REPORT

GROUNDWATER ASSESSMENT (HYDROGEOLOGICAL) REPORT

Southwestern Landfill Proposal Environmental Assessment
Zorra Township, Ontario

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1.0 INTRODUCTION

An Environmental Assessment (EA) is being prepared by Walker Environmental Group Inc. (“Walker”) under Ontario’s Environmental Assessment Act (“the Act”) for the “provision of future landfill capacity at the Carmeuse Lime (Canada) Ltd. (The Quarry) site in Oxford County for solid, non-hazardous waste generated in the Province of Ontario”.

This hydrogeological assessment is one in a series of technical studies that have been completed by qualified experts to examine the potential effects of the proposed landfill on the environment, all in accordance with the requirements set out in the Approved Amended Terms of Reference (ToR) dated May 10, 2016. This report accompanies and supports the Environmental Assessment Report prepared by Walker.

Walker has carried out extensive consultation with government agencies, Aboriginal groups and interested members of the public regarding this study; details are provided separately in the EA report.

1.1 Background

A list of references for this report is provided in Section 15.0. A glossary of terms used in this report is provided as Appendix A.

1.2 Role in the EA Process

Summary tables for the EA criteria and studies are provided in Appendix B.

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2.0 PURPOSE AND OBJECTIVES

The **purpose** of this study is to complete a hydrogeological and landfill gas assessment of the landfill proposed by Walker.

The overall **objectives** of the study are listed below, in general accordance with the requirements for the assessment of an undertaking as set out in Section 6.1(2)(c) of the *Environmental Assessment Act*, and as specifically detailed in Section 8.1 of the ToR:

- Describe the **environment potentially affected** by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking.
- Carry out an evaluation of the **environmental effects** of the proposed undertaking, using the relevant environmental assessment criteria set out in the ToR (see Appendix B).
- Carry out an evaluation of any additional impact management actions that may be necessary to **prevent, change or mitigate any (negative) environmental effects**.
- Prepare a description and evaluation of the **environmental advantages and disadvantages** of the proposed undertaking, based on the net environmental effects that will result following mitigation.
- Prepare monitoring, contingency and impact management plans to **remedy the environmental effects** of the proposed undertaking.

In addition, this report is also intended to provide hydrogeological information in support of subsequent approvals including an Environmental Compliance Approval under the *Environmental Protection Act* and O. Reg 232/98.

3.0 THE PROPOSED UNDERTAKING

The landfill proposed by Walker is described in detail in the *Environmental Assessment Report*. Following is a brief summary for the benefit of the reader, highlighting aspects of the proposal most relevant to this study.

The landfill is to be located on a portion of Carmeuse's landholdings at its Beachville Quarry ("Southwest Quarry") in the Township of Zorra, Oxford County. Approximately 17.4 million cubic metres (m^3) of solid, non-hazardous waste and daily/intermediate cover will be deposited within a footprint of about 59 hectares (ha). The balance of the 81.6 ha area will be comprised of buffer areas for monitoring, maintenance, environmental controls and other necessary infrastructure (see Figure 1 in Appendix C).

Landfill construction will proceed progressively in a series of cells, generally from north-to-south (see Figure 1 in Appendix C). The former quarry floor will be backfilled to within about 30 to 40 metres below ground surface (m bgs) with engineered fill, and then a *Generic Design Option II – Double Liner* system (as specified by the Ministry of Environment, Conservation & Parks in the *Landfill Standards* under *Ontario Regulation (O. Reg.) 232/98;* (see Figure 2 in Appendix C) will be constructed across the bottom and up the sides of the landfill to contain and collect leachate (Figure 3 in Appendix C). Up to 850,000 tonnes per year of solid, non-hazardous waste, and up to 250,000 tonnes per year of daily/intermediate cover soils[1] will then be placed and compacted above the liner in a series of small working areas approximately 0.2 ha in size at any given time, in order to minimize the exposed waste. Waste will be covered with soil on a daily basis, and a final cap with vegetation will be applied when the landfill reaches its final height, which peaks at about 15 m above ground (Figure 4 in Appendix C). A landfill gas collection system will also be installed as the landfill/cell development progresses.

Most of the supporting infrastructure for the landfill will be located in the buffer area along the northern perimeter, including the leachate and gas treatment plants. Leachate collected from the liner system will be treated on-site and the clean effluent from the treatment plant will be discharged into the Patterson-Robbins Drain next to the treatment plant. Clean precipitation and groundwater that has not come into contact with waste will be segregated in a storm water management pond before being discharged from the site (Figure 1 in Appendix C). Landfill gas will be collected in a network of extraction wells and pipes. Initially, the landfill gas will be flared (combusted), but when the quantities permit the gas will be beneficially utilized as a renewable fuel.

The site will be open for waste deliveries from 7:00 a.m. to 5:00 p.m. on weekdays and from 7:00 a.m. to 1:00 p.m. on Saturdays but closed on Sundays and statutory holidays. On-site construction activities may start up to one hour before opening and continue up to two hours after closure. The primary designated haul route (i.e., for all waste trucks except deliveries from the local area, if any) is from Highway 401 north along County Road #6, then west into the quarry property through the initial gated entrance; trucks will then follow a newly constructed haul route across the quarry site to a secondary landfill site entrance at the northwestern corner of the site (Figure 5 in Appendix C). Vehicle traffic, including waste trucks as well as construction vehicles and staff, are expected to average approximately 210 trips per day.

[1] The daily/intermediate cover soil could consist of acceptable and suitable waste soils, and would be reported as waste, so the total reported waste receipts could be up to 1,100,000 tonnes per year.

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Nuisance controls will include speed enforcement, regular haul road cleaning (on- and off-site), litter fencing and pick-up, and bird/pest management, with a public complaint reporting and response system.

There will be monitoring programs / plans for equipment operation, leachate, groundwater, surface water, air emissions, gas, noise, and particulates (dust).

The landfill is anticipated to receive waste for approximately 20 years commencing in about 2023. After closure, maintenance and operation of the relevant environmental controls and monitoring will carry on during the Post-Closure period, until there is no further risk of environmental contamination. The end-use is assumed to be passive green space and/or agriculture, but the design is flexible to accommodate other potential end-uses at the time of closure.

4.0 ENVIRONMENTAL ASSESSMENT CRITERIA AND INDICATORS

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The **environmental assessment criteria**, as approved in the ToR, are tabulated in Appendix B, Table B-1. In the table, check marks indicate which technical studies are assigned primary ("lead") responsibility for assessing each of the criteria. Following are the EA criteria which are assigned to this study:

Table 1: Environmental Assessment Criteria Assigned to the Study

EA Criteria	Criteria Number[2]	Definition/Rationale
Explosive hazard due to combustible gas accumulation in confined spaces	1	Gas produced within a waste disposal facility (e.g., methane) can move through the ground and accumulate in confined spaces (e.g., manholes, basements, etc.) on or immediately adjacent to the waste disposal facility. There is potential for the gas to combust, creating an explosion and fire hazard.
Effects due to contact with groundwater or surface water	4	Contaminants associated with a waste disposal site have the potential to seep into the groundwater or surface water. This could pose a public health concern if it enters local drinking water supplies, or if it mixes with surface water.
Impact on the availability of groundwater supply to wells	33	A waste disposal facility can impact the availability of groundwater supply if groundwater is pumped from aquifers or if recharge to aquifers is reduced.
Effects on stream baseflow quantity/quality.	34	The presence of a waste disposal facility has the potential to affect the quality or quantity of baseflow to surface water.

Furthermore, the criteria for this EA were designed to be cross-disciplinary to permit an assessment of cumulative effects. Table B-2 in Appendix B, from the ToR, illustrates some (though not necessarily all) of the key

[2] As provided in Table B-I EA Criteria Table in Appendix B

interconnectivities between the studies. As a result, this study provides input/data to additional environmental criteria that will be addressed through studies conducted by other experts including (but not limited to):

- Flood hazard - The construction of a waste disposal facility can disrupt natural surface water drainage patterns, causing a potential for increased flooding.
- Loss / Displacement of surface water resources - Construction of a waste disposal facility may cause the removal of all or part of a natural stream or pond.

Indicators identify how the potential environmental effects will be measured for each criterion. Following are the indicators that were applied to each of the primary EA criteria addressed in this assessment:

Table 2: Proposed Indicators for Each Environmental Assessment Criteria

EA Criteria	Proposed Indicators/Measures
Explosive hazard due to combustible gas accumulation in confined spaces	■ Ontario Regulation 347, General – Waste Management (as amended). ■ Ontario Regulation 232/98, Landfilling Sites (as amended).
Effects due to contact with contaminated groundwater or surface water	■ Ontario Regulation 347 General – Waste management (as amended) ■ Ontario Regulation 232/98 Landfilling Sites (as amended) ■ Safe Drinking Water Act, 2002, Ontario Regulation 169/03 Ontario Drinking Water Quality Standards ■ Water Management – Policies, Guidelines and Provincial Water Quality Objectives (Guideline B-1-3) ■ Guideline B-7 Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities ■ Guideline B-7-1 Determination of Contaminant Limits and Attenuation Zones ■ Canadian Environmental Quality Guidelines, Canadian Council of Ministers of the Environment (CCME) ■ Ontario Regulation 153/04 (as amended) and its associated “rationale” documents ■ Comparisons of predicted groundwater concentrations to acute, sub-chronic, and chronic oral health-based benchmarks.
Impact on the availability of groundwater supply to wells	■ Ontario Water Resources Act (OWRA). ■ Water Taking Regulation O. Reg. 387/04.

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EA Criteria	Proposed Indicators/Measures
	■ Environmental Protection Act (EPA).
Effects on stream baseflow quantity/quality	■ Sections 53 and 34 of the Ontario Water Resources Act (OWRA) ■ Environmental Protection Act (EPA). ■ Guide to Permit to Take Water Application (2007) ■ Water Taking Regulation O. Reg. 387/04. ■ Appropriate water quality guidelines (e.g. PWQO or CCME)

5.0 STUDY DURATION

Two main **study durations** (or time frames) for this proposed landfill have been identified in the ToR:

Operational Period (or "Operations" period herein)	The time during which the waste disposal facility is constructed, filled with waste, and capped. These activities are combined since they occur progressively (i.e., overlap) on a cell-by-cell basis, and they have a similar range of potential effects (e.g., there is heavy equipment active on the site).
Post-Closure Period	The time after the site is closed to waste receipt. Activities are normally limited to operation of control systems, routine property maintenance and monitoring, and thus have a more limited range of potential effects.

The approved EA Criteria in Table B-1, Appendix B indicate the relevant study duration(s) associated with each of the criteria used in this assessment.

In addition, **common reference periods** or milestone dates were also defined for the operational period of the landfill:

Start of Construction	Est. 2022	Just prior to the start of landfill cell construction activities and operation, representing the existing baseline conditions.
Mid-Point	Est. 2034	Approximately midway through the landfill cell construction activities and operation. (note: start of landfilling in 2024)
Closure	Est. 2044	At the completion of the landfill cell construction activities and operation, representing the full operating size of the proposed landfill.

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6.0 STUDY AREAS

For the purposes of this EA, three general **study areas** were established in the ToR:

On-Site and in the Site Vicinity:	*On-site* includes the proposed waste disposal facility plus the associated buffer zones. *Site vicinity* is the area immediately adjacent to the waste disposal facility property that is directly affected by the on-site activities. Its size is variable depending on the particular criteria being addressed.
Along the Haul Routes:	The primary route along which the waste disposal facility truck traffic would move between a major provincial highway and the proposed waste disposal facility site entrance, plus the properties directly adjacent to these roads.
Wider Area:	The broader community, generally beyond the immediate site vicinity. Depending on the particular criteria this may include neighbourhoods, local municipalities, the Oxford County, or the Province of Ontario.

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The tables of approved EA Criteria in Appendix B indicate the relevant study area(s) associated with each of the criteria in this assessment.

Although these three general study areas were common across all of the studies, their actual physical boundaries were not necessarily identical for every study or criterion; a flexible approach was used, and the study area boundaries were adjusted as the work progressed to ensure that they adequately encompassed the potential significant effects of the proposed landfill.

For this assessment, the final study areas are:

Table 3: Study Areas Associated with Each Environmental Criteria

EA Criteria	Associated Study Areas	Rationale
Explosive and/or asphyxiation hazard due to combustible gas accumulation in confined or enclosed spaces	On-Site and Gas Collection Site Vicinity – The On-Site study area includes The Quarry site and the landfill buffer zones. The Gas Collection Site Vicinity includes the On-Site study area and the local area extending to about 500 metres (m) in all directions.	Gas produced within a waste disposal facility can move through the ground or groundwater and accumulate in confined or enclosed spaces on or immediately adjacent to the waste disposal facility.
Effects due to contact with contaminated groundwater or surface water	On-Site and Groundwater Site Vicinity - The On-Site study area includes The Quarry site and the landfill buffer zones. The Groundwater Site Vicinity also includes the local area where the groundwater level may potentially be drawn down to below existing water levels, due to the	Contaminants associated with a waste disposal site can enter the groundwater or surface water and impact off-site groundwater or surface water.

EA Criteria	Associated Study Areas	Rationale
	existing and proposed activities at the Site (i.e. quarrying).	
Impact on the availability of groundwater supply to wells	On-Site and Groundwater Site Vicinity - The On-Site study area includes The Quarry site and the landfill buffer zones. The Groundwater Site Vicinity also includes the local area where the groundwater may potentially be drawn down to below existing water levels, due to the existing and proposed activities at the Site (i.e. quarrying).	A waste disposal facility can impact the availability of groundwater supply if groundwater is pumped from aquifers or if recharge to aquifers is reduced.
Effects on stream baseflow quantity/quality	On-Site and Groundwater Site Vicinity - The On-Site study area includes The Quarry site and the landfill buffer zones. The Groundwater Site Vicinity also includes the local area where the groundwater may potentially be drawn down to below existing water levels, due to the existing and proposed activities at the Site (i.e. quarrying).	The presence of a waste disposal facility has the potential to affect the quality or quantity of baseflow to surface water.

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The Groundwater Site Vicinity area was established early in the EA process to reliably encompass all potential zone(s) of influence of the landfill and thus provide focus to the geographic extent of the study. The Groundwater Site Vicinity extends to about 1 km around the proposed landfill as shown on Figure 6.1.

Where appropriate and relevant, **common receptor points** were also selected collaboratively by the technical experts so that the potential overlapping or cumulative effects of the proposed landfill could be assessed at these common receptor points. The common receptor points used in this study are the closest residences to the existing Southwest Quarry and the Thames River as the closest natural surface water feature.

7.0 METHODOLOGIES - GROUNDWATER

As this project involves the development of a landfill within an existing quarry, available existing data on the geology and hydrogeology of the site is considered and incorporated into the assessment, as appropriate. The work described herein builds on the data already available to augment the understanding of the site to a level of detail suitable for the purpose of supporting a submission for *Environmental Assessment Act* (EAA) application for approval for development of the landfill.

The development of the work plan was created to specifically address the groundwater components of the EA and subsurface conditions in relation to potential for gas migration.

7.1 Background Data Collection

The Groundwater component includes the subcomponents groundwater quality and groundwater flow (quantity). The following tasks were undertaken to characterize existing environmental conditions:

Data Review and Site Reconnaissance

The data review and site reconnaissance task consisted of the following activities:

- Review of published geological and hydrogeological maps and reports, water well data, regional groundwater and wellhead protection studies, regional and local topographic and drainage mapping, previous subsurface investigation findings, and interpretation.
- Review of groundwater results from annual monitoring reports including depth to water table and water quality analysis.
- Review of key groundwater-related features identified by the community (e.g. the Community Liaison Committee tour, door-to-door surveys, domestic well monitoring and other public inputs and comments).
- Review of available site-specific studies previously undertaken to corroborate hydraulic conductivity in the bedrock aquifer(s) and groundwater flow directions estimated prior to the field program; establishment of the drawdown distance associated with the existing Southwest Quarry dewatering to serve as input for groundwater modelling.
- Review of the groundwater sample data at select water supply wells in the Groundwater Site Vicinity and the Wider Area to adequately characterize baseline groundwater quality.
- Completion of a site reconnaissance to corroborate the results of the desktop review, document general site drainage and identify potential groundwater-dependent receptors in the area.
- Consideration of any other pertinent information, as available.

Water Well Assessment

An inventory of private/domestic and public water wells was carried out based on the Ministry of Environment, Conservation and Parks (MECP or “Ministry”, formerly the MOECC) water well records. A door-to-door survey was completed within the Groundwater Site Vicinity. Visited wells, including those along Beachville Road, are anticipated to be within the zone of influence of the existing Southwest Quarry dewatering and part of the local groundwater flow regime (upgradient).

7.2 Field Data Collection

The following provides a summary of the activities that were undertaken for the hydrogeological component. Program specifics, such as media assessed, investigative methodologies, numbers and locations of sampling points and the analytical parameters were determined based on the results of the review of available background information and proposed design alternatives for the landfill; these included:

- Retention of an expert in karst geology to provide input into the program as well as participation in data collection and interpretation with respect to the presence or absence of karst features.
- Review of available site-specific studies previously undertaken to determine hydraulic conductivity in the bedrock aquifer(s) and assess groundwater flow directions.

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- Drilling boreholes in the overburden and bedrock at representative locations within the Groundwater Site Vicinity, to characterize site geological and hydrogeological conditions, including potential surface water and groundwater interactions.
- Geophysical logging and detailed hydraulic conductivity testing (i.e. packer testing) on selected boreholes to confirm site stratigraphy and assess the physical and hydrogeological properties of the bedrock on the site, as described below.

Borehole Drilling and Monitoring Well Installations

- A total of six borehole locations were proposed around the perimeter of the proposed landfill as shown on Figure 6.1.
- Borehole locations 1, 2 and 3 were completed within the western portion of the Groundwater Site Vicinity at the locations shown on Figure 6.1. Three boreholes were drilled through the overburden and into the bedrock at each of these locations and instrumented with monitoring wells. The deepest of these (borehole “A”) was advanced to a depth of about 60 m bgs. The core was logged for lithology, fractures (depth and orientation) and geotechnical indices including total core recovery (TCR), solid core recovery (SCR), and rock quality designation (RQD). The screened intervals in the bedrock targeted zones of higher permeability (as determined by core logging, geophysics and packer testing) and/or stratigraphic contacts. Additional monitoring wells were installed in the overburden and screened to target zones of higher permeability and the water table with one location screened in the Zorra (Tavistock) till.
- Borehole location 4 was situated on the Southwest Quarry floor. The deep borehole (“A”) was completed in the Bois Blanc Formation, at an approximate depth of 22 m bgs beneath the quarry floor. A shallow depth borehole, (“B”), was also installed beneath the quarry floor, in the Amherstburg Formation, at an approximate depth of 17 m bgs. Both boreholes were installed with monitoring wells to determine the vertical hydraulic gradient beneath the quarry floor.
- Borehole location 5 was situated to the south of the quarry, north of Former West Quarry. The deep borehole (“A”) was completed in the Amherstburg Formation. Shallow depth boreholes, (“B” and “C”), were installed in the Lucas Formation and shallow fractured portion of the Lucas Formation respectively. The screened intervals in the bedrock targeted zones of higher permeability (as determined by core logging, geophysics and packer testing) and/or stratigraphic contacts.
- Borehole location 6 was situated adjacent to the Thames River. Two boreholes targeting bedrock were drilled and each instrumented with a monitoring well to allow for assessment of hydraulic gradients in the vicinity of the Thames River as part of groundwater-surface water interactions. The deeper borehole (“A”) was completed in the Lucas formation at an approximate depth of 33 m bgs. The shallower borehole (“B”) was completed at the water table in the shallow fractured portion of the Lucas Formation.

Borehole Geophysics

The open cored boreholes were geophysically logged for natural gamma and conductivity following drilling. The geophysical logging identified the lithological intervals in each borehole and was used to design the appropriate intervals for well screens and annular seals in the monitoring wells. The open boreholes were also video-logged to evaluate the downhole geology as well as the potential presence of karstic features. The boreholes were pumped to lower the water level in the wells to induce flow into the borehole. The flow into the borehole was logged using

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an impeller (spinner) flow meter to evaluate the inflow in the borehole (e.g., fractures) which was used for the karst evaluation.

Hydraulic Conductivity Testing

The hydraulic conductivity of the bedrock was evaluated through packer testing of the deep borehole at about 3.1 m intervals at each cored hole location. Rising and/or falling head tests were also conducted in the monitoring wells to estimate the hydraulic conductivity of the monitoring intervals.

Groundwater Flow Modeling

A three-dimensional groundwater flow (MODFLOW) computer model was developed to support the landfill design and approvals process and is detailed in Appendix D.

Karst Study

A karst study was conducted to determine the potential presence or absence of karst in the area that is relevant to the landfill design, the net effects analysis, proposed contingency measures and the groundwater monitoring plan. The study involved examination of potential karstic features in areas of exposed bedrock and interpretation of field findings. The karst study was conducted by Dr. Stephen Worthington, a recognized karst expert, in conjunction with Golder.

The karst work program involved:

- An initial inspection of the Southwest Quarry faces and bedrock exposures in the area to assess any karstic features;
- Field assessment of overburden and general topography in the vicinity of the Southwest Quarry;
- Review of regional and local geology;
- Flow logging in deep boreholes using an impeller (spinner) flow meter to identify potential zones of groundwater discharge; and,
- The boreholes were video-logged to determine whether they are potentially related to karstic features.

The karst study (concluding no karstic features are located in the vicinity of the Southwest Quarry) is provided as Appendix E to this report.

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Baseline Groundwater Monitoring

Following the installation of the monitoring wells, pressure transducers equipped with dataloggers, configured to record water levels and temperatures at regular intervals, were installed at key locations. The data was downloaded quarterly, at which time a complete round of water level measurements was carried out. The data was used to assess horizontal and vertical groundwater gradients.

In conjunction with the quarterly water level monitoring events, groundwater sampling was undertaken in order to determine the seasonal variations in groundwater quality. Groundwater samples were collected using dedicated sampling equipment and analysed by an independent accredited laboratory for the parameters listed in Section 10 of O. Reg. 232/98, as well as for a suite of groundwater quality indicator parameters.

7.3 Data Analysis

The background and field data collected were used to summarize and assess the water quality conditions to establish a baseline for the site. The wells were used to assess the groundwater flow regime and water quality in both the overburden and bedrock at selected depths and locations in order to fulfill the requirements of the baseline hydrogeological assessment for the EA and O. Reg. 232/98.

The baseline hydrogeological assessment was used to develop a conceptual hydrogeological model, which provided a framework for evaluating potential impacts on nearby groundwater receptors (e.g., domestic and municipal water wells, discharges to surface water) as a result of the proposed site development.

A key aspect of the baseline hydrogeological assessment is the integration with the hydrological component, assessing the overall water balance conditions and evaluation of the landfill water discharge.

The landfill design and available existing environmental conditions were reviewed to identify potential project-environment interactions and, where feasible, potential mitigation measures were incorporated and assessed.

Groundwater Flow Modeling

A three-dimensional groundwater flow (MODFLOW) computer model was developed to support the landfill design and approvals process and is detailed in Appendix D. In summary, the model was constructed on the basis of site data collected during the field program and pre-existing regional hydrogeologic interpretations (Golder, 2010), calibrated to Existing Conditions including measured water levels and quarry inflows, and thereafter used to simulate Operations and Post-Closure conditions including key hydraulic components of the engineered landfill facility as based on the Facility Characteristics Assumptions document (Walker, 2019). Output from the modelling included assessing landfill infiltration, hydraulic head distribution in and around the landfill and seepage collection. For the purpose of assessing monitoring locations and contingency plan feasibility, output from the model also included seepage bypass flow rates and directions The broader hydraulic interaction of the landfill with surrounding hydrologic features, including quarries, quarry lakes, the Thames River and municipal wells, was also considered in the model.

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Hydrogeological Net Effects Assessment

A hydrogeological assessment was conducted to evaluate the potential net effects of the proposed landfill on surrounding groundwater and surface water resources and receptors (including the surrounding water wells). This included an analysis of the hydraulic containment scenario under operating landfill conditions and Post-Closure conditions.

In addition to the above assessment of potential effects, the following list of activities was conducted:

- The degree of potential effects was compared using applicable criteria and indicators; and,
- The potential for leachate from the landfill impacting adjacent properties was assessed.

Prediction of future environmental conditions was completed using modelling and other methods, and appropriate objectives, standards, policies and legislation. This specifically identified, recognized, and determined potential effects upon the Wellhead Protection Areas (WHPA) associated with the municipal drinking water wells, Highly Vulnerable Aquifers (HVA) and Significant Groundwater Recharge Areas (SGRA) identified in the source water protection studies. Further, the County of Oxford was consulted to identify any pre-existing plans for municipal well field expansion and incorporate those into the evaluation. Anecdotal information indicates that the County of

Oxford is not currently planning to expand the municipal water supply well system over the short or long-term (A.R. Lotimer, *pers. comm.*, March 22, 2019).

It is noted that the modelling of future baseline conditions for the proposed undertaking included specific consideration of the ongoing dewatering and rehabilitation of the quarries currently operated by Carmeuse Lime (Canada) Ltd.

Finally, the prediction of future environmental effects, assuming all mitigation measures are implemented, was undertaken. The remaining effects or 'net effects' were documented with outcomes discussed in the net effects section for each environmental component.

Landfill Gas

Subsurface Landfill gas migration controls will include the extension of the liner to ground surface at the landfill perimeter to provide a physical barrier to subsurface landfill gas migration, and the operation of a gas collection system, to reduce or eliminate positive gas pressure within the landfill. The potential for landfill gas migration in the subsurface was assessed through:

- A review of the subsurface soil and groundwater characteristics, obtained through the groundwater field data program noted above, in the context of the facility characteristics to evaluate potential migration pathways for landfill gas through the subsurface; and,
- A review of the location and extent of potential receptors and migration pathways, including subsurface utility corridors and buildings in the site vicinity.

Based on the results of this review, and consultation with the EA Management Team and the Design & Operations Team, potential future environmental effects were assessed, assuming all planned mitigation measures are implemented. The remaining effects or 'net effects', were documented with outcomes discussed in the net effects section for Landfill Gas.

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8.0 DATA COLLECTION

8.1 Background Data

The hydrogeological characterization of the Groundwater Site Vicinity involved groundwater exploration and assessment carried out in 2017 followed by groundwater monitoring through to December 2018. The assessment has built upon the review of information available from previous work. The following sections provide an overview of the assessment program and discussion while more detailed discussions of each aspect of the assessment along with the results including borehole logs and monitoring data are provided in the appendices.

A list of references is provided in Section 15.0. A glossary of terms is provided as Appendix A.

8.1.1 Regional Geology

8.1.1.1 Overburden

According to the Ministry of Northern Development and Mines, Quaternary Geology Map No. 2281 "Woodstock Area", the overburden in the area of the Site consists of yellow to brown silt to sandy silt Zorra (Tavistock) Till and sand of glaciofluvial origin with interbedded layers of sand, silt and gravel of modern alluvium or glaciofluvial outwash origins as seen in Figure 8.1. The overburden deposits to the west of the Southwest Quarry (encountered at borehole locations 1, 2 and 3), ranged in thickness between about 19.6 and 20.6 m, whereas deposits nearer to the quarry (encountered at locations 4, 5 and 6) ranged in thickness between about 0 and 13.0 m.

The detailed overburden stratigraphy is shown on the Record of Borehole sheets in Appendix F. Grain size distribution curves for representative overburden samples are also provided in Appendix F.

8.1.1.2 Bedrock

According to Ontario Division of Mines Map 2254 titled "Paleozoic Geology of Southern Ontario", the region is underlain by Middle Devonian aged limestones and dolostones of the Dundee Formation of the Hamilton Group and slightly older limestones and dolostones of the Lucas Formation of the Detroit River Group. The Dundee Formation subcrops west of the area of the site and sharply and unconformably overlies the Detroit River Group, which has been subdivided into the Lucas and Amherstburg Formations. The Lucas formation is exposed at the Site and conformably overlies the Amherstburg at the Southwest Quarry floor. The Detroit River Group overlies Lower Devonian aged limestone of the Bois Blanc Formation, which is not exposed at the Site.

Based on Ontario Division of Mines Preliminary Map P.169 titled "Bedrock Topography Series – Woodstock Sheet", bedrock in the area of the Site subcrops between 10 and 25 m bgs. The bedrock surface topography in the vicinity of the site generally dips in a south/southeast direction with local depressions in the vicinity of the site, as shown on Figure 8.2. Based on borehole drilling during the current assessment, as discussed in further detail below, bedrock was encountered between 6.7 and 20.6 m bgs, with the exception of location 4 where the bedrock is exposed on the quarry floor.

General lithological descriptions of each of the above-noted formations are provided in the following subsections.

Hamilton Group – Dundee Formation

According to Armstrong and Carter (2010), the Dundee Formation consists of grey to tan to brown, fossiliferous, medium to thick bedded, limestones and dolostones. The Dundee formation is typically 35 to 45 m thick with common bituminous partings, microstylolites and chert nodules. Naturally occurring oil staining may be present in more porous, fossiliferous beds and along fractures. Fossils include crinoids, brachiopods, rugose and tabulate corals, trilobites and rostroconchs.

Detroit River Group – Lucas and Amherstburg Formation

The Detroit River Group can be subdivided into the Lucas and Amherstburg Formations. The Lucas Formation is the uppermost formation of the Detroit River Group and may be subdivided into three lithofacies: undifferentiated Lucas Formation; Anderdon Member limestone; and the Anderdon Member sandy limestone or dolostones.

The undifferentiated Lucas Formation is described by Armstrong and Carter (2010) as a thin to medium bedded, light grey to grey-brown, fine crystalline, poorly fossiliferous dolostone and limestone with stromatolitic laminations. Anhydrite and gypsum beds may be present, with breccias related to the dissolution of these evaporites also present. The Anderdon Member consists mainly of light to dark grey-brown, thin to medium bedded, fine grained, sparsely fossiliferous limestone interlayered with coarse grained bioclastic limestone. Bioclasts predominantly consist of stromatoporoids and amphipora, with less abundant rugose and tabulate corals. The sandy limestone unit tends to occur at the top of the Anderdon Member or interbedded with the uppermost strata of the Lucas. This unit has been described as medium to massively bedded, medium to coarse grained, fossiliferous sandy limestones or dolostones.

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Regionally, the thickness of the Lucas Formation varies, thinning towards the southeast from its maximum thickness of about 100 m near the community of Sarnia in Lambton County, until it pinches out near Lake Erie in Norfolk County. According to Conestoga-Rovers & Associates (2001) the thickness of the Lucas Formation in the area of the site is about 30 m, which is similar to the thicknesses encountered in boreholes drilled as part of this assessment.

Armstrong and Carter (2010) describe the Amherstburg Formation as tan to grey-brown to dark brown, fine to coarse grained, bituminous, bioclastic, fossiliferous limestones and dolostones. Bioherms dominated by stromatoporoids are locally significant. Fossils also include rugose and tabulate corals, brachiopods, crinoids, cephalopods and trilobites.

The Amherstburg Formation is up to 60 m in thickness and conformably and gradationally overlies the Lower Devonian aged Bois Blanc Formation. According to Conestoga-Rovers & Associates (2001) the thickness of the Amherstburg Formation is 15 m in the area of the Site.

Bois Blanc Formation

The Bois Blanc Formation is also of Middle Devonian age and rests unconformably on the Upper Silurian Bass Islands Dolomite. Armstrong and Carter (2010) describe the Bois Blanc Formation as greenish grey to grey-brown, thin to medium bedded, fine to medium grained, fossiliferous, bioturbated, cherty limestone and dolostone. The chert ranges from white to grey to black in colour and can locally account for up to 90% of the rock volume. Fossils include rugose corals, tabulate corals, some amphipora and brachiopods. Sandstones occur either at the base of the Bois Blanc Formation or as interbeds in the lower part of the formation.

In Ontario, the Bois Blanc Formation ranges in thickness from 3 to 50 m and is generally thicker towards the centre of the Michigan Basin. According to Conestoga-Rovers & Associates (2001) the top of the Bois Blanc Formation occurs about 235 m above mean sea level (amsl) in the area of the Site and the unit is about 40 m thick.

8.1.2 Regional Hydrogeology

There are three potential overburden aquifers and one bedrock aquifer present in the Groundwater Site Vicinity. They are described as follows (Goff & Brown, 1981):

- A shallow, generally unconfined, overburden aquifer consisting of surficial sand and/or sand and gravel deposits. This shallow aquifer may be overlain in some locations by thin deposits of lower permeability material such as silt, clay or till.
- An intermediate depth, generally confined, overburden aquifer consisting of discontinuous layers or lenses of sands and/or gravels.
- A deeply buried, generally confined, overburden aquifer consisting of sands and/or gravels.
- A bedrock aquifer consisting of Middle Devonian age limestone of the Lucas and Amherstburg Formations.

The mapping provided by Goff and Brown (1981) indicates that the shallow overburden aquifer is present throughout the Site but is discontinuous to the north, west, and south of the Thames. This shallow aquifer may be overlain in some locations by thin deposits of lower permeability material (clay or clayey deposits). The extent of the shallow overburden aquifer roughly corresponds to the surficial glaciofluvial outwash deposits. The intermediate overburden aquifer is not present at the Southwest Quarry but is present south of the Thames River

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according to the available mapping. The deep overburden aquifer is not present at the Southwest Quarry. The bedrock aquifer, which consists of the Lucas and Amherstburg Formation limestones, is available throughout the region.

Previous hydrogeological studies (CRA, 2014; GHD, 2016) indicate that there are four relatively extensive water-bearing zones within the bedrock. These zones were described as follows:

- The Upper Zone: This zone represents the upper 10 to 15 m of bedrock and is the principal water bearing unit for local domestic water supply wells. According to CRA (2001) the majority of the domestic wells in the area are completed within this zone. Groundwater is also found at deeper elevations between 240 and 250 m amsl.
- The 230 m Zone: This zone occurs between 227 and 241 m amsl and is the principal water bearing unit for industrial and commercial wells. Regionally (further afield from the Groundwater Site Vicinity) and according to Golder (2018), this zone was inferred to correspond to the contact between the Amherstburg Formation and the underlying Bois Blanc Formation. The 210 m Zone: This zone occurs at elevations between 200 and 220 m amsl.
- The 185 m Zone: This zone occurs at elevations between 170 and 195 m amsl and is the principal water bearing unit for the local municipal supply wells.

The flow zones from previous studies were identified as part of the current assessment. The upper zone includes the “shallow weathered zone” of the Lucas formation in this report. The contact between the Amherstburg and the Bois Blanc formation, “the 230 m zone”, is interpreted to be present at borehole location 4 in this assessment. The other two flow zones (210 m and 185 m zones) identified by previous hydrogeological studies were not encountered.

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8.1.2.1 Water Supply

Water Well Information System

Golder queried the MECP Water Well Information System (WWIS) database for all wells located within the Groundwater Site Vicinity plus an additional 500 m radius. Data for 183 wells was retrieved. The approximate locations of these wells, as indicated in the MECP water well records, are shown on Figure 8.3. A summary of the MECP query is provided in Appendix G.

For the 183 well records received from the MECP, 144 records correspond to wells that are used for water supply. The remaining 39 records are recorded to be abandoned, observation wells, test holes, recharge well, not a well or the record is incomplete. The water well location plan including door-to-door surveyed wells is provided as Figure 8.3.

Five of the 144 wells reportedly used for water supply were completed in overburden deposits to depths ranging between about 11.0 and 33.5 m bgs. The reported well yields for the overburden wells were highly variable and, where reported, generally ranged between about 14 and 45 litres per minute (L/min). All five of the overburden well records indicated the well provided fresh water. The deeper overburden wells are likely completed as overburden-bedrock interface wells, exploiting granular deposits hydraulically connected to the underlying fractured bedrock.

Two water supply wells had incomplete records.

The remaining 137 well records for the water supply wells indicated termination and/or completion in bedrock at total depths ranging between about 7.6 and 134.4 m bgs. The reported yield for these bedrock wells ranged between about 8 and 2,182.1 L/min. A total of 120 of all bedrock well records indicated fresh water quality, nine records indicated sulphurous or mineralized water and the remaining eight records were untested or unknown.

As shown in Appendix G, the reported water usage for many of the water supply well records were domestic or agricultural; however, 12 well records indicated commercial or industrial use and four records indicated public or municipal use. Three records were not completed and one record was listed as not used. The majority of the domestic water supply well records are installed into the shallow weathered zone of the Lucas formation (GHD, 2016).

Piped Municipal Water Supply

Based on information obtained from the County of Oxford, a piped municipal water supply is available in the Town of Ingersoll with the closest residence on the municipal water supply system located about 1 km southwest as well as the nearest residence on the municipal water supply system in Beachville located about 3 km northeast of the Southwest Quarry. Properties located outside of Ingersoll and Beachville are inferred to not have a piped municipal supply but rely on a domestic groundwater well for their primary water supply. As a result, a door-to-door survey was carried out to obtain current information on existing domestic water supply wells in the Groundwater Site Vicinity. The methodology and results of the survey are described below.

Domestic Water Well survey

A preliminary list of municipal addresses for properties within the survey area was compiled using property assessment information obtained from the municipality and included all properties within the Groundwater Site Vicinity plus an additional 500 m radius A total of 62 properties were included in the survey. On June 11 and 18, 2018, a notification letter was delivered to residents and/or businesses in the survey area to request their participation in the well survey. Based on field observations, the list of municipal addresses receiving the survey was updated, as required. The properties surveyed are summarized in Appendix G.

Representatives from Golder and Walker attempted to contact each resident or business, via door-knocking, included in the survey while canvassing the area on June 11, 2018. Brief interviews were conducted to obtain information regarding water wells located on each property. A follow-up canvas, similar to the activity carried out on June 11, was carried out on the evening of June 18, 2018 for residents who were not available during the initial visit. A letter of explanation, a well survey questionnaire and postage-paid return envelope were left at the properties where the resident or property owner was unavailable during both door-to-door surveys. Water well information was successfully obtained for seven properties. No information or responses were received to date for the remaining properties. A summary of the completed survey forms is provided in Appendix G. The approximate locations of the wells identified during the door-to-door survey are shown on Figure 8.3.

Municipal Wells

Several municipal wells are present in the area, including wells that are part of the Ingersoll and Beachville well fields. Correspondence from the County of Oxford indicated that there are six active municipal water supply wells that supply the Town of Ingersoll and one in Beachville:

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- Ingersoll Well 2 (Merritt)
  - Located about 3 km southwest of the Southwest Quarry, Well 2 is a bedrock supply well with a total depth of about 140 m. In 2018 an average daily volume of 230 m^3 of water was pumped from this well for water supply in Ingersoll. The average static water level at this well in 2018 was recorded at about 32 m bgs with a pump intake at about 60 m bgs.
- Ingersoll Well 3 (Hamilton)
  - Located about 6 km southwest of the Southwest Quarry, Well 3 is a bedrock supply well with a total depth of about 117 m. In 2018 an average daily volume of 630 m^3 of water was pumped from this well for water supply in Ingersoll. The average static water level at this well in 2018 was recorded at about 31 m bgs with a pump intake at about 44 m bgs.
- Ingersoll Well 5 (Canterbury)
  - Located about 2.3 km southwest of the Southwest Quarry, Well 5 is a bedrock well with a total depth of about 109 m. In 2018 an average daily volume of 1,755 m^3 of water was pumped from this well for water supply in Ingersoll. The average static water level at this well in 2018 was recorded at about 30 m bgs with a pump intake at about 49 m bgs.
- Ingersoll Well 7 (West)
  - Located about 4.3 km southwest of the Southwest Quarry, Well 7 is a bedrock well with a total depth of about 123 m. Well 7 was not used in 2018. The static water level at the time of construction in 1977 was 13 m bgs with a pump intake at about 41 m bgs.
- Ingersoll Well 8 (Dunn's)
  - Located about 1 km southwest of the Southwest Quarry, Well 8 is a bedrock well with a total depth of about 125 m. In 2018 an average daily volume of 172 m^3 of water was pumped from this well for water supply in Ingersoll. The average static water level at this well in 2018 was recorded at about 50 m bgs with a pump intake at about 55 m bgs.
- Ingersoll Well 10 (Thompson)
  - Located about 5 km southwest of the Southwest Quarry, Well 10 is a bedrock well with a total depth of about 113 m. In 2018 an average daily volume of 2,948 m^3 of water was pumped from this well for water supply in Ingersoll. The average static water level at this well in 2018 was recorded at about 31 m bgs with a pump intake at about 44 m bgs.
- Beachville Well 1 (West Hill)
  - Located about 3.3 km northeast of the Southwest Quarry, Well 1 is a bedrock well with a total depth of about 91 m. The static water level at the time of construction in 1973 was 40 m bgs with a recommended pump intake of 50 m bgs.

The approximate locations of the municipal wells are shown on Figure 8.4. The closest municipal well to the Groundwater Site Vicinity is Ingersoll Well No. 8, which is located about 1 km southwest of the active Southwest Quarry.

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8.1.2.2 Source Water Protection

Significant Groundwater Recharge Areas

For the purposes of defining the Significant Groundwater Recharge Areas (SGRAs) in the Upper Thames Region Source Protection Area (SPA), areas that have a recharge of more than 1.15 times the average recharge of the SPA are considered to be SGRAs (MOECC, 2009). Based on the results of the assessment undertaken for the Upper Thames Region SPA, portions of the Groundwater Site Vicinity are located within a SGRA (Thames-Sydenham and Region Source Protection Committee, 2015). However, these SGRA designations appear to be the result of regional scale, pre-quarry (i.e. historic overburden) surficial geology mapping that is no longer applicable. Given that dewatering and upward gradients at the quarry floor effectively prevent any significant recharge from occurring, the active Southwest Quarry should not be considered a SGRA.

Highly Vulnerable Aquifers

In the Thames-Sydenham and Region Assessment Report, Highly Vulnerable Aquifers (HVAs) were mapped using the Intrinsic Susceptibility Index (ISI) method, which is based on the method developed by the MECP that assigns an equivalent hydraulic conductivity value for the strata overlying the first significant aquifer to each well record in their WWIS (Thames-Sydenham and Region Source Protection Committee, 2015). The resultant values are then categorized as high, medium or low vulnerability for the aquifer. Surficial geology mapping was used to refine the limits of the HVAs (Thames-Sydenham and Region Source Protection Committee, 2015).

Based on the results of the vulnerability assessment undertaken for the Upper Thames SPA, the Groundwater Site Vicinity is located within an HVA (Thames-Sydenham and Region Source Protection Committee, 2015). However, this HVA designation relies on surficial geology mapping that no longer applies to the Groundwater Site Vicinity (see above text regarding SGRAs).

Preliminary Map S111 titled “Susceptibility of Ground Water to Contamination, Woodstock Sheet” indicates that the area of the Groundwater Site Vicinity is mapped as generally having a high susceptibility to contamination due to deposits of highly permeable glaciofluvial sands and gravels as well as occurrence of outcrops of fractured cherty limestone bedrock.

Wellhead Protection Areas

As detailed in the Thames-Sydenham and Region Assessment Report, Wellhead Protection Areas (WHPAs) are the vulnerable areas around groundwater sources that have been delineated using computer-based three-dimensional groundwater flow models. The WHPA for each well or well field is delineated by estimating the groundwater time of travel to the well, with defined zones typically extending out to an area representing the 5 to 25-year time of travel to the well (i.e., “WHPA-D”).

Based on mapping provided in the Thames-Sydenham and Region Assessment Report, the proposed landfill is not located within a WHPA (Thames-Sydenham and Region Source Protection Committee, 2015). The closest approach of the Ingersoll Well 8 WHPA to the proposed landfill is at Ingersoll Well 8 itself, about 1 km southwest of the active Southwest Quarry and extends to the northwest. Beachville Well 2 is located about 3.3 km northeast of the quarry. The WHPA extends to the north and east, away from the Groundwater Site Vicinity. The assessment of potential impacts on these features is considered in the net effects analysis.

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8.2 Field Data

8.2.1 Borehole Drilling and Well Installation

The hydrogeological assessment involved the drilling and installation of monitoring wells at three "off-site" (locations 1, 2 and 3 – further away from the active Southwest Quarry) and three on-site (locations 4, 5 and 6) locations (Figure 6.1). All six locations are within the Groundwater Site Vicinity. Shallow and deep bedrock wells were installed at each location for a total of 16 bedrock wells. Overburden wells were installed at locations 1, 2 and 3 for a total of four overburden wells. These monitoring wells were completed from September 2017 through to February 2018 and are designated MW17-1 through MW17-6 followed by a letter, where "A", "B" and "C" represent the bedrock wells and "D" and "E" represent the overburden wells. Well locations and the Groundwater Site Vicinity are shown on Figure 6.1. A 78-millimetre (mm) diameter borehole was drilled using auger, tri-cone and HQ coring equipment with water flush and completed to depths varying from 3.2 to 62.1 m below ground surface (m bgs) in order to target pre-determined stratigraphic horizons. The bedrock core was logged to determine the rock conditions and stratigraphy of the formations encountered. Hydraulic conductivity (packer) testing was carried out in boreholes BH17-1A through BH17-6A at about 3.1 m intervals in conjunction with drilling.

Monitoring wells, with the exception of monitors at location 4, were installed in each borehole using 51 mm inside diameter ("ID") Schedule 40 polyvinyl chloride ("PVC") casing and 51 mm ID Schedule 40 PVC well screens. The sand pack surrounding the screen was constructed using #3 silica sand and extended about 0.6 to 6.2 m above the screen. A bentonite seal consisting of bentonite solids (e.g., Holeplug™) was placed above the filter pack with a minimum thickness of 0.5 m. Monitoring wells at locations 4 were installed in each borehole using 32 mm ID Schedule 40 PVC casing and 32 mm ID Schedule 40 PVC pre-packed well screens. The gravel surrounding the screen was constructed using pea gravel and extended about 1.4 to 2.1 m above the screen. A bentonite seal consisting of bentonite solids was placed above the filter pack with a minimum thickness of 0.2 m. Each monitoring well was completed at ground surface with an aboveground protective casing set in concrete and the casing was sealed with a PVC j-plug. Monitoring wells were developed following completion using either an airlift method with nitrogen gas or using inertial pumps with Waterra® tubing and surge blocks. Well construction details are provided in the respective Record of Borehole sheets provided in Appendix F.

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Following installation of all of the monitoring wells, Golder surveyed each of the locations for reference to a geodetic datum. Details of the monitoring well locations and surveyed elevations are provided in Table I and can be found on the borehole records in Appendix F.

8.2.2 Borehole Geophysics Survey

A total of six boreholes were logged with geophysical methods between September 23, 2017 and February 5, 2018. The geophysical logging consisted of Natural Gamma, Apparent Conductivity, and Spinner Flowmeter tests. The flowmeter testing was conducted under ambient and dynamic pumping conditions (where possible), to identify the flowing zones in the formation rock.

The logging system used was a Mount Sopris 4MX1000 Winch and Advanced Logic Technology (ALT) Matrix Logging box. The probes were made by Mount Sopris Instruments (MSI).

The geophysical probe run speeds and sampling intervals are outlined in Table 4 below. The logged depths of the probes for each borehole are summarized in the table below.

Table 4: Geophysical Logging Parameters

Probe Name	Logging Speed (m/min)	Sampling Interval (m)	Comments
Natural Gamma	2.5	0.025	Measures the natural gamma radiation emitted form the formation rock. Associated with clay-bearing minerals and higher potassium content.
Apparent Conductivity	4.0	0.05	Measures the bulk apparent electrical conductivity of the formation rock. Associated with clay-bearing minerals.
Spinner Flowmeter	5, 10, 15	0.05	Measures the relative motion of water in the fluid column. Run at different speeds to capture different flow regimes.

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Table 5: Geophysical Logging Intervals

Borehole Name	Gamma Log	Conductivity Log	Spinner (Ambient)	Spinner (Dynamic)
BH17-1A	0 – 62 m	21 – 62 m	14 – 60 m	20 – 60 m
BH17-2A	0 – 56 m	21 – 56 m	16 – 56 m	22 – 55 m
BH17-3A	0 – 52 m	20 – 51 m	17 – 48 m	21 – 47 m
BH17-4A	0 – 22 m	1 – 22 m	1 – 22 m	4 – 22 m
BH17-5A	0 – 43 m	8 – 42 m	21 – 42 m	-
BH17-6A	0 – 33 m	14 – 33 m	27 – 33 m	-

Geophysical logs for each borehole surveyed are provided in Appendix H.

8.2.3 Hydraulic Conductivity Testing

8.2.3.1 Slug Test

Single well response tests were conducted at monitoring well locations MW17-1, MW17-2, MW17-3, MW17-5 and MW17-6 to estimate the hydraulic conductivity ("K") of the screened intervals. Due to flowing artesian conditions, single well response tests of this nature were not completed at MW17-4. Prior to testing, each monitoring well was suitably developed as discussed above in section 8.2.1. A summary of the falling and rising head tests is provided Table I-II in Appendix I. Prior to initiating the tests, each monitoring well was instrumented with a pressure transducer equipped with a data logger to measure water levels at a suitable frequency.

The water level dataset collected during the single well response tests was analyzed using the AQTESOLV software package. Hydraulic conductivity values for each test were estimated using the Bouwer-Rice analytical solution.

8.2.3.2 Packer Test

A total of 50 packer tests were completed to assess the horizontal hydraulic conductivity of the bedrock at the "A" boreholes at each drilling location. The packer tests were conducted in about 3.1 metre intervals in the open boreholes (MW17-1A through MW17-6A) as the borehole was being advanced to the target depth. Prior to the start of each packer test, the open borehole was developed by flushing with water and over-pumping until clear water was produced. Drill rod seal tests were also performed prior to the initiation of all the packer tests to determine the competency of the drill rods.

The testing was conducted using a single array packer assembly with intervals ranging from 1.2 to 5.2 m. The overlap between test intervals was generally between 0.1 to 0.3 m.

All packer tests were performed using the falling head test method, where the column of water representing the static water level within the packer interval is raised by adding water from an external source. Subsequently, the water column falls while the water level and elapsed time are recorded. The packers were inflated with nitrogen gas to pressures of about 200 pounds per square inch (psi) to ensure an adequate seal between the packer glands and within the borehole. Following the inflation of the packers, the water column in the test interval was monitored within the drill rods until static or near static conditions were observed over periods of 5 to 30 minutes. The drill rods were then filled with water and the falling head test was initiated. The water level and elapsed time was then measured using a DT-Diver Water Level Logger until the water level returned to its static level or until one hour had elapsed. In some cases, recovery of the water level to static was not achievable due to inferred low hydraulic conductivity. Manual water level measurements were also recorded during each test.

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The packer test data sets for all falling head tests were analyzed by the Bouwer-Rice method using the AQTESOLV© software program. The use of the Bouwer-Rice analytical solution for the determination of hydraulic conductivity of fractured rocks is deemed appropriate based on the scale of the Southwest Quarry and proposed landfill, which makes it impractical to consider individual flow paths within the bedrock. The net effect of the fractures, in terms of their ability to conduct water under the influence of a hydraulic gradient, must be considered as a bulk hydraulic conductivity. In this study, the geometric mean of analyzed hydraulic conductivity values is implemented for further use. During this process, minor analytical errors in the analysis of the data are not significant.

Results of the packer test data are summarized in Appendix I Table I-I. A scatter plot of hydraulic conductivity test results is provided as Figure 8.5.

8.2.4 Groundwater Level Monitoring

Following the installation of each monitoring well, well development was completed in general accordance with Golder's Standard Operating Procedure No. 5: Monitoring Well Development. Each monitoring well was developed to remove fine particles from the filter pack and to remove any fluids introduced to the monitoring well during drilling and to ensure fresh formation water has entered the well prior to groundwater sample collection.

Starting February 26, 2018, Golder initiated quarterly groundwater monitoring involving groundwater level collection in each of the newly installed monitoring wells for a period of 12 months. Water levels in each well were measured using an electronic water level meter. The water level meter was appropriately cleaned using a liquid

Alconox™ and distilled water rinse to prevent cross contamination between monitored locations. Groundwater elevation data are provided in Table I.

Inferred groundwater piezometric surfaces are provided on Figures 8.6 through 8.10.

8.2.5 Groundwater Quality Sampling

Prior to sampling, water levels in each well were measured using an electronic water level meter. The water level meter was appropriately cleaned using a liquid Alconox™ and distilled water rinse to prevent cross contamination between monitored locations. Monitoring wells were purged of either a volume of water equivalent to three standing well volumes using dedicated inertial lift pumps installed in each well or until field parameters (temperature, pH, specific conductivity, dissolved oxygen, and oxidation-reduction potential) were stabilized using a low-flow, minimum drawdown bladder pump or peristaltic pump. Monitoring well MW17-3D was purged until dry using a bailer and did not recover (insufficient volume for sampling) and therefore was not sampled.

The samples collected for metals, mercury and chromium VI analyses were field filtered using a disposable in-line 0.45-micron filter attached directly to the inertial lift pumps assemblage. Samples were stored on ice and delivered by Golder under chain-of-custody to the Maxxam Analytics Inc. (Maxxam) depot in London, Ontario.

Groundwater quality results are provided in Table II, with laboratory Certificates of Analyses provided in Appendix J.

8.2.6 Door to Door Water Well Survey and Monitoring

Golder queried the MECP water well information system for data for all wells located within about 1 km of the proposed landfill. Data for 183 wells was retrieved and a summary of the MECP query is provided in on Table G-I in Appendix G and discussed in Section 8.1.2.1. Golder attempted to contact 62 residences as part of the water well survey.

As of April 2019, a total of seven residences opted to be included in the domestic well monitoring initiative. On November 19, 2018, Golder collected a groundwater sample from two residences located on Beachville Road. On December 7, 2018, Golder collected a groundwater sample from two residences located on Beachville Road, Ingersoll, Ontario. On January 29, 2019, Golder collected a groundwater sample from three residences located on Beachville Road. A water level was also measured in the well of two residences on Beachville Road.

The water well location plan including door to door surveyed wells is provided as Figure 8.3. Summarized results of the water well survey and ongoing monitoring are provided in Appendix G.

9.0 ENVIRONMENT POTENTIALLY AFFECTED BY THE UNDERTAKING

Section 6.1(2)(c)(i) of the Act requires a “*description of the environment that will be affected or might reasonably be expected to be affected, directly or indirectly*”. Section 8.2 of the ToR describes the methodology by which the environment potentially affected by the proposed landfill is to be developed, notably including both the existing environment as well as the environment that would be expected to exist in the future without the proposed undertaking (i.e., the environmental baseline conditions, or the “*do nothing*” alternative).

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9.1 Baseline Assumptions

9.1.1 Land Use Forecast

A common set of assumptions were provided by MHBC Planning on behalf of Walker regarding the forecast land uses in the area, so that this study could reflect any reasonably foreseeable changes in the uses of the land on and around the proposed landfill site (including the expected ongoing operation of the quarries and lime plants in the vicinity of the site). These assumptions are detailed in Walker's *Environmental Assessment Report*, while a brief summary of the aspects relevant to this study follows.

9.1.2 Climate Change Forecast

Another set of common assumptions that were established for the purpose of this EA is the potential for climate change, so that these could be considered in the individual studies of the potential effects of the proposed landfill. These assumptions are detailed in Walker's *Environmental Assessment Report* and basically adopt the guidance in the Ontario Ministry of Natural Resources and Forestry's *Climate change projections for Ontario: An updated synthesis for policymakers and planners.*

9.2 Environmental Baseline Conditions

9.2.1 Existing Conditions

9.2.1.1 Drilling Results

The stratigraphic sequence encountered during the drilling program included the Zorra (Tavistock) Till, interbedded with discontinuous sand lenses, the Lucas Formation, the Amherstburg Formation and the Bois Blanc Formation. Details of the stratigraphic sequence and general slope of the rock strata extending down to the Bois Blanc Formation is shown on the conceptual hydrogeological model presented on Figure 9.1.

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Overburden

In general, the subsurface soil conditions encountered at borehole locations BH17-1 through BH17-3 consisted of surficial dark brown topsoil underlain by extensive deposits of sand to clay till with discontinuous layers of sand, silty sand, sandy silt, silt, clay, sand and gravel to the bedrock surface. The subsurface conditions encountered at borehole locations BH17-5 and BH17-6 consisted of dark brown topsoil underlain by discontinuous layers of sand, silty sand, sandy silt, clay, sand and gravel to the bedrock surface. The overburden deposits ranged in thickness between about 6.7 and 20.6 m. No overburden was encountered at borehole location BH17-4 where it has been stripped away as part of quarrying.

The detailed overburden stratigraphy is shown on the Record of Borehole sheets in Appendix F. Grain size distribution curves for representative overburden samples are provided in Appendix F.

Lucas Formation

The Lucas Formation was the uppermost stratigraphic unit encountered at each borehole location during bedrock coring, with BH17-4 being the singular exception. The Lucas Formation generally consisted of a fresh to slightly weathered, fine to medium grained, thin to medium bedded, medium grey to brown limestone, with argillaceous zones, shale and nodular horizons and stylolites. Fossil content varied, but consisted of recrystallized, millimetre-scale fossil debris and larger remnant fossils, including corals and stromatoporoids.

As shown on the Record of Borehole sheets in Appendix F, the Lucas Formation was subdivided into stratigraphic units based on bedding, fossil content and colour. The upper and lower contacts between subdivisions were gradational and should be considered approximate.

Based on the observations of the bedrock core and for the purposed of this report, the "Shallow Weathered Zone" of the Lucas Formation is comprised of the upper 3 m of bedrock.

The Lucas Formation was encountered at depths ranging from about 6.7 to 20.6 metres below ground surface (m bgs), which corresponded to elevations of 263.8 to 269.6 m amsl.

The contact between the Lucas Formation and the underlying Amherstburg Formation was generally marked with the appearance of irregular clasts of chert and occurred at a depth ranging between about 39.4 and 54.1 m bgs, corresponding to elevations ranging between 231.1 and 236.1 m amsl. The thickness of the Lucas Formation encountered in the boreholes ranged between about 32.7 and 33.5m.

Borehole locations BH17-3 and BH17-6 were terminated within the Lucas Formation at depths of about 52.2 and 33.0 m bgs, respectively, corresponding to elevations of 227.6 and 241.8 m amsl, respectively.

Amherstburg Formation

The Amherstburg Formation was the lowermost stratigraphic unit encountered at borehole locations BH17-1, BH17-2 and BH17-5 during bedrock coring and the uppermost stratigraphic unit encountered at borehole location BH17-4. The Amherstburg Formation consisted of medium brown to medium grey, microcrystalline to fine crystalline, thin to medium bedded, fossiliferous limestone. The formation was interbedded with medium brown to medium grey limestone and nodular limestone with coral fragments and chert. The fossil content within the limestone varied from abundant millimetre-scale bioclastic debris to recrystallized remnant fossils up to 0.2 m in thickness, including stromatoporoids and corals.

The Amherstburg Formation was inferred to occur at a depth ranging between about 39.4 and 54.1 m bgs, corresponding to elevations ranging between 231.1 and 236.1 m amsl, with the exception at borehole location BH17-4. Borehole location BH17-4 was located within the base of the Southwest Quarry and therefore the Amherstburg Formation was encountered at the ground surface, corresponding to an elevation of 241.3 m amsl.

The boreholes fully penetrated or were terminated within the Amherstburg Formation at depths ranging between about 16.5 and 62.1 m bgs, corresponding to elevations ranging between 224.8 and 228.1 m amsl.

Bois Blanc Formation

The Bois Blanc Formation was the lowermost stratigraphic unit encountered at borehole location BH17-4 during bedrock coring. The Bois Blanc Formation consisted of fresh, fine to medium grained, thin to medium bedded, brown to grey, bioclastic and bioturbated limestone, with interbedded argillaceous limestone and shale, with altered and irregular blue-grey chert horizons and nodules.

The Bois Blanc Formation was inferred to occur at a depth of about 16.5 m bgs at borehole location BH17-4, corresponding to an elevation of 224.8 m amsl. The borehole was terminated within the Bois Blanc at a depth of about 22.4 m bgs, corresponding to an elevation of 218.9 m amsl.

9.2.1.2 Summary of Borehole Geophysical Characteristics

Six boreholes were logged with Natural Gamma, Apparent Conductivity, and Spinner Flowmeter probes. The results of the logging are presented in detail (1:20) and summary (1:200) scale plots in Appendix H.

The apparent conductivity response varied from about 10 to 25 millisiemens per metre (mS/m), with higher values in response to proximity of the metal well casing. The natural gamma response varied from 0 to 100 counts per

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second (cps), with typical plateaus being between 25 and 30 cps. The flowmeter response showed flow values between 0 and ±7 litres per minute.

Table 6 shows a breakdown of the ambient flow regimes for each borehole, according to the spinner flowmeter, with approximate depths and rates for the sources and/or sinks of flow.

Table 6: Flowmeter Testing Results

Borehole	Depth (m bgs)	Giving Flow (L/min)	Taking Flow (L/min)
BH17-1A	24.8	3.0	-
	46.6	-	3.0
BH17-2A	21.8	1.0	
	26.2	1.0	-
	46.5	-	2.0
BH17-3A	21.2	2.2	-
	25.2	-	0.3
	29.2	-	0.4
	46.9	-	1.5
BH17-4A	2.2	-	5.0
	14.0	-	2.0
	20.0	6.5	-
	22.0	0.5	-
BH17-5A	22.6	1.0	-
	28.2	1.0	-
	31.4	-	2.5
	33.6	0.5	-
BH17-6A	27.4	1.5	-
	28.4	0.5	-
	30.6	-	1.0
	31.6	-	1.0

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9.2.1.3 *Summary of Hydraulic Conductivity Characteristics*

A total of 36 falling head and 28 rising head single well response tests were conducted in monitoring wells installed within the overburden, shallow weathered zone, and the Lucas Formation.

No single well response (slug) tests were completed in the A monitoring wells as packer tests were previously performed at the same screened intervals. Also, no single well response tests were completed at MW17-4 due to the artesian conditions that exist at this location. The results of all single well response tests are presented in Table I-II in Appendix I.

The results of the 16 single well response tests completed within the overburden wells returned an average hydraulic conductivity value ranging from 2.7 x 10^{-6} metres per second (m/s) at monitoring well MW17-1D to 2.2 x 10^{-4} m/s at monitoring well MW17-3E. All but one overburden screen targeted zones of higher permeability material; as such, these results are more reflective of granular seams within the till rather than the till itself.

The results of the 48 single well response tests completed within the Lucas Formation, including the shallow weathered zone, returned a range of hydraulic conductivities. A total of 19 tests were completed within the shallow weathered zone wells and returned an average hydraulic conductivity value ranging from 2.2 x 10^{-5} m/s at monitoring well MW17-2C to 2.6 x 10^{-5} at monitoring well MW17-3C. The remaining 29 tests were completed within the Lucas Formation and returned an average hydraulic conductivity value ranging from 2.8 x 10^{-6} at monitoring well MW17-1B to 1.5 x 10^{-4} m/s at monitoring well MW17-5C.

A total of 50 packer tests were completed within borehole locations MW17-1A through MW17-6A. As mentioned previously, the packer testing was conducted in set intervals from the approximate top of rock to the bottom of the borehole. The results of all the tests are presented in Table I-I and the summary of each test including a plot is compiled in Appendix I. The results of the tests are also presented on the record of borehole logs in Appendix F.

The individual packer test results are plotted on Figure 8.5 which indicates the overall range of hydraulic conductivity with elevation. Figure 8.5 indicates that the hydraulic conductivity of the rock sequence varies between 2.0 x 10^{-9} m/s and 4.0 x 10^{-4} m/s. The test results characterize the hydraulic conductivity of the individual formations and suggest that wide variation in hydraulic conductivity may occur within a given unit both laterally and vertically.

Examination of the exposed quarry faces, core logging and packer testing results indicate that the hydraulic conductivity of the bedrock is primarily related to open, near-horizontal bedding partings within the rock. Therefore, the upper range of hydraulic conductivity values determined during packer testing are considered to primarily reflect horizontal permeability along the open bedding partings. The vertical permeability of the intact beds of rock separating the open bedding partings is anticipated to be much lower.

Due to the observed static water levels within the open boreholes during packer testing, the majority of the packer test intervals (40 tests) were completed within the Lucas Formation, including the shallow weathered zone. At borehole BH17-5A and BH17-6A, the static water levels were below the shallow weathered zone and therefore no packer tests were completed in that zone. Eight packer test intervals were completed within the Amherstburg Formation at boreholes BH17-1A, BH17-2A, BH17-4A and BH17-5A. Two packer test intervals were completed within the Bois Blanc Formation at borehole BH17-4A.

The results of the 40 packer test intervals that fall within the Lucas Formation, including the shallow weathered zone returned a wide range of results from 4.0 x 10^{-4} m/s to 2.0 x 10^{-9} m/s.

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Due to the length of the packer interval, two tests at boreholes BH17-1A and BH17-2A straddled the shallow weathered zone and the Lucas Formation. As a unit, the shallow weathered zone is about 3 m in thickness. The 31 packer tests completed completely within Lucas Formation returned a range of results from 4.0 x 10^{-4} m/s to 2.0 x 10^{-9} m/s whereas the nine packer tests completed completely within the shallow weathered zone returned a range of results from 5.1 x 10^{-5} m/s to 9.1 x 10^{-7} m/s.

Eight packer tests were completed within the Amherstburg Formation. Due to the length of the packer interval, two tests at borehole BH17-2A and BH17-5A straddled the Lucas formation and the Amherstburg Formation. The results from the eight tests completed in the Amherstburg Formation ranged from 1.4 x 10^{-4} m/s to 9.8 x 10^{-9} m/s.

Two packer tests were completed within the Bois Blanc Formation. The results from the tests completed in the Bois Blanc Formation ranged from 3.9 x 10^{-4} m/s to 2.4 x 10^{-8} m/s.

9.2.1.4 Groundwater Flow

Quarterly groundwater level monitoring was initiated in February 2018 and included all 20 monitoring wells identified in section 8.2.1. During each groundwater monitoring event, the static water level in each of the monitoring wells was measured using a commercially available electronic water level meter, with the exception of monitoring location MW17-4. At monitoring location MW17-4, a PVC extension or pressure gauge was used to calculate the water level for the artesian flowing wells. The groundwater level measurements were referenced to top of casing elevations, as surveyed by Golder in March 2018.

On March 23 and April 2, 2018, pressure transducers equipped with dataloggers were installed in monitoring wells MW17-1A through MW17-6A, with the exception of MW17-4A (flowing artesian). The dataloggers were configured to record water level and temperature at 1-hour intervals and the data was downloaded during the third and fourth sampling events. The transducer readings were compensated for changes in atmospheric pressure, using data collected by a barometric pressure transducer set up at the Site for the duration of the monitoring period. During the compensation process, level offsets using the corresponding manual water level measurements collected at the time of the download were applied to these data to convert the recorded water levels to geodetic elevations. A hydrograph of the corrected water levels is provided on Figure 9.2. The manually measured groundwater elevations are also included on Figures 9.2 and summarized in Table I.

Overburden

The overburden groundwater piezometric surface is presented on Figure 8.6 based on the groundwater levels collected on August 21, 2018.

Over the course of the monitoring period, the groundwater elevations in the overburden monitoring wells (MW17-1D, MW17-2D, through MW17-3D and MW17-3E) have varied between 1.0 and 1.7 m. The measured groundwater elevations within the overburden have ranged from a maximum of 289.6 m amsl at MW17-1D to a minimum of 270.0 m amsl at MW17-3D. In general, the trends in water level elevations in each monitoring well completed in the overburden were similar over the monitoring period, with higher water elevations measured in spring and lower elevations measured during the fall.

Based on Figure 8.6, the overburden groundwater west of the Southwest Quarry was inferred to flow towards the northeast.

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Lucas Formation

The Lucas Formation wells (MW17-1B, MW17-1C, MW17-2B, MW17-2C, MW17-3A, MW17-3B, MW17-3C, MW17-5B, MW17-5C, MW17-6A and MW17-6B) were either completely installed within the Lucas Formation or mostly installed within the Lucas Formation and partially within the overlying overburden or underlying Amherstburg Formation. Three of the twelve monitoring wells within the Lucas Formation (MW17-1C, MW17-2C and MW17-3C) were installed within the shallow weathered zone of the Lucas Formation. The inferred piezometric surfaces for the shallow weathered zone (upper Lucas) and the underlying Lucas Formation, (hereafter, the "Lucas Formation" which excludes the shallow weathered zone) are presented on Figures 8.7 and 8.9, based on the groundwater levels collected on August 21, 2018.

The groundwater levels in the shallow weathered zone were observed to vary between 0.8 and 1.1 m corresponding to a maximum of 287.6 m amsl at MW17-1C and a minimum of 261.1 m amsl at MW17-3C. The groundwater levels within the Lucas Formation wells were observed to vary between 1.1 and 1.8 m corresponding to a maximum of 254.8 m amsl at MW17-1B to a minimum of 245.6 m amsl at MW17-2B. In general, as seen on Figure 8.7, the groundwater levels in the shallow weathered zone indicate radial flow towards the Southwest Quarry in response to ongoing dewatering activities while groundwater further afield from the quarry appears to flow towards the Thames River (southwest). Additional water level data acquired from the annual Permit to Take Water (PTTW or "Permit") monitoring ongoing at the Southwest Quarry are shown on Figure 8.8 to visualize the radial flow towards the Southwest Quarry.

The wells included in Figure 8.8 are for visual representation only as the wells acquired from the PTTW monitoring are believed to be mostly open hole bedrock wells with no depth or well construction details available. The generated piezometric surface does not account for the hydraulic effects of the quarry wall, instead it assumes that the drawdown cone extends radially outwards from the quarry floor, which is at an elevation of about 230 m amsl. Based on Figure 8.9, the groundwater levels within monitoring wells screened within the Lucas Formation, underlying the shallow weathered zone, indicate radial flow towards the Southwest Quarry in response to the ongoing dewatering activities.

A hydrograph of the measured water levels for the Lucas Formation monitoring wells are included on Figure 9.2. The manually measured groundwater elevations are summarized in Table I. In general, the water levels measured in the shallow weathered zone were generally consistent with the trend observed in the overburden monitoring wells.

Amherstburg Formation

The Amherstburg Formation groundwater wells (MW17-1A, MW17-2A, MW17-4B and MW-5A) are either completely installed within the Amherstburg Formation or mostly within the formation and partially within the overlying Lucas Formation. The inferred piezometric surface for the Amherstburg Formation is presented on Figure 8.10 based on the groundwater levels collected on August 21, 2018.

Over the course of the monitoring period, the groundwater levels in the Amherstburg Formation were observed to generally vary between 0.5 and 2.3 m. The measured groundwater elevations within the Amherstburg Formation at the site have ranged from a minimum of 238.2 m amsl at MW17-2A to a maximum of 247.6 m amsl at MW17-5A.

Based on Figure 8.10, the groundwater levels within the Amherstburg Formation indicate radial flow towards the Southwest Quarry as a result of ongoing dewatering activities.

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According to GHD (2016) the groundwater flow direction within the bedrock north of the Thames River occurs in a southeasterly direction while the flow direction south of the Thames River occurs in a northwest direction. These well locations span a much larger area and may not be influenced by the ongoing dewatering activities.

A hydrograph of the measured water levels for the Amherstburg Formation monitoring wells are included on Figure 9.2. The manually measured groundwater elevations are summarized in Table I.

Bois Blanc Formation

The Bois Blanc Formation groundwater well (MW17-4A) was completely installed within the Bois Blanc Formation. Over the course of the monitoring period, the groundwater elevation within the Bois Blanc Formation at monitoring well MW17-4A has ranged from 244.5 to 245.4 m amsl.

9.2.1.5 Vertical Groundwater Gradients

Based on measured groundwater levels, vertical hydraulic gradients were calculated between successive monitoring wells at each location for each monitoring event. Table 7 provides a summary of vertical groundwater gradients and shows the inferred trend over the period of record.

In general, there was a strong downward vertical gradient in the Groundwater Site Vicinity, which was relatively stable over the period of record, with the following exceptions:

- An upward vertical hydraulic gradient was observed at monitoring location 4 (i.e. monitoring wells MW17-4A and MW17-4B);
- A slight increase in gradient magnitude was observed between MW17-1B and MW17-1C for the period of record;
- A slight decrease was observed between MW17-1C and MW17-1D for the period of record;
- An increase was observed between MW17-3B and MW17-3C for the period of record, with a slight decrease in May 2018;
- A decrease was observed between MW17-3D and MW17-3E from February to May 2018, with an increase in November 2018;
- An increase was observed between MW17-5A and MW17-5B from February to May 2018 and has since stabilized; and,
- A decrease was observed between MW17-5B and MW17-5C for the period of record, with a slight increase in November 2018.

The results show a strong downward hydraulic gradient (about 0.9 to 2.1) between the shallow weathered zone of the Lucas Formation and the underlying Lucas Formation at the locations of well nests MW17-1, MW17-2 and MW17-3. In addition, a strong downward hydraulic gradient (about 0.4 to 1.0) between the Lucas Formation and the underlying Amherstburg Formation at MW17-1 (MW17-1A and MW17-1B) and MW17-2 (MW17-2A and MW17-2B).

Furthermore, the results indicate a stable upward hydraulic gradient (about 0.5 to 0.6) between the Bois Blanc Formation and the overlying Amherstburg Formation at MW17-4. Monitoring wells MW17-4A and MW17-4B are

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located within the base of the Southwest Quarry indicating that groundwater levels and gradient are strongly influenced by dewatering activities on-site.

Table 7: Summary of Vertical Groundwater Gradients

Monitoring Location	Monitoring Wells	Vertical Gradient (m/m)				Trend
		26-Feb-18	22-May-18	21-Aug-18	28-Nov-18	
1	MW17-1A & MW17-1B	0.46	0.39	0.45	0.46	●
	MW17-1B & MW17-1C	2.00	2.06	2.04	2.09	▲
	MW17-1C & MW17-1D	0.14	0.15	0.13	0.08	▼
2	MW17-2A & MW17-2B	1.01	1.04	0.98	0.98	●
	MW17-2B & MW17-2C	1.08	1.04	1.07	1.11	●
	MW17-2C & MW17-2D	0.61	0.62	0.59	0.59	●
3	MW17-3A & MW17-3B	0.04	0.04	0.04	0.04	●
	MW17-3B & MW17-3C	0.98	0.93	1.01	1.06	▲
	MW17-3C & MW17-3D	0.42	0.45	0.50	0.43	●
	MW17-3D & MW17-3E	1.33	1.23	0.98	1.25	▼
4	MW17-4A & MW17-4B	-0.50	-0.59	-0.49	--	●
5	MW17-5A & MW17-5B	0.17	0.29	0.28	0.26	▲
	MW17-5B & MW17-5C	0.09	0.06	0.04	0.07	▼
6	MW17-6A & MW17-6B	0.04	0.05	0.06	0.06	●

Notes:

1) ”m/m” represents metre per metre.
2) ”- -” no groundwater elevations were measured during sampling event.
3) Positive values represent an upward gradient.
4) Negative values represent a downward gradient.
5) ● represent stable trend with time.
6) ▲ represent increasing trend with time.
7) ▼ represent decreasing trend with time.

9.2.1.6 Groundwater Quality

The groundwater quality within the Groundwater Site Vicinity is presented and discussed in terms of the following water bearing geological formations: Overburden, Lucas Formation, Amherstburg Formation and the Bois Blanc Formation.

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A quarterly groundwater sampling program was initiated in February 2018 and included all 20 monitoring wells identified in section 8.2.1, with the exception of MW17-3D, which, as noted above, did not yield sufficient water for sampling. With the exception of November 2018, Golder collected a total of 19 groundwater samples during each sampling event and the samples were analyzed for a suite of water quality indicator parameters, including major anions and cations, dissolved organic carbon (DOC), dissolved metals, and volatile organics. In November 2018, groundwater in the monitoring wells at MW17-4 was frozen within the casing and therefore no samples were collected. A summary of the groundwater quality results is provided below and the data is presented in Table II. A copy of the laboratory Certificate of Analyses are provided in Appendix J.

Overburden

A total of 12 groundwater samples were collected from monitoring wells MW17-1D, MW17-2D and MW17-3E to characterize the groundwater quality within the overburden.

A Piper plot diagram is provided on Figure 9.3 which shows the concentrations of cations and anions in 12 groundwater samples. The plot suggests that a calcium-bicarbonate groundwater type is present in the overburden within the western portion of the Groundwater Site Vicinity. There was little variation between anion and cation concentrations observed among overburden monitoring wells.

A Durov plot diagram is provided on Figure 9.4 which shows the concentrations of cations and anions as well as total dissolved solids (TDS) and pH by sample. The plot suggests a recharge water type which may reflect an ion exchange between dissolved calcium and bicarbonate. Furthermore, groundwater within the overburden has a pH value between 7.8 and 8.3 with a minimum TDS concentration of 260 mg/L at monitoring well MW17-1D and a maximum TDS concentration of 590 mg/L at monitoring well MW17-3E.

A Schoeller plot diagram is provided on Figure 9.5 which shows the relative concentrations of anions and cations by sample. Noteworthy findings are provided below:

- The concentrations of dissolved potassium in groundwater collected from monitoring well MW17-3E (11,000-29,000 µg/L) were elevated compared to the groundwater concentrations measured from monitoring wells MW17-1D (980-1,100 µg/L) and MW17-2D (810-1,100 µg/L).
- The concentrations of nitrate in groundwater collected from monitoring well MW17-2D (9.46-11.30 mg/L) were elevated compared to the groundwater concentrations measured from MW17-1D (<0.10-0.12 mg/L) and MW17-3E (1.17-4.09 mg/L).
- The concentrations of dissolved calcium in groundwater collected from monitoring well MW17-1D (36,000-39,000 µg/L) were lower than the groundwater concentrations measured from MW17-2D (75,000-97,000 µg/L) and MW17-3E (71,000-13,000 µg/L).
- The concentrations of dissolved sodium in groundwater collected from monitoring well MW17-2D (2,000-2,300 µg/L) were lower than the groundwater concentrations measured from MW17-1D (17,000 µg/L) and MW17-3E (8,100-17,000 µg/L).
- The concentrations of sulphate in groundwater collected from monitoring well MW17-2D (11-13 µg/L) were lower than the groundwater concentrations measured from MW17-1D (37-42 µg/L) and MW17-3E (29-81 µg/L).

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The average groundwater concentration of dissolved chloride measured from the overburden wells was 17 mg/L with a minimum and maximum concentration of 7.7 and 23.0 mg/L, at monitoring well MW17-3E. The dissolved chloride concentrations are summarized on Table III.

In May, August and November 2018, toluene was detected above the laboratory reportable detection limit (”RDL”) in groundwater collected from all three overburden wells at concentrations between about 0.25 to 0.80 µg/L.

In August and November 2018, p+m (and total) xylene was detected in groundwater collected from monitoring well MW17-3E at concentrations of 0.23 and 0.24 µg/L, respectively.

Toluene and xylene detections at low levels such as those listed above are inferred to be naturally-occurring or biogenic (Armstrong & Carter, 2010, Slaine & Barker, 1991).

Shallow Weathered Zone

The shallow weathered zone of the Lucas Formation is a local aquifer in this area due to its higher quality and yield when compared to underlying formations.

A total of 12 groundwater samples were collected from three monitoring wells MW17-1C, MW17-2C and MW17-3C, to characterize the groundwater quality within the shallow weathered zone.

A Piper plot diagram is provided on Figure 9.6 and shows the concentrations of cations and anions in 12 groundwater samples. Similar to the overburden monitoring wells, the plot suggests that a calcium-bicarbonate groundwater type is present in the shallow weathered zone within the western portion of the Site Vicinity. There was little variation between anion and cation concentrations observed from all shallow weathered zone wells.

A Durov plot diagram is provided on Figure 9.7 and shows the concentrations of cations and anions as well as TDS and pH by sample. The plot suggests a recharge groundwater type or groundwater originating from limestone and dolostone which may reflect an ion exchange between dissolved calcium and bicarbonate. Furthermore, groundwater within the shallow weathered zone had a pH value between 7.9 and 8.3 with a minimum TDS concentration of 210 at MW17-1C and a maximum concentration of 360 at MW17-2C. It is evident from Figures 9.4 and 9.7 that groundwater in the overburden and shallow weathered zone within the Groundwater Site Vicinity have similar chemical signatures, with evidence of groundwater mixing at monitoring well MW17-2C.

A Schoeller plot diagram is provided on Figure 9.8 and shows the relative concentrations of anions and cations by sample. The following noteworthy findings are provided below:

- The concentrations of dissolved calcium, dissolved chloride, sulphate and nitrate in groundwater collected from monitoring well MW17-1C were lower than the groundwater concentrations measured from monitoring wells MW17-2C and MW17-3C.
- The concentrations of sodium in samples collected from monitoring well MW17-2C (2,700-3,500 µg/L) were lower than the groundwater concentrations measured in samples from monitoring wells MW17-1C (15,000-18,000 µg/L) and MW17-3C (10,000-12,000 µg/L).
- The concentrations of sulphate in groundwater collected from monitoring well MW17-3C (45-47 µg/L) were elevated compared to groundwater concentrations measured from monitoring wells MW17-1C (9.6-12.0 µg/L) and MW17-2C (14-20 µg/L).

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- The concentrations of nitrate in groundwater collected from monitoring well MW17-2C (8.23-9.92 µg/L) were elevated compared to the groundwater concentrations measured from monitoring wells MW17-1C (<0.10 µg/L) and MW17-3C (0.40-0.56 µg/L).

The average groundwater concentration of dissolved chloride measured from the shallow weathered zone wells was 9.9 mg/L with a minimum concentration below the laboratory RDL at monitoring well MW17-1C and a maximum concentration of 17 mg/L at monitoring well MW17-3C. The dissolved chloride concentrations are summarized on Table III.

In August 2018, toluene was detected in groundwater collected from monitoring well MW17-3C, in the western portion of the Groundwater Site Vicinity, at a concentration of 2.4 µg/L.

Toluene detections at low levels such as those listed above are inferred to be naturally-occurring or biogenic (Armstrong & Carter, 2010, Slaine & Barker, 1991).

Lucas Formation

A total of 32 groundwater samples were collected from monitoring wells MW17-1B, MW17-2B, MW17-3A, MW17-3B, MW17-5B, MW17-5C, MW17-6A and MW17-6B to characterize the groundwater quality within Lucas Formation.

A Piper plot diagram is provided on Figure 9.9 and shows the concentrations cations and anions in 32 groundwater samples. The plot suggests that a calcium-bicarbonate to calcium-sulphate groundwater type is present in the lower Lucas Formation, with the exception at monitoring MW17-1B which strongly suggests a calcium-bicarbonate groundwater type. There was moderate to high variation between anion and cation concentrations observed in groundwater from the Lucas Formation wells, however, monitoring wells MW17-3A, MW17-3B, and MW17-5B show similar chemical signatures. In addition, seasonal variation between cation and anion concentrations was observed in groundwater collected from monitoring wells MW17-5C, MW17-6A and MW17-6B, located south of the proposed landfill location.

A Durov plot diagram is provided on Figure 9.10 and shows the concentrations of cations and anions as well as TDS and pH by sample. The plot suggests groundwater collected from monitoring wells MW17-2B, MW17-3A, MW17-5B and MW17-6A reflect simple dissolution or mixing which is represented by no dominant anions or cations. Whereas, groundwater collected from monitoring wells MW17-1B, MW17-3B, MW17-5C and MW17-6B have chemical signatures similar to the shallow weathered zone, which is dominated by dissolved calcium, dissolved magnesium and bicarbonate. These monitoring wells are screened at higher elevations, and therefore may be influenced from groundwater within the shallow weathered zone. Furthermore, groundwater collected from the Lucas Formation, have pH values between 7.8 and 8.2 with a minimum TDS concentration of 190 mg/L at monitoring well MW17-1A and a maximum TDS concentration of 1,100 mg/L at monitoring well MW17-6A.

A Schoeller plot diagram is provided on Figure 9.11 that shows the relative concentrations of anions and cations by sample. The following noteworthy findings are provided below:

- The concentration of dissolved sodium and dissolved chloride in groundwater collected from monitoring well MW17-6A, during the August 2018 sampling event, were elevated compared to the variation observed for the period of record at all other Lucas Formation wells.

- The concentration of dissolved chloride and sulphate in groundwater collected from monitoring well MW17-1B were lower than the concentrations measured from all other Lucas Formation wells.

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The average groundwater concentration of dissolved chloride measured from the Lucas Formation wells was 56 mg/L with a minimum concentration below the laboratory RDL at monitoring well MW17-1B and a maximum concentration of 410 mg/L at monitoring well MW17-6A. The maximum concentration was considered anomalous, as the measured dissolved chloride concentration from groundwater collected from the Lucas Formation generally ranged from <1.0 to 110 mg/L. The dissolved chloride concentrations are summarized on Table III.

During the groundwater sampling program, toluene was detected in groundwater collected from monitoring wells MW17-1B, MW17-2B, MW17-3B and MW17-5B at concentrations between about 0.25 to 1.8 µg/L. No additional volatile organic parameters were detected above the laboratory RDL within the Lucas Formation.

Toluene detections at low levels such as those listed above are inferred to be naturally-occurring or biogenic (Armstrong & Carter, 2010, Slaine & Barker, 1991).

Amherstburg Formation

A total of 15 groundwater samples were collected from monitoring wells MW17-1A, MW-17-2A, MW17-4B and MW17-5A to characterize the groundwater quality within the Amherstburg Formation.

A Piper plot diagram is provided on Figure 9.12 and shows the concentrations cations and anions in 15 groundwater samples. The plot suggests that a calcium-bicarbonate to calcium-sulphate groundwater type is present in the Amherstburg Formation within the Groundwater Site Vicinity. There was little variation in cation concentrations in groundwater collected from the Amherstburg Formation wells, however, moderate variation in anion concentrations. Furthermore, there was seasonal variation in anion concentrations between sampling events at monitoring well MW17-1A.

A Durov plot diagram is provided on Figure 9.13 and shows the concentrations of cations and anions as well as TDS and pH by sample. Similar to the Lucas Formation, the plot suggests groundwater collected from monitoring wells MW17-1A, MW17-2A, MW17-4B and MW17-5A reflect simple dissolution or mixing (no dominant anions and cations) with the exception of two samples collected from MW17-1A which were dominated by bicarbonate. Furthermore, groundwater collected from the Amherstburg Formation has a pH value between 7.9 and 8.3 with a minimum TDS concentration of 250 mg/L at monitoring well MW17-1A and a maximum concentration of 840 mg/L at monitoring well MW17-5A. It is evident from Figures 9.10 and 9.13 that groundwater from the Lucas Formation and the Amherstburg Formation at monitoring wells MW17-1A and MW17-5A have slightly different chemical signatures and that groundwater from the Lucas Formation is likely mixing with the underlying aquifer.

A Schoeller plot diagram is provided on Figure 9.14 that shows the relative concentrations of anions and cations by sample. The following noteworthy findings are provided below:

- The concentrations of dissolved calcium (32,000-49,000 µg/L) in groundwater collected from monitoring well MW17-1A were lower than the groundwater concentrations measured from monitoring wells MW17-2A (70,000-77,000 µg/L), MW17-4B (81,000-90,000 µg/L) and MW17-5A (74,000-81,000 µg/L).
- The concentrations of dissolved sulphate (34-57 mg/L) in groundwater collected from monitoring well MW17-1A, during the February and May sampling events, were lower than the groundwater concentrations measured throughout the monitoring period from monitoring wells MW17-2A (140-180 mg/L), MW17-4B (130-140 mg/L) and MW17-5A (330-350 mg/L).

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- The concentrations of dissolved magnesium (58,000-65,000 µg/L) in groundwater collected from monitoring well MW17-5A were elevated compared to groundwater concentrations measured from MW17-1A (20,000-36,000 µg/L), MW17-2A (31,000-37,000 µg/L) and MW17-4B (34,000-37,000 µg/L).
- The concentrations of dissolved sodium (91,000-120,000 ug/L) in groundwater collected from monitoring well MW17-5A were elevated compared to groundwater concentrations measured from MW17-1A (22,000-56,000 µg/L), MW17-2A (47,000-49,000 µg/L) and MW17-4B (49,000-57,000 µg/L).

The average groundwater concentration of dissolved chloride measured from the Amherstburg Formation wells was 60 mg/L with a minimum concentration of 6.6 mg/L at monitoring well MW17-1A and a maximum concentration of 89 mg/L at monitoring well MW17-5A. The dissolved chloride concentrations are summarized on Table III.

In February of 2018, benzene was detected in groundwater collected from monitoring well MW17-2A at a concentration of 0.22 µg/L.

In February/March and May 2018, toluene was detected in groundwater collected from monitoring wells MW17-1A, MW17-2A and MW17-5A at concentrations of 0.20, 0.69, 0.45, 0.35, 0.26 and 0.46 µg/L, respectively.

In May 2018, p+m (and total) xylene was detected in groundwater collected from monitoring well MW17-1A at a concentration of 0.26 µg/L. This detection was considered anomalous as total xylene was only detected above the laboratory RDL once during the period of record for all Amherstburg Formation wells.

Benzene, toluene and xylene detections at low levels such as those listed above are inferred to be naturally-occurring or biogenic (Armstrong & Carter, 2010, Slaine & Barker, 1991).

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Bois Blanc Formation

A total of three groundwater samples were collected from monitoring wells MW17-4A to characterize the groundwater quality within the Bois Blanc Formation. According to Golder (2018), the transition zone between the Bois Blanc and overlying Amherstburg Formation is a principal water bearing unit for industrial and commercial wells.

A Piper plot diagram is provided on Figure 9.15 and shows the concentrations cations and anions in 3 groundwater samples. The plot suggests that a calcium-bicarbonate groundwater type is present in the Bois Blanc Formation at the Site. There was little variation in the cation and anion concentrations observed at monitoring well MW17-4A between each monitoring event.

A Durov plot diagram is provided on Figure 9.16 and shows the concentrations of cations and anions as well as TDS and pH by sample. The plot suggests a recharge groundwater type or groundwater originating from limestone and dolostone which may reflect an ion exchange between dissolved calcium and bicarbonate. Furthermore, groundwater collected from the Bois Blanc Formation had a pH value between 7.9 and 8.1 with a TDS concentration ranging from 470 to 540 mg/L.

A Schoeller plot diagram is provided on Figure 9.17 that shows the relative concentrations of anions and cations by sample. The groundwater concentrations were consistent with the concentrations observed from monitoring well MW17-4B and the overlying Amherstburg Formation.

The average groundwater concentration of dissolved chloride from the Bois Blanc Formation well was 53 mg/L with a minimum concentration of 42 mg/L and a maximum concentration of 59 mg/L. The dissolved chloride concentrations are summarized on Table III.

9.2.1.7 Groundwater Use Survey Results

The results of the survey are summarized in Table G-II. Out of the 62 addresses contacted for the door to door survey, no response was received from 53 residences. Seven residences returned completed surveys and two returned the survey with no information provided. The survey results identified seven active wells. Where reported, the well depths ranged between about 27 and 46 m bgs; however, well depth was not reported for three of the identified active wells. Where possible, the door-to-door survey results have been correlated to the MECP water well records data.

As shown in Table G-II, the reported water use for many of the identified water supply wells was domestic or irrigation. Five surveys indicated that the well water quality was good, one well had colour, taste, odour and sediment issues and one did not specify water quality.

On November 19, December 7, 2018 and January 29, 2019, the first monitoring event occurred for residences who opted to be included in the domestic well monitoring initiative. These results were provided to the residences under separate cover. Five of the wells are believed to be located in the shallow weathered bedrock (of the Lucas formation) and two are believed to be installed into the Lucas formation. The analytical results from the first round of sampling indicate that these seven wells have a similar chemical signature as the monitoring wells included in this assessment.

The results of this first sampling event indicate that most parameters tested were similar or fell within the range of variability over the course of record for the domestic water supply wells compared to the monitoring wells. Five exceptions were noted as follows:

- Shallow weathered bedrock (upper Lucas Formation)
  - Dissolved arsenic concentrations of 8.0 µg/L compared to a maximum of 4.1 µg/L recorded in the monitoring wells
  - Dissolved iron concentrations of 760 µg/L compared to a maximum of 340 µg/L recorded in the monitoring wells
  - Dissolved manganese concentrations of 170 µg/L compared to a maximum of 47 µg/L recorded in the monitoring wells
- Lucas Formation
  - Dissolved copper concentrations of 8.3 µg/L compared to a maximum of 1.7 µg/L recorded in the monitoring wells
  - Dissolved manganese concentrations of 44 µg/L compared to a maximum of 13 µg/L recorded in the monitoring wells

Domestic well owners who consent will be considered to be included in the long-term groundwater monitoring plan for the landfill.

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9.2.1.8 Quarry Dewatering

Permit to Take Water

In order to mine to the depth permitted by the existing quarry licence, dewatering of the quarry is currently carried out under PTTW No. 6132-B6JLRR, which was issued in 2019 by the MECP for the purposes of quarry dewatering and industrial processing. The PTTW lists nine sources for the water taking, as summarized in Table 8, below.

Table 8: Summary of PTTW Sources

Source Name	Purpose	Max. Rate per Minute (litres)	Max. Taken per Day (litres)	Max. Days Taken per Year
Well No. 1	Industrial	5,555	7,000,000	365
Well No. 6	Industrial	5,555	7,000,000	365
Thames River	Industrial	1,736	2,500,000	365
Truck Wash Well 1	Industrial	416	600,000	365
Replacement Truck Wash Well 2	Industrial	400	576,000	365
Pugmill Well	Industrial	200	288,000	365
West Quarry Pond (Former West Quarry)	Dewatering	34,700	49,970,000	60
		10,000	14,400,000	306
East Quarry Pond	Dewatering	40,000	57,600,000	60
		17,000	24,480,000	306
Centre Quarry Pond (Centre Plant)	Dewatering	70,000	100,800,000	120
		30,000	43,200,000	246

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To satisfy the PTTW conditions, groundwater levels are monitored on a quarterly basis in five on-site surface water locations, 10 on-site groundwater locations, 14 off-Site domestic groundwater wells, and one off-site monitoring well. The results of the monitoring are summarized in a biannual report. Relevant documents prepared by GHD (formally Conestoga-Rovers & Associates) were supplied by Carmeuse and GHD for our review and incorporated, as appropriate, into the current assessment.

Water Management

Currently, water that accumulates on the active quarry floor (Southwest Quarry), either through direct precipitation, runoff or groundwater inflow, is directed (primarily via passive gravity flow supplemented with some satellite pumping) to settling ponds located in the Centre Plant area immediately north of the Thames River. Water is then pumped to the Thames River or into the Former West Quarry inferred to be in accordance with Carmeuse

Lime's Certificate of Approval. Groundwater inflow from the exposed bedrock is limited and occurs primarily along two rock faces in the southern and western faces of the Southwest quarry. The current base of the Southwest Quarry varies with an approximate elevation of about 230 m to the north and about 240 m amsl towards the southern sections. The water level in the Southwest Quarry sump is currently maintained at about an elevation of 230 m amsl through active pumping. The MECP issued Amended Environmental Compliance Approval (ECA) No. 5598-9VDRBR to Carmeuse on June 15, 2015. This new ECA allows surface water and groundwater to be diverted from the settling ponds in the Centre Plant area to the Former West Quarry as an occasional alternative to the Thames River.

Carmeuse Lime has not pumped water from the Former West Quarry since April 30, 2011, in order to maintain the water level above the permitted minimum water level elevation of 245 m amsl. However, pumping out of the Former West Quarry is allowed with limitation according to the current permit. Since 2015, some of the discharged water from Centre Plant has been diverted to the Former West Quarry. No other surface water feature is connected upstream or downstream of the Former West Quarry.

Water from the East Quarry is collected in ponds prior to discharge to the Thames River. The kiln at the East Plant is no longer in operation, thus, water for the scrubber is no longer pumped from the Thames River for this purpose. Some water is still required though for the hydrator and pH adjustment. The minimum water level allowed under the current PTTW at the East Quarry is 235 m amsl.

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Sump Discharge

Daily discharge rates from the Former West Quarry, East Quarry and Centre Plant are monitored by Carmeuse and were previously summarized in GHD (2018) for the period of 2007 and 2017.

Table 9: Sump Discharge Rates

Sump Location	Minimum / Maximum	Mean Daily Taking (Litres per day)	Year Recorded
Former West Quarry	Minimum	0	2012-2017
	Maximum	8,846,000	2007
East Quarry	Minimum	4,701,000	2009
	Maximum	12,166,000	2007
Centre Plant	Minimum	18,898,000	2016
	Maximum	34,125,000	2017

9.2.1.9 Conceptual Hydrogeological Model

A conceptual hydrogeological model has been developed based on the field exploration and data analysis (Figure 9.1). The hydrogeological profiles for the site are provided on Figures 9.18 and 9.19. The uppermost bedrock at the site consists of the Lucas formation. The upper 3 m of the Lucas formation is more weathered than the underlying rock and is referred to as the shallow weathered zone. This zone has a higher hydraulic conductivity than the underlying limestone due to the effects of solution weathering. The Lucas formation is underlain by Amherstburg formation limestone. The results of groundwater level monitoring and contouring of the measured groundwater levels has indicated inward groundwater flow to the Southwest Quarry, Locally, groundwater levels are lowered in response to quarry dewatering. Outside of the zone of influence of quarry dewatering, the regional direction of groundwater flow is toward the Thames River.

The bedrock is considered to have a high vertical anisotropy due to the presence of argillaceous shales interbedded with the limestone. These horizons were indicated by the borehole geophysical logging which indicated the presence of more argillaceous to shaley content with an elevated gamma signal compared to limestone.

There are elevated hydraulic conductivity test results in some of the packer test intervals in the general range of elevation from about 230 to 240 m amsl. Inspection of the rock core and viewing of the borehole camera logs has indicated that these do not appear to be related to a single permeable horizon, such as a vuggy zone aquifer due to gypsum dissolution, but rather to isolated fractures. The test results do, however, indicate a general trend of high hydraulic conductivity test results within this elevation range as shown on the scatter plot of packer test results.

There is also an apparent hydraulic connection in the deeper bedrock to the Southwest Quarry sump. This is indicated by the groundwater levels in the shallow and deep bedrock, which are close to the sump level, shown on the hydrogeological profiles. It is not apparent from the borehole logging or the observation of the quarry faces whether this permeable horizon is in the strata above or below the quarry floor. Visual inspection of the quarry faces has not indicated the presence of horizons with high rates of groundwater inflow. This highly conductive zone may be situated below the Southwest Quarry floor.

The hydrogeological cross-sectional profiles and groundwater contours reflect inward flow to the quarry. There is interpreted to be flow from the Former West Quarry to the south toward the quarry sump which is at a lower elevation. There is also interpreted to be some flow from the Thames River toward the flooded Former West Quarry since the Thames River has a higher water level elevation as shown on the conceptual model profiles.

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9.2.1.10 Existing Conditions Baseline Groundwater Model

The Existing Conditions baseline groundwater model was constructed on the basis of the site characterization data and conceptual model (see above) merged with pre-existing regional interpretations (Golder, 2010). A detailed description of the Existing Conditions conceptual model implementation within a numerical framework is provided in Appendix D. A condensed summary is provided below.

Model Domain and Grid

The model domain encapsulates the site and regional surroundings, covering an area of approximately 380 km^2 (Figure D-1). The model domain retains the same extents as the pre-existing “Ingersoll Model” (Golder, 2010) and is delineated based on hydrogeologic boundaries as described further below. Vertically, the model top is constrained by topography and the bottom is bounded by the base of the Bois Blanc Formation (see Figure D-3 and Figure D-4). The model finite difference grid is comprised of 2.4 million cells ranging in size from 10 m x 10 m within the Groundwater Site Vicinity to 100 m x 100 m regionally over 13 numerical layers.

Hydrostratigraphy and Material Properties

Table 10 summarizes the modelled hydrostratigraphy and material properties.

Table 10: Model Hydrostratigraphy and Material Properties

Conceptual Sequence	Unit	Model Layers	Thickness	Hydraulic Conductivity (K)	Recharge Rates
1	Overburden – Aeolian / Alluvial [Coarse-Grained] Deposits	1 – 4	See Figure D-6A	$K_H = 1 \times 10^{-4}$ m/s, $K_V = 1 \times 10^{-8}$ m/s	200 mm/yr to 350 mm/yr
2	Overburden – Till Deposits	1 – 4	See Figure D-6A	$K_H = 1 \times 10^{-7}$ m/s, $K_V = 1 \times 10^{-8}$ m/s	25 mm/yr to 100 mm/yr
3A	Lucas Formation	5 – 8	Site Area = ~30 m Regional = 20 m	Site Area: $K_H = 2 \times 10^{-5}$ m/s, $K_V = 1 \times 10^{-9}$ m/s Regional: $K_H = 1 \times 10^{-4}$ m/s, $K_V = 6 \times 10^{-9}$ m/s	-
3B	Lucas Formation High K Horizon	8 (Site Area Only)	Site Area = 7.5 m	Site Area: $K_H = 5 \times 10^{-4}$ m/s, $K_V = 2.5 \times 10^{-8}$ m/s	-
4	Amherstburg Formation	9 – 11	20 m	$K_H = 3 \times 10^{-9}$ m/s, $K_V = 3 \times 10^{-9}$ m/s	-
5	Bois Blanc Formation	12 – 13	45 m	$K_H = 6 \times 10^{-5}$ m/s, $K_V = 6 \times 10^{-5}$ m/s	-

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Boundary Conditions

Regional boundary conditions (Figure D-9) include a mix of constant head and no flow (inactive cells) designed to facilitate the inferred regional flow pattern of roughly north to south. Major surface water features such as the Thames River are assigned as constant head cells with head elevations consistent with topography. Minor surface water features in the vicinity of the site, such as Patterson-Robins Drain, are assigned as drain cells with head elevations consistent with topography.

The Groundwater Site Vicinity consists of four main boundary condition features (Figure D-9): 1) the active, dewatered Southwest Quarry; 2) the dewatered East Quarry; 3) the dewatered Centre Plant quarry; and 4) the Former West Quarry. The dewatered quarries are modelled using drain cells within their footprint (or volume) with head elevations consistent with the quarry slopes and floor. The Former West Quarry is largely modelled as constant head cells at a water level of 253 m amsl.

The Lafarge Woodstock Quarry, which is located approximately 3 km northwest of the Site, is coarsely approximated in the model using drain cells within its volume with head elevations consistent with the quarry slopes and floor.

Municipal Pumping Wells and Other Major Groundwater Users

The Ingersoll, Beachville and Mount Elgin municipal supply wells are included in the model with pumping rates reflective of 2018 average daily water taking. An additional ten private Permit to Take Water groundwater users are included within the model comprising a total of 15 pumping wells. The majority of the PTTWs lie east of the Thames River with the closest to the active Southwest Quarry located 3.5 km to the southwest. The modelled rates correspond to the permitted maximum daily rate(s) listed in the permit.

Calibration

Calibration involves the iterative adjustment of model inputs to achieve simulated groundwater flow conditions reasonably consistent with measured site-specific Existing Conditions data. Calibration targets include: site groundwater levels; MECP WWIS well water levels; groundwater elevations maps (i.e. matching patterns); and Carmeuse Lime quarry groundwater inflows. Goodness-of-fit for each calibration iteration is assessed via statistical indicators and other quantitative or qualitative means, including: assessing site and global mean residual; mean absolute residual; normalized root mean squared percentage; simulated versus observed head plots; comparison to inferred water level patterns; and comparison to measured quarry inflows.

As the prior Ingersoll Model calibration (Golder, 2010) generally provides for a reasonable set of regional inputs, and site data within the Amherstburg and Bois Blanc Formations is limited, the main focus of the calibration is fine tuning the hydraulic conductivities of the Lucas Formation, particularly within the Groundwater Site Vicinity. The following adjustments are particularly important to obtain a satisfactory calibration:

1) **Vertical Anisotropy**. Relatively large anisotropies in the Lucas Formation bedrock (K_H:K_V = 20,000:1) and overburden coarse grained material (K_H:K_V = 10,000:1) are applied to obtain the large downward gradients observed in the Site well nests. These anisotropies are applied both at the site and regionally to beneficial effect.

2) **Lucas Formation Hydraulic Conductivity.** The upper 22.5 m (Layers 5 – 7) of Lucas Formation is assigned a reduced hydraulic conductivity ($K_H = 2 \times 10^{-5}$ m/s) in the area of the site relative to the prior regional input ($K_H = 1 \times 10^{-4}$ m/s). However, the bottom 7.5 m (Layer 8) of Lucas Formation is assigned a relatively high hydraulic conductivity ($K_H = 5 \times 10^{-4}$ m/s) local to the site. These adjustments are supported by Site hydraulic testing data and are required to approximate quarry inflows and the large vertical gradients observed at Site wells (and in particular to establish a hydraulic connection between the deep A-series wells and the bottom of the quarry via a deep higher permeability horizon).

The calibrated model output shows regional overburden and bedrock flow patterns that compare reasonably well to inferred trends based on measured water levels (Figure D-11 and Figure D-12). Groundwater highs (divides) occur along topographic ridges whereas groundwater lows (discharge areas) occur within valleys and adjacent to drainage features.

A satisfactory calibration to site and MECP WWIS water levels is obtained for goodness-of-fit statistical indicators (Figure D-14). Of particular note, the large downward gradients observed at the site are successfully modelled.

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Lastly, simulated groundwater inflows at the Southwest Quarry and Centre Plant (30,000 m^3/d) and East Quarry (3,200 m^3/d) are within 10% of their target flow rates.

Thus, through the calibration process it is found that the recharge rates, hydraulic conductivities of the geologic units, simulated flow patterns and quarry inflows are in good agreement with available field data. The calibrated Existing Conditions model values are therefore considered to represent reasonable estimates for use in estimating Future Baseline, Operations and Post-Closure conditions.

9.2.2 Future Baseline Groundwater Model

The purpose of the Future Baseline scenario is to establish the hydrogeological conditions upon which the relative effects of Operations and Post-Closure may be assessed. Note that the beginning of Operations is sufficiently far in advance that future changes to hydrogeologic conditions, mainly as a result of surrounding quarry expansion, will make the Existing Conditions calibrated model described above non-applicable for direct comparison purposes. A detailed description of the Future Baseline groundwater modelling is provided in Appendix D. A condensed summary is provided below.

A model depiction of the Future Baseline Scenario inputs is illustrated on Figure D-14. The scenario includes the following components from the Beachville Quarries Operational Plan 2 of 5 and Cross-Sections 5 of 5 (MHBC, 2018):

- Phase A is generally complete with the Site quarry mined and dewatered to a floor elevation of approximately 225 m amsl. The quarry lands immediately east of the Site are mined and dewatered to a floor elevation of approximately 230 m amsl. This dewatering is accomplished using drain cells in a similar manner as described previously.
- The Phase 1W, 2W and 3W lands north of the Site and immediately north of Road 64 and the Phase 2E and 3E lands east of County Road 6 have yet to undergo quarrying and are thus considered unaltered from Existing Conditions.
- The Former West Quarry remains filled with the water level at approximately 253 m amsl; and,
- Regionally, the remainder of the model input remains the same as previously reported.

The Future Baseline is not a *landfill* scenario but is included in future model scenario flow budget comparisons (Table 11) so the reader may comprehend the large change in water taking within the site area from quarry to landfill conditions. During the Future Baseline, quarry dewatering at the site alone is estimated to be 33,000 m^3/d; compare this with the total water taking at the landfill drainage collection which ranges from approximately 430 m^3/d to 685 m^3/d (see section 10.3.3.1 below).

The hydraulic head distributions in the Lucas Formation for the Future Baseline scenario in the vicinity of the site is shown on Figure D-17. The Future Baseline scenario depresses water levels down to less than 240 m amsl in the vicinity of the Site as a result of quarry dewatering. During the landfill scenarios, the local water levels recover to an elevation of +/- 260 m amsl at the site, with the landfill drainage collection system controlling heads at this mark (as described in sections below).

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10.0 EVALUATION OF THE PROPOSED LANDFILL

An evaluation of the potential effects of the landfill on groundwater and surface water quantity and quality was assessed as part of a hydrogeological net effects analysis.

The hydrogeological net effects analysis is focussed on the issue of potential for contamination of water well groundwater supplies and surface water resources as set out in the EA documentation. The net effects analysis also considers the potential impacts related to ongoing quarry development in the context of cumulative effects. The net effects of the following criteria are evaluated as part of this hydrogeological assessment.

- Criterion 1: Explosive hazard due to combustible gas accumulation in confined spaces.
- Criterion 4: Effects due to contact with groundwater or surface water
- Criterion 33: Impact on the availability of groundwater supply to wells
- Criterion 34: Effects of stream baseflow quantity/quality

The net effects of each of these criteria are evaluated in the following.

10.1 Criterion 1: Explosive Hazard Due to Combustible Gas Accumulation in Confined Spaces

10.1.1 Potential Effects

The proposed landfill is located in an area of predominantly industrial land uses with rural residential properties mostly concentrated to the south of the Thames River with the Town of Ingersoll located about 1 km west of the proposed landfill. The results of the soil and groundwater assessments presented above indicate horizons of higher permeability in both the overburden and the underlying bedrock that could, under certain conditions (significant and persistent gas pressure, unsaturated conditions), potentially provide pathways for lateral migration of landfill gas. Based on the information reviewed, no utility corridors occur adjacent to the site that could provide pathways for potential gas migration. Closest receptors include a rural residential property located 200 metres southwest of the southwest corner of the proposed waste footprint and residential properties located south of the Thames River, approximately 600 metres south of the southern limit of the proposed waste footprint, at their closest approach.

The following aspects of the proposed design and layout act to mitigate the risk of combustible gas accumulation in confined or enclosed spaces in the area of the proposed landfill:

- the generic double composite liner system will prevent the lateral movement of gases and contact between gases and underlying groundwater
- the landfill gas collection system would lower or eliminate positive gas pressure within the landfill thus removing the driving force for gas migration;
- the permeable landfill cover design will allow for gas to escape thus limiting gas pressure; and,
- the nearest residential structure is greater than 100 m from the waste footprint.

These four factors indicate that no explosive hazard would be expected with the proposed landfill as the potential for lateral methane gas movement beyond the waste footprint would be very low.

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10.1.2 Potential for Cumulative Effects

There are no other known sources of combustible gas on or in the vicinity of the proposed landfill, so there is no potential for cumulative effects.

10.1.3 Additional Mitigation Recommendations

As noted above, the proposed design of the landfill already incorporates sufficient controls to eliminate the potential for any subsurface gas migration from the proposed landfill; therefore, no further mitigation is necessary.

10.1.4 Net Effects

There is no significant potential for subsurface landfill gas migration beyond the landfill.

10.1.5 Summary

The net effects analysis is summarized in Table IV.

10.2 Criterion 4: Effects Due to Contact with Groundwater or Surface Water

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The following section is reproduced from the groundwater modelling discussion (Appendix D) to provide a link between source water protection and EA criteria.

10.2.1 Source Water Protection Considerations

The modelling portion of this hydrogeological assessment considers potential effects upon source water protection “vulnerable areas”; namely:

1) Significant Groundwater Recharge Areas (SGRAs);

2) Highly Vulnerable Aquifers (HVAs); and

3) Wellhead Protection Areas (WHPAs).

The general approach to developing vulnerable areas is described in Technical Rules: Assessment Report (Ministry of Environment and Climate Change, 2009). For the Ingersoll area, specific vulnerable areas are mapped in the MECP-approved Source Protection Plan with supporting technical documentation provided in Upper Thames River Source Protection Area Assessment Report (Thames-Sydenham Source Protection Committee, 2015).

SGRA

According to the Technical Rules, an SGRA is an area that annually recharges water to the underlying aquifer at a rate that is greater than the rate of recharge across the whole of the related groundwater recharge area by a factor of 1.15 or more; or, the area that annually recharges a volume of water to the underlying aquifer that is 55% or more of available surplus.

The Assessment Report estimates the average recharge of the Upper Thames area to be 132 mm/yr. Under Existing and Future Baseline very little surplus is allowed to infiltrate the site (<132 mm/yr) as a result of quarry dewatering so the Site should not be classified as SGRA. Likewise, under Operations and Post-Closure conditions, the infiltration through the landfill cap will be captured by the leachate collection system (see previous sections). Therefore, the landfill should not prompt an SGRA area designation.

HVA

According to the Technical Rules, the vulnerability of an aquifer may be assessed using a quantitative analysis such as the calculation of intrinsic susceptibility index, aquifer vulnerability index, surface to aquifer advection time, or surface to well advection time. Each approach is in some way related to groundwater time of travel; in other words, vulnerability increases as the time for a surficial contaminant to reach the water table (or shallowest significant aquifer) decreases.

The removal of overburden from within a quarry would, in and of itself, allow for decreased time for surficial inputs to reach the groundwater system. However, as mentioned previously, very little water entering the quarry will become recharge to the aquifer owing to the removal of surplus from the quarry and the local upward gradients maintained by dewatering. Nonetheless, the absence of any "buffer zone" between the quarry and surrounding groundwater system could lead to an HVA designation based on the Technical Rules methodology. Under landfill Operations and Post-Closure conditions, the aquifer vulnerability relative to the existing quarry condition would decrease, primarily as a result of the large amount of backfilled till underneath the landfill and the actions of the landfill liner and leachate collection system which would dramatically limit the connection between water within the waste and the surrounding groundwater system. Therefore, the landfill will have no adverse effect on aquifer vulnerability relative to baseline. The removal of overburden from the quarry lands is an interim condition. During the rehabilitation phase, the quarry will be backfilled with overburden to about 280 m amsl.

WHPA-Q1/Q2

The Technical Rules set out several classes of groundwater WHPAs. The first set described herein, WHPAs Q1 and Q2, are intended to protective of water quantity.

According to the Technical Rules, WHPA-Q1 is the combined area that is the drawdown cone of influence of a municipal well plus the whole of the cones of influence of all other wells that intersect that area and any surface water drainage area upstream of, and including, a losing reach of a stream that contributes a significant portion of surface water to the wells. WHPA-Q2 is the area defined in WHPA-Q1 and any area outside the WHPA-Q1 where a future reduction in recharge would have a measurable impact on the municipal wells.

WHPA-Q1/Q2 were modelled as part of the Tier Three Water Budget and Local Area Risk Assessment, Oxford County (Matrix, 2014). The Site, in addition to most of Ingersoll and Beachville, lies within the modelled WHPA-Q1 / Q2. The following is stated in the Assessment Report with respect to this broad area:

"Based on the results of the Risk Assessment modelling scenarios…all Local Areas [WHPA Q1/Q2] assessed were classified as having a Low Risk Level. This is largely due to an abundance of capacity in municipal supply wells. Following the Technical Rules, no consumptive water users or potential reductions to groundwater recharge within the Local Area are classified as significant water quantity threats. Under all scenarios investigated, municipal wells were able to withdraw their allocated quantity of water, without exceeding safe available drawdown thresholds within the well, or without impacts to other water uses."

The Operations and Post-Closure Scenarios will result in far less water taking than is currently occurring at the quarry or will occur under Future Pre-Landfill Baseline conditions. As such, the WHPA-Q1/Q2 will not be expanded, capacity at the municipal wells will not be adversely impacted, and the Local Area will remain as Low Risk Level.

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WHPA-A, B, C and D

WHPA-A, B, C, and D are based on water supply well time-of-travel capture zones at municipal wells as follows:

1. WHPA-A: 100 metre radius around well;
2. WHPA-B: less than or equal to 2-year time of travel;
3. WHPA-C: between 2-year and 5-year time of travel;
4. WHPA-D: between 5-year and 25-year time of travel.

These WHPAs are intended to be protective of well water quality. In other words, a chemical or pathogen that enters the groundwater system within these WHPAs has a heightened probability to be captured by the associated water supply well.

Ingersoll WHPA-A, B, C and D were modelled as part of the Oxford County Groundwater Protection Study: Phase II (Golder, 2010). Under that prior work, the Site is external to any modelled WHPA-A, B, C or D. However, the prior model applied a Carmeuse quarry floor elevation of 260 m amsl; currently the Southwest Quarry has deepened to about 230 to 240 m amsl. This (already present) change alone will have far greater affect on surrounding WHPAs than any affect future landfill Operations and Post-Closure conditions may have. In addition, municipal well pumping rates have (and will continue) to change at Ingersoll wellfields.

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Nonetheless, for illustration, we have provided figures comparing the originally modelled 25-year capture zones (source output for the WHPA-D in Golder, 2010) versus the 25-year capture zones modelled under Pre-Landfill Future Baseline, Operations, and Post-Closure (Figure D-18). To allow for a more direct comparison, we have applied the pumping rates as originally modelled in 2010 and as listed on Figure D-18. The difference between the two WHPA sets is, again, largely a result of major changes in surrounding future quarry layouts and, to a secondary degree, updates in the model hydrogeologic refinements as described in previous sections.

Notably, all modelled capture zones remain external to the Site except for the capture zone of Well 8 under Post-Closure wherein a small number of particles (four) travel beneath the Site. Three of the four particles terminate (i.e. are "recharged") from north of the Site whereas one particle appears recharged from underneath the Site.

10.2.2 Potential Effects

The proposed landfill design incorporates the Generic Design Option II – Double Liner in accordance with Ontario Regulation 232/98, which is fully protective of groundwater quality at the property boundary. Below are some relevant excerpts from Section 4.5 of the MECP document, *Landfill Standards: A guideline on the regulatory and approval requirements for new/expanding land, January 2012* that reference this:

- "The Regulation (Ontario Regulation 232/98) includes two generic design options which incorporate specific liner and leachate collection system designs. To ensure the generic designs can be used within a broad range of hydrogeologic settings, the designs have been developed such that the Reasonable Use limits for groundwater protection will be met without reliance on contaminant attenuation in the landfill buffer area."
- "The generic designs have been developed such that they will meet Reasonable Use limits within a broad range of hydrogeologic settings, as defined for their use."
- "The generic designs have been developed using contaminant transport modelling to assess performance of the liner and leachate collection systems relative to meeting the Ministry's Reasonable Use limits. Input

parameters (design criteria such as waste and leachate characteristics) used in the computer modelling were the same as those included in the Regulation and referred to above under Site Specific Design."

Since the landfill design incorporates a generic double composite liner design, it is considered that there will be no impacts on groundwater quality beyond the site boundary. The landfill performance will be monitored, and proven contingency measures can be implemented, if required, in the event of unanticipated issues with landfill performance to ensure that there are not unacceptable off-site impacts on groundwater quality.

10.2.3 Potential for Cumulative Effects

As noted above, the landfill design ensures that the Ministry's Reasonable Use limits will be met on-site throughout the operating and Post-Closure periods of the proposed landfill (i.e., for the full contaminating lifespan of the landfill). As a result, no potential is created for cumulative effects on off-site groundwater quality.

10.2.4 Additional Mitigation Recommendations

As noted above, the proposed design of the site, in particular the generic double composite liner system designed in accordance with O. Reg. 232/98, will ensure that there is no unacceptable impact on groundwater quality over the entire lifespan of the landfill; therefore, no further mitigation is considered necessary.

10.2.5 Net Effects

Based on the foregoing, it is concluded that there is no potential for unacceptable impact on groundwater quality related to the proposed landfill.

10.2.6 Summary

The net effects analysis is provided in Table V.

10.3 Criterion 33: Impact on the Availability of Groundwater Supply to Wells

The following section is reproduced from the groundwater modelling discussion (Appendix D) to provide a link between groundwater supply considerations and EA criteria.

10.3.1 Groundwater Model Predictive Analysis

Three sequential scenarios are considered in our modelled predictive analysis of the landfill design:

1) Future Pre-Landfill Baseline;

2) Operations; and

3) Post-Closure.

For each scenario, the model input (layer structure, boundary conditions, hydraulic conductivity etc.) is adjusted to approximate the landfill design in the Facilities Characteristics Assumptions [FCA] document (Walker, 2019) and surrounding quarry development (MHBC, 2018). For each landfill scenario the following model output is considered in support of the effects assessment for groundwater supply considerations:

- Groundwater flow budget at the landfill; and,
- Hydraulic head distribution in and around the landfill.

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10.3.2 Predictive Scenario Implementation in Model

10.3.2.1 Future Pre-Landfill Baseline

The purpose of the Future Pre-Landfill Baseline scenario is to establish the hydrogeological conditions upon which the relative effects of Operations and Post-Closure may be assessed. Note that the beginning of Operations is sufficiently far in advance of 2018 that future changes to hydrogeologic conditions, mainly as a result of surrounding quarry expansion, will make the Existing Conditions calibrated model (described in Appendix D) applicable for direct comparison purposes.

10.3.2.2 Operations

The Operations Scenario considers the landfill at full-build out and is fully described in Appendix D.

In addition, the Operations scenario includes the following components from the Beachville Quarries Operational Plan 2 of 5 and Cross-Sections 5 of 5 (MHBC, 2018):

- The quarry lands immediately to the east are mined and continue to be dewatered to a floor elevation of approximately 230 m amsl as per the Future Pre-Landfill Baseline Scenario.
- The Phase 1W, 2W and 3W lands immediately north of Road 64 and the Phase 2E and 3E lands east of County Road 6 have yet to undergo quarrying and are thus considered unaltered from their existing state.
- The Former West Quarry remains filled with the water level at approximately 253 m amsl.

10.3.2.3 Post-Closure

A model depiction of the Post-Closure Scenario inputs is provided in Appendix D. The Post-Closure scenario shares the same inputs as the Operations Scenario in the vicinity of the landfill (see previous section), including precipitation infiltration, waste, leachate collection drain and liner characteristics. The surrounding landscape has been modified to incorporate relevant components from the Beachville Quarries Rehabilitation Plan 4 of 5 (MHBC, 2018) as discussed below.

Following rehabilitation, there will be four new quarry lakes present in addition to the Former West Quarry. The lakebeds are comprised of backfilled till (assumed $K_H = K_V = 1 \times 10^{-6}$ m/s) from the bottom of the prior quarry floor (approximately 225 m amsl to 230 m amsl) up to the lake bottom (approximately 240 to 250 m amsl). The lake shorelines are also comprised of backfilled till. For simplicity in the model, shorelines are implemented as vertical walls as opposed to sloped beaches. From the lake bottom to the top of the lake level are constant head cells with assigned water levels ranging from 276 m amsl in the two northern lakes to 267 m amsl at the Centre Plant lake per MHBC, 2018. Above lake level but within the lake footprint, model cells are assigned drain cells in order to allow for a seepage face condition from the surrounding backfilled till “shoreline” into the lake.

Rehabilitated areas surrounding the new quarry lakes are comprised of backfilled till (assumed $K_H = K_V = 1 \times 10^{-6}$ m/s) from the bottom of the prior quarry floor (approximately 225 m amsl to 230 m amsl) up to rehabilitated ground surface. In most areas the top of the backfilled till reaches elevations similar to that of Existing Conditions topography; in these cases, the till is simply applied from the quarry floor to the surface of the model. In other areas, the rehabilitated topography dips significantly below that of Existing Conditions topography; in these instances, no-flow cells are placed within what is now “air” in the model, thus approximating the new ground surface in the Post-Closure model and avoiding an onerous and unnecessary reconstruction of the top of layer 1.

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10.3.3 Predictive Analysis Results

10.3.3.1 Groundwater Flow Budgets

As previously mentioned in Section 9.2.2, the Future Baseline is not a *landfill* scenario groundwater budget but is nonetheless included so the reader may comprehend the large change in water taking from quarry to landfill conditions. During the Pre-Landfill Future Baseline, quarry dewatering at the site alone is estimated to be 33,000 m^3/d (for simplicity listed under “Drainage Collection” row); compare this with the much-reduced total water taking at the landfill leachate collection system which ranges from approximately 430 m^3/d to 685 m^3/d.

The Operations, Post-Closure and Post-Closure Contingency scenarios all have the same amount of infiltration into the waste (419.5 m^3/d, or 258 mm/yr). An additional, but smaller, source of seepage enters the landfill through its flanks (e.g. 11.2 m^3/d for Operations). The vast majority of seepage that enters the landfill is intercepted by the leachate collection system (refer to Appendix D).

10.3.3.2 Hydraulic Head Distribution

The Future Baseline scenario depresses water levels down to less than 240 m amsl in the vicinity of the Southwest Quarry as a result of quarry dewatering. During the landfill scenarios, the local water levels recover to an elevation of +/- 260 m amsl at the site, with the landfill drainage collection system controlling heads at this mark.

Surrounding the site, the Operations and Post-Closure scenarios have different head distributions. During Operations, sub-regional heads are dominated by the continued quarry dewatering to the east which depresses water levels to less than 240 m amsl. During Post-Closure, the quarry dewatering has ceased, and the quarries are now partially backfilled and waterbodies develop with prescribed elevations (see previous sections). Sub-regional heads are now most influenced by the Former West Quarry (253 m amsl). As expected, the Post-Closure scenario has practically the same head distribution.

10.3.4 Potential Effects

An assessment of the potential effects of the landfill on groundwater supply to water wells was completed using results and interpretation of numerical modeling (Appendix D). A key component of the assessment was a comparison of the simulated groundwater elevation contours during the operations period of the landfill with the expected groundwater elevation contours during the fully excavated quarry condition but prior to backfill for landfill construction. The comparison indicates that there is no marked difference between the simulated groundwater level contours for the operations period at the landfill and the no-landfill scenario (fully excavated quarry prior to backfill for landfill construction). Given that the modelling results show no marked difference in groundwater elevations (piezometric or potentiometric surface) between the two aforementioned, it is inferred that there will be no impacts to the drawdown cone as a result of construction and operation of the landfill.

A comparison was also made between the simulated groundwater level contours for the future baseline case and the Post-Closure scenario. The results of the comparison indicate that there is no significant increase in the simulated groundwater level drawdown between the two scenarios. The operation of the landfill will not increase the drawdown associated with quarry dewatering activities and therefore will not negatively impact the quantity of the groundwater supplies.

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10.3.5 Potential for Cumulative Effects

The modelling analyses demonstrate that groundwater levels within the Groundwater Site Vicinity are, and will continue to be, controlled by quarry dewatering. The construction, operation and closure of the proposed landfill has no significant effects on these groundwater levels and, therefore, there is no cumulative effect

10.3.6 Additional Mitigation Recommendations

Given the above, there is no need for any further mitigation necessary in the design or operation of the proposed landfill in order to protect the availability of groundwater supply to wells in the area.

10.3.7 Net Effects

Based on the foregoing, it is concluded that there is no potential for unacceptable impact on groundwater supply to area water wells related to the proposed landfill.

10.3.8 Summary

The net effects analysis is provided in Table VI.

10.4 Criterion 34: Effects of Stream Baseflow Quantity/Quality

10.4.1 Potential Effects

As previously discussed, the landfill will be constructed and operated in a quarry, where dewatering controls the groundwater levels in the Groundwater Site Vicinity. As demonstrated by the modelling analyses, there will be no additional drawdown related to the design and operation of the landfill. Therefore, there will be no negative effect of the construction or operation of the landfill on stream baseflow.

10.4.2 Potential for Cumulative Effects

The modelling analyses demonstrate that groundwater levels in the Groundwater Site Vicinity are, and will continue to be, controlled by quarry dewatering. The construction, operation and closure of the proposed landfill has no significant effects on these groundwater levels and, therefore, there is no cumulative effect.

10.4.3 Additional Mitigation Recommendations

Given the above, there is no need for any further mitigation necessary in the design or operation of the proposed landfill to prevent impacts on stream baseflow in the area.

10.4.4 Net Effects

Based on the above, it is concluded that there is no potential for unacceptable impact on stream baseflow related to the proposed landfill.

10.4.5 Summary

It is concluded that, there will be no net effects on stream baseflow quantity or quality. The net effects analysis is provided in Table VII.

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11.0 GROUNDWATER MONITORING AND CONTINGENCY MEASURES

11.1 Post-Closure Contingency

Since the landfill design incorporates a generic liner design which is protective of groundwater quality at the property boundary, it is inferred that there will be no impacts on groundwater quality beyond the site boundary. Nevertheless, an additional Post-Closure model scenario was developed for contingency purposes to examine contingency options and is presented in Appendix D. In this scenario, the HDPE liner is assumed to have come to the end of its functional life at some point during Post-Closure leaving only the clay component of the liner intact. Under this scenario the liner hydraulic conductivity is changed to $K_H = K_V = 1 \times 10^{-9}$ m/s (i.e. the vertical hydraulic conductivity is increased to be reflective solely of clay material).

For the purpose of evaluating possible contingency measures, an extremely small amount of seepage collection bypass is simulated to occur in Operations (0.2 m^3/d or 0.1 mm/yr) and Post-Closure (0.01 m^3/d, or 0.006 mm/yr) scenarios. Under the Post-Closure Contingency scenario, collection bypass is still small (4.3 m^3/d or 3 mm/yr) but increases as a result of the effective removal of the HDPE component of the liner system. The discharge locations for seepage that bypasses the landfill collection system is discussed further in section 11.3.

11.2 Hydraulic Head Distribution

Surrounding the site, the Operations and Post-Closure scenarios have different head distributions. During Operations, sub-regional heads are dominated by the continued quarry dewatering to the east which depresses water levels to less than 240 m amsl. During Post-Closure, the quarry dewatering has ceased, and the quarries are now partially backfilled lakes with prescribed elevations (see previous sections). Sub-regional heads are now most influenced by the Former West Quarry (253 m amsl). As expected, the Post-Closure and Post-Closure Contingency scenarios have practically the same head distribution (see Appendix D, Figure D-18) given the small change in parameters between these two simulations.

11.3 Seepage Particle Tracking

The purpose of particle tracking is to simulate and evaluate where seepage bypass (or movement of leachate) emanating from the landfill could ultimately discharge to examine contingency options. (see Table D-6 – Seepage at Landfill, Out). This analysis also identifies where groundwater monitoring should be focused. Particle tracking is conducted by seeding the landfill drainage layer (model layer 6) and the layer immediately below the landfill (model layer 8) with 73 roughly equally spaced particles within the landfill footprint (146 particles total). The particles are then forward tracked using MODPATH to their ultimate seepage destination. The results of particle tracking are provided in Appendix D and are used to inform the monitoring plan locations and contingency measures as detailed in the following sections.

Under the Operations scenario, the majority of particles released at the landfill either discharge at the adjacent dewatered quarry to the immediate east or remain within the landfill leachate collection system. A very small number of particles (three) discharge at the Former West Quarry. Almost all of the simulated 0.2 m^3/d of water leaving the landfill discharges at the quarry location during Operations, with less than 0.001 m^3/d discharging at the Former West Quarry. With respect to the particles remaining within the landfill leachate collection system: this “re-entry” occurs because the drainage layer has a slight slope to it such that particles released on the upgradient end of the layer may be captured by drains in the downgradient end. Flows associated with this situation are implicitly accounted for within the landfill leachate collection system water budget.

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Under the Post-Closure scenario, particles leaving the landfill discharge at the Former West Quarry to the south. Thus, all of the simulated 0.01 m^3/d of water emanating from the landfill discharges at this Former West Quarry location during Post-Closure.

The Post-Closure Contingency scenario exhibits similar results to the Post-Closure scenario, although in this case the seepage rate reporting to the Former West Quarry is 4.3 m^3/d.

It should be noted that the scenarios listed above indicate that all particles discharge within the leachate collection system, an active quarry, or a former quarry; no particles are shown to migrate to off-site receptors.

11.4 Monitoring Plan

Based on the predictive modelling, the following have been identified as key items for consideration with respect to a groundwater monitoring plan (to be developed in detail in the future) at or near the Groundwater Site Vicinity:

- Seasonal water level measurements in each of the major hydrogeologic formations distributed sufficiently to confirm groundwater flow patterns (twice per year at a minimum).
- There are two existing monitoring wells between the proposed landfill and downgradient property boundary. The monitoring well network should be augmented by four additional monitoring wells to the west and east of the existing monitoring wells (see Figure 11.1). These four wells could be monitored to confirm presence or absence of on-site impacts to groundwater quality.
- Annual representative sampling from each of the major hydrogeologic formations, upgradient and downgradient of the landfill, analysed for the *Comprehensive List* of parameters (O. Reg 232/98, Schedule 5, Column 1).
- Seasonal representative sampling from each of the major hydrogeologic formations, up gradient and down gradient of the landfill, analysed for the *Indicator List* of parameters (O. Reg 232/98, Schedule 5, Column 2).
- Subject to landowner permission, annual representative sampling from selected representative domestic water wells within the Groundwater Site Vicinity, analysed for the *Indicator List* of parameters (O. Reg 232/98, Schedule 5, Column 2), with the well owner provided with a copy of these results within 90 days of obtaining the sample.
- Seasonal combustible gas measurements in an appropriate network of monitoring wells around the landfill perimeter to detect migration of Landfill Gases.

11.5 Contingency Plan

Should the groundwater monitoring plan identify the potential for any unanticipated leachate impacts in groundwater beyond the property boundaries, then contingency plans would be immediately implemented. The MECP would be notified and a detailed plan for the design, operation, maintenance, monitoring and reporting of the contingency system(s) would be prepared and submitted for approval and implemented as soon as necessary. These contingency components are mutually supportive, and each component is potentially capable of providing adequate control with the others available as additional levels of contingency. Therefore, there is considerable redundancy in the overall groundwater contingency plan. The groundwater contingency plan could include one or more of the following components depending on the specific circumstances.

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11.5.1 Leachate Purge Wells

A series of wells could be installed into the waste and/or into the leachate collection system to reduce leachate mounding by pumping out and removing leachate from within the landfill for treatment. Leachate purge wells are a proven technology for pumping of the leachate from the waste in the event of mounding or the leachate levels in the waste. The leachate wells would be positioned, designed, and installed appropriately to reduce the mounding to acceptable levels. This approach could be utilized to prevent or mitigate leachate seeps through the sides of the landfill and/or into the bedrock groundwater flow system. The actual number and location of leachate purge wells would be determined based on the specific requirements identified by the future monitoring plan.

11.5.2 Quarry Floor Underdrain System

The current Southwest Quarry includes drainage trenches and sumps on the quarry floor that are used for dewatering purposes. Some of these will be preserved and engineered as drainage galleries when the quarry floor is backfilled so that they can be used to capture any seepage through the liner and through the backfill before it reaches the site boundary. This underdrain system would capture any potential leachate seepage from the base of the landfill such that it does not enter the bedrock groundwater flow system. In addition, our hydrogeological assessment has shown the presence of upward hydraulic gradients in the bedrock beneath the quarry. The upward gradients create a physical barrier to downward seepage beneath the landfill into the underlying bedrock. Groundwater from beneath the landfill would flow upward and mix with any unanticipated leachate migrating through the base of the landfill.

11.5.3 Groundwater Purge Wells

A series of wells can be drilled and pumped out at the perimeter of the landfill at any location(s) and depth(s) necessary to capture any leachate that migrates below the liner before it reaches the property boundary. The results of groundwater modeling have indicated that in the event of seepage from the landfill, the flow pathway will be southward toward the southern boundary. There will be a series of monitoring wells positioned along the southern property boundary that will be sampled for general groundwater chemistry and leachate indicator parameters. If the monitoring results indicate elevated levels of leachate indicator parameters due to unanticipated leakage of leachate from the landfill, leachate purge wells could be installed in the bedrock along the southern property boundary to prevent off-site migration of leachate impacted groundwater. The number, location, design and pumping of wells would be dependent on the specific impacts requiring mitigation. Decision making for well location and design may include test pumping to confirm that the wells have adequate drawdown capacity and appropriate spacing to prevent off-site migration of contaminants.

A scenario was simulated by the groundwater modeling in order to assess the groundwater flow pathways from the landfill in the event of unanticipated seepage. The scenario was completed in order to assess the appropriate location of monitoring wells and to evaluate the general feasibility of groundwater purge wells placed near monitoring wells and the effective, proven, industry-standard contingency measures. The key potential groundwater receptors are the water wells situated to the south of the quarry property as previously discussed. The key potential surface water receptor is the Former West Quarry. Our conceptualization and modeling results indicated a southward seepage pathway toward the Former West Quarry, which acts as both a discharge zone for water from the Thames River and a recharge zone for water to the active Southwest quarry.

As mentioned previously, there are two existing monitoring wells between the proposed landfill and downgradient property boundary. The monitoring well network could be augmented by four additional monitoring wells to the west and east of the existing monitoring wells (see Figure 11.1).

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Based on the above, there will be no groundwater quality impacts related to unanticipated seepage from the quarry, since a monitoring plan will be in place and contingency measures can be implemented as required, based on the monitoring plan.

11.5.4 Landfill Gas Contingency Measures

As noted previously, based on the proposed landfill design, no net environmental effects related to explosive hazard due to combustible gas accumulation in confined spaces or asphyxiation hazard due to oxygen depletion are anticipated. Due to the low potential for movement of gas as mentioned in Section 10.1.1, the proposed landfill design with an accompanying gas monitoring plan would be appropriate for the proposed landfill site. If the results of monitoring indicate elevated methane concentrations, according to the Ontario Ministry's guideline D-4-1 "Assessing methane hazards from landfill sites", an assessment of the source and potential pathways of the combustible gas would be undertaken. This assessment may include additional monitoring events or locations. If unacceptable methane concentrations were confirmed following these measures, alternate contingency measures would be implemented to reduce the migration of landfill gasses, which could include source and/or perimeter controls such as passive or active venting systems, including trenches and/or wells to prevent off-site migration of gas.

12.0 CLIMATE CHANGE CONSIDERATIONS

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Future changes in climate trends may have some impact on landfill hydraulic behaviour. Of particular focus would be the potential change in infiltration as a result of more frequent and/or higher intensity precipitation. The potential for increased landfill infiltration rates under certain climate change scenarios are evaluated in the Walker Baseline Forecast Assumptions on Climate Change (McDermid et al, 2015) and are as follows:

- Base Case Infiltration Without Climate Change: 258 mm/yr [~419 m^3/d]
- 2011 – 2040 With Climate Change: 307 mm/yr [~499 m^3/d]
- 2041 – 2070 With Climate Change: 343 mm/yr [~558 m^3/d]
- 2071 – 2100+ With Climate Change: 352 mm/yr [~573 m^3/d]

The base case Operations, Post-Closure and Post-Closure Contingency model scenarios described previously are re-run using an alternate set of climate change-based infiltration rates as noted above. The site groundwater budget results are presented in Appendix D and Table 12 below.

Table 11: Predictive Scenario Site Groundwater Budget Simulated Results with Climate Change Infiltration

Source/Sink	Operations		Post-Closure		Post-Closure Contingency	
	In (m^3/d)	Out (m^3/d)	In (m^3/d)	Out (m^3/d)	In (m^3/d)	Out (m^3/d)
Landfill Infiltration	499.2	-	557.7	-	572.6	-
Seepage at Landfill	11.2	0.2	10.7	0.01	258	4.5
Seepage at Quarry	-	-	-	-	-	-

Source/Sink	Operations		Post-Closure		Post-Closure Contingency	
Drainage Collection	-	510.2	-	568.4	-	826.1
TOTAL	*510.4*	*510.4*	*568.4*	*568.4*	*830.6*	*830.6*

Despite the increased infiltration rates under climate change influences, the seepage bypass rates remain the same or within 5% of the base case. The particle tracking results are practically the same as the base case (Figure D-17). This lack of change is explained in part because of the efficacy of the drainage collection / liner system but also because the increased infiltration, although higher than base case, is not sufficiently large to cause significant changes in the landfill hydraulic behaviour.

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13.0 CONCLUSIONS

13.1 Site Characterization

1) The overburden in the area of the site consists of yellow to brown silt to sandy silt Zorra (Tavistock) Till and sand of glaciofluvial origin with interbedded layers of sand, silt and gravel of modern alluvium or glaciofluvial outwash origins. The overburden at the Site is comprised of sand and gravel of glaciofluvial outwash origin.

2) The groundwater elevations in the overburden monitoring wells (MW17-1D, MW17-2D, through MW17-3D and MW17-3E) have varied between 1.0 and 1.7 m. The measured groundwater elevations within the overburden have ranged from a maximum of 289.6 m amsl at MW17-1D to a minimum of 270.0 m amsl at MW17-3D. In general, the overburden groundwater east of the quarry was inferred to flow towards the northeast.

3) The region is underlain by Middle Devonian aged limestones and dolostones of the Dundee Formation of the Hamilton Group and slightly older limestones and dolostones of the Lucas Formation of the Detroit River Group. The Dundee Formation sharply and unconformably overlies the Detroit River Group, which has been subdivided into the Lucas and Amherstburg Formations. Where present, the Lucas Formation conformably overlies the Amherstburg Formation. The Detroit River Group overlies Lower Devonian aged limestones of the Bois Blanc Formation, which is not exposed at the Site.

4) The Lucas Formation was encountered at depths ranging from about 6.7 to 20.6 metres below ground surface (m bgs), which corresponded to elevations of 263.8 to 269.6 m amsl. The contact between the Lucas Formation and the underlying Amherstburg Formation was generally marked with the appearance of irregular clasts of chert and occurred at a depth ranging between about 39.4 and 54.1 m bgs, corresponding to elevations ranging between 231.1 and 236.1 m amsl. The thickness of the Lucas Formation encountered in the boreholes ranged between about 32.7 and 33.5 m.

5) The “Shallow Weathered Zone” of the Lucas Formation is comprised of the upper 3 m of bedrock.

6) The Amherstburg Formation was inferred to occur at a depth ranging between about 39.4 and 54.1 m bgs, corresponding to elevations ranging between 231.1 and 236.1 m amsl, with the exception at borehole location BH17-4. Borehole location BH17-4 was located within the base of the Southwest Quarry and

therefore the Amherstburg Formation was encountered at the ground surface, corresponding to an elevation of 241.3 m amsl.

7) The Bois Blanc Formation was inferred to occur at a depth of about 16.5 m bgs, corresponding to an elevation of 224.8 m amsl. The borehole was terminated within the Bois Blanc at a depth of about 22.4 m bgs, corresponding to an elevation of 218.9 m amsl.

8) The groundwater levels in the shallow weathered zone were observed to vary between 287.6 m and 261.1 m amsl. In general, the groundwater levels in the shallow weathered zone indicate radial flow towards the Southwest Quarry in response to ongoing dewatering activities while groundwater further afield of the quarry appears to flow towards the Thames River (southwest).

9) The groundwater elevations within the Lucas Formation wells were observed to vary between 254.8 m amsl and 245.6 m amsl.

10) The measured groundwater elevations within the Amherstburg Formation at the Site vary between 247.6 m amsl and 238.2 m amsl.

11) The groundwater elevation within the Bois Blanc Formation at monitoring well MW17-4A has ranged from 244.5 to 245.4 m amsl.

12) A relatively stable downward vertical gradient was observed in the monitoring wells around the quarry excavation during the period of record. An upward gradient was observed at the on-site bedrock wells at location 4.

13) Quarterly groundwater sampling was initiated in February 2018. Groundwater samples were analyzed for a suite of water quality indicator parameters, including major anions and cations, dissolved organic carbon (DOC), dissolved metals, and volatile organic compounds.

14) A calcium-bicarbonate groundwater type is present in the overburden, the shallow weathered zone, and the Bois Blanc Formation within the Groundwater Site Vicinity. By contrast, a calcium-bicarbonate to calcium-sulphate groundwater type is present in the Lucas Formation and Amherstburg Formation within the Groundwater Site Vicinity.

15) Benzene, toluene and xylene detections at low levels such as those listed above in the groundwater quality summary are inferred to be naturally-occurring or biogenic (Armstrong & Carter, 2010, Slaine & Barker, 1991).

16) Golder queried the MECP water well information system for data for all wells located within 500 m of the Groundwater Site Vicinity. Data for 183 wells was retrieved. Five of the 144 wells reportedly used for water supply were completed in overburden deposits to depths ranging between 11.0 and 33.5 m bgs. The remaining 137 well records for the water supply wells indicated termination and/or completion in bedrock at total depths ranging between 7.6 and 134.4 m bgs.

17) Based on information obtained from the municipality, a piped municipal water supply is not currently available to all water users in the Groundwater Site Vicinity. Nearby properties are inferred to rely on groundwater for their primary water supply. As a result, a door-to-door survey was carried out in 2018 to obtain current information on existing domestic water supply wells. As of June 2019, a total of seven residences opted to be included in the domestic well monitoring initiative. On November 19, 2018, Golder collected a groundwater

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sample from two residences located on Beachville Road. On December 7, 2018, Golder collected a groundwater sample from two additional residences located on Beachville Road. On January 29, 2019, Golder collected a groundwater sample from a residence on Road 62 and two residences located on Beachville Road. A water level was also measured in the well at two residences on Beachville Road.

14.0 MAJOR CONCLUSIONS

1) The results of the assessment indicated that the proposed landfill will not result in any negative net effects in relation to the environmental criteria assessed.

2) A 3D numerical groundwater model was constructed to simulate flow at the Groundwater Site Vicinity and regional surroundings. Through the calibration process it was found that recharge rates, the hydraulic conductivities of the geologic units, and the simulated flow patterns are in good agreement with available field data. Calibrated model values are considered to represent reasonable estimates for use in predictive analysis involving landfill Operations and Post-Closure scenarios.

3) The modelled predictive analysis indicates that landfill Operations and Post-Closure scenarios will have a beneficial effect on water quantity through reduced water taking and water level recovery relative to pre-landfill (dewatered quarry) baseline. The modelled predictive analysis simulates extremely small (<1 mm/year) amounts of seepage bypassing the landfill leachate collection system. During the Operations period, the majority of this seepage reports to the adjacent quarry to the east with a minor amount reporting to the Former West Quarry. During the Post-Closure period, this seepage reports to the Former West Quarry.

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4) A modelled Post-Closure contingency scenario was examined wherein the functional life of the HDPE liner has expired leaving only the clay component of the liner. Under this scenario, landfill seepage bypassing the collection system remains small (3 mm/year) and continues to report to the Former West Quarry.

5) The presence of the landfill is not expected to affect source water protection mapping of Significant Groundwater Recharge Areas, Highly Vulnerable Areas, or Wellhead Protection Areas (WHPA) Q1/Q2. The landfill may have some influence on future mapping for municipal well WHPA-A, B, C, D; however, this influence will be minor compared to the effect of surrounding quarry dewatering and/or quarry lakes and future changes in pumping rates at the municipal wells themselves.

6) The results of the soil and groundwater assessments indicate horizons of higher permeability in both the overburden and the underlying bedrock that could, under certain conditions (significant and persistent gas pressure, unsaturated conditions), potentially provide pathways for lateral migration of landfill gas. However, the design components of the proposed landfill will work to effectively eliminate gas migration through the removal of gas pressure, the use of a generic double composite liner system and the placement of migration barriers such that no explosive hazard would be expected with the proposed landfill as the potential for lateral methane gas movement beyond the waste footprint would be very low.

7) Since the landfill design incorporates a generic liner design which is protective of groundwater quality at the property boundary, it is inferred that there will be no impacts on groundwater quality beyond the site boundary. The landfill performance will be monitored, and proven contingency measures can be

implemented, as required, in the event of unanticipated issues with landfill performance. Therefore, there will be no net effects due to contact with groundwater or surface water.

8) The landfill will be situated within an existing quarry and will not increase the amount of groundwater level drawdown related to quarry dewatering. Therefore, there will be no significant negative impacts on the groundwater quantity for water well supply or surface water quantity related to the landfill. Therefore, there will be no net effects on groundwater supply to the wells.

9) The groundwater level drawdown that could potentially affect stream baseflow is related to the expansion and deepening of the quarry. There will be no additional drawdown related to the design and operation of the landfill. Therefore, there will be no negative effect of the construction or operation of the quarry on stream baseflow. Therefore, there will be no net effects on stream baseflow quantity or quality.

10) The proposed landfill setting is in an existing quarry which would allow for the application of several feasible contingency measures in the event that seepage through the liner should occur.

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Summary of Groundwater Elevations

Hydrogeological Assessment
Southwestern Landfill
Zorra Township, Ontario

Station	26-Feb-18		22-May-18		21-Aug-18		28-Nov-18	
	(mbtor)	(masl)	(mbtor)	(masl)	(mbtor)	(masl)	(mbtor)	(masl)
MW17-1A	44.706	246.710	45.082	246.334	46.267	245.149	46.444	244.972
MW17-1B	36.633	254.793	38.192	253.234	38.441	252.985	38.361	253.065
MW17-1C	3.734	287.637	4.212	287.159	4.824	286.547	3.842	287.529
MW17-1D	1.791	289.661	2.214	289.238	2.987	288.465	2.775	288.677
MW17-2A	46.667	238.942	46.749	238.860	47.125	238.484	47.407	238.202
MW17-2B	39.105	246.501	38.914	246.692	39.785	245.821	40.03	245.576
MW17-2C	16.352	269.188	16.940	268.600	17.103	268.437	16.586	268.954
MW17-2D	3.171	282.405	3.541	282.035	4.401	281.175	3.894	281.682
MW17-3A	31.649	249.234	31.437	249.446	32.704	248.179	33.001	247.882
MW17-3B	31.258	249.666	31.087	249.837	32.374	248.550	32.629	248.295
MW17-3C	19.111	261.970	19.567	261.514	19.937	261.144	19.598	261.483
MW17-3D	11.012	270.105	10.878	270.239	10.197	270.920	11.153	269.964
MW17-3E	1.415	279.815	2.027	279.203	3.114	278.116	2.096	279.134
MW17-4A[1]	-3.042	245.011	-3.429	245.398	-2.554	244.523	--	--
MW17-4B[2]	-0.097	241.968	0.032	241.839	0.357	241.514	--	--
MW17-5A	24.094	247.584	25.131	246.547	26.082	245.596	26.365	245.313
MW17-5B	22.441	249.181	22.319	249.303	23.377	248.245	23.826	247.796
MW17-5C	21.711	249.982	21.904	249.789	23.092	248.601	23.283	248.410
MW17-6A	26.041	250.011	26.094	249.958	27.204	248.848	27.371	248.681
MW17-6B	25.914	250.218	25.921	250.211	26.975	249.157	27.164	248.968

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Notes:
1) MW17-4A has a strong artesian flow - measured using pressure gauage calculation.
2) MW17-4B has a weak artesian flow - measured using extension pvc pipe when needed.
-- indicates no water level was measured. In November, 2018, the monitoring wells MW17-4A and MW17-4B were frozen.

Prepared by: RM
Checked by: DC

Summary of Groundwater Quality

Hydrogeological Assessment
Southwest ern Landfill
Zorra Township, Ontario

Parameter	Sample Date	[EB]				[TB]				MW17-1A				MW17-1B			
	Unit	01-Mar-2018 Equipment Blank	23-May-2018 Equipment Blank	22-Aug-2018 Equipment Blank	30-Nov-2018 Equipment Blank	26-Feb-2018 Trip Blank	22-May-2018 Trip Blank	24-Aug-2018 Trip Blank	30-Nov-2018 Trip Blank	27-Feb-2018 MW17-1A	24-May-2018 MW17-1A	23-Aug-2018 MW17-1A	28-Nov-2018 MW17-1A	01-Mar-2018 MW17-1B	24-May-2018 MW17-1B	23-Aug-2018 MW17-1B	28-Nov-2018 MW17-1B
Calculated Parameters																	
Bicarb. Alkalinity (calc. as CaCO3)		2.4	1.7	1.1	<1.0					200	190	200	200	180	180	180	170
Calculated TDS	mg/L	1.0	1.0	1.0	<1.0	-	-	-	-	250	300	390	450	190	190	200	190
Carb. Alkalinity (calc. as CaCO3)		<1.0	<1.0	<1.0	<1.0					2.3	3.3	2.1	1.7	2.2	2.7	2.3	1.7
Hardness (CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	-	-	-	-	160	190	240	270	130	140	140	140
Inorganics																	
Total Ammonia-N	mg/L	<0.050	<0.050	<0.050	<0.050	-	-	-	-	0.29	0.26 (1)	0.34	0.36 (1)	0.14	0.18	0.16	0.19
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	<4.0	<4.0	<4.0	-	-	-	-	4.6	<4.0	<4.0	5.1	<4.0	<4.0	<4.0	<4.0
Conductivity	umho/cm	2.4	1.4	1.4	2.0	-	-	-	-	450	530	670	780	350	340	350	350
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	<0.10	0.12	<0.10	-	-	-	-	0.33	0.23 (1)	0.34	0.32 (1)	0.23	0.20	0.19	0.13
Dissolved Organic Carbon	mg/L	0.74	<0.50	<0.50	<0.50	-	-	-	-	0.79	0.70	0.82	1.0	0.67	0.58	0.62	0.80
pH	pH	6.46	6.22	6.00	5.98	-	-	-	-	8.10	8.26	8.04	7.95	8.10	8.21	8.13	8.03
Phenols-4AAP	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	0.010	<0.004	<0.004	<0.004	-	-	-	-	0.067	0.08	0.051	0.05	0.006	<0.004	0.008	0.011
Dissolved Sulphate (SO4)	mg/L	<1.0	<1.0	<1.0	<1.0	-	-	-	-	34	57	99	140	7.6	7.4	8.0	11
Alkalinity (Total as CaCO3)	mg/L	2.4	1.7	1.1	<1.0	-	-	-	-	200	200	210	210	180	180	180	170
Dissolved Chloride (Cl)	mg/L	<1.0	<1.0	<1.0	<1.0	-	-	-	-	6.6	16	27	35	<1.0	<1.0	<1.0	<1.0
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	<0.010	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	mg/L	<0.10	<0.10	<0.10	<0.10	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrate + Nitrite (N)	mg/L	<0.10	<0.10	<0.10	<0.10	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Calculated Parameters																	
Chromium (+3)	ug/L	<5	<5	<5	<5	-	-	-	-	<5	<5	<5	<5	<5	<5	<5	<5
Metals																	
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	<0.50	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	<5.0	<5.0	-	-	-	-	5.5	5.9	18	<5.0	7.1	<5.0	5.3	<5.0
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	-	-	-	-	2.0	1.4	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Barium (Ba)	ug/L	<2.0	<2.0	<2.0	<2.0	-	-	-	-	100	80	78	58	84	84	94	90
Dissolved Boron (B)	ug/L	<10	<10	<10	<10	-	-	-	-	53	70	93	100	56	61	60	62
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Calcium (Ca)	ug/L	<200	<200	<200	<200	-	-	-	-	32000	38000	45000	49000	24000	24000	25000	24000
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	-	-	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Copper (Cu)	ug/L	<1.0	<1.0	2.2	<1.0	-	-	-	-	<1.0	2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Iron (Fe)	ug/L	<100	<100	<100	<100	-	-	-	-	<100	<100	190	230	<100	<100	<100	<100
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	ug/L	<50	<50	<50	<50	-	-	-	-	20000	24000	31000	36000	18000	18000	19000	18000
Dissolved Manganese (Mn)	ug/L	<2.0	<2.0	<2.0	<2.0	-	-	-	-	8.6	6.2	8.0	5.6	<2.0	<2.0	<2.0	<2.0
Dissolved Potassium (K)	ug/L	<200	<200	<200	<200	-	-	-	-	1500	1900	2400	2600	1100	1100	1200	1200
Dissolved Sodium (Na)	ug/L	<100	<100	<100	<100	-	-	-	-	22000	32000	46000	56000	17000	19000	20000	20000
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	-	-	-	-	7.2	5.2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Volatile Organics																	
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	0.69	<0.20	<0.20	0.46	<0.20	<0.20	<0.20
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.26	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.26	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Surrogate Recovery (%)																	
4-Bromofluorobenzene	%	90	84	88	89	91	85	90	93	99	84	90	93	100	88	87	94
D4-1,2-Dichloroethane	%	104	105	106	109	104	105	102	90	106	109	101	102	104	109	102	104
D8-Toluene	%	96	95	99	94	97	95	98	101	98	93	99	96	99	94	99	94

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Notes:

-	Not analyzed.
<	Less than reported detection limit.
mg/L	miligrams per liter
umho/cm	micromhos per centimeter
ug/L	micrograms per liter
(1)	TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.
(2)	Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordinly.
(3)	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
(4)	No sample was collect at monitoring wells MW17-4A and MW17-4B in November 2018, due to frozen groundwater within the casing.
	Table to be read in conjunction with the report.

Summary of Groundwater Quality

Hydrogeological Assessment
Southwest ern Landfill
Zorra Township, Ontario

Parameter	Sample Date	MW17-1C				MW17-1D				MW17-2A				MW17-2B			
		26-Feb-2018	24-May-2018	23-Aug-2018	28-Nov-2018	26-Feb-2018	24-May-2018	23-Aug-2018	28-Nov-2018	27-Feb-2018	23-May-2018	24-Aug-2018	29-Nov-2018	27-Feb-2018	23-May-2018	24-Aug-2018	29-Nov-2018
	Unit	MW17-1C	MW17-1C	MW17-1C	MW17-1C	MW17-1D	MW17-1D	MW17-1D	MW17-1D	MW17-2A	MW17-2A	MW17-2A	MW17-2A	MW17-2B	MW17-2B	MW17-2B	MW17-2B
Calculated Parameters																	
Bicarb. Alkalinity (calc. as CaCO3)		190	190	190	180	180	180	180	180	200	200	190	170	180	170	180	160
Calculated TDS	mg/L	210	210	210	210	270	260	270	270	520	530	510	470	490	480	490	470
Carb. Alkalinity (calc. as CaCO3)		2.4	3.2	2.3	2.1	2.1	3.0	2.3	2.0	2.2	2.6	1.5	1.3	1.5	1.9	1.5	1.3
Hardness (CaCO3)	mg/L	150	150	160	160	190	200	210	210	330	330	330	300	290	300	320	290
Inorganics																	
Total Ammonia-N	mg/L	0.16	0.20 (1)	0.20	0.23	0.33	0.31 (1)	0.32	0.38 (1)	0.12	0.15 (1)	0.093	0.082	0.19	<0.050	<0.050	<0.050
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Conductivity	umho/cm	380	350	370	380	490	480	470	480	920	880	850	830	880	830	820	820
Total Kjeldahl Nitrogen (TKN)	mg/L	0.25	0.18 (1)	0.21	0.10	0.42	0.30 (1)	0.42	0.32 (1)	0.20	0.14 (1)	0.11	0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Organic Carbon	mg/L	0.69	0.60	0.72	0.82	0.87	0.60	0.69	1.4	1.0	0.77	0.98	0.95	1.0	0.90	1.1	0.97
pH	pH	8.11	8.25	8.11	8.07	8.08	8.25	8.12	8.08	8.08	8.13	7.93	7.93	7.95	8.08	7.94	7.92
Phenols-4AAP	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	0.020	0.012	0.026	0.033	2.2	0.9	0.68	1.4	0.007	0.024	0.010	0.006	0.008	0.022	0.010	<0.004
Dissolved Sulphate (SO4)	mg/L	12	10	11	9.6	42	37	41	39	170	180	160	140	150	150	140	140
Alkalinity (Total as CaCO3)	mg/L	200	190	190	190	180	180	190	180	200	210	190	170	180	170	180	160
Dissolved Chloride (Cl)	mg/L	1.1	1.3	1.2	<1.0	20	20	18	20	65	64	65	70	75	71	71	71
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	<0.010	0.016	<0.010	<0.010	<0.010	0.017	<0.010	0.058	0.041	0.026	0.028	0.025	0.027
Nitrate (N)	mg/L	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	0.29	0.35	1.07	1.04	0.97	0.70
Nitrate + Nitrite (N)	mg/L	<0.10	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	0.35	0.39	1.10	1.07	0.99	0.72
Calculated Parameters																	
Chromium (+3)	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Metals																	
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Arsenic (As)	ug/L	3.8	4.1	4.1	3.6	11	11	11	11	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Barium (Ba)	ug/L	87	91	100	95	56	59	53	56	24	22	30	29	33	32	32	30
Dissolved Boron (B)	ug/L	42	46	39	48	38	40	32	39	91	97	75	59	54	54	53	54
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Calcium (Ca)	ug/L	31000	32000	34000	33000	36000	38000	39000	39000	70000	71000	77000	70000	73000	78000	83000	72000
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Copper (Cu)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	1.7	<1.0	1.1	<1.0
Dissolved Iron (Fe)	ug/L	180	250	300	340	140	110	170	190	<100	<100	<100	<100	<100	<100	<100	<100
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	ug/L	18000	18000	19000	19000	25000	26000	26000	26000	37000	37000	34000	31000	27000	26000	28000	27000
Dissolved Manganese (Mn)	ug/L	6.9	7.1	8.4	9.3	12	12	12	12	4.6	3.8	6.4	7.8	10	9.3	11	10
Dissolved Potassium (K)	ug/L	960	960	1100	1100	980	1000	1100	1000	3300	3300	3800	3800	3700	3700	4100	3900
Dissolved Sodium (Na)	ug/L	15000	16000	17000	18000	17000	17000	17000	17000	49000	49000	48000	47000	43000	44000	46000	47000
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.8	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Volatile Organics																	
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.22	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.27	0.30	0.80	0.45	0.35	<0.20	<0.20	<0.20	0.65	0.25	<0.20
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Surrogate Recovery (%)																	
4-Bromofluorobenzene	%	99	80	84	93	100	79	84	92	101	85	86	92	99	85	84	92
D4-1,2-Dichloroethane	%	105	114	102	104	108	113	100	105	107	111	102	103	104	112	101	103
D8-Toluene	%	98	94	98	95	97	95	100	96	98	93	99	95	97	95	99	95

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Notes:

-	Not analyzed.
<	Less than reported detection limit.
mg/L	miligrams per liter
umho/cm	micromhos per centimeter
ug/L	micrograms per liter
(1)	TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.
(2)	Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordinly.
(3)	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(4)	No sample was collect at monitoring wells MW17-4A and MW17-4B in November 2018, due to frozen groundwater within the casing.
	Table to be read in conjunction with the report.

Summary of Groundwater Quality

Hydrogeological Assessment
Southwest ern Landfill
Zorra Township, Ontario

Parameter	Sample Date	MW17-2C								MW17-2D				MW17-3A			
		27-Feb-2018	**27-Feb-2018**	**23-May-2018**	**23-May-2018**	**24-Aug-2018**	**24-Aug-2018**	**29-Nov-2018**	**29-Nov-2018**	**28-Feb-2018**	**23-May-2018**	**24-Aug-2018**	**29-Nov-2018**	**28-Feb-2018**	**24-May-2018**	**22-Aug-2018**	**30-Nov-2018**
	Unit	MW17-2C	UP-2C (Field Duplicate	MW17-2C	UP-2C (Field Duplicate	MW17-2C	UP-2C (Field Duplicate	MW17-2C	UP-2C (Field Duplicate	MW17-2D	MW17-2D	MW17-2D	MW17-2D	MW17-3A	MW17-3A	MW17-3A	MW17-3A
Calculated Parameters																	
Bicarb. Alkalinity (calc. as CaCO3)		220	230	240	240	270	260	250	240	230	260	270	270	180	170	180	170
Calculated TDS	mg/L	310	320	330	320	360	360	340	340	310	340	360	360	460	460	450	450
Carb. Alkalinity (calc. as CaCO3)		2.1	2.1	2.4	2.5	2.1	2.1	1.7	1.8	1.9	2.1	2.1	1.9	1.4	2.0	1.4	1.8
Hardness (CaCO3)	mg/L	250	260	280	280	320	330	300	300	260	300	330	320	280	290	300	290
Inorganics																	
Total Ammonia-N	mg/L	<0.050	<0.050	0.051	0.078	<0.050	<0.050	<0.050	<0.050	0.15	0.14	0.18	0.15	0.058	0.054	<0.050	0.074
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	7.7	<4.0	<4.0	4.8	<4.0	<4.0	<4.0	<4.0
Conductivity	umho/cm	570	570	550	570	610	610	600	600	570	580	620	630	840	790	780	800
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.50 (2)	<0.50 (2)	<0.20 (2)	0.23	<0.50 (2)	<0.50 (2)	<0.50 (2)	<0.50 (2)	<0.50 (2)	<0.50 (2)	<0.50 (2)	0.71	0.12	<0.10	<0.10	<0.10
Dissolved Organic Carbon	mg/L	0.92	0.70	0.60	0.62	0.80	0.72	0.72	0.86	0.69	0.64	0.83	0.69	0.99	0.94	1.0	1.1
pH	pH	7.99	8.00	8.01	8.03	7.92	7.92	7.85	7.90	7.93	7.93	7.92	7.87	7.91	8.08	7.91	8.06
Phenols-4AAP	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	0.35	0.38	0.25	0.27	0.16	0.16	0.051	0.053	8.5	3.9	2.6	7.1	0.027	<0.004	0.011	<0.004
Dissolved Sulphate (SO4)	mg/L	20	20	17	17	14	15	14	14	13	12	11	13	130	130	120	130
Alkalinity (Total as CaCO3)	mg/L	230	230	250	250	270	270	250	250	230	260	270	270	180	170	180	170
Dissolved Chloride (Cl)	mg/L	14	14	11	11	12	11	12	12	<20 (3)	12	12	12	69	72	66	66
Nitrite (N)	mg/L	0.013	0.014	0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	mg/L	9.56	9.55	8.23	7.46	9.65	9.66	9.92	9.88	11.3	9.46	10.2	9.85	1.36	1.54	1.68	1.36
Nitrate + Nitrite (N)	mg/L	9.57	9.57	8.24	7.47	9.65	9.66	9.92	9.88	11.3	9.46	10.2	9.85	1.36	1.54	1.68	1.36
Calculated Parameters																	
Chromium (+3)	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Metals																	
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.51	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	14	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Barium (Ba)	ug/L	32	31	32	32	26	28	20	21	19	19	22	20	39	33	36	34
Dissolved Boron (B)	ug/L	12	12	12	13	<10	<10	12	12	<10	<10	<10	12	58	55	55	58
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Calcium (Ca)	ug/L	72000	73000	80000	81000	94000	96000	87000	89000	75000	89000	97000	94000	63000	69000	70000	67000
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Copper (Cu)	ug/L	1.9	<1.0	<1.0	<1.0	1.8	1.4	<1.0	<1.0	<1.0	<1.0	2.1	<1.0	<1.0	<1.0	1.3	<1.0
Dissolved Iron (Fe)	ug/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	110	<100	<100	<100
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	ug/L	18000	18000	20000	19000	20000	21000	20000	19000	18000	19000	21000	20000	30000	28000	30000	30000
Dissolved Manganese (Mn)	ug/L	7.7	6.9	7.0	7.6	<2.0	<2.0	<2.0	<2.0	9.6	<2.0	<2.0	7.2	2.7	<2.0	<2.0	<2.0
Dissolved Potassium (K)	ug/L	670	670	680	650	780	820	730	740	1100	810	910	870	3300	3400	3300	3400
Dissolved Sodium (Na)	ug/L	3500	3500	3500	3500	2900	2900	2700	2700	2000	2100	2300	2300	41000	43000	44000	45000
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Volatile Organics																	
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.31	0.35	0.25	<0.20	<0.20	<0.20	<0.20
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Surrogate Recovery (%)																	
4-Bromofluorobenzene	%	99	98	80	82	87	86	91	90	99	83	86	91	99	87	87	91
D4-1,2-Dichloroethane	%	105	105	109	110	101	102	104	109	104	110	102	105	106	107	104	105
D8-Toluene	%	98	98	96	94	96	95	96	94	98	94	95	94	98	94	101	95

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Notes:

-	Not analyzed.
<	Less than reported detection limit.
mg/L	miligrams per liter
umho/cm	micromhos per centimeter
ug/L	micrograms per liter
(1)	TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.
(2)	Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordinly.
(3)	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(4)	No sample was collect at monitoring wells MW17-4A and MW17-4B in November 2018, due to frozen groundwater within the casing.
	Table to be read in conjunction with the report.

Summary of Groundwater Quality

Hydrogeological Assessment
Southwest ern Landfill
Zorra Township, Ontario

Parameter	Sample Date	MW17-3B				MW17-3C				MW17-3E				MW17-4A [(4)]		
		28-Feb-2018	22-May-2018	22-Aug-2018	30-Nov-2018	28-Feb-2018	22-May-2018	22-Aug-2018	30-Nov-2018	28-Feb-2018	22-May-2018	22-Aug-2018	30-Nov-2018	01-Mar-2018	23-May-2018	22-Aug-2018
	Unit	MW17-3B	MW17-3B	MW17-3B	MW17-3B	MW17-3C	MW17-3C	MW17-3C	MW17-3C	MW17-3E	MW17-3E	MW17-3E	MW17-3E	MW17-4A	MW17-4A	MW17-4A
Calculated Parameters																
Bicarb. Alkalinity (calc. as CaCO3)		210	200	210	200	240	230	230	230	290	330	390	400	280	270	280
Calculated TDS	mg/L	270	280	290	280	320	320	330	320	350	390	590	550	470	520	540
Carb. Alkalinity (calc. as CaCO3)		2.3	2.9	2.3	2.2	2.4	2.6	2.5	1.8	2.6	2.1	2.9	2.4	2.4	3.3	2.2
Hardness (CaCO3)	mg/L	200	210	230	220	250	260	280	270	260	330	470	460	330	350	380
Inorganics																
Total Ammonia-N	mg/L	0.14	0.14	0.12	0.17 (1)	<0.050	<0.050	0.069	<0.050	0.10	0.094	0.25	0.18	0.14	0.35	0.15
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	11	<4.0	5.4	<4.0	<4.0	<4.0	<4.0
Conductivity	umho/cm	510	500	500	510	590	560	560	580	620	670	940	950	860	880	900
Total Kjeldahl Nitrogen (TKN)	mg/L	0.17	0.14	0.21	0.14 (1)	<0.10	<0.10	<0.10	0.15	0.85	0.69	2.6	1.2	0.19	0.58	0.19
Dissolved Organic Carbon	mg/L	0.61	<0.50	0.61	0.60	0.80	0.69	0.81	0.80	2.2	2.1	2.3	2.7	1.2	0.89	0.96
pH	pH	8.07	8.17	8.07	8.06	8.03	8.08	8.06	7.93	7.98	7.83	7.90	7.80	7.95	8.10	7.92
Phenols-4AAP	mg/L	0.0015	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	<0.0010	0.0015	<0.0010	<0.0010
Total Phosphorus	mg/L	0.031	0.007	0.006	0.008	0.020	0.029	0.005	0.005	13	20	30	5.3	0.005	<0.004	0.004
Dissolved Sulphate (SO4)	mg/L	53	53	53	54	47	44	47	45	35	29	81	72	95	120	120
Alkalinity (Total as CaCO3)	mg/L	210	210	210	200	240	230	240	230	290	330	400	400	290	280	280
Dissolved Chloride (Cl)	mg/L	3.7	3.8	4.4	3.9	16	16	16	17	11	7.7	23	23	42	59	59
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	mg/L	<0.10	<0.10	<0.10	<0.10	0.51	0.40	0.55	0.56	1.43	1.17	4.09	1.83	<0.10	<0.10	<0.10
Nitrate + Nitrite (N)	mg/L	<0.10	<0.10	<0.10	<0.10	0.51	0.40	0.55	0.56	1.43	1.17	4.09	1.83	<0.10	<0.10	<0.10
Calculated Parameters																
Chromium (+3)	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Metals																
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	6.9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	12	6.3	<5.0
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Barium (Ba)	ug/L	37	36	38	36	86	84	88	86	52	67	130	93	35	45	36
Dissolved Boron (B)	ug/L	89	96	97	97	22	26	27	27	20	31	57	37	60	78	78
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Calcium (Ca)	ug/L	34000	37000	40000	38000	58000	62000	65000	62000	71000	93000	130000	130000	80000	85000	89000
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Copper (Cu)	ug/L	<1.0	<1.0	<1.0	<1.0	3.2	<1.0	<1.0	<1.0	1.4	2.8	2.1	2.0	<1.0	<1.0	<1.0
Dissolved Iron (Fe)	ug/L	110	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	ug/L	28000	29000	31000	30000	26000	26000	28000	27000	21000	23000	35000	36000	32000	33000	38000
Dissolved Manganese (Mn)	ug/L	2.2	2.2	<2.0	<2.0	12	13	13	11	<2.0	<2.0	<2.0	<2.0	19	18	17
Dissolved Potassium (K)	ug/L	1500	1600	1600	1700	1500	1500	1600	1600	11000	13000	29000	17000	1900	2100	2300
Dissolved Sodium (Na)	ug/L	18000	19000	19000	19000	10000	11000	12000	12000	8800	8100	17000	17000	33000	43000	49000
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Volatile Organics																
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Toluene	ug/L	<0.20	<0.20	<0.20	0.48	<0.20	<0.20	2.4	<0.20	<0.20	0.28	0.37	0.34	<0.20	<0.20	<0.20
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.23	0.24	<0.20	<0.20	<0.20
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.23	0.24	<0.20	<0.20	<0.20
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Surrogate Recovery (%)																
4-Bromofluorobenzene	%	98	81	92	92	92	84	89	91	97	81	85	90	99	83	84
D4-1,2-Dichloroethane	%	106	110	105	107	117	112	103	108	100	107	103	107	104	113	103
D8-Toluene	%	98	94	100	96	98	94	101	95	99	95	102	95	98	93	101

Notes:

-	Not analyzed.
<	Less than reported detection limit.
mg/L	miligrams per liter
umho/cm	micromhos per centimeter
ug/L	micrograms per liter
(1)	TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.
(2)	Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordinly.
(3)	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(4)	No sample was collect at monitoring wells MW17-4A and MW17-4B in November 2018, due to frozen groundwater within the casing.
	Table to be read in conjunction with the report.

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Summary of Groundwater Quality

Hydrogeological Assessment
Southwest ern Landfill
Zorra Township, Ontario

Parameter	Sample Date	MW17-4B [4]			MW17-5A				MW17-5B				MW17-5C			
		01-Mar-2018	23-May-2018	22-Aug-2018	02-Mar-2018	22-May-2018	23-Aug-2018	29-Nov-2018	02-Mar-2018	23-May-2018	21-Aug-2018	29-Nov-2018	02-Mar-2018	23-May-2018	21-Aug-2018	28-Nov-2018
	Unit	MW17-4B	MW17-4B	MW17-4B	MW17-5A	MW17-5A	MW17-5A	MW17-5A	MW17-5B	MW17-5B	MW17-5B	MW17-5B	MW17-5C	MW17-5C	MW17-5C	MW17-5C
Calculated Parameters																
Bicarb. Alkalinity (calc. as CaCO3)		270	270	270	230	230	230	230	180	170	150	170	290	240	160	200
Calculated TDS	mg/L	540	560	570	840	800	810	800	450	460	450	450	530	450	280	390
Carb. Alkalinity (calc. as CaCO3)		1.8	2.6	2.1	1.7	2.6	1.8	1.6	1.9	1.8	1.6	1.5	1.8	2.1	1.6	1.3
Hardness (CaCO3)	mg/L	340	360	380	420	450	470	460	270	290	270	290	410	350	230	320
Inorganics																
Total Ammonia-N	mg/L	0.13	0.24	0.17	0.30	0.34	0.31	0.33	<0.050	<0.050	<0.050	<0.050	<0.050	0.10	<0.050	<0.050
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	<4.0	<4.0	18	<4.0	<4.0	9.1	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Conductivity	umho/cm	880	950	950	1400	1300	1300	1300	820	770	760	800	880	740	480	680
Total Kjeldahl Nitrogen (TKN)	mg/L	0.28	0.25	0.19	0.48	0.37	0.38	0.34	<0.10	<0.10	<0.10	<0.10	0.10	0.21	<0.10	0.14
Dissolved Organic Carbon	mg/L	1.1	0.91	1.0	5.5	1.0	1.3	1.1	1.1	0.94	0.91	1.1	1.3	0.87	0.89	1.2
pH	pH	7.86	8.02	7.91	7.90	8.07	7.92	7.87	8.06	8.04	8.07	7.99	7.81	7.97	8.03	7.84
Phenols-4AAP	mg/L	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus	mg/L	0.004	<0.004	0.006	0.020	0.016	0.012	0.009	0.005	0.004	0.029	0.07	0.006	<0.004	0.006	<0.004
Dissolved Sulphate (SO4)	mg/L	130	140	140	350	330	330	330	120	130	140	130	140	130	82	120
Alkalinity (Total as CaCO3)	mg/L	270	270	270	230	230	230	230	180	180	150	170	290	240	160	210
Dissolved Chloride (Cl)	mg/L	71	75	70	89	86	81	83	70	69	71	66	23	20	8.2	18
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	0.024	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.082	0.046	0.045	0.153
Nitrate (N)	mg/L	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	2.03	2.06	1.72	1.72	2.83	1.09	<0.10	1.45
Nitrate + Nitrite (N)	mg/L	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	2.03	2.06	1.72	1.72	2.91	1.13	0.13	1.60
Calculated Parameters																
Chromium (+3)	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Metals																
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	<5.0	5.7	24	5.8	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	3.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Barium (Ba)	ug/L	31	30	32	25	15	13	12	35	37	37	37	36	34	31	40
Dissolved Boron (B)	ug/L	78	87	88	150	150	150	150	48	53	48	50	33	24	11	22
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19
Dissolved Calcium (Ca)	ug/L	81000	85000	90000	74000	78000	81000	77000	67000	73000	63000	71000	120000	99000	65000	88000
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Copper (Cu)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Iron (Fe)	ug/L	<100	<100	<100	<100	150	160	<100	<100	<100	<100	<100	<100	<100	<100	<100
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	ug/L	34000	35000	37000	58000	61000	65000	64000	26000	26000	27000	28000	28000	26000	17000	25000
Dissolved Manganese (Mn)	ug/L	14	14	15	11	5.4	2.3	2.6	<2.0	<2.0	<2.0	<2.0	13	8.6	7.9	13
Dissolved Potassium (K)	ug/L	2200	2400	2400	3500	3400	3700	3700	3500	3700	3600	3700	6000	3300	1500	2200
Dissolved Sodium (Na)	ug/L	49000	54000	57000	120000	91000	94000	94000	40000	43000	46000	44000	16000	10000	6000	8900
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	8.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	7.2	20	36	71
Volatile Organics																
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Toluene	ug/L	<0.20	<0.20	<0.20	0.26	0.46	<0.20	<0.20	<0.20	<0.20	<0.20	1.8	<0.20	<0.20	<0.20	<0.20
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Surrogate Recovery (%)																
4-Bromofluorobenzene	%	99	84	86	98	84	89	91	98	83	85	91	98	82	85	90
D4-1,2-Dichloroethane	%	104	111	102	103	107	103	108	104	112	106	108	104	111	105	110
D8-Toluene	%	97	94	101	98	94	98	94	98	94	96	93	97	94	97	94

DRAFT

Notes:

-	Not analyzed.
<	Less than reported detection limit.
mg/L	miligrams per liter
umho/cm	micromhos per centimeter
ug/L	micrograms per liter
(1)	TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.
(2)	Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordinly.
(3)	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(4)	No sample was collect at monitoring wells MW17-4A and MW17-4B in November 2018, due to frozen groundwater within the casing.
	Table to be read in conjunction with the report.

Summary of Groundwater Quality

Hydrogeological Assessment
Southwest ern Landfill
Zorra Township, Ontario

Parameter	Sample Date	MW17-6A								MW17-6B			
		28-Feb-2018	**28-Feb-2018**	**22-May-2018**	**22-May-2018**	**21-Aug-2018**	**21-Aug-2018**	**28-Nov-2018**	**28-Nov-2018**	**28-Feb-2018**	**22-May-2018**	**21-Aug-2018**	**21-Aug-2018**
	Unit	MW17-6A	UP-6A (Field Duplicat	MW17-6A	UP-6A (Field Duplicat	MW17-6A	UP-6A (Field Duplicat	MW17-6A	UP-6A (Field Duplicat	MW17-6B	MW17-6B	MW17-6B	MW17-6B
Calculated Parameters													
Bicarb. Alkalinity (calc. as CaCO3)		220	220	250	250	300	300	270	270	260	310	270	280
Calculated TDS	mg/L	450	450	450	450	1100	1100	540	540	460	540	440	430
Carb. Alkalinity (calc. as CaCO3)		2.0	2.3	2.6	4.1	3.5	3.4	1.8	1.8	2.0	2.5	2.8	1.7
Hardness (CaCO3)	mg/L	270	270	280	290	410	420	330	320	310	440	370	360
Inorganics													
Total Ammonia-N	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.059	<0.050	0.081
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	9.4	4.2	<4.0	<4.0	<4.0	<4.0
Conductivity	umho/cm	850	860	810	800	2000	2000	1000	1000	840	900	740	760
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	0.22	0.38	<0.10	<0.10	0.10	0.18
Dissolved Organic Carbon	mg/L	1.9	1.8	1.5	1.5	1.6	1.7	2.8	2.4	1.2	0.73	0.87	0.83
pH	pH	7.98	8.03	8.04	8.25	8.10	8.08	7.85	7.85	7.92	7.93	8.03	7.82
Phenols-4AAP	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	<0.0010
Total Phosphorus	mg/L	0.026	0.027	0.018	0.017	0.025	0.027	0.050	0.050	0.020	<0.004	0.010	<0.004
Dissolved Sulphate (SO4)	mg/L	49	48	39	36	48	48	37	40	72	130	76	76
Alkalinity (Total as CaCO3)	mg/L	220	230	250	250	300	300	270	270	260	320	280	280
Dissolved Chloride (Cl)	mg/L	93	94	82	81	410	410	110	110	64	38	33	31
Nitrite (N)	mg/L	<0.010	<0.010	0.025	0.025	<0.010	<0.010	<0.010	<0.010	0.085	<0.010	0.087	0.083
Nitrate (N)	mg/L	3.68	3.78	2.71	2.74	2.73	2.78	5.92	5.91	1.78	<0.10	1.22	1.39
Nitrate + Nitrite (N)	mg/L	3.68	3.78	2.74	2.77	2.73	2.78	5.92	5.91	1.87	<0.10	1.31	1.47
Calculated Parameters													
Chromium (+3)	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Metals													
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Barium (Ba)	ug/L	48	50	48	48	100	100	46	46	69	66	56	68
Dissolved Boron (B)	ug/L	17	18	28	28	18	19	23	22	26	27	17	26
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Calcium (Ca)	ug/L	78000	78000	83000	85000	130000	130000	98000	95000	84000	120000	100000	93000
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Copper (Cu)	ug/L	1.6	<1.0	1.3	1.5	1.3	1.3	2.0	7.3	2.5	<1.0	<1.0	<1.0
Dissolved Iron (Fe)	ug/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	ug/L	19000	19000	19000	20000	22000	22000	21000	21000	24000	35000	30000	31000
Dissolved Manganese (Mn)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	34	47	40	42
Dissolved Potassium (K)	ug/L	5800	5900	2600	2800	3700	3700	3300	3300	2500	2300	1900	2000
Dissolved Sodium (Na)	ug/L	44000	43000	49000	50000	240000	240000	69000	69000	35000	14000	13000	14000
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	9.8	5.1	<5.0	<5.0	6.4	9.0	7.4	5.4	5.8
Volatile Organics													
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Surrogate Recovery (%)													
4-Bromofluorobenzene	%	91	87	82	82	83	87	90	90	89	82	85	90
D4-1,2-Dichloroethane	%	115	104	113	108	106	112	109	109	119	115	106	107
D8-Toluene	%	98	98	94	97	96	93	95	95	98	93	97	94

DRAFT

Notes:

-	Not analyzed.
<	Less than reported detection limit.
mg/L	miligrams per liter
umho/cm	micromhos per centimeter
ug/L	micrograms per liter
(1)	TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.
(2)	Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordinly.
(3)	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly
(4)	No sample was collect at monitoring wells MW17-4A and MW17-4B in November 2018, due to frozen groundwater within the casing.
	Table to be read in conjunction with the report.

Summary of Chloride Concentrations

Hydrogeological Assessment
Southwestern Landfill
Zorra Township, Ontairo

	Chloride (mg/L)			
Sampling Event	Q1	Q2	Q3	Q4
MW17-1A	6.6	16	27	35
MW17-1B	<1.0	<1.0	<1.0	<1.0
MW17-1C	1.1	1.3	1.2	<1.0
MW17-1D	20	20	18	20
MW17-2A	65	64	65	70
MW17-2B	75	71	71	71
MW17-2C	14	11	12	12
MW17-2D	<20 (1)	12	12	12
MW17-3A	69	72	66	66
MW17-3B	3.7	3.8	4.4	3.9
MW17-3C	16	16	16	17
MW17-3E	11	7.7	23	23
MW17-4A	42	59	59	--
MW17-4B	71	75	70	--
MW17-5A	89	86	81	83
MW17-5B	70	69	71	66
MW17-5C	23	20	8.2	18
MW17-6A	93	82	410	110
MW17-6B	64	38	33	31

DRAFT

Notes:

--	No water level was measured in November 2018 due to frozen groundwater within the casing.
<	Less than reported detection limit.
mg/L	miligrams per liter
(1)	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
	Table to be read in conjunction with the report.

Table IV: Explosive hazard due to combustible gas accumulation in confined spaces

Study Area	Duration	Baseline ("Do Nothing" Alternative)	Potential Effects		Additional Mitigation	Net Effects		Impact Management
			Landfill	Cumulative		Landfill	Cumulative	
On-Site & Vicinity	Operational Period	No Landfill gas is generated, only background concentrations of combustible gas (from natural or other sources) is present in the subsurface.	Landfill gases generated at the landfill could migrate through the subsurface in the overburden or bedrock onto neighboring properties.	Landfill gas concentrations could add to existing background concentrations of combustible gases.	Generic liner design and associated landfill gas collection and management measures will prevent unacceptable migration of landfill gas into neighbouring properties.	No net effects.	No associated cumulative impacts.	Contingencies can be implemented based on the results of landfill gas monitoring including additional source and/or perimeter controls, such passive or active venting systems, including trenches and/or wells, to prevent offsite migration of gas.
	Post-Closure Period	No Landfill gas is generated, only background concentrations of combustible gas (from natural or other sources) is present in the subsurface.	Landfill gases generated at the landfill could migrate through the subsurface in the overburden or bedrock onto neighboring properties.	Landfill gas concentrations could add to existing background concentrations of combustible gases.	Generic liner design and associated landfill gas collection and management measures will prevent unacceptable migration of landfill gas into neighbouring properties.	No net effects.	No associated cumulative impacts.	Contingencies can be implemented based on the results of landfill gas monitoring including additional source and/or perimeter controls, such passive or active venting systems, including trenches and/or wells, to prevent offsite migration of gas.

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Table V: Effects due to contact with groundwater or surface water

Study Area	Duration	Baseline ("Do Nothing" Alternative)	Potential Effects		Additional Mitigation	Net Effects		Impact Management
			Landfill	Cumulative		Landfill	Cumulative	
On-Site & Vicinity	Operational Period	In the absence of the landfill, groundwater quality will be characterized by background concentrations (from natural or other sources).	Leachate related parameters could migrate onto neighbouring properties as constituents of groundwater.	Concentrations of leachate related parameters would be additive to background concentrations.	Generic liner design and leachate collection system is protective of groundwater quality at the site boundaries.	No net effects. Generic design is protective of groundwater quality at the site boundaries.	No associated cumulative impacts.	Contingencies can be implemented based on the results of groundwater quality monitoring. Proven and effective contingency measures, including Leachate purge wells in bedrock, leachate extraction wells in waste, permeable underdrain can be implemented based on results of groundwater model to ensure there are no off-site impacts.
	Post-Closure Period	In the absence of the landfill, groundwater quality will be characterized by background concentrations (from natural or other sources).	Leachate related parameters could migrate onto neighbouring properties as constituents of groundwater.	Concentrations of leachate related parameters would be additive to background concentrations.	Generic liner design and leachate collection system is protective of groundwater quality at the site boundaries.	No net effects. Generic design is protective of groundwater quality at the site boundaries.	No associated cumulative impacts.	Contingencies can be implemented based on the results of groundwater quality monitoring. Proven and effective contingency measures, including Leachate purge wells in bedrock, leachate extraction wells in waste, permeable underdrain can be implemented based on results of groundwater model to ensure there are no off-site impacts.

DRAFT

Table VI: Impact on the availability of groundwater supply to wells

Study Area	Duration	Baseline ("Do Nothing" Alternative)	Potential Effects		Additional Mitigation	Net Effects		Impact Management
			Landfill	Cumulative		Landfill	Cumulative	
On-Site & Vicinity	Operational Period	Effects on availability of groundwater supply related to expansion and deepening the quarry	No additional groundwater level drawdown or pumping of groundwater related to the construction or operation of the landfill. There will be no negative net effect on the availability of groundwater supply.	No cumulative impacts	No additional mitigation required related to the landfill	No net effects	No cumulative impacts	No required impact management related to the construction or operation of the landfill
	Post-Closure Period	Effects on availability of groundwater supply related to expansion and deepening the quarry	No additional groundwater level drawdown or pumping of groundwater related to the construction or operation of the landfill. There will be no negative net effect on the availability of groundwater supply.	No cumulative impacts	No additional mitigation required related to the landfill	No net effects	No cumulative impacts	No required impact management related to the construction or operation of the landfill

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Table VII: Effects on stream baseflow quantity/quality

Study Area	Duration	Baseline ("Do Nothing" Alternative)	Potential Effects		Additional Mitigation	Net Effects		Impact Management
			Landfill	Cumulative		Landfill	Cumulative	
On-Site & Vicinity	Operational Period	Stream baseflow quantity could be affected by groundwater	Landfill design or construction will not increase quarry drawdown. Stream baseflow will not be negatively impacted by the landfill since it will not increase groundwater level drawdown.	No cumulative impacts	No additional mitigation required related to landfill design or construction for groundwater quantity criterion. Mitigation to prevent unanticipated seepage of leachate impacted groundwater to surface water could include leachate extraction wells or a permeable underdrain	No net affects on baseflow quantity or quality.	No cumulative impacts	Contingencies can be implemented based on the results of groundwater monitoring program
	Post-Closure Period	Stream baseflow quantity could be affected by groundwater	Landfill design or construction will not increase quarry drawdown. Stream baseflow will not be negatively impacted by the landfill since it will not increase groundwater level drawdown.	No cumulative impacts	No additional mitigation required related to landfill design or construction for groundwater quantity criterion. Mitigation to prevent unanticipated seepage of leachate impacted groundwater to surface water could include leachate extraction wells or a permeable underdrain	No net affects on baseflow quantity or quality.	No cumulative impacts	Contingencies can be implemented based on the results of groundwater monitoring program

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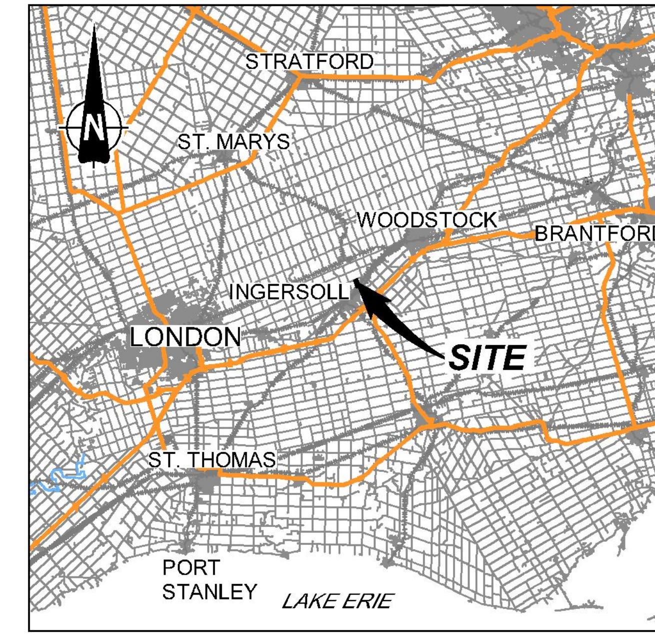

KEY PLAN

LEGEND

BOREHOLE/MONITORING WELL

STUDY AREAS:

SITE BOUNDARY

GROUNDWATER SITE VICINITY

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) WALKER ENVIRONMENTAL, FIGURE 5, "APPROVED AMENDED TERMS OF REFERENCE, MAY 20, 2016;
3) MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017; AND
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FOR PROFILES, REFER TO FIGURES 9.18 AND 9.19.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

LOCATION PLAN

GOLDER

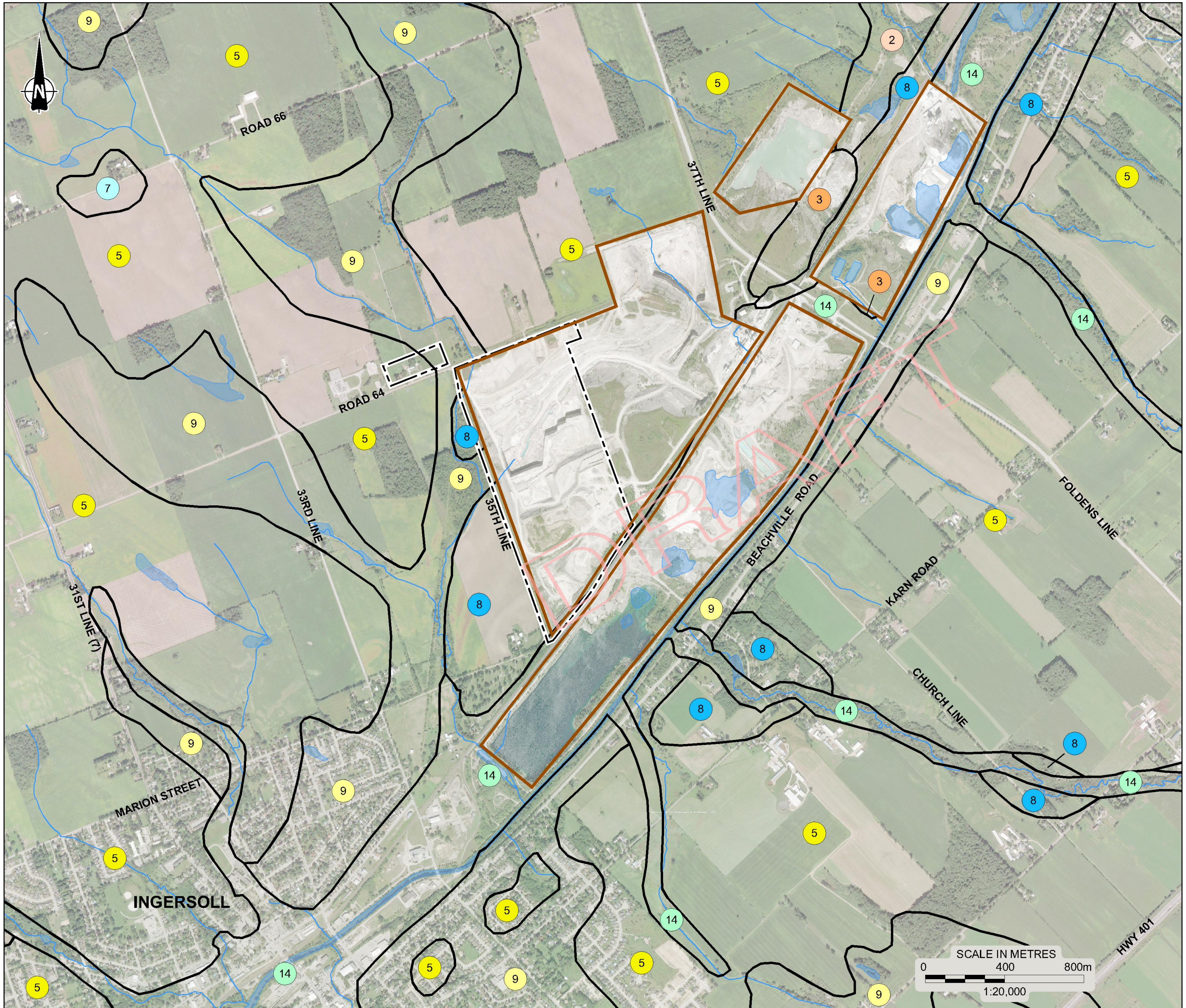
PROJECT No.	1664706	FILE No. 1664706-2000-R0306-1	
		SCALE AS SHOWN	REV.
CADD	DH/AK/ZB	Oct 7/19	
CHECK	RM		

FIGURE 6.1

Client: Walker Environmental Group Inc.

Original Format is Tabloid 279mm x 432mm

Drawing file: 1664706-2000-R0306-1.dwg Oct 07, 2019 – 10:27am



LEGEND

- - - SITE BOUNDARY
—— QUARRY ACTIVITY

QUATERNARY GEOLOGY:

—— GEOLOGICAL UNIT LIMIT

2 Catfish Creek Till: Stony silty and till. Includes older drift valley in walls
3 Port Stanley Till: Silt till. Includes older drift valley in walls
5 Zorra (Tavistock) Till: Yellow to brown, silt to sandy silt till
7 Ice contact stratified drift. Sand and gravel - includes some till or silt
8 Gravel and gravelly sand of glaciofluvial outwash origin. Frequently overlain by several feet of sand or silt
9 Sand of glaciofluvial origin
14 Modern alluvium undifferentiated. Silt, sand, gravel

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) WALKER ENVIRONMENTAL, FIGURE 5, "APPROVED AMENDED TERMS OF REFERENCE, MAY 20, 2016;
3) MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017; AND
4) MINISTRY OF NORTHERN DEVELOPMENT AND MINES, QUATERNARY GEOLOGY, MAP 4785, WOODSTOCK AREA, © QUEEN'S PRINTER FOR ONTARIO, 1971.

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PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
QUATERNARY GEOLOGY

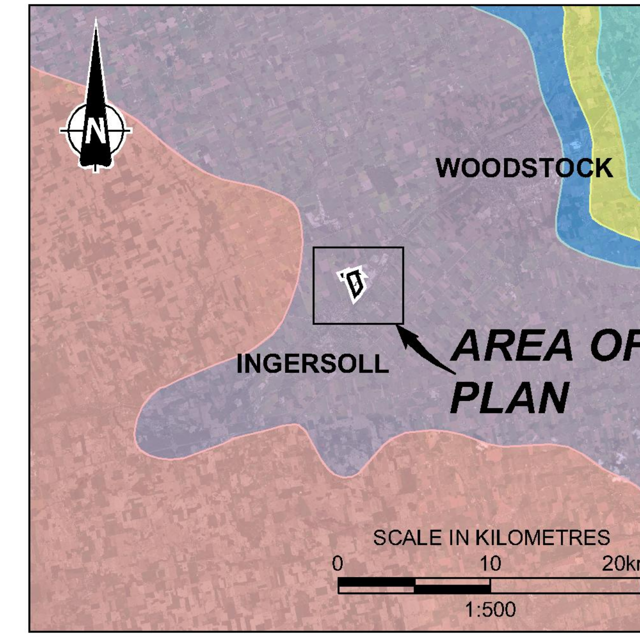
GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0308-1
		SCALE	AS SHOWN
CADD	ZJB/DCH	Oct 7/19	REV.
CHECK			

FIGURE 8.1

Drawing file: 1664706-2000-R0308-1.dwg Oct 07, 2019 – 10:31am Original Format is Tabloid 279mm x 432mm Client: Walker Environmental Group Inc.

BEDROCK TOPOGRAPHY



BEDROCK GEOLOGY

LEGEND

- SITE BOUNDARY
- BEDROCK TOPOGRAPHY
- DUNDEE FORMATION
- DETROIT RIVER GROUP; LUCAS AND AMHERSTBURG FORMATIONS
- BOIS BLANC FORMATION; ORISKANY FORMATION
- BASS ISLANDS FORMATION
- SALINA FORMATION

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) WALKER ENVIRONMENTAL, FIGURE 5, "APPROVED AMENDED TERMS OF REFERENCE, MAY 20, 2016; AND
3) MNR LIO, OBTAINED 2018, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2018.

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
BEDROCK GEOLOGY AND TOPOGRAPHY

GOLDER

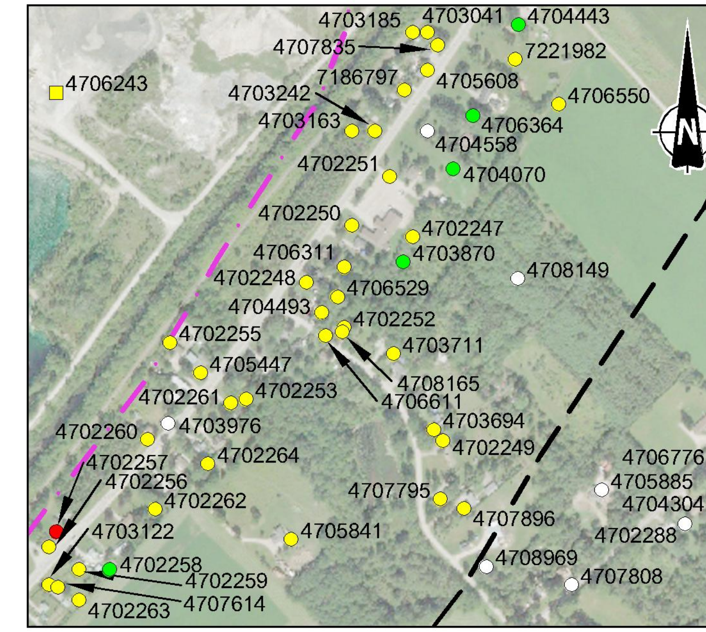
PROJECT No.	1664706	FILE No.	1664706-2000-R0308-2
		SCALE	AS SHOWN
CADD	DCH/ZJB	Oct 7/19	REV.
CHECK	RM		

FIGURE 8.2

Client: Walker Environmental Group Inc.

Drawing file: 1664706-2000-R0308-2.dwg Oct 07, 2019 – 10:38am Original Format is Tabloid 279mm x 432mm

Client: Walker Environmental Group Inc
Original Format is Tabloid 279mm x 432mm
Drawing file: 1664706-2000-R0308-3.dwg Oct 07, 2019 - 11:27am



INSET A (SCALE: 1:10,000)

LEGEND

WATER WELL TYPE:

- DOMESTIC WATER WELL AS IDENTIFIED BY THE MOECC
- PUBLIC/MUNICIPAL WATER WELL AS IDENTIFIED BY THE MOECC
- INDUSTRY WATER WELL AS IDENTIFIED BY THE MOECC

SURVEY RESPONSE:

- VISITED AND CONSENT TO MONITOR WAS PROVIDED
- VISITED AND WAITING ON A RESPONSE
- VISITED AND CONSENT TO MONITOR WAS DENIED
- NOT VISITED

STUDY AREAS:

- SITE BOUNDARY
- 500m FROM SITE BOUNDARY
- GROUNDWATER SITE VICINITY

REFERENCE

DRAWING BASED ON BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
MOECC WATER WELL DATABASE AS OF APRIL 4, 2017; AND MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017.

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

WATER WELL LOCATION PLAN AND DOOR TO DOOR WELL SURVEY RESULTS

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0308-3
		SCALE	AS SHOWN
CADD	DH/ZB/AS	Oct 7/19	REV.
CHECK	KM		

FIGURE 8.3

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
Drawing file: 1664706-2000-R0308-4.dwg Oct 07, 2019 - 10:44am

LEGEND

SITE BOUNDARY

MUNICIPAL WELL

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) MNR LIO, OBTAINED 2018, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2018.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

ALL LOCATIONS ARE APPROXIMATE.

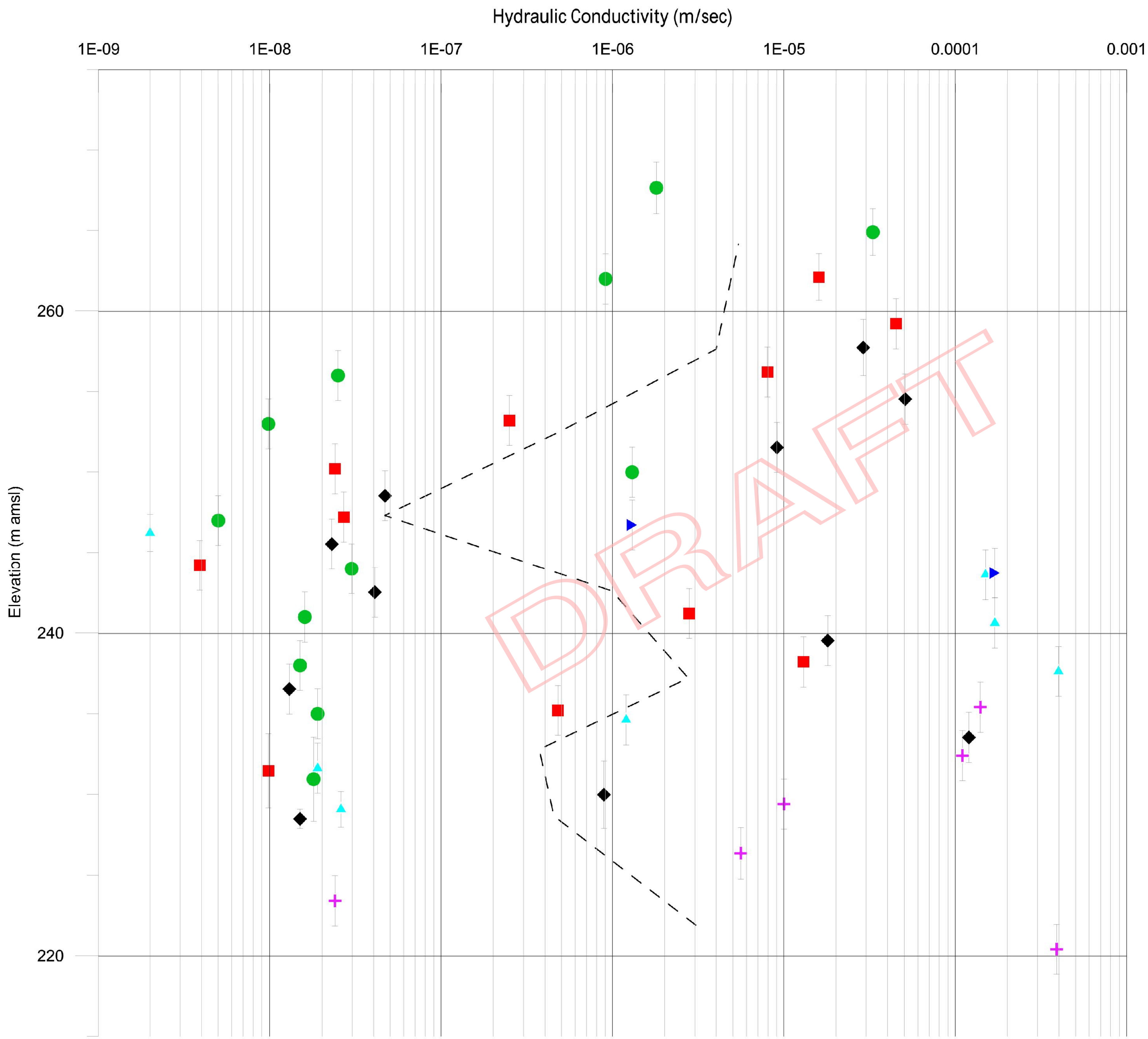
PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
MUNICIPAL WELL LOCATION PLAN

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0308-4
		SCALE	AS SHOWN
CADD	DCH/ZJB	Oct 7/19	REV.
CHECK	RM		

FIGURE 8.4



LEGEND

- BH17-1A
- BH17-2A
- BH17-3A
- BH17-4A
- BH17-5A
- BH17-6A
- GEOMEAN

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

QUARRY FLOOR APPROXIMATELY 230m to 240m (m amsl).

PROJECT	HYDROGEOLOGICAL ASSESSMENT SOUTHWEST LANDFILL ZORRA TOWNSHIP, ONTARIO
TITLE	**HYDRAULIC CONDUCTIVITY DISTRIBUTION SCATTER PLOT**

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0308-5		
		SCALE AS SHOWN	REV.	
CADD	ZJB/DCH	June 26/19		
CHECK	[signature]			

FIGURE 8.5

Drawing file: 1664706-2000-R0308-5.dwg Jun 26, 2019 - 3:48pm Original Format is Tabloid 279mm x 432mm Client: Walker Environmental Group Inc.

LEGEND

MONITORING WELL

STUDY AREAS:

SITE BOUNDARY

GROUNDWATER SITE VICINITY

288.47m MEASURED GROUNDWATER ELEVATION - m amsl (AUGUST 21, 2018)

INFERRED GROUNDWATER FLOW DIRECTION

INFERRED GROUNDWATER CONTOUR

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) WALKER ENVIRONMENTAL, FIGURE 5, "APPROVED AMENDED TERMS OF REFERENCE, MAY 20, 2016; AND
3) MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

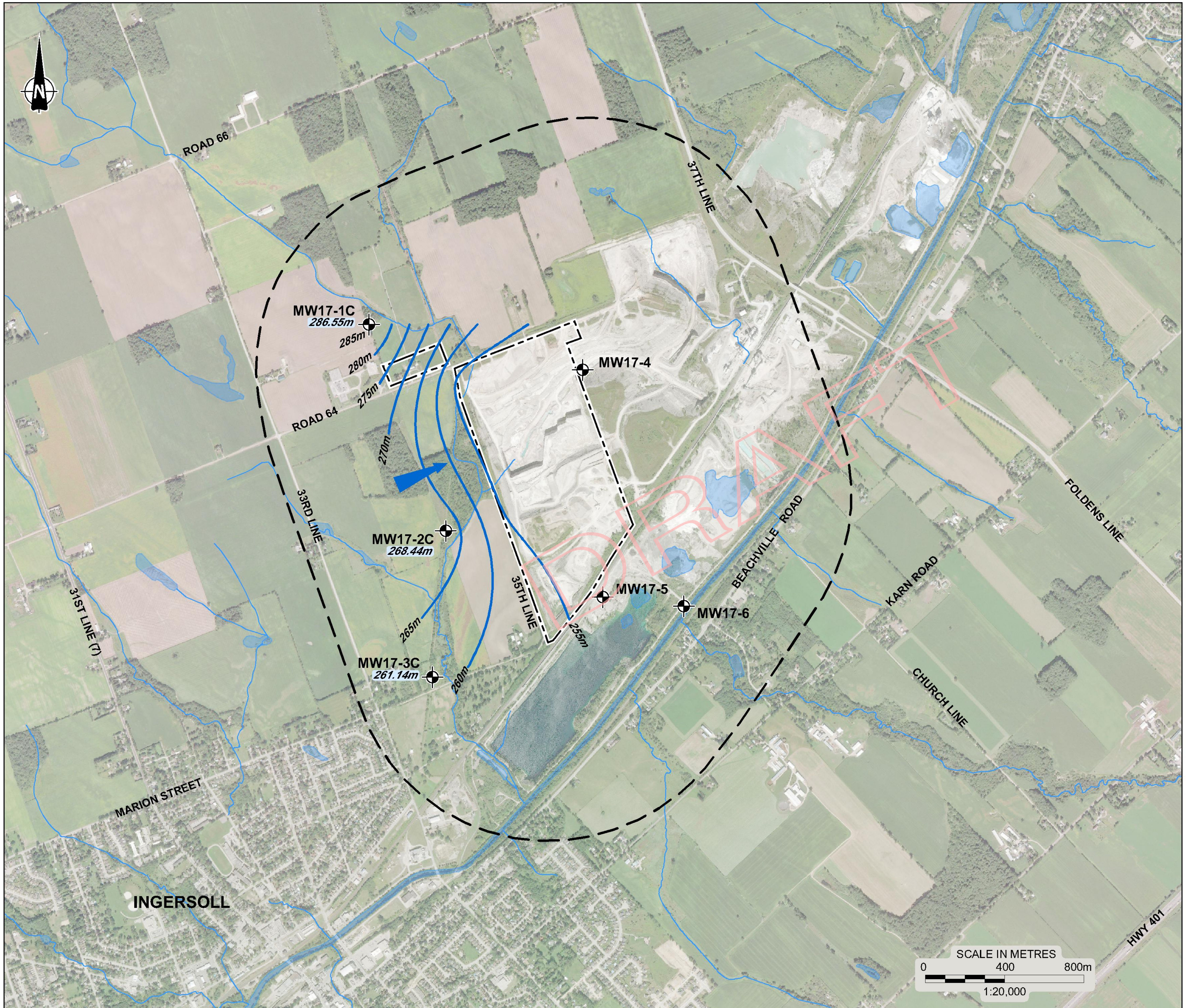
TITLE
INFERRED PIEZOMETRIC SURFACE OVERBURDEN

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0308-6	
		SCALE AS SHOWN	REV.
CADD	DH/ZB/AS	Oct 7/19	
CHECK	RM		

FIGURE 8.6

Drawing file: 1664706-2000-R0308-6.dwg Oct 07, 2019 – 12:46pm 0 25mm Original Format is Tabloid 279mm x 432mm Client: Walker Environmental Group Inc.



LEGEND

MONITORING WELL

STUDY AREAS:

SITE BOUNDARY

GROUNDWATER SITE VICINITY

287.16m MEASURED GROUNDWATER ELEVATION - m amsl (AUGUST 21, 2018)

INFERRED GROUNDWATER FLOW DIRECTION

INFERRED GROUNDWATER CONTOUR

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) WALKER ENVIRONMENTAL, FIGURE 5, "APPROVED AMENDED TERMS OF REFERENCE, MAY 20, 2016; AND
3) MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017.

NOTES

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BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

INFERRED PIEZOMETRIC SURFACE
SHALLOW WEATHERED ZONE

GOLDER

PROJECT No.	1664706		FILE No. 1664706-2000-R0308-7	
			SCALE AS SHOWN	REV.
CADD	DH/ZB/AS	Oct 7/19		
CHECK	RM		**FIGURE 8.7**	

Drawing file: 1664706-2000-R0308-7.dwg Oct 07, 2019 - 12:45pm Original Format is Tabloid 279mm x 432mm Client: Walker Environmental Group Inc.

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
Drawing file: 1664706-2000-R0308-8.dwg Oct 07, 2019 – 10:52am

LEGEND

- MONITORING WELL
- BEDROCK WELL (GHD)
- SURFACE WATER (GHD)
- BEDROCK WELL (DOOR TO DOOR)

STUDY AREAS:

- SITE BOUNDARY
- GROUNDWATER SITE VICINITY

- 287.16m — MEASURED GROUNDWATER ELEVATION - m amsl (GOLDER, AUGUST 21, 2018)
- 31.47m — MEASURED GROUNDWATER ELEVATION - mbgs (WELL NOT SURVEYED)
- 238.94m — MEASURED GROUNDWATER ELEVATION - m amsl (GHD, DECEMBER, 20, 2017)
- INFERRED GROUNDWATER FLOW DIRECTION
- INFERRED SHALLOW GROUNDWATER CONTOUR

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) WALKER ENVIRONMENTAL, FIGURE 5, "APPROVED AMENDED TERMS OF REFERENCE, MAY 20, 2016; AND
3) MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017.
4) GHD 2016/2017 MONITORING REPORT, CARMEUSE LIME (CANADA) LIMITED, INGERSOLL, ONTARIO, FIGURE 5.9.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
INFERRED PIEZOMETRIC SURFACE SHALLOW WEATHERED ZONE (GHD WELLS)

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0308-8		
		SCALE	AS SHOWN	REV.	
CADD	DH/ZB/AS	Oct 7/19			
CHECK	RM				

FIGURE 8.8

LEGEND

MONITORING WELL

STUDY AREAS:

SITE BOUNDARY

GROUNDWATER SITE VICINITY

245.82m MEASURED GROUNDWATER ELEVATION - m amsl (AUGUST 21, 2018)

INFERRED GROUNDWATER FLOW DIRECTION

INFERRED GROUNDWATER CONTOUR

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) WALKER ENVIRONMENTAL, FIGURE 5, "APPROVED AMENDED TERMS OF REFERENCE, MAY 20, 2016; AND
3) MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
INFERRED PIEZOMETRIC SURFACE
LUCAS FORMATION

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0308-9
		SCALE	AS SHOWN
CADD	DH/ZB/AS	Oct 7/19	REV.
CHECK	RM		

FIGURE 8.9

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
Drawing file: 1664706-2000-R0308-9.dwg Oct 07, 2019 - 12:43pm

LEGEND

- MONITORING WELL
- MUNICIPAL WELL

STUDY AREAS:

- SITE BOUNDARY
- GROUNDWATER SITE VICINITY

245.82m MEASURED GROUNDWATER ELEVATION - m amsl (AUGUST 21, 2018)

INFERRED GROUNDWATER FLOW DIRECTION

INFERRED GROUNDWATER CONTOUR

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) WALKER ENVIRONMENTAL, FIGURE 5, "APPROVED AMENDED TERMS OF REFERENCE, MAY 20, 2016; AND
3) MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017.

NOTES

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BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

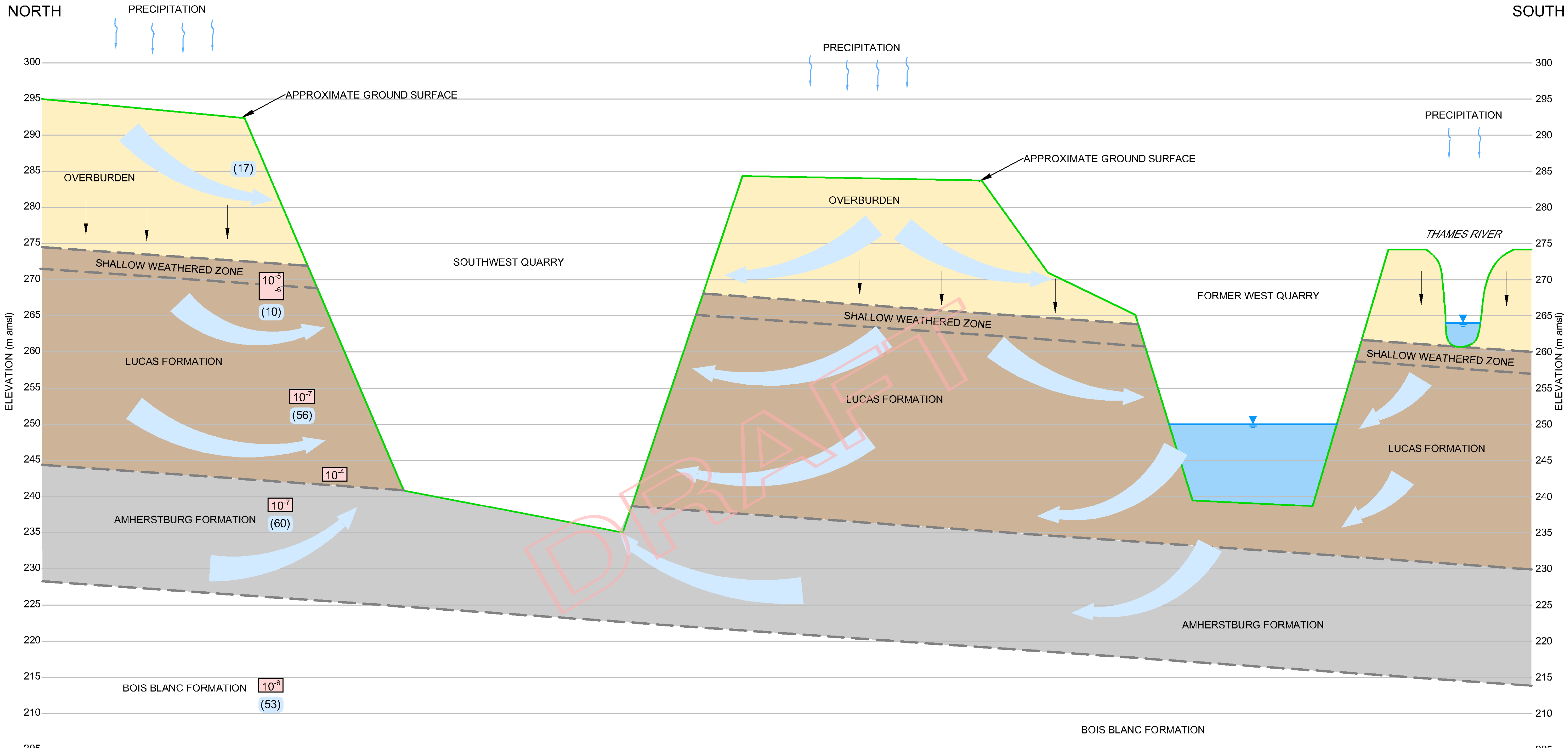
INFERRED PIEZOMETRIC SURFACE AMHERSTBURG FORMATION

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0308-10	
		SCALE	AS SHOWN	REV.
CADD	DH/ZB/AS	Oct 7/19	
CHECK	RM		

FIGURE 8.10

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
25mm 0
Drawing file: 1664706-2000-R0308-10.dwg Oct 07, 2019 – 12:47pm



LEGEND

PRECIPITATION

INFILTRATION

INFERRED GROUNDWATER FLOW

10^{-8} HYDRAULIC CONDUCTIVITY (K) VALUE IN (m/s) FROM HYDRAULIC TESTING

(59) AVERAGE DISSOLVED CHLORIDE CONCENTRATION IN GROUNDWATER (mg/L)

OVERBURDEN

LUCAS FORMATION

AMHERSTBURG FORMATION

REFERENCE

DRAWING BASED ON "Carmeuse Lime Beachville Topo 11-14-17.dwg" PROVIDED BY WALKER ENVIRONMENTAL.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

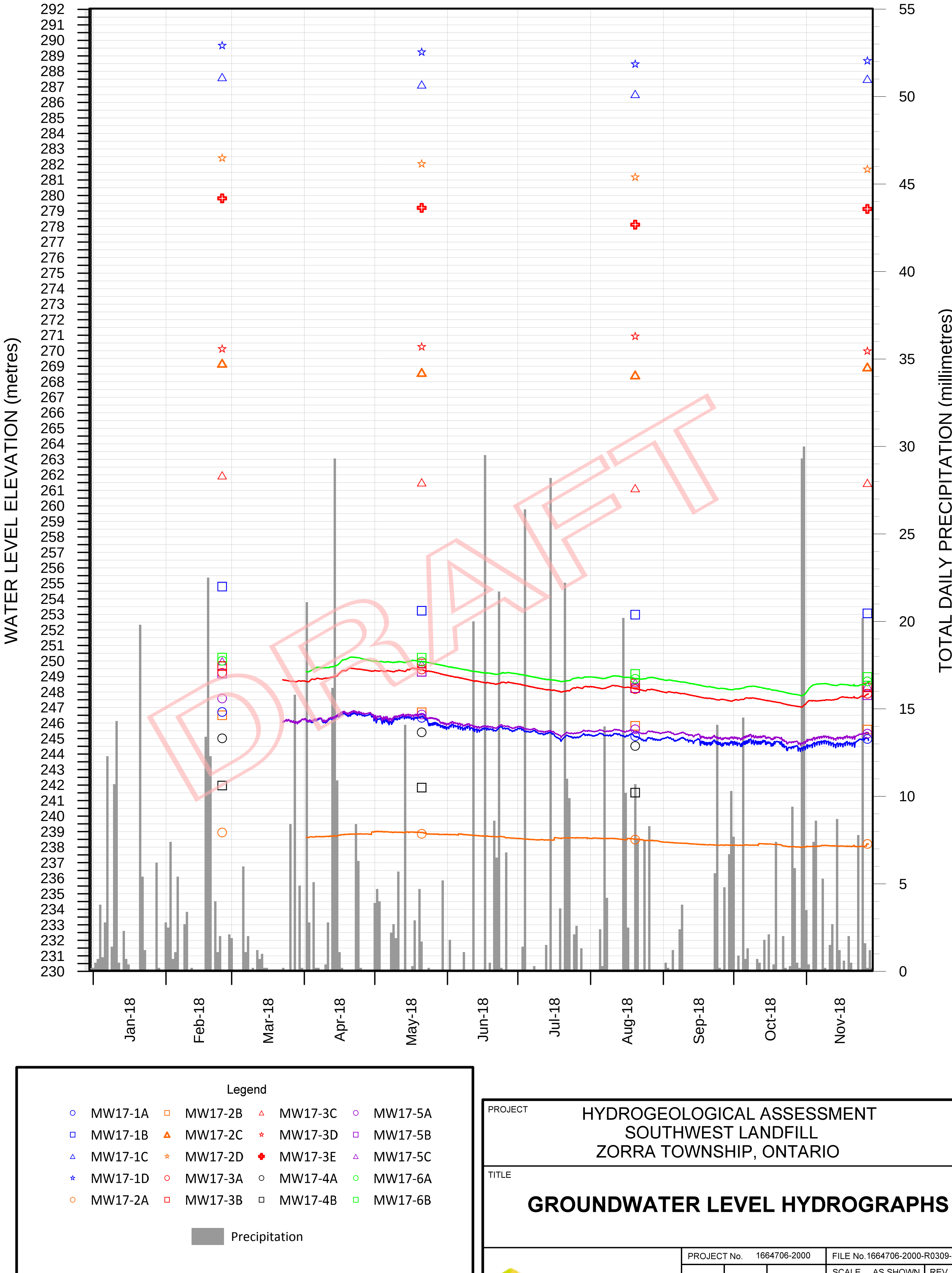
CONCEPTUAL HYDROGEOLOGICAL MODEL

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0309-1
		SCALE	AS SHOWN	REV.
CADD	DH/AS/ZB	Oct 7/19	
CHECK	RM		

FIGURE 9.1

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
25mm 0
Drawing file: 1664706-2000-R0309-1.dwg Oct 07, 2019 - 11:03am



Notes:
1) Weather data sourced from MECP-MCS for station London CS (I.D. 6144478)
2) This figure is to be read in conjunction with the accompanying text.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

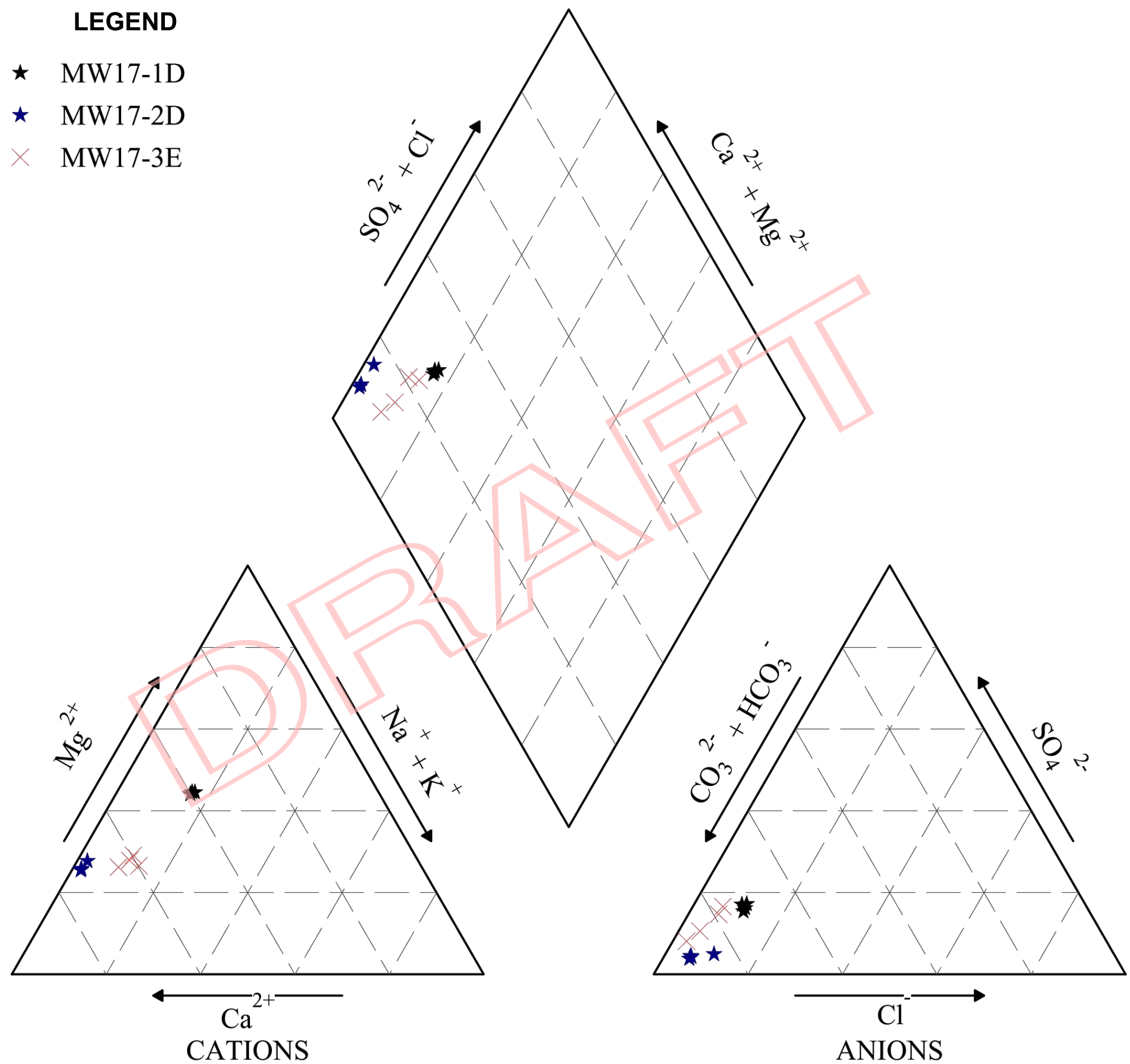
TITLE
GROUNDWATER LEVEL HYDROGRAPHS

GOLDER

PROJECT No.	1664706-2000		FILE No. 1664706-2000-R0309-2	
			SCALE AS SHOWN	REV. 0
DWN	RM	Apr 30/19	**FIGURE 9.2**	
CHECK	RM			

Client: Walker Environmental Group Inc.

Original Format is Letter 279mm x 216mm



DRAFT

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL.

ALL LOCATIONS ARE APPROXIMATE.

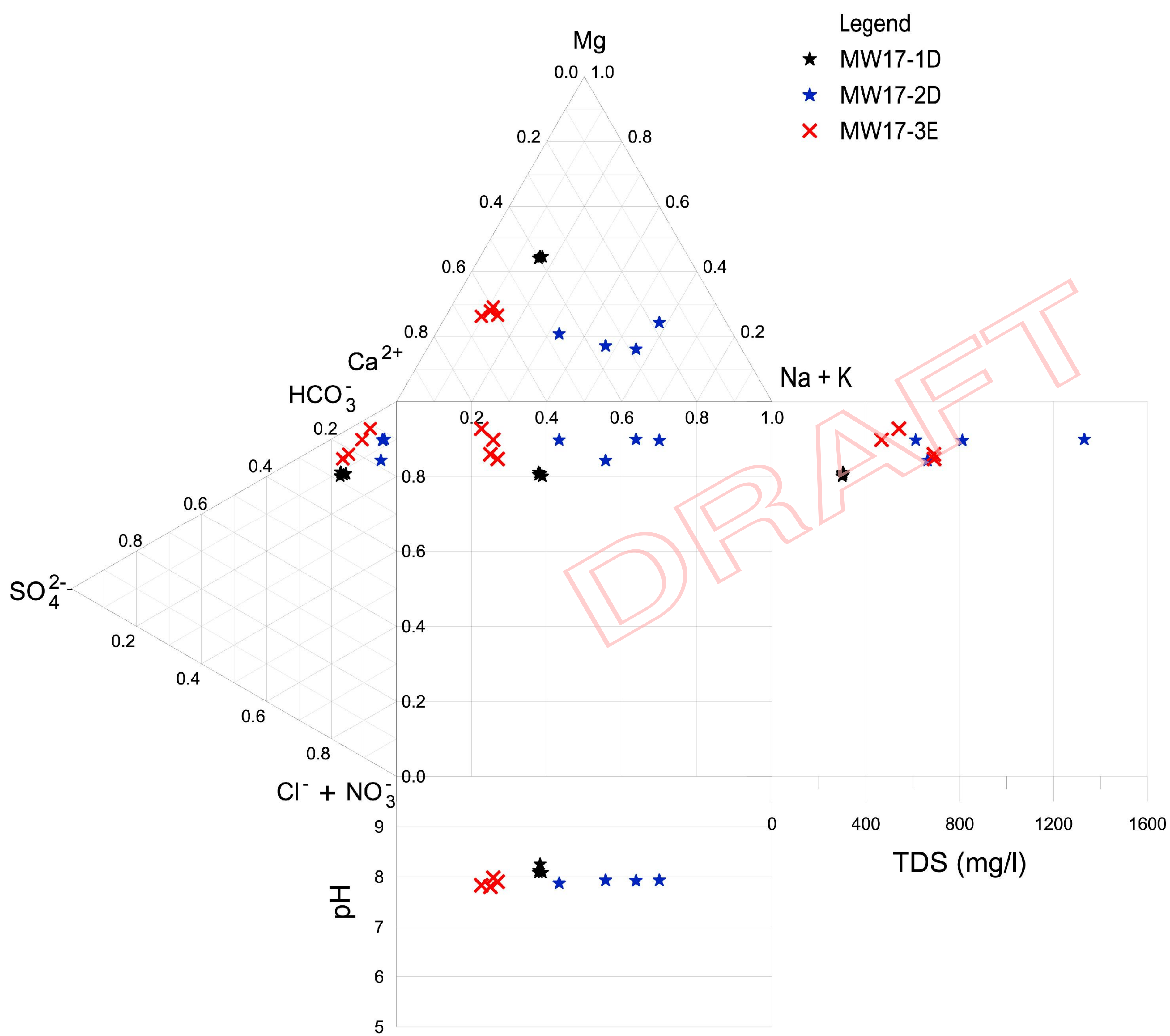
PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
PIPER PLOT FOR GROUNDWATER SAMPLES OVERBURDEN

GOLDER

PROJECT No.		1664706	FILE No. 1664706-2000-R0309-3	
			SCALE AS SHOWN	REV.
CADD	AMS/DCH	May 22/19	**FIGURE 9.3**	
CHECK	RM			

25mm 0



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

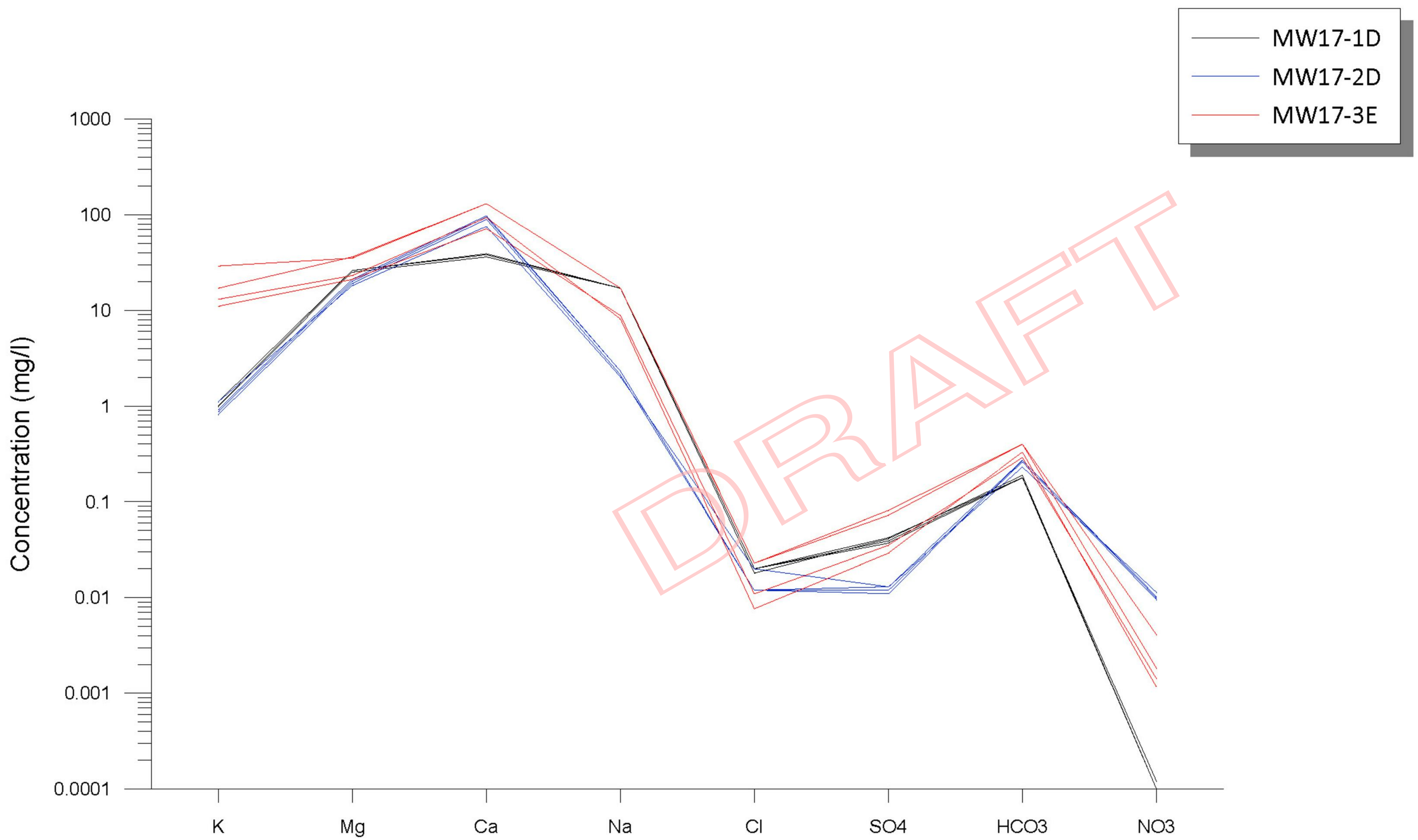
TITLE

DUROV PLOT FOR GROUNDWATER SAMPLES OVERBURDEN

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0309-4
		SCALE	AS SHOWN
CADD	AMS/DCH	May 22/19	REV.
CHECK			**FIGURE 9.4**

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
Drawing file: 1664706-2000-R0309-4.dwg May 22, 2019 – 4:30pm



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

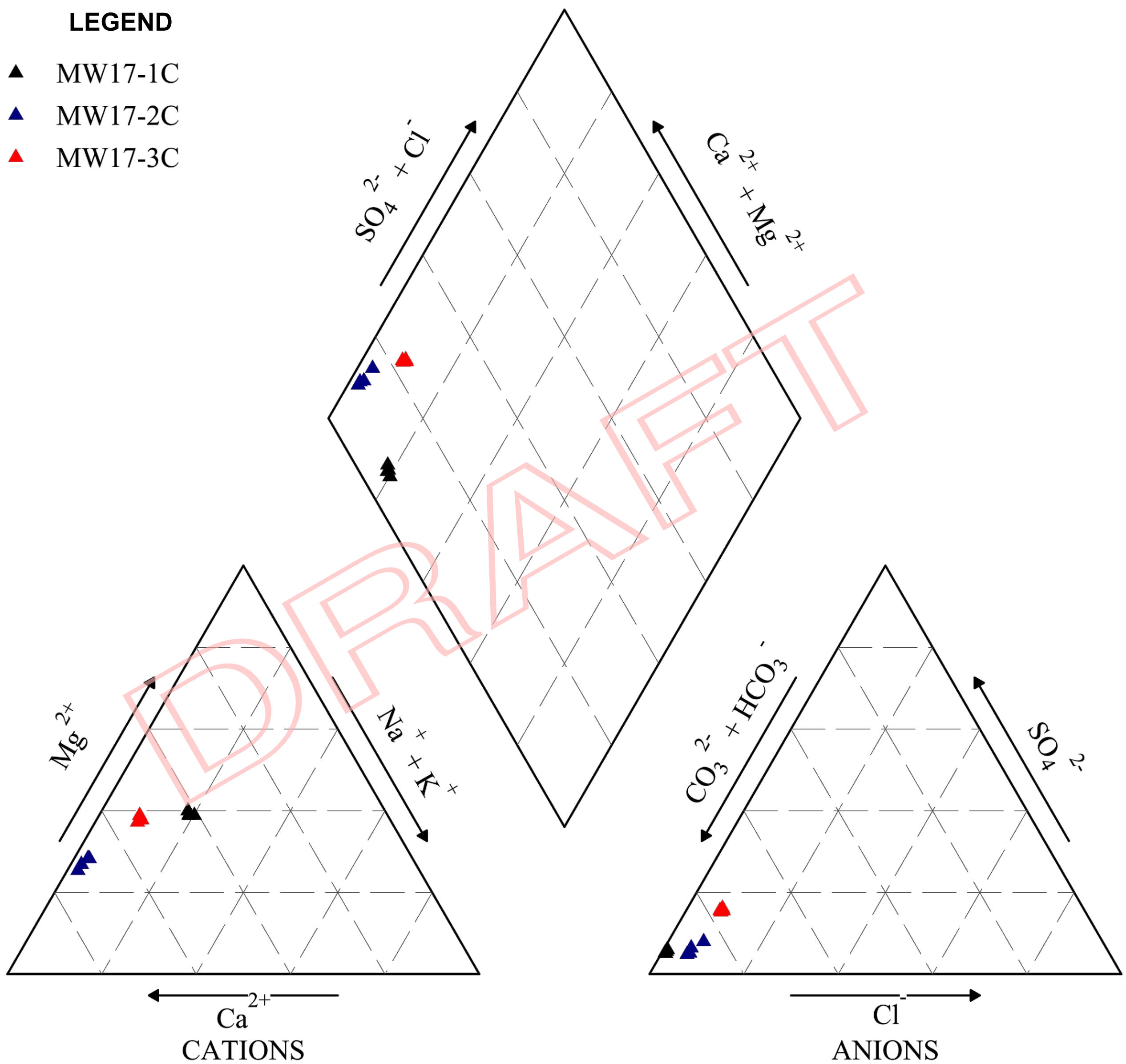
SCHOELLER PLOT FOR GROUNDWATER SAMPLES OVERBURDEN

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0309-5	
		SCALE AS SHOWN	REV.
CADD	AMS/DCH	Oct 7/19	
CHECK	RM		

FIGURE 9.5

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
25mm 0
Oct 07, 2019 - 1:01pm
Drawing file: 1664706-2000-R0309-5.dwg



DRAFT

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

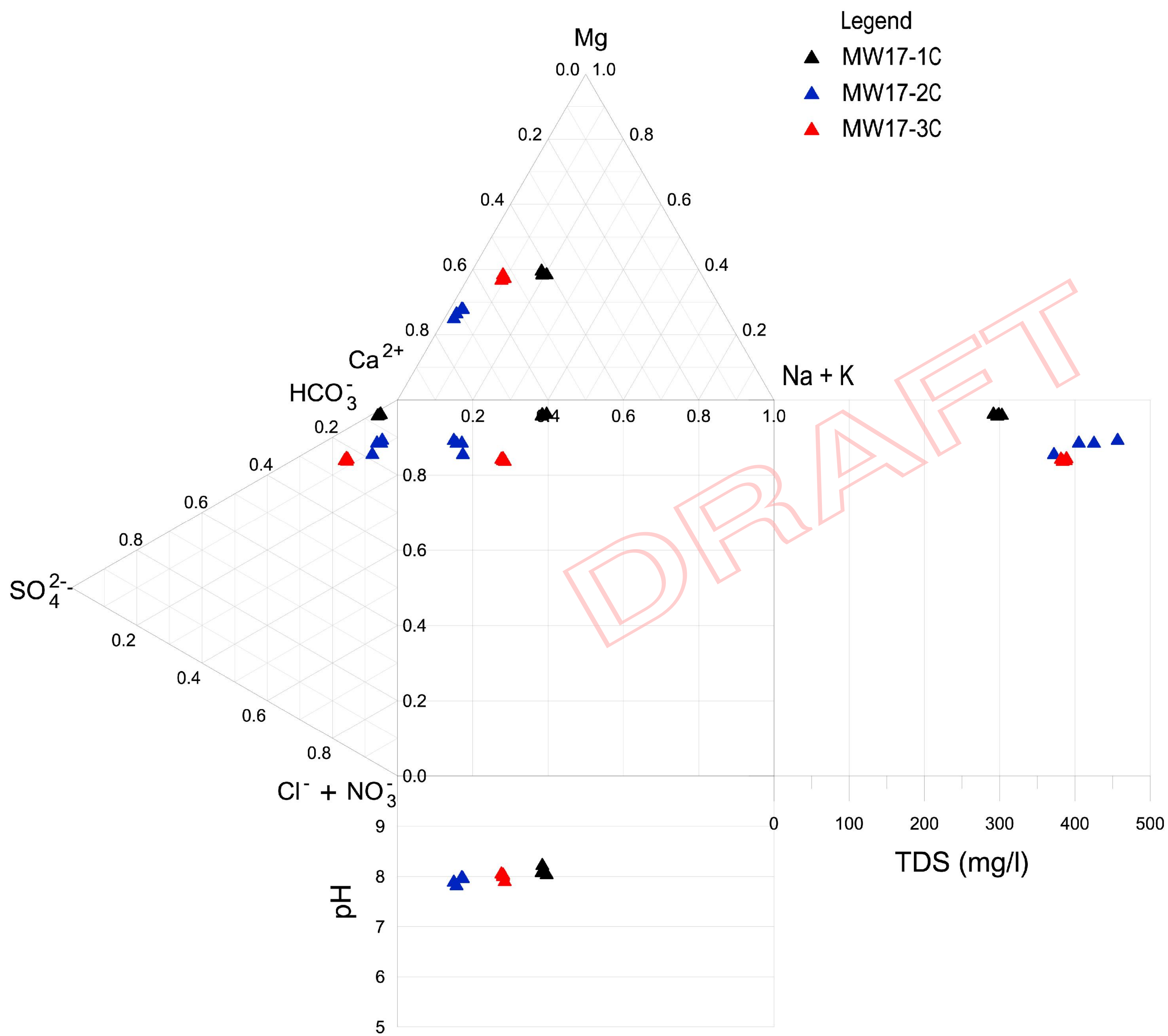
TITLE
PIPER PLOT FOR GROUNDWATER SAMPLES SHALLOW WEATHERED ZONE

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0309-6	
		SCALE AS SHOWN	REV.
CADD	AMS/DCH	May 22/19	
CHECK	RM		

FIGURE 9.6

Drawing file: 1664706-2000-R0309-6.dwg May 22, 2019 - 4:34pm Original Format is Letter 279mm x 216mm Client: Walker Environmental Group Inc.
0 25mm



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
DUROV PLOT FOR GROUNDWATER SAMPLES SHALLOW WEATHERED ZONE

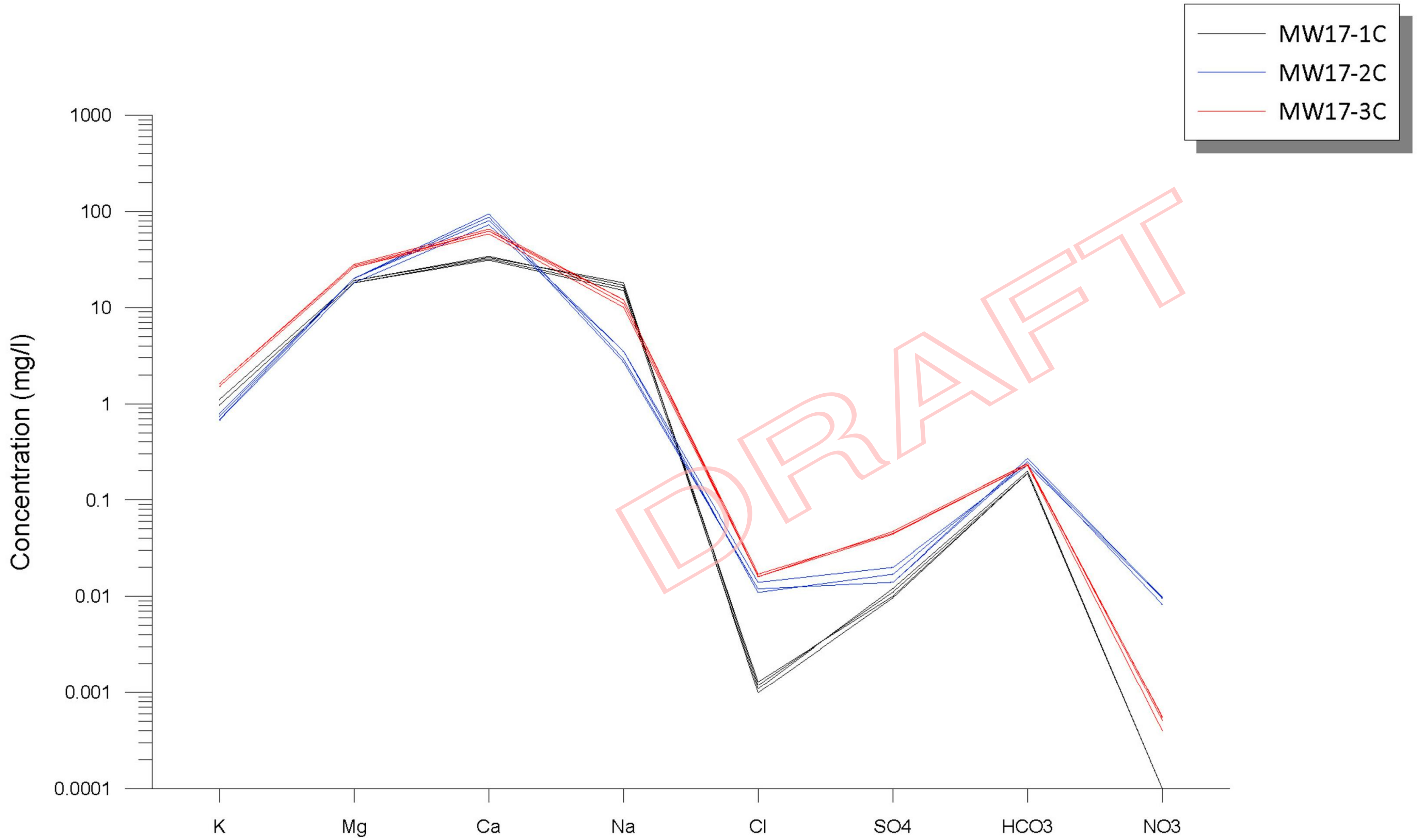
GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0309-7
		SCALE	AS SHOWN
CADD	AMS/DCH	May 22/19	
CHECK			

FIGURE 9.7

Drawing file: 1664706-2000-R0309-7.dwg May 22, 2019 - 4:34pm Original Format is Tabloid 279mm x 432mm Client: Walker Environmental Group Inc.

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
Oct 07, 2019 - 1:04pm
Drawing file: 1664706-2000-R0309-8.dwg



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

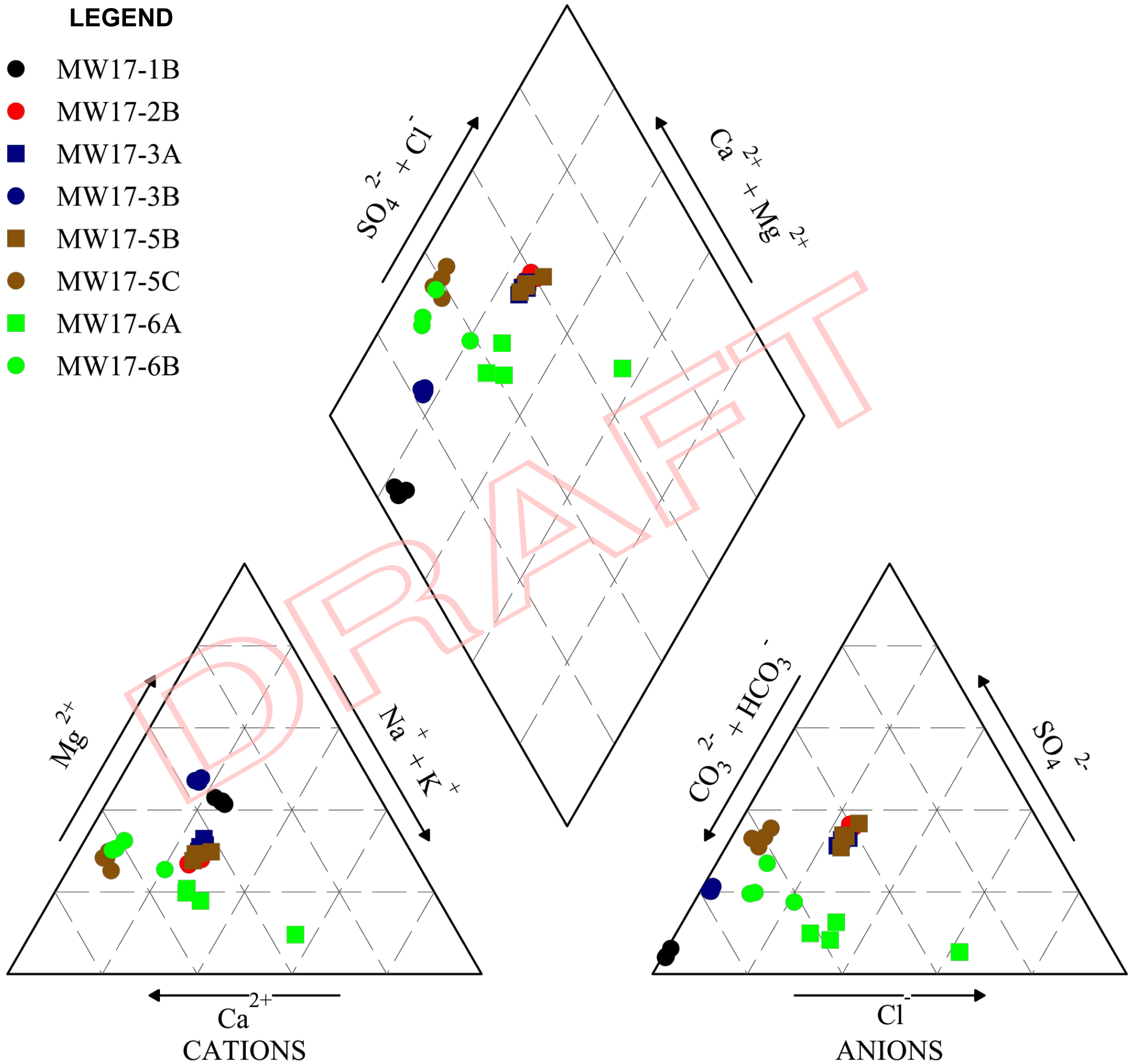
SCHOELLER PLOT FOR GROUNDWATER SAMPLES SHALLOW WEATHERED ZONE

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0309-8
		SCALE	AS SHOWN
CADD	AMS/DCH	Oct 7/19	REV.
CHECK	RM		

FIGURE 9.8

Client: Walker Environmental Group Inc.
Original Format is Letter 279mm x 216mm
May 22, 2019 - 4:39pm
Drawing file: 1664706-2000-R0309-9.dwg



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL.

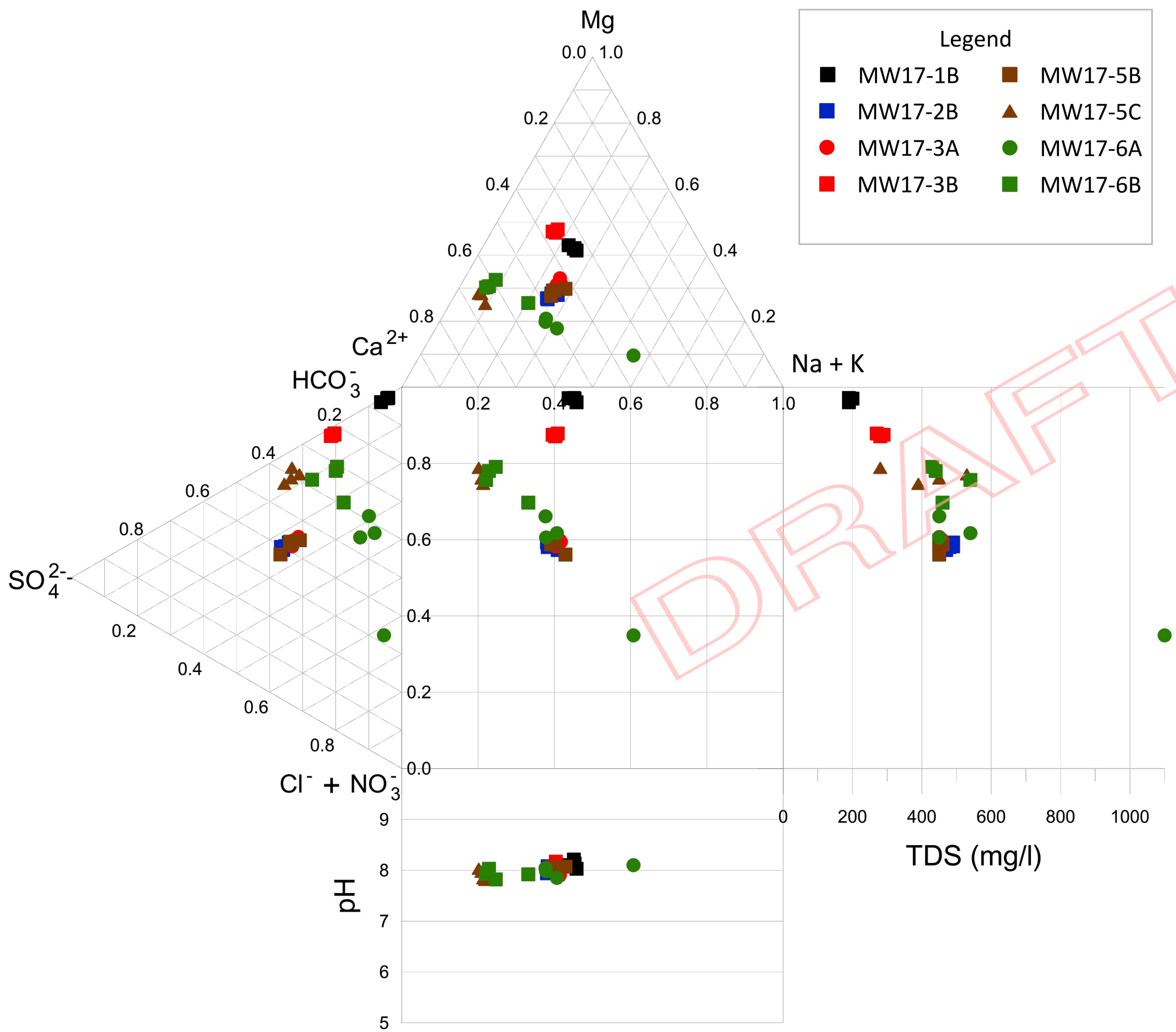
ALL LOCATIONS ARE APPROXIMATE.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
PIPER PLOT FOR GROUNDWATER SAMPLES
LUCAS FORMATION

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0309-9	
		SCALE AS SHOWN	REV.
CADD	AMS/DCH	May 22/19	
CHECK	RM		**FIGURE 9.9**



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

DUROV PLOT FOR GROUNDWATER SAMPLES LUCAS FORMATION

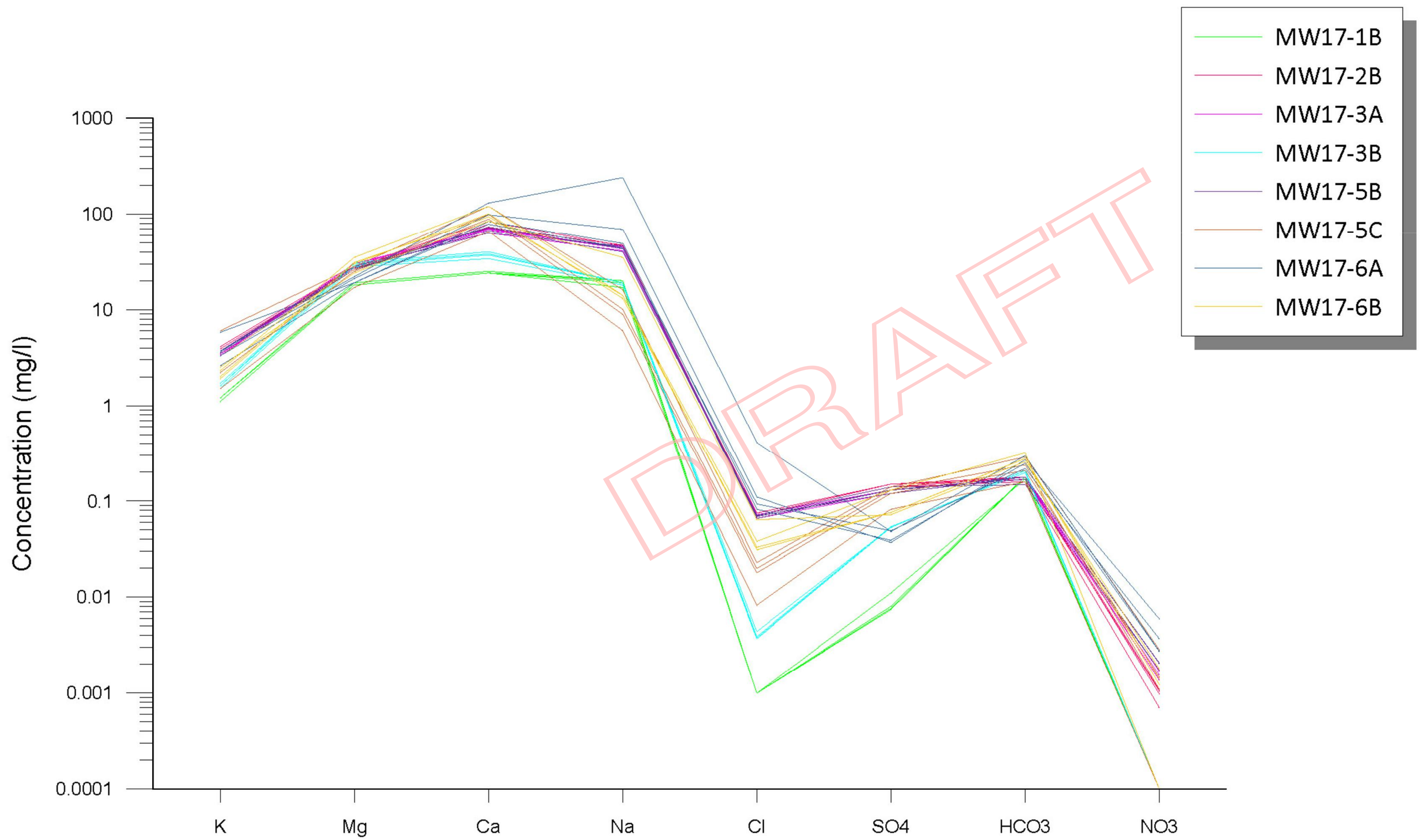
GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0309-10	
		SCALE AS SHOWN	REV.
CADD	AMS/DCH	May 22/19	
CHECK	RM		

FIGURE 9.10

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
25mm 0
Drawing file: 1664706-2000-R0309-10.dwg May 22, 2019 - 4:40pm

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
Oct 07, 2019 - 1:16pm
Drawing file: 1664706-2000-R0309-11.dwg



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

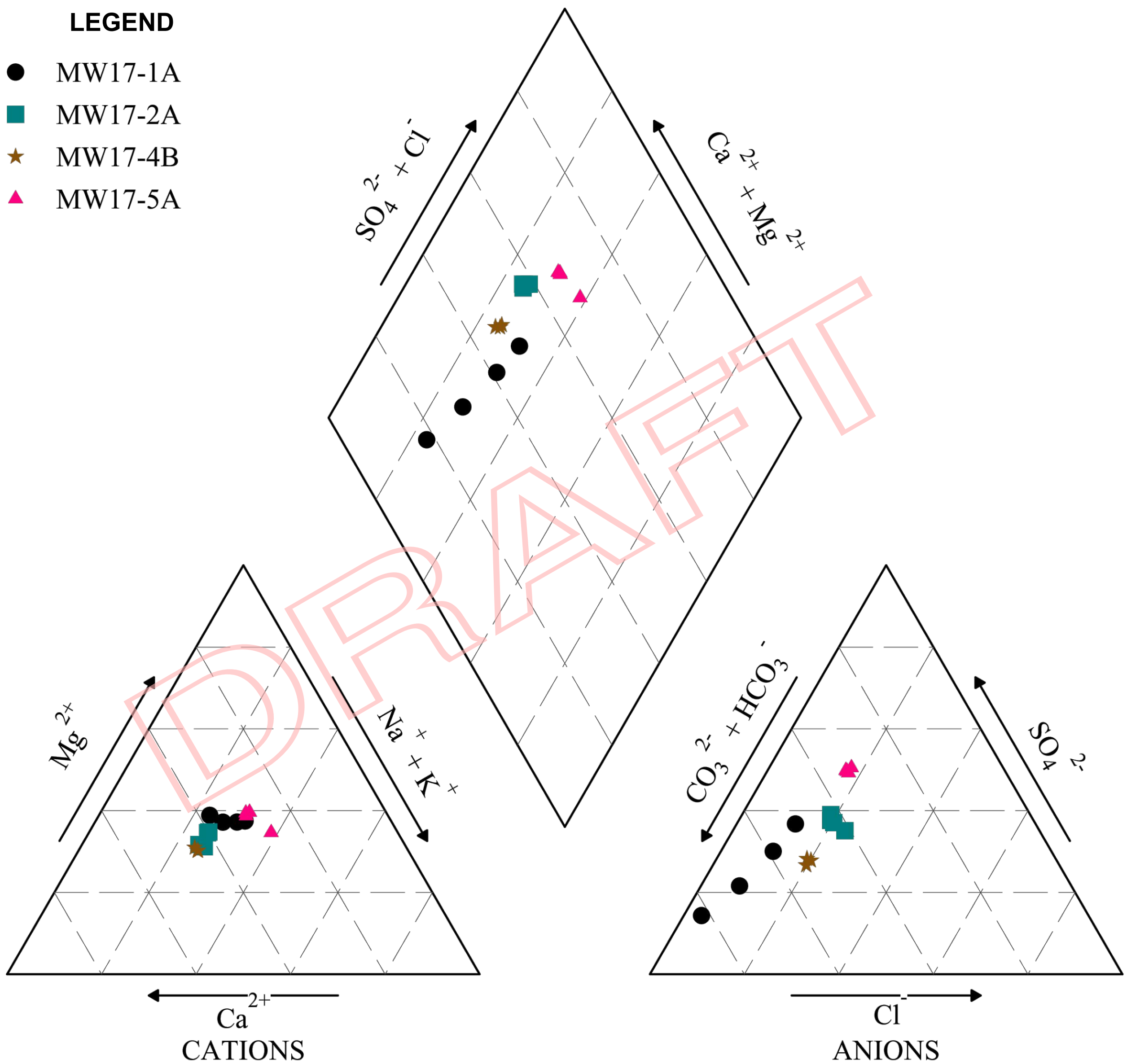
TITLE

SCHOELLER PLOT FOR GROUNDWATER SAMPLES
LUCAS FORMATION

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0309-11	
		SCALE AS SHOWN	REV.
CADD	AMS/DCH	Oct 7/19	
CHECK	KM		**FIGURE 9.11**

Client: Walker Environmental Group Inc.
Original Format is Letter 279mm x 216mm
Drawing file: 1664706-2000-R0309-12.dwg May 22, 2019 - 4:41pm



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED WITH THE EXCEPTION AT MONITORING WELL MW17-4B

GROUNDWATER WITHIN THE CASING OF MW17-4B WAS FROZEN DURING THE NOVEMBER 2018 SAMPLING EVENT AND THEREFORE NO SAMPLE WAS COLLECTED

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
PIPER PLOT FOR GROUNDWATER SAMPLES AMHERSTBURG FORMATION

GOLDER

PROJECT No.		1664706	FILE No. 1664706-2000-R0309-12	
			SCALE AS SHOWN	REV.
CADD	AMS/DCH	May 22/19	**FIGURE 9.12**	
CHECK	RM			

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
May 22, 2019 – 4:42pm
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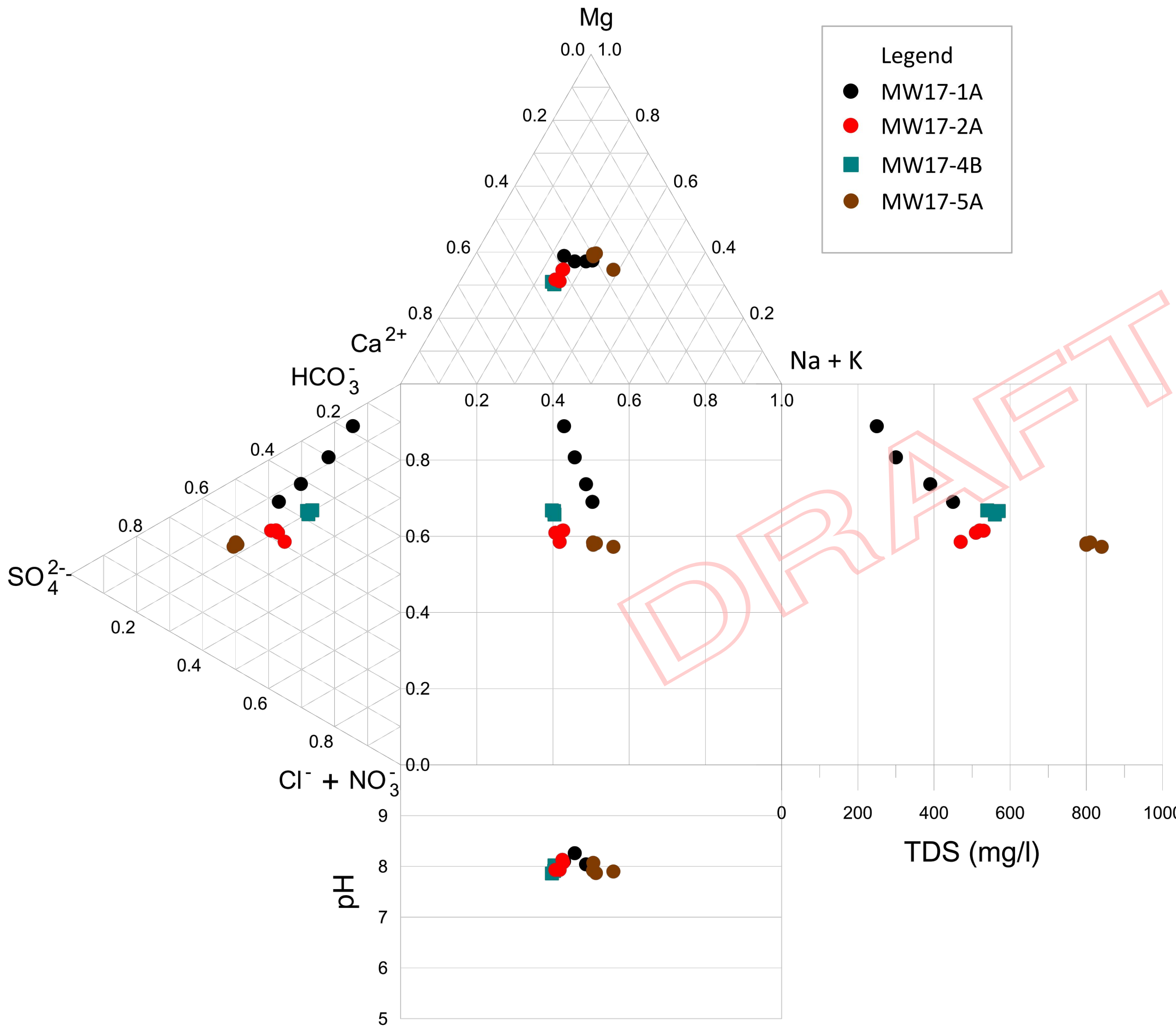


NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL, WITH THE EXCEPTION AT MONITORING WELL MW17-4B. GROUNDWATER WITHIN THE CASING OF MONITORING WELL MW17-4B WAS FROZEN DURING THE NOVEMBER 2018 SAMPLING EVENT AND THEREFORE NO SAMPLE WAS COLLECTED.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

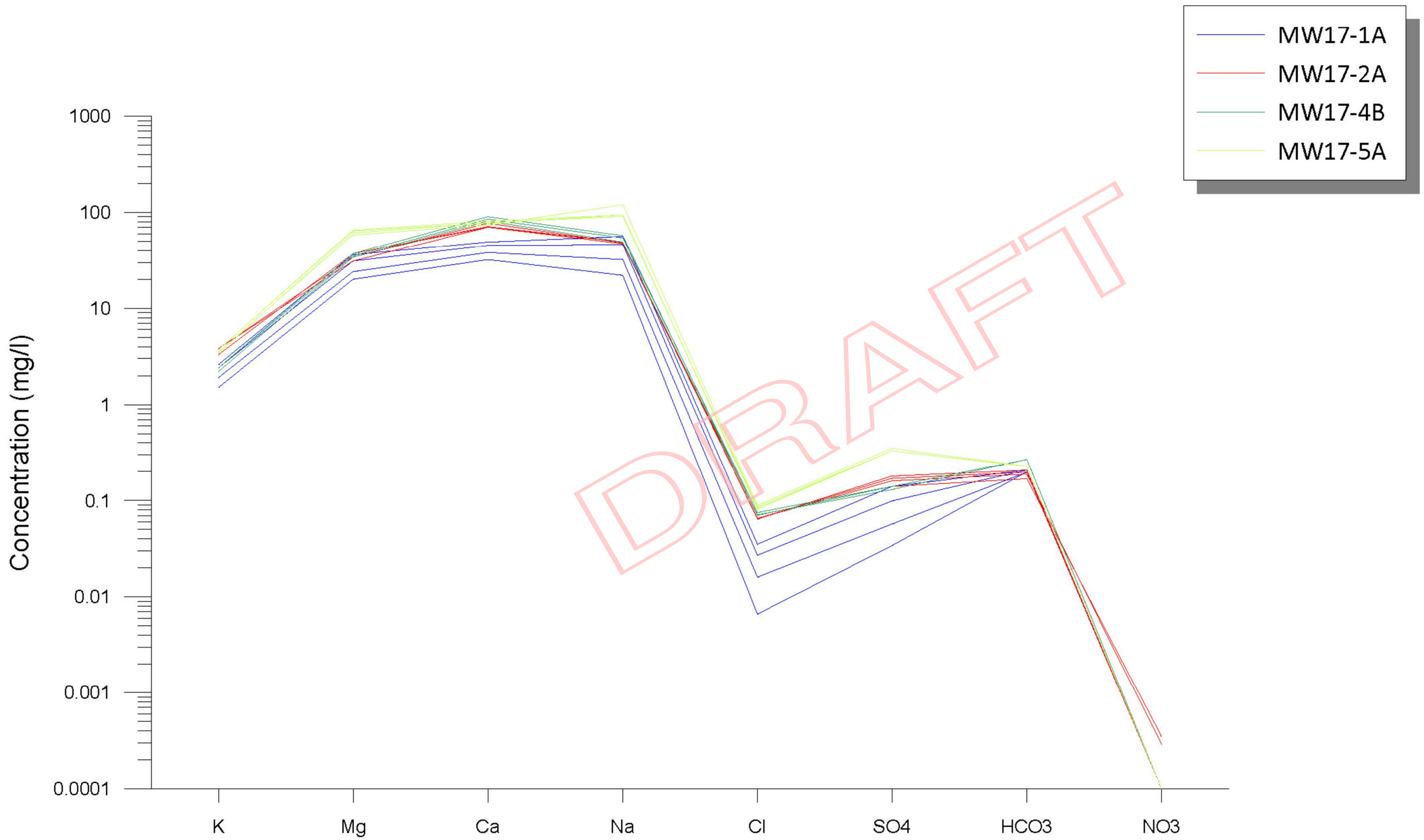
TITLE

DUROV PLOT FOR GROUNDWATER SAMPLES AMHERSTBURG FORMATION

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0309-13	
		SCALE AS SHOWN	REV.
CADD	AMS/DCH	May 22/19	
CHECK	RM		**FIGURE 9.13**

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
Oct 07, 2019 - 1:11pm
Drawing file: 1664706-2000-R0309-14.dwg



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF FOUR GROUNDWATER SAMPLES WERE COLLECTED FROM EACH MONITORING WELL, WITH THE EXCEPTION AT MONITORING WELL MW17-4B.

GROUNDWATER WITHIN THE CASING OF MONITORING WELL MW17-4B WAS FROZEN DURING THE NOVEMBER 2018 SAMPLING EVENT AND THEREFORE NO SAMPLE WAS COLLECTED

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

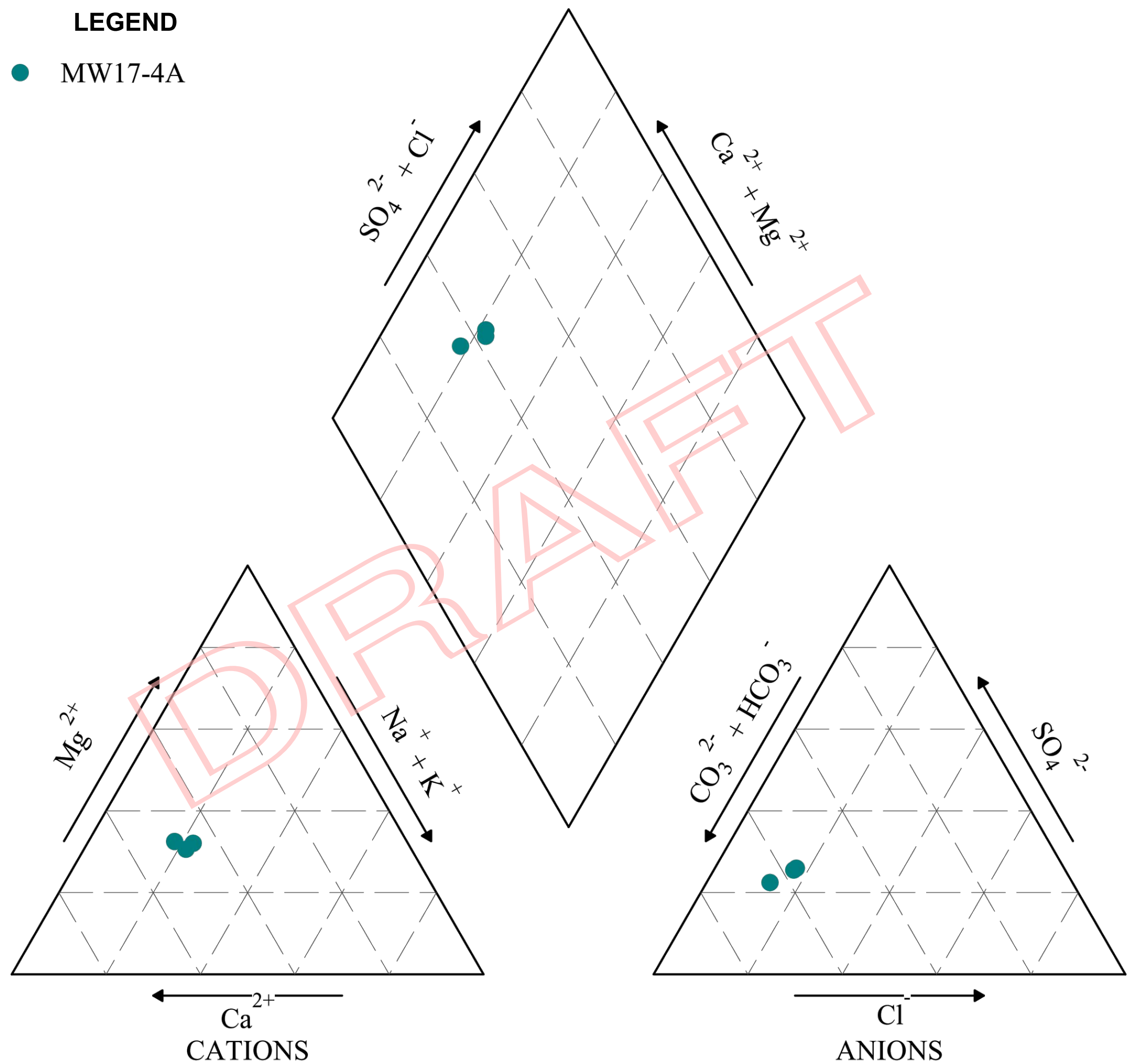
SCHOELLER PLOT FOR GROUNDWATER SAMPLES AMHERSTBURG FORMATION

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0309-14
		SCALE	AS SHOWN
CADD	AMS/DCH	Oct 7/19	REV.
CHECK	RM		

FIGURE 9.14

Client: Walker Environmental Group Inc.
Original Format is Letter 279mm x 216mm
May 22, 2019 - 4:48pm
Drawing file: 1664706-2000-R0309-15.dwg



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

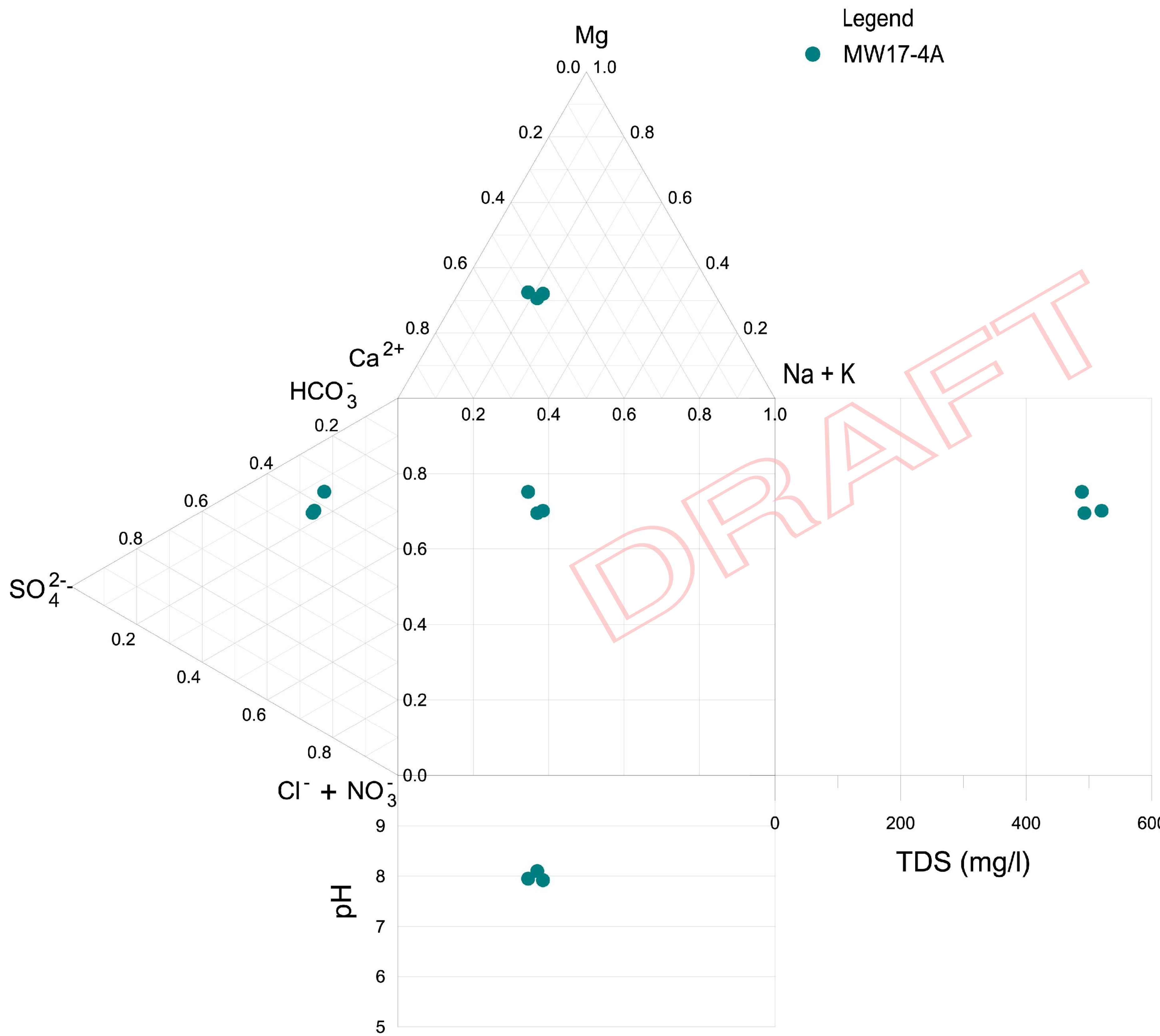
ALL LOCATIONS ARE APPROXIMATE.

PROJECT: HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE: **PIPER PLOT FOR GROUNDWATER SAMPLES BOIS BLANC FORMATION**

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0309-15
		SCALE AS SHOWN	REV.
CADD	AMS/DCH	May 22/19	
CHECK	RM		**FIGURE 9.15**



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF 3 GROUNDWATER SAMPLES WERE COLLECTED.

GROUNDWATER WITHIN THE CASING OF MONITORING WELL MW17-4A WAS FROZEN DURING THE NOVEMBER 2018 SAMPLING EVENT AND THEREFORE NO SAMPLE WAS COLLECTED.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

DUROV PLOT FOR GROUNDWATER SAMPLES BOIS BLANC FORMATION

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0309-16
		SCALE	AS SHOWN
CADD	AMS/DCH	May 22/19	REV.
CHECK			**FIGURE 9.16**

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
May 22, 2019 – 4:49pm
Drawing file: 1664706-2000-R0309-16.dwg

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
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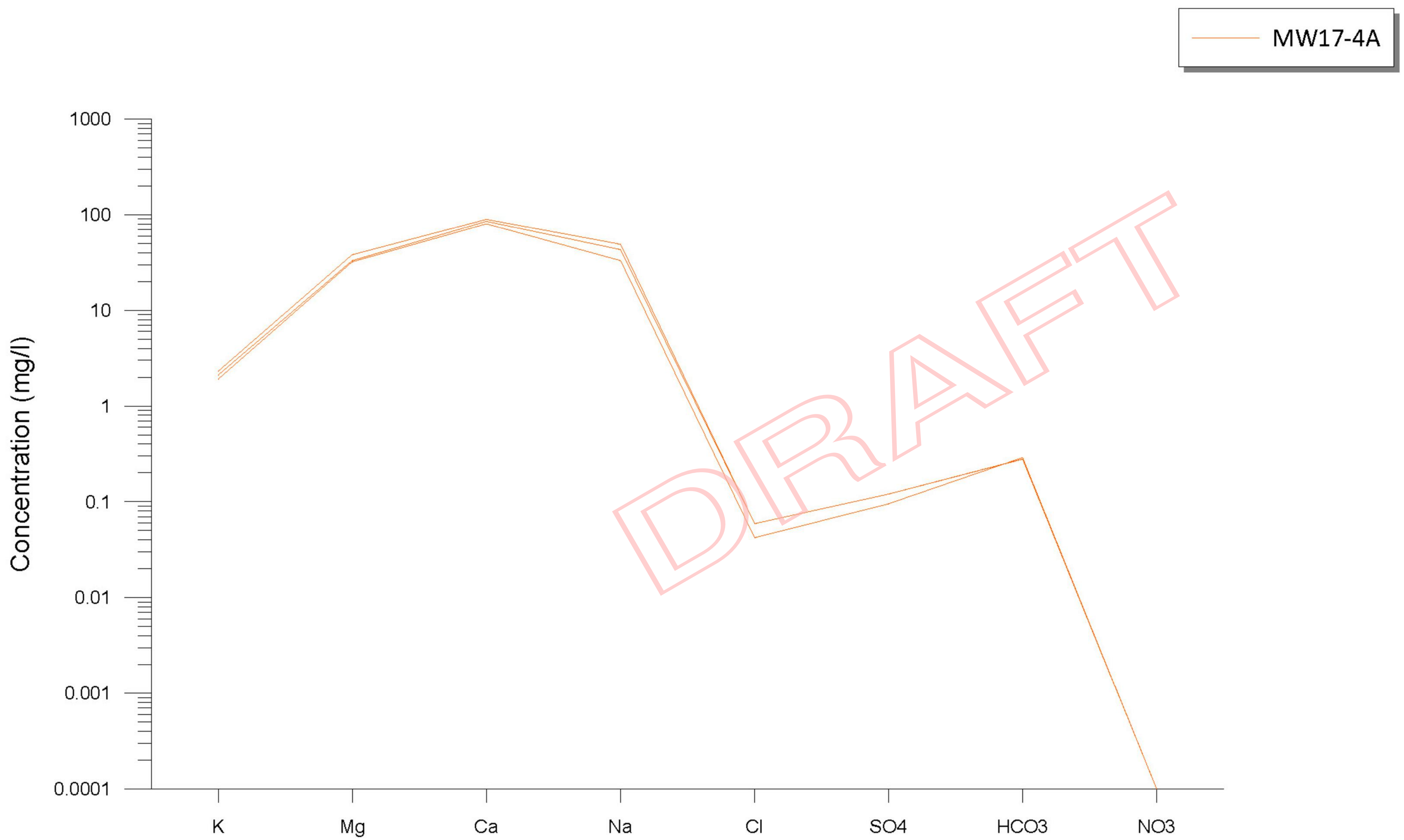
Oct 07, 2019 - 1:13pm
Drawing file: 1664706-2000-R0309-17.dwg



NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

A TOTAL OF THREE GROUNDWATER SAMPLES WERE COLLECTED.

GROUNDWATER WITHIN THE CASING OF MONITORING WELL MW17-4A WAS FROZEN DURING THE NOVEMBER 2018 SAMPLING EVENT AND THEREFORE NO SAMPLE WAS COLLECTED.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

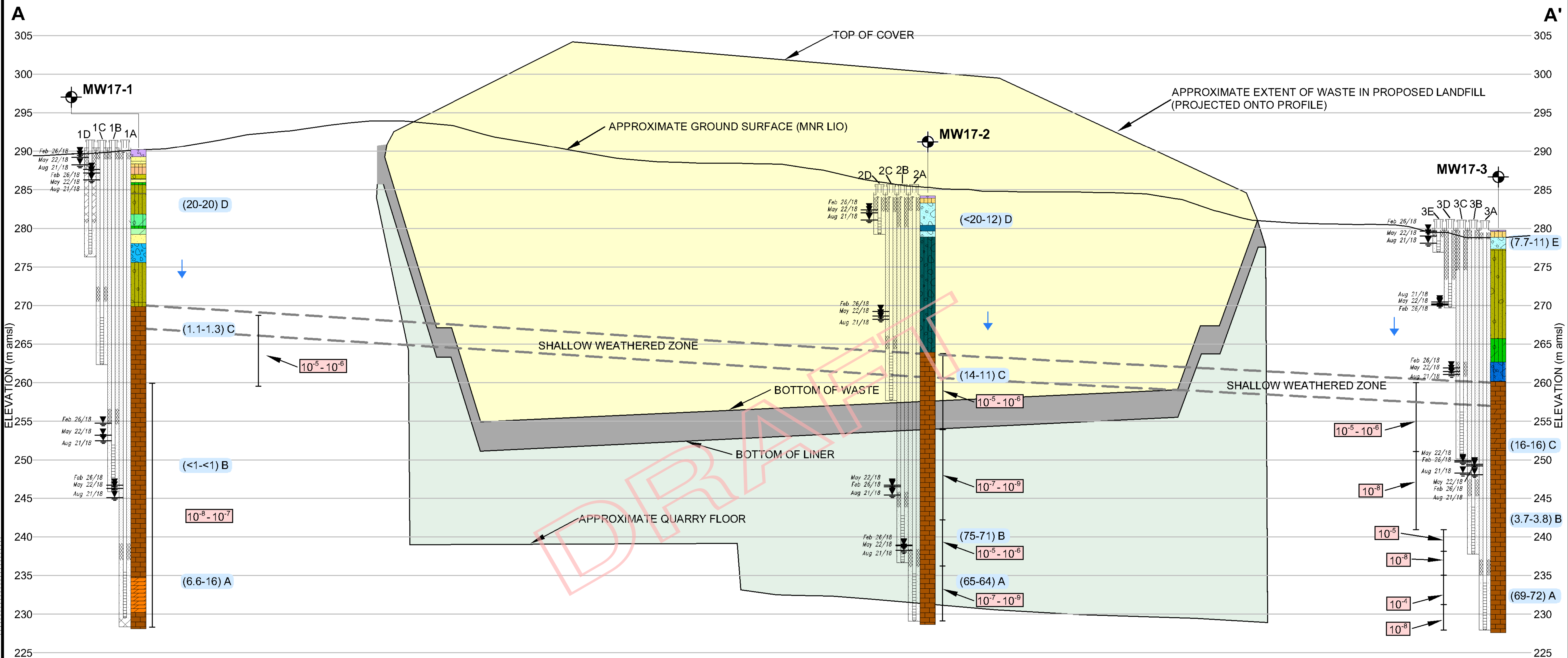
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

SCHOELLER PLOT FOR GROUNDWATER SAMPLES
BOIS BLANC FORMATION

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0309-17
		SCALE	AS SHOWN REV.
CADD	AMS/DCH Oct 7/19		
CHECK	RM		**FIGURE 9.17**



LEGEND

- BOREHOLE/MONITORING WELL
- 10^{-8} HYDRAULIC CONDUCTIVITY (K) VALUE IN (m/s) FROM PACKER TESTING
- (42-59) RANGE IN DISSOLVED CHLORIDE CONCENTRATION IN GROUNDWATER (mg/L)
- A MONITORING WELL IDENTIFIER
- INFERRED VERTICAL GROUNDWATER GRADIENT

SIMPLIFIED STRATIGRAPHY

TOPSOIL
SAND
SAND TILL
SILTY SAND
SAND & GRAVEL
GRAVEL
SILT
SILT TILL
SANDY SILT
CLAY
SILTY CLAY TILL
CLAYEY SILT TILL
SAND & SILT TILL
SANDY SILTY GRAVEL TILL
GRAVELLY SAND
SILTY SAND & GRAVEL TILL
LIMESTONE

INSTALLATION DETAILS

WELL
ENCOUNTERED GROUNDWATER DURING DRILLING
MEASURED WATER LEVEL
STRATA PLOT
FOR DETAILS REFER TO RECORD OF BOREHOLES

REFERENCE

DRAWING BASED ON MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017; AND FIGURE 3: SECTION VIEWS, FROM PDF "Facility Characteristics Assumptions.pdf" PROVIDED BY WALKER ENVIRONMENTAL.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.
FOR PROFILE LOCATION, REFER TO FIGURE 7-1.
ALL LOCATIONS ARE APPROXIMATE.

HORIZONTAL SCALE IN METRES 0 100 200m 1:5,000

VERTICAL SCALE IN METRES 0 10 20m 1:500

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

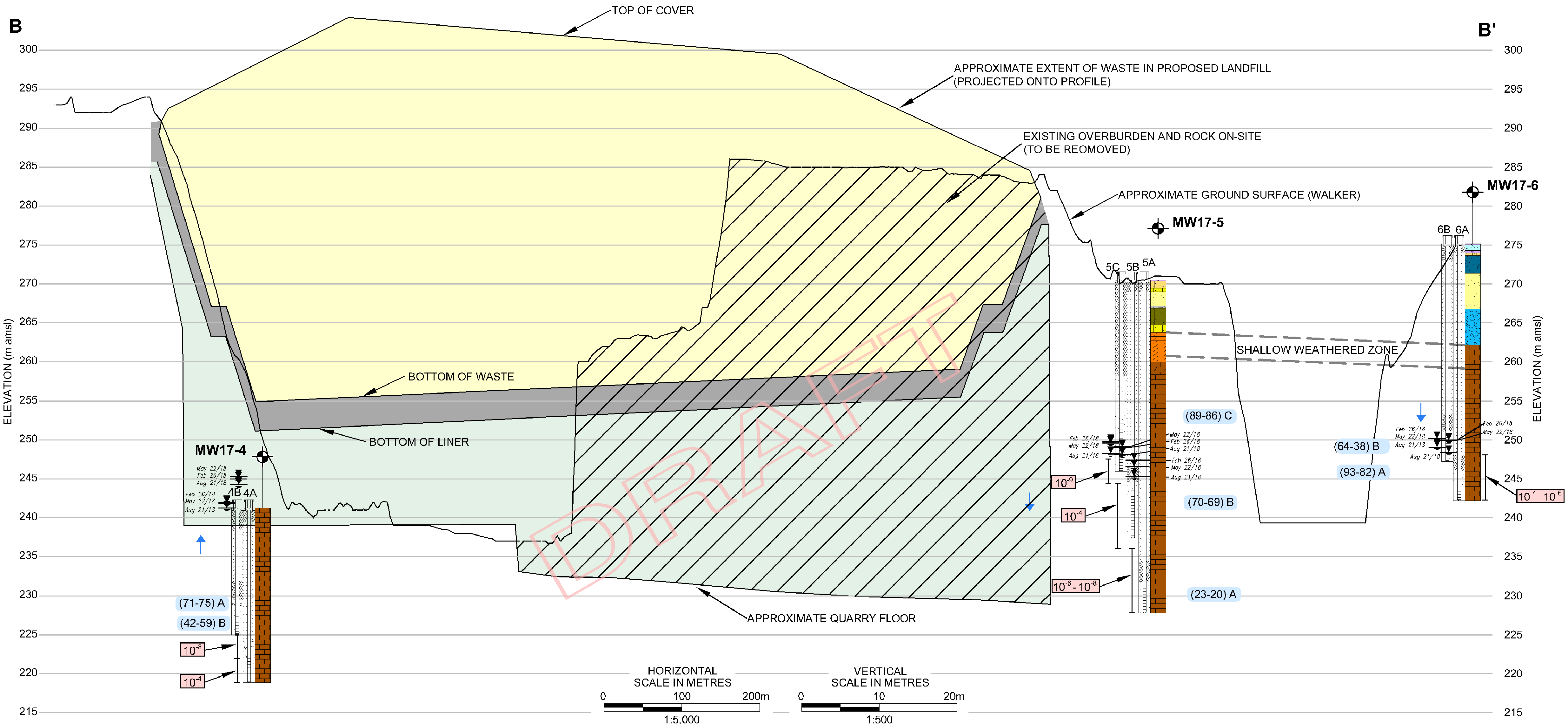
TITLE
HYDROGEOLOGICAL PROFILE A

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R0309-18	
		SCALE AS SHOWN	REV.
CADD	ZB/DH/AS	Oct 7/19	
CHECK			**FIGURE 9.18**

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
Drawing file: 1664706-2000-R0309-18.dwg Oct 07, 2019 – 11:17am

Client: Walker Environmental Group Inc.
Original Format is Tabloid 279mm x 432mm
Oct 07, 2019 – 11:21am
Drawing file: 1664706-2000-R0309-19.dwg



LEGEND

- BOREHOLE/MONITORING WELL
- 10-8 — HYDRAULIC CONDUCTIVITY (K) VALUE IN (m/s) FROM PACKER TESTING
- (42-59) — RANGE IN DISSOLVED CHLORIDE CONCENTRATION IN GROUNDWATER (mg/L)
- A — MONITORING WELL IDENTIFIER
- INFERRED VERTICAL GROUNDWATER GRADIENT

SIMPLIFIED STRATIGRAPHY

TOPSOIL	CLAY
SAND	SANDY SILT
SILTY SAND	GRAVEL
SAND & GRAVEL	GRAVELLY SAND
SAND & SILT	LIMESTONE

INSTALLATION DETAILS

WELL
ENCOUNTERED GROUNDWATER DURING DRILLING
MEASURED WATER LEVEL
STRATA PLOT
FOR DETAILS REFER TO RECORD OF BOREHOLES

REFERENCE

DRAWING BASED ON ACAD DRAWING "Carmeuse Lime Beachville topo 11-14-17.dwg" PROVIDED BY WALKER ENVIRONMENTAL, JULY 17, 2018; AND FIGURE 3: SECTION VIEWS, FROM PDF "Facility Characteristics Assumptions.pdf" PROVIDED BY WALKER ENVIRONMENTAL.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.
FOR PROFILE LOCATION, REFER TO FIGURE 7-1.
ALL LOCATIONS ARE APPROXIMATE.

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
HYDROGEOLOGICAL PROFILE B

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R0309-19
CADD	ZB/DH/AS	Oct 7/19	SCALE AS SHOWN	REV.
CHECK	RM		

FIGURE 9.19

LEGEND

PROPOSED BOREHOLE/MONITORING WELL

BOREHOLE/MONITORING WELL

STUDY AREAS:

SITE BOUNDARY

GROUNDWATER SITE VICINITY

REFERENCE

DRAWING BASED ON :

1) BING IMAGERY AS OF AUGUST 16, 2017 (IMAGE DATE UNKNOWN);
2) WALKER ENVIRONMENTAL, FIGURE 5, "APPROVED AMENDED TERMS OF REFERENCE, MAY 20, 2016; AND
3) MNR LIO, OBTAINED 2009, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017.

NOTES

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BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

PROPOSED MONITORING WELL LOCATION PLAN

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R03011-1
		SCALE	AS SHOWN
CADD	DCH	May 22/19	REV.
CHECK	RM		

FIGURE 11.1

Drawing file: 1664706-2000-R03011-1.dwg May 22, 2019 - 4:54pm Original Format is Tabloid 279mm x 432mm Client: Walker Environmental Group Inc.

APPENDIX A

Glossary of Terms

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APPENDIX A - GLOSSARY OF TERMS

anisotropy	the directional variation of a property at a point.
aquifer	a consolidated or unconsolidated geologic unit (material, stratum, or formation) or set of connected units that yields water of suitable quality to wells or springs in economically usable amounts.
aquitard	a geologic material, stratum, or formation of low permeability (a confining unit) that transmits significant amounts of water on a regional scale or over geologic time.
artesian	hydrostratigraphically confined. In the common usage, this implies the existence of flowing wells. However, all flowing wells are not artesian nor do all artesian wells flow.
auger	rotary drilling equipment, used in soils or poorly-consolidated materials, that removes cuttings from a borehole by mechanical means without the use of drilling fluids. Augers operate on the inclined plane or screw principle.
bailer	a (usually cylindrical) device for withdrawing or collecting water from a well or borehole.
baseflow	groundwater flow to a surface water body (lake, swamp, or stream)
bladder pump	a positive displacement pump for sampling groundwater.
borehole	a hole drilled into the earth into which well casings or piezometers may be installed.
capture zone	the part of an aquifer that contributes water to a pumping well.
casing	a pipe that is in a well or borehole. More specifically, a casing is a tubular, water-tight structure installed in the excavated or drilled hole to maintain the well opening and, along with cementing, to confine the groundwaters to their zones of origin and to prevent the entrance of surface contaminants.
catchment	the area of land drained by a single stream or river or, in the case of karst, drained by a single doline or group of dolines. Catchment and watershed are equivalent terms.
conceptual model	a clear, qualitative physical description of how a hydrogeological system behaves.
discharge	the water leaving a groundwater system by flow to surface water, to the land surface, or to the atmosphere.
domestic well use	water used by and connected to a household for personal needs or for household purposes, such as drinking, bathing, heating, cooking, sanitation or cleaning, and landscape irrigation. Ancillary use may include water of domestic animals.
Durov diagram	a graphical procedure using anion-cation hydrochemical facies, similar to a Piper Diagram, with a projection to a 4th dimension, such as TDS.
filter pack	coarse sand packed around the screen of a well.

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fracture	a subplanar discontinuity in a rock or soil formed by mechanical stresses. A fracture is visible to the naked eye and is open (i.e., not filled with minerals).
homogeneity	the property of a parameter or system whose values are unchanged over space.
Hvorslev method	a method for evaluating slug-test data (Hvorslev, 1951).
hydraulic conductivity (K)	the volume of fluid that flows through a unit area of porous medium for a unit hydraulic gradient normal to that area.
hydraulic gradient	the change in hydraulic head with direction.
hydraulic head (h)	the elevation in a well in reference to a specific datum; the mechanical energy per unit weight of water.
hydrograph	a chart depicting either discharge or water level as a function of time.
hydrostratigraphic unit	a formation, part of a formation, or group of formations of significant lateral extent that compose a unit of reasonably distinct (similar) hydrogeologic parameters and responses.
isotropy	the condition in which the properties of a system or a parameter do not vary with direction.
karst	1) a geologic terrain or surface landscape with distinctive characteristics of relief and drainage arising primarily from dissolution of rock (or soils) by natural waters; 2) sometimes applied loosely to any dissolution in a rock by flowing groundwater. Karst(ic) terrains are underlain by rocks that have undergone significant dissolution by groundwater flow and are characterized by: 1, closed depressions of various size and arrangement; 2, disrupted surface drainage; and 3, caves and underground drainage systems.
monitor(ing) well	a well used to monitor water levels or water quality opposed to a well used to produce water.
outcrop	where a formation is present at the Earth's surface.
overburden	material overlying a deposit of bedrock
packer	an inflatable tool on a drill string that is used to seal off certain lengths of a borehole.
permeability	the ease with which a porous medium can transmit water or other fluids.
Piper diagram	a graphical means of displaying the ratios of the principal ionic constituents in water (modified from Davis and DeWiest, 1966, and Freeze and Cherry, 1979).
potentiometric surface (piezometric)	a surface of equal hydraulic heads or potentials typically depicted by a map of equipotentials such as a map of water-table elevations.
precipitation	water condensing from the atmosphere and falling in drops or particles (e.g., snow, hail, sleet) to the land surface

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public water supply well	a well providing groundwater to the public.
purging	removing stagnant water from a well. This is generally conducted prior to sampling wells for chemical analysis.
runoff	water from precipitation, snowmelt, or irrigation running over the surface of the Earth.
Schoeller diagram	a graphical means of displaying the ratios of the principal ionic constituents in water. The logs of the equivalents are connected by lines.
screen	open part of the well screen.
slug test	a test of media hydraulic properties (typically permeability and storativity) in which a volume of water is added or removed instantaneously from a well or piezometer and its response measured and analyzed.
static water level	the level of water in a well that is not affected by pumping.
unsaturated	the condition when the porosity is not filled with water.
water table	a surface at or near the top of the phreatic zone (zone of saturation) where the fluid pressure is equal to atmospheric pressure.
watershed	the area of land drained by a single stream or river or, in the case of karst, drained by a single doline or group of dolines. Watershed and catchment are equivalent terms.
well	any artificial excavation or borehole constructed for the purposes: 1) of exploring for or producing groundwater, or 2) for injection, monitoring or dewatering purposes.
wellhead protection area	a designated surface and subsurface area surrounding a well or a well field through which contaminants could pass an eventually reach the aquifer that supplies the well or well field.

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REFERENCE

Sharp, John M., Jr., 2007, A Glossary of Hydrogeological Terms: Department of Geological Sciences, The University of Texas, Austin, Texas, 63p.

APPENDIX B

Environmental Assessment Criteria and Studies

DRAFT

Table B-1 – EA Criteria Table

	Criteria	Definition/ Rationale	Studies Addressing the Criteria													Study Areas			Duration	
			Agriculture	Air Quality	Archaeology	Cultural Heritage	Ecology	Economic/ Financial	Groundwater/ Surface Water	Human Health	Land Use	Noise/Vibration	Social	Traffic	Visual/ Landscape	On-Site & Site Vicinity	Along the Haul Route	Wider Area	Operational Period	Post-Closure Period
	Public Health & Safety																			
1	Explosive hazard due to combustible gas accumulation in confined spaces.	Gas produced within a waste disposal facility (e.g., methane) can move through the ground and accumulate in confined spaces (e.g., manholes, basements, etc.) on or immediately adjacent to the waste disposal facility. There is potential for the gas to combust, creating an explosion and fire hazard.							☑							✓			✓	✓
2	Effects due to exposure to air emissions.	Waste disposal facilities can produce gases containing contaminants that degrade air quality if they are emitted to the atmosphere. Other operations, such as leachate collection facilities, can also produce emissions that could degrade air quality in the vicinity of the site. Air quality in the vicinity of the site should meet regulated air quality standards in order to protect public health.		☑						☑						✓			✓	✓
3	Effects due to fine particulate exposure.	Construction, operation, and truck haulage activities at a waste disposal facility can lead to increased levels of particulate (dust) in the air. Airbourne fine particulate is a health concern in certain size ranges exposure durations.		☑						☑						✓	✓		✓	
4	Effects due to contact with contaminated groundwater or surface water.	Contaminants associated with a waste disposal site have the potential to seep into the groundwater or surface water. This could pose a public health concern if it enters local drinking water supplies, or if it mixes with surface water.							☑	☑						✓			✓	✓
5	Flood hazard.	The construction of a waste disposal facility can disrupt natural surface water drainage patterns, causing a potential for increased flooding.							☑							✓			✓	✓
6	Disease transmission *via* insects or vermin.	Insects and vermin drawn to a waste disposal facility may have the potential to transmit diseases.					☑									✓			✓	✓
Public Health & Safety (continued)																				
7	Potential for traffic collisions.	The risk of traffic collisions may increase along the haul routes to the waste disposal facility. This includes the risk to pedestrian, bicycle and farm machinery.												☑			✓		✓	

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	Criteria	Definition/ Rationale	Studies Addressing the Criteria													Study Areas			Duration	
			Agriculture	Air Quality	Archaeology	Cultural Heritage	Ecology	Economic/ Financial	Groundwater/ Surface Water	Human Health	Land Use	Noise/Vibration	Social	Traffic	Visual/ Landscape	On-Site & Site Vicinity	Along the Haul Routes	Wider Area	Operational Period	Post-Closure Period
8	Aviation impacts due to bird interference.	Birds may be attracted to waste disposal facilities. This can pose a risk of bird strikes on aircraft in the vicinity of the site, especially during take-off and landing altitudes.					☑									✓			✓	
Social and Cultural																				
9	Displacement of residents from houses.	Any residents living on a future waste disposal site will have to relocate, which can cause inconvenience and stress to the residents.											☑			✓			✓	✓
10	Disruption to use and enjoyment of residential properties.	Potential nuisance effects associated with the waste disposal facility operation, or traffic moving to and from the waste disposal facility along the haul route, may disturb the daily activities and uses of residential properties. Disturbances could result from noise, dust, litter, odour, visibility,											☑			✓	✓		✓	✓
11	Disruption to use and enjoyment of public facilities and institutions.	Potential nuisance effects associated with waste disposal facility operations, or traffic moving to and from the waste disposal facility, may disturb the daily activities at community facilities. Disturbances could result from noise, dust, litter, odour, visibility, birds and traffic congestion.											☑			✓	✓		✓	
12	Disruption to local traffic networks.	Increased traffic volume resulting from a waste disposal facility could disturb the overall traffic flow along the haul routes, and effectively reduce the available road capacity.												☑			✓		✓	
13	Visual impact of the waste disposal facility.	Development and operation of a waste disposal facility can affect the visual appeal of a landscape.													☑	✓			✓	✓
14	Nuisance associated with vermin.	Waste disposal facilities can attract vermin and birds, which can be a nuisance and lead to a decrease in property enjoyment by area residents. Vermin and birds can also be a nuisance to											☑			✓			✓	

☑ Study that will be primarily responsible for addressing criterion.

Note: Many of the studies will provide key input to criteria that will be address through other impact assessment studies.

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#	Criteria	Definition/ Rationale	Studies Addressing the Criteria													Study Areas			Duration	
			Agriculture	Air Quality	Archaeology	Cultural Heritage	Ecology	Economic/ Financial	Groundwater/ Surface Water	Human Health	Land Use	Noise/Vibration	Social	Traffic	Visual/ Landscape	On-Site & Site Vicinity	Along the Haul Route	Wider Area	Operational Period	Post-Closure Period
Social and Cultural (continued)																				
15	Displacement/disturbance of cultural/heritage resources.	Cultural resources (including heritage buildings, cemeteries and cultural landscapes) are an important component of human heritage. These non-renewable cultural resources may be displaced by the construction of a waste disposal facility. The use and enjoyment of cultural resources may also be disturbed by the ongoing operation and traffic. Disturbances could result from noise, dust, odour, visibility, birds, litter and traffic congestion.				☑										✓	✓		✓	✓
16	Effects on land resources, traditional activities or other interests of Aboriginal Communities.	Major new developments of any type may have positive or negative effects on the interests of Aboriginal Communities (i.e., businesses opportunities, joint ventures)											☑					✓	✓	✓
17	Displacement/destruction of archaeological resources.	Archaeological resources are non-renewable cultural resources that can be destroyed by the construction and operation of a waste disposal facility.			☑											✓			✓	
18	Level of public service provided by the waste disposal facility.	The presence of a waste disposal operation within a municipality can provide an increased level of public service (e.g., convenient access to waste disposal services) to local residents and businesses, as well as those in the broader community(ies).						☑										✓	✓	✓
19	Effects on other public services.	The presence of a waste disposal facility may have positive or negative spin-off effects on other public services in the community (e.g., leachate trucking, waste water treatment capacity, if there is discharge to the sewer system).						☑									✓	✓	✓	✓

DRAFT

☑ Study that will be primarily responsible for addressing criterion.

Note: Many of the studies will provide key input to criteria that will be address through other impact assessment studies.

DRAFT

	Criteria	Definition/ Rationale	Studies Addressing the Criteria													Study Areas			Duration	
			Agriculture	Air Quality	Archaeology	Cultural Heritage	Ecology	Economic/ Financial	Groundwater/ Surface Water	Human Health	Land Use	Noise/Vibration	Social	Traffic	Visual/ Landscape	On-Site & Site Vicinity	Along the Haul Routes	Wider Area	Operational Period	Post-Closure Period
Social and Cultural (continued)																				
20	Changes to community character/cohesion.	Community character and cohesion refer to physical characteristics, social stability, attractiveness as a place to live and patterns of social interaction. A waste disposal facility may actually or perceptually interfere with these important community attributes.											☑			✓	✓	✓	✓	✓
21	Compatibility with municipal land use designations and official plans.	A waste disposal facility has the potential to affect the viability of present and future land uses, which may have an effect on planning decisions made in the surrounding community.									☑					✓		✓	✓	✓
Economics																				
22	Displacement/disruption of businesses or farms.	Any on-site businesses or farms would be displaced by a waste disposal facility, and there could be financial losses as a result of relocation. Some types of businesses located in the site vicinity or along the haul routes may suffer financial losses due to the potential nuisance effects or perceived effects associated with the operation of a waste disposal facility such as noise, litter, dust, odour, visibility, birds, vermin and traffic congestion.						☑								✓	✓		✓	
23	Property value impacts.	The establishment and operation of a waste disposal facility may adversely affect property values in the site vicinity or along the haul routes.						☑								✓	✓		✓	✓
24	Direct employment in waste disposal facility construction and operation.	A waste disposal facility may create new employment opportunities both in the construction and day-to-day operation.						☑										✓	✓	
25	Indirect employment in related industries and services.	A waste disposal facility has the potential to have impacts on employment opportunities in local firms supplying products or services directly, or as secondary suppliers.						☑										✓	✓	

☑ Study that will be primarily responsible for addressing criterion.

Note: Many of the studies will provide key input to criteria that will be address through other impact assessment studies.

	Criteria	Definition/ Rationale	Studies Addressing the Criteria													Study Areas			Duration	
			Agriculture	Air Quality	Archaeology	Cultural Heritage	Ecology	Economic/ Financial	Groundwater/ Surface Water	Human Health	Land Use	Noise/Vibration	Social	Traffic	Visual/ Landscape	On-Site & Site Vicinity	Along the Haul Route	Wider Area	Operational Period	Post-Closure Period
Economics (continued)																				
26	New business opportunities related directly to waste disposal facility construction and operation.	A large capital project, such as the construction and operation of a waste disposal facility, can create new opportunities for local businesses supplying products or services.						☑										✓	✓	
27	New business opportunities in related industries and services.	New opportunities may be created for local businesses, or as secondary suppliers to industries working for the waste disposal facility (e.g., restaurants, gas stations, machine shops, repair shops, welding shops, equipment rentals, etc.).						☑										✓	✓	
28	Public costs for indirect liabilities.	Some public services may have to be upgraded to accommodate the establishment and operation of a waste disposal facility (e.g., snow removal, sewer and water connections, etc.).						☑										✓	✓	✓
29	Effects on the municipal tax base.	A waste disposal facility has the potential to affect municipal tax revenues from the site it occupies.						☑										✓	✓	✓
30	Effect on the cost of service to customers.	The costs of constructing a waste disposal facility will effect the price of tipping fees to the site. This affects the cost of service to customers in Oxford County and the province.						☑										✓	✓	
31	Effects on the provincial/ federal tax base.	A waste disposal facility has the potential to affect provincial/federal tax revenues.						☑										✓	✓	✓
Natural Environment & Resources																				
32	Loss/displacement of surface water resources.	Construction of a waste disposal facility may cause the removal of all or part of a natural stream or pond.							☑							✓			✓	
33	Impact on the availability of groundwater supply to wells.	A waste disposal facility can impact the availability of groundwater supply if groundwater is pumped from aquifers or if recharge to aquifers is reduced.							☑							✓			✓	✓
34	Effects on stream baseflow quantity/quality.	The presence of a waste disposal facility has the potential to affect the quality or quantity of baseflow to surface water.							☑							✓			✓	✓

☑ Study that will be primarily responsible for addressing criterion.

Note: Many of the studies will provide key input to criteria that will be address through other impact assessment studies.

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	Criteria	Definition/ Rationale	Studies Addressing the Criteria													Study Areas			Duration	
			Agriculture	Air Quality	Archaeology	Cultural Heritage	Ecology	Economic/ Financial	Groundwater/ Surface Water	Human Health	Land Use	Noise/Vibration	Social	Traffic	Visual/ Landscape	On-Site & Site Vicinity	Along the Haul Route	Wider Area	Operational Period	Post-Closure Period
Natural Environment & Resources (Continued)																				
35	Loss/disturbance of terrestrial ecosystems.	Terrestrial ecosystems refer to the land-based habitats connected through the vegetation cover; their protection and integration maintains and regulates ecological health. Waste disposal facility operations and/or traffic may remove or disturb the functioning of these systems.					☑									✓	✓		✓	
36	Loss/disturbance of aquatic ecosystems.	Aquatic ecosystems refer to the water-based habitats connected through the surface water; their protection and integration maintains and regulates ecological health. Waste disposal facility operations may remove or disturb the functioning of these systems.					☑									✓			✓	
37	Displacement of agricultural land.	The establishment of a waste disposal facility has the potential to displace existing or potential agricultural resources, including the loss of prime agricultural land.	☑													✓			✓	✓
38	Disruption of farm operations.	The establishment and operation of the waste disposal facility may affect agricultural crop or livestock production and related agriculture activities	☑													✓	✓		✓	✓
39	Sterilization of industrial mineral resources.	The establishment of a waste disposal facility may limit the opportunity to extract industrial mineral resources located beneath the site.									☑					✓			✓	✓
40	Displacement of forestry resources.	The establishment of a waste disposal facility may limit the opportunity to utilize forestry resources on or near the site.									☑					✓			✓	✓
41	Loss/disruption of recreational resources.	Waste disposal facility operations and traffic may displace/disrupt existing recreational resources in the area, which could adversely affect the community at large. Disturbances could result from noise, dust, odour, visibility, birds and traffic congestion. Recreational resources include naturalist and interpretive opportunities.											☑			✓	✓		✓	✓

☑ Study that will be primarily responsible for addressing criterion.

Note: Many of the studies will provide key input to criteria that will be address through other impact assessment studies.

Table B-2 – EA Technical Studies Interconnectivity Matrix

Because effectively evaluating the EA criteria provided in Table B-1 may require input from experts in many disciplines, WEG adopted a methodology that facilitates a cross-functional approach among the experts. Each EA criterion has been assigned a 'lead' expert for reporting purposes (see Table B-1). The lead expert is responsible for coordinating efforts with any other expert they determine necessary to effectively report on that criterion as well as providing information to other experts who need input from them to report on any other criteria. Table B-2 provides possible relationships required between experts to effectively report on their respective EA criteria. The actual relationships will be developed during the EA process in consultation with interested parties.

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		Reference Studies												
		Agriculture	Air Quality	Archaeology	Cultural Heritage	Ecology	Economic / Financial	Groundwater / Surface Water	Human Health	Land Use	Noise / Vibration	Social	Traffic	Visual/ Landscape
Technical Studies	Agriculture		✓							✓	✓		✓	
	Air Quality												✓	
	Archaeology													
	Cultural Heritage									✓		✓		✓
	Ecology		✓					✓			✓		✓	
	Economic / Financial	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
	Groundwater / Surface Water	✓										✓		
	Human Health		✓					✓			✓			
	Land Use													
	Noise / Vibration													
	Social	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
	Traffic	✓								✓		✓		
	Visual Landscape											✓		

APPENDIX C

Walker Environmental Group Figures

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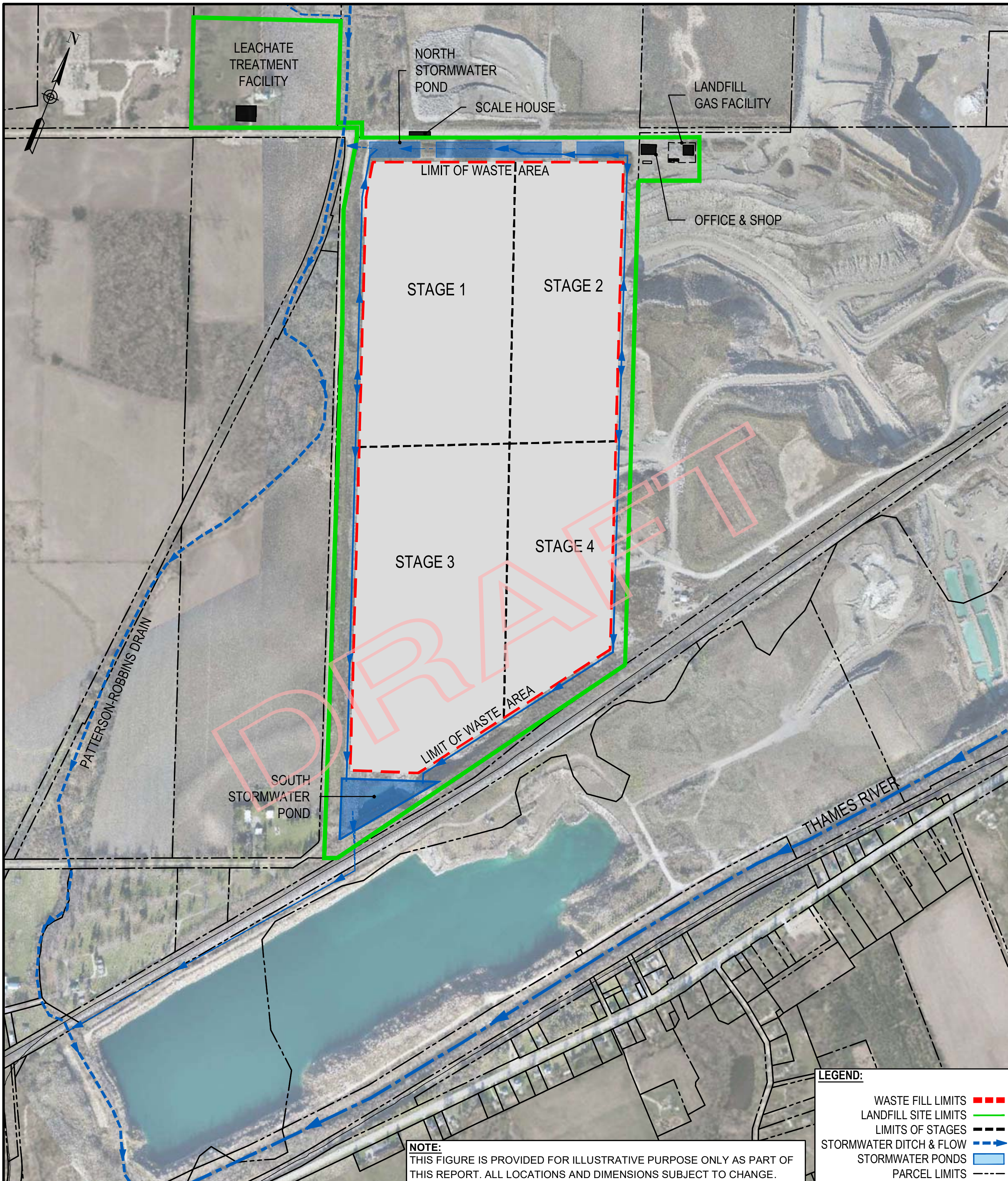
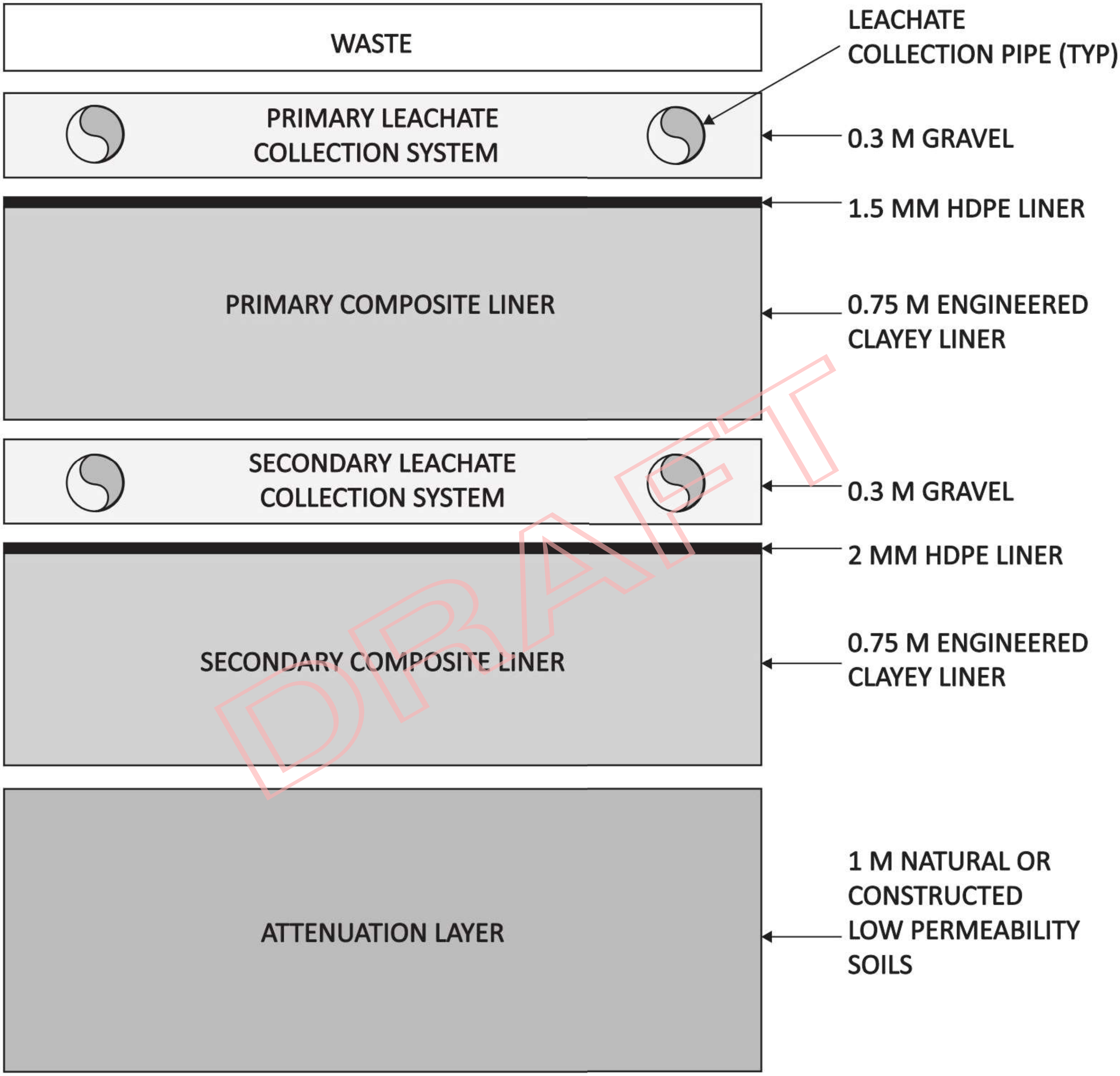


NOTE:
THIS FIGURE IS PROVIDED FOR ILLUSTRATIVE PURPOSE ONLY AS PART OF THIS REPORT. ALL LOCATIONS AND DIMENSIONS SUBJECT TO CHANGE.

Owner	Project	Project No.	Scale Bar	
walker environmental	**SOUTHWESTERN LANDFILL**	967243		
	Drawing	Drawn: JThompson	Scale: 1:10000	Date (D-M-Y): 08JAN20
	SITE PLAN	Approved: DFry	Drawing No.: **Figure 1**	Revision No.: **G**

File Name: \\10.99.10.56\data\WEG\CAD & ENG\NWSL\967243- SWLF\EA Figures\Technical Report\Figure 1 (From Draft EA)_(E)_20DEC19.dwg Plotted: Jan 08, 2020 @ 2:25pm by Joseph



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NOTE:
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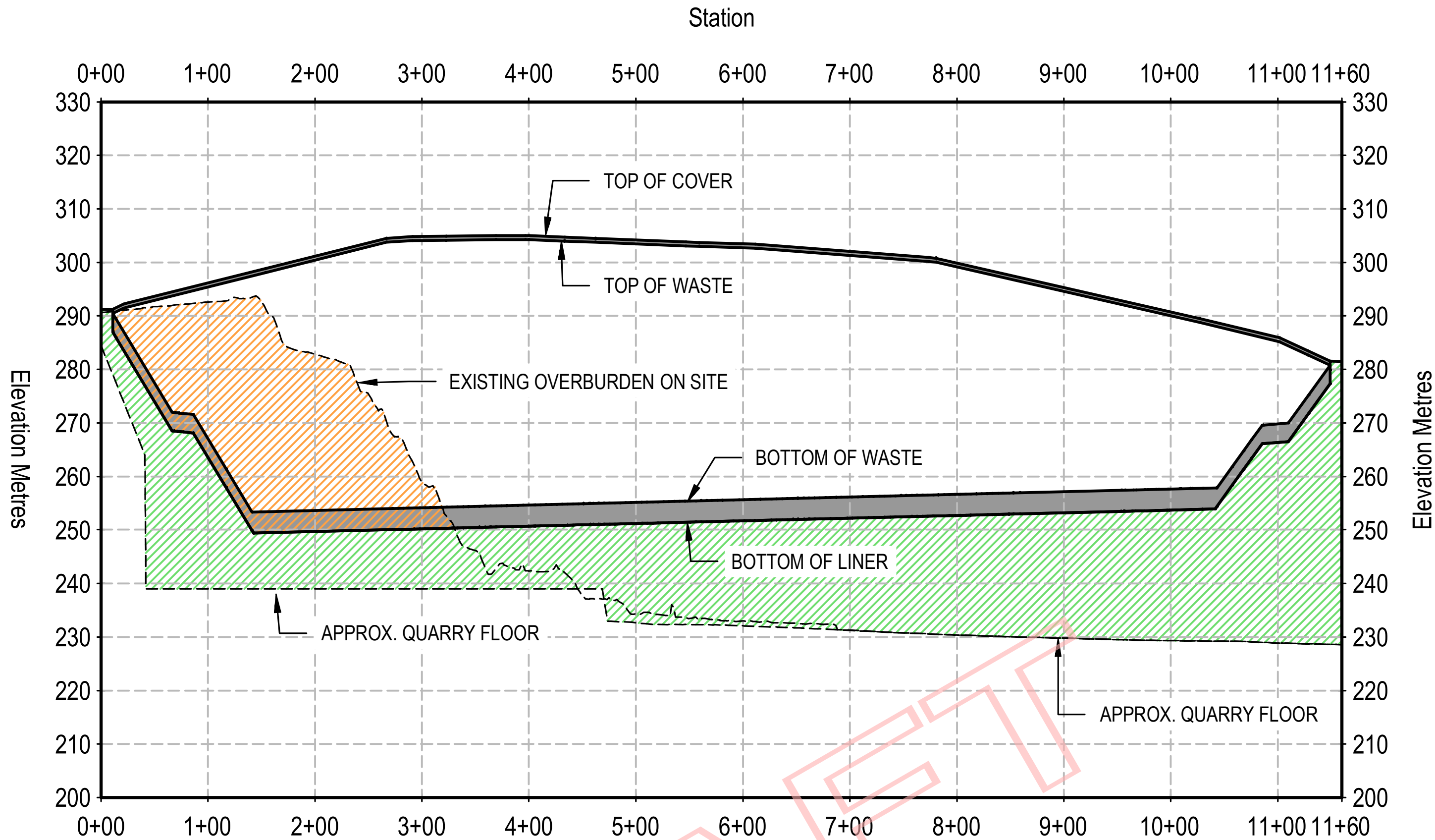
		Drawn: TTamburri	Scale: NTS	Date (D-M-Y): 7JAN19
	Drawing: LANDFILL LINER SYSTEM	Approved: DFry	Drawing No.: Figure 2	Revision No.: C

File Name: C:\Users\Tania\appdata\local\temp\AcPublish_7684\Figure 1_(A)_7DEC18.dwg Plotted: Jan 07, 2019 @ 10:27am by Tania



NORTH - SOUTH SECTION VIEW

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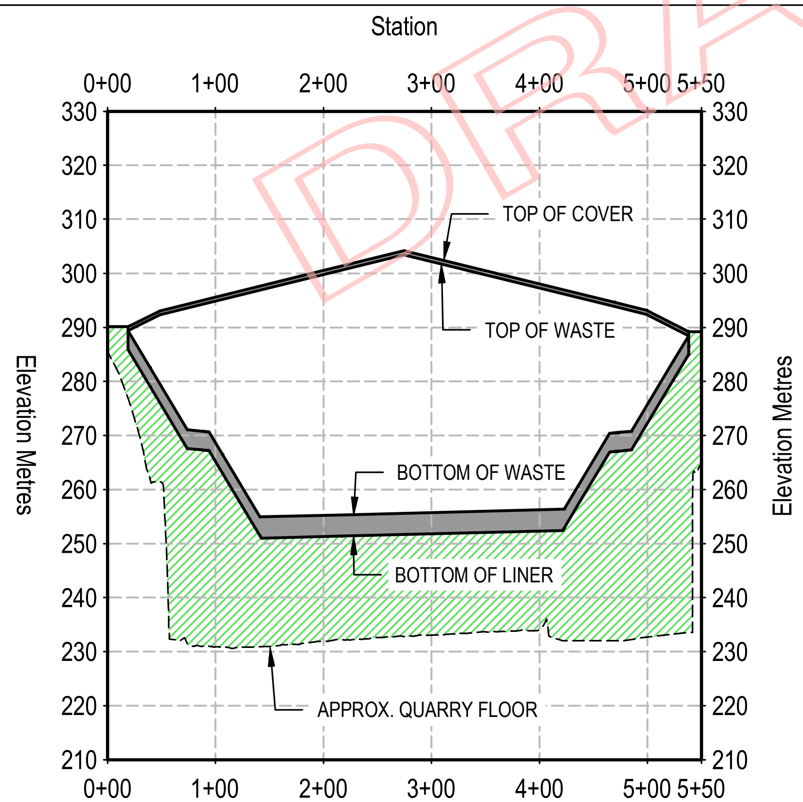

WEST- EAST SECTION VIEW

NOTE:
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	Drawing: SECTION VIEWS	Approved: DFry	Drawing No.: Figure 3	Revision No.: E

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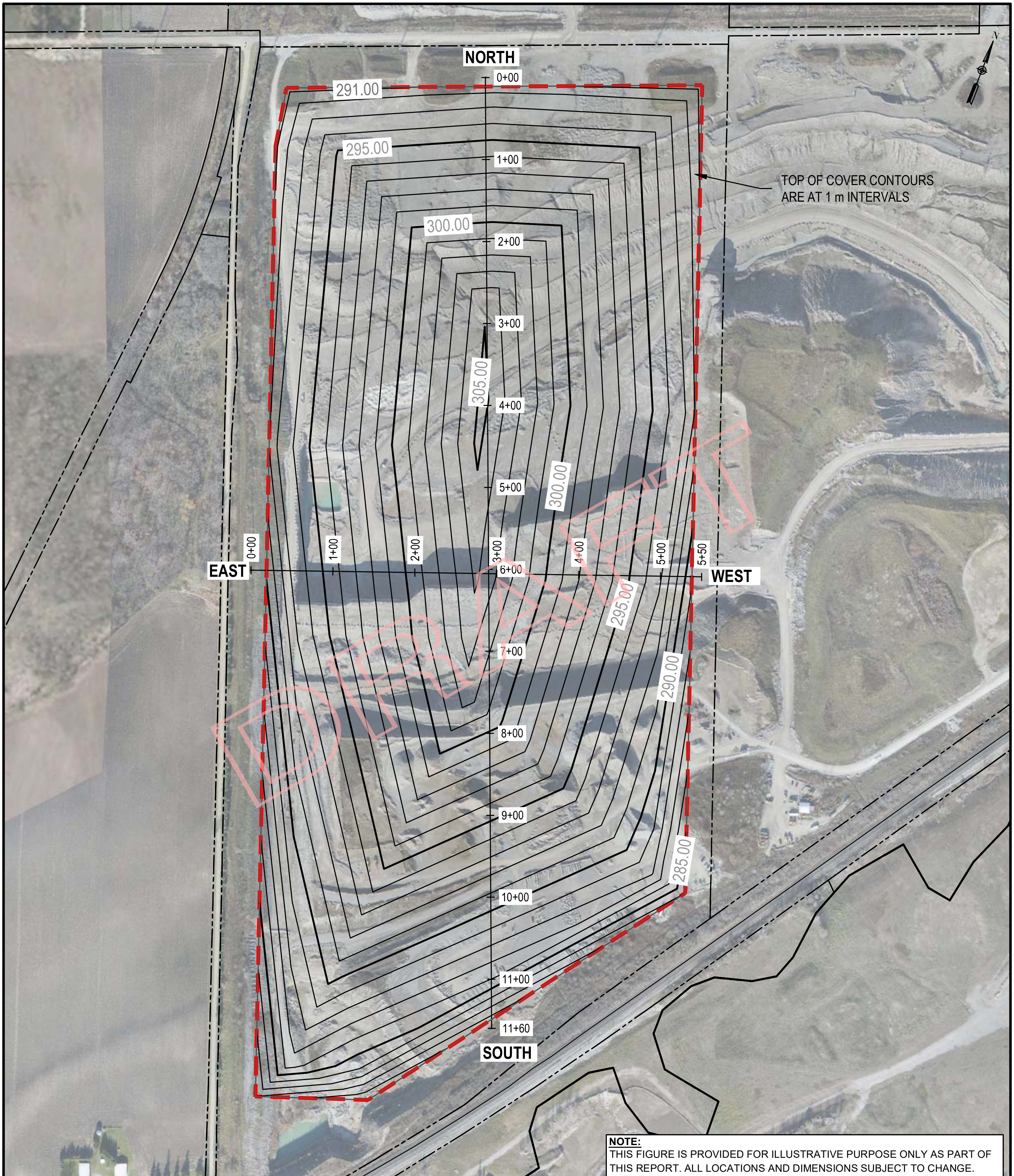

NOTE:
THIS FIGURE IS PROVIDED FOR ILLUSTRATIVE PURPOSE ONLY AS PART OF THIS REPORT. ALL LOCATIONS AND DIMENSIONS SUBJECT TO CHANGE.

Owner	Project	Project No.	Scale Bar	
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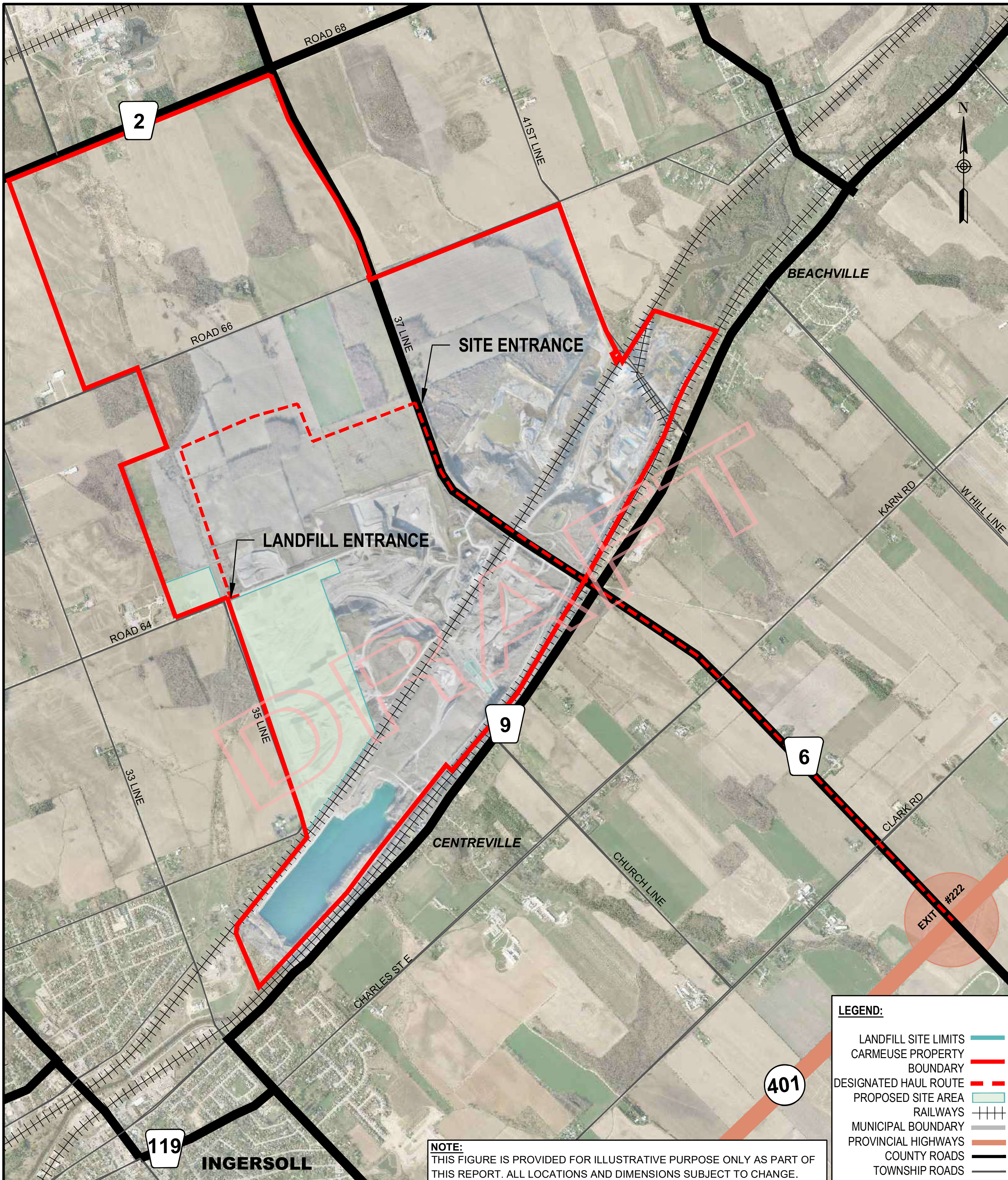
		Drawn: JThompson	Scale: NTS	Date (D-M-Y): 07JAN20
	Drawing: PLAN VIEW TOP OF COVER	Approved: DFry	Drawing No.: Figure 4	Revision No.: E

File Name: \\10.99.10.56\data\WEG\CAD & ENG\NWSL\967243- SWLF\EA Figures\Technical Report\Figure 1 (From Draft EA)_(E)_20DEC19.dwg Plotted: Jan 07, 2020 @ 12:42pm by Joseph



Owner	Project	Project No.	Scale Bar	
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	Drawing	Drawn: JThompson	Scale: 1:30000	Date (D-M-Y): 08JAN20
	SITE LOCATION & HAUL ROUTE	Approved: DFry	Drawing No.: Figure 5	Revision No.: E

File Name: \\10.99.10.56\data\WEG\CAD & ENG\NWSL\967243- SWLF\EA Figures\Technical Report\Figure 5 (From Draft EA)_(D)_20DCE19.dwg Plotted: Jan 08, 2020 @ 1:40pm by Joseph

APPENDIX D

Groundwater Model

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APPENDIX D – GROUNDWATER MODEL

1.0 GROUNDWATER MODELLING

Numerical groundwater flow modelling is conducted in support of the EA. The ultimate objectives of the modelling are to refine the understanding of site hydraulic behaviour and to predict potential groundwater impacts as a result of the proposed landfill design. The model area is presented in Figure D-1.

The modelling consists of the following sequential phases:

1) Model Development;
2) Model Calibration to Existing Conditions; and
3) Predictive Analysis of Landfill Design:
    a) Future Baseline
    b) Operations
    c) Post-Closure

This section provides a description of each phase and associated results for inclusion in the overall effects assessment.

1.1 Scope of Work

The following are the pertinent scope items regarding groundwater modelling:

1) Review of published geological and hydrogeological maps and reports, water well data, regional groundwater and wellhead protection studies, regional and local topographic and drainage mapping, previous subsurface investigation findings, and interpretation.
2) The baseline hydrogeological assessment was used to develop a conceptual hydrogeological model, which will provide a framework for evaluating potential impacts on nearby groundwater receptors (e.g., private and municipal water wells, discharges to surface water) as a result of the proposed site development.
3) A three-dimensional groundwater flow model was developed to support the landfill design and approvals process. The groundwater flow model was constructed and calibrated to existing conditions.
4) The model was used to assess the hydrogeological aspects of the design and net environmental effects in the operating and post-closure stages of the landfill. Prediction of future environmental conditions was completed using modelling and other methods, and appropriate objectives, standards, policies and legislation. Additional mitigation measures, if required, were identified and refined as necessary [including]. any potential effects upon the Wellhead Protection Areas (WHPA) associated with the municipal drinking water wells, Highly Vulnerable Aquifers (HVA) and Significant Groundwater Recharge Areas (SGRA) identified in the source water protection studies. Further, the County of Oxford was consulted with to identify any pre-existing plans for municipal well field expansion and incorporate those into the evaluation.

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1.2 Integration with Prior Modelling

To meet the objectives of the Scope of Work the model must simulate the site in detail but also consider its relationship with the surrounding regional system. To this end, the site conceptualization is merged with the pre-existing “Ingersoll Model” as reported in the County of Oxford *Groundwater Vulnerability Assessment for the Wellhead Protection Areas (Groundwater Modelling Study)* (Golder, 2010). The Ingersoll model provides a reasonable basis for the current work in that:

- The Ingersoll Model includes both the site and surrounding Ingersoll area centrally within its domain.
- The Ingersoll Model was used to develop the Ingersoll wellhead protection areas (WHPAs) as mapped in the MECP-approved Source Protection Plan (Thames-Sydenham Source Protection and Region Source Protection Committee, 2015).
- The Ingersoll Model’s pre-existing geologic surfaces and hydraulic conductivity inputs compare reasonably well with site data and thus provide a reasonable basis for model updates and refinement.

As will be described in subsequent sections, most model parameter updates occurred within the Groundwater Site Vicinity. In some cases, extending refinements regionally was warranted. In order to provide a comprehensive understanding of the entire model, both the pre-existing regional interpretation and site updates are jointly reported on herein.

1.3 Model Development

1.3.1 General Assumptions

The following general assumptions are employed in the model construction:

1) The model considers steady-state flow and reflects average annual conditions.
2) Groundwater flow is three-dimensional (3D). The model construct allows for both lateral and vertical flow paths between adjacent hydrostratigraphic units. It follows that groundwater may flow from overburden to bedrock and vice versa within a continuous system.
3) Only the groundwater flow system is explicitly modelled. Whereas key aspects of the surface water system are included in the model (for example the Thames River), these are only considered relative to their interaction with the groundwater system. As a result, surface processes such as precipitation, evaporation, overland flow and surface water pumping are not directly modelled. The only exception to this is in the Post-Closure scenario, wherein future post-quarry lakes are applied surplus inputs and their lake levels are calculated within the groundwater model.
4) Groundwater flow, including that in the bedrock system, may be simulated as an equivalent porous medium (EPM). In this setting, groundwater flow is a function of the hydraulic gradient and the hydraulic conductivity of the medium. An EPM assumption is deemed sufficient for characterizing groundwater flow at the scale of this analysis.
5) The landfill Operations and Post-Closure scenarios assume that the hydraulic system within the landfill, including that of the waste, leachate collection system and liner, is connected with the surrounding groundwater system in a continuous and dynamic way. In other words, the hydraulic head in the landfill may influence, or be influenced by, the hydraulic heads (water levels) surrounding the landfill - including those at

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nearby dewatered quarries or flooded quarry lakes. In reality, the practical imperviousness of the liner system may result in the hydraulic system within the landfill being "perched", or hydraulically disconnected from the surrounding groundwater system. However, the assumption of hydraulic connection is conservative from the effects assessment perspective.

1.3.2 Code

The MODFLOW-2005 code (Harbaugh, 2005) is used to simulate groundwater flow at the site. MODFLOW is a multi-purpose 3D groundwater flow code developed by the United States Geological Survey. It is modular in nature and uses the finite difference formulation of the groundwater flow equation in its solution. MODFLOW is recognized as an industry standard for general purpose groundwater flow modelling and has gained wide acceptance from academia, consultants and regulatory agencies worldwide.

Visual MODFLOW Classic is used as the pre and post-processor for the simulations presented in this report.

The Algebraic Multigrid Methods for Systems Solver (SAMG) is used to solve the groundwater flow equations.

MODPATH (Pollock, 1989), a companion code to MODFLOW, is used to complete the particle tracking (capture zone / seepage analysis) described in this report.

1.3.3 Domain and Grid Discretization

The model domain encapsulates the Groundwater Site Vicinity and regional surrounds, covering an area of approximately 380 square kilometres (km^2) (Figure D-1). The model domain retains the same extents as the prior Ingersoll Model and is delineated based on hydrogeologic boundaries as described further below.

Horizontally, the numerical grid cell size ranges from approximately 10 m x 10 m within the Groundwater Site Vicinity and at municipal wells to 100 m x 100 m regionally.

Vertically, the model top is constrained by topography and the bottom is bounded by the base of the Bois Blanc Formation (see Figure D-3 and Figure D-4). Within this construct are 13 numerical model layers. The current layering includes nine additional numerical layers over the original Ingersoll Model. The primary purpose of the additional numerical layers is to allow for a more accurate implementation of the quarry geometry and associated vertical head profile.

The model is comprised of approximately 2.4 million active cells in total.

1.3.4 Topography

Ground surface elevation within the model domain ranges from a high of approximately 350 metres above mean sea level (m amsl) at the eastern flank along the Ingersoll Moraine to a low of 230 m amsl in the area of the Southwest Quarry sump (Figure D-2).

Model layer elevations in the vicinity of the Southwest Quarry, including the top of Layer 1 (i.e. topography), are constructed to approximate pre-quarry ground elevations. In other words, the model layers are allowed to extend through the quarry interior (Figure D-3/D-4) rather than having topography collapse at the quarry down to ~230 m amsl. The quarry geometry is implemented within these layers via the application of drain cells reflecting the elevation of the quarry side walls and floor as described below. This approach is taken to allow the hydrostratigraphic layers intersecting the quarry walls to retain transmissivity and thus allow potential seepage to occur along the quarry face.

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1.3.5 Drainage

Ingersoll and the majority of the model domain lie within the South Thames River/Reynolds Creek subwatershed "08T" as mapped by the Thames Sydenham and Region SPC (2015). The Thames River, the primary discharge zone in the subwatershed, flows from northeast (~280 m amsl) to southwest (~255 m amsl) somewhat centrally through the model domain. The elevation of the Thames River in the vicinity of the site is approximately +/- 262 m amsl. Several other surface water features are considered within the model domain, including an upstream section of the Middle Thames River, Reynolds Creek, Halls Creek, and Cemetery Creek (Figure D-2).

1.3.6 Hydrostratigraphy and Material Properties

The modelled hydrostratigraphy and material properties are summarized in Table D-1 and illustrated on Figures D-3 and D-4. A further discussion on these model inputs follows Table D-1.

Table D-1: Summary of Model Hydrostratigraphy and Material Properties

Conceptual Sequence	Unit	Model Layers	Thickness	Hydraulic Conductivity (K)	Recharge Rates
1	Overburden – Aeolian / Alluvial [Coarse-Grained] Deposits	1 – 4	See Figure D-6A	$K_H = 1 \times 10^{-4}$ m/s, $K_V = 1 \times 10^{-8}$ m/s	200 mm/yr to 350 mm/yr
2	Overburden – Till Deposits	1 – 4	See Figure D-6A	$K_H = 1 \times 10^{-7}$ m/s, $K_V = 1 \times 10^{-8}$ m/s	25 mm/yr to 100 mm/yr
3A	Lucas Formation	5 – 8	Site Area = ~30 m Regional = 20 m	Site Area: $K_H = 2 \times 10^{-5}$ m/s, $K_V = 1 \times 10^{-9}$ m/s Regional: $K_H = 1 \times 10^{-4}$ m/s, $K_V = 6 \times 10^{-9}$ m/s	-
3B	Lucas Formation High K Horizon	8 (Site Area Only)	Site Area = 7.5 m	Site Area: $K_H = 5 \times 10^{-4}$ m/s, $K_V = 2.5 \times 10^{-8}$ m/s	-
4	Amherstburg Formation	9 – 11	20 m	$K_H = 3 \times 10^{-9}$ m/s, $K_V = 3 \times 10^{-9}$ m/s	-
5	Bois Blanc Formation	12 – 13	45 m	$K_H = 6 \times 10^{-5}$ m/s, $K_V = 6 \times 10^{-5}$ m/s	-

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Overburden

As per Golder, 2010, the delineation of Till versus Coarse-Grained deposits within the overburden is guided by surficial geology mapping (Figure D-5). These materials are implemented from ground surface to bedrock in the model (Layers 1 through 4). Overburden thickness (Figure D-6A) is maintained from the original modelling with refinements in the area of the site based on borehole picks.

The Till hydraulic conductivity in the original modelling ranged from 1×10^{-7} m/s to 5×10^{-8} m/s and was isotropic (Golder, 2010). Under the current analysis a reasonable calibration is found by simplifying the Till to a single horizontal hydraulic conductivity ($K_H = 1 \times 10^{-7}$ m/s). Additionally, slightly lowering the vertical hydraulic conductivity ($K_V = 1 \times 10^{-8}$ m/s) is found to be beneficial in calibrating to overburden wells at the site.

The Coarse-Grained lateral hydraulic conductivity from the original modelling ($K_H = 1 \times 10^{-4}$ m/s) is maintained. Borehole logging at the site indicates the Coarse-Grained units are interbedded with seams of clayey, silty and till-based sub-units. This occurrence is approximated in the model by introducing an anisotropy wherein the vertical hydraulic conductivity reflects that of the Till material ($K_V = 1 \times 10^{-8}$ m/s).

The overburden hydraulic conductivity distribution is illustrated in plan view on Figure D-7A.

Lucas Formation

The Lucas Formation is the first bedrock unit encountered in the model; the vast majority of the Southwest Quarry is mined within this unit. Bedrock surface is illustrated on Figure D-6B. Thickness ranges from 30 m at the site (based on site borehole logging picks) to 20 m regionally (based on prior modelling). The unit is subdivided into four uniform thickness numerical layers (Layers 5 through 8).

Regionally, the Lucas Formation lateral hydraulic conductivity from the original modelling is maintained ($K_H = 1 \times 10^{-4}$ m/s to 2×10^{-4} m/s). In the area of the site, the lateral hydraulic conductivity is reduced ($K_H = 2 \times 10^{-5}$ m/s). Also, in the area of the site, a higher permeability horizon ($K_H = 5 \times 10^{-4}$ m/s) is delineated at the base of the Lucas (Layer 8 in the model). A K_H:K_V anisotropy of 20,000:1 is applied for all Lucas Formation layers. These updates are applied to be more reflective of site data and to refine the calibration to site water levels and quarry inflows as discussed below.

The Lucas Formation hydraulic conductivity distribution is illustrated in plan view on Figure D-7B (Layers 5 through 7) and Figure D-7C (Layer 8).

Amherstburg Formation

The Amherstburg Formation underlies the Lucas Formation. The modelled thickness is based on the prior modelling and is maintained at 20 m (Golder, 2010). The unit is subdivided into three uniform thickness layers (Layers 9 through 11).

The Amherstburg Formation hydraulic conductivity from the original modelling is maintained ($K_H = K_V = 3 \times 10^{-9}$ m/s). The modelled hydraulic conductivity is uniform across the model domain and is thus not shown on a plan view figure.

Bois Blanc Formation

The Bois Blanc Formation underlies the Amherstburg Formation. The unit is subdivided into two numerical layers with thicknesses of 15 m and 30 m (Layers 12 and 13).

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The Bois Blanc hydraulic conductivity from the original modelling is maintained ($K_H = K_v = 6 \times 10^{-5}$ m/s). The modelled hydraulic conductivity is uniform across the model domain and is thus not shown on a plan view figure.

1.3.7 Recharge

The modelled recharge distribution (Figure D-8) is based on the prior modelling (Golder, 2010) and is related to surficial geology. Tills receive between 25 to 100 mm/yr of recharge whereas Coarse-Grained deposits received between 200 mm/yr and 350 mm/yr.

1.3.8 Boundary Conditions

Regional

The current model approximates regional boundary conditions established in the original Ingersoll Model (Figure D-9). The following is noted:

- The northeast and west boundaries of the model generally follow inferred bedrock flowlines and are therefore assigned as “no flow” boundaries (i.e. inactive cells) in all model layers.
- The north and south boundaries follow inferred groundwater elevation contours and are consequently assigned as constant head boundaries at elevations of approximately 290 m amsl to 260 m amsl, respectively, in all model layers.
- Major surface water features such as the Thames River are assigned as constant head cells with elevations consistent with topography. These surface water boundaries are located in Layer 1, except in the vicinity of the site where the Thames River is observed to be in contact with bedrock. In this latter situation the constant head cells are applied in Layer 5 (top of Lucas Formation) with inactive cells input above these constant head cells.
- The Lafarge Woodstock Quarry, which is located approximately 3 km northwest of the site, is coarsely approximated over its footprint using drain cells. Drain cells fill the quarry volume from the approximate quarry floor (240 m amsl in Layer 9) to ground surface. Above the floor, the interior quarry drain cells are assigned a head elevation equivalent to the bottom of the layer they reside in plus 2 m in order to allow seepage to occur along the quarry walls. The drain cells are assigned a conductance of 100 m^2/d.

Site

The site and surrounds consist of four main boundary condition features (Figure D-9):

1) the active, dewatered Southwest Quarry;
2) the dewatered East Quarry;
3) the dewatered Center Plant quarry; and
4) the flooded Former West Quarry .

Detailed mapping of quarry layouts provided by Carmeuse Lime is used to implement current conditions in the model. At the Southwest Quarry, drain cells fill the quarry volume from the approximate quarry floor (230+ m amsl in Layer 10 up to 8) to ground surface (see Figure D-3 and Figure D-4). Above the floor, the interior quarry drain cells are assigned a head elevation equivalent to the bottom of the layer they reside in plus 1 m to allow seepage

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to occur along the quarry walls. The drain cells are assigned a conductance of 100 m^2/d. The Center Plant and East Quarries are implemented in a similar fashion as the Southwest Quarry.

The Former West Quarry is now a flooded lake at an approximate surface water elevation of 253 m amsl. The lake is implemented as constant head cells at a fixed elevation of 253 m amsl in Layers 6 through 8. The remaining layers above the lake are assigned drain cells at the elevation of the layer plus 1 m to allow for seepage to occur along the above-water lake walls.

1.3.9 Municipal Pumping Wells and Major Groundwater Users

The locations of municipal pumping wells and other major groundwater users included in the model are shown on Figure D-10.

There are three municipal groundwater supply systems within the model domain (Table D-2):

1) Ingersoll (7 wells);

2) Beachville (one well); and

3) Mount Elgin (one well).

All of these systems draw from the Lucas and/or Bois Blanc Formation aquifers. Ingersoll Well 8 is the closest municipal well located approximately 1 km to the west. Average pumping rates are applied in the model based on the annual drinking water system summary reports for 2018 (Oxford County, 2018).

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Table D-2: Municipal Well Summary

System	Well ID	Easting	Northing	Open Interval Depth (m)	Modelled Aquifer Units	2018 Avg Pumping / Model Rate (m^3/d)
Ingersoll	Well 2	509,286	4,764,512	61 – 140	Bois Blanc	230
Ingersoll	Well 3	506,018	4,762,836	15 – 117	Lucas / Bois Blanc	620
Ingersoll	Well 5	510,880	4,764,896	28 – 109	Lucas / Bois Blanc	1,730
Ingersoll	Well 7	508,090	4,763,764	42 – 123	Bois Blanc	0
Ingersoll	Well 8	509,666	4,766,792	38 – 125	Lucas / Bois Blanc	170
Ingersoll	Well 10	509,782	4,762,379	45 – 113	Lucas / Bois Blanc	2,920
Ingersoll	Well 11	509,106	4,761,533	43 – 116	Bois Blanc	0
Beachville	Well 1	513,690	4,770,022	32 – 91	Lucas / Bois Blanc	30
Mount Elgin	Well 3	516,696	4,756,565	55 – 60	Lucas	120

There are ten active private Permit to Take Water (PTTW) groundwater users within the model comprising a total of 15 wells (Table D-3). Their modelled rate corresponds to the permitted maximum daily rate(s) listed in the permit. In our experience with similar projects, the actual amount of a water taking is typically much less than the maximum permitted rate. Actual water taking / water use data was not readily available at the time of this report. The majority of the PTTWs lie east of the Thames River with the closest to the site being located 3.5 km to the southwest.

Table D-3: Non-Municipal and Non-Quarry Active Groundwater Permit to Take Water Details

Permit	Easting	Northing	Use	Modelled Aquifer Units	Permit / Model Rate (m^3/d)
2168-AGNM9Q	517,446	4,756,813	Golf Irrigation	Lucas	818
2662-9F7QAX	505,327	4,761,785	Food Process	Lucas	1,309
	505,484	4,761,678	Food Process	Lucas	982
3878-ANZN8G	508,506	4,772,239	Cooling Water	Lucas/Bois Blanc	893
	508,530	4,772,208	Cooling Water	Lucas/Bois Blanc	1,786
4780-83DHNS[1]	514,956	4,767,125	Communal	Overburden	319
	514,995	4,767,071	Communal	Overburden	319
4882-9UHRCX	510,601	4,763,493	Golf Irrigation	Lucas	245
5871-A8WRQP	508,578	4,763,891	Manufacturing	Lucas	806
7387-A7VLSP	503,769	4,757,704	Golf Irrigation	Lucas/Bois Blanc	2,000
8130-98NGZ6	508,393	4,764,187	Remediation	Lucas	43
	508,400	4,764,183	Remediation	Lucas/Bois Blanc	65
	508,497	4,764,070	Remediation	Lucas	9
8753-93LK2T	504,496	4,757,706	Communal	Lucas/Bois Blanc	164
8853-98CJDU	515,482	4,758,375	Agricultural	Lucas	436

Note: 1. This PTTW pumping is omitted from the calibrated model as it appeared to be causing significant drawdown at surrounding overburden wells with static water levels pre-dating the pumping.
2. Temporary construction dewatering permits and dugout pond sources are not included in the model.

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1.4 Calibration

1.4.1 Approach

Calibration involves the iterative adjustment of model inputs to achieve simulated groundwater flow conditions reasonably consistent with measured site-specific data. The prior Ingersoll Model calibration (Golder, 2010) generally provides for a reasonable set of regional inputs, particularly with respect to layer thicknesses, recharge, hydraulic conductivities, and boundary condition assignments. In addition, as site-specific measurements or testing within the Amherstburg and Bois Blanc Formations is limited, there is little basis in this analysis to adjust inputs at these formations. Thus, the main focus of the current calibration is fine tuning the hydraulic conductivities of the Lucas Formation, particularly within the Groundwater Site Vicinity.

Goodness-of-fit for each calibration iteration is assessed via statistical and other quantitative or qualitative means including:

- *Mean Residual:* This term indicates the average difference between observed and simulated water levels. The mean residual may suggest the degree to which the model is, on average, predicting heads above or below the observed dataset. A mean residual approaching zero is usually desired.
- *Mean Absolute Residual:* This indicator represents the average absolute value of the difference between observed and simulated water levels. A mean absolute residual of less than 5 m is considered reasonable given the localized behaviour of water levels (for e.g. large, unique vertical gradients at each well) relative to the scale of the model. Globally, a somewhat larger mean absolute residual is acceptable given the data characteristics of the MECP Water Well Information System (WWIS).
- *NRMS*: This indicator, expressed in percentage, is the RMS divided by (or normalized by) the range of observed values for the dataset multiplied by 100%. NRMS may be considered a better indicator of goodness of fit as it accounts for the scale of the potential range of water levels. In this assessment NRMS magnitude is subjective, and, aside from the expectation of a decreasing NRMS with a calibration improvement, there is not a set target value that may be quantitatively ascribed. Nonetheless, based on Golder’s experience, a NRMS target of 10% or less is frequently employed as the minimum target in Ontario.
- *Calibration Plot*: Simulated versus observed head values are compared on a plot with a central 45 degree line. In an idealized result, each point will lie along the 45-degree line. However, this seldom occurs in practice. Instead, the calibration plot is used as a visual inspection tool to determine goodness-of-fit and to detect any simulation bias (too high or too low relative to measured data) in the output.
- *Comparison to Water Level Maps*: The model output is visually compared to inferred groundwater elevation maps for both overburden and bedrock.
- *Comparison to Measured Flows*: Simulated quarry inflows are compared to measured inflows at the site quarry and surrounding quarries.

1.4.2 Targets

There are four main calibration targets:

1) Site groundwater levels;

2) MECP WWIS well water levels;

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3) Groundwater elevation maps; and

4) Carmeuse Lime quarry groundwater inflows.

Site Groundwater Levels

Site groundwater levels were collected during 2018 on the following dates: February 26, May 22, August 21 and November 28. The average water level at each well over this period is utilized as the model calibration target (Table D-4).

Table D-4: Site Groundwater Levels for Model

Well ID	Easting	Northing	Ground Elevation (m amsl)	Screen Top (m bgs)	Screen Bottom (m bgs)	Formation	2018 Average Water Level (m amsl)
MW17-1A	509,693	4,768,617	290.4	53.4	62.1	Amherstburg	245.8
MW17-1B	509,694	4,768,616	290.5	35.8	44.6	Lucas	253.5
MW17-1C	509,695	4,768,614	290.4	19.9	28.1	Lucas	287.2
MW17-1D	509,695	4,768,613	290.5	9.7	13.8	Overburden	289.0
MW17-2A	510,081	4,767,575	284.7	48.5	55.6	Amherstburg	238.6
MW17-2B	510,081	4,767,576	284.6	40.8	48.0	Lucas	246.1
MW17-2C	510,081	4,767,578	284.6	20.3	27.0	Lucas	268.8
MW17-2D	510,081	4,767,580	284.7	2.4	5.4	Overburden	281.8
MW17-3A	510,015	4,766,841	280.1	45.0	52.2	Lucas	248.7
MW17-3B	510,014	4,766,842	280.0	34.8	42.3	Lucas	249.1
MW17-3C	510,013	4,766,840	280.1	19.3	30.0	Lucas	261.5
MW17-3D	510,013	4,766,841	280.1	6.7	10.4	Overburden	270.3
MW17-3E	510,012	4,766,843	280.3	1.2	3.2	Overburden	279.1
MW17-4A	510,772	4,768,389	241.3	17.2	22.4	Bois Blanc	245.0
MW17-4B	510,771	4,768,388	241.2	11.7	16.3	Amherstburg	241.8
MW17-5A	510,870	4,767,243	270.7	38.7	42.7	Amherstburg	246.3
MW17-5B	510,869	4,767,242	270.7	25.9	33.2	Lucas	248.6

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Well ID	Easting	Northing	Ground Elevation (m amsl)	Screen Top (m bgs)	Screen Bottom (m bgs)	Formation	2018 Average Water Level (m amsl)
MW17-5C	510,868	4,767,241	270.7	12.3	24.5	Lucas	249.2
MW17-6A	511,280	4,767,200	275.2	29.0	33.0	Lucas	247.3
MW17-6B	511,280	4,767,201	275.2	24.0	27.9	Lucas	248.8

MECP WWIS Well Water Levels

Static water levels in the MECP WWIS (MECP, 2018) provide regional calibration targets (Figure D-11 and D-12); however, these data must be used with caution for several reasons, including:

- Frequent inaccuracies in well coordinates and log information;
- Bedrock wells are typically completed as an "open hole" that straddles several units; as such the static water level may be more representative of a quasi-averaging of several hydrostratigraphic units as opposed to water level in a singular discrete unit (which is what the model calculates). Furthermore, this "averaging" would tend to obscure vertical gradients that would otherwise be observed if individual units were screened at the well location (as is the case at the site wells).
- The timeframe of measurement at individual wells spans from 1941 to 2017. Older water levels, particularly those in the area of long-term dewatering (for example, near municipal pumping wells) may no longer be applicable.

Thus, a QA/QC process is followed to distill a usable dataset as follows:

- Remove wells with database location inaccuracy greater than 300 metres;
- Remove singular wells which produce large, discrete "bullseyes" relative to multi-well supported, regional flow patterns (difference +/- 10 m).
- Remove wells in the vicinity of the quarry that, based on their static water level and historic drill date, are no longer reflective of current conditions.

In total, 1,778 MECP water well records are used in the model calibration dataset.

Groundwater Elevation Maps

The model output is compared to inferred groundwater elevation maps for both overburden (Figure D-11) and bedrock (Figure D-12). The maps provide a large-scale "averaging" of water level patterns in overburden and bedrock and mainly serve as a high-level visual comparison tool. The groundwater elevation maps are developed using both site and MECP WWIS database water levels.

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Quarry Inflows

The current groundwater contribution to quarry inflows is derived via analysis of water taking records provided by Carmeuse Lime and water balance calculations in the Surface Water Report under separate cover. Data from the year 2017 is used in the model calibration as a full record for 2018 had yet to be obtained during the calibration process. In 2017, the estimated approximate groundwater inflow to the quarries is as follows:

- Southwest Quarry and Center Plant quarry: 30,000 m^3/day
- East Quarry: 3,200 m^3/day

There are no measured inflows / outflows for the flooded Former West Quarry; however, as this feature's water level is below that of the Thames River to the south and above that of the quarry to the north, it likely behaves as both a discharge and recharge zone for groundwater.

1.4.3 Calibration Adjustments

Most of the calibration effort focused on adjusting model parameters in the Southwest Quarry area and local surrounds. Several minor hydraulic conductivity and recharge adjustments are made relative to the prior work (Golder, 2010) in order to optimize calibration; however, the following adjustments are particularly important to obtain a satisfactory calibration:

1) **Vertical Anisotropy**. Relatively large anisotropies in the Lucas Formation bedrock (K_H:K_V = 20,000:1) and overburden coarse-grained material (K_H:K_V = 10,000:1) are applied to facilitate the large downward gradients observed in the site well nests. These anisotropies are applied both at the site and regionally to beneficial effect.

2) **Lucas Formation Hydraulic Conductivity.** The upper 22.5 m (Layers 5 – 7) of Lucas Formation is assigned a reduced hydraulic conductivity ($K_H = 2 \times 10^{-5}$ m/s) in the area of the site relative to the prior regional input ($K_H = 1 \times 10^{-4}$ m/s). The bottom 7.5 m (Layer 8) of Lucas Formation is assigned a relatively high hydraulic conductivity ($K_H = 5 \times 10^{-4}$ m/s) local to the site. These adjustments are supported by hydraulic testing data and are required to approximate quarry inflows and the large vertical gradients observed (and in particular to establish a hydraulic connection between the deep A-series wells and the bottom of the quarry via a deep higher permeability horizon).

1.4.4 Results

Site Groundwater Levels

The site groundwater levels calibration statistics are summarized in Figure D-13, including a calibration plot, individual well residuals and goodness-of-fit indicators. The results indicate a satisfactory calibration in each statistical indicator and no undue bias in site trends. Residual mean is 0.5 m, absolute residual mean is 3.6 m and NRMS is 8.2%. Of particular note, the large downward gradients observed at the site are successfully modelled.

MECP WWIS Well Water Levels

The regional MECP WWIS water level calibration statistics are summarized in Figure D-14, including a calibration plot and goodness-of-fit indicators. Residual mean is 1.7 m, absolute residual mean is 5.9 m, and RMS is 9.4%. These statistics are considered reasonable given the far-field, regional distribution of much of the MECP WWIS data and the aforementioned data limitations. There is some bias towards over-estimating heads in the deeper

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bedrock layers; however, most of the larger residuals (10 m +) occur in locations several kilometres away and are not considered directly relevant to the modelling of the future landfill.

Groundwater Elevation Maps

Simulated overburden and bedrock groundwater patterns (Figure D-11 and Figure D-12) compare reasonably well with our understanding of shallow and deep groundwater behaviour.. Groundwater highs (divides) occur along topographic ridges whereas groundwater lows (discharge areas) occur within valleys and adjacent to drainage features.

Quarry Inflows

Simulated quarry inflows match closely with groundwater inflows estimated in 2017 (Table D-5). In particular, the Southwest Quarry and Center Plant quarry's inflows are within 10% of the target flow rate.

Table D-5: Simulated Versus Observed Quarry Inflows

Quarry	Estimated Average Groundwater Inflow 2017 (m^3/day)	Simulated Groundwater Inflow (m^3/day)
Southwest Quarry and Center Plant quarry	30,000	29,100
East Quarry	3,200	3,500

The Former West Quarry is simulated to have an inflow of 4,800 m^3/day and an outflow of 4,700 m^3/day for a net flow into the lake of 100 m^3/day. The in/out function of the Former West Quarry is consistent with its conceptualization as both a discharge zone for water from the Thames River and a recharge zone for water to the active Southwest Quarry.

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1.4.5 Conclusions

Through the calibration process it is found that the recharge rates, hydraulic conductivities of the geologic units, simulated flow patterns and quarry inflows are in good agreement with available field data. The calibrated model values are therefore considered to represent reasonable estimates for use in estimating future Operations and Post-Closure conditions.

1.5 Predictive Analysis

Three sequential scenarios are considered in the predictive analysis of the landfill design:

1) Future Pre-Landfill Baseline;

2) Operations; and

3) Post-Closure.

In addition, a theoretical contingency scenario is considered under Post-Closure conditions.

For each scenario, the model input (layer structure, boundary conditions, hydraulic conductivity etc.) is adjusted to approximate the landfill design in the Facilities Characteristics Assumptions [FCA] document (Walker, 2019) and surrounding quarry development (MHBC, 2018). For each landfill scenario the following model output is considered in support of the effects assessment:

- Groundwater flow budget at the landfill;
- Hydraulic head distribution in and around the landfill; and
- Particle tracking of seepage pathways from the landfill.

1.5.1 Predictive Scenario Implementation in Model

1.5.1.1 Future Pre-Landfill Baseline

The purpose of the Future Pre-Landfill Baseline scenario is to establish the hydrogeological conditions upon which the relative effects of Operations and Post-Closure may be assessed. Note that the beginning of Operations is sufficiently far in advance of 2018 that future changes to hydrogeologic conditions, mainly as a result of surrounding quarry expansion, will make the Existing Conditions calibrated model described above non-applicable for direct comparison purposes.

A model depiction of the Future Pre-Landfill Baseline Scenario inputs is illustrated on Figure D-14. The scenario includes the following components from the Beachville Quarries Operational Plan 2 of 5 and Cross-Sections 5 of 5 (MHBC, 2018):

- Phase A is generally complete with the Southwest Quarry mined and dewatered to a floor elevation of approximately 225 m amsl. The quarry lands immediately to the east are mined and dewatered to a floor elevation of approximately 230 m amsl. This dewatering is accomplished using drain cells in a similar manner as described in the Boundary Conditions section above.
- The Phase 1W, 2W and 3W lands to the north and immediately north of Road 64 and the Phase 2E and 3E lands east of County Road 6 have yet to undergo quarrying and are thus considered unaltered from Existing Conditions.
- The Former West Quarry remains flooded with the water level at approximately 253 m amsl.
- Regionally, the remainder of the model input remains the same as previously reported.

1.5.1.2 Operations

The Operations Scenario considers the landfill at full-build out. A model depiction of the Operations Scenario inputs is illustrated on Figure D-15. The following hydraulically-pertinent components from the Facilities Characteristics Assumptions document (Walker, 2019) are considered with additional assumptions as noted:

- Topography crests along the centreline of the landfill at a maximum elevation of 305 m amsl and slopes to 290 m amsl at the landfill perimeter. The bottom of the waste resides at approximately ~260 m amsl, infilling the prior quarried-out volume to this depth. The waste footprint is approximately 59.3 ha.
- The waste is assigned an assumed hydraulic conductivity of $K_H = K_V = 1 \times 10^{-5}$ m/s. This assignment ignores progressive compaction through the waste depth and is thus considered conservative with respect to potential seepage rates through the landfill. An infiltration rate of 258 mm/yr is applied over the waste footprint (Golder, 2019).

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- The FCA design shows a liner system underlying the waste with an alternating "primary" and "secondary" system of leachate collection pipe drains in clear stone, thin HDPE liner, composite clay liner, and thereafter an attenuation layer. For the purpose of the 3D flow modelling within the regional scale model, this multi-unit system is combined and simplified into the following key hydraulic components:
  - A single 0.3 m drainage layer with an assumed hydraulic conductivity of $K_H = K_V = 1 \times 10^{-2}$ m/s (in effect the primary drainage collection system). The drainage layer is assigned drain cell elevations corresponding to the top of the drainage layer. These drain cells can only remove, not provide, water to the system. The drainage layer requires the addition of a new, uniformly thick (0.3 m) numerical model layer underlying the landfill. External to the site, the drainage layer adopts the hydraulic properties of the native rock.
  - The drainage layer is underlain by a single, "combined" HDPE and clay liner with a hydraulic conductivity of $K_H = 1 \times 10^{-9}$ m/s and $K_V = 1 \times 10^{-12}$ m/s. The horizontal hydraulic conductivity is reflective of the clay whereas the lower vertical hydraulic conductivity reflects the HDPE liner. The liner layer requires the addition of a new, uniformly thick (1.5 m) numerical model layer underlying the aforementioned drainage layer; this thickness is representative of the combined thickness of the primary and secondary liners. The liner is also applied along the flanks of the landfill. External to the Southwest Quarry, the liner layer adopts the hydraulic properties of the native rock.
  - The volume between the bottom of the liner and the exposed quarry rock (at ~225 m amsl) is occupied by structural fill with an assumed hydraulic conductivity of $K_H = K_V = 1 \times 10^{-6}$ m/s.

Note that the above landfill implementation "overwrites" the Southwest Quarry drain cells that were previously present in the Future Pre-Landfill Baseline model described above.

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In addition, the Operations scenario includes the following components from the Beachville Quarries Operational Plan 2 of 5 and Cross-Sections 5 of 5 (MHBC, 2018):

- The quarry lands immediately to the east are mined and continue to be dewatered to a floor elevation of approximately 230 m amsl as per the Future Pre-Landfill Baseline Scenario.
- The Phase 1W, 2W and 3W lands immediately north of Road 64 and the Phase 2E and 3E lands east of County Road 6 have yet to undergo quarrying and are thus considered unaltered from their existing state.
- The Former West Quarry remains flooded with the water level at approximately 253 m amsl.

1.5.1.3 Post-Closure

A model depiction of the Post-Closure Scenario inputs is illustrated on Figure D-16. The Post-Closure scenario shares the same inputs as the Operations Scenario in the vicinity of the landfill (see previous section), including infiltration, waste, leachate collection drain and liner characteristics. The surrounding landscape has been modified to incorporate relevant components from the Beachville Quarries Rehabilitation Plan 4 of 5 (MHBC, 2018) as discussed below.

There are four new quarry lakes present in addition to the Former West Quarry. The lakebeds are comprised of backfilled till (assumed $K_H = K_V = 1 \times 10^{-6}$ m/s) from the bottom of the prior quarry floor (approximately 225 m amsl to 230 m amsl) up to the lake bottom (approximately 240 to 250 m amsl). The lake shorelines are also comprised of backfilled till. For simplicity in the model, shorelines are implemented as vertical walls as opposed to sloped beaches. From the lake bottom to the top of the lake level are constant head cells with assigned water levels ranging from 276 m amsl in the two northern lakes to 267 m amsl at the Center Plant quarry lake per MHBC, 2018. Above lake level but within the lake footprint, model cells are assigned drain cells in order to allow for a seepage face condition from the surrounding backfilled till "shoreline" into the lake.

Rehabilitated areas surrounding the quarry lakes are comprised of backfilled till (assumed $K_H = K_V = 1 \times 10^{-6}$ m/s) from the bottom of the prior Southwest Quarry floor (approximately 225 m amsl to 230 m amsl) up to rehabilitated ground surface. In most areas the top of the backfilled till reaches elevations similar to that of Existing Conditions topography; in these cases, the till is simply applied from the quarry floor to the surface of the model. In other areas, the rehabilitated topography dips significantly below that of Existing Conditions topography; in these instances, no-flow cells are placed within what is now "air" in the model, thus approximating the new ground surface in the Post-Closure model and avoiding an onerous and unnecessary reconstruction of the top of layer 1.

1.5.1.4 Post-Closure Contingency

An additional Post-Closure scenario is developed for contingency purposes. In this scenario the HDPE liner is assumed to have come to the end of its functional life at some point during Post-Closure leaving only the clay component of the liner intact. Under this scenario the liner hydraulic conductivity is changed to $K_H = K_V = 1 \times 10^{-9}$ m/s (i.e. the vertical hydraulic conductivity is increased to be reflective solely of clay material).

1.5.2 Predictive Analysis Results

1.5.2.1 Groundwater Flow Budgets

A summary of the groundwater flow budget for each scenario is provided in Table D-6.

Table D-6: Predictive Scenario Site Groundwater Budget Simulated Results

Source/Sink	Future Baseline		Operations		Post-Closure		Post-Closure Contingency	
	In (m^3/d)	Out (m^3/d)	In (m^3/d)	Out (m^3/d)	In (m^3/d)	Out (m^3/d)	In (m^3/d)	Out (m^3/d)
Site Infiltration	0	-	419.5	-	419.5	-	419.5	-
Seepage at Landfill	-	-	11.2	0.2	10.7	0.01	265.7	4.3
Seepage at Quarry	33,000	-	-	-	-	-	-	-
Drainage Collection	-	33,000	-	430.5	-	430.2	-	680.9
TOTAL	*33,000*	*33,000*	*430.7*	*430.7*	*430.2*	*430.2*	*685.2*	*685.2*

The following is noted regarding the site groundwater budgets:

The Future Baseline is not a *landfill* scenario groundwater budget but is nonetheless included so the reader may comprehend the large change in water taking from quarry to landfill conditions. During the Future Baseline quarry

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dewatering at the site alone is estimated to be 33,000 m^3/d (for simplicity listed under "Drainage Collection" row); compare this with the much reduced total water taking at the landfill drainage collection which ranges from approximately 430 m^3/d to 685 m^3/d.

The Operations, Post-Closure and Post-Closure Contingency scenarios all have the same amount of infiltration into the waste (419.5 m^3/d, or 258 mm/yr). An additional, but smaller, source of seepage enters the landfill through its flanks (e.g. 11.2 m^3/d for Operations). The vast majority of seepage that enters the landfill is intercepted by the drainage collection system (Table D-6 – Drainage Collection, Out). An extremely small amount of seepage collection bypass is simulated to occur in Operations (0.2 m^3/d or 0.1 mm/yr) and Post-Closure (0.01 m^3/d, or 0.006 mm/yr) scenarios. Under the Post-Closure Contingency scenario, collection bypass is still small (4.3 m^3/d or 3 mm/yr) but increases as a result of the effective removal of the HDPE component of the liner system. The discharge locations for seepage that bypasses the landfill collection system is discussed further below.

1.5.2.2 Hydraulic Head Distribution

The hydraulic head distributions in the Lucas Formation (model layer 6) for Future Baseline, Operations, Post-Closure and Post-Closure contingency scenarios in the vicinity of the site are shown on Figure D-17.

The Future Baseline scenario depresses water levels down to less than 240 m amsl in the vicinity of the Southwest Quarry as a result of quarry dewatering. During the landfill scenarios, the local water levels recover to an elevation of +/- 260 m amsl at the site, with the landfill drainage collection system controlling heads at this mark.

Surrounding the site, the Operations and Post-Closure scenarios have different head distributions. During Operations, sub-regional heads are dominated by the continued quarry dewatering to the east which depresses water levels to less than 240 m amsl. During Post-Closure, the quarry dewatering has ceased, and the quarries are now partially backfilled lakes with prescribed elevations (see previous sections). Sub-regional heads are now most influenced by the Former West Quarry (253 m amsl). As expected, the Post-Closure and Post-Closure Contingency scenarios have practically the same head distribution given the small change in parameters between these two simulations.

1.5.2.3 Seepage Particle Tracking

The purpose of particle tracking in this analysis is to evaluate where seepage bypass emanating from the landfill ultimately discharges (see Table D-6 – Seepage at Landfill, Out). Particle tracking is conducted by seeding the landfill drainage layer (model layer 6) and the layer immediately below the landfill (model layer 8) with 73 roughly equally spaced particles within the landfill footprint (146 particles total). The particles are then forward tracked using MODPATH to their ultimate seepage destination.

The results of particle tracking are overlain upon the hydraulic head distribution (Figure D-18) with the following noted:

Under the Operations scenario, the majority of particles released at the landfill either discharge at the adjacent dewatered quarry to the immediate east or remain within the landfill drainage collection system. A very small number of particles (three) discharge at the Former West Quarry . Almost all of the simulated 0.2 m^3/d of water leaving the landfill (Table D-6 – Seepage at Landfill, Out) discharges at the quarry location during Operations, with less than 0.001 m^3/d discharging at the Former West Quarry . With respect to the particles remaining within the

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landfill collection system: this "re-entry" occurs because the drainage layer has a slight slope to it such that particles released on the upgradient end of the layer may be captured by drains in the downgradient end. Flows associated with this situation are implicitly accounted for within the Drainage Collection water budget (Table 6 – Drainage Collection, Out).

Under the Post-Closure scenario, particles leaving the landfill discharge at the Former West Quarry to the south. Thus, all of the simulated 0.01 m³/d of water emanating from the landfill discharges at the Former West Quarry location during Post-Closure.

The Post-Closure Contingency scenario exhibits similar results to the Post-Closure scenario, although in this case the seepage rate reporting to the Former West Quarry is 4.3 m³/d.

1.5.3 Climate Change Considerations

Future changes in climate trends may have some impact on landfill hydraulic behaviour. Of particular focus would be the potential change in infiltration as a result of more frequent and/or higher intensity precipitation. The potential for increased landfill infiltration rates under certain climate change scenarios are evaluated in the Walker Baseline Forecast Assumptions on Climate Change (McDermid et al., 2015) and are as follows:

- Base Case Infiltration Without Climate Change: 258 mm/yr [~419 m³/d]
- 2011 – 2040 With Climate Change: 307 mm/yr [~499 m³/d]
- 2041 – 2070 With Climate Change: 343 mm/yr [~558 m³/d]
- 2071 – 2100+ With Climate Change: 352 mm/yr [~573 m³/d]

The base case Operations, Post-Closure and Post-Closure Contingency model scenarios described previously are re-run using an alternate set of climate change-based infiltration rates as noted above. The groundwater budget results are presented below in Table D-7.

Table D-7: Predictive Scenario Site Groundwater Budget Simulated Results with Climate Change Infiltration

Source/Sink	Operations		Post-Closure		Post-Closure Contingency	
	In (m³/d)	Out (m³/d)	In (m³/d)	Out (m³/d)	In (m³/d)	Out (m³/d)
Landfill Infiltration	499.2	-	557.7	-	572.6	-
Seepage at Landfill	11.2	0.2	10.7	0.01	258	4.5
Seepage at Quarry	-	-	-	-	-	-
Drainage Collection	-	510.2	-	568.4	-	826.1
TOTAL	*510.4*	*510.4*	*568.4*	*568.4*	*830.6*	*830.6*

Despite the increased infiltration rates under climate change influences, the seepage bypass rates remain the same or within 5% of the base case. The particle tracking results are practically the same as the base case

(Figure D-17). This lack of change is explained in part because of the efficacy of the drainage collection / liner system but also because the increased infiltration, although higher than base case, is not sufficiently large to cause significant changes in the landfill hydraulic behaviour.

1.5.4 Source Water Protection Considerations

The modelling assessment considers potential effects upon source water protection "vulnerable areas"; namely:

1) Significant Groundwater Recharge Areas (SGRAs);

2) Highly Vulnerable Aquifers (HVAs); and

3) Wellhead Protection Areas (WHPAs).

The general approach to developing vulnerable areas is described in Technical Rules: Assessment Report (Ministry of Environment and Climate Change, 2009). For the Ingersoll area, specific vulnerable areas are mapped in the MECP-approved Source Protection Plan with supporting technical documentation provided in Upper Thames River Source Protection Area Assessment Report (Thames-Sydenham Source Protection Committee, 2015).

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SGRA

According to the Technical Rules, an SGRA is an area that annually recharges water to the underlying aquifer at a rate that is greater than the rate of recharge across the whole of the related groundwater recharge area by a factor of 1.15 or more; or, the area that annually recharges a volume of water to the underlying aquifer that is 55% or more of available surplus.

The Assessment Report estimates the average recharge of the Upper Thames area to be 132 mm/yr. Under Existing and Future Baseline very little surplus is allowed to infiltrate the site (<132 mm/yr) as a result of quarry dewatering so the site should not be classified as SGRA. Likewise, under Operations and Post-Closure conditions, the vast majority of infiltration though the landfill will be captured by the drainage collection system (see previous sections). Therefore, the landfill should not prompt an SGRA designation.

HVA

According to the Technical Rules, the vulnerability of an aquifer may be assessed using a quantitative analysis such as the calculation of intrinsic susceptibility index, aquifer vulnerability index, surface to aquifer advection time, or surface to well advection time. Each approach is in some way related to groundwater time of travel. In other words, vulnerability increases as the time for a surficial contaminant to reach the water table (or shallowest significant aquifer) decreases.

The removal of overburden from within a quarry would, in and of itself, allow for decreased time for surficial inputs to reach the groundwater system. As mentioned previously, very little water entering the quarry will become recharge to the aquifer owing to the removal of surplus from the quarry and the local upward gradients maintained by dewatering. Nonetheless, the absence of any "buffer zone" between the quarry and surrounding groundwater system could lead to an HVA designation based on the Technical Rules methodology. Under landfill Operations and Closure conditions, the aquifer vulnerability relative to the existing quarry condition would decrease, primarily as a result of the large amount of backfilled till underneath the landfill and the actions of the drainage collection system and liner which would dramatically limit the connection between water within the waste and the surrounding groundwater system. As a result of the limited hydraulic connection, the landfill will have no adverse effect on aquifer vulnerability relative to baseline.

WHPA-Q1/Q2

The Technical Rules set out several classes of groundwater WHPAs. The first set described herein, WHPAs Q1 and Q2, are intended to be protective of water quantity.

According to the Technical Rules, WHPA-Q1 is the combined area that is the drawdown cone of influence of a municipal well plus the whole of the cones of influence of all other wells that intersect that area and any surface water drainage area upstream of, and including, a losing reach of a stream that contributes a significant portion of surface water to the wells. WHPA-Q2 is the area defined in WHPA-Q1 and any area outside the WHPA-Q1 where a future reduction in recharge would have a measurable impact on the municipal wells.

WHPA-Q1/Q2 were modelled as part of the Tier Three Water Budget and Local Area Risk Assessment, Oxford County (Matrix, 2014). The site, in addition to most of Ingersoll and Beachville, lies within the modelled WHPA-Q1 / Q2. The following is stated in the Assessment Report with respect to this broad area:

"Based on the results of the Risk Assessment modelling scenarios…all Local Areas [WHPA Q1/Q2] assessed were classified as having a Low Risk Level. This is largely due to an abundance of capacity in municipal supply wells. Following the Technical Rules, no consumptive water users or potential reductions to groundwater recharge within the Local Area are classified as significant water quantity threats. Under all scenarios investigated, municipal wells were able to withdraw their allocated quantity of water, without exceeding safe available drawdown thresholds within the well, or without impacts to other water uses."

The Operations and Post-Closure Scenarios will result in far less water taking than is currently occurring at the Southwest Quarry or will occur under Future Pre-Landfill Baseline conditions. As such, the WHPA-Q1/Q2 will not be expanded, capacity at the municipal wells will not be adversely impacted, and the Local Area will remain as Low Risk Level.

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WHPA-A, B, C and D

WHPA-A, B, C, and D are based on water supply well time-of-travel capture zones at municipal wells as follows:

1. WHPA-A: 100 metre radius around well;
2. WHPA-B: less than or equal to 2-year time of travel;
3. WHPA-C: between 2-year and 5-year time of travel;
4. WHPA-D: between 5-year and 25-year time of travel.

These WHPAs are intended to be protective of well water quality. In other words, a chemical or pathogen that enters the groundwater system within these WHPAs has a heightened probability to be captured by the associated water supply well.

Ingersoll WHPA-A, B, C and D were modelled as part of the Oxford County Groundwater Protection Study: Phase II (Golder, 2010). Under that prior work, the site is external to any modelled WHPA-A, B, C or D. However, the prior model applied a Carmeuse quarry floor elevation of 260 m amsl; currently the Southwest Quarry has deepened to 235 m amsl. This (already present) change alone will have far greater affect on surrounding WHPAs than any affect future landfill Operations and Closure conditions may have. In addition, municipal well pumping rates have (and will continue) to change at Ingersoll wellfields.

Nonetheless, for illustration, we have provided figures comparing the originally modelled 25-year capture zones (source output for the WHPA-D in Golder, 2010) versus the 25-year capture zones modelled under Pre-Landfill Future Baseline, Operations, and Post-Closure (Figure D-18). To allow for a more direct comparison, we have applied the pumping rates as originally modelled in 2010 and as listed on Figure D-18. The difference between the two capture zone sets is, again, largely a result of major changes in surrounding future quarry layouts and, to a secondary degree, updates in the model hydrogeologic refinements as described in previous sections.

Notably, all modelled capture zones remain external to the site except for the capture zone of Well 8 under Post-Closure wherein a small number of particles (four) travel beneath the site. Three of the four particles terminate (i.e. are “recharged”) from north of the site whereas one particle appears recharged from underneath the Southwest Quarry.

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APPENDIX E

Karst Study

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Karst Assessment of the bedrock aquifer at the site of the proposed Southwestern Landfill
Stephen R.H. Worthington, Worthington Groundwater

1. Introduction

An assessment of karst in the bedrock aquifer at the site of the proposed Southwestern Landfill (site) was carried out to determine the nature and extent of karst development in the area. The site sits within the property of Carmeuse Lime in the Township of Zorra, Ontario. The greatest karst development in carbonate aquifers generally occurs close to the bedrock surface, especially where there are no overlying sediments or soil, such as in parts of the Bruce Peninsula. There is also substantial karst development, and caves are sometimes formed, where there are substantial streams that sink directly into carbonate bedrock. Accordingly, orthophotography was checked to determine whether there were in sinking streams in the area around the Carmeuse Lime quarry. A site visit was made to the quarry in summer (September 11, 2018) to observe and photograph the extent and nature of karstic cavities and preferential flow into the quarry in low-flow conditions. A second visit was made during a cold period in winter (February 1, 2019) to observe and photograph preferential flow into the quarry in high-flow conditions. These observations were supplemented by analysis of the data from flow meter profiles, packer tests, and video recordings in six boreholes.

Tracer testing is a commonly-used investigation technique in karst investigations, especially to determine the destination of stream water lost at karstic sinkpoints. However, no karstic sinking streams were identified at or near the site in the current investigation. Tracer testing during a pumping test was also considered. This would give evidence on the apertures of the larger fractures where preferential flow is taking place. However, it was decided that more comprehensive information on preferential flow could be gathered from wells across the site by using a combination of packer testing, downhole video, and flowmeter logging. Accordingly, tracer testing during a pumping test was considered to be superfluous.

2. Results

2.1 Regional evidence for karstic sinking streams

One sinking stream was identified from the orthophotography (location 2 in Figure 1, with the arrow indicating the direction in which the photograph was taken). A visit to this feature showed an enclosed depression in a soybean field. Both Figure 1 and Figure 2 show that the lowest parts of the depression are marked by substantial growth of weeds, and it is inferred that this is an area that drains slowly and that may become flooded during the spring freshet. The retarded drainage indicates that the depression is a hollow in the sediments, which are of glaciofluvial origin, rather than a karstic depression.

2.2 Flow into the quarry

The Thames River flows in a straight, artificial channel along the south side of the Carmeuse Lime property (Figure 1) and is about 50 m higher than the Water level in the Flooded Former West Quarry shown in Figure 3. The location of the photograph is shown in Figure 1. The higher head in the river than in the quarry means that there is groundwater flow from the river into the quarry. This is manifested by the seepage face in Figure 3, where there is widespread distributed flow into the quarry.

A series of photos were taken in the lowest part of the active quarry (site of proposed landfill), where the low elevation results in there being the greatest potential for groundwater flow from the bedrock into the quarry. The locations of these photos are shown in Figure 4, and the photos are shown in Figures 5 to 10. The part of the quarry north of the hydro line was also visited. Its location is shown in

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Figure 1, and two photos are shown in Figure 11. Further information about flow into the quarry is provided in the figure captions accompanying this report.

2.3 Preferential flow from well data

Geophysical logging of the A series of wells included flow meter measurements in ambient conditions in all six wells, and logging in dynamic conditions while pumping the well at 5-10 L/min in four of the wells. Abrupt changes in the flow rate from the flow meter logging suggested that there was preferential flow into the wells from fractures rather than seepage from the matrix of the rock. Downhole video recordings of all six wells were viewed and these confirmed the inference, with it being clear in most cases that flow was from single, near-horizontal bedding-plane fractures. Examples are shown in Figures 12 and 13. Percentages of total flow from individual fractures were calculated primarily from the results of the flow meter measurements while the wells were pumping, supplemented by flowmeter measurements while the wells were not pumping and by packer test measurements. Results are listed in Table 1. No calculations were made for BH17-6A because the static water level was less than 5 m above the bottom of the borehole, and this is too small an interval to give meaningful results.

Table 1. Percentage of the total flows in each well that come from the most productive fractures

Well	**Fracture with highest discharge (% of flow)**	**Fracture with second highest discharge (% of flow)**	**Fracture with third highest discharge (% of flow)**
BH17-1A	79	21	-
BH17-2A	71	14	14
BH17-3A	53	23	13
BH17-4A	48	37	-
BH17-5A	50	20	20
Mean	**60**	**23**	

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The hydraulic conductivity in each well had been measured by packer testing (Appendix E), and this enabled the aperture of the flowing fractures to be estimated from the cubic law

$K = \rho g N b^3 / 12 :$

where K is the hydraulic conductivity, ρ is the density of water, g is gravitational acceleration, N is fractures per unit distance, b is fracture aperture, and *:* is dynamic viscosity. Calculated fracture apertures are given in Table 2.

Table 2. Calculated fracture apertures derived from slug tests and flowmeter measurements

Well	Average K (m/s)	Testing interval (m)	Fracture depth (m)	Percentage of flow	Fracture K (m/s)	Fracture aperture (mm)
BH17-1A	2.82E-06	40.9	24.8	79	2.23E-06	0.53
	2.82E-06	40.9	46.5	21	5.92E-07	0.34
BH17-2A	7.71E-06	34.4	22.2	71	5.47E-06	0.67
	7.71E-06	34.4	26.2	14	1.08E-06	0.39
	7.71E-06	34.4	46.5	14	1.08E-06	0.39
BH17-3A	2.24E-05	32.0	46.9	53	1.19E-05	0.85
	2.24E-05	32.0	25.2	23	5.15E-06	0.64
	2.24E-05	32.0	21.2	13	2.91E-06	0.53
BH17-4A	1.12E-04	18.1	20.0	48	5.39E-05	1.16
	1.12E-04	18.1	2.2	37	4.15E-05	1.06
BH17-5A	1.15E-04	19.4	31.4	50	5.75E-05	1.21
	1.15E-04	19.4	22.6	20	2.30E-05	0.89
	1.15E-04	19.4	28.2	20	2.30E-05	0.89
	1.15E-04	19.4	33.6	10	1.15E-05	0.71

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3. Interpretation

There are five commonly-used definitions of what constitutes a karst aquifer (Worthington et al., 2017). The aquifer at Ingersoll fulfills two of those definitions (presence of solutionally-enlarged preferential flow paths; hydraulic conductivity >10^{-6} m/s). There is no evidence that it fulfills the three other definitions (presence of caves; presence of turbulent flow; presence of a karst landscape). However, in any hydrogeological investigation it is not important to define whether an aquifer is or is not karstic. Instead, it is important from a karstic perspective to identify the nature and extent of solution in the aquifer and how that has modified permeability and storage characteristics.

The most substantial manifestation of karst in the area is in the weathered zone in the upper several metres of bedrock, where processes including stress relief by unloading, frost shattering due to freeze-thaw enlargement of fracture apertures, and dissolution have combined to produce a zone with a high frequency of open fractures. As noted below, the apertures of the fractures are expected to be on the order of a few millimeters or less. There are fewer open fractures at greater depths, and the focussed discharges from fractures in the quarry walls demonstrate the nature of preferential flow in the bedrock.

The iron staining in Figure 10 shows precipitation of iron oxides, presumably from the weathering of pyrite or other iron minerals in the rock. The iron staining highlights how most flow is from one single bedding plane, and that there is focussed flow from fractures along this bedding plane. This results initially from the natural variability of fracture apertures causing preferential flow in some locations, augmented by the dissolution of the rock. The greatest dissolution occurs where there is the greatest flow, resulting in a positive feedback process that has resulted in enlarged fractures with apertures >1 mm in some places. The higher water table in winter results in there being substantial flow from a bedding plane that is several metres higher than the principal bedding plane from which discharge occurs in summer (Figure 10, bottom photo).

The flow meter and video logging complement the observations of the quarry faces. Most flow into the boreholes comes from just a few fractures, and typically half the flow comes from a single fracture, and a quarter from a second fracture. This pattern is extremely common in bedrock aquifers and is similar to worldwide values of flow in bedrock aquifers (Figure 14). The calculations show that fracture apertures of the most productive fractures in the six wells tested range from 0.53 mm to 1.21 mm (Table 2). These apertures are hydraulic apertures and assume that the fractures have constant apertures and have smooth walls. Actual apertures will be somewhat larger than the calculated apertures, possibly by a factor of two to three. No large-aperture openings were observed in the quarry walls. This finding is expected and reflects the lack of large sinking streams in the area.

The borehole data at the site complement the quarry face observations, showing that most flow is through selected fractures spaced a few metres apart, with the fractures having apertures up to several millimetres. This means that the carbonate aquifer will behave as a porous medium for flow at a scale of greater than a few tens of metres, because a block of rock of that scale would have a substantial number of interconnected flowing fractures.

Reference

Worthington, S.R., Jeannin, P.Y., Alexander, E.C., Davies, G.J. and Schindel, G.M., 2017. Contrasting definitions for the term 'karst aquifer'. Hydrogeology Journal, 25(5), pp.1237-1240.

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Figure 1. Orthophotography from Google Earth, showing the site and surrounding area. The area of the inset is shown in Figure 4. The numbers indicate the locations of photos taken and the respective figure numbers. The arrows indicate the directions in which the photos were taken.

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Figure 2. Shallow valley extending from the woodland on the right to a closed depression in the centre of the photo. Water may become ponded here in winter, which indicates that the vertical permeability is low and that the depression does not have a karstic function.

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Figure 3. Looking south to the rock face of an old quarry. The Thames River is 50 m higher than the quarry lake and seepage from the river emerges along the length of the rock face.

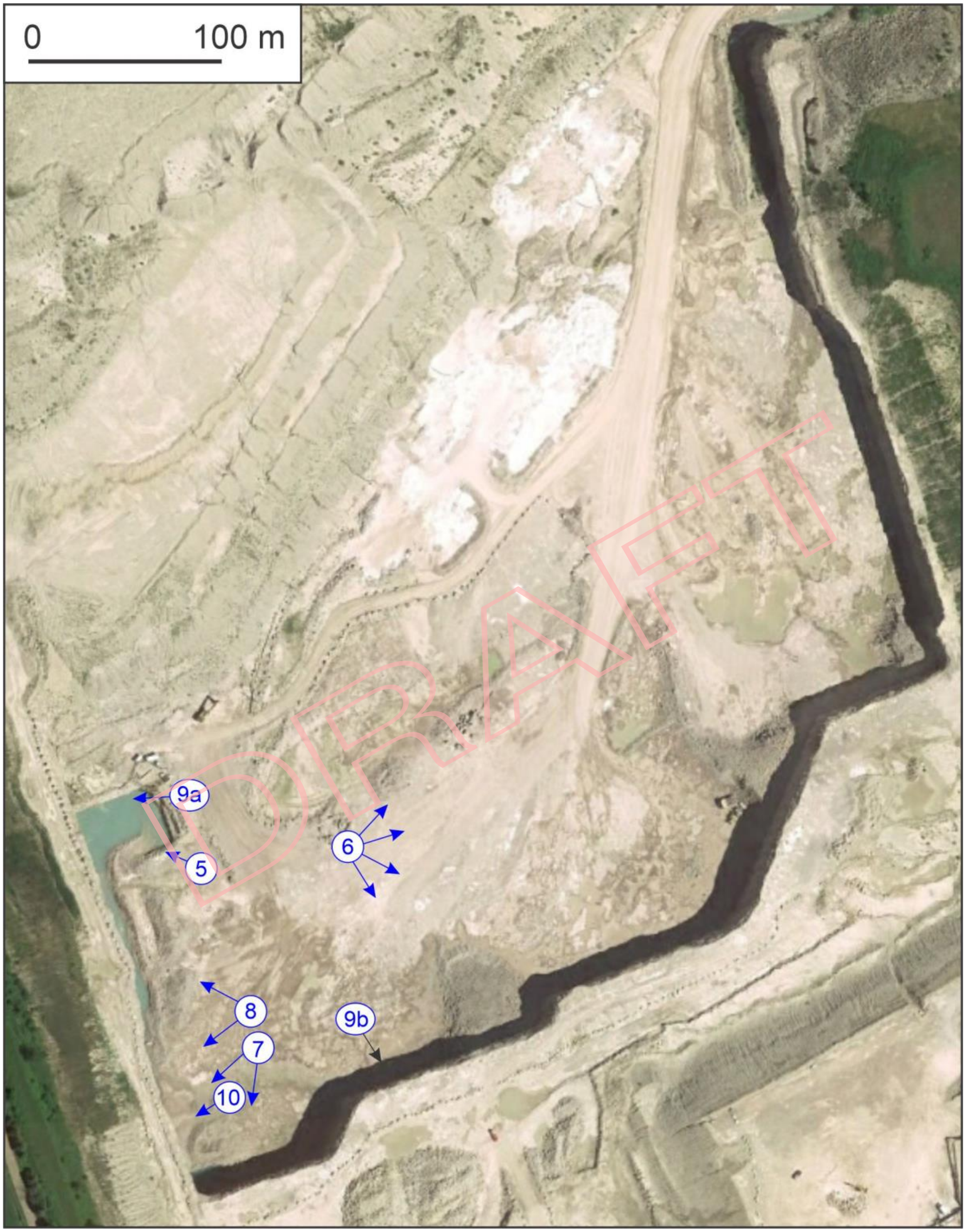

Figure 4. Orthophotography from Google Earth, showing the lowest part of the active quarry. The numbers indicate the locations of photos taken and the respective figure numbers. The arrows indicate the directions in which the photos were taken.

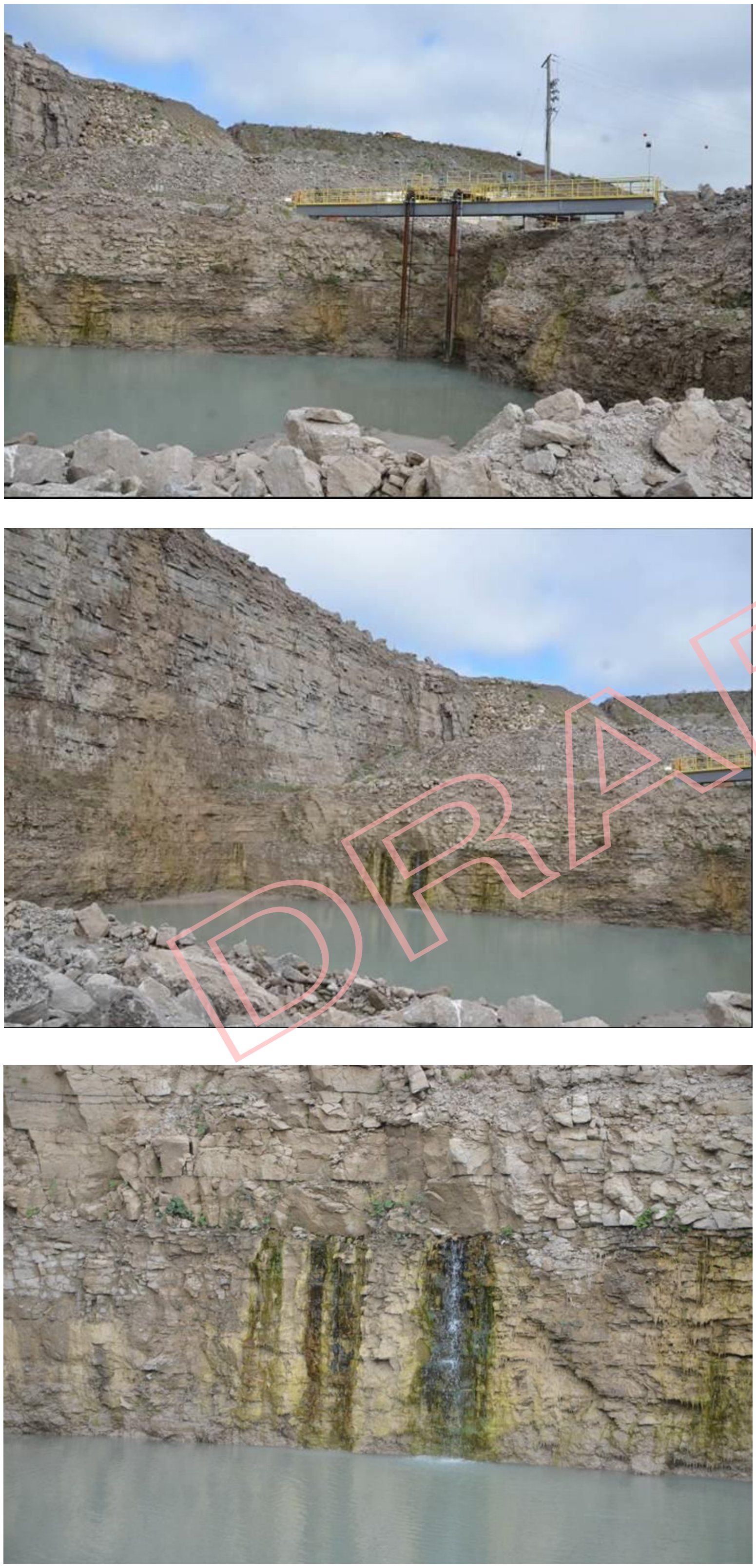

Figure 5. Looking west to the sump in the active quarry. The water surface is ~230 m above sea level. This is the lowest point in the quarry and so there is groundwater flow towards the sump from all directions. The north side of the sump pool has the largest preferential flows into the pool. Most of the water emerges from a single bedding plane, where the largest aperture is probably several millimetres. Nearby blasting activities may have resulted in fracture enlargement here.

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Figure 6. Overlapping panoramic views of the east and south faces of the active quarry, showing negligible groundwater flow from the east face (top photo) and distributed flow along the length of the south face (bottom photos). The blue arrow shows the location of the largest inflow to the south face. A close-up of the inflow is shown in Figure 9.

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Figure 7. The south-west corner of the active quarry. The rubble is from a blast that had taken place a few hours before the photos were taken, resulting in shattering of icicles on the south face, on the left of the photos. The absence of icicles on the west face, or the right of the photos, was caused by substantial flow of warm (~9 degree C) groundwater from the quarry face. The temperature had been below freezing for more than a week before the site visit and was about -10 degrees C at the time of the visit.

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Figure 8. Two overlapping panoramic views of the west face of the active quarry. The sump is a short distance to the right of the lower photo.

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Figure 9. Views of the two largest discharges from the quarry face observed on the visit of February 1, 2019.
(Top) A point discharge into the quarry sump. The same location is also shown in summer in Figure 5.
(Bottom) A point discharge from the south face. The location is shown by the blue arrow in Figure 6.

Figure 10.
(Top two photos) Staining from the precipitation of iron oxides on the west face of the quarry. The staining shows that most flow into the quarry in this section of the face emanated from a series of point discharges from the same bedding plane.

The bottom photo shows the same location in winter. The higher water table in winter has resulted in there being substantial flow from a bedding plane several metres above the one associated with the iron staining.

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Figure 11. The top photo shows a representative rock face in the part of the quarry north of the hydro line. More than 1000 m of rock face were examined here, and no large-aperture openings were observed. The largest point discharge is shown in the lower photo. However, the base of the rock face is obscured for rubble in many places, as shown in the top photo, and most areas did not have observed seepage.

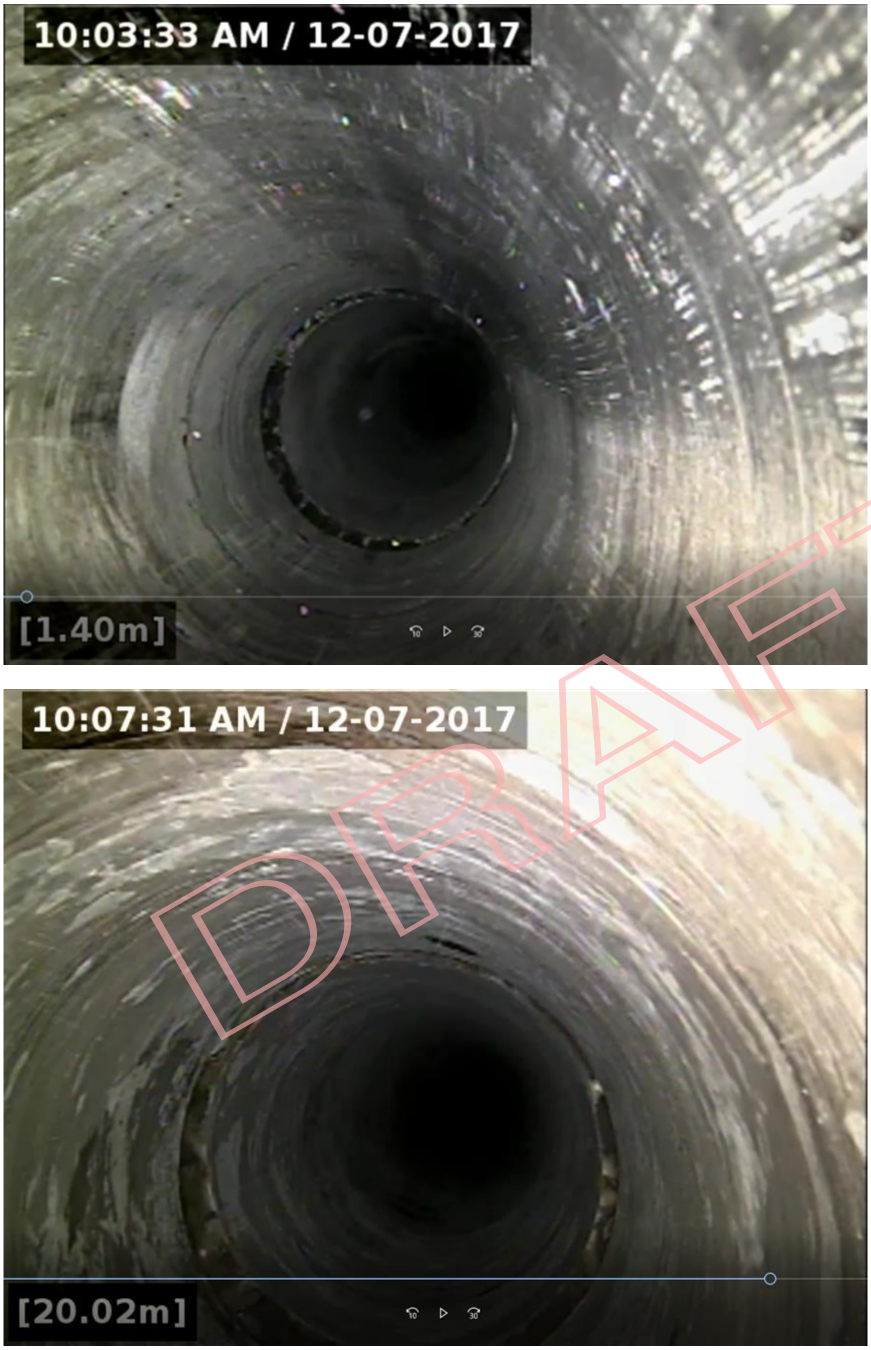

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Figure 12. Views looking down BH17-4A in ambient flow conditions. A flow of 5 L/min is flowing from the bedding-plane fracture at a depth of 2.0 m, seen in the top photo, and flowing down the borehole. Additional inflow increases the flow to almost 7 L/min at 20 m, where almost all the flow leaves the borehole.

Figure 13. Views looking down BH17-5A in ambient flow conditions. The top photo shows a bedding-plane fracture at a depth of 28.2 m, where there is a flow of 1 L/min into the borehole. The lower photo shows a bedding-plane fracture at a depth of 31.4 m where downward flow of 2 L/min exits the borehole. In addition, there is also upward flow to this bedding plane of 0.5 L/min, and this flow also flows out of the well at this bedding plane.

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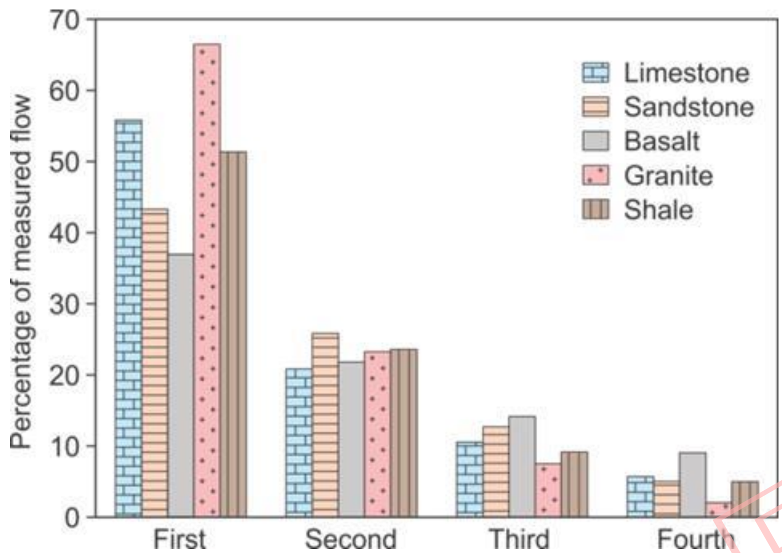

Figure 14. Average percentage of flow from the four most productive fractures into wells in the five major lithologies, based on flowmeter data from 77 wells (from Worthington et al., 2016, Earth-Science Reviews, Vol. 160, pp. 188-202). The limestone data comes from 18 wells, with the most productive fracture having a mean of 53%, a standard deviation of 21%, and a range from 16% to 100%.

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APPENDIX F

Record of Borehole Sheets and Monitoring Well Construction Details

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RECORD OF DRILLHOLE: BH17-1A

PROJECT: 1664706
LOCATION: N 4768615.0 ;E 509690.0
INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: September 13-25, 2017
DRILL RIG: TRACK MOUNTED ACKER SOIL - MAX
DRILLING CONTRACTOR: ORBIT GARANT

DATUM: GEODETIC

JN - Joint; FLT - Fault; SHR - Shear; VN - Vein; CJ - Conjugate; BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage; PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular; PO - Polished; K - Slickensided; SM - Smooth; Ro - Rough; MB - Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	ELEV. (m amsl) / DEPTH (m)	RUN No.	TYPE
0		GROUND SURFACE	290.21		
	POWER AUGER, 108mm ID HOLLOW STEM	TOPSOIL; dark brown	0.00	1	SS
1		(SP) SAND, medium to fine, trace gravel; brown	289.30 / 0.91	2	SS
		(SP) SAND, fine, some silt, with gravel; brown, with organic staining	288.69 / 1.52		
2		(ML) SANDY SILT, trace clay; grey	288.38 / 1.83	3	SS
	WASH BORING	(ML) SILT, trace sand, trace clay, crushed limestone; brown to grey	287.92 / 2.29	4	SS
3		(SP) SAND, fine to medium, some gravel; grey, TILL	287.01 / 3.20	5	SS
4		(ML) SILT, gravel	286.40 / 3.84	6	SS
		(SP) SAND, fine; grey		7	SS
		(ML) CLAYEY SILT, some gravel; grey, TILL	285.94 / 4.27		
5		(SP-ML) SAND and SILT, some clay, trace gravel; grey, TILL	285.64 / 4.57	8, 9, 10	SS
		(SP) SAND, medium to fine, some gravel; grey	284.57 / 5.64	11	SS
6		(SP-ML) SAND and SILT, some gravel, some clay; grey, TILL	5.74	12, 13, 14	SS
8		(CL) SILTY CLAY, trace gravel, interbedded with sand and gravel; grey, TILL	281.83 / 8.38	15	SS
9		(CL) SILTY CLAY, trace gravel, interbedded with sand and gravel; grey, TILL		16, 17	SS
10		(ML) CLAYEY SILT, trace gravel; grey, TILL	280.30 / 9.91	18	SS
		(CI) CLAY; dark grey	280.00 / 10.21	19, 20	SS
11		(SP) SAND, some silt; grey	279.21 / 11.00	21	SS
12		(GP) GRAVEL, crushed limestone, outwash deposits, with cobbles/boulders	278.02 / 12.19	22	SS
13	ROTARY DRILLING, HQ CASING				
14	WASH BORING	(SP-ML)SAND and SILT, some gravel, trace clay; grey to brown, TILL, with cobbles and boulders	275.58 / 14.63	23, 24	SS
20		(SP-ML) SAND and SILT, some clay, trace gravel; brown, TILL	270.40 / 19.81	25	SS
20.57	ROTARY DRILLING, HQ CASING	LUCAS FORMATION, 20.57m to 54.08m, Fresh to slightly weathered, fine to medium grained, thin to medium bedded, medium grey to brown LIMESTONE, with argillaceous shale and nodular horizons and stylolites	269.64 / 20.57	1	
		24.0m to 28.0m coarsening upwards		2–5	
		26.94m to 27.06m: argillaceous laminations		6	
28		28.00m to 31.00m: dark grey, fining upwards	262.21 / 28.00		
		27.73m to 27.88m: argillaceous laminations		7	
30		28.00m to 31.00m: dark grey, fining upwards	259.21	8	
32		32.16m to 33.53m: Very fine-grained texture		9–11	
37		28.28m to 28.31m: argillaceous laminations		12	
		36.69m to 36.76m: argillaceous laminae		13, 14	
40		37.39m to 37.46m: argillaceous laminae		15	
		40.23m to 40.24m: argillaceous lamination			
		41.40m to 41.80m: argillaceous		16	
		41.91m to 42.37m: fine grained to very fine grained		17	
45		42.67m to 42.85m: nodular textured			
		44.68m to 44.80m: nodular textured and argillaceous			
		44.83m to 44.99m: wavy argillaceous laminations			
		45.23m to 45.28m: nodular textured and argillaceous		18	
		45.30m to 45.80m: argillaceous			
47		45.69m to 45.81m: nodular textured		19	
48		47.60m to 47.10m: wavy argillaceous laminations		20	
49		48.16m to 48.40m: algae fossil layer			
50		48.89m to 49.67m: fine grained		21	
51		49.99m to 50.02m: argillaceous and nodular textured			
		50.75m to 50.96m: nontonodular textured limestone		22	
52		51.90m to 52.06m: dark grey argillaceous limestone			
		51.08m to 51.66m: mottled grey to brown color		23	
54		AMHERSTBURG FORMATION, 54.08m to 62.10m, Medium to dark grey argillaceous LIMESTONE with interbedded medium brown to medium grey limestone and nodular limestone with coral fragments and chert	236.13 / 54.08	24–29	
62		END OF BOREHOLE	228.11 / 62.10		

GEOPHYSICAL RECORD: GAMMA (cps) 20 40 60 80; CONDUCTIVITY (Ms/m) 2 4 6 8; FLOW RATE (AMBIENT); FLOW RATE (DYNAMIC) -10 Lpm 10

INSTALLATION AND GROUNDWATER OBSERVATIONS: MW17-1D, MW17-1C, MW17-1B, MW17-1A

Top of Pipe Elev. 291.45m; Top of Pipe Elev. 291.37m; Top of Pipe Elev. 291.43m; Top of Pipe Elev. 291.42m

Concrete; Granular bentonite; Feb 26/18; May 22/18; Filter sand; Grout; 50mm Diam., Slot 10, Schedule 40, PVC Screen; Caved Material

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PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
CENTREVILLE, ONTARIO

TITLE
BH17-1A

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R03_BH
CADD	ZJB	May 6/19
CHECK	RM	
SCALE	AS SHOWN	REV.

BH17-1A

Client: Walker Environmental Group Inc.

PROJECT: 1664706

LOCATION: N 4767574.2 ;E 510080.7

INCLINATION: -90° AZIMUTH: ---

RECORD OF DRILLHOLE: BH17-2A

DRILLING DATE: October 4-19, 2017

DRILL RIG: TRACK MOUNTED ACKER SOIL - MAX

DRILLING CONTRACTOR: ORBIT GARANT

SHEET 1 OF 1

DATUM: GEODETIC

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate; BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage; PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular; PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

Column headings: DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. (m amsl) / DEPTH (m) | RUN No. | TYPE | RECOVERY (TOTAL CORE %, SOLID CORE %) | R.Q.D. % | FRACT. INDEX PER 0.3 m | DISCONTINUITY DATA (B Angle, DIP w.r.t. CORE AXIS, TYPE AND SURFACE DESCRIPTION, Jcon, Jr, Ja) | HYDRAULIC CONDUCTIVITY K, cm/sec (10-8, 10-6, 10-4, 10-2) | GEOPHYSICAL RECORD (GAMMA (cps) 20 40 60 80; CONDUCTIVITY (mS/m) 2 4 6 8; FLOW RATE (AMBIENT), FLOW RATE (DYNAMIC) -10 Lpm 10) | INSTALLATION AND GROUNDWATER OBSERVATIONS (MW17-2D, MW17-2C, MW17-2B, MW17-2A)

Drilling Record	Description	Elev. (m amsl) / Depth (m)
	GROUND SURFACE	284.65
POWER AUGER, 108mm ID HOLLOW STEM	TOPSOIL	0.00
	(SM) SANDY SILT; light brown to orange	284.35 / 0.30
	(SP/GP) SAND AND GRAVEL; with cobbles	283.74 / 0.91
WASH BORING	(ML) SILT, some gravel, some sand, trace clay; grey, TILL	279.32 / 5.33
ROTARY DRILLING, HQ CASING	LUCAS FORMATION, 20.27m to 53.55m, Fresh to slightly weathered, fine to medium grained, thin to medium bedded, medium grey to brown LIMESTONE, with argillaceous shale and nodular horizons, stylolites and fossil fragements	264.38 / 20.27
	20.27m to 25.00m medium grey to brown limestone	
	25.00m to 31.00m: interbedded argillaceous limestone and limestone	
	27.24m to 27.36m: medium to dark grey argillaceous bed	
	27.58m to 27.60m: medium to dark grey argillaceous to shaley thin interbed	
	31.00m to 36.00m: medium grey to brown limestone	
	36.50m to 37.50m: medium to dark grey argillaceous horizon	
	36.57m to 36.81m: argillaceous to shaley bed dark grey to black	
	37.50m to 53.55m: medium grey to brown limestone with interbedded argillaceous limestone	
	44.71m to 44.71m: medium to dark grey argillaceous laminations	
	45.50m: weathered stylolite	
	46.42m to 47.09m: medium to dark grey argillaceous laminations	
	47.02m to 47.39m: medium to dark grey argillaceous laminations	
	AMHERSTBURG FORMATION, 53.55m to 55.55m, Medium to dark grey, mottled to marble texture, fine grained, argillaceous LIMESTONE with interbedded medium brown to medium grey, fine to medium grained limestone and nodular limestone with coral fragments and chert	230.66 / 53.55
	END OF BOREHOLE	228.66 / 55.55

Soil samples: Runs 1–3 SS; 4 AS; 5–14 SS; 25 SS. Rock core runs 1–20.

Installation: Top of Pipe Elev. 285.58m (MW17-2D); Top of Pipe Elev. 285.54m (MW17-2C); Top of Pipe Elev. 285.61m (MW17-2B); Top of Pipe Elev. 285.61m (MW17-2A). Concrete; Granular bentonite; Filter sand; Grout; 50mm Diam., Slot 10, Schedule 40 PVC Screen.

DRAFT

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
CENTREVILLE, ONTARIO

TITLE
BH17-2A

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R03_BH
CADD	ZJB	May 6/19	SCALE AS SHOWN, REV.
CHECK	RM		BH17-2A

Drawing file: 1664706-2000-R03_BH.dwg May 06, 2019 - 8:13am

PROJECT: 1664706

LOCATION: N 4766840.5 ;E 510013.2

INCLINATION: -90° AZIMUTH: ---

RECORD OF DRILLHOLE: BH17-3A

DRILLING DATE: October 31-November 11, 2017

DRILL RIG: TRACK MOUNTED ACKER SOIL - MAX

DRILLING CONTRACTOR: ORBIT GARANT

SHEET 1 OF 1

DATUM: GEODETIC

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate, BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage, PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular, PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DRILLING RECORD: POWER AUGER, 108mm ID HOLLOW STEM (0 to approx. 3.4 m); WASH BORING (approx. 3.4 to 4.3 m)

DESCRIPTION	ELEV. (m amsl) / DEPTH (m)	RUN No.	TYPE
GROUND SURFACE	279.76		
TOPSOIL	0.00	1	SS
(SM) SANDY SILT	0.15	2	SS
(SP/GP) SAND AND GRAVEL, cobbles	278.85 / 0.91	3	SS
		4	AS
(SM) SILTY SAND	277.32 / 2.44	5	SS
(SP-ML) SAND and SILT, some gravel, some clay; grey, TILL; hard	2.59	6–19	SS
(ML) CLAYEY SILT, some sand, some gravel; grey, TILL	265.74 / 14.02	20–22	SS
(SM) SANDY SILT, some sand, some gravel; brown to grey, TILL; hard	262.69 / 17.07	23	SS
LUCAS FORMATION, 19.61m to 52.15m, Fresh to slightly weathered, fine to medium grained, thin to medium bedded, medium grey to brown LIMESTONE, with argillaceous, shale and nodular horizons and stylolites	260.15 / 19.61	1–23	
21.10m to 21.70m: argillaceous to shiley limestone			
20.40m to 24.00m: fine grained limestone			
25.00m to 28.00m: medium from grey to brown limestone			
28.00m to 30.00m: argillaceous limestone			
30.00m to 32.00m: argillaceous limestone and limestone fining upward			
32.25m to 33.03m: argillaceous			
32.00m to 34.35m: medium brown to grey limestone with argillaceous laminations			
33.13m to 34.44m: very fine to fine grained light grey limestone			
35.00m to 36.5m: argillaceous limestone			
36.50m to 45.00m: limestone with argillaceous laminations and thin interbeds			
37.18m to 38.03m: very fine to fine grained light grey limestone			
40.65m to 40.72m: wavy argillaceous laminations			
40.96m to 41.23m: dark grey to black nodular argillaceous			
41.91m to 42.37m: fine grained to very fine grained			
42.67m to 42.85m: nodular textured			
44.68m to 44.80m: nodular textured and argillaceous			
44.83m to 44.99m: wavy argillaceous laminations			
45.00m to 47.00m: argillaceous limestone and limestone	234.76 / 45.00		
45.23m to 45.28m: nodular textured and argillaceous			
47.00m to 52.15m: medium grey to brown limestone	232.76 / 47.00		
47.60m to 47.10m: wavy argillaceous laminations			
48.16m to 48.40m: algae fossil layer			
49.10m to 49.16m: nodular textured limestone			
48.89m to 49.67m: fine grained			
49.72m to 49.78m: nodular textured limestone			
49.99m to 50.02m: argillaceous and nodular textured			
50.75m to 50.96m: nontonodular textured			
51.08m to 51.66m: mottled color			
51.51m to 51.60m: nodular textured limestone			
51.78m to 51.83m: nodular textured limestone			
END OF BOREHOLE	227.61 / 52.15		

GEOPHYSICAL RECORD: GAMMA (cps); CONDUCTIVITY (Ms/m); FLOW RATE (AMBIENT); FLOW RATE (DYNAMIC) Lpm

INSTALLATION AND GROUNDWATER OBSERVATIONS: MW17-3E, MW17-3D, MW17-3C, MW17-3B, MW17-3A

Top of Pipe Elev. 281.23m; Top of Pipe Elev. 281.12m; Top of Pipe Elev. 281.08m; Top of Pipe Elev. 280.92m; Top of Pipe Elev. 280.88m

Concrete; Granular bentonite; Filter sand; Grout; 50mm Diam., Slot 10, Schedule 40, PVC Screen; Feb 26/18; May 22/18

DRAFT

PROJECT: HYDROGEOLOGICAL ASSESSMENT SOUTHWEST LANDFILL CENTREVILLE, ONTARIO

TITLE: BH17-3A

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R03_BH
CADD	ZJB May 6/19	SCALE AS SHOWN REV.
CHECK	RM	BH17-3A

PROJECT: 1664706

LOCATION: N 4768390.7 ;E 510770.3

INCLINATION: -90° AZIMUTH: ---

RECORD OF DRILLHOLE: BH17-4A

DRILLING DATE: November 27-December 1, 2017

DRILL RIG: TRACK MOUNTED ACKER SOIL - MAX

DRILLING CONTRACTOR: ORBIT GARANT

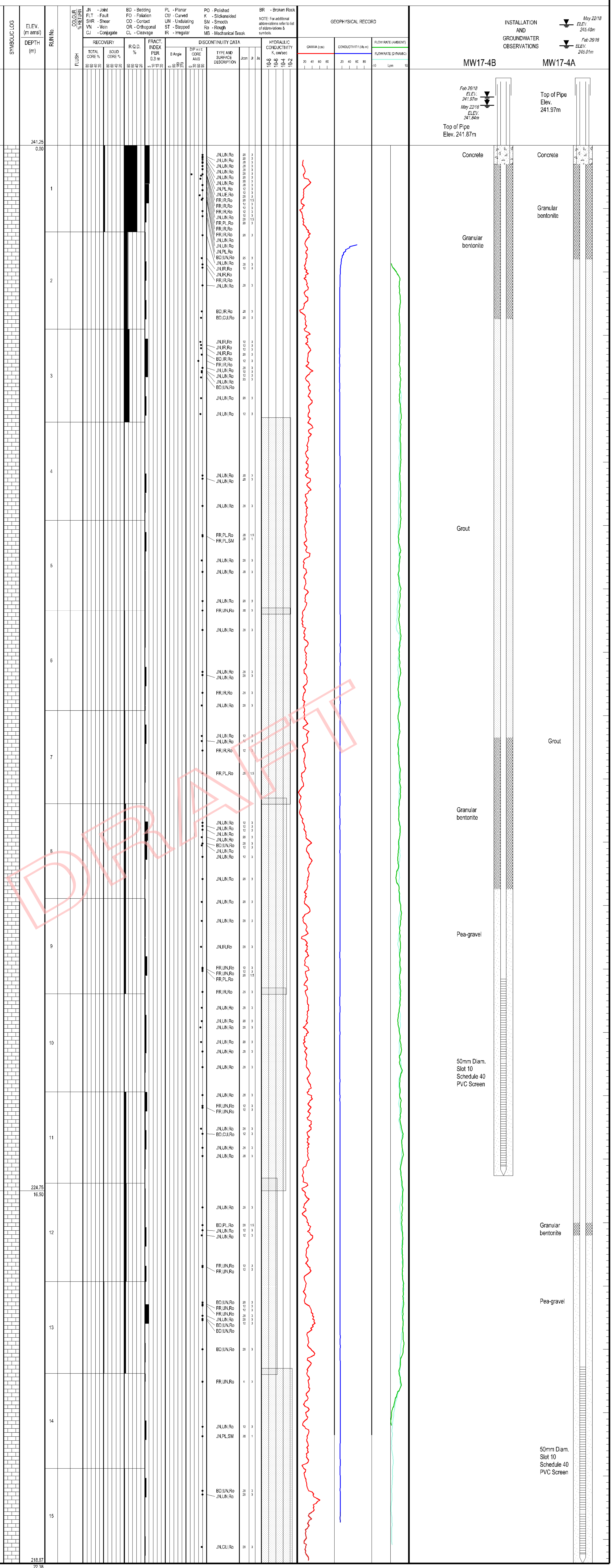
SHEET 1 OF 1

DATUM: GEODETIC

JN - Joint	BD - Bedding
FLT - Fault	FO - Foliation
SHR - Shear	CO - Contact
VN - Vein	OR - Orthogonal
CJ - Conjugate	CL - Cleavage
PL - Planar	PO - Polished
CU - Curved	K - Slickensided
UN - Undulating	SM - Smooth
ST - Stepped	Ro - Rough
IR - Irregular	MB - Mechanical Break
BR - Broken Rock	

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH (m)	ELEV. (m amsl)	DESCRIPTION
		GROUND SURFACE
0.00	241.25	AMHERSTBURG FORMATION, 0.00m to 16.50m, Medium to dark grey argillaceous LIMESTONE with interbedded medium brown to medium grey limestone and nodular limestone with coral fragments and chert
		0.00m to 4.00m: coarsening upward
		6.12m to 6.21m: coral debris
		6.43m to 6.46m: coral debris
		4.00m to 10.00m: fining upwards
		7.35m to 7.44m: coral debris 7.35m to 7.53m: coral fragment
		9.33m to 9.57m: pelletal texture
		10.67m to 10.94m: pelletal texture
		14.02m to 14.29m: coral fragment
16.50	224.75	BOIS BLANC FORMATION, 16.50m to 22.38m, fresh, fine to medium grained, thin to medium bedded, brown to grey, bioclastic and bioturbated limestone, with interbedded argillaceous limestone and shale, with altered and irregular blue-grey chert horizons and nodules Cherty below 16.50m
		19.51m to 21.03m: cherty
		21.06m to 21.30m: shale bed
22.38	218.87	END OF BOREHOLE



PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
CENTREVILLE, ONTARIO

TITLE

BH17-4A

GOLDER

PROJECT No.	1664706	FILE No 1664706-2000-R03_BH
CADD	ZJB	May 6/19
CHECK	RM	
SCALE	AS SHOWN	REV.

BH17-4A

Client: Walker Environmental Group Inc.

Drawing file: 1664706-2000-R03_BH.dwg May 06, 2019 - 8:12am

Client: Walker Environmental Group Inc.

PROJECT: 1664706

RECORD OF DRILLHOLE: BH17-5A

SHEET 1 OF 1

LOCATION: N 4767507.3 ;E 511077.5

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: January 25-February 1, 2018

DRILL RIG: TRACK MOUNTED

DRILLING CONTRACTOR: ORBIT GARANT

DATUM: GEODETIC

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate; BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage; PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular; PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

Columns: DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. (m amsl) / DEPTH (m) | RUN No. | TYPE | RECOVERY (TOTAL CORE %, SOLID CORE %) | R.Q.D. % | FRACT. INDEX PER 0.3 m | DISCONTINUITY DATA (B Angle, DIP w.r.t. CORE AXIS, TYPE AND SURFACE DESCRIPTION, Jcon, Jr, Ja) | HYDRAULIC CONDUCTIVITY K, cm/sec | GEOPHYSICAL RECORD (GAMMA (cps), CONDUCTIVITY (Ms/m), FLOW RATE (AMBIENT)) | INSTALLATION AND GROUNDWATER OBSERVATIONS (MW17-5C, MW17-5B, MW17-5A)

Drilling record: POWER AUGER, 108mm ID HOLLOW STEM (0 to 3.35 m); WASH BORING (3.35 to 6.73 m)

Description	Elev. (m amsl)	Depth (m)	Run No. / Type
GROUND SURFACE	270.52		
TOPSOIL, dark brown		0.00	
(ML) SANDY SILT, some gravel; dark brown		0.15	1 SS, 2 SS
(SM) SILTY SAND, trace gravel; brown	269.45	1.07	3 SS
(SP) SAND, some silt, gravel; brown	269.00	1.52	4 SS, 5 SS, 6 SS
BOULDER	267.17	3.35	
(CH) CLAY, dark green	266.86	3.66	7 SS
(PT) SANDY SILT, trace clay, with peat; dark brown	265.77	4.75	8 SS
(SP) SAND, brown	264.73	5.79	9 SS
LUCAS FORMATION, 6.73m to 39.40m, Fresh to slightly weathered, fine to medium grained, thin to medium bedded, medium grey to brown LIMESTONE, with argillaceous shale and nodular horizons, stylolites and fossil fragments	263.79	6.73	Runs 1–22
8.00m to 13.40m: medium to dark grey argillaceous limestone			
13.40m to 16.20m: medium brown to grey limestone			
18.80m to 19.00m: dark grey shaley to argillaceous limestone			
16.20m to 21.80m: dark to medium grey argillaceous limestone			
24.11m to 24.38m: medium to dark grey argillaceous limestone			
24.41m to 24.70m: medium to dark grey argillaceous limestone			
24.93m to 25.47m: medium to dark grey argillaceous limestone			
26.12m to 26.49m: medium to dark grey argillaceous limestone			
26.33m to 26.39m: medium to dark grey argillaceous limestone			
26.54m to 26.85m: medium to dark grey argillaceous limestone			
27.00m to 27.05m: medium to dark grey argillaceous limestone			
27.73m to 27.76m: medium to dark grey argillaceous limestone			
28.07m to 28.34m: medium to dark grey argillaceous limestone			
28.95m to 29.05m: medium to dark grey argillaceous limestone			
29.53m to 29.68m: medium to dark grey argillaceous limestone			
21.8m to 39.40m: medium brown to medium grey limestone			
31.16m: weather stylolite with clay infill.			
AMHERSTBURG FORMATION, 39.40m to 42.70m, Medium to dark grey , mottled to marble textured, fine grained argillaceous LIMESTONE with interbedded medium brown to medium grey, fine to medium grained limestone and nodular limestone with coral fragments and chert. 39.41m to 39.62m: soft sediment deformation texture, mottled (marble) texture, diagonal connect between Lucas and Amhurstburg Formation 39.92m to 40.54m: dark bioclastic microbreccia	231.12	39.40	Runs 23–25
END OF BOREHOLE	227.82	42.70	

Installation and groundwater observations:

- MW17-5C: Top of Pipe Elev. 271.69m; Concrete; Granular bentonite; Grout; 50mm Diam. Slot 10 Schedule 40 PVC Screen; Granular bentonite; Filter sand
- MW17-5B: Top of Pipe Elev. 271.62m; Concrete; Granular bentonite; Grout; Granular bentonite; Filter sand; 50mm Diam. Slot 10 Schedule 40 PVC Screen
- MW17-5A: Top of Pipe Elev. 271.68m; Concrete; Granular bentonite; Grout; Granular bentonite; Filter sand; 50mm Diam. Slot 10 Schedule 40 PVC Screen

DRAFT

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
CENTREVILLE, ONTARIO

TITLE

BH17-5A

PROJECT No.	1664706	FILE No.	1664706-2000-R03_BH
		SCALE	AS SHOWN REV.
CADD	ZJB	May 6/19	
CHECK	RM		BH17-5A

GOLDER

Drawing file: 1664706-2000-R03_BH.dwg May 06, 2019 - 8:12am

Client: Walker Environmental Group Inc.

PROJECT: 1664706

LOCATION: N 4767199.1 ;E 511279.7

INCLINATION: -90°   AZIMUTH: ---

RECORD OF DRILLHOLE: BH17-6A

DRILLING DATE: December 5-13, 2017

DRILL RIG: TRACK MOUNTED ACKER SOIL - MAX

DRILLING CONTRACTOR: ORBIT GARANT

SHEET 1 OF 1

DATUM: GEODETIC

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate, BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage, PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular, PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

Column headings: DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. (m amsl) / DEPTH (m) | RUN No. | TYPE | RECOVERY (TOTAL CORE %, SOLID CORE %) | R.Q.D. % | FRACT. INDEX PER 0.3 m | DISCONTINUITY DATA (B Angle, DIP w.r.t. CORE AXIS, TYPE AND SURFACE DESCRIPTION, Jcon, Jr, Ja) | HYDRAULIC CONDUCTIVITY K, cm/sec | GEOPHYSICAL RECORD (GAMMA (cps), CONDUCTIVITY (Ms/m), FLOW RATE (AMBIENT)) | INSTALLATION AND GROUNDWATER OBSERVATIONS

Elev. (m amsl) / Depth (m)	Description	Run No. / Type
275.17	GROUND SURFACE	
0.00	TOPSOIL; brown	
0.15	(SP/GP) SAND AND GRAVEL; grey	1 SS, 2 SS
274.26 / 0.91	TOPSOIL; dark brown	3 SS
274.00 / 1.17	(SM) SANDY SILT, some clay, some gravel; brown	4 SS
273.65 / 1.52	(SP/GP) SAND AND GRAVEL; grey to brown	5 SS, 6 SS, 7 SS
271.36 / 3.81	(SP) SAND, fine to medium; brown	8 SS, 9 SS, 10 SS, 11 SS, 12 SS, 13 SS, 14 SS, 15 SS, 16 SS
266.79 / 8.38	GRAVEL, cobbles and boulders	17 SS, 18 HQ RC, 19 HQ RC
262.17 / 13.00	LUCAS FORMATION 13.00m to 32.99m, Fresh to slightly weathered, fine to medium grained, thin to medium bedded, medium grey to brown LIMESTONE, with argillaceous shale and nodular horizons and stylolites	1–14
	15.57m to 15.86m: Dark grey argillaceous dolostone with laminar to wavy bedding partings	
	16.18m to 16.37m: Dark grey limestone with laminar to wavy bedding partings	
	16.46m to 16.52m: Dark grey argillaceous limestone with laminar to wavy bedding partings	
	19.81m to 20.17m: Dark grey to black argillaceous to shaley limestone, laminar and medium grey to brown limestone	
	19.91m to 20.50m: Dark grey, argillaceous limestone with laminar bedding partings	
	24.23m to 24.41m: Nodular textured argillaceous limestone	
	25.63m to 26.00m: Dark to light grey nodular and textured argillaceous limestone and nodular limestone	
	25.00m to 32.00m: Fining upward	
	28.65m to 29.41m: Nodular limestone with angular mud clasts and argillaceous laminae	
	29.14m to 29.17m: Argillaceous laminations	
	28.30m to 30.47m: Nodular texture limestone and argillaceous limestone	
	30.63m: Weathered Fracture	
	30.00m to 32.00m: coarsening upward	
	32.22m: Weathered Fracture	
241.78 / 32.99	END OF BOREHOLE	

Drilling record: POWER AUGER, 108mm ID HOLLOW STEM (0 to 9 m); WASH BORING (9 to 13 m); ROTARY DRILLING, HQ CASING (13 to 32.99 m)

DRAFT

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
CENTREVILLE, ONTARIO

TITLE

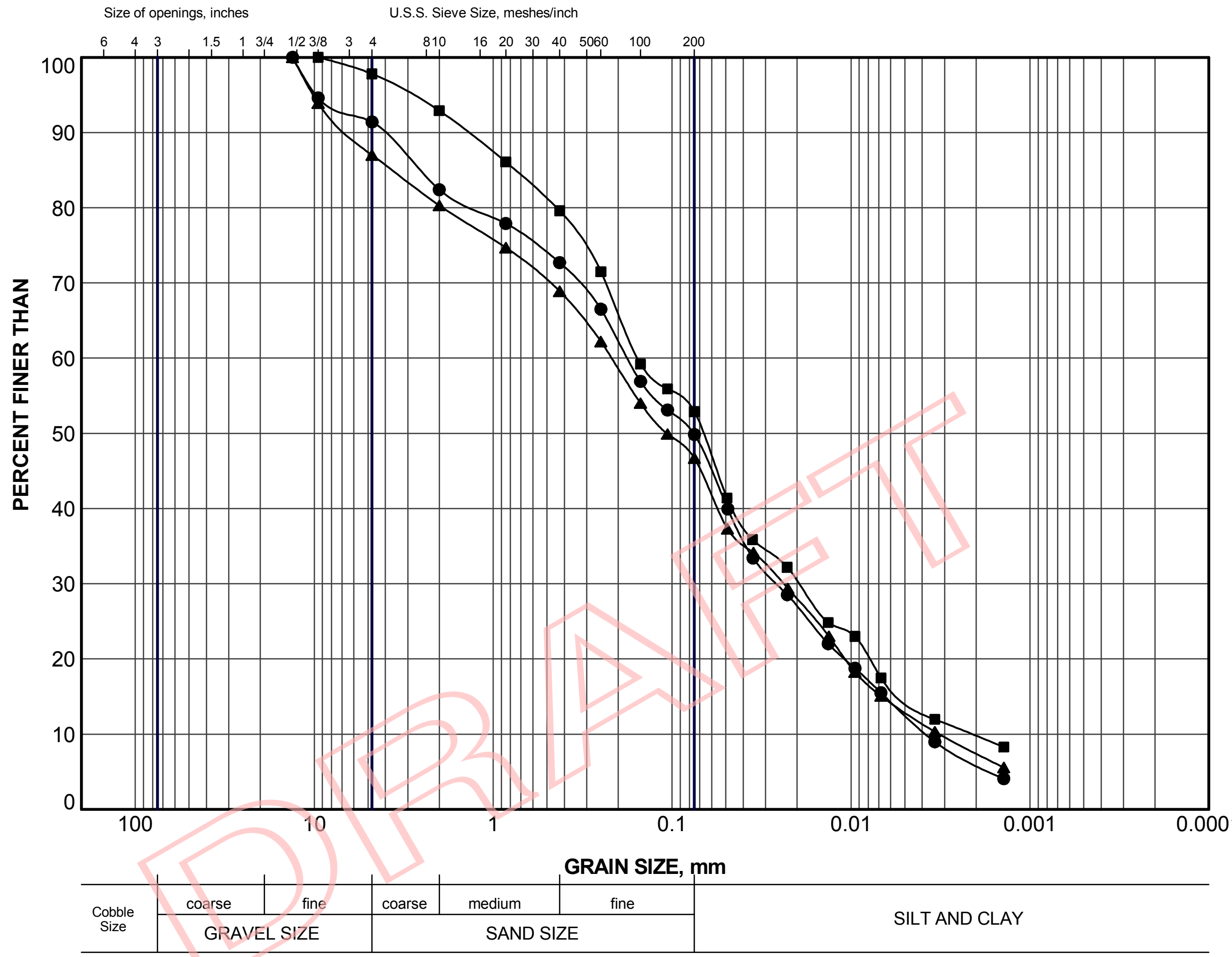
BH17-6A

GOLDER

PROJECT No.	1664706	FILE No. 1664706-2000-R03_BH
CADD	ZJB	May 6/19
CHECK	RM	
SCALE	AS SHOWN	REV.

BH17-6A

Drawing file: 1664706-2000-R03_BH.dwg May 06, 2019 – 8:11am



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH17-1A	13	283.8
■	BH17-1A	25	270.0
▲	BH17-3A	14	270.5

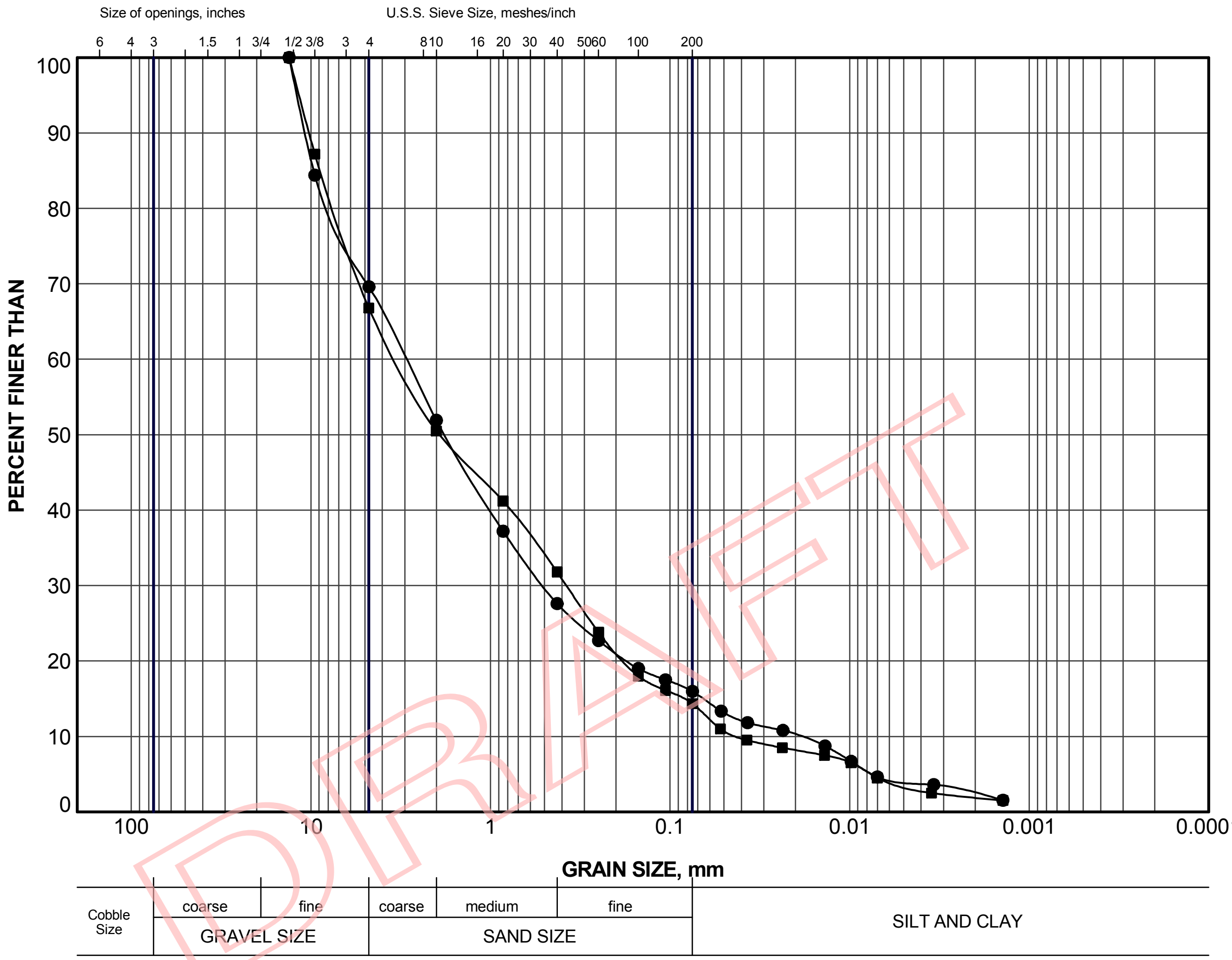
PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
GRAIN SIZE DISTRIBUTION
SAND and SILT TILL

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R030F1
		SCALE	N/A REV.
DRAWN	AMS	June 26/19	
CHECK	RM		**FIGURE F-1**

LDN_GSD GLDR_LDN.GDT 23-01-19 12:45



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH17-2A	7	280.1
■	BH17-6A	5	272.9

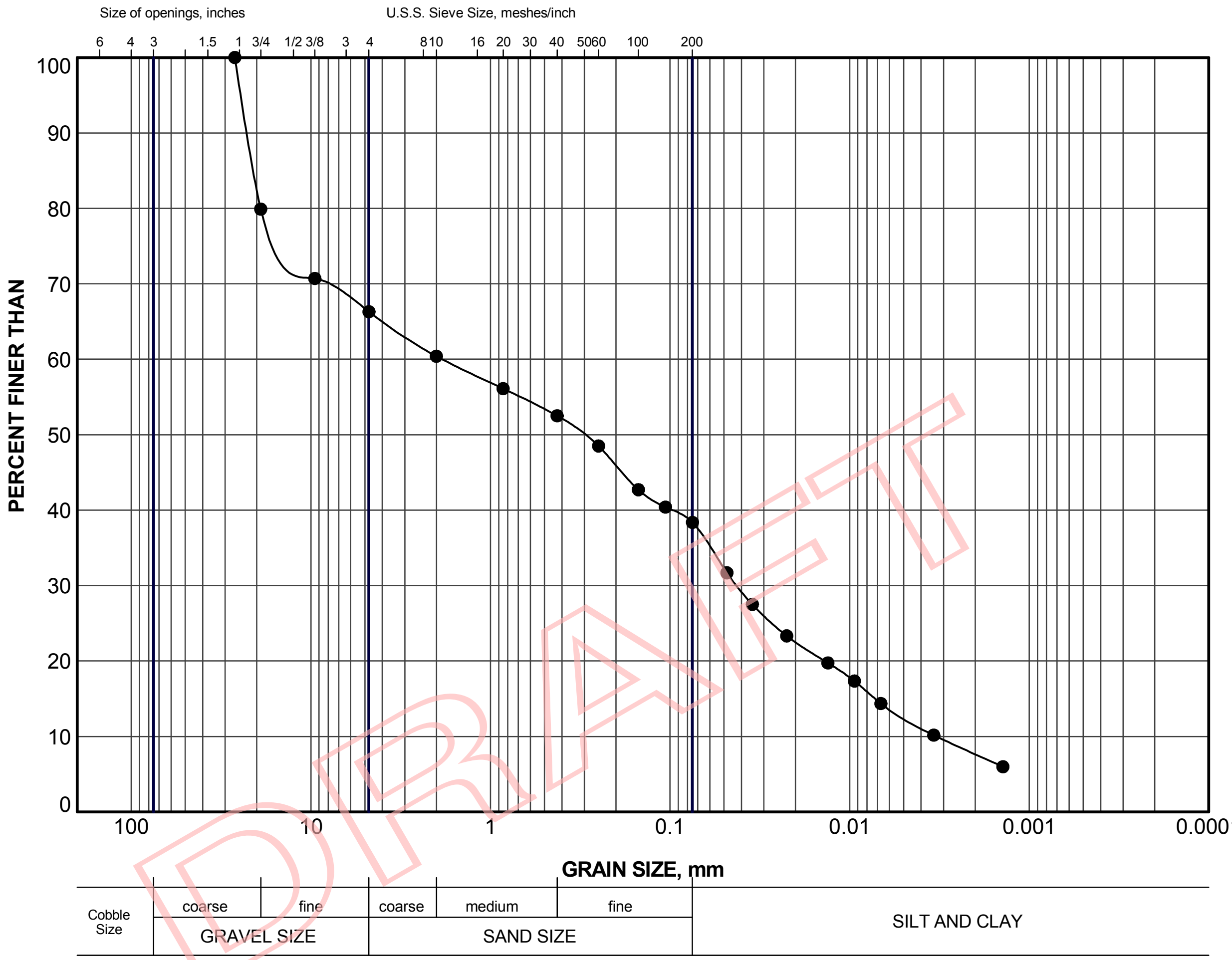
PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
GRAIN SIZE DISTRIBUTION
gravelly SAND

GOLDER

PROJECT No.	1664706		FILE No.	1664706-2000-R030F2
			SCALE N/A	REV.
DRAWN	AMS	June 26/19	**FIGURE F-2**	
CHECK	RM			

LDN_GSD GLDR_LDN.GDT 23-01-19 12:49



DRAFT

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH17-2A	13	276.4

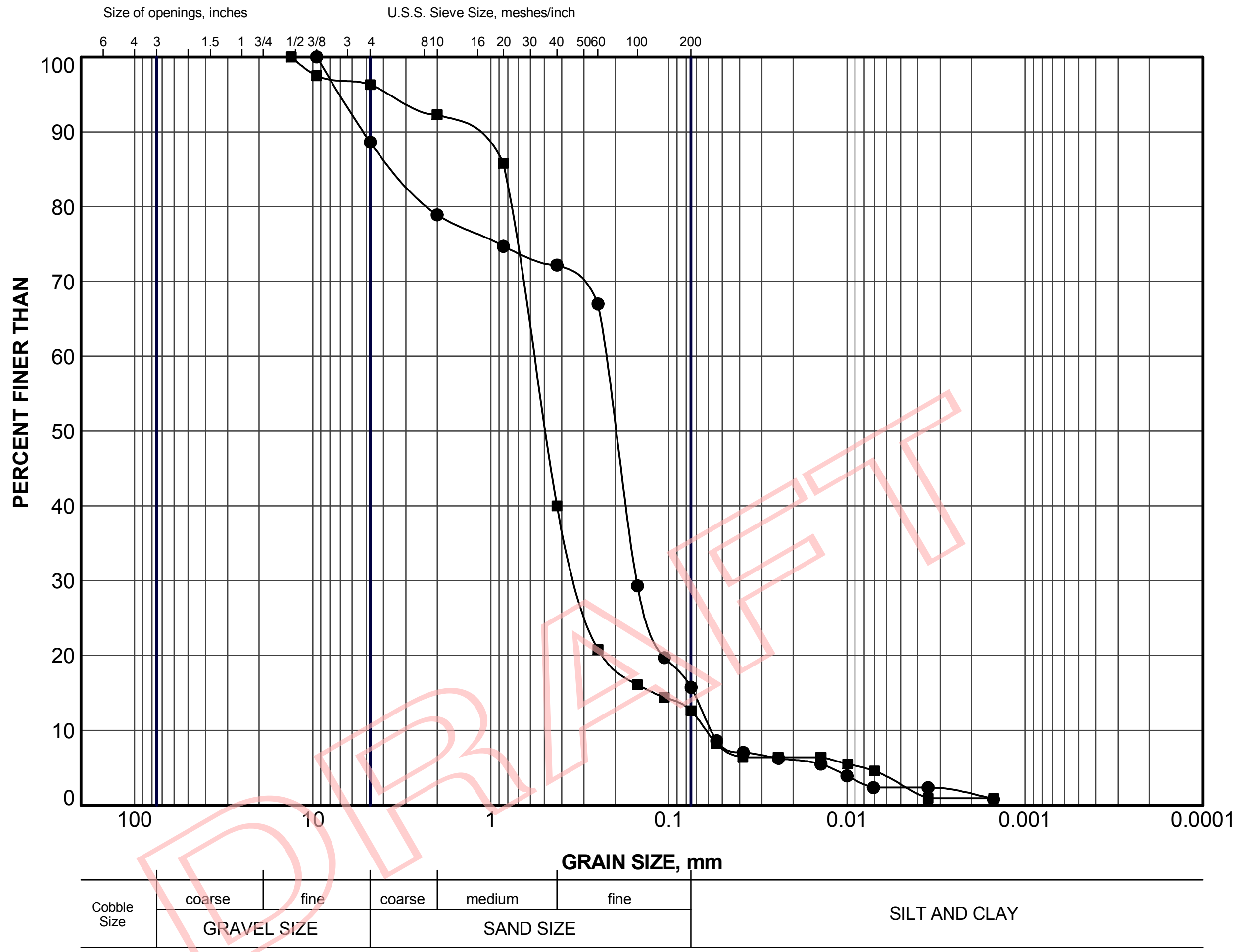
PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
GRAIN SIZE DISTRIBUTION
sandy SILTY GRAVEL TILL

GOLDER

PROJECT No.		1664706	FILE No.	1664706-2000-R030F3
			SCALE N/A	REV.
DRAWN	AMS	June 26/19	**FIGURE F-3**	
CHECK	RM			

LDN_GSD GLDR_LDN.GDT 23-01-19 12:52



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH17-3A	5	277.2
■	BH17-5A	9	264.4

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

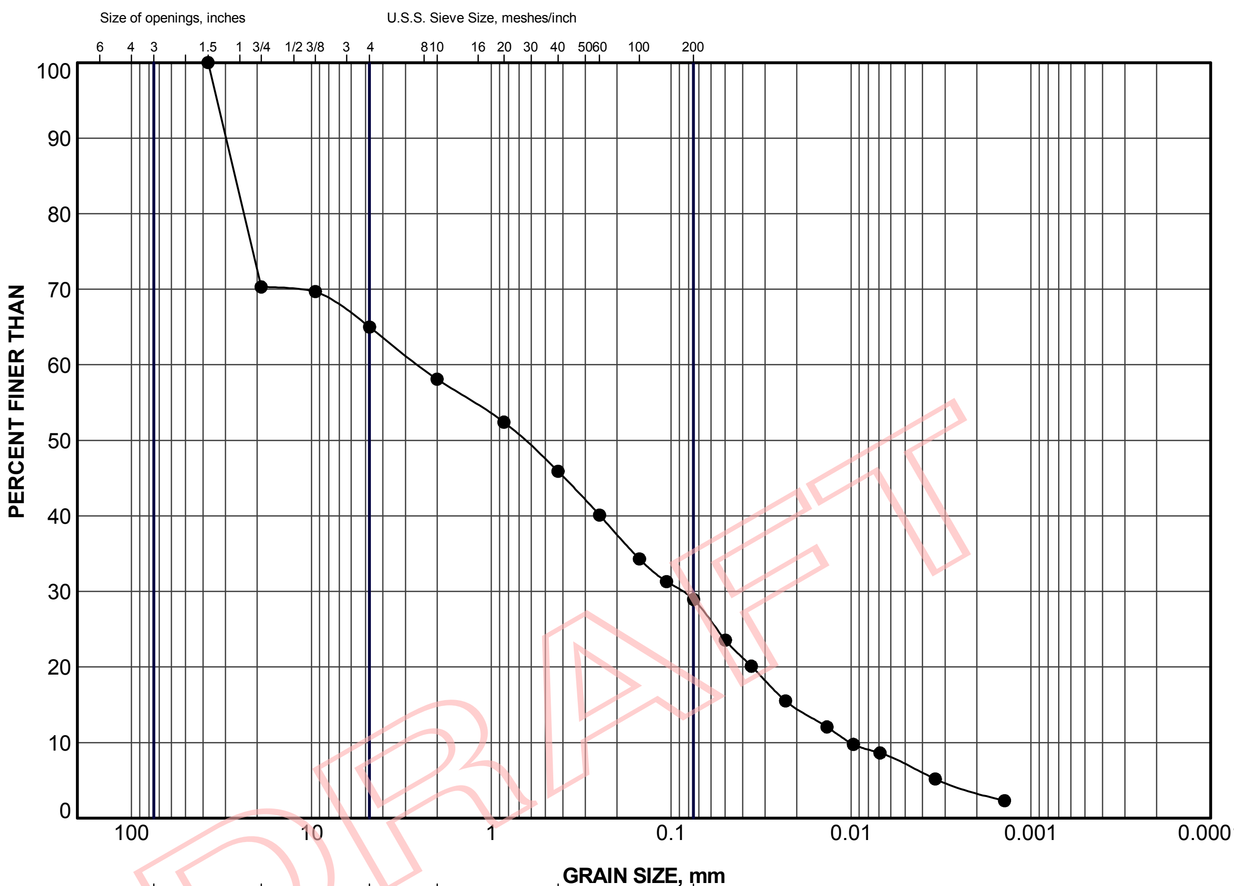
TITLE
GRAIN SIZE DISTRIBUTION
SILTY SAND

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R030F4	
		SCALE	N/A	REV.
DRAWN	AMS	June 26/19		
CHECK	RM			

FIGURE F-4

LDN_GSD GLDR_LDN.GDT 23-01-19 12:55



Cobble Size	GRAVEL SIZE		SAND SIZE			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH17-3A	23	262.1

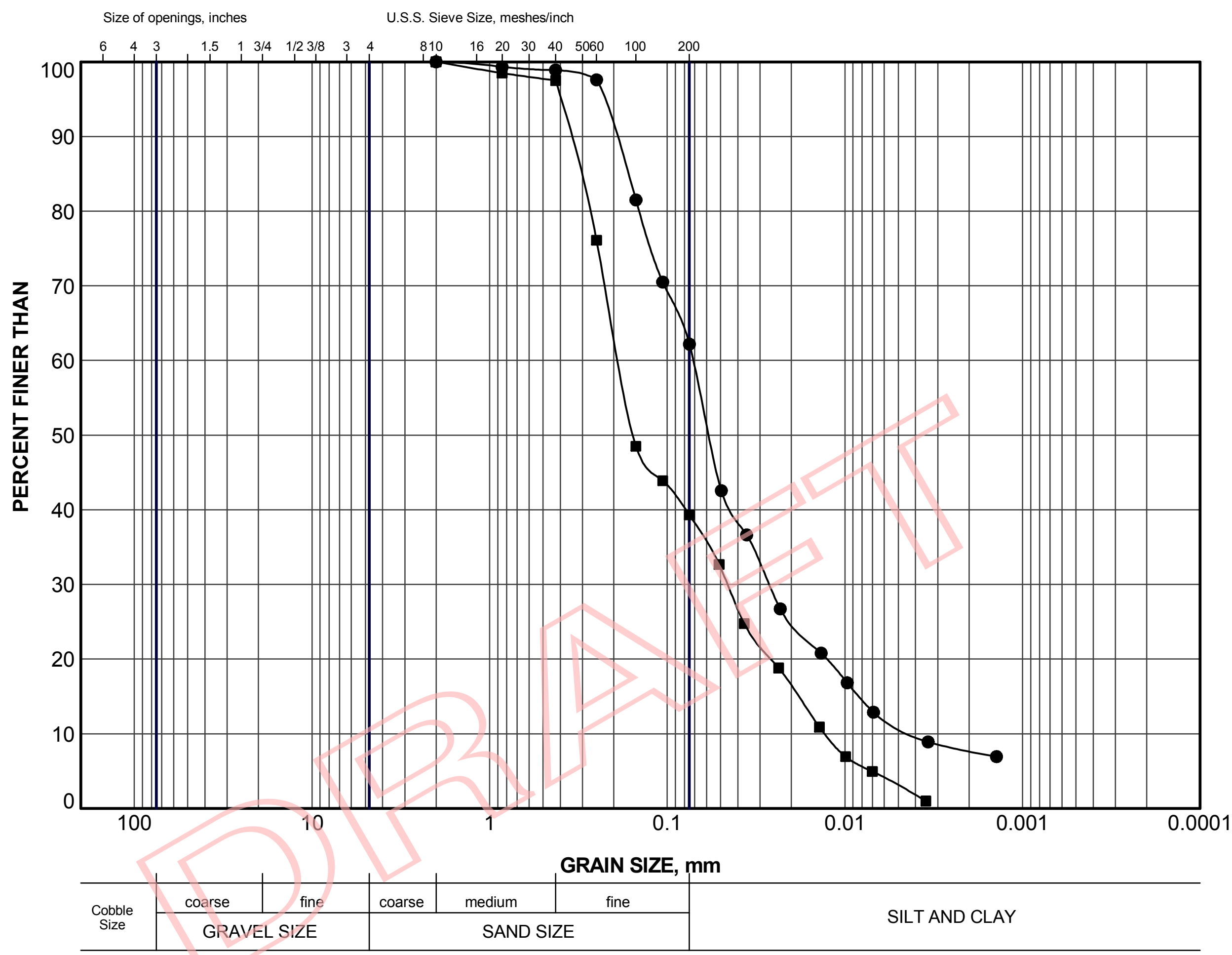
PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
GRAIN SIZE DISTRIBUTION
SILTY SAND and GRAVEL TILL

GOLDER

PROJECT No.	1664706		FILE No.	1664706-2000-R030F5
			SCALE N/A	REV.
DRAWN	AMS	June 26/19	**FIGURE F-5**	
CHECK	RM			

LDN_GSD GLDR_LDN.GDT 23-01-19 13:56



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH17-5A	7	265.9
■	BH17-5A	8	265.6

PROJECT

HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE

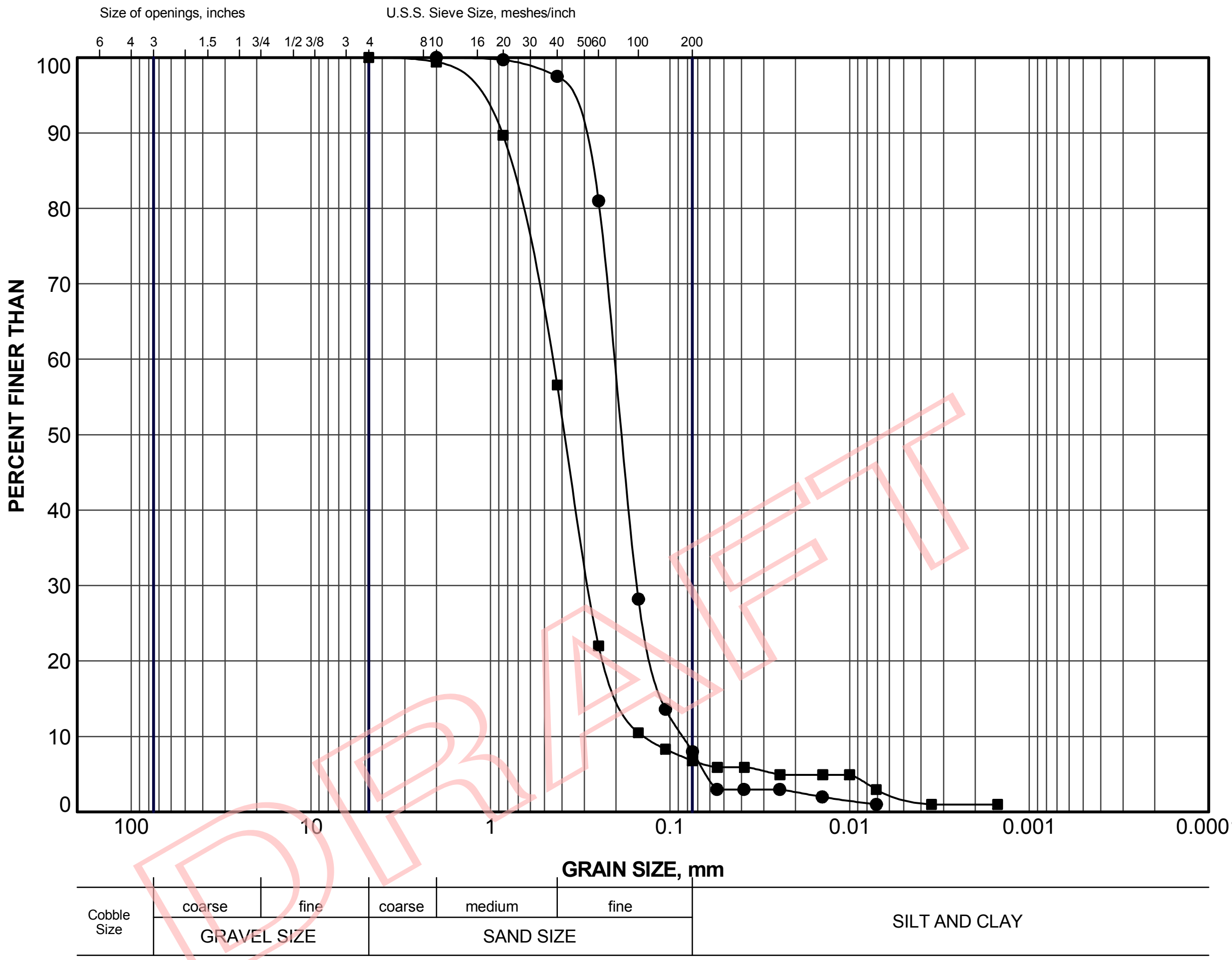
GRAIN SIZE DISTRIBUTION

SAND and SILT

GOLDER

PROJECT No.	1664706		FILE No.	1664706-2000-R030F6
			SCALE N/A	REV.
DRAWN	AMS	June 26/19	**FIGURE F-6**	
CHECK	RM			

LDN_GSD GLDR_LDN.GDT 23-01-19 14:00



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH17-6A	13	269.1
■	BH17-6A	16	266.8

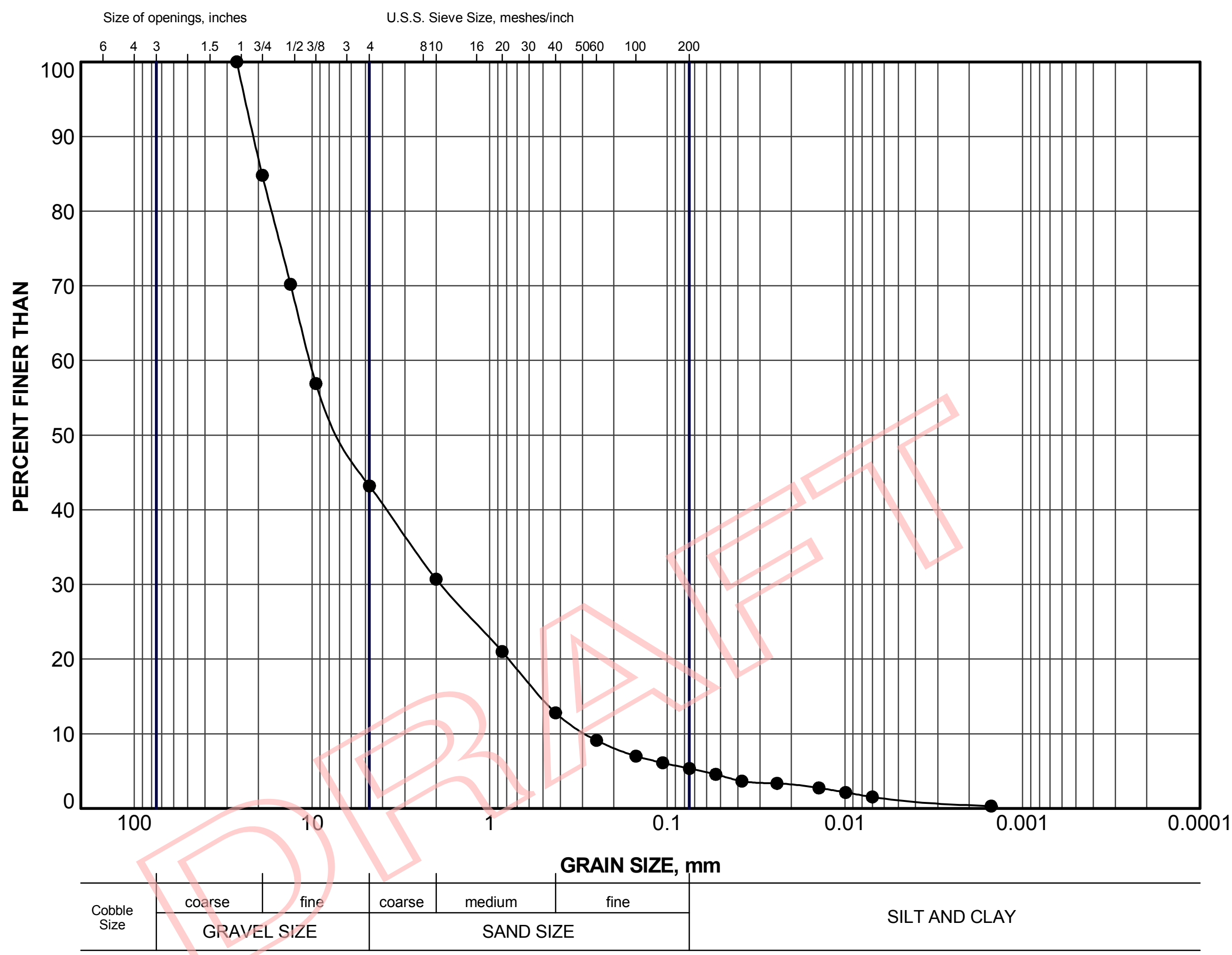
PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
GRAIN SIZE DISTRIBUTION
SAND

GOLDER

PROJECT No.	1664706	FILE No.	1664706-2000-R030F7
		SCALE N/A	REV.
DRAWN	AMS	June 26/19	**FIGURE F-7**
CHECK	RM		

LDN_GSD GLDR_LDN.GDT 23-01-19 14:03



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LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH17-2A	9	279.2

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

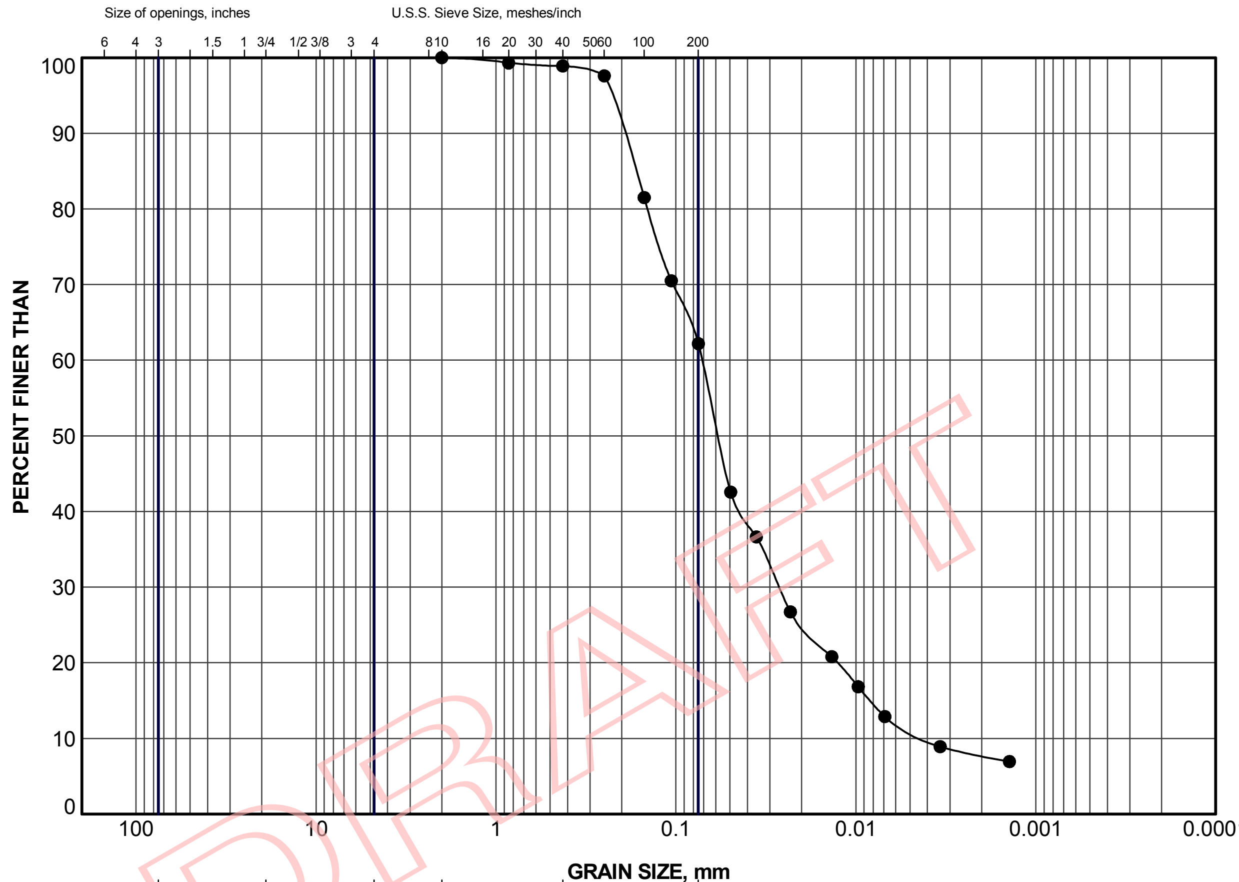
TITLE
GRAIN SIZE DISTRIBUTION
SAND and GRAVEL

GOLDER

PROJECT No.	1664706		FILE No.	1664706-2000-R030F8
			SCALE	N/A	REV.
DRAWN	AMS	June 26/19		
CHECK	RM			

FIGURE F-8

LDN_GSD GLDR_LDN.GDT 24-01-19 11:57



Cobble Size	GRAVEL SIZE		SAND SIZE			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

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LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH17-5A	7	265.9

PROJECT
HYDROGEOLOGICAL ASSESSMENT
SOUTHWEST LANDFILL
ZORRA TOWNSHIP, ONTARIO

TITLE
GRAIN SIZE DISTRIBUTION
CLAY

GOLDER

PROJECT No.		1664706	FILE No. 1664706-2000-R030F9
			SCALE N/A REV.
DRAWN	AMS	June 26/19	**FIGURE F-9**
CHECK	RM		

LDN_GSD GLDR_LDN.GDT 17-01-19 10:13

APPENDIX G

Door-to-Door Water Well Survey and Monitoring Results

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Summary of MECP Water Well Records

Hydrogeological Assessment
Southwest Landfill
Centreville, Ontario

MOECC Well No.	UTM Coordinates Easting (NAD 83)	UTM Coordinates Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth: Water Found (metres)	Depth: Total Depth (metres)	Test Pumping: Static Level (metres)	Test Pumping: Level (metres)	Test Pumping: Rate (L/min)	Test Pumping: Duration (minutes)	Stratigraphy: Material				Depth to Unit Base (metres)	Aquifer Type
3709749	511525	4766944	20/11/2003		Boring		Observation Wells	Not Used		7.00					BROWN	SAND	GRAVEL	FILL	3.00	Overburden
															BROWN	SILT	CLAY		5.00	
															GREY	SAND	GRAVEL		7.00	
4701694	509724	4766613	17/04/1957	152	Cable Tool	FRESH	Water Supply	Domestic	35.36	35.36	27.43	27.43	22.73	1		GRAVEL			8.23	Bedrock
																HARDPAN			32.00	
																GRAVEL	HARDPAN		34.75	
																LIMESTONE			35.36	
4701924	508914	4768758	01/07/1948	102	Cable Tool	FRESH	Water Supply	Livestock/Domestic		32.92	22.86	23.77	27.28	24	BROWN	CLAY			6.10	Bedrock
															BLUE	CLAY	STONES		18.29	
																HARDPAN	STONES		29.87	
																LIMESTONE			32.92	
4701925	508974	4769103	18/03/1961	102	Cable Tool	FRESH	Water Supply	Livestock/Domestic	29.87	30.48	1.52	7.01	22.73	2	BROWN	CLAY			5.18	Bedrock
															BLUE	CLAY			7.62	
																HARDPAN			18.29	
															GREY	LIMESTONE			30.48	
4701926	509894	4768363	31/05/1961	127	Cable Tool	FRESH	Water Supply	Livestock/Domestic	29.57	29.57	8.53	18.29	27.28	5	BROWN	CLAY			3.66	Bedrock
															BLUE	CLAY			10.67	
																HARDPAN			24.99	
																LIMESTONE			29.57	
4701927	511109	4768873	05/10/1953	102	Cable Tool	FRESH	Water Supply	Livestock/Domestic		27.13	19.81	22.86	22.73	3	BROWN	CLAY			6.10	Bedrock
																HARDPAN	STONES		25.60	
																LIMESTONE			27.13	
4701943	509614	4767183	30/05/1956	102	Cable Tool	FRESH	Water Supply	Domestic	30.48	30.48	20.73	22.25	22.73	2	BLUE	CLAY			12.19	Bedrock
																HARDPAN	STONES		28.65	
																LIMESTONE			30.48	
4701944	510314	4766923	12/07/1955	203	Rotary (Convent.)		Observation Wells			13.41						TOPSOIL			0.30	Overburden
																CLAY	MEDIUM SAND		13.41	
4701945	510124	4768178	01/03/1964	102	Cable Tool	FRESH	Water Supply	Domestic	22.56	24.99	3.05	6.10	45.46	4		CLAY	MEDIUM SAND	GRAVEL	16.76	Bedrock
															GREY	LIMESTONE			24.99	
4701946	510864	4768823	18/07/1955	203	Cable Tool		Not A Well			25.91						CLAY	MEDIUM SAND		3.96	Bedrock
																CLAY	MEDIUM SAND	GRAVEL	10.67	
																HARDPAN			19.20	
																CLAY	MEDIUM SAND		21.95	
																CLAY			25.60	
																LIMESTONE			25.91	
4701947	511609	4768648	28/12/1947	102	Cable Tool	FRESH	Water Supply	Livestock	11.28	18.90	11.28		13.64	4		CLAY	MEDIUM SAND		2.44	Bedrock
																GRAVEL			6.71	
																HARDPAN			14.02	
																LIMESTONE			18.90	
4701948	511714	4768648	16/09/1957	254	Cable Tool	FRESH	Water Supply	Cooling And A/C	15.24	53.34	27.43		454.61			HARDPAN			3.05	Bedrock
																GRAVEL	STONES		9.14	
															GREY	LIMESTONE			53.34	
4701955	510169	4766773	26/07/1963	305	Cable Tool	FRESH	Water Supply	Municipal	40.54	134.42	9.45	23.47	2182.12	24		TOPSOIL			0.30	Bedrock
																COARSE SAND			5.79	
																CLAY	GRAVEL		7.32	
																LIMESTONE			10.06	
															BROWN	LIMESTONE			11.58	
															GREY	LIMESTONE			37.80	
															BROWN	LIMESTONE			49.99	
															GREY	LIMESTONE			134.42	
4702238	512594	4767493	02/12/1949	102	Cable Tool	FRESH	Water Supply	Domestic	15.85	15.85	5.18		9.09	1		MEDIUM SAND			12.19	Bedrock
																ROCK			15.85	
4702242	512314	4768103	30/03/1962	102	Cable Tool	FRESH	Water Supply	Domestic	19.51	19.51	15.24	16.76	18.18	4		GRAVEL	STONES		6.10	Bedrock
																HARDPAN	STONES		14.33	
																LIMESTONE			19.51	

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Prepared by: RM
Checked by: DC

Summary of MECP Water Well Records

Hydrogeological Assessment
Southwest Landfill
Centreville, Ontario

MOECC Well No.	UTM Coordinates Easting (NAD 83)	UTM Coordinates Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth: Water Found (metres)	Depth: Total Depth (metres)	Static Level (metres)	Test Pumping: Level (metres)	Test Pumping: Rate (L/min)	Test Pumping: Duration (minutes)	Stratigraphy	Stratigraphy: Material			Depth to Unit Base (metres)	Aquifer Type
4702243	512234	4768363	06/09/1963	102	Cable Tool	FRESH	Water Supply	Domestic	36.58	38.10	30.48	31.09	31.82	2		GRAVEL	STONES		3.66	Bedrock
																HARDPAN	STONES		12.19	
															GREY	CLAY	BOULDERS		15.24	
															GREY	LIMESTONE			38.10	
4702244	512194	4768253	13/10/1966	102	Cable Tool	FRESH	Water Supply	Domestic	26.82	26.82	24.99	26.52	9.09	3	BROWN	CLAY			2.44	Bedrock
																MEDIUM SAND	GRAVEL		12.19	
																STONES	HARDPAN		14.33	
																LIMESTONE			26.82	
4702246	511854	4767743	30/09/1950	102	Cable Tool	FRESH	Water Supply	Domestic	19.51	19.51	6.10	7.62	13.64	1		GRAVEL			6.10	Bedrock
																FINE SAND			13.72	
																ROCK			19.51	
4702247	511594	4767203	27/11/1949	102	Cable Tool	FRESH	Water Supply	Livestock/Domestic	15.24	15.24	3.66		13.64	1		CLAY			14.63	Overburden
																GRAVEL			15.24	
4702248	511454	4767143	04/03/1953	102	Cable Tool	FRESH	Water Supply	Domestic	18.29	18.29	12.19	13.11	22.73	3		HARDPAN	STONES		15.24	Bedrock
																LIMESTONE			18.29	
4702249	511634	4766933	28/09/1954	102	Cable Tool	FRESH	Water Supply	Domestic	33.22	33.22	15.85	24.99	18.18	6		CLAY			17.68	Bedrock
																HARDPAN	GRAVEL		18.59	
																QUICKSAND			23.77	
															BROWN	LIMESTONE			33.22	
4702250	511514	4767218	20/08/1956	127	Cable Tool	FRESH	Water Supply	Domestic	15.24	15.54	7.62	8.84	22.73			CLAY	STONES	GRAVEL	12.80	Bedrock
																LIMESTONE			15.54	
4702251	511564	4767283	14/02/1967	102	Cable Tool	FRESH	Water Supply	Domestic	15.54	16.76	10.97	12.80	27.28	3		MEDIUM SAND	GRAVEL	STONES	12.19	Bedrock
															WHITE	HARDPAN			14.02	
																ROCK			16.76	
4702252	511504	4767083	30/03/1967	102	Cable Tool	FRESH	Water Supply	Domestic	22.86	22.86	17.37	22.25	18.18	3	BROWN	CLAY			1.22	Bedrock
																MEDIUM SAND	GRAVEL		9.14	
																HARDPAN	STONES		17.98	
																LIMESTONE			22.86	
4702253	511374	4766988	10/05/1947	102	Cable Tool	FRESH	Water Supply	Domestic	10.97	10.97	4.88		13.64	2		GRAVEL			6.10	Overburden
																HARDPAN			10.36	
																GRAVEL			10.97	
4702254	510954	4766613	19/07/1949	102	Cable Tool	Not stated	Water Supply	Domestic	16.46	16.46	5.49		13.64	1		MEDIUM SAND			12.80	Bedrock
																ROCK			16.46	
4702255	511274	4767063	15/05/1947	102	Cable Tool	FRESH	Water Supply	Domestic	12.19	12.19	6.10		13.64	2		CLAY	MEDIUM SAND		6.10	Bedrock
																HARDPAN			10.06	
																LIMESTONE			12.19	
4702256	511114	4766793	25/07/1948	102	Cable Tool	Not stated	Water Supply	Domestic	12.50	12.50	6.10		13.64	2		STONES			3.05	Bedrock
																MEDIUM SAND			6.10	
																HARDPAN			9.14	
																MEDIUM SAND			10.97	
																ROCK			12.50	
4702257	511124	4766813	27/07/1949	102	Cable Tool	Not stated	Water Supply	Domestic	7.62	7.62	2.13		13.64	1		MEDIUM SAND			6.71	Bedrock
																ROCK			7.62	
4702258	511194	4766763	17/11/1954	102	Cable Tool	FRESH	Water Supply	Domestic	15.85	15.85	10.67	10.67	27.28	2		TOPSOIL			0.61	Bedrock
																FINE SAND			11.28	
																STONES	HARDPAN		15.24	
																LIMESTONE			15.85	
4702259	511154	4766763	14/01/1955	127	Cable Tool	FRESH	Water Supply	Domestic	16.46	16.46	8.84	10.06	27.28	3		PREV. DRILLED			11.58	Bedrock
																GRAVEL			12.80	
																LIMESTONE			16.46	
4702260	511244	4766935	24/11/1956	102	Cable Tool	FRESH	Water Supply	Domestic	13.41	13.41	9.14	11.58	22.73	1		GRAVEL			12.50	Bedrock
																LIMESTONE			13.41	
4702261	511354	4766983	27/05/1959	152	Cable Tool	FRESH	Water Supply	Domestic	16.46	16.46	11.58	13.72	27.28	1	RED	MEDIUM SAND			8.53	Bedrock
																HARDPAN	BOULDERS		13.41	
																LIMESTONE			16.46	
4702262	511254	4766843	29/09/1962	102	Cable Tool	FRESH	Water Supply	Domestic	17.07	17.37	10.67	11.58	22.73	4		MEDIUM SAND			6.40	Bedrock
																CLAY	GRAVEL		13.11	
																CLAY	BOULDERS		15.54	
															GREY	LIMESTONE			17.37	

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Summary of MECP Water Well Records

Hydrogeological Assessment
Southwest Landfill
Centreville, Ontario

MOECC Well No.	UTM Coordinates Easting (NAD 83)	UTM Coordinates Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth: Water Found (metres)	Depth: Total Depth (metres)	Depth: Static Level (metres)	Test Pumping: Level (metres)	Test Pumping: Rate (L/min)	Test Pumping: Duration (minutes)	Stratigraphy	Stratigraphy: Material			Depth to Unit Base (metres)	Aquifer Type
4702263	511154	4766723	05/04/1966	102	Cable Tool	FRESH	Water Supply	Domestic	15.54	15.54	10.67	12.19	22.73	4	RED	MEDIUM SAND			6.10	Bedrock
																MEDIUM SAND	GRAVEL		14.63	
																LIMESTONE			15.24	
															GREY	ROCK			15.54	
4702264	511324	4766903	18/05/1966	102	Cable Tool	FRESH	Water Supply	Domestic	19.20	19.20	13.72	14.63	22.73	3	BROWN	CLAY			1.22	Bedrock
																MEDIUM SAND	GRAVEL	STONES	17.07	
																ROCK			19.20	
4702265	510854	4766143	30/08/1947	127	Cable Tool	Not stated	Water Supply	Domestic	23.77	24.38	9.14		13.64	2		MEDIUM SAND			12.19	Bedrock
																HARDPAN			18.29	
																ROCK			24.38	
4702266	510754	4766343	22/07/1949	102	Cable Tool	Not stated	Water Supply	Domestic	19.20	19.81	7.62		13.64	1		STONES			3.05	Bedrock
																MEDIUM SAND			13.72	
																ROCK			19.81	
4702267	510964	4765983	10/06/1960	102	Cable Tool	FRESH	Water Supply	Domestic	33.22	33.53	22.86	22.86	27.28	2		GRAVEL	MEDIUM SAND		12.19	Overburden
															BLUE	CLAY			24.38	
																HARDPAN			33.22	
																GRAVEL			33.53	
4702288	511954	4766823	05/11/1959	102	Cable Tool	FRESH	Water Supply	Domestic	22.56	23.16	13.72	15.24	22.73	2	BROWN	CLAY			4.57	Bedrock
																HARDPAN	STONES		22.25	
																LIMESTONE			23.16	
4702289	511939	4766568	26/09/1960	102	Cable Tool	FRESH	Water Supply	Livestock/Domestic	35.05	35.66	26.21	29.26	54.55	8		FILL			0.91	Bedrock
																GRAVEL	STONES	HARDPAN	7.32	
																CLAY	MEDIUM SAND		10.67	
																CLAY			15.24	
																HARDPAN			18.90	
																GRAVEL			21.64	
																CLAY			29.87	
																FINE SAND			30.18	
																GRAVEL	MEDIUM SAND		34.14	
															GREY	LIMESTONE			35.66	
4702290	511774	4766663	31/05/1961	102	Cable Tool	FRESH	Water Supply	Domestic	18.29	19.81	10.36	13.11	31.82	2.5		TOPSOIL	MEDIUM SAND		1.83	Overburden
															GREY	CLAY			8.53	
																MEDIUM SAND	CLAY	BOULDERS	10.97	
															GREY	CLAY			17.07	
																MEDIUM SAND	GRAVEL		18.29	
																COARSE SAND	GRAVEL		19.81	
4702292	511414	4766273	26/02/1964	102	Cable Tool	FRESH	Water Supply	Livestock/Domestic	30.48	30.48	16.76	19.81	27.28	5		MEDIUM SAND			6.10	Bedrock
																MEDIUM SAND	GRAVEL	STONES	21.34	
																HARDPAN			28.65	
																LIMESTONE			30.48	
4702294	511399	4766303	28/09/1954	102	Cable Tool	FRESH	Water Supply	Livestock/Domestic	35.36	35.66	19.51	21.34	27.28	3	BROWN	CLAY			3.05	Bedrock
																HARDPAN	STONES		34.75	
																LIMESTONE			35.66	
4702711	510993	4765983	14/06/1968	102	Cable Tool	FRESH	Water Supply	Livestock/Domestic	36.58	36.88	19.81	21.34	22.73	3		MEDIUM SAND	GRAVEL		9.14	Bedrock
															BLUE	CLAY			21.34	
																HARDPAN	STONES		35.05	
																SHALE			36.58	
																LIMESTONE			36.88	
4702930	512214	4767033	25/10/1969	102	Cable Tool	FRESH	Water Supply	Domestic	39.62	40.54	25.91	28.96	18.18	3	BROWN	CLAY			1.52	Bedrock
															BLUE	CLAY			15.24	
															BLUE	CLAY	STONES		22.86	
																HARDPAN	STONES		33.53	
															WHITE	HARDPAN			37.19	
																LIMESTONE			40.54	
4703001	509604	4768273	17/04/1970	152	Cable Tool	MINERIAL	Water Supply	Industrial	35.97	36.58	5.18	32.61	68.19	18	YELLOW	TOPSOIL	GRAVEL		1.52	Bedrock
															BLACK	OVERBURDEN			3.66	
															YELLOW	CLAY			6.71	
															YELLOW	CLAY	STONES		29.87	
															GREY	LIMESTONE			36.58	

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Summary of MECP Water Well Records

Hydrogeological Assessment
Southwest Landfill
Centreville, Ontario

MOECC Well No.	UTM Coordinates Easting (NAD 83)	Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth: Water Found (metres)	Depth: Total Depth (metres)	Depth: Static Level (metres)	Test Pumping: Level (metres)	Test Pumping: Rate (L/min)	Test Pumping: Duration (minutes)	Stratigraphy: Material				Depth to Unit Base (metres)	Aquifer Type
4703025	511614	4768533	22/07/1970	305	Cable Tool	SULPHUR	Water Supply	Industrial	21.34	86.87	24.38	29.87	1591.13	8	BROWN	FILL	BOULDERS	CLAY	1.52	Bedrock
															BROWN	CLAY	GRAVEL		5.79	
															BROWN	GRAVEL			7.32	
															BROWN	LIMESTONE			11.89	
															BROWN	LIMESTONE	SHALE		47.24	
															WHITE	LIMESTONE			50.29	
															GREY	LIMESTONE			52.43	
															BROWN	LIMESTONE	SHALE		59.13	
															BROWN	LIMESTONE			77.72	
															GREY	LIMESTONE			80.77	
															BROWN	LIMESTONE			86.87	
4703041	511614	4767473	09/07/1970	102	Cable Tool	SULPHUR	Water Supply	Domestic	39.32	39.62	26.52	27.74	22.73	2	BROWN	MEDIUM SAND			6.71	Bedrock
																GRAVEL			13.11	
															BROWN	LIMESTONE			39.62	
4703122	511114	4766743	04/03/1971	102	Cable Tool	FRESH	Water Supply	Domestic	16.76	16.76	10.67	13.72	22.73	1	RED	MEDIUM SAND			11.58	Bedrock
															GREY	MEDIUM SAND	GRAVEL		13.72	
															WHITE	HARDPAN			14.63	
															GREY	ROCK			16.76	
4703163	511514	4767343	26/05/1971	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	24.38	24.38	18.29	19.81	36.37	2	BLACK	TOPSOIL			0.61	Bedrock
															BROWN	MEDIUM SAND	GRAVEL		9.75	
															BROWN	LIMESTONE			24.38	
4703165	509614	4766673	31/05/1971	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	38.10	47.24	34.14	34.14	36.37	2	BROWN	CLAY	GRAVEL		7.62	Bedrock
															BLUE	CLAY	STONES		19.81	
																HARDPAN	STONES		30.48	
															WHITE	HARDPAN	STONES		34.75	
															BROWN	LIMESTONE			35.36	
															GREEN	ROCK			38.10	
															BROWN	LIMESTONE			47.24	
4703185	511594	4767473	11/06/1971	102	Cable Tool	FRESH	Water Supply	Domestic	19.81	24.38	19.81	19.81	36.37	2	BROWN	MEDIUM SAND	GRAVEL		10.67	Bedrock
															BROWN	LIMESTONE			24.38	
4703187	510814	4765973	04/06/1971	127	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	40.54	40.54	27.43	28.96	36.37	2		PREVIOUSLY DUG			1.22	Bedrock
															GREY	CLAY	MEDIUM SAND		15.24	
																HARDPAN	STONES		37.19	
															BROWN	LIMESTONE			40.54	
4703242	511544	4767343	18/08/1971	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	15.54	24.38	18.29	19.81	36.37	2	BROWN	MEDIUM SAND	GRAVEL		9.75	Bedrock
															BROWN	LIMESTONE			24.38	
4703277	509794	4766863	23/10/1971	127	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	42.98	43.28	33.53	38.10	54.55	2.17	BROWN	CLAY	STONES		13.72	Bedrock
															BLUE	HARDPAN	GRAVEL	STONES	27.43	
															BLUE	CLAY			35.05	
																HARDPAN			36.88	
															BROWN	LIMESTONE			43.28	
4703334	511684	4766523	03/12/1971	127	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	43.28	70.10	36.58	45.72	54.55	2	BROWN	CLAY	STONES		1.52	Bedrock
															BROWN	CLAY	GRAVEL		4.57	
																HARDPAN	STONES		12.19	
																HARDPAN	MEDIUM SAND	STONES	16.76	
																HARDPAN			33.53	
															BROWN	LIMESTONE			70.10	
4703572	510434	4767043	19/12/1972	127	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	38.10	38.10	27.43	30.48	31.82	2		FILL			0.61	Bedrock
															BROWN	OVERBURDEN			0.91	
																GRAVEL	STONES		7.62	
															BLUE	CLAY			15.24	
																GRAVEL	STONES		22.25	
															BROWN	LIMESTONE			38.10	
4703684	512229	4768308	22/06/1973	127	Cable Tool	FRESH	Water Supply	Domestic	30.48	30.48	24.38	29.87	13.64	6	BROWN	SAND			0.61	Bedrock
															RED	SAND			11.28	
																SAND	GRAVEL		15.54	
															GREY	LIMESTONE			30.48	

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Summary of MECP Water Well Records

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MOECC Well No.	UTM Coordinates Easting (NAD 83)	UTM Coordinates Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth: Water Found (metres)	Depth: Total Depth (metres)	Depth: Static Level (metres)	Test Pumping: Level (metres)	Test Pumping: Rate (L/min)	Test Pumping: Duration (minutes)	Stratigraphy: Material				Depth to Unit Base (metres)	Aquifer Type
4703694	511622	4766948	12/07/1973	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	28.96	28.96	18.29	22.86	18.18	2.25	BROWN	CLAY	STONES		4.57	Bedrock
															GREY	CLAY	GRAVEL	STONES	24.38	
															BROWN	LIMESTONE			28.96	
4703711	511569	4767048	18/08/1973	127	Cable Tool	FRESH	Water Supply	Domestic	38.10	38.10	12.19	12.19	27.28	2		CLAY	STONES		22.86	Bedrock
																GRAVEL			24.38	
																LIMESTONE			38.10	
4703789	509434	4766565	07/11/1973	127	Cable Tool	FRESH	Recharge Well		28.65	28.96	12.19	16.76	54.55	2	BROWN	CLAY			4.57	Bedrock
															BLUE	CLAY	STONES	GRAVEL	27.13	
															BROWN	LIMESTONE			28.96	
4703829	509354	4766543	16/11/1973	127	Cable Tool	FRESH	Water Supply	Domestic	22.25	22.56	10.67	13.72	45.46	3	GREY	TOPSOIL			0.61	Overburden
															BLUE	CLAY	STONES		9.14	
															GREY	GRAVEL	SAND	CLAY	22.25	
															GREY	GRAVEL			22.56	
4703870	511582	4767170	18/04/1974	127	Cable Tool	FRESH	Water Supply	Domestic	26.52	26.82	21.34	21.95	45.46	1.25	BLACK	TOPSOIL	GRAVEL		0.30	Bedrock
															BROWN	CLAY	GRAVEL	SAND	1.83	
															BROWN	CLAY	SAND	GRAVEL	7.32	
															BROWN	SAND	CLAY		7.62	
															BROWN	CLAY	GRAVEL	BOULDERS	9.45	
															BROWN	SAND	CLAY		12.80	
															BROWN	CLAY	SAND		16.76	
															BROWN	LIMESTONE			21.64	
															BROWN	LIMESTONE			22.86	
															BROWN	LIMESTONE			26.52	
															BROWN	LIMESTONE			26.82	
4703881	509490	4766611	16/05/1974	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	28.65	28.96	12.19	15.24	45.46	1.5	BROWN	CLAY			5.18	Bedrock
															BLUE	CLAY	SANDSTONE	STONES	27.43	
															BROWN	LIMESTONE			28.96	
4703931	511577	4768770	28/06/1974	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	24.38	42.67	37.80	41.15	22.73	1.5	BROWN	CLAY			4.88	Bedrock
															BLUE	HARDPAN	BOULDERS		19.81	
															BROWN	LIMESTONE			42.67	
4703976	511271	4766956	26/08/1974	127	Rotary (Air)	FRESH	Water Supply	Domestic	15.24	15.24	9.14	12.19	22.73	1.5	BROWN	CLAY			1.52	Bedrock
															BROWN	SAND	GRAVEL		11.28	
															GREY	HARDPAN	SHALE		13.72	
															BROWN	LIMESTONE			15.24	
4704070	511648	4767293	12/12/1974	127	Rotary (Air)	FRESH	Water Supply	Domestic	48.77	48.77	32.92	36.58	22.73	1.5	BROWN	CLAY	SAND		5.49	Bedrock
															BROWN	GRAVEL	CLAY	STONES	15.85	
															BROWN	LIMESTONE			48.77	
4704086	511643	4767468	28/11/1974	127	Rotary (Air)	SULPHUR	Abandoned-Quality	Not Used	41.76	42.06	27.74	38.10	13.64	2	BROWN	SAND			10.67	Bedrock
															BROWN	LIMESTONE			42.06	
4704099	509222	4766502	17/01/1975	102	Cable Tool	FRESH	Water Supply	Domestic	24.99	25.30	8.84	15.24	45.46	1	BROWN	CLAY	SAND		0.91	Bedrock
															BROWN	SAND	CLAY		4.27	
															GREY	CLAY	BOULDERS	SAND	15.54	
															GREY	CLAY	SAND	GRAVEL	22.56	
															BROWN	SAND	CLAY	GRAVEL	24.08	
															BROWN	SHALE			24.69	
															GREY	LIMESTONE			25.30	
4704124	512094	4766923	17/04/1975	102	Rotary (Convent.)	FRESH	Water Supply	Domestic	34.14	40.84	23.47	26.21	27.28	1	BROWN	CLAY	SAND	GRAVEL	12.80	Bedrock
															GREY	CLAY	SAND	GRAVEL	27.74	
															BROWN	CLAY	GRAVEL	HARD	31.39	
															BROWN	LIMESTONE	HARD		34.14	
															GREY	LIMESTONE	HARD		40.84	
4704125	510934	4766503	23/04/1975	102	Rotary (Convent.)	FRESH	Water Supply	Domestic	19.51	26.21	14.63	15.24	22.73	1	BLACK	TOPSOIL	SOFT		0.30	Bedrock
															BROWN	CLAY	GRAVEL	BOULDERS	13.41	
															GREY	CLAY	SAND	GRAVEL	15.85	
															BROWN	LIMESTONE	HARD		19.20	
															GREY	LIMESTONE	HARD		26.21	
4704162	512014	4766543	04/06/1975	152	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	38.71	39.93	25.91	35.05	136.38	2	BROWN	CLAY	STONES		6.71	Bedrock
															BLUE	CLAY	STONES		15.24	
															GREY	HARDPAN	GRAVEL		37.19	
															BROWN	LIMESTONE			39.93	

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MOECC Well No.	UTM Coordinates Easting (NAD 83)	UTM Coordinates Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth: Water Found (metres)	Depth: Total Depth (metres)	Depth: Static Level (metres)	Test Pumping: Level (metres)	Test Pumping: Rate (L/min)	Test Pumping: Duration (minutes)	Stratigraphy	Stratigraphy: Material			Depth to Unit Base (metres)	Aquifer Type
4704304	511994	4766843	23/10/1975	102	Cable Tool	FRESH	Water Supply	Domestic	30.78	32.92	15.24	17.68	54.55	1		HARDPAN			20.73	Bedrock
																FINE SAND			30.78	
																FINE GRAVEL	WATER-BEARING		32.61	
															BROWN	LIMESTONE	HARD		32.92	
4704306	511714	4768523	05/12/1975	152	Rotary (Convent.)		Abandoned-Supply			47.24					BROWN	STONES	FILL		1.52	Bedrock
															BROWN	SAND			9.14	
															BROWN	LIMESTONE			47.24	
4704307	511774	4768623	10/12/1975	152	Rotary (Convent.)	SULPHUR	Abandoned-Supply		60.96	70.10	24.38	70.10	13.64	1	BROWN	STONES	FILL		1.52	Bedrock
															BROWN	SAND			3.35	
															GREY	HARDPAN	STONES		5.79	
															BROWN	LIMESTONE			30.48	
																LIMESTONE	SOFT		43.59	
															BROWN	LIMESTONE	HARD		48.77	
															GREY	LIMESTONE	VERY	HARD	70.10	
4704443	511734	4767483	17/08/1976	127	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	45.72	46.94	28.35	33.53	36.37	1.5	BROWN	CLAY	GRAVEL		5.79	Bedrock
															BLUE	CLAY	STONES		16.46	
															BROWN	LIMESTONE			46.94	
4704493	511474	4767103	02/09/1976	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	26.21	26.52	19.81	23.16	54.55	2	BROWN	CLAY	GRAVEL	STONES	4.88	Bedrock
															GREY	HARDPAN	STONEY		14.02	
															BROWN	LIMESTONE			26.52	
4704558	511614	4767343	18/05/1977	127	Cable Tool	FRESH	Water Supply	Domestic	24.69	24.69	11.89	22.25	31.82	3.25	BROWN	GRAVEL	STONES		10.36	Bedrock
															GREY	SHALE	SAND	LAYERED	12.80	
															GREY	LIMESTONE	HARD		24.69	
4704608	511674	4767543	08/06/1977	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	42.67	45.11	27.43	33.53	36.37	2	BROWN	SAND	GRAVEL		13.72	Bedrock
															BROWN	LIMESTONE	ROCK		45.11	
4704614	512154	4768203	22/07/1977	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	24.38	51.82	27.43	45.72	18.18	2	BROWN	CLAY			1.52	Bedrock
															BROWN	GRAVEL			4.57	
															GREY	CLAY	STONES		15.24	
															BROWN	LIMESTONE	ROCK		50.29	
															BLUE	ROCK	HARD		51.82	
4704670	510574	4766723	14/10/1977	152	Rotary (Convent.)	FRESH	Water Supply	Industrial/Domestic	13.72	55.78	29.87	38.10	113.65	2	BROWN	FILL	GRAVEL	STONES	6.71	Bedrock
																ROCK	SOFT		10.67	
															BROWN	LIMESTONE			36.58	
															BROWN	LIMESTONE	LAYERED		55.78	
4704960	512374	4768423	27/04/1979	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	45.72	45.72	27.43	36.58	22.73	2	BROWN	GRAVEL	STONES		7.62	Bedrock
															GREY	HARDPAN	STONES		17.68	
															BROWN	LIMESTONE	STONES		45.72	
4704961	512314	4768423	25/04/1979	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	33.53	33.53	27.43	30.48	36.37	2	BROWN	SAND	GRAVEL		6.10	Bedrock
															GREY	HARDPAN	STONES		14.94	
															BROWN	LIMESTONE			33.53	
4705098	509654	4766783	12/10/1979	305	Rotary (Convent.)		Water Supply	Municipal		125.27	41.15	46.33	36.37	24		TOPSOIL			0.30	Bedrock
															BROWN	CLAY	GRAVEL	BOULDERS	1.83	
																SAND	GRAVEL		3.35	
															BROWN	CLAY	GRAVEL	BOULDERS	4.27	
																TILL	SILT	STONEY	9.45	
																BOULDERS	STONES	CLAY	15.85	
															GREY	CLAY	GRAVEL	SILTY	19.81	
																BOULDERS	CLAY	SILTY	20.73	
															GREY	CLAY	STONEY		22.56	
																TILL	SILT	STONEY	28.35	
																LIMESTONE	SHALE		29.26	
																SHALE			31.39	
																LIMESTONE	SHALE	LAYERED	34.75	
															GREY	LIMESTONE	HARD		36.88	
															BROWN	LIMESTONE			37.49	
																SHALE			46.63	
															BROWN	LIMESTONE	HARD	LAYERED	97.54	
															GREY	LIMESTONE	HARD		103.33	
															BROWN	LIMESTONE	HARD	LAYERED	120.70	
															GREY	LIMESTONE			125.27	

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MOECC Well No.	UTM Coordinates Easting (NAD 83)	UTM Coordinates Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth: Water Found (metres)	Depth: Total Depth (metres)	Depth: Static Level (metres)	Test Pumping: Level (metres)	Test Pumping: Rate (L/min)	Test Pumping: Duration (minutes)	Stratigraphy: Material				Depth to Unit Base (metres)	Aquifer Type
4705111	511714	4766523	26/11/1979	127	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	56.39	60.96	39.62	53.34	90.92	2	BROWN	CLAY	SOFT		15.24	Bedrock
															GREY	HARDPAN	STONES		39.62	
															BROWN	LIMESTONE	SOFT		60.96	
4705189	511334	4767323	18/04/1980	127	Rotary (Convent.)	FRESH	Test Hole		18.29	43.28					BROWN	GRAVEL			1.83	Bedrock
															BROWN	SAND	GRAVEL		6.10	
															GREY	HARDPAN	BOULDERS		11.28	
															BROWN	LIMESTONE			43.28	
4705190	511614	4767583	17/04/1980	127	Rotary (Convent.)	FRESH	Test Hole		39.62	39.62					BROWN	FILL	STONES		1.52	Bedrock
															GREY	HARDPAN	GRAVEL		10.36	
															BROWN	LIMESTONE	STONES		39.62	
4705191	511624	4767403	17/04/1980	127	Cable Tool	FRESH	Test Hole		42.67	43.28					BROWN	GRAVEL	STONES	HARD	2.44	Bedrock
															BROWN	CLAY			6.10	
															GREY	HARDPAN	STONES		11.58	
															BROWN	LIMESTONE	STONES		43.28	
4705214	508974	4767983	02/07/1980	127	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	29.87	30.48	6.10	13.72	68.19	2	BROWN	CLAY	STONES		4.57	Bedrock
															GREY	HARDPAN	STONES		28.96	
															BROWN	SHALE	STONES		30.18	
															BROWN	LIMESTONE			30.48	
4705259	511014	4765863	03/09/1980	127	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	44.50	44.50	35.66	41.15	45.46	2	BROWN	SAND			3.05	Bedrock
															BROWN	CLAY	GRAVEL		6.10	
															GREY	HARDPAN	STONES	HARD	33.53	
															BROWN	LIMESTONE			44.50	
4705305	511014	4766603	19/01/1981	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	23.77	24.38	13.72	16.76	45.46	1.5	BROWN	GRAVEL	STONES	CLAY	6.10	Bedrock
															GREY	HARDPAN	GRAVEL	STONES	15.24	
															GREY	LIMESTONE	STONES		24.38	
4705306	512574	4767383	18/12/1980	127	Rotary (Convent.)	FRESH	Water Supply	Livestock/Domestic	50.60	51.82	42.67	47.24	45.46	1.5	BROWN	CLAY			1.52	Bedrock
															BROWN	GRAVEL	SAND		10.67	
															GREY	CLAY	STONES		30.48	
															GREY	HARDPAN	STONES		41.45	
															BROWN	LIMESTONE			51.82	
4705386	510954	4767423	19/06/1981	203	Rotary (Convent.)	FRESH	Water Supply	Domestic/Cooling And A/C	36.58	52.73	28.35	45.72	272.77	2	BROWN	FILL			6.10	Bedrock
															BROWN	LIMESTONE	SHALE		7.32	
															BROWN	LIMESTONE			52.73	
4705387	510954	4767383	23/06/1981	127	Rotary (Convent.)	FRESH	Water Supply	Industrial	12.19	60.96	18.29	54.86	9.09	2	BROWN	FILL			6.10	Bedrock
															BROWN	SHALE			7.32	
															BROWN	LIMESTONE			52.73	
															BROWN	LIMESTONE	HARD	LAYERED	60.96	
4705447	511314	4767023	07/12/1981	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	15.24	16.76	10.97	15.24	22.73	2	BROWN	GRAVEL			3.05	Bedrock
															BROWN	SAND			10.67	
															GREY	HARDPAN	STONES		13.72	
															BROWN	LIMESTONE			16.76	
4705494	511014	4766603	23/06/1982	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	16.76	33.53	27.13	32.00	13.64	2	BROWN	GRAVEL	STONES		14.33	Bedrock
															BROWN	LIMESTONE	STONES		33.53	
4705608	511614	4767423	26/10/1983	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	36.58	45.11	27.43	42.67	22.73	1.5	BROWN	SAND	GRAVEL		10.67	Bedrock
															BROWN	LIMESTONE	STONES		45.11	
4705820	512294	4767123	25/10/1985	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	42.67	42.67	30.48	33.53	45.46	1.5	BROWN	CLAY	GRAVEL		4.57	Bedrock
															GREY	CLAY	STONES		18.29	
															GREY	HARDPAN	STONES		39.32	
															BROWN	LIMESTONE			42.67	
4705841	511434	4766803	15/01/1985	127	Cable Tool	FRESH	Water Supply	Domestic	26.52	26.82	23.77	24.38	40.91	1	BROWN	CLAY	STONES	DENSE	0.61	Bedrock
															BROWN	GRAVEL	CLAY		6.71	
															GREY	SAND		PACKED	7.92	
															GREY	GRAVEL	CLAY		10.97	
															GREY	GRAVEL	SAND		20.12	
															GREY	SAND	CLAY	PACKED	20.73	
															GREY	GRAVEL	CLAY		25.91	
															BROWN	LIMESTONE		HARD	26.82	
4705848	511594	4768543	26/02/1986	152	Rotary (Convent.)	FRESH	Water Supply	Industrial	7.01	62.48	10.67	30.48	68.19	1.5	GREY	HARDPAN			1.52	Bedrock
															BROWN	SAND			3.05	
															BROWN	LIMESTONE			62.48	

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Prepared by: RM
Checked by: DC

Summary of MECP Water Well Records

Hydrogeological Assessment
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MOECC	UTM Coordinates		Date	Casing	Drilling	Water	Well	Water	Depth			Test Pumping			Stratigraphy					
Well No.	Easting (NAD 83)	Northing (NAD 83)	Drilled	Diameter (millimetres)	Method	Quality	Status	Use	Water Found (metres)	Total Depth (metres)	Static Level (metres)	Level (metres)	Rate (L/min)	Duration (minutes)	Material				Depth to Unit Base (metres)	Aquifer Type
4705885	511844	4766868	04/06/1986	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	24.08	30.48	20.42	27.43	27.28	2	BROWN	SAND			4.27	Bedrock
															GREY	COARSE GRAVEL	STONES	DRY	10.36	
															BROWN	CLAY			12.19	
															GREY	CLAY	BOULDERS		20.42	
															GREY	LIMESTONE			30.48	
4705899	509264	4766493	16/06/1986	127	Cable Tool	FRESH	Test Hole		34.44	34.75	15.24	21.34	45.46	1.5	BROWN	TOPSOIL			0.61	Bedrock
															BROWN	SAND	GRAVEL		3.96	
															GREY	CLAY	STONES	GRAVEL	26.21	
															GREY	SHALE			26.52	
															GREY	LIMESTONE			34.75	
4705952	511584	4768528	07/10/1986	203	Rotary (Convent.)	SULPHUR	Water Supply	Industrial	73.46	91.44	25.91	60.96	136.38	3	BROWN	CLAY		GRAVELLY	7.01	Bedrock
															BROWN	LIMESTONE	ROCK		91.44	
4706002	512344	4768528	25/02/1987	127	Cable Tool	FRESH	Water Supply	Domestic	37.19	37.19	28.96	34.75	45.46	2	BROWN	FILL	STONES		1.22	Bedrock
															BROWN	CLAY	STONES		4.57	
															GREY	HARDPAN	STONES		14.02	
															BROWN	LIMESTONE			37.19	
4706058	511014	4766613	18/06/1987	102	Rotary (Convent.)	FRESH	Water Supply	Domestic	48.77	49.38	32.00	42.67	45.46	1.5	BROWN	GRAVEL	STONES		14.33	Bedrock
															BROWN	LIMESTONE	ROCK		33.53	
															BROWN	LIMESTONE			49.38	
4706139	509354	4766533	30/09/1987	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	29.26	29.57	14.33	18.29	45.46	1.5	BROWN	CLAY			10.36	Bedrock
															GREY	SAND	GRAVEL		18.29	
															GREY	CLAY			28.04	
															GREY	LIMESTONE			29.57	
4706243	511124	4767393	25/04/1988	152	Rotary (Convent.)	FRESH	Water Supply	Industrial	39.62	56.39	33.53	36.58	227.30	1.5	BROWN	FILL	LIMESTONE		36.58	Bedrock
															BROWN	LIMESTONE	ROCK		56.39	
4706271	510919	4766513	17/06/1988	102	Rotary (Convent.)	FRESH	Water Supply	Domestic	73.15	79.86	39.62	45.72	45.46	2	BROWN	CLAY	BOULDERS		3.05	Bedrock
															GREY	CLAY	STONES	GRAVELLY	17.98	
															BROWN	LIMESTONE			79.86	
4706311	511504	4767163	09/07/1988	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	45.72	47.55	29.26	42.67	36.37	1.5	BROWN	GRAVEL	STONES		13.11	Bedrock
															BROWN	LIMESTONE			47.55	
4706364	511674	4767363	16/09/1988	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	47.55	47.55	27.74	41.15	36.37	1.5	BROWN	CLAY	GRAVEL		4.27	Bedrock
															GREY	HARDPAN	STONES		15.24	
															BROWN	LIMESTONE			47.55	
4706430	512223	4767818	07/11/1988	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	45.72	47.24	40.23	44.20	45.46	5.5	BROWN	CLAY		GRAVELLY	7.62	Bedrock
																GRAVEL	STONES		9.14	
															GREY	CLAY	GRAVELLY		15.85	
															GREY	HARDPAN	STONES		32.92	
															BROWN	LIMESTONE			47.24	
4706529	511495	4767124	29/05/1989	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	23.16	23.16	14.02	21.34	31.82	1.5	BROWN	GRAVEL	CLAY		4.57	Bedrock
															GREY	HARDPAN	STONES	GRAVELLY	13.41	
															BROWN	LIMESTONE			23.16	
4706550	511787	4767378	12/07/1989	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	45.72	46.02	35.05	36.58	27.28	1.5	BROWN	CLAY	GRAVEL		5.79	Bedrock
															BLUE	CLAY	STONES		16.46	
															BROWN	LIMESTONE	ROCK		46.02	
4706587	512455	4768481	24/08/1989	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	41.45	41.45	34.14	39.01	45.46	1.5	BROWN	GRAVEL	STONES		4.57	Bedrock
															GREY	HARDPAN	STONES		17.68	
															BROWN	LIMESTONE			41.45	
4706611	511479	4767072	22/09/1989	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	44.20	44.20	35.05	39.62	36.37	2	BROWN	SAND	CLAY		4.57	Bedrock
															GREY	CLAY	GRAVEL		15.24	
															BROWN	SHALE			16.76	
															BROWN	LIMESTONE			44.20	
4706612	510704	4766292	12/09/1989	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	47.24	47.24	39.32	44.50	45.46	2	BROWN	CLAY		GRAVELLY	6.10	Bedrock
															BLUE	CLAY		GRAVELLY	10.67	
															GREY	HARDPAN			18.29	
															BROWN	LIMESTONE			47.24	
4706633	511826	4767611	04/10/1989	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	50.29	50.29	32.61	45.72	45.46	2	BROWN	GRAVEL	STONES		3.66	Bedrock
															GREY	CLAY	STONES		6.10	
															GREY	HARDPAN	STONES	GRAVELLY	19.51	
															BROWN	LIMESTONE			50.29	

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Summary of MECP Water Well Records

Hydrogeological Assessment
Southwest Landfill
Centreville, Ontario

MOECC	UTM Coordinates		Date	Casing	Drilling	Water	Well	Water	Water	Depth Total	Static	Test Pumping Level	Rate	Duration	Stratigraphy				Depth to	Aquifer
Well No.	Easting (NAD 83)	Northing (NAD 83)	Drilled	Diameter (millimetres)	Method	Quality	Status	Use	Found (metres)	Depth (metres)	Level (metres)	Level (metres)	Rate (L/min)	Duration (minutes)		Material			Unit Base (metres)	Type
4706725	510150	4766455	20/12/1989	305	TBD		Abandoned-Supply			103.94						TOPSOIL			0.30	Bedrock
																COARSE SAND		DRY	5.79	
																CLAY	GRAVEL		7.32	
																LIMESTONE		FRACTURED	10.06	
															BROWN	LIMESTONE			11.58	
															GREY	LIMESTONE			37.80	
															BROWN	LIMESTONE			49.99	
															GREY	LIMESTONE			103.94	
4706742	510804	4767603	16/05/1990		Rotary (Convent.)		Test Hole			56.39					BROWN	CLAY			0.91	Bedrock
															GREY	GRAVEL			4.57	
															GREY	GRAVEL	STONES		7.62	
															GREY	CLAY	GRAVEL	STONES	21.64	
															GREY	SHALE			23.16	
															BROWN	SHALE	SAND		23.47	
															GREY	LIMESTONE			56.39	
4706743	510739	4767773	15/05/1990		Rotary (Convent.)		Test Hole	Not Used		60.96					BROWN	CLAY			0.91	Bedrock
															GREY	GRAVEL			10.36	
															GREY	CLAY	STONES		24.08	
															GREY	SHALE	STONES		25.91	
															GREY	SHALE	LIMESTONE		60.96	
4706744	510864	4767443	14/05/1990	127	Rotary (Convent.)		Test Hole	Not Used		59.44					BROWN	CLAY		SILTY	1.22	Bedrock
															GREY	GRAVEL	CLAY		9.14	
															GREY	HARDPAN			22.25	
															GREY	SHALE			22.86	
															GREY	ROCK			23.47	
																LIMESTONE			59.44	
4706745	510684	4767173	11/05/1990	127	Rotary (Convent.)	FRESH	Water Supply	Not Used	59.44	59.44	21.64	59.44	13.64	2	BROWN	CLAY			0.91	Bedrock
															GREY	GRAVEL			3.05	
															BROWN	CLAY	STONES		7.62	
															GREY	CLAY			9.75	
																SLATE			10.36	
															GREY	CLAY	STONES		19.81	
															GREY	LIMESTONE	LAYERED		59.44	
4706746	510624	4767343	10/05/1990	127	Rotary (Convent.)	FRESH	Test Hole	Not Used	24.38	60.96		24.38	45.46	2	BROWN	CLAY			0.91	Bedrock
															GREY	GRAVEL	CLAY		6.71	
															GREY	CLAY	STONES		21.34	
															GREY	LIMESTONE	LAYERED		60.96	
4706747	510559	4767513	09/05/1990	127	Rotary (Convent.)	FRESH	Test Hole	Not Used	36.58	59.44		36.58	36.37	2	BROWN	CLAY		SANDY	0.91	Bedrock
															GREY	GRAVEL			5.18	
															GREY	CLAY	GRAVEL		24.69	
															GREY	SHALE			25.30	
															GREY	LIMESTONE			30.48	
															GREY	LIMESTONE	LAYERED		59.44	
4706748	510494	4767683	09/05/1990	127	Rotary (Convent.)	FRESH	Test Hole	Not Used	30.48	59.44		30.48	36.37	2	BROWN	CLAY			1.22	Bedrock
																GRAVEL			6.71	
																GRAVEL	CLAY		12.19	
																GRAVEL	HARDPAN		23.16	
															BROWN	LIMESTONE			41.15	
															GREY	LIMESTONE			59.44	
4706776	511994	4766900	25/05/1990	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	35.97	35.97	24.38	30.48	36.37	2	BROWN	CLAY	GRAVEL	STONES	4.27	Bedrock
															GREY	CLAY	STONES		25.91	
															GREY	CLAY		GRAVELLY	31.09	
															GREY	LIMESTONE			35.97	
4706832	511011	4765921	27/08/1990	127	Rotary (Convent.)	FRESH	Water Supply	Domestic/Livestock	54.56	54.56	40.54	48.77	45.46	3	BROWN	SAND			3.05	Bedrock
															BROWN	CLAY	GRAVEL		6.10	
															GREY	HARDPAN	STONES	HARD	33.53	
															BROWN	LIMESTONE			44.50	
															BROWN	LIMESTONE			54.56	

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Summary of MECP Water Well Records

Hydrogeological Assessment
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MOECC Well No.	UTM Coordinates Easting (NAD 83)	UTM Coordinates Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth Water Found (metres)	Depth Total Depth (metres)	Depth Static Level (metres)	Test Pumping Level (metres)	Test Pumping Rate (L/min)	Test Pumping Duration (minutes)	Stratigraphy Material				Depth to Unit Base (metres)	Aquifer Type
4706877	511546	4768644	16/04/1991	152	Rotary (Convent.)	SULPHUR	Water Supply	Industrial	73.46	102.11					BROWN	CLAY		GRAVELLY	7.01	Bedrock
															BROWN	LIMESTONE	ROCK		91.44	
															BROWN	LIMESTONE	ROCK		99.06	
															BROWN	LIMESTONE	ROCK		102.11	
4706998	509670	4768383	14/11/1991	127	Rotary (Convent.)	FRESH	Water Supply	Domestic/Commercial	53.34	53.34	5.49	24.38	54.55	2		GRAVEL	SILT		0.91	Bedrock
															GREY	CLAY		GRAVELLY	9.14	
															GREY	CLAY		STICKY	15.24	
															GREY	HARDPAN			27.43	
															BROWN	LIMESTONE			53.34	
4707216	510687	4765743	30/10/1993	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	47.85	47.85	28.96	42.67	45.46	2	BROWN	GRAVEL			4.57	Bedrock
															BROWN	CLAY	GRAVEL		9.14	
															GREY	CLAY	HARD		21.34	
															GREY	HARDPAN	STONES		36.88	
															BROWN	LIMESTONE			47.85	
4707266	511026	4765951	09/06/1994	152	Rotary (Convent.)	MINERIAL	Water Supply	Domestic/Livestock	57.61	57.61	44.20	50.29	68.19	2	BROWN	CLAY			4.57	Bedrock
															GREY	CLAY			24.38	
																HARDPAN			31.70	
																HARDPAN	GRAVEL	SHALE	34.75	
															BROWN	LIMESTONE			57.61	
4707267	512259	4768356	22/06/1994	127	Rotary (Convent.)	MINERIAL	Water Supply	Domestic	41.76	41.76	29.87	35.05	36.37	2	BROWN	CLAY			4.88	Bedrock
															GREY	GRAVEL	STONES		10.97	
															GREY	HARDPAN			16.76	
															GREY	LIMESTONE			41.76	
4707400	511604	4768485	15/06/1995				Abandoned-Supply			21.34						PREV. DRILLED			21.34	Overburden
4707401	511562	4768733	15/06/1995				Abandoned-Supply			15.24						PREV. DRILLED			15.24	Overburden
4707402	511602	4768395	15/06/1995				Abandoned-Supply			12.80						PREV. DRILLED			12.80	Overburden
4707424	512263	4768258	20/07/1995	127	Rotary (Convent.)	MINERIAL	Water Supply	Domestic	20.42	20.42	11.58	15.24	68.19	3	BROWN	CLAY	STONES		5.49	Bedrock
															BROWN	CLAY	BOULDERS		8.53	
															GREY	LIMESTONE			20.42	
4707591	510507	4767773	08/11/1996	102	Rotary (Convent.)	FRESH	Abandoned-Supply		3.66	58.83					BROWN	COARSE GRAVEL	BOULDERS		6.10	Bedrock
															GREY	GRAVEL			9.14	
															GREY	CLAY	SILTY	BOULDERS	21.34	
															GREY	GRAVEL	STONES		24.08	
															BROWN	ROCK			25.30	
															WHITE	LIMESTONE			55.78	
															BROWN	ROCK			58.83	
4707592	510725	4767878	19/11/1996	102		FRESH			9.14	61.57					BROWN	GRAVEL	STONES		9.14	Bedrock
															GREY	GRAVEL			10.67	
															GREY	CLAY	SILTY	STONES	19.81	
															GREY	GRAVEL	SAND		21.34	
															GREY	CLAY	SILTY	STONES	26.82	
															BROWN	ROCK			28.35	
															GREY	LIMESTONE			53.95	
															WHITE	LIMESTONE			59.13	
															BROWN	ROCK			61.57	
4707593	510613	4767293	03/11/1996	102	Diamond	FRESH	Abandoned-Supply		6.10	60.35					BLACK	TOPSOIL	GRAVEL	CLAY	0.61	Bedrock
															BROWN	CLAY	SANDY		2.13	
															BROWN	GRAVEL	BOULDERS		7.01	
															GREY	CLAY	SILTY	STONES	17.07	
															BLUE	BOULDERS			17.68	
															GREY	SAND	GRAVEL	SILT	21.95	
															BLUE	TILL			22.25	
															GREY	ROCK			26.21	
															WHITE	LIMESTONE			53.04	
															BROWN	ROCK			60.35	
4707594	510665	4767363	22/11/1996	102	Rotary (Convent.)	FRESH	Abandoned-Supply	Not Used	7.62	61.57					BROWN	COARSE GRAVEL	STONES		7.62	Bedrock
															GREY	GRAVEL	SAND		9.14	
															GREY	CLAY	SILTY	STONES	18.29	
															GREY	SAND	GRAVEL		21.34	
															GREY	CLAY	SILTY	GRAVEL	22.86	
															GREY	ROCK			27.43	
															GREY	LIMESTONE			60.35	
															BROWN	ROCK			61.57	

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Summary of MECP Water Well Records

Hydrogeological Assessment
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MOECC Well No.	UTM Coordinates Easting (NAD 83)	UTM Coordinates Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth Water Found (metres)	Depth Total Depth (metres)	Static Level (metres)	Test Pumping Level (metres)	Test Pumping Rate (L/min)	Test Pumping Duration (minutes)	Stratigraphy Material			Depth to Unit Base (metres)	Aquifer Type
4707614	511126	4766740	12/03/1997	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	24.38	24.38	11.58	19.81	27.28	2	BROWN	CLAY		6.10	Bedrock
															GREY	HARDPAN	STONES	14.94	
															BROWN	LIMESTONE		24.38	
4707795	511631	4766856	05/08/1998	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	41.15	41.15	33.53	38.10	36.37	2	BROWN	CLAY	HARD	4.57	Bedrock
																STONES	HARDPAN	22.25	
															BROWN	LIMESTONE		41.15	
4707808	511804	4766743	08/09/1998	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	41.76	41.76	30.48	38.71	27.28	3		FILL		3.05	Bedrock
																GRAVEL		13.72	
															GREY	HARDPAN		20.42	
															BROWN	LIMESTONE		41.76	
4707832	510834	4767147	22/09/1998	152	Rotary (Convent.)	FRESH	Water Supply	Domestic/Public	80.16	80.16	27.74	45.72	136.38	2	BROWN	GRAVEL	SANDY	7.62	Bedrock
															BROWN	LIMESTONE		80.16	
4707835	511627	4767456	30/10/1998	102	Rotary (Convent.)	FRESH	Water Supply	Domestic	72.24	72.24	32.92	68.58	45.46	2		PREV. DRILLED		42.06	Bedrock
															BROWN	LIMESTONE		72.24	
4707896	511662	4766844	24/11/1998	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	48.16	48.16	39.32	45.11	36.37	2	BROWN	CLAY	STONES	4.57	Bedrock
															GREY	CLAY		12.19	
															GREY	HARDPAN		27.13	
															BROWN	LIMESTONE		48.16	
4707930	510954	4767365	12/01/1999	152		Not stated	Water Supply		76.20	76.20	28.35	45.72	227.30	3		PREV. DRILLED		67.06	Bedrock
															BROWN	LIMESTONE		76.20	
4708149	511733	4767148	11/01/2000	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	53.95	53.95	38.71	48.77	36.37	2	BROWN	LIMESTONE		53.95	Bedrock
4708150	512159	4767613	20/03/2000	152	Rotary (Convent.)	FRESH	Water Supply	Domestic	39.62	39.62	36.27	38.10	45.46	3	BROWN	CLAY		4.57	Bedrock
															GREY	HARDPAN	FRACTURED	22.86	
															BROWN	LIMESTONE		39.62	
4708163	512249	4769074	01/04/2000	152	Rotary (Convent.)	FRESH	Water Supply	Public	92.35	92.35	22.25	73.15	454.61	3		GRAVEL	STONES	4.57	Bedrock
																HARDPAN	STONES	13.11	
															BROWN	LIMESTONE		92.35	
4708165	511501	4767077	17/04/2000	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	47.85	47.85	39.01	44.50	45.46	2	BROWN	GRAVEL		4.57	Bedrock
															GREY	HARDPAN		18.29	
															BROWN	LIMESTONE		47.85	
4708166	511691	4767417	12/04/2000	152	Not Known	Not stated			43.89	43.89	29.87	40.84	68.19	2		GRAVEL	STONEY	14.94	Bedrock
															BROWN	LIMESTONE		43.89	
4708422	511983	4768618	31/10/2001	152	Rotary (Air)	FRESH	Water Supply	Industrial	67.97	67.97	25.91	54.86	90.92	2		FILL	LIMESTONE	29.87	Bedrock
															BROWN	LIMESTONE		67.97	
4708473	509231	4766600	29/04/2002	127	Rotary (Convent.)	FRESH	Water Supply	Domestic	29.26	29.26	11.28	16.76	54.55	2	BROWN	CLAY		4.57	Bedrock
															GREY	CLAY	STONES	12.19	
															GREY	HARDPAN		19.51	
															BROWN	LIMESTONE		29.26	
4708492	511879	4766524	03/06/2002	152	Rotary (Convent.)	FRESH	Water Supply	Livestock	45.72	45.72	28.96	39.62	136.38	3	BROWN	CLAY		4.57	Bedrock
															GREY	HARDPAN		38.40	
															BROWN	LIMESTONE		45.72	
4708546	511852	4766520	11/09/2002	152	Rotary (Convent.)	FRESH	Water Supply	Domestic/Livestock	76.20	76.20	45.72	70.10	136.38	2	BROWN	CLAY		4.57	Bedrock
															GREY	CLAY		15.24	
															GREY	HARDPAN		38.40	
															GREY	LIMESTONE		76.20	
4708641	509263	4768864	17/02/2003	152	Rotary (Convent.)	FRESH	Water Supply	Livestock	33.53	33.53	1.52	27.43	90.92	2	BROWN	CLAY	STONES	4.57	Bedrock
															GREY	HARDPAN	STONES	17.37	
															BROWN	LIMESTONE		33.53	
4708749	512558	4768103	22/09/2003	152	Rotary (Convent.)	FRESH	Water Supply	Domestic	47.55	47.55	35.05	44.20	54.55	2	BROWN	CLAY		4.57	Bedrock
															GREY	CLAY		16.76	
															GREY	HARDPAN		41.15	
															BROWN	LIMESTONE		47.55	
4708968	511672	4766788	01/10/2004				Abandoned-Supply			3.66								3.66	
4708969	511691	4766767	01/10/2004	156	Rotary (Air)	MINERIAL	Water Supply	Domestic	23.48	23.48	15.55	19.82	68.19	2	BROWN	CLAY	STONES	4.57	Bedrock
															GREY	HARDPAN	STONES	19.21	
															BROWN	LIMESTONE	FRACTURED	23.48	
4708996	511483	4768794	05/01/2005	156	Rotary (Convent.)	FRESH	Water Supply	Domestic	60.06	60.06	41.16	54.88	45.46	1.5	BROWN	CLAY		4.57	Bedrock
															GREY	HARDPAN		21.34	
															BROWN	LIMESTONE		60.06	
4708998	511492	4768785	03/02/2005				Abandoned-Supply			47.87								16.40	
																		47.87	

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Summary of MECP Water Well Records

Hydrogeological Assessment
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MOECC Well No.	UTM Coordinates Easting (NAD 83)	UTM Coordinates Northing (NAD 83)	Date Drilled	Casing Diameter (millimetres)	Drilling Method	Water Quality	Well Status	Water Use	Depth: Water Found (metres)	Depth: Total Depth (metres)	Test Pumping: Static Level (metres)	Test Pumping: Level (metres)	Test Pumping: Rate (L/min)	Test Pumping: Duration (minutes)	Stratigraphy: Material				Stratigraphy: Depth to Unit Base (metres)	Aquifer Type
4709272	510357	4765812	06/07/2006				Abandoned-Other													
4709294	509846	4768348	18/05/2006	159	Rotary (Air)		Water Supply	Livestock	60.05	60.05	41.76	53.64	8.00	1.5	BROWN	CLAY			4.57	Bedrock
															GREY	CLAY			12.80	
															GREY	HARDPAN			25.30	
															BROWN	LIMESTONE			60.05	
4709353	511429	4766549	21/09/2006	159	Rotary (Convent.)	FRESH	Water Supply	Domestic/Livestock	47.85	47.85	28.35	33.53	30.00	1.5	BROWN	CLAY	STONES		4.57	Bedrock
															GREY	HARDPAN	STONES		30.48	
															BROWN	LIMESTONE			47.85	
7040111	509546	4768307	24/11/2006		Boring		Abandoned-Other													
7116479	511524	4766961	11/06/2008	19	BORING	Not stated	Test Hole	Monitoring	4.90	7.80	2.00				BROWN	SILT		TOPSOIL	0.15	
															BROWN	SAND	GRAVEL		5.40	
															BROWN	SAND	GRAVEL		7.80	
7119076	510515	4770115	08/10/2008	92	Not Known	FRESH	Observation Wells	Monitoring			18.29		45.46	1						
7122071	511554	4768528	06/04/2009				Water Supply													
7122072	511561	4768535	06/04/2009				Water Supply													
7143466	510101	4766479	18/03/2010				Abandoned-Other													
7144999	510394	4768795	03/04/2010				Observation Wells													
7145925	511241	4769821	30/04/2010				Abandoned-Other													
7146058	510032	4766035	05/05/2010		Driving		Test Hole	Test Hole		3.96					BROWN	TOPSOIL	SAND	LOOSE	1.52	
															BROWN	SAND	SAND	SOFT	2.13	
															BROWN	SAND	GRAVEL		3.96	
7158157	509429	4766576	16/12/2010				Abandoned-Other													
7170494	508897	4768770	12/09/2011	159	Rotary (Convent.)	FRESH	Water Supply	Domestic	35.66	35.66	10.36	24.38	45.46	1.5	BROWN	CLAY			4.57	
															GREY	HARDPAN			26.21	
															BROWN	LIMESTONE			35.66	
7186059	510093	4766478	15/08/2012	51	Boring		Observation Wells	Monitoring		9.14					BROWN	SAND	SILT	STONES	3.66	
															GREY	SAND	SILT	STONES	6.10	
															BROWN	SAND	SILT	FINE SAND	7.92	
															GREY	SAND	GRAVEL	WATER-BEARING	9.14	
7186797	511583	4767397	31/07/2012	159	Rotary (Convent.)	FRESH	Water Supply	Domestic	47.85	47.85	27.43	27.43	45.46	1.5	BROWN	SAND	GRAVEL		10.67	
															BROWN	LIMESTONE			47.85	
7186798	511481	4766901	31/07/2012				Abandoned-Other													
7206210	511783	4767548	20/06/2013	159	Rotary (Convent.)	FRESH	Water Supply	Domestic	46.33	46.33	29.57	41.76	45.46	1.5	BROWN	CLAY	STONES		4.57	
															GREY	HARDPAN	STONES		16.76	
															BROWN	LIMESTONE			46.33	
7221982	511729	4767437	14/05/2014	159	Rotary (Convent.)	FRESH	Water Supply	Domestic	47.85	47.85	32.31	44.20	45.46	1.5	BROWN	GRAVEL	STONES		5.18	
															GREY	HARDPAN	STONES		17.37	
															BROWN	LIMESTONE			47.85	
7271630	512312	4767079	30/08/2016	152	Rotary (Convent.)	FRESH	Water Supply	Domestic	39.62	41.76	28.65	33.53	68.19	2	BROWN	GRAVEL			4.88	
															GREY	CLAY	GRAVEL		9.75	
															GREY	CLAY			29.26	
															GREY	HARDPAN			37.80	
															GREY	LIMESTONE			41.76	

NOTES: 1. Well records provided electronically by the Ontario Ministry of the Environment, Conservation and Parks on July 3, 2018.
2. See Figure 8.3 for well locations.
3. Table to be read in conjuction with accompanying report.

DRAFT

Summary of Well Survey Results

Hydrogeological Assessment
Southwest Landfill
Centreville, Ontario

STREET	RESPONSE DATE[2]	EASTING[3]	NORTHING[3]	APPROXIMATE YEAR CONSTRUCTED	WELL TYPE	CASING TYPE	CASING DIAMETER (mm)	REPORTED NO. OF WELLS	REPORTED WELL DEPTH (m)	REPORTED WATER QUALITY	WATER USE	COMMENTS
33rd Line	June 25 2018	509794	4766863	1971	Drilled	Steel	152.4	1	44	Good	Domestic	Well head not easily accessible, no previous quality testing.
33rd Line	June 19 2018	*509527*	*4767484*	-	-	-	-	1	-	Good	Domestic/ Irrigation	Owner had limited information. Possible refers to well ID 4701943
33rd Line											Industry	
Mill Line											Domestic	
Mill Line											Domestic	
Mill Line												
Mill Line											Domestic	
Mill Line											Domestic	
Mill Line												
Mill Line											Domestic	
Mill Line											Domestic	
Mill Line											Domestic	
Mill Line											Domestic	
Mill Line												
Mill Line											Domestic	
Mill Line												
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd												
Beachville Rd												
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd	June 26 2018	-	-	-	-	-	-	-	-	-	Domestic	No Well information provided, consent form returned negative
Beachville Rd	June 27 2018	*511182*	*47667745*	-	-	-	-	1	-	-	Domestic	Owner had limited information. Possibly Well ID. 4702258.
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd												
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd												
Beachville Rd												
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd												
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd												
Beachville Rd	February 7 2019	*511572*	*4767199*	1974	Drilled	Steel	127	1	27	Good	Domestic	Hi-Way Pentecostal Church.Well can go dry due to demand. Refers to Well ID 4703870.
Beachville Rd	-	*511585*	*4767281*	-	Drilled	Steel	127	1	-	Issues	Domestic	Colour, taste, odour, sediment problems. Possibly referes to well ID 4702251.
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd												
Beachville Rd											Domestic	
Beachville Rd												
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Beachville Rd	June 19 2018	*511731*	*4767446*	1988	Drilled	Steel	127	1	37	Good	Domestic	Installed in a bedrock aquifer, previous quality testing done in 2012. Possibly refers to Well ID 4706364.
Beachville Rd												
Beachville Rd											Domestic	
Beachville Rd												
Beachville Rd											Domestic	
Beachville Rd											Domestic	

DRAFT

Prepared by;
Checked by:

Summary of Well Survey Results

Hydrogeological Assessment
Southwest Landfill
Centreville, Ontario

STREET	RESPONSE DATE[2]	EASTING[3]	NORTHING[3]	APPROXIMATE YEAR CONSTRUCTED	WELL TYPE	CASING TYPE	CASING DIAMETER (mm)	REPORTED NO. OF WELLS	REPORTED WELL DEPTH (m)	REPORTED WATER QUALITY	WATER USE	COMMENTS
Beachville Rd											Domestic	
Beachville Rd	June 21 2018	*511726*	*4767488*	2013	Drilled	Steel	159	1	46	Good	Domestic	Sulfur smell without treatment. Refer to Well ID 7206210.
Beachville Rd											Domestic	
Beachville Rd											Domestic	
Carmeuse Quarry											Public/ Municipal	
Carmeuse Quarry											Public/ Municipal	
Carmeuse Quarry											Domestic	
Carmeuse Quarry											Industry	
Carmeuse Quarry											Industry	
Carmeuse Quarry											Domestic	
Road 62	-	-	-	-	-	-	114	-	30	-	Domestic	Possibly refers to well 4701943.

NOTES: 1. MN is Municipal Number / Emergency Response Number.
2. Notification letters delivered on June 11 and 18, 2018; initial door to door survey completed on June 11, 2018. Follow-up survey was completed during the morning of Jun 25, 2018. A response after this date indicates the questionnaire was subsequently completed by telephone interview or mail in survey.
3. Approximate UTM coordinates (NAD 83, zone 17T) determined from handheld GPS, values in italics estimated from on-line mapping. See Figure 10 for approximate well locations.
4. "-" indicates information not available or not applicable.
5. "*" indicates approximate coordinates based on municipal number location
6. Blank records indicate that a response for the survey was not received at the time of reporting.
7. Table to be read in conjunction with accompanying text.

Prepared By: STH
Checked By: VT

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APPENDIX H

Geophysical Logs - Monitoring Wells

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GEOPHYSICAL RECORD OF BOREHOLE: BH17-1A

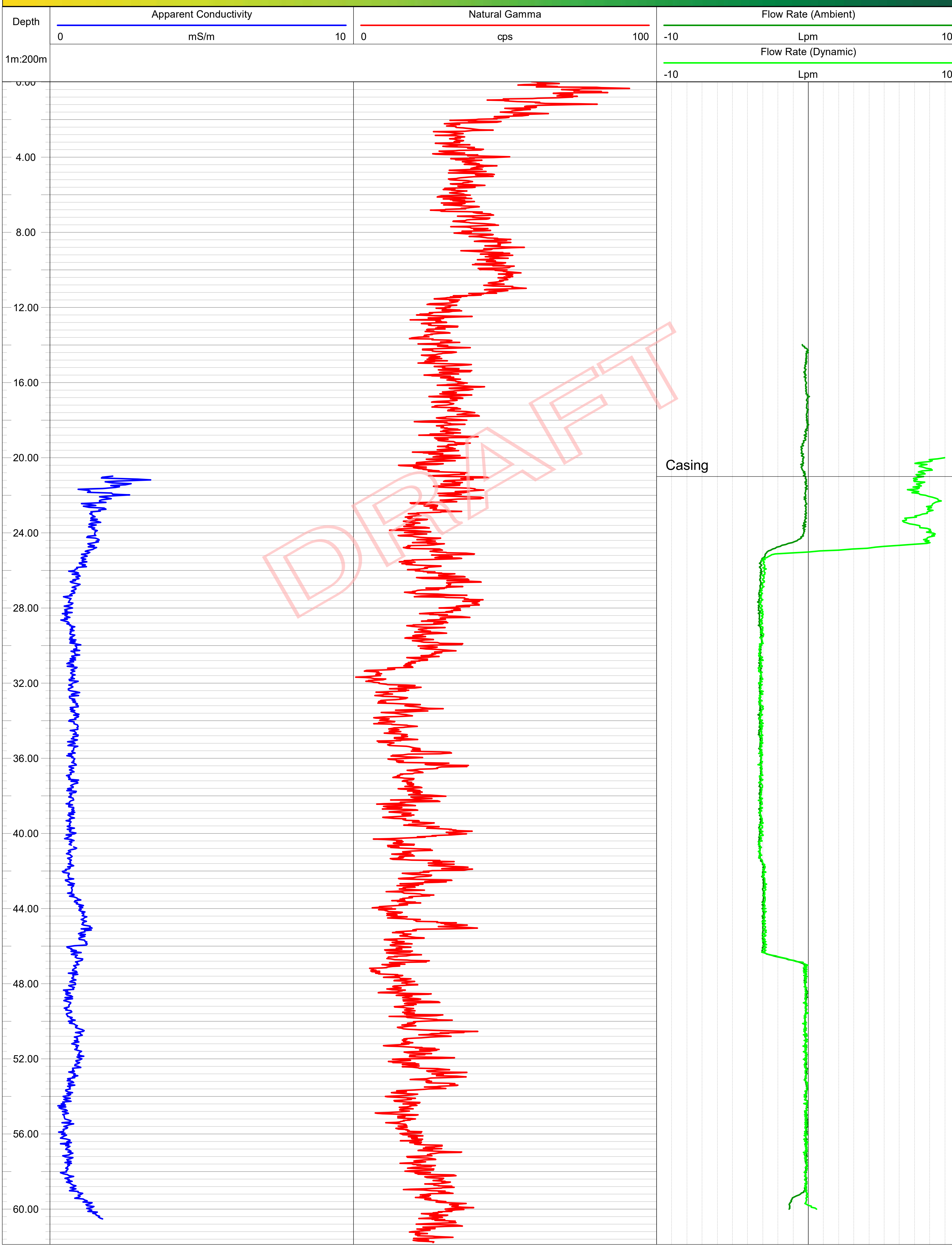
Project Number: 1664706

Client: Walker Environmental

Date: March 2018

Datum:	NAD83, UTM Zone 17N	**Elevation:**	290.44 m asl	**Borehole Diameter:**	HQ	**Water Level:**	13.5 m bgs	**Location:**	Ingersoll, ON
Easting:	509,693.36 m	**Depth Reference:**	"0" at Ground	**Casing Diameter:**	100 mm	**Borehole Inclination:**	0 deg, Vertical	**Log Date:**	23-Sep-17
Northing:	4,768,616.69 m	**Drilled Depth:**	61 m bgs	**Casing Depth:**	21 m bgs	**Borehole Azimuth:**	N/A	**Logged By:**	AR

Notes: Dynamic flow rates measured under pumping conditions of 6.82 Litres per minute, drawdown 1.85 m (stable). Negative flow rates indicate downward flow, positive upward.

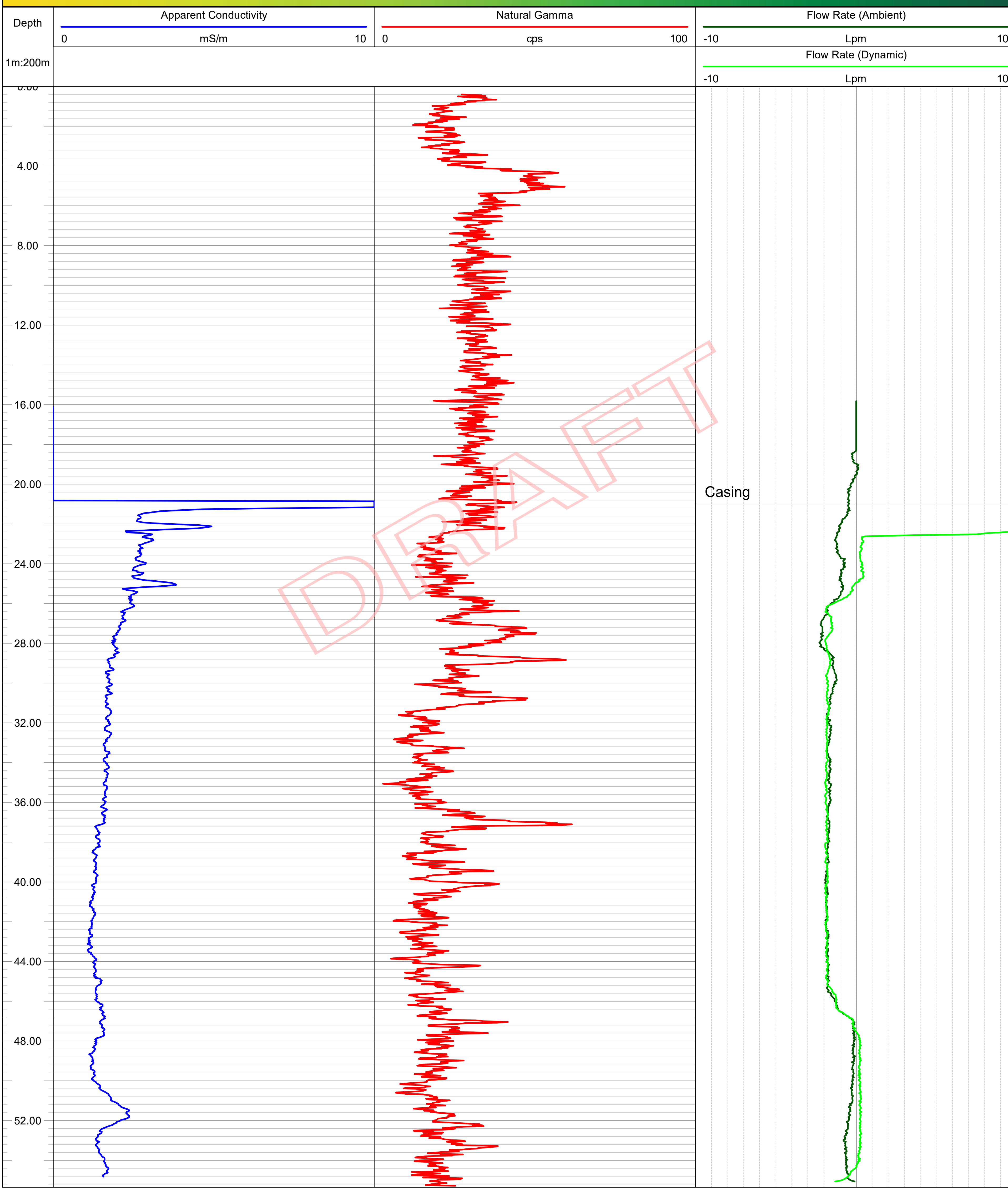


GEOPHYSICAL RECORD OF BOREHOLE: BH17-2A

Project Number: 1664706
Client: Walker Environmental
Date: March 2018

Datum:	NAD83, UTM Zone 17N	**Elevation:**	284.65 m asl	**Borehole Diameter:**	HQ	**Water Level:**	19.1 m bgs	**Location:**	Ingersoll, ON
Easting:	510,081.01 m	**Depth Reference:**	"0" at Ground	**Casing Diameter:**	HQ	**Borehole Inclination:**	0 deg, Vertical	**Log Date:**	17-Oct-17
Northing:	4,767,574.63 m	**Drilled Depth:**	55.3 m bgs	**Casing Depth:**	21 m bgs	**Borehole Azimuth:**	N/A	**Logged By:**	AR

Notes: Dynamic flow rates measured under pumping conditions of 10.0 Litres per minute, drawdown 0.5 m (stable). Negative flow rates indicate downward flow, positive upward.



GEOPHYSICAL RECORD OF BOREHOLE: BH17-3A

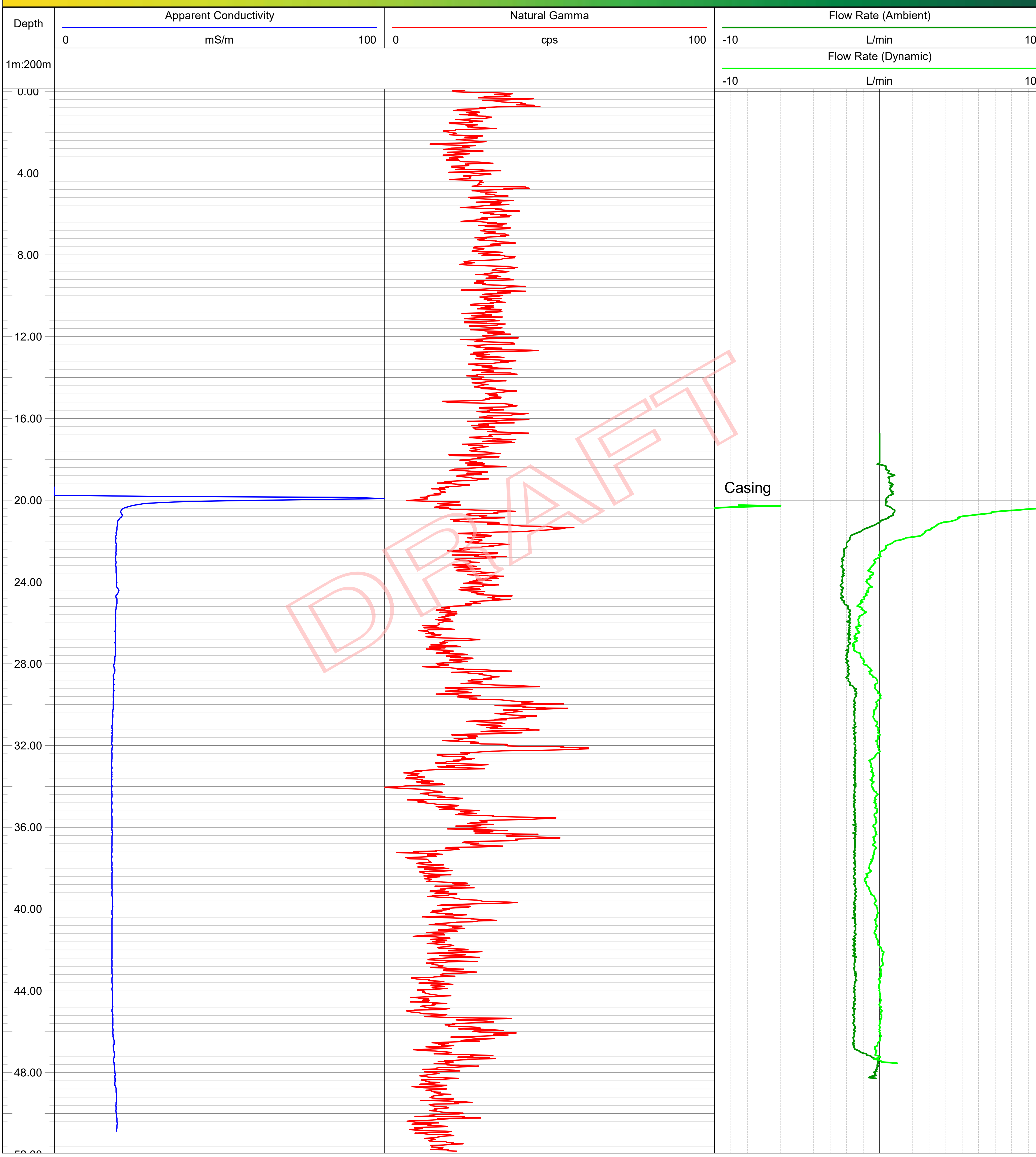
Project Number: 1664706

Client: Walker Environmental

Date: March 2018

Datum:	NAD83, UTM Zone 17N	**Elevation:**	280.08 m asl	**Borehole Diameter:**	HQ	**Water Level:**	18.3 m bgs	**Location:**	Ingersoll, ON
Easting:	510,014.78 m	**Depth Reference:**	"0" at Ground	**Casing Diameter:**	HQ	**Borehole Inclination:**	0 deg, Vertical	**Log Date:**	10-Nov-17
Northing:	4,766,840.54 m	**Drilled Depth:**	52 m bgs	**Casing Depth:**	20 m bgs	**Borehole Azimuth:**	N/A	**Logged By:**	AR

Notes: Dynamic flow rates measured under pumping conditions of 10.0 Litres per minute, draw down of 0.5 m (stable). Negative flow rates indicate downward flow, positive upward.



GEOPHYSICAL RECORD OF BOREHOLE: BH17-4A

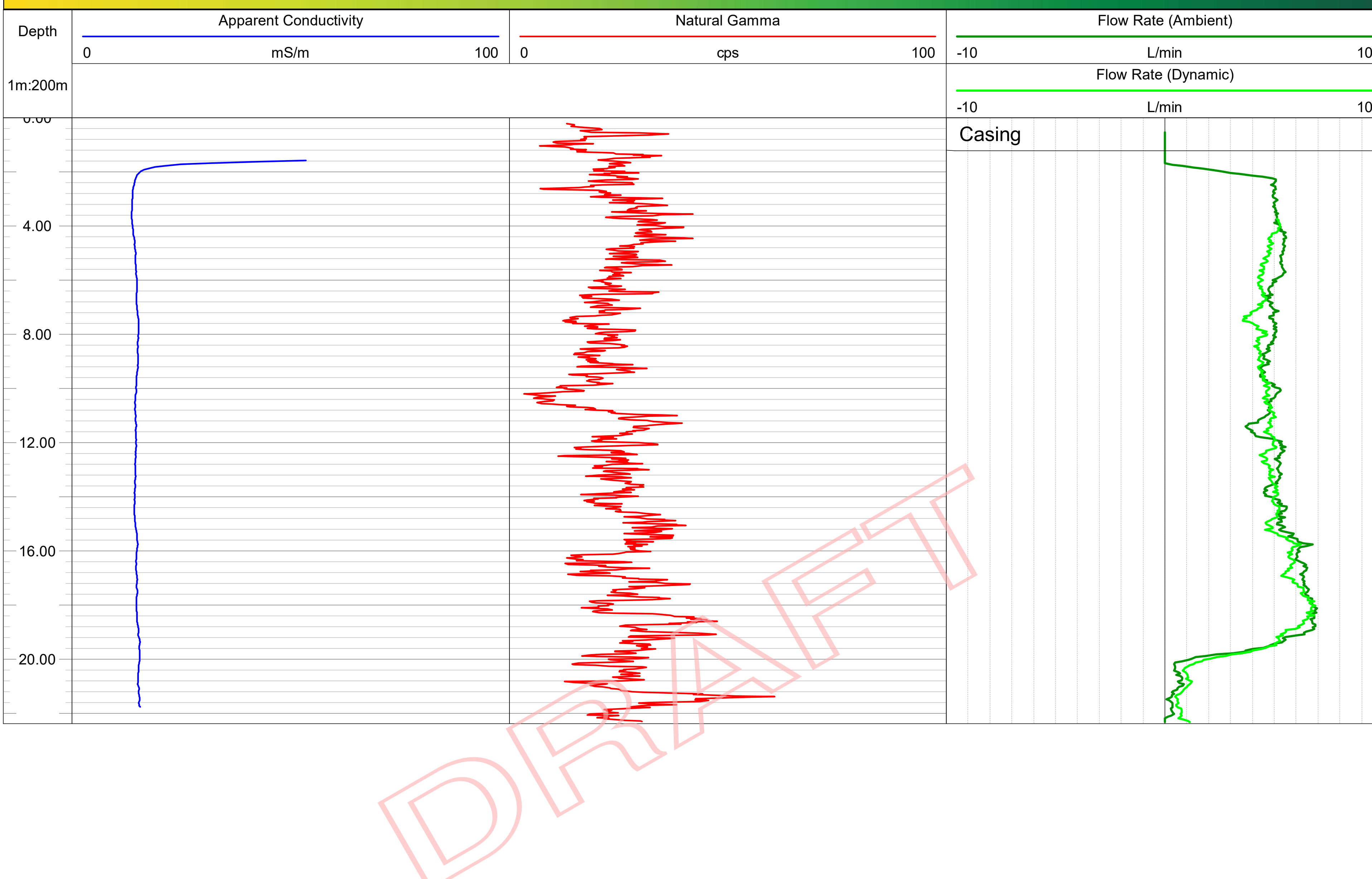
Project Number: 1664706

Client: Walker Environmental

Date: March 2018

Datum:	NAD83, UTM Zone 17N	**Elevation:**	241.25 m asl	**Borehole Diameter:**	96 mm	**Water Level:**	-0.2 m bgs	**Location:**	Ingersoll, ON
Easting:	510,771.50 m	**Depth Reference:**	"0" at Ground	**Casing Diameter:**	96 mm	**Borehole Inclination:**	0 deg, Vertical	**Log Date:**	7-Dec-17
Northing:	4,768,388.76 m	**Drilled Depth:**	22.5 m bgs	**Casing Depth:**	1.1 m bgs	**Borehole Azimuth:**	N/A	**Logged By:**	AR

Notes: Dynamic flow rates measured under pumping conditions of 5.26 Litres per minute, draw down of 0.1 m (stable). Negative flow rates indicate downward flow, positive upward.



GOLDER

GEOPHYSICAL RECORD OF BOREHOLE: BH17-5A

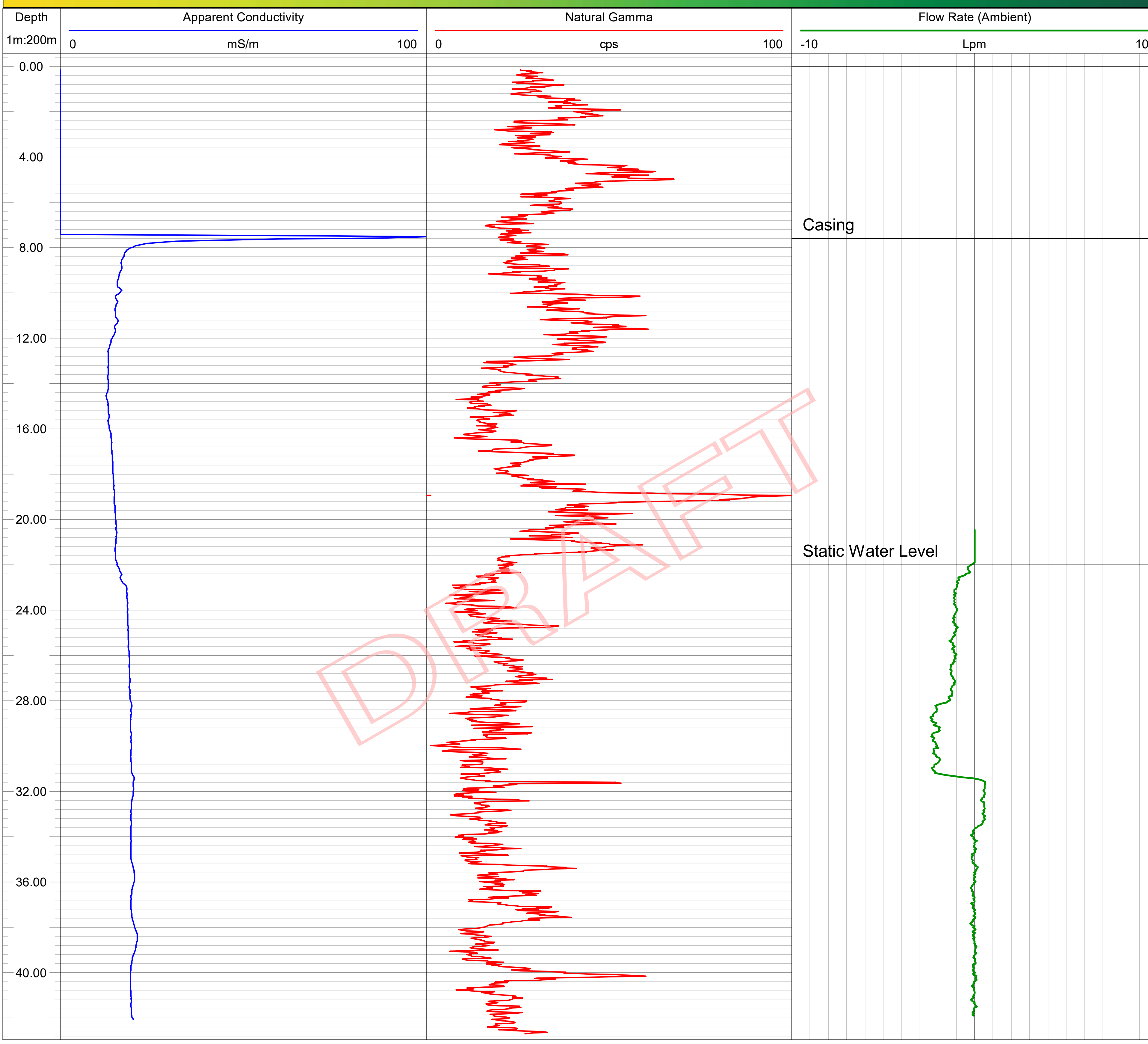
Project Number: 1664706

Client: Walker Environmental

Date: March 2018

Datum:	NAD83, UTM Zone 17N	**Elevation:**	270.52 m asl	**Borehole Diameter:**	HQ	**Water Level:**	22 m bgs	**Location:**	Ingersoll, ON
Easting:	510,870.94 m	**Depth Reference:**	"0" at Ground	**Casing Diameter:**	100 mm	**Borehole Inclination:**	0 deg, Vertical	**Log Date:**	5-Feb-2018
Northing:	4,767,244.54 m	**Drilled Depth:**	42.7 m bgs	**Casing Depth:**	7.6 m bgs	**Borehole Azimuth:**	N/A	**Logged By:**	AR

Notes: Available pump unable to affect flow rate or change water level - dynamic flow testing not useful. Negative flow rates indicate downward flow, positive upward.



GOLDER

GEOPHYSICAL RECORD OF BOREHOLE: BH17-6A

Project Number: 1664706

Client: Walker Environmental

Date: December 2017

Datum:	NAD83, UTM Zone 17N	**Elevation:**	275.17 m asl	**Borehole Diameter:**	96 mm	**Water Level:**	27 m bgs	**Location:**	Ingersoll, ON
Easting:	511,279.57 m	**Depth Reference:**	"0" at Ground	**Casing Diameter:**	96 mm	**Borehole Inclination:**	0 deg, Vertical	**Log Date:**	12-Dec-17
Northing:	4,767,199.97 m	**Drilled Depth:**	32.8 m bgs	**Casing Depth:**	13 m bgs	**Borehole Azimuth:**	N/A	**Logged By:**	AR

Notes:

APPENDIX I

Summary of Hydraulic Testing.

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SUMMARY OF HYDRAULIC TESTING RESULTS - PACKER TESTS

Hydrogeological Assessment
Southwest Landfill
Ingersoll, Ontario

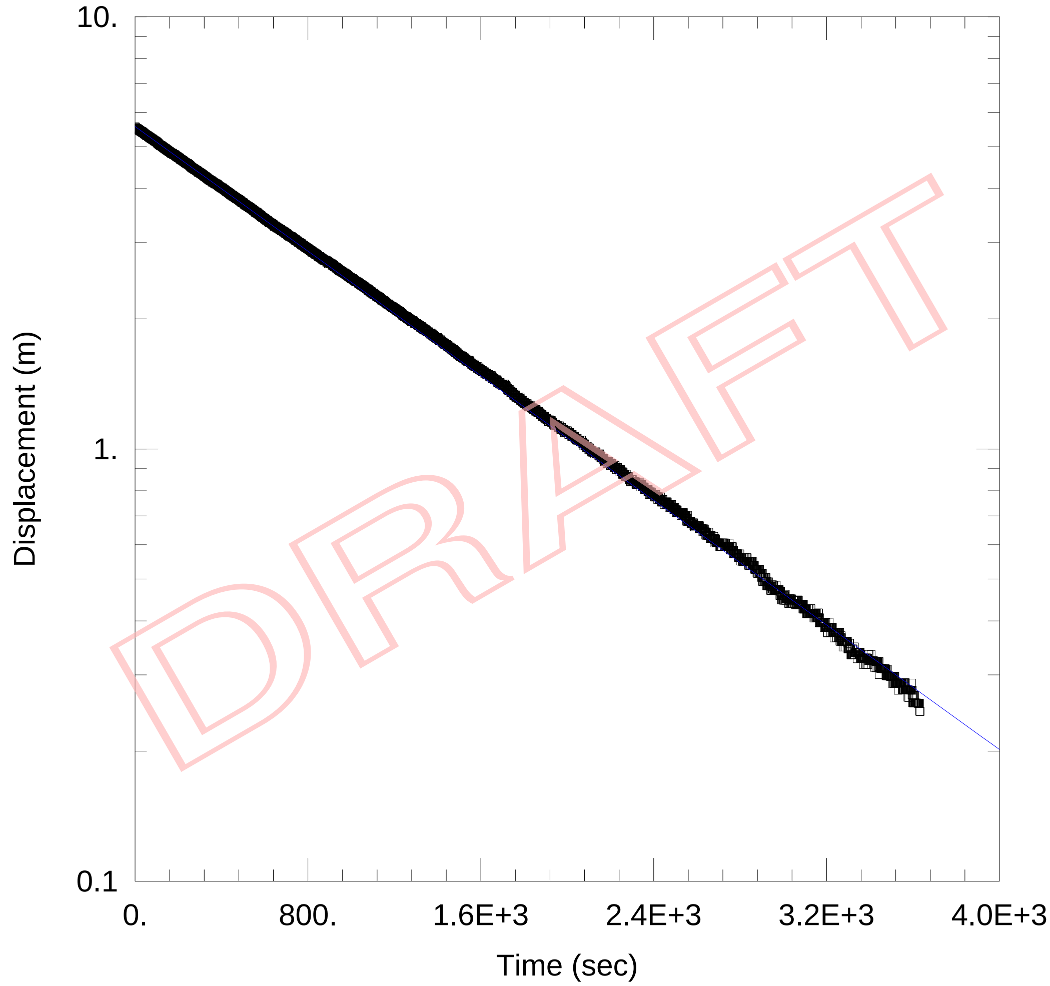
DRAFT

BOREHOLE	TEST No.	TEST INTERVAL		TEST INTERVAL		HYDRAULIC CONDUCTIVITY (m/s)
		From (m bgs)	To (m bgs)	From (m amsl)	To (m amsl)	
BH17-1A	1	21.2	24.4	269.2	266.0	1.8×10^{-6}
	2	24.1	27.0	266.3	263.4	3.3×10^{-5}
	3	26.9	30.0	263.5	260.4	9.1×10^{-7}
	4	29.8	33.0	260.6	257.4	5.8×10^{-9}
	5	32.9	36.0	257.5	254.4	2.6×10^{-8}
	6	35.9	39.0	254.5	251.4	9.8×10^{-9}
	7	38.9	42.0	251.5	248.4	1.4×10^{-6}
	8	41.9	45.0	248.5	245.4	5.0×10^{-9}
	9	44.9	48.0	245.5	242.4	3.0×10^{-8}
	10	47.9	51.0	242.5	239.4	1.6×10^{-8}
	11	50.9	54.0	239.5	236.4	1.5×10^{-8}
	12	53.9	57.0	236.5	233.4	1.9×10^{-8}
	13	26.9	62.1	263.5	228.3	1.8×10^{-8}
BH17-2A	1	21.1	24	263.6	260.7	1.6×10^{-5}
	2	23.9	27	260.8	257.7	4.5×10^{-5}
	3	26.9	30	257.8	254.7	8.0×10^{-6}
	4	29.9	33	254.8	251.7	2.5×10^{-7}
	5	32.9	36	251.8	248.7	2.4×10^{-8}
	6	35.9	39	248.8	245.7	2.7×10^{-8}
	7	38.9	42	245.8	242.7	3.9×10^{-9}
	8	41.9	45	242.8	239.7	2.8×10^{-6}
	9	44.9	48	239.8	236.7	1.3×10^{-5}
	10	47.9	51	236.8	233.7	4.8×10^{-7}
	11	50.9	55.5	233.8	229.2	9.8×10^{-9}
BH17-3A	1	20.6	24.1	259.5	256.0	2.9×10^{-5}
	2	24	27.1	256.1	253.0	5.1×10^{-5}
	3	27	30.1	253.1	250.0	9.1×10^{-6}
	4	30	33.1	250.1	247.0	4.7×10^{-8}
	5	33	36.1	247.1	244.0	2.3×10^{-8}
	6	36	39.1	244.1	241.0	4.1×10^{-8}
	7	39	42.1	241.1	238.0	1.8×10^{-5}
	8	42	45.1	238.1	235.0	1.3×10^{-8}
	9	45	48.1	235.1	232.0	1.2×10^{-4}
	10	48	52.2	232.1	227.9	8.9×10^{-7}
	11	51	52.2	229.1	227.9	1.5×10^{-8}
BH17-4A	1	4.3	7.4	237.0	233.9	1.4×10^{-4}
	2	7.3	10.4	234.0	230.9	1.1×10^{-4}
	3	10.3	13.4	231.0	227.9	1.0×10^{-5}
	4	13.3	16.5	228.0	224.8	5.6×10^{-6}
	5	16.3	19.4	225.0	221.9	2.4×10^{-8}
	6	19.3	22.4	222.0	218.9	3.9×10^{-4}
BH17-5A	1	23.3	25.6	247.4	245.1	2.0×10^{-9}
	2	25.5	28.6	245.2	242.1	1.5×10^{-4}
	3	28.5	31.6	242.2	239.1	1.7×10^{-4}
	4	31.5	34.6	239.2	236.1	4.0×10^{-4}
	5	34.5	37.6	236.2	233.1	1.2×10^{-6}
	6	37.5	40.6	233.2	230.1	1.9×10^{-8}
	7	40.5	42.7	230.2	228.0	2.6×10^{-8}
BH17-6A	5	26.9	30.0	248.3	245.2	1.3×10^{-6}
	6	29.9	33.0	245.3	242.2	1.7×10^{-4}

NOTES:
1. "m bgs" stands for metres below ground surface.
2. "m amsl" stands for metres above mean sea level.
3. Hydraulic conductivity results provided in metres per second (m/s).
4. Table to be read in conjunction with the report.

BH17-1A #1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

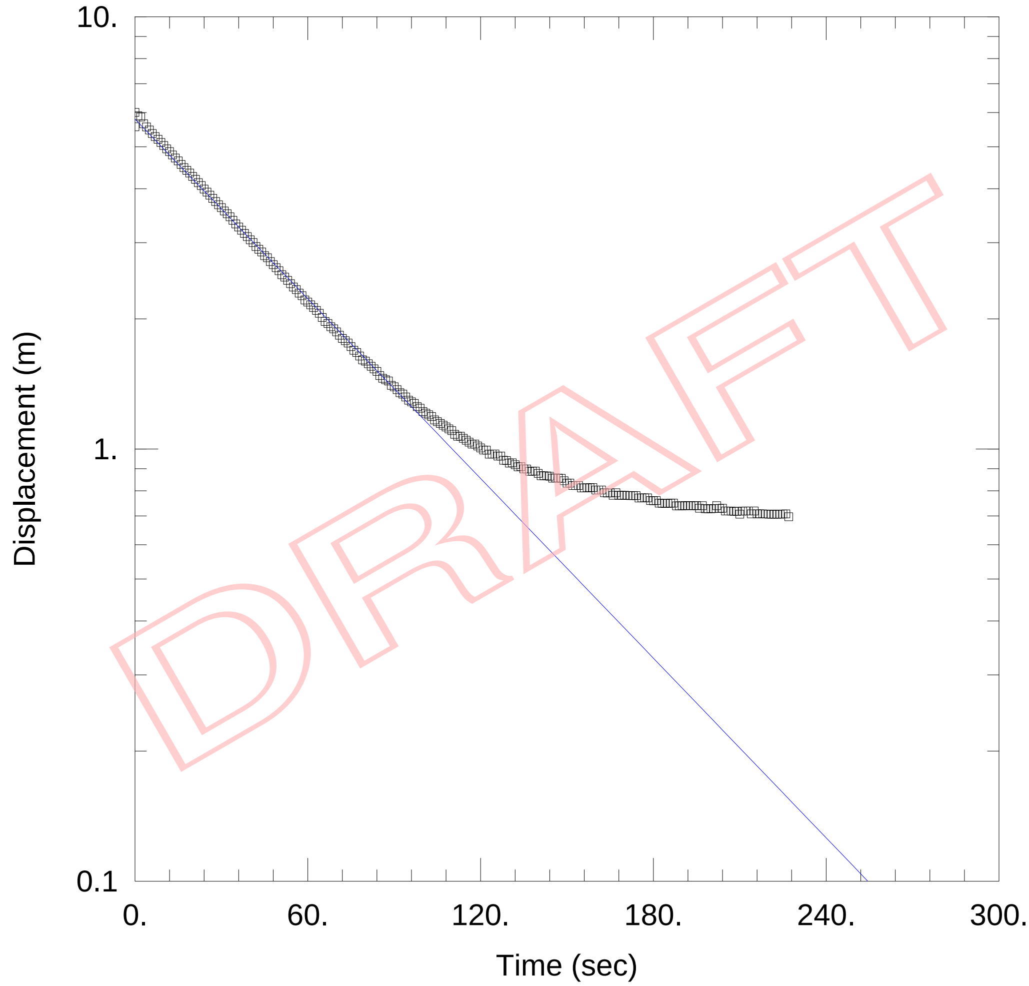
K = 1.754E-6 m/sec   y0 = 5.573 m

WELL DATA (BH17-1A #1)

Initial Displacement: 5.562 m
Static Water Column Height: 20.34 m
Total Well Penetration Depth: 20.34 m
Screen Length: 2.9 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

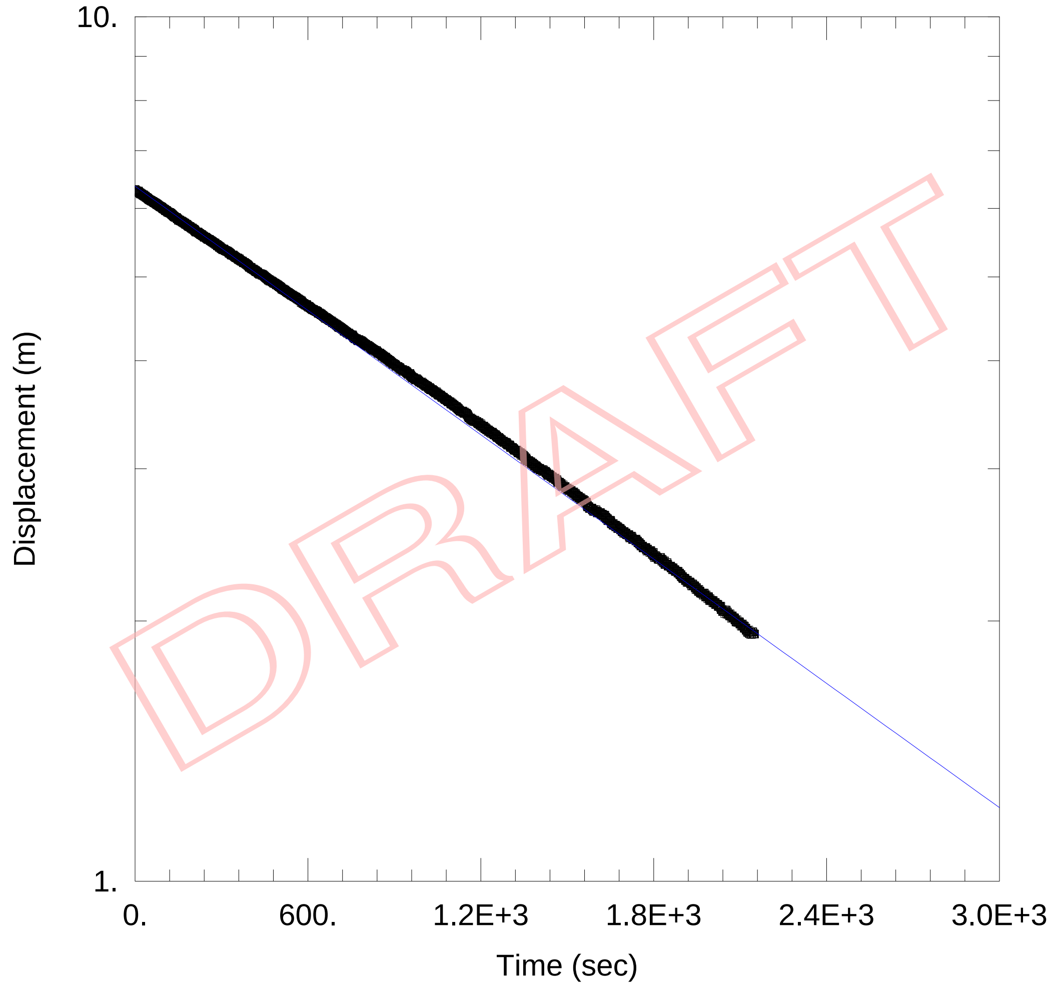
K = 3.312E-5 m/sec   y0 = 5.796 m

WELL DATA (BH17-1A #2)

Initial Displacement: 5.562 m
Static Water Column Height: 20.34 m
Total Well Penetration Depth: 17.34 m
Screen Length: 2.9 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

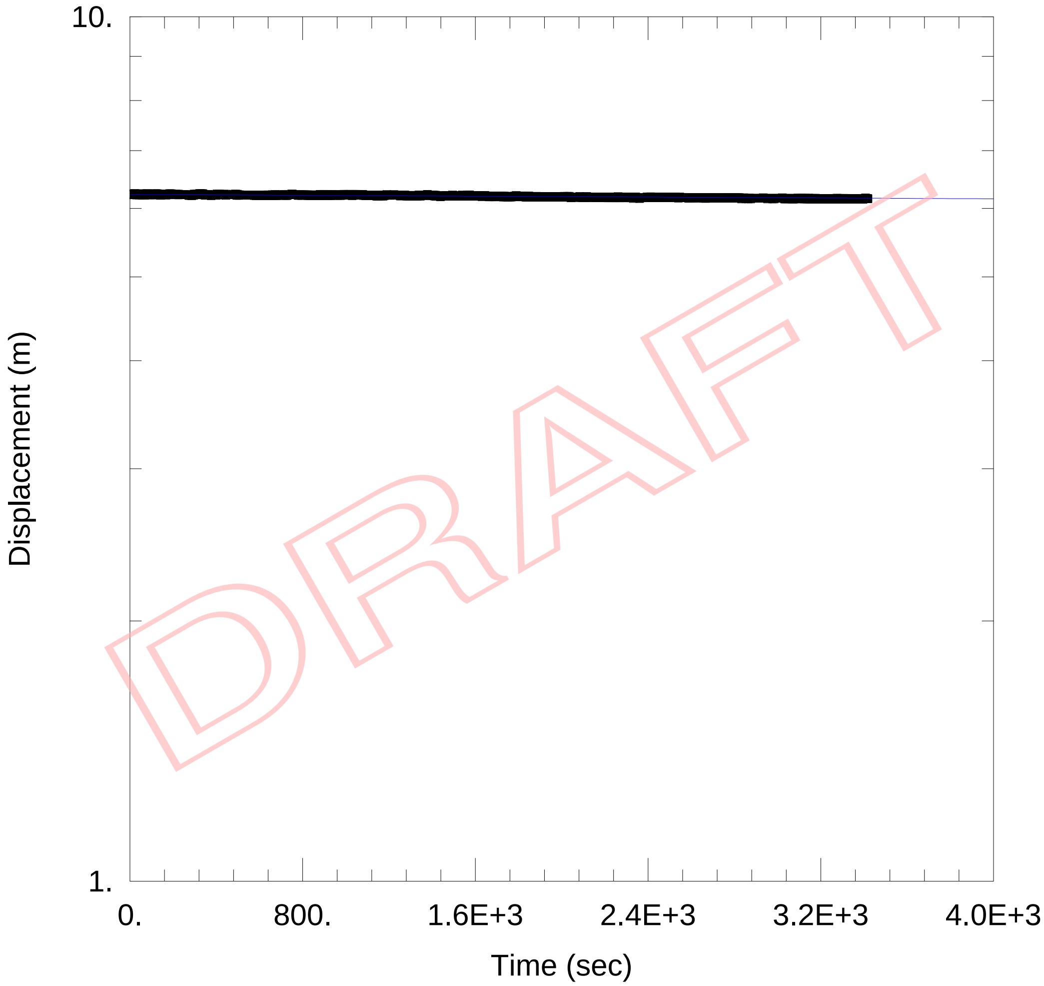
K = 9.124E-7 m/sec   y0 = 6.368 m

WELL DATA (BH17-1A #3)

Initial Displacement: 6.31 m
Static Water Column Height: 24.87 m
Total Well Penetration Depth: 24.87 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #4

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

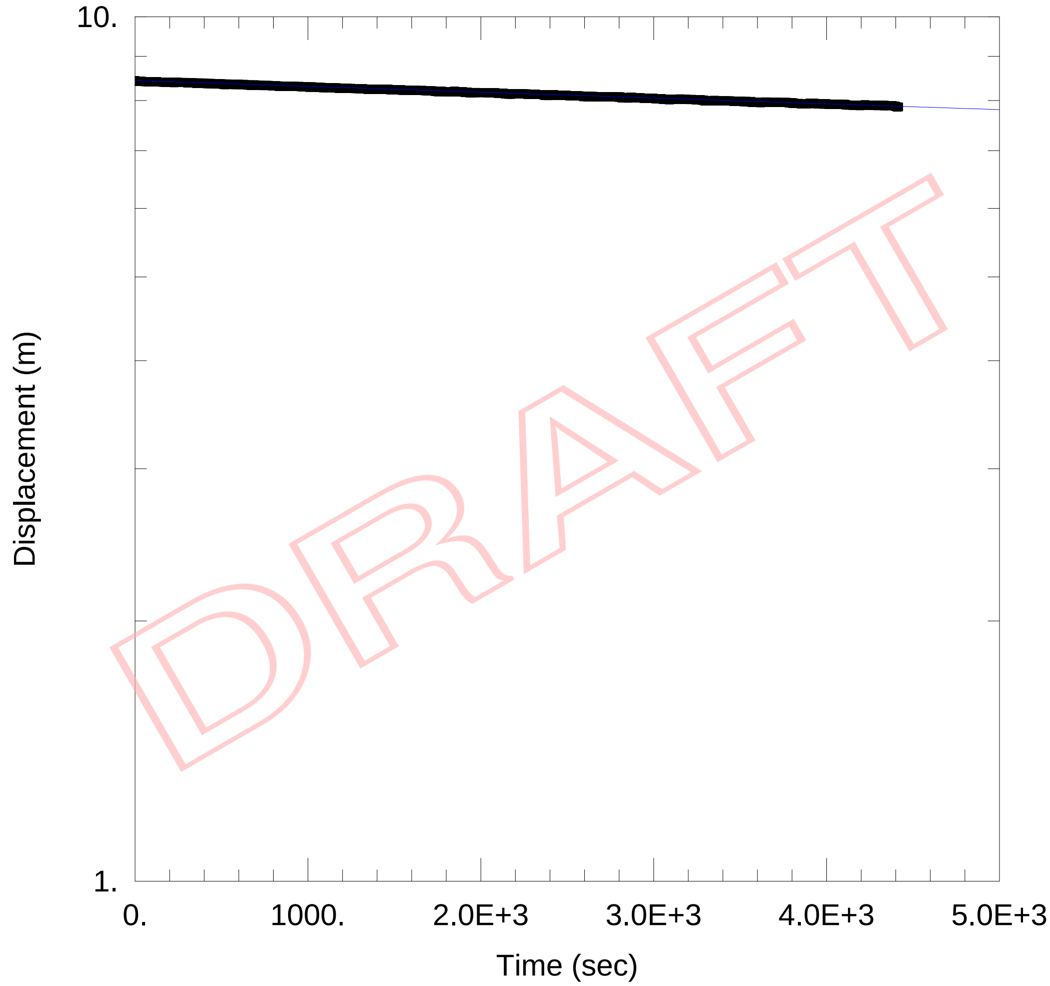
K = 5.776E-9 m/sec   y0 = 6.228 m

WELL DATA (BH17-1A #4)

Initial Displacement: 6.24 m
Static Water Column Height: 28.72 m
Total Well Penetration Depth: 28.72 m
Screen Length: 3.2 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #5

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

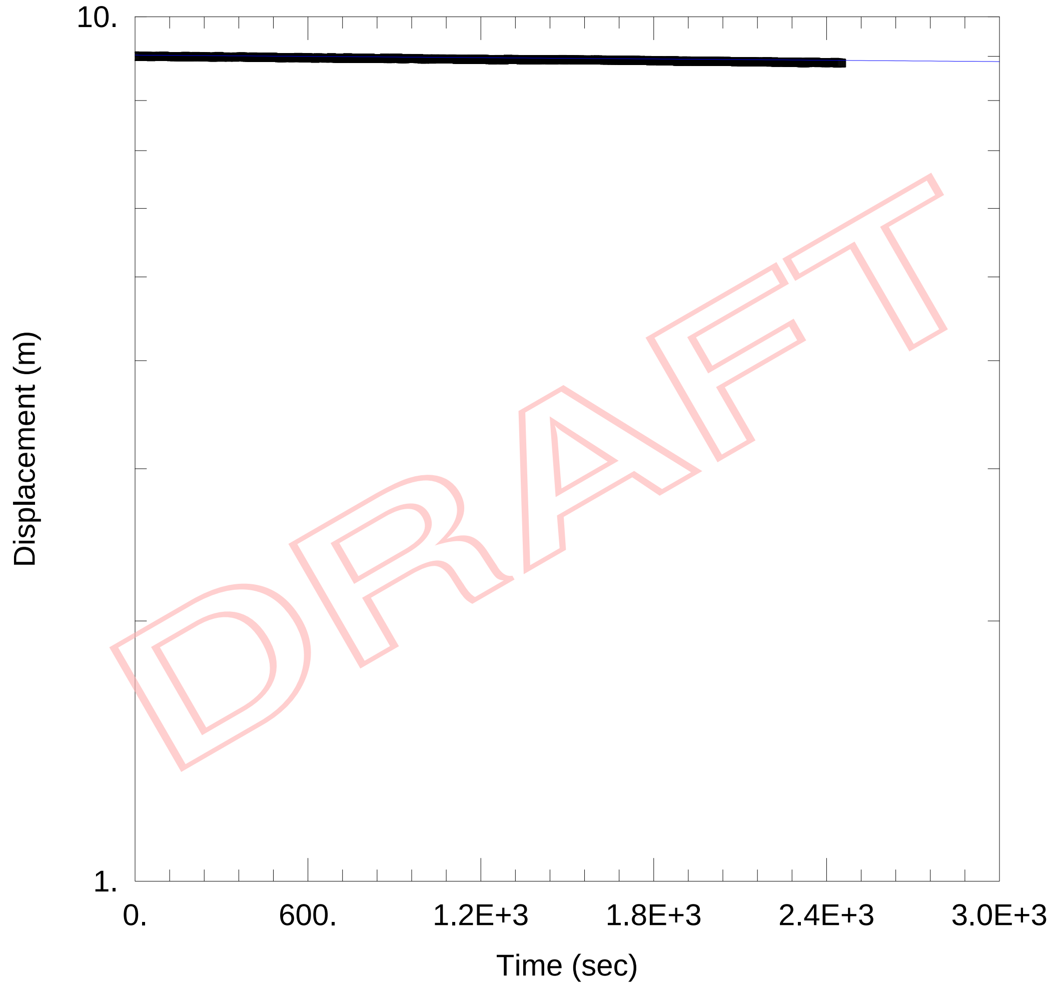
K = 2.615E-8 m/sec   y0 = 8.437 m

WELL DATA (BH17-1A #5)

Initial Displacement: 8.441 m
Static Water Column Height: 29.38 m
Total Well Penetration Depth: 29.38 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #6

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

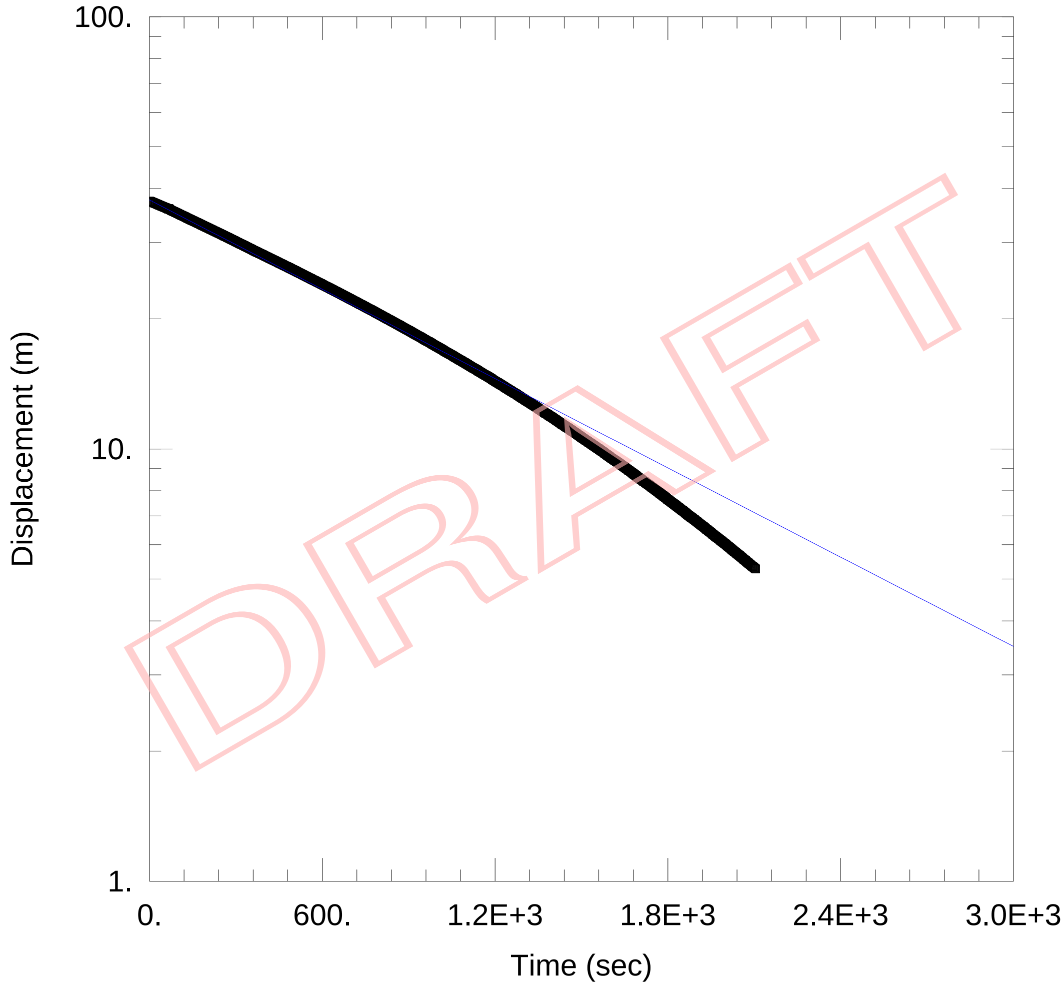
K = 9.802E-9 m/sec   y0 = 9.029 m

WELL DATA (BH17-1A #6)

Initial Displacement: 9.015 m
Static Water Column Height: 31.81 m
Total Well Penetration Depth: 31.81 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #7

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

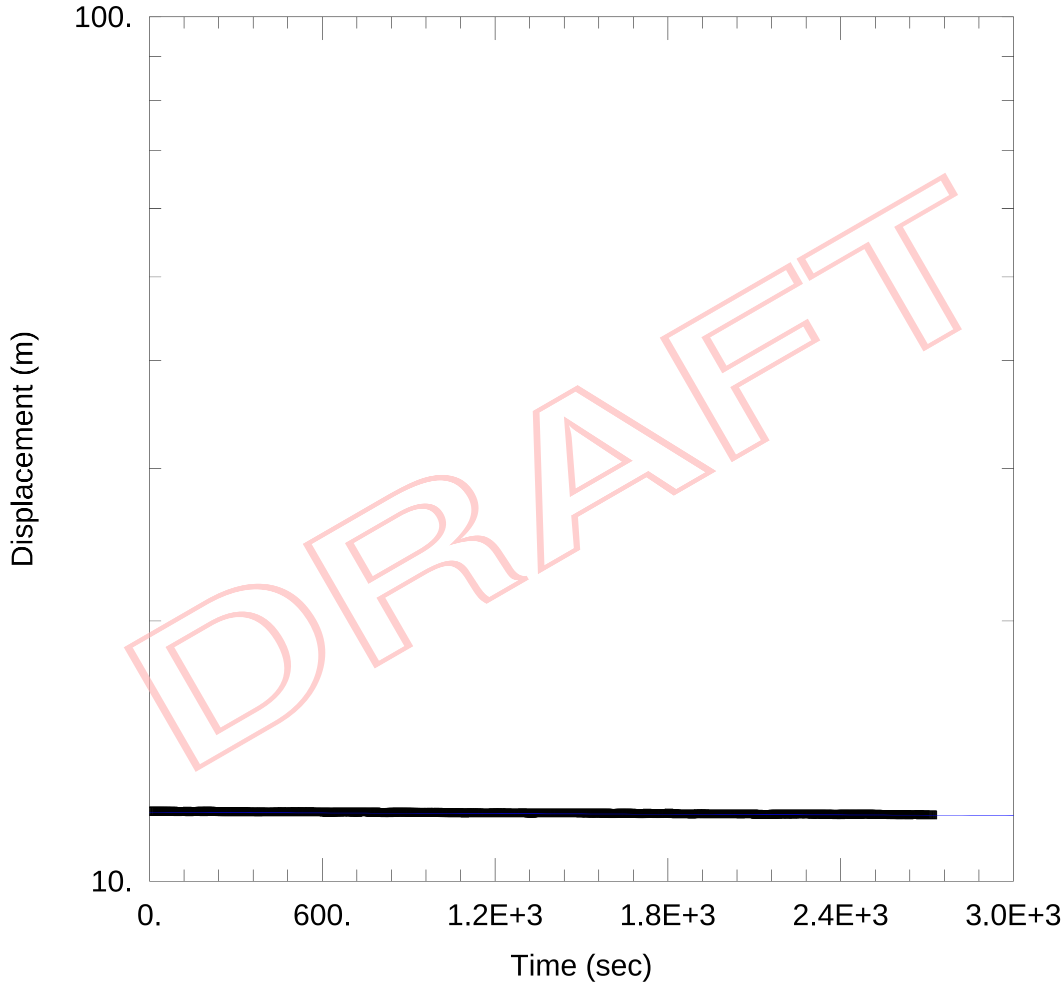
K = 1.362E-6 m/sec   y0 = 37.67 m

WELL DATA (BH17-1A #7)

Initial Displacement: 37.44 m
Static Water Column Height: 6.382 m
Total Well Penetration Depth: 6.382 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #8

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

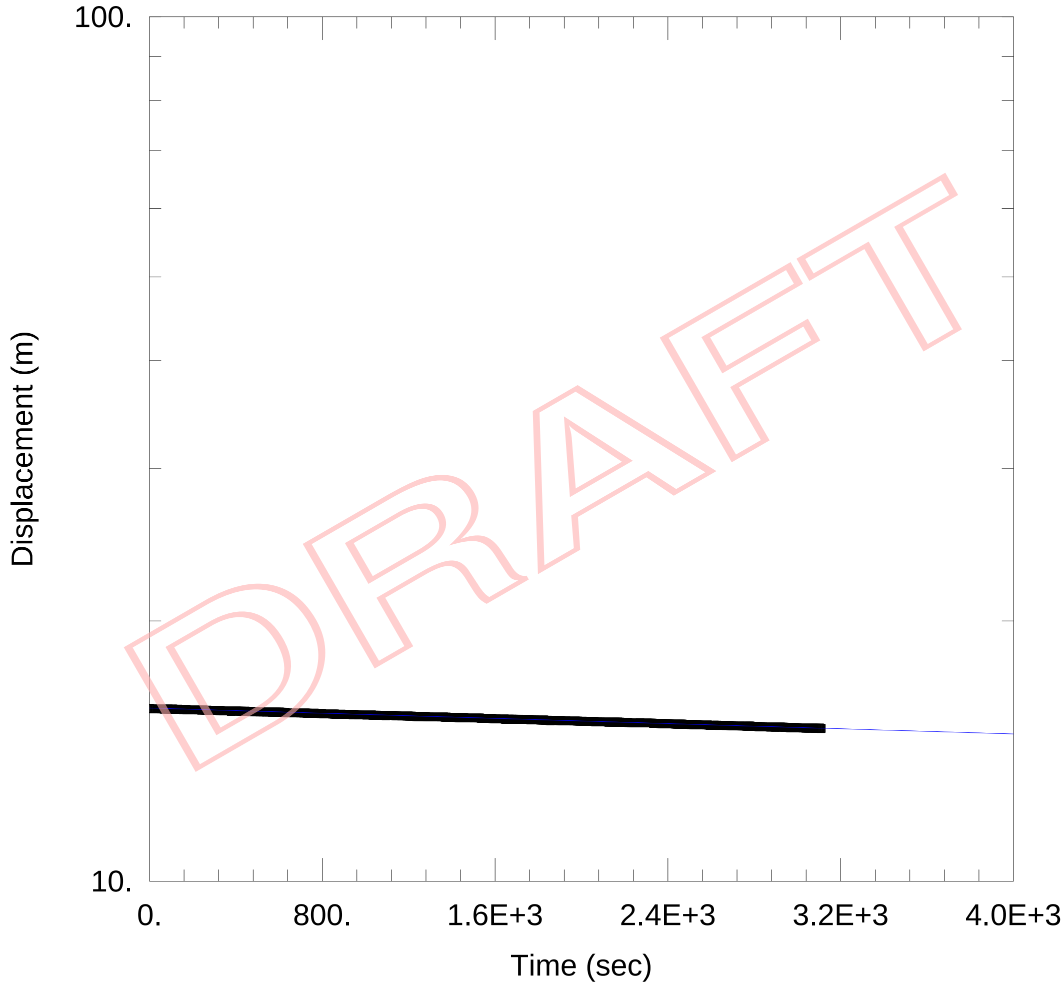
K = 4.97E-9 m/sec   y0 = 12.01 m

WELL DATA (BH17-1A #8)

Initial Displacement: 12.06 m
Static Water Column Height: 34.77 m
Total Well Penetration Depth: 34.77 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #9

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

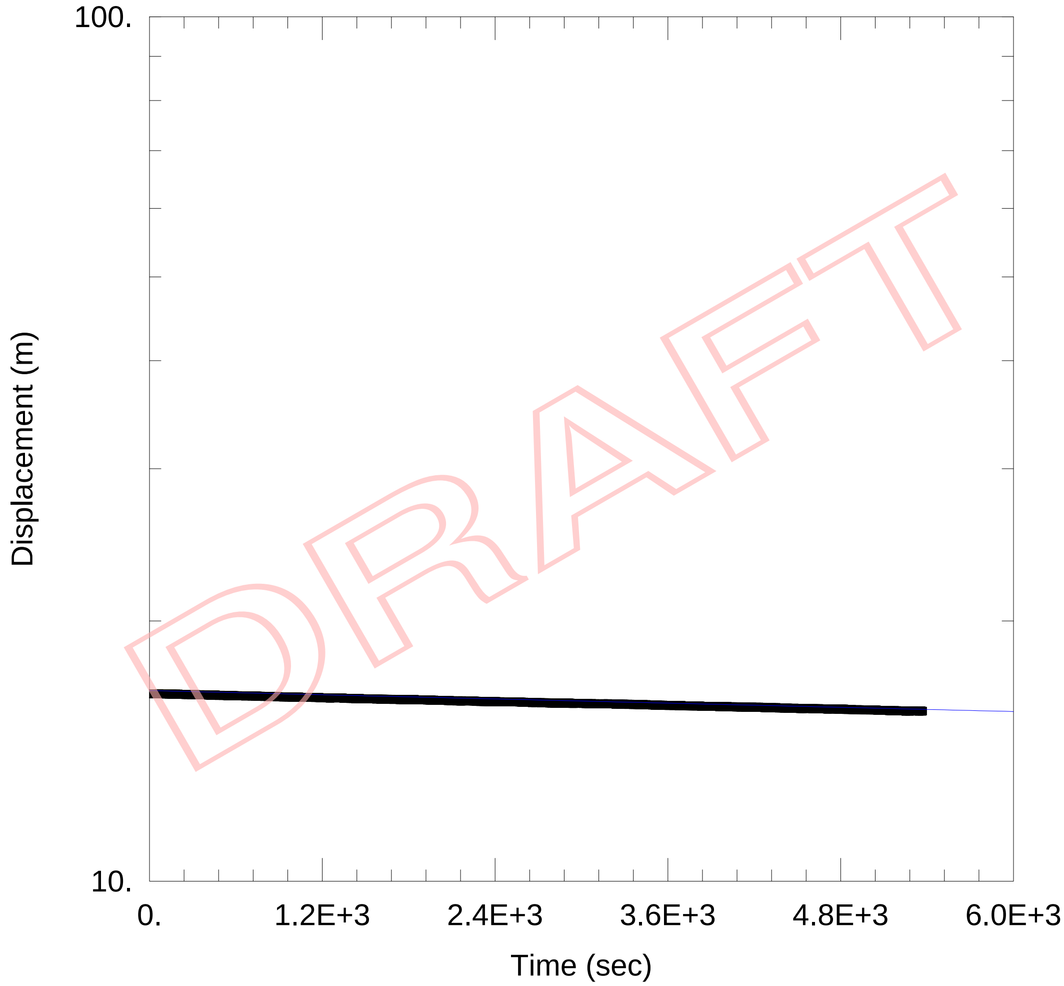
K = 2.968E-8 m/sec   y0 = 15.86 m

WELL DATA (BH17-1A #9)

Initial Displacement: 15.85 m
Static Water Column Height: 33.97 m
Total Well Penetration Depth: 33.97 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #10

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

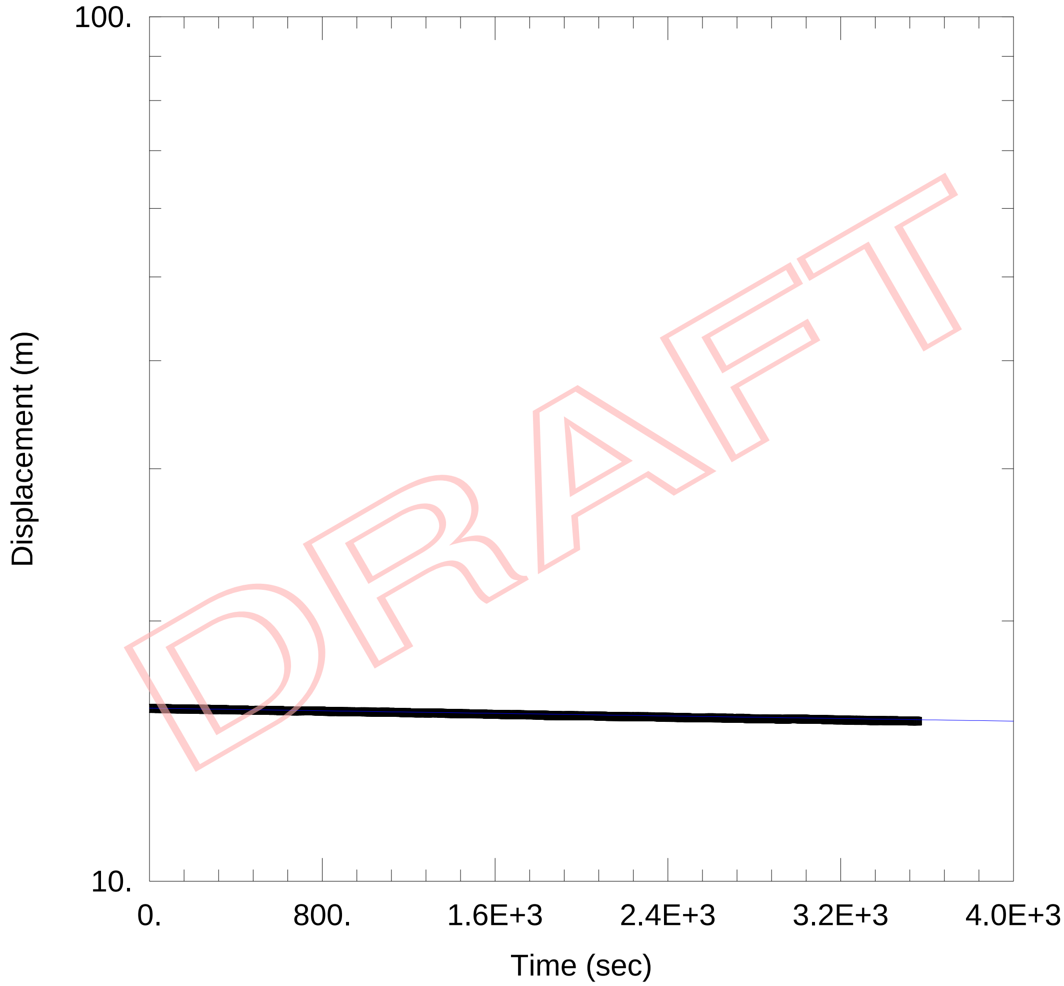
K = 1.611E-8 m/sec   y0 = 16.62 m

WELL DATA (BH17-1A #10)

Initial Displacement: 16.48 m
Static Water Column Height: 36.34 m
Total Well Penetration Depth: 36.34 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #11

Prepared By:	Prepared For:
Golder	Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

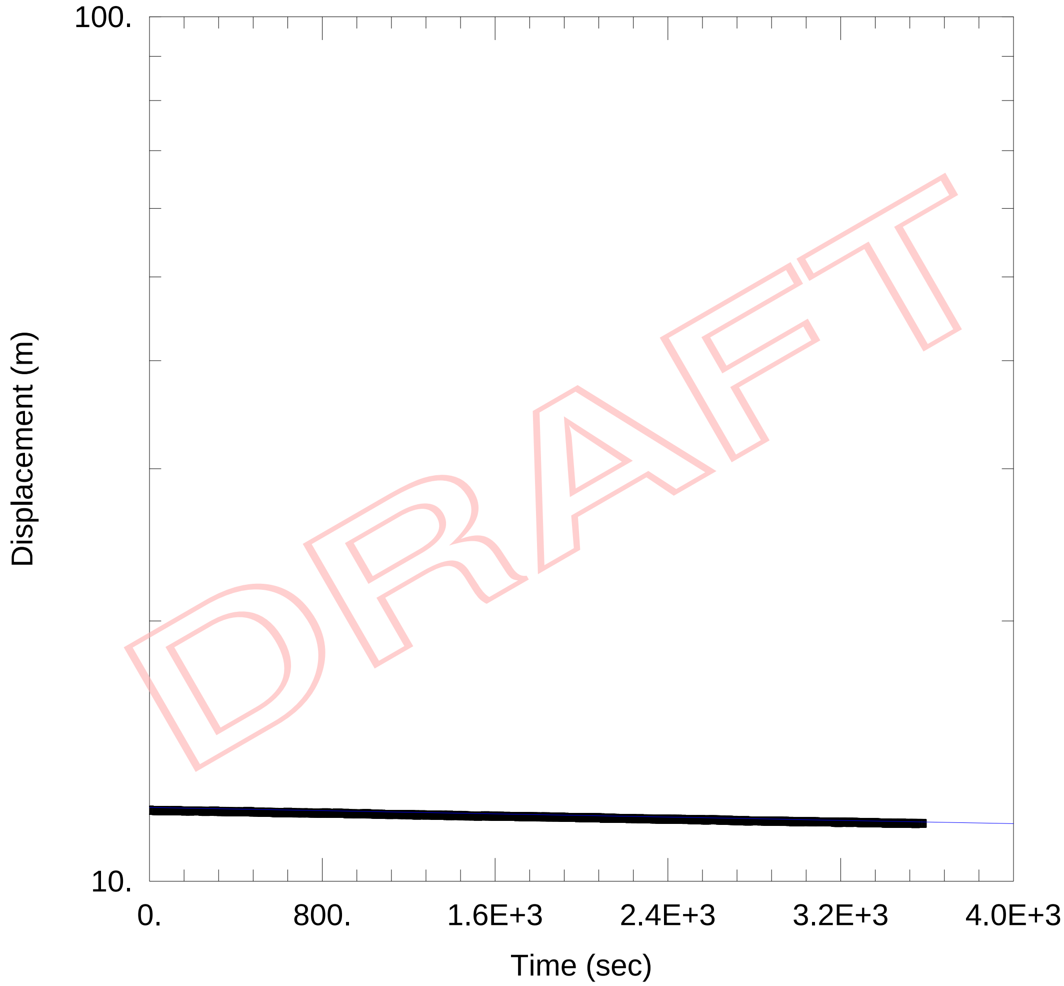
K = 1.507E-8 m/sec   y0 = 15.85 m

WELL DATA (BH17-1A #11)

Initial Displacement: 15.85 m
Static Water Column Height: 39.97 m
Total Well Penetration Depth: 39.97 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #12

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

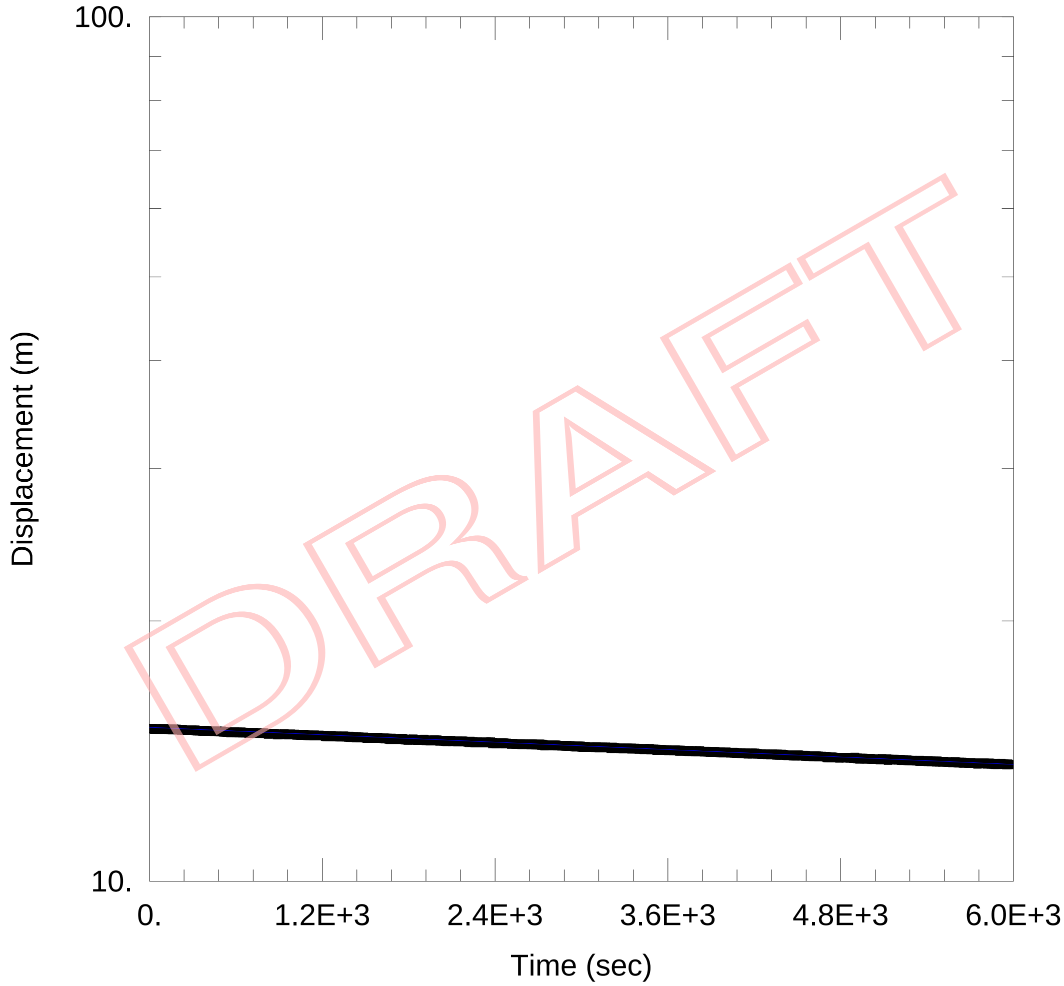
K = 1.913E-8 m/sec   y0 = 12.17 m

WELL DATA (BH17-1A #12)

Initial Displacement: 12.09 m
Static Water Column Height: 46.73 m
Total Well Penetration Depth: 46.73 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-1A #13

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

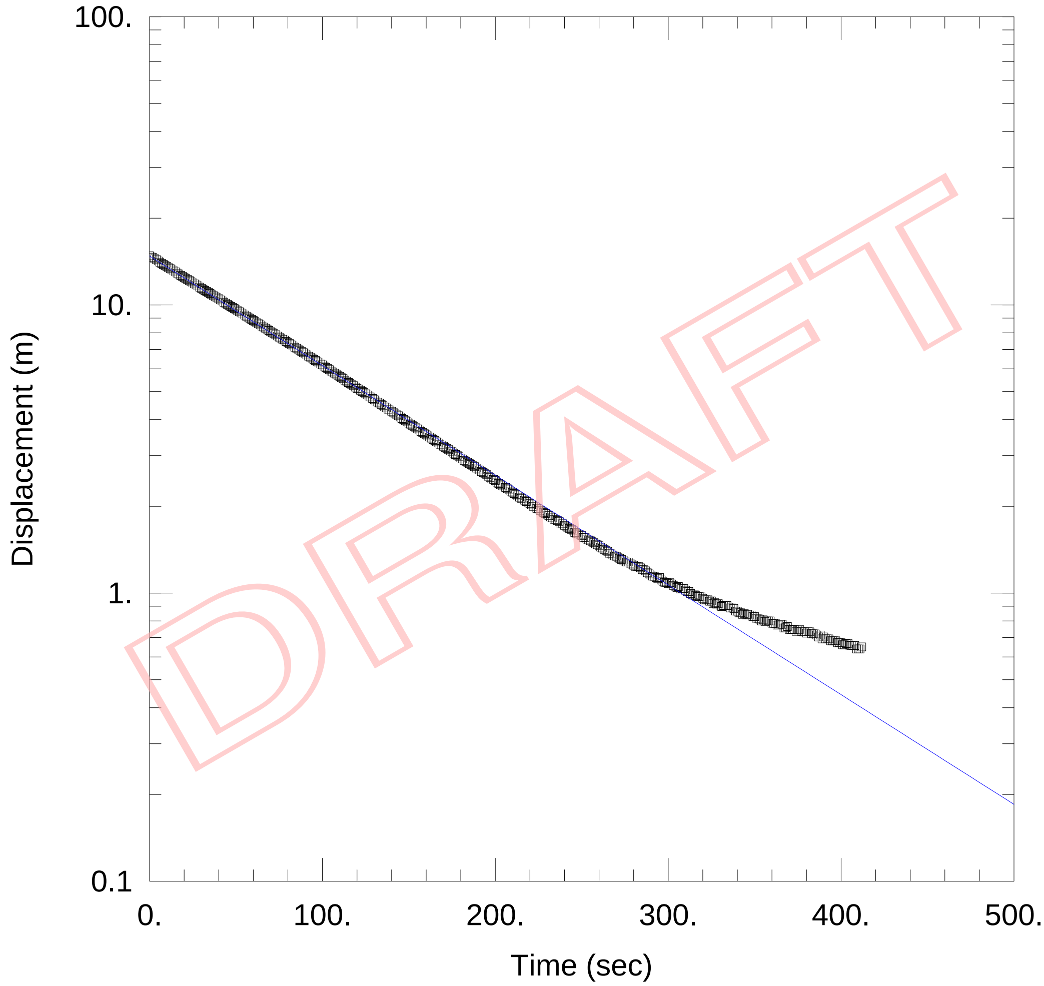
K = 1.811E-8 m/sec   y0 = 15.06 m

WELL DATA (BH17-1A #13)

Initial Displacement: 15.02 m
Static Water Column Height: 48.91 m
Total Well Penetration Depth: 48.91 m
Screen Length: 5.2 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #1

Prepared By:	Prepared For:
Golder	Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

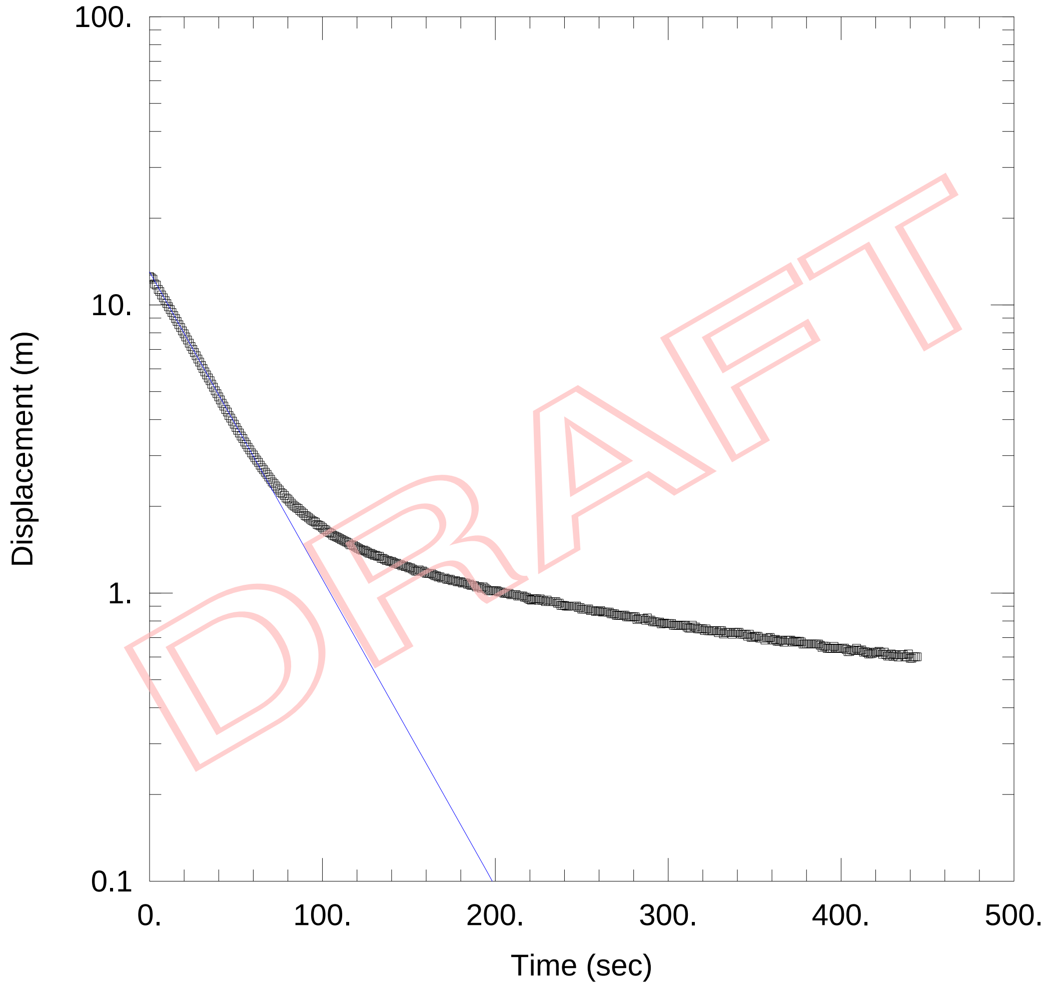
K = 1.651E-5 m/sec   y0 = 14.78 m

WELL DATA (BH17-2A #1)

Initial Displacement: 14.8 m
Static Water Column Height: 7.96 m
Total Well Penetration Depth: 7.96 m
Screen Length: 2.9 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #2

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



DRAFT

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

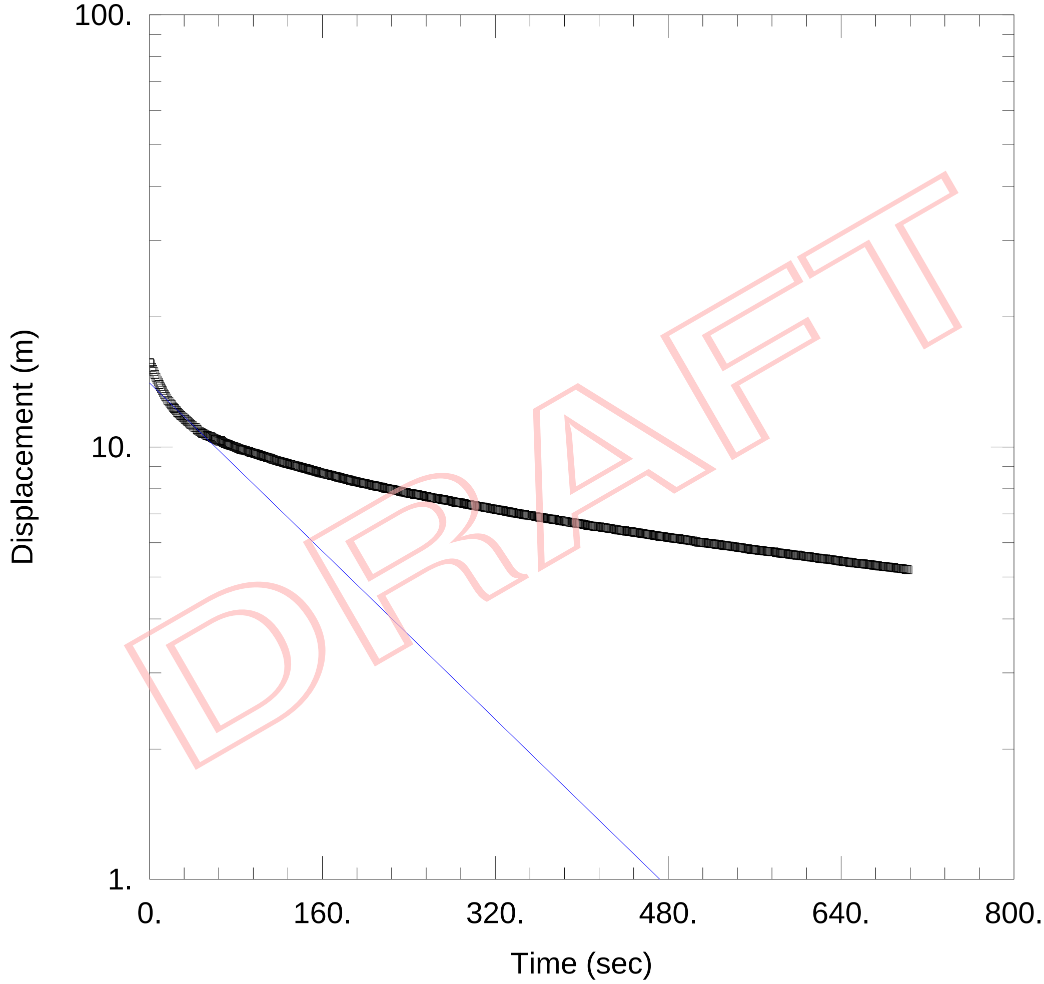
K = 4.516E-5 m/sec   y0 = 13.01 m

WELL DATA (BH17-2A #2)

Initial Displacement: 12.51 m
Static Water Column Height: 10.69 m
Total Well Penetration Depth: 10.69 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #3

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

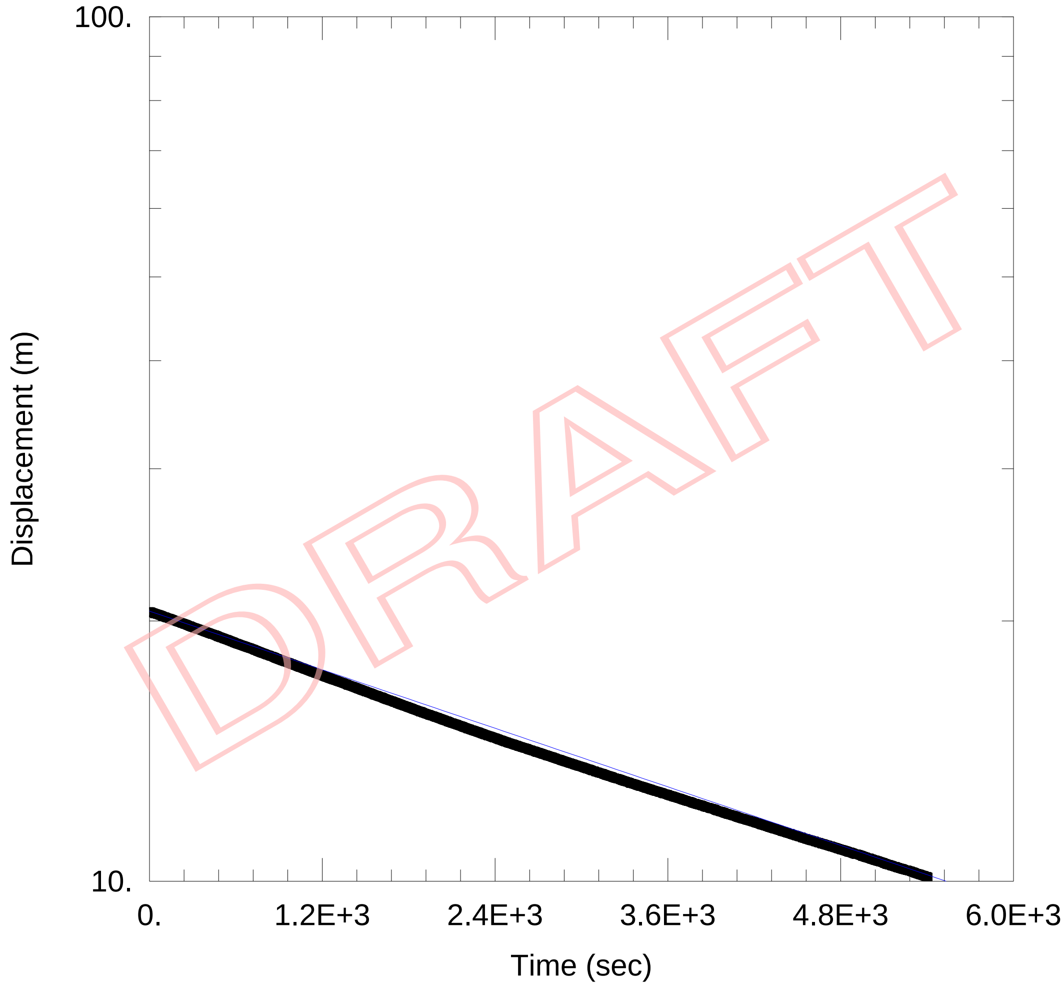
K = 7.949E-6 m/sec   y0 = 14.06 m

WELL DATA (BH17-2A #3)

Initial Displacement: 15.66 m
Static Water Column Height: 8.4 m
Total Well Penetration Depth: 8.4 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #4

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

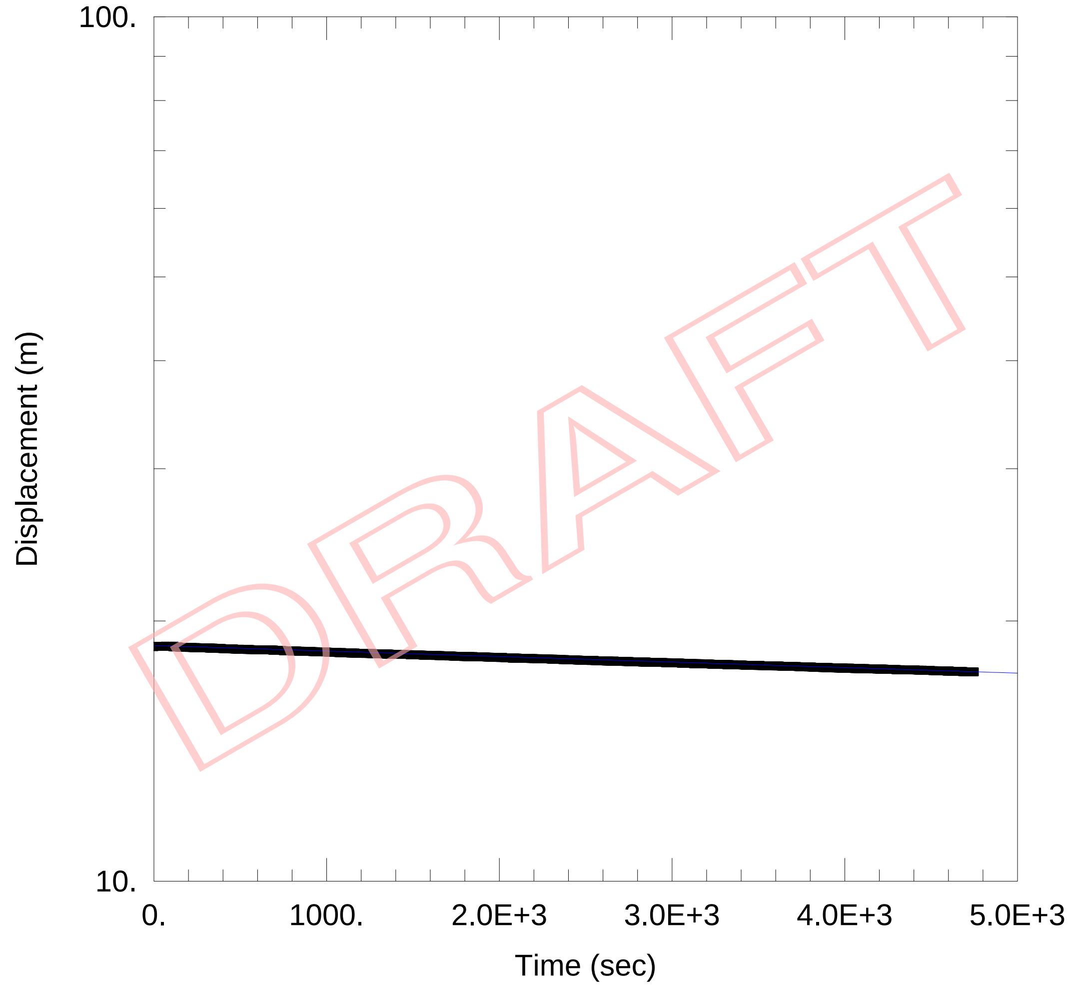
K = 2.479E-7 m/sec   y0 = 20.53 m

WELL DATA (BH17-2A #4)

Initial Displacement: 20.51 m
Static Water Column Height: 14.27 m
Total Well Penetration Depth: 14.27 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #5

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

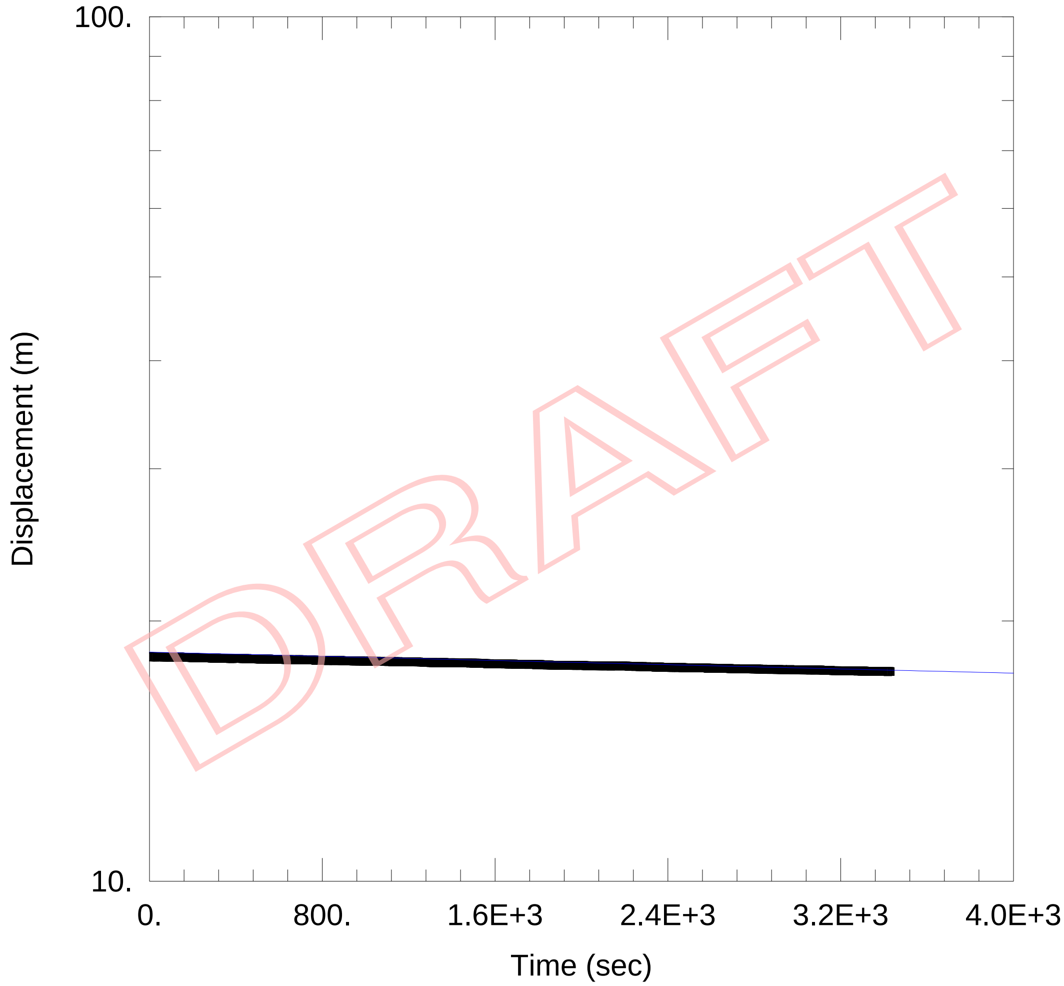
K = 2.348E-8 m/sec   y0 = 18.73 m

WELL DATA (BH17-2A #5)

Initial Displacement: 18.68 m
Static Water Column Height: 19.1 m
Total Well Penetration Depth: 19.1 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #6

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

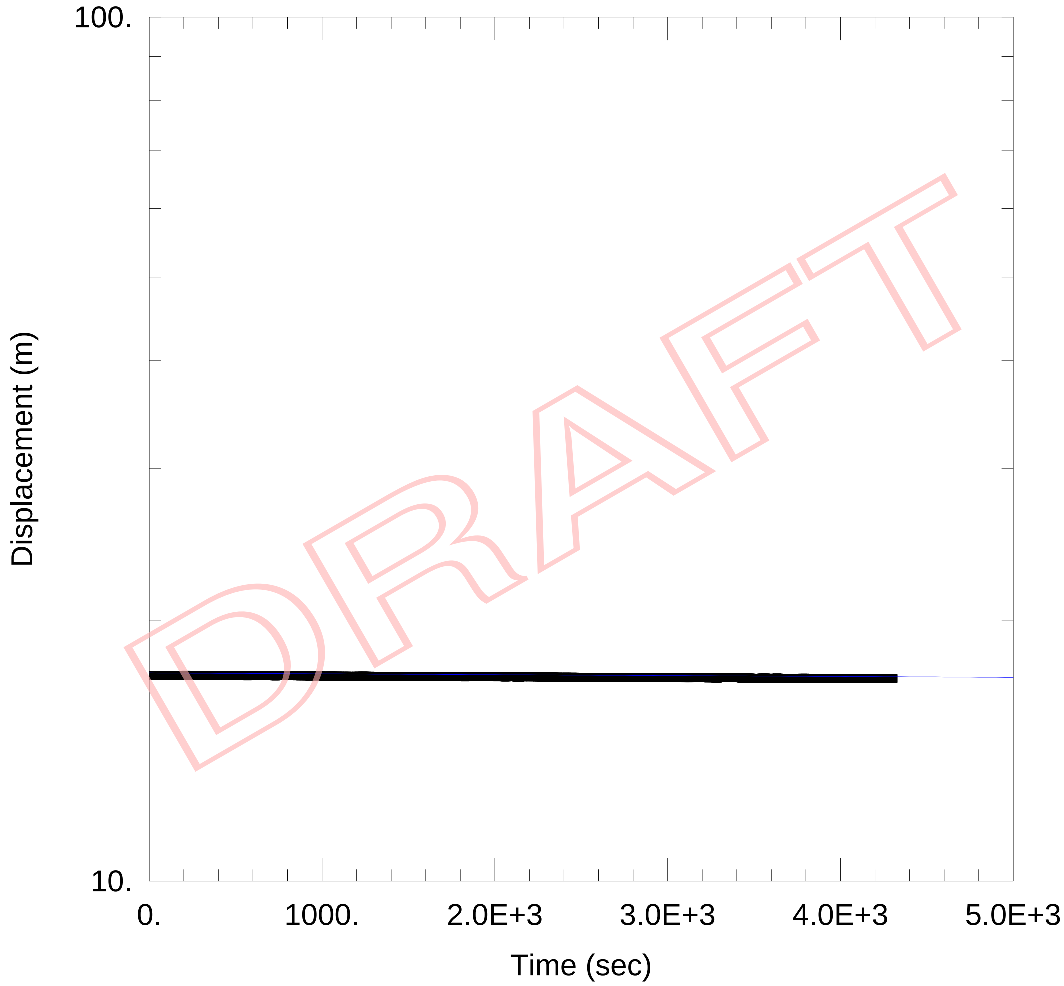
K = 2.744E-8 m/sec   y0 = 18.41 m

WELL DATA (BH17-2A #6)

Initial Displacement: 18.2 m
Static Water Column Height: 22.73 m
Total Well Penetration Depth: 22.72 m
Screen Length: 3.2 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #7

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

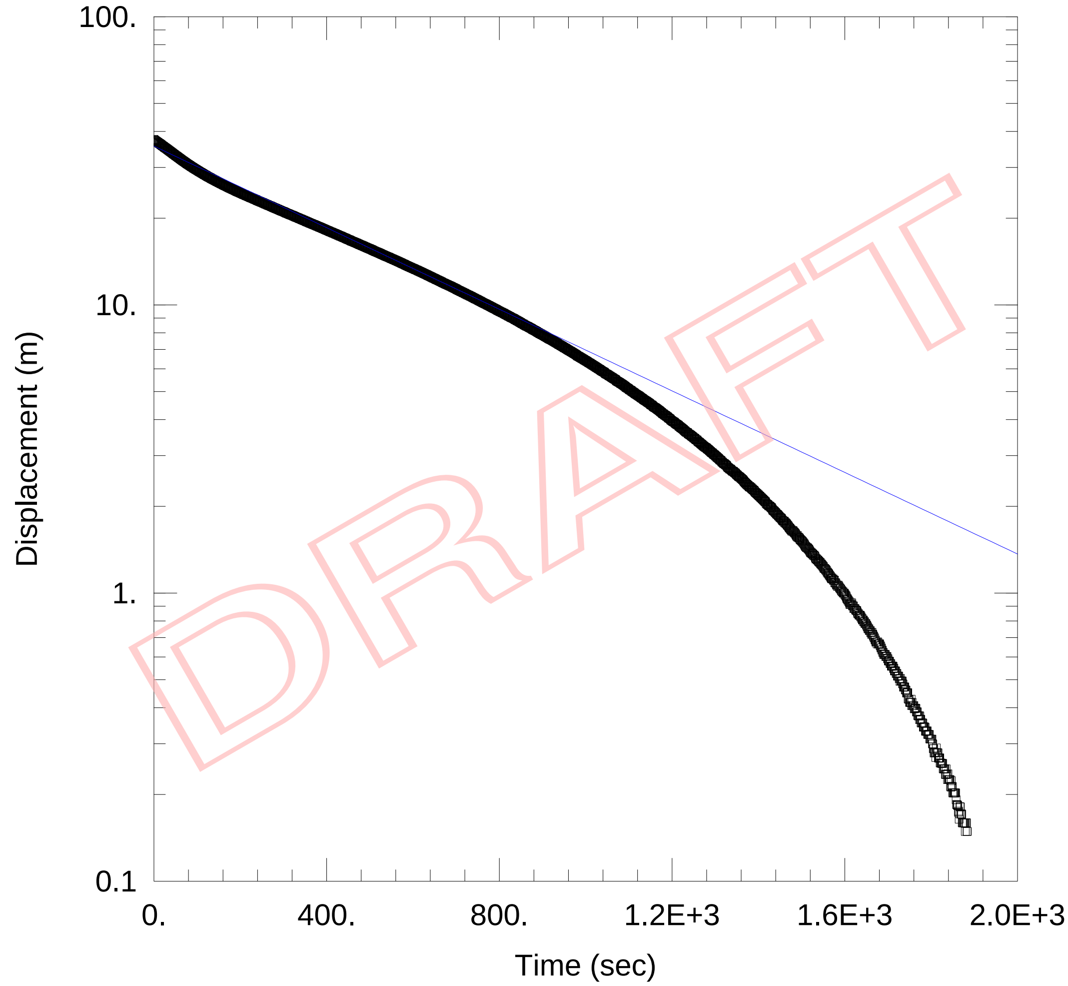
K = 3.907E-9 m/sec   y0 = 17.41 m

WELL DATA (BH17-2A #7)

Initial Displacement: 17.31 m
Static Water Column Height: 26.51 m
Total Well Penetration Depth: 26.51 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #8

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

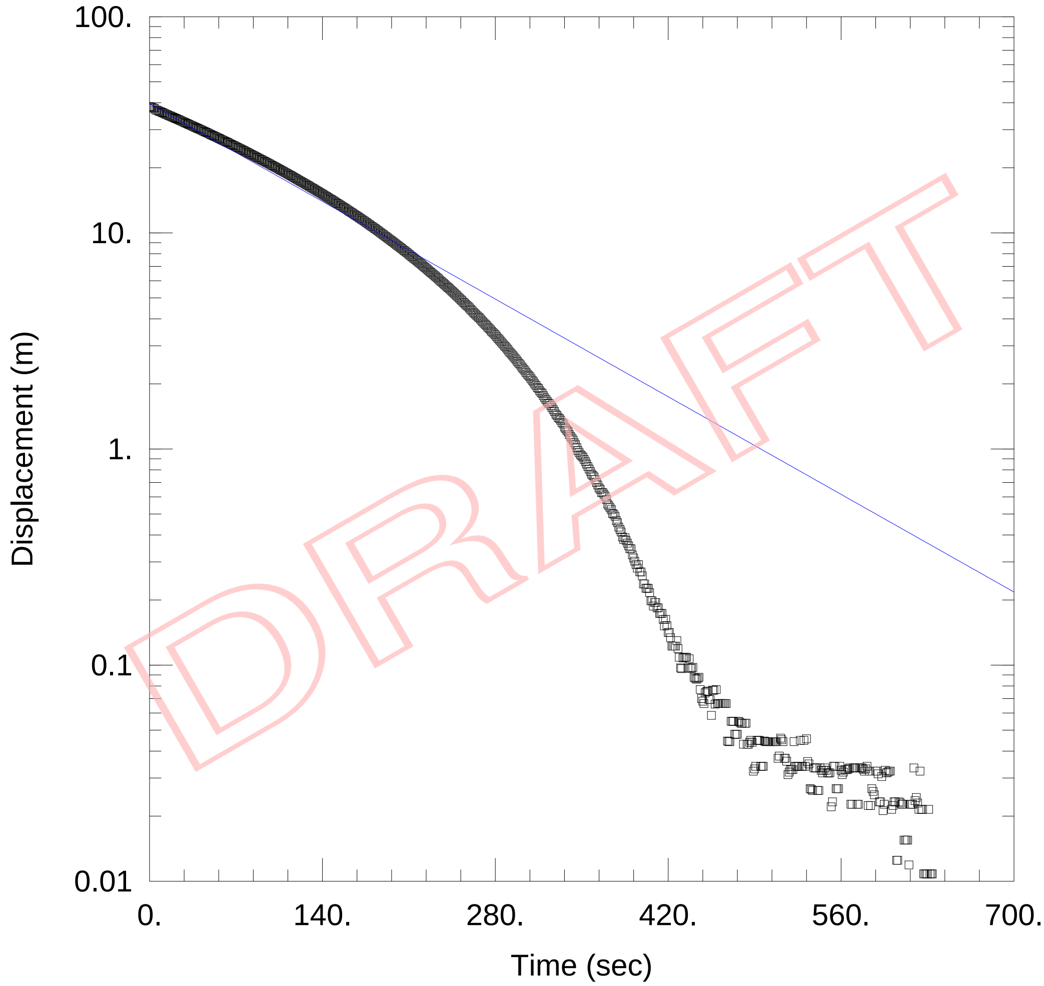
K = 2.827E-6 m/sec y0 = 35.57 m

WELL DATA (BH17-2A #8)

Initial Displacement: 37.49 m
Static Water Column Height: 6.84 m
Total Well Penetration Depth: 6.84 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #9

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

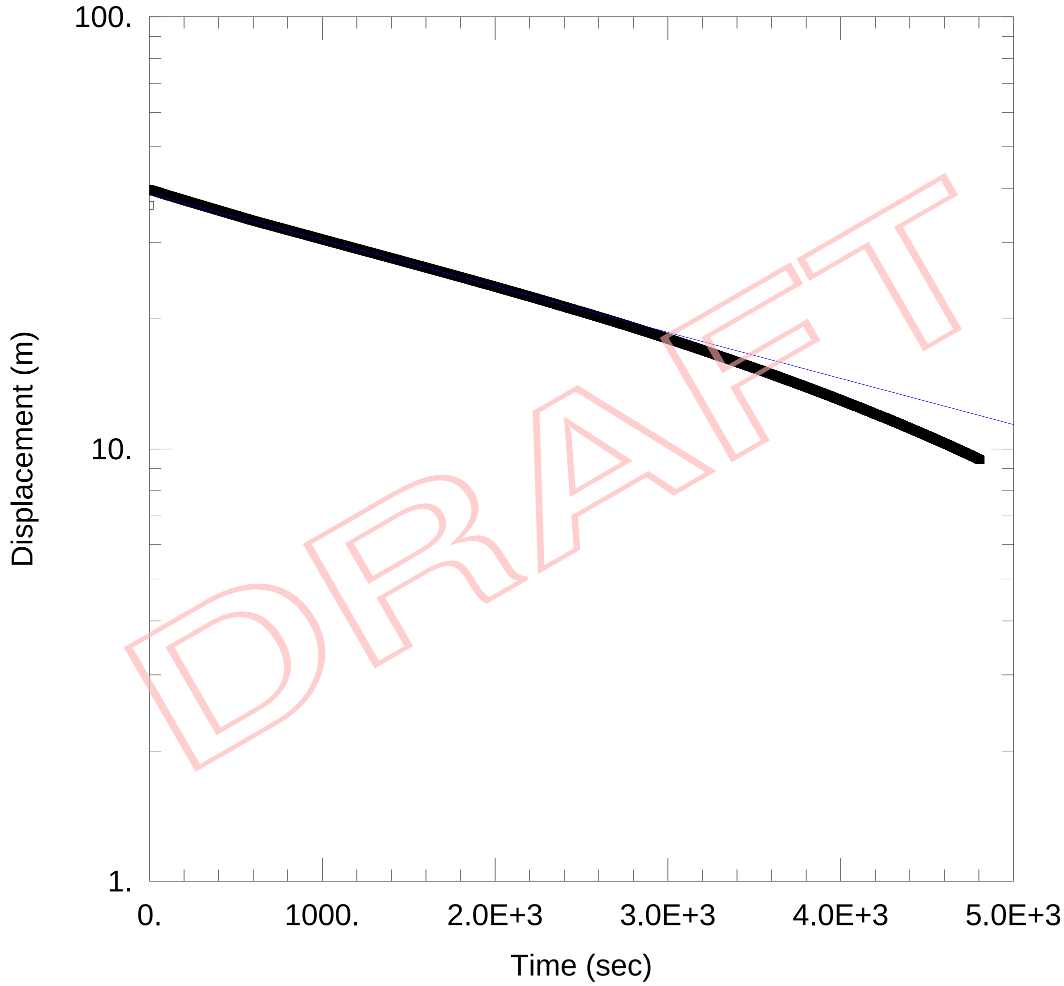
K = 1.259E-5 m/sec   y0 = 39.57 m

WELL DATA (BH17-2A #9)

Initial Displacement: 38.37 m
Static Water Column Height: 5.76 m
Total Well Penetration Depth: 5.76 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #10

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

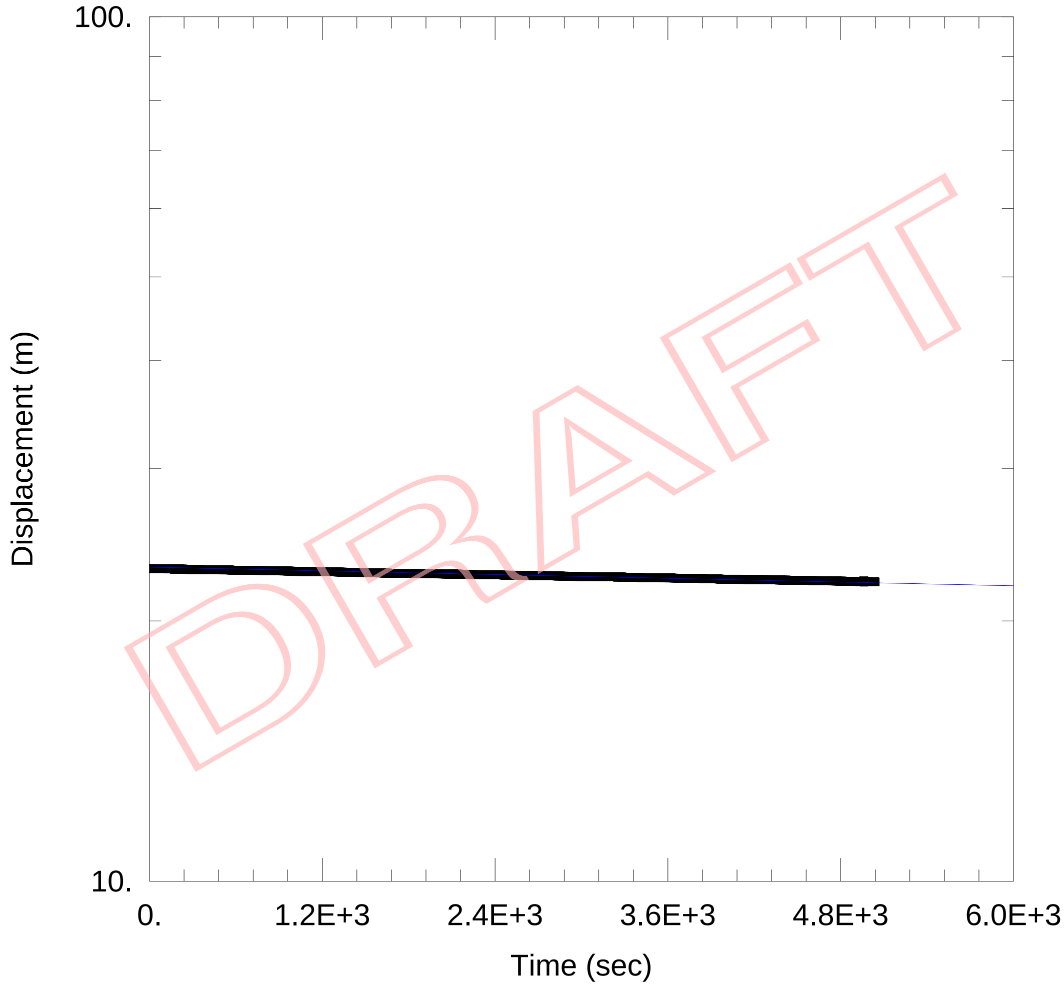
K = 4.75E-7 m/sec   y0 = 38.92 m

WELL DATA (BH17-2A #10)

Initial Displacement: 36.63 m
Static Water Column Height: 16. m
Total Well Penetration Depth: 16. m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-2A #11

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

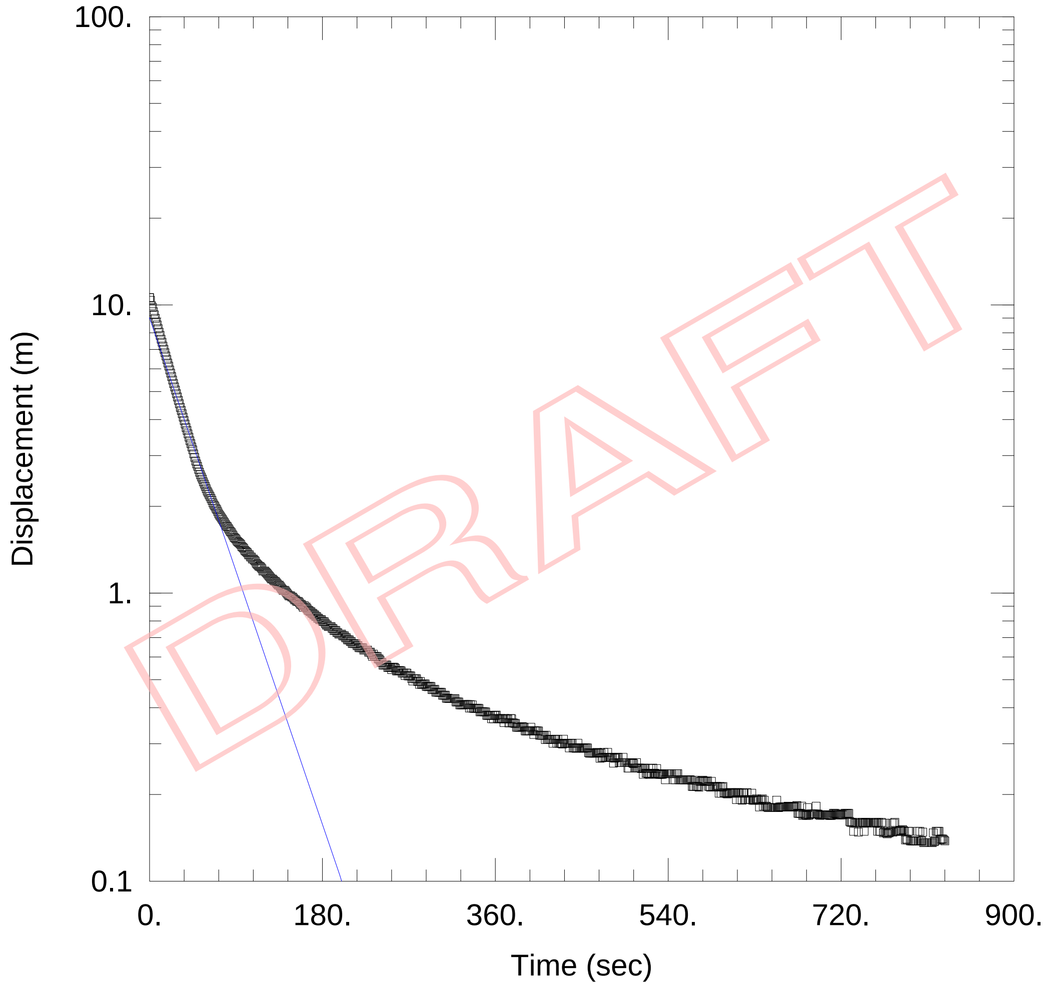
K = 9.838E-9 m/sec   y0 = 23.08 m

WELL DATA (BH17-2A #11)

Initial Displacement: 23. m
Static Water Column Height: 34.32 m
Total Well Penetration Depth: 34.32 m
Screen Length: 4.6 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #1

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

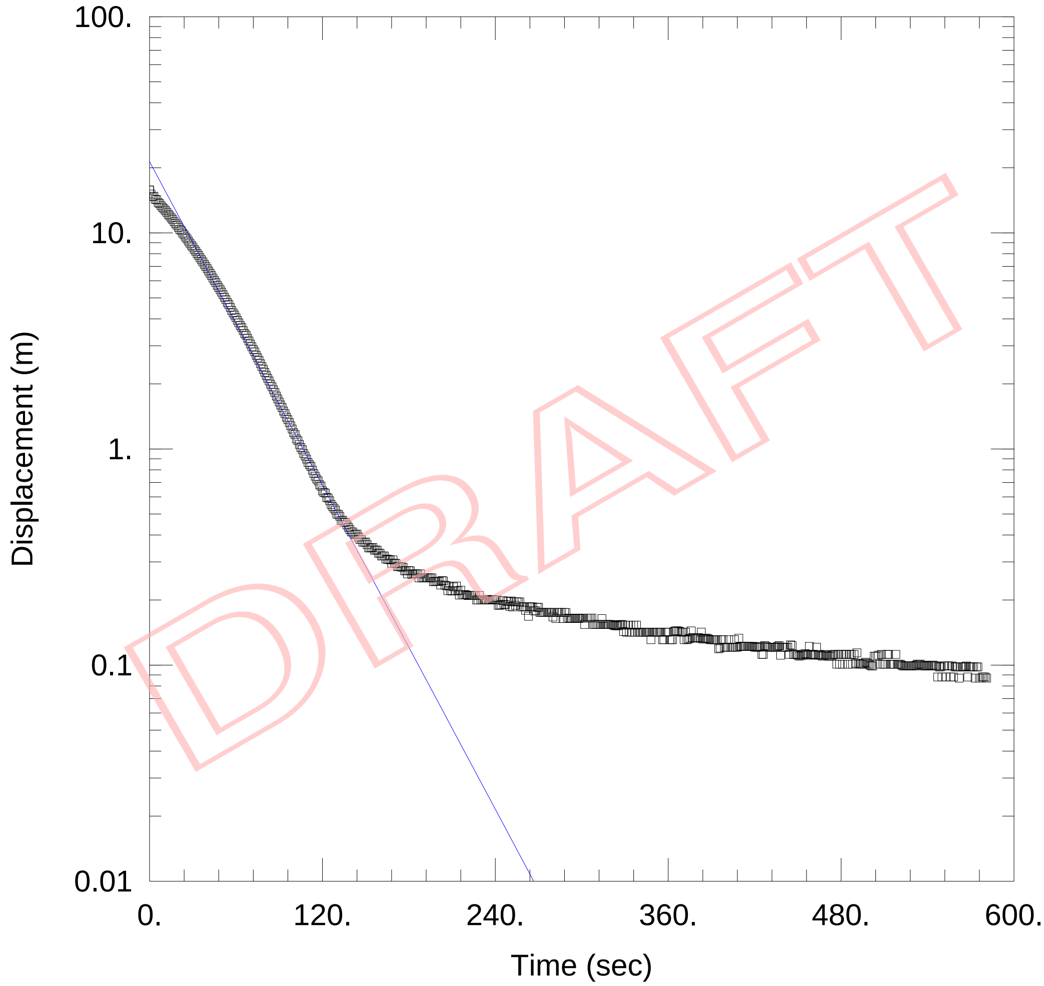
K = 2.927E-5 m/sec   y0 = 9.019 m

WELL DATA (BH17-3A #1)

Initial Displacement: 10.6 m
Static Water Column Height: 10.07 m
Total Well Penetration Depth: 10.07 m
Screen Length: 3.5 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

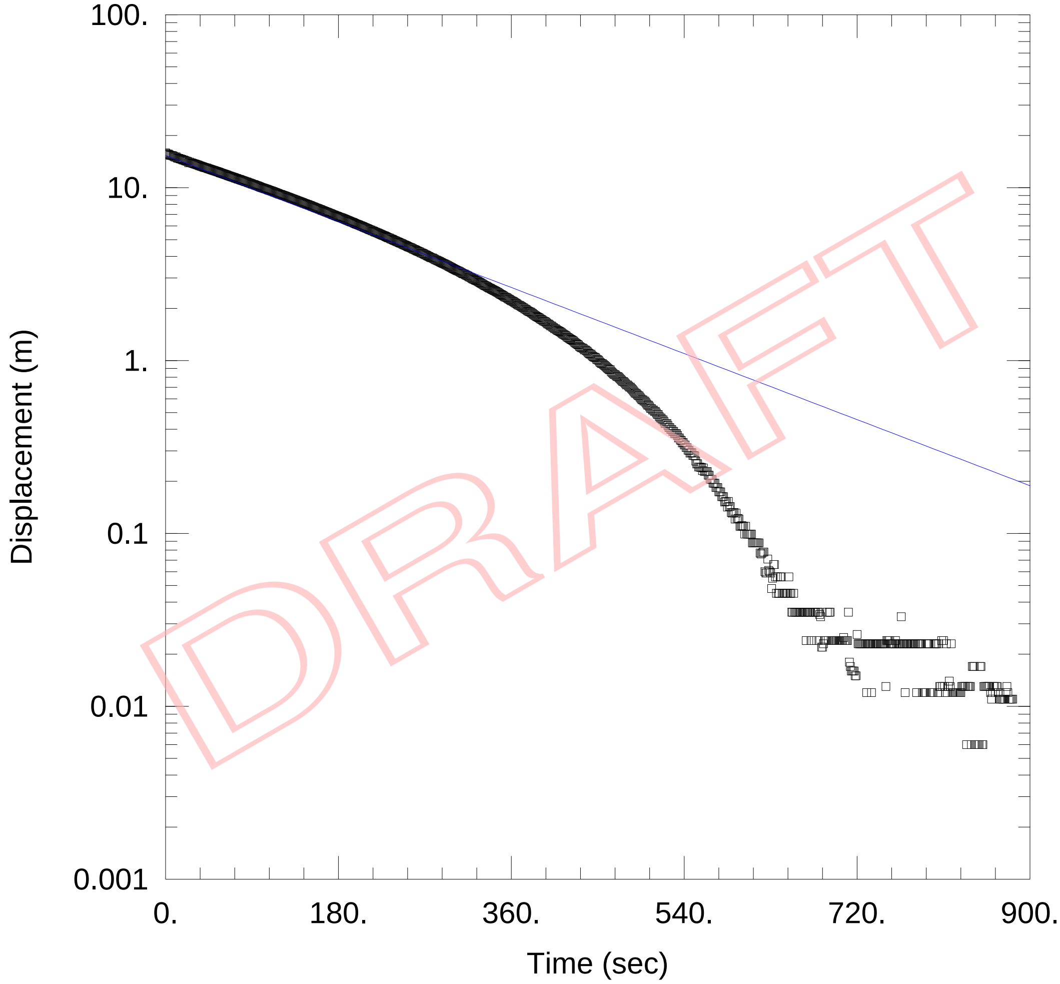
K = 5.075E-5 m/sec   y0 = 21.35 m

WELL DATA (BH17-3A #2)

Initial Displacement: 15.77 m
Static Water Column Height: 7.78 m
Total Well Penetration Depth: 7.78 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #3

Prepared By:	Prepared For:
Golder	Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

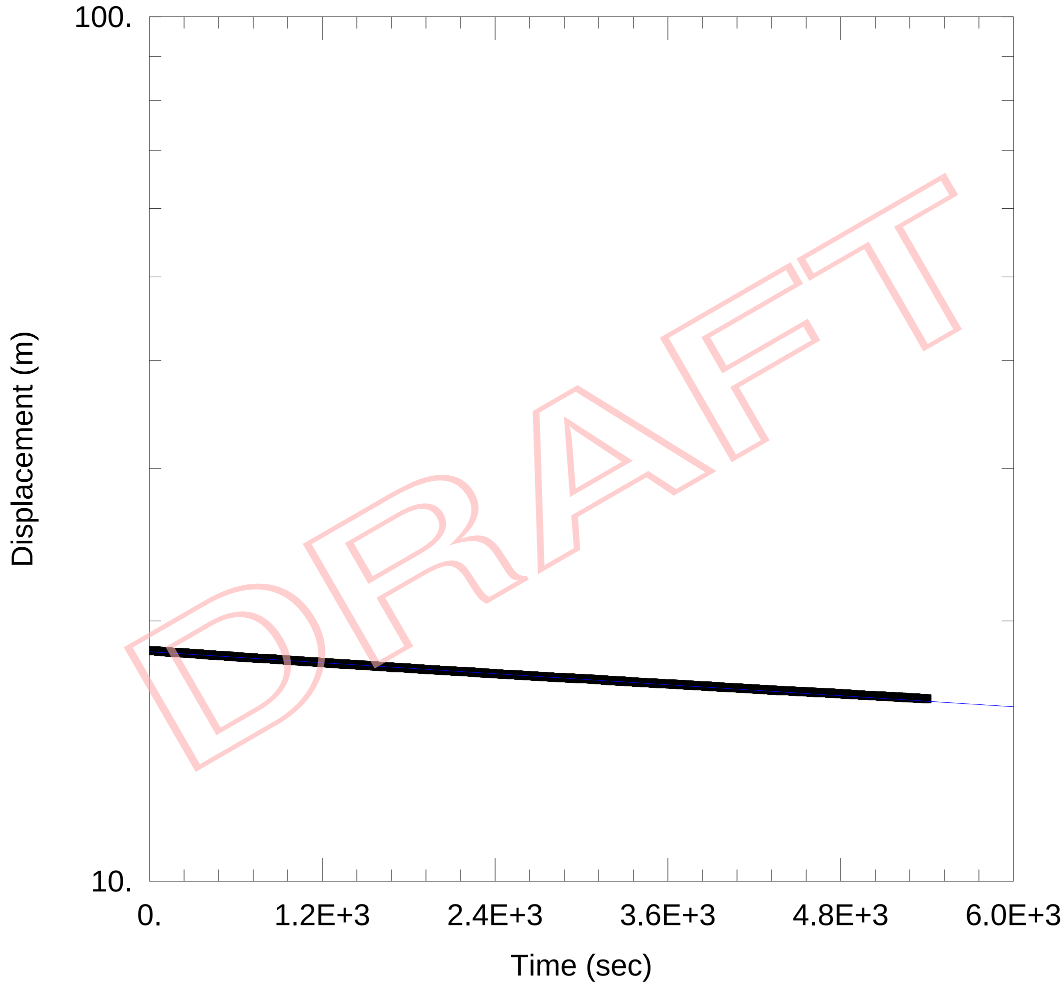
K = 9.05E-6 m/sec y0 = 15.37 m

WELL DATA (BH17-3A #3)

Initial Displacement: 15.86 m
Static Water Column Height: 11.24 m
Total Well Penetration Depth: 11.24 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #4

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

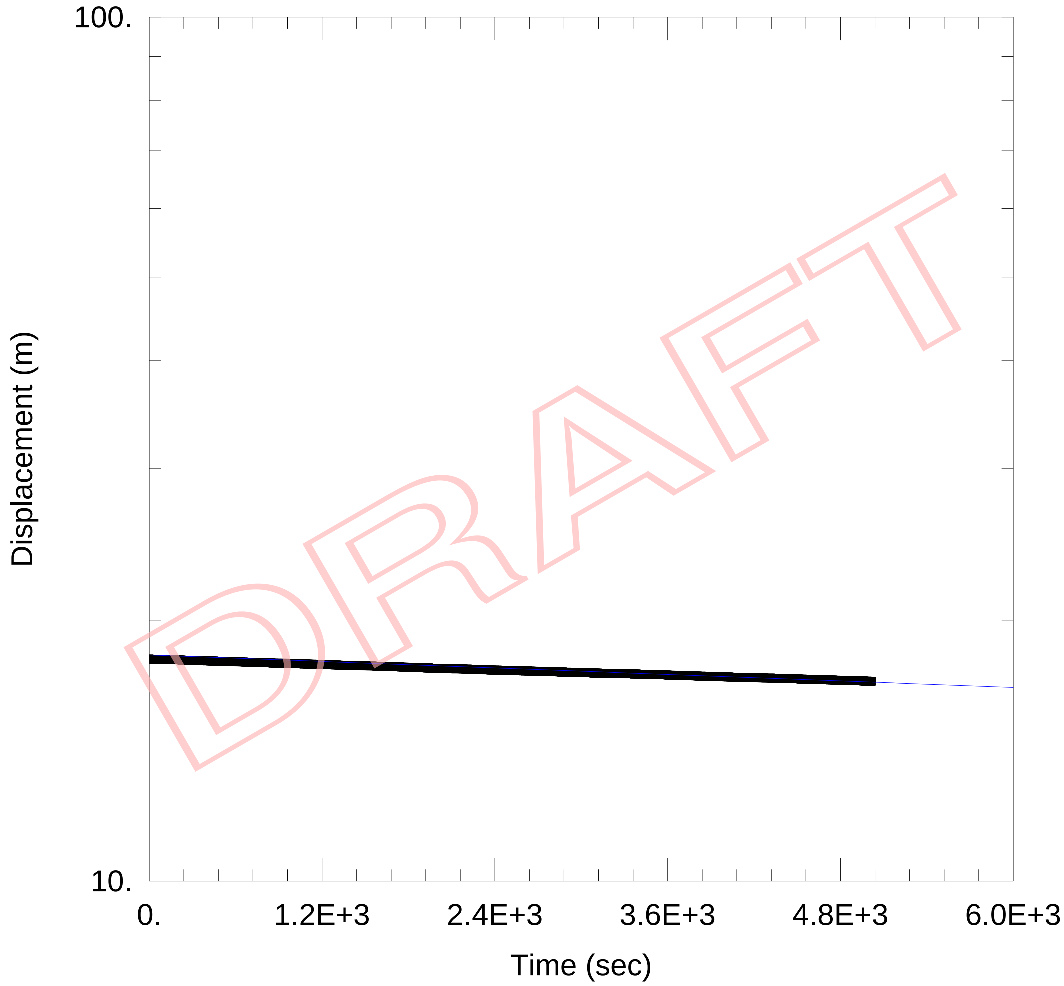
K = 4.735E-8 m/sec   y0 = 18.42 m

WELL DATA (BH17-3A #4)

Initial Displacement: 18.48 m
Static Water Column Height: 16.34 m
Total Well Penetration Depth: 16.34 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #5

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

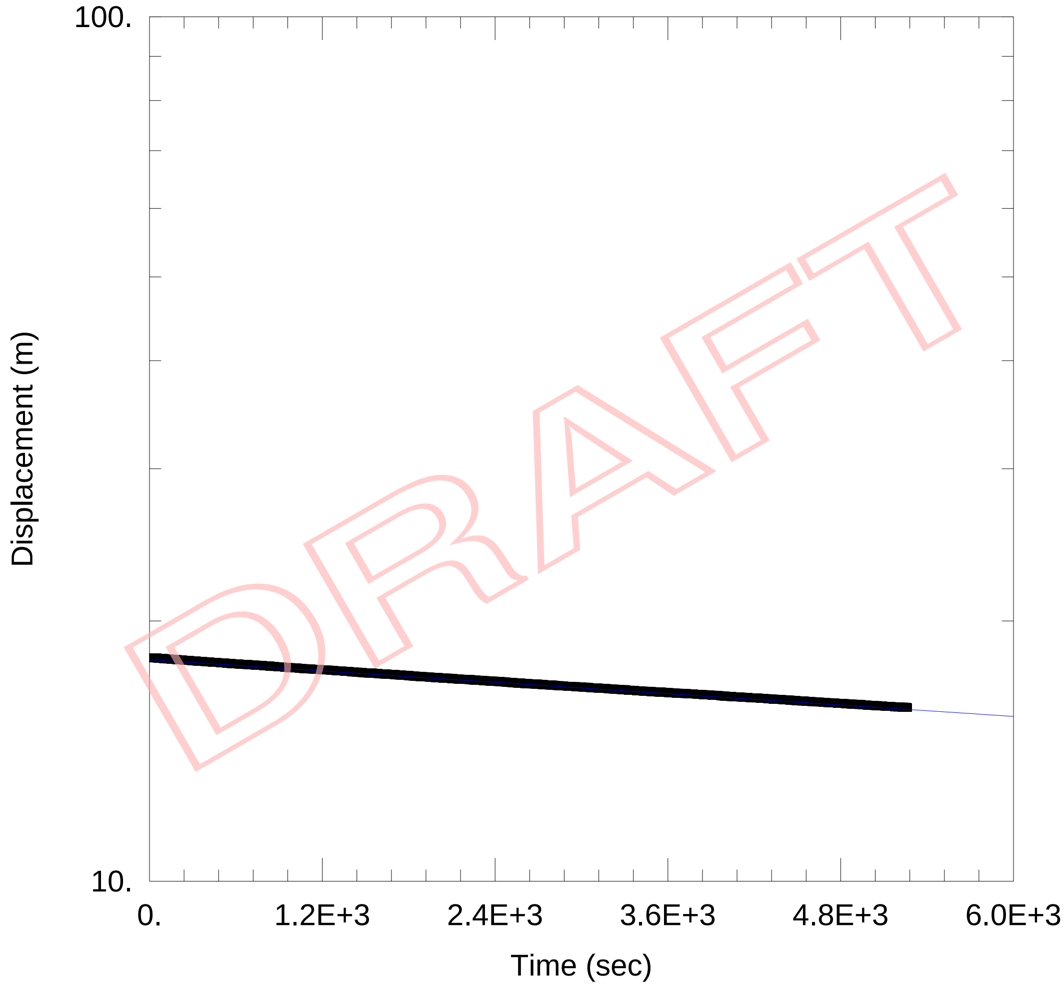
K = 2.316E-8 m/sec   y0 = 18.26 m

WELL DATA (BH17-3A #5)

Initial Displacement: 18.07 m
Static Water Column Height: 19.75 m
Total Well Penetration Depth: 19.75 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #6

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



DRAFT

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

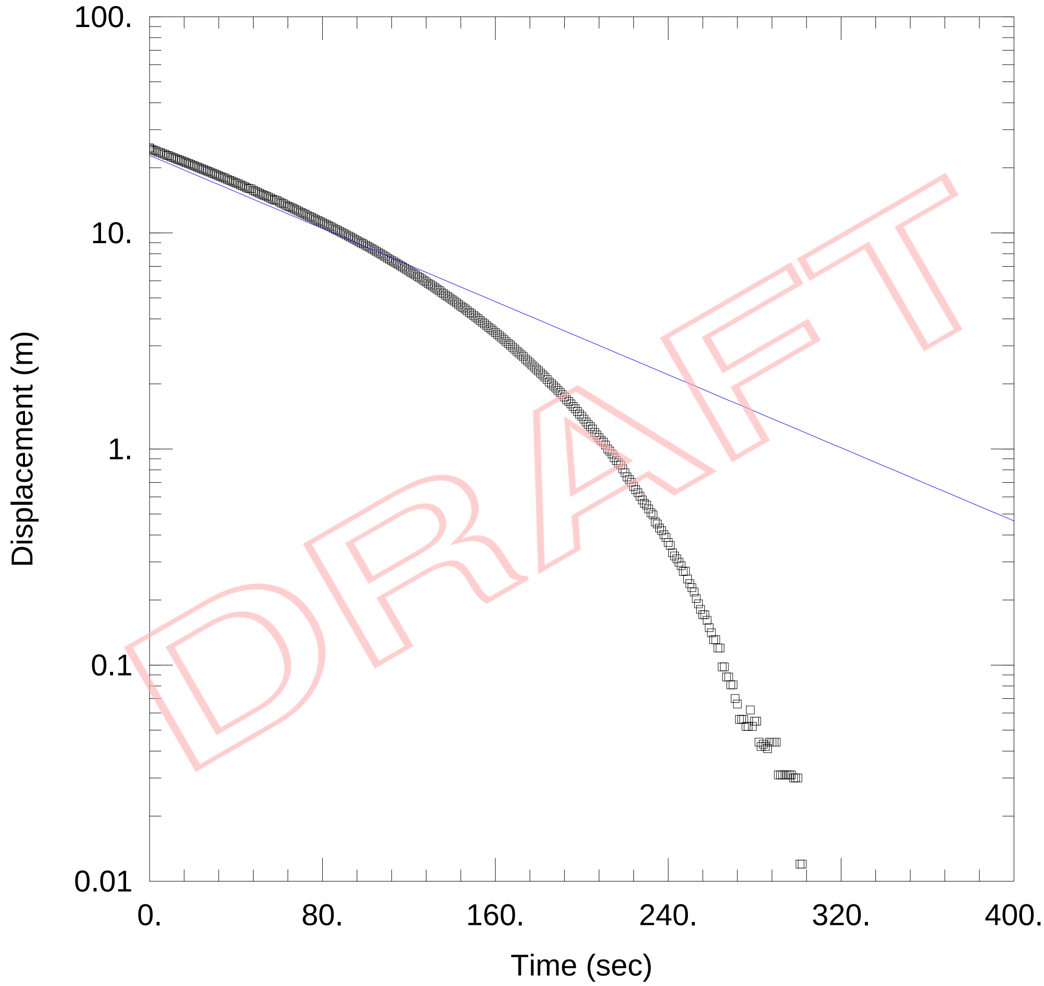
K = 4.119E-8 m/sec y0 = 18.04 m

WELL DATA (BH17-3A #6)

Initial Displacement: 18.14 m
Static Water Column Height: 22.68 m
Total Well Penetration Depth: 22.68 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #7

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

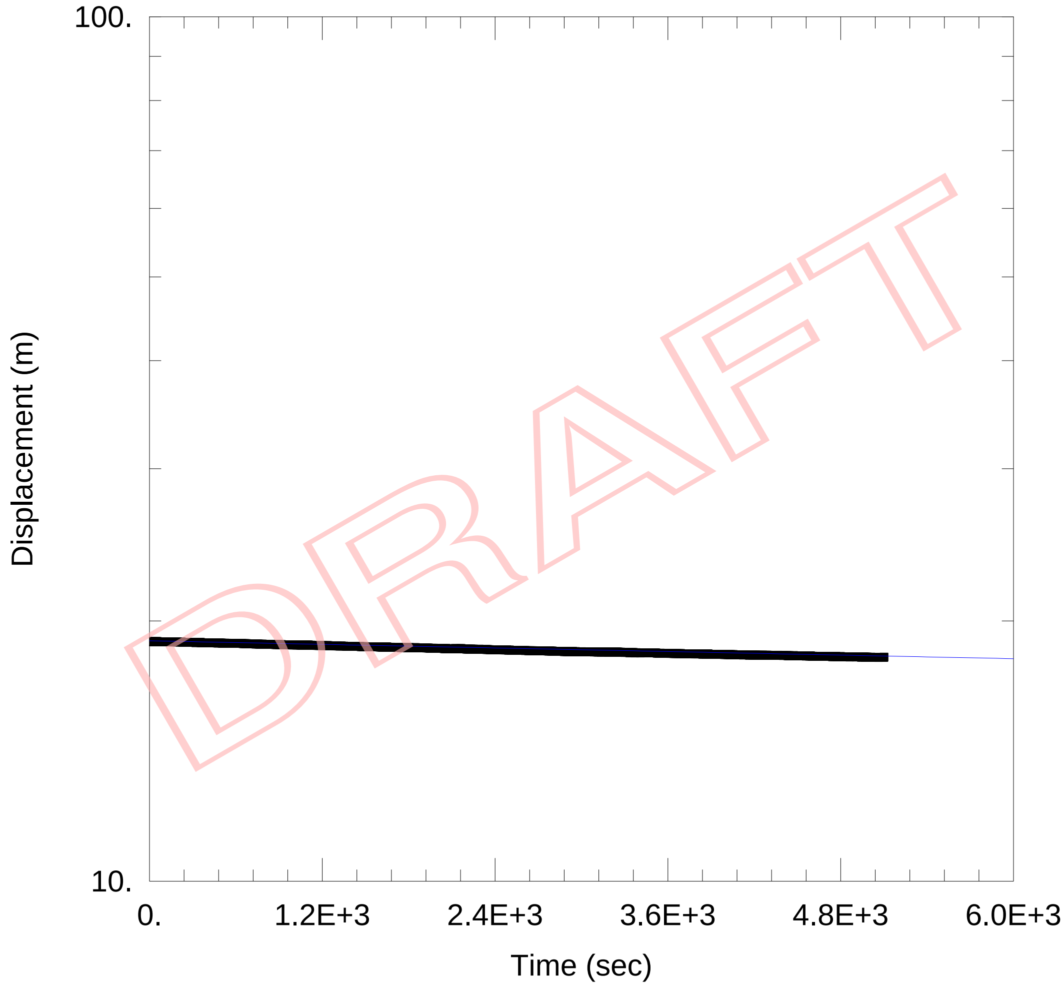
K = 1.819E-5 m/sec   y0 = 22.82 m

WELL DATA (BH17-3A #7)

Initial Displacement: 24.68 m
Static Water Column Height: 12.11 m
Total Well Penetration Depth: 12.11 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #8

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

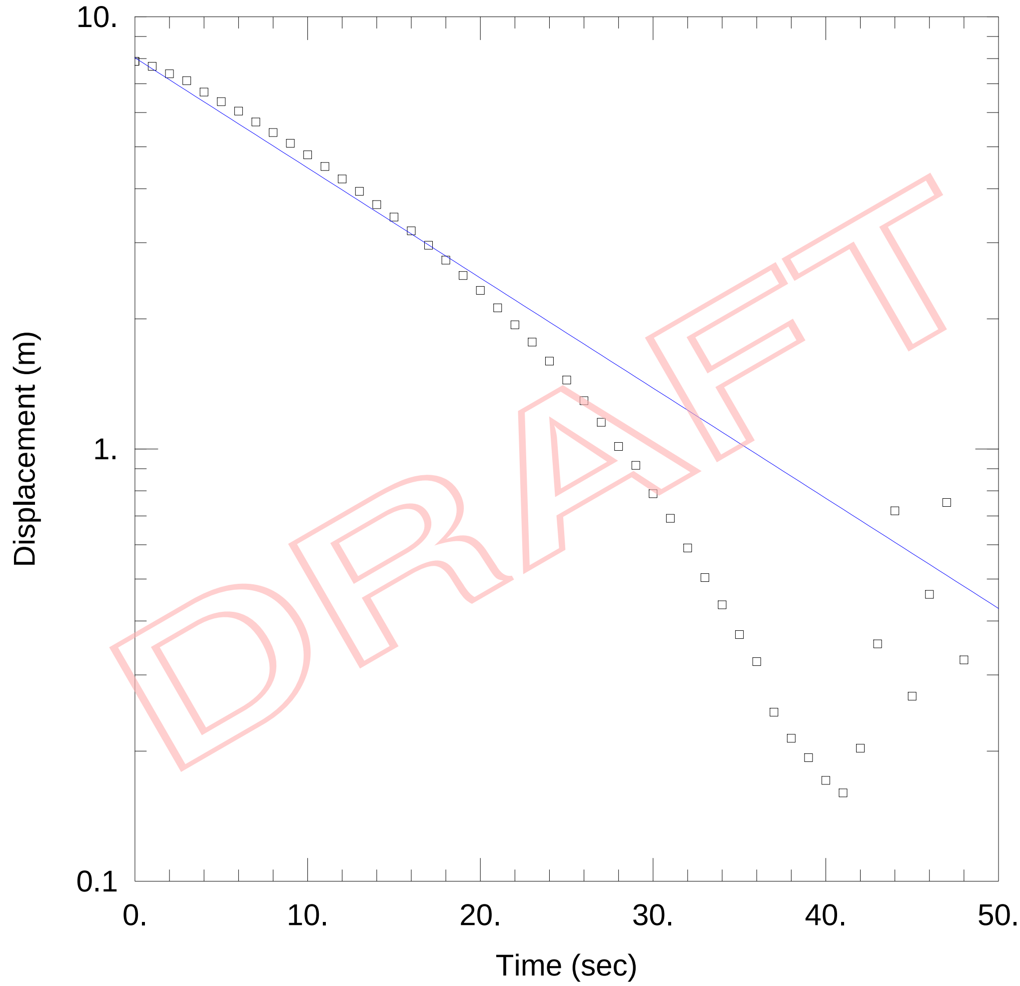
K = 1.333E-8 m/sec   y0 = 18.97 m

WELL DATA (BH17-3A #8)

Initial Displacement: 18.93 m
Static Water Column Height: 27.88 m
Total Well Penetration Depth: 27.88 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #9

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

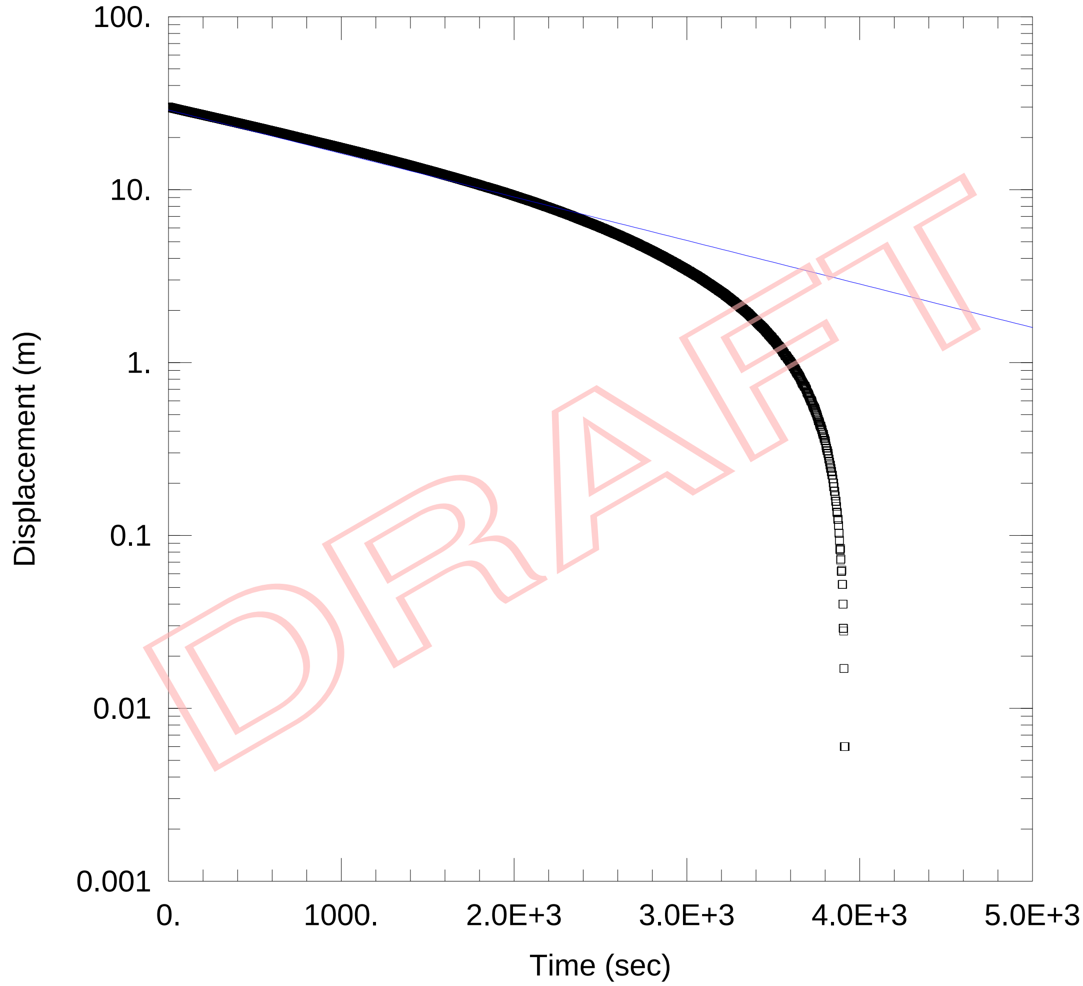
K = 0.0001148 m/sec y0 = 8.037 m

WELL DATA (BH17-3A #9)

Initial Displacement: 7.883 m
Static Water Column Height: 17.73 m
Total Well Penetration Depth: 17.73 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #10

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

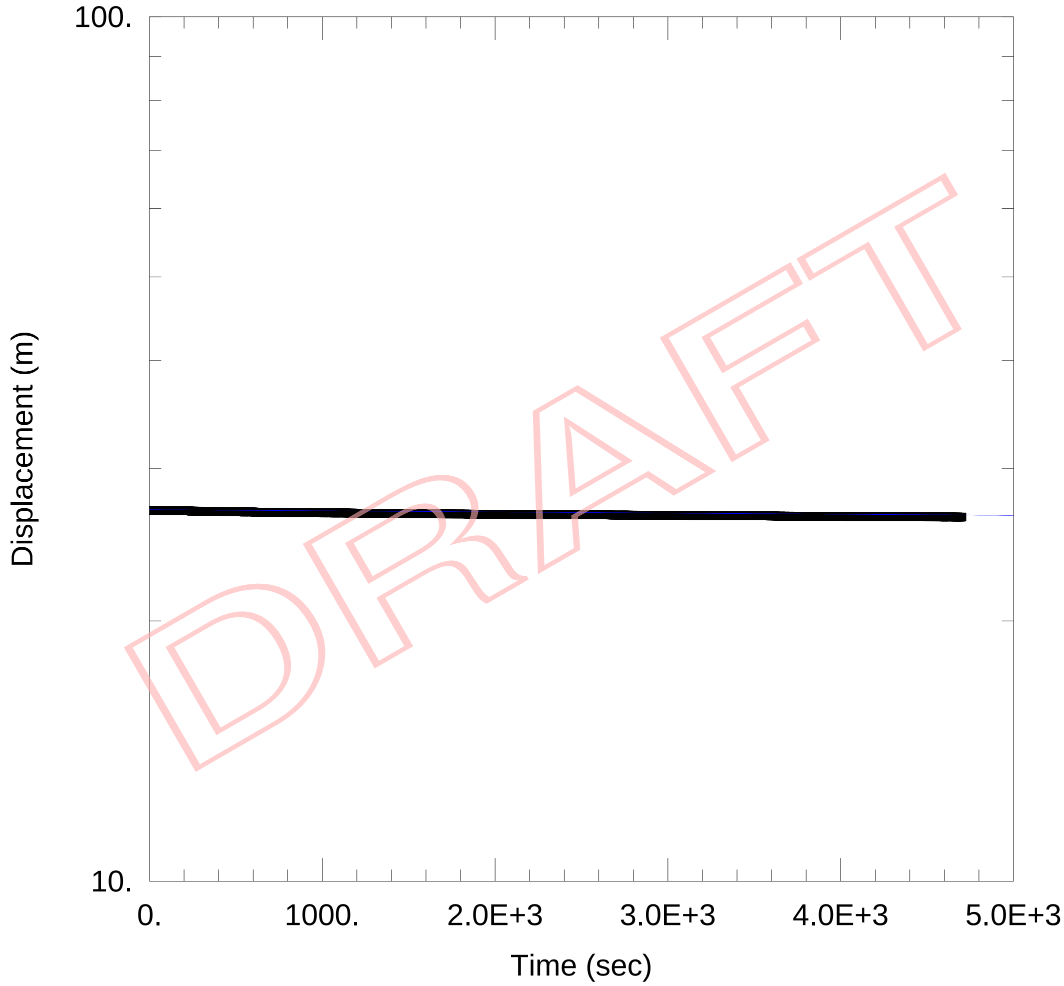
K = 8.86E-7 m/sec   y0 = 28.89 m

WELL DATA (BH17-3A #10)

Initial Displacement: 30.04 m
Static Water Column Height: 23.77 m
Total Well Penetration Depth: 23.77 m
Screen Length: 4.2 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-3A #11

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

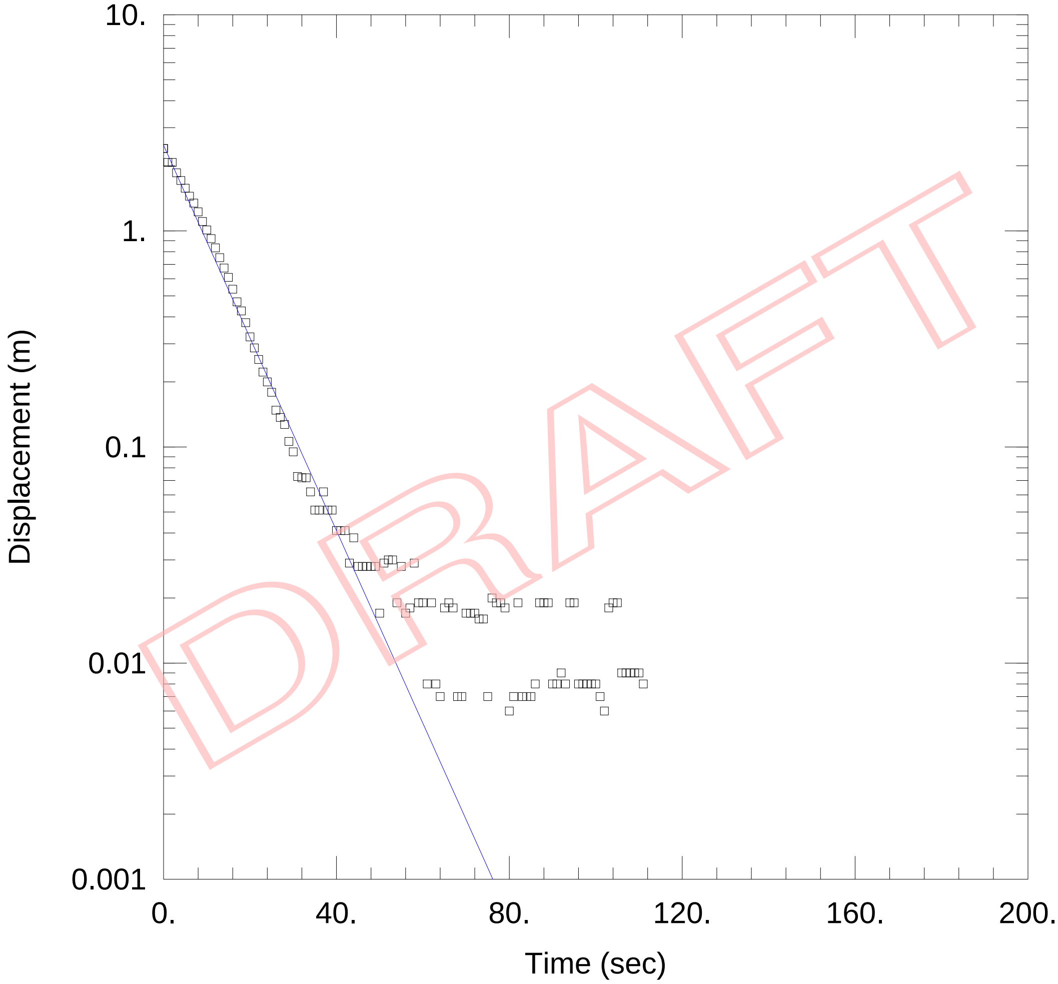
K = 1.497E-8 m/sec   y0 = 26.9 m

WELL DATA (BH17-3A #11)

Initial Displacement: 26.82 m
Static Water Column Height: 27.07 m
Total Well Penetration Depth: 27.07 m
Screen Length: 1.2 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-4A #1

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

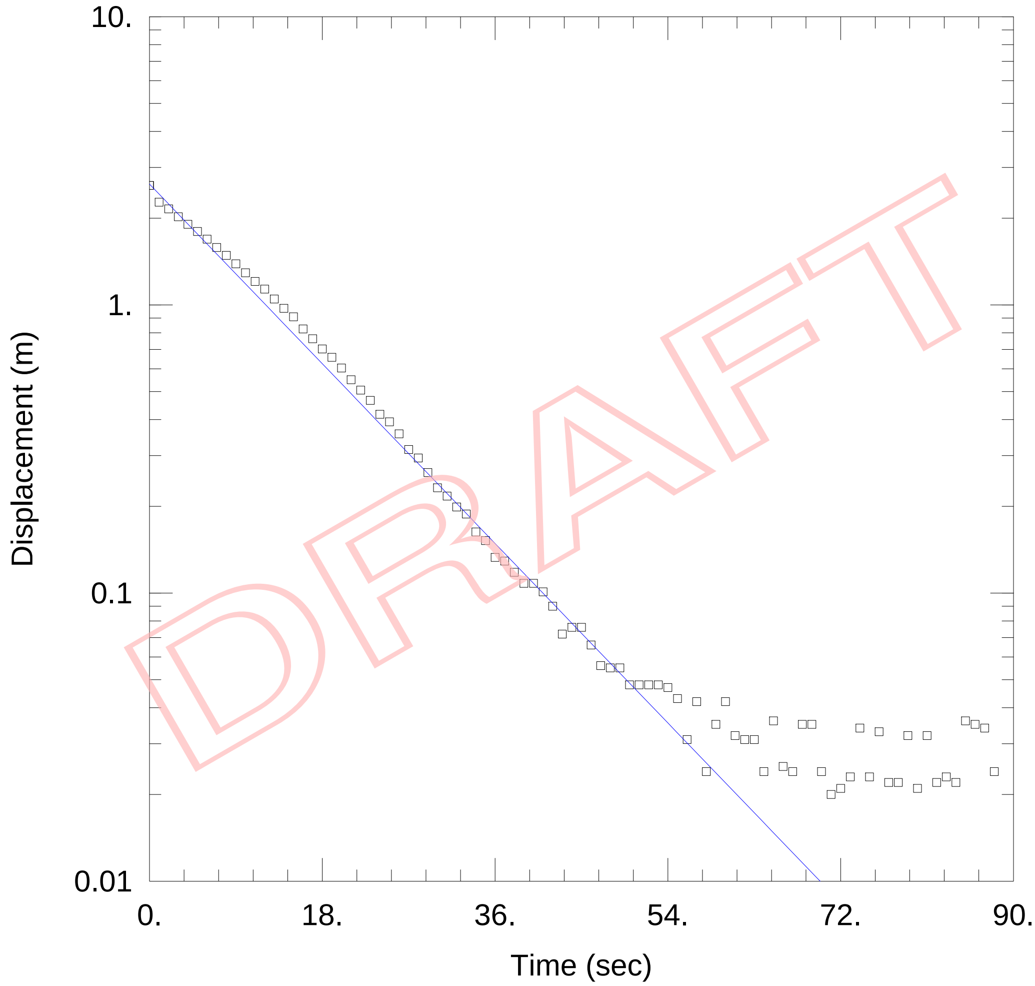
K = 0.0001412 m/sec   y0 = 2.489 m

WELL DATA (BH17-4A #1)

Initial Displacement: 2.406 m
Static Water Column Height: 5.78 m
Total Well Penetration Depth: 5.75 m
Screen Length: 3. m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-4A #2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

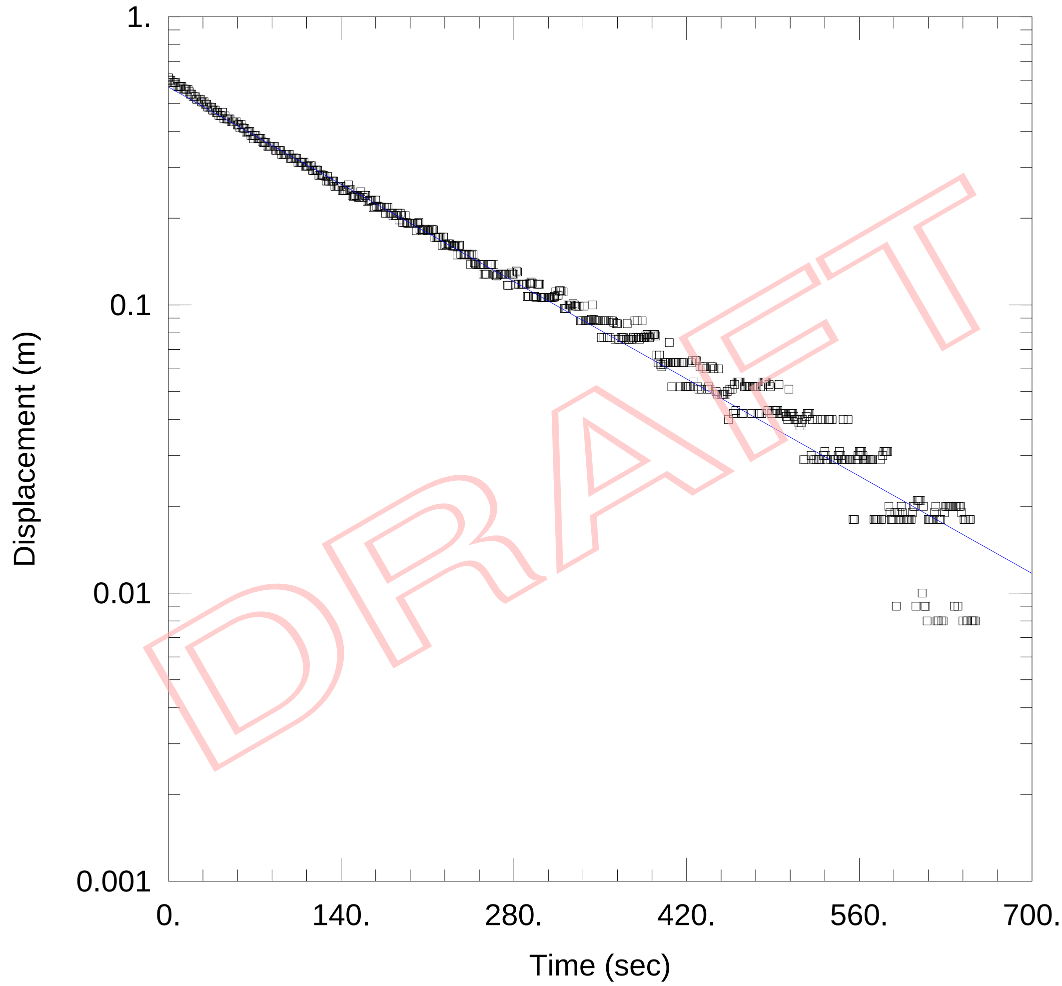
K = 0.0001144 m/sec   y0 = 2.624 m

WELL DATA (BH17-4A #2)

Initial Displacement: 2.597 m
Static Water Column Height: 9.03 m
Total Well Penetration Depth: 8.99 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-4A #3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

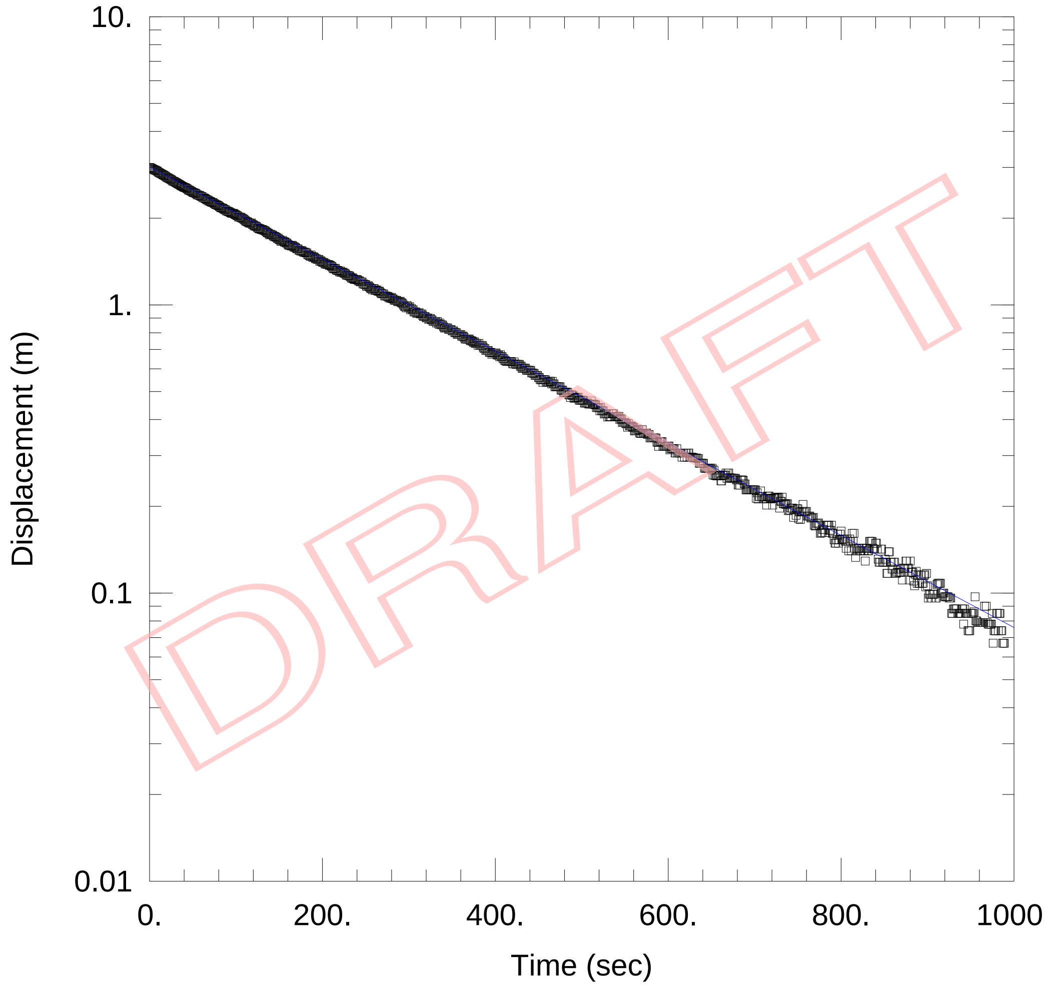
K = 1.037E-5 m/sec   y0 = 0.5705 m

WELL DATA (BH17-4A #3)

Initial Displacement: 0.614 m
Static Water Column Height: 12.02 m
Total Well Penetration Depth: 11.99 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-4A #4

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

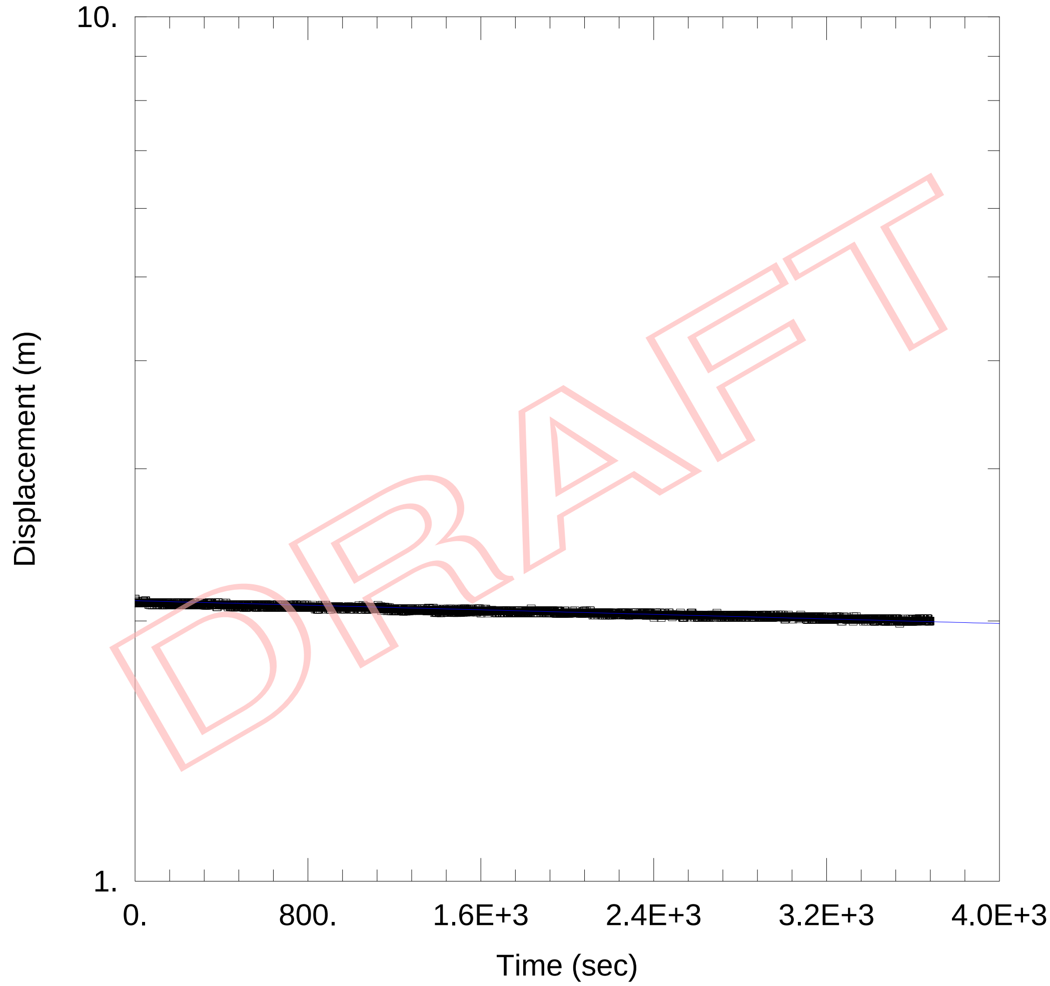
K = 5.64E-6 m/sec   y0 = 3.015 m

WELL DATA (BH17-4A #4)

Initial Displacement: 2.994 m
Static Water Column Height: 18.39 m
Total Well Penetration Depth: 17.39 m
Screen Length: 3.2 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-4A #5

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

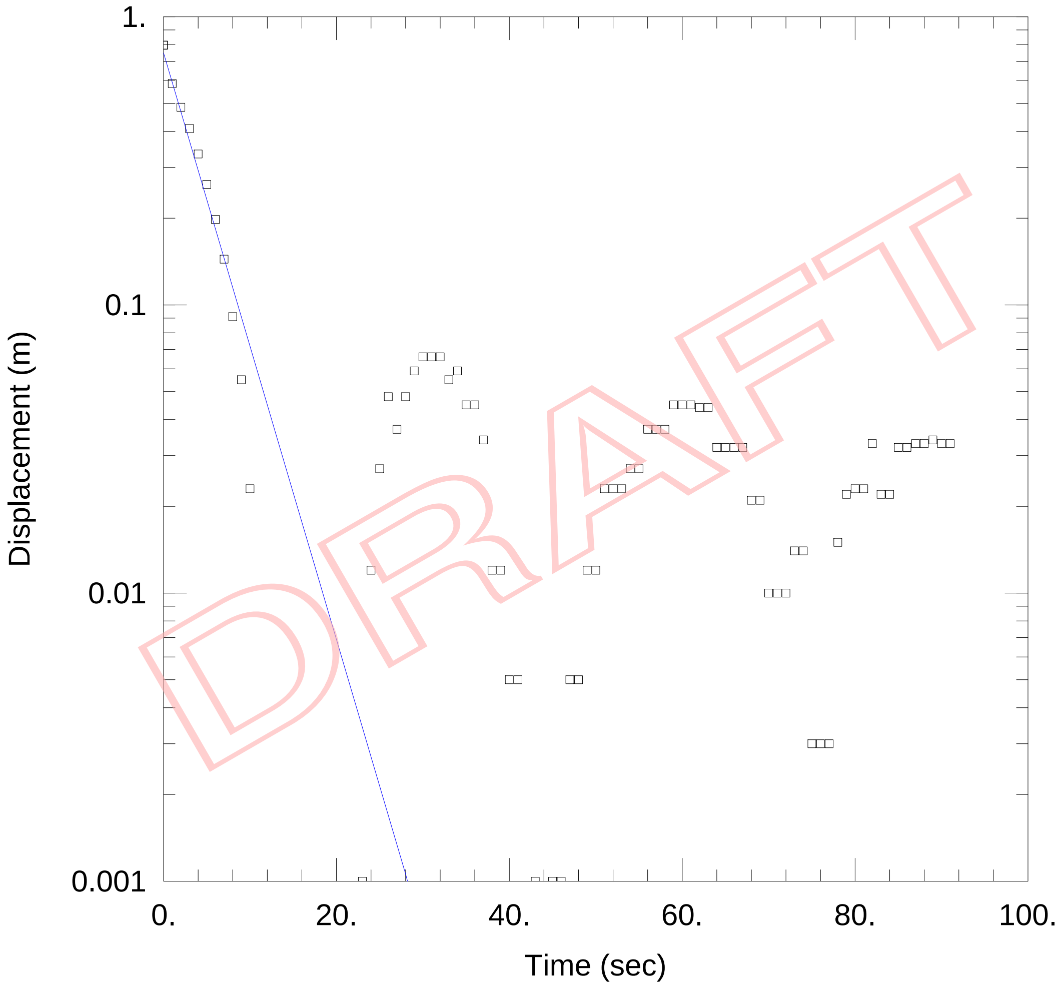
K = 2.428E-8 m/sec y0 = 2.111 m

WELL DATA (BH17-4A #5)

Initial Displacement: 2.119 m
Static Water Column Height: 19.19 m
Total Well Penetration Depth: 19.19 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-4A #6

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

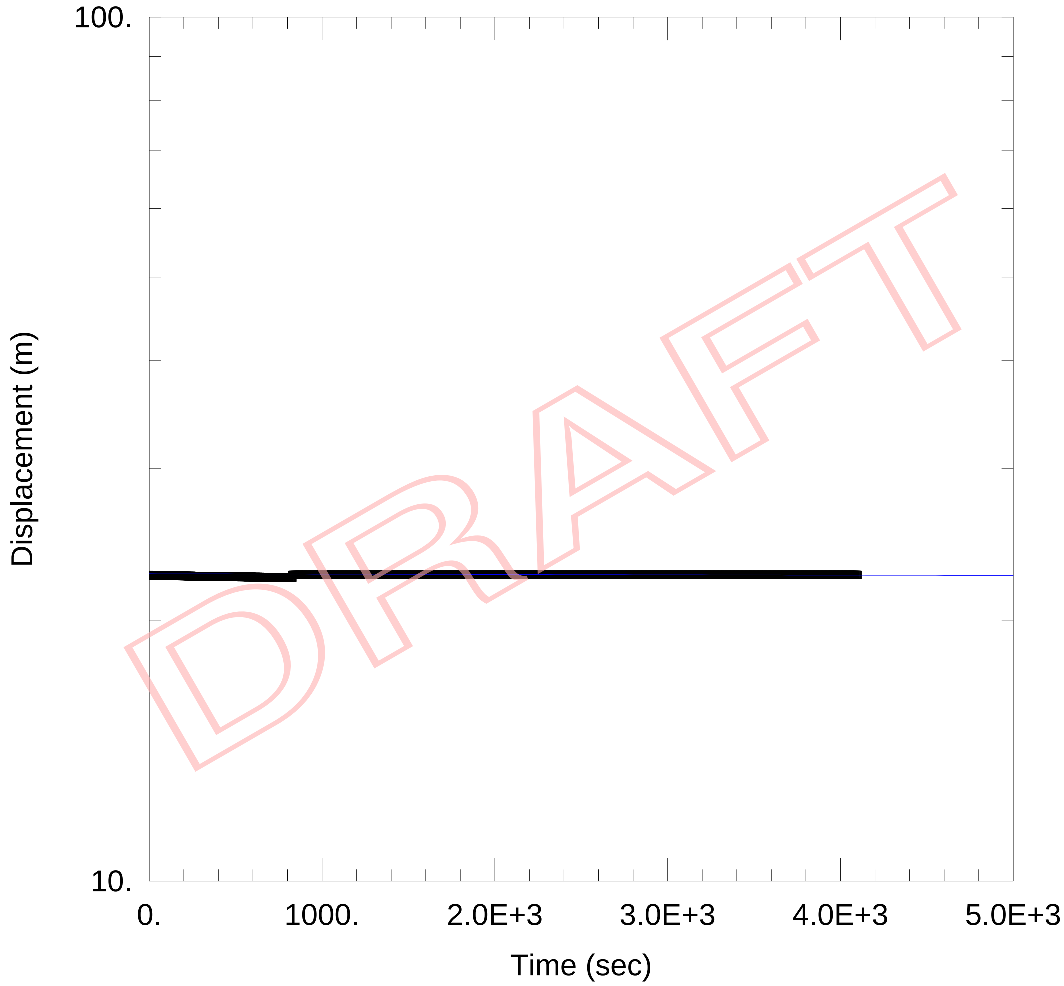
K = 0.0003898 m/sec   y0 = 0.7485 m

WELL DATA (BH17-4A #6)

Initial Displacement: 0.797 m
Static Water Column Height: 26.09 m
Total Well Penetration Depth: 26.09 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-5A #1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

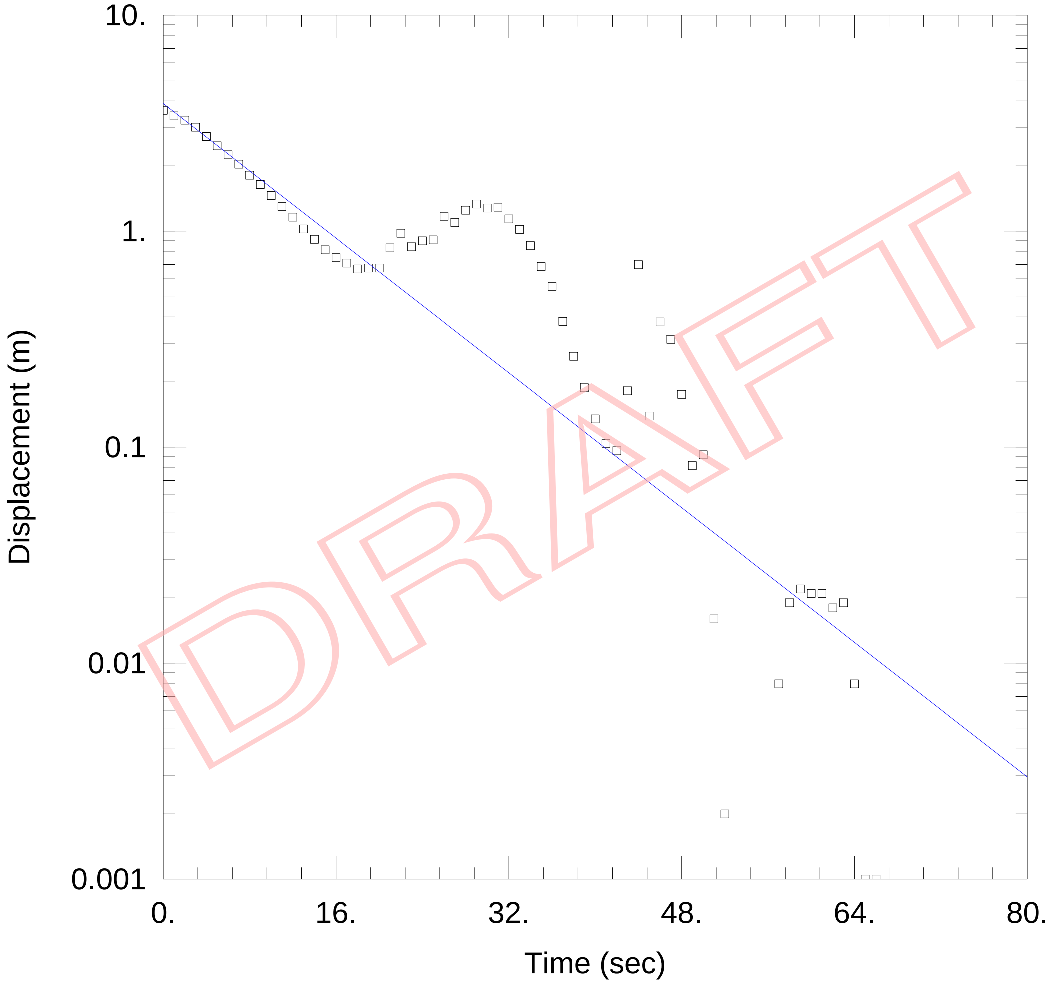
K = 2.022E-9 m/sec   y0 = 22.68 m

WELL DATA (BH17-5A)

Initial Displacement: 22.6 m
Static Water Column Height: 4.501 m
Total Well Penetration Depth: 4.501 m
Screen Length: 2.3 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-5A #2

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

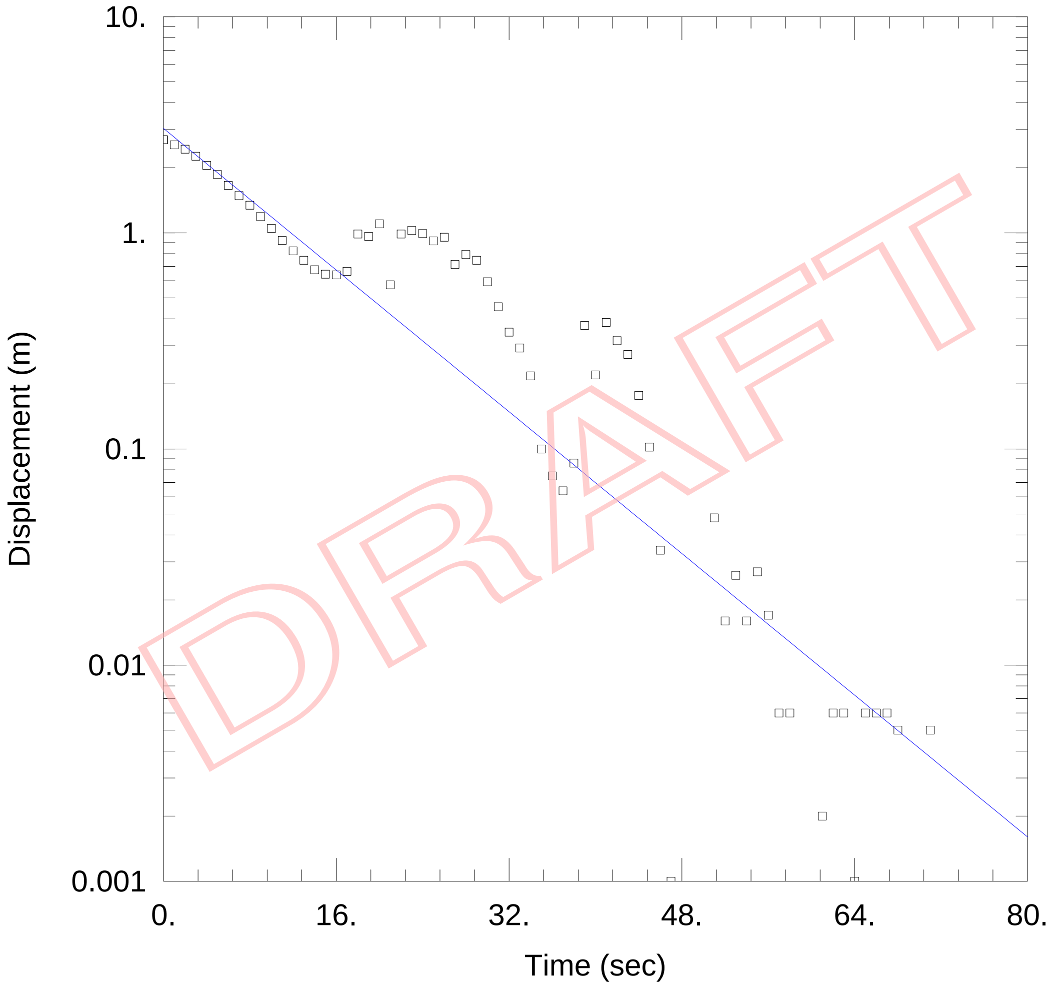
K = 0.0001522 m/sec   y0 = 3.892 m

WELL DATA (BH17-5A)

Initial Displacement: 3.623 m
Static Water Column Height: 6.92 m
Total Well Penetration Depth: 6.92 m
Screen Length: 3.18 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-5A #3

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

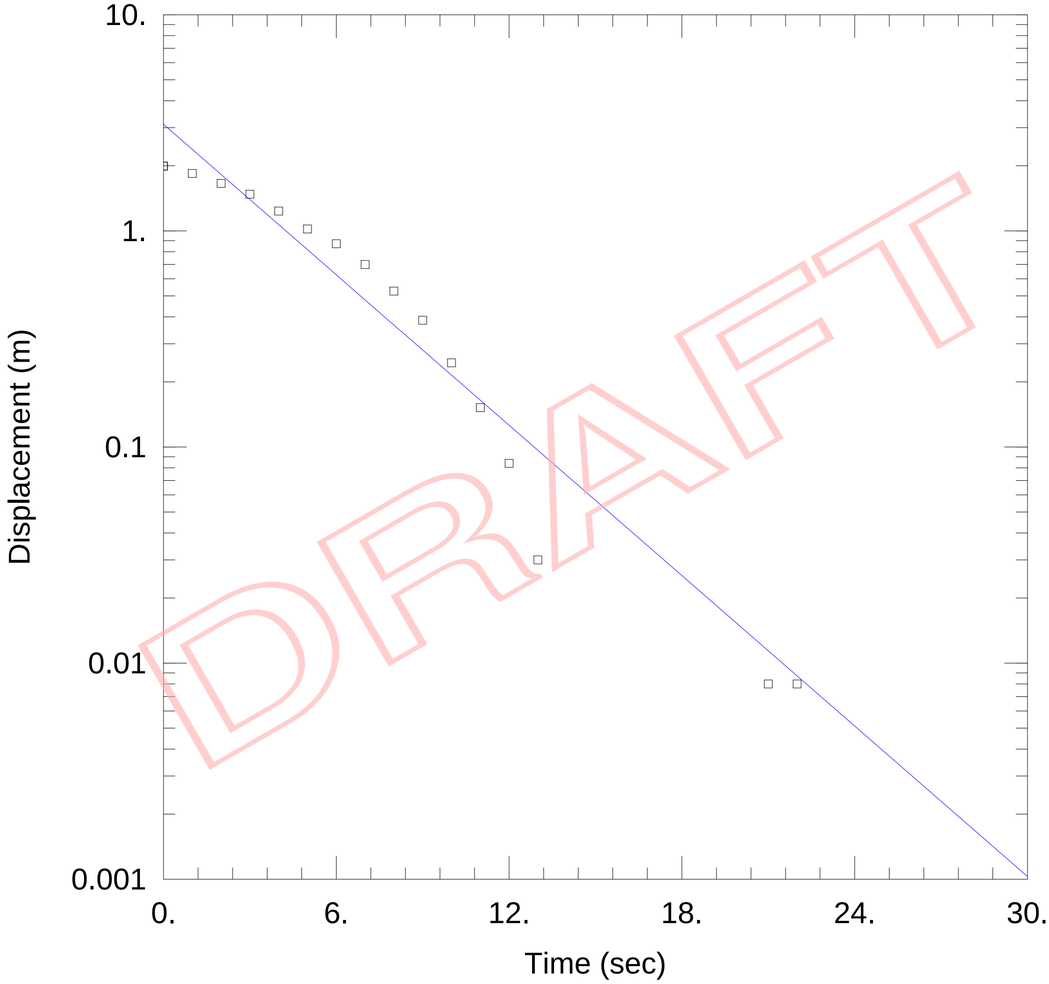
K = 0.0001702 m/sec   y0 = 3.043 m

WELL DATA (BH17-5A)

Initial Displacement: 2.698 m
Static Water Column Height: 9.155 m
Total Well Penetration Depth: 9.155 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-5A #4

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

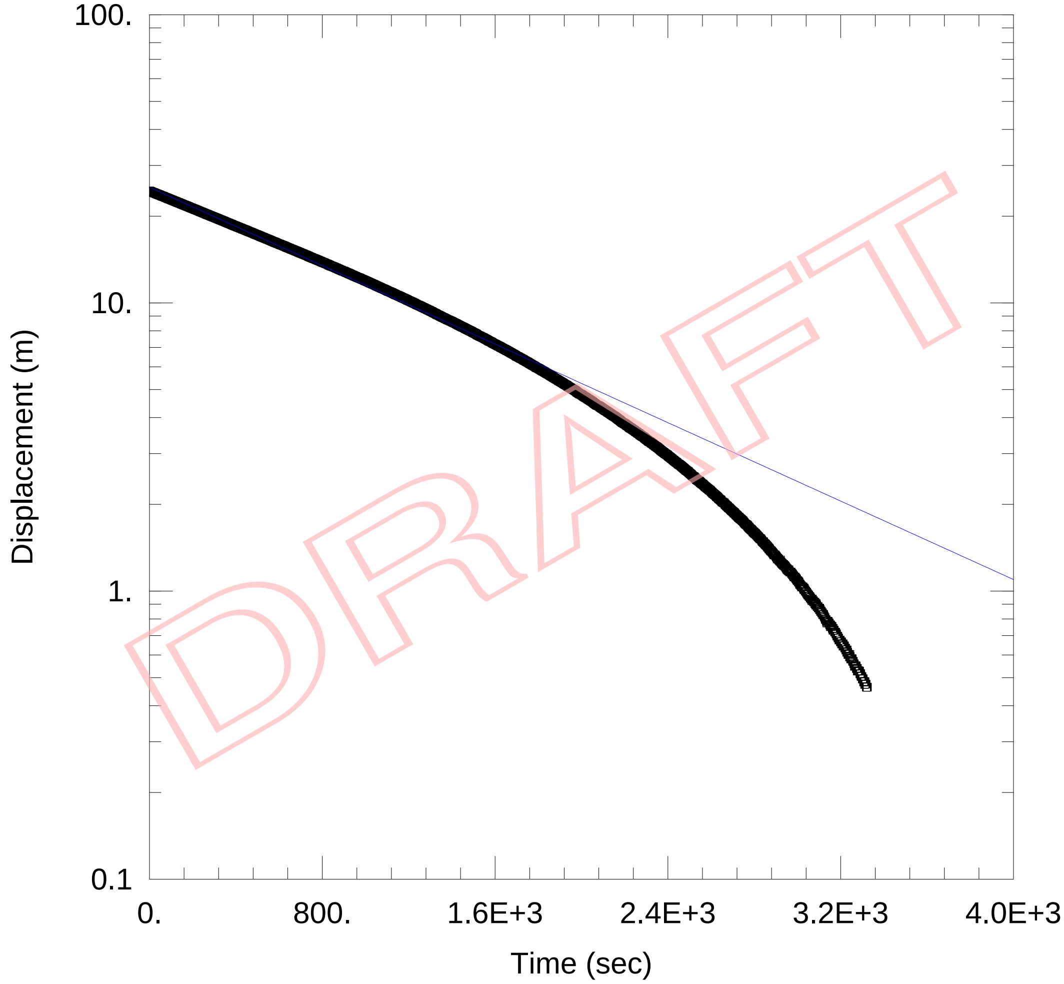
K = 0.0003949 m/sec   y0 = 3.111 m

WELL DATA (BH17-5A)

Initial Displacement: 1.995 m
Static Water Column Height: 12.12 m
Total Well Penetration Depth: 12.12 m
Screen Length: 3.15 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-5A #5

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

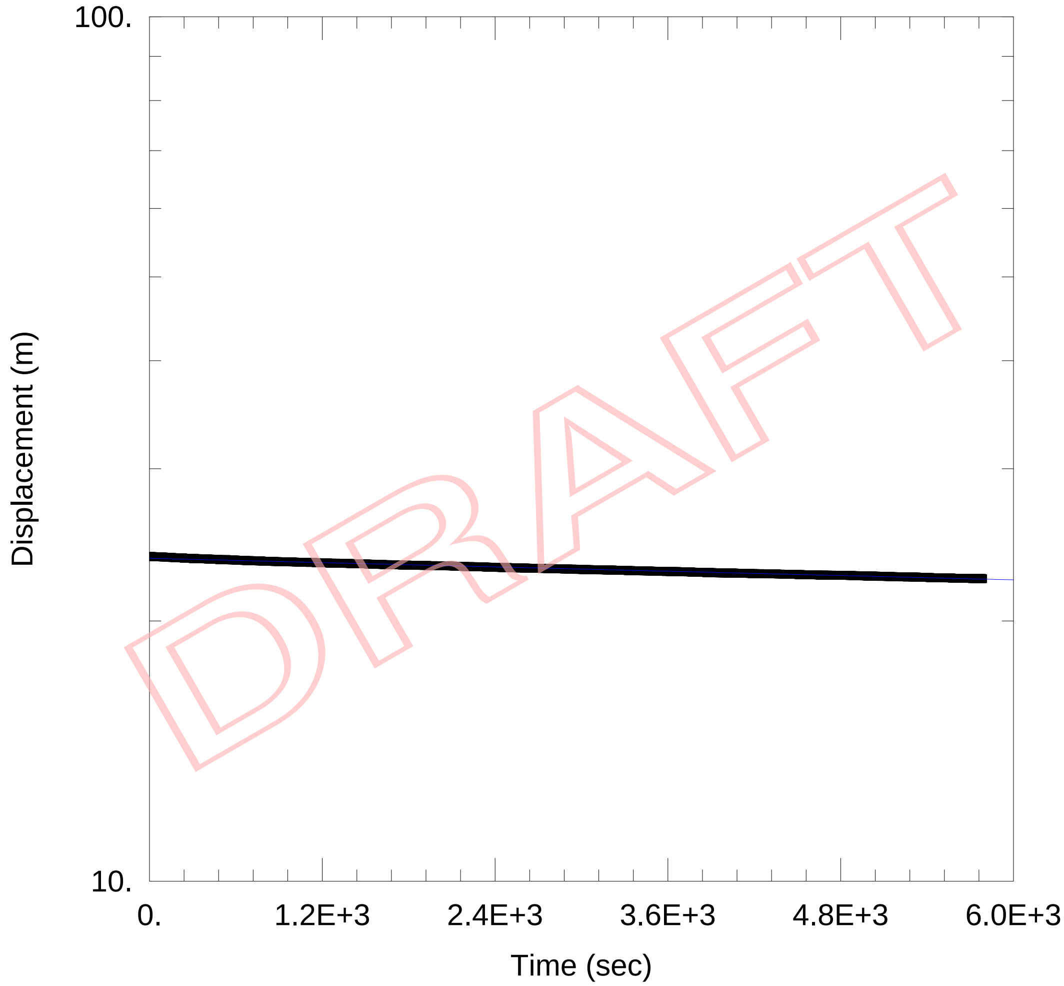
K = 1.181E-6 m/sec   y0 = 25.19 m

WELL DATA (BH17-5A)

Initial Displacement: 24.46 m
Static Water Column Height: 14.46 m
Total Well Penetration Depth: 14.46 m
Screen Length: 3.17 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-5A #6

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

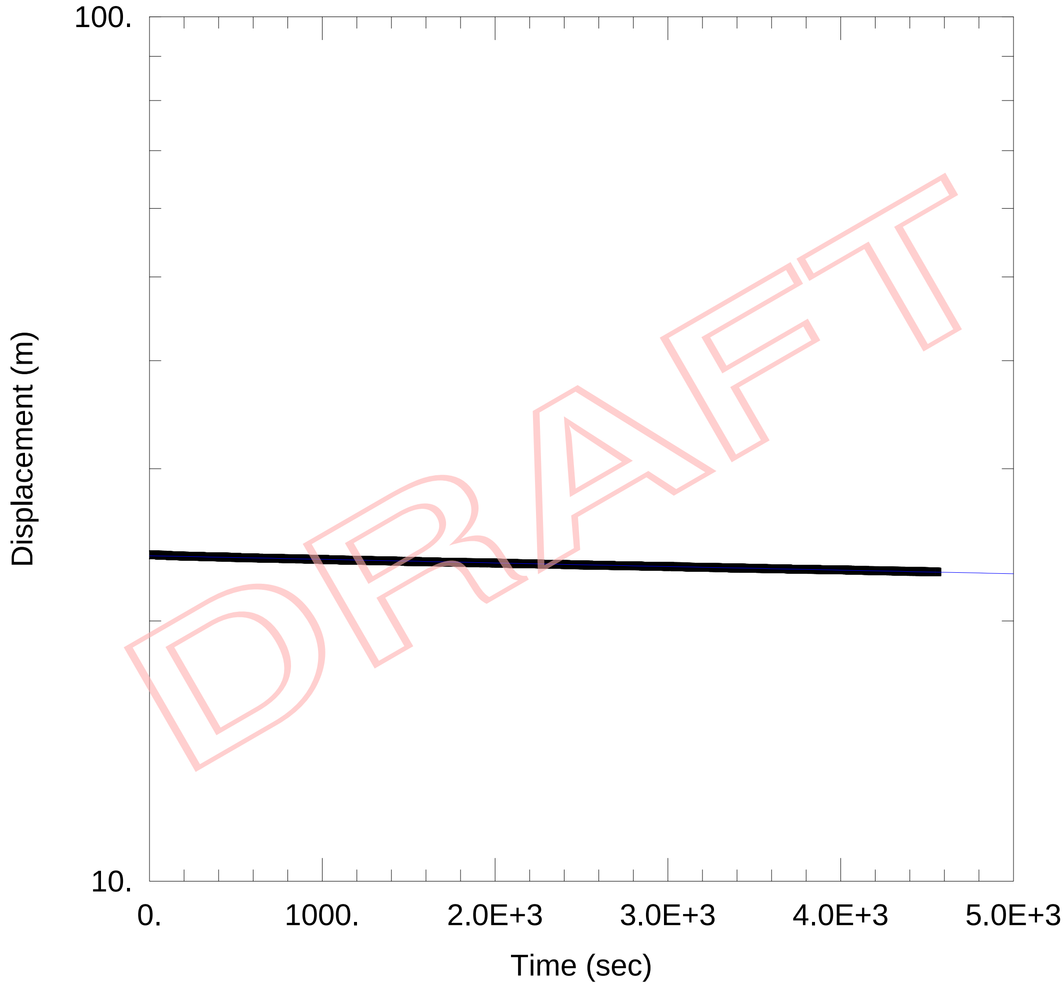
K = 1.877E-8 m/sec   y0 = 23.63 m

WELL DATA (BH17-5A)

Initial Displacement: 23.75 m
Static Water Column Height: 18.56 m
Total Well Penetration Depth: 18.56 m
Screen Length: 3.11 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-5A #7

Prepared By:	Prepared For:
Golder	Walker
Project: 1664706.2000	Location: Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

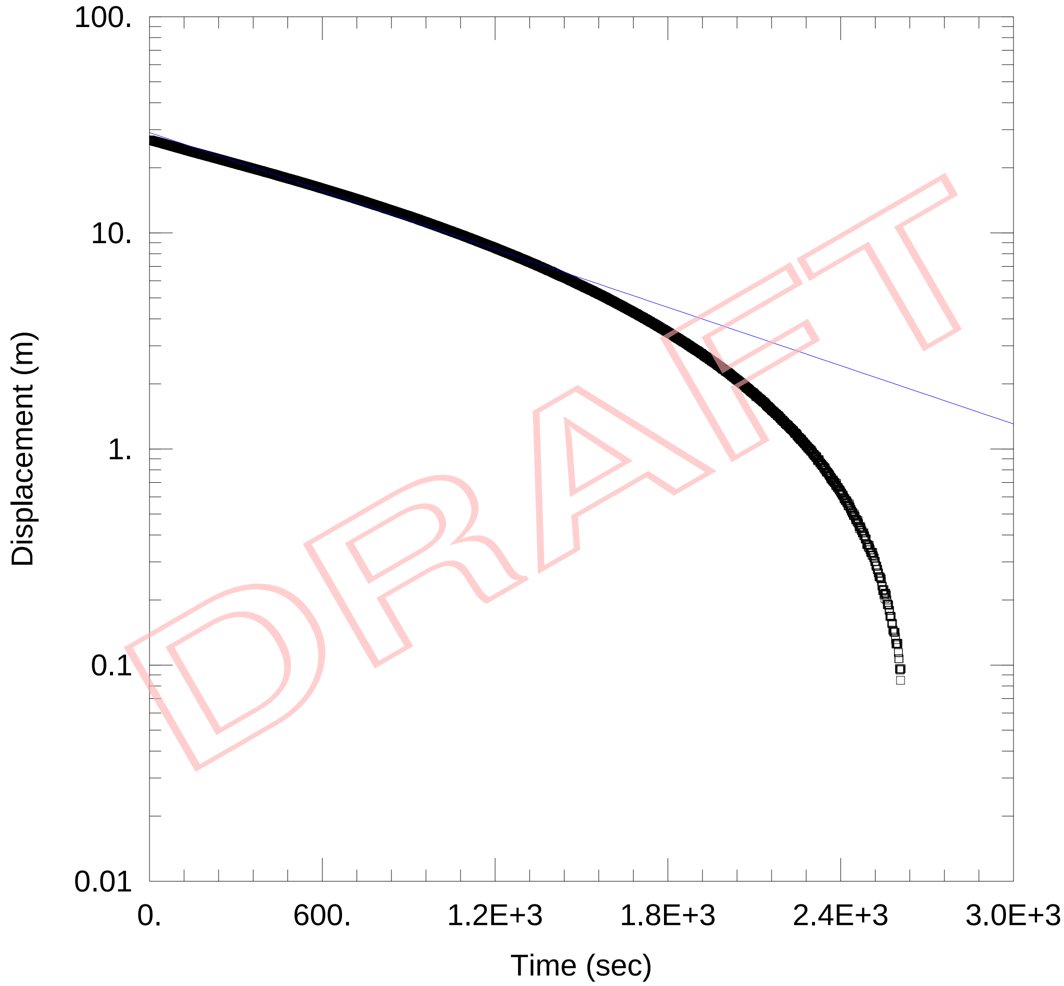
K = 2.547E-8 m/sec   y0 = 23.79 m

WELL DATA (BH17-5A)

Initial Displacement: 23.86 m
Static Water Column Height: 20.61 m
Total Well Penetration Depth: 20.61 m
Screen Length: 2.27 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-6A #5

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

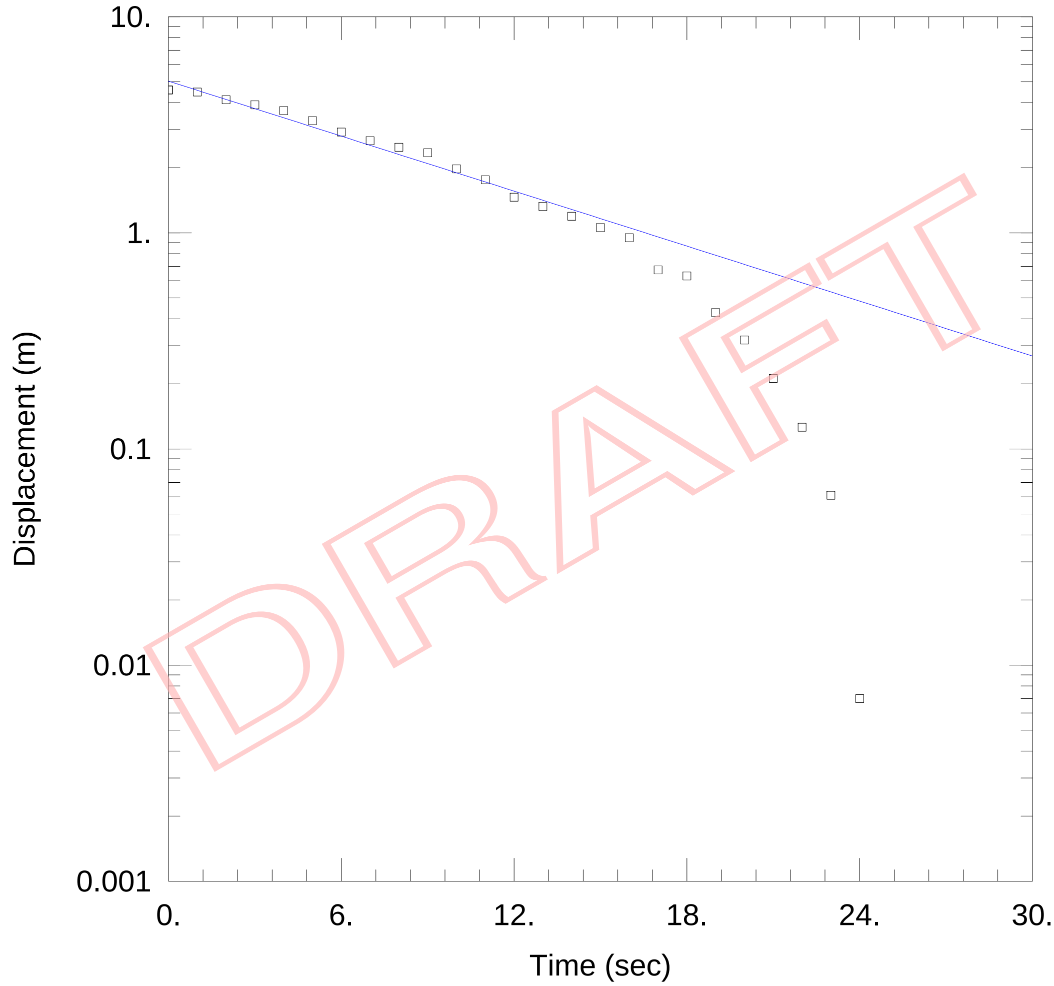
K = 1.339E-6 m/sec   y0 = 29.13 m

WELL DATA (BH17-6A #5)

Initial Displacement: 26.93 m
Static Water Column Height: 4.83 m
Total Well Penetration Depth: 4.83 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

BH17-6A #6

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Centreville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0001704 m/sec   y0 = 5.035 m

WELL DATA (BH17-6A #6)

Initial Displacement: 4.58 m
Static Water Column Height: 7.135 m
Total Well Penetration Depth: 7.135 m
Screen Length: 3.1 m
Casing Radius: 0.048 m
Well Radius: 0.048 m

SUMMARY OF HYDRAULIC TESTING - SLUG TESTS

Hydrogeological Assessment
Southwest Landfill
Centreville, Ontario

MONITORING WELL	TEST No.	TEST TYPE	HYDRAULIC CONDUCTIVITY (m/s)
MW17-1B	1	Falling Head	2.98×10^{-6}
	2	Falling Head	2.34×10^{-6}
	3	Falling Head	2.98×10^{-6}
		Average	**2.77×10^{-6}**
MW17-1C	1	Falling Head	1.95×10^{-5}
	1	Rising Head	2.23×10^{-5}
	2	Falling Head	2.17×10^{-5}
	2	Rising Head	2.83×10^{-5}
	3	Falling Head	1.99×10^{-5}
	3	Rising Head	2.92×10^{-5}
		Average	**2.35×10^{-5}**
MW17-1D	1	Falling Head	2.71×10^{-6}
	1	Rising Head	2.74×10^{-6}
		Average	**2.73×10^{-6}**
MW17-2B	1	Falling Head	5.62×10^{-5}
	1	Rising Head	3.73×10^{-5}
	2	Falling Head	5.30×10^{-5}
	2	Rising Head	3.69×10^{-5}
	3	Falling Head	5.39×10^{-5}
	3	Rising Head	3.84×10^{-5}
	4	Falling Head	5.46×10^{-5}
	4	Rising Head	4.04×10^{-5}
		Average	**4.63×10^{-5}**
MW17-2C	1	Falling Head	2.41×10^{-5}
	1	Rising Head	1.81×10^{-5}
	2	Falling Head	1.88×10^{-5}
	2	Rising Head	2.32×10^{-5}
	3	Falling Head	2.21×10^{-5}
	3	Rising Head	2.36×10^{-5}
	4	Falling Head	2.03×10^{-5}
		Average	**2.15×10^{-5}**
MW17-2D	1	Falling Head	1.33×10^{-4}
	1	Rising Head	1.23×10^{-4}
	2	Falling Head	9.67×10^{-5}
	2	Rising Head	9.40×10^{-5}
	3	Falling Head	8.19×10^{-5}
	3	Rising Head	9.23×10^{-5}
	4	Falling Head	7.07×10^{-5}
	4	Rising Head	1.10×10^{-4}
		Average	**1.00×10^{-4}**

DRAFT

SUMMARY OF HYDRAULIC TESTING - SLUG TESTS

Hydrogeological Assessment
Southwest Landfill
Centreville, Ontario

Table E-II Continued

MW17-3B	1	Falling Head	3.25×10^{-5}
	2	Falling Head	3.90×10^{-5}
		Average	**3.58×10^{-5}**
MW17-3C	1	Falling Head	2.43×10^{-5}
	1	Rising Head	3.12×10^{-5}
	2	Falling Head	2.47×10^{-5}
	2	Rising Head	2.86×10^{-5}
	3	Falling Head	1.74×10^{-5}
	3	Rising Head	3.19×10^{-5}
		Average	**2.64×10^{-5}**
MW17-3E	1	Falling Head	2.46×10^{-4}
	1	Rising Head	1.63×10^{-4}
	2	Falling Head	1.68×10^{-4}
	2	Rising Head	4.08×10^{-4}
	3	Falling Head	1.71×10^{-4}
	3	Rising Head	1.69×10^{-4}
		Average	**2.21×10^{-4}**
MW17-5B	1	Falling Head	1.63×10^{-4}
	1	Rising Head	1.12×10^{-4}
	2	Falling Head	7.34×10^{-5}
		Average	**1.16×10^{-4}**
MW17-5C	1	Falling Head	1.51×10^{-4}
	1	Rising Head	1.58×10^{-4}
	2	Falling Head	2.06×10^{-4}
	2	Rising Head	1.16×10^{-4}
	3	Falling Head	1.27×10^{-4}
		Average	**1.52×10^{-4}**
MW17-6B	1	Falling Head	6.98×10^{-5}
	1	Rising Head	1.43×10^{-4}
	2	Falling Head	7.39×10^{-5}
	2	Rising Head	1.30×10^{-4}
	3	Falling Head	7.07×10^{-5}
	3	Rising Head	1.39×10^{-4}
	4	Falling Head	8.81×10^{-5}
	4	Rising Head	1.44×10^{-4}
		Average	**1.07×10^{-4}**

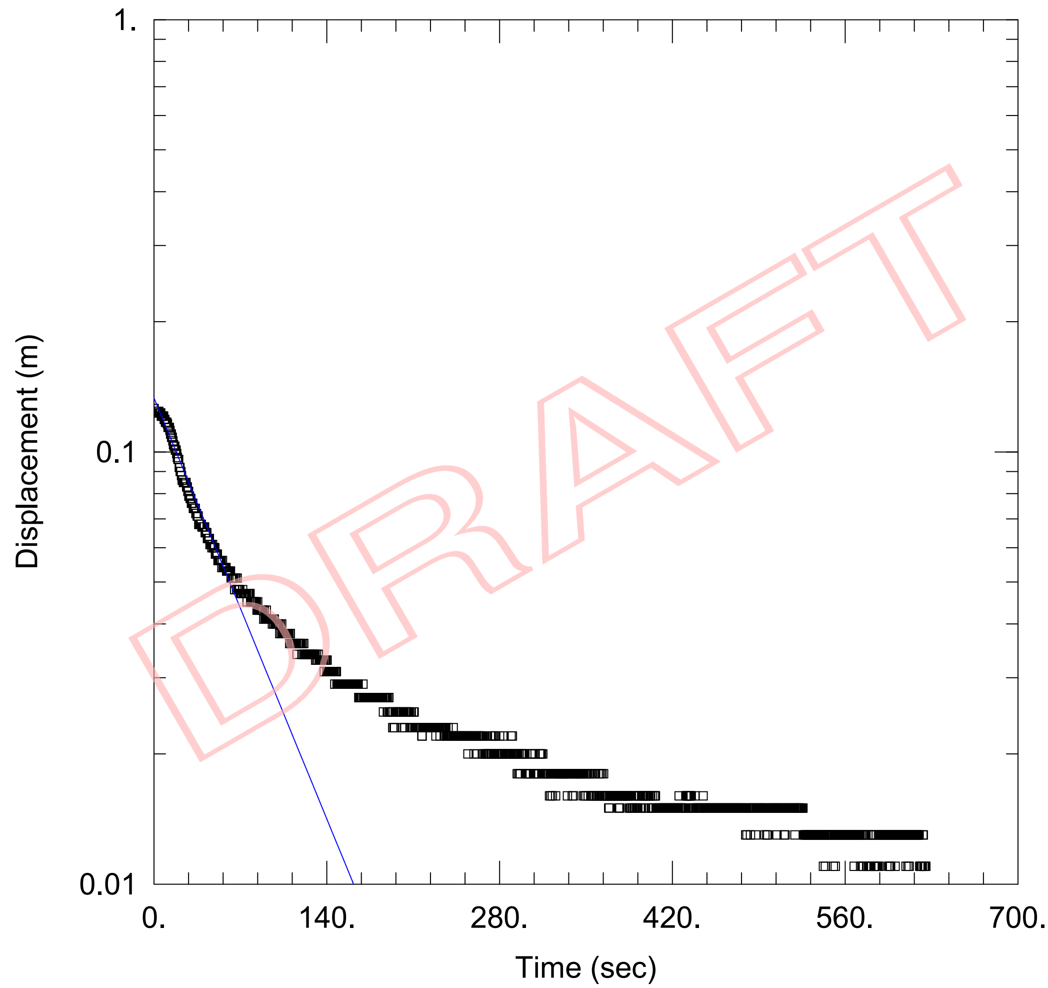
DRAFT

Notes:
1. Hydraulic conductivity results provided in metres per second (m/s).
2. Table to be read in conjunction with accompanying text.

Prepared by: DC
Checked by: RM

MW17-1B FH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

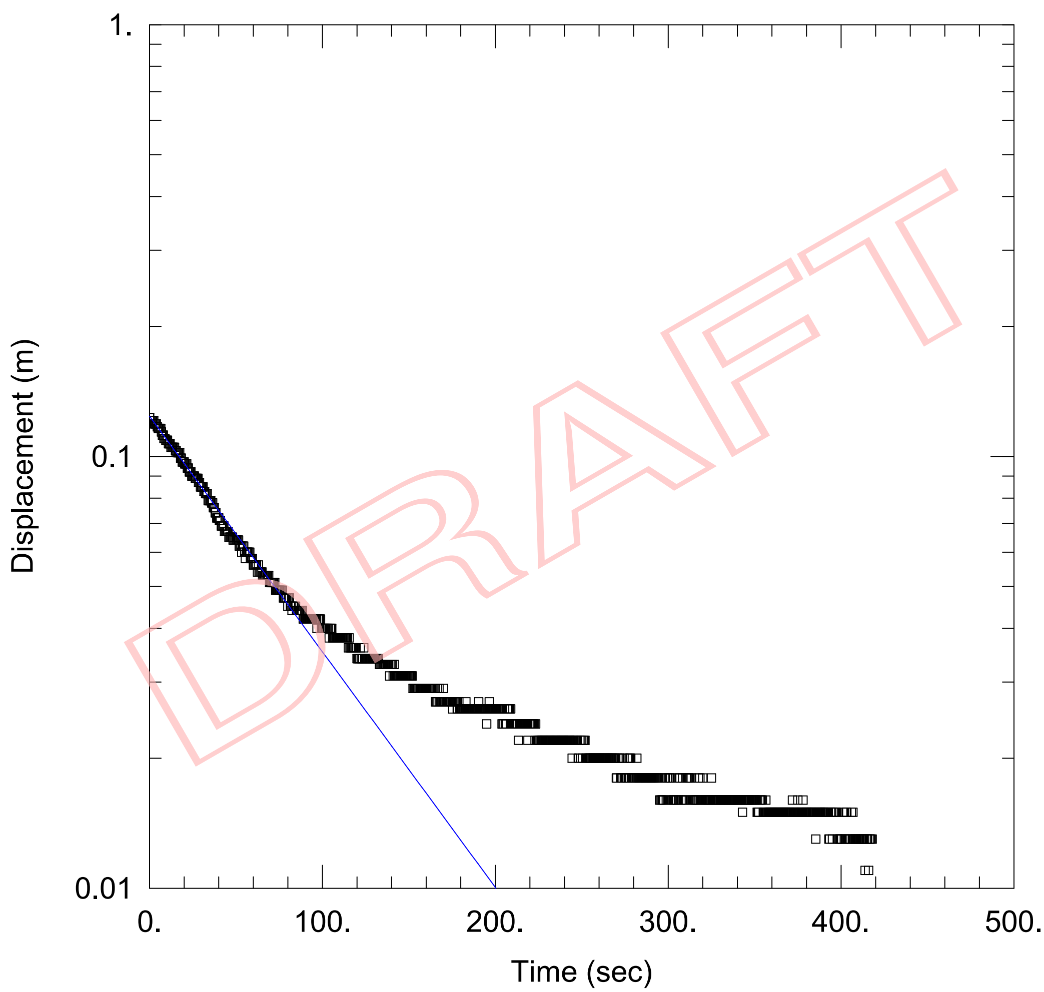
K = 2.98E-6 m/sec   y0 = 0.1333 m

WELL DATA (MW17-1B)

Initial Displacement: 0.126 m
Static Water Column Height: 7.29 m
Total Well Penetration Depth: 8.8 m
Screen Length: 8.8 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1B FH2

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

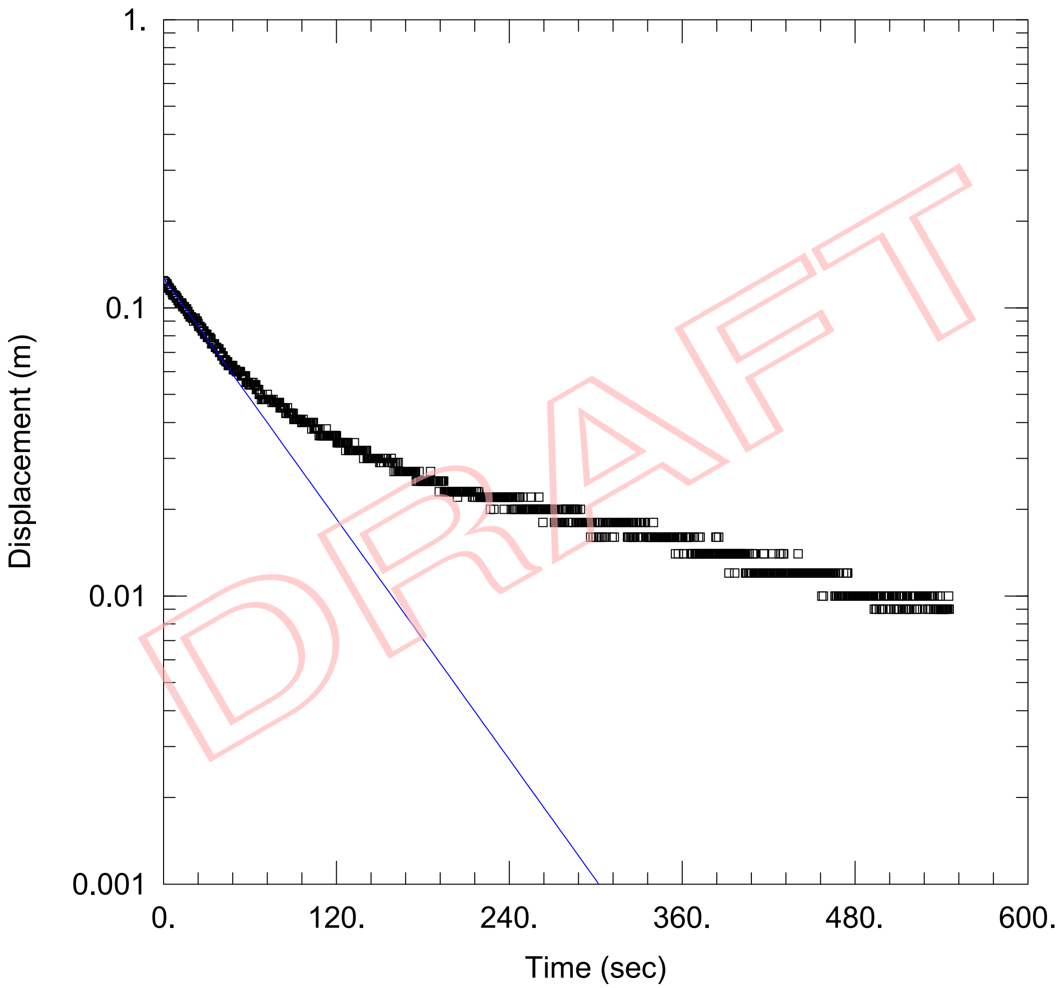
K = 2.337E-6 m/sec   y0 = 0.1239 m

WELL DATA (MW17-1B)

Initial Displacement: 0.123 m
Static Water Column Height: 7.29 m
Total Well Penetration Depth: 8.8 m
Screen Length: 8.8 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1B FH3

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

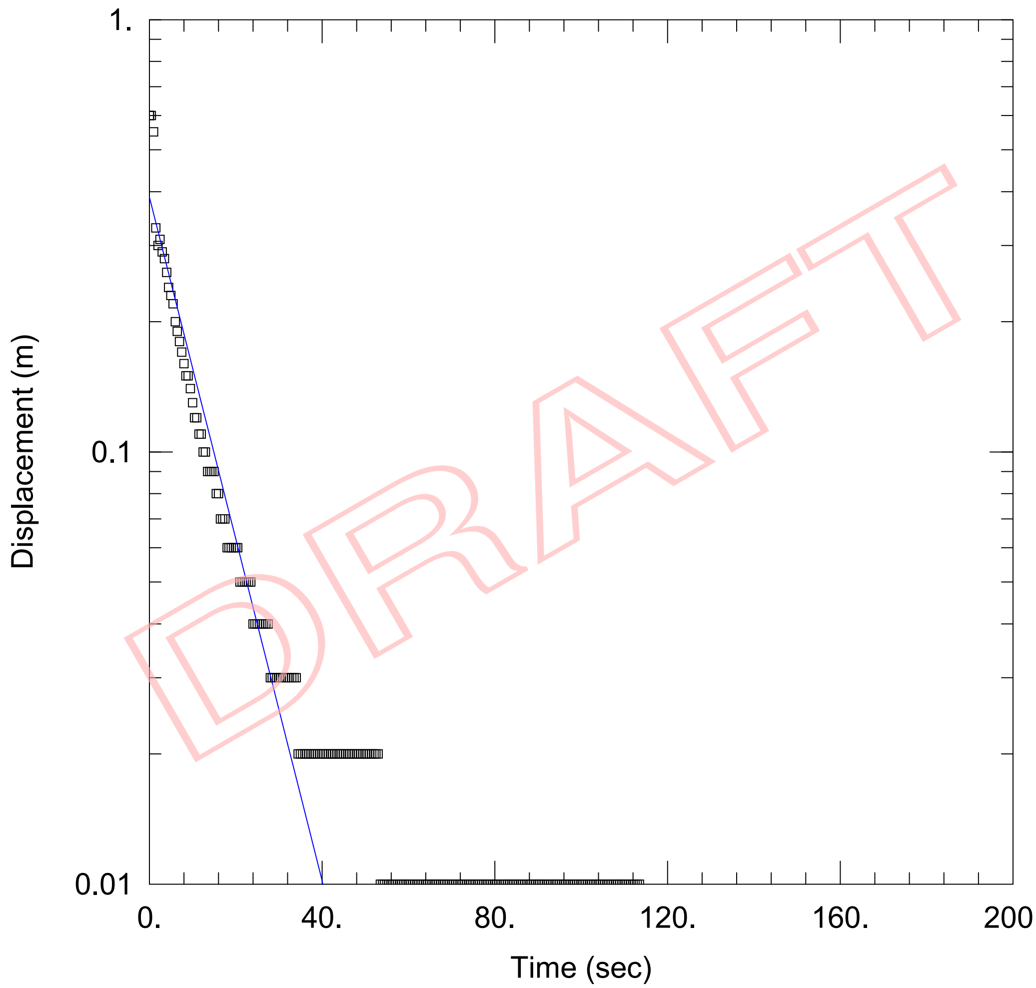
K = 2.98E-6 m/sec   y0 = 0.1265 m

WELL DATA (MW17-1B)

Initial Displacement: 0.124 m
Static Water Column Height: 7.29 m
Total Well Penetration Depth: 8.8 m
Screen Length: 8.8 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1C FH1

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

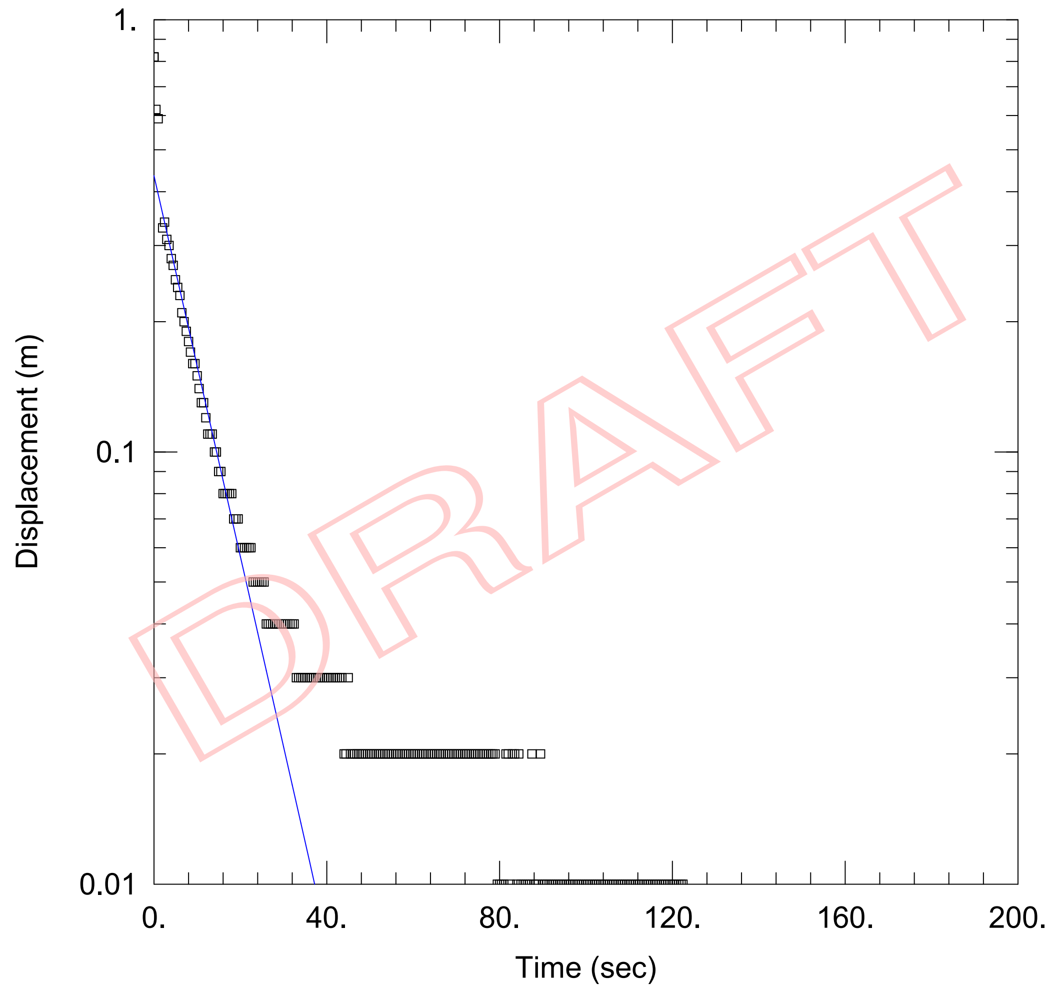
K = 1.945E-5 m/sec   y0 = 0.3881 m

WELL DATA (MW17-1C)

Initial Displacement: 0.6 m
Static Water Column Height: 25.08 m
Total Well Penetration Depth: 25.08 m
Screen Length: 8.2 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1C FH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

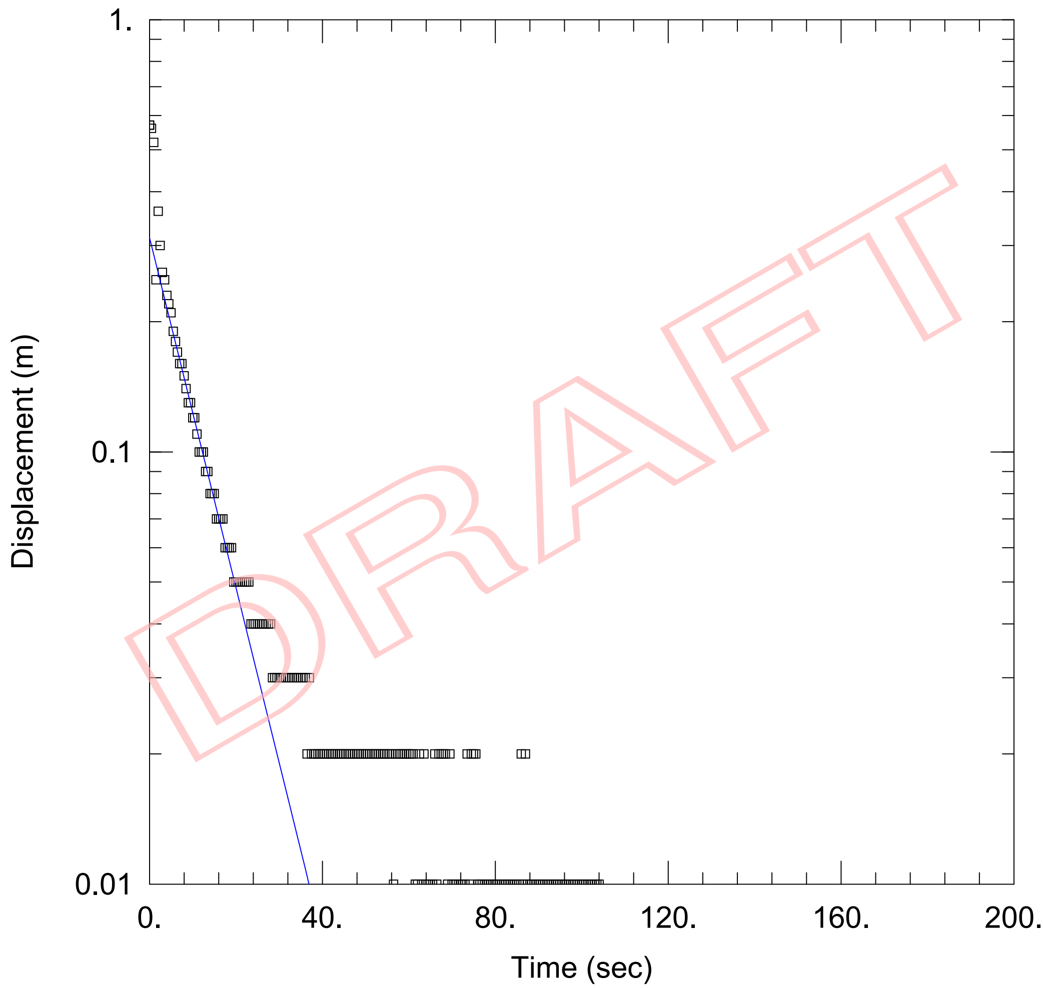
K = 2.167E-5 m/sec y0 = 0.4351 m

WELL DATA (MW17-1C)

Initial Displacement: 0.82 m
Static Water Column Height: 25.08 m
Total Well Penetration Depth: 25.08 m
Screen Length: 8.2 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1C FH3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

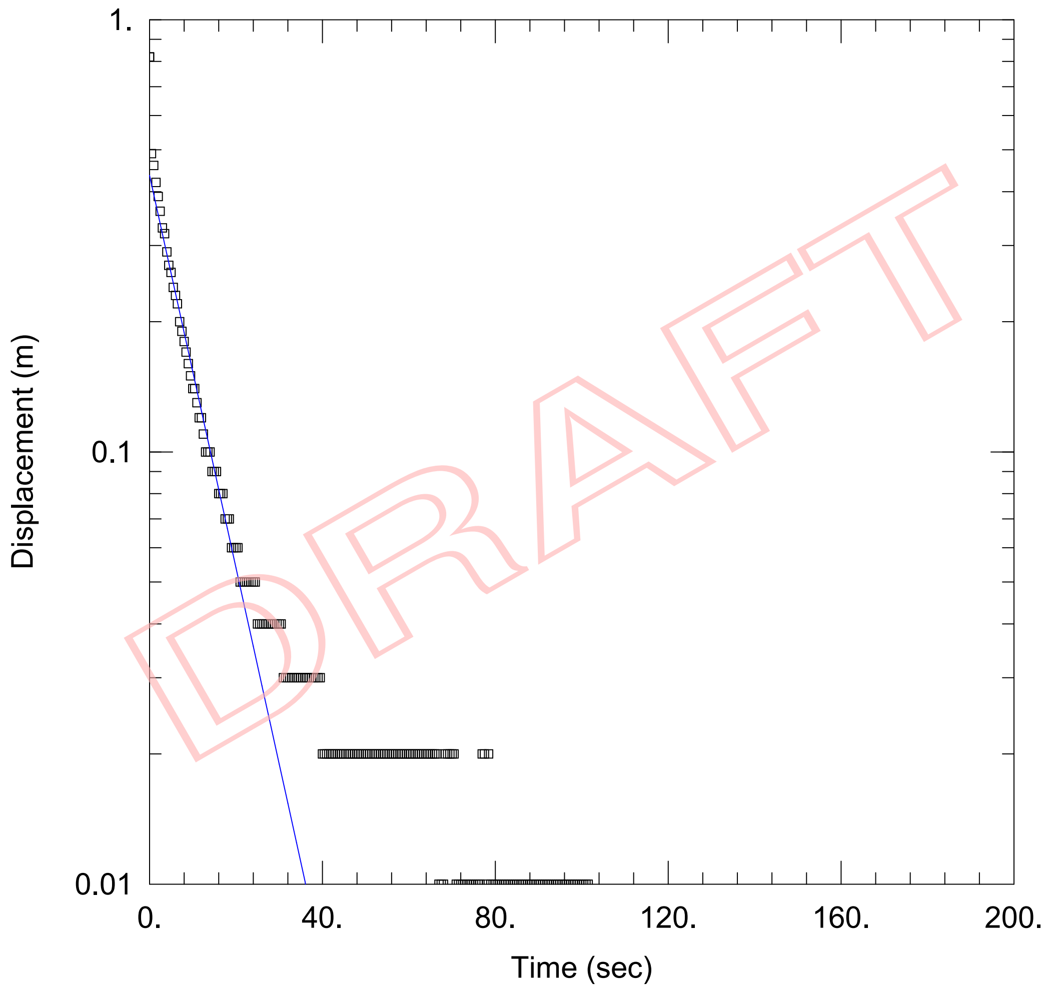
K = 1.992E-5 m/sec y0 = 0.3127 m

WELL DATA (MW17-1C)

Initial Displacement: 0.57 m
Static Water Column Height: 25.08 m
Total Well Penetration Depth: 25.08 m
Screen Length: 8.2 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1C RH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

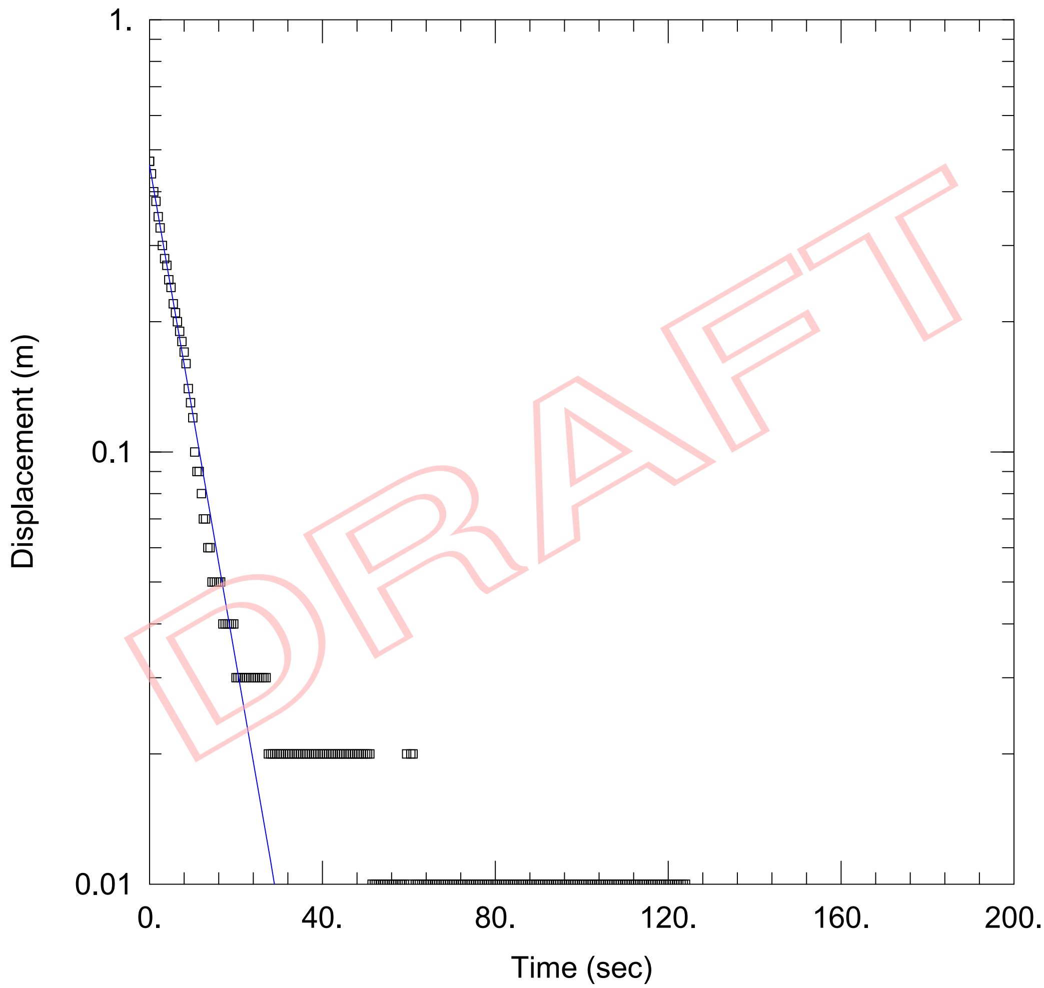
K = 2.233E-5 m/sec   y0 = 0.4358 m

WELL DATA (MW17-1C)

Initial Displacement: 0.82 m
Static Water Column Height: 25.08 m
Total Well Penetration Depth: 25.08 m
Screen Length: 8.2 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1C RH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

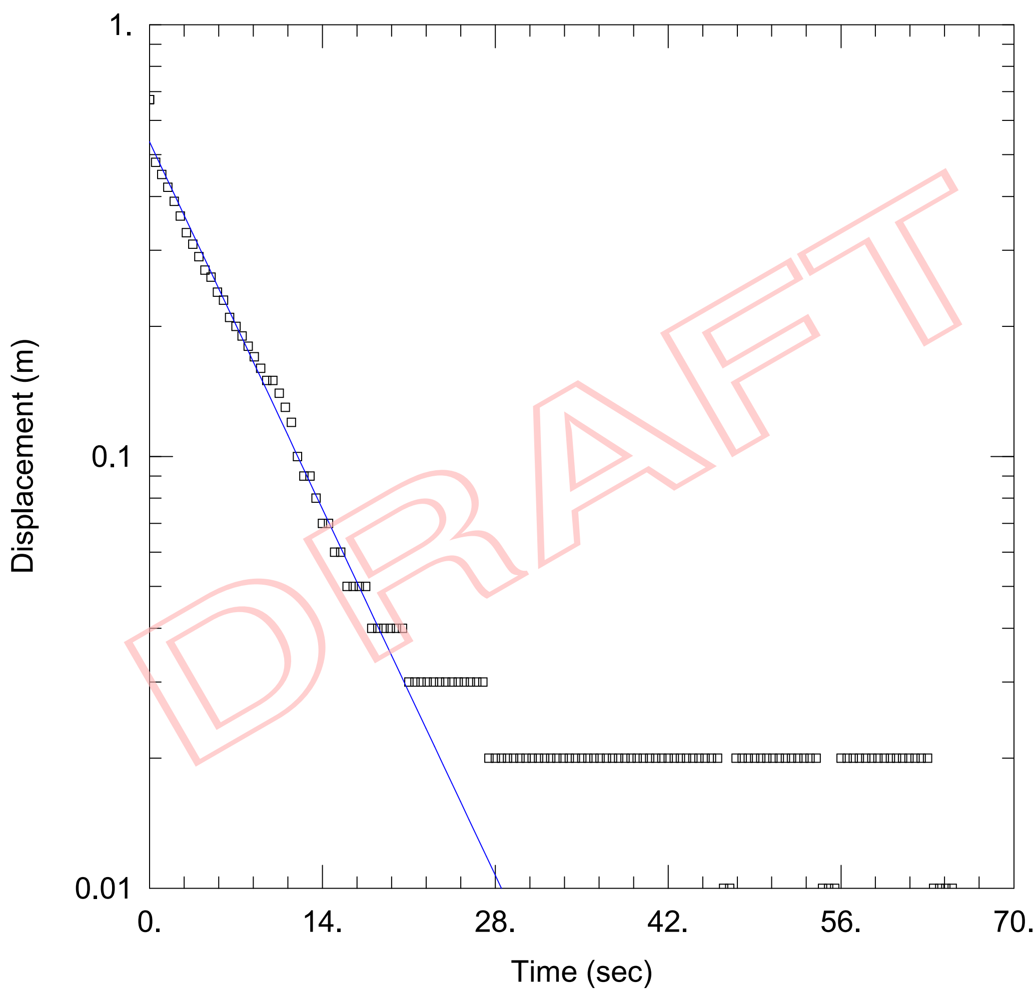
K = 2.827E-5 m/sec   y0 = 0.4596 m

WELL DATA (MW17-1C)

Initial Displacement: 0.47 m
Static Water Column Height: 25.08 m
Total Well Penetration Depth: 25.08 m
Screen Length: 8.2 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1C RH3

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

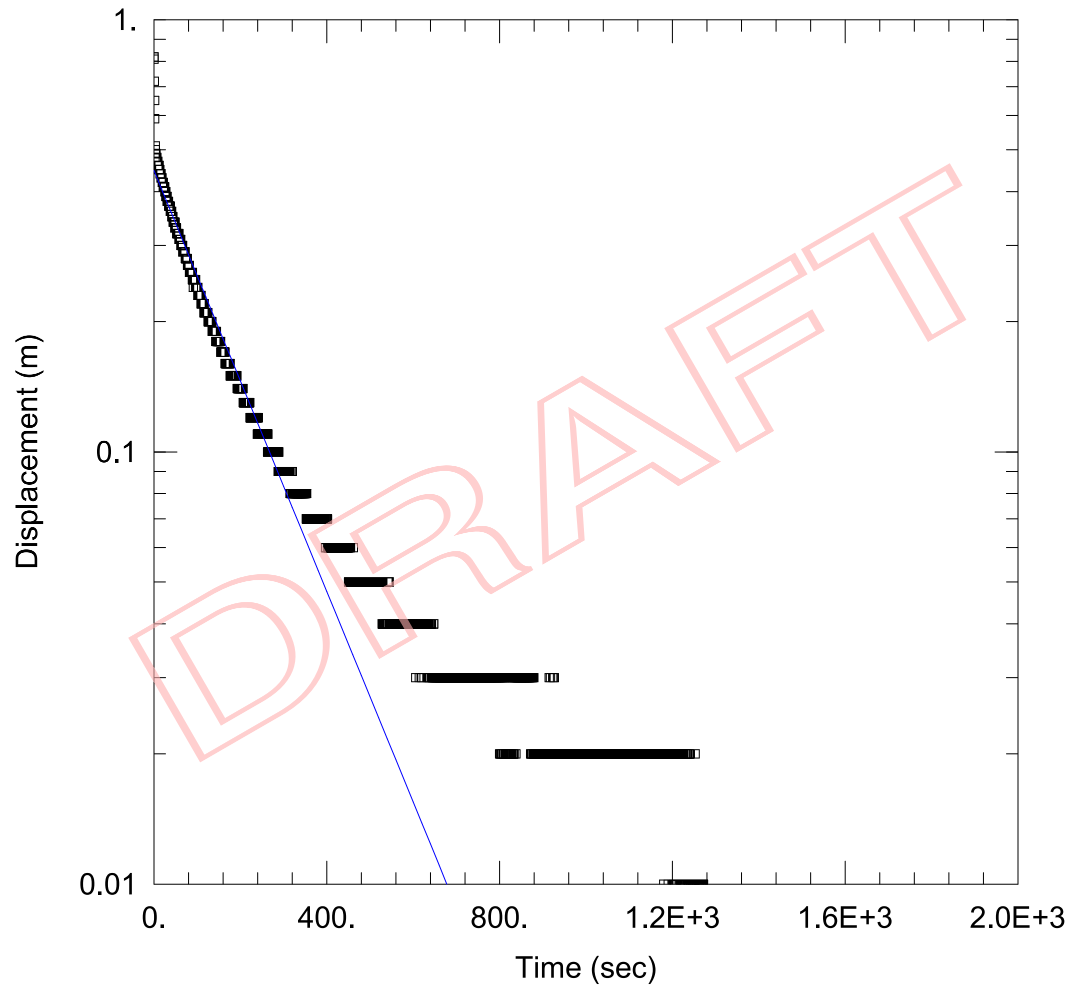
K = 2.982E-5 m/sec   y0 = 0.5348 m

WELL DATA (MW17-1C)

Initial Displacement: 0.67 m
Static Water Column Height: 25.08 m
Total Well Penetration Depth: 25.08 m
Screen Length: 8.2 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1D FH1

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

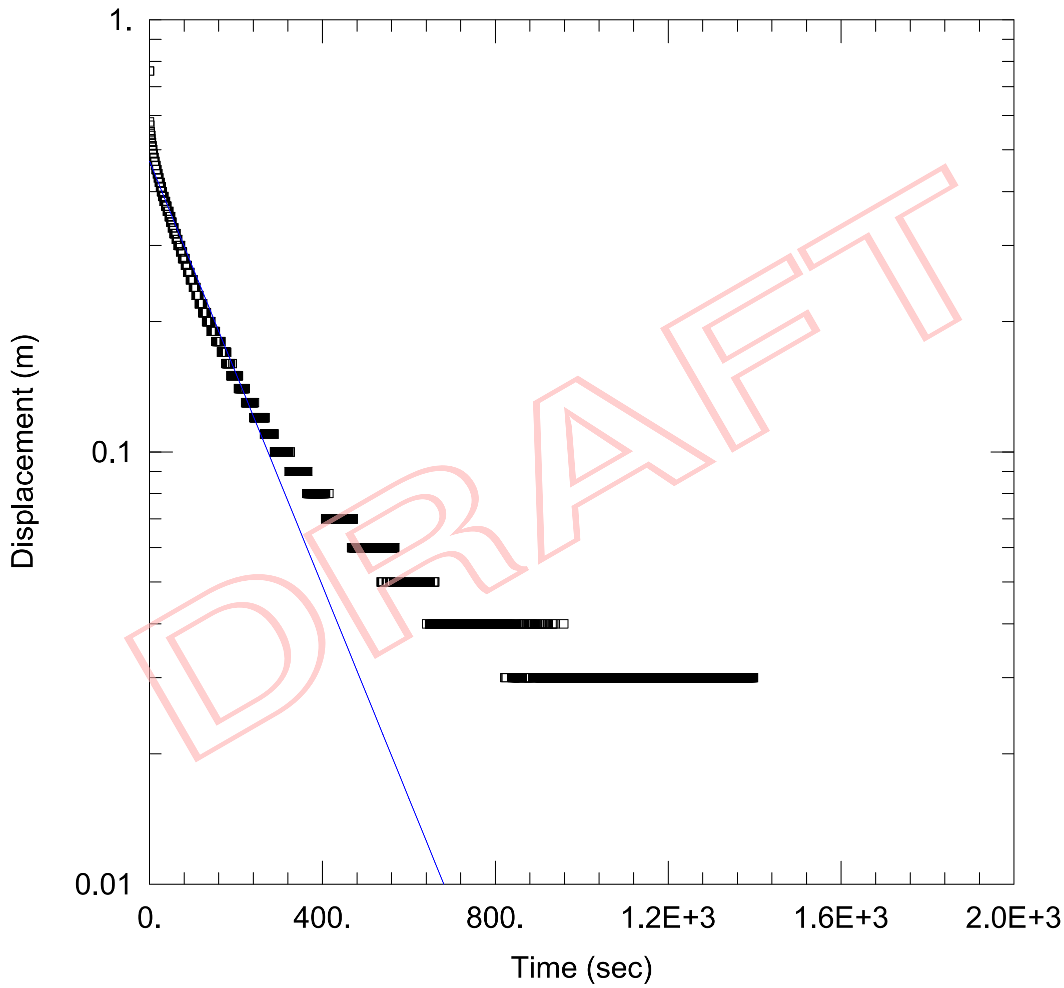
K = 2.712E-6 m/sec   y0 = 0.4475 m

WELL DATA (MW17-1D)

Initial Displacement: 0.82 m
Static Water Column Height: 12.86 m
Total Well Penetration Depth: 12.86 m
Screen Length: 4.12 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-1D RH1

Prepared By:	Prepared For:
Golder	Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

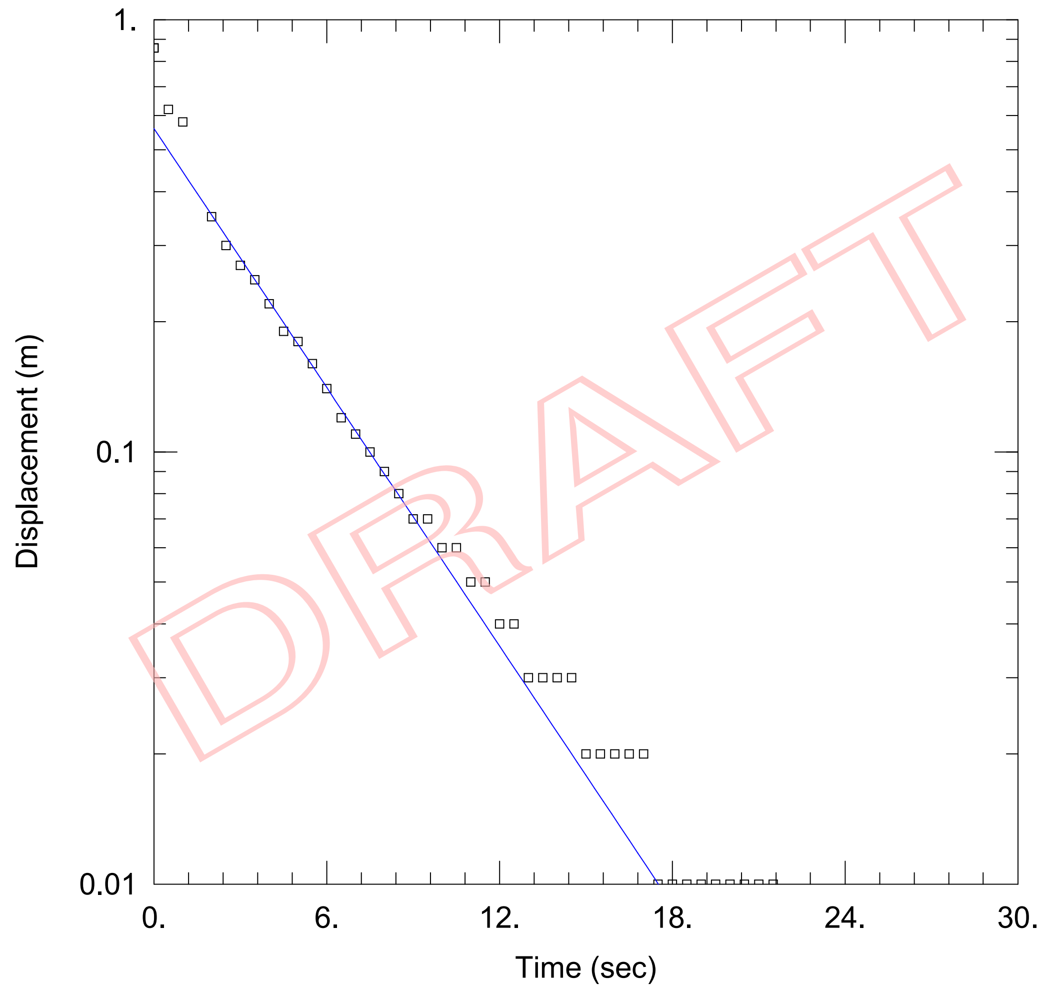
K = 2.737E-6 m/sec   y0 = 0.4702 m

WELL DATA (MW17-1D)

Initial Displacement: 0.76 m
Static Water Column Height: 12.86 m
Total Well Penetration Depth: 12.86 m
Screen Length: 4.12 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2B FH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 5.617E-5 m/sec   y0 = 0.5594 m

AQUIFER DATA

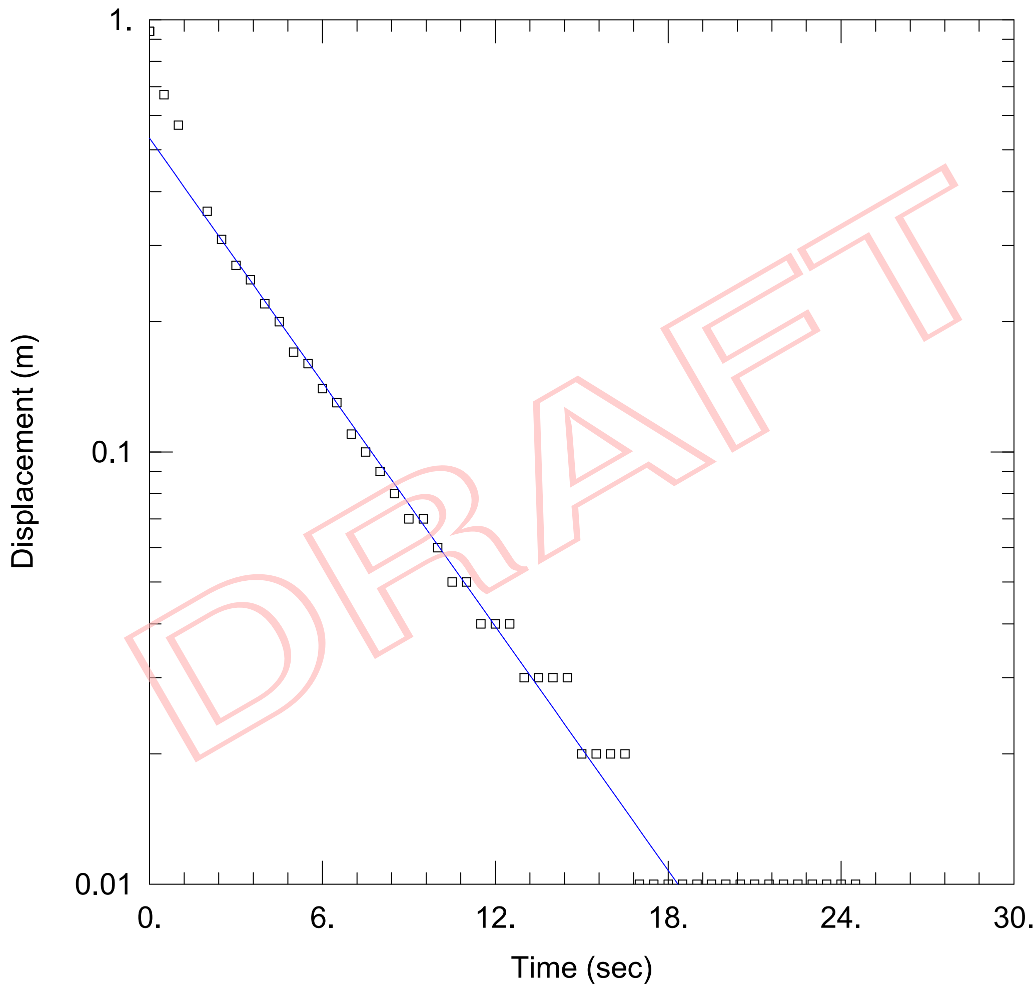
Saturated Thickness: 9.6 rAnisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2B)

Initial Displacement: 0.86 m
Static Water Column Height: 9.6 m
Total Well Penetration Depth: 9.6 m
Screen Length: 7.18 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2B FH2

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 5.298E-5 m/sec y0 = 0.5315 m

AQUIFER DATA

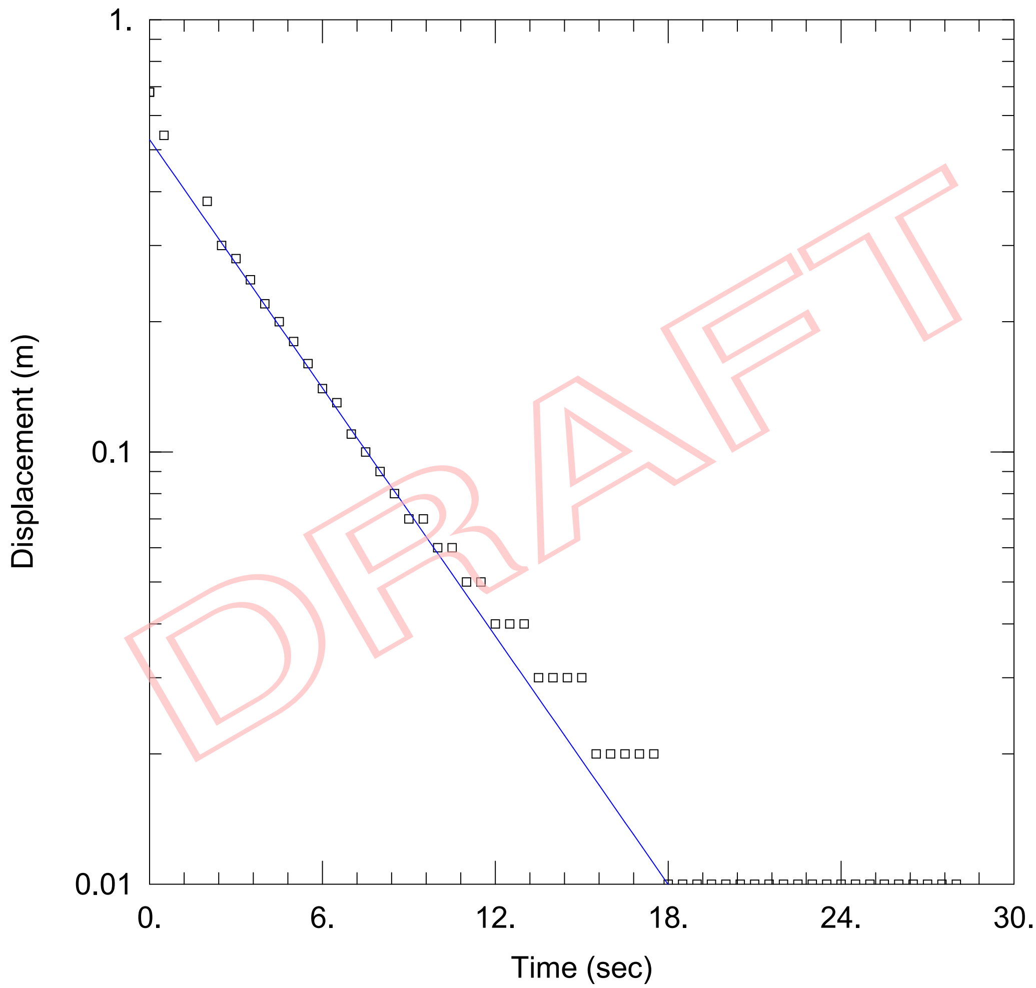
Saturated Thickness: 9.6 rAnisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2B)

Initial Displacement: 0.94 m
Static Water Column Height: 9.6 m
Total Well Penetration Depth: 9.6 m
Screen Length: 7.18 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2B FH3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 5.39E-5 m/sec   y0 = 0.528 m

AQUIFER DATA

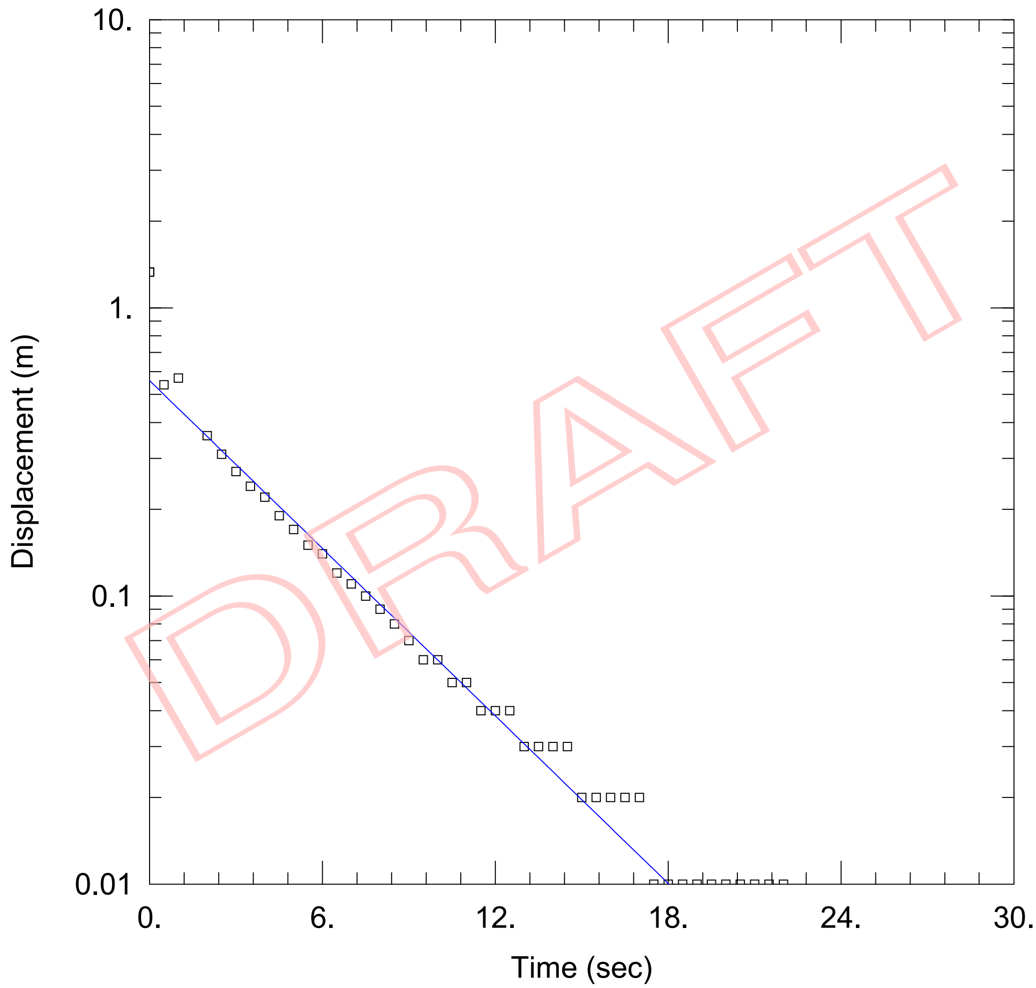
Saturated Thickness: 9.6 rAnisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2B)

Initial Displacement: 0.68 m
Static Water Column Height: 9.6 m
Total Well Penetration Depth: 9.6 m
Screen Length: 7.18 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2B FH4

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 5.457E-5 m/sec   y0 = 0.5584 m

AQUIFER DATA

Saturated Thickness: 9.6 rAnisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2B)

Initial Displacement: 1.33 m
Static Water Column Height: 9.6 m
Total Well Penetration Depth: 9.6 m
Screen Length: 7.18 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

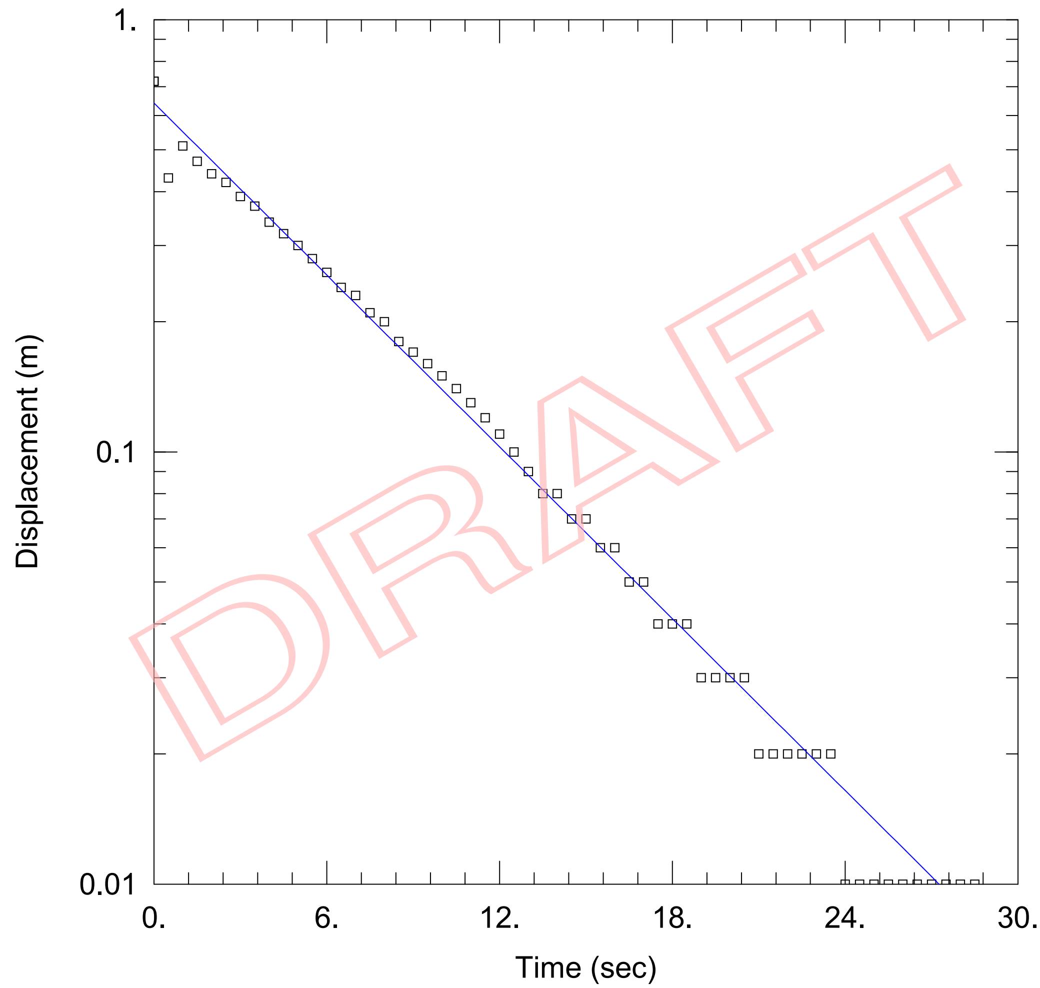
MW17-2B RH1

Prepared By:
Golder

Prepared For:
Walker

Project:
1664706.2000

Location:
Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 3.731E-5 m/sec   y0 = 0.6411 m

AQUIFER DATA

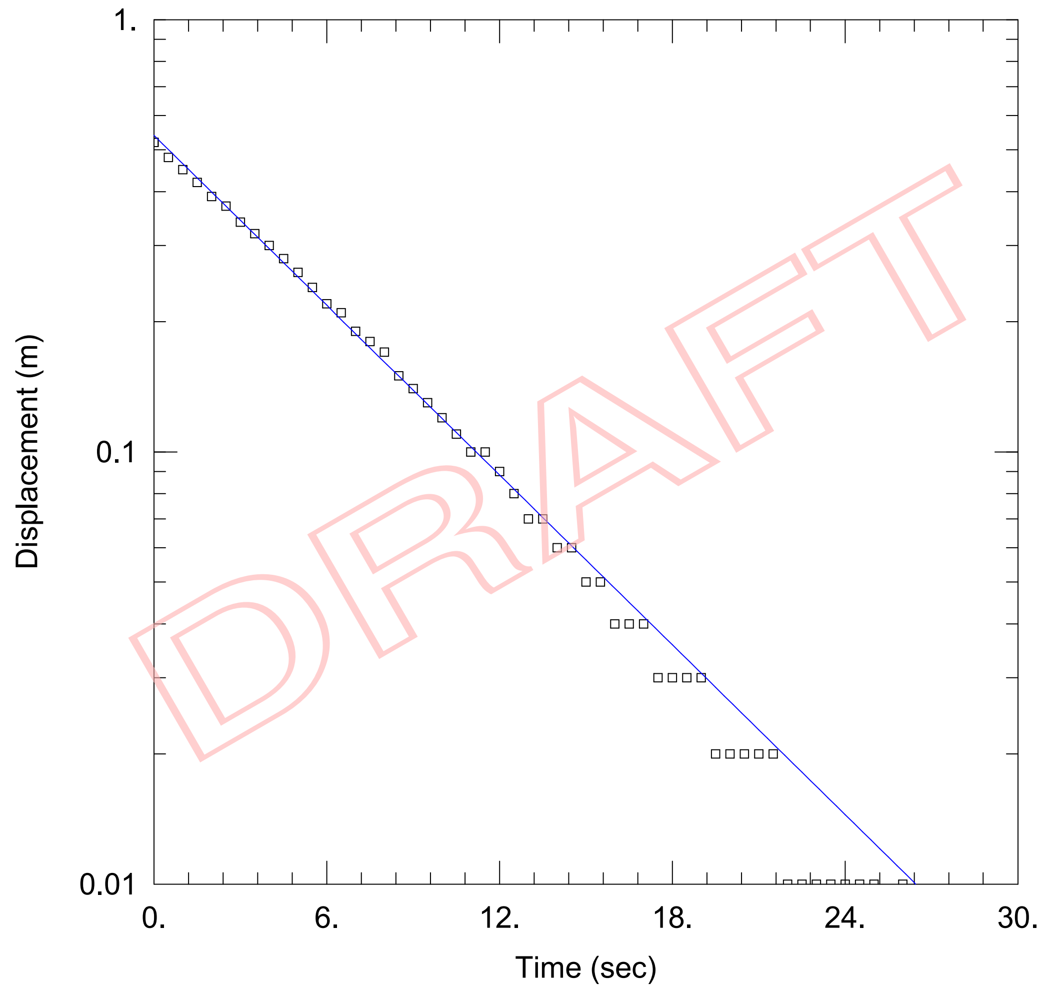
Saturated Thickness: 9.6 rAnisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2B)

Initial Displacement: 0.72 m
Static Water Column Height: 9.6 m
Total Well Penetration Depth: 9.6 m
Screen Length: 7.18 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2B RH2

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 3.687E-5 m/sec y0 = 0.5398 m

AQUIFER DATA

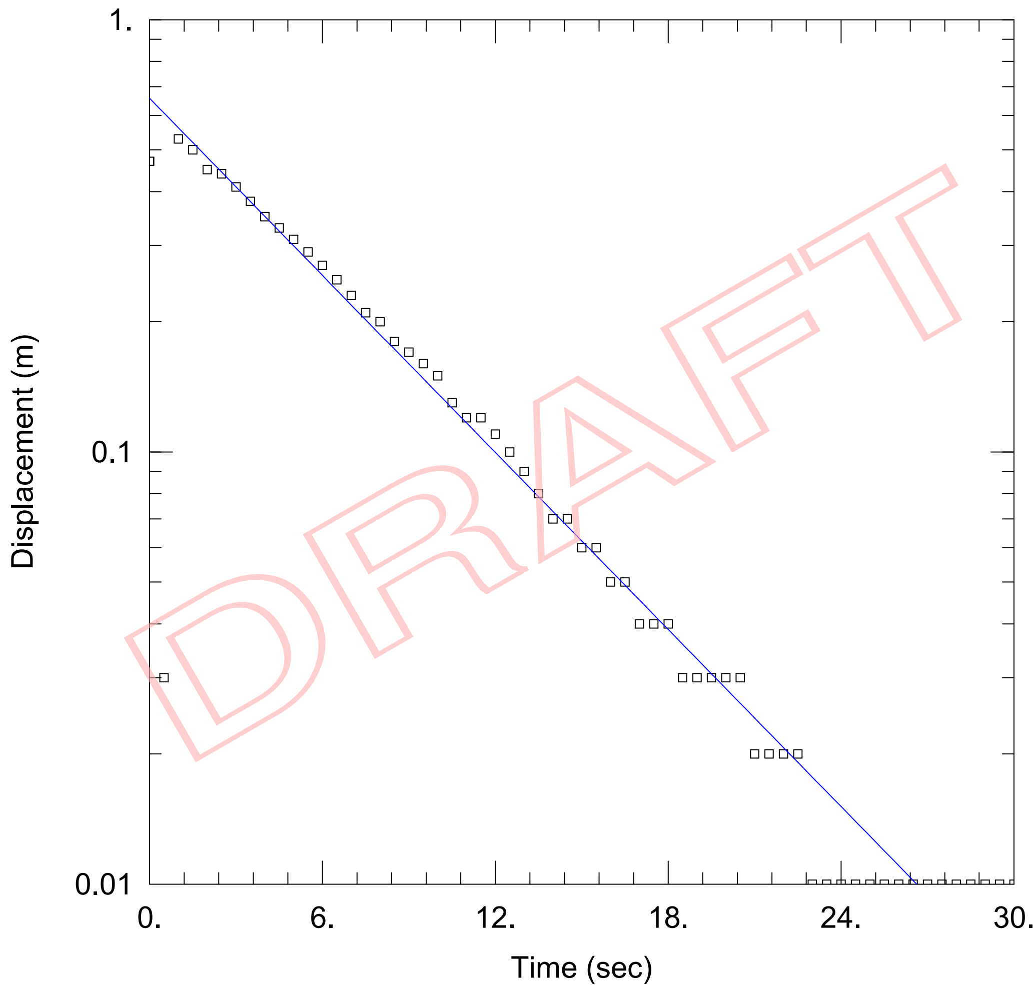
Saturated Thickness: 9.6 rAnisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2B)

Initial Displacement: 0.52 m
Static Water Column Height: 9.6 m
Total Well Penetration Depth: 9.6 m
Screen Length: 7.18 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2B RH3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 3.844E-5 m/sec   y0 = 0.6578 m

AQUIFER DATA

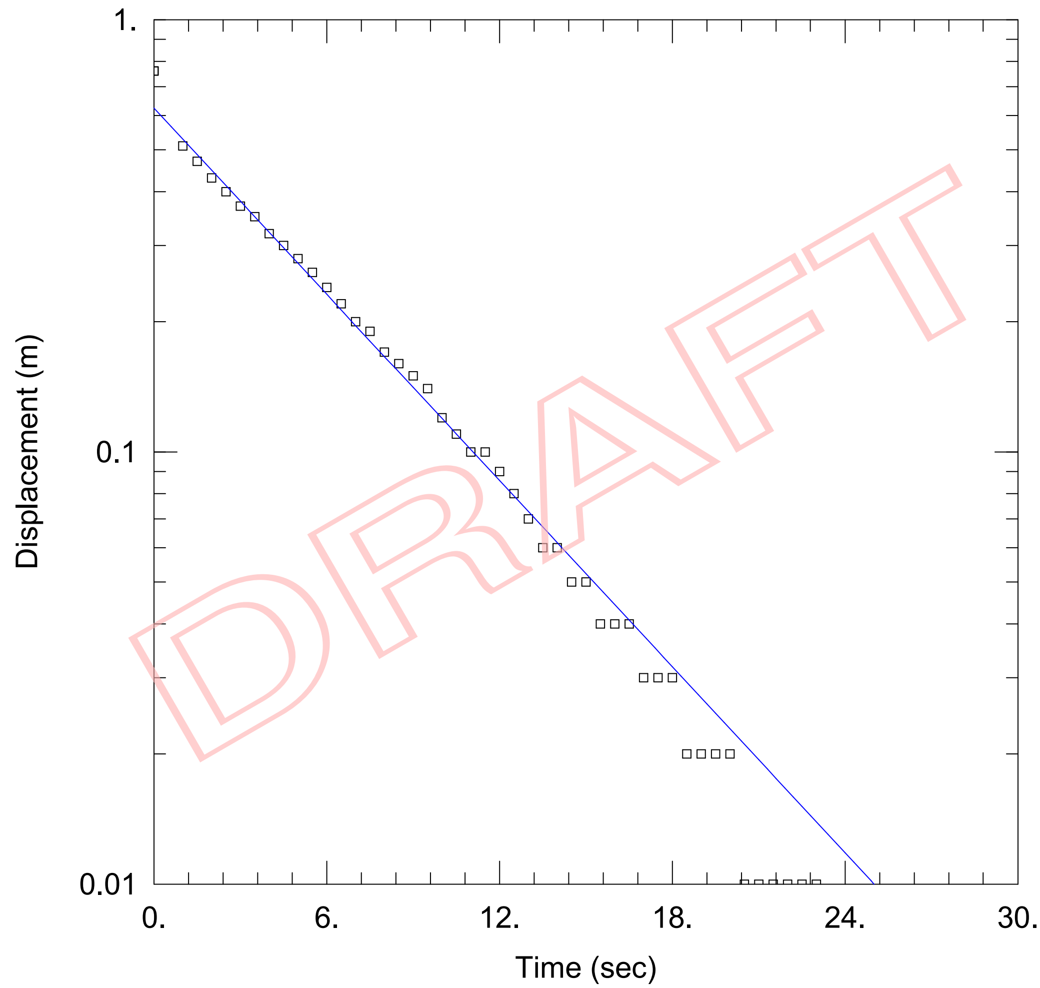
Saturated Thickness: 9.6 rAnisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2B)

Initial Displacement: 0.47 m
Static Water Column Height: 9.6 m
Total Well Penetration Depth: 9.6 m
Screen Length: 7.18 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2B RH4

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 4.043E-5 m/sec   y0 = 0.6244 m

AQUIFER DATA

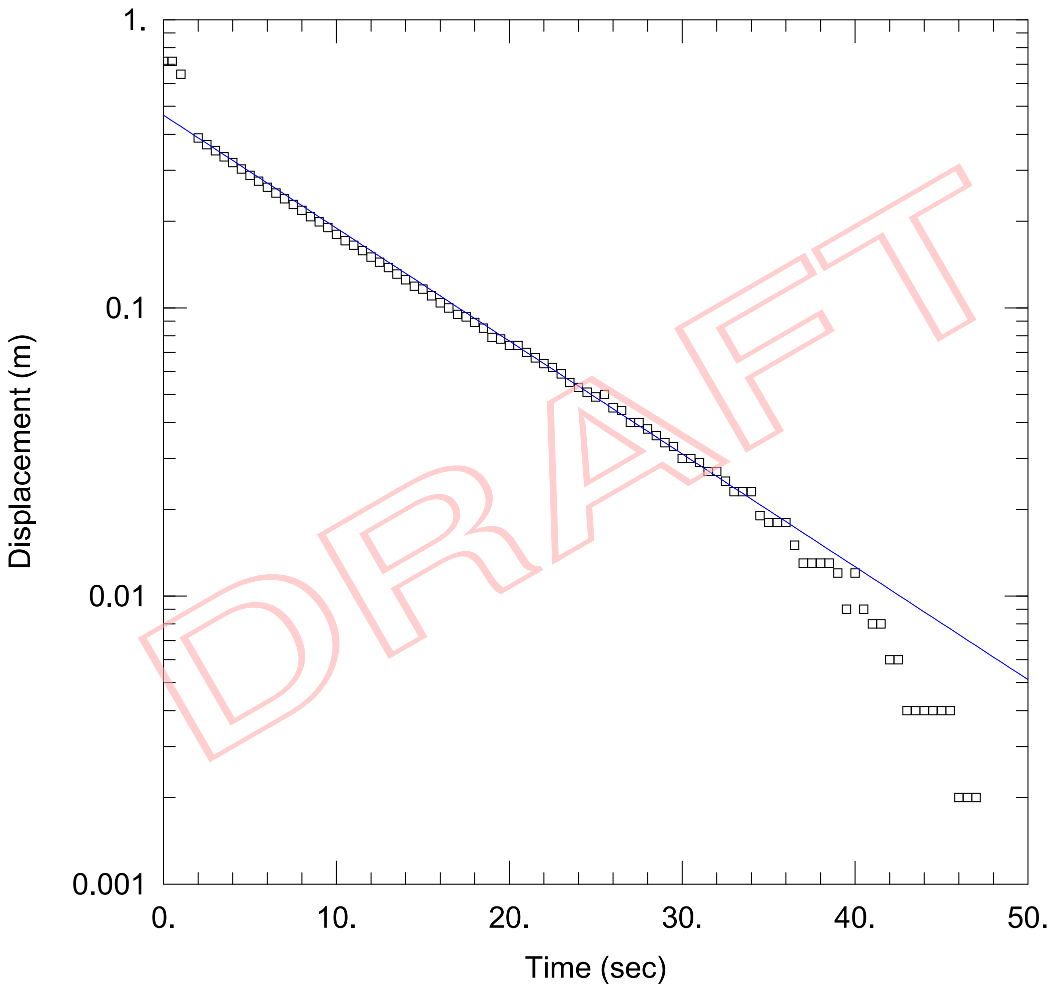
Saturated Thickness: 9.6 rAnisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2B)

Initial Displacement: 0.76 m
Static Water Column Height: 9.6 m
Total Well Penetration Depth: 9.6 m
Screen Length: 7.18 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2C FH1

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.413E-5 m/sec   y0 = 0.4657 m

AQUIFER DATA

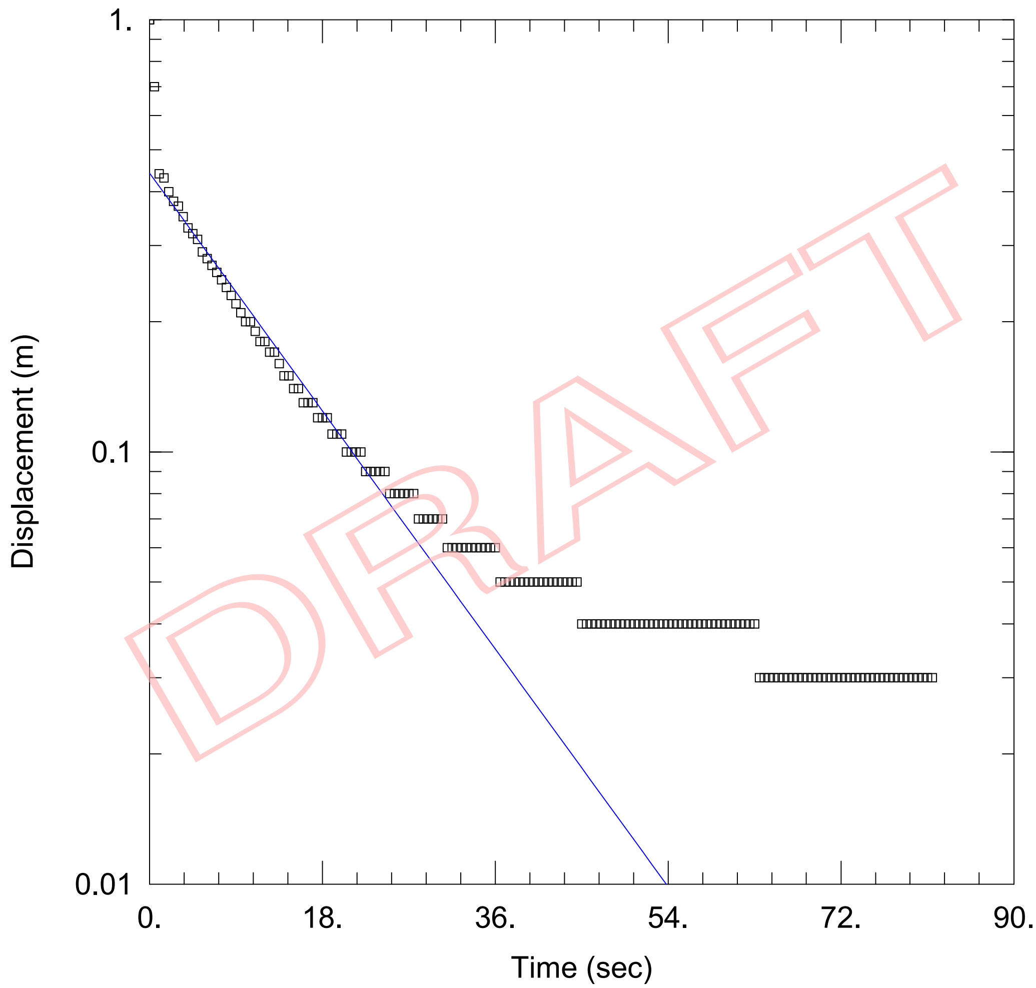
Saturated Thickness: 6.86 Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2C)

Initial Displacement: 0.717 m
Static Water Column Height: 11.41 m
Total Well Penetration Depth: 11.4 m
Screen Length: 6.68 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2C FH2

Prepared By:	Prepared For:
Golder	Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.883E-5 m/sec y0 = 0.4415 m

AQUIFER DATA

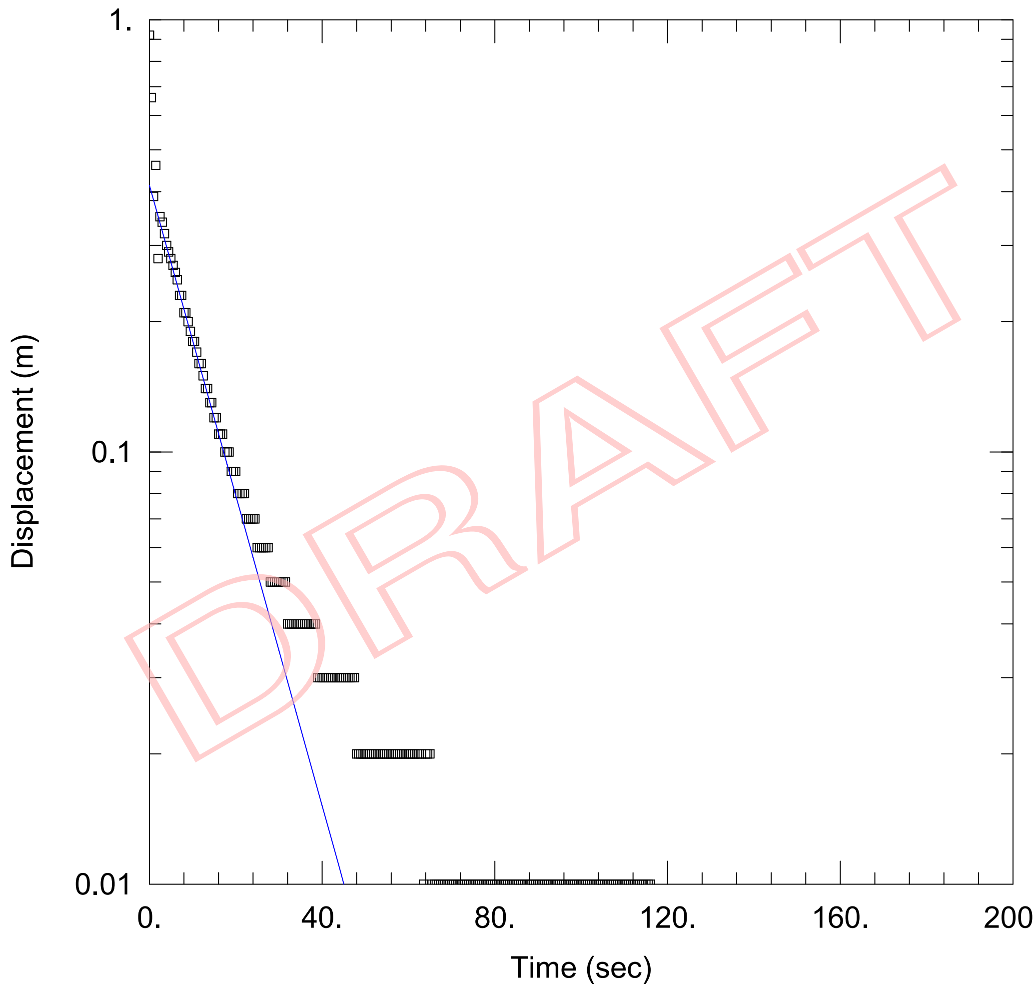
Saturated Thickness: 6.86 Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2C)

Initial Displacement: 1. m
Static Water Column Height: 11.41 m
Total Well Penetration Depth: 11.4 m
Screen Length: 6.68 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2C FH3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.211E-5 m/sec   y0 = 0.414 m

AQUIFER DATA

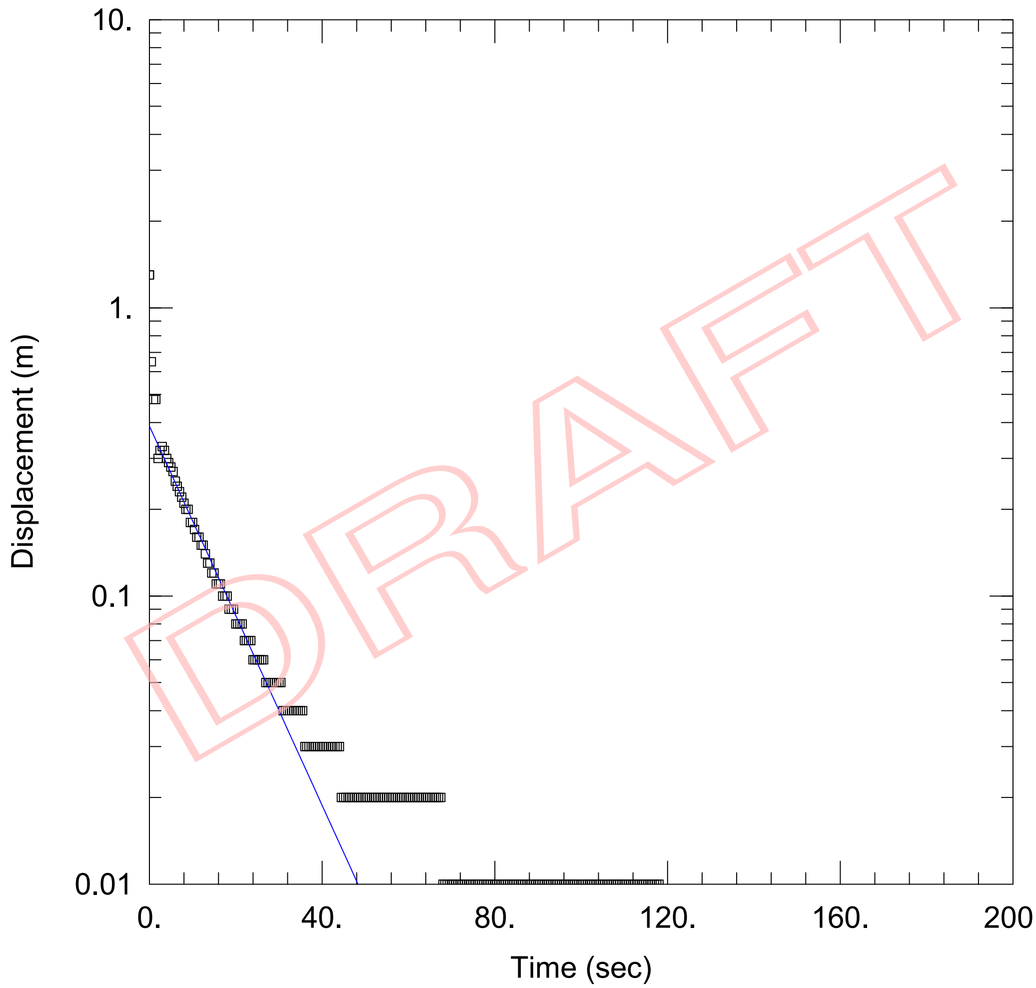
Saturated Thickness: 6.86 Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2C)

Initial Displacement: 0.92 m
Static Water Column Height: 11.41 m
Total Well Penetration Depth: 11.4 m
Screen Length: 6.68 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2C FH4

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.028E-5 m/sec   y0 = 0.389 m

AQUIFER DATA

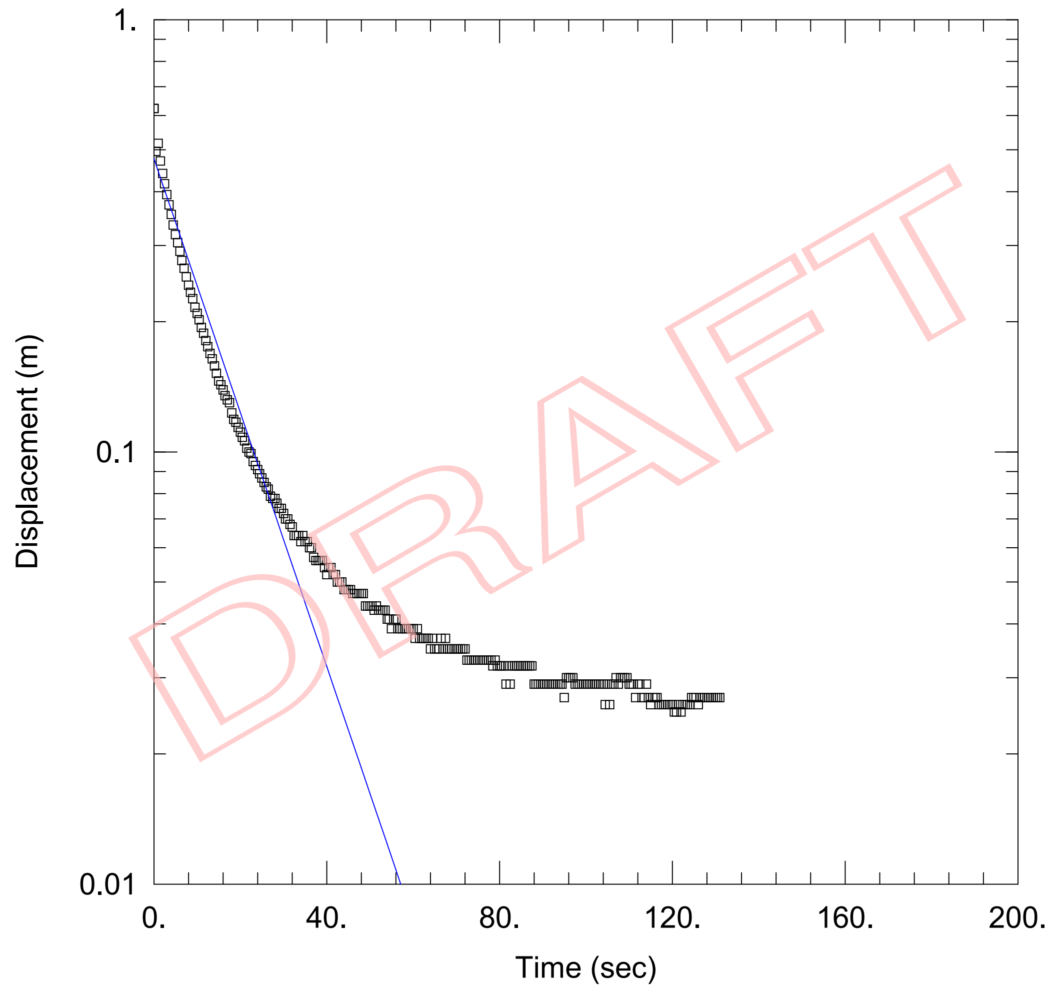
Saturated Thickness: 6.86 Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2C)

Initial Displacement: 1.3 m
Static Water Column Height: 11.41 m
Total Well Penetration Depth: 11.4 m
Screen Length: 6.68 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2C RH1

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.809E-5 m/sec   y0 = 0.4762 m

AQUIFER DATA

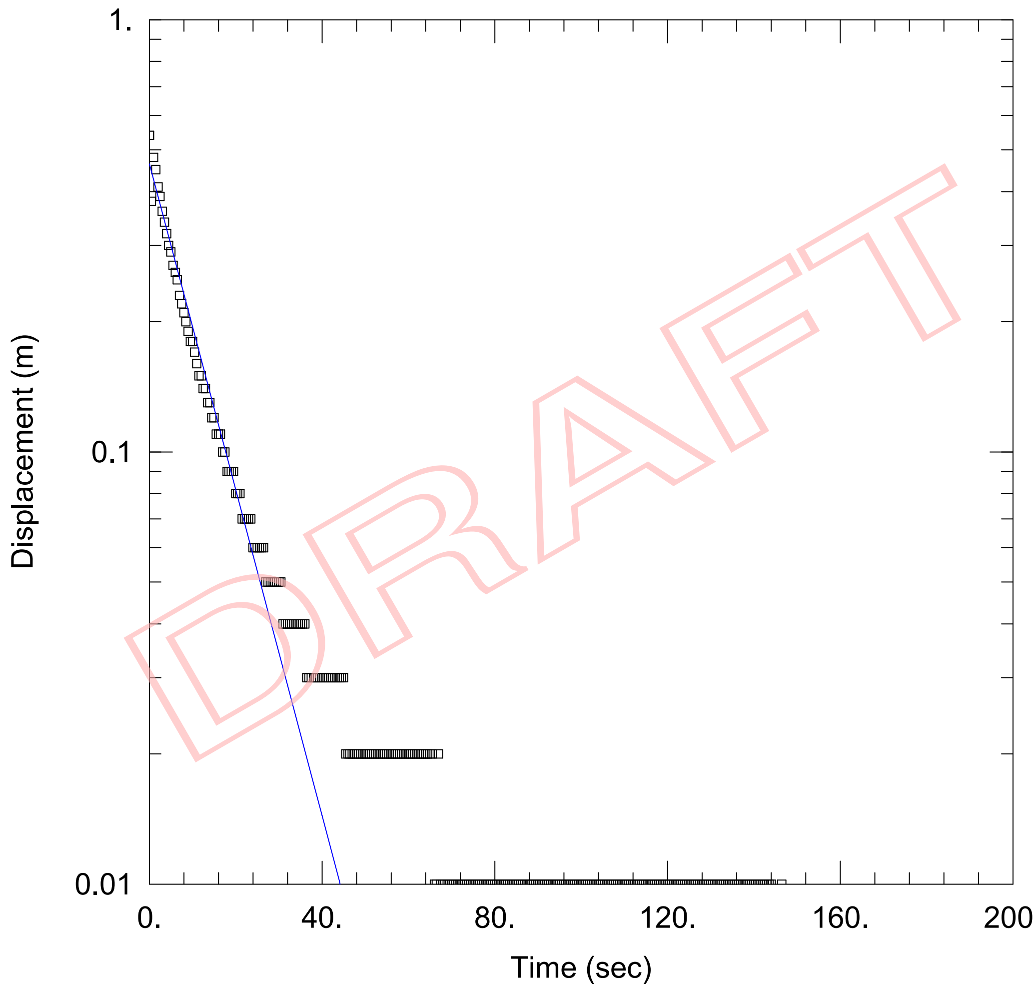
Saturated Thickness: 6.86 Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2C)

Initial Displacement: 0.623 m
Static Water Column Height: 11.41 m
Total Well Penetration Depth: 11.4 m
Screen Length: 6.68 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2C RH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.323E-5 m/sec   y0 = 0.4636 m

AQUIFER DATA

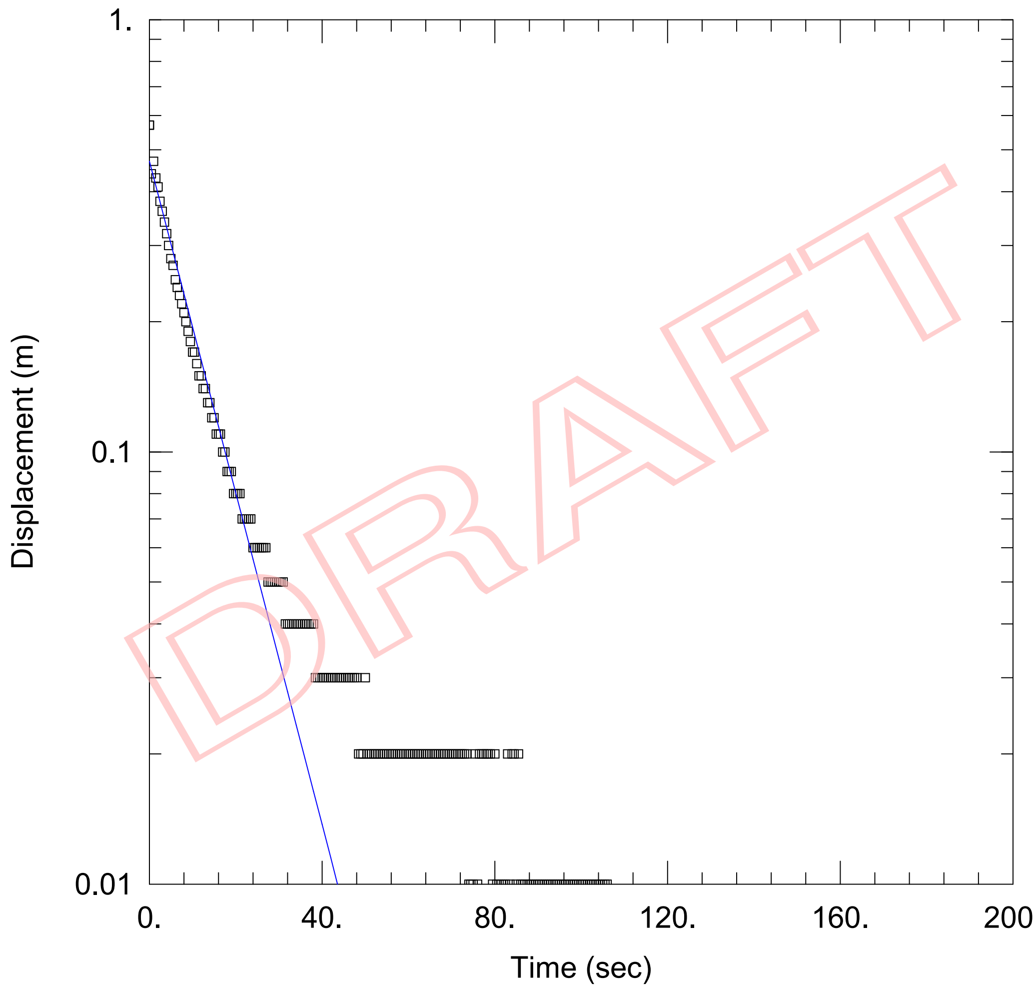
Saturated Thickness: 6.86 Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2C)

Initial Displacement: 0.54 m
Static Water Column Height: 11.41 m
Total Well Penetration Depth: 11.4 m
Screen Length: 6.68 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2C RH3

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.363E-5 m/sec   y0 = 0.4703 m

AQUIFER DATA

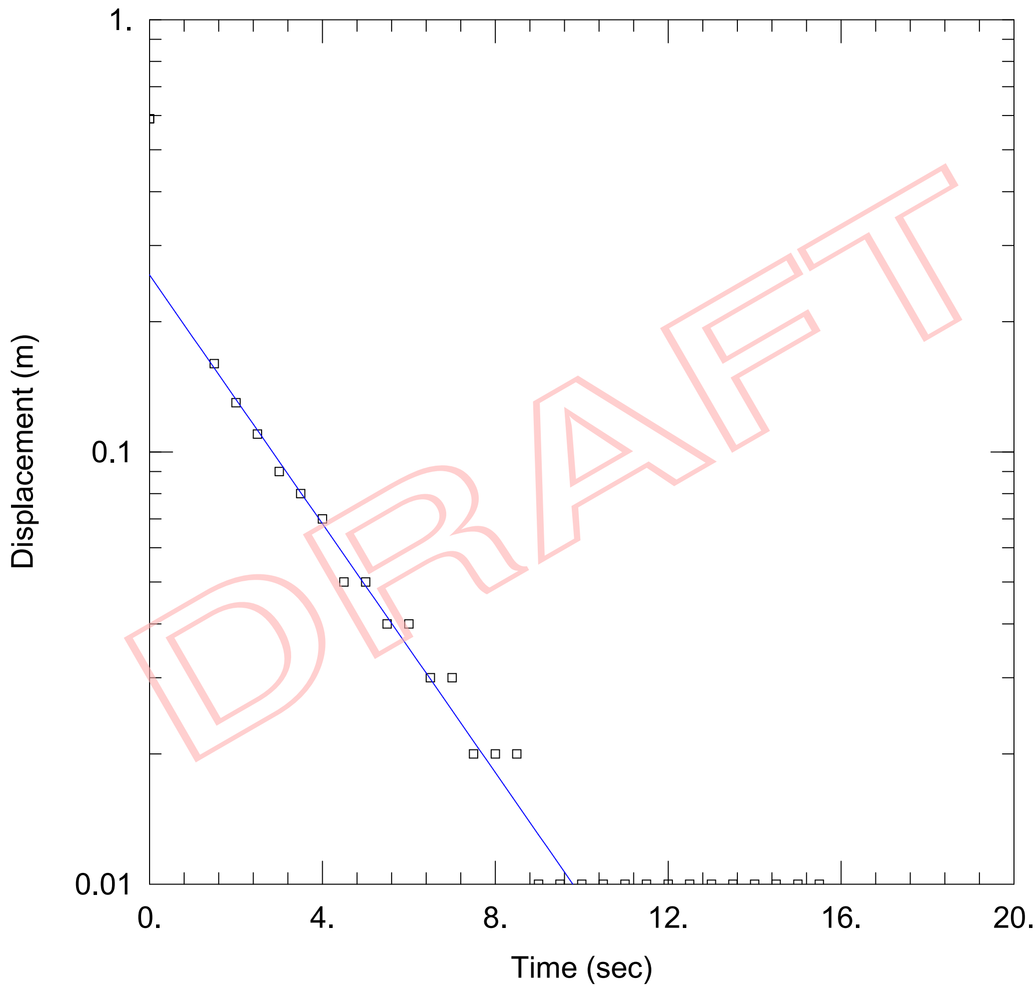
Saturated Thickness: 6.86 Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW17-2C)

Initial Displacement: 0.57 m
Static Water Column Height: 11.41 m
Total Well Penetration Depth: 11.4 m
Screen Length: 6.68 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2D FH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0001328 m/sec y0 = 0.2565 m

AQUIFER DATA

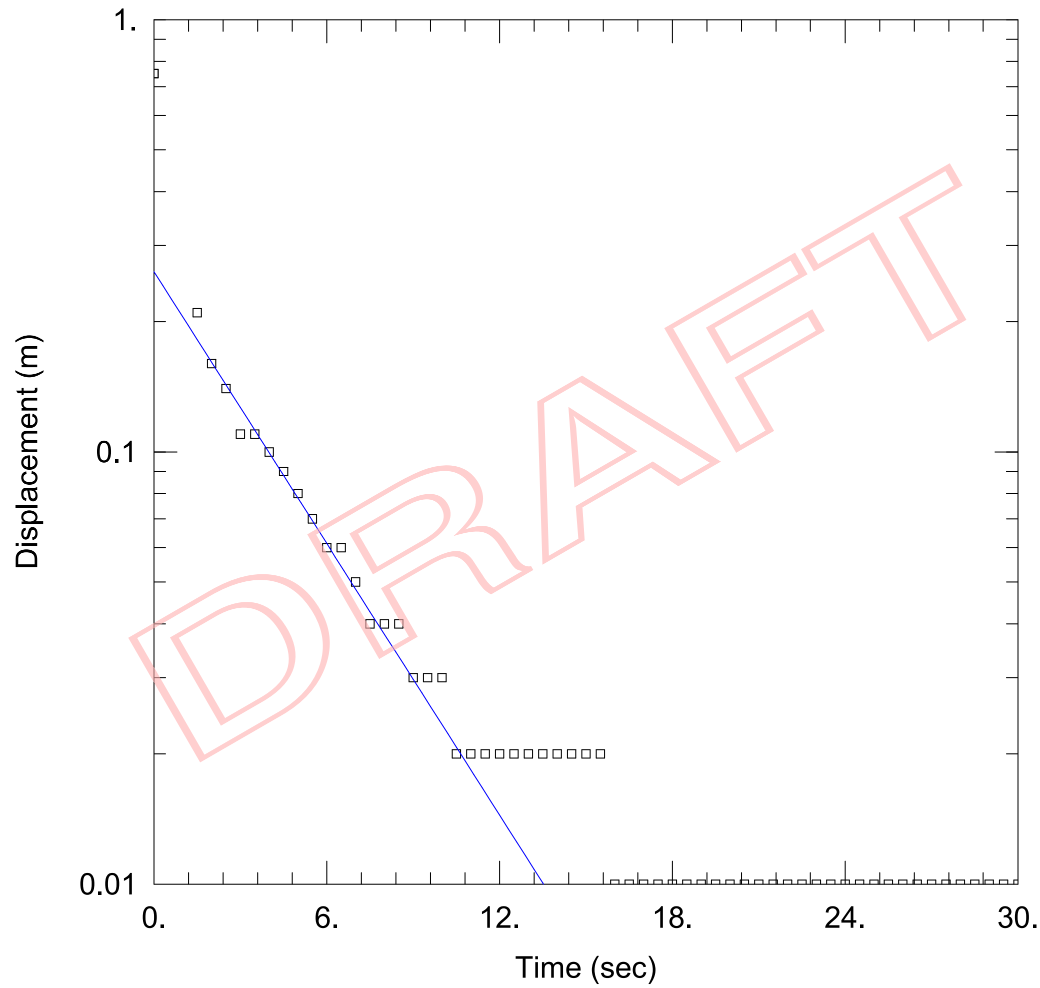
Saturated Thickness: 2.66 Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW17-2D)

Initial Displacement: 0.59 m
Static Water Column Height: 2.76 m
Total Well Penetration Depth: 3. m
Screen Length: 3. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2D FH2

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 9.669E-5 m/sec   y0 = 0.2612 m

AQUIFER DATA

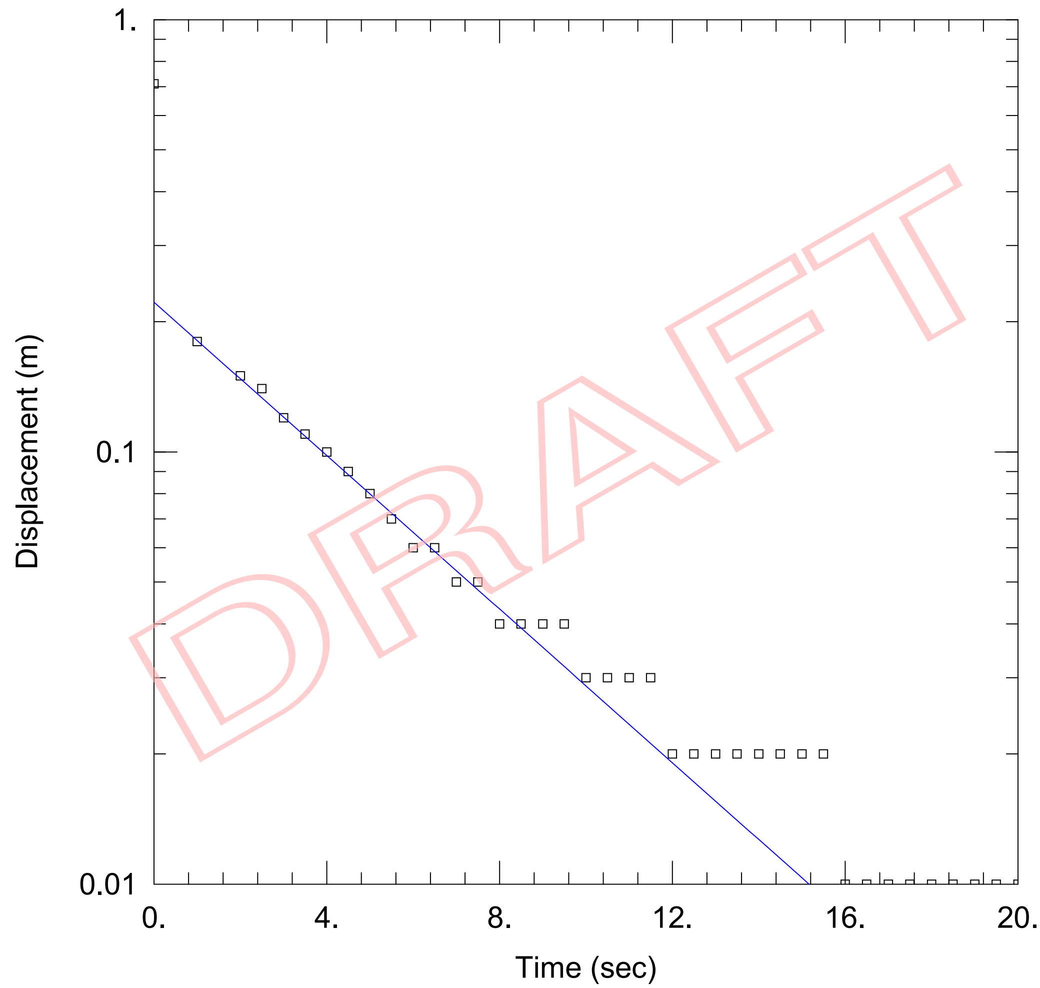
Saturated Thickness: 2.66 Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW17-2D)

Initial Displacement: 0.75 m
Static Water Column Height: 2.76 m
Total Well Penetration Depth: 3. m
Screen Length: 3. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2D FH3

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 8.191E-5 m/sec y0 = 0.222 m

AQUIFER DATA

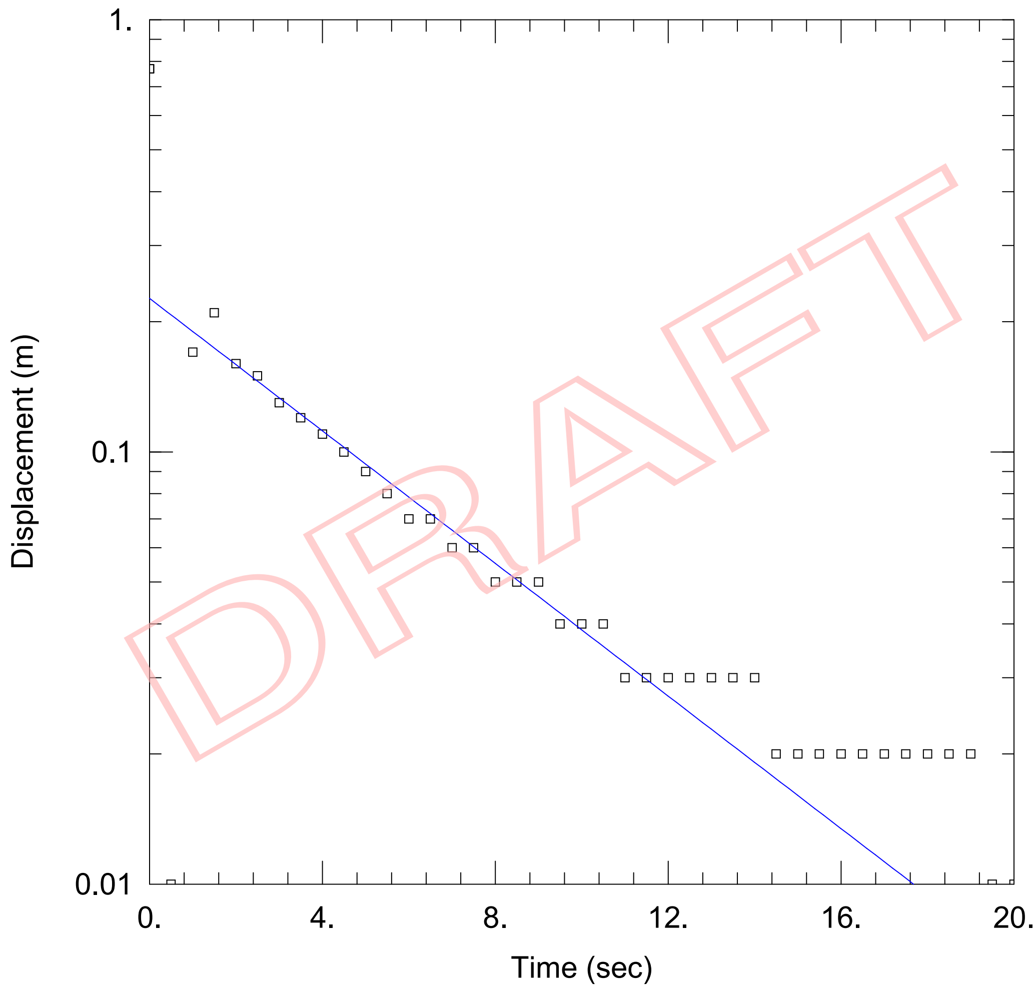
Saturated Thickness: 2.66 Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW17-2D)

Initial Displacement: 0.71 m
Static Water Column Height: 2.76 m
Total Well Penetration Depth: 3. m
Screen Length: 3. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2D FH4

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 7.072E-5 m/sec   y0 = 0.2265 m

AQUIFER DATA

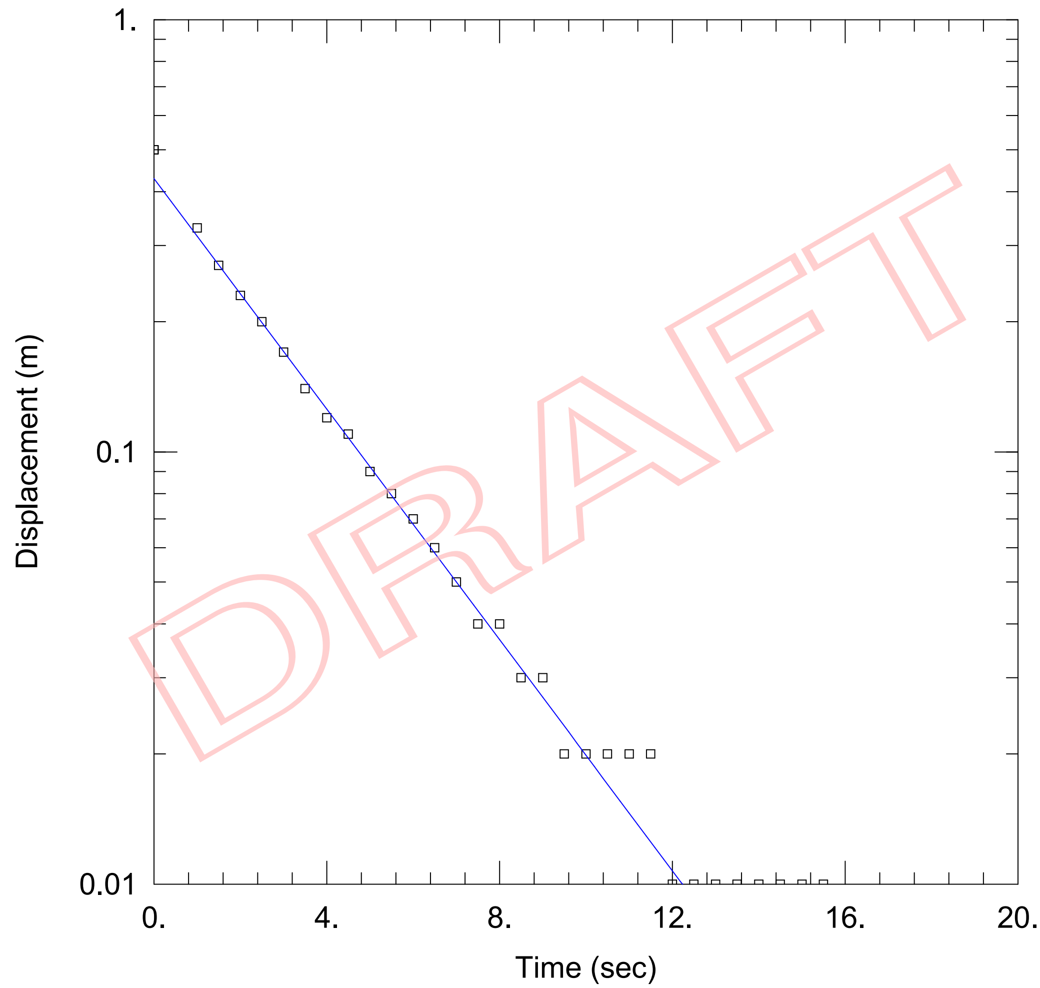
Saturated Thickness: 2.66 Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW17-2D)

Initial Displacement: 0.77 m
Static Water Column Height: 2.76 m
Total Well Penetration Depth: 3. m
Screen Length: 3. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2D RH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0001231 m/sec y0 = 0.4286 m

AQUIFER DATA

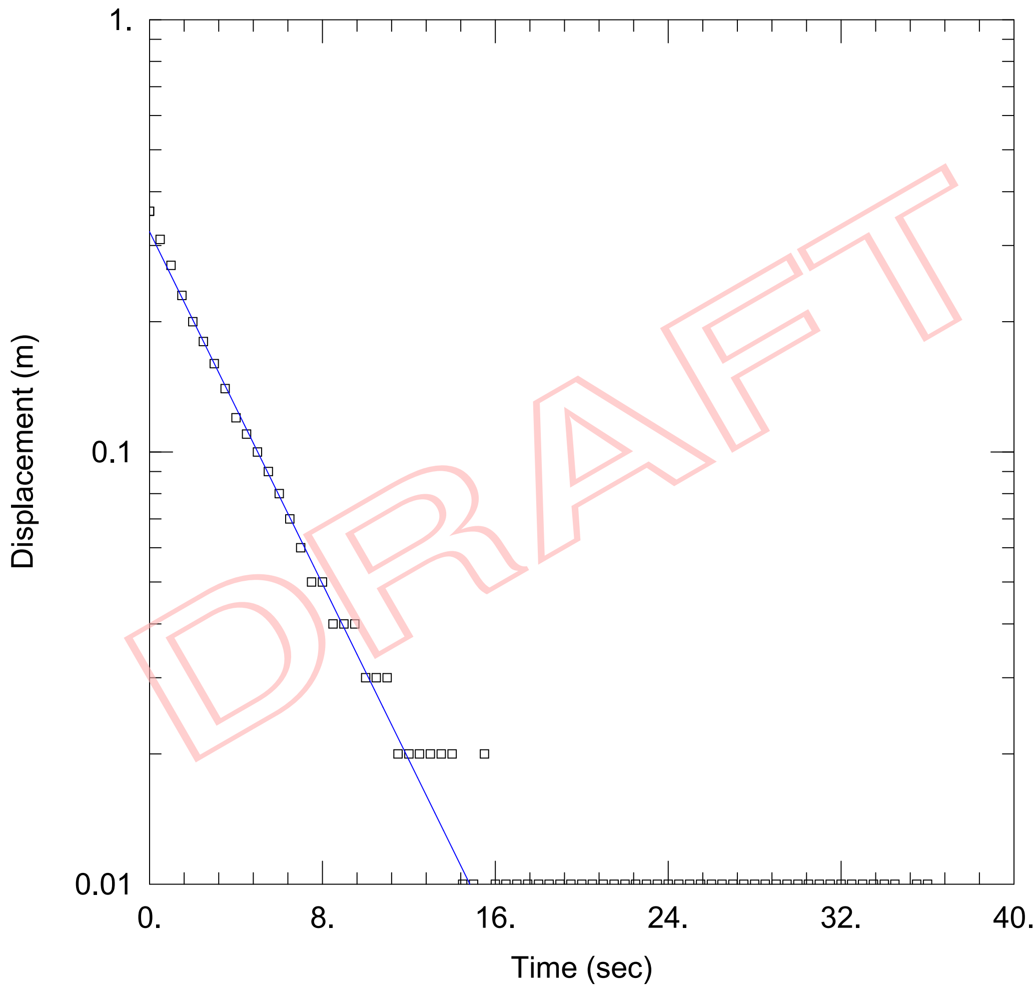
Saturated Thickness: 2.66 Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW17-2D)

Initial Displacement: 0.5 m
Static Water Column Height: 2.76 m
Total Well Penetration Depth: 3. m
Screen Length: 3. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2D RH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 9.401E-5 m/sec   y0 = 0.3231 m

AQUIFER DATA

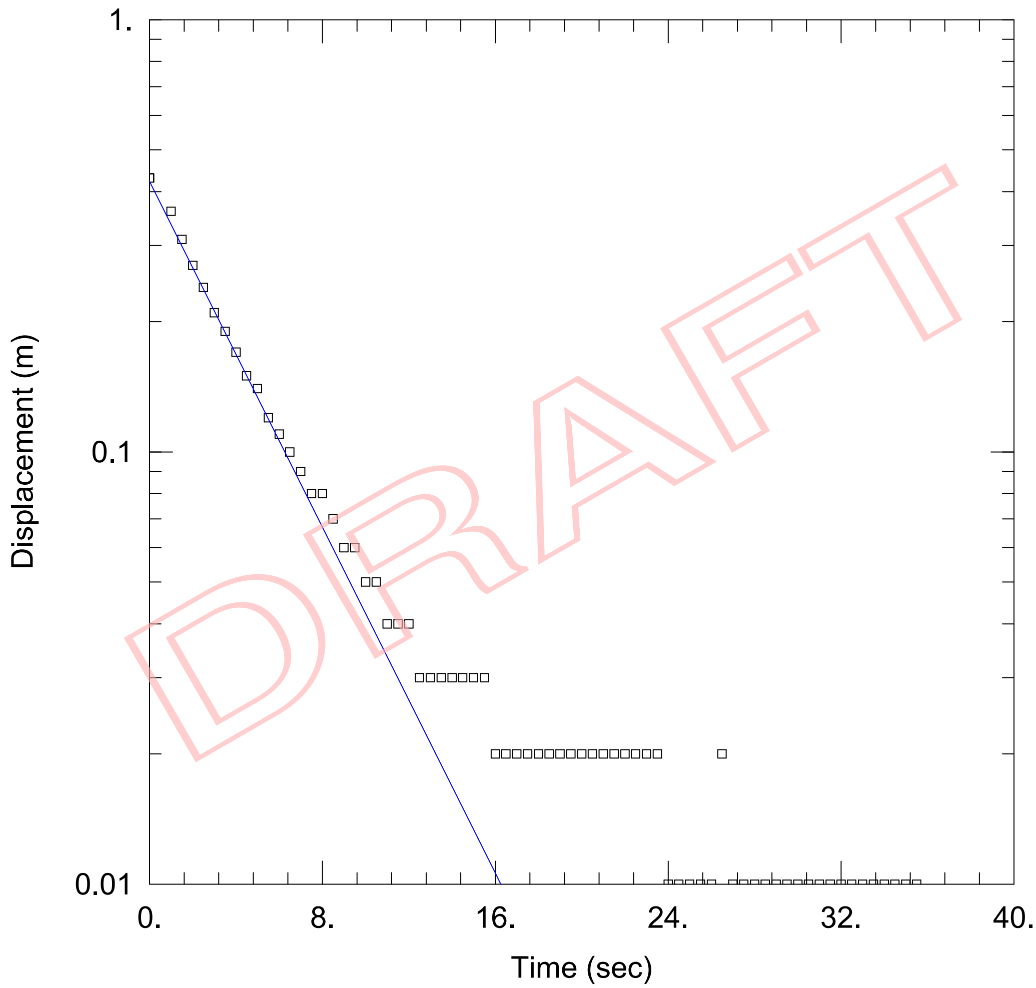
Saturated Thickness: 2.66 Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW17-2D)

Initial Displacement: 0.36 m
Static Water Column Height: 2.76 m
Total Well Penetration Depth: 3. m
Screen Length: 3. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-2D RH3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 9.23E-5 m/sec
y0 = 0.4226 m

AQUIFER DATA

Saturated Thickness: 2.66 Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW17-2D)

Initial Displacement: 0.43 m
Static Water Column Height: 2.76 m
Total Well Penetration Depth: 3. m
Screen Length: 3. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

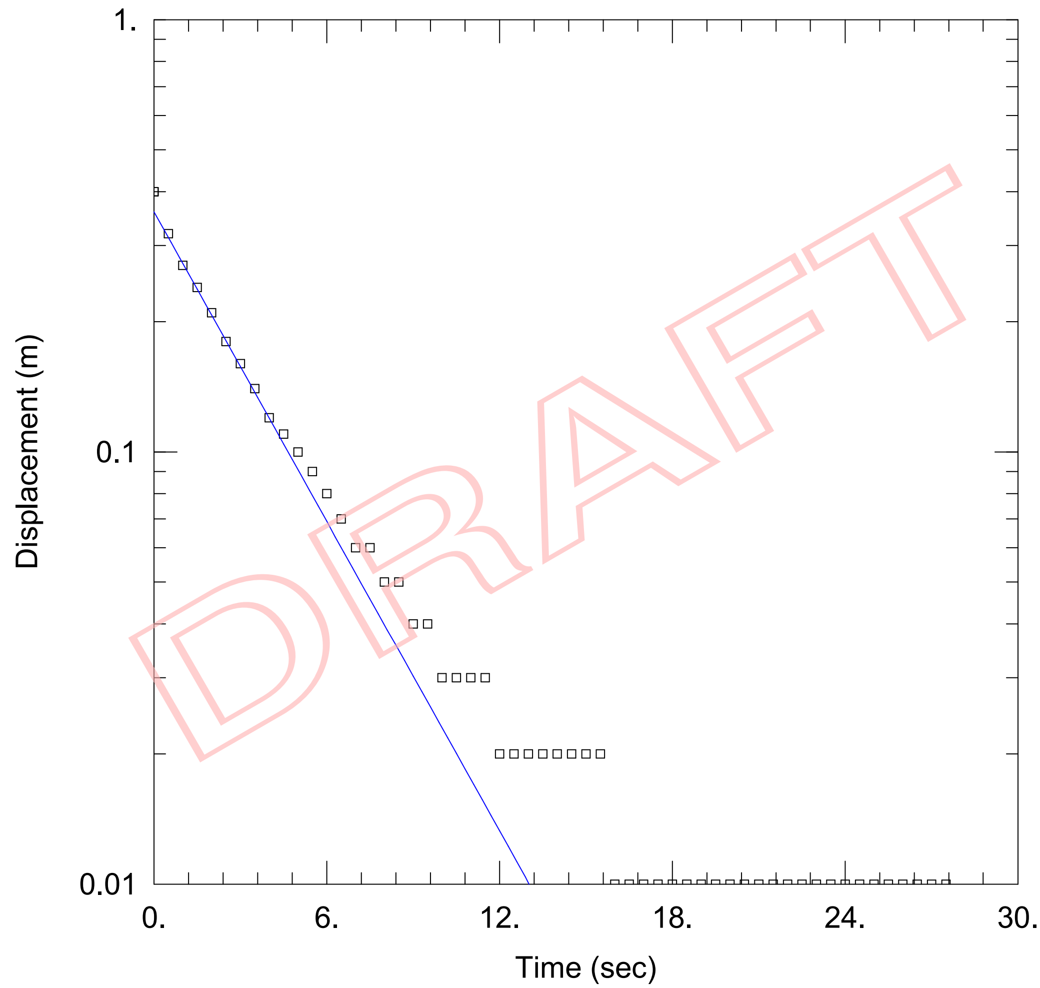
MW17-2D RH4

Prepared By:
Golder

Prepared For:
Walker

Project:
1664706.2000

Location:
Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0001101 m/sec   y0 = 0.3594 m

AQUIFER DATA

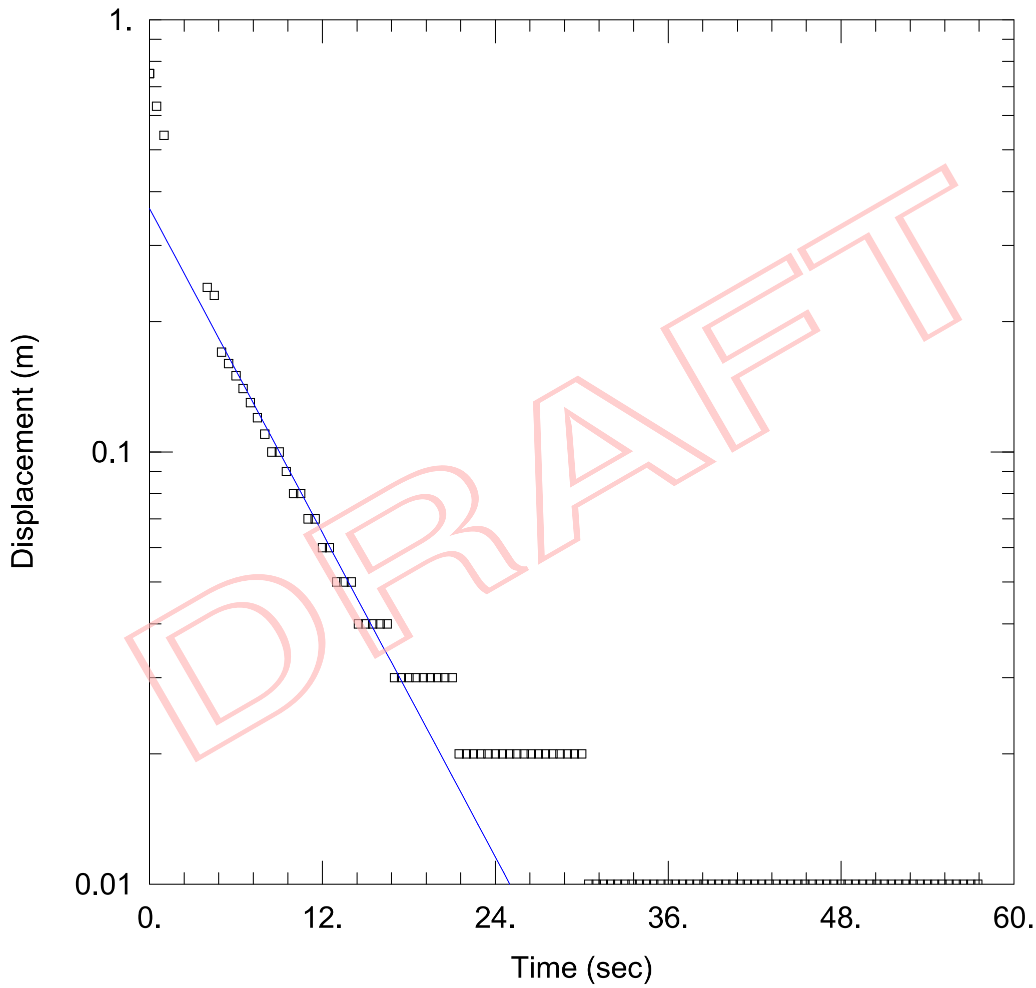
Saturated Thickness: 2.66 Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW17-2D)

Initial Displacement: 0.4 m
Static Water Column Height: 2.76 m
Total Well Penetration Depth: 3. m
Screen Length: 3. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3B FH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



DRAFT

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

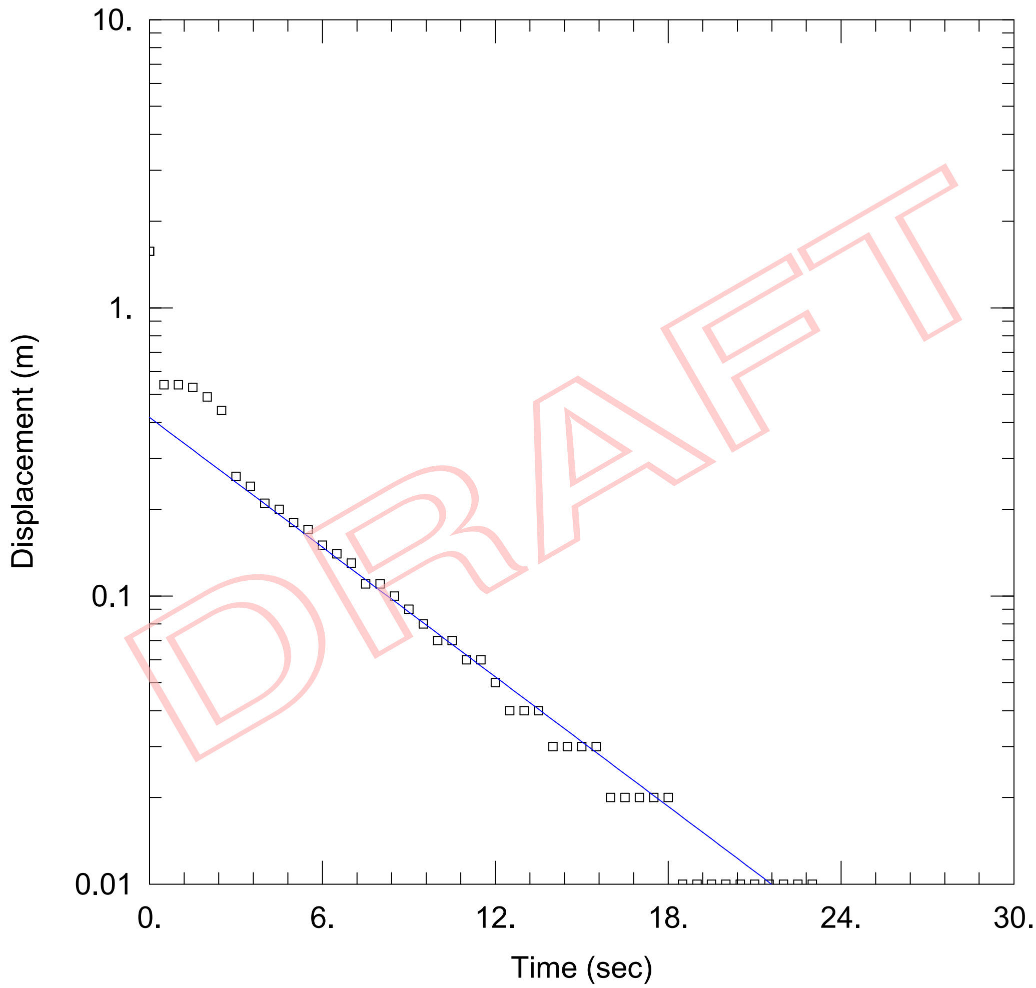
K = 3.249E-5 m/sec y0 = 0.3656 m

WELL DATA (MW17-3B)

Initial Displacement: 0.75 m
Static Water Column Height: 12.32 m
Total Well Penetration Depth: 12.32 m
Screen Length: 8.356 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3B FH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

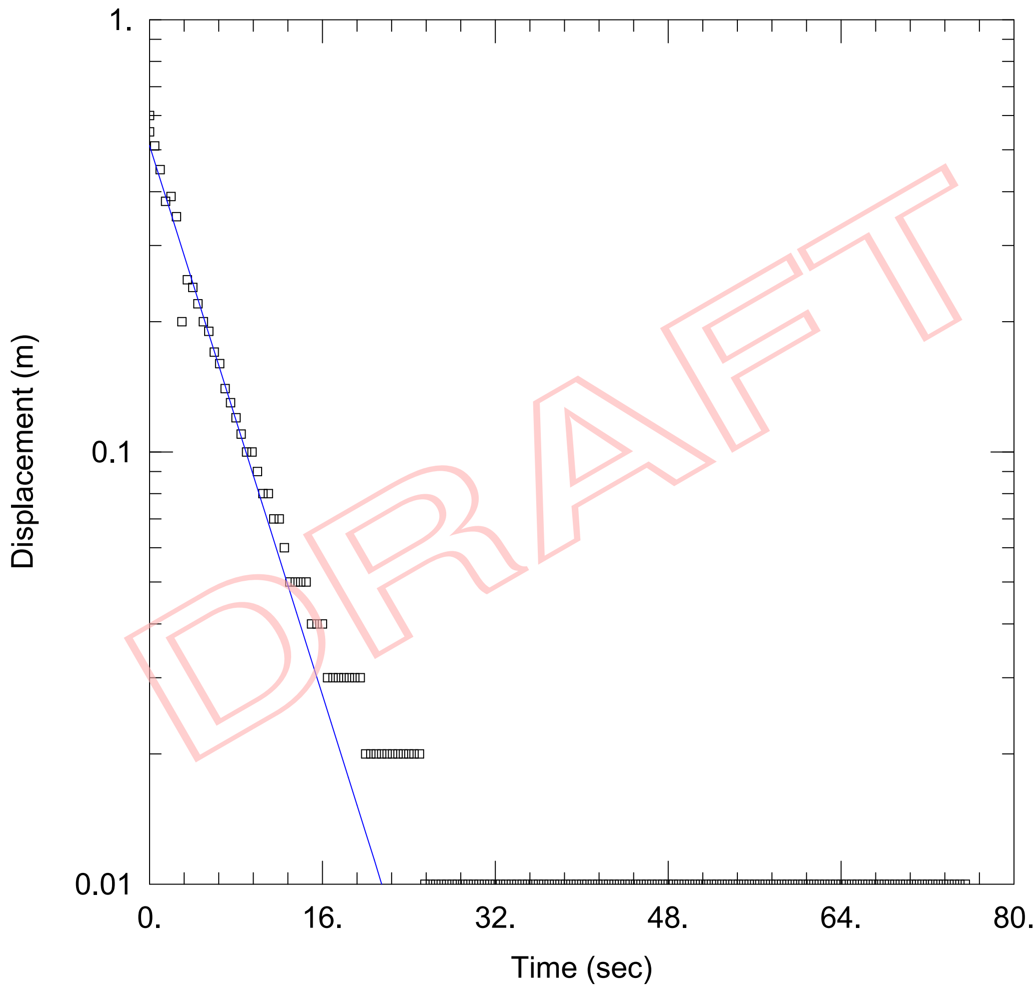
K = 3.898E-5 m/sec   y0 = 0.4163 m

WELL DATA (MW17-3B)

Initial Displacement: 1.57 m
Static Water Column Height: 12.32 m
Total Well Penetration Depth: 12.32 m
Screen Length: 8.356 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3C FH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

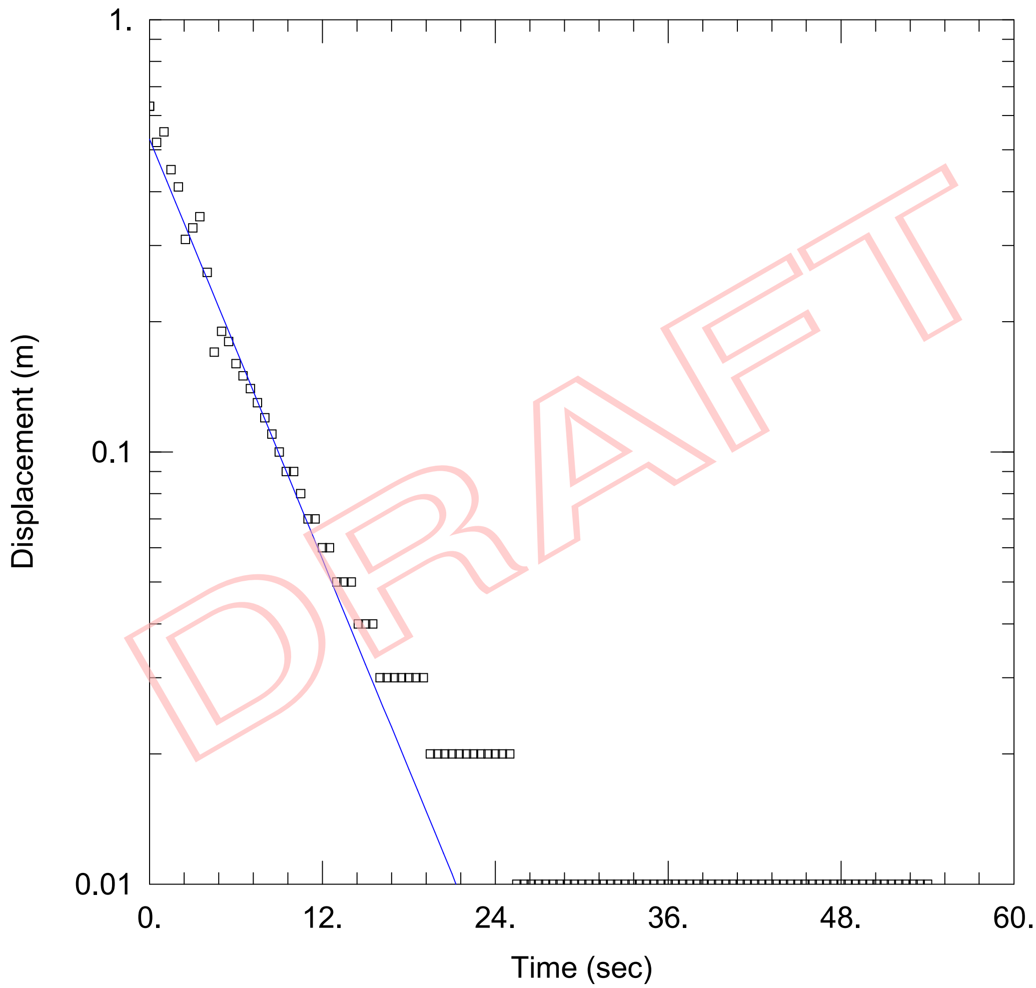
K = 2.425E-5 m/sec   y0 = 0.5114 m

WELL DATA (MW17-3C)

Initial Displacement: 0.6 m
Static Water Column Height: 11.89 m
Total Well Penetration Depth: 11.89 m
Screen Length: 11.3 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3C FH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

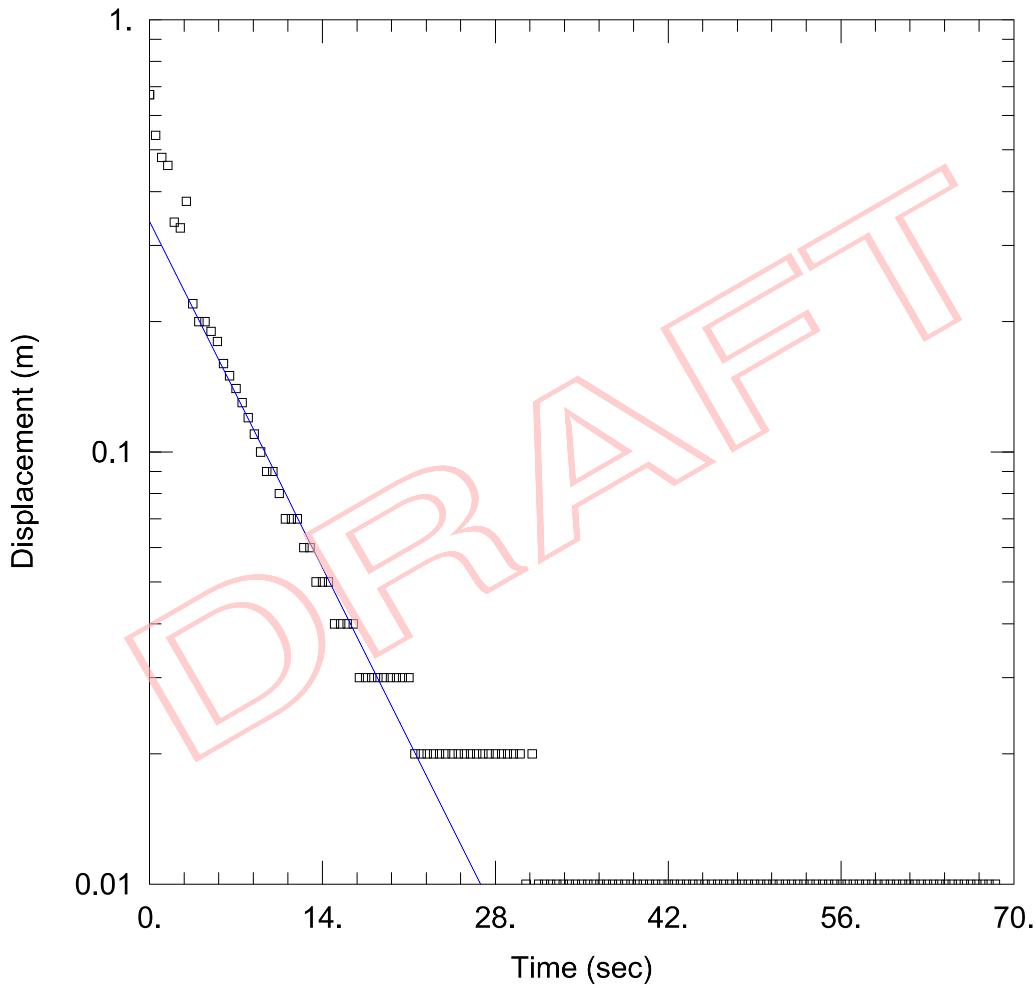
K = 2.471E-5 m/sec   y0 = 0.5288 m

WELL DATA (MW17-3C)

Initial Displacement: 0.63 m
Static Water Column Height: 11.89 m
Total Well Penetration Depth: 11.89 m
Screen Length: 11.3 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3C FH3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

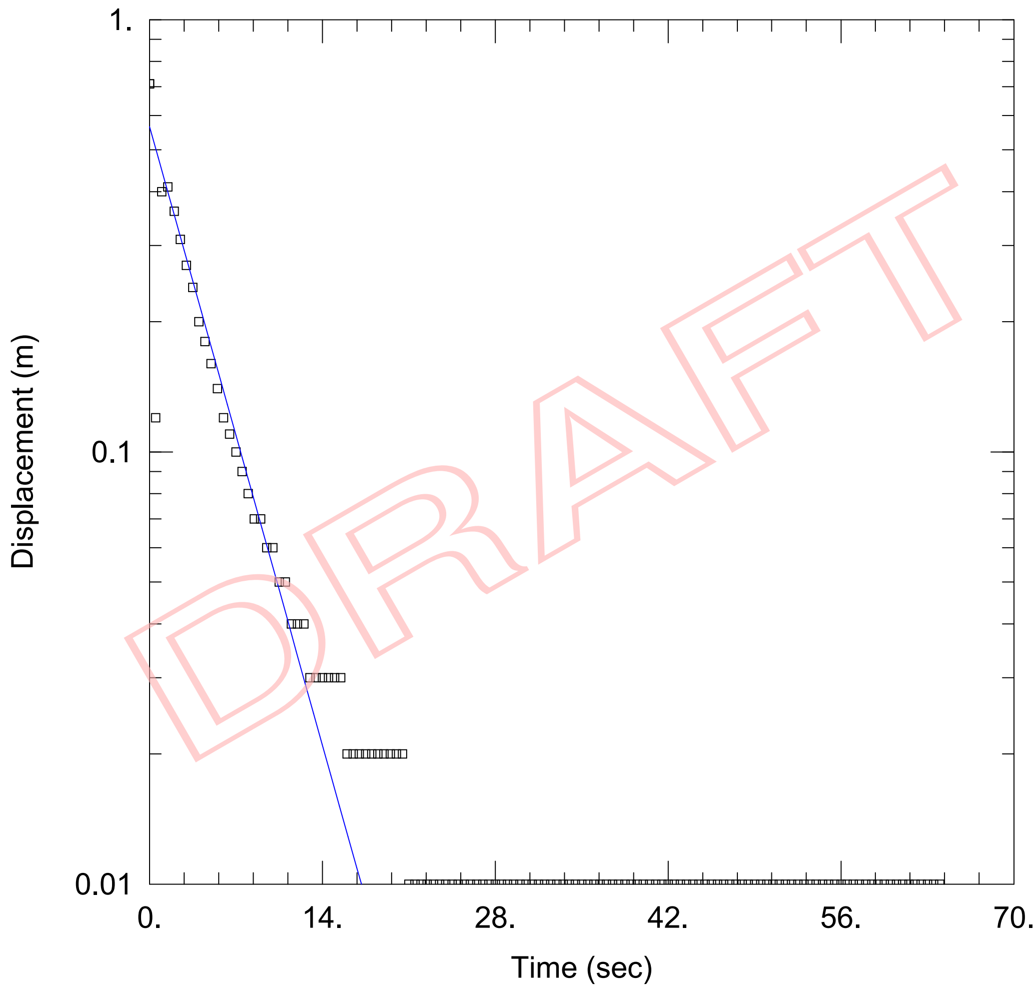
K = 1.744E-5 m/sec   y0 = 0.3415 m

WELL DATA (MW17-3C)

Initial Displacement: 0.67 m
Static Water Column Height: 11.89 m
Total Well Penetration Depth: 11.89 m
Screen Length: 11.3 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3C RH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

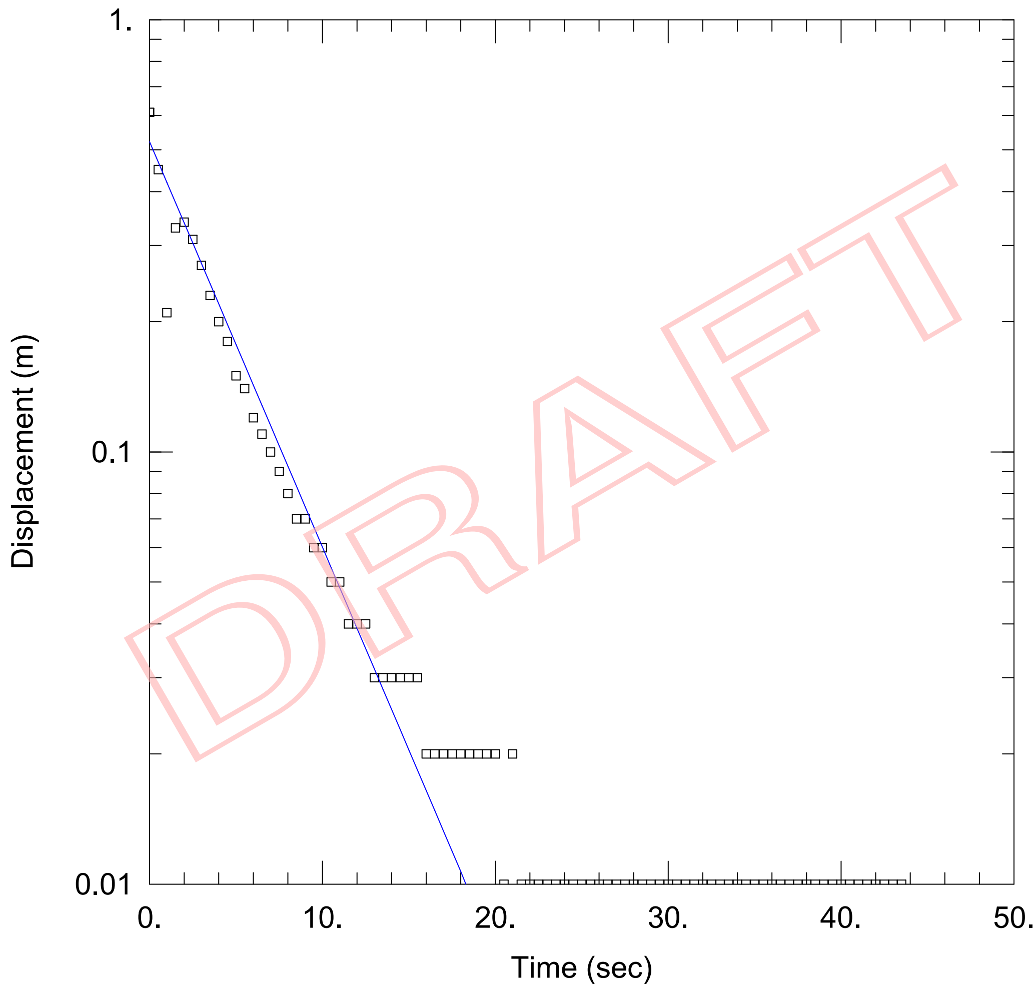
K = 3.115E-5 m/sec   y0 = 0.5654 m

WELL DATA (MW17-3C)

Initial Displacement: 0.71 m
Static Water Column Height: 11.89 m
Total Well Penetration Depth: 11.89 m
Screen Length: 11.3 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3C RH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

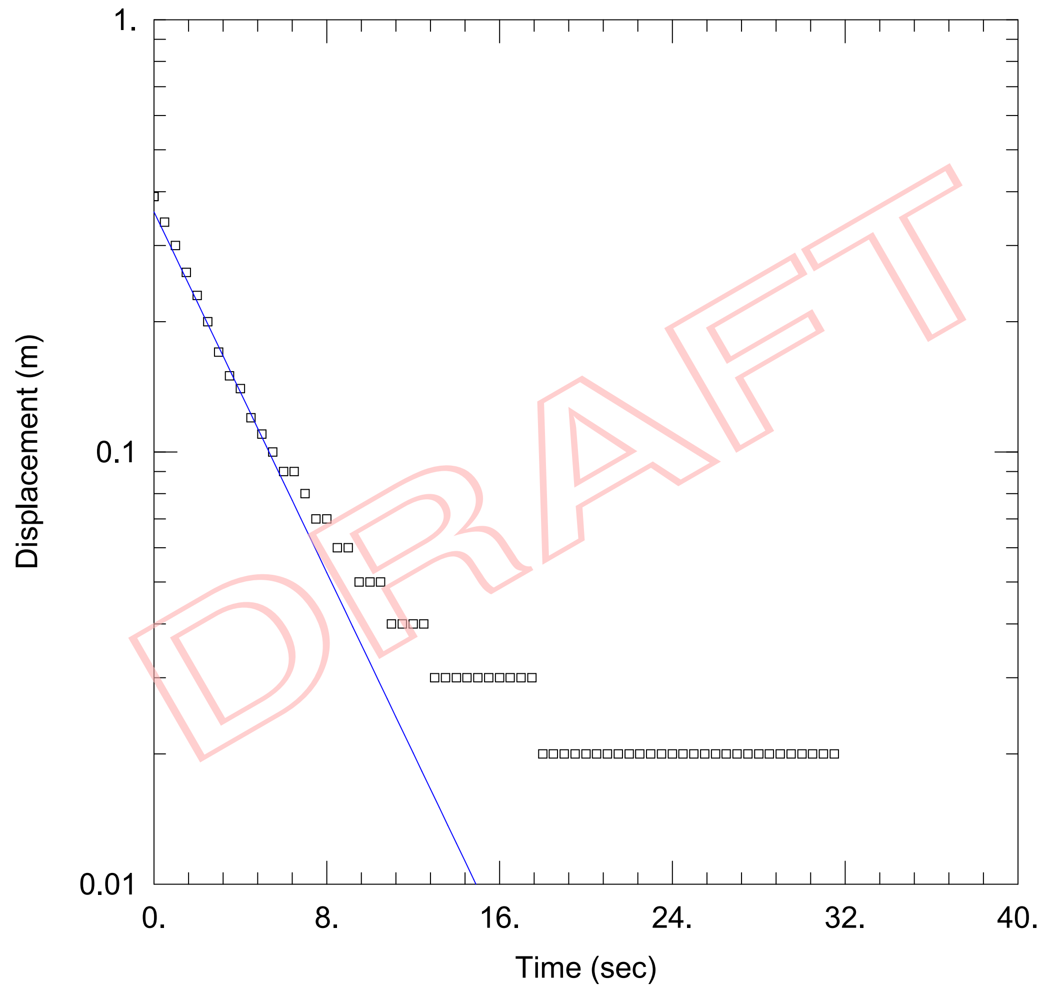
K = 2.863E-5 m/sec   y0 = 0.5218 m

WELL DATA (MW17-3C)

Initial Displacement: 0.61 m
Static Water Column Height: 11.89 m
Total Well Penetration Depth: 11.89 m
Screen Length: 11.3 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3C RH3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

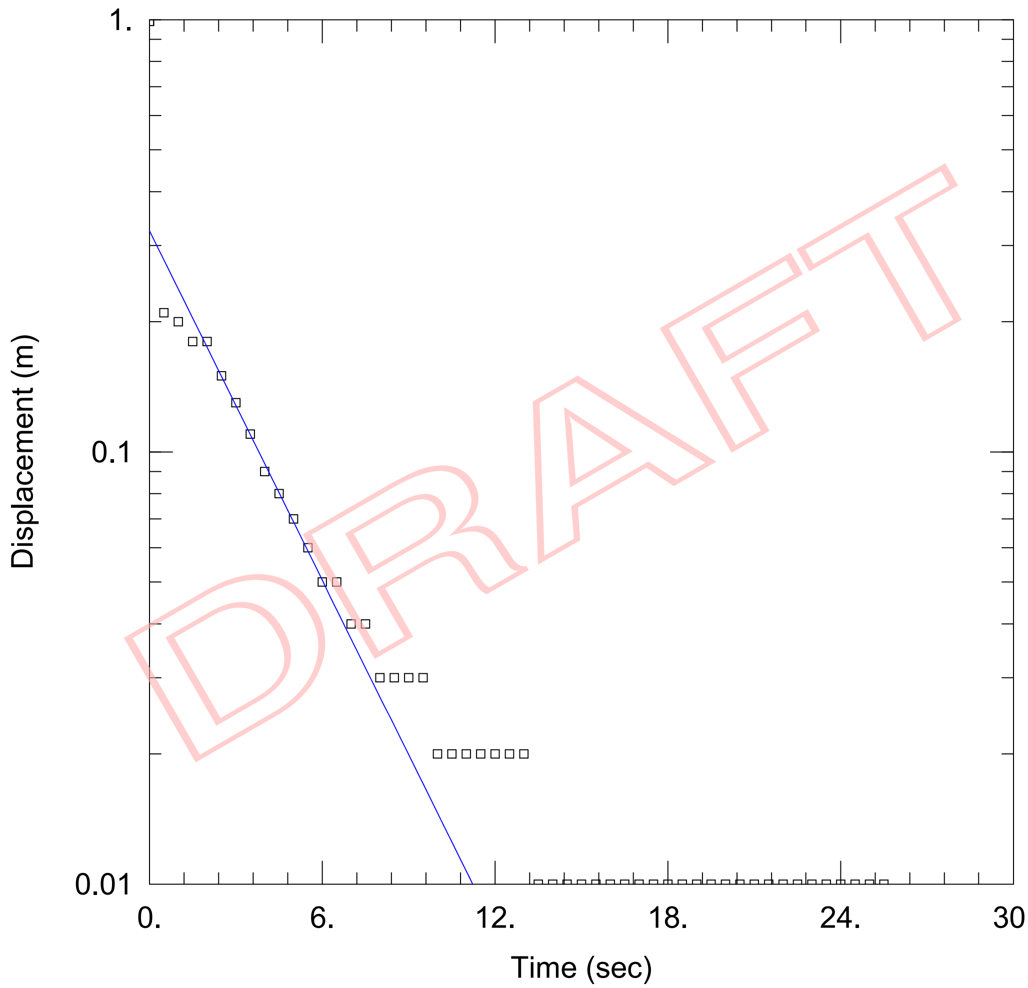
K = 3.185E-5 m/sec y0 = 0.3594 m

WELL DATA (MW17-3C)

Initial Displacement: 0.39 m
Static Water Column Height: 11.89 m
Total Well Penetration Depth: 11.89 m
Screen Length: 11.3 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3E FH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

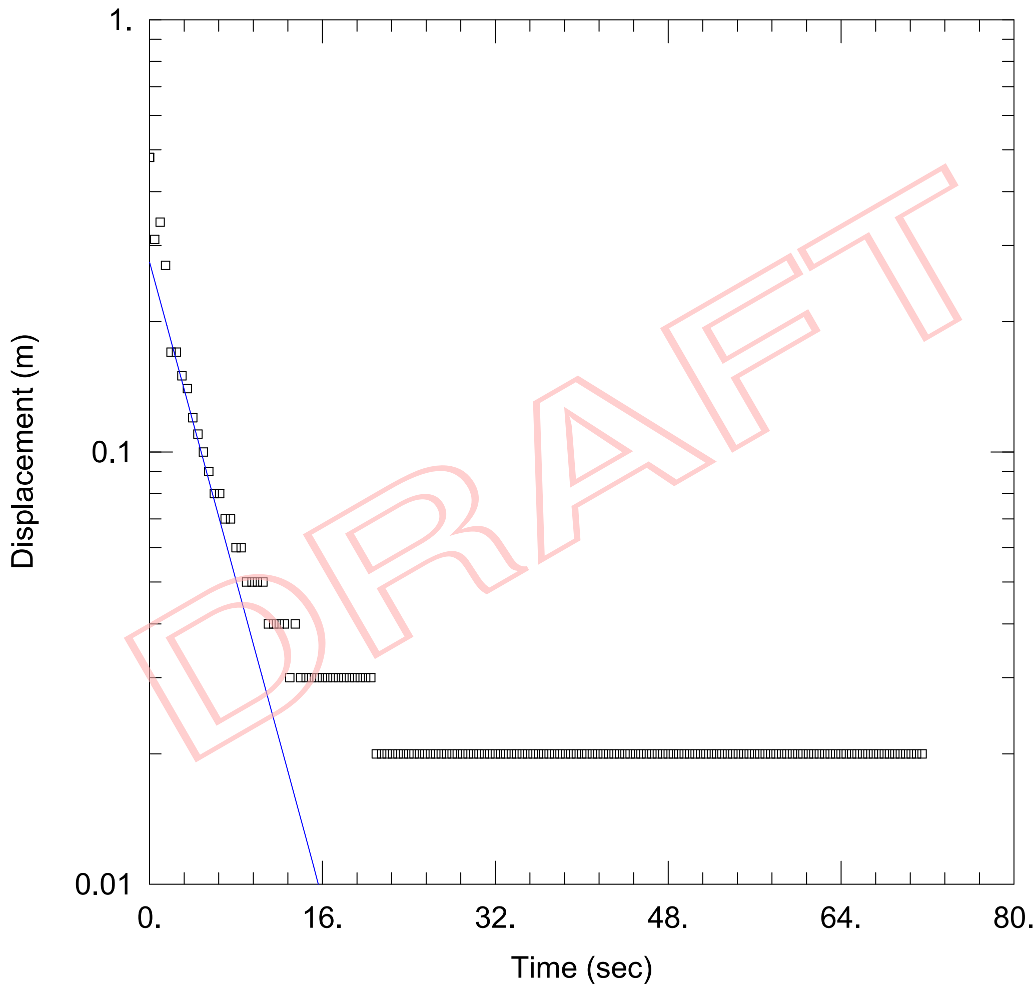
K = 0.0002461 m/sec   y0 = 0.3246 m

WELL DATA (MW17-3E)

Initial Displacement: 0.99 m
Static Water Column Height: 2.46 m
Total Well Penetration Depth: 1.168 m
Screen Length: 1. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3E FH2

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

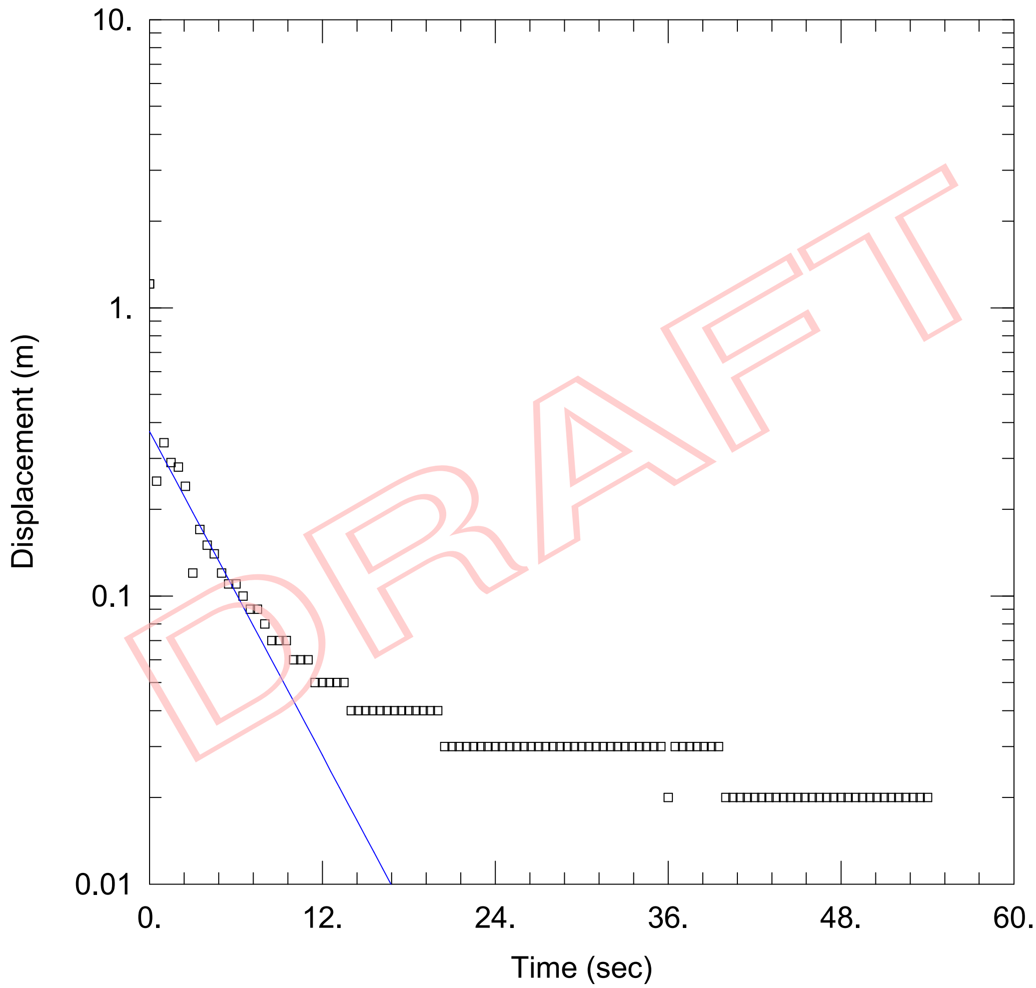
K = 0.0001682 m/sec   y0 = 0.2749 m

WELL DATA (MW17-3E)

Initial Displacement: 0.48 m
Static Water Column Height: 2.46 m
Total Well Penetration Depth: 1.168 m
Screen Length: 1. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3E FH3

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

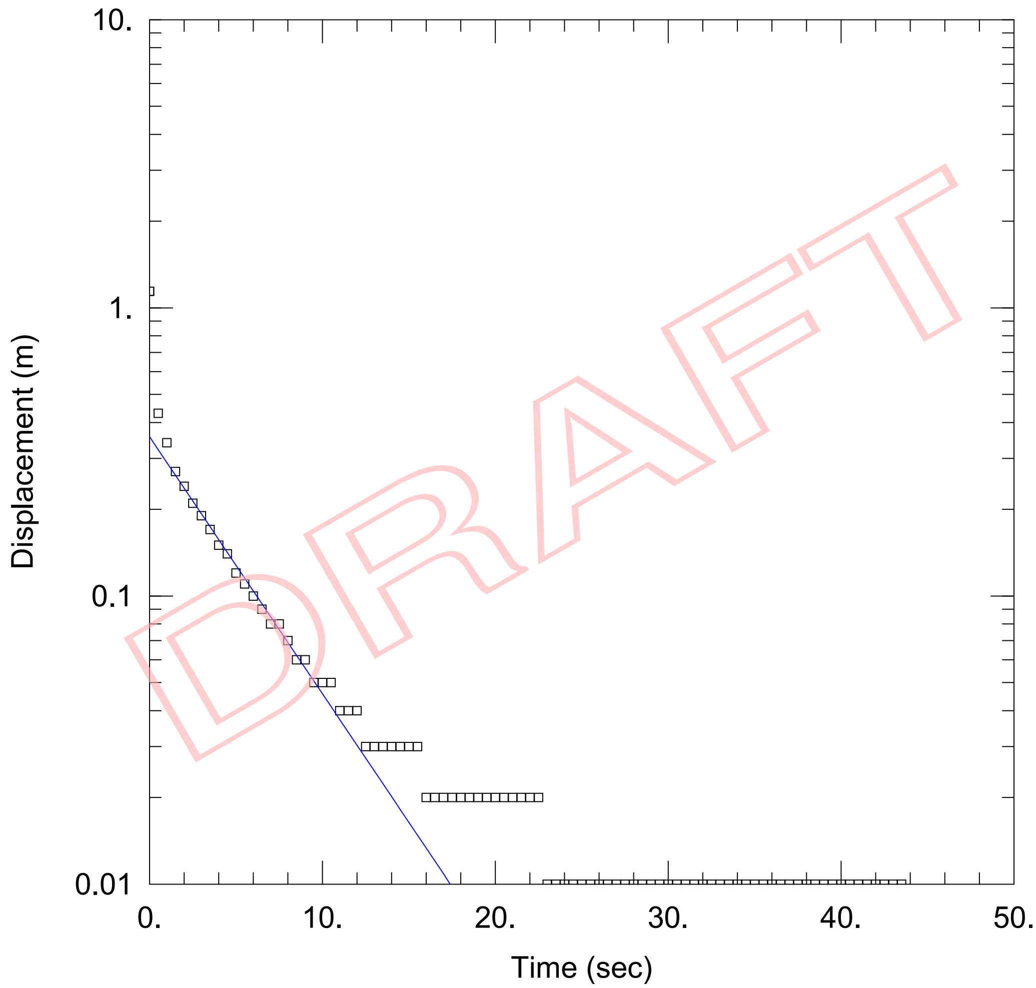
K = 0.0001711 m/sec   y0 = 0.3722 m

WELL DATA (MW17-3E)

Initial Displacement: 1.21 m
Static Water Column Height: 2.46 m
Total Well Penetration Depth: 1.168 m
Screen Length: 1. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3E RH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

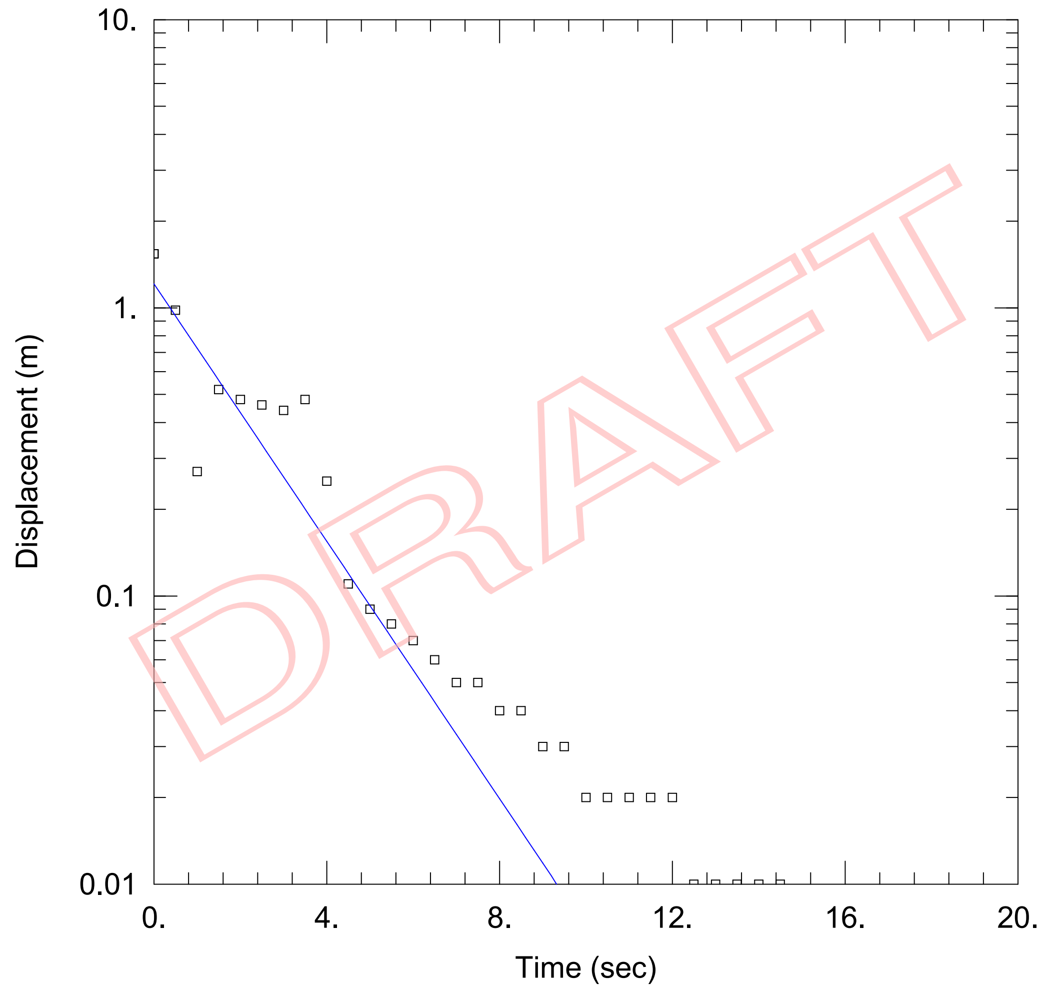
K = 0.000163 m/sec y0 = 0.3567 m

WELL DATA (MW17-3E)

Initial Displacement: 1.14 m
Static Water Column Height: 2.46 m
Total Well Penetration Depth: 1.168 m
Screen Length: 1. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3E RH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

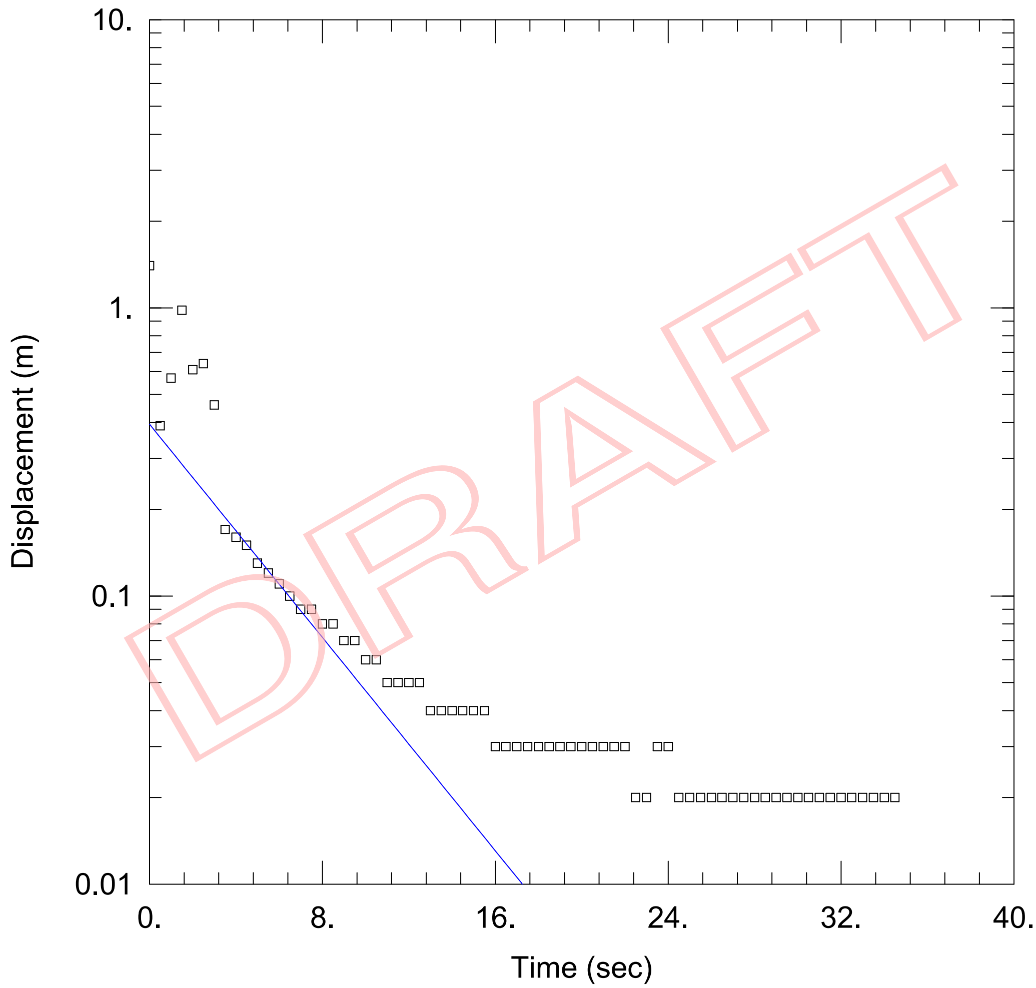
K = 0.0004081 m/sec   y0 = 1.21 m

WELL DATA (MW17-3E)

Initial Displacement: 1.54 m
Static Water Column Height: 2.46 m
Total Well Penetration Depth: 1.168 m
Screen Length: 1. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-3E RH3

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

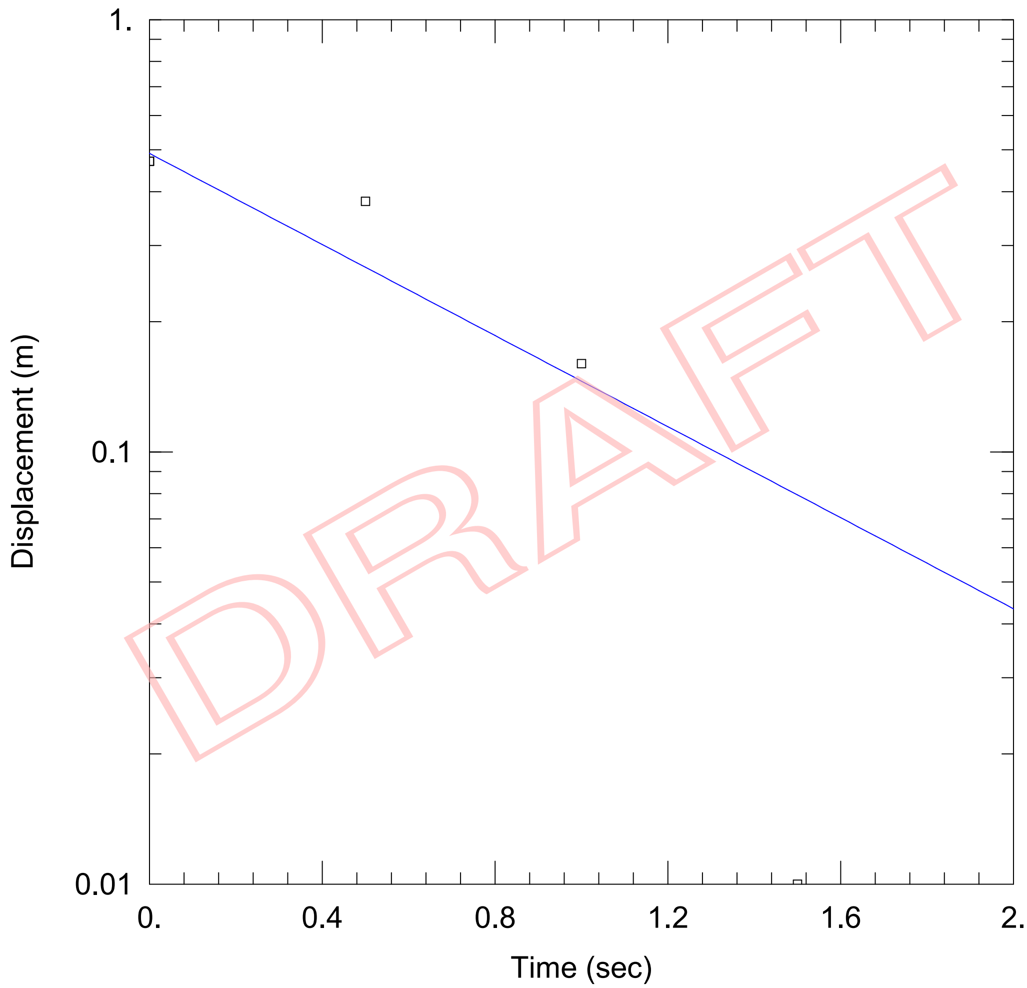
K = 0.000169 m/sec y0 = 0.3942 m

WELL DATA (MW17-3E)

Initial Displacement: 14. m
Static Water Column Height: 2.46 m
Total Well Penetration Depth: 1.168 m
Screen Length: 1. m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-5B FH1

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

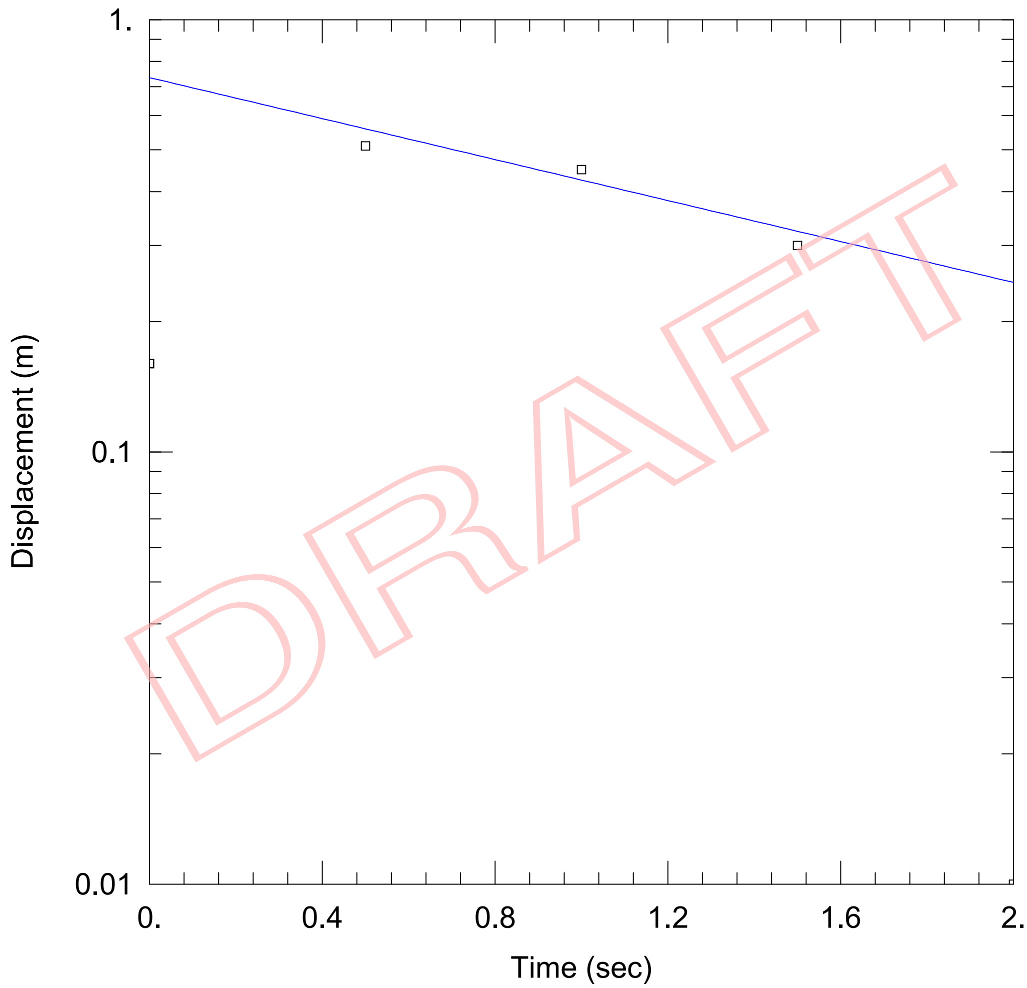
K = 0.0001631 m/sec   y0 = 0.4902 m

WELL DATA (New Well)

Initial Displacement: 0.47 m
Static Water Column Height: 11.27 m
Total Well Penetration Depth: 15.32 m
Screen Length: 11.27 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-5B FH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

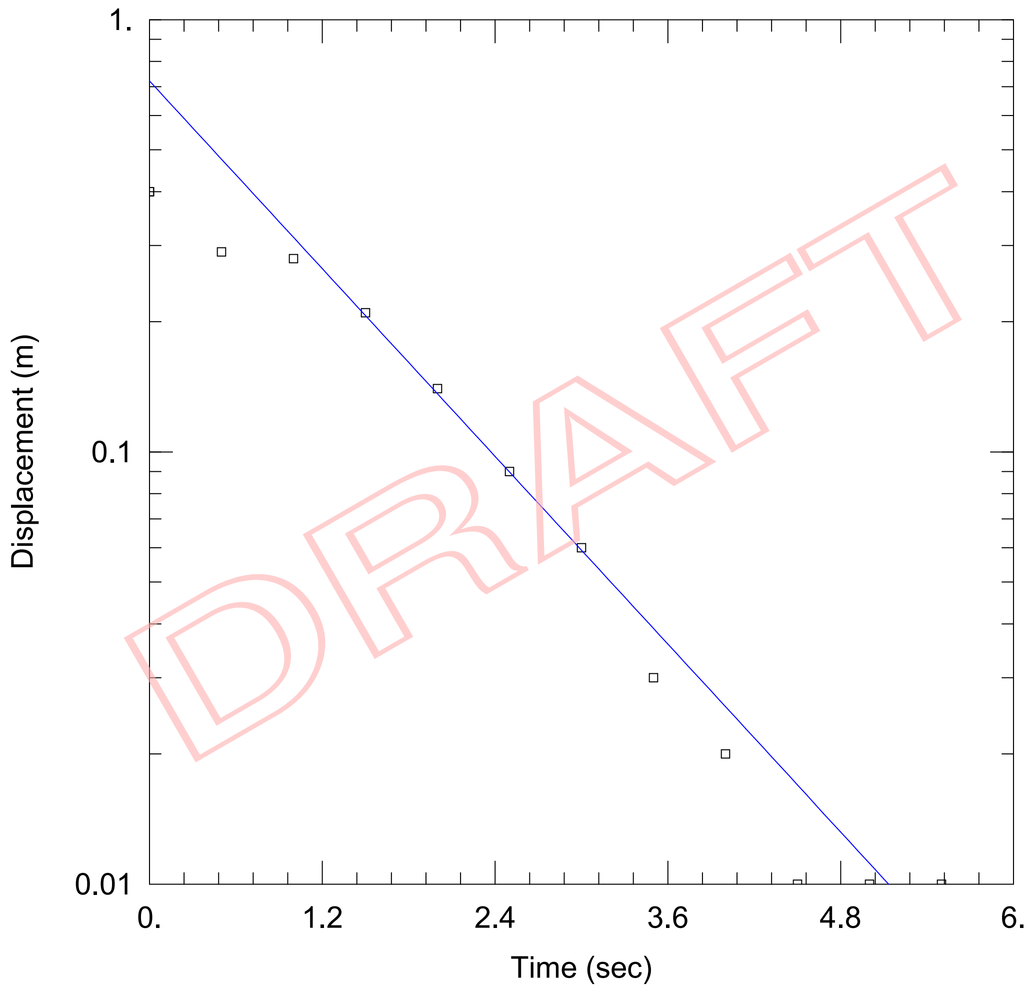
K = 7.337E-5 m/sec   y0 = 0.7343 m

WELL DATA (New Well)

Initial Displacement: 0.16 m
Static Water Column Height: 11.27 m
Total Well Penetration Depth: 15.32 m
Screen Length: 11.27 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-5B RH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

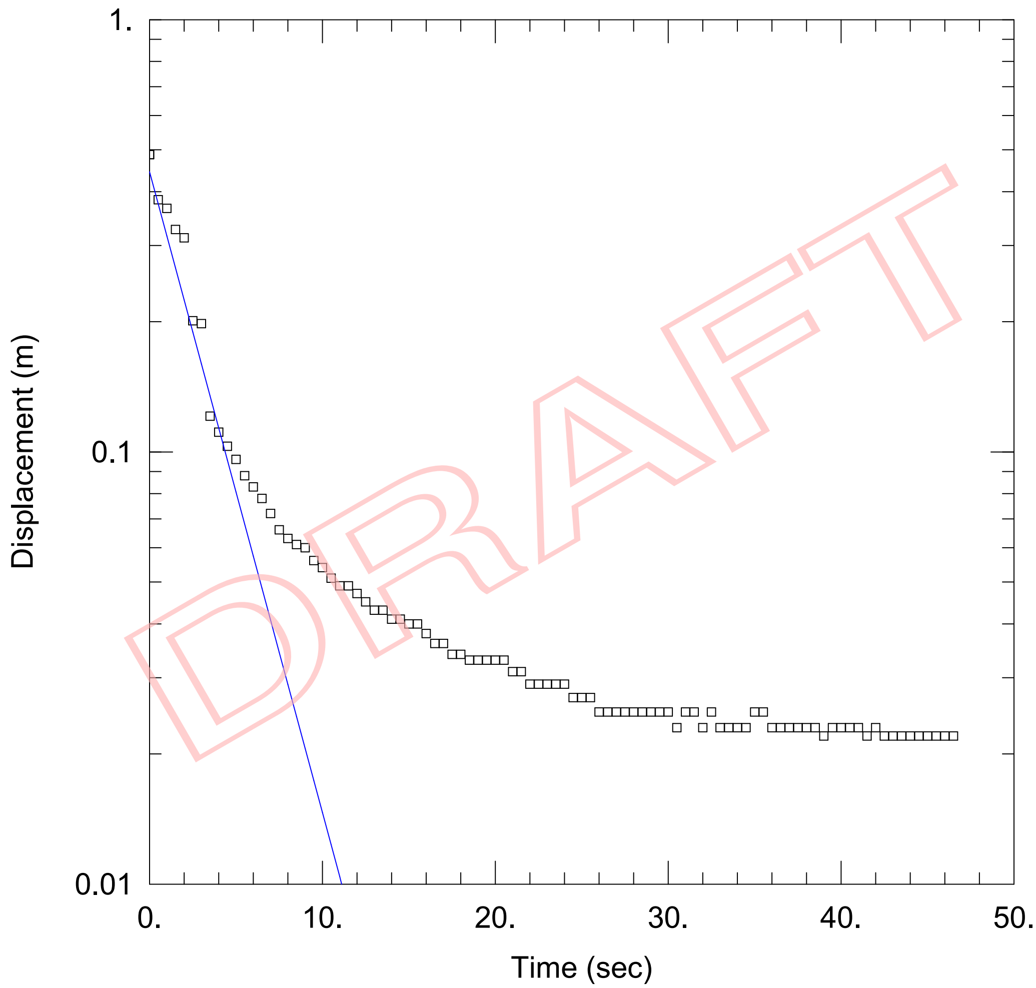
K = 0.000112 m/sec   y0 = 0.7213 m

WELL DATA (New Well)

Initial Displacement: 0.4 m
Static Water Column Height: 11.27 m
Total Well Penetration Depth: 15.32 m
Screen Length: 11.27 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-5C FH1

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

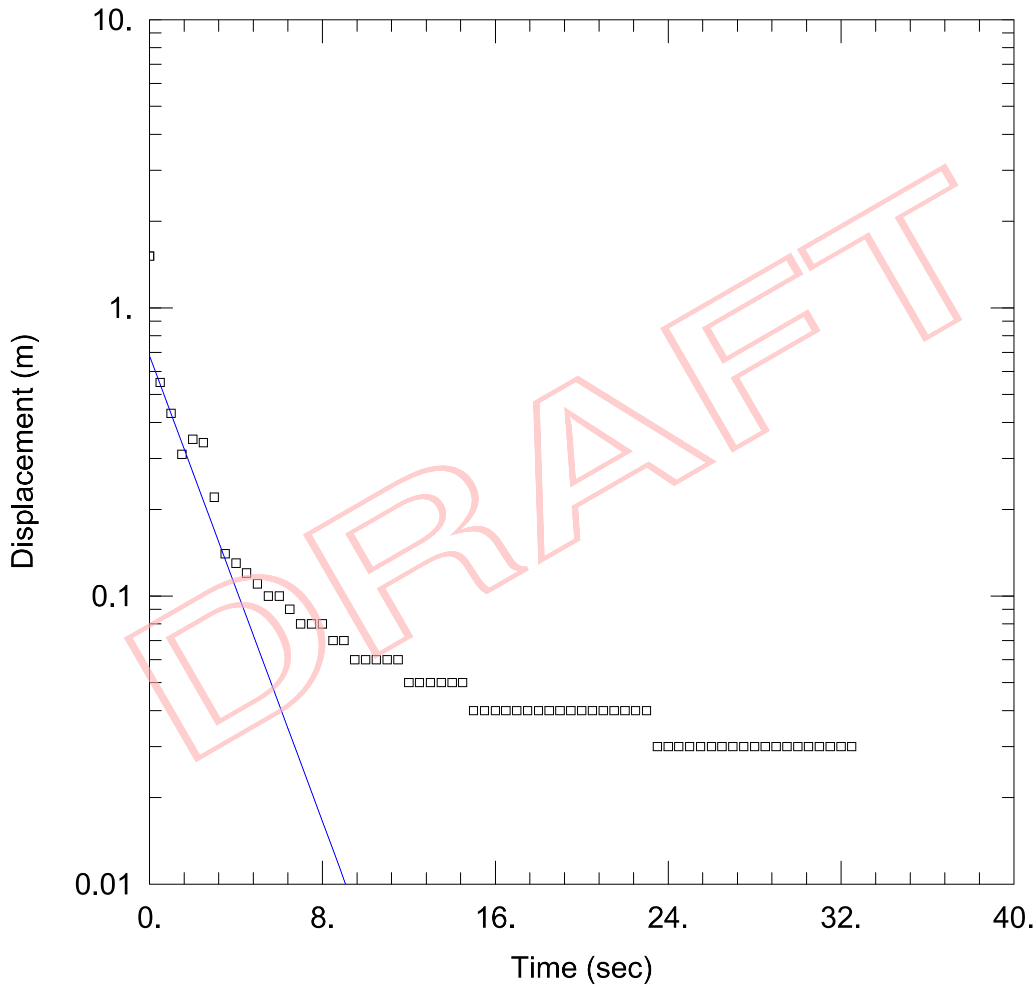
K = 0.000151 m/sec y0 = 0.4446 m

WELL DATA (MW17-5C)

Initial Displacement: 0.487 m
Static Water Column Height: 3.09 m
Total Well Penetration Depth: 12.25 m
Screen Length: 12.25 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-5C FH2

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

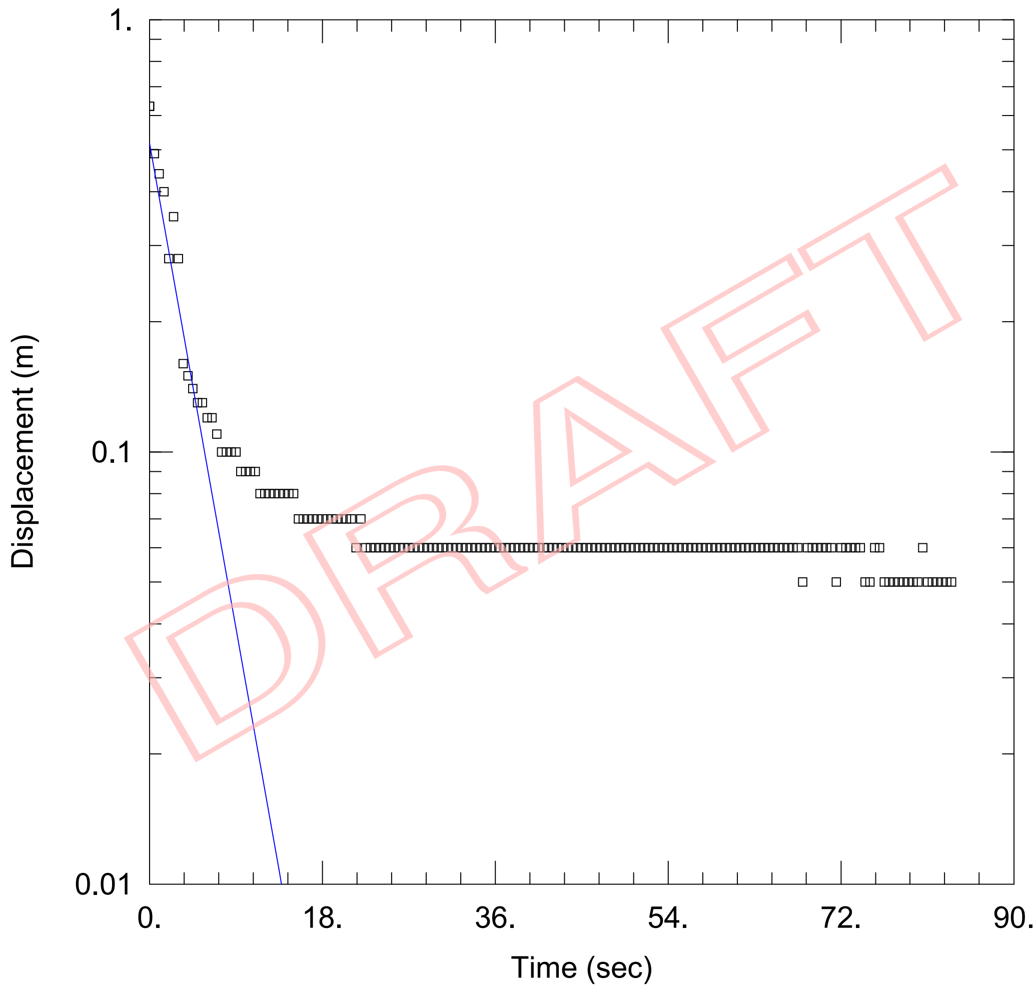
K = 0.0002057 m/sec   y0 = 0.6813 m

WELL DATA (MW17-5C)

Initial Displacement: 1.51 m
Static Water Column Height: 3.09 m
Total Well Penetration Depth: 12.25 m
Screen Length: 12.25 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-5C FH3

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

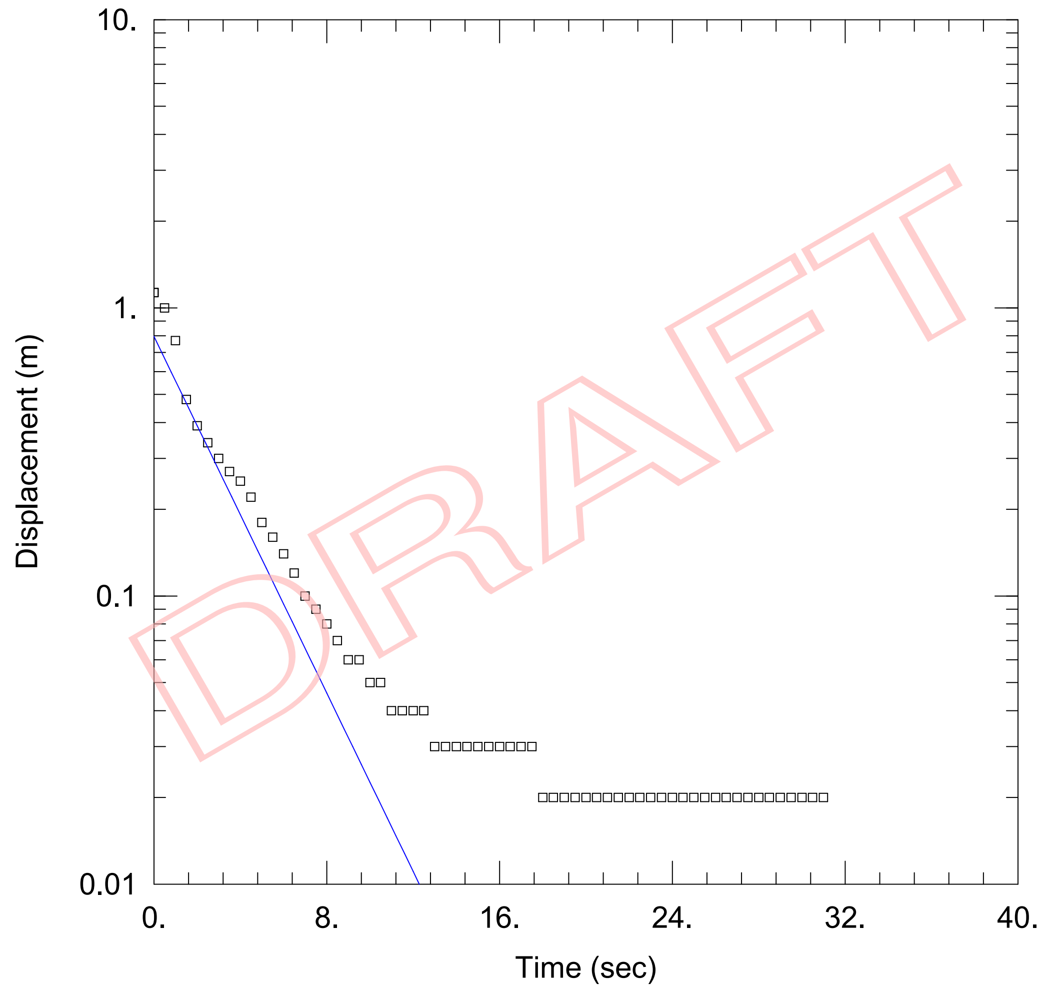
K = 0.000127 m/sec y0 = 0.5169 m

WELL DATA (MW17-5C)

Initial Displacement: 0.63 m
Static Water Column Height: 3.09 m
Total Well Penetration Depth: 12.25 m
Screen Length: 12.25 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-5C RH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

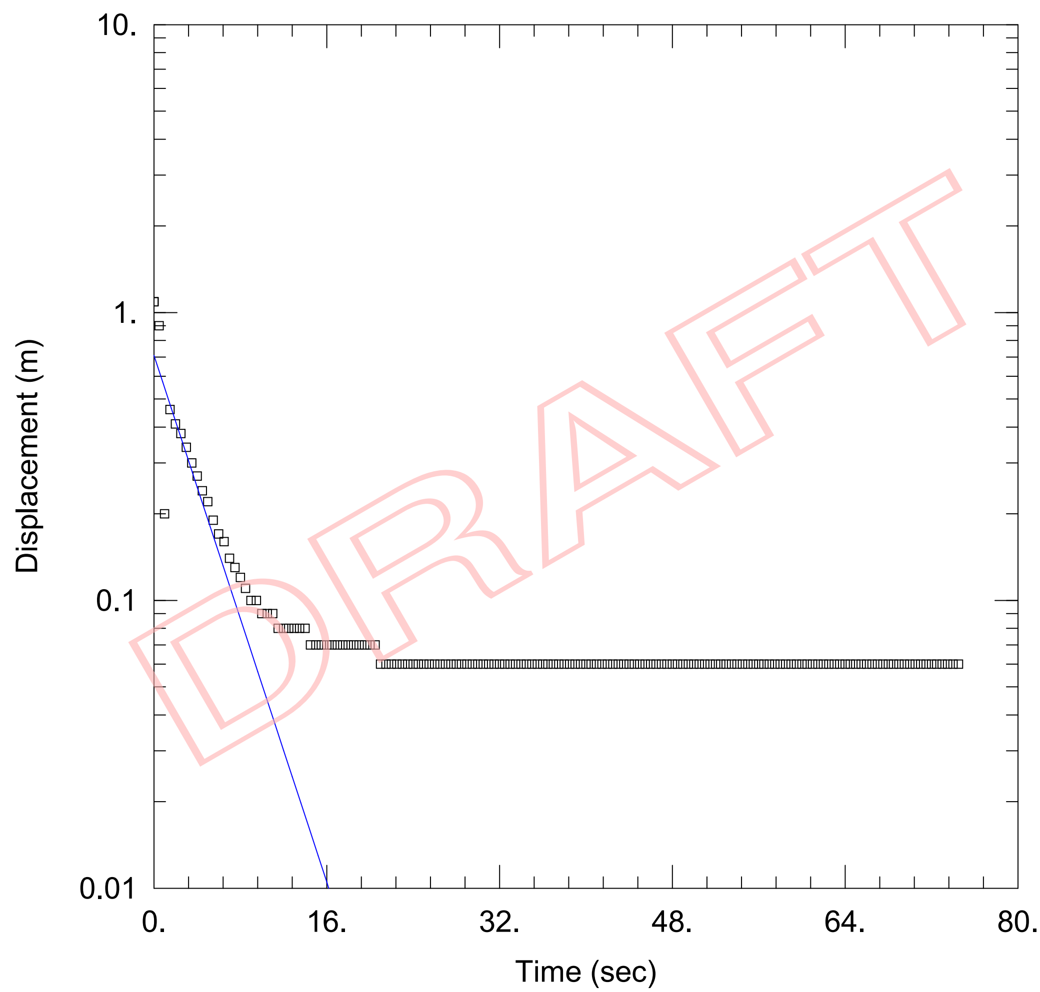
K = 0.0001576 m/sec   y0 = 0.795 m

WELL DATA (MW17-5C)

Initial Displacement: 1.13 m
Static Water Column Height: 3.09 m
Total Well Penetration Depth: 12.25 m
Screen Length: 12.25 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-5C RH2

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

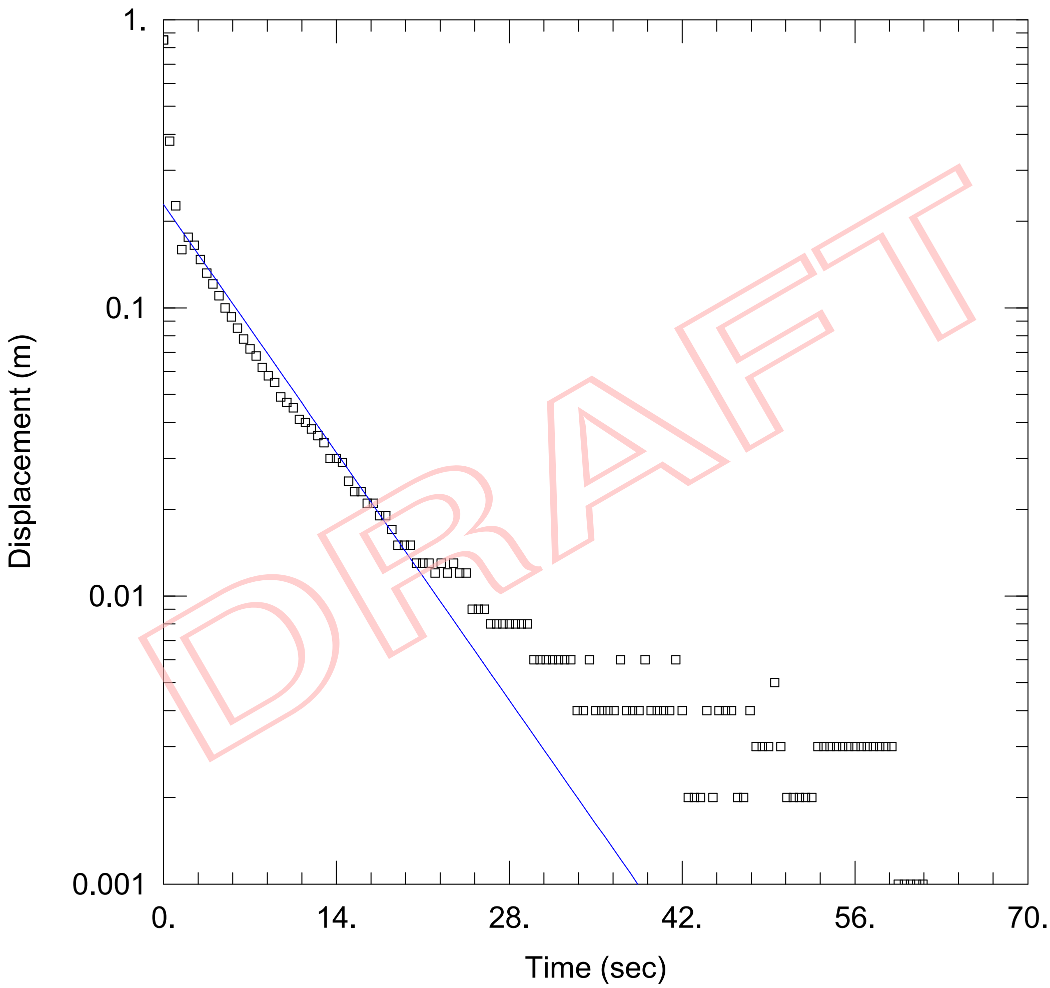
K = 0.0001164 m/sec   y0 = 0.7088 m

WELL DATA (MW17-5C)

Initial Displacement: 1.09 m
Static Water Column Height: 3.09 m
Total Well Penetration Depth: 12.25 m
Screen Length: 12.25 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-6B FH1

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

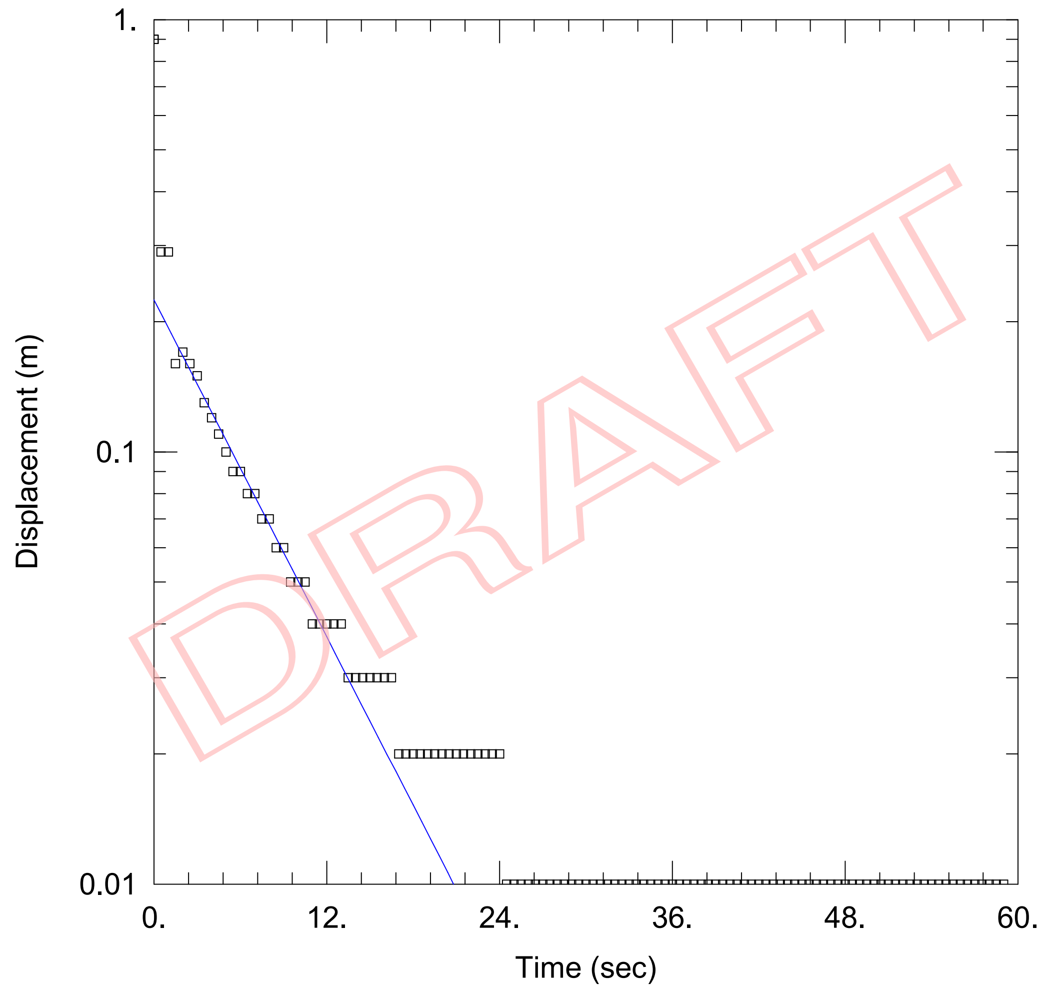
K = 6.983E-5 m/sec   y0 = 0.228 m

WELL DATA (MW17-6B)

Initial Displacement: 0.849 m
Static Water Column Height: 2.25 m
Total Well Penetration Depth: 3.91 m
Screen Length: 3.91 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-6B FH2

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 7.387E-5 m/sec   y0 = 0.2247 m

WELL DATA (MW17-6B)

Initial Displacement: 0.9 m
Static Water Column Height: 2.25 m
Total Well Penetration Depth: 3.91 m
Screen Length: 3.91 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

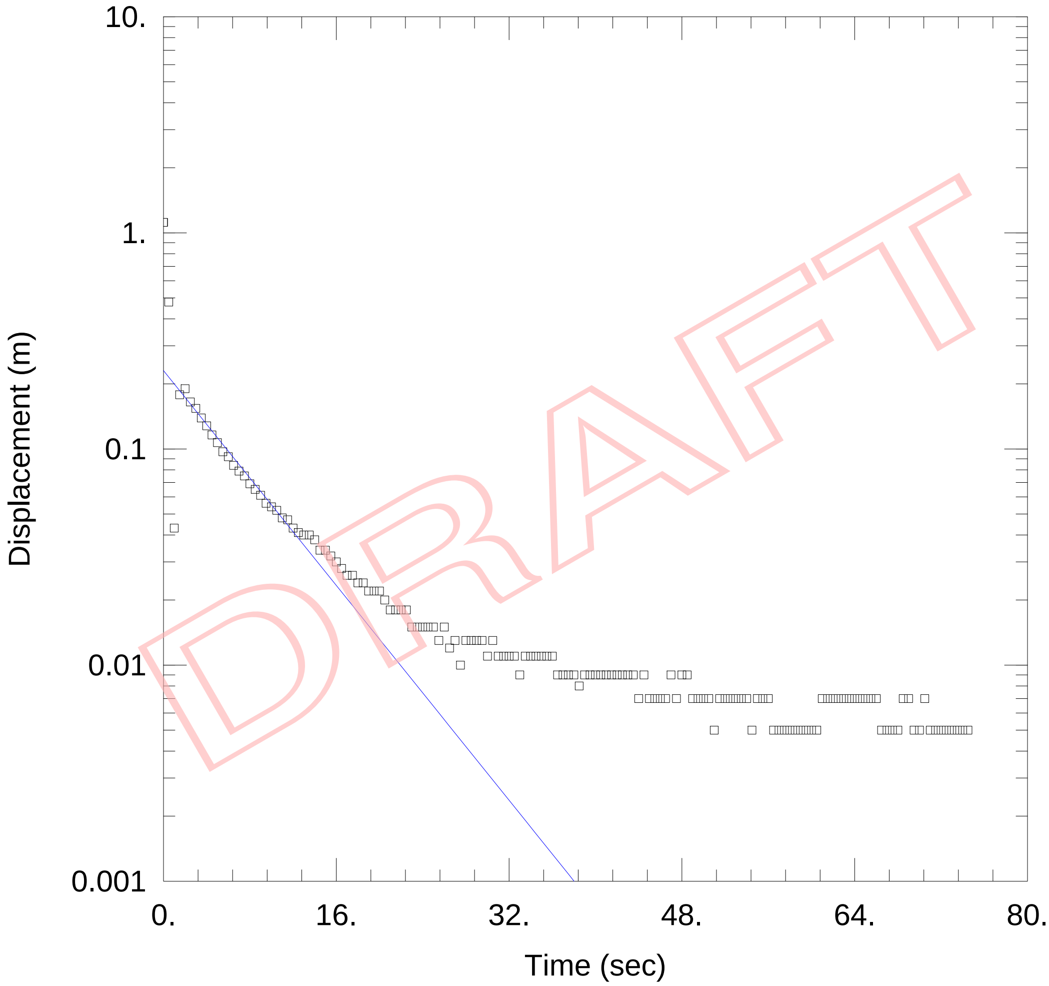
MW17-6B FH3

Prepared By:
Golder

Prepared For:
Walker

Project:
1664706.2000

Location:
Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

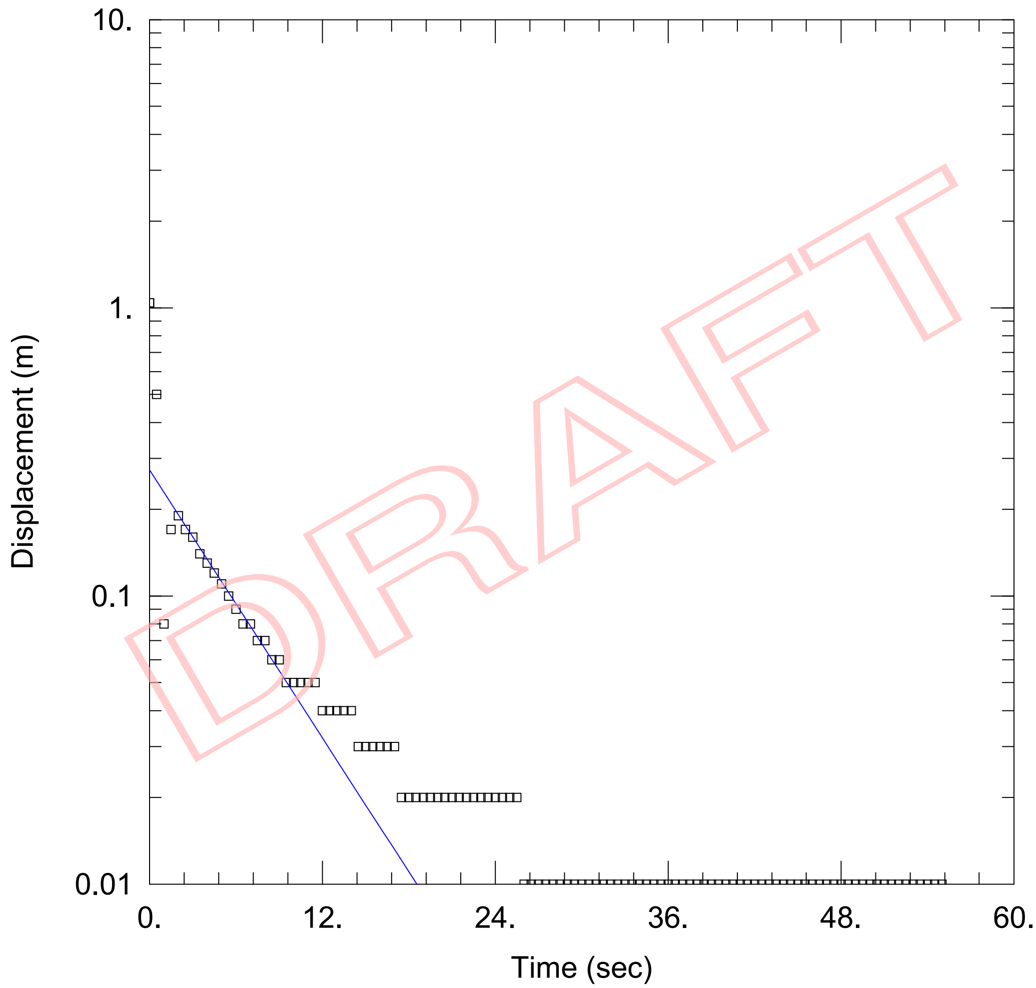
K = 7.069E-5 m/sec   y0 = 0.2304 m

WELL DATA (MW17-6B)

Initial Displacement: 1.119 m
Static Water Column Height: 2.25 m
Total Well Penetration Depth: 3.91 m
Screen Length: 3.91 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-6B FH4

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

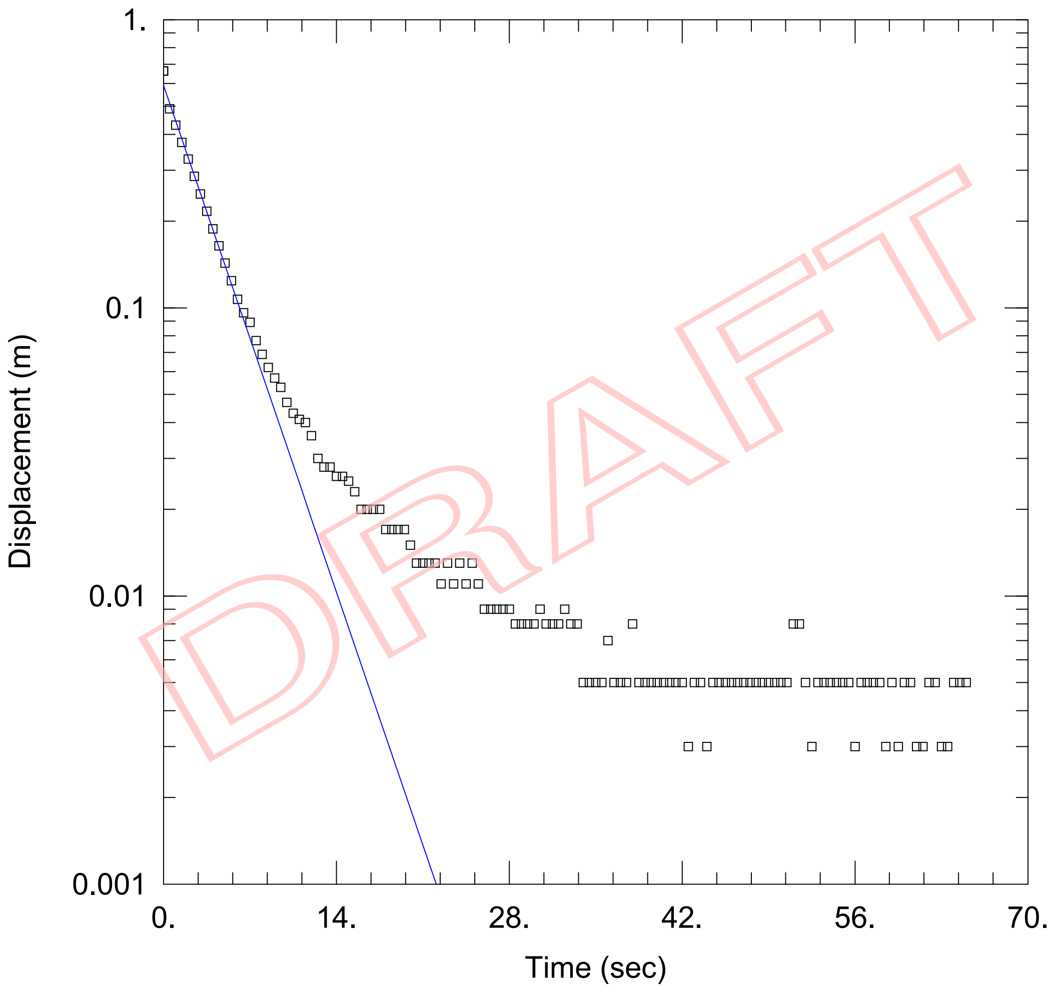
K = 8.81E-5 m/sec   y0 = 0.2735 m

WELL DATA (MW17-6B)

Initial Displacement: 1.04 m
Static Water Column Height: 2.25 m
Total Well Penetration Depth: 3.91 m
Screen Length: 3.91 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-6B RH1

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0001427 m/sec   y0 = 0.5907 m

WELL DATA (MW17-6B)

Initial Displacement: 0.664 m
Static Water Column Height: 2.25 m
Total Well Penetration Depth: 3.91 m
Screen Length: 3.91 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

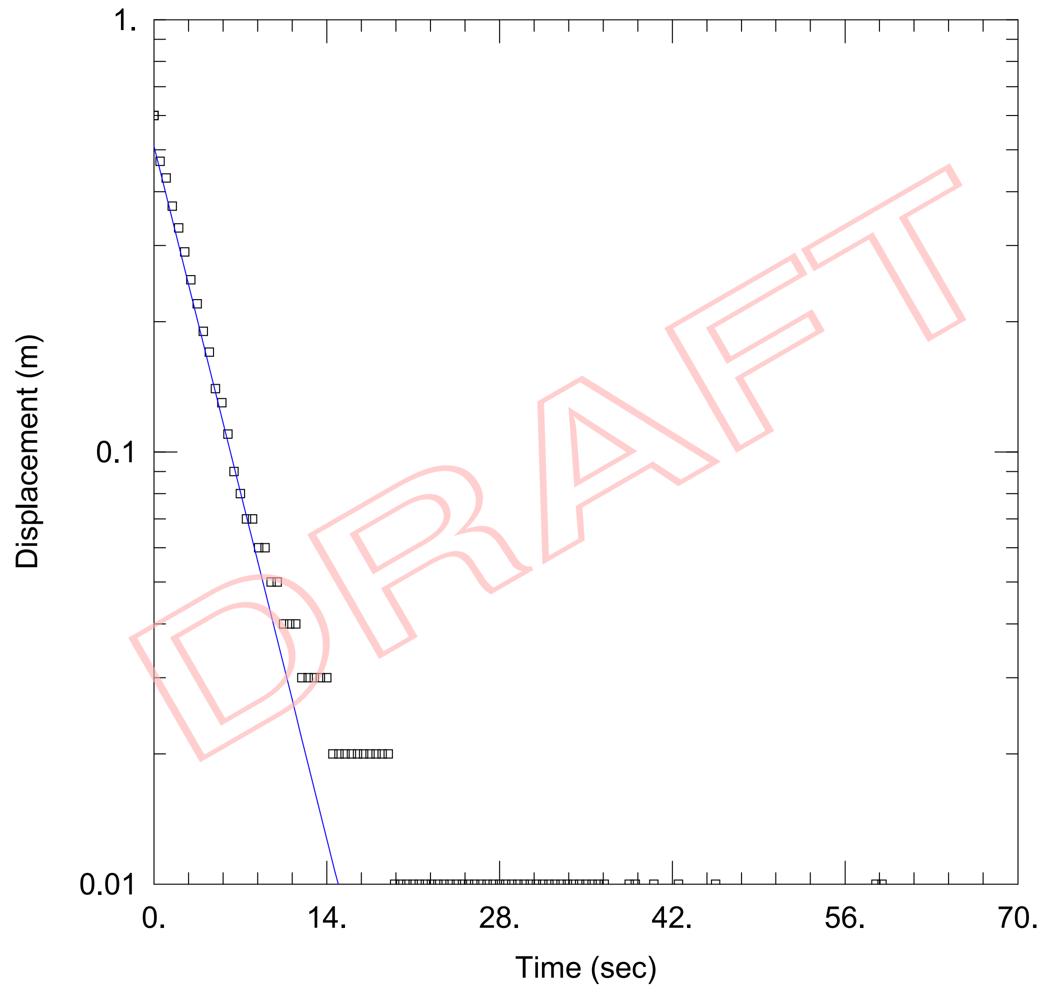
MW17-6B RH2

Prepared By:
Golder

Prepared For:
Walker

Project:
1664706.2000

Location:
Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

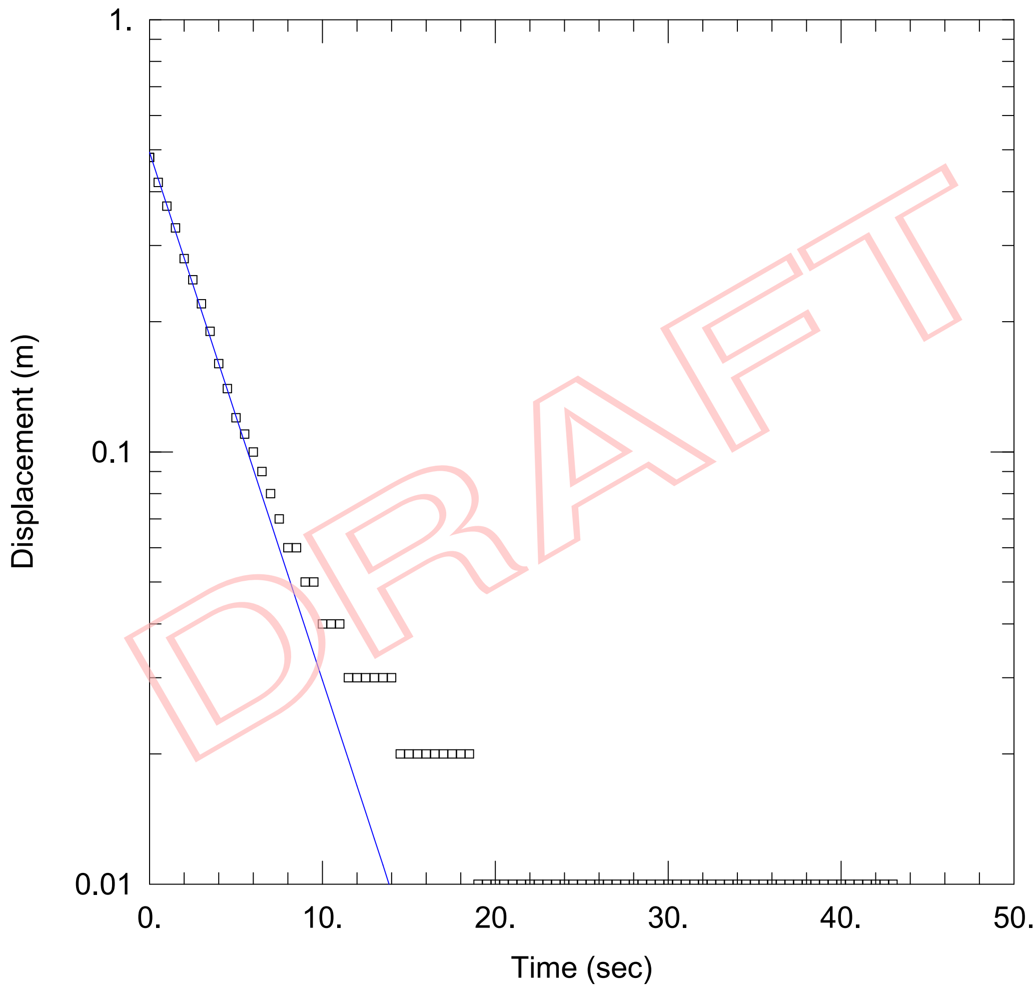
K = 0.0001301 m/sec   y0 = 0.5098 m

WELL DATA (MW17-6B)

Initial Displacement: 0.6 m
Static Water Column Height: 2.25 m
Total Well Penetration Depth: 3.91 m
Screen Length: 3.91 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-6B RH3

Prepared By: Golder	Prepared For: Walker
Project: 1664706.2000	Location: Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

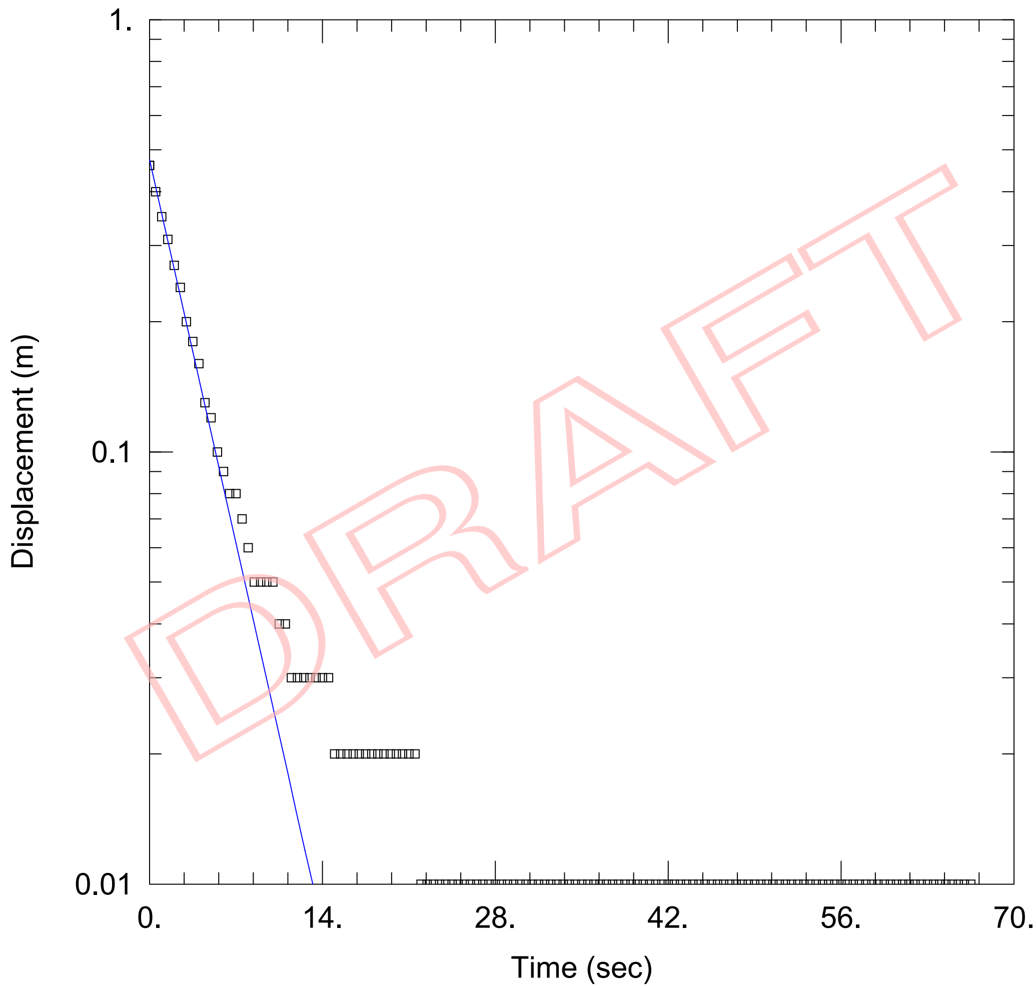
K = 0.000139 m/sec   y0 = 0.4929 m

WELL DATA (MW17-6B)

Initial Displacement: 0.48 m
Static Water Column Height: 2.25 m
Total Well Penetration Depth: 3.91 m
Screen Length: 3.91 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

MW17-6B RH4

Prepared By:	Prepared For:
Golder	Walker
Project:	Location:
1664706.2000	Beachville



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0001442 m/sec   y0 = 0.4741 m

WELL DATA (MW17-6B)

Initial Displacement: 0.46 m
Static Water Column Height: 2.25 m
Total Well Penetration Depth: 3.91 m
Screen Length: 3.91 m
Casing Radius: 0.026 m
Well Radius: 0.048 m

APPENDIX J

Groundwater Quality Results - Laboratory Certificates of Analysis

DRAFT

Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706
Site Location: Walker Landfill

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Your C.O.C. #: 664707-01-01, 664707-02-01, 664707-03-01

Report Date: 2018/12/07
Report #: R5515959
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8C5271
Received: 2018/05/25, 14:12

Sample Matrix: Water
Samples Received: 23

DRAFT

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	19	N/A	2018/05/29	CAM SOP-00448	SM 23 2320 B m
Alkalinity	3	N/A	2018/05/30	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	22	N/A	2018/12/07	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	20	N/A	2018/05/29	CAM SOP-00463	EPA 325.2 m
Chloride by Automated Colourimetry	2	N/A	2018/05/30	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand	21	N/A	2018/05/30	CAM SOP-00416	SM 23 5220 D m
Chemical Oxygen Demand	1	N/A	2018/05/31	CAM SOP-00416	SM 23 5220 D m
Conductivity	19	N/A	2018/05/29	CAM SOP-00414	SM 23 2510 m
Conductivity	3	N/A	2018/05/30	CAM SOP-00414	SM 23 2510 m
Chromium 3+ by calculation	3	2018/05/26	2018/05/31		
Chromium 3+ by calculation	19	2018/05/26	2018/06/01		
Chromium (VI) in Water	22	N/A	2018/05/29	CAM SOP-00436	EPA 7199 m
Dissolved Organic Carbon (DOC) (1)	22	N/A	2018/05/29	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	3	N/A	2018/05/31	CAM SOP 00102/00408/00447	SM 2340 B
Hardness (calculated as CaCO3)	19	N/A	2018/06/01	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	6	2018/05/28	2018/05/29	CAM SOP-00453	EPA 7470A m
Mercury in Water by CVAA	13	2018/05/29	2018/05/29	CAM SOP-00453	EPA 7470A m
Mercury in Water by CVAA	3	2018/05/30	2018/05/31	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	2	N/A	2018/05/30	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	1	N/A	2018/05/31	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	19	N/A	2018/06/01	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	21	N/A	2018/05/30	CAM SOP-00441	EPA GS I-2522-90 m
Total Ammonia-N	1	N/A	2018/06/01	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	20	N/A	2018/05/29	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Nitrate (NO3) and Nitrite (NO2) in Water (2)	2	N/A	2018/05/30	CAM SOP-00440	SM 23 4500-NO3I/NO2B

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

Your Project #: 1664706
Site Location: Walker Landfill

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Your C.O.C. #: 664707-01-01, 664707-02-01, 664707-03-01

Report Date: 2018/12/07
Report #: R5515959
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8C5271
Received: 2018/05/25, 14:12

Sample Matrix: Water
Samples Received: 23

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
pH	19	N/A	2018/05/29	CAM SOP-00413	SM 4500H+ B m
pH	3	N/A	2018/05/30	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	16	N/A	2018/05/29	CAM SOP-00444	OMOE E3179 m
Phenols (4AAP)	6	N/A	2018/05/30	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	20	N/A	2018/05/29	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	2	N/A	2018/05/30	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	3	N/A	2018/05/31		
Total Dissolved Solids (TDS calc)	19	N/A	2018/06/01		
Total Kjeldahl Nitrogen in Water	16	2018/05/29	2018/05/30	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	5	2018/05/29	2018/05/31	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	1	2018/05/31	2018/06/01	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	20	2018/05/29	2018/05/31	CAM SOP-00407	SM 23 4500 P B H m
Total Phosphorus (Colourimetric)	2	2018/05/30	2018/05/31	CAM SOP-00407	SM 23 4500 P B H m
Volatile Organic Compounds and F1 PHCs	3	N/A	2018/05/30	CAM SOP-00230	EPA 8260C m
Volatile Organic Compounds and F1 PHCs	20	N/A	2018/05/31	CAM SOP-00230	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise

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Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706
Site Location: Walker Landfill

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Your C.O.C. #: 664707-01-01, 664707-02-01, 664707-03-01

Report Date: 2018/12/07
Report #: R5515959
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8C5271
Received: 2018/05/25, 14:12

agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

DRAFT

Encryption Key

Christine Gripton
Senior Project Manager
07 Dec 2018 14:40:29

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: CGripton@maxxam.ca
Phone# (800)268-7396 Ext:250
==
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 Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG638			GUG638			GUG639		
Sampling Date		2018/05/24 15:30			2018/05/24 15:30			2018/05/22 14:47		
COC Number		664707-01-01			664707-01-01			664707-01-01		
	UNITS	**MW17-3A**	**RDL**	**QC Batch**	**MW17-3A Lab-Dup**	**RDL**	**QC Batch**	**MW17-3E**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	170	1.0	5876590				330	1.0	5876590
Calculated TDS	mg/L	460	1.0	5549719				390	1.0	5549719
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.0	1.0	5876590				2.1	1.0	5876590
Hardness (CaCO3)	mg/L	290	1.0	5549714				330	1.0	5549714
Inorganics										
Total Ammonia-N	mg/L	0.054	0.050	5553558				0.094	0.050	5553558
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5553018	<4.0	4.0	5553018	<4.0	4.0	5553018
Conductivity	umho/cm	790	1.0	5552055				670	1.0	5553206
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5553010				0.69	0.20	5553010
Dissolved Organic Carbon	mg/L	0.94	0.50	5551004				2.1	0.50	5551004
pH	pH	8.08		5552058				7.83		5553207
Phenols-4AAP	mg/L	<0.0010	0.0010	5552005				<0.0010	0.0010	5552005
Total Phosphorus	mg/L	<0.004	0.004	5553050				20	0.4	5553050
Dissolved Sulphate (SO4)	mg/L	130	1.0	5552153				29	1.0	5553420
Alkalinity (Total as CaCO3)	mg/L	170	1.0	5552052				330	1.0	5553197
Dissolved Chloride (Cl-)	mg/L	72	1.0	5552149				7.7	1.0	5553411
Nitrite (N)	mg/L	<0.010	0.010	5552075				<0.010	0.010	5553064
Nitrate (N)	mg/L	1.54	0.10	5552075				1.17	0.10	5553064
Nitrate + Nitrite (N)	mg/L	1.54	0.10	5552075				1.17	0.10	5553064

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

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG640		GUG641			GUG642		
Sampling Date		2018/05/22 13:15		2018/05/22 10:25			2018/05/24 14:00		
COC Number		664707-01-01		664707-01-01			664707-01-01		
	UNITS	**MW17-3B**	**QC Batch**	**MW17-5A**	**RDL**	**QC Batch**	**MW17-1A**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	200	5876590	230	1.0	5876590	190	1.0	5876590
Calculated TDS	mg/L	280	5549719	800	1.0	5549719	300	1.0	5549719
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.9	5876590	2.6	1.0	5876590	3.3	1.0	5876590
Hardness (CaCO3)	mg/L	210	5549714	450	1.0	5549714	190	1.0	5549714
Inorganics									
Total Ammonia-N	mg/L	0.14	5553558	0.34	0.050	5553558	0.26 (1)	0.050	5553558
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	5553018	<4.0	4.0	5553018	<4.0	4.0	5553018
Conductivity	umho/cm	500	5552055	1300	1.0	5552055	530	1.0	5552055
Total Kjeldahl Nitrogen (TKN)	mg/L	0.14	5553010	0.37	0.10	5553010	0.23 (1)	0.10	5553010
Dissolved Organic Carbon	mg/L	<0.50	5551004	1.0	0.50	5551004	0.70	0.50	5551004
pH	pH	8.17	5552058	8.07		5552058	8.26		5552058
Phenols-4AAP	mg/L	<0.0010	5551854	<0.0010	0.0010	5553922	<0.0010	0.0010	5551854
Total Phosphorus	mg/L	0.007	5553050	0.016	0.004	5553050	0.08	0.02	5553050
Dissolved Sulphate (SO4)	mg/L	53	5552153	330	1.0	5552153	57	1.0	5552153
Alkalinity (Total as CaCO3)	mg/L	210	5552052	230	1.0	5552052	200	1.0	5552052
Dissolved Chloride (Cl-)	mg/L	3.8	5552149	86	1.0	5552149	16	1.0	5552149
Nitrite (N)	mg/L	<0.010	5552075	<0.010	0.010	5552075	<0.010	0.010	5552075
Nitrate (N)	mg/L	<0.10	5552075	<0.10	0.10	5552075	<0.10	0.10	5552075
Nitrate + Nitrite (N)	mg/L	<0.10	5552075	<0.10	0.10	5552075	<0.10	0.10	5552075

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

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

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG643			GUG643			GUG644		
Sampling Date		2018/05/24 11:30			2018/05/24 11:30			2018/05/23 16:10		
COC Number		664707-01-01			664707-01-01			664707-01-01		
	UNITS	**MW17-1B**	**RDL**	**QC Batch**	**MW17-1B Lab-Dup**	**RDL**	**QC Batch**	**MW17-2D**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	180	1.0	5876590				260	1.0	5876590
Calculated TDS	mg/L	190	1.0	5549719				340	1.0	5549719
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.7	1.0	5876590				2.1	1.0	5876590
Hardness (CaCO3)	mg/L	140	1.0	5549714				300	1.0	5549714
Inorganics										
Total Ammonia-N	mg/L	0.18	0.050	5553558	0.16	0.050	5553558	0.14	0.050	5553558
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5553018				<4.0	4.0	5553018
Conductivity	umho/cm	340	1.0	5552055	330	1.0	5552055	580	1.0	5553206
Total Kjeldahl Nitrogen (TKN)	mg/L	0.20	0.20	5553010				<0.50 (1)	0.50	5553010
Dissolved Organic Carbon	mg/L	0.58	0.50	5551004				0.64	0.50	5551004
pH	pH	8.21		5552058	8.24		5552058	7.93		5553207
Phenols-4AAP	mg/L	<0.0010	0.0010	5551854				<0.0010	0.0010	5551854
Total Phosphorus	mg/L	<0.004	0.004	5553050				3.9	0.4	5553050
Dissolved Sulphate (SO4)	mg/L	7.4	1.0	5552153				12	1.0	5552153
Alkalinity (Total as CaCO3)	mg/L	180	1.0	5552052	180	1.0	5552052	260	1.0	5553197
Dissolved Chloride (Cl-)	mg/L	<1.0	1.0	5552149				12	1.0	5552149
Nitrite (N)	mg/L	<0.010	0.010	5552075				<0.010	0.010	5552075
Nitrate (N)	mg/L	<0.10	0.10	5552075				9.46	0.10	5552075
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5552075				9.46	0.10	5552075

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG645			GUG645		
Sampling Date		2018/05/23 15:35			2018/05/23 15:35		
COC Number		664707-01-01			664707-01-01		
	UNITS	**MW17-2C**	**RDL**	**QC Batch**	**MW17-2C Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	240	1.0	5876590			
Calculated TDS	mg/L	330	1.0	5549719			
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.4	1.0	5876590			
Hardness (CaCO3)	mg/L	280	1.0	5549714			
Inorganics							
Total Ammonia-N	mg/L	0.051	0.050	5553558			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5553018			
Conductivity	umho/cm	550	1.0	5552055			
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.20 (1)	0.20	5553010			
Dissolved Organic Carbon	mg/L	0.60	0.50	5551004			
pH	pH	8.01		5552058			
Phenols-4AAP	mg/L	<0.0010	0.0010	5552005	<0.0010	0.0010	5552005
Total Phosphorus	mg/L	0.25	0.02	5553050			
Dissolved Sulphate (SO4)	mg/L	17	1.0	5552153			
Alkalinity (Total as CaCO3)	mg/L	250	1.0	5552052			
Dissolved Chloride (Cl-)	mg/L	11	1.0	5552149			
Nitrite (N)	mg/L	0.010	0.010	5552075			
Nitrate (N)	mg/L	8.23	0.10	5552075			
Nitrate + Nitrite (N)	mg/L	8.24	0.10	5552075			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG646		GUG647			GUG647		
Sampling Date		2018/05/23 15:35		2018/05/23 16:00			2018/05/23 16:00		
COC Number		664707-01-01		664707-01-01			664707-01-01		
	UNITS	**DUP-2C**	**RDL**	**MW17-2A**	**RDL**	**QC Batch**	**MW17-2A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	240	1.0	200	1.0	5876590			
Calculated TDS	mg/L	320	1.0	530	1.0	5549719			
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.5	1.0	2.6	1.0	5876590			
Hardness (CaCO3)	mg/L	280	1.0	330	1.0	5549714			
Inorganics									
Total Ammonia-N	mg/L	0.078	0.050	0.15 (1)	0.050	5553558			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	<4.0	4.0	5553018			
Conductivity	umho/cm	570	1.0	880	1.0	5552055			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.23	0.20	0.14 (1)	0.10	5553010	0.13 (1)	0.10	5553010
Dissolved Organic Carbon	mg/L	0.62	0.50	0.77	0.50	5551004			
pH	pH	8.03		8.13		5552058			
Phenols-4AAP	mg/L	<0.0010	0.0010	<0.0010	0.0010	5552005			
Total Phosphorus	mg/L	0.27	0.02	0.024	0.004	5553050			
Dissolved Sulphate (SO4)	mg/L	17	1.0	180	1.0	5552153			
Alkalinity (Total as CaCO3)	mg/L	250	1.0	210	1.0	5552052			
Dissolved Chloride (Cl-)	mg/L	11	1.0	64	1.0	5552149			
Nitrite (N)	mg/L	0.011	0.010	<0.010	0.010	5552075			
Nitrate (N)	mg/L	7.46	0.10	<0.10	0.10	5552075			
Nitrate + Nitrite (N)	mg/L	7.47	0.10	<0.10	0.10	5552075			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

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Maxxam
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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG648	GUG649			GUG649		
Sampling Date		2018/05/23 17:45	2018/05/23 13:35			2018/05/23 13:35		
COC Number		664707-02-01	664707-02-01			664707-02-01		
	UNITS	**MW17-2B**	**MW17-4B**	**RDL**	**QC Batch**	**MW17-4B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters								
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	170	270	1.0	5876590			
Calculated TDS	mg/L	480	560	1.0	5549719			
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.9	2.6	1.0	5876590			
Hardness (CaCO3)	mg/L	300	360	1.0	5549714			
Inorganics								
Total Ammonia-N	mg/L	<0.050	0.24	0.050	5553558			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	<4.0	4.0	5553018			
Conductivity	umho/cm	830	950	1.0	5552055			
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.25	0.10	5553010			
Dissolved Organic Carbon	mg/L	0.90	0.91	0.50	5551004	0.88	0.50	5551004
pH	pH	8.08	8.02		5552058			
Phenols-4AAP	mg/L	<0.0010	<0.0010	0.0010	5551854			
Total Phosphorus	mg/L	0.022	<0.004	0.004	5553050			
Dissolved Sulphate (SO4)	mg/L	150	140	1.0	5552153			
Alkalinity (Total as CaCO3)	mg/L	170	270	1.0	5552052			
Dissolved Chloride (Cl-)	mg/L	71	75	1.0	5552149			
Nitrite (N)	mg/L	0.028	<0.010	0.010	5552075			
Nitrate (N)	mg/L	1.04	<0.10	0.10	5552075			
Nitrate + Nitrite (N)	mg/L	1.07	<0.10	0.10	5552075			

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG650			GUG651		GUG652		
Sampling Date		2018/05/23 13:19			2018/05/23 10:12		2018/05/23 11:30		
COC Number		664707-02-01			664707-02-01		664707-02-01		
	UNITS	MW17-4A	RDL	QC Batch	MW17-5C	QC Batch	MW17-5B	RDL	QC Batch
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	270	1.0	5876590	240	5876590	170	1.0	5876590
Calculated TDS	mg/L	520	1.0	5549719	450	5549719	460	1.0	5549719
Carb. Alkalinity (calc. as CaCO3)	mg/L	3.3	1.0	5876590	2.1	5876590	1.8	1.0	5876590
Hardness (CaCO3)	mg/L	350	1.0	5549714	350	5549714	290	1.0	5549714
Inorganics									
Total Ammonia-N	mg/L	0.35	0.050	5557676	0.10	5553558	<0.050	0.050	5553558
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5553018	<4.0	5553018	<4.0	4.0	5553018
Conductivity	umho/cm	880	1.0	5552055	740	5552055	770	1.0	5553206
Total Kjeldahl Nitrogen (TKN)	mg/L	0.58	0.20	5557658	0.21	5553010	<0.10	0.10	5553010
Dissolved Organic Carbon	mg/L	0.89	0.50	5551004	0.87	5551004	0.94	0.50	5551004
pH	pH	8.10		5552058	7.97	5552058	8.04		5553207
Phenols-4AAP	mg/L	<0.0010	0.0010	5552005	<0.0010	5551854	<0.0010	0.0010	5551854
Total Phosphorus	mg/L	<0.004	0.004	5553050	<0.004	5553050	0.004	0.004	5553050
Dissolved Sulphate (SO4)	mg/L	120	1.0	5552153	130	5552153	130	1.0	5553420
Alkalinity (Total as CaCO3)	mg/L	280	1.0	5552052	240	5552052	180	1.0	5553197
Dissolved Chloride (Cl-)	mg/L	59	1.0	5552149	20	5552149	69	1.0	5553411
Nitrite (N)	mg/L	<0.010	0.010	5552075	0.046	5552075	<0.010	0.010	5553064
Nitrate (N)	mg/L	<0.10	0.10	5552075	1.09	5552075	2.06	0.10	5553064
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5552075	1.13	5552075	2.06	0.10	5553064

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG653			GUG653			GUG654		
Sampling Date		2018/05/22 14:00			2018/05/22 14:00			2018/05/24 10:25		
COC Number		664707-02-01			664707-02-01			664707-02-01		
	UNITS	**MW17-3C**	**RDL**	**QC Batch**	**MW17-3C Lab-Dup**	**RDL**	**QC Batch**	**MW17-1C**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	230	1.0	5876590				190	1.0	5876590
Calculated TDS	mg/L	320	1.0	5549719				210	1.0	5549719
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.6	1.0	5876590				3.2	1.0	5876590
Hardness (CaCO3)	mg/L	260	1.0	5549714				150	1.0	5549714
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	5553558				0.20 (1)	0.050	5553558
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5553018				<4.0	4.0	5553018
Conductivity	umho/cm	560	1.0	5552055				350	1.0	5552055
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5553010				0.18 (1)	0.10	5553010
Dissolved Organic Carbon	mg/L	0.69	0.50	5551004				0.60	0.50	5551595
pH	pH	8.08		5552058				8.25		5552058
Phenols-4AAP	mg/L	<0.0010	0.0010	5551854				<0.0010	0.0010	5554005
Total Phosphorus	mg/L	0.029	0.004	5553050	0.027	0.004	5553050	0.012	0.004	5553050
Dissolved Sulphate (SO4)	mg/L	44	1.0	5552153				10	1.0	5552153
Alkalinity (Total as CaCO3)	mg/L	230	1.0	5552052				190	1.0	5552052
Dissolved Chloride (Cl-)	mg/L	16	1.0	5552149				1.3	1.0	5552149
Nitrite (N)	mg/L	<0.010	0.010	5552075				<0.010	0.010	5552075
Nitrate (N)	mg/L	0.40	0.10	5552075				<0.10	0.10	5552075
Nitrate + Nitrite (N)	mg/L	0.40	0.10	5552075				<0.10	0.10	5552075

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG655			GUG655			GUG656		
Sampling Date		2018/05/22 16:18			2018/05/22 16:18			2018/05/22 16:30		
COC Number		664707-02-01			664707-02-01			664707-02-01		
	UNITS	**MW17-6B**	**RDL**	**QC Batch**	**MW17-6B Lab-Dup**	**RDL**	**QC Batch**	**MW17-6A**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	310	1.0	5876590				250	1.0	5876590
Calculated TDS	mg/L	540	1.0	5549719				450	1.0	5549719
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.5	1.0	5876590				2.6	1.0	5876590
Hardness (CaCO3)	mg/L	440	1.0	5549964				280	1.0	5549964
Inorganics										
Total Ammonia-N	mg/L	0.059	0.050	5553558				<0.050	0.050	5553558
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5553018				<4.0	4.0	5553018
Conductivity	umho/cm	900	1.0	5552055				810	1.0	5552055
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5553010				<0.10	0.10	5553010
Dissolved Organic Carbon	mg/L	0.73	0.50	5551595				1.5	0.50	5551595
pH	pH	7.93		5552058				8.04		5552058
Phenols-4AAP	mg/L	<0.0010	0.0010	5554005				<0.0010	0.0010	5555920
Total Phosphorus	mg/L	<0.004	0.004	5553050				0.018	0.004	5553050
Dissolved Sulphate (SO4)	mg/L	130	1.0	5552153	130	1.0	5552153	39	1.0	5552153
Alkalinity (Total as CaCO3)	mg/L	320	1.0	5552052				250	1.0	5552052
Dissolved Chloride (Cl-)	mg/L	38	1.0	5552149	38	1.0	5552149	82	1.0	5552149
Nitrite (N)	mg/L	<0.010	0.010	5552075				0.025	0.010	5552075
Nitrate (N)	mg/L	<0.10	0.10	5552075				2.71	0.10	5552075
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5552075				2.74	0.10	5552075

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

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG657			GUG657			GUG659		
Sampling Date		2018/05/24 11:15			2018/05/24 11:15			2018/05/23 14:00		
COC Number		664707-02-01			664707-02-01			664707-03-01		
	UNITS	**MW17-1D**	**RDL**	**QC Batch**	**MW17-1D Lab-Dup**	**RDL**	**QC Batch**	**EB**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	180	1.0	5876590				1.7	1.0	5876590
Calculated TDS	mg/L	260	1.0	5549719				1.0	1.0	5549719
Carb. Alkalinity (calc. as CaCO3)	mg/L	3.0	1.0	5876590				<1.0	1.0	5876590
Hardness (CaCO3)	mg/L	200	1.0	5549964				<1.0	1.0	5549964
Inorganics										
Total Ammonia-N	mg/L	0.31 (1)	0.050	5553558				<0.050	0.050	5553306
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5553018				<4.0	4.0	5553235
Conductivity	umho/cm	480	1.0	5552055				1.4	1.0	5552055
Total Kjeldahl Nitrogen (TKN)	mg/L	0.30 (1)	0.10	5553010				<0.10	0.10	5553464
Dissolved Organic Carbon	mg/L	0.60	0.50	5551595				<0.50	0.50	5551595
pH	pH	8.25		5552058				6.22		5552058
Phenols-4AAP	mg/L	<0.0010	0.0010	5554005				<0.0010	0.0010	5554005
Total Phosphorus	mg/L	0.9	0.1	5553050				<0.004	0.004	5554624
Dissolved Sulphate (SO4)	mg/L	37	1.0	5552153				<1.0	1.0	5552153
Alkalinity (Total as CaCO3)	mg/L	180	1.0	5552052				1.7	1.0	5552052
Dissolved Chloride (Cl-)	mg/L	20	1.0	5552149				<1.0	1.0	5552149
Nitrite (N)	mg/L	<0.010	0.010	5552075	<0.010	0.010	5552075	<0.010	0.010	5552075
Nitrate (N)	mg/L	<0.10	0.10	5552075	<0.10	0.10	5552075	<0.10	0.10	5552075
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5552075	<0.10	0.10	5552075	<0.10	0.10	5552075

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GUG660			GUG660		
Sampling Date		2018/05/22 16:30			2018/05/22 16:30		
COC Number		664707-03-01			664707-03-01		
	UNITS	**DUP-6A**	**RDL**	**QC Batch**	**DUP-6A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	250	1.0	5876590			
Calculated TDS	mg/L	450	1.0	5549719			
Carb. Alkalinity (calc. as CaCO3)	mg/L	4.1	1.0	5876590			
Hardness (CaCO3)	mg/L	290	1.0	5549964			
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	5553306			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5553235	<4.0	4.0	5553235
Conductivity	umho/cm	800	1.0	5552055			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.11	0.10	5553464			
Dissolved Organic Carbon	mg/L	1.5	0.50	5551595			
pH	pH	8.25		5552058			
Phenols-4AAP	mg/L	<0.0010	0.0010	5555920			
Total Phosphorus	mg/L	0.017	0.004	5554624			
Dissolved Sulphate (SO4)	mg/L	36	1.0	5552153			
Alkalinity (Total as CaCO3)	mg/L	250	1.0	5552052			
Dissolved Chloride (Cl-)	mg/L	81	1.0	5552149			
Nitrite (N)	mg/L	0.025	0.010	5552075			
Nitrate (N)	mg/L	2.74	0.10	5552075			
Nitrate + Nitrite (N)	mg/L	2.77	0.10	5552075			

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

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GUG638		GUG639		GUG640		GUG641		
Sampling Date		2018/05/24 15:30		2018/05/22 14:47		2018/05/22 13:15		2018/05/22 10:25		
COC Number		664707-01-01		664707-01-01		664707-01-01		664707-01-01		
	UNITS	**MW17-3A**	**QC Batch**	**MW17-3E**	**QC Batch**	**MW17-3B**	**RDL**	**MW17-5A**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	5549962	<5	5549962	<5	5	<5	5	5549962
Metals										
Chromium (VI)	ug/L	<0.50	5551149	<0.50	5551149	<0.50	0.50	<0.50	0.50	5551149
Mercury (Hg)	mg/L	<0.0001	5552621	<0.0001	5554984	<0.0001	0.0001	<0.0001	0.0001	5552621
Dissolved Aluminum (Al)	ug/L	<5.0	5552788	<5.0	5552788	<5.0	5.0	24	5.0	5552788
Dissolved Arsenic (As)	ug/L	<1.0	5552788	<1.0	5552788	<1.0	1.0	3.3	1.0	5552788
Dissolved Barium (Ba)	ug/L	33	5552788	67	5552788	36	2.0	15	2.0	5552788
Dissolved Boron (B)	ug/L	55	5552788	31	5552788	96	10	150	10	5552788
Dissolved Cadmium (Cd)	ug/L	<0.10	5552788	<0.10	5552788	<0.10	0.10	<0.10	0.10	5552788
Dissolved Calcium (Ca)	ug/L	69000	5552788	93000	5552788	37000	200	78000	400	5552788
Dissolved Chromium (Cr)	ug/L	<5.0	5552788	<5.0	5552788	<5.0	5.0	<5.0	5.0	5552788
Dissolved Copper (Cu)	ug/L	<1.0	5552788	2.8	5552788	<1.0	1.0	<1.0	1.0	5552788
Dissolved Iron (Fe)	ug/L	<100	5552788	<100	5552788	<100	100	150	100	5552788
Dissolved Lead (Pb)	ug/L	<0.50	5552788	<0.50	5552788	<0.50	0.50	<0.50	0.50	5552788
Dissolved Magnesium (Mg)	ug/L	28000	5552788	23000	5552788	29000	50	61000	50	5552788
Dissolved Manganese (Mn)	ug/L	<2.0	5552788	<2.0	5552788	2.2	2.0	5.4	2.0	5552788
Dissolved Potassium (K)	ug/L	3400	5552788	13000	5552788	1600	200	3400	200	5552788
Dissolved Sodium (Na)	ug/L	43000	5552788	8100	5552788	19000	100	91000	100	5552788
Dissolved Zinc (Zn)	ug/L	<5.0	5552788	<5.0	5552788	<5.0	5.0	<5.0	5.0	5552788

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GUG642		GUG643			GUG643		
Sampling Date		2018/05/24 14:00		2018/05/24 11:30			2018/05/24 11:30		
COC Number		664707-01-01		664707-01-01			664707-01-01		
	UNITS	**MW17-1A**	**QC Batch**	**MW17-1B**	**RDL**	**QC Batch**	**MW17-1B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Chromium (+3)	ug/L	<5	5549962	<5	5	5549962			
Metals									
Chromium (VI)	ug/L	<0.50	5551149	<0.50	0.50	5551149			
Mercury (Hg)	mg/L	<0.0001	5552729	<0.0001	0.0001	5552621	<0.0001	0.0001	5552621
Dissolved Aluminum (Al)	ug/L	5.9	5552788	<5.0	5.0	5552788			
Dissolved Arsenic (As)	ug/L	1.4	5552788	<1.0	1.0	5552788			
Dissolved Barium (Ba)	ug/L	80	5552788	84	2.0	5552788			
Dissolved Boron (B)	ug/L	70	5552788	61	10	5552788			
Dissolved Cadmium (Cd)	ug/L	<0.10	5552788	<0.10	0.10	5552788			
Dissolved Calcium (Ca)	ug/L	38000	5552788	24000	200	5552788			
Dissolved Chromium (Cr)	ug/L	<5.0	5552788	<5.0	5.0	5552788			
Dissolved Copper (Cu)	ug/L	2.0	5552788	<1.0	1.0	5552788			
Dissolved Iron (Fe)	ug/L	<100	5552788	<100	100	5552788			
Dissolved Lead (Pb)	ug/L	<0.50	5552788	<0.50	0.50	5552788			
Dissolved Magnesium (Mg)	ug/L	24000	5552788	18000	50	5552788			
Dissolved Manganese (Mn)	ug/L	6.2	5552788	<2.0	2.0	5552788			
Dissolved Potassium (K)	ug/L	1900	5552788	1100	200	5552788			
Dissolved Sodium (Na)	ug/L	32000	5552788	19000	100	5552788			
Dissolved Zinc (Zn)	ug/L	5.2	5552788	<5.0	5.0	5552788			

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

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GUG644		GUG645		GUG646		GUG647		
Sampling Date		2018/05/23 16:10		2018/05/23 15:35		2018/05/23 15:35		2018/05/23 16:00		
COC Number		664707-01-01		664707-01-01		664707-01-01		664707-01-01		
	UNITS	MW17-2D	QC Batch	MW17-2C	QC Batch	DUP-2C	QC Batch	MW17-2A	RDL	QC Batch
Calculated Parameters										
Chromium (+3)	ug/L	<5	5549962	<5	5549962	<5	5549962	<5	5	5549962
Metals										
Chromium (VI)	ug/L	0.51	5551149	<0.50	5551149	<0.50	5551149	<0.50	0.50	5551149
Mercury (Hg)	mg/L	<0.0001	5554984	<0.0001	5552621	<0.0001	5552729	<0.0001	0.0001	5552621
Dissolved Aluminum (Al)	ug/L	<5.0	5552788	<5.0	5552788	<5.0	5552788	<5.0	5.0	5552788
Dissolved Arsenic (As)	ug/L	<1.0	5552788	<1.0	5552788	<1.0	5552788	<1.0	1.0	5552788
Dissolved Barium (Ba)	ug/L	19	5552788	32	5552788	32	5552788	22	2.0	5552788
Dissolved Boron (B)	ug/L	<10	5552788	12	5552788	13	5552788	97	10	5552788
Dissolved Cadmium (Cd)	ug/L	<0.10	5552788	<0.10	5552788	<0.10	5552788	<0.10	0.10	5552788
Dissolved Calcium (Ca)	ug/L	89000	5552788	80000	5552788	81000	5552788	71000	200	5552788
Dissolved Chromium (Cr)	ug/L	<5.0	5552788	<5.0	5552788	<5.0	5552788	<5.0	5.0	5552788
Dissolved Copper (Cu)	ug/L	<1.0	5552788	<1.0	5552788	<1.0	5552788	<1.0	1.0	5552788
Dissolved Iron (Fe)	ug/L	<100	5552788	<100	5552788	<100	5552788	<100	100	5552788
Dissolved Lead (Pb)	ug/L	<0.50	5552788	<0.50	5552788	<0.50	5552788	<0.50	0.50	5552788
Dissolved Magnesium (Mg)	ug/L	19000	5552788	20000	5552788	19000	5552788	37000	50	5552788
Dissolved Manganese (Mn)	ug/L	<2.0	5552788	7.0	5552788	7.6	5552788	3.8	2.0	5552788
Dissolved Potassium (K)	ug/L	810	5552788	680	5552788	650	5552788	3300	200	5552788
Dissolved Sodium (Na)	ug/L	2100	5552788	3500	5552788	3500	5552788	49000	100	5552788
Dissolved Zinc (Zn)	ug/L	<5.0	5552788	<5.0	5552788	<5.0	5552788	<5.0	5.0	5552788

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GUG648		GUG649		GUG650		
Sampling Date		2018/05/23 17:45		2018/05/23 13:35		2018/05/23 13:19		
COC Number		664707-02-01		664707-02-01		664707-02-01		
	UNITS	MW17-2B	RDL	MW17-4B	QC Batch	MW17-4A	RDL	QC Batch
Calculated Parameters								
Chromium (+3)	ug/L	<5	5	<5	5549962	<5	5	5549962
Metals								
Chromium (VI)	ug/L	<0.50	0.50	<0.50	5551149	<0.50	0.50	5551149
Mercury (Hg)	mg/L	<0.0001	0.0001	<0.0001	5552729	<0.0001	0.0001	5554666
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	<5.0	5552788	6.3	5.0	5552788
Dissolved Arsenic (As)	ug/L	<1.0	1.0	<1.0	5552788	<1.0	1.0	5552788
Dissolved Barium (Ba)	ug/L	32	2.0	30	5552788	45	2.0	5552788
Dissolved Boron (B)	ug/L	54	10	87	5552788	78	10	5552788
Dissolved Cadmium (Cd)	ug/L	<0.10	0.10	<0.10	5552788	<0.10	0.10	5552788
Dissolved Calcium (Ca)	ug/L	78000	200	85000	5552788	85000	400	5552788
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	<5.0	5552788	<5.0	5.0	5552788
Dissolved Copper (Cu)	ug/L	<1.0	1.0	<1.0	5552788	<1.0	1.0	5552788
Dissolved Iron (Fe)	ug/L	<100	100	<100	5552788	<100	100	5552788
Dissolved Lead (Pb)	ug/L	<0.50	0.50	<0.50	5552788	<0.50	0.50	5552788
Dissolved Magnesium (Mg)	ug/L	26000	50	35000	5552788	33000	50	5552788
Dissolved Manganese (Mn)	ug/L	9.3	2.0	14	5552788	18	2.0	5552788
Dissolved Potassium (K)	ug/L	3700	200	2400	5552788	2100	200	5552788
Dissolved Sodium (Na)	ug/L	44000	100	54000	5552788	43000	100	5552788
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	<5.0	5552788	<5.0	5.0	5552788

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GUG651	GUG652	GUG653		GUG654		
Sampling Date		2018/05/23 10:12	2018/05/23 11:30	2018/05/22 14:00		2018/05/24 10:25		
COC Number		664707-02-01	664707-02-01	664707-02-01		664707-02-01		
	UNITS	**MW17-5C**	**MW17-5B**	**MW17-3C**	**QC Batch**	**MW17-1C**	**RDL**	**QC Batch**
Calculated Parameters								
Chromium (+3)	ug/L	<5	<5	<5	5549962	<5	5	5549962
Metals								
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	5551149	<0.50	0.50	5551149
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	5552621	<0.0001	0.0001	5551252
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	6.9	5552788	<5.0	5.0	5552788
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	5552788	4.1	1.0	5552788
Dissolved Barium (Ba)	ug/L	34	37	84	5552788	91	2.0	5552788
Dissolved Boron (B)	ug/L	24	53	26	5552788	46	10	5552788
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	5552788	<0.10	0.10	5552788
Dissolved Calcium (Ca)	ug/L	99000	73000	62000	5552788	32000	200	5552788
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	5552788	<5.0	5.0	5552788
Dissolved Copper (Cu)	ug/L	<1.0	<1.0	<1.0	5552788	<1.0	1.0	5552788
Dissolved Iron (Fe)	ug/L	<100	<100	<100	5552788	250	100	5552788
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	5552788	<0.50	0.50	5552788
Dissolved Magnesium (Mg)	ug/L	26000	26000	26000	5552788	18000	50	5552788
Dissolved Manganese (Mn)	ug/L	8.6	<2.0	13	5552788	7.1	2.0	5552788
Dissolved Potassium (K)	ug/L	3300	3700	1500	5552788	960	200	5552788
Dissolved Sodium (Na)	ug/L	10000	43000	11000	5552788	16000	100	5552788
Dissolved Zinc (Zn)	ug/L	20	<5.0	<5.0	5552788	<5.0	5.0	5552788

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

DRAFT

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GUG654			GUG655	GUG656			GUG656		
Sampling Date		2018/05/24 10:25			2018/05/22 16:18	2018/05/22 16:30			2018/05/22 16:30		
COC Number		664707-02-01			664707-02-01	664707-02-01			664707-02-01		
	UNITS	**MW17-1C Lab-Dup**	**RDL**	**QC Batch**	**MW17-6B**	**MW17-6A**	**RDL**	**QC Batch**	**MW17-6A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters											
Chromium (+3)	ug/L				<5	<5	5	5549962			
Metals											
Chromium (VI)	ug/L	<0.50	0.50	5551149	<0.50	<0.50	0.50	5542393			
Mercury (Hg)	mg/L				<0.0001	<0.0001	0.0001	5551252			
Dissolved Aluminum (Al)	ug/L				<5.0	<5.0	5.0	5552788	<5.0	5.0	5552788
Dissolved Arsenic (As)	ug/L				<1.0	<1.0	1.0	5552788	<1.0	1.0	5552788
Dissolved Barium (Ba)	ug/L				66	48	2.0	5552788	46	2.0	5552788
Dissolved Boron (B)	ug/L				27	28	10	5552788	28	10	5552788
Dissolved Cadmium (Cd)	ug/L				<0.10	<0.10	0.10	5552788	<0.10	0.10	5552788
Dissolved Calcium (Ca)	ug/L				120000	83000	200	5552788	82000	200	5552788
Dissolved Chromium (Cr)	ug/L				<5.0	<5.0	5.0	5552788	<5.0	5.0	5552788
Dissolved Copper (Cu)	ug/L				<1.0	1.3	1.0	5552788	1.4	1.0	5552788
Dissolved Iron (Fe)	ug/L				<100	<100	100	5552788	<100	100	5552788
Dissolved Lead (Pb)	ug/L				<0.50	<0.50	0.50	5552788	<0.50	0.50	5552788
Dissolved Magnesium (Mg)	ug/L				35000	19000	50	5552788	18000	50	5552788
Dissolved Manganese (Mn)	ug/L				47	<2.0	2.0	5552788	<2.0	2.0	5552788
Dissolved Potassium (K)	ug/L				2300	2600	200	5552788	2600	200	5552788
Dissolved Sodium (Na)	ug/L				14000	49000	100	5552788	48000	100	5552788
Dissolved Zinc (Zn)	ug/L				7.4	<5.0	5.0	5552788	5.1	5.0	5552788

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

DRAFT

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GUG657	GUG659	GUG660			GUG660		
Sampling Date		2018/05/24 11:15	2018/05/23 14:00	2018/05/22 16:30			2018/05/22 16:30		
COC Number		664707-02-01	664707-03-01	664707-03-01			664707-03-01		
	UNITS	**MW17-1D**	**EB**	**DUP-6A**	**RDL**	**QC Batch**	**DUP-6A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Chromium (+3)	ug/L	<5	<5	<5	5	5549962			
Metals									
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	0.50	5542393			
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	0.0001	5551252	<0.0001	0.0001	5551252
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	<5.0	5.0	5552695			
Dissolved Arsenic (As)	ug/L	11	<1.0	<1.0	1.0	5552695			
Dissolved Barium (Ba)	ug/L	59	<2.0	48	2.0	5552695			
Dissolved Boron (B)	ug/L	40	<10	28	10	5552695			
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	0.10	5552695			
Dissolved Calcium (Ca)	ug/L	38000	<200	85000	200	5552695			
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	5.0	5552695			
Dissolved Copper (Cu)	ug/L	<1.0	<1.0	1.5	1.0	5552695			
Dissolved Iron (Fe)	ug/L	110	<100	<100	100	5552695			
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	0.50	5552695			
Dissolved Magnesium (Mg)	ug/L	26000	<50	20000	50	5552695			
Dissolved Manganese (Mn)	ug/L	12	<2.0	<2.0	2.0	5552695			
Dissolved Potassium (K)	ug/L	1000	<200	2800	200	5552695			
Dissolved Sodium (Na)	ug/L	17000	<100	50000	100	5552695			
Dissolved Zinc (Zn)	ug/L	5.8	<5.0	9.8	5.0	5552695			

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

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		GUG638	GUG639	GUG639	GUG640	GUG641		
Sampling Date		2018/05/24 15:30	2018/05/22 14:47	2018/05/22 14:47	2018/05/22 13:15	2018/05/22 10:25		
COC Number		664707-01-01	664707-01-01	664707-01-01	664707-01-01	664707-01-01		
	UNITS	**MW17-3A**	**MW17-3E**	**MW17-3E Lab-Dup**	**MW17-3B**	**MW17-5A**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5551399
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5551399
Toluene	ug/L	<0.20	0.28	0.25	<0.20	0.46	0.20	5551399
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5551399
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	87	81	86	81	84		5551399
D4-1,2-Dichloroethane	%	107	107	109	110	107		5551399
D8-Toluene	%	94	95	94	94	94		5551399

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

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		GUG642	GUG643	GUG644	GUG645	GUG646		
Sampling Date		2018/05/24 14:00	2018/05/24 11:30	2018/05/23 16:10	2018/05/23 15:35	2018/05/23 15:35		
COC Number		664707-01-01	664707-01-01	664707-01-01	664707-01-01	664707-01-01		
	UNITS	**MW17-1A**	**MW17-1B**	**MW17-2D**	**MW17-2C**	**DUP-2C**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5551399
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5551399
Toluene	ug/L	0.69	<0.20	0.31	<0.20	<0.20	0.20	5551399
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
p+m-Xylene	ug/L	0.26	<0.20	<0.20	<0.20	<0.20	0.20	5551399
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
Total Xylenes	ug/L	0.26	<0.20	<0.20	<0.20	<0.20	0.20	5551399
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5551399
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	84	88	83	80	82		5551399
D4-1,2-Dichloroethane	%	109	109	110	109	110		5551399
D8-Toluene	%	93	94	94	96	94		5551399

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		GUG647	GUG648	GUG649	GUG650	GUG651		
Sampling Date		2018/05/23 16:00	2018/05/23 17:45	2018/05/23 13:35	2018/05/23 13:19	2018/05/23 10:12		
COC Number		664707-01-01	664707-02-01	664707-02-01	664707-02-01	664707-02-01		
	UNITS	MW17-2A	MW17-2B	MW17-4B	MW17-4A	MW17-5C	RDL	QC Batch
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5551399
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5551399
Toluene	ug/L	0.35	0.65	<0.20	<0.20	<0.20	0.20	5551399
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5551399
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	85	85	84	83	82		5551399
D4-1,2-Dichloroethane	%	111	112	111	113	111		5551399
D8-Toluene	%	93	95	94	93	94		5551399

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		GUG652	GUG653	GUG654	GUG655	GUG656		
Sampling Date		2018/05/23 11:30	2018/05/22 14:00	2018/05/24 10:25	2018/05/22 16:18	2018/05/22 16:30		
COC Number		664707-02-01	664707-02-01	664707-02-01	664707-02-01	664707-02-01		
	UNITS	**MW17-5B**	**MW17-3C**	**MW17-1C**	**MW17-6B**	**MW17-6A**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5551399
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5551399
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5551399
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5551399
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	83	84	80	82	82		5551399
D4-1,2-Dichloroethane	%	112	112	114	115	113		5551399
D8-Toluene	%	94	94	94	93	94		5551399

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		GUG657		GUG658	GUG659	GUG660		
Sampling Date		2018/05/24 11:15		2018/05/22	2018/05/23 14:00	2018/05/22 16:30		
COC Number		664707-02-01		664707-03-01	664707-03-01	664707-03-01		
	UNITS	**MW17-1D**	**QC Batch**	**TRIP BLANK**	**EB**	**DUP-6A**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	5551399	<0.20	<0.20	<0.20	0.20	5550734
1,4-Dichlorobenzene	ug/L	<0.50	5551399	<0.50	<0.50	<0.50	0.50	5550734
Methylene Chloride(Dichloromethane)	ug/L	<2.0	5551399	<2.0	<2.0	<2.0	2.0	5550734
Toluene	ug/L	0.27	5551399	<0.20	<0.20	<0.20	0.20	5550734
Vinyl Chloride	ug/L	<0.20	5551399	<0.20	<0.20	<0.20	0.20	5550734
p+m-Xylene	ug/L	<0.20	5551399	<0.20	<0.20	<0.20	0.20	5550734
o-Xylene	ug/L	<0.20	5551399	<0.20	<0.20	<0.20	0.20	5550734
Total Xylenes	ug/L	<0.20	5551399	<0.20	<0.20	<0.20	0.20	5550734
F1 (C6-C10)	ug/L	<25	5551399	<25	<25	<25	25	5550734
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	79	5551399	85	84	82		5550734
D4-1,2-Dichloroethane	%	113	5551399	105	105	108		5550734
D8-Toluene	%	95	5551399	95	95	97		5550734

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

DRAFT

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TEST SUMMARY

Maxxam ID: GUG638
Sample ID: MW17-3A
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5552005	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

DRAFT

Maxxam ID: GUG638 Dup
Sample ID: MW17-3A
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani

Maxxam ID: GUG639
Sample ID: MW17-3E
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5553197	N/A	2018/05/30	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5553411	N/A	2018/05/30	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5553206	N/A	2018/05/30	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5554984	2018/05/30	2018/05/31	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG639
Sample ID: MW17-3E
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5553064	N/A	2018/05/30	Chandra Nandlal
pH	AT	5553207	N/A	2018/05/30	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5552005	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5553420	N/A	2018/05/30	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/31	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG639 Dup
Sample ID: MW17-3E
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG640
Sample ID: MW17-3B
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5551854	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

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Maxxam A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG641
Sample ID: MW17-5A
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5553922	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

DRAFT

Maxxam ID: GUG642
Sample ID: MW17-1A
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552729	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5551854	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG642
Sample ID: MW17-1A
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG643
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5551854	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/31	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG643 Dup
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
pH	AT	5552058	N/A	2018/05/29	Surinder Rai

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A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG644
Sample ID: MW17-2D
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5553197	N/A	2018/05/30	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5553206	N/A	2018/05/30	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5554984	2018/05/30	2018/05/31	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5553207	N/A	2018/05/30	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5551854	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/31	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

DRAFT

Maxxam ID: GUG645
Sample ID: MW17-2C
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5552005	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/31	Rajni Tyagi

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TEST SUMMARY

Maxxam ID: GUG645
Sample ID: MW17-2C
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG645 Dup
Sample ID: MW17-2C
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Phenols (4AAP)	TECH/PHEN	5552005	N/A	2018/05/29	Zahid Soikot

Maxxam ID: GUG646
Sample ID: DUP-2C
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552729	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5552005	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/31	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG647
Sample ID: MW17-2A
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine

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A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG647
Sample ID: MW17-2A
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5552005	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

DRAFT

Maxxam ID: GUG647 Dup
Sample ID: MW17-2A
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi

Maxxam ID: GUG648
Sample ID: MW17-2B
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552729	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG648
Sample ID: MW17-2B
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Phenols (4AAP)	TECH/PHEN	5551854	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG649
Sample ID: MW17-4B
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552729	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5551854	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG649 Dup
Sample ID: MW17-4B
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG650
Sample ID: MW17-4A
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5554666	2018/05/30	2018/05/31	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5557676	N/A	2018/06/01	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5552005	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5557658	2018/05/31	2018/06/01	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

DRAFT

Maxxam ID: GUG651
Sample ID: MW17-5C
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5551854	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi

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A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG651 **Collected:** 2018/05/23
Sample ID: MW17-5C **Shipped:**
Matrix: Water **Received:** 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG652 **Collected:** 2018/05/23
Sample ID: MW17-5B **Shipped:**
Matrix: Water **Received:** 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5553197	N/A	2018/05/30	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5553411	N/A	2018/05/30	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5553206	N/A	2018/05/30	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5553064	N/A	2018/05/30	Chandra Nandlal
pH	AT	5553207	N/A	2018/05/30	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5551854	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5553420	N/A	2018/05/30	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG653 **Collected:** 2018/05/22
Sample ID: MW17-3C **Shipped:**
Matrix: Water **Received:** 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551004	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5552621	2018/05/29	2018/05/29	Ron Morrison

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG653
Sample ID: MW17-3C
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5551854	N/A	2018/05/29	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG653 Dup
Sample ID: MW17-3C
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal

Maxxam ID: GUG654
Sample ID: MW17-1C
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551595	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549714	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5551252	2018/05/28	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5554005	N/A	2018/05/30	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG654 Dup
Sample ID: MW17-1C
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5551149	N/A	2018/05/29	Lang Le

Maxxam ID: GUG655
Sample ID: MW17-6B
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5542393	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551595	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549964	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5551252	2018/05/28	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5554005	N/A	2018/05/30	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

DRAFT

Maxxam ID: GUG655 Dup
Sample ID: MW17-6B
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu

Maxxam ID: GUG656
Sample ID: MW17-6A
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG656
Sample ID: MW17-6A
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/06/01	2018/06/01	Automated Statchk
Chromium (VI) in Water	IC	5542393	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551595	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549964	N/A	2018/06/01	Automated Statchk
Mercury in Water by CVAA	CV/AA	5551252	2018/05/28	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5555920	N/A	2018/05/30	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/06/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG656 Dup
Sample ID: MW17-6A
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	5552788	N/A	2018/06/01	Thao Nguyen

Maxxam ID: GUG657
Sample ID: MW17-1D
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553018	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/05/31	2018/05/31	Automated Statchk
Chromium (VI) in Water	IC	5542393	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551595	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549964	N/A	2018/05/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5551252	2018/05/28	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552695	N/A	2018/05/30	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5553558	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG657
Sample ID: MW17-1D
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Phenols (4AAP)	TECH/PHEN	5554005	N/A	2018/05/30	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/05/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553010	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5553050	2018/05/29	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5551399	N/A	2018/05/31	Denis Reid

Maxxam ID: GUG657 Dup
Sample ID: MW17-1D
Matrix: Water

Collected: 2018/05/24
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal

Maxxam ID: GUG658
Sample ID: TRIP BLANK
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5550734	N/A	2018/05/30	Denis Reid

Maxxam ID: GUG659
Sample ID: EB
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553235	N/A	2018/05/31	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/05/31	2018/05/31	Automated Statchk
Chromium (VI) in Water	IC	5542393	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551595	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549964	N/A	2018/05/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5551252	2018/05/28	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552695	N/A	2018/05/31	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5553306	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5554005	N/A	2018/05/30	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/05/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553464	2018/05/29	2018/05/30	Rajni Tyagi

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GUG659
Sample ID: EB
Matrix: Water

Collected: 2018/05/23
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	5554624	2018/05/30	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5550734	N/A	2018/05/30	Denis Reid

Maxxam ID: GUG660
Sample ID: DUP-6A
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5552052	N/A	2018/05/29	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5552149	N/A	2018/05/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5553235	N/A	2018/05/30	Shivani Shivani
Conductivity	AT	5552055	N/A	2018/05/29	Surinder Rai
Chromium 3+ by calculation		5549962	2018/05/31	2018/05/31	Automated Statchk
Chromium (VI) in Water	IC	5542393	N/A	2018/05/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5551595	N/A	2018/05/29	Nimarta Singh
Hardness (calculated as CaCO3)		5549964	N/A	2018/05/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5551252	2018/05/28	2018/05/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5552695	N/A	2018/05/30	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5553306	N/A	2018/05/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5552075	N/A	2018/05/29	Chandra Nandlal
pH	AT	5552058	N/A	2018/05/29	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5555920	N/A	2018/05/30	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5552153	N/A	2018/05/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5549719	N/A	2018/05/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5553464	2018/05/29	2018/05/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5554624	2018/05/30	2018/05/31	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5550734	N/A	2018/05/30	Denis Reid

Maxxam ID: GUG660 Dup
Sample ID: DUP-6A
Matrix: Water

Collected: 2018/05/22
Shipped:
Received: 2018/05/25

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5553235	N/A	2018/05/30	Shivani Shivani
Mercury in Water by CVAA	CV/AA	5551252	2018/05/28	2018/05/29	Ron Morrison

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GENERAL COMMENTS

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

Package 1	2.7°C
Package 2	4.7°C
Package 3	1.3°C
Package 4	4.3°C
Package 5	3.0°C

Revised report (2018/12/07): Includes calculations for Carbonate and Bicarbonate Alkalinity.

Sample GUG638 [MW17-3A] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample GUG642 [MW17-1A] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample GUG644 [MW17-2D] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent. Hexavalent Chromium > Total/Dissolved Chromium: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample GUG645 [MW17-2C] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample GUG647 [MW17-2A] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample GUG654 [MW17-1C] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample GUG655 [MW17-6B] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample GUG657 [MW17-1D] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5550734	4-Bromofluorobenzene	2018/05/29	103	70 - 130	103	70 - 130	90	%				
5550734	D4-1,2-Dichloroethane	2018/05/29	102	70 - 130	101	70 - 130	101	%				
5550734	D8-Toluene	2018/05/29	101	70 - 130	102	70 - 130	97	%				
5551399	4-Bromofluorobenzene	2018/05/30	99	70 - 130	101	70 - 130	84	%				
5551399	D4-1,2-Dichloroethane	2018/05/30	102	70 - 130	109	70 - 130	106	%				
5551399	D8-Toluene	2018/05/30	104	70 - 130	102	70 - 130	95	%				
5542393	Chromium (VI)	2018/05/29	106	80 - 120	103	80 - 120	<0.50	ug/L	NC	20		
5550734	1,4-Dichlorobenzene	2018/05/29	93	70 - 130	95	70 - 130	<0.50	ug/L	NC	30		
5550734	Benzene	2018/05/29	90	70 - 130	96	70 - 130	<0.20	ug/L	NC	30		
5550734	F1 (C6-C10)	2018/05/29	91	60 - 140	102	60 - 140	<25	ug/L	NC	30		
5550734	Methylene Chloride(Dichloromethane)	2018/05/29	98	70 - 130	105	70 - 130	<2.0	ug/L	NC	30		
5550734	o-Xylene	2018/05/29	84	70 - 130	91	70 - 130	<0.20	ug/L	NC	30		
5550734	p+m-Xylene	2018/05/29	86	70 - 130	93	70 - 130	<0.20	ug/L	NC	30		
5550734	Toluene	2018/05/29	94	70 - 130	100	70 - 130	<0.20	ug/L	NC	30		
5550734	Total Xylenes	2018/05/29					<0.20	ug/L	NC	30		
5550734	Vinyl Chloride	2018/05/29	137 (1)	70 - 130	90	70 - 130	<0.20	ug/L	NC	30		
5551004	Dissolved Organic Carbon	2018/05/29	90	80 - 120	97	80 - 120	<0.50	mg/L	3.7	20		
5551149	Chromium (VI)	2018/05/29	104	80 - 120	103	80 - 120	<0.50	ug/L	NC	20		
5551252	Mercury (Hg)	2018/05/29	101	75 - 125	95	80 - 120	<0.0001	mg/L	NC	20		
5551399	1,4-Dichlorobenzene	2018/05/31	87	70 - 130	92	70 - 130	<0.50	ug/L	NC	30		
5551399	Benzene	2018/05/31	94	70 - 130	102	70 - 130	<0.20	ug/L	NC	30		
5551399	F1 (C6-C10)	2018/05/31	105	60 - 140	100	60 - 140	<25	ug/L	NC	30		
5551399	Methylene Chloride(Dichloromethane)	2018/05/31	104	70 - 130	113	70 - 130	<2.0	ug/L	NC	30		
5551399	o-Xylene	2018/05/31	83	70 - 130	89	70 - 130	<0.20	ug/L	NC	30		
5551399	p+m-Xylene	2018/05/31	83	70 - 130	88	70 - 130	<0.20	ug/L	NC	30		
5551399	Toluene	2018/05/31	96	70 - 130	101	70 - 130	<0.20	ug/L	9.5	30		
5551399	Total Xylenes	2018/05/31					<0.20	ug/L	NC	30		
5551399	Vinyl Chloride	2018/05/31	97	70 - 130	168 (1)	70 - 130	<0.20	ug/L	NC	30		
5551595	Dissolved Organic Carbon	2018/05/29	92	80 - 120	98	80 - 120	<0.50	mg/L	0.096	20		
5551854	Phenols-4AAP	2018/05/29	94	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
5552005	Phenols-4AAP	2018/05/29	95	80 - 120	97	80 - 120	<0.0010	mg/L	NC	20		

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8C5271
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5552052	Alkalinity (Total as CaCO3)	2018/05/29			95	85 - 115	<1.0	mg/L	0.035	20		
5552055	Conductivity	2018/05/29			101	85 - 115	<1.0	umho/cm	1.8	25		
5552058	pH	2018/05/29			102	98 - 103			0.35	N/A		
5552075	Nitrate (N)	2018/05/29	91	80 - 120	98	80 - 120	<0.10	mg/L	NC	20		
5552075	Nitrite (N)	2018/05/29	96	80 - 120	96	80 - 120	<0.010	mg/L	NC	20		
5552149	Dissolved Chloride (Cl-)	2018/05/29	NC	80 - 120	104	80 - 120	<1.0	mg/L	0.22	20		
5552153	Dissolved Sulphate (SO4)	2018/05/29	NC	75 - 125	103	80 - 120	<1.0	mg/L	1.5	20		
5552621	Mercury (Hg)	2018/05/29	104	75 - 125	102	80 - 120	<0.0001	mg/L	NC	20		
5552695	Dissolved Aluminum (Al)	2018/05/30	103	80 - 120	97	80 - 120	<5.0	ug/L				
5552695	Dissolved Arsenic (As)	2018/05/30	103	80 - 120	97	80 - 120	<1.0	ug/L	8.3	20		
5552695	Dissolved Barium (Ba)	2018/05/30	104	80 - 120	100	80 - 120	<2.0	ug/L	8.0	20		
5552695	Dissolved Boron (B)	2018/05/30	106	80 - 120	101	80 - 120	<10	ug/L	7.4	20		
5552695	Dissolved Cadmium (Cd)	2018/05/30	107	80 - 120	100	80 - 120	<0.10	ug/L	NC	20		
5552695	Dissolved Calcium (Ca)	2018/05/30	NC	80 - 120	97	80 - 120	<200	ug/L	9.6	20		
5552695	Dissolved Chromium (Cr)	2018/05/30	102	80 - 120	98	80 - 120	<5.0	ug/L	NC	20		
5552695	Dissolved Copper (Cu)	2018/05/30	105	80 - 120	99	80 - 120	<1.0	ug/L	10	20		
5552695	Dissolved Iron (Fe)	2018/05/30	105	80 - 120	99	80 - 120	<100	ug/L	8.7	20		
5552695	Dissolved Lead (Pb)	2018/05/30	101	80 - 120	99	80 - 120	<0.50	ug/L	NC	20		
5552695	Dissolved Magnesium (Mg)	2018/05/30	NC	80 - 120	99	80 - 120	<50	ug/L	8.0	20		
5552695	Dissolved Manganese (Mn)	2018/05/30	100	80 - 120	95	80 - 120	<2.0	ug/L	8.2	20		
5552695	Dissolved Potassium (K)	2018/05/30	105	80 - 120	99	80 - 120	<200	ug/L	8.6	20		
5552695	Dissolved Sodium (Na)	2018/05/30	NC	80 - 120	97	80 - 120	<100	ug/L	8.7	20		
5552695	Dissolved Zinc (Zn)	2018/05/30	103	80 - 120	99	80 - 120	<5.0	ug/L	9.8	20		
5552729	Mercury (Hg)	2018/05/29	101	75 - 125	97	80 - 120	<0.0001	mg/L	NC	20		
5552788	Dissolved Aluminum (Al)	2018/06/01	104	80 - 120	97	80 - 120	<5.0	ug/L	NC	20		
5552788	Dissolved Arsenic (As)	2018/06/01	102	80 - 120	95	80 - 120	<1.0	ug/L	NC	20		
5552788	Dissolved Barium (Ba)	2018/06/01	101	80 - 120	96	80 - 120	<2.0	ug/L	4.5	20		
5552788	Dissolved Boron (B)	2018/06/01	108	80 - 120	99	80 - 120	<10	ug/L	2.6	20		
5552788	Dissolved Cadmium (Cd)	2018/06/01	104	80 - 120	96	80 - 120	<0.10	ug/L	NC	20		
5552788	Dissolved Calcium (Ca)	2018/06/01	NC	80 - 120	97	80 - 120	<200	ug/L	1.1	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5552788	Dissolved Chromium (Cr)	2018/06/01	102	80 - 120	94	80 - 120	<5.0	ug/L	NC	20		
5552788	Dissolved Copper (Cu)	2018/06/01	103	80 - 120	97	80 - 120	<1.0	ug/L	4.1	20		
5552788	Dissolved Iron (Fe)	2018/06/01	105	80 - 120	99	80 - 120	<100	ug/L	NC	20		
5552788	Dissolved Lead (Pb)	2018/06/01	99	80 - 120	94	80 - 120	<0.50	ug/L	NC	20		
5552788	Dissolved Magnesium (Mg)	2018/06/01	99	80 - 120	97	80 - 120	<50	ug/L	2.3	20		
5552788	Dissolved Manganese (Mn)	2018/06/01	102	80 - 120	95	80 - 120	<2.0	ug/L	NC	20		
5552788	Dissolved Potassium (K)	2018/06/01	103	80 - 120	97	80 - 120	<200	ug/L	1.4	20		
5552788	Dissolved Sodium (Na)	2018/06/01	NC	80 - 120	98	80 - 120	<100	ug/L	2.2	20		
5552788	Dissolved Zinc (Zn)	2018/06/01	101	80 - 120	95	80 - 120	<5.0	ug/L	2.1	20		
5553010	Total Kjeldahl Nitrogen (TKN)	2018/05/30	107	80 - 120	106	80 - 120	<0.10	mg/L	7.4 (2)	20	102	80 - 120
5553018	Total Chemical Oxygen Demand (COD)	2018/05/30	101	80 - 120	95	80 - 120	<4.0	mg/L	NC	20		
5553050	Total Phosphorus	2018/05/31	97	80 - 120	92	80 - 120	<0.004	mg/L	7.1	20	95	80 - 120
5553064	Nitrate (N)	2018/05/30	89	80 - 120	97	80 - 120	<0.10	mg/L	NC	20		
5553064	Nitrite (N)	2018/05/30	88	80 - 120	94	80 - 120	<0.010	mg/L	NC	20		
5553197	Alkalinity (Total as CaCO3)	2018/05/30			95	85 - 115	<1.0	mg/L	0.53	20		
5553206	Conductivity	2018/05/30			101	85 - 115	<1.0	umho/cm	2.2	25		
5553207	pH	2018/05/30			102	98 - 103			0.079	N/A		
5553235	Total Chemical Oxygen Demand (COD)	2018/05/30	102	80 - 120	100	80 - 120	<4.0	mg/L	NC	20		
5553306	Total Ammonia-N	2018/05/30	95	75 - 125	99	80 - 120	<0.050	mg/L	3.6	20		
5553411	Dissolved Chloride (Cl-)	2018/05/30	76	80 - 120	102	80 - 120	<1.0	mg/L	1.3	20		
5553420	Dissolved Sulphate (SO4)	2018/05/30	93	75 - 125	100	80 - 120	<1.0	mg/L	0.25	20		
5553464	Total Kjeldahl Nitrogen (TKN)	2018/05/30	106	80 - 120	99	80 - 120	<0.10	mg/L	1.5	20	98	80 - 120
5553558	Total Ammonia-N	2018/05/30	96	75 - 125	101	80 - 120	<0.050	mg/L	11	20		
5553922	Phenols-4AAP	2018/05/29	94	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
5554005	Phenols-4AAP	2018/05/30	93	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
5554624	Total Phosphorus	2018/05/31	NC	80 - 120	99	80 - 120	<0.004	mg/L	5.1	20	97	80 - 120
5554666	Mercury (Hg)	2018/05/31	96	75 - 125	94	80 - 120	<0.0001	mg/L	NC	20		
5554984	Mercury (Hg)	2018/05/31	102	75 - 125	98	80 - 120	<0.0001	mg/L	NC	20		
5555920	Phenols-4AAP	2018/05/30	93	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
5557658	Total Kjeldahl Nitrogen (TKN)	2018/06/01	112	80 - 120	96	80 - 120	<0.10	mg/L	13	20	97	80 - 120

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Maxxam
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Maxxam Job #: B8C5271
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5557676	Total Ammonia-N	2018/06/01	97	75 - 125	102	80 - 120	<0.050	mg/L	NC	20		

N/A = Not Applicable

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

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

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

(1) The recovery was above the upper control limit. This may represent a high bias in some results for this specific analyte. For results that were not detected (ND), this potential bias has no impact.

(2) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

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Maxxam Job #: B8C5271
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Cristina Carriere, Scientific Service Specialist

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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Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706
Site Location: Walker Landfill
Your C.O.C. #: 678720-01-01

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515951
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8L6828
Received: 2018/08/21, 15:14

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	5	N/A	2018/08/25	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	5	N/A	2018/12/07	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	5	N/A	2018/08/24	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand	5	N/A	2018/08/24	CAM SOP-00416	SM 23 5220 D m
Conductivity	5	N/A	2018/08/25	CAM SOP-00414	SM 23 2510 m
Chromium 3+ by calculation	5	2018/08/22	2018/08/28		
Chromium (VI) in Water	5	N/A	2018/08/28	CAM SOP-00436	EPA 7199 m
Dissolved Organic Carbon (DOC) (1)	5	N/A	2018/08/24	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	5	N/A	2018/08/24	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	5	2018/08/27	2018/08/27	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	5	N/A	2018/08/23	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	5	N/A	2018/09/12	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	5	N/A	2018/08/24	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	5	N/A	2018/08/25	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	5	N/A	2018/08/24	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	5	N/A	2018/08/24	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	5	N/A	2018/08/27		
Total Kjeldahl Nitrogen in Water	1	2018/08/27	2018/08/27	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	4	2018/08/27	2018/08/28	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	5	2018/08/27	2018/08/27	CAM SOP-00407	SM 23 4500 P B H m
Volatile Organic Compounds and F1 PHCs	4	N/A	2018/08/24	CAM SOP-00230	EPA 8260C m
Volatile Organic Compounds and F1 PHCs	1	N/A	2018/08/27	CAM SOP-00230	EPA 8260C m

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Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless

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Report Date: 2018/12/07
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CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8L6828
Received: 2018/08/21, 15:14

indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

DRAFT

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: CGripton@maxxam.ca
Phone# (800)268-7396 Ext:250
==
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Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		HNX762		HNX763			HNX763		
Sampling Date		2018/08/21 11:45		2018/08/21 10:50			2018/08/21 10:50		
COC Number		678720-01-01		678720-01-01			678720-01-01		
	UNITS	**MW17-5B**	**QC Batch**	**MW17-5C**	**RDL**	**QC Batch**	**MW17-5C Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	150	5876590	160	1.0	5876590			
Calculated TDS	mg/L	450	5694078	280	1.0	5694078			
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.6	5876590	1.6	1.0	5876590			
Hardness (CaCO3)	mg/L	270	5693695	230	1.0	5693695			
Inorganics									
Total Ammonia-N	mg/L	<0.050	5724918	<0.050	0.050	5724918			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	5698116	<4.0	4.0	5698116			
Conductivity	umho/cm	760	5696403	480	1.0	5696403			
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	5701337	<0.10	0.10	5701337			
Dissolved Organic Carbon	mg/L	0.91	5697771	0.89	0.50	5697771			
pH	pH	8.07	5696405	8.03		5696405			
Phenols-4AAP	mg/L	<0.0010	5696141	<0.0010	0.0010	5696121			
Total Phosphorus	mg/L	0.029	5700260	0.006	0.004	5700260	0.005	0.004	5700260
Dissolved Sulphate (SO4)	mg/L	140	5696488	82	1.0	5696488			
Alkalinity (Total as CaCO3)	mg/L	150	5696401	160	1.0	5696401			
Dissolved Chloride (Cl-)	mg/L	71	5696486	8.2	1.0	5696486			
Nitrite (N)	mg/L	<0.010	5695999	0.045	0.010	5695999			
Nitrate (N)	mg/L	1.72	5695999	<0.10	0.10	5695999			
Nitrate + Nitrite (N)	mg/L	1.72	5695999	0.13	0.10	5695999			

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

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

Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		HNX764			HNX765			HNX765		
Sampling Date		2018/08/21 13:50			2018/08/21 13:15			2018/08/21 13:15		
COC Number		678720-01-01			678720-01-01			678720-01-01		
	UNITS	**MW17-6A**	**RDL**	**QC Batch**	**MW17-6B**	**RDL**	**QC Batch**	**MW17-6B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	300	1.0	5876590	270	1.0	5876590			
Calculated TDS	mg/L	1100	1.0	5694078	440	1.0	5694078			
Carb. Alkalinity (calc. as CaCO3)	mg/L	3.5	1.0	5876590	2.8	1.0	5876590			
Hardness (CaCO3)	mg/L	410	1.0	5693695	370	1.0	5693695			
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	5724918	<0.050	0.050	5724918			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5698116	<4.0	4.0	5698116	<4.0	4.0	5698116
Conductivity	umho/cm	2000	1.0	5696403	740	1.0	5696403			
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5701337	0.10	0.10	5700413			
Dissolved Organic Carbon	mg/L	1.6	0.50	5697771	0.87	0.50	5696281			
pH	pH	8.10		5696405	8.03		5696405			
Phenols-4AAP	mg/L	<0.0010	0.0010	5696121	0.0014	0.0010	5696141			
Total Phosphorus	mg/L	0.025	0.004	5700260	0.010	0.004	5700260			
Dissolved Sulphate (SO4)	mg/L	48	1.0	5696488	76	1.0	5696488			
Alkalinity (Total as CaCO3)	mg/L	300	1.0	5696401	280	1.0	5696401			
Dissolved Chloride (Cl-)	mg/L	410	5.0	5696486	33	1.0	5696486			
Nitrite (N)	mg/L	<0.010	0.010	5695999	0.087	0.010	5695999			
Nitrate (N)	mg/L	2.73	0.10	5695999	1.22	0.10	5695999			
Nitrate + Nitrite (N)	mg/L	2.73	0.10	5695999	1.31	0.10	5695999			

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		HNX766			HNX766		
Sampling Date		2018/08/21 14:10			2018/08/21 14:10		
COC Number		678720-01-01			678720-01-01		
	UNITS	**DUP-6A**	**RDL**	**QC Batch**	**DUP-6A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	300	1.0	5876590			
Calculated TDS	mg/L	1100	1.0	5694078			
Carb. Alkalinity (calc. as CaCO3)	mg/L	3.4	1.0	5876590			
Hardness (CaCO3)	mg/L	420	1.0	5693695			
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	5724918			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5698116			
Conductivity	umho/cm	2000	1.0	5696403			
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5701337	<0.10	0.10	5701337
Dissolved Organic Carbon	mg/L	1.7	0.50	5697771			
pH	pH	8.08		5696405			
Phenols-4AAP	mg/L	0.0011	0.0010	5696121			
Total Phosphorus	mg/L	0.027	0.004	5700260			
Dissolved Sulphate (SO4)	mg/L	48	1.0	5696488			
Alkalinity (Total as CaCO3)	mg/L	300	1.0	5696401			
Dissolved Chloride (Cl-)	mg/L	410	5.0	5696486			
Nitrite (N)	mg/L	<0.010	0.010	5695999			
Nitrate (N)	mg/L	2.78	0.10	5695999			
Nitrate + Nitrite (N)	mg/L	2.78	0.10	5695999			

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

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Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		HNX762	HNX763	HNX764	HNX765			HNX765		
Sampling Date		2018/08/21 11:45	2018/08/21 10:50	2018/08/21 13:50	2018/08/21 13:15			2018/08/21 13:15		
COC Number		678720-01-01	678720-01-01	678720-01-01	678720-01-01			678720-01-01		
	UNITS	**MW17-5B**	**MW17-5C**	**MW17-6A**	**MW17-6B**	**RDL**	**QC Batch**	**MW17-6B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	<5	<5	<5	5	5694353			
Metals										
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	5693697			
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	5700616	<0.0001	0.0001	5700616
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	5695095			
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	5695095			
Dissolved Barium (Ba)	ug/L	37	31	100	56	2.0	5695095			
Dissolved Boron (B)	ug/L	48	11	18	17	10	5695095			
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	5695095			
Dissolved Calcium (Ca)	ug/L	63000	65000	130000	100000	200	5695095			
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	5695095			
Dissolved Copper (Cu)	ug/L	<1.0	<1.0	1.3	<1.0	1.0	5695095			
Dissolved Iron (Fe)	ug/L	<100	<100	<100	<100	100	5695095			
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	5695095			
Dissolved Magnesium (Mg)	ug/L	27000	17000	22000	30000	50	5695095			
Dissolved Manganese (Mn)	ug/L	<2.0	7.9	<2.0	40	2.0	5695095			
Dissolved Potassium (K)	ug/L	3600	1500	3700	1900	200	5695095			
Dissolved Sodium (Na)	ug/L	46000	6000	240000	13000	100	5695095			
Dissolved Zinc (Zn)	ug/L	<5.0	36	5.1	5.4	5.0	5695095			

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		HNX766		
Sampling Date		2018/08/21 14:10		
COC Number		678720-01-01		
	UNITS	**DUP-6A**	**RDL**	**QC Batch**
Calculated Parameters				
Chromium (+3)	ug/L	<5	5	5694353
Metals				
Chromium (VI)	ug/L	<0.50	0.50	5693697
Mercury (Hg)	mg/L	<0.0001	0.0001	5700616
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	5695095
Dissolved Arsenic (As)	ug/L	<1.0	1.0	5695095
Dissolved Barium (Ba)	ug/L	100	2.0	5695095
Dissolved Boron (B)	ug/L	19	10	5695095
Dissolved Cadmium (Cd)	ug/L	<0.10	0.10	5695095
Dissolved Calcium (Ca)	ug/L	130000	200	5695095
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	5695095
Dissolved Copper (Cu)	ug/L	1.3	1.0	5695095
Dissolved Iron (Fe)	ug/L	<100	100	5695095
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5695095
Dissolved Magnesium (Mg)	ug/L	22000	50	5695095
Dissolved Manganese (Mn)	ug/L	<2.0	2.0	5695095
Dissolved Potassium (K)	ug/L	3700	200	5695095
Dissolved Sodium (Na)	ug/L	240000	100	5695095
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5695095

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QC Batch = Quality Control Batch

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A Bureau Veritas Group Company

Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		HNX762	HNX763	HNX764	HNX765	HNX766		
Sampling Date		2018/08/21 11:45	2018/08/21 10:50	2018/08/21 13:50	2018/08/21 13:15	2018/08/21 14:10		
COC Number		678720-01-01	678720-01-01	678720-01-01	678720-01-01	678720-01-01		
	UNITS	**MW17-5B**	**MW17-5C**	**MW17-6A**	**MW17-6B**	**DUP-6A**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5692976
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5692976
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5692976
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5692976
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5692976
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5692976
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5692976
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5692976
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5692976
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	85	85	83	85	87		5692976
D4-1,2-Dichloroethane	%	106	105	106	106	112		5692976
D8-Toluene	%	96	97	96	97	93		5692976

RDL = Reportable Detection Limit
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Maxxam
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Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

DRAFT

Maxxam ID: HNX762
Sample ID: MW17-5B
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5696401	N/A	2018/08/25	Yogesh Patel
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5696486	N/A	2018/08/24	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5698116	N/A	2018/08/24	Shivani Shivani
Conductivity	AT	5696403	N/A	2018/08/25	Yogesh Patel
Chromium 3+ by calculation		5694353	2018/08/28	2018/08/28	Automated Statchk
Chromium (VI) in Water	IC	5693697	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5697771	N/A	2018/08/24	Nimarta Singh
Hardness (calculated as CaCO3)		5693695	N/A	2018/08/24	Automated Statchk
Mercury in Water by CVAA	CV/AA	5700616	2018/08/27	2018/08/27	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5695095	N/A	2018/08/23	Thao Nguyen
Total Ammonia-N	LACH/NH4	5724918	N/A	2018/09/12	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5695999	N/A	2018/08/24	Charles Opoku-Ware
pH	AT	5696405	N/A	2018/08/25	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	5696141	N/A	2018/08/24	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5696488	N/A	2018/08/24	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5694078	N/A	2018/08/27	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701337	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5700260	2018/08/27	2018/08/27	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5692976	N/A	2018/08/24	Denis Reid

Maxxam ID: HNX763
Sample ID: MW17-5C
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5696401	N/A	2018/08/25	Yogesh Patel
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5696486	N/A	2018/08/24	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5698116	N/A	2018/08/24	Shivani Shivani
Conductivity	AT	5696403	N/A	2018/08/25	Yogesh Patel
Chromium 3+ by calculation		5694353	2018/08/28	2018/08/28	Automated Statchk
Chromium (VI) in Water	IC	5693697	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5697771	N/A	2018/08/24	Nimarta Singh
Hardness (calculated as CaCO3)		5693695	N/A	2018/08/24	Automated Statchk
Mercury in Water by CVAA	CV/AA	5700616	2018/08/27	2018/08/27	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5695095	N/A	2018/08/23	Thao Nguyen
Total Ammonia-N	LACH/NH4	5724918	N/A	2018/09/12	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5695999	N/A	2018/08/24	Charles Opoku-Ware
pH	AT	5696405	N/A	2018/08/25	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	5696121	N/A	2018/08/24	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5696488	N/A	2018/08/24	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5694078	N/A	2018/08/27	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701337	2018/08/27	2018/08/28	Rajni Tyagi

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

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A Bureau Veritas Group Company

Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HNX763
Sample ID: MW17-5C
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	5700260	2018/08/27	2018/08/27	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5692976	N/A	2018/08/24	Denis Reid

Maxxam ID: HNX763 Dup
Sample ID: MW17-5C
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	5700260	2018/08/27	2018/08/27	Amanpreet Sappal

Maxxam ID: HNX764
Sample ID: MW17-6A
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5696401	N/A	2018/08/25	Yogesh Patel
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5696486	N/A	2018/08/24	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5698116	N/A	2018/08/24	Shivani Shivani
Conductivity	AT	5696403	N/A	2018/08/25	Yogesh Patel
Chromium 3+ by calculation		5694353	2018/08/28	2018/08/28	Automated Statchk
Chromium (VI) in Water	IC	5693697	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5697771	N/A	2018/08/24	Nimarta Singh
Hardness (calculated as CaCO3)		5693695	N/A	2018/08/24	Automated Statchk
Mercury in Water by CVAA	CV/AA	5700616	2018/08/27	2018/08/27	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5695095	N/A	2018/08/23	Thao Nguyen
Total Ammonia-N	LACH/NH4	5724918	N/A	2018/09/12	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5695999	N/A	2018/08/24	Charles Opoku-Ware
pH	AT	5696405	N/A	2018/08/25	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	5696121	N/A	2018/08/24	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5696488	N/A	2018/08/24	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5694078	N/A	2018/08/27	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701337	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5700260	2018/08/27	2018/08/27	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5692976	N/A	2018/08/24	Denis Reid

Maxxam ID: HNX765
Sample ID: MW17-6B
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5696401	N/A	2018/08/25	Yogesh Patel
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5696486	N/A	2018/08/24	Deonarine Ramnarine

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Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HNX765
Sample ID: MW17-6B
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5698116	N/A	2018/08/24	Shivani Shivani
Conductivity	AT	5696403	N/A	2018/08/25	Yogesh Patel
Chromium 3+ by calculation		5694353	2018/08/28	2018/08/28	Automated Statchk
Chromium (VI) in Water	IC	5693697	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5696281	N/A	2018/08/24	Nimarta Singh
Hardness (calculated as CaCO3)		5693695	N/A	2018/08/24	Automated Statchk
Mercury in Water by CVAA	CV/AA	5700616	2018/08/27	2018/08/27	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5695095	N/A	2018/08/23	Thao Nguyen
Total Ammonia-N	LACH/NH4	5724918	N/A	2018/09/12	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5695999	N/A	2018/08/24	Charles Opoku-Ware
pH	AT	5696405	N/A	2018/08/25	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	5696141	N/A	2018/08/24	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5696488	N/A	2018/08/24	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5694078	N/A	2018/08/27	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5700413	2018/08/27	2018/08/27	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5700260	2018/08/27	2018/08/27	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5692976	N/A	2018/08/24	Denis Reid

Maxxam ID: HNX765 Dup
Sample ID: MW17-6B
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5698116	N/A	2018/08/24	Shivani Shivani
Mercury in Water by CVAA	CV/AA	5700616	2018/08/27	2018/08/27	Ron Morrison

Maxxam ID: HNX766
Sample ID: DUP-6A
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5696401	N/A	2018/08/25	Yogesh Patel
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5696486	N/A	2018/08/24	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5698116	N/A	2018/08/24	Shivani Shivani
Conductivity	AT	5696403	N/A	2018/08/25	Yogesh Patel
Chromium 3+ by calculation		5694353	2018/08/28	2018/08/28	Automated Statchk
Chromium (VI) in Water	IC	5693697	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5697771	N/A	2018/08/24	Nimarta Singh
Hardness (calculated as CaCO3)		5693695	N/A	2018/08/24	Automated Statchk
Mercury in Water by CVAA	CV/AA	5700616	2018/08/27	2018/08/27	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5695095	N/A	2018/08/23	Thao Nguyen
Total Ammonia-N	LACH/NH4	5724918	N/A	2018/09/12	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5695999	N/A	2018/08/24	Charles Opoku-Ware

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Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HNX766
Sample ID: DUP-6A
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH	AT	5696405	N/A	2018/08/25	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	5696121	N/A	2018/08/24	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5696488	N/A	2018/08/24	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5694078	N/A	2018/08/27	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701337	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5700260	2018/08/27	2018/08/27	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5692976	N/A	2018/08/27	Denis Reid

Maxxam ID: HNX766 Dup
Sample ID: DUP-6A
Matrix: Water

Collected: 2018/08/21
Shipped:
Received: 2018/08/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Kjeldahl Nitrogen in Water	SKAL	5701337	2018/08/27	2018/08/28	Rajni Tyagi

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GENERAL COMMENTS

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

Package 1	9.7°C

Revised report (2018/12/07): Includes Carbonate/Bicarbonate Alkalinity calculations.

Results relate only to the items tested.

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Maxxam
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Maxxam Job #: B8L6828
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5692976	4-Bromofluorobenzene	2018/08/24	96	70 - 130	95	70 - 130	84	%				
5692976	D4-1,2-Dichloroethane	2018/08/24	104	70 - 130	100	70 - 130	102	%				
5692976	D8-Toluene	2018/08/24	104	70 - 130	103	70 - 130	99	%				
5692976	1,4-Dichlorobenzene	2018/08/24	100	70 - 130	100	70 - 130	<0.50	ug/L	NC	30		
5692976	Benzene	2018/08/24	95	70 - 130	93	70 - 130	<0.20	ug/L	NC	30		
5692976	F1 (C6-C10)	2018/08/24	89	60 - 140	88	60 - 140	<25	ug/L	NC	30		
5692976	Methylene Chloride(Dichloromethane)	2018/08/24	93	70 - 130	90	70 - 130	<2.0	ug/L	NC	30		
5692976	o-Xylene	2018/08/24	93	70 - 130	93	70 - 130	<0.20	ug/L	NC	30		
5692976	p+m-Xylene	2018/08/24	93	70 - 130	93	70 - 130	<0.20	ug/L	NC	30		
5692976	Toluene	2018/08/24	94	70 - 130	94	70 - 130	<0.20	ug/L	NC	30		
5692976	Total Xylenes	2018/08/24					<0.20	ug/L	NC	30		
5692976	Vinyl Chloride	2018/08/24	92	70 - 130	93	70 - 130	<0.20	ug/L	NC	30		
5693697	Chromium (VI)	2018/08/28	100	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		
5695095	Dissolved Aluminum (Al)	2018/08/23	86	80 - 120	93	80 - 120	<5.0	ug/L				
5695095	Dissolved Arsenic (As)	2018/08/23	91	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
5695095	Dissolved Barium (Ba)	2018/08/23	90	80 - 120	95	80 - 120	<2.0	ug/L				
5695095	Dissolved Boron (B)	2018/08/23	94	80 - 120	95	80 - 120	<10	ug/L				
5695095	Dissolved Cadmium (Cd)	2018/08/23	89	80 - 120	96	80 - 120	<0.10	ug/L	NC	20		
5695095	Dissolved Calcium (Ca)	2018/08/23	89	80 - 120	96	80 - 120	<200	ug/L	6.6	20		
5695095	Dissolved Chromium (Cr)	2018/08/23	92	80 - 120	99	80 - 120	<5.0	ug/L				
5695095	Dissolved Copper (Cu)	2018/08/23	94	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
5695095	Dissolved Iron (Fe)	2018/08/23	97	80 - 120	103	80 - 120	<100	ug/L				
5695095	Dissolved Lead (Pb)	2018/08/23	94	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		
5695095	Dissolved Magnesium (Mg)	2018/08/23	94	80 - 120	101	80 - 120	<50	ug/L	5.2	20		
5695095	Dissolved Manganese (Mn)	2018/08/23	85	80 - 120	91	80 - 120	<2.0	ug/L				
5695095	Dissolved Potassium (K)	2018/08/23	94	80 - 120	99	80 - 120	<200	ug/L	4.4	20		
5695095	Dissolved Sodium (Na)	2018/08/23	96	80 - 120	101	80 - 120	<100	ug/L	6.4	20		
5695095	Dissolved Zinc (Zn)	2018/08/23	90	80 - 120	96	80 - 120	<5.0	ug/L	3.0	20		
5695999	Nitrate (N)	2018/08/24	93	80 - 120	92	80 - 120	<0.10	mg/L	0.61	20		
5695999	Nitrite (N)	2018/08/24	100	80 - 120	98	80 - 120	<0.010	mg/L	NC	20		
5696121	Phenols-4AAP	2018/08/24	100	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5696141	Phenols-4AAP	2018/08/27	98	80 - 120	102	80 - 120	<0.0010	mg/L	NC (1)	20		
5696281	Dissolved Organic Carbon	2018/08/24	94	80 - 120	96	80 - 120	<0.50	mg/L	1.9	20		
5696401	Alkalinity (Total as CaCO3)	2018/08/25			98	85 - 115	<1.0	mg/L	0.88	20		
5696403	Conductivity	2018/08/25			101	85 - 115	<1.0	umho/cm	0.69	25		
5696405	pH	2018/08/25			102	98 - 103			0.45	N/A		
5696486	Dissolved Chloride (Cl-)	2018/08/24	NC	80 - 120	101	80 - 120	<1.0	mg/L	0.34	20		
5696488	Dissolved Sulphate (SO4)	2018/08/24	101	75 - 125	107	80 - 120	<1.0	mg/L	4.0	20		
5697771	Dissolved Organic Carbon	2018/08/24	94	80 - 120	94	80 - 120	<0.50	mg/L	0.39	20		
5698116	Total Chemical Oxygen Demand (COD)	2018/08/24	101	80 - 120	101	80 - 120	<4.0	mg/L	NC	20		
5700260	Total Phosphorus	2018/08/27	86	80 - 120	94	80 - 120	<0.004	mg/L	NC	20	94	80 - 120
5700413	Total Kjeldahl Nitrogen (TKN)	2018/08/27	99	80 - 120	103	80 - 120	<0.10	mg/L	NC	20	95	80 - 120
5700616	Mercury (Hg)	2018/08/27	100	75 - 125	95	80 - 120	<0.0001	mg/L	NC	20		
5701337	Total Kjeldahl Nitrogen (TKN)	2018/08/28	99	80 - 120	93	80 - 120	<0.10	mg/L	NC	20	99	80 - 120
5724918	Total Ammonia-N	2018/09/12	NC	75 - 125	100	80 - 120	<0.050	mg/L	0.80 (2)	20		

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N/A = Not Applicable

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

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

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

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

(2) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

Maxxam Job #: B8L6828
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

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

DRAFT

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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Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706
Site Location: Walker Landfill
Your C.O.C. #: 678720-02-01

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515950
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8L8302
Received: 2018/08/23, 09:25

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	7	N/A	2018/08/27	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	7	N/A	2018/12/07	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	7	N/A	2018/08/27	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand	7	N/A	2018/08/28	CAM SOP-00416	SM 23 5220 D m
Conductivity	7	N/A	2018/08/27	CAM SOP-00414	SM 23 2510 m
Chromium 3+ by calculation	7	2018/08/24	2018/08/29		
Chromium (VI) in Water	7	N/A	2018/08/28	CAM SOP-00436	EPA 7199 m
Dissolved Organic Carbon (DOC) (1)	5	N/A	2018/08/25	CAM SOP-00446	SM 23 5310 B m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2018/08/27	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	7	N/A	2018/08/28	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	7	2018/08/28	2018/08/28	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	7	N/A	2018/08/28	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	7	N/A	2018/08/28	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	7	N/A	2018/08/27	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	7	N/A	2018/08/27	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	7	N/A	2018/08/27	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	7	N/A	2018/08/27	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	7	N/A	2018/08/28		
Total Kjeldahl Nitrogen in Water	7	2018/08/27	2018/08/28	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	7	2018/08/28	2018/08/28	CAM SOP-00407	SM 23 4500 P B H m
Volatile Organic Compounds and F1 PHCs	2	N/A	2018/08/27	CAM SOP-00230	EPA 8260C m
Volatile Organic Compounds and F1 PHCs	5	N/A	2018/08/28	CAM SOP-00230	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless

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Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706
Site Location: Walker Landfill
Your C.O.C. #: 678720-02-01

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515950
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8L8302
Received: 2018/08/23, 09:25

indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

DRAFT

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: CGripton@maxxam.ca
Phone# (800)268-7396 Ext:250
==
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 Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

RESULTS OF ANALYSES OF WATER

Maxxam ID		HOE889		HOE890			HOE891		
Sampling Date		2018/08/22 12:50		2018/08/22 11:00			2018/08/22 12:25		
COC Number		678720-02-01		678720-02-01			678720-02-01		
	UNITS	MW17-3A	QC Batch	MW17-3B	RDL	QC Batch	MW17-3E	RDL	QC Batch
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	180	5876590	210	1.0	5876590	390	1.0	5876590
Calculated TDS	mg/L	450	5697242	290	1.0	5697242	590	1.0	5697242
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.4	5876590	2.3	1.0	5876590	2.9	1.0	5876590
Hardness (CaCO3)	mg/L	300	5697241	230	1.0	5697241	470	1.0	5697241
Inorganics									
Total Ammonia-N	mg/L	<0.050	5701332	0.12	0.050	5701332	0.25	0.050	5701332
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	5701341	<4.0	4.0	5701341	5.4	4.0	5701341
Conductivity	umho/cm	780	5698266	500	1.0	5698266	940	1.0	5698266
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	5701345	0.21	0.10	5701345	2.6	0.10	5701345
Dissolved Organic Carbon	mg/L	1.0	5698246	0.61	0.50	5698246	2.3	0.50	5698281
pH	pH	7.91	5698272	8.07		5698272	7.90		5698272
Phenols-4AAP	mg/L	<0.0010	5700274	<0.0010	0.0010	5700263	0.0015	0.0010	5700274
Total Phosphorus	mg/L	0.011	5702010	0.006	0.004	5702010	30	0.2	5702010
Dissolved Sulphate (SO4)	mg/L	120	5698364	53	1.0	5698364	81	1.0	5698364
Alkalinity (Total as CaCO3)	mg/L	180	5698255	210	1.0	5698255	400	1.0	5698255
Dissolved Chloride (Cl-)	mg/L	66	5698361	4.4	1.0	5698361	23	1.0	5698361
Nitrite (N)	mg/L	<0.010	5698293	<0.010	0.010	5698293	<0.010	0.010	5698293
Nitrate (N)	mg/L	1.68	5698293	<0.10	0.10	5698293	4.09	0.10	5698293
Nitrate + Nitrite (N)	mg/L	1.68	5698293	<0.10	0.10	5698293	4.09	0.10	5698293

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

RESULTS OF ANALYSES OF WATER

Maxxam ID		HOE892			HOE892		
Sampling Date		2018/08/22 13:30			2018/08/22 13:30		
COC Number		678720-02-01			678720-02-01		
	UNITS	**MW17-3C**	**RDL**	**QC Batch**	**MW17-3C Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	230	1.0	5876590			
Calculated TDS	mg/L	330	1.0	5697242			
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.5	1.0	5876590			
Hardness (CaCO3)	mg/L	280	1.0	5697241			
Inorganics							
Total Ammonia-N	mg/L	0.069	0.050	5701332	0.078	0.050	5701332
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5701341			
Conductivity	umho/cm	560	1.0	5698266			
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5701345			
Dissolved Organic Carbon	mg/L	0.81	0.50	5698281			
pH	pH	8.06		5698272			
Phenols-4AAP	mg/L	<0.0010	0.0010	5700274	<0.0010	0.0010	5700274
Total Phosphorus	mg/L	0.005	0.004	5702010	0.005	0.004	5702010
Dissolved Sulphate (SO4)	mg/L	47	1.0	5698364			
Alkalinity (Total as CaCO3)	mg/L	240	1.0	5698255			
Dissolved Chloride (Cl-)	mg/L	16	1.0	5698361			
Nitrite (N)	mg/L	<0.010	0.010	5698293			
Nitrate (N)	mg/L	0.55	0.10	5698293			
Nitrate + Nitrite (N)	mg/L	0.55	0.10	5698293			

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

RESULTS OF ANALYSES OF WATER

Maxxam ID		HOE893	HOE894	HOE895			HOE895		
Sampling Date		2018/08/22 15:30	2018/08/22 16:00	2018/08/22 15:00			2018/08/22 15:00		
COC Number		678720-02-01	678720-02-01	678720-02-01			678720-02-01		
	UNITS	**MW17-4B**	**MW17-4A**	**EB**	**RDL**	**QC Batch**	**EB Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	270	280	1.1	1.0	5876590			
Calculated TDS	mg/L	570	540	1.0	1.0	5697242			
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.1	2.2	<1.0	1.0	5876590			
Hardness (CaCO3)	mg/L	380	380	<1.0	1.0	5697241			
Inorganics									
Total Ammonia-N	mg/L	0.17	0.15	<0.050	0.050	5701332			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	<4.0	<4.0	4.0	5701341	<4.0	4.0	5701341
Conductivity	umho/cm	950	900	1.4	1.0	5698266			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.19	0.19	0.12	0.10	5701345	<0.10	0.10	5701345
Dissolved Organic Carbon	mg/L	1.0	0.96	<0.50	0.50	5698246			
pH	pH	7.91	7.92	6.00		5698272			
Phenols-4AAP	mg/L	<0.0010	<0.0010	<0.0010	0.0010	5700274			
Total Phosphorus	mg/L	0.006	0.004	<0.004	0.004	5702010			
Dissolved Sulphate (SO4)	mg/L	140	120	<1.0	1.0	5698364			
Alkalinity (Total as CaCO3)	mg/L	270	280	1.1	1.0	5698255			
Dissolved Chloride (Cl-)	mg/L	70	59	<1.0	1.0	5698361			
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	0.010	5698293			
Nitrate (N)	mg/L	<0.10	<0.10	<0.10	0.10	5698293			
Nitrate + Nitrite (N)	mg/L	<0.10	<0.10	<0.10	0.10	5698293			

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		HOE889			HOE889			HOE890		
Sampling Date		2018/08/22 12:50			2018/08/22 12:50			2018/08/22 11:00		
COC Number		678720-02-01			678720-02-01			678720-02-01		
	UNITS	**MW17-3A**	**RDL**	**QC Batch**	**MW17-3A Lab-Dup**	**RDL**	**QC Batch**	**MW17-3B**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	5	5697451				<5	5	5697451
Metals										
Chromium (VI)	ug/L	<0.50	0.50	5695915				<0.50	0.50	5695915
Mercury (Hg)	mg/L	<0.0001	0.0001	5702098	<0.0001	0.0001	5702098	<0.0001	0.0001	5702098
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	5697522				<5.0	5.0	5697522
Dissolved Arsenic (As)	ug/L	<1.0	1.0	5697522				<1.0	1.0	5697522
Dissolved Barium (Ba)	ug/L	36	2.0	5697522				38	2.0	5697522
Dissolved Boron (B)	ug/L	55	10	5697522				97	10	5697522
Dissolved Cadmium (Cd)	ug/L	<0.10	0.10	5697522				<0.10	0.10	5697522
Dissolved Calcium (Ca)	ug/L	70000	200	5697522				40000	200	5697522
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	5697522				<5.0	5.0	5697522
Dissolved Copper (Cu)	ug/L	1.3	1.0	5697522				<1.0	1.0	5697522
Dissolved Iron (Fe)	ug/L	<100	100	5697522				<100	100	5697522
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5697522				<0.50	0.50	5697522
Dissolved Magnesium (Mg)	ug/L	30000	50	5697522				31000	50	5697522
Dissolved Manganese (Mn)	ug/L	<2.0	2.0	5697522				<2.0	2.0	5697522
Dissolved Potassium (K)	ug/L	3300	200	5697522				1600	200	5697522
Dissolved Sodium (Na)	ug/L	44000	100	5697522				19000	100	5697522
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5697522				<5.0	5.0	5697522

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

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Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		HOE891	HOE892		HOE893			HOE893		
Sampling Date		2018/08/22 12:25	2018/08/22 13:30		2018/08/22 15:30			2018/08/22 15:30		
COC Number		678720-02-01	678720-02-01		678720-02-01			678720-02-01		
	UNITS	**MW17-3E**	**MW17-3C**	**RDL**	**MW17-4B**	**RDL**	**QC Batch**	**MW17-4B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	<5	5	<5	5	5697451			
Metals										
Chromium (VI)	ug/L	<0.50	<0.50	0.50	<0.50	0.50	5695915	<0.50	0.50	5695915
Mercury (Hg)	mg/L	<0.0001	<0.0001	0.0001	<0.0001	0.0001	5702098			
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	5.0	<5.0	5.0	5697522			
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	1.0	<1.0	1.0	5697522			
Dissolved Barium (Ba)	ug/L	130	88	2.0	32	2.0	5697522			
Dissolved Boron (B)	ug/L	57	27	10	88	10	5697522			
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	0.10	<0.10	0.10	5697522			
Dissolved Calcium (Ca)	ug/L	130000	65000	200	90000	400	5697522			
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	5.0	<5.0	5.0	5697522			
Dissolved Copper (Cu)	ug/L	2.1	<1.0	1.0	<1.0	1.0	5697522			
Dissolved Iron (Fe)	ug/L	<100	<100	100	<100	100	5697522			
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	0.50	<0.50	0.50	5697522			
Dissolved Magnesium (Mg)	ug/L	35000	28000	50	37000	50	5697522			
Dissolved Manganese (Mn)	ug/L	<2.0	13	2.0	15	2.0	5697522			
Dissolved Potassium (K)	ug/L	29000	1600	200	2400	200	5697522			
Dissolved Sodium (Na)	ug/L	17000	12000	100	57000	100	5697522			
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	5.0	<5.0	5.0	5697522			

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		HOE894		HOE895		
Sampling Date		2018/08/22 16:00		2018/08/22 15:00		
COC Number		678720-02-01		678720-02-01		
	UNITS	**MW17-4A**	**RDL**	**EB**	**RDL**	**QC Batch**
Calculated Parameters						
Chromium (+3)	ug/L	<5	5	<5	5	5697451
Metals						
Chromium (VI)	ug/L	<0.50	0.50	<0.50	0.50	5695915
Mercury (Hg)	mg/L	<0.0001	0.0001	<0.0001	0.0001	5702098
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	<5.0	5.0	5697522
Dissolved Arsenic (As)	ug/L	<1.0	1.0	<1.0	1.0	5697522
Dissolved Barium (Ba)	ug/L	36	2.0	<2.0	2.0	5697522
Dissolved Boron (B)	ug/L	78	10	<10	10	5697522
Dissolved Cadmium (Cd)	ug/L	<0.10	0.10	<0.10	0.10	5697522
Dissolved Calcium (Ca)	ug/L	89000	400	<200	200	5697522
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	<5.0	5.0	5697522
Dissolved Copper (Cu)	ug/L	<1.0	1.0	2.2	1.0	5697522
Dissolved Iron (Fe)	ug/L	<100	100	<100	100	5697522
Dissolved Lead (Pb)	ug/L	<0.50	0.50	<0.50	0.50	5697522
Dissolved Magnesium (Mg)	ug/L	38000	50	<50	50	5697522
Dissolved Manganese (Mn)	ug/L	17	2.0	<2.0	2.0	5697522
Dissolved Potassium (K)	ug/L	2300	200	<200	200	5697522
Dissolved Sodium (Na)	ug/L	49000	100	<100	100	5697522
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	<5.0	5.0	5697522

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QC Batch = Quality Control Batch

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Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		HOE889	HOE890	HOE890	HOE891	HOE892		
Sampling Date		2018/08/22 12:50	2018/08/22 11:00	2018/08/22 11:00	2018/08/22 12:25	2018/08/22 13:30		
COC Number		678720-02-01	678720-02-01	678720-02-01	678720-02-01	678720-02-01		
	UNITS	**MW17-3A**	**MW17-3B**	**MW17-3B Lab-Dup**	**MW17-3E**	**MW17-3C**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5699468
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5699468
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5699468
Toluene	ug/L	<0.20	<0.20	<0.20	0.37	2.4	0.20	5699468
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5699468
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	0.23	<0.20	0.20	5699468
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5699468
Total Xylenes	ug/L	<0.20	<0.20	<0.20	0.23	<0.20	0.20	5699468
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5699468
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	87	92	91	85	89		5699468
D4-1,2-Dichloroethane	%	104	105	105	103	103		5699468
D8-Toluene	%	101	100	99	102	101		5699468

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Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		HOE893	HOE894	HOE895		
Sampling Date		2018/08/22 15:30	2018/08/22 16:00	2018/08/22 15:00		
COC Number		678720-02-01	678720-02-01	678720-02-01		
	UNITS	**MW17-4B**	**MW17-4A**	**EB**	**RDL**	**QC Batch**
Volatile Organics						
Benzene	ug/L	<0.20	<0.20	<0.20	0.20	5699468
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	5699468
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	2.0	5699468
Toluene	ug/L	<0.20	<0.20	<0.20	0.20	5699468
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	0.20	5699468
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	0.20	5699468
o-Xylene	ug/L	<0.20	<0.20	<0.20	0.20	5699468
Total Xylenes	ug/L	<0.20	<0.20	<0.20	0.20	5699468
F1 (C6-C10)	ug/L	<25	<25	<25	25	5699468
Surrogate Recovery (%)						
4-Bromofluorobenzene	%	86	84	88		5699468
D4-1,2-Dichloroethane	%	102	103	106		5699468
D8-Toluene	%	101	101	99		5699468

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

TEST SUMMARY

Maxxam ID: HOE889
Sample ID: MW17-3A
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5698255	N/A	2018/08/27	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5698361	N/A	2018/08/27	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5701341	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5698266	N/A	2018/08/27	Surinder Rai
Chromium 3+ by calculation		5697451	2018/08/29	2018/08/29	Automated Statchk
Chromium (VI) in Water	IC	5695915	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5698246	N/A	2018/08/25	Nimarta Singh
Hardness (calculated as CaCO3)		5697241	N/A	2018/08/28	Automated Statchk
Mercury in Water by CVAA	CV/AA	5702098	2018/08/28	2018/08/28	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5697522	N/A	2018/08/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5701332	N/A	2018/08/28	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5698293	N/A	2018/08/27	Chandra Nandlal
pH	AT	5698272	N/A	2018/08/27	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5700274	N/A	2018/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5698364	N/A	2018/08/27	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5697242	N/A	2018/08/28	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701345	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5699468	N/A	2018/08/27	Xueming Jiang

DRAFT

Maxxam ID: HOE889 Dup
Sample ID: MW17-3A
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury in Water by CVAA	CV/AA	5702098	2018/08/28	2018/08/28	Ron Morrison

Maxxam ID: HOE890
Sample ID: MW17-3B
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5698255	N/A	2018/08/27	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5698361	N/A	2018/08/27	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5701341	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5698266	N/A	2018/08/27	Surinder Rai
Chromium 3+ by calculation		5697451	2018/08/29	2018/08/29	Automated Statchk
Chromium (VI) in Water	IC	5695915	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5698246	N/A	2018/08/25	Nimarta Singh
Hardness (calculated as CaCO3)		5697241	N/A	2018/08/28	Automated Statchk
Mercury in Water by CVAA	CV/AA	5702098	2018/08/28	2018/08/28	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5697522	N/A	2018/08/28	Arefa Dabhad

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

TEST SUMMARY

Maxxam ID: HOE890
Sample ID: MW17-3B
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5701332	N/A	2018/08/28	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5698293	N/A	2018/08/27	Chandra Nandlal
pH	AT	5698272	N/A	2018/08/27	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5700263	N/A	2018/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5698364	N/A	2018/08/27	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5697242	N/A	2018/08/28	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701345	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5699468	N/A	2018/08/27	Xueming Jiang

Maxxam ID: HOE890 Dup
Sample ID: MW17-3B
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5699468	N/A	2018/08/28	Xueming Jiang

Maxxam ID: HOE891
Sample ID: MW17-3E
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5698255	N/A	2018/08/27	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5698361	N/A	2018/08/27	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5701341	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5698266	N/A	2018/08/27	Surinder Rai
Chromium 3+ by calculation		5697451	2018/08/29	2018/08/29	Automated Statchk
Chromium (VI) in Water	IC	5695915	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5698281	N/A	2018/08/27	Shivani Shivani
Hardness (calculated as CaCO3)		5697241	N/A	2018/08/28	Automated Statchk
Mercury in Water by CVAA	CV/AA	5702098	2018/08/28	2018/08/28	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5697522	N/A	2018/08/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5701332	N/A	2018/08/28	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5698293	N/A	2018/08/27	Chandra Nandlal
pH	AT	5698272	N/A	2018/08/27	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5700274	N/A	2018/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5698364	N/A	2018/08/27	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5697242	N/A	2018/08/28	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701345	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5699468	N/A	2018/08/28	Xueming Jiang

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

TEST SUMMARY

Maxxam ID: HOE892
Sample ID: MW17-3C
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5698255	N/A	2018/08/27	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5698361	N/A	2018/08/27	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5701341	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5698266	N/A	2018/08/27	Surinder Rai
Chromium 3+ by calculation		5697451	2018/08/29	2018/08/29	Automated Statchk
Chromium (VI) in Water	IC	5695915	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5698281	N/A	2018/08/27	Shivani Shivani
Hardness (calculated as CaCO3)		5697241	N/A	2018/08/28	Automated Statchk
Mercury in Water by CVAA	CV/AA	5702098	2018/08/28	2018/08/28	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5697522	N/A	2018/08/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5701332	N/A	2018/08/28	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5698293	N/A	2018/08/27	Chandra Nandlal
pH	AT	5698272	N/A	2018/08/27	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5700274	N/A	2018/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5698364	N/A	2018/08/27	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5697242	N/A	2018/08/28	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701345	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5699468	N/A	2018/08/28	Xueming Jiang

DRAFT

Maxxam ID: HOE892 Dup
Sample ID: MW17-3C
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5701332	N/A	2018/08/28	Parminder Sangha
Phenols (4AAP)	TECH/PHEN	5700274	N/A	2018/08/27	Bramdeo Motiram
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal

Maxxam ID: HOE893
Sample ID: MW17-4B
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5698255	N/A	2018/08/27	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5698361	N/A	2018/08/27	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5701341	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5698266	N/A	2018/08/27	Surinder Rai
Chromium 3+ by calculation		5697451	2018/08/29	2018/08/29	Automated Statchk
Chromium (VI) in Water	IC	5695915	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5698246	N/A	2018/08/25	Nimarta Singh
Hardness (calculated as CaCO3)		5697241	N/A	2018/08/28	Automated Statchk

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Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

TEST SUMMARY

Maxxam ID: HOE893
Sample ID: MW17-4B
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury in Water by CVAA	CV/AA	5702098	2018/08/28	2018/08/28	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5697522	N/A	2018/08/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5701332	N/A	2018/08/28	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5698293	N/A	2018/08/27	Chandra Nandlal
pH	AT	5698272	N/A	2018/08/27	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5700274	N/A	2018/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5698364	N/A	2018/08/27	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5697242	N/A	2018/08/28	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701345	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5699468	N/A	2018/08/28	Xueming Jiang

Maxxam ID: HOE893 Dup
Sample ID: MW17-4B
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5695915	N/A	2018/08/28	Lang Le

Maxxam ID: HOE894
Sample ID: MW17-4A
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5698255	N/A	2018/08/27	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5698361	N/A	2018/08/27	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5701341	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5698266	N/A	2018/08/27	Surinder Rai
Chromium 3+ by calculation		5697451	2018/08/29	2018/08/29	Automated Statchk
Chromium (VI) in Water	IC	5695915	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5698246	N/A	2018/08/25	Nimarta Singh
Hardness (calculated as CaCO3)		5697241	N/A	2018/08/28	Automated Statchk
Mercury in Water by CVAA	CV/AA	5702098	2018/08/28	2018/08/28	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5697522	N/A	2018/08/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5701332	N/A	2018/08/28	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5698293	N/A	2018/08/27	Chandra Nandlal
pH	AT	5698272	N/A	2018/08/27	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5700274	N/A	2018/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5698364	N/A	2018/08/27	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5697242	N/A	2018/08/28	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701345	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5699468	N/A	2018/08/28	Xueming Jiang

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Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

TEST SUMMARY

Maxxam ID: HOE895
Sample ID: EB
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5698255	N/A	2018/08/27	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5698361	N/A	2018/08/27	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5701341	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5698266	N/A	2018/08/27	Surinder Rai
Chromium 3+ by calculation		5697451	2018/08/29	2018/08/29	Automated Statchk
Chromium (VI) in Water	IC	5695915	N/A	2018/08/28	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5698246	N/A	2018/08/25	Nimarta Singh
Hardness (calculated as CaCO3)		5697241	N/A	2018/08/28	Automated Statchk
Mercury in Water by CVAA	CV/AA	5702098	2018/08/28	2018/08/28	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5697522	N/A	2018/08/28	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5701332	N/A	2018/08/28	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5698293	N/A	2018/08/27	Chandra Nandlal
pH	AT	5698272	N/A	2018/08/27	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5700274	N/A	2018/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5698364	N/A	2018/08/27	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5697242	N/A	2018/08/28	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5701345	2018/08/27	2018/08/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5699468	N/A	2018/08/28	Xueming Jiang

Maxxam ID: HOE895 Dup
Sample ID: EB
Matrix: Water

Collected: 2018/08/22
Shipped:
Received: 2018/08/23

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5701341	N/A	2018/08/28	Shivani Shivani
Total Kjeldahl Nitrogen in Water	SKAL	5701345	2018/08/27	2018/08/28	Rajni Tyagi

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GENERAL COMMENTS

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

Package 1	2.3°C
Package 2	2.0°C

Revised report (2018/12/07): Includes Carbonate/Bicarbonate Alkalinity calculations.

Sample HOE892 [MW17-3C] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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Maxxam Job #: B8L8302
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5699468	4-Bromofluorobenzene	2018/08/27	100	70 - 130	99	70 - 130	90	%				
5699468	D4-1,2-Dichloroethane	2018/08/27	104	70 - 130	105	70 - 130	104	%				
5699468	D8-Toluene	2018/08/27	101	70 - 130	102	70 - 130	100	%				
5695915	Chromium (VI)	2018/08/28	100	80 - 120	100	80 - 120	<0.50	ug/L	NC	20		
5697522	Dissolved Aluminum (Al)	2018/08/28	106	80 - 120	101	80 - 120	<5.0	ug/L				
5697522	Dissolved Arsenic (As)	2018/08/28	102	80 - 120	100	80 - 120	<1.0	ug/L	5.3	20		
5697522	Dissolved Barium (Ba)	2018/08/28	102	80 - 120	100	80 - 120	<2.0	ug/L	0.016	20		
5697522	Dissolved Boron (B)	2018/08/28	102	80 - 120	98	80 - 120	<10	ug/L	1.4	20		
5697522	Dissolved Cadmium (Cd)	2018/08/28	104	80 - 120	100	80 - 120	<0.10	ug/L	NC	20		
5697522	Dissolved Calcium (Ca)	2018/08/28	NC	80 - 120	99	80 - 120	<200	ug/L				
5697522	Dissolved Chromium (Cr)	2018/08/28	97	80 - 120	97	80 - 120	<5.0	ug/L	NC	20		
5697522	Dissolved Copper (Cu)	2018/08/28	103	80 - 120	101	80 - 120	<1.0	ug/L	0.62	20		
5697522	Dissolved Iron (Fe)	2018/08/28	101	80 - 120	100	80 - 120	<100	ug/L				
5697522	Dissolved Lead (Pb)	2018/08/28	100	80 - 120	101	80 - 120	<0.50	ug/L	NC	20		
5697522	Dissolved Magnesium (Mg)	2018/08/28	NC	80 - 120	101	80 - 120	<50	ug/L				
5697522	Dissolved Manganese (Mn)	2018/08/28	NC	80 - 120	100	80 - 120	<2.0	ug/L				
5697522	Dissolved Potassium (K)	2018/08/28	104	80 - 120	101	80 - 120	<200	ug/L				
5697522	Dissolved Sodium (Na)	2018/08/28	100	80 - 120	100	80 - 120	<100	ug/L	2.6	20		
5697522	Dissolved Zinc (Zn)	2018/08/28	99	80 - 120	100	80 - 120	<5.0	ug/L	5.3	20		
5698246	Dissolved Organic Carbon	2018/08/24	94	80 - 120	98	80 - 120	<0.50	mg/L	5.1	20		
5698255	Alkalinity (Total as CaCO3)	2018/08/28			96	85 - 115	<1.0	mg/L	0.40	20		
5698266	Conductivity	2018/08/28			100	85 - 115	<1.0	umho/cm	0.41	25		
5698272	pH	2018/08/28			101	98 - 103			0.37	N/A		
5698281	Dissolved Organic Carbon	2018/08/27	95	80 - 120	98	80 - 120	<0.50	mg/L	0.23	20		
5698293	Nitrate (N)	2018/08/27	112	80 - 120	110	80 - 120	<0.10	mg/L	0.18	20		
5698293	Nitrite (N)	2018/08/27	103	80 - 120	101	80 - 120	<0.010	mg/L	12	20		
5698361	Dissolved Chloride (Cl-)	2018/08/27	NC	80 - 120	102	80 - 120	<1.0	mg/L	3.0	20		
5698364	Dissolved Sulphate (SO4)	2018/08/27	90	75 - 125	100	80 - 120	<1.0	mg/L	NC	20		
5699468	1,4-Dichlorobenzene	2018/08/28	108	70 - 130	112	70 - 130	<0.50	ug/L	NC	30		
5699468	Benzene	2018/08/28	95	70 - 130	96	70 - 130	<0.20	ug/L	NC	30		

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Maxxam Job #: B8L8302
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5699468	F1 (C6-C10)	2018/08/28	96	60 - 140	95	60 - 140	<25	ug/L	NC	30		
5699468	Methylene Chloride(Dichloromethane)	2018/08/28	96	70 - 130	94	70 - 130	<2.0	ug/L	NC	30		
5699468	o-Xylene	2018/08/28	97	70 - 130	99	70 - 130	<0.20	ug/L	NC	30		
5699468	p+m-Xylene	2018/08/28	93	70 - 130	96	70 - 130	<0.20	ug/L	NC	30		
5699468	Toluene	2018/08/28	95	70 - 130	97	70 - 130	<0.20	ug/L	NC	30		
5699468	Total Xylenes	2018/08/28					<0.20	ug/L	NC	30		
5699468	Vinyl Chloride	2018/08/28	89	70 - 130	182 (1)	70 - 130	<0.20	ug/L	NC	30		
5700263	Phenols-4AAP	2018/08/27	98	80 - 120	100	80 - 120	<0.0010	mg/L	9.5	20		
5700274	Phenols-4AAP	2018/08/27	98	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
5701332	Total Ammonia-N	2018/08/28	105	75 - 125	101	80 - 120	<0.050	mg/L	12	20		
5701341	Total Chemical Oxygen Demand (COD)	2018/08/28	101	80 - 120	100	80 - 120	<4.0	mg/L	NC	20		
5701345	Total Kjeldahl Nitrogen (TKN)	2018/08/28	96	80 - 120	94	80 - 120	<0.10	mg/L	18	20	91	80 - 120
5702010	Total Phosphorus	2018/08/28	94	80 - 120	91	80 - 120	<0.004	mg/L	12	20	94	80 - 120
5702098	Mercury (Hg)	2018/08/28	96	75 - 125	92	80 - 120	<0.0001	mg/L	NC	20		

N/A = Not Applicable

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

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

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

(1) The recovery was above the upper control limit. This may represent a high bias in some results for this specific analyte. For results that were not detected (ND), this potential bias has no impact.

DRAFT

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

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L8302
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MG

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Cristina Carriere, Scientific Service Specialist

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.

DRAFT

Your Project #: 1664706
Your C.O.C. #: 580739-16-01

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515948
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

DRAFT

MAXXAM JOB #: B8L9823
Received: 2018/08/24, 13:30

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	5	N/A	2018/08/29	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	5	N/A	2018/12/07	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	4	N/A	2018/08/28	CAM SOP-00463	EPA 325.2 m
Chloride by Automated Colourimetry	1	N/A	2018/08/29	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand	4	N/A	2018/08/28	CAM SOP-00416	SM 23 5220 D m
Chemical Oxygen Demand	1	N/A	2018/08/30	CAM SOP-00416	SM 23 5220 D m
Conductivity	5	N/A	2018/08/29	CAM SOP-00414	SM 23 2510 m
Chromium 3+ by calculation	5	2018/08/25	2018/08/31		
Chromium (VI) in Water	5	N/A	2018/08/29	CAM SOP-00436	EPA 7199 m
Dissolved Organic Carbon (DOC) (1)	4	N/A	2018/08/27	CAM SOP-00446	SM 23 5310 B m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2018/08/28	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	5	N/A	2018/08/31	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	5	2018/08/29	2018/08/29	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	2	N/A	2018/08/30	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	3	N/A	2018/08/31	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	3	N/A	2018/08/28	CAM SOP-00441	EPA GS I-2522-90 m
Total Ammonia-N	2	N/A	2018/08/30	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	5	N/A	2018/08/28	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	5	N/A	2018/08/29	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	2	N/A	2018/08/27	CAM SOP-00444	OMOE E3179 m
Phenols (4AAP)	2	N/A	2018/08/28	CAM SOP-00444	OMOE E3179 m
Phenols (4AAP)	1	N/A	2018/08/29	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	4	N/A	2018/08/28	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	1	N/A	2018/08/29	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	5	N/A	2018/08/31		
Total Kjeldahl Nitrogen in Water	2	2018/08/28	2018/08/29	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	3	2018/08/28	2018/08/30	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	5	2018/08/28	2018/08/28	CAM SOP-00407	SM 23 4500 P B H m
Volatile Organic Compounds and F1 PHCs	3	N/A	2018/08/29	CAM SOP-00230	EPA 8260C m

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Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706
Your C.O.C. #: 580739-16-01

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515948
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8L9823
Received: 2018/08/24, 13:30

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Volatile Organic Compounds and F1 PHCs	3	N/A	2018/08/30	CAM SOP-00230	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

DRAFT

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Maxxam
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Your Project #: 1664706
Your C.O.C. #: 580739-16-01

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515948
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8L9823
Received: 2018/08/24, 13:30

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: CGripton@maxxam.ca
Phone# (800)268-7396 Ext:250
==
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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Maxxam
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Maxxam Job #: B8L9823
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		HOM903			HOM904		HOM905		
Sampling Date		2018/08/24 08:45			2018/08/24 09:15		2018/08/24 09:30		
COC Number		580739-16-01			580739-16-01		580739-16-01		
	UNITS	**MW17-2D**	**RDL**	**QC Batch**	**MW17-2C**	**QC Batch**	**DUP-2C**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	270	1.0	5876590	270	5876590	260	1.0	5876590
Calculated TDS	mg/L	360	1.0	5699452	360	5699452	360	1.0	5699452
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.1	1.0	5876590	2.1	5876590	2.1	1.0	5876590
Hardness (CaCO3)	mg/L	330	1.0	5699432	320	5699432	330	1.0	5699432
Inorganics									
Total Ammonia-N	mg/L	0.18	0.050	5702314	<0.050	5701312	<0.050	0.050	5702314
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5702708	<4.0	5702708	<4.0	4.0	5702708
Conductivity	umho/cm	620	1.0	5703346	610	5703346	610	1.0	5703346
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.50 (1)	0.50	5702667	<0.50 (1)	5702667	<0.50 (1)	0.50	5702667
Dissolved Organic Carbon	mg/L	0.83	0.50	5699778	0.80	5699778	0.72	0.50	5700947
pH	pH	7.92		5703354	7.92	5703354	7.92		5703354
Phenols-4AAP	mg/L	<0.0010	0.0010	5700289	<0.0010	5700304	<0.0010	0.0010	5700289
Total Phosphorus	mg/L	2.6	0.2	5702010	0.16	5702010	0.16	0.02	5702010
Dissolved Sulphate (SO4)	mg/L	11	1.0	5701555	14	5701555	15	1.0	5701555
Alkalinity (Total as CaCO3)	mg/L	270	1.0	5703342	270	5703342	270	1.0	5703342
Dissolved Chloride (Cl-)	mg/L	12	1.0	5701551	12	5701551	11	1.0	5701551
Nitrite (N)	mg/L	<0.010	0.010	5701545	<0.010	5701545	<0.010	0.010	5701545
Nitrate (N)	mg/L	10.2	0.10	5701545	9.65	5701545	9.66	0.10	5701545
Nitrate + Nitrite (N)	mg/L	10.2	0.10	5701545	9.65	5701545	9.66	0.10	5701545

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Maxxam Job #: B8L9823
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		HOM906			HOM906			HOM907		
Sampling Date		2018/08/24 10:45			2018/08/24 10:45			2018/08/24 12:00		
COC Number		580739-16-01			580739-16-01			580739-16-01		
	UNITS	**MW17-2B**	**RDL**	**QC Batch**	**MW17-2B Lab-Dup**	**RDL**	**QC Batch**	**MW17-2A**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	180	1.0	5876590				190	1.0	5876590
Calculated TDS	mg/L	490	1.0	5699452				510	1.0	5699452
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.5	1.0	5876590				1.5	1.0	5876590
Hardness (CaCO3)	mg/L	320	1.0	5699432				330	1.0	5699432
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	5701312				0.093	0.050	5701312
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5702705	<4.0	4.0	5702705	<4.0	4.0	5702708
Conductivity	umho/cm	820	1.0	5703346				850	1.0	5703346
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5702667				0.11	0.10	5702667
Dissolved Organic Carbon	mg/L	1.1	0.50	5699778				0.98	0.50	5699778
pH	pH	7.94		5703354				7.93		5703354
Phenols-4AAP	mg/L	<0.0010	0.0010	5702250				<0.0010	0.0010	5700304
Total Phosphorus	mg/L	0.010	0.004	5702010				0.010	0.004	5702010
Dissolved Sulphate (SO4)	mg/L	140	1.0	5701555				160	1.0	5703208
Alkalinity (Total as CaCO3)	mg/L	180	1.0	5703342				190	1.0	5703342
Dissolved Chloride (Cl-)	mg/L	71	1.0	5701551				65	1.0	5703202
Nitrite (N)	mg/L	0.025	0.010	5701545				0.058	0.010	5701545
Nitrate (N)	mg/L	0.97	0.10	5701545				0.29	0.10	5701545
Nitrate + Nitrite (N)	mg/L	0.99	0.10	5701545				0.35	0.10	5701545

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

Maxxam ID		HOM907		
Sampling Date		2018/08/24 12:00		
COC Number		580739-16-01		
	UNITS	**MW17-2A Lab-Dup**	**RDL**	**QC Batch**
Inorganics				
Dissolved Sulphate (SO4)	mg/L	160	1.0	5703208
Dissolved Chloride (Cl-)	mg/L	65	1.0	5703202

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

DRAFT

Maxxam Job #: B8L9823
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		HOM903	HOM904	HOM905	HOM906	HOM907		
Sampling Date		2018/08/24 08:45	2018/08/24 09:15	2018/08/24 09:30	2018/08/24 10:45	2018/08/24 12:00		
COC Number		580739-16-01	580739-16-01	580739-16-01	580739-16-01	580739-16-01		
	UNITS	**MW17-2D**	**MW17-2C**	**DUP-2C**	**MW17-2B**	**MW17-2A**	**RDL**	**QC Batch**
Calculated Parameters								
Chromium (+3)	ug/L	<5	<5	<5	<5	<5	5	5699451
Metals								
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5700897
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	5704903
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	14	<5.0	<5.0	5.0	5700415
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	5700415
Dissolved Barium (Ba)	ug/L	22	26	28	32	30	2.0	5700415
Dissolved Boron (B)	ug/L	<10	<10	<10	53	75	10	5700415
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	5700415
Dissolved Calcium (Ca)	ug/L	97000	94000	96000	83000	77000	200	5700415
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	5700415
Dissolved Copper (Cu)	ug/L	2.1	1.8	1.4	1.1	<1.0	1.0	5700415
Dissolved Iron (Fe)	ug/L	<100	<100	<100	<100	<100	100	5700415
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5700415
Dissolved Magnesium (Mg)	ug/L	21000	20000	21000	28000	34000	50	5700415
Dissolved Manganese (Mn)	ug/L	<2.0	<2.0	<2.0	11	6.4	2.0	5700415
Dissolved Potassium (K)	ug/L	910	780	820	4100	3800	200	5700415
Dissolved Sodium (Na)	ug/L	2300	2900	2900	46000	48000	100	5700415
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	5700415

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

DRAFT

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Maxxam
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Maxxam Job #: B8L9823
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		HOM903	HOM904	HOM905		HOM906	HOM907		
Sampling Date		2018/08/24 08:45	2018/08/24 09:15	2018/08/24 09:30		2018/08/24 10:45	2018/08/24 12:00		
COC Number		580739-16-01	580739-16-01	580739-16-01		580739-16-01	580739-16-01		
	UNITS	**MW17-2D**	**MW17-2C**	**DUP-2C**	**QC Batch**	**MW17-2B**	**MW17-2A**	**RDL**	**QC Batch**
Volatile Organics									
Benzene	ug/L	<0.20	<0.20	<0.20	5690946	<0.20	<0.20	0.20	5701017
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	5690946	<0.50	<0.50	0.50	5701017
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	5690946	<2.0	<2.0	2.0	5701017
Toluene	ug/L	0.35	<0.20	<0.20	5690946	0.25	<0.20	0.20	5701017
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	5690946	<0.20	<0.20	0.20	5701017
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	5690946	<0.20	<0.20	0.20	5701017
o-Xylene	ug/L	<0.20	<0.20	<0.20	5690946	<0.20	<0.20	0.20	5701017
Total Xylenes	ug/L	<0.20	<0.20	<0.20	5690946	<0.20	<0.20	0.20	5701017
F1 (C6-C10)	ug/L	<25	<25	<25	5690946	<25	<25	25	5701017
Surrogate Recovery (%)									
4-Bromofluorobenzene	%	86	87	86	5690946	84	86		5701017
D4-1,2-Dichloroethane	%	102	101	102	5690946	101	102		5701017
D8-Toluene	%	95	96	95	5690946	99	99		5701017

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		HOM908		
Sampling Date				
COC Number		580739-16-01		
	UNITS	**TRIP BLANK**	**RDL**	**QC Batch**
Volatile Organics				
Benzene	ug/L	<0.20	0.20	5701017
1,4-Dichlorobenzene	ug/L	<0.50	0.50	5701017
Methylene Chloride(Dichloromethane)	ug/L	<2.0	2.0	5701017
Toluene	ug/L	<0.20	0.20	5701017
Vinyl Chloride	ug/L	<0.20	0.20	5701017
p+m-Xylene	ug/L	<0.20	0.20	5701017
o-Xylene	ug/L	<0.20	0.20	5701017
Total Xylenes	ug/L	<0.20	0.20	5701017
F1 (C6-C10)	ug/L	<25	25	5701017
Surrogate Recovery (%)				
4-Bromofluorobenzene	%	90		5701017
D4-1,2-Dichloroethane	%	102		5701017
D8-Toluene	%	98		5701017

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

DRAFT

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Maxxam Job #: B8L9823
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HOM903
Sample ID: MW17-2D
Matrix: Water

Collected: 2018/08/24
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5703342	N/A	2018/08/29	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5701551	N/A	2018/08/28	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702708	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5703346	N/A	2018/08/29	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5700897	N/A	2018/08/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5699778	N/A	2018/08/27	Anastassia Hamanov
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5704903	2018/08/29	2018/08/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5700415	N/A	2018/08/31	Thao Nguyen
Total Ammonia-N	LACH/NH4	5702314	N/A	2018/08/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5701545	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5703354	N/A	2018/08/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5700289	N/A	2018/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5701555	N/A	2018/08/28	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5702667	2018/08/28	2018/08/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5690946	N/A	2018/08/30	Denis Reid

DRAFT

Maxxam ID: HOM904
Sample ID: MW17-2C
Matrix: Water

Collected: 2018/08/24
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5703342	N/A	2018/08/29	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5701551	N/A	2018/08/28	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702708	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5703346	N/A	2018/08/29	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5700897	N/A	2018/08/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5699778	N/A	2018/08/27	Anastassia Hamanov
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5704903	2018/08/29	2018/08/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5700415	N/A	2018/08/31	Thao Nguyen
Total Ammonia-N	LACH/NH4	5701312	N/A	2018/08/28	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5701545	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5703354	N/A	2018/08/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5700304	N/A	2018/08/28	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5701555	N/A	2018/08/28	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5702667	2018/08/28	2018/08/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal

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TEST SUMMARY

Maxxam ID: HOM904
Sample ID: MW17-2C
Matrix: Water

Collected: 2018/08/24
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5690946	N/A	2018/08/30	Denis Reid

Maxxam ID: HOM905
Sample ID: DUP-2C
Matrix: Water

Collected: 2018/08/24
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5703342	N/A	2018/08/29	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5701551	N/A	2018/08/28	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702708	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5703346	N/A	2018/08/29	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5700897	N/A	2018/08/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5700947	N/A	2018/08/28	Nimarta Singh
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5704903	2018/08/29	2018/08/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5700415	N/A	2018/08/31	Thao Nguyen
Total Ammonia-N	LACH/NH4	5702314	N/A	2018/08/30	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5701545	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5703354	N/A	2018/08/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5700289	N/A	2018/08/27	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5701555	N/A	2018/08/28	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5702667	2018/08/28	2018/08/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5690946	N/A	2018/08/30	Denis Reid

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Maxxam ID: HOM906
Sample ID: MW17-2B
Matrix: Water

Collected: 2018/08/24
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5703342	N/A	2018/08/29	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5701551	N/A	2018/08/28	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702705	N/A	2018/08/30	Shivani Shivani
Conductivity	AT	5703346	N/A	2018/08/29	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5700897	N/A	2018/08/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5699778	N/A	2018/08/27	Anastassia Hamanov
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5704903	2018/08/29	2018/08/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5700415	N/A	2018/08/30	Thao Nguyen
Total Ammonia-N	LACH/NH4	5701312	N/A	2018/08/28	Parminder Sangha

Maxxam Job #: B8L9823
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HOM906
Sample ID: MW17-2B
Matrix: Water

Collected: 2018/08/24
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5701545	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5703354	N/A	2018/08/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5702250	N/A	2018/08/29	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5701555	N/A	2018/08/28	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5702667	2018/08/28	2018/08/29	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5701017	N/A	2018/08/29	Karen Hughes

Maxxam ID: HOM906 Dup
Sample ID: MW17-2B
Matrix: Water

Collected: 2018/08/24
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5702705	N/A	2018/08/30	Shivani Shivani

Maxxam ID: HOM907
Sample ID: MW17-2A
Matrix: Water

Collected: 2018/08/24
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5703342	N/A	2018/08/29	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5703202	N/A	2018/08/29	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702708	N/A	2018/08/28	Shivani Shivani
Conductivity	AT	5703346	N/A	2018/08/29	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5700897	N/A	2018/08/29	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5699778	N/A	2018/08/27	Anastassia Hamanov
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5704903	2018/08/29	2018/08/29	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5700415	N/A	2018/08/30	Thao Nguyen
Total Ammonia-N	LACH/NH4	5701312	N/A	2018/08/28	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5701545	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5703354	N/A	2018/08/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5700304	N/A	2018/08/28	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5703208	N/A	2018/08/29	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5702667	2018/08/28	2018/08/29	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702010	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5701017	N/A	2018/08/29	Karen Hughes

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Maxxam Job #: B8L9823
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HOM907 Dup
Sample ID: MW17-2A
Matrix: Water

Collected: 2018/08/24
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	5703202	N/A	2018/08/29	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	5703208	N/A	2018/08/29	Deonarine Ramnarine

Maxxam ID: HOM908
Sample ID: TRIP BLANK
Matrix: Water

Collected:
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5701017	N/A	2018/08/29	Karen Hughes

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Maxxam Job #: B8L9823
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

GENERAL COMMENTS

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

Package 1	5.0°C

Revised report (2018/12/07): Includes Carbonate/Bicarbonate Alkalinity calculations.

Sample HOM903 [MW17-2D] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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Maxxam Job #: B8L9823
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

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			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5690946	4-Bromofluorobenzene	2018/08/29	95	70 - 130	96	70 - 130	84	%				
5690946	D4-1,2-Dichloroethane	2018/08/29	105	70 - 130	104	70 - 130	103	%				
5690946	D8-Toluene	2018/08/29	103	70 - 130	104	70 - 130	95	%				
5701017	4-Bromofluorobenzene	2018/08/28	105	70 - 130	105	70 - 130	101	%				
5701017	D4-1,2-Dichloroethane	2018/08/28	111	70 - 130	109	70 - 130	108	%				
5701017	D8-Toluene	2018/08/28	105	70 - 130	105	70 - 130	99	%				
5690946	1,4-Dichlorobenzene	2018/08/29	93	70 - 130	94	70 - 130	<0.50	ug/L	NC	30		
5690946	Benzene	2018/08/29	91	70 - 130	92	70 - 130	<0.20	ug/L	5.0	30		
5690946	F1 (C6-C10)	2018/08/29	95	60 - 140	96	60 - 140	<25	ug/L	NC	30		
5690946	Methylene Chloride(Dichloromethane)	2018/08/29	91	70 - 130	92	70 - 130	<2.0	ug/L	NC	30		
5690946	o-Xylene	2018/08/29	86	70 - 130	89	70 - 130	<0.20	ug/L	NC	30		
5690946	p+m-Xylene	2018/08/29	82	70 - 130	86	70 - 130	<0.20	ug/L	NC	30		
5690946	Toluene	2018/08/29	89	70 - 130	93	70 - 130	<0.20	ug/L	13	30		
5690946	Total Xylenes	2018/08/29					<0.20	ug/L	NC	30		
5690946	Vinyl Chloride	2018/08/29	85	70 - 130	86	70 - 130	<0.20	ug/L	NC	30		
5699778	Dissolved Organic Carbon	2018/08/27	94	80 - 120	97	80 - 120	<0.50	mg/L	NC	20		
5700289	Phenols-4AAP	2018/08/27	100	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
5700304	Phenols-4AAP	2018/08/28	96	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
5700415	Dissolved Aluminum (Al)	2018/08/30	108	80 - 120	103	80 - 120	<5.0	ug/L				
5700415	Dissolved Arsenic (As)	2018/08/30	105	80 - 120	103	80 - 120	<1.0	ug/L				
5700415	Dissolved Barium (Ba)	2018/08/30	104	80 - 120	101	80 - 120	<2.0	ug/L				
5700415	Dissolved Boron (B)	2018/08/30	108	80 - 120	101	80 - 120	<10	ug/L				
5700415	Dissolved Cadmium (Cd)	2018/08/30	101	80 - 120	100	80 - 120	<0.10	ug/L				
5700415	Dissolved Calcium (Ca)	2018/08/30	NC	80 - 120	100	80 - 120	<200	ug/L				
5700415	Dissolved Chromium (Cr)	2018/08/30	103	80 - 120	99	80 - 120	<5.0	ug/L				
5700415	Dissolved Copper (Cu)	2018/08/30	105	80 - 120	100	80 - 120	<1.0	ug/L				
5700415	Dissolved Iron (Fe)	2018/08/30	105	80 - 120	102	80 - 120	<100	ug/L				
5700415	Dissolved Lead (Pb)	2018/08/30	96	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		
5700415	Dissolved Magnesium (Mg)	2018/08/30	NC	80 - 120	102	80 - 120	<50	ug/L				
5700415	Dissolved Manganese (Mn)	2018/08/30	102	80 - 120	100	80 - 120	<2.0	ug/L				
5700415	Dissolved Potassium (K)	2018/08/30	109	80 - 120	102	80 - 120	<200	ug/L				

Maxxam Job #: B8L9823
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

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			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5700415	Dissolved Sodium (Na)	2018/08/30	NC	80 - 120	100	80 - 120	<100	ug/L				
5700415	Dissolved Zinc (Zn)	2018/08/30	95	80 - 120	99	80 - 120	<5.0	ug/L				
5700897	Chromium (VI)	2018/08/29	100	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		
5700947	Dissolved Organic Carbon	2018/08/28	95	80 - 120	98	80 - 120	<0.50	mg/L	1.2	20		
5701017	1,4-Dichlorobenzene	2018/08/28	92	70 - 130	113	70 - 130	<0.50	ug/L				
5701017	Benzene	2018/08/28	99	70 - 130	102	70 - 130	<0.20	ug/L	NC	30		
5701017	F1 (C6-C10)	2018/08/28	91	60 - 140	93	60 - 140	<25	ug/L	NC	30		
5701017	Methylene Chloride(Dichloromethane)	2018/08/28	99	70 - 130	101	70 - 130	<2.0	ug/L				
5701017	o-Xylene	2018/08/28	83	70 - 130	88	70 - 130	<0.20	ug/L	NC	30		
5701017	p+m-Xylene	2018/08/28	84	70 - 130	89	70 - 130	<0.20	ug/L	NC	30		
5701017	Toluene	2018/08/28	91	70 - 130	95	70 - 130	<0.20	ug/L	NC	30		
5701017	Total Xylenes	2018/08/28					<0.20	ug/L	NC	30		
5701017	Vinyl Chloride	2018/08/28	101	70 - 130	107	70 - 130	<0.20	ug/L				
5701312	Total Ammonia-N	2018/08/28	95	75 - 125	100	80 - 120	<0.050	mg/L	NC	20		
5701545	Nitrate (N)	2018/08/28	99	80 - 120	95	80 - 120	<0.10	mg/L	NC	20		
5701545	Nitrite (N)	2018/08/28	92	80 - 120	99	80 - 120	<0.010	mg/L	NC	20		
5701551	Dissolved Chloride (Cl-)	2018/08/28	NC	80 - 120	100	80 - 120	<1.0	mg/L	0.18	20		
5701555	Dissolved Sulphate (SO4)	2018/08/28	NC	75 - 125	103	80 - 120	<1.0	mg/L	0.91	20		
5702010	Total Phosphorus	2018/08/28	94	80 - 120	91	80 - 120	<0.004	mg/L	12	20	94	80 - 120
5702250	Phenols-4AAP	2018/08/28	98	80 - 120	97	80 - 120	<0.0010	mg/L	NC	20		
5702314	Total Ammonia-N	2018/08/30	NC	75 - 125	103	80 - 120	<0.050	mg/L	0.79	20		
5702667	Total Kjeldahl Nitrogen (TKN)	2018/08/29	NC	80 - 120	95	80 - 120	<0.10	mg/L	0.27	20	95	80 - 120
5702705	Total Chemical Oxygen Demand (COD)	2018/08/30	105	80 - 120	102	80 - 120	<4.0	mg/L	NC	20		
5702708	Total Chemical Oxygen Demand (COD)	2018/08/28	96	80 - 120	99	80 - 120	<4.0	mg/L	NC	20		
5703202	Dissolved Chloride (Cl-)	2018/08/29	NC	80 - 120	100	80 - 120	<1.0	mg/L	0.19	20		
5703208	Dissolved Sulphate (SO4)	2018/08/29	NC	75 - 125	103	80 - 120	<1.0	mg/L	0.87	20		
5703342	Alkalinity (Total as CaCO3)	2018/08/29			97	85 - 115	<1.0	mg/L	0.26	20		
5703346	Conductivity	2018/08/29			103	85 - 115	<1.0	umho/cm	1.1	25		
5703354	pH	2018/08/29			101	98 - 103			0.26	N/A		

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L9823
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5704903	Mercury (Hg)	2018/08/29	85	75 - 125	96	80 - 120	<0.0001	mg/L	NC	20		

N/A = Not Applicable

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

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

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

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Maxxam Job #: B8L9823
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Sampler Initials: MC

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Cristina Carriere, Scientific Service Specialist

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

Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706
Site Location: Walker Landfill
Your C.O.C. #: 678720-03-01

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515945
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

DRAFT

MAXXAM JOB #: B8L9864
Received: 2018/08/24, 16:51

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	2	N/A	2018/08/28	CAM SOP-00448	SM 23 2320 B m
Alkalinity	3	N/A	2018/08/29	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	5	N/A	2018/12/07	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	5	N/A	2018/08/28	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand	5	N/A	2018/08/29	CAM SOP-00416	SM 23 5220 D m
Conductivity	2	N/A	2018/08/28	CAM SOP-00414	SM 23 2510 m
Conductivity	3	N/A	2018/08/29	CAM SOP-00414	SM 23 2510 m
Chromium 3+ by calculation	5	2018/08/25	2018/08/31		
Chromium (VI) in Water	5	N/A	2018/08/30	CAM SOP-00436	EPA 7199 m
Dissolved Organic Carbon (DOC) (1)	5	N/A	2018/08/29	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	5	N/A	2018/08/31	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	2	2018/08/29	2018/08/30	CAM SOP-00453	EPA 7470A m
Mercury in Water by CVAA	3	2018/08/30	2018/08/30	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	5	N/A	2018/08/30	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	5	N/A	2018/08/31	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	5	N/A	2018/08/28	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	2	N/A	2018/08/28	CAM SOP-00413	SM 4500H+ B m
pH	3	N/A	2018/08/29	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	5	N/A	2018/08/28	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	5	N/A	2018/08/28	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	5	N/A	2018/08/31		
Total Kjeldahl Nitrogen in Water	5	2018/08/28	2018/08/30	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	5	2018/08/28	2018/08/28	CAM SOP-00407	SM 23 4500 P B H m
Volatile Organic Compounds and F1 PHCs	5	N/A	2018/08/29	CAM SOP-00230	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

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CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8L9864
Received: 2018/08/24, 16:51

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

DRAFT

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: CGripton@maxxam.ca
Phone# (800)268-7396 Ext:250
==
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
A Bureau Veritas Group Company

Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		HON203			HON203			HON204		
Sampling Date		2018/08/23 11:50			2018/08/23 11:50			2018/08/23 13:30		
COC Number		678720-03-01			678720-03-01			678720-03-01		
	UNITS	**MW17-1B**	**RDL**	**QC Batch**	**MW17-1B Lab-Dup**	**RDL**	**QC Batch**	**MW17-1A**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	180	1.0	5874605				200	1.0	5874605
Calculated TDS	mg/L	200	1.0	5699452				390	1.0	5699452
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.3	1.0	5874605				2.1	1.0	5874605
Hardness (CaCO3)	mg/L	140	1.0	5699432				240	1.0	5699432
Inorganics										
Total Ammonia-N	mg/L	0.16	0.050	5702323				0.34	0.050	5702323
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5702296				<4.0	4.0	5702296
Conductivity	umho/cm	350	1.0	5703346				670	1.0	5703346
Total Kjeldahl Nitrogen (TKN)	mg/L	0.19	0.10	5702721				0.34	0.10	5702721
Dissolved Organic Carbon	mg/L	0.62	0.50	5701273				0.82	0.50	5701273
pH	pH	8.13		5703354				8.04		5703354
Phenols-4AAP	mg/L	<0.0010	0.0010	5702250				<0.0010	0.0010	5702250
Total Phosphorus	mg/L	0.008	0.004	5702015	0.006	0.004	5702015	0.051	0.004	5702015
Dissolved Sulphate (SO4)	mg/L	8.0	1.0	5701067				99	1.0	5701067
Alkalinity (Total as CaCO3)	mg/L	180	1.0	5703342				210	1.0	5703342
Dissolved Chloride (Cl-)	mg/L	<1.0	1.0	5701060				27	1.0	5701060
Nitrite (N)	mg/L	<0.010	0.010	5700895				<0.010	0.010	5701545
Nitrate (N)	mg/L	<0.10	0.10	5700895				<0.10	0.10	5701545
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5700895				<0.10	0.10	5701545

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		HON204			HON205			HON206		
Sampling Date		2018/08/23 13:30			2018/08/23 10:55			2018/08/23 09:30		
COC Number		678720-03-01			678720-03-01			678720-03-01		
	UNITS	**MW17-1A Lab-Dup**	**RDL**	**QC Batch**	**MW17-1C**	**RDL**	**QC Batch**	**MW17-1D**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				190	1.0	5874605	180	1.0	5874605
Calculated TDS	mg/L				210	1.0	5699452	270	1.0	5699452
Carb. Alkalinity (calc. as CaCO3)	mg/L				2.3	1.0	5874605	2.3	1.0	5874605
Hardness (CaCO3)	mg/L				160	1.0	5699432	210	1.0	5699432
Inorganics										
Total Ammonia-N	mg/L				0.20	0.050	5702323	0.32	0.050	5702323
Total Chemical Oxygen Demand (COD)	mg/L				<4.0	4.0	5702296	<4.0	4.0	5702296
Conductivity	umho/cm	660	1.0	5703346	370	1.0	5701079	470	1.0	5703346
Total Kjeldahl Nitrogen (TKN)	mg/L				0.21	0.10	5702721	0.42	0.10	5702283
Dissolved Organic Carbon	mg/L				0.72	0.50	5701273	0.69	0.50	5701273
pH	pH	8.06		5703354	8.11		5701081	8.12		5703354
Phenols-4AAP	mg/L				<0.0010	0.0010	5702250	<0.0010	0.0010	5702250
Total Phosphorus	mg/L				0.026	0.004	5702015	0.68	0.02	5702015
Dissolved Sulphate (SO4)	mg/L				11	1.0	5701067	41	1.0	5701067
Alkalinity (Total as CaCO3)	mg/L	210	1.0	5703342	190	1.0	5701073	190	1.0	5703342
Dissolved Chloride (Cl-)	mg/L				1.2	1.0	5701060	18	1.0	5701060
Nitrite (N)	mg/L				<0.010	0.010	5700895	<0.010	0.010	5700895
Nitrate (N)	mg/L				<0.10	0.10	5700895	<0.10	0.10	5700895
Nitrate + Nitrite (N)	mg/L				<0.10	0.10	5700895	<0.10	0.10	5700895

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

DRAFT

Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		HON207		
Sampling Date		2018/08/23 15:30		
COC Number		678720-03-01		
	UNITS	**MW17-5A**	**RDL**	**QC Batch**
Calculated Parameters				
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	230	1.0	5876590
Calculated TDS	mg/L	810	1.0	5699452
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.8	1.0	5876590
Hardness (CaCO3)	mg/L	470	1.0	5699432
Inorganics				
Total Ammonia-N	mg/L	0.31	0.050	5702323
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5702296
Conductivity	umho/cm	1300	1.0	5701079
Total Kjeldahl Nitrogen (TKN)	mg/L	0.38	0.10	5703101
Dissolved Organic Carbon	mg/L	1.3	0.50	5701273
pH	pH	7.92		5701081
Phenols-4AAP	mg/L	<0.0010	0.0010	5702250
Total Phosphorus	mg/L	0.012	0.004	5702015
Dissolved Sulphate (SO4)	mg/L	330	1.0	5701067
Alkalinity (Total as CaCO3)	mg/L	230	1.0	5701073
Dissolved Chloride (Cl-)	mg/L	81	1.0	5701060
Nitrite (N)	mg/L	<0.010	0.010	5700895
Nitrate (N)	mg/L	<0.10	0.10	5700895
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5700895

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

DRAFT

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		HON203	HON204		HON205			HON205		
Sampling Date		2018/08/23 11:50	2018/08/23 13:30		2018/08/23 10:55			2018/08/23 10:55		
COC Number		678720-03-01	678720-03-01		678720-03-01			678720-03-01		
	UNITS	**MW17-1B**	**MW17-1A**	**QC Batch**	**MW17-1C**	**RDL**	**QC Batch**	**MW17-1C Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	<5	5699451	<5	5	5699451			
Metals										
Chromium (VI)	ug/L	<0.50	<0.50	5702901	<0.50	0.50	5702901	<0.50	0.50	5702901
Mercury (Hg)	mg/L	<0.0001	<0.0001	5707040	<0.0001	0.0001	5705033			
Dissolved Aluminum (Al)	ug/L	5.3	18	5701180	<5.0	5.0	5701180			
Dissolved Arsenic (As)	ug/L	<1.0	1.0	5701180	4.1	1.0	5701180			
Dissolved Barium (Ba)	ug/L	94	78	5701180	100	2.0	5701180			
Dissolved Boron (B)	ug/L	60	93	5701180	39	10	5701180			
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	5701180	<0.10	0.10	5701180			
Dissolved Calcium (Ca)	ug/L	25000	45000	5701180	34000	200	5701180			
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	5701180	<5.0	5.0	5701180			
Dissolved Copper (Cu)	ug/L	<1.0	<1.0	5701180	<1.0	1.0	5701180			
Dissolved Iron (Fe)	ug/L	<100	190	5701180	300	100	5701180			
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	5701180	<0.50	0.50	5701180			
Dissolved Magnesium (Mg)	ug/L	19000	31000	5701180	19000	50	5701180			
Dissolved Manganese (Mn)	ug/L	<2.0	8.0	5701180	8.4	2.0	5701180			
Dissolved Potassium (K)	ug/L	1200	2400	5701180	1100	200	5701180			
Dissolved Sodium (Na)	ug/L	20000	46000	5701180	17000	100	5701180			
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	5701180	<5.0	5.0	5701180			

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

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Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		HON206			HON207			HON207		
Sampling Date		2018/08/23 09:30			2018/08/23 15:30			2018/08/23 15:30		
COC Number		678720-03-01			678720-03-01			678720-03-01		
	UNITS	**MW17-1D**	**RDL**	**QC Batch**	**MW17-5A**	**RDL**	**QC Batch**	**MW17-5A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	5	5699451	<5	5	5699451			
Metals										
Chromium (VI)	ug/L	<0.50	0.50	5702901	<0.50	0.50	5702901			
Mercury (Hg)	mg/L	<0.0001	0.0001	5705033	<0.0001	0.0001	5707040	<0.0001	0.0001	5707040
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	5701180	5.8	5.0	5701180			
Dissolved Arsenic (As)	ug/L	11	1.0	5701180	<1.0	1.0	5701180			
Dissolved Barium (Ba)	ug/L	53	2.0	5701180	13	2.0	5701180			
Dissolved Boron (B)	ug/L	32	10	5701180	150	10	5701180			
Dissolved Cadmium (Cd)	ug/L	<0.10	0.10	5701180	<0.10	0.10	5701180			
Dissolved Calcium (Ca)	ug/L	39000	200	5701180	81000	1000	5701180			
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	5701180	<5.0	5.0	5701180			
Dissolved Copper (Cu)	ug/L	<1.0	1.0	5701180	<1.0	1.0	5701180			
Dissolved Iron (Fe)	ug/L	170	100	5701180	160	100	5701180			
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5701180	<0.50	0.50	5701180			
Dissolved Magnesium (Mg)	ug/L	26000	50	5701180	65000	50	5701180			
Dissolved Manganese (Mn)	ug/L	12	2.0	5701180	2.3	2.0	5701180			
Dissolved Potassium (K)	ug/L	1100	200	5701180	3700	200	5701180			
Dissolved Sodium (Na)	ug/L	17000	100	5701180	94000	100	5701180			
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5701180	<5.0	5.0	5701180			

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

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Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		HON203	HON204	HON205	HON206	HON207		
Sampling Date		2018/08/23 11:50	2018/08/23 13:30	2018/08/23 10:55	2018/08/23 09:30	2018/08/23 15:30		
COC Number		678720-03-01	678720-03-01	678720-03-01	678720-03-01	678720-03-01		
	UNITS	**MW17-1B**	**MW17-1A**	**MW17-1C**	**MW17-1D**	**MW17-5A**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5701017
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5701017
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5701017
Toluene	ug/L	<0.20	<0.20	<0.20	0.30	<0.20	0.20	5701017
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5701017
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5701017
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5701017
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5701017
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5701017
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	87	90	84	84	89		5701017
D4-1,2-Dichloroethane	%	102	101	102	100	103		5701017
D8-Toluene	%	99	99	98	100	98		5701017

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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A Bureau Veritas Group Company

Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HON203
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5703342	N/A	2018/08/29	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5701060	N/A	2018/08/28	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702296	N/A	2018/08/29	Shivani Shivani
Conductivity	AT	5703346	N/A	2018/08/29	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5702901	N/A	2018/08/30	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5701273	N/A	2018/08/29	Nimarta Singh
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5707040	2018/08/30	2018/08/30	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5701180	N/A	2018/08/30	Thao Nguyen
Total Ammonia-N	LACH/NH4	5702323	N/A	2018/08/31	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5700895	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5703354	N/A	2018/08/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5702250	N/A	2018/08/28	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5701067	N/A	2018/08/28	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5702721	2018/08/28	2018/08/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702015	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5701017	N/A	2018/08/29	Karen Hughes

DRAFT

Maxxam ID: HON203 Dup
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	5702015	2018/08/28	2018/08/28	Amanpreet Sappal

Maxxam ID: HON204
Sample ID: MW17-1A
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5703342	N/A	2018/08/29	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5701060	N/A	2018/08/28	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702296	N/A	2018/08/29	Shivani Shivani
Conductivity	AT	5703346	N/A	2018/08/29	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5702901	N/A	2018/08/30	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5701273	N/A	2018/08/29	Nimarta Singh
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5707040	2018/08/30	2018/08/30	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5701180	N/A	2018/08/30	Thao Nguyen

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Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HON204
Sample ID: MW17-1A
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5702323	N/A	2018/08/31	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5701545	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5703354	N/A	2018/08/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5702250	N/A	2018/08/28	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5701067	N/A	2018/08/28	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5702721	2018/08/28	2018/08/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702015	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5701017	N/A	2018/08/29	Karen Hughes

Maxxam ID: HON204 Dup
Sample ID: MW17-1A
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5703342	N/A	2018/08/29	Neil Dassanayake
Conductivity	AT	5703346	N/A	2018/08/29	Neil Dassanayake
pH	AT	5703354	N/A	2018/08/29	Neil Dassanayake

Maxxam ID: HON205
Sample ID: MW17-1C
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5701073	N/A	2018/08/28	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5701060	N/A	2018/08/28	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702296	N/A	2018/08/29	Shivani Shivani
Conductivity	AT	5701079	N/A	2018/08/28	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5702901	N/A	2018/08/30	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5701273	N/A	2018/08/29	Nimarta Singh
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5705033	2018/08/29	2018/08/30	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5701180	N/A	2018/08/30	Thao Nguyen
Total Ammonia-N	LACH/NH4	5702323	N/A	2018/08/31	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5700895	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5701081	N/A	2018/08/28	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5702250	N/A	2018/08/28	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5701067	N/A	2018/08/28	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5702721	2018/08/28	2018/08/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702015	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5701017	N/A	2018/08/29	Karen Hughes

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Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HON205 Dup
Sample ID: MW17-1C
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5702901	N/A	2018/08/30	Lang Le

Maxxam ID: HON206
Sample ID: MW17-1D
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5703342	N/A	2018/08/29	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5701060	N/A	2018/08/28	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702296	N/A	2018/08/29	Shivani Shivani
Conductivity	AT	5703346	N/A	2018/08/29	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5702901	N/A	2018/08/30	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5701273	N/A	2018/08/29	Nimarta Singh
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5705033	2018/08/29	2018/08/30	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5701180	N/A	2018/08/30	Thao Nguyen
Total Ammonia-N	LACH/NH4	5702323	N/A	2018/08/31	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5700895	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5703354	N/A	2018/08/29	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5702250	N/A	2018/08/28	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5701067	N/A	2018/08/28	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5702283	2018/08/28	2018/08/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702015	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5701017	N/A	2018/08/29	Karen Hughes

Maxxam ID: HON207
Sample ID: MW17-5A
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5701073	N/A	2018/08/28	Neil Dassanayake
Carbonate, Bicarbonate and Hydroxide	CALC	5876590	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5701060	N/A	2018/08/28	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5702296	N/A	2018/08/29	Shivani Shivani
Conductivity	AT	5701079	N/A	2018/08/28	Neil Dassanayake
Chromium 3+ by calculation		5699451	2018/08/31	2018/08/31	Automated Statchk
Chromium (VI) in Water	IC	5702901	N/A	2018/08/30	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5701273	N/A	2018/08/29	Nimarta Singh
Hardness (calculated as CaCO3)		5699432	N/A	2018/08/31	Automated Statchk
Mercury in Water by CVAA	CV/AA	5707040	2018/08/30	2018/08/30	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5701180	N/A	2018/08/30	Thao Nguyen

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Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: HON207
Sample ID: MW17-5A
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5702323	N/A	2018/08/31	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5700895	N/A	2018/08/28	Charles Opoku-Ware
pH	AT	5701081	N/A	2018/08/28	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	5702250	N/A	2018/08/28	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5701067	N/A	2018/08/28	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5699452	N/A	2018/08/31	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5703101	2018/08/28	2018/08/30	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5702015	2018/08/28	2018/08/28	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5701017	N/A	2018/08/29	Karen Hughes

Maxxam ID: HON207 Dup
Sample ID: MW17-5A
Matrix: Water

Collected: 2018/08/23
Shipped:
Received: 2018/08/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury in Water by CVAA	CV/AA	5707040	2018/08/30	2018/08/30	Ron Morrison

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Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

GENERAL COMMENTS

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

Package 1	9.7°C

Revised report (2018/12/07): Includes Carbonate/Bicarbonate Alkalinity calculations.

Results relate only to the items tested.

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Maxxam Job #: B8L9864
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5701017	4-Bromofluorobenzene	2018/08/28	105	70 - 130	105	70 - 130	101	%				
5701017	D4-1,2-Dichloroethane	2018/08/28	111	70 - 130	109	70 - 130	108	%				
5701017	D8-Toluene	2018/08/28	105	70 - 130	105	70 - 130	99	%				
5700895	Nitrate (N)	2018/08/28	98	80 - 120	96	80 - 120	<0.10	mg/L	NC	20		
5700895	Nitrite (N)	2018/08/28	101	80 - 120	99	80 - 120	<0.010	mg/L	NC	20		
5701017	1,4-Dichlorobenzene	2018/08/28	92	70 - 130	113	70 - 130	<0.50	ug/L				
5701017	Benzene	2018/08/28	99	70 - 130	102	70 - 130	<0.20	ug/L	NC	30		
5701017	F1 (C6-C10)	2018/08/28	91	60 - 140	93	60 - 140	<25	ug/L	NC	30		
5701017	Methylene Chloride(Dichloromethane)	2018/08/28	99	70 - 130	101	70 - 130	<2.0	ug/L				
5701017	o-Xylene	2018/08/28	83	70 - 130	88	70 - 130	<0.20	ug/L	NC	30		
5701017	p+m-Xylene	2018/08/28	84	70 - 130	89	70 - 130	<0.20	ug/L	NC	30		
5701017	Toluene	2018/08/28	91	70 - 130	95	70 - 130	<0.20	ug/L	NC	30		
5701017	Total Xylenes	2018/08/28					<0.20	ug/L	NC	30		
5701017	Vinyl Chloride	2018/08/28	101	70 - 130	107	70 - 130	<0.20	ug/L				
5701060	Dissolved Chloride (Cl-)	2018/08/28	NC	80 - 120	100	80 - 120	<1.0	mg/L	2.2	20		
5701067	Dissolved Sulphate (SO4)	2018/08/28	NC	75 - 125	105	80 - 120	<1.0	mg/L	2.0	20		
5701073	Alkalinity (Total as CaCO3)	2018/08/28			97	85 - 115	<1.0	mg/L	1.4	20		
5701079	Conductivity	2018/08/28			102	85 - 115	<1.0	umho/cm	0.064	25		
5701081	pH	2018/08/28			102	98 - 103			0.32	N/A		
5701180	Dissolved Aluminum (Al)	2018/08/30	106	80 - 120	103	80 - 120	<5.0	ug/L				
5701180	Dissolved Arsenic (As)	2018/08/30	105	80 - 120	100	80 - 120	<1.0	ug/L				
5701180	Dissolved Barium (Ba)	2018/08/30	106	80 - 120	102	80 - 120	<2.0	ug/L				
5701180	Dissolved Boron (B)	2018/08/30	106	80 - 120	101	80 - 120	<10	ug/L				
5701180	Dissolved Cadmium (Cd)	2018/08/30	104	80 - 120	99	80 - 120	<0.10	ug/L				
5701180	Dissolved Calcium (Ca)	2018/08/30	NC	80 - 120	101	80 - 120	<200	ug/L				
5701180	Dissolved Chromium (Cr)	2018/08/30	102	80 - 120	98	80 - 120	<5.0	ug/L				
5701180	Dissolved Copper (Cu)	2018/08/30	103	80 - 120	100	80 - 120	<1.0	ug/L				
5701180	Dissolved Iron (Fe)	2018/08/30	105	80 - 120	100	80 - 120	<100	ug/L	NC	20		
5701180	Dissolved Lead (Pb)	2018/08/30	101	80 - 120	99	80 - 120	<0.50	ug/L				
5701180	Dissolved Magnesium (Mg)	2018/08/30	100	80 - 120	102	80 - 120	<50	ug/L				

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Maxxam Job #: B8L9864
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**% Recovery**	**QC Limits**	**Value**	**UNITS**	**Value (%)**	**QC Limits**	**% Recovery**	**QC Limits**
5701180	Dissolved Manganese (Mn)	2018/08/30	104	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
5701180	Dissolved Potassium (K)	2018/08/30	106	80 - 120	102	80 - 120	<200	ug/L				
5701180	Dissolved Sodium (Na)	2018/08/30	103	80 - 120	100	80 - 120	<100	ug/L				
5701180	Dissolved Zinc (Zn)	2018/08/30	101	80 - 120	97	80 - 120	<5.0	ug/L				
5701273	Dissolved Organic Carbon	2018/08/28	94	80 - 120	97	80 - 120	<0.50	mg/L	0.69	20		
5701545	Nitrate (N)	2018/08/28	99	80 - 120	95	80 - 120	<0.10	mg/L	NC	20		
5701545	Nitrite (N)	2018/08/28	92	80 - 120	99	80 - 120	<0.010	mg/L	NC	20		
5702015	Total Phosphorus	2018/08/28	92	80 - 120	94	80 - 120	<0.004	mg/L	NC	20	97	80 - 120
5702250	Phenols-4AAP	2018/08/28	98	80 - 120	97	80 - 120	<0.0010	mg/L	NC	20		
5702283	Total Kjeldahl Nitrogen (TKN)	2018/08/31	100	80 - 120	103	80 - 120	<0.10	mg/L	NC (1)	20	102	80 - 120
5702296	Total Chemical Oxygen Demand (COD)	2018/08/29	98	80 - 120	96	80 - 120	<4.0	mg/L	0	20		
5702323	Total Ammonia-N	2018/08/31	97	75 - 125	101	80 - 120	<0.050	mg/L	2.9	20		
5702721	Total Kjeldahl Nitrogen (TKN)	2018/08/31	86	80 - 120	104	80 - 120	<0.10	mg/L	NC (1)	20	102	80 - 120
5702901	Chromium (VI)	2018/08/30	100	80 - 120	101	80 - 120	<0.50	ug/L	NC	20		
5703101	Total Kjeldahl Nitrogen (TKN)	2018/08/31	NC	80 - 120	100	80 - 120	<0.10	mg/L	2.0	20	102	80 - 120
5703342	Alkalinity (Total as CaCO3)	2018/08/29			97	85 - 115	<1.0	mg/L	0.26	20		
5703346	Conductivity	2018/08/29			103	85 - 115	<1.0	umho/cm	1.1	25		
5703354	pH	2018/08/29			101	98 - 103			0.26	N/A		
5705033	Mercury (Hg)	2018/08/30	99	75 - 125	93	80 - 120	<0.0001	mg/L	NC	20		

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Maxxam Job #: B8L9864
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5707040	Mercury (Hg)	2018/08/30	98	75 - 125	93	80 - 120	<0.0001	mg/L	NC	20		

N/A = Not Applicable

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

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

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

(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Maxxam
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Maxxam Job #: B8L9864
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Cristina Carriere, Scientific Service Specialist

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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Maxxam
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Your Project #: 1664706
Site Location: Walker Landfill

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Your C.O.C. #: 694194-01-01, 694194-02-01, 694194-03-01

Report Date: 2018/12/07
Report #: R5516631
Version: 1 - Final

DRAFT

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8W1363
Received: 2018/11/30, 14:55

Sample Matrix: Water
Samples Received: 21

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	19	N/A	2018/12/04	CAM SOP-00448	SM 23 2320 B m
Alkalinity	1	N/A	2018/12/05	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	20	N/A	2018/12/06	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	11	N/A	2018/12/04	CAM SOP-00463	EPA 325.2 m
Chloride by Automated Colourimetry	9	N/A	2018/12/05	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand	4	N/A	2018/12/03	CAM SOP-00416	SM 23 5220 D m
Chemical Oxygen Demand	15	N/A	2018/12/04	CAM SOP-00416	SM 23 5220 D m
Chemical Oxygen Demand	1	N/A	2018/12/05	CAM SOP-00416	SM 23 5220 D m
Conductivity	20	N/A	2018/12/04	CAM SOP-00414	SM 23 2510 m
Chromium 3+ by calculation	20	2018/12/01	2018/12/05		
Chromium (VI) in Water	20	N/A	2018/12/04	CAM SOP-00436	EPA 7199 m
Dissolved Organic Carbon (DOC) (1)	13	N/A	2018/12/04	CAM SOP-00446	SM 23 5310 B m
Dissolved Organic Carbon (DOC) (1)	7	N/A	2018/12/05	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	20	N/A	2018/12/04	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA	10	2018/12/04	2018/12/04	CAM SOP-00453	EPA 7470A m
Mercury in Water by CVAA	10	2018/12/04	2018/12/05	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	20	N/A	2018/12/03	CAM SOP-00447	EPA 6020B m
Total Ammonia-N	4	N/A	2018/12/04	CAM SOP-00441	EPA GS I-2522-90 m
Total Ammonia-N	15	N/A	2018/12/05	CAM SOP-00441	EPA GS I-2522-90 m
Total Ammonia-N	1	N/A	2018/12/07	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	20	N/A	2018/12/04	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	19	N/A	2018/12/04	CAM SOP-00413	SM 4500H+ B m
pH	1	N/A	2018/12/05	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	15	N/A	2018/12/03	CAM SOP-00444	OMOE E3179 m
Phenols (4AAP)	1	N/A	2018/12/04	CAM SOP-00444	OMOE E3179 m
Phenols (4AAP)	4	N/A	2018/12/05	CAM SOP-00444	OMOE E3179 m

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

Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706
Site Location: Walker Landfill

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Your C.O.C. #: 694194-01-01, 694194-02-01, 694194-03-01

Report Date: 2018/12/07
Report #: R5516631
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8W1363
Received: 2018/11/30, 14:55

Sample Matrix: Water
Samples Received: 21

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Sulphate by Automated Colourimetry	11	N/A	2018/12/04	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	9	N/A	2018/12/05	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	20	N/A	2018/12/05		
Total Kjeldahl Nitrogen in Water	4	2018/12/03	2018/12/04	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	9	2018/12/04	2018/12/04	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	6	2018/12/04	2018/12/05	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	1	2018/12/07	2018/12/07	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	4	2018/12/03	2018/12/05	CAM SOP-00407	SM 23 4500 P B H m
Total Phosphorus (Colourimetric)	16	2018/12/04	2018/12/05	CAM SOP-00407	SM 23 4500 P B H m
Volatile Organic Compounds and F1 PHCs	19	N/A	2018/12/05	CAM SOP-00230	EPA 8260C m
Volatile Organic Compounds and F1 PHCs	2	N/A	2018/12/06	CAM SOP-00230	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

DRAFT

Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706
Site Location: Walker Landfill

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Your C.O.C. #: 694194-01-01, 694194-02-01, 694194-03-01

Report Date: 2018/12/07
Report #: R5516631
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8W1363
Received: 2018/11/30, 14:55

Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

DRAFT

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: CGripton@maxxam.ca
Phone# (800)268-7396 Ext:250
==

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
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB722		ILB723		ILB724		
Sampling Date		2018/11/28 13:05		2018/11/28 14:55		2018/11/28 12:00		
COC Number		694194-01-01		694194-01-01		694194-01-01		
	UNITS	**MW17-1A**	**RDL**	**MW17-1B**	**RDL**	**MW17-1C**	**RDL**	**QC Batch**
Calculated Parameters								
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	200	1.0	170	1.0	180	1.0	5874605
Calculated TDS	mg/L	450	1.0	190	1.0	210	1.0	5866765
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.7	1.0	1.7	1.0	2.1	1.0	5874605
Hardness (CaCO3)	mg/L	270	1.0	140	1.0	160	1.0	5866760
Inorganics								
Total Ammonia-N	mg/L	0.36 (1)	0.050	0.19	0.050	0.23	0.050	5870269
Total Chemical Oxygen Demand (COD)	mg/L	5.1	4.0	<4.0	4.0	<4.0	4.0	5870030
Conductivity	umho/cm	780	1.0	350	1.0	380	1.0	5868220
Total Kjeldahl Nitrogen (TKN)	mg/L	0.32 (1)	0.10	0.13	0.10	0.10	0.10	5870331
Dissolved Organic Carbon	mg/L	1.0	0.50	0.80	0.50	0.82	0.50	5868470
pH	pH	7.95		8.03		8.07		5868222
Phenols-4AAP	mg/L	<0.0010	0.0010	<0.0010	0.0010	<0.0010	0.0010	5867779
Total Phosphorus	mg/L	0.05	0.02	0.011	0.004	0.033	0.008	5869889
Dissolved Sulphate (SO4)	mg/L	140	1.0	11	1.0	9.6	1.0	5869076
Alkalinity (Total as CaCO3)	mg/L	210	1.0	170	1.0	190	1.0	5868214
Dissolved Chloride (Cl-)	mg/L	35	1.0	<1.0	1.0	<1.0	1.0	5869049
Nitrite (N)	mg/L	<0.010	0.010	<0.010	0.010	<0.010	0.010	5868292
Nitrate (N)	mg/L	<0.10	0.10	<0.10	0.10	<0.10	0.10	5868292
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	<0.10	0.10	<0.10	0.10	5868292

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

DRAFT

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB724			ILB725			ILB726		
Sampling Date		2018/11/28 12:00			2018/11/28 14:45			2018/11/29 10:00		
COC Number		694194-01-01			694194-01-01			694194-01-01		
	UNITS	**MW17-1C Lab-Dup**	**RDL**	**QC Batch**	**MW17-1D**	**RDL**	**QC Batch**	**MW17-2A**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				180	1.0	5874605	170	1.0	5874605
Calculated TDS	mg/L				270	1.0	5866765	470	1.0	5866765
Carb. Alkalinity (calc. as CaCO3)	mg/L				2.0	1.0	5874605	1.3	1.0	5874605
Hardness (CaCO3)	mg/L				210	1.0	5866760	300	1.0	5866760
Inorganics										
Total Ammonia-N	mg/L				0.38 (1)	0.050	5870168	0.082	0.050	5870269
Total Chemical Oxygen Demand (COD)	mg/L				<4.0	4.0	5870030	<4.0	4.0	5870030
Conductivity	umho/cm				480	1.0	5868220	830	1.0	5868220
Total Kjeldahl Nitrogen (TKN)	mg/L	0.18	0.10	5870331	0.32	0.10	5876435	0.10	0.10	5870331
Dissolved Organic Carbon	mg/L				1.4	0.50	5868470	0.95	0.50	5868484
pH	pH				8.08		5868222	7.93		5868222
Phenols-4AAP	mg/L				<0.0010	0.0010	5867779	<0.0010	0.0010	5867779
Total Phosphorus	mg/L				1.4	0.2	5869889	0.006	0.004	5869889
Dissolved Sulphate (SO4)	mg/L				39	1.0	5869076	140	1.0	5869657
Alkalinity (Total as CaCO3)	mg/L				180	1.0	5868214	170	1.0	5868214
Dissolved Chloride (Cl-)	mg/L				20	1.0	5869049	70	1.0	5869643
Nitrite (N)	mg/L				<0.010	0.010	5868292	0.041	0.010	5868292
Nitrate (N)	mg/L				<0.10	0.10	5868292	0.35	0.10	5868292
Nitrate + Nitrite (N)	mg/L				<0.10	0.10	5868292	0.39	0.10	5868292

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

DRAFT

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB727			ILB728		
Sampling Date		2018/11/29 11:00			2018/11/29 10:55		
COC Number		694194-01-01			694194-01-01		
	UNITS	**MW17-2B**	**RDL**	**QC Batch**	**MW17-2C**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	160	1.0	5874605	250	1.0	5874605
Calculated TDS	mg/L	470	1.0	5866765	340	1.0	5866765
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.3	1.0	5874605	1.7	1.0	5874605
Hardness (CaCO3)	mg/L	290	1.0	5866760	300	1.0	5866760
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	5870269	<0.050	0.050	5870269
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5870030	<4.0	4.0	5870030
Conductivity	umho/cm	820	1.0	5868220	600	1.0	5868220
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5870331	<0.50 (1)	0.50	5870331
Dissolved Organic Carbon	mg/L	0.97	0.50	5868484	0.72	0.50	5868484
pH	pH	7.92		5868222	7.85		5868222
Phenols-4AAP	mg/L	<0.0010	0.0010	5867788	<0.0010	0.0010	5867779
Total Phosphorus	mg/L	<0.004	0.004	5869889	0.051	0.008	5869889
Dissolved Sulphate (SO4)	mg/L	140	1.0	5869076	14	1.0	5869657
Alkalinity (Total as CaCO3)	mg/L	160	1.0	5868214	250	1.0	5868214
Dissolved Chloride (Cl-)	mg/L	71	1.0	5869049	12	1.0	5869643
Nitrite (N)	mg/L	0.027	0.010	5868292	<0.010	0.010	5868292
Nitrate (N)	mg/L	0.70	0.10	5868292	9.92	0.10	5868292
Nitrate + Nitrite (N)	mg/L	0.72	0.10	5868292	9.92	0.10	5868292

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB729			ILB730			ILB730		
Sampling Date		2018/11/29 09:30			2018/11/30 10:37			2018/11/30 10:37		
COC Number		694194-01-01			694194-01-01			694194-01-01		
	UNITS	**MW17-2D**	**RDL**	**QC Batch**	**MW17-3A**	**RDL**	**QC Batch**	**MW17-3A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	270	1.0	5874605	170	1.0	5874605			
Calculated TDS	mg/L	360	1.0	5866765	450	1.0	5866765			
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.9	1.0	5874605	1.8	1.0	5874605			
Hardness (CaCO3)	mg/L	320	1.0	5866760	290	1.0	5866760			
Inorganics										
Total Ammonia-N	mg/L	0.15	0.050	5870269	0.074	0.050	5870269			
Total Chemical Oxygen Demand (COD)	mg/L	4.8	4.0	5870030	<4.0	4.0	5870030			
Conductivity	umho/cm	630	1.0	5868220	800	1.0	5868220			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.71	0.50	5870331	<0.10	0.10	5870331			
Dissolved Organic Carbon	mg/L	0.69	0.50	5868484	1.1	0.50	5868470			
pH	pH	7.87		5868222	8.06		5868222			
Phenols-4AAP	mg/L	<0.0010	0.0010	5867784	<0.0010	0.0010	5867788			
Total Phosphorus	mg/L	7.1	0.8	5869889	<0.004	0.004	5869889	<0.004	0.004	5869889
Dissolved Sulphate (SO4)	mg/L	13	1.0	5869657	130	1.0	5869076	120	1.0	5869076
Alkalinity (Total as CaCO3)	mg/L	270	1.0	5868214	170	1.0	5868214			
Dissolved Chloride (Cl-)	mg/L	12	1.0	5869643	66	1.0	5869049	67	1.0	5869049
Nitrite (N)	mg/L	<0.010	0.010	5868292	<0.010	0.010	5868292			
Nitrate (N)	mg/L	9.85	0.10	5868292	1.36	0.10	5868292			
Nitrate + Nitrite (N)	mg/L	9.85	0.10	5868292	1.36	0.10	5868292			

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

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB731		ILB732			ILB733		
Sampling Date		2018/11/30 09:55		2018/11/30 11:05			2018/11/30 09:20		
COC Number		694194-01-01		694194-02-01			694194-02-01		
	UNITS	**MW17-3B**	**QC Batch**	**MW17-3C**	**RDL**	**QC Batch**	**MW17-3E**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	200	5874605	230	1.0	5874605	400	1.0	5874605
Calculated TDS	mg/L	280	5866765	320	1.0	5866765	550	1.0	5866765
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.2	5874605	1.8	1.0	5874605	2.4	1.0	5874605
Hardness (CaCO3)	mg/L	220	5866760	270	1.0	5866760	460	1.0	5866760
Inorganics									
Total Ammonia-N	mg/L	0.17 (1)	5870269	<0.050	0.050	5868344	0.18	0.050	5870269
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	5870030	<4.0	4.0	5868341	<4.0	4.0	5870030
Conductivity	umho/cm	510	5868220	580	1.0	5868220	950	1.0	5868220
Total Kjeldahl Nitrogen (TKN)	mg/L	0.14 (1)	5870331	0.15	0.10	5868312	1.2	0.10	5870331
Dissolved Organic Carbon	mg/L	0.60	5868470	0.80	0.50	5868484	2.7	0.50	5868484
pH	pH	8.06	5868222	7.93		5868222	7.80		5868222
Phenols-4AAP	mg/L	<0.0010	5867784	<0.0010	0.0010	5867784	<0.0010	0.0010	5867788
Total Phosphorus	mg/L	0.008	5869889	0.005	0.004	5868637	5.3	0.8	5869889
Dissolved Sulphate (SO4)	mg/L	54	5869657	45	1.0	5869076	72	1.0	5869657
Alkalinity (Total as CaCO3)	mg/L	200	5868214	230	1.0	5868214	400	1.0	5868214
Dissolved Chloride (Cl-)	mg/L	3.9	5869643	17	1.0	5869049	23	1.0	5869643
Nitrite (N)	mg/L	<0.010	5868292	<0.010	0.010	5868292	<0.010	0.010	5868292
Nitrate (N)	mg/L	<0.10	5868292	0.56	0.10	5868292	1.83	0.10	5868292
Nitrate + Nitrite (N)	mg/L	<0.10	5868292	0.56	0.10	5868292	1.83	0.10	5868292

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) TKN < NH4: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB734			ILB735		
Sampling Date		2018/11/29 13:30			2018/11/29 13:50		
COC Number		694194-02-01			694194-02-01		
	UNITS	**MW17-5A**	**RDL**	**QC Batch**	**MW17-5B**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	230	1.0	5874605	170	1.0	5874605
Calculated TDS	mg/L	800	1.0	5866765	450	1.0	5866765
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.6	1.0	5874605	1.5	1.0	5874605
Hardness (CaCO3)	mg/L	460	1.0	5866760	290	1.0	5866760
Inorganics							
Total Ammonia-N	mg/L	0.33	0.050	5870269	<0.050	0.050	5870269
Total Chemical Oxygen Demand (COD)	mg/L	9.1	4.0	5870030	<4.0	4.0	5870030
Conductivity	umho/cm	1300	1.0	5868220	800	1.0	5868220
Total Kjeldahl Nitrogen (TKN)	mg/L	0.34	0.10	5870331	<0.10	0.10	5870331
Dissolved Organic Carbon	mg/L	1.1	0.50	5868484	1.1	0.50	5868484
pH	pH	7.87		5868222	7.99		5868222
Phenols-4AAP	mg/L	<0.0010	0.0010	5867779	0.0014	0.0010	5867788
Total Phosphorus	mg/L	0.009	0.004	5869889	0.07	0.02	5869889
Dissolved Sulphate (SO4)	mg/L	330	1.0	5869657	130	1.0	5869657
Alkalinity (Total as CaCO3)	mg/L	230	1.0	5868214	170	1.0	5868214
Dissolved Chloride (Cl-)	mg/L	83	1.0	5869643	66	1.0	5869643
Nitrite (N)	mg/L	<0.010	0.010	5868294	<0.010	0.010	5868292
Nitrate (N)	mg/L	<0.10	0.10	5868294	1.72	0.10	5868292
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5868294	1.72	0.10	5868292

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB736			ILB736			ILB737		
Sampling Date		2018/11/28 16:25			2018/11/28 16:25			2018/11/29 15:50		
COC Number		694194-02-01			694194-02-01			694194-02-01		
	UNITS	MW17-5C	RDL	QC Batch	MW17-5C Lab-Dup	RDL	QC Batch	MW17-6A	RDL	QC Batch
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	200	1.0	5874605				270	1.0	5874605
Calculated TDS	mg/L	390	1.0	5866765				540	1.0	5866765
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.3	1.0	5874605				1.8	1.0	5874605
Hardness (CaCO3)	mg/L	320	1.0	5866760				330	1.0	5866760
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	5870269				<0.050	0.050	5870269
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5870030				9.4	4.0	5870030
Conductivity	umho/cm	680	1.0	5868220				1000	1.0	5868220
Total Kjeldahl Nitrogen (TKN)	mg/L	0.14	0.10	5870331				0.22	0.20	5870331
Dissolved Organic Carbon	mg/L	1.2	0.50	5868484				2.8	0.50	5868484
pH	pH	7.84		5868222				7.85		5868222
Phenols-4AAP	mg/L	<0.0010	0.0010	5867779				<0.0010	0.0010	5867788
Total Phosphorus	mg/L	<0.004	0.004	5869889				0.050	0.004	5869889
Dissolved Sulphate (SO4)	mg/L	120	1.0	5869076				37	1.0	5869076
Alkalinity (Total as CaCO3)	mg/L	210	1.0	5868214				270	1.0	5868214
Dissolved Chloride (Cl-)	mg/L	18	1.0	5869049				110	1.0	5869049
Nitrite (N)	mg/L	0.153	0.010	5868292	0.151	0.010	5868292	<0.010	0.010	5868292
Nitrate (N)	mg/L	1.45	0.10	5868292	1.44	0.10	5868292	5.92	0.10	5868292
Nitrate + Nitrite (N)	mg/L	1.60	0.10	5868292	1.59	0.10	5868292	5.92	0.10	5868292

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB737			ILB738			ILB738		
Sampling Date		2018/11/29 15:50			2018/11/29 15:48			2018/11/29 15:48		
COC Number		694194-02-01			694194-02-01			694194-02-01		
	UNITS	**MW17-6A Lab-Dup**	**RDL**	**QC Batch**	**MW17-6B**	**RDL**	**QC Batch**	**MW17-6B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				280	1.0	5874605			
Calculated TDS	mg/L				430	1.0	5866765			
Carb. Alkalinity (calc. as CaCO3)	mg/L				1.7	1.0	5874605			
Hardness (CaCO3)	mg/L				360	1.0	5866760			
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	5870269	0.081	0.050	5868344			
Total Chemical Oxygen Demand (COD)	mg/L				<4.0	4.0	5868341			
Conductivity	umho/cm				760	1.0	5868220			
Total Kjeldahl Nitrogen (TKN)	mg/L				0.18	0.10	5868312			
Dissolved Organic Carbon	mg/L				0.83	0.50	5868484			
pH	pH				7.82		5868222			
Phenols-4AAP	mg/L				<0.0010	0.0010	5867779			
Total Phosphorus	mg/L				<0.004	0.004	5868637	<0.004	0.004	5868637
Dissolved Sulphate (SO4)	mg/L				76	1.0	5869076			
Alkalinity (Total as CaCO3)	mg/L				280	1.0	5868214			
Dissolved Chloride (Cl-)	mg/L				31	1.0	5869049			
Nitrite (N)	mg/L				0.083	0.010	5868292			
Nitrate (N)	mg/L				1.39	0.10	5868292			
Nitrate + Nitrite (N)	mg/L				1.47	0.10	5868292			

RDL = Reportable Detection Limit
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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB739			ILB740		
Sampling Date		2018/11/29 11:15			2018/11/29 16:15		
COC Number		694194-02-01			694194-02-01		
	UNITS	**DUP-2C**	**RDL**	**QC Batch**	**DUP-6A**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	240	1.0	5874605	270	1.0	5874605
Calculated TDS	mg/L	340	1.0	5866765	540	1.0	5866765
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.8	1.0	5874605	1.8	1.0	5874605
Hardness (CaCO3)	mg/L	300	1.0	5866760	320	1.0	5866760
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	5870269	<0.050	0.050	5868344
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5870030	4.2	4.0	5868341
Conductivity	umho/cm	600	1.0	5868592	1000	1.0	5868220
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.50 (1)	0.50	5870331	0.38	0.20	5868312
Dissolved Organic Carbon	mg/L	0.86	0.50	5868484	2.4	0.50	5868484
pH	pH	7.90		5868593	7.85		5868222
Phenols-4AAP	mg/L	0.0010	0.0010	5867788	<0.0010	0.0010	5867784
Total Phosphorus	mg/L	0.053	0.008	5869889	0.050	0.004	5868637
Dissolved Sulphate (SO4)	mg/L	14	1.0	5869076	40	1.0	5869657
Alkalinity (Total as CaCO3)	mg/L	250	1.0	5868583	270	1.0	5868214
Dissolved Chloride (Cl-)	mg/L	12	1.0	5869049	110	1.0	5869643
Nitrite (N)	mg/L	<0.010	0.010	5868292	<0.010	0.010	5868292
Nitrate (N)	mg/L	9.88	0.10	5868292	5.91	0.10	5868292
Nitrate + Nitrite (N)	mg/L	9.88	0.10	5868292	5.91	0.10	5868292

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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RESULTS OF ANALYSES OF WATER

Maxxam ID		ILB741			ILB741		
Sampling Date		2018/11/30 12:30			2018/11/30 12:30		
COC Number		694194-02-01			694194-02-01		
	UNITS	**EB**	**RDL**	**QC Batch**	**EB Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5874605			
Calculated TDS	mg/L	<1.0	1.0	5866765			
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5874605			
Hardness (CaCO3)	mg/L	<1.0	1.0	5866760			
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	5868344			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5868341			
Conductivity	umho/cm	2.0	1.0	5868592	1.6	1.0	5868592
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	5868312			
Dissolved Organic Carbon	mg/L	<0.50	0.50	5868470	<0.50	0.50	5868470
pH	pH	5.98		5868593	5.87		5868593
Phenols-4AAP	mg/L	<0.0010	0.0010	5867779			
Total Phosphorus	mg/L	<0.004	0.004	5868637			
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	5869657			
Alkalinity (Total as CaCO3)	mg/L	<1.0	1.0	5868583	<1.0	1.0	5868583
Dissolved Chloride (Cl-)	mg/L	<1.0	1.0	5869643			
Nitrite (N)	mg/L	<0.010	0.010	5868292			
Nitrate (N)	mg/L	<0.10	0.10	5868292			
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5868292			

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		ILB722			ILB722			ILB723	ILB724		
Sampling Date		2018/11/28 13:05			2018/11/28 13:05			2018/11/28 14:55	2018/11/28 12:00		
COC Number		694194-01-01			694194-01-01			694194-01-01	694194-01-01		
	UNITS	**MW17-1A**	**RDL**	**QC Batch**	**MW17-1A Lab-Dup**	**RDL**	**QC Batch**	**MW17-1B**	**MW17-1C**	**RDL**	**QC Batch**
Calculated Parameters											
Chromium (+3)	ug/L	<5	5	5866794				<5	<5	5	5866794
Metals											
Chromium (VI)	ug/L	<0.50	0.50	5868925				<0.50	<0.50	0.50	5868925
Mercury (Hg)	mg/L	<0.0001	0.0001	5869902				<0.0001	<0.0001	0.0001	5869902
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	5867689	<5.0	5.0	5867689	<5.0	<5.0	5.0	5867689
Dissolved Arsenic (As)	ug/L	<1.0	1.0	5867689	<1.0	1.0	5867689	<1.0	3.6	1.0	5867689
Dissolved Barium (Ba)	ug/L	58	2.0	5867689	59	2.0	5867689	90	95	2.0	5867689
Dissolved Boron (B)	ug/L	100	10	5867689	100	10	5867689	62	48	10	5867689
Dissolved Cadmium (Cd)	ug/L	<0.10	0.10	5867689	<0.10	0.10	5867689	<0.10	<0.10	0.10	5867689
Dissolved Calcium (Ca)	ug/L	49000	200	5867689	48000	200	5867689	24000	33000	200	5867689
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	5867689	<5.0	5.0	5867689	<5.0	<5.0	5.0	5867689
Dissolved Copper (Cu)	ug/L	<1.0	1.0	5867689	<1.0	1.0	5867689	<1.0	<1.0	1.0	5867689
Dissolved Iron (Fe)	ug/L	230	100	5867689	230	100	5867689	<100	340	100	5867689
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5867689	<0.50	0.50	5867689	<0.50	<0.50	0.50	5867689
Dissolved Magnesium (Mg)	ug/L	36000	50	5867689	35000	50	5867689	18000	19000	50	5867689
Dissolved Manganese (Mn)	ug/L	5.6	2.0	5867689	5.6	2.0	5867689	<2.0	9.3	2.0	5867689
Dissolved Potassium (K)	ug/L	2600	200	5867689	2600	200	5867689	1200	1100	200	5867689
Dissolved Sodium (Na)	ug/L	56000	100	5867689	56000	100	5867689	20000	18000	100	5867689
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5867689	<5.0	5.0	5867689	<5.0	<5.0	5.0	5867689

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

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		ILB725	ILB726		ILB727	ILB728	ILB729		
Sampling Date		2018/11/28 14:45	2018/11/29 10:00		2018/11/29 11:00	2018/11/29 10:55	2018/11/29 09:30		
COC Number		694194-01-01	694194-01-01		694194-01-01	694194-01-01	694194-01-01		
	UNITS	**MW17-1D**	**MW17-2A**	**QC Batch**	**MW17-2B**	**MW17-2C**	**MW17-2D**	**RDL**	**QC Batch**
Calculated Parameters									
Chromium (+3)	ug/L	<5	<5	5866794	<5	<5	<5	5	5866794
Metals									
Chromium (VI)	ug/L	<0.50	<0.50	5868925	<0.50	<0.50	<0.50	0.50	5868925
Mercury (Hg)	mg/L	<0.0001	<0.0001	5869902	<0.0001	<0.0001	<0.0001	0.0001	5870437
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	5867689	<5.0	<5.0	<5.0	5.0	5867689
Dissolved Arsenic (As)	ug/L	11	<1.0	5867689	<1.0	<1.0	<1.0	1.0	5867689
Dissolved Barium (Ba)	ug/L	56	29	5867689	30	20	20	2.0	5867689
Dissolved Boron (B)	ug/L	39	59	5867689	54	12	12	10	5867689
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	5867689	<0.10	<0.10	<0.10	0.10	5867689
Dissolved Calcium (Ca)	ug/L	39000	70000	5867689	72000	87000	94000	200	5867689
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	5867689	<5.0	<5.0	<5.0	5.0	5867689
Dissolved Copper (Cu)	ug/L	1.2	<1.0	5867689	<1.0	<1.0	<1.0	1.0	5867689
Dissolved Iron (Fe)	ug/L	190	<100	5867689	<100	<100	<100	100	5867689
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	5867689	<0.50	<0.50	<0.50	0.50	5867689
Dissolved Magnesium (Mg)	ug/L	26000	31000	5867689	27000	20000	20000	50	5867689
Dissolved Manganese (Mn)	ug/L	12	7.8	5867689	10	<2.0	7.2	2.0	5867689
Dissolved Potassium (K)	ug/L	1000	3800	5867689	3900	730	870	200	5867689
Dissolved Sodium (Na)	ug/L	17000	47000	5867689	47000	2700	2300	100	5867689
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	5867689	<5.0	<5.0	<5.0	5.0	5867689

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		ILB729			ILB730	ILB731		ILB732		
Sampling Date		2018/11/29 09:30			2018/11/30 10:37	2018/11/30 09:55		2018/11/30 11:05		
COC Number		694194-01-01			694194-01-01	694194-01-01		694194-02-01		
	UNITS	**MW17-2D Lab-Dup**	**RDL**	**QC Batch**	**MW17-3A**	**MW17-3B**	**QC Batch**	**MW17-3C**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L				<5	<5	5866794	<5	5	5866794
Metals										
Chromium (VI)	ug/L	<0.50	0.50	5868925	<0.50	<0.50	5868925	<0.50	0.50	5868925
Mercury (Hg)	mg/L				<0.0001	<0.0001	5870437	<0.0001	0.0001	5869902
Dissolved Aluminum (Al)	ug/L				<5.0	<5.0	5867689	<5.0	5.0	5867689
Dissolved Arsenic (As)	ug/L				<1.0	<1.0	5867689	<1.0	1.0	5867689
Dissolved Barium (Ba)	ug/L				34	36	5867689	86	2.0	5867689
Dissolved Boron (B)	ug/L				58	97	5867689	27	10	5867689
Dissolved Cadmium (Cd)	ug/L				<0.10	<0.10	5867689	<0.10	0.10	5867689
Dissolved Calcium (Ca)	ug/L				67000	38000	5867689	62000	200	5867689
Dissolved Chromium (Cr)	ug/L				<5.0	<5.0	5867689	<5.0	5.0	5867689
Dissolved Copper (Cu)	ug/L				<1.0	<1.0	5867689	<1.0	1.0	5867689
Dissolved Iron (Fe)	ug/L				<100	<100	5867689	<100	100	5867689
Dissolved Lead (Pb)	ug/L				<0.50	<0.50	5867689	<0.50	0.50	5867689
Dissolved Magnesium (Mg)	ug/L				30000	30000	5867689	27000	50	5867689
Dissolved Manganese (Mn)	ug/L				<2.0	<2.0	5867689	11	2.0	5867689
Dissolved Potassium (K)	ug/L				3400	1700	5867689	1600	200	5867689
Dissolved Sodium (Na)	ug/L				45000	19000	5867689	12000	100	5867689
Dissolved Zinc (Zn)	ug/L				<5.0	<5.0	5867689	<5.0	5.0	5867689

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		ILB733			ILB733			ILB734		
Sampling Date		2018/11/30 09:20			2018/11/30 09:20			2018/11/29 13:30		
COC Number		694194-02-01			694194-02-01			694194-02-01		
	UNITS	**MW17-3E**	**RDL**	**QC Batch**	**MW17-3E Lab-Dup**	**RDL**	**QC Batch**	**MW17-5A**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	5	5866794				<5	5	5866794
Metals										
Chromium (VI)	ug/L	<0.50	0.50	5868925				<0.50	0.50	5868925
Mercury (Hg)	mg/L	<0.0001	0.0001	5869902	<0.0001	0.0001	5869902	<0.0001	0.0001	5869902
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	5867689				<5.0	5.0	5867689
Dissolved Arsenic (As)	ug/L	<1.0	1.0	5867689				<1.0	1.0	5867689
Dissolved Barium (Ba)	ug/L	93	2.0	5867689				12	2.0	5867689
Dissolved Boron (B)	ug/L	37	10	5867689				150	10	5867689
Dissolved Cadmium (Cd)	ug/L	<0.10	0.10	5867689				<0.10	0.10	5867689
Dissolved Calcium (Ca)	ug/L	130000	200	5867689				77000	1000	5867689
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	5867689				<5.0	5.0	5867689
Dissolved Copper (Cu)	ug/L	2.0	1.0	5867689				<1.0	1.0	5867689
Dissolved Iron (Fe)	ug/L	<100	100	5867689				<100	100	5867689
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5867689				<0.50	0.50	5867689
Dissolved Magnesium (Mg)	ug/L	36000	50	5867689				64000	50	5867689
Dissolved Manganese (Mn)	ug/L	<2.0	2.0	5867689				2.6	2.0	5867689
Dissolved Potassium (K)	ug/L	17000	200	5867689				3700	200	5867689
Dissolved Sodium (Na)	ug/L	17000	100	5867689				94000	100	5867689
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5867689				<5.0	5.0	5867689

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		ILB735		ILB736		ILB737	ILB738		
Sampling Date		2018/11/29 13:50		2018/11/28 16:25		2018/11/29 15:50	2018/11/29 15:48		
COC Number		694194-02-01		694194-02-01		694194-02-01	694194-02-01		
	UNITS	MW17-5B	QC Batch	MW17-5C	QC Batch	MW17-6A	MW17-6B	RDL	QC Batch
Calculated Parameters									
Chromium (+3)	ug/L	<5	5866794	<5	5866794	<5	<5	5	5866794
Metals									
Chromium (VI)	ug/L	<0.50	5868925	<0.50	5868925	<0.50	<0.50	0.50	5868925
Mercury (Hg)	mg/L	<0.0001	5870437	<0.0001	5869902	<0.0001	<0.0001	0.0001	5870437
Dissolved Aluminum (Al)	ug/L	<5.0	5867689	<5.0	5867689	<5.0	<5.0	5.0	5867689
Dissolved Arsenic (As)	ug/L	<1.0	5867689	<1.0	5867689	<1.0	<1.0	1.0	5867689
Dissolved Barium (Ba)	ug/L	37	5867689	40	5867689	46	68	2.0	5867689
Dissolved Boron (B)	ug/L	50	5867689	22	5867689	23	26	10	5867689
Dissolved Cadmium (Cd)	ug/L	<0.10	5867689	0.19	5867689	<0.10	<0.10	0.10	5867689
Dissolved Calcium (Ca)	ug/L	71000	5867689	88000	5867689	98000	93000	200	5867689
Dissolved Chromium (Cr)	ug/L	<5.0	5867689	<5.0	5867689	<5.0	<5.0	5.0	5867689
Dissolved Copper (Cu)	ug/L	<1.0	5867689	<1.0	5867689	2.0	<1.0	1.0	5867689
Dissolved Iron (Fe)	ug/L	<100	5867689	<100	5867689	<100	<100	100	5867689
Dissolved Lead (Pb)	ug/L	<0.50	5867689	<0.50	5867689	<0.50	<0.50	0.50	5867689
Dissolved Magnesium (Mg)	ug/L	28000	5867689	25000	5867689	21000	31000	50	5867689
Dissolved Manganese (Mn)	ug/L	<2.0	5867689	13	5867689	<2.0	42	2.0	5867689
Dissolved Potassium (K)	ug/L	3700	5867689	2200	5867689	3300	2000	200	5867689
Dissolved Sodium (Na)	ug/L	44000	5867689	8900	5867689	69000	14000	100	5867689
Dissolved Zinc (Zn)	ug/L	<5.0	5867689	71	5867689	<5.0	5.8	5.0	5867689

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		ILB739		ILB740		ILB741		
Sampling Date		2018/11/29 11:15		2018/11/29 16:15		2018/11/30 12:30		
COC Number		694194-02-01		694194-02-01		694194-02-01		
	UNITS	**DUP-2C**	**QC Batch**	**DUP-6A**	**QC Batch**	**EB**	**RDL**	**QC Batch**
Calculated Parameters								
Chromium (+3)	ug/L	<5	5866794	<5	5866794	<5	5	5866794
Metals								
Chromium (VI)	ug/L	<0.50	5868925	<0.50	5868925	<0.50	0.50	5868925
Mercury (Hg)	mg/L	<0.0001	5870437	<0.0001	5869902	<0.0001	0.0001	5870437
Dissolved Aluminum (Al)	ug/L	<5.0	5867689	<5.0	5867689	<5.0	5.0	5867689
Dissolved Arsenic (As)	ug/L	<1.0	5867689	<1.0	5867689	<1.0	1.0	5867689
Dissolved Barium (Ba)	ug/L	21	5867689	46	5867689	<2.0	2.0	5867689
Dissolved Boron (B)	ug/L	12	5867689	22	5867689	<10	10	5867689
Dissolved Cadmium (Cd)	ug/L	<0.10	5867689	<0.10	5867689	<0.10	0.10	5867689
Dissolved Calcium (Ca)	ug/L	89000	5867689	95000	5867689	<200	200	5867689
Dissolved Chromium (Cr)	ug/L	<5.0	5867689	<5.0	5867689	<5.0	5.0	5867689
Dissolved Copper (Cu)	ug/L	<1.0	5867689	7.3	5867689	<1.0	1.0	5867689
Dissolved Iron (Fe)	ug/L	<100	5867689	<100	5867689	<100	100	5867689
Dissolved Lead (Pb)	ug/L	<0.50	5867689	<0.50	5867689	<0.50	0.50	5867689
Dissolved Magnesium (Mg)	ug/L	19000	5867689	21000	5867689	<50	50	5867689
Dissolved Manganese (Mn)	ug/L	<2.0	5867689	<2.0	5867689	<2.0	2.0	5867689
Dissolved Potassium (K)	ug/L	740	5867689	3300	5867689	<200	200	5867689
Dissolved Sodium (Na)	ug/L	2700	5867689	69000	5867689	<100	100	5867689
Dissolved Zinc (Zn)	ug/L	<5.0	5867689	6.4	5867689	<5.0	5.0	5867689

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		ILB741		
Sampling Date		2018/11/30 12:30		
COC Number		694194-02-01		
	UNITS	**EB Lab-Dup**	**RDL**	**QC Batch**
Metals				
Mercury (Hg)	mg/L	<0.0001	0.0001	5870437

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		ILB722	ILB723	ILB723	ILB724	ILB725		
Sampling Date		2018/11/28 13:05	2018/11/28 14:55	2018/11/28 14:55	2018/11/28 12:00	2018/11/28 14:45		
COC Number		694194-01-01	694194-01-01	694194-01-01	694194-01-01	694194-01-01		
	UNITS	**MW17-1A**	**MW17-1B**	**MW17-1B Lab-Dup**	**MW17-1C**	**MW17-1D**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5867588
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5867588
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	0.80	0.20	5867588
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5867588
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	93	94	94	93	92		5867588
D4-1,2-Dichloroethane	%	102	104	104	104	105		5867588
D8-Toluene	%	96	94	95	95	96		5867588

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

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		ILB726	ILB727	ILB728	ILB729	ILB730		
Sampling Date		2018/11/29 10:00	2018/11/29 11:00	2018/11/29 10:55	2018/11/29 09:30	2018/11/30 10:37		
COC Number		694194-01-01	694194-01-01	694194-01-01	694194-01-01	694194-01-01		
	UNITS	**MW17-2A**	**MW17-2B**	**MW17-2C**	**MW17-2D**	**MW17-3A**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5867588
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5867588
Toluene	ug/L	<0.20	<0.20	<0.20	0.25	<0.20	0.20	5867588
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5867588
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	92	92	91	91	91		5867588
D4-1,2-Dichloroethane	%	103	103	104	105	105		5867588
D8-Toluene	%	95	95	96	94	95		5867588

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		ILB731	ILB732	ILB733	ILB734	ILB735		
Sampling Date		2018/11/30 09:55	2018/11/30 11:05	2018/11/30 09:20	2018/11/29 13:30	2018/11/29 13:50		
COC Number		694194-01-01	694194-02-01	694194-02-01	694194-02-01	694194-02-01		
	UNITS	**MW17-3B**	**MW17-3C**	**MW17-3E**	**MW17-5A**	**MW17-5B**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5867588
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5867588
Toluene	ug/L	0.48	<0.20	0.34	<0.20	1.8	0.20	5867588
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
p+m-Xylene	ug/L	<0.20	<0.20	0.24	<0.20	<0.20	0.20	5867588
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
Total Xylenes	ug/L	<0.20	<0.20	0.24	<0.20	<0.20	0.20	5867588
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5867588
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	92	91	90	91	91		5867588
D4-1,2-Dichloroethane	%	107	108	107	108	108		5867588
D8-Toluene	%	96	95	95	94	93		5867588

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		ILB736	ILB737	ILB738	ILB739	ILB740		
Sampling Date		2018/11/28 16:25	2018/11/29 15:50	2018/11/29 15:48	2018/11/29 11:15	2018/11/29 16:15		
COC Number		694194-02-01	694194-02-01	694194-02-01	694194-02-01	694194-02-01		
	UNITS	MW17-5C	MW17-6A	MW17-6B	DUP-2C	DUP-6A	RDL	QC Batch
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5867588
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5867588
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5867588
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5867588
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	90	90	90	90	90		5867588
D4-1,2-Dichloroethane	%	110	109	107	109	109		5867588
D8-Toluene	%	94	95	94	94	95		5867588

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		ILB741		ILB742		
Sampling Date		2018/11/30 12:30				
COC Number		694194-02-01		694194-03-01		
	UNITS	**EB**	**QC Batch**	**TRIP BLANK**	**RDL**	**QC Batch**
Volatile Organics						
Benzene	ug/L	<0.20	5867588	<0.20	0.20	5867386
1,4-Dichlorobenzene	ug/L	<0.50	5867588	<0.50	0.50	5867386
Methylene Chloride(Dichloromethane)	ug/L	<2.0	5867588	<2.0	2.0	5867386
Toluene	ug/L	<0.20	5867588	<0.20	0.20	5867386
Vinyl Chloride	ug/L	<0.20	5867588	<0.20	0.20	5867386
p+m-Xylene	ug/L	<0.20	5867588	<0.20	0.20	5867386
o-Xylene	ug/L	<0.20	5867588	<0.20	0.20	5867386
Total Xylenes	ug/L	<0.20	5867588	<0.20	0.20	5867386
F1 (C6-C10)	ug/L	<25	5867588	<25	25	5867386
Surrogate Recovery (%)						
4-Bromofluorobenzene	%	89	5867588	93		5867386
D4-1,2-Dichloroethane	%	109	5867588	90		5867386
D8-Toluene	%	94	5867588	101		5867386

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam
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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB722
Sample ID: MW17-1A
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868470	N/A	2018/12/05	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/05	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB722 Dup
Sample ID: MW17-1A
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad

Maxxam ID: ILB723
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868470	N/A	2018/12/05	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB723
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/06	Xueming Jiang

Maxxam ID: ILB723 Dup
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/06	Xueming Jiang

Maxxam ID: ILB724
Sample ID: MW17-1C
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868470	N/A	2018/12/05	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

DRAFT

Maxxam ID: ILB724 Dup
Sample ID: MW17-1C
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani

Maxxam ID: ILB725
Sample ID: MW17-1D
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868470	N/A	2018/12/05	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870168	N/A	2018/12/07	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5876435	2018/12/07	2018/12/07	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB726
Sample ID: MW17-2A
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869643	N/A	2018/12/05	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB726
Sample ID: MW17-2A
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869657	N/A	2018/12/05	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB727
Sample ID: MW17-2B
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867788	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB728
Sample ID: MW17-2C
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869643	N/A	2018/12/05	Alina Dobreanu

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Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB728
Sample ID: MW17-2C
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869657	N/A	2018/12/05	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/05	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB729
Sample ID: MW17-2D
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869643	N/A	2018/12/05	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/05	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867784	N/A	2018/12/05	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869657	N/A	2018/12/05	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/05	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

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Maxxam ID: ILB729 Dup
Sample ID: MW17-2D
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le

Maxxam ID: ILB730
Sample ID: MW17-3A
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868470	N/A	2018/12/05	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867788	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB730 Dup
Sample ID: MW17-3A
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal

Maxxam ID: ILB731
Sample ID: MW17-3B
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB731
Sample ID: MW17-3B
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	5869643	N/A	2018/12/05	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868470	N/A	2018/12/05	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867784	N/A	2018/12/05	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869657	N/A	2018/12/05	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

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Maxxam ID: ILB732
Sample ID: MW17-3C
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5868341	N/A	2018/12/03	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5868344	N/A	2018/12/04	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867784	N/A	2018/12/05	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5868312	2018/12/03	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5868637	2018/12/03	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB733
Sample ID: MW17-3E
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869643	N/A	2018/12/05	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867788	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869657	N/A	2018/12/05	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB733 Dup
Sample ID: MW17-3E
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison

Maxxam ID: ILB734
Sample ID: MW17-5A
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869643	N/A	2018/12/05	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB734
Sample ID: MW17-5A
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868294	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869657	N/A	2018/12/05	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB735
Sample ID: MW17-5B
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869643	N/A	2018/12/05	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867788	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869657	N/A	2018/12/05	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/05	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB736
Sample ID: MW17-5C
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB736
Sample ID: MW17-5C
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB736 Dup
Sample ID: MW17-5C
Matrix: Water

Collected: 2018/11/28
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal

Maxxam ID: ILB737
Sample ID: MW17-6A
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB737
Sample ID: MW17-6A
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Phenols (4AAP)	TECH/PHEN	5867788	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/05	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB737 Dup
Sample ID: MW17-6A
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware

Maxxam ID: ILB738
Sample ID: MW17-6B
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5868341	N/A	2018/12/03	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5868344	N/A	2018/12/04	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5868312	2018/12/03	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5868637	2018/12/03	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB738 Dup
Sample ID: MW17-6B
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	5868637	2018/12/03	2018/12/05	Amanpreet Sappal

Maxxam ID: ILB739
Sample ID: DUP-2C
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868583	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869049	N/A	2018/12/04	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5870030	N/A	2018/12/04	Nimarta Singh
Conductivity	AT	5868592	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5870269	N/A	2018/12/05	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868593	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867788	N/A	2018/12/04	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869076	N/A	2018/12/04	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5870331	2018/12/04	2018/12/05	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5869889	2018/12/04	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

DRAFT

Maxxam ID: ILB740
Sample ID: DUP-6A
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868214	N/A	2018/12/04	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869643	N/A	2018/12/05	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5868341	N/A	2018/12/03	Nimarta Singh
Conductivity	AT	5868220	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868484	N/A	2018/12/04	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5869902	2018/12/04	2018/12/04	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB740
Sample ID: DUP-6A
Matrix: Water

Collected: 2018/11/29
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5868344	N/A	2018/12/04	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868222	N/A	2018/12/04	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867784	N/A	2018/12/05	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869657	N/A	2018/12/05	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5868312	2018/12/03	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5868637	2018/12/03	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/05	Xueming Jiang

Maxxam ID: ILB741
Sample ID: EB
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868583	N/A	2018/12/05	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5874605	N/A	2018/12/06	Automated Statchk
Chloride by Automated Colourimetry	KONE	5869643	N/A	2018/12/05	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5868341	N/A	2018/12/03	Nimarta Singh
Conductivity	AT	5868592	N/A	2018/12/04	Surinder Rai
Chromium 3+ by calculation		5866794	2018/12/05	2018/12/05	Automated Statchk
Chromium (VI) in Water	IC	5868925	N/A	2018/12/04	Lang Le
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868470	N/A	2018/12/05	Mandeep Kaur
Hardness (calculated as CaCO3)		5866760	N/A	2018/12/04	Automated Statchk
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5867689	N/A	2018/12/03	Arefa Dabhad
Total Ammonia-N	LACH/NH4	5868344	N/A	2018/12/04	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5868292	N/A	2018/12/04	Chandra Nandlal
pH	AT	5868593	N/A	2018/12/05	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5867779	N/A	2018/12/03	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5869657	N/A	2018/12/05	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5866765	N/A	2018/12/05	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5868312	2018/12/03	2018/12/04	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	5868637	2018/12/03	2018/12/05	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867588	N/A	2018/12/06	Xueming Jiang

Maxxam ID: ILB741 Dup
Sample ID: EB
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5868583	N/A	2018/12/05	Surinder Rai
Conductivity	AT	5868592	N/A	2018/12/04	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5868470	N/A	2018/12/05	Mandeep Kaur

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

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: ILB741 Dup
Sample ID: EB
Matrix: Water

Collected: 2018/11/30
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury in Water by CVAA	CV/AA	5870437	2018/12/04	2018/12/05	Ron Morrison
pH	AT	5868593	N/A	2018/12/05	Surinder Rai

Maxxam ID: ILB742
Sample ID: TRIP BLANK
Matrix: Water

Collected:
Shipped:
Received: 2018/11/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5867386	N/A	2018/12/05	Yang (Philip) Yu

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GENERAL COMMENTS

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

Package 1	3.3°C
Package 2	2.7°C
Package 3	3.3°C
Package 4	2.3°C

Sample ILB722 [MW17-1A] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample ILB723 [MW17-1B] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample ILB724 [MW17-1C] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample ILB725 [MW17-1D] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample ILB731 [MW17-3B] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

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			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5867386	4-Bromofluorobenzene	2018/12/04	96	70 - 130	96	70 - 130	94	%				
5867386	D4-1,2-Dichloroethane	2018/12/04	92	70 - 130	89	70 - 130	88	%				
5867386	D8-Toluene	2018/12/04	102	70 - 130	103	70 - 130	102	%				
5867588	4-Bromofluorobenzene	2018/12/05	101	70 - 130	102	70 - 130	94	%				
5867588	D4-1,2-Dichloroethane	2018/12/05	99	70 - 130	100	70 - 130	99	%				
5867588	D8-Toluene	2018/12/05	105	70 - 130	104	70 - 130	97	%				
5867386	1,4-Dichlorobenzene	2018/12/04	91	70 - 130	91	70 - 130	<0.50	ug/L	NC	30		
5867386	Benzene	2018/12/04	91	70 - 130	92	70 - 130	<0.20	ug/L	NC	30		
5867386	F1 (C6-C10)	2018/12/04	95	60 - 140	92	60 - 140	<25	ug/L	NC	30		
5867386	Methylene Chloride(Dichloromethane)	2018/12/04	101	70 - 130	100	70 - 130	<2.0	ug/L	NC	30		
5867386	o-Xylene	2018/12/04	85	70 - 130	87	70 - 130	<0.20	ug/L	NC	30		
5867386	p+m-Xylene	2018/12/04	81	70 - 130	83	70 - 130	<0.20	ug/L	NC	30		
5867386	Toluene	2018/12/04	96	70 - 130	99	70 - 130	<0.20	ug/L	NC	30		
5867386	Total Xylenes	2018/12/04					<0.20	ug/L	NC	30		
5867386	Vinyl Chloride	2018/12/04	87	70 - 130	88	70 - 130	<0.20	ug/L	NC	30		
5867588	1,4-Dichlorobenzene	2018/12/06	94	70 - 130	100	70 - 130	<0.50	ug/L	NC	30		
5867588	Benzene	2018/12/06	90	70 - 130	96	70 - 130	<0.20	ug/L	NC	30		
5867588	F1 (C6-C10)	2018/12/06	99	60 - 140	98	60 - 140	<25	ug/L	NC	30		
5867588	Methylene Chloride(Dichloromethane)	2018/12/06	94	70 - 130	102	70 - 130	<2.0	ug/L	NC	30		
5867588	o-Xylene	2018/12/06	96	70 - 130	102	70 - 130	<0.20	ug/L	NC	30		
5867588	p+m-Xylene	2018/12/06	91	70 - 130	98	70 - 130	<0.20	ug/L	NC	30		
5867588	Toluene	2018/12/06	92	70 - 130	97	70 - 130	<0.20	ug/L	NC	30		
5867588	Total Xylenes	2018/12/06					<0.20	ug/L	NC	30		
5867588	Vinyl Chloride	2018/12/06	85	70 - 130	102	70 - 130	<0.20	ug/L	NC	30		
5867689	Dissolved Aluminum (Al)	2018/12/03	103	80 - 120	101	80 - 120	<5.0	ug/L	NC	20		
5867689	Dissolved Arsenic (As)	2018/12/03	103	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
5867689	Dissolved Barium (Ba)	2018/12/03	104	80 - 120	99	80 - 120	<2.0	ug/L	2.5	20		
5867689	Dissolved Boron (B)	2018/12/03	98	80 - 120	96	80 - 120	<10	ug/L	2.4	20		
5867689	Dissolved Cadmium (Cd)	2018/12/03	109	80 - 120	101	80 - 120	<0.10	ug/L	NC	20		
5867689	Dissolved Calcium (Ca)	2018/12/03	NC	80 - 120	100	80 - 120	<200	ug/L	2.1	20		
5867689	Dissolved Chromium (Cr)	2018/12/03	103	80 - 120	99	80 - 120	<5.0	ug/L	NC	20		

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

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B8W1363
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5867689	Dissolved Copper (Cu)	2018/12/03	106	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
5867689	Dissolved Iron (Fe)	2018/12/03	110	80 - 120	101	80 - 120	<100	ug/L	0.62	20		
5867689	Dissolved Lead (Pb)	2018/12/03	102	80 - 120	96	80 - 120	<0.50	ug/L	NC	20		
5867689	Dissolved Magnesium (Mg)	2018/12/03	NC	80 - 120	101	80 - 120	<50	ug/L	3.2	20		
5867689	Dissolved Manganese (Mn)	2018/12/03	106	80 - 120	100	80 - 120	<2.0	ug/L	0.71	20		
5867689	Dissolved Potassium (K)	2018/12/03	113	80 - 120	104	80 - 120	<200	ug/L	0.18	20		
5867689	Dissolved Sodium (Na)	2018/12/03	NC	80 - 120	105	80 - 120	<100	ug/L	1.1	20		
5867689	Dissolved Zinc (Zn)	2018/12/03	104	80 - 120	102	80 - 120	<5.0	ug/L	NC	20		
5867779	Phenols-4AAP	2018/12/03	95	80 - 120	97	80 - 120	<0.0010	mg/L	12	20		
5867784	Phenols-4AAP	2018/12/05	NC	80 - 120	102	80 - 120	<0.0010	mg/L	11	20		
5867788	Phenols-4AAP	2018/12/04	101	80 - 120	99	80 - 120	<0.0010	mg/L	7.8	20		
5868214	Alkalinity (Total as CaCO3)	2018/12/04			95	85 - 115	<1.0	mg/L	0.29	20		
5868220	Conductivity	2018/12/04			101	85 - 115	<1.0	umho/cm	0.18	25		
5868222	pH	2018/12/04			102	98 - 103			0.46	N/A		
5868292	Nitrate (N)	2018/12/04	94	80 - 120	98	80 - 120	<0.10	mg/L	0.65	20		
5868292	Nitrite (N)	2018/12/04	94	80 - 120	98	80 - 120	<0.010	mg/L	1.6	20		
5868294	Nitrate (N)	2018/12/04	95	80 - 120	97	80 - 120	<0.10	mg/L	0.21	20		
5868294	Nitrite (N)	2018/12/04	98	80 - 120	98	80 - 120	<0.010	mg/L				
5868312	Total Kjeldahl Nitrogen (TKN)	2018/12/04	87	80 - 120	101	80 - 120	<0.10	mg/L	NC (1)	20	114	80 - 120
5868341	Total Chemical Oxygen Demand (COD)	2018/12/03	98	80 - 120	103	80 - 120	<4.0	mg/L	2.1	20		
5868344	Total Ammonia-N	2018/12/04	97	75 - 125	105	80 - 120	<0.050	mg/L	NC	20		
5868470	Dissolved Organic Carbon	2018/12/05	93	80 - 120	95	80 - 120	<0.50	mg/L	NC	20		
5868484	Dissolved Organic Carbon	2018/12/04	98	80 - 120	97	80 - 120	<0.50	mg/L	0.19	20		
5868583	Alkalinity (Total as CaCO3)	2018/12/05			97	85 - 115	<1.0	mg/L	NC	20		
5868592	Conductivity	2018/12/04			102	85 - 115	<1.0	umho/cm	19	25		
5868593	pH	2018/12/05			102	98 - 103			2.0	N/A		
5868637	Total Phosphorus	2018/12/05	88	80 - 120	89	80 - 120	<0.004	mg/L	NC	20	93	80 - 120
5868925	Chromium (VI)	2018/12/04	100	80 - 120	101	80 - 120	<0.50	ug/L	NC	20		
5869049	Dissolved Chloride (Cl-)	2018/12/04	NC	80 - 120	101	80 - 120	<1.0	mg/L	0.31	20		

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5869076	Dissolved Sulphate (SO4)	2018/12/04	NC	75 - 125	104	80 - 120	<1.0	mg/L	1.6	20		
5869643	Dissolved Chloride (Cl-)	2018/12/05	114	80 - 120	103	80 - 120	<1.0	mg/L	NC	20		
5869657	Dissolved Sulphate (SO4)	2018/12/05	104	75 - 125	104	80 - 120	<1.0	mg/L	1.2	20		
5869889	Total Phosphorus	2018/12/05	94	80 - 120	87	80 - 120	<0.004	mg/L	NC	20	89	80 - 120
5869902	Mercury (Hg)	2018/12/04	89	75 - 125	95	80 - 120	<0.0001	mg/L	NC	20		
5870030	Total Chemical Oxygen Demand (COD)	2018/12/04	100	80 - 120	101	80 - 120	<4.0	mg/L	17	20		
5870168	Total Ammonia-N	2018/12/07	94	75 - 125	98	80 - 120	<0.050	mg/L	4.0	20		
5870269	Total Ammonia-N	2018/12/05	101	75 - 125	105	80 - 120	<0.050	mg/L	NC	20		
5870331	Total Kjeldahl Nitrogen (TKN)	2018/12/04	103	80 - 120	103	80 - 120	<0.10	mg/L	NC	20	97	80 - 120
5870437	Mercury (Hg)	2018/12/05	91	75 - 125	98	80 - 120	<0.0001	mg/L	NC	20		
5876435	Total Kjeldahl Nitrogen (TKN)	2018/12/07	103	80 - 120	100	80 - 120	<0.10	mg/L	0.46	20	103	80 - 120

N/A = Not Applicable

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.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

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

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

(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Maxxam Job #: B8W1363
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706
Site Location: Walker Landfill
Sampler Initials: MC

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

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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Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706.2000.7
Your C.O.C. #: 651534-01-01

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515963
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B850536
Received: 2018/03/05, 16:40

Sample Matrix: Water
Samples Received: 23

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity (1)	22	N/A	2018/03/08	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide (1)	22	N/A	2018/12/07	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry (1)	2	N/A	2018/03/08	CAM SOP-00463	EPA 325.2 m
Chloride by Automated Colourimetry (1)	20	N/A	2018/03/09	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand (1)	22	N/A	2018/03/08	CAM SOP-00416	SM 23 5220 D m
Conductivity (1)	22	N/A	2018/03/08	CAM SOP-00414	SM 23 2510 m
Chromium 3+ by calculation (1)	19	2018/03/07	2018/03/09		
Chromium 3+ by calculation (1)	2	2018/03/07	2018/03/12		
Chromium 3+ by calculation (1)	1	2018/03/07	2018/03/13		
Chromium (VI) in Water (1)	22	N/A	2018/03/09	CAM SOP-00436	EPA 7199 m
Dissolved Organic Carbon (DOC) (1, 2)	22	N/A	2018/03/07	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3) (1)	2	N/A	2018/03/08	CAM SOP 00102/00408/00447	SM 2340 B
Hardness (calculated as CaCO3) (1)	20	N/A	2018/03/09	CAM SOP 00102/00408/00447	SM 2340 B
Mercury in Water by CVAA (1)	19	2018/03/07	2018/03/08	CAM SOP-00453	EPA 7470A m
Mercury in Water by CVAA (1)	3	2018/03/08	2018/03/08	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS (1)	21	N/A	2018/03/08	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS (1)	1	N/A	2018/03/13	CAM SOP-00447	EPA 6020B m
Total Ammonia-N (1)	22	N/A	2018/03/08	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1, 3)	14	N/A	2018/03/08	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Nitrate (NO3) and Nitrite (NO2) in Water (1, 3)	8	N/A	2018/03/09	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH (1)	22	N/A	2018/03/08	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP) (1)	22	N/A	2018/03/08	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry (1)	22	N/A	2018/03/09	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc) (1)	21	N/A	2018/03/09		
Total Dissolved Solids (TDS calc) (1)	1	N/A	2018/03/13		
Total Kjeldahl Nitrogen in Water (1)	22	2018/03/08	2018/03/08	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric) (1)	15	2018/03/08	2018/03/08	CAM SOP-00407	SM 23 4500 P B H m
Total Phosphorus (Colourimetric) (1)	4	2018/03/08	2018/03/09	CAM SOP-00407	SM 23 4500 P B H m

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Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706.2000.7
Your C.O.C. #: 651534-01-01

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309 Exeter Rd
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London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515963
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B850536
Received: 2018/03/05, 16:40

Sample Matrix: Water
Samples Received: 23

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Total Phosphorus (Colourimetric) (1)	1	2018/03/08	2018/03/12	CAM SOP-00407	SM 23 4500 P B H m
Total Phosphorus (Colourimetric) (1)	1	2018/03/09	2018/03/11	CAM SOP-00407	SM 23 4500 P B H m
Total Phosphorus (Colourimetric) (1)	1	2018/03/09	2018/03/12	CAM SOP-00407	SM 23 4500 P B H m
Volatile Organic Compounds and F1 PHCs (1)	17	N/A	2018/03/08	CAM SOP-00230	EPA 8260C m
Volatile Organic Compounds and F1 PHCs (1)	3	N/A	2018/03/09	CAM SOP-00230	EPA 8260C m
Volatile Organic Compounds and F1 PHCs (1)	3	N/A	2018/03/12	CAM SOP-00230	EPA 8260C m

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Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Maxxam
A Bureau Veritas Group Company

Your Project #: 1664706.2000.7
Your C.O.C. #: 651534-01-01

Attention: Richard McCracken

Golder Associates Ltd
309 Exeter Rd
Unit 1
London, ON
CANADA N6L 1C1

Report Date: 2018/12/07
Report #: R5515963
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B850536
Received: 2018/03/05, 16:40

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: CGripton@maxxam.ca
Phone# (800)268-7396 Ext:250
==
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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A Bureau Veritas Group Company

Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB946		GFB947			GFB947		
Sampling Date		2018/02/27 10:40		2018/03/01 14:20			2018/03/01 14:20		
COC Number		651534-01-01		651534-01-01			651534-01-01		
	UNITS	**MW17-1A**	**QC Batch**	**MW17-1B**	**RDL**	**QC Batch**	**MW17-1B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	200	5876633	180	1.0	5876633			
Calculated TDS	mg/L	250	5429488	190	1.0	5429488			
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.3	5876633	2.2	1.0	5876633			
Hardness (CaCO3)	mg/L	160	5429487	130	1.0	5429487			
Inorganics									
Total Ammonia-N	mg/L	0.29	5431761	0.14	0.050	5431761			
Total Chemical Oxygen Demand (COD)	mg/L	4.6	5431248	<4.0	4.0	5431800	<4.0	4.0	5431800
Conductivity	umho/cm	450	5430141	350	1.0	5430141			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.33	5431377	0.23	0.10	5431377			
Dissolved Organic Carbon	mg/L	0.79	5429953	0.67	0.50	5429953			
pH	pH	8.10	5430144	8.10		5430144			
Phenols-4AAP	mg/L	<0.0010	5431404	<0.0010	0.0010	5431404			
Total Phosphorus	mg/L	0.067	5431472	0.006	0.004	5431472	0.007	0.004	5431472
Dissolved Sulphate (SO4)	mg/L	34	5430105	7.6	1.0	5430105			
Alkalinity (Total as CaCO3)	mg/L	200	5430136	180	1.0	5430136			
Dissolved Chloride (Cl-)	mg/L	6.6	5430098	<1.0	1.0	5430098			
Nitrite (N)	mg/L	<0.010	5430094	<0.010	0.010	5430094			
Nitrate (N)	mg/L	<0.10	5430094	<0.10	0.10	5430094			
Nitrate + Nitrite (N)	mg/L	<0.10	5430094	<0.10	0.10	5430094			

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

DRAFT

Maxxam Analytics International Corporation o/a Maxxam Analytics 49-55 Elizabeth Ave, Suite 101A, St.John's, NL, Canada A1A 1W9 Tel: 709-754-0203 Toll Free: 888-492-7227 Fax: 709-754-8612 www.maxxamanalytics.com

Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB948			GFB948			GFB949		
Sampling Date		2018/02/26 15:00			2018/02/26 15:00			2018/02/26 15:15		
COC Number		651534-01-01			651534-01-01			651534-01-01		
	UNITS	MW17-1C	RDL	QC Batch	MW17-1C Lab-Dup	RDL	QC Batch	MW17-1D	RDL	QC Batch
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	190	1.0	5876633				180	1.0	5876633
Calculated TDS	mg/L	210	1.0	5429488				270	1.0	5429488
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.4	1.0	5876633				2.1	1.0	5876633
Hardness (CaCO3)	mg/L	150	1.0	5429487				190	1.0	5429487
Inorganics										
Total Ammonia-N	mg/L	0.16	0.050	5431761				0.33	0.050	5431761
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5431248				<4.0	4.0	5431248
Conductivity	umho/cm	380	1.0	5430141				490	1.0	5430141
Total Kjeldahl Nitrogen (TKN)	mg/L	0.25	0.10	5431377				0.42	0.10	5431377
Dissolved Organic Carbon	mg/L	0.69	0.50	5429953				0.87	0.50	5429953
pH	pH	8.11		5430144				8.08		5430144
Phenols-4AAP	mg/L	<0.0010	0.0010	5431391				<0.0010	0.0010	5431391
Total Phosphorus	mg/L	0.020	0.004	5431472				2.2	0.04	5431472
Dissolved Sulphate (SO4)	mg/L	12	1.0	5430105	11	1.0	5430105	42	1.0	5430105
Alkalinity (Total as CaCO3)	mg/L	200	1.0	5430136				180	1.0	5430136
Dissolved Chloride (Cl-)	mg/L	1.1	1.0	5430098	1.1	1.0	5430098	20	1.0	5430098
Nitrite (N)	mg/L	<0.010	0.010	5430094				0.016	0.010	5432691
Nitrate (N)	mg/L	<0.10	0.10	5430094				0.12	0.10	5432691
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5430094				0.14	0.10	5432691

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB950		GFB951			GFB951		
Sampling Date		2018/02/27 13:08		2018/02/27 15:30			2018/02/27 15:30		
COC Number		651534-01-01		651534-01-01			651534-01-01		
	UNITS	**MW17-2A**	**QC Batch**	**MW17-2B**	**RDL**	**QC Batch**	**MW17-2B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	200	5876633	180	1.0	5876633			
Calculated TDS	mg/L	520	5429488	490	1.0	5429488			
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.2	5876633	1.5	1.0	5876633			
Hardness (CaCO3)	mg/L	330	5429487	290	1.0	5429487			
Inorganics									
Total Ammonia-N	mg/L	0.12	5431761	0.19	0.050	5431761			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	5431248	<4.0	4.0	5431248			
Conductivity	umho/cm	920	5430141	880	1.0	5430141			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.20	5431377	<0.10	0.10	5431377			
Dissolved Organic Carbon	mg/L	1.0	5429953	1.0	0.50	5429956	1.0	0.50	5429956
pH	pH	8.08	5430144	7.95		5430144			
Phenols-4AAP	mg/L	<0.0010	5431391	<0.0010	0.0010	5431391			
Total Phosphorus	mg/L	0.007	5431472	0.008	0.004	5431472			
Dissolved Sulphate (SO4)	mg/L	170	5430105	150	1.0	5430105			
Alkalinity (Total as CaCO3)	mg/L	200	5430136	180	1.0	5430136			
Dissolved Chloride (Cl-)	mg/L	65	5430098	75	1.0	5430098			
Nitrite (N)	mg/L	0.017	5432691	0.026	0.010	5432691			
Nitrate (N)	mg/L	<0.10	5432691	1.07	0.10	5432691			
Nitrate + Nitrite (N)	mg/L	<0.10	5432691	1.10	0.10	5432691			

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

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A Bureau Veritas Group Company

Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB952		GFB953	GFB954		
Sampling Date		2018/02/27 13:35		2018/02/28 15:50	2018/02/28 17:00		
COC Number		651534-01-01		651534-01-01	651534-01-01		
	UNITS	**MW17-2C**	**RDL**	**MW17-3A**	**MW17-3B**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	220	1.0	180	210	1.0	5876633
Calculated TDS	mg/L	310	1.0	460	270	1.0	5429488
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.1	1.0	1.4	2.3	1.0	5876633
Hardness (CaCO3)	mg/L	250	1.0	280	200	1.0	5429487
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	0.058	0.14	0.050	5431761
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	<4.0	<4.0	4.0	5431248
Conductivity	umho/cm	570	1.0	840	510	1.0	5430141
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.50 (1)	0.50	0.12	0.17	0.10	5431377
Dissolved Organic Carbon	mg/L	0.92	0.50	0.99	0.61	0.50	5429953
pH	pH	7.99		7.91	8.07		5430144
Phenols-4AAP	mg/L	<0.0010	0.0010	<0.0010	0.0015	0.0010	5431391
Total Phosphorus	mg/L	0.35	0.04	0.027	0.031	0.004	5431472
Dissolved Sulphate (SO4)	mg/L	20	1.0	130	53	1.0	5430105
Alkalinity (Total as CaCO3)	mg/L	230	1.0	180	210	1.0	5430136
Dissolved Chloride (Cl-)	mg/L	14	1.0	69	3.7	1.0	5430098
Nitrite (N)	mg/L	0.013	0.010	<0.010	<0.010	0.010	5430094
Nitrate (N)	mg/L	9.56	0.10	1.36	<0.10	0.10	5430094
Nitrate + Nitrite (N)	mg/L	9.57	0.10	1.36	<0.10	0.10	5430094

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB954			GFB955			GFB956		
Sampling Date		2018/02/28 17:00			2018/02/28 15:30			2018/02/28 15:00		
COC Number		651534-01-01			651534-01-01			651534-01-01		
	UNITS	**MW17-3B Lab-Dup**	**RDL**	**QC Batch**	**MW17-2D**	**RDL**	**QC Batch**	**MW17-3E**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				230	1.0	5876633	290	1.0	5876633
Calculated TDS	mg/L				310	1.0	5429488	350	1.0	5429488
Carb. Alkalinity (calc. as CaCO3)	mg/L				1.9	1.0	5876633	2.6	1.0	5876633
Hardness (CaCO3)	mg/L				260	1.0	5429487	260	1.0	5429487
Inorganics										
Total Ammonia-N	mg/L	0.13	0.050	5431761	0.15	0.050	5431761	0.10	0.050	5431764
Total Chemical Oxygen Demand (COD)	mg/L				7.7	4.0	5431248	11	4.0	5431800
Conductivity	umho/cm				570	1.0	5430242	620	1.0	5430141
Total Kjeldahl Nitrogen (TKN)	mg/L				<0.50 (1)	0.50	5431377	0.85	0.10	5431811
Dissolved Organic Carbon	mg/L				0.69	0.50	5429953	2.2	0.50	5429953
pH	pH				7.93		5430246	7.98		5430144
Phenols-4AAP	mg/L				<0.0010	0.0010	5431404	<0.0010	0.0010	5431391
Total Phosphorus	mg/L				8.5	0.2	5431472	13	1	5433738
Dissolved Sulphate (SO4)	mg/L				13	1.0	5430153	35	1.0	5430105
Alkalinity (Total as CaCO3)	mg/L				230	1.0	5430235	290	1.0	5430136
Dissolved Chloride (Cl-)	mg/L				<20 (2)	20	5430167	11	1.0	5430098
Nitrite (N)	mg/L				<0.010	0.010	5432691	<0.010	0.010	5432691
Nitrate (N)	mg/L				11.3	0.10	5432691	1.43	0.10	5432691
Nitrate + Nitrite (N)	mg/L				11.3	0.10	5432691	1.43	0.10	5432691

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.
(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB957			GFB957		
Sampling Date		2018/03/01 17:15			2018/03/01 17:15		
COC Number		651534-01-01			651534-01-01		
	UNITS	**MW17-4A**	**RDL**	**QC Batch**	**MW17-4A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	280	1.0	5876633			
Calculated TDS	mg/L	470	1.0	5429488			
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.4	1.0	5876633			
Hardness (CaCO3)	mg/L	330	1.0	5429487			
Inorganics							
Total Ammonia-N	mg/L	0.14	0.050	5431761			
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5431248	<4.0	4.0	5431248
Conductivity	umho/cm	860	1.0	5430141			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.19	0.10	5431377			
Dissolved Organic Carbon	mg/L	1.2	0.50	5429953			
pH	pH	7.95		5430144			
Phenols-4AAP	mg/L	0.0015	0.0010	5431404	0.0015	0.0010	5431404
Total Phosphorus	mg/L	0.005	0.004	5431472			
Dissolved Sulphate (SO4)	mg/L	95	1.0	5430105			
Alkalinity (Total as CaCO3)	mg/L	290	1.0	5430136			
Dissolved Chloride (Cl-)	mg/L	42	1.0	5430098			
Nitrite (N)	mg/L	<0.010	0.010	5430094			
Nitrate (N)	mg/L	<0.10	0.10	5430094			
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5430094			

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

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB958			GFB958			GFB959		
Sampling Date		2018/03/01 17:45			2018/03/01 17:45			2018/03/02 09:35		
COC Number		651534-01-01			651534-01-01			651534-01-01		
	UNITS	**MW17-4B**	**RDL**	**QC Batch**	**MW17-4B Lab-Dup**	**RDL**	**QC Batch**	**MW17-5A**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	270	1.0	5876633				230	1.0	5876633
Calculated TDS	mg/L	540	1.0	5429488				840	1.0	5429488
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.8	1.0	5876633				1.7	1.0	5876633
Hardness (CaCO3)	mg/L	340	1.0	5429487				420	1.0	5429487
Inorganics										
Total Ammonia-N	mg/L	0.13	0.050	5431764				0.30	0.050	5431761
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5431800				18	4.0	5431248
Conductivity	umho/cm	880	1.0	5430242	970	1.0	5430242	1400	1.0	5430141
Total Kjeldahl Nitrogen (TKN)	mg/L	0.28	0.10	5431811				0.48	0.10	5431377
Dissolved Organic Carbon	mg/L	1.1	0.50	5429953				5.5	0.50	5429953
pH	pH	7.86		5430246	7.89		5430246	7.90		5430144
Phenols-4AAP	mg/L	0.0016	0.0010	5431391				<0.0010	0.0010	5431391
Total Phosphorus	mg/L	0.004	0.004	5433738				0.020	0.004	5431472
Dissolved Sulphate (SO4)	mg/L	130	1.0	5430105				350	2.0	5430153
Alkalinity (Total as CaCO3)	mg/L	270	1.0	5430235	270	1.0	5430235	230	1.0	5430136
Dissolved Chloride (Cl-)	mg/L	71	1.0	5430098				89	1.0	5430167
Nitrite (N)	mg/L	<0.010	0.010	5432691				0.024	0.010	5430094
Nitrate (N)	mg/L	<0.10	0.10	5432691				0.11	0.10	5430094
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	5432691				0.13	0.10	5430094

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB959			GFB960		GFB961		
Sampling Date		2018/03/02 09:35			2018/03/02 08:30		2018/03/02 10:15		
COC Number		651534-01-01			651534-01-01		651534-01-01		
	UNITS	**MW17-5A Lab-Dup**	**RDL**	**QC Batch**	**MW17-5B**	**QC Batch**	**MW17-5C**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				180	5876633	290	1.0	5876633
Calculated TDS	mg/L				450	5429488	530	1.0	5429488
Carb. Alkalinity (calc. as CaCO3)	mg/L				1.9	5876633	1.8	1.0	5876633
Hardness (CaCO3)	mg/L				270	5429487	410	1.0	5429487
Inorganics									
Total Ammonia-N	mg/L				<0.050	5431761	<0.050	0.050	5431761
Total Chemical Oxygen Demand (COD)	mg/L				<4.0	5431248	<4.0	4.0	5431248
Conductivity	umho/cm				820	5430141	880	1.0	5430141
Total Kjeldahl Nitrogen (TKN)	mg/L				<0.10	5431377	0.10	0.10	5431377
Dissolved Organic Carbon	mg/L	5.4	0.50	5429953	1.1	5429953	1.3	0.50	5429956
pH	pH				8.06	5430144	7.81		5430144
Phenols-4AAP	mg/L				<0.0010	5431404	<0.0010	0.0010	5431391
Total Phosphorus	mg/L				0.005	5431472	0.006	0.004	5431472
Dissolved Sulphate (SO4)	mg/L				120	5430105	140	1.0	5430105
Alkalinity (Total as CaCO3)	mg/L				180	5430136	290	1.0	5430136
Dissolved Chloride (Cl-)	mg/L				70	5430098	23	1.0	5430098
Nitrite (N)	mg/L				<0.010	5430094	0.082	0.010	5430094
Nitrate (N)	mg/L				2.03	5430094	2.83	0.10	5430094
Nitrate + Nitrite (N)	mg/L				2.03	5430094	2.91	0.10	5430094

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

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB961			GFB962	GFB963	GFB964		
Sampling Date		2018/03/02 10:15			2018/02/28 12:50	2018/02/28 16:40	2018/02/28 12:40		
COC Number		651534-01-01			651534-01-01	651534-01-01	651534-01-01		
	UNITS	**MW17-5C Lab-Dup**	**RDL**	**QC Batch**	**MW17-6A**	**MW17-3C**	**MW17-6B**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				220	240	260	1.0	5876633
Calculated TDS	mg/L				450	320	460	1.0	5429488
Carb. Alkalinity (calc. as CaCO3)	mg/L				2.0	2.4	2.0	1.0	5876633
Hardness (CaCO3)	mg/L				270	250	310	1.0	5429487
Inorganics									
Total Ammonia-N	mg/L				<0.050	<0.050	<0.050	0.050	5431761
Total Chemical Oxygen Demand (COD)	mg/L				<4.0	<4.0	<4.0	4.0	5431248
Conductivity	umho/cm	880	1.0	5430141	850	590	840	1.0	5430141
Total Kjeldahl Nitrogen (TKN)	mg/L	0.12	0.10	5431377	<0.10	<0.10	<0.10	0.10	5431377
Dissolved Organic Carbon	mg/L				1.9	0.80	1.2	0.50	5429953
pH	pH	7.84		5430144	7.98	8.03	7.92		5430144
Phenols-4AAP	mg/L				<0.0010	<0.0010	<0.0010	0.0010	5431391
Total Phosphorus	mg/L				0.026	0.020	0.020	0.004	5431472
Dissolved Sulphate (SO4)	mg/L				49	47	72	1.0	5430105
Alkalinity (Total as CaCO3)	mg/L	300	1.0	5430136	220	240	260	1.0	5430136
Dissolved Chloride (Cl-)	mg/L				93	16	64	1.0	5430098
Nitrite (N)	mg/L	0.081	0.010	5430094	<0.010	<0.010	0.085	0.010	5430094
Nitrate (N)	mg/L	2.89	0.10	5430094	3.68	0.51	1.78	0.10	5430094
Nitrate + Nitrite (N)	mg/L	2.97	0.10	5430094	3.68	0.51	1.87	0.10	5430094

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

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

RESULTS OF ANALYSES OF WATER

Maxxam ID		GFB965			GFB966	GFB967		
Sampling Date		2018/02/27 13:50			2018/02/28 13:00	2018/03/01 16:15		
COC Number		651534-01-01			651534-01-01	651534-01-01		
	UNITS	**DUP-2C**	**RDL**	**QC Batch**	**DUP-6A**	**EB**	**RDL**	**QC Batch**
Calculated Parameters								
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	230	1.0	5876633	220	2.4	1.0	5876633
Calculated TDS	mg/L	320	1.0	5429488	450	1.0	1.0	5429488
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.1	1.0	5876633	2.3	<1.0	1.0	5876633
Hardness (CaCO3)	mg/L	260	1.0	5429487	270	<1.0	1.0	5429487
Inorganics								
Total Ammonia-N	mg/L	<0.050	0.050	5431761	<0.050	<0.050	0.050	5431761
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	5431248	<4.0	<4.0	4.0	5431248
Conductivity	umho/cm	570	1.0	5430141	860	2.4	1.0	5430141
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.50 (1)	0.50	5431377	<0.10	<0.10	0.10	5431377
Dissolved Organic Carbon	mg/L	0.70	0.50	5429953	1.8	0.74	0.50	5429953
pH	pH	8.00		5430144	8.03	6.46		5430144
Phenols-4AAP	mg/L	<0.0010	0.0010	5431391	<0.0010	<0.0010	0.0010	5431404
Total Phosphorus	mg/L	0.38	0.04	5431472	0.027	0.010	0.004	5431472
Dissolved Sulphate (SO4)	mg/L	20	1.0	5430105	48	<1.0	1.0	5430105
Alkalinity (Total as CaCO3)	mg/L	230	1.0	5430136	230	2.4	1.0	5430136
Dissolved Chloride (Cl-)	mg/L	14	1.0	5430098	94	<1.0	1.0	5430098
Nitrite (N)	mg/L	0.014	0.010	5430094	<0.010	<0.010	0.010	5432691
Nitrate (N)	mg/L	9.55	0.10	5430094	3.78	<0.10	0.10	5432691
Nitrate + Nitrite (N)	mg/L	9.57	0.10	5430094	3.78	<0.10	0.10	5432691

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GFB946		GFB947			GFB947		
Sampling Date		2018/02/27 10:40		2018/03/01 14:20			2018/03/01 14:20		
COC Number		651534-01-01		651534-01-01			651534-01-01		
	UNITS	**MW17-1A**	**QC Batch**	**MW17-1B**	**RDL**	**QC Batch**	**MW17-1B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters									
Chromium (+3)	ug/L	<5	5429485	<5	5	5429485			
Metals									
Chromium (VI)	ug/L	<0.50	5433654	<0.50	0.50	5433624	<0.50	0.50	5433624
Mercury (Hg)	mg/L	<0.0001	5431759	<0.0001	0.0001	5430929	<0.0001	0.0001	5430929
Dissolved Aluminum (Al)	ug/L	5.5	5429877	7.1	5.0	5429877			
Dissolved Arsenic (As)	ug/L	2.0	5429877	<1.0	1.0	5429877			
Dissolved Barium (Ba)	ug/L	100	5429877	84	2.0	5429877			
Dissolved Boron (B)	ug/L	53	5429877	56	10	5429877			
Dissolved Cadmium (Cd)	ug/L	<0.10	5429877	<0.10	0.10	5429877			
Dissolved Calcium (Ca)	ug/L	32000	5429877	24000	200	5429877			
Dissolved Chromium (Cr)	ug/L	<5.0	5429877	<5.0	5.0	5429877			
Dissolved Copper (Cu)	ug/L	<1.0	5429877	<1.0	1.0	5429877			
Dissolved Iron (Fe)	ug/L	<100	5429877	<100	100	5429877			
Dissolved Lead (Pb)	ug/L	<0.50	5429877	<0.50	0.50	5429877			
Dissolved Magnesium (Mg)	ug/L	20000	5429877	18000	50	5429877			
Dissolved Manganese (Mn)	ug/L	8.6	5429877	<2.0	2.0	5429877			
Dissolved Potassium (K)	ug/L	1500	5429877	1100	200	5429877			
Dissolved Sodium (Na)	ug/L	22000	5429877	17000	100	5429877			
Dissolved Zinc (Zn)	ug/L	7.2	5429877	<5.0	5.0	5429877			

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

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A Bureau Veritas Group Company

Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GFB948		GFB949		GFB950		GFB951		
Sampling Date		2018/02/26 15:00		2018/02/26 15:15		2018/02/27 13:08		2018/02/27 15:30		
COC Number		651534-01-01		651534-01-01		651534-01-01		651534-01-01		
	UNITS	**MW17-1C**	**QC Batch**	**MW17-1D**	**QC Batch**	**MW17-2A**	**QC Batch**	**MW17-2B**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	5429485	<5	5429485	<5	5429485	<5	5	5429485
Metals										
Chromium (VI)	ug/L	<0.50	5433624	<0.50	5433624	<0.50	5433624	<0.50	0.50	5433624
Mercury (Hg)	mg/L	<0.0001	5431759	<0.0001	5430929	<0.0001	5430929	<0.0001	0.0001	5430929
Dissolved Aluminum (Al)	ug/L	<5.0	5429877	<5.0	5429877	<5.0	5429394	<5.0	5.0	5429877
Dissolved Arsenic (As)	ug/L	3.8	5429877	11	5429877	<1.0	5429394	<1.0	1.0	5429877
Dissolved Barium (Ba)	ug/L	87	5429877	56	5429877	24	5429394	33	2.0	5429877
Dissolved Boron (B)	ug/L	42	5429877	38	5429877	91	5429394	54	10	5429877
Dissolved Cadmium (Cd)	ug/L	<0.10	5429877	<0.10	5429877	<0.10	5429394	<0.10	0.10	5429877
Dissolved Calcium (Ca)	ug/L	31000	5429877	36000	5429877	70000	5429394	73000	200	5429877
Dissolved Chromium (Cr)	ug/L	<5.0	5429877	<5.0	5429877	<5.0	5429394	<5.0	5.0	5429877
Dissolved Copper (Cu)	ug/L	<1.0	5429877	<1.0	5429877	<1.0	5429394	1.7	1.0	5429877
Dissolved Iron (Fe)	ug/L	180	5429877	140	5429877	<100	5429394	<100	100	5429877
Dissolved Lead (Pb)	ug/L	<0.50	5429877	<0.50	5429877	<0.50	5429394	<0.50	0.50	5429877
Dissolved Magnesium (Mg)	ug/L	18000	5429877	25000	5429877	37000	5429394	27000	50	5429877
Dissolved Manganese (Mn)	ug/L	6.9	5429877	12	5429877	4.6	5429394	10	2.0	5429877
Dissolved Potassium (K)	ug/L	960	5429877	980	5429877	3300	5429394	3700	200	5429877
Dissolved Sodium (Na)	ug/L	15000	5429877	17000	5429877	49000	5429394	43000	100	5429877
Dissolved Zinc (Zn)	ug/L	<5.0	5429877	<5.0	5429877	<5.0	5429394	<5.0	5.0	5429877

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GFB952		GFB953		GFB954	GFB955		
Sampling Date		2018/02/27 13:35		2018/02/28 15:50		2018/02/28 17:00	2018/02/28 15:30		
COC Number		651534-01-01		651534-01-01		651534-01-01	651534-01-01		
	UNITS	**MW17-2C**	**QC Batch**	**MW17-3A**	**QC Batch**	**MW17-3B**	**MW17-2D**	**RDL**	**QC Batch**
Calculated Parameters									
Chromium (+3)	ug/L	<5	5429485	<5	5429485	<5	<5	5	5429485
Metals									
Chromium (VI)	ug/L	<0.50	5433624	<0.50	5433654	<0.50	<0.50	0.50	5433624
Mercury (Hg)	mg/L	<0.0001	5431759	<0.0001	5430929	<0.0001	<0.0001	0.0001	5430929
Dissolved Aluminum (Al)	ug/L	<5.0	5429877	<5.0	5429877	<5.0	<5.0	5.0	5429877
Dissolved Arsenic (As)	ug/L	<1.0	5429877	<1.0	5429877	<1.0	<1.0	1.0	5429877
Dissolved Barium (Ba)	ug/L	32	5429877	39	5429877	37	19	2.0	5429877
Dissolved Boron (B)	ug/L	12	5429877	58	5429877	89	<10	10	5429877
Dissolved Cadmium (Cd)	ug/L	<0.10	5429877	<0.10	5429877	<0.10	<0.10	0.10	5429877
Dissolved Calcium (Ca)	ug/L	72000	5429877	63000	5429877	34000	75000	200	5429877
Dissolved Chromium (Cr)	ug/L	<5.0	5429877	<5.0	5429877	<5.0	<5.0	5.0	5429877
Dissolved Copper (Cu)	ug/L	1.9	5429877	<1.0	5429877	<1.0	<1.0	1.0	5429877
Dissolved Iron (Fe)	ug/L	<100	5429877	110	5429877	110	<100	100	5429877
Dissolved Lead (Pb)	ug/L	<0.50	5429877	<0.50	5429877	<0.50	<0.50	0.50	5429877
Dissolved Magnesium (Mg)	ug/L	18000	5429877	30000	5429877	28000	18000	50	5429877
Dissolved Manganese (Mn)	ug/L	7.7	5429877	2.7	5429877	2.2	9.6	2.0	5429877
Dissolved Potassium (K)	ug/L	670	5429877	3300	5429877	1500	1100	200	5429877
Dissolved Sodium (Na)	ug/L	3500	5429877	41000	5429877	18000	2000	100	5429877
Dissolved Zinc (Zn)	ug/L	<5.0	5429877	<5.0	5429877	<5.0	<5.0	5.0	5429877

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GFB956	GFB957		GFB958	GFB959		GFB960		
Sampling Date		2018/02/28 15:00	2018/03/01 17:15		2018/03/01 17:45	2018/03/02 09:35		2018/03/02 08:30		
COC Number		651534-01-01	651534-01-01		651534-01-01	651534-01-01		651534-01-01		
	UNITS	**MW17-3E**	**MW17-4A**	**RDL**	**MW17-4B**	**MW17-5A**	**RDL**	**MW17-5B**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	<5	5	<5	<5	5	<5	5	5429485
Metals										
Chromium (VI)	ug/L	<0.50	<0.50	0.50	<0.50	<0.50	0.50	<0.50	0.50	5433624
Mercury (Hg)	mg/L	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0001	5430929
Dissolved Aluminum (Al)	ug/L	<5.0	12	5.0	<5.0	5.7	5.0	<5.0	5.0	5429877
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	1.0	<1.0	<1.0	1.0	<1.0	1.0	5429877
Dissolved Barium (Ba)	ug/L	52	35	2.0	31	25	2.0	35	2.0	5429877
Dissolved Boron (B)	ug/L	20	60	10	78	150	10	48	10	5429877
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	0.10	<0.10	<0.10	0.10	<0.10	0.10	5429877
Dissolved Calcium (Ca)	ug/L	71000	80000	200	81000	74000	400	67000	200	5429877
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	5.0	<5.0	<5.0	5.0	<5.0	5.0	5429877
Dissolved Copper (Cu)	ug/L	1.4	<1.0	1.0	<1.0	<1.0	1.0	<1.0	1.0	5429877
Dissolved Iron (Fe)	ug/L	<100	<100	100	<100	<100	100	<100	100	5429877
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	0.50	<0.50	<0.50	0.50	<0.50	0.50	5429877
Dissolved Magnesium (Mg)	ug/L	21000	32000	50	34000	58000	50	26000	50	5429877
Dissolved Manganese (Mn)	ug/L	<2.0	19	2.0	14	11	2.0	<2.0	2.0	5429877
Dissolved Potassium (K)	ug/L	11000	1900	200	2200	3500	200	3500	200	5429877
Dissolved Sodium (Na)	ug/L	8800	33000	100	49000	120000	100	40000	100	5429877
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	5.0	<5.0	8.5	5.0	<5.0	5.0	5429877

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GFB961	GFB962	GFB963	GFB964			GFB964		
Sampling Date		2018/03/02 10:15	2018/02/28 12:50	2018/02/28 16:40	2018/02/28 12:40			2018/02/28 12:40		
COC Number		651534-01-01	651534-01-01	651534-01-01	651534-01-01			651534-01-01		
	UNITS	**MW17-5C**	**MW17-6A**	**MW17-3C**	**MW17-6B**	**RDL**	**QC Batch**	**MW17-6B Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters										
Chromium (+3)	ug/L	<5	<5	<5	<5	5	5429485			
Metals										
Chromium (VI)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	5433624			
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	5430929			
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	5429877	<5.0	5.0	5429877
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	5429877	<1.0	1.0	5429877
Dissolved Barium (Ba)	ug/L	36	48	86	69	2.0	5429877	66	2.0	5429877
Dissolved Boron (B)	ug/L	33	17	22	26	10	5429877	25	10	5429877
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	5429877	<0.10	0.10	5429877
Dissolved Calcium (Ca)	ug/L	120000	78000	58000	84000	200	5429877	83000	200	5429877
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	5429877	<5.0	5.0	5429877
Dissolved Copper (Cu)	ug/L	<1.0	1.6	3.2	2.5	1.0	5429877	2.5	1.0	5429877
Dissolved Iron (Fe)	ug/L	<100	<100	<100	<100	100	5429877	<100	100	5429877
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	5429877	<0.50	0.50	5429877
Dissolved Magnesium (Mg)	ug/L	28000	19000	26000	24000	50	5429877	24000	50	5429877
Dissolved Manganese (Mn)	ug/L	13	<2.0	12	34	2.0	5429877	33	2.0	5429877
Dissolved Potassium (K)	ug/L	6000	5800	1500	2500	200	5429877	2400	200	5429877
Dissolved Sodium (Na)	ug/L	16000	44000	10000	35000	100	5429877	34000	100	5429877
Dissolved Zinc (Zn)	ug/L	7.2	<5.0	5.5	9.0	5.0	5429877	9.2	5.0	5429877

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

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		GFB965	GFB966		GFB967		
Sampling Date		2018/02/27 13:50	2018/02/28 13:00		2018/03/01 16:15		
COC Number		651534-01-01	651534-01-01		651534-01-01		
	UNITS	DUP-2C	DUP-6A	QC Batch	EB	RDL	QC Batch
Calculated Parameters							
Chromium (+3)	ug/L	<5	<5	5429485	<5	5	5429485
Metals							
Chromium (VI)	ug/L	<0.50	<0.50	5433624	<0.50	0.50	5433624
Mercury (Hg)	mg/L	<0.0001	<0.0001	5430929	<0.0001	0.0001	5430929
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	5429877	<5.0	5.0	5429394
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	5429877	<1.0	1.0	5429394
Dissolved Barium (Ba)	ug/L	31	50	5429877	<2.0	2.0	5429394
Dissolved Boron (B)	ug/L	12	18	5429877	<10	10	5429394
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	5429877	<0.10	0.10	5429394
Dissolved Calcium (Ca)	ug/L	73000	78000	5429877	<200	200	5429394
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	5429877	<5.0	5.0	5429394
Dissolved Copper (Cu)	ug/L	<1.0	<1.0	5429877	<1.0	1.0	5429394
Dissolved Iron (Fe)	ug/L	<100	<100	5429877	<100	100	5429394
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	5429877	<0.50	0.50	5429394
Dissolved Magnesium (Mg)	ug/L	18000	19000	5429877	<50	50	5429394
Dissolved Manganese (Mn)	ug/L	6.9	<2.0	5429877	<2.0	2.0	5429394
Dissolved Potassium (K)	ug/L	670	5900	5429877	<200	200	5429394
Dissolved Sodium (Na)	ug/L	3500	43000	5429877	<100	100	5429394
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	5429877	<5.0	5.0	5429394

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		GFB946	GFB947	GFB947	GFB948	GFB949		
Sampling Date		2018/02/27 10:40	2018/03/01 14:20	2018/03/01 14:20	2018/02/26 15:00	2018/02/26 15:15		
COC Number		651534-01-01	651534-01-01	651534-01-01	651534-01-01	651534-01-01		
	UNITS	**MW17-1A**	**MW17-1B**	**MW17-1B Lab-Dup**	**MW17-1C**	**MW17-1D**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5430103
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5430103
Toluene	ug/L	0.20	0.46	0.43	<0.20	<0.20	0.20	5430103
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5430103
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	99	100	100	99	100		5430103
D4-1,2-Dichloroethane	%	106	104	106	105	108		5430103
D8-Toluene	%	98	99	97	98	97		5430103

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

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		GFB950	GFB951	GFB952	GFB953	GFB954		
Sampling Date		2018/02/27 13:08	2018/02/27 15:30	2018/02/27 13:35	2018/02/28 15:50	2018/02/28 17:00		
COC Number		651534-01-01	651534-01-01	651534-01-01	651534-01-01	651534-01-01		
	UNITS	**MW17-2A**	**MW17-2B**	**MW17-2C**	**MW17-3A**	**MW17-3B**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	0.22	<0.20	<0.20	<0.20	<0.20	0.20	5430103
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5430103
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5430103
Toluene	ug/L	0.45	<0.20	<0.20	<0.20	<0.20	0.20	5430103
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5430103
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	101	99	99	99	98		5430103
D4-1,2-Dichloroethane	%	107	104	105	106	106		5430103
D8-Toluene	%	98	97	98	98	98		5430103

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		GFB955	GFB956	GFB957	GFB958	GFB959		
Sampling Date		2018/02/28 15:30	2018/02/28 15:00	2018/03/01 17:15	2018/03/01 17:45	2018/03/02 09:35		
COC Number		651534-01-01	651534-01-01	651534-01-01	651534-01-01	651534-01-01		
	UNITS	**MW17-2D**	**MW17-3E**	**MW17-4A**	**MW17-4B**	**MW17-5A**	**RDL**	**QC Batch**
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5430103
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5430103
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	0.26	0.20	5430103
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5430103
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	99	97	99	99	98		5430103
D4-1,2-Dichloroethane	%	104	100	104	104	103		5430103
D8-Toluene	%	98	99	98	97	98		5430103

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID		GFB960	GFB961	GFB962	GFB963	GFB964		
Sampling Date		2018/03/02 08:30	2018/03/02 10:15	2018/02/28 12:50	2018/02/28 16:40	2018/02/28 12:40		
COC Number		651534-01-01	651534-01-01	651534-01-01	651534-01-01	651534-01-01		
	UNITS	MW17-5B	MW17-5C	MW17-6A	MW17-3C	MW17-6B	RDL	QC Batch
Volatile Organics								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	5430103
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	5430103
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5430103
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	25	5430103
Surrogate Recovery (%)								
4-Bromofluorobenzene	%	98	98	91	92	89		5430103
D4-1,2-Dichloroethane	%	104	104	115	117	119		5430103
D8-Toluene	%	98	97	98	98	98		5430103

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

DRAFT

Maxxam ID		GFB965		GFB966	GFB967		GFB968		
Sampling Date		2018/02/27 13:50		2018/02/28 13:00	2018/03/01 16:15		2018/02/26		
COC Number		651534-01-01		651534-01-01	651534-01-01		651534-01-01		
	UNITS	DUP-2C	QC Batch	DUP-6A	EB	QC Batch	TRIP BLANK	RDL	QC Batch
Volatile Organics									
Benzene	ug/L	<0.20	5430103	<0.20	<0.20	5429587	<0.20	0.20	5426113
1,4-Dichlorobenzene	ug/L	<0.50	5430103	<0.50	<0.50	5429587	<0.50	0.50	5426113
Methylene Chloride(Dichloromethane)	ug/L	<2.0	5430103	<2.0	<2.0	5429587	<2.0	2.0	5426113
Toluene	ug/L	<0.20	5430103	<0.20	<0.20	5429587	<0.20	0.20	5426113
Vinyl Chloride	ug/L	<0.20	5430103	<0.20	<0.20	5429587	<0.20	0.20	5426113
p+m-Xylene	ug/L	<0.20	5430103	<0.20	<0.20	5429587	<0.20	0.20	5426113
o-Xylene	ug/L	<0.20	5430103	<0.20	<0.20	5429587	<0.20	0.20	5426113
Total Xylenes	ug/L	<0.20	5430103	<0.20	<0.20	5429587	<0.20	0.20	5426113
F1 (C6-C10)	ug/L	<25	5430103	<25	<25	5429587	<25	25	5426113
Surrogate Recovery (%)									
4-Bromofluorobenzene	%	98	5430103	87	90	5429587	91		5426113
D4-1,2-Dichloroethane	%	105	5430103	104	104	5429587	104		5426113
D8-Toluene	%	98	5430103	98	96	5429587	97		5426113

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GFB946
Sample ID: MW17-1A
Matrix: Water

Collected: 2018/02/27
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/12	2018/03/12	Automated Statchk
Chromium (VI) in Water	IC	5433654	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5431759	2018/03/08	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431404	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

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Maxxam ID: GFB947
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431800	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431404	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal

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TEST SUMMARY

Maxxam ID: GFB947
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB947 Dup
Sample ID: MW17-1B
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5431800	N/A	2018/03/08	Yogesh Patel
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

DRAFT

Maxxam ID: GFB948
Sample ID: MW17-1C
Matrix: Water

Collected: 2018/02/26
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5431759	2018/03/08	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB948 Dup
Sample ID: MW17-1C
Matrix: Water

Collected: 2018/02/26
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine

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TEST SUMMARY

Maxxam ID: GFB949
Sample ID: MW17-1D
Matrix: Water

Collected: 2018/02/26
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5432691	N/A	2018/03/09	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/09	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB950
Sample ID: MW17-2A
Matrix: Water

Collected: 2018/02/27
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/08	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429394	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5432691	N/A	2018/03/09	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/09	Amanpreet Sappal

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Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
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TEST SUMMARY

Maxxam ID: GFB950
Sample ID: MW17-2A
Matrix: Water

Collected: 2018/02/27
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB951
Sample ID: MW17-2B
Matrix: Water

Collected: 2018/02/27
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429956	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5432691	N/A	2018/03/09	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

DRAFT

Maxxam ID: GFB951 Dup
Sample ID: MW17-2B
Matrix: Water

Collected: 2018/02/27
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429956	N/A	2018/07/03	Nimarta Singh

Maxxam ID: GFB952
Sample ID: MW17-2C
Matrix: Water

Collected: 2018/02/27
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk

Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GFB952
Sample ID: MW17-2C
Matrix: Water

Collected: 2018/02/27
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5431759	2018/03/08	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/09	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB953
Sample ID: MW17-3A
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/12	2018/03/12	Automated Statchk
Chromium (VI) in Water	IC	5433654	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GFB954
Sample ID: MW17-3B
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB954 Dup
Sample ID: MW17-3B
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha

Maxxam ID: GFB955
Sample ID: MW17-2D
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430235	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430167	N/A	2018/03/08	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430242	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha

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Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GFB955
Sample ID: MW17-2D
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5432691	N/A	2018/03/09	Chandra Nandlal
pH	AT	5430246	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431404	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430153	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/09	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB956
Sample ID: MW17-3E
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431800	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431764	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5432691	N/A	2018/03/09	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431811	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5433738	2018/03/09	2018/03/12	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB957
Sample ID: MW17-4A
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
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TEST SUMMARY

Maxxam ID: GFB957
Sample ID: MW17-4A
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431404	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB957 Dup
Sample ID: MW17-4A
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	5431404	N/A	2018/03/08	Bramdeo Motiram

Maxxam ID: GFB958
Sample ID: MW17-4B
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430235	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431800	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430242	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431764	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5432691	N/A	2018/03/09	Chandra Nandlal
pH	AT	5430246	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine

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TEST SUMMARY

Maxxam ID: GFB958
Sample ID: MW17-4B
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431811	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5433738	2018/03/09	2018/03/11	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB958 Dup
Sample ID: MW17-4B
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430235	N/A	2018/03/08	Surinder Rai
Conductivity	AT	5430242	N/A	2018/03/08	Surinder Rai
pH	AT	5430246	N/A	2018/03/08	Surinder Rai

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Maxxam ID: GFB959
Sample ID: MW17-5A
Matrix: Water

Collected: 2018/03/02
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430167	N/A	2018/03/08	Alina Dobreanu
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430153	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB959 Dup
Sample ID: MW17-5A
Matrix: Water

Collected: 2018/03/02
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh

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Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GFB960 **Collected:** 2018/03/02
Sample ID: MW17-5B **Shipped:**
Matrix: Water **Received:** 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431404	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/08	Anna Gabrielyan

Maxxam ID: GFB961 **Collected:** 2018/03/02
Sample ID: MW17-5C **Shipped:**
Matrix: Water **Received:** 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429956	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GFB961
Sample ID: MW17-5C
Matrix: Water

Collected: 2018/03/02
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/09	Anna Gabrielyan

Maxxam ID: GFB961 Dup
Sample ID: MW17-5C
Matrix: Water

Collected: 2018/03/02
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi

DRAFT

Maxxam ID: GFB962
Sample ID: MW17-6A
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/12	Anna Gabrielyan

Maxxam ID: GFB963
Sample ID: MW17-3C
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GFB963
Sample ID: MW17-3C
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/12	Anna Gabrielyan

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Maxxam ID: GFB964
Sample ID: MW17-6B
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/12	Anna Gabrielyan

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

TEST SUMMARY

Maxxam ID: GFB964 Dup
Sample ID: MW17-6B
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg

Maxxam ID: GFB965
Sample ID: DUP-2C
Matrix: Water

Collected: 2018/02/27
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5430094	N/A	2018/03/08	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431391	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/12	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5430103	N/A	2018/03/09	Anna Gabrielyan

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Maxxam ID: GFB966
Sample ID: DUP-6A
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/09	2018/03/09	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/09	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429877	N/A	2018/03/08	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha

TEST SUMMARY

Maxxam ID: GFB966
Sample ID: DUP-6A
Matrix: Water

Collected: 2018/02/28
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5432691	N/A	2018/03/09	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431404	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/09	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5429587	N/A	2018/03/08	Xueming Jiang

Maxxam ID: GFB967
Sample ID: EB
Matrix: Water

Collected: 2018/03/01
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5430136	N/A	2018/03/08	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5876633	N/A	2018/12/07	Anastassia Hamanov
Chloride by Automated Colourimetry	KONE	5430098	N/A	2018/03/09	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5431248	N/A	2018/03/08	Yogesh Patel
Conductivity	AT	5430141	N/A	2018/03/08	Surinder Rai
Chromium 3+ by calculation		5429485	2018/03/13	2018/03/13	Automated Statchk
Chromium (VI) in Water	IC	5433624	N/A	2018/03/09	Rupinder Sihota
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5429953	N/A	2018/03/07	Nimarta Singh
Hardness (calculated as CaCO3)		5429487	N/A	2018/03/08	Automated Statchk
Mercury in Water by CVAA	CV/AA	5430929	2018/03/07	2018/03/08	Ron Morrison
Dissolved Metals by ICPMS	ICP/MS	5429394	N/A	2018/03/13	Matthew Ritenburg
Total Ammonia-N	LACH/NH4	5431761	N/A	2018/03/08	Parminder Sangha
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5432691	N/A	2018/03/09	Chandra Nandlal
pH	AT	5430144	N/A	2018/03/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5431404	N/A	2018/03/08	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	5430105	N/A	2018/03/09	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5429488	N/A	2018/03/13	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	5431377	2018/03/08	2018/03/08	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	5431472	2018/03/08	2018/03/08	Amanpreet Sappal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5429587	N/A	2018/03/08	Xueming Jiang

Maxxam ID: GFB968
Sample ID: TRIP BLANK
Matrix: Water

Collected: 2018/02/26
Shipped:
Received: 2018/03/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5426113	N/A	2018/03/09	Xueming Jiang

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Maxxam Job #: B850536
Report Date: 2018/12/07

Golder Associates Ltd
Client Project #: 1664706.2000.7
Sampler Initials: MC

GENERAL COMMENTS

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

Package 1	4.3°C
Package 2	5.0°C
Package 3	4.3°C
Package 4	0.3°C
Package 5	4.7°C
Package 6	2.0°C

Revised report (2018/12/07): Includes calculations for Carbonate/Bicarbonate Alkalinity.

Sample GFB951 [MW17-2B] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample GFB955 [MW17-2D] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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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).

Anastassia Hamanov, Scientific Specialist

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

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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