0.0005	0.0021	< 0.1	< 0.01	7.76	< 0.001	0.13	2.6	26	50	542	< 0.7	0.014
M103	10/22/2014	740	< 0.15	< 0.001	0.18	< 2	0.26	< 0.0001	140	11	140	< 0.005	0.001	1750	< 0.001	5.3	690	< 0.1	< 0.0005	84	0.02	< 0.0002	< 0.0005	0.011	< 0.1	< 0.01	7.7	< 0.001	0.17	5.8	130	43	996	< 0.7	< 0.005
OW37-s	10/21/2014	150	< 0.15	< 0.001	0.093	< 2	0.11	< 0.0001	28	4	68	< 0.005	< 0.0005	525	< 0.001	2	140	< 0.1	< 0.0005	18	0.13	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8.05	< 0.001	0.03	9.1	42	2	256	< 0.7	< 0.005
Intermediate BedrockGroundwater Flow Zone																																			
M5-3	10/23/2014	450	1.37	< 0.001	0.17	6	1.2	< 0.0001	34	14	43	< 0.005	< 0.0005	969	< 0.001	3.2	200	< 0.1	< 0.0005	27	0.0028	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8.04	0.029	0.06	13	140	9	522	1.2	< 0.005
M6-3	10/23/2014	1100	4.47	< 0.001	1.3	3	0.25	< 0.0001	720	140	1400	0.014	< 0.0025	8820	< 0.005	45	1800	< 0.1	0.00051	0.12	< 0.002	< 0.0002	< 0.0013	0.026	< 0.1	< 0.01	12.2	0.012	0.04	54	600	49	4220	6.6	< 0.005
M9-3	10/23/2014	260	1.2	< 0.001	0.04	3	0.62	< 0.0001	33	< 4	75	< 0.005	< 0.0005	748	< 0.001	2.9	180	0.1	< 0.0005	23	0.014	< 0.0002	< 0.0005	< 0.001	< 0.1	0.01	8.15	< 0.001	0.05	12	77	9	376	1.1	< 0.005
M10-1	10/21/2014	540	0.8	0.001	0.28	< 2	0.31	< 0.0001	180	17	160	< 0.005	< 0.0005	1580	< 0.001	7.2	620	20	< 0.0005	44	0.77	< 0.0002	< 0.0005	0.0051	< 0.1	< 0.01	7.5	< 0.001	0.07	5.9	84	27	912	1.2	0.0071
M49-1	10/21/2014	390	0.78	< 0.001	0.043	< 2	1.1	< 0.0001	11	7.3	320	< 0.005	< 0.0005	1880	< 0.002	4.2	51	< 0.1	< 0.0005	5.5	0.011	< 0.0002	< 0.0005	0.0011	< 0.1	< 0.01	8.26	< 0.001	< 0.15	7.2	370	27	1190	1.1	< 0.005
M49-2	10/21/2014	740	1.53	< 0.001	0.048	52	2.2	< 0.0001	14	80	250	< 0.005	< 0.0005	2340	< 0.002	2.4	69	< 0.1	< 0.0005	8.2	0.0058	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8.65	0.093	< 0.15	9.6	490	36	1360	1.8	< 0.005
M52-1	10/23/2014	470	1.05	< 0.001	0.27	7	1.4	< 0.0001	36	15	210	< 0.005	< 0.0005	1580	< 0.001	2.3	180	0.62	< 0.0005	22	0.0086	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8	< 0.001	0.07	12	270	6	832	1.3	< 0.005
M56-2	10/23/2014	290	< 0.15	< 0.001	0.19	< 2	0.072	< 0.0001	78	< 4	20	< 0.005	< 0.0005	751	< 0.001	1.8	390	< 0.1	< 0.0005	47	0.065	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8.04	< 0.001	0.04	3	13	89	428	< 0.7	< 0.005
M58-3	10/22/2014	310	< 0.15	< 0.001	0.14	< 2	< 0.01	< 0.0001	92	< 4	5	< 0.005	< 0.0005	647	< 0.001	1.2	360	< 0.1	< 0.0005	31	< 0.002	< 0.0002	< 0.0005	< 0.001	0.18	< 0.01	7.85	< 0.001	0.03	1.5	5.2	40	368	< 0.7	< 0.005
M59-2	10/23/2014	430	0.48	< 0.001	0.22	< 2	0.23	< 0.0001	130	17	63	< 0.005	< 0.0005	1030	< 0.001	7.5	470	< 0.1	< 0.0005	37	0.013	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	7.7	0.0035	0.03	5.1	34	39	602	< 0.7	< 0.005
M59-3	10/23/2014	310	< 0.15	< 0.001	0.12	< 2	0.065	< 0.0001	120	< 4	27	< 0.005	< 0.0005	733	< 0.001	4.1	360	0.17	< 0.0005	16	0.028	< 0.0002	< 0.0005	< 0.001	0.5	< 0.01	7.83	< 0.001	< 0.03	2.2	15	50	424	< 0.7	< 0.005
M59-4	10/23/2014	290	0.41	0.0037	0.11	< 2	0.43	< 0.0001	68	< 4	8	< 0.005	< 0.0005	647	< 0.001	2.6	310	1.7	< 0.0005	34	0.017	< 0.0002	< 0.0005	< 0.001	< 0.1	0.047	7.94	< 0.001	0.07	5.9	23	54	376	< 0.7	< 0.005
M70-1	10/23/2014	500	2.37	0.0012	0.062	7	1.8	< 0.0001	150	35	1700	< 0.005	< 0.0005	7460	< 0.005	4.5	880	4	< 0.0005	120	0.096	< 0.0002	< 0.0005	0.0028	< 0.1	< 0.01	7.81	< 0.001	0.05	21	1300	920	4440	2.5	< 0.01
M72	10/22/2014	260	0.6	< 0.001	0.16	13	0.41	< 0.0001	56	18	31	< 0.005	< 0.0005	614	< 0.001	1.8	280	< 0.1	< 0.0005	34	0.0028	< 0.0002	< 0.0005	0.0021	< 0.1	< 0.01	7.98	0.048	< 0.03	7.4	19	22	324	< 0.7	0.0064
M74	10/22/2014	310	1.25	< 0.001	0.11	6	0.95	< 0.0001	37	9	32	< 0.005	< 0.0005	761	< 0.001	1.6	190	< 0.1	< 0.0005	23	0.02	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8.15	0.0023	0.3	12	91	48	408	1.4	< 0.005
M75	10/21/2014	410	1.64	< 0.001	0.08	7	1.3	< 0.0001	35	42	76	0.013	< 0.0005	1180	< 0.001	2.3	180	< 0.1	< 0.0005	23	0.008	< 0.0002	< 500	< 0.001	< 0.10	< 0.01	8.12	0.0046	0.45	15	180	93	682	3	< 0.005
M80-1	10/22/2014	130	0.45	< 0.001	0.038	8	0.38	< 0.0001	22	11	28	< 0.005	< 0.0005	379	< 0.001	1.9	110	< 0.1	< 0.0005	12	0.0044	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	7.59	0.025	< 0.03	4.4	39	10	212	< 0.7	< 0.005
M82-1	10/22/2014	330	0.99	< 0.001	0.19	< 2	1	< 0.0001	50	7.7	45	< 0.005	< 0.0005	866	< 0.001	2.8	240	< 0.1	< 0.0005	27	< 0.002	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8.05	0.012	0.04	9.5	93	58	492	1.2	< 0.005
M82-2	10/22/2014	340	0.29	< 0.001	0.14	< 2	0.16	< 0.0001	110	< 4	26	< 0.005	< 0.0005	807	< 0.001	3	400	< 0.1	< 0.0005	31	0.018	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	7.93	0.0011	< 0.03	3.9	20	68	460	< 0.7	< 0.005
M91-1	10/22/2014	300	0.76	< 0.001	0.087	10	0.86	< 0.0001	44	< 4	14	0.007	< 0.0005	671	< 0.001	2.1	210	0.21	< 0.0005	23	0.0066	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	8.05	< 0.001	0.11	7.3	66	42	382	1.1	< 0.005
M95-1	10/22/2014	340	< 0.15	< 0.001	0.14	< 2	0.02	< 0.0001	110	< 4	8	< 0.005	< 0.0005	733	< 0.001	1.9	390	0.1	< 0.0005	28	< 0.002	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	7.95	< 0.001	< 0.03	2.2	6.5	58	416	< 0.7	< 0.005
M105	10/22/2014	470	0.82	< 0.001	0.25	8	0.43	< 0.0001	170	22	310	< 0.005	< 0.0005	1880	< 0.001	6.6	670	< 0.1	< 0.0005	63	0.0083	< 0.0002	< 0.0005	0.0046	< 0.1	< 0.01	7.69	0.019	0.03	8.2	130	13	1140	1.4	< 0.005
M107	10/22/2014	480	0.24	< 0.001	0.14	< 2	0.15	< 0.0001	160	16	130	< 0.005	< 0.0005	1290	< 0.001	6	550	9.5	< 0.0005	38	0.5	< 0.0002	< 0.0005	0.0039	< 0.1	< 0.01	7.67	< 0.001	< 0.03	3.7	63	9	694	0.7	< 0.005
OW1	10/23/2014	470	2.97	< 0.001	0.095	11	1.2	< 0.0001	42	21	45	< 0.005	< 0.0005	1100	< 0.001	2.7	230	< 0.1	< 0.0005	30	0.0074	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	7.91	< 0.001	0.44	12	160	52	606	3.5	< 0.005
OW4	10/23/2014	1000	0.69	< 0.001	0.17	4	0.89	< 0.0001	150	120	440	< 0.005	0.00051	3120	< 0.002	42	790	9.5	< 0.0005	97	0.2	< 0.0002	< 0.0005	0.045	< 0.1	< 0.01	7.61	0.0046	0.07	8.7	410	16	1790	3.5	< 0.005
OW54-d	10/23/2014	260	1.22	< 0.001	0.052	3	0.58	< 0.0001	46	< 4	100	< 0.005	< 0.0005	847	< 0.001	3.6	250	< 0.1	< 0.0005	31	0.028	< 0.0002	< 0.0005	< 0.001	< 0.1	< 0.01	7.95	< 0.001	< 0.03	13	73	18	424	1.1	< 0.005

[1] Shallow groundwater monitoring wells not sampled: M29, M39, M58-4, M71 (see text for details)

[2] M107: Originally labelled as M106 in EMP dated June 29, 2010

Table 5b: Groundwater Quality Results and Reasonable Use Limits - October 21-23, 2014

Name	Date	Alkalinity mg/L	Boron mg/L	Chloride mg/L	Chromium mg/L	Dissolved Organic Carbon mg/L	Iron mg/L	Manganese mg/L	Sodium mg/L	Total Dissolved Solids mg/L
Shallow Groundwater Flow Zone *										
RUL		*386*	*1.27*	*128*	*0.014*	*3.1*	*0.18*	*0.028*	*104*	*415*
M41	05/06/2014	470	0.06	190	< 0.005	3.7	< 0.1	0.024	49	940
M53-4	05/06/2014	440	0.019	2	< 0.005	2.9	< 0.1	0.0088	47	608
M54-4	10/22/2014	380	0.034	77	0.0082	4.3	< 0.1	0.01	45	624
M66-2	10/22/2014	340	0.47	100	< 0.005	3.9	2.7	0.042	110	860
M67-2	10/22/2014	360	1	5	< 0.005	2.9	0.99	0.05	59	428
M80-2	10/22/2014	340	0.049	78	< 0.005	2.7	< 0.1	0.021	15	518
M87-2	10/23/2014	230	0.037	28	0.012	1.6	< 0.1	0.13	14	308
OW37-s	10/21/2014	150	0.11	68	< 0.005	2	< 0.1	0.13	42	256
Intermediate BedrockGroundwater Flow Zone										
RUL		*403*	*1.3*	*130*	*0.014*	*3.4*	*0.18*	*0.037*	*106*	*478*
M5-3	10/23/2014	450	1.2	43	< 0.005	3.2	< 0.1	0.0028	140	522
M6-3	10/23/2014	1100	0.25	1400	0.014	45	< 0.1	< 0.002	600	4220
M9-3	10/23/2014	260	0.62	75	< 0.005	2.9	0.1	0.014	77	376
M10-1	10/21/2014	540	0.31	160	< 0.005	7.2	20	0.77	84	912
M49-1	10/21/2014	390	1.1	320	< 0.005	4.2	< 0.1	0.011	370	1190
M56-2	10/23/2014	290	0.072	20	< 0.005	1.8	< 0.1	0.065	13	428
M58-3	10/22/2014	310	< 0.01	5	< 0.005	1.2	< 0.1	< 0.002	5.2	368
M70-1	10/23/2014	500	1.8	1700	< 0.005	4.5	4	0.096	1300	4440
M80-1	10/22/2014	130	0.38	28	< 0.005	1.9	< 0.1	0.0044	39	212
M82-1	10/22/2014	330	1	45	< 0.005	2.8	< 0.1	< 0.002	93	492
M82-2	10/22/2014	340	0.16	26	< 0.005	3	< 0.1	0.018	20	460
M107	10/22/2014	480	0.15	130	< 0.005	6	9.5	0.5	63	694
OW1	10/23/2014	470	1.2	45	< 0.005	2.7	< 0.1	0.0074	160	606
OW4	10/23/2014	1000	0.89	440	< 0.005	42	9.5	0.2	410	1790
OW54-d	10/23/2014	260	0.58	100	< 0.005	3.6	< 0.1	0.028	73	424

* Shallow groundwater monitoring wells not sampled: M29, M39, M58-4 (see text for details)

Groundwater results exceed Reasonable Use Limits (RUL) *0.05*

Table 6: Water Quality Results from Off-Site Domestic Supply Wells - October 23, 2014

		ODWSOG		1097 Beechwood Rd	1144 Beechwood Rd	1181 Beechwood Rd	1206 Beechwood Rd	1250 Beechwood Rd	1252 Beechwood Rd	1264 Beechwood Rd
Inorganic and General Parameters										
Alkalinity (as CaCO3)	mg/L	30-500	OG	310	350	400	360	***610***	340	370
Ammonia	mg/L			< 0.15	1.89	2	< 0.15	0.58	< 0.15	1.02
Arsenic	mg/L	0.025	IMAC	< 0.001	< 0.001	< 0.001	< 0.001	0.0021	0.001	< 0.001
Barium	mg/L	1	MAC	0.1	0.057	0.14	0.16	0.35	0.14	0.095
Biochemical Oxygen Demand	mg/L			< 2	3	12	< 2	3	< 2	13
Boron	mg/L	5	IMAC	0.053	0.92	1	0.043	0.14	0.071	0.62
Cadmium	mg/L	0.005	IMAC	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Calcium	mg/L			99	110	120	160	230	110	110
Chemical Oxygen Demand	mg/L			< 4	9	21	< 4	15	< 4	14
Chloride	mg/L	250	AO	2	***700***	***460***	***330***	190	19	***410***
Chromium	mg/L	0.05	MAC	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Cobalt	mg/L			< 0.0005	< 0.0005	< 0.0005	0.00068	0.00086	< 0.0005	0.00096
Conductivity	µS/cm			632	2920	2310	1930	1760	799	2020
Copper	mg/L	1	AO	0.011	< 0.001	0.016	0.2	< 0.001	0.0014	0.0014
Dissolved Organic Carbon	mg/L	5	AO	3.5	3.5	3.7	3.3	***7.2***	2.1	4.1
Hardness (as CaCO3)	mg/L	80-100	OG	***330***	***550***	***560***	***530***	***760***	***400***	***460***
Iron	mg/L	0.3	AO	< 0.1	***2.4***	< 0.1	***2.8***	***27***	***5.5***	***11***
Lead	mg/L	0.01	MAC	< 0.0005	0.00058	0.004	***0.043***	< 0.0005	0.00058	< 0.0005
Magnesium	mg/L			15	66	62	25	49	32	55
Manganese	mg/L	0.05	AO	< 0.002	0.032	0.0066	***0.47***	***1.6***	***0.16***	***0.28***
Mercury	mg/L	0.001	MAC	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Naphthalene	mg/L	10	MAC	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Nickel	mg/L			< 0.001	< 0.001	0.0019	0.0036	0.0067	0.002	0.0024
Nitrate	mg/L	10	MAC	2.95	< 0.1	< 0.1	0.32	< 0.1	0.65	< 0.1
Nitrite	mg/L	1	MAC	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.018	< 0.01
pH (Lab)	unitless	6.5-8.5	OG	7.93	7.93	7.64	7.67	7.47	7.84	7.79
Phenols	mg/L			< 0.001	0.001	0.0098	< 0.001	< 0.001	< 0.001	0.0038
Phosphorus (total)	mg/L			0.05	0.29	0.05	0.11	0.04	< 0.03	0.03
Potassium	mg/L			8.1	24	16	12	5.2	2.8	11
Sodium	mg/L	200 20	AO (see note)	6.2	***360***	***230***	***190***	***75***	20	***240***
Sulphate	mg/L	500	AO	13	< 1	30	74	10	59	3
Total Dissolved Solids	mg/L	500	AO	348	***1590***	***1250***	***1060***	***1040***	446	***1060***
Total Kjeldahl Nitrogen	mg/L			< 0.7	1.9	2.1	< 0.7	1.1	< 0.7	1.2
Zinc	mg/L	5	AO	0.042	0.023	0.0073	0.055	0.041	0.057	0.07

Exceeds ODWSOG

ODWSOG: Ontario Drinking Water Objective Standards and Guidelines
OG: Operational Guidelines
MAC: Maximum Acceptable Concentration
IMAC: Interim Maximum Acceptable Concentration
AO: Asthetic Objectives

Note: The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L

Table 6: Water Quality Results from Off-Site Domestic Supply Wells - October 23, 2014

		ODWSOG		1097 Beechwood Rd	1144 Beechwood Rd	1181 Beechwood Rd	1206 Beechwood Rd	1250 Beechwood Rd	1252 Beechwood Rd	1264 Beechwood Rd
Volatile Organic Compounds (VOC)										
1,1,1,2-Tetrachloroethane	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,1,1-Trichloroethane	mg/L			< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.012	< 0.0001
1,1,2,2-Tetrachloroethane	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,1,2-Trichloroethane	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,1-Dichloroethane	mg/L			< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0031	0.016	< 0.0001
1,1-Dichloroethylene	mg/L	0.014	MAC	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00015	0.0019	0.00015
1,2-Dibromoethane	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,2-Dichlorobenzene (o)	mg/L	0.2 0.003	MAC AO	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,2-Dichloroethane	mg/L	0.005	IMAC	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,2-Dichloropropane	mg/L			< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
1,3,5-Trimethylbenzene	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,3-Dichlorobenzene (m)	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
1,4-Dichlorobenzene (p)	mg/L	0.005 0.001	MAC AO	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Benzene	mg/L	0.005	MAC	< 0.0001	0.00014	0.0001	< 0.0001	< 0.0001	< 0.0001	0.003
Bromodichloromethane	mg/L			0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Bromoform	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Bromomethane	mg/L			< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Carbon Tetrachloride	mg/L	0.005	MAC	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chlorobenzene	mg/L			< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chloroethane	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0021	0.0027	0.006
Chloroform	mg/L			0.00042	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chloromethane	mg/L			< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Cis-1,2-Dichloroethylene	mg/L			< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cis-1,3-Dichloropropylene	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dibromochloromethane	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dichloromethane	mg/L	0.05	MAC	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Ethylbenzene	mg/L	0.002	AO	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00011
m+p-Xylene	mg/L			< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00047
o-Xylene	mg/L			< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00024
Styrene	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Tetrachloroethylene	mg/L	0.03	MAC	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00016	< 0.0001
Toluene	mg/L	0.024	AO	< 0.0002	0.00033	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.00065
Trans-1,2-dichloroethylene	mg/L			< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Trans-1,3-dichloropropene	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Trichloroethylene	mg/L	0.005	MAC	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00014	< 0.0001
Trichlorofluoromethane	mg/L			< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Vinyl Chloride	mg/L	0.002	MAC	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.00021	< 0.0002	< 0.0002

Exceeds ODWSOG

ODWSOG: Ontario Drinking Water Objective Standards and Guidelines
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MAC: Maximum Acceptable Concentration
IMAC: Interim Maximum Acceptable Concentration
AO: Asthetic Objectives

Note: The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L

Table 7: Surface Water Characteristics - October 20, 2014

Date	Parameter		Surface Water Station						
			S2	S3	S4R	S5	S6	S7	S8R
20-Oct-14	Velocity:	m/s	NM	NM	NM	NM	NM	NM	NM
	Depth:	m	0.11	0.62	Dry	Dry	0.05	0.06	0.08
	Width:	m	1.25	0.12	Dry	Dry	0.14	0.83	0.3
	Estimated Flow Rate:	m^3/s	NM	NM	NM	NM	NM	NM	NM

NM: Not Measured (flow was insufficient to register on the flow meter - very small flow observed)

Table 8: Surface Water Quality Results - October 20, 2014

			Marysville Creek				Beechwood Ditch
			S2	S3	S6	S7	S8R
			(upstream)	(downstream)	(downstream)	(downstream)	(downstream)
		Date	10/20/2014	10/20/2014	10/20/2014	10/20/2014	10/20/2014
Reading Name	Units	PWQO					
Inorganic and General Parameters							
Alkalinity	µg/L		240000	260000	340000	280000	250000
Ammonia	µg/L		<150	<150	<150	580	<150
Ammonia (unionized)	µg/L	20	0.45727	0.63407	0.59364	0.99322	2.25683
Arsenic	µg/L	100	<1	<1	3	<1	<1
Barium	µg/L		81	110	340	69	58
Biochemical Oxygen Demand	µg/L		< 2000	< 2000	2000	< 2000	3000
Boron	µg/L	200	21	26	41	< 20	< 20
Cadmium	µg/L	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Calcium	µg/L		94000	100000	120000	98000	95000
Chemical Oxygen Demand	µg/L		34000	21000	60000	26000	11000
Chloride	µg/L		22000	59000	26000	26000	11000
Chromium (III)	µg/L	8.9	< 5	< 5	< 5	< 5	< 5
Chromium (VI)	µg/L	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium (Total)	µg/L	100	< 5	< 5	< 5	< 5	< 5
Cobalt	µg/L	0.9	< 0.5	0.9	*13*	< 0.5	< 0.5
Conductivity	µS/cm		574	735	714	621	581
Copper	µg/L	5	< 2	2	*13*	< 2	< 2
Cyanide (free)	µg/L	5	< 2	< 2	< 2	< 2	< 2
Hardness	µg/L		260000	280000	320000	270000	270000
Iron	µg/L	300	200	*3500*	*18000*	140	50
Lead	µg/L	25	< 0.5	0.9	7.2	< 0.5	< 0.5
Magnesium	µg/L		12000	16000	24000	15000	18000
Mercury	µg/L	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Nickel	µg/L	25	< 1	2	12	2	< 1
Nitrate	µg/L		< 100	< 100	220	< 100	< 100
Nitrite	µg/L		< 10	< 10	< 10	< 10	< 10
Phenols	µg/L	1	*1.3*	< 1	< 1	< 1	*16*
Phosphorus (total)	µg/L	30	*63*	*120*	*570*	*76*	16
Potassium	µg/L		9000	11000	9000	7000	3000
Sodium	µg/L		10000	41000	23000	19000	11000
Sulphate	µg/L		31000	49000	11000	17000	49000
Total Dissolved Solids	µg/L		364000	460000	406000	382000	342000
Total Kjeldahl Nitrogen	µg/L		900	800	2300	800	< 700
Total Suspended Solids	µg/L		< 1000	2000	40000	2000	7000
Zinc	µg/L	30	< 10	10	*71*	< 10	< 10
PAHs							
Naphthalene	µg/L	7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Field Measured							
Conductivity (Field)	µS/cm		548	769	698	740	556
Dissoved Oxygen (Field)	mg/L		6.61	7.04	4	4.02	9.75
pH (Field)	unitless	6.5-8.5	7.31	7.44	7.43	7.06	7.94
Temperature (Field)	°C		7.28	7.64	7.10	7.25	9.27

Table 9: Subsurface Gas Monitoring Results - October 20, 2014

Gas Monitor	Location	Reading (ppm)
GM1	North of garage area, south of waste mound	0
GM2	Southwest corner of waste mound	0
GM3	Northeast corner of waste mound	0
GM4-1	Southeast corner of waste mound	0
GM4-2		0
GM5	Northwest corner of waste mound	0
GM6	North of waste mound	0

* The instrument detection limit was 1% LEL

Table 10: Additional Investigations

Description of Activities	Reporting Completed in 2014	Ongoing Work in 2015
CAZ Investigation: • Multiple long duration pumping tests at selected borehole locations to characterize fracture connections in the proposed CAZ monitoring network • Drilling, Downhole Geophysics, Packer Testing, Monitoring well installation, Well Development and Surveying of additional boreholes in the proposed CAZ • Groundwater sampling in order to develop a one-time "snapshot" of groundwater conditions for the CAZ application technical documents • Additional sampling events conducted to obtain information for the CAZ application technical documents, including: 1,4 dioxane sampling in shallow groundwater north of landfill and in Marysville Creek; re-sampling of CAZ wells	- Technical Supporting Document for Draft CAZ Application (October 30, 2014) - Draft Report, Hydrogeologic Investigation in the Area of the Proposed CAZ (October 30, 2014) - Draft Report, Environmental Monitoring Plan (October 30, 2014)	- Continuing investigation of the proposed CAZ area to further delineate the extent of leachate impacts to groundwater - Revised EMP to be prepared on completion of further groundwater investigation
Town of Greater Napanee Requirements: • Monthly North/South Chambers combined leachate sampling (Jan-Dec)	- Monthly reports prepared for the Town of Greater Napanee	- Monitoring and reporting to continue in 2015
ECA Monitoring Requirements - Storm Water Ponds and Leachate: • Storm Water Ponds ❖Monthly sampling for inorganic and general chemistry parameter lists (March, April, May, and October, November, December) ❖Quarterly Sampling of the ECA Storm water ponds for Toxicity (March, June, September, December) • Leachate (North Chamber) ❖Quarterly sampling list (March, July, September, December) ❖Annual sampling chemistry list (May)	- Monitoring results from the 2013 calendar year for the stormwater ponds and leachate locations were reported in the 2013 Annual Report, prepared by WSP Canada Inc. and dated March 2014 - Monitoring results from the 2014 calendar year will be reported in the 2014 Annual Report, to be prepared in March 2015.	- Monitoring and reporting to continue in 2015
WMCC Wildlife Learning Centre: • Quarterly sampling of water supply (Bacteria parameters) (March, June, September, December)	- No reporting applicable; monitoring is for WM internal use.	- Monitoring to continue in 2015
Work related to ERT Mediations: • Summer water level collection round (including leachate wells)	- Results reported in Fall 2014 Semi-Annual Monitoring Report, dated January 2015	- Technical meetings and mediation to continue as/when required in 2015
Data Logger Study: • Installation of levelogger equipment into a selected list of groundwater and surface water locations as part of a long term groundwater elevation study • Installation of a Stingray flow monitoring device to measure peak flows in Marysville Creek	- Status updates prepared for parties to ERT mediation	- Data collection to continue to July 2015 (one-year study duration)

FIGURES

WASTE MANAGEMENT
RICHMOND LANDFILL
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Figure 1:
Site Plan and Monitoring Locations

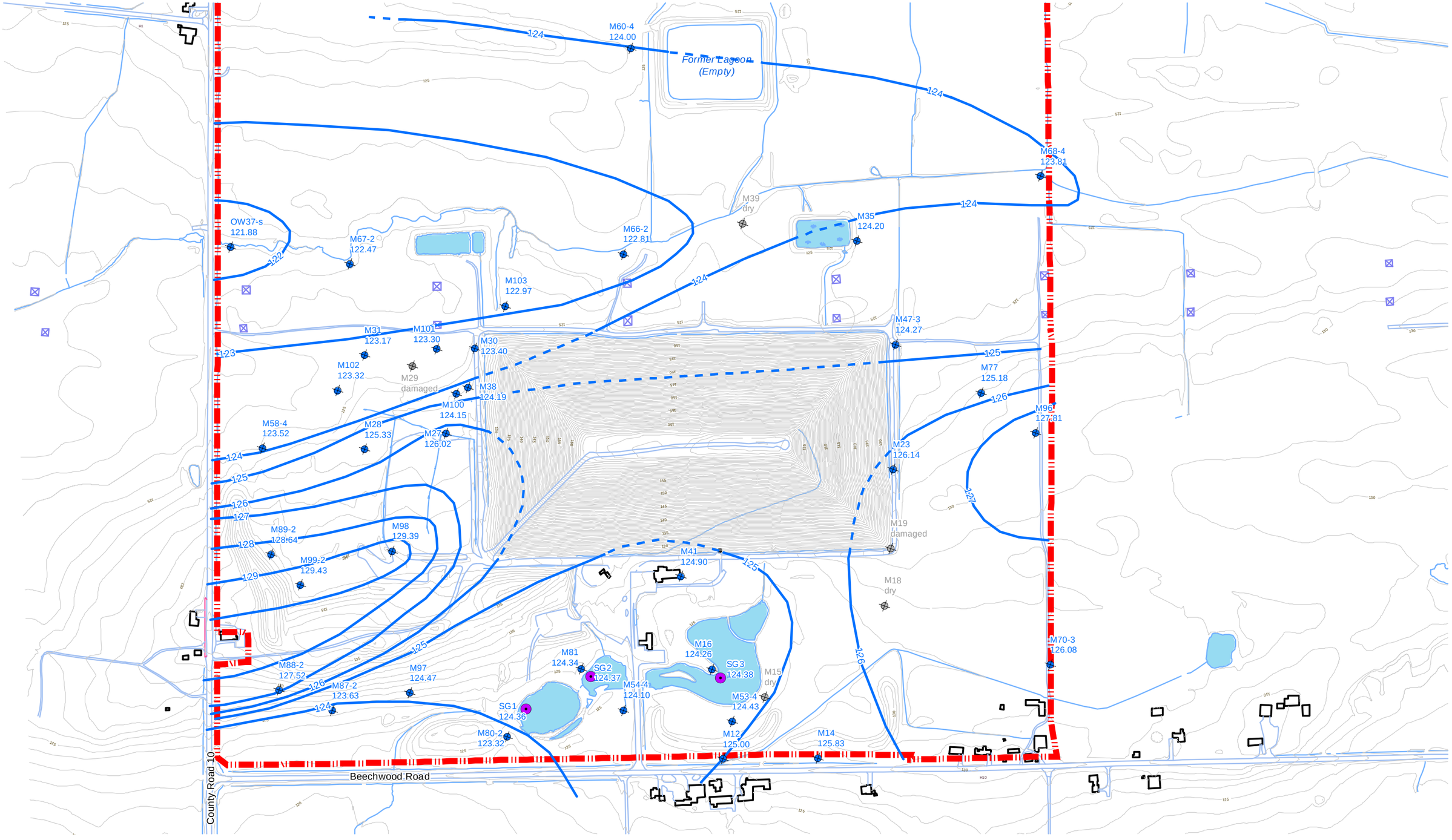
M35 Monitoring Well Used to Measure Water Level (Not Sampled)
M53-4 Monitoring Well Used to Measure Water Level and Sampled for Chemistry
M5-3 Monitoring Well Sampled for Chemistry (Not used for Water Levels)
1097 Beechwood Domestic Water Supply Well Sampled for Chemistry
GM1 Gas Monitoring Well
Property Boundary
Chambers
SG-1 Staff Gauge
LW-P1 Lechate Monitoring Well
S2 Surface Water Monitoring Location

Project : K-B12321-00-05
Data Source: WM Canada, WESA, HPA Ltd. Base Mapping
Date: January 2015

Prepared by:
WESA Geomatics

Units:
UTM NAD 83 Zone 18

Scale: 1:6000



WASTE MANAGEMENT
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Figure 2a:
Shallow Groundwater Flow Zone Potentiometric Surface - August 20, 2014

M58-4 Shallow Groundwater Zone Elevation Monitor
Topographic Contour Lines
Surface Water
Hydro Tower
Potentiometric Surface (masl)
Property Boundary
Note: M15: Not used in contouring, see text for details
SG-1 Pond Elevation
Monitoring Well - No Waterlevel Measurement

Project : K-B12321-00-05
Data Source: WM Canada, WESA, HPA Ltd. Base Mapping
Date: January 2015

Prepared by:
WESA Geomatics

Units:
UTM NAD 83 Zone 18

Scale: 1:5000

WASTE MANAGEMENT
RICHMOND LANDFILL
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Figure 2b:
Shallow Groundwater Flow Zone Potentiometric Surface - October 20, 2014

M58-4 Shallow Groundwater Zone Elevation Monitor
Topographic Contour Lines
Surface Water
Hydro Tower
Potentiometric Surface (masl)
Property Boundary
Note: M15: Not used in contouring, see text for details
SG-1 Pond Elevation
Monitoring Well - No Waterlevel Measurement

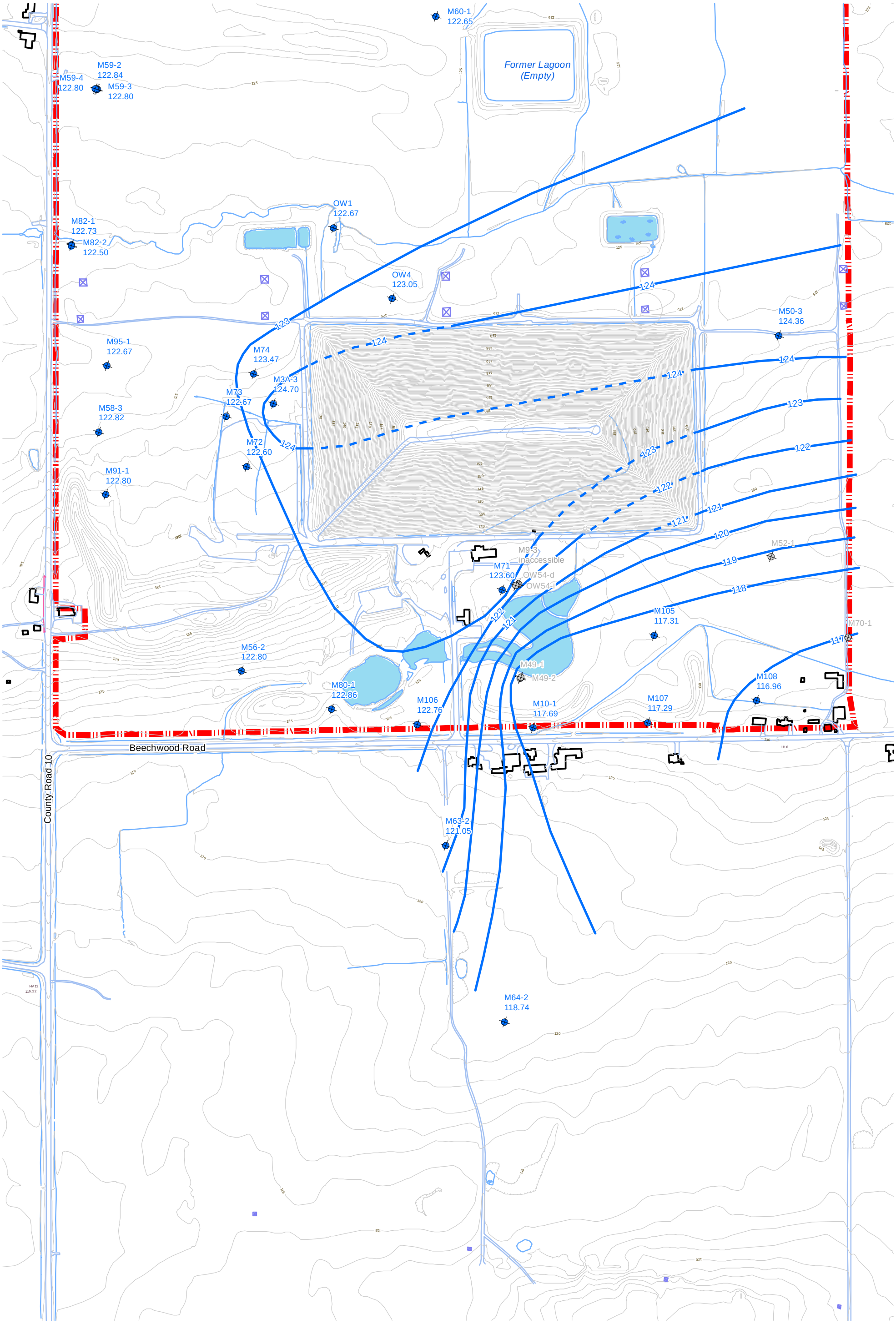
Project : K-B12321-00-05
Data Source: WM Canada, WESA, HPA Ltd. Base Mapping.
Date: January 2015

Prepared by:
WESA Geomatics

Units:
UTM NAD 83 Zone 18

Scale: 1:5000

0 12.5 25 50 75 100
Meters



WASTE MANAGEMENT
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M58-3 Intermediate Groundwater Zone Elevation Monitor

M49-1:Not used in contouring, see text for details

Topographic Contour Lines

Potentiometric Surface (masl)

Hydro Tower

Surface Water

Property Boundary

Project : K-B12321-00-05
Data Source: WM Canada, WESA, HPA Ltd. Base Mapping
Date: January 2015

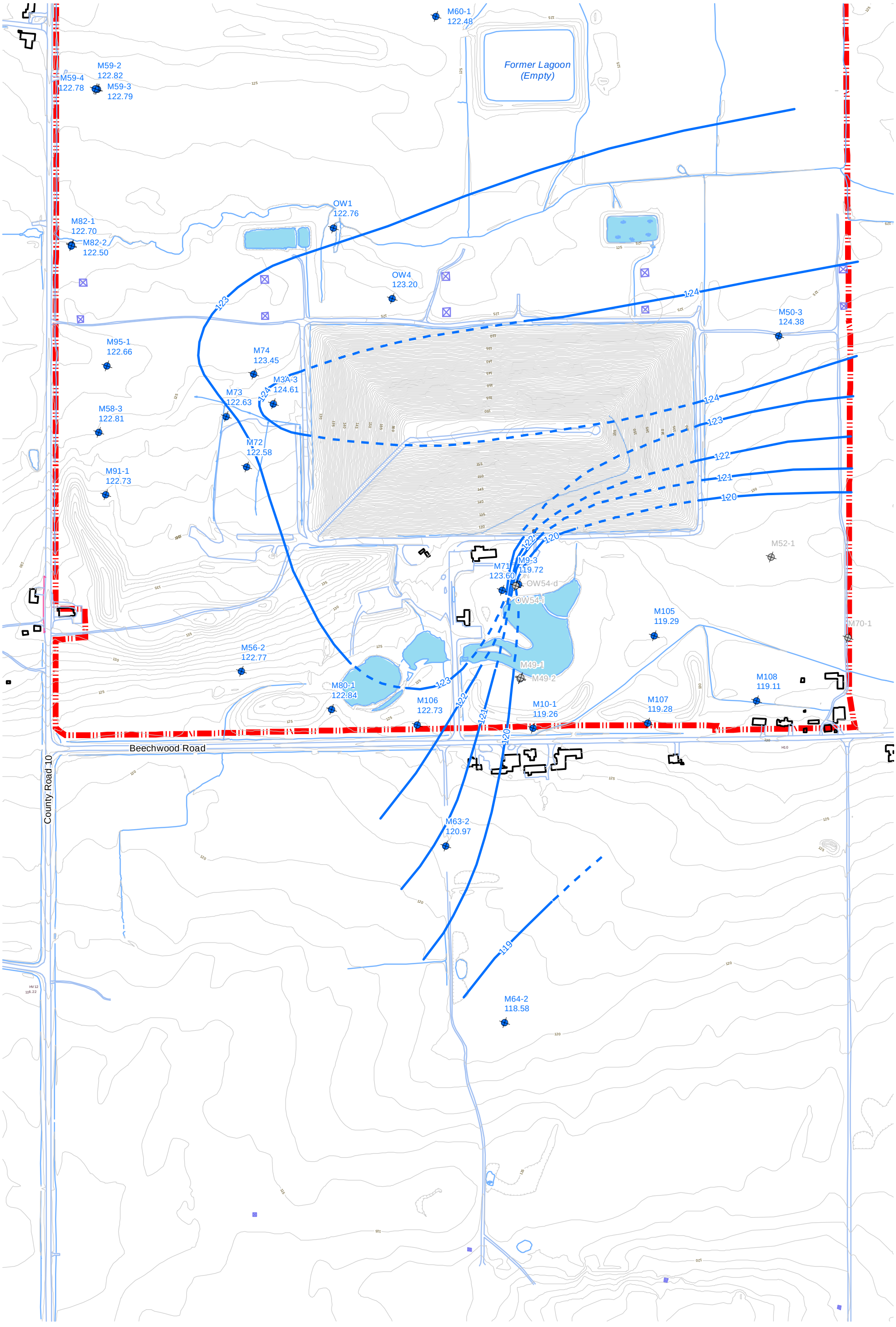
Prepared by:
WESA Geomatics

Units:
UTM NAD 83 Zone 18

Scale: 1:5000

50 25 0 50 100
Meters

Figure 3a:
Intermediate Bedrock Groundwater Flow Zone Potentiometric Surface - August 20, 2014



WASTE MANAGEMENT
RICHMOND LANDFILL
FALL 2014 SEMI-ANNUAL REPORT

M58-3 Intermediate Groundwater Zone Elevation Monitor

M49-1:Not used in contouring, see text for details

Topographic Contour Lines

Potentiometric Surface (masl)

Hydro Tower

Surface Water

Property Boundary

Project : K-B12321-00-05
Data Source: WM Canada, WESA, HPA Ltd. Base Mapping
Date: January 2015

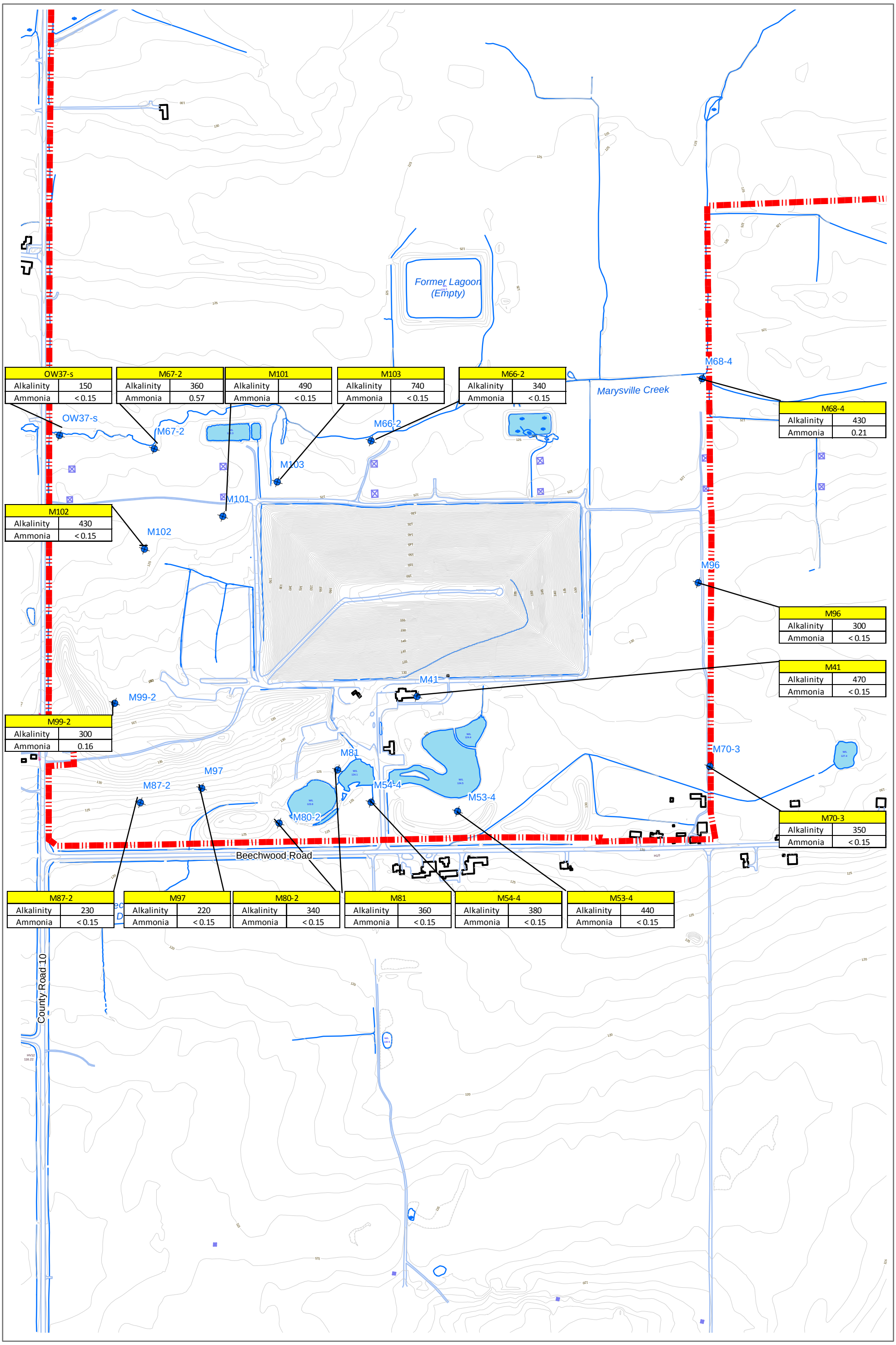
Prepared by: WESA Geomatics

Units: UTM NAD 83 Zone 18

Scale: 1:5000

50 25 0 50 100
Meters

Figure 3b:
Intermediate Bedrock Groundwater Flow Zone Potentiometric Surface - October 20, 2014



WASTE MANAGEMENT
RICHMOND LANDFILL
FALL 2014 SEMI-ANNUAL REPORT
Figure 4:
Shallow Flow Zone Concentrations

Groundwater samples were collected as part of the Fall 2014 monitoring event, during the period from October 20 – October 23, 2014

Legend

M53-4 — Shallow Monitoring Well Sampled for Chemistry

Property Boundary

Parameter	Units
Alkalinity	mg/L CaCO3
Ammonia	mg/L

Project : K-B12321-00-05
Data Source: WM Canada, WESA, HPA Ltd. Base Mapping
Date: January 2015

0 12.525 50 75 100
Metres

Prepared by:
WESA Geomatics

Units:
UTM NAD 83 Zone 18

Scale: 1:6000

WESA a BluMetric company

WM WASTE MANAGEMENT

M59-2	
Alkalinity	430
Ammonia	0.48

M59-3	
Alkalinity	310
Ammonia	< 0.15

M59-4	
Alkalinity	290
Ammonia	0.41

M82-1	
Alkalinity	330
Ammonia	0.99

M95-1	
Alkalinity	340
Ammonia	< 0.15

OW1	
Alkalinity	470
Ammonia	2.97

M5-3	
Alkalinity	450
Ammonia	1.37

M75	
Alkalinity	410
Ammonia	1.64

M6-3	
Alkalinity	1100
Ammonia	4.47

M82-2	
Alkalinity	340
Ammonia	0.29

M74	
Alkalinity	310
Ammonia	1.25

OW4	
Alkalinity	1000
Ammonia	0.69

M58-3	
Alkalinity	310
Ammonia	< 0.15

M72	
Alkalinity	260
Ammonia	0.6

M91-1	
Alkalinity	300
Ammonia	0.76

M56-2	
Alkalinity	290
Ammonia	< 0.15

M80-1	
Alkalinity	130
Ammonia	0.45

M10-1	
Alkalinity	540
Ammonia	0.8

M107	
Alkalinity	480
Ammonia	0.24

M9-3	
Alkalinity	260
Ammonia	1.2

OW54-d	
Alkalinity	260
Ammonia	1.22

M52-1	
Alkalinity	470
Ammonia	1.05

M105	
Alkalinity	470
Ammonia	0.82

M70-1	
Alkalinity	500
Ammonia	2.37

M49-1	
Alkalinity	390
Ammonia	0.78

M49-2	
Alkalinity	740
Ammonia	1.53

M60-1
Former Lagoon (Empty)
M59-4
M59-3
M59-2
M82-1
M82-2
OW1
M5-3
M75
M6-3
OW4
M95-1
M74
M58-3
M72
M91-1
M56-2
M80-1
M9-3
OW54-d
M52-1
M105
M70-1
M49-2
M49-1
M10-1
M107
Beechwood Road
County Road 10

WASTE MANAGEMENT
RICHMOND LANDFILL
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Figure 5:
Intermediate Flow Zone Concentrations
Groundwater samples were collected as part of the
Fall 2014 monitoring event, during the period from October 20 – October 23, 2014

Legend

M53-4 Intermediate Monitoring Well Sampled for Chemistry

Property Boundary

Parameter	Units
Alkalinity	mg/L CaCO3
Ammonia	mg/L

Project : K-B12321-00-05
Data Source: WM Canada, WESA, HPA Ltd. Base Mapping
Date: January 2015

0 12.5 25 50 75 100
Metres

Prepared by:
WESA Geomatics

Units:
UTM NAD 83 Zone 18

Scale: 1:6000

WESA a BluMetric company

WM WASTE MANAGEMENT

Former Lagoon (empty)

Marysville Creek

Beechwood Road

County Road 10

1264 Beechwood Rd	
Alkalinity	370
Ammonia	1.02

1206 Beechwood Rd	
Alkalinity	360
Ammonia	< 0.15

1181 Beechwood Rd	
Alkalinity	400
Ammonia	2

1097 Beechwood Rd	
Alkalinity	310
Ammonia	< 0.15

1252 Beechwood Rd	
Alkalinity	340
Ammonia	< 0.15

1250 Beechwood Rd	
Alkalinity	610
Ammonia	0.58

1144 Beechwood Rd	
Alkalinity	350
Ammonia	1.89

1252 Beechwood Rd
1250 Beechwood Rd
1264 Beechwood Rd
1206 Beechwood Rd
1181 Beechwood Rd
1121 Beechwood Rd
1097 Beechwood Rd
1144 Beechwood Rd

WASTE MANAGEMENT
RICHMOND LANDFILL
FALL 2014 SEMI-ANNUAL REPORT
Figure 6:
Domestic Well Concentrations

Groundwater samples were collected as part of the Fall 2014 monitoring event, during the period from October 20 – October 23, 2014

Legend

M53-4 Domestic Well Sampled for Chemistry

Property Boundary

Parameter	Units
Alkalinity	mg/L CaCO3
Ammonia	mg/L

Project : K-B12321-00-05
Data Source: WM Canada, WESA, HPA Ltd. Base Mapping
Date: January 2015

0 12.525 50 75 100
Metres

Prepared by:
WESA Geomatics

Units:
UTM NAD 83 Zone 18

Scale: 1:6000

WESA a BluMetric company

WM WASTE MANAGEMENT

APPENDIX A

Monitoring Well Inventory

APPENDIX A - Monitoring Well Inventory

Monitoring Well	Easting	Northing
2054	335293	4902797
2055	335402	4902782
M3A-1	334990	4902928
M3A-2	334990	4902930
M3A-3	334990	4902930
M4-1	335006	4903036
M4-2	335006	4903038
M4-3	335006	4903038
M5-1	335003	4903162
M5-2	335003	4903163
M5-3	335003	4903163
M6-1	335200	4903172
M6-2	335201	4903174
M6-3	335201	4903174
M9-1	335410	4902787
M9-2	335410	4902789
M9-3	335410	4902789
M9R-1	335400	4902787
M10-1	335494	4902596
M10-2	335494	4902596
M10-3	335494	4902594
M12	335500	4902596
M14	335625	4902637
M15	335528	4902695
M16	335447	4902710
M18	335648	4902866
M19	335632	4902944
M23	335602	4903049
M27	334997	4902908
M28	334897	4902853
M29	334924	4902983
M30	334999	4903033
M31	334857	4902977
M35	335458	4903336
M38	335006	4902978
M39	335299	4903310
M41	335368	4902818
M42-1	335006	4903006
M42-2	335007	4903008
M42-3	335007	4903008
M43-1	335475	4902588
M43-2	335476	4902590
M43-3	335476	4902590
M45-1	334790	4904582
M45-2	334790	4904582
M45-3	334790	4904582
M46-1	335185	4903230
M46-2	335185	4903232
M47-1	335552	4903214
M47-2	335552	4903215
M47-3	335552	4903215
M48-1	334838	4902564
M48-2	334839	4902565
M48-3	334839	4902565

APPENDIX A - Monitoring Well Inventory

Monitoring Well	Easting	Northing
M49-1	335454	4902658
M49-2	335455	4902660
M49-3	335455	4902660
M50-1	335660	4903247
M50-2	335660	4903248
M50-3	335660	4903248
M51-1	335714	4903073
M51-2	335714	4903075
M51-3	335714	4903075
M52-1	335748	4902939
M52-2	335748	4902940
M52-3	335748	4902940
M53-1	335501	4902651
M53-2	335499	4902650
M53-3	335498	4902650
M53-4	335496	4902649
M54-1	335346	4902623
M54-2	335347	4902622
M54-3	335347	4902620
M54-4	335348	4902618
M55-1	334961	4903151
M55-2	334962	4903149
M55-3	334962	4903148
M55-4	334963	4903146
M56-1	335066	4902508
M56-2	335065	4902545
M57	335418	4902623
M58-1	334760	4902816
M58-2	334760	4902814
M58-3	334761	4902812
M58-4	334761	4902811
M59-1	334609	4903287
M59-2	334607	4903287
M59-3	334606	4903287
M59-4	334604	4903287
M60-1	335044	4903538
M60-3	335079	4903494
M60-4	335077	4903494
M61-1	334457	4903750
M61-2	334456	4903749
M61-3	334455	4903748
M61-4	334454	4903747
M62-1	335166	4904438
M62-2	335168	4904441
M62-3	335166	4904441
M62-4	335165	4904440
M63-1	335424	4902393
M63-2	335425	4902394
M64-1	335585	4902174
M64-2	335585	4902176
M65-1	335297	4903314
M65-2	335298	4903316
M66-1	335154	4903218
M66-2	335155	4903219

APPENDIX A - Monitoring Well Inventory

Monitoring Well	Easting	Northing
M67-1	334799	4903089
M67-2	334799	4903090
M68-1	335670	4903504
M68-2	335671	4903502
M68-3	335671	4903500
M68-4	335672	4903499
M69-1	335062	4904299
M69-2	335063	4904298
M69-3	335063	4904296
M69-4	335064	4904295
M70-1	335890	4902862
M70-2	335891	4902860
M70-3	335891	4902858
M71	335390	4902773
M72	334981	4902831
M73	334931	4902891
M74	334950	4902962
M75	335151	4903215
M76	335675	4903217
M77	335685	4903188
M78	335391	4902776
M79	335673	4903215
M80-1	335207	4902532
M80-2	335206	4902534
M81	335275	4902654
M82-1	334640	4903060
M82-2	334641	4903058
M83	335169	4903156
M84	334702	4903072
M85	334999	4903208
M86	335077	4903195
M87-1	334959	4902493
M87-2	334965	4902495
M88-1	334883	4902497
M88-2	334885	4902499
M89-1	334815	4902673
M89-2	334818	4902674
M90-1	334520	4903845
M90-2	334522	4903843
M91-1	334798	4902729
M91-2	334792	4902734
M93	335006	4903908
M94-1	335497	4903519
M94-2	335486	4903526
M95-1	334743	4902908
M95-2	334740	4902917
M96	335774	4903158
M97	335059	4902551
M98	334976	4902730
M99-1	334869	4902646
M99-2	334869	4902646
M100	334994	4902965
M101	334949	4903015
M102	334836	4902919

APPENDIX A - Monitoring Well Inventory

Monitoring Well	Easting	Northing
M103	335021	4903101
M104	335150	4903152
M105	335620	4902778
M106	335331	4902549
M107	335650	4902654
M108	335791	4902733
M109-1	335405	4902844
M109-2	335407	4902840
M110-1	335543	4902883
M110-2	335546	4902884
M111-1	335250	4902774
M111-2	335254	4902774
M112-1	335274	4902692
M112-2	335277	4902693
M113-1	335123	4902751
M113-2	335119	4902750
M114-1	335437	4902530
M114-2	335439	4902528
M115-1	335489	4902561
M115-2	335490	4902558
M116	335480	4902494
M117	335586	4902525
M121	335529	4902337
M122	335742	4902433
M123	335905	4902479
M125	335561	4902368
M166	336069	4902589
M167	336266	4902624
M168	336063	4902714
M170	335889	4902865
M171	335759	4903206
M172	335490	4902593
M173	335661	4901812
M174	335961	4901879
M176	336613	4902308
M177	335784	4902084
M178-1	336032	4902202
M178-2	336032	4902202
M178-3	336032	4902202
M179	336338	4902357
M180	336801	4902677
M181-1	335912	4901492
M181-2	335912	4901492
M182	336402	4901643
M183	336953	4901770
M184	336176	4901998
M185-1	336170	4902151
M185-2	336170	4902151
M186	336509	4902627
OW1	334995	4903200
OW4	335108	4903128
OW5	335113	4903134
OW36	334799	4903100
OW37-d	334630	4903063

APPENDIX A - Monitoring Well Inventory

Monitoring Well	Easting	Northing
OW37-s	334634	4903062
OW54-d	335406	4902785
OW54-i	335406	4902785
OW54-s	335406	4902785
OW55-d	335376	4903186
OW55-i	335376	4903186
OW55-s	335376	4903184
OW56-d	335106	4903131
OW56-i	335106	4903131
OW56-s	335106	4903129
OW57	335117	4902762
PW1	335465	4902639
PW2	334988	4903095
PW3	335620	4902778
PW4	335626	4902775
PW5	335066	4902547

APPENDIX B

Results from Analytical Quality Assurance / Quality Control (QA/QC) Program

APPENDIX B - RESULTS FROM QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PROGRAM

Summary of Results with Relative Percent Difference (RPD [1]) greater than 20%

Location	Parameter	Unit	Regular Sample	Field Duplicate	RPD (%)	MDL [2]	Comment
S2	Nitrite	mg/L	0.063	0.078	**21.28**	0.01	Less than ~5 x MDL
M105	Biochemical Oxygen Demand	mg/L	8	6	**28.57**	2	Less than ~5 x MDL
M105	Phosphorus (total)	mg/L	0.03	0.04	**28.57**	0.03	Less than ~5 x MDL
M58-3	Chloride	mg/L	5	4	**22.22**	1	Less than ~5 x MDL
M59-2	Chemical Oxygen Demand	mg/L	17	22	**25.64**	4	Less than ~5 x MDL

Note 1: RPD (%) = 100 * ABS (Regular Sample - Duplicate Sample) / ([Regular Sample + Duplicate Sample] / 2)
Note 2: MDL = Laboratory Method Detection Limit

Detailed Results from Field Duplicate vs. Regular Samples - Fall 2014

Reading Name	Units	S2 2014-10-20 Regular Sample	S2 2014-10-20 Field Duplicate	RPD (%)
Alkalinity	mg/L	240	240	0.00
Ammonia	mg/L	< 0.15	< 0.15	0.00
Ammonia (unionized)	mg/L	< 0.0005	< 0.0005	0.00
Arsenic	mg/L	< 0.001	< 0.001	0.00
Barium	mg/L	0.081	0.082	1.23
Biochemical Oxygen Demand	mg/L	< 2	< 2	0.00
Boron	mg/L	0.021	0.02	4.88
Cadmium	mg/L	< 0.0001	< 0.0001	0.00
Calcium	mg/L	94	95	1.06
Chemical Oxygen Demand	mg/L	34	36	5.71
Chloride	mg/L	22	22	0.00
Chromium (III)	mg/L	< 0.005	< 0.005	0.00
Chromium (Total)	mg/L	< 0.005	< 0.005	0.00
Chromium (VI)	mg/L	< 0.0005	< 0.0005	0.00
Cobalt	mg/L	< 0.0005	< 0.0005	0.00
Conductivity	mg/L	574	576	0.35
Copper	mg/L	< 0.002	< 0.002	0.00
Cyanide (free)	mg/L	< 0.002	< 0.002	0.00
Field Temperature	µS/cm	7.28	7.28	0.00
Hardness	mg/L	260	260	0.00
Iron	mg/L	0.2	0.2	0.00
Lead	mg/L	< 0.0005	< 0.0005	0.00
Magnesium	mg/L	12	12	0.00
Mercury	mg/L	< 0.0002	< 0.0002	0.00
Naphthalene	mg/L	< 0.0005	< 0.0005	0.00
Nickel	mg/L	< 0.001	< 0.001	0.00
Nitrate	mg/L	< 0.1	< 0.1	0.00
Nitrite	mg/L	< 0.01	< 0.01	0.00
Nitrite + Nitrate	mg/L	< 0.1	< 0.1	0.00
pH (Field)	mg/L	7.31	7.31	0.00
Phenols	mg/L	0.0013	0.0012	8.00
Phosphorus (total)	mg/L	0.063	0.078	**21.28**
Potassium	mg/L	9	9	0.00
Sodium	mg/L	10	10	0.00
Sulphate	mg/L	31	32	3.17
Total Dissolved Solids	mg/L	364	370	1.63
Total Kjeldahl Nitrogen	mg/L	0.9	0.9	0.00
Total Suspended Solids	mg/L	< 1	1	0.00
Zinc	mg/L	< 0.01	< 0.01	0.00
Strontium	mg/L	0.17	0.16	6.06
Sulphate	mg/L	4	4	0.00
Thallium	mg/L	< 0.0002	< 0.0002	0.00
Tin	mg/L	< 0.002	< 0.002	0.00
Titanium	mg/L	< 0.005	< 0.005	0.00
Total Dissolved Solids	mg/L	244	246	0.82
Total Kjeldahl Nitrogen	mg/L	1.6	1.7	6.06
Total Suspended Solids	mg/L	1	< 1	0.00
Uranium	mg/L	0.0009	0.0008	11.76
Vanadium	mg/L	< 0.001	< 0.001	0.00
Zinc	mg/L	< 0.01	< 0.01	0.00

Detailed Results from Field Duplicate vs. Regular Samples - Fall 2014 (continued)

Reading Name	Units	M105 2014-10-22 Regular Sample	M105 2014-10-22 Field Duplicate	RPD (%)
Alkalinity	mg/L	470	470	0.00
Ammonia	mg/L	0.82	0.81	1.23
Arsenic	mg/L	< 0.001	< 0.001	0.00
Barium	mg/L	0.25	0.24	4.08
Biochemical Oxygen Demand	mg/L	8	6	**28.57**
Boron	mg/L	0.43	0.43	0.00
Cadmium	mg/L	< 0.0001	< 0.0001	0.00
Calcium	mg/L	170	170	0.00
Chemical Oxygen Demand	mg/L	22	22	0.00
Chloride	mg/L	310	310	0.00
Chromium (Total)	mg/L	< 0.005	< 0.005	0.00
Cobalt	mg/L	< 0.0005	< 0.0005	0.00
Conductivity	mg/L	1880	1880	0.00
Copper	mg/L	< 0.001	< 0.001	0.00
Dissolved Organic Carbon	mg/L	6.6	6.9	4.44
Hardness	mg/L	670	670	0.00
Iron	mg/L	< 0.1	< 0.1	0.00
Lead	mg/L	< 0.0005	< 0.0005	0.00
Magnesium	mg/L	63	63	0.00
Manganese	mg/L	0.0083	0.0095	13.48
Mercury	mg/L	< 0.0002	< 0.0002	0.00
Naphthalene	mg/L	< 0.0005	< 0.0005	0.00
Nickel	mg/L	0.0046	0.0043	6.74
Nitrate	mg/L	< 0.1	< 0.1	0.00
Nitrite	mg/L	< 0.01	< 0.01	0.00
Nitrite + Nitrate	mg/L	< 0.1	< 0.1	0.00
pH (Lab)	mg/L	7.69	7.71	0.26
Phenols	mg/L	0.019	0.022	14.63
Phosphorus (total)	mg/L	0.03	0.04	**28.57**
Potassium	mg/L	8.2	8.1	1.23
Sodium	mg/L	130	130	0.00
Sulphate	mg/L	13	14	7.41
Total Dissolved Solids	mg/L	1140	1120	1.77
Total Kjeldahl Nitrogen	mg/L	1.4	1.4	0.00
Zinc	mg/L	< 0.005	< 0.005	0.00

Detailed Results from Field Duplicate vs. Regular Samples - Fall 2014 (continued)

Reading Name	Units	M107 2014-10-22 Regular Sample	M107 2014-10-22 Field Duplicate	RPD (%)
Alkalinity	mg/L	480	480	0.00
Ammonia	mg/L	0.24	0.21	13.33
Arsenic	mg/L	< 0.001	< 0.001	0.00
Barium	mg/L	0.14	0.14	0.00
Biochemical Oxygen Demand	mg/L	< 2	< 2	0.00
Boron	mg/L	0.15	0.15	0.00
Cadmium	mg/L	< 0.0001	< 0.0001	0.00
Calcium	mg/L	160	160	0.00
Chemical Oxygen Demand	mg/L	16	14	13.33
Chloride	mg/L	130	140	7.41
Chromium (Total)	mg/L	< 0.005	< 0.005	0.00
Cobalt	mg/L	< 0.0005	< 0.0005	0.00
Conductivity	µS/cm	1290	1280	0.78
Copper	mg/L	< 0.001	< 0.001	0.00
Dissolved Organic Carbon	mg/L	6	5.9	1.68
Hardness	mg/L	550	550	0.00
Iron	mg/L	9.5	9.3	2.13
Lead	mg/L	< 0.0005	< 0.0005	0.00
Magnesium	mg/L	38	37	2.67
Manganese	mg/L	0.5	0.5	0.00
Mercury	mg/L	< 0.0002	< 0.0002	0.00
Naphthalene	mg/L	< 0.0005	< 0.0005	0.00
Nickel	mg/L	0.0039	0.0037	5.26
Nitrate	mg/L	< 0.1	< 0.1	0.00
Nitrite	mg/L	< 0.01	< 0.01	0.00
Nitrite + Nitrate	mg/L	< 0.1	< 0.1	0.00
pH (Lab)	unitless	7.67	7.69	0.26
Phenols	mg/L	< 0.001	< 0.001	0.00
Phosphorus (total)	mg/L	< 0.03	0.03	0.00
Potassium	mg/L	3.7	3.7	0.00
Sodium	mg/L	63	63	0.00
Sulphate	mg/L	9	9	0.00
Total Dissolved Solids	mg/L	694	704	1.43
Total Kjeldahl Nitrogen	mg/L	0.7	0.8	13.33
Zinc	mg/L	< 0.005	< 0.005	0.00

Detailed Results from Field Duplicate vs. Regular Samples - Fall 2014 (continued)

Reading Name	Units	M56-2 2014-10-23 Regular Sample	M56-2 2014-10-23 Field Duplicate	RPD (%)
Alkalinity	mg/L	290	290	0.00
Ammonia	mg/L	< 0.15	< 0.15	0.00
Arsenic	mg/L	< 0.001	< 0.001	0.00
Barium	mg/L	0.19	0.19	0.00
Biochemical Oxygen Demand	mg/L	< 2	< 2	0.00
Boron	mg/L	0.072	0.07	2.82
Cadmium	mg/L	< 0.0001	< 0.0001	0.00
Calcium	mg/L	78	76	2.60
Chemical Oxygen Demand	mg/L	< 4	< 4	0.00
Chloride	mg/L	20	20	0.00
Chromium (Total)	mg/L	< 0.005	< 0.005	0.00
Cobalt	mg/L	< 0.0005	< 0.0005	0.00
Conductivity	µS/cm	751	750	0.13
Copper	mg/L	< 0.001	< 0.001	0.00
Dissolved Organic Carbon	mg/L	1.8	2	10.53
Hardness	mg/L	390	380	2.60
Iron	mg/L	< 0.1	< 0.1	0.00
Lead	mg/L	< 0.0005	< 0.0005	0.00
Magnesium	mg/L	47	47	0.00
Manganese	mg/L	0.065	0.065	0.00
Mercury	mg/L	< 0.0002	< 0.0002	0.00
Naphthalene	mg/L	< 0.0005	< 0.0005	0.00
Nickel	mg/L	< 0.001	< 0.001	0.00
Nitrate	mg/L	< 0.1	< 0.1	0.00
Nitrite	mg/L	< 0.01	< 0.01	0.00
Nitrite + Nitrate	mg/L	< 0.1	< 0.1	0.00
pH (Lab)	unitless	8.04	7.99	0.62
Phenols	mg/L	< 0.001	< 0.001	0.00
Phosphorus (total)	mg/L	0.04	0.04	0.00
Potassium	mg/L	3	3	0.00
Sodium	mg/L	13	13	0.00
Sulphate	mg/L	89	90	1.12
Total Dissolved Solids	mg/L	428	434	1.39
Total Kjeldahl Nitrogen	mg/L	< 0.7	< 0.7	0.00
Zinc	mg/L	< 0.005	< 0.005	0.00

Detailed Results from Field Duplicate vs. Regular Samples - Spring 2014 (continued)

Reading Name	Units	M58-3 2014-10-22 Regular Sample	M58-3 2014-10-22 Field Duplicate	RPD (%)
Alkalinity	mg/L	310	320	3.17
Ammonia	mg/L	< 0.15	< 0.15	0.00
Arsenic	mg/L	< 0.001	< 0.001	0.00
Barium	mg/L	0.14	0.14	0.00
Biochemical Oxygen Demand	mg/L	< 2	< 2	0.00
Boron	mg/L	< 0.01	0.013	0.00
Cadmium	mg/L	< 0.0001	< 0.0001	0.00
Calcium	mg/L	92	91	1.09
Chemical Oxygen Demand	mg/L	< 4	< 4	0.00
Chloride	mg/L	5	4	**22.22**
Chromium (Total)	mg/L	< 0.005	< 0.005	0.00
Cobalt	mg/L	< 0.0005	< 0.0005	0.00
Conductivity	µS/cm	647	653	0.92
Copper	mg/L	< 0.001	< 0.001	0.00
Dissolved Organic Carbon	mg/L	1.2	1.4	15.38
Hardness	mg/L	360	350	2.82
Iron	mg/L	< 0.1	< 0.1	0.00
Lead	mg/L	< 0.0005	< 0.0005	0.00
Magnesium	mg/L	31	31	0.00
Manganese	mg/L	< 0.002	< 0.002	0.00
Mercury	mg/L	< 0.0002	< 0.0002	0.00
Naphthalene	mg/L	< 0.0005	< 0.0005	0.00
Nickel	mg/L	< 0.001	< 0.001	0.00
Nitrate	mg/L	0.18	0.17	5.71
Nitrite	mg/L	< 0.01	< 0.01	0.00
Nitrite + Nitrate	mg/L	0.18	0.17	5.71
pH (Lab)	unitless	7.85	7.98	1.64
Phenols	mg/L	< 0.001	< 0.001	0.00
Phosphorus (total)	mg/L	0.03	0.03	0.00
Potassium	mg/L	1.5	1.5	0.00
Sodium	mg/L	5.2	5.2	0.00
Sulphate	mg/L	40	41	2.47
Total Dissolved Solids	mg/L	368	368	0.00
Total Kjeldahl Nitrogen	mg/L	< 0.7	< 0.7	0.00
Zinc	mg/L	< 0.005	< 0.005	0.00

Detailed Results from Field Duplicate vs. Regular Samples - Fall 2014 (continued)

Reading Name	Units	M59-2 2014-10-23 Regular Sample	M59-2 2014-10-23 Field Duplicate	RPD (%)
Alkalinity	mg/L	430	440	2.30
Ammonia	mg/L	0.48	0.48	0.00
Arsenic	mg/L	< 0.001	< 0.001	0.00
Barium	mg/L	0.22	0.22	0.00
Biochemical Oxygen Demand	mg/L	< 2	< 2	0.00
Boron	mg/L	0.23	0.23	0.00
Cadmium	mg/L	< 0.0001	< 0.0001	0.00
Calcium	mg/L	130	130	0.00
Chemical Oxygen Demand	mg/L	17	22	**25.64**
Chloride	mg/L	63	62	1.60
Chromium (Total)	mg/L	< 0.005	< 0.005	0.00
Cobalt	mg/L	< 0.0005	< 0.0005	0.00
Conductivity	µS/cm	1030	1020	0.98
Copper	mg/L	< 0.001	< 0.001	0.00
Dissolved Organic Carbon	mg/L	7.5	7.5	0.00
Hardness	mg/L	470	470	0.00
Iron	mg/L	< 0.1	< 0.1	0.00
Lead	mg/L	< 0.0005	< 0.0005	0.00
Magnesium	mg/L	37	38	2.67
Manganese	mg/L	0.013	0.014	7.41
Mercury	mg/L	< 0.0002	< 0.0002	0.00
Naphthalene	mg/L	< 0.0005	< 0.0005	0.00
Nickel	mg/L	< 0.001	< 0.001	0.00
Nitrate	mg/L	< 0.1	< 0.1	0.00
Nitrite	mg/L	< 0.01	< 0.01	0.00
Nitrite + Nitrate	mg/L	< 0.1	< 0.1	0.00
pH (Lab)	unitless	7.7	7.77	0.90
Phenols	mg/L	0.0035	0.0037	5.56
Phosphorus (total)	mg/L	0.03	0.03	0.00
Potassium	mg/L	5.1	5.2	1.94
Sodium	mg/L	34	34	0.00
Sulphate	mg/L	39	34	13.70
Total Dissolved Solids	mg/L	602	598	0.67
Total Kjeldahl Nitrogen	mg/L	< 0.7	0.9	0.00
Zinc	mg/L	< 0.005	< 0.005	0.00

APPENDIX B - RESULTS FROM QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PROGRAM

Detailed Results from Field Blank Samples - Fall 2014

Reading Name	Units	Blank - Field 2014-10-21	Blank - Field 2014-10-22
Alkalinity	mg/L	2.3	1.9
Ammonia	mg/L	< 0.15	< 0.15
Arsenic	mg/L	< 0.001	< 0.001
Barium	mg/L	< 0.002	< 0.002
Biochemical Oxygen Demand	mg/L	< 2	< 2
Boron	mg/L	0.01	< 0.01
Cadmium	mg/L	< 0.0001	< 0.0001
Calcium	mg/L	< 0.2	< 0.2
Chemical Oxygen Demand	mg/L	< 4	< 4
Chloride	mg/L	< 1	< 1
Chromium (Total)	mg/L	< 0.005	< 0.005
Cobalt	mg/L	< 0.0005	< 0.0005
Conductivity	µS/cm	1	1
Copper	mg/L	< 0.001	< 0.001
Dissolved Organic Carbon	mg/L	0.7	0.6
Hardness	mg/L	< 1	< 1
Iron	mg/L	< 0.1	< 0.1
Lead	mg/L	< 0.0005	< 0.0005
Magnesium	mg/L	< 0.05	< 0.05
Manganese	mg/L	< 0.002	< 0.002
Mercury	mg/L	< 0.0002	< 0.0002
Naphthalene	mg/L	< 0.0005	< 0.0005
Nickel	mg/L	< 0.001	< 0.001
Nitrate	mg/L	< 0.1	< 0.1
Nitrite	mg/L	< 0.01	< 0.01
Nitrite + Nitrate	mg/L	< 0.1	< 0.1
pH (Lab)	unitless	6.71	6.63
Phenols	mg/L	< 0.001	< 0.001
Phosphorus (total)	mg/L	< 0.03	< 0.03
Potassium	mg/L	< 0.2	< 0.2
Sodium	mg/L	< 0.1	< 0.1
Sulphate	mg/L	< 1	< 1
Total Dissolved Solids	mg/L	12	< 10
Total Kjeldahl Nitrogen	mg/L	< 0.7	< 0.7
Zinc	mg/L	< 0.005	< 0.005

APPENDIX B - RESULTS FROM QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PROGRAM

Detailed Results from Trip Blank Sample - Fall 2014

Reading Name	Units	Blank - Trip 2014-10-21	Blank - Trip 2014-10-22	Blank - Trip 2014-10-23
Alkalinity	mg/L	2.4	< 1	1.9
Ammonia	mg/L	< 0.15	< 0.15	< 0.15
Arsenic	mg/L	< 0.001	< 0.001	< 0.001
Barium	mg/L	< 0.002	< 0.002	< 0.002
Biochemical Oxygen Demand	mg/L	< 2	< 2	< 2
Boron	mg/L	< 0.01	< 0.01	< 0.01
Cadmium	mg/L	< 0.0001	< 0.0001	< 0.0001
Calcium	mg/L	< 0.2	< 0.2	< 0.2
Chemical Oxygen Demand	mg/L	< 4	< 4	< 4
Chloride	mg/L	< 1	< 1	< 1
Chromium (Total)	mg/L	< 0.005	< 0.005	< 0.005
Cobalt	mg/L	< 0.0005	< 0.0005	< 0.0005
Conductivity	µS/cm	1	1	1
Dissolved Organic Carbon	mg/L	0.3	0.34	0.29
Hardness	mg/L	< 1	< 1	< 1
Iron	mg/L	< 0.1	< 0.1	< 0.1
Lead	mg/L	< 0.0005	< 0.0005	< 0.0005
Magnesium	mg/L	< 0.05	< 0.05	< 0.05
Manganese	mg/L	< 0.002	< 0.002	< 0.002
Mercury	mg/L	< 0.0002	< 0.0002	< 0.0002
Naphthalene	mg/L	< 0.0005	< 0.0005	< 0.0005
Nickel	mg/L	< 0.001	< 0.001	< 0.001
Nitrate	mg/L	< 0.1	< 0.1	< 0.1
Nitrite	mg/L	< 0.01	< 0.01	< 0.01
Nitrite + Nitrate	mg/L	< 0.1	< 0.1	< 0.1
pH (Lab)	unitless	6.71	5.81	6.65
Phenols	mg/L	< 0.001	< 0.001	< 0.001
Phosphorus (total)	mg/L	< 0.03	< 0.03	< 0.03
Total Dissolved Solids	mg/L	< 10	< 10	< 10
Total Kjeldahl Nitrogen	mg/L	< 0.7	< 0.7	< 0.7
Zinc	mg/L	< 0.005	< 0.005	< 0.005

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