



February 23, 2013

HYDROGEOLOGICAL ASSESSMENT

Drury Creek Solid Waste Disposal Facility

Submitted to:

Ms. Laura Prentice
Senior Program Manager
Land Development Unit
Community Services, Infrastructure Development Branch
PO Box 2703, Main Administration Building
Whitehorse, YT Y1A 2C6

REPORT



Report Number: 1114360073-514-R-Rev0-2800

Distribution:

2 Copies - Yukon Government Community Services
2 Copies - Golder Associates Ltd.





Executive Summary

Golder Associates Ltd. (“Golder”) was retained by the Government of Yukon Community Services Infrastructure Branch on September 28, 2011 to complete a groundwater monitoring well network installation and hydrogeological assessment program at up to 20 solid waste facilities located across the Territory. The Drury Creek Solid Waste Disposal Facility (the “Facility” or “Site”) is one of the sites included in the program. A multiphase approach was implemented at each Facility in order to carry out the hydrogeological assessment. The first phase completed for the program was a review of Site-specific requirements and considerations. The second phase was the preparation of a work plan and schedule. The third phase was the development and presentation of a Background Research and Facility Site Assessment Plan. The fourth phase consisted of the drill program tender specification and tender process management. The fifth phase consisted of the installation of a monitoring well network and collection of data on water levels, water quality, and aquifer parameters. The sixth and final phase resulted in a draft of this Hydrogeological Assessment Report, documenting the results of the investigation.

In summary, the information obtained during the Site Assessment indicated the following:

- **Site Description:** The Drury Creek Solid Waste Disposal Facility is located in the southern portion of Yukon, within the Pelly Mountains Ecological Region, and Little Salmon Carmacks and Ross River Dena First Nations’ traditional territory, at latitude 62° 12’ north, and longitude 134° 23’ west. The Site is accessed by a gravel road off the north side of the Robert Campbell Highway, approximately 110 km east of the Village of Carmacks and 47 km west of Faro, just east of the kilometre post 470. It is located on a six hectare Community Services Reserve (Disposition # 15304). The Facility serves as a solid waste disposal facility for the Yukon Government Highways camp at Drury Creek and approximately 10 year round residents in the Drury Creek area. The Facility accepts primarily domestic waste, construction waste, demolition waste, and grubbing waste. Scrap metals are segregated and transported off-Site when volumes warrant. According to the 2008 Solid Waste Management Plan for the Facility, automotive waste, including tires, waste oils, and derelict vehicle bodies were not accepted at the Site; however, a waste oil segregation area was observed during the second site reconnaissance. No evidence of spills or discharges was observed during the Site reconnaissance.

Site Topography: The Facility is at an elevation of approximately 665 m (2,180 feet) above sea level and lies within the Little Salmon Lake watershed. A cleared area of approximately 10,000 square meters is present at the Facility, which slopes to the southeast at approximately 0.03 m/m. Local surficial geology is mapped as a glaciofluvial delta and colluvial apron sediments, consisting primarily of sand and gravel with minor silt. The regional hydraulic gradient near the Site is expected to follow the regional topography, which slopes southeast towards Little Salmon Lake.

- **Stratigraphy and Hydrogeology:**
 - Surface expression at the Site is dominated by quaternary surficial deposits;



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

- Subsurface conditions were investigated with the installation of three monitoring wells, including DC-MW12-01, DC-MW12-02, and DC-MW12-03, which were completed from July 12 through 14, 2012, under the supervision of Golder Associates, for the establishment of a monitoring well network at the Site;
 - The Site stratigraphy was investigated to a maximum depth of 18.0 m in DC-MW12-02, and was found to consist of 13.7 m of sand and gravel with minor silt, overlying 3.4 meters of sandy clay, overlying bedrock;
 - During the drilling of DC-MW12-01 an unconfined aquifer was encountered at 5.2 m below grade (bg) consisting of silty sand; at DC-MW12-03 an unconfined aquifer was encountered at approximately 14.5 m bg in similar material; and at DC-MW12-02 an unconfined aquifer was encountered at approximately 13.7 m bg in a sandy clay;
 - Hydraulic response tests were performed on all three monitoring wells. The results of these tests indicate the hydraulic conductivity of the unconfined aquifer underlying the Site ranges from 4×10^{-6} m/s to 1×10^{-4} m/s. These values are considered reasonable for the units encountered during installation of each of these wells;
 - The horizontal hydraulic gradient at the Site was estimated, using groundwater elevation data, to be approximately 0.22 m/m, sloping to the southeast;
 - Groundwater velocity in the surficial aquifer is estimated to range between approximately 2.5×10^{-6} m/s and 6×10^{-5} m/s (approximately 0.2 to 5.4 metres per day); and
 - Based on the groundwater flow direction, it was determined that both DC-MW12-02 and DC-MW12-03 are downgradient of the Site, and FA-MW12-01 is upgradient of the Site; therefore, the requirements for one upgradient and two downgradient wells at the Site have been met.
- Groundwater Chemistry:
- The results of a desktop study and several Site visits indicate that the Yukon Contaminated Sites Regulation (CSR) criteria for freshwater aquatic life and drinking water are applicable at the Site;
 - Groundwater samples were collected from all monitoring wells on September 1, 2012, and a surface water sample was collected from a small pond approximately 200 m southeast of the Facility on September 2, 2012, in order to complete the initial monitoring event at the Facility;
 - Iron was found to exceed the CSR for drinking water quality in the sample from DC-MW12-03;
 - Manganese exceeded the CSR for drinking water quality in samples from all three of the monitoring wells;
 - Trichlorofluoromethane (Freon 11) was detected in DC-MW12-02. Presence of this chemical is consistent with influence from landfill leachate; and
 - No other analytes exceeded CSR standards at the Site.



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

The following recommendations are made, based on the results of the 2012 hydrogeological assessment presented in this report:

- As required by the Facility's Waste Management Permit, future groundwater monitoring should be conducted twice a year (spring and late summer);
- Groundwater quality at the Facility should be re-evaluated following two rounds of groundwater monitoring to determine if there are any potential impacts present from landfill leachate; and
- Monitoring well location, elevation for ground surface, and the elevation of the top of the PVC standpipe (measuring point) should be surveyed for each well by a professional land surveyor prior to the next monitoring event.



Study Limitations

This report was prepared for the Government of Yukon, Community Services Infrastructure Development Branch.

The inferences concerning the Drury Creek Solid Waste Disposal Facility contained in this report are based on information obtained during the assessment conducted by Golder personnel, and are based solely on the condition of the property at the time of the Site reconnaissance, installation of monitoring wells, and groundwater monitoring events, supplemented by historical and interview information obtained by Golder, as described in this report.

This report was prepared, based in part, on information obtained from historic information sources. In evaluating the subject Site, Golder has relied in good faith on information provided. We accept no responsibility for deficiency or inaccuracy contained in this report as a result of our reliance on the aforementioned information.

The findings and conclusions documented in this report have been prepared for the specific application to this project, and have been developed in a manner consistent with that level of care normally exercised by environmental professionals currently practicing under similar conditions in the jurisdiction.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

With respect to regulatory compliance issues, regulatory statutes are subject to interpretation. These interpretations may change over time, and should be reviewed.

If new information is discovered during future work, Golder should be requested to re-evaluate the conclusions of this report and to provide amendments, as required, prior to any reliance upon the information presented herein.



Table of Contents

1.0 INTRODUCTION.....	1
1.1 Background	1
1.2 Purpose and Objectives.....	1
1.3 Scope and Sequence of Work	1
1.4 Qualifications of Assessors.....	2
1.5 Authorization.....	3
2.0 SITE DESCRIPTION AND HISTORY	3
2.1 Site Location	3
2.2 Site History	3
3.0 METHODOLOGY.....	3
3.1 Preliminary Hydrogeological Assessment.....	3
3.1.1 Data sources	4
3.1.2 Site Inspections.....	5
3.1.3 Background Geological Information Sources	5
3.1.4 Contaminated Sites Registry.....	5
3.1.5 Review of Solid Waste Disposal Facility Permit and Waste Management Plan	5
3.1.6 Review of Environment Yukon Information	6
3.2 Field Investigations	6
3.2.1 Scope of Field Investigations	6
3.2.2 Groundwater Monitoring Well Network.....	6
3.2.3 Monitoring Well Surveying	8
3.2.4 Groundwater Monitoring Event	8
3.2.5 Rising Head Hydraulic Response Tests.....	9
3.3 Laboratory Analysis	9
3.4 Quality Assurance / Quality Control	9
3.5 Application of Applicable Water Quality Standards.....	11
4.0 CONCEPTUAL HYDROGEOLOGICAL MODEL	12
4.1 Setting	12



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

4.2	Climate	13
4.3	Geology and Hydrogeology	13
4.3.1	Geological Framework	13
4.3.2	Principal Aquifer	13
4.4	Groundwater Flow Systems.....	14
4.4.1	Regional Groundwater Flow.....	14
4.4.2	Local Groundwater Flow	14
4.5	Hydraulic Response Tests.....	14
4.6	Estimated Linear Groundwater Velocity.....	14
4.7	Potential Contamination of Groundwater and Transport Mechanisms.....	15
5.0	GROUNDWATER IMPACT ASSESSMENT.....	15
5.1	Review of Groundwater Chemistry	15
5.2	Interpretation of Groundwater Chemistry.....	17
6.0	CONCLUSIONS.....	18
7.0	RECOMMENDATIONS.....	19
8.0	CLOSURE.....	19



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

TABLES

Table 1: Summary of Waste Disposal Facility Permits and Groundwater Monitoring Requirements	6
Table 2: Well Construction Details	8
Table 3: Monitoring Well Locations and Groundwater Elevations from the Monitoring Event on September 2, 2012	8
Table 4: Parameters Analyzed in September 2012	9
Table 5: Review of QA/QC Procedures Taken	10
Table 6: Applicable Water Quality Standards	11
Table 7 Aquifer Units Encountered at the Site	13
Table 8: Estimated Hydraulic Conductivity	14
Table 9: Important Groundwater Chemistry Results	15

FIGURES

Figure 1: Key Plan
Figure 2: Site Plan and Cross-Section Location
Figure 3: Regional Surficial Geology
Figure 4: Cross Section A-A'
Figure 5: Regional Drainage and Land Zoning
Figure 6: Monitoring Well Location Map and Groundwater Elevation
Figure 7: Schoeller Plot
Figure 8: Piper Plot
Figure 9: Stiff Diagram

APPENDICES

APPENDIX A

Site Photographs

APPENDIX B

Well Construction Logs

APPENDIX C

Well Development and Sampling Sheets

APPENDIX D

Slug Test Data

APPENDIX E

Analytical Reports and Chain of Custody Forms



1.0 INTRODUCTION

1.1 Background

Golder Associates Ltd. ("Golder") was retained by the Government of Yukon Community Services Infrastructure Branch on September 28, 2011 to complete a groundwater monitoring well network installation and hydrogeological assessment program at up to 20 solid waste facilities located across the Territory. The Drury Creek Solid Waste Disposal Facility (the "Facility" or the "Site") is one of the sites included in the program. This report presents the findings of our investigation.

These works have been performed in accordance with the approved scope of work detailed in Golder's proposal (P1-1436-0073) dated August 29, 2011, accepted by Yukon Government Community Services on October 7, 2011, and additional works detailed in our letter dated April 26, 2012 and accepted April 30, 2012.

1.2 Purpose and Objectives

A phased approach is typically implemented in order to develop a Site-specific groundwater monitoring program. The following objectives are included in the development of the program:

- Develop a conceptual hydrogeological model of the Site using existing data that identifies potential contaminant source(s), pathways, and receptors;
- Visit the Site to confirm the hydrogeological model, assess Site conditions and identify monitoring well locations;
- Design a monitoring well network and drilling program;
- Install groundwater monitoring wells in accordance with the plan;
- Sample the groundwater and, if applicable, surface water;
- Analyze the data and identify potential impacts;
- With the new data, re-evaluate the conceptual hydrogeological model and groundwater monitoring program; and
- Provide recommendations, if needed, to further assess potential impacts to groundwater quality.

1.3 Scope and Sequence of Work

The following scope of work was proposed to develop the conceptual hydrogeological model for the Site and installation of a monitoring well network. This work was performed in accordance with the Waste Management Permit (Permit No. 80-011 effective January 1, 2011 to December 31, 2011), relevant Environment Yukon Protocols, and in accordance with the Yukon Environmental and Socioeconomic Assessment Act (YESAA) Decision Document issued for the Site (Document Number 2011-0292-023-2).



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

In summary, the work completed at the Facility included the following six phases:

- Phase 1 assessed the needs for special considerations at the Site;
- Phase 2 outlined a work plan and schedule;
- Phase 3 consisted of background research and finalization of a draft of the Site Assessment Plan;
- Phase 4 consisted of the drill program tender specification and tender process management;
- Phase 5 consisted of the installation of a monitoring well network and collection of data on water levels, water quality, and aquifer parameters; and
- Phase 6 resulted in the preparation of a draft of this Hydrogeological Assessment Report, documenting the results of this investigation.

1.4 Qualifications of Assessors

Project Manager

The role of Project Manager was filled by Gary Hamilton, P. Geo., of Golder's Burnaby, BC office. Mr. Hamilton is a senior contaminant Hydrogeologist and Principal with Golder Associates. He has over 25 years of experience, has completed landfill monitoring projects locally, and is very familiar with Yukon environmental regulations. Mr. Hamilton conducted the initial Site inspections, coordinated the drilling work, and reviewed this assessment report.

Project Director

The role of Project Director was filled by Guy Patrick, P.Eng., of Golder's Victoria, BC office. Mr. Patrick is a senior Hydrogeologist and a Principal with Golder Associates. He is a Professional Engineer registered with the Association of Professional Engineers of the Yukon Territory. Mr. Patrick has over 30 years of experience in the field of environmental and hydrogeological assessments.

Field Hydrogeologist-Engineer

The role of Project Hydrogeologist was filled by Calvin Beebe of Golder's Nelson, BC office. Mr. Beebe has an M.Sc. degree in Hydrogeology from Saint Francis Xavier University (2012) and has completed numerous projects as a Hydrogeologist with Golder Associates including work on contaminated sites, and works with senior personnel on a regular basis.

Mr. Beebe was assisted by Ms. Andrea Badger, who joined Golder in May 2012. She obtained a B.Sc. in Civil Engineering with an Environmental Option, from the University of Alberta, Edmonton (2012) and a Diploma of Northern Studies, Outdoor and Environmental Studies at Yukon College, Whitehorse (2007). She has been involved with monitoring well drilling, development, testing and sampling at landfills across the Yukon since beginning work at Golder. She has also been involved with surface water monitoring at a construction site in Northern British Columbia.



1.5 Authorization

Written authorization and a signed contract to proceed with the work outlined in our proposal dated August 29, 2011 was received by Ms. Laura Prentice, Program Manager, on October 7, 2011. Golder received e-mail authorization to proceed with additional work detailed in our letter dated April 26, 2012 on April 30, 2012. The Change Order for the work was attached to the e-mail message.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Location

The Drury Creek Solid Waste Disposal Facility is in the southern portion of Yukon at latitude 62° 12' north and longitude 134° 23' west. The Site is accessed by a gravel road off the north side of the Robert Campbell Highway, approximately 110 km east of the Village of Carmacks and 47 km west of Faro, just east of the kilometre post 470. It is located on a 6 hectare Community Services Reserve (Disposition # 15304).

2.2 Site History

The Facility was developed to serve the Government of Yukon highway camp and highway construction activities. The Facility was identified as a private solid waste facility, but the permit has been changed to accommodate approximately ten users from the Drury Creek area in addition to highway camp residents. Domestic, commercial and demolition waste are burned at the Facility. In 2009, the Facility's historical permits expired and the Facility underwent YESAA evaluation in 2009 for the proposed continued operation and management.

3.0 METHODOLOGY

3.1 Preliminary Hydrogeological Assessment

The preliminary hydrogeological assessment involved a desktop review, interpretation of existing information, and an inspection of the Facility. The initial inspection of the Facility was conducted on October 21, 2011, and a follow up inspection was conducted on July 12, 2012, coinciding with the beginning of the monitoring well drilling program. The purpose of the preliminary hydrogeological assessment was to identify the appropriate drilling methods and equipment, and potential well locations for the installation of a monitoring well network. This portion of the work included the following three tasks:

- Compilation and review of available information;
- Assessment and interpretation of available hydrogeological data; and
- Development of a conceptual hydrogeological model.



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

3.1.1 Data sources

- Data used to complete the hydrogeological assessment was obtained from the following sources:
- Bouwer, H. and R.C. Rice, 1976. *A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells*, Water Resources Research, vol. 12, no. 3, pp. 423-428.
- Environment Canada, Meteorological Service of Canada Last Modified 2012-05-29, Website: [http://www.climate.weatheroffice.ec.gc.ca/climate_normals/Canadian Climate Normals or Averages 1971-2000](http://www.climate.weatheroffice.ec.gc.ca/climate_normals/Canadian_Climate_Normals_or_Averages_1971-2000).
- Fetter, C. W., *Applied Hydrogeology*, Third Edition, PRENTICE HALL, New Jersey. 1994.
- Government of Yukon. Environment Act Contaminated Sites Regulation. O.I.C. 2002/171, *Schedule 3- Generic Numerical Water Standards for Protection of Freshwater Aquatic Life*.
- Government of Yukon, Yukon Environment, Protocol for the Contaminated Sites Regulation Under the Environment Act. 2011.
- Government of Yukon, Yukon Geological Survey, YGS MapMaker Online Website: <http://maps.gov.yk.ca/imf.jsp?site=YGS>
- Government of Yukon, Yukon Mining and Lands Viewer Website: <http://maps.gov.yk.ca/imf.jsp?site=miningLands>
- Government of Yukon, Yukon Water, Water Data Catalogue Website: <http://yukonwater.ca/MonitoringYukonWater/WaterDataCatalogue/>
- Government of Yukon, Department of Environment, Compiled from The Yukon Water Well Registry *Summary of Yukon Water Wells*, May 11, 2006- Website: <http://www.env.gov.yk.ca/monitoringenvironment/hydrology.php>
- Natural Resources Canada, Groundwater Information Network Website: http://ngwd-bdnes.cits.nrcan.gc.ca/service/api_ngwds:gin/en/wmc/aquifermap.html
- Site inspections of October 21, 2011 and July 12, 2012.
- Surveys and Mapping Branch, Department of Energy, Mines, and Resources. The Atlas of Canada Website: <http://atlas.nrcan.gc.ca/site/english/maps/topo/map> Map 105 I/01, scale 1:50,000.
- Toleman, C., 2011. Government of Yukon, Highways and Public Works, *Solid Waste Management Plan – Drury Creek Solid Waste Disposal Facility*.
- Ward, B.C., and Jackson, L.E., Jr., 1993. *Surficial Geology, Telegraph Mountain, Yukon Territory*, Geological Survey of Canada, Map 1789A, scale 1:100,000.



3.1.2 Site Inspections

Prior to the Facility reconnaissance, Golder developed a Facility-specific health and safety plan (HASP) for implementation during the field work. The health and safety plan included a description of the potential hazards that could be encountered during the Facility reconnaissance and proposed mitigation. Site inspections were conducted on October 21, 2011 and July 12, 2012. The initial Site visit was conducted to review the layout of the Facility and confirm geological and topographic information obtained from the review of background data. Proposed monitoring well locations were also reviewed for access constraints. During the second Site visit, the monitoring wells were drilled and installed. Selected photographs of the Facility were taken during the reconnaissance and are presented in Appendix A.

3.1.3 Background Geological Information Sources

Geological information was obtained through a review of topographic and geological maps from the Yukon Department of Energy Mines and Resources, and through the Canadian Geological Survey. Additional data on the subsurface of the surrounding area was obtained through the online Groundwater Information Network (GIN), provided by Natural Resources Canada (NRCAN), and the Yukon Water Well Registry and a search of the Yukon Water online Data Catalogue.

3.1.4 Contaminated Sites Registry

A Site Registry search was conducted by Yukon Environment on December 1, 2011. The search identified no contaminated site files or spill reports for the Drury Creek Solid Waste Disposal Facility; however, it was noted that the Facility does not have any analytical results in the file to compare against Yukon CSR standards to determine if any contamination exists. It was also noted that the Facility was largely unmonitored, and that there may have been opportunity for improper disposal and potentially unreported spillage of contaminants during its operation.

3.1.5 Review of Solid Waste Disposal Facility Permit and Waste Management Plan

Waste Management Permit No. 80-011 was issued on March 17, 2011 for the Facility. It states that the Facility is to be operated in compliance with any applicable requirements in federal, territorial, and municipal legislation including the Environment Act and Solid Waste Regulations.

Monitoring requirements set out in Waste Management Permit 80-011 include:

- Monitoring water levels and collecting water samples from groundwater monitoring wells at the Facility twice a year (spring and late summer);
- Sampling of downgradient surface water bodies concurrently with the groundwater sampling;
- Analyze surface water and groundwater samples for the parameters outlined in Section 3.3;
- Analyze water samples at a laboratory that is accredited as conforming to ISO/IEC 17025 by an accrediting body that conforms to ISO/IEC 17011 standards; and
- Submitting monitoring results to Environment Yukon by January 31 each year.



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

A summary of the Facility permits and groundwater monitoring requirements for the Site are summarized in Table 1 below.

Table 1: Summary of Waste Disposal Facility Permits and Groundwater Monitoring Requirements

Site	Site Disposal Facility Permit Number	Permit Type	Solid Waste Management Plan	Required Groundwater Monitoring
Faro Solid Waste Disposal Facility	80-011	Landfill & Air Emissions	Highways and Public Works (2011)	Twice Per Year

3.1.6 Review of Environment Yukon Information

Golder reviewed documents pertaining to the Drury Creek Facility on the Yukon Environment and Socioeconomic Board (YESAB) online registry, and from several other sources, on October 25, 2012. Documents reviewed included: the most current waste facility permit issued for the Facility, the most current Solid Waste Management Plan, and the Yukon Environmental and Socioeconomic Act Decision Document.

3.2 Field Investigations

3.2.1 Scope of Field Investigations

The scope of the field investigations included the following:

- Three (3) on-Site monitoring wells were completed by Midnight Sun Drilling under the supervision of Golder Associates from July 12 through 14, 2012;
- Monitoring wells DC-MW12-01, DC-MW12-02, and DC-MW12-03 were developed and sampled by Golder on September 1, 2012. The water level at each well was measured prior to purging and sampling, and physiochemical parameters were monitored at each well during development and sampling;
- A surface water sample was taken from a small pond, located approximately 200 m southeast of the Site, on September 2, 2012;
- Groundwater and surface water samples were sent to ALS Environmental laboratory in Whitehorse, YT;
- Slug tests were carried out on FA-MW12-01, FA-MW12-03 and FA-MW12-04, on September 2, 2012 to assess horizontal hydraulic conductivity and linear groundwater velocity at the Site; and
- Results of field and laboratory data are summarized and interpreted in this report.

3.2.2 Groundwater Monitoring Well Network

Groundwater monitoring well installation was undertaken in general accordance with Yukon Contaminated Site Regulation Protocol (Yukon Environment, 2011).



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

Three groundwater monitoring wells were proposed for installation at the Site to characterize groundwater conditions underlying the waste disposal Facility. A Site plan showing the monitoring well locations and key Site features is provided in Figure 2. DC-MW12-01 was intended to characterize upgradient groundwater conditions, while FA-MW12-02 and FA-MW12-03 were intended to assess groundwater conditions downgradient of the landfill. Locations of the monitoring wells were selected based on aerial photography, review of Site history, Site topography, suspected groundwater flow direction, and a Site inspection.

Specifics for each well are listed below:

- DC-MW12-01 was installed in the northwest edge of the Site, and advanced to a depth of 8.2 m below grade (bg);
- DC-MW12-02 was installed on the southeast edge of the Site, near the east corner, and advanced to a depth of 18.0 m bg; and
- DC-MW12-03 was installed near the south corner of the Site, and advanced to a depth of 16.6 m bg.

All wells were installed using a Driltech Marlin 5 truck-mounted air rotary drill rig.

Grab samples of drill cuttings were taken at regular intervals to log the stratigraphy encountered in each borehole. Borehole logs, documenting observed stratigraphy, along with well construction details, are provided in Appendix B. A summary of the stratigraphy and well construction details is provided in Table 2.

Each monitoring well was completed with the top of the well screen installed as close as possible to the interval where the moisture content of the formation appeared to be transitioning from unsaturated to saturated conditions.

Installation details are included on the borehole logs in Appendix B. Typical completion details are:

- Monitoring wells were completed with 50 mm, flush threaded Schedule 40 PVC casing;
- A 3 m long PVC, factory-slotted well screen (10-slot) was installed in two of the three monitoring wells;
- PVC casing was installed above the well screen to between 0.8 m and 1.0 m above grade;
- A silica sand filter pack was used to fill the annulus between the PVC well screen and the borehole wall. The sand pack was extended approximately 1 m above the top of the screened interval;
- A bentonite chip seal, approximately 1 m thick, was placed directly above the sand pack. The remainder of the annulus was filled with bentonite grout;
- Each well was covered with a PVC end-cap and a lockable steel protective casing was installed to protect the wellhead;
- All wells were developed by removing a minimum of 3 well volumes using dedicated Waterra™ tubing and a Hydrolift™ pump or hand bailer. Development logs are provided in Appendix C.



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

Table 2: Well Construction Details

Well ID	Drilled Depth (m bg)	Aquifer Unit Monitored	Casing Diameter (mm)	Screened Interval (m bg)	Filter Pack Interval (m bg)
DC-MW12-01	8.2	silty fine SAND.	50	5.2 – 8.2	4.5 – 8.2
DC-MW12-02	18.0	BEDROCK/SANDY CLAY	50	14.9 – 18.0	13.4 – 18.0
DC-MW12-03	16.6	SAND with some gravel	50	13.6 – 16.6	12.7 – 16.6

3.2.3 Monitoring Well Surveying

Golder carried out a level survey to determine the vertical elevation to the top of the PVC wellhead (measuring point) for each well on July 12, 2012. Initial absolute elevation was surveyed relative to the top of PVC pipe at DC-MW12-01, which was obtained using a Trimble hand-held GPS instrument with a vertical accuracy of ± 0.7 m. In order to accurately determine groundwater elevation and flow direction, a level survey between wells was also carried out to an accuracy of ± 1 cm. Elevations for DC-MW12-02 and DC-MW12-03 are reported based on the level survey and the GPS reading for TOC at DC-MW12-01. Table 3 presents a summary of survey data and water level measurements (recorded on September 2, 2012).

Table 3: Monitoring Well Locations and Groundwater Elevations from the Monitoring Event on September 2, 2012

Well ID	UTM Coordinates (Zone 8 North)	Top of PVC Casing Elevation (masl)	Standing Water Level (mbtoc)	Groundwater Elevation (masl)
DC-MW12-01	6896737.3 m N 530960.5 m E	669.54	6.63	662.91
DC-MW12-02	6896727.8 m N 584476.9 m E	668.31	16.34	651.97
DC-MW12-03	6896700.4 m N 530991.3 m E	669.26	15.83	653.43

3.2.4 Groundwater Monitoring Event

Monitoring wells DC-MW12-01, DC-MW12-02, and DC-MW12-03 were purged and sampled by Golder on September 1, 2012. The procedure used for sampling followed Contaminated Sites Regulation Protocol no. 7. Prior to purging each well, the water level was first measured with an electronic measuring tape. Approximately four well volumes were then purged from each well, using 5/8" high density polyethylene (HDPE) Waterra™ tubing, a foot valve, and a Hydrolift™ pump. During purging, physiochemical parameters (pH, temperature, EC) were collected at regular intervals using a Hanna Instruments HI 991300 meter, and purging continued until field parameters were stable before sampling. Groundwater development and sampling datasheets are presented in Appendix C. In addition to the three groundwater monitoring wells that were sampled, a surface water sample was collected on September 2, 2012 from a Little Salmon Lake, approximately 175 metres south of the Site.



Sample containers and appropriate preservatives were obtained from ALS's Whitehorse laboratory. Samples for dissolved metals were field filtered using 0.45-micron, in-line filters and preserved with nitric acid. All samples were kept in coolers with ice packs prior to their delivery, and were delivered within appropriate holding times. ALS is certified by the Canadian Association for Laboratory Accreditation, and is accredited as conforming to ISO/IEC 17025.

3.2.5 Rising Head Hydraulic Response Tests

Hydraulic response (slug) tests were performed on DC-MW12-01, DC-MW12-02, and DC-MW12-03 on September 2, 2012, to assess the hydraulic conductivity of the surficial aquifer underlying the Site. Tests were performed using 1.0 m and 1.5 m long, solid 38 mm diameter PVC slugs, and a Solinst Levellogger pressure transducer set to measure head fluctuations at one-second intervals. Manual water level measurements were also recorded throughout the tests.

Multiple rising head tests were completed for each well. A summary of the analysis of these tests is provided in Section 4.5.

3.3 Laboratory Analysis

Parameters included in the laboratory testing of groundwater samples are summarized in Table 4. The parameter list complies with the Facility's Waste Management Permit (Permit No. 80-011).

Sampling and analysis were undertaken in general accordance with Yukon Contaminated Site Regulation (CSR) Protocols 2 and 5 (Government of Yukon, 2011).

Table 4: Parameters Analyzed in September 2012

Sample ID	General Parameters	Nutrients	Dissolved Metals	PAH, BTEX, DOC	VOCs
DC-MW12-01	√	√	√	√	√
DC-MW12-02	√	√	√	√	√
DC-MW12-03	√	√	√	√	√
Surface Water	√	√	√	√	√

3.4 Quality Assurance / Quality Control

Table 5 provides a detailed description of the Quality Assurance (QA) and Quality Control (QC) measures taken by Golder to ensure the accuracy and integrity of groundwater quality sample analysis.



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

Table 5: Review of QA/QC Procedures Taken

QA/QC Aspect	Evidence and Evaluation
Data Representativeness	
Sample Integrity	All samples were kept at the appropriate temperature and delivered to the laboratory within the appropriate holding times.
Background Samples	DC-MW12-01 was confirmed to be upgradient of the Site and is used to provide background groundwater quality data.
Field Procedures	Monitoring wells were purged/developed and sampled using dedicated tubing. Equipment used in sampling more than one well was decontaminated using soap (Alconox™) and distilled water. Surface water samples were collected using one-time-use syringes.
Calibration of Field Equipment	Calibration of field equipment was undertaken daily, prior to sampling wells.
Data Precision and Accuracy	
Blind Duplicate	One blind duplicate was collected from FA-MW12-04 (Report #1114360073-1100) during the August/September 2012 groundwater monitoring event. Of the 110 analyte pairs tested, RPD values could not be calculated for 89 of the pairs, as both values in each pair were below the laboratory method detection limit (MDL). Of the remaining analyte pairs tested, 1 exceeded the RPD ¹ acceptance criteria of $\pm 30\%$ and only 2 exceeded 5%.
Trip Blanks	A trip blank was not collected during the August 2012 groundwater monitoring event.
Laboratory Internal QA/QC	Laboratory QA/QC is detailed in the primary laboratory report (Appendix E). Overall, the lab report showed acceptable testing frequency and acceptable results for the method blanks, laboratory duplicates and matrix spikes.
Holding Times	Samples were delivered outside the acceptable (24 hour) hold time for physical parameters, however field parameters were taken during sample collection to compensate. Analysis of nitrate and nitrite took place 1 day outside the 3 day recommended holding time.
Laboratory Detection Limit	Laboratory reports indicate that detection limits were below the standards applicable to this assessment.
Charge Balance	Charge balance was calculated on each of the samples analyzed by the laboratory. Percent error in charge balance for all samples was below 6.2 %.
Completeness of test program	Wells were sampled in accordance with the Site Assessment and Work Plan criteria.
Validity of Data Set	The data quality review indicates significant discrepancy between the FDA and the FD. No significant systematic errors in the analysis process for groundwater were found. The results of laboratory internal QA/QC and analysis of blind duplicates were acceptable, and therefore, the data set is considered valid and complete for use as the basis for groundwater assessment.

¹ RPD calculations are presented in Appendix E of Golder's draft report entitled "Beaver Creek Solid Waste Disposal Facility Hydrogeological Assessment" dated August 10, 2012.



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

3.5 Application of Applicable Water Quality Standards

In accordance with the Government of Yukon's solid waste facility monitoring requirements, groundwater wells and a downgradient surface water receptor were sampled and tested for the following parameters:

- Major ions (Ca, Mg, Na, K, Cl, SO₄, N, NO₂, NO₃ and P)
- Bicarbonate
- Chemical oxygen demand
- pH
- Total Kjeldahl Nitrogen
- Dissolved Metals
- Total dissolved solids
- EPH_{w10-32} & VH_{w6-10}
- Mercury
- Ammonia
- BTEX
- Hardness
- Dissolved organic carbon
- PAHs
- Alkalinity
- VOCs
- Carbonate

Groundwater and surface water analytical results were compared to the Yukon CSR water quality standards or to the Canadian Environmental Quality Guidelines for constituents where no Yukon standards were available.

The four types of water uses outlined in the CSR, the relevant water quality standards, and their applicability to this assessment are presented in Table 6.

Table 6: Applicable Water Quality Standards

Water Use	Applicable Water Quality Standard	Applicable Plume Radius (km)	Applicability to Assessment
Aquatic Life	Schedule 3 – Contaminated Sites Regulation (O.I.C. 2002/171)	1	Applicable
Drinking Water	Schedule 3 – Contaminated Sites Regulation (O.I.C. 2002/171)	1.5	Not Applicable
Irrigation	Schedule 3 – Contaminated Sites Regulation (O.I.C. 2002/171)	1.5	Not Applicable
Livestock	Schedule 3 – Contaminated Sites Regulation (O.I.C. 2002/171)	1.5	Not Applicable

The following discusses the applicability of each water quality standard to the Facility.

Aquatic Life

A search of the Yukon Lands viewer website and Google Earth Images, conducted by Golder October 26, 2012, showed two small creeks and Little Salmon Lake falling within a 1 km radius of the Site, as specified in the CSR, under which aquatic life standards are applied. It was therefore determined that aquatic life standards were **applicable** to the Facility.



DRURY CREEK SOLID WASTE DISPOSAL FACILITY HYDROGEOLOGICAL ASSESSMENT

Drinking Water

A search of drinking water wells on the Groundwater Information Network website and the Yukon Water Data Catalogue (accessed October 26, 2012) showed no drinking water wells, within the 1.5 km radius of the Site, specified by the Yukon CSR, under which drinking water guidelines are applied. A review of the solid waste management plan for the Site revealed that there is a residence located approximately 2 km to the east of the Facility. It was there deemed that CSR drinking water standards were **not applicable** to the Facility.

Irrigation

A review of the Summary of Yukon Water Wells, compiled from The Yukon Water Well Registry, reviewed by Golder on October 23, 2012, showed no irrigation wells on record for the Drury Creek area. It should be noted that this is not a complete record of all wells in the Yukon, and it is possible that there are irrigation wells in the area. A review of Google Earth Images from 2012, conducted by Golder on October 26, 2012, as well as the Site visit in July 2012 showed no agricultural land within 1.5 km of the Facility. It was therefore considered that CSR water quality standards for irrigation are **not applicable** to the Facility.

Livestock

A review of the Summary of Yukon Water Wells, compiled from The Yukon Water Well Registry, reviewed by Golder on October 23, 2012, showed no wells on record as being for livestock use in the Drury Creek area. It should be noted that this is not a complete record of all wells in the Yukon. A review of the Solid Waste Operation Plan (Government of Yukon, 2008) as well as several Site visits also did not indicate the presence of livestock in the vicinity of the Facility. It was therefore considered that CSR standards for livestock are **not applicable** to the Facility.

4.0 CONCEPTUAL HYDROGEOLOGICAL MODEL

4.1 Setting

The Drury Creek Solid Waste Disposal Facility is located in the southern portion of Yukon, within the Pelly Mountains Ecological Region, and Little Salmon/Carmacks and Ross River Dena First Nations traditional territory, at latitude 62° 12' north, and longitude 134° 23' west. The Facility serves as a solid waste disposal facility for the Yukon Government highway camp at Drury Creek and approximately 10 year round residents in the Drury Creek area. The Facility accepts primarily domestic waste, construction waste, demolition and grubbing waste. Scrap metals are transported off-Site when volumes warrant. According to the 2008 Solid Waste Management Plan for the Facility, automotive waste, including tires, waste oils, and derelict vehicle bodies were not accepted at the Site; however, a waste oil segregation area was observed during the second Site reconnaissance. No evidence of spills or discharges was observed during the Site reconnaissance.



4.2 Climate

There is no weather station at Drury Creek, weather information and statistics are taken from the Faro climate station (Climate ID 2100517), located approximately 71 kilometres east of the Facility at an elevation of 716.60 m above sea level. Regional precipitation includes both rainfall and snowfall with highest precipitation occurring in July at 58.8 mm and a low precipitation in April at 8 mm. The average annual precipitation reported at the Faro station is approximately 316 mm, including 111.6 cm of snowfall. Temperature at the site ranges from a low average of -21.5 in January to a high average of 15°C in July (Environment Canada, 2012).

Annual precipitation is relatively low (approximately 316 mm per year). This suggests that the amount of infiltration of water through buried waste at the Site and into the subsurface soils is relatively low. With a significant portion of the precipitation occurring in the form of snow, and the relatively cold climate, little infiltration would be expected during the winter months. The greatest potential for infiltration of water through the waste is during the spring snow melt; however, a significant portion of the water from snow melt would typically occur as surface runoff during this period.

4.3 Geology and Hydrogeology

4.3.1 Geological Framework

The southern Yukon, including the Drury Creek area, has undergone several episodes of glaciation, the most recent being the Quaternary McConnell glaciation. During that period, sediments such as glacial till and glaciofluvial and glaciolacustrine sediments were deposited, especially in low elevation areas such as the Magundy River Valley, where the Site is located.

The Drury Creek area is mapped as being underlain primarily by till and colluvial apron sediments of Quaternary origin, and modern alluvial plain and lacustrine sediments associated with Magundy River and Little Salmon Lake respectively. Bedrock exposures are found at higher elevations in the mountains to the northeast of the Site.

Surficial geology maps published by the Yukon Geological Survey (YGS) indicate natural surficial materials at the Site consist of colluvial apron and glaciofluvial delta sediments. Deposits are poorly to well sorted sand and gravel with minor silt, and range from 1 m to greater than 5 m in thickness (Ward and Jackson, 1993).

4.3.2 Principal Aquifer

As shown in Figure 4, it is inferred that groundwater at the Site occurs in a shallow, unconfined, aquifer composed primarily of unconsolidated sand and silt, with minor gravel and clay. For the purpose of this report, this aquifer has been named the Surficial Aquifer (Table 7).

Table 7 Aquifer Units Encountered at the Site

Aquifer Name	Location	Aquifer Type	Comments
Surficial Aquifer	DC-MW12-01 DC-MW12-02 DC-MW12-03	Unconfined; unconsolidated porous media	<ul style="list-style-type: none">▪ Sand and silt with minor gravel and clay▪ Shallow aquifer



4.4 Groundwater Flow Systems

4.4.1 Regional Groundwater Flow

Topography in the area surrounding the Facility slopes from the Little Salmon Range, located to the northwest of the Site (elevation approximately 1000 m amsl), southeast towards Little Salmon Lake (elevation 610 m amsl). Regional hydraulic gradient is inferred to be a subdued replica of this topographic gradient; therefore, regional groundwater flow is inferred to be primarily to the southeast discharging to Little Salmon Lake.

4.4.2 Local Groundwater Flow

Golder used the groundwater depth data from September 2, 2012 and well survey elevation information collected in July 2012 to calculate the groundwater elevation at each monitoring well. The water level measurements and groundwater elevations are presented in Table 3.

Local groundwater flow direction at the Site is inferred, using groundwater elevation data, to be approximately 0.22 m/m, sloping to the southeast (Figure 6).

4.5 Hydraulic Response Tests

Golder Associates conducted slug tests on all of the newly installed monitoring wells at the Facility. The slug tests were analyzed using AQTESOLV version 4.5, and the results are included in Appendix D. Table 8 provides a summary of the findings.

Table 8: Estimated Hydraulic Conductivity

Monitoring Well ID	Primary Hydrogeological Unit	Solution Used	Calculated Hydraulic Conductivity (m/s)
DC-MW12-01	Silty Sand	Bouwer-Rice (1976)	1×10^{-5}
DC-MW12-02	Sandy Clay	Bouwer-Rice (1976)	4×10^{-6}
DC-MW12-03	Sand and Gravel	Bouwer-Rice (1976)	1×10^{-4}

4.6 Estimated Linear Groundwater Velocity

As determined from the slug tests summarized in Table 8, the hydraulic conductivity of the shallow aquifer underlying the Site is ranges between 4×10^{-6} m/s and 1×10^{-4} m/s. The horizontal hydraulic gradient across the Site was assessed, using the monitoring well network, to be approximately 0.22 m/m to the southeast. A range of reasonable linear groundwater velocities is calculated using the following equation:

$$V = (Ki)/n$$

Where:

V: is the groundwater velocity in meters per second (m/s);

K: is the hydraulic conductivity in m/s as determined by slug testing;

i: is the horizontal hydraulic gradient (m/m); and

n: is the porosity which is estimated to be approximately 0.35 (Fetter, 1994) in sand and gravel.



The resulting groundwater velocity is estimated to be between 2.5×10^{-6} m/s and 6×10^{-5} m/s (approximately 0.2 to 5.4 metres per day). Groundwater at the Site may travel faster or slower than these estimates due to inaccuracies or seasonal variations in these parameters.

4.7 Potential Contamination of Groundwater and Transport Mechanisms

Potential sources and transport mechanisms of groundwater contamination are evaluated based on the Site history, Site inspections, hydrogeological investigation, and contaminant transport principals. Potential sources include:

- Leachate from present and former domestic waste, commercial waste, metals, wood, construction debris, and any other potential waste disposed of at the Facility. Potential contaminants leaching from these sources include: heavy metals, nutrients (NO_3 , NH_3), organic hydrocarbons (Fuels, PAH's, chlorinated hydrocarbons), and salts; and
- Leakage and spillage from on-Site hydrocarbon storage areas.

Transport mechanisms that may act on these sources of contamination and cause potential contamination of downgradient receptors include:

- Percolation of precipitation from the surface, through the unsaturated zone, and into the saturated zone; and
- Transport of contaminants within the saturated zone (aquifer) to other downgradient locations.

5.0 GROUNDWATER IMPACT ASSESSMENT

5.1 Review of Groundwater Chemistry

As discussed in Section 3.2.4, one round of groundwater monitoring was conducted on all three monitoring wells at the Facility on September 1, 2012, and one surface water location downgradient from the Site on September 2, 2012. Chain of custody forms for the groundwater samples collected, the complete groundwater chemistry results, and QA/QC data can be found in Appendix E. Table 9 summarizes important parameters from the groundwater chemistry results, which are used to identify potential leachate contamination.

Table 9: Important Groundwater Chemistry Results

Sample Location	Total Dissolved Solids (mg/L)	Chloride (mg/L)	Ammonia (mg/L)	Sulphate (mg/L)	DOC (mg/L)	Sodium (mg/L)
DC-MW12-01	510	<2.5	0.041	65.7	1.25	8.4
DC-MW12-02	828	61.9	0.180	129	2.20	30.4
DC-MW12-03	627	18.0	0.128	79.3	3.40	16.2
Surface Water	157	<0.50	<0.0050	26.0	2.39	<2.0



Total Dissolved Solids

Total dissolved solids (TDS) is a measurement of the total amount of dissolved organic and inorganic material contained within a liquid. Elevated TDS can indicate the presence of groundwater contamination caused by, for example, landfill leachate. Typically, major ions that comprise TDS include: NO_3 , NH_3 , Na, K, Mg, Ca, SO_4 , Cl, and HCO_3 . TDS in the monitoring well samples ranged from 510 mg/L to 828 mg/L, and was 157 mg/L in the surface water sample. TDS for the both the monitoring well samples and the surface water sample is considered to be within normal range for naturally occurring water, however the level in DC-MW12-02 was slightly elevated over the background levels (DC-MW12-01).

Dissolved Organic Carbon

Dissolved organic carbon (DOC) concentrations can be elevated by the presence of leachate originating from decomposed organic matter. Levels associated with landfill leachate can be in the hundreds or thousands of mg/L. DOC levels from samples at the Site ranged from 1.25 mg/L to 3.40 mg/L. This is considered to be within the normal range of variation for DOC, and does not indicate influence from landfill leachate. There is no CSR standard for DOC.

Chloride

Chloride is often used as a tracer for anthropogenic influence on groundwater. Elevated chloride levels are associated with a number of sources including sewage, leachate, and road salting. In the case of landfills, elevated chloride might be expected due to degradation of waste with a high chloride concentration. Chloride levels from the monitoring well network ranged from non-detect in DC-MW12-01 to 61.9 mg/L in DC-MW12-02. Levels in samples taken from all wells were within the range normally expected in naturally occurring waters, and did not exceed CSR drinking water standard of 250 mg/L.

Ammonia

Ammonia is a typical landfill leachate indicator. Ammonia concentrations in the groundwater samples ranged from 0.041 mg/L to 0.180 mg/L in the monitoring well samples. Ammonia was below detectable levels in the surface water sample. All levels were within the normal range for naturally occurring waters, and no concentrations exceeded the applicable CSR standard for freshwater aquatic life.

Metals

Metals concentrations in all surface water and groundwater samples were within the range expected in naturally occurring waters. Manganese concentration in the monitoring well samples exceeded the CSR drinking water standard. Iron exceeded the CSR in DC-MW12-03. The CSR standards for magnesium and iron are intended to protect against odour and taste concerns.



Organics

Detectable levels of organic constituents are often a sign of leachate contamination. Hydrocarbons analyzed included: BTEX, PAH, $\text{EPH}_{\text{w10-32}}$ & $\text{VH}_{\text{w6-10}}$, and chlorinated hydrocarbons. Trichlorofluoromethane (Freon 11) was detected at a concentration of 0.0014 mg/L in DC-MW12-03. Since this is not a naturally occurring chemical, and is not typically associated with the drilling method used to install monitoring wells, it is an indication of influence from leachate.

5.2 Interpretation of Groundwater Chemistry

Factors that may affect natural groundwater quality include:

- The source and chemical composition of recharge water;
- The lithological and hydrological properties of the geologic unit;
- The various chemical processes occurring within the geologic unit; and
- The amount of time the water has remained in contact with the geologic unit (residence time).

These factors may affect the type and quantities of dissolved constituents in groundwater. The ionic composition of water can be used to classify the water into ionic types based on the dominant dissolved cation and anion, expressed in milliequivalents per litre (meq/L). These can be compared for different water samples using various types of plots.

The ionic compositions of samples from the Site were compared to identify differences in water chemistry by plotting the meq/L concentrations of the samples on three types of diagrams: a Schoeller plot (Figure 7), a Piper diagram (Figure 8), and a Stiff diagram (Figure 9).

- Schoeller: The Schoeller semi-logarithmic diagram (Figure 7) shows total concentrations of major cations and anions, and may be used to identify different water types. Here, it shows that concentrations of major ions are different for each sample. In general, concentrations of all major ions are higher in DC-MW12-02 and DC-MW12-03 than they are in DC-MW12-01 or the surface water sample.
- Piper: The Piper diagram (Figure 8) is used to compare the ratios of major ions and can be used to identify different water types. Here, the piper diagram shows that all of the samples have a noticeably different composition of major ions but that in general they are all grouped in the same region of the plot. Using the Piper plot DC-MW12-01 and DC-MW12-03 are classified as Ca-Mg-HCO_3 type water, DC-MW12-02 is classified as Mg-Ca-HCO_3 type water, and the surface water sample is classified as $\text{Ca-Mg-HCO}_3\text{-SO}_4$ type water.
- Stiff: The stiff diagram allows for differences in groundwater chemistry to be presented and viewed spatially. Here, the stiff diagram shows that all of the samples have slightly different chemical composition, but all have a similar major ion composition.



6.0 CONCLUSIONS

The following conclusions are made based on the results of the 2012 hydrogeological assessment:

■ Stratigraphy and Hydrogeology:

- Surface expression at the Site is dominated by quaternary surficial deposits;
- Subsurface conditions were investigated with the installation of three monitoring wells, including DC-MW12-01, DC-MW12-02, and DC-MW12-03, which were completed from July 12 through 14, 2012, under the supervision of Golder Associates, for the establishment of a monitoring well network at the Site;
- The Site stratigraphy was investigated to a maximum depth of 18.0 m in DC-MW12-02, and was found to consist of 13.7 m of sand and gravel with minor silt, overlying 3.4 meters of sandy clay, overlying bedrock;
- During the drilling of DC-MW12-01 an unconfined aquifer was encountered at 5.2 m below grade (bg) consisting of silty sand; at DC-MW12-03 an unconfined aquifer was encountered at approximately 14.5 m bg in similar material; and at DC-MW12-02 an unconfined aquifer was encountered at approximately 13.7 m bg in a sandy clay;
- Hydraulic response tests were performed on all three monitoring wells. The results of these tests indicate the hydraulic conductivity of the unconfined aquifer underlying the Site ranges from 4×10^{-6} m/s to 1×10^{-4} m/s. These values are considered reasonable for the units encountered during installation of each of these wells;
- The horizontal hydraulic gradient at the Site was estimated, using groundwater elevation data, to be approximately 0.22 m/m, sloping to the southeast;
- Groundwater velocity in the surficial aquifer is estimated to range between approximately 2.5×10^{-6} m/s and 6×10^{-5} m/s (approximately 0.2 to 5.4 metres per day); and
- Based on the groundwater flow direction, it was determined that both DC-MW12-02 and DC-MW12-03 are downgradient of the Site, and FA-MW12-01 is upgradient of the Site; therefore, the requirements for one upgradient and two downgradient wells at the Site have been met.

■ Groundwater Chemistry:

- The results of a desktop study and several Site visits indicate that only the Yukon Contaminated Sites Regulation (CSR) criteria for freshwater aquatic life are applicable at the Site;
- Groundwater samples were collected from all monitoring wells on September 1, 2012, and a surface water sample was collected from a small pond approximately 200 m southeast of the Facility on September 2, 2012, in order to complete the initial monitoring event at the Facility;
- Iron was found to exceed the CSR for drinking water quality in the sample from DC-MW12-03;
- Manganese exceeded the CSR for drinking water quality in samples from all three of the monitoring wells;
- Trichlorofluoromethane (Freon 11) was detected in DC-MW12-02. Presence of this chemical is consistent with influence from landfill leachate; and
- No other analytes exceeded CSR standards at the Site.



7.0 RECOMMENDATIONS

The following recommendations are made based on the results of the hydrogeological assessment presented in this report:

- As required by the Facility's Waste Management Permit, future groundwater monitoring should be conducted twice a year (spring and late summer);
- Groundwater quality at the Facility should be reevaluated following two rounds of groundwater monitoring to determine if there are any potential impacts present from landfill leachate; and
- Monitoring well location, elevation for ground surface, and the elevation of the top of the PVC standpipe (measuring point) should be surveyed for each well by a professional land surveyor prior to the next monitoring event.

8.0 CLOSURE

We trust that this draft report is adequate for your current needs. Should you have any questions or require any additional information, please contact the undersigned at your convenience.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Calvin Beebe, M.Sc.
Hydrogeologist

Reviewed By:

ORIGINAL SIGNED

Gary Hamilton, P.Geo.
Principal Hydrogeologist

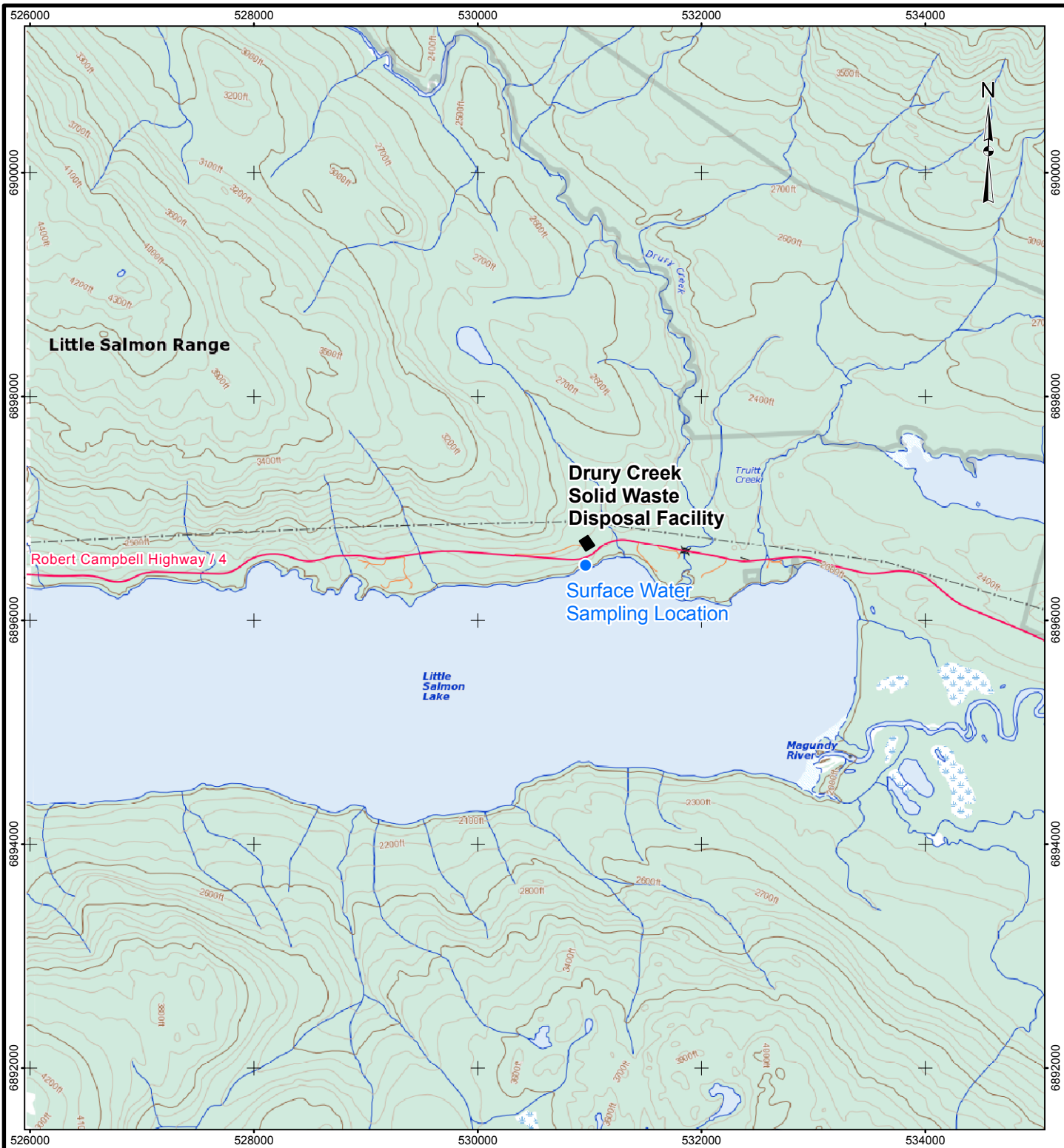
ORIGINAL SIGNED

Guy C. Patrick, P.Eng.
Principal Senior Hydrogeologist

CB/GJH/GCP/syd

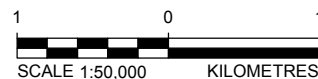
o:\final\2011\1436\11-1436-0073\1114360073-514-r-rev0-2800\1114360073-514-r-rev0-2800-hydrogeo assess 23feb_13.docx

\\golder.gts\gait\Burnaby\CAD-GIS\Bur-Graphics\Projects\2011\11-1436-0073\GIS\Mapping\MXD\Hydrology\Drury_Creek\Figure_01_Key_Plan.mxd



LEGEND

- SURFACE WATER SAMPLING LOCATION
- FACILITY



REFERENCE

BASEDATA OBTAINED FROM GEOGRATIS (NATURAL RESOURCES CANADA).
DATUM: NAD83 PROJECTION: UTM ZONE 8

PROJECT YUKON GOVERNMENT - COMMUNITY SERVICES
SOLID WASTE DISPOSAL FACILITY
DRURY CREEK, YUKON

TITLE

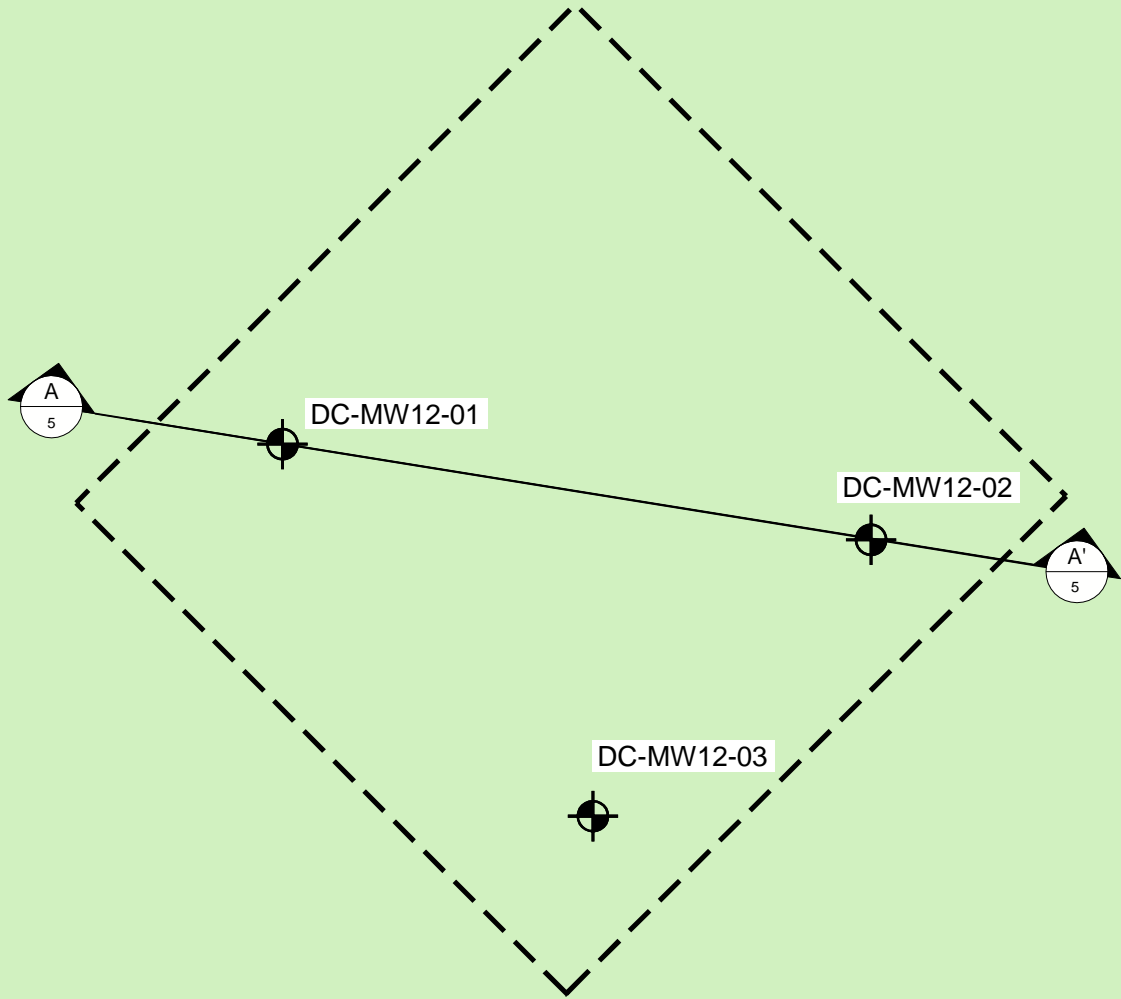
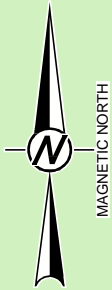
KEY PLAN





PROJECT No.	11-1436-0073	PHASE No.	2800
DESIGN	CB	12 Sept 2012	SCALE AS SHOWN
GIS	CD	18 Sept 2012	REV. 0
CHECK			
REVIEW			

FIGURE: 1

\\BucGraphics\Projects\2011\1436\11-1436-073\Drafting\Phase 2800\Task 2860\Graphics\11-1436-0073-2800-2860-01.dwg [Layout: 17X11 FIG 2] Modified: hanna, 12/03/2012 4:55 PM [Plotted: hanna, 12/19/2012]



LEGEND

-  MONITORING WELL LOCATION
-  APPROXIMATE EXTENT OF FACILITY

NOTES


- SITE PLAN IS NOT CONSISTENT WITH OBSERVED CONDITION DURING DRILLING, BUT IS INTENDED TO SHOW LOCATIONS OF NEWLY INSTALLED MONITORING WELLS IN RELATION TO BURIED STRUCTURES.

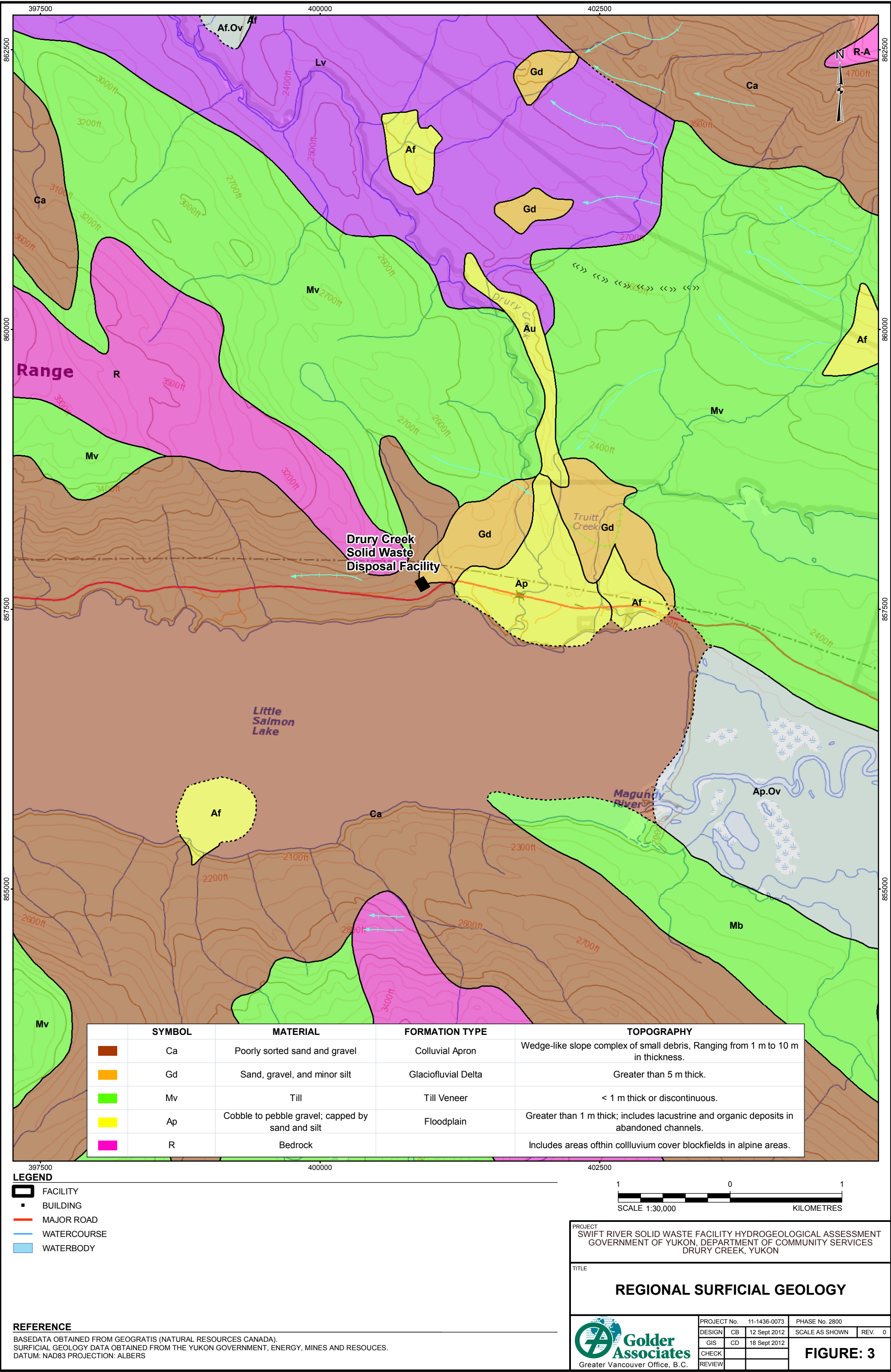
REFERENCES



PROJECT: GOVERNMENT OF YUKON, DEPARTMENT OF COMMUNITY SERVICES
SOLID WASTE DISPOSAL FACILITY
DRURY CREEK, YUKON

TITLE: **SITE PLAN AND CROSS SECTION LOCATION**

	PROJECT No. 1114360073-2800-2860			FILE No. 11-1436-0073-2800-2860-01	
	DESIGN	CB	28NOV12	SCALE	AS SHOWN
	CADD	TS	30NOV12		
	CHECK	----	----		
	REVIEW	----	----		
FIGURE 2					




0 8 16 24m
1:400
VERTICAL SCALE EXAGGERATION 2.0X

PROJECT

GOVERNMENT OF YUKON,
DEPARTMENT OF COMMUNITY SERVICES
DRURY CREEK, Y.T.

TITLE

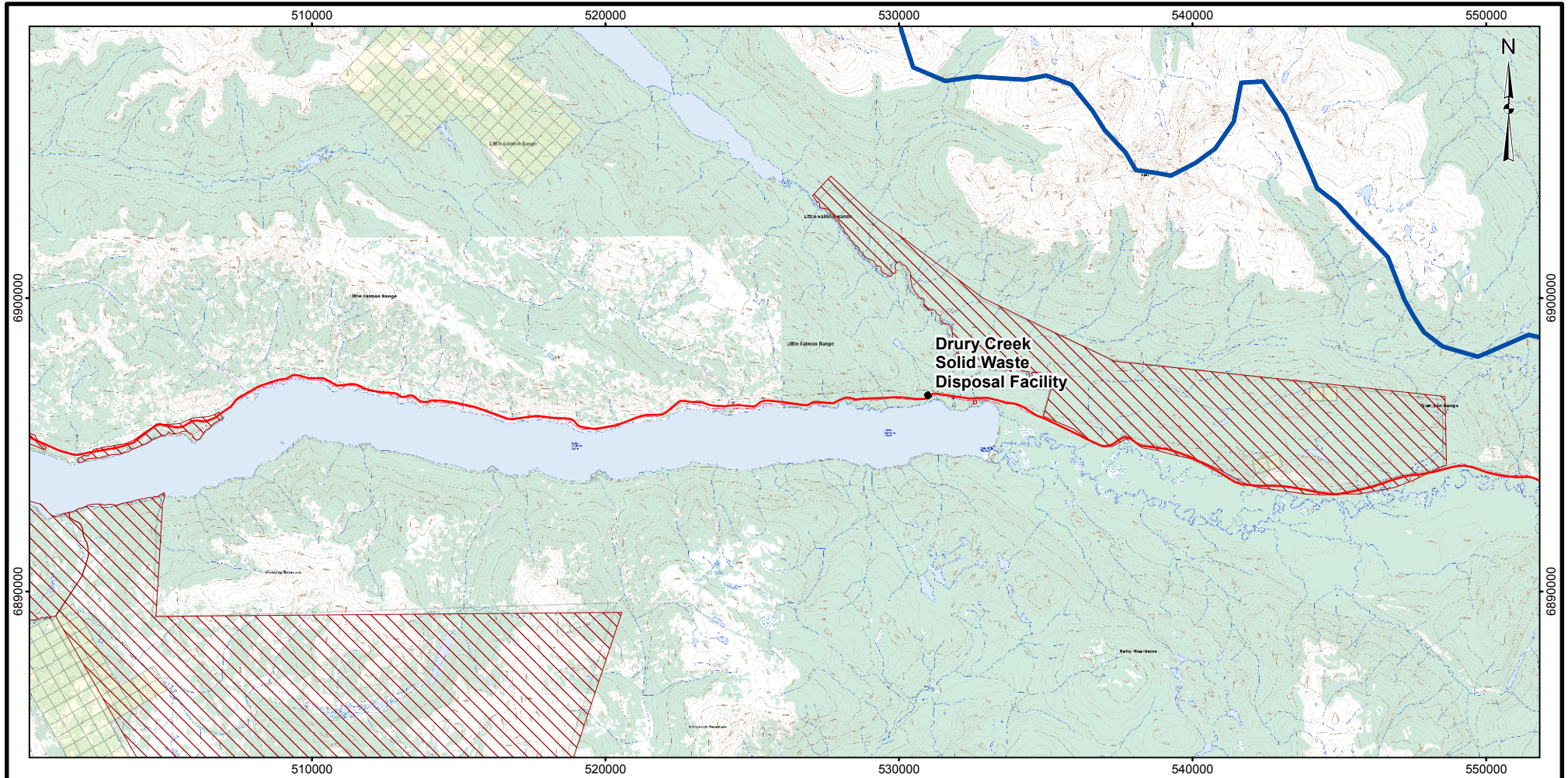
CONCEPTUAL HYDROGEOLOGICAL
CROSS - SECTION A-A'

Golder
Associates

PROJECT No.	11-1436-0073/2800	
DESIGN	GJH	31DEC12
CADD	JHL	02JAN13
CHECK		
REVIEW		

FILE No.	1114360073-2800-2860-04
SCALE	AS SHOWN

FIGURE 4

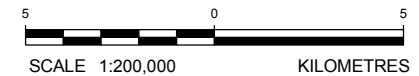


LEGEND

- MAJOR HIGHWAY
- FACILITY
- FIRST NATIONS LANDS
- PARK/PROTECTED AREA
- QUARTZ CLAIM
- WATERSHED BOUNDARY

REFERENCE

FEATURE DATA OBTAINED FROM THE YUKON GOVERNMENT YGS MAPMAKER ONLINE. BASEDATA OBTAINED FROM GEOGRATIS (NATURAL RESOURCES CANADA).
 DATUM: NAD83 PROJECTION: UTM ZONE 08



PROJECT
 SWIFT RIVER SOLID WASTE FACILITY HYDROGEOLOGICAL ASSESSMENT
 GOVERNMENT OF YUKON, DEPARTMENT OF COMMUNITY SERVICES
 DRURY CREEK, YUKON

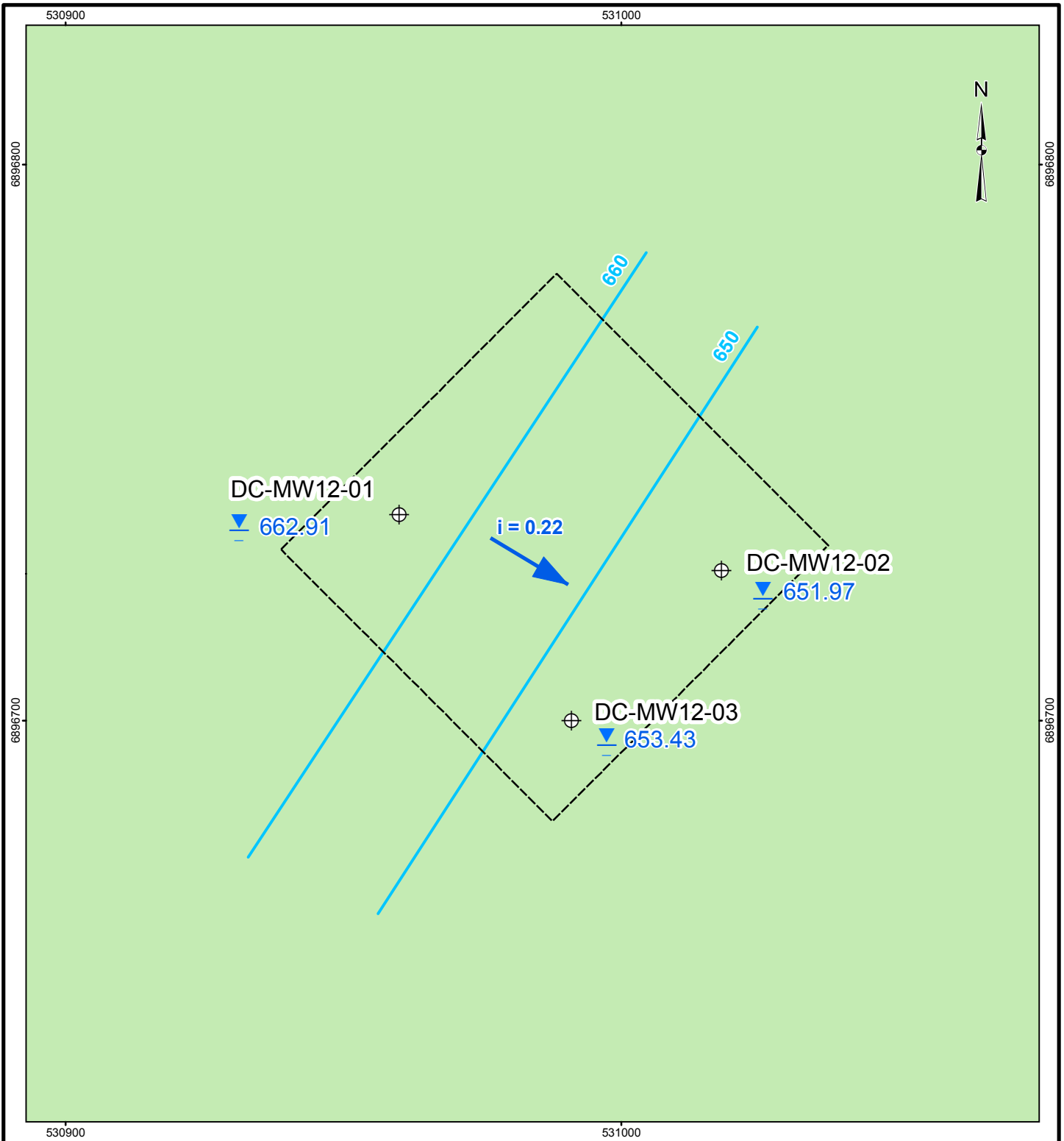
TITLE
REGIONAL DRAINAGE & LAND ZONING









PROJECT No. 11-1436-0073		PHASE No. 2800	
DESIGN	CB	06 Sept 2012	SCALE AS SHOWN
GIS	CD	20 Sept 2012	REV. 0
CHECK			
REVIEW			

FIGURE: 5

\\golder.gds\gait\Burnaby\CAD-GIS\Bur-Graphics\Projects\2011\11436\11-1436-0073\GIS\Mapping\MXD\Hydrogeology\Drury_Creek\Figure_06_Borehole_location.mxd



LEGEND

-  MONITORING WELL
-  GROUNDWATER ELEVATION (MASL) - MEASURED ON AUGUST 24, 2012
-  GROUNDWATER CONTOUR (MASL)
-  APPROXIMATE EXTENT OF FACILITY
-  GROUNDWATER FLOW DIRECTION
-  HYDRAULIC GRADIENT

REFERENCE

DATUM: NAD83 PROJECTION: UTM ZONE 8



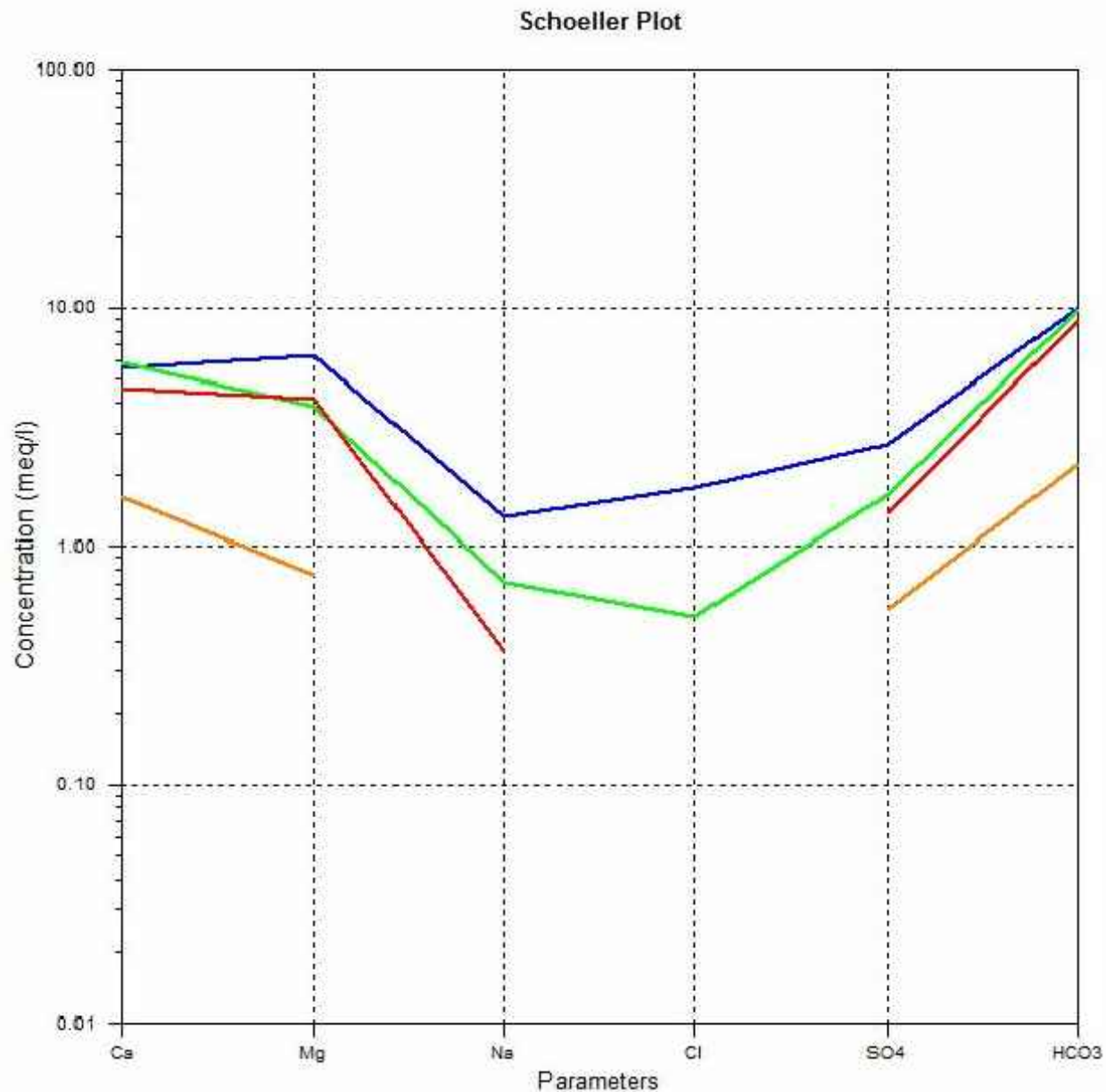
PROJECT YUKON GOVERNMENT - COMMUNITY SERVICES
SOLID WASTE DISPOSAL FACILITY
DRURY CREEK, YUKON

TITLE

BOREHOLE LOCATION MAP GROUNDWATER ELEVATION



PROJECT No. 11-1436-0073			PHASE No. 2800	
DESIGN	CB	12 Sept 2012	SCALE AS SHOWN	REV. 0
GIS	CD	18 Sept 2012	FIGURE: 6	
CHECK				
REVIEW				



LEGEND

Sampling Results
September 2012

- DC-MW12-01
- DC-MW12-02
- DC-MW12-03
- Drury Creek Surface Water

PROJECT YUKON GOVERNMENT - COMMUNITY SERVICES
SOLID WASTE DISPOSAL FACILITY
DRURY CREEK, YUKON

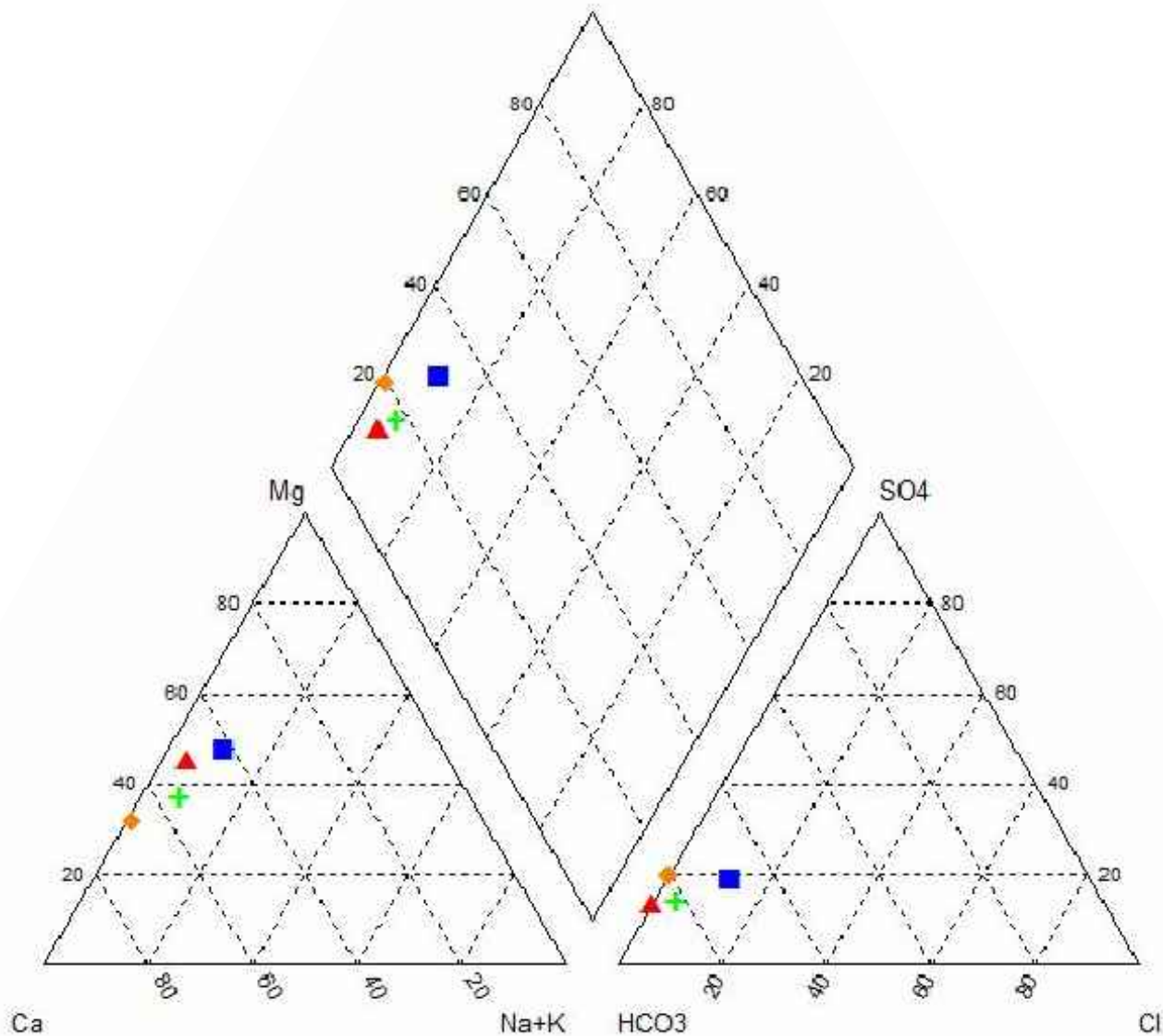
TITLE

SCHOELLER PLOT



PROJECT No.	11-1436-0073	FILE No.	1114360073-2800-2860-FIG_07
DESIGN		SCALE	NOT TO SCALE
CADD	JD	16NOV12	
CHECK			
REVIEW			

FIGURE 7



LEGEND

Sample Results
September 2012

- ▲ DC-MW12-01
- DC-MW12-02
- + DC-MW12-03
- ◆ Drury Creek Surface Water

PROJECT YUKON GOVERNMENT - COMMUNITY SERVICES
SOLID WASTE DISPOSAL FACILITY
DRURY CREEK, YUKON

TITLE

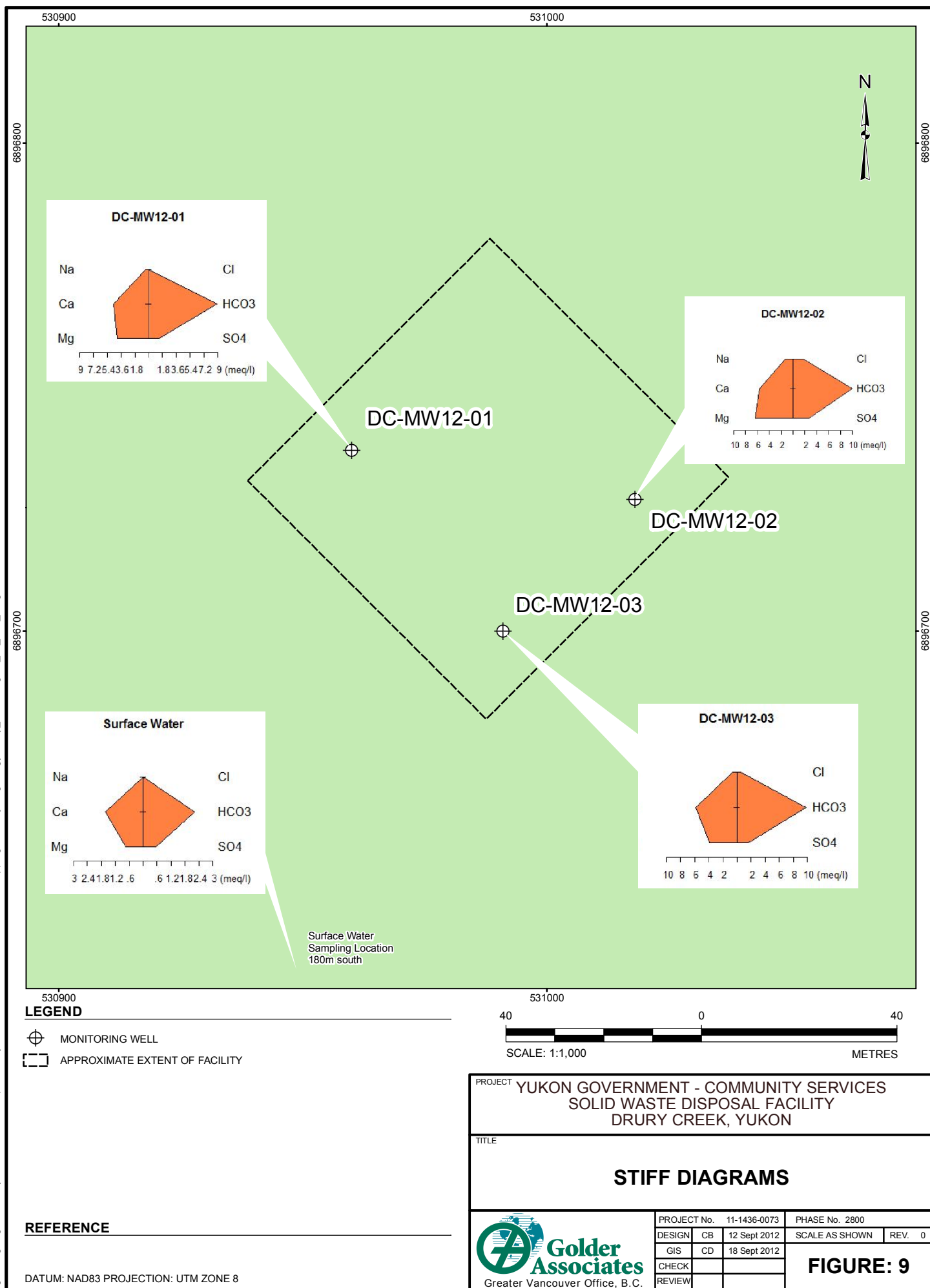
PIPER PLOT



PROJECT No.	11-1436-0073	FILE No.	1114360073-2800-2860-FIG_08
DESIGN		SCALE	NOT TO SCALE
CADD	JD	16NOV12	
CHECK			
REVIEW			

FIGURE 8

\\golder.gds\gait\Burnaby\CAD-GIS\Bur-Graphics\Projects\2011\11-1436-0073\GIS\Mapping\MXD\Hydrogeology\Drury_Creek\Figure_09_Stiff_Diagrams.mxd





APPENDIX A

Site Photographs



APPENDIX A

Site Photographs



Photograph 1: Drury Creek Facility Waste Disposal Trench; looking west.



Photograph 2: Drury Creek Facility; looking northwest.



APPENDIX A

Site Photographs



Photograph 3: Drury Creek Facility; looking south.

o:\final\2011\1436\11-1436-0073\1114360073-514-r-rev0-2800\appendices\app a\site photos.docx



APPENDIX B

Well Construction Logs

PROJECT No.: 11-1436-0073 (2800)

RECORD OF MONITORING WELL: DC-MW12-01SHEET 1 OF 1
DATUM: Local

CLIENT: Yukon Government Community Services

PROJECT: Yukon Landfill Assessment

LOCATION: Drury Creek

DRILLING DATE: July 12, 2012

DRILLING CONTRACTOR: Midnight Sun Drilling

N: ~6896737.3 E: ~530960.465

Note: Northing and Easting Coordinates have been determined by
GPS in the field and are approximate only.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES				PID ppm		WATER CONTENT PERCENT Wp I — W — I Wi	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
		DESCRIPTION	STRATA PLOT ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	CORE No.	CORE RECOVERY %	PID ppm			
0	M5 Dritech Truck Mounted Auger Drill Rig Air Rotary	Ground Surface (ML) sandy SILT, some clay, brown to grey, wet.	0.00									Stickup = 0.97m
1		(GW-SW) GRAVEL and SAND, well graded, moist.	0.91									
2												
3												
4		(SM) SILTY fine SAND, brown, moist.	3.96									Bentonite Seal
5		- wet at 5.18m depth.										
6												
7												
8												10/20 Silica Sand
9												
10												51mm Slotted PVC Pipe
		End of Monitoring Well.	8.23									

DEPTH SCALE

1 : 50



LOGGED: CB

CHECKED: **DRAFT**

File N:\BUR\GRAPHICS\PROJECTS\2011\1436-0073\2800\DC\GPJ_Output Form BC_BOREHOLE (ENVIRO). Template BC REGION TEMPLATE BETA (GDT Library BC REGION LIBRARY GLB Idrozdak 09/13/12)

PROJECT No.: 11-1436-0073 (2800)

RECORD OF MONITORING WELL: DC-MW12-02SHEET 1 OF 2
DATUM: Local

CLIENT: Yukon Government Community Services

PROJECT: Yukon Landfill Assessment



LOCATION: Drury Creek

DRILLING DATE: July 12, 2012

DRILLING CONTRACTOR: Midnight Sun Drilling

N: ~6896727.81 E: ~531018.854

Note: Northing and Easting Coordinates have been determined by
GPS in the field and are approximate only.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES				PID ppm		WATER CONTENT PERCENT		ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	CORE No.	CORE RECOVERY %	PID ppm	Wp			W	Wi
0	M5 Drilltech Truck Mounted Auger Drill Rig Air Rotary	Ground Surface (SW-GW) SAND and GRAVEL, trace silt, with cobbles.		0.00									Stickup = 0.81m		
1															
2															
3															
4															
5															
6															
7															
8															
9															
10		(SW) gravelly SAND, trace silt, brown, moist.		7.32									Bentonite Seal		
11															
12															
13															
14															
15															
16															
17															
18															
19															
CONTINUED NEXT PAGE															

DEPTH SCALE

1 : 50



LOGGED: CB

CHECKED: **DRAFT**

CLIENT: Yukon Government Community Services
PROJECT: Yukon Landfill Assessment
LOCATION: Drury Creek

DRILLING DATE: July 12, 2012

DRILLING CONTRACTOR: Midnight Sun Drilling

N: ~6896727.81 E: ~531018.854
Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

[illegible]

DEPTH SCALE

1 : 50

LOGGED: CB

CHECKED: **DRAFT**

CLIENT: Yukon Government Community Services

PROJECT: Yukon Landfill Assessment

LOCATION: Drury Creek

N: ~6896700.39 E: ~530991.254

Note: Northing and Easting Coordinates have been determined by GPS in the field and are approximate only.

DRILLING DATE: July 12, 2012

DRILLING CONTRACTOR: Midnight Sun Drilling

GPS in the field and are approximate only.																
DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PID ppm		WATER CONTENT PERCENT				ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	CORE No.	CORE RECOVERY %	PID ppm	Wp	WI				
0	M5 Driltech Truck Mounted Auger Drill Rig Air Rotary	Ground Surface (GW) sandy GRAVEL, trace silt, brown, moist.		0.00											Stickup = 1.02m	
1																
2																
3		(GM) sandy GRAVEL, some silt, brown, moist.		3.05												
4																
5		(GW) sandy GRAVEL, trace silt, brown, moist.		5.18											Bentonite Seal	
6																
7																
8		(SM-GM) SAND and GRAVEL, some silt.		7.62												
9																
10																
CONTINUED NEXT PAGE																

DEPTH SCALE

1 : 50

LOGGED: CB

CHECKED: **DRAFT**

PROJECT No.: 11-1436-0073 (2800)

RECORD OF MONITORING WELL: DC-MW12-03SHEET 2 OF 2
DATUM: Local

CLIENT: Yukon Government Community Services

PROJECT: Yukon Landfill Assessment

LOCATION: Drury Creek

DRILLING DATE: July 12, 2012

DRILLING CONTRACTOR: Midnight Sun Drilling

N: ~6896700.39 E: ~530991.254

Note: Northing and Easting Coordinates have been determined by
GPS in the field and are approximate only.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES					PID ppm		WATER CONTENT PERCENT Wp I — W — I Wi	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
		DESCRIPTION	STRATA PLOT ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	CORE No.	CORE RECOVERY %	PID ppm	PID ppm			
10	M5 Drilltech Truck Mounted Auger Drill Rig Air Rotary	(SM-GM) SAND and GRAVEL, some silt. (continued)											Bentonite Seal 10/20 Silica Sand 51mm Slotted PVC Pipe
11													
12													
13													
14		- wet at 14.02m depth.											
15													
16		(SM) SILTY SAND, trace gravel, dark grey, wet.	15.54										
17		End of Monitoring Well.	16.61										
18													
19													
20													

DEPTH SCALE

1 : 50



LOGGED: CB

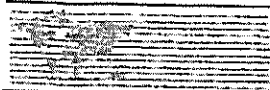
CHECKED: **DRAFT**

File N:\BUR\GRAPHICS\PROJECTS\2011\436-0073\DRAWING\GINT\11-1436-0073 (2800) DCI.GPJ Output Form BC_BOREHOLE (ENVIRO). Template BC_REGION TEMPLATE BETA (GDT Library\BC_REGION\LIBRARY GLB Iborzdzak 09/13/12)



APPENDIX C

Well Development and Sampling Sheets



GROUNDWATER DEVELOPMENT AND PURGING/SAMPLING DATA SHEET

☒ Development
☒ Purging/Sampling

Well No.: DC NUMBER 3 (DC-mw12-01)

Project No.: 11-1436-0073/12900

Location: DBV 0530959 6996736

Date: 01 SEP-12 Time: 16:45

Weather: OVERCAST Temperature: 10°C

Completed by: A. BADGER

MONITORING WELL INFORMATION

Time of Measurement: 16:45

Tidally Influenced: ☐ Yes ☒ No

Depth to product: _____ Product thickness: _____

One well volume: _____

Depth to water Below Top of Casing: A 6.63 metres

(B-A)*2.0 = 7.57 litres - for a 51 mm (2.0 inch) diameter well

Depth to Bottom of Well Below Top of Casing: B 9.10 metres

(B-A)*1.1 = _____ litres - for a 38 mm (1.5 inch) diameter well

Diameter Standpipe: C _____ mm

Sample intake depth: _____ metres

EQUIPMENT LIST

MANNA HE99300

pH and Temp. Meter: Model _____ Serial No. _____

Calibration Buffers: ☒ 4 ☒ 7 ☐ 10

Conductivity Meter: Model _____ Serial No. _____

Calibration Solution: _____

Dissolved Oxygen Meter: Model _____ Serial No. _____

☐ D.O. Chemet Ampoule

Pump: ☐ None ☐ Waterra ☐ Peristaltic ☐ Submersible

☐ Bailor Type: _____

Pump Details: _____

WELL DEVELOPMENT/PURGING

Purge Volume: Well Vol. X 2.14 = 2.25 litres

Avg. Flow Rate: _____ L/min.

Start: 16:55 Finish: 17:19

Time	Volume Removed (L)	Temp. (°C)	pH (Units)	Cond. (µS/cm)	Redox (mV)	Diss. O ₂ (mg/L or %)	Water Level (m)	Remarks
17:00	1	7.5	7.47					
17:03	5	6.2	7.51				6.74	
17:07	10	5.5	7.51				6.90	
17:11	15	5.3	7.32				6.79	
17:15	20	5.2	7.45				6.83	
17:19	25	5.2	7.80					SAMPLE COLLECTOR
								SCM AT WELL
								STICKUP REMOVED
								NEW STICKUP
								HEIGHT 0.97m
								*DOC NOT PRESERVED

Comments:

OR FILTERED.

Odour: ☐ Yes ☐ No If yes _____

Sheen: ☐ Yes ☐ No If yes _____ Hydrocarbon-like ☐ OR Metallic-like ☒ RED-BROWN

Turbidity: Clear ||||| (1) ||||| Very Silty

Analysis	Type	Container Size							Filtered	Preservatives
		40 mL	100 mL	250 mL	500 mL	1 L	2 L	4 L		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	

SCN No. _____ Consumables: ☐ Waterra Tubing ☐ HDPE/Teflon Tubing ☐ Groundwater Filter _____
Field Dup. _____ ☐ Silicon Tubing ☐ D.O. Ampoules _____

GROUNDWATER DEVELOPMENT AND PURGING/SAMPLING DATA SHEET

☐ Development
☒ Purging/Sampling

Well No.: DC Number 2 (DC-mw12-02) Project No.: 11-1436-0073/2800
Location: AG V 0531015 6 89 6727 Date: 01-SEP-12 Time: 15:40
Weather: OUTCLOUD Temperature: 10°C Completed by: _____

MONITORING WELL INFORMATION

Time of Measurement: 15:40 Tidally Influenced: ☐ Yes ☒ No
Depth to product: _____ Product thickness: _____ One well volume: _____
Depth to water Below Top of Casing: A 16.34 metres (B-A)*2.0 = 2.402 4.90 litres - for a 51 mm (2.0 inch) diameter well
Depth to Bottom of Well Below Top of Casing: B 15.79 metres (B-A)*1.1 = _____ litres - for a 38 mm (1.5 inch) diameter well
Diameter Standpipe: C _____ mm Sample intake depth: _____ metres

EQUIPMENT LIST

HANNA HI 91420

pH and Temp. Meter: Model _____ Serial No. _____ Calibration Buffers: ☒ 4 ☒ 7 ☐ 10
Conductivity Meter: Model _____ Serial No. _____ Calibration Solution: _____
Dissolved Oxygen Meter: Model _____ Serial No. _____ ☐ D.O. Chemet Ampoule
Pump: ☐ None ☒ Waterra ☐ Peristaltic ☐ Submersible ☐ Bailer Type: _____
Pump Details: _____

WELL DEVELOPMENT/PURGING

Purge Volume: Well Vol. X 5.42 = 20 litres
Avg. Flow Rate: _____ L/min. Start: 15:20 Finish: 16:18

Time	Volume Removed (L)	Temp. (°C)	pH (Units)	Cond. (µS/cm)	Redox (mV)	Diss. O ₂ (mg/L) or %	Water Level (m)	Remarks
15:50	05	9.8	7.31					
15:52	5	6.6	7.36				17.09	
15:56	10	5.3	7.38				17.35	
15:58	15	5.1	7.29				17.34	
16:02	20	5.5	7.50					
16:10							17.72	
16:18	25	5.4	7.14				17.95	SAMPLE COLLECTED
								* DOX NOT
								FILTERED OR
								PRESERVED

Comments:

Odour: ☐ Yes ☐ No If yes _____
Sheen: ☐ Yes ☐ No If yes _____ Hydrocarbon-like ☐ OR Metallic-like ☐
Turbidity: Clear ☒ Very Silty

Analysis	Type	Container Size							Filtered	Preservatives
		40 mL	100 mL	250 mL	500 mL	1 L	2 L	4 L		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No	

SCN No. _____ Consumables: ☐ Waterra Tubing ☐ HDPE/Teflon Tubing ☐ Groundwater Filter
Field Dup. _____ ☐ Silicon Tubing ☐ D.O. Ampoules ☐

GROUNDWATER DEVELOPMENT AND PURGING/SAMPLING DATA SHEET

☒ Development
☒ Purging/Sampling

Well No.: DC NUMBER 1 (DC-mw12-03) Project No.: 44-1-138-0033/2300
Location: 08 V 0530988 6896702 Date: 01 SEP 12 Time: 1500
Weather: 01521057 Temperature: 10°C Completed by: A BAOGER

MONITORING WELL INFORMATION

Time of Measurement: 15.00 Tidally Influenced: ☐ Yes ☐ No
Depth to product: _____ Product thickness: _____ One well volume: _____
Depth to water Below Top of Casing: A 15.82 metres (B-A)*2.0 = 2.082 9.06 litres - for a 51 mm (2.0 inch) diameter well
Depth to Bottom of Well Below Top of Casing: B 17.80 metres (B-A)*1.1 = _____ litres - for a 38 mm (1.5 inch) diameter well
Diameter Standpipe: C mm Sample intake depth: _____ metres

EQUIPMENT LIST

pH and Temp. Meter: Model _____ Serial No. _____ Calibration Buffers: ☐ 4 ☒ 7 ☐ 10
Conductivity Meter: Model _____ Serial No. _____ Calibration Solution: _____
Dissolved Oxygen Meter: Model _____ Serial No. _____ ☐ D.O. Chemet Ampoule
Pump: ☐ None ☐ Waterra ☐ Peristaltic ☐ Submersible ☐ Bailor Type: _____
Pump Details: _____

WELL DEVELOPMENT/PURGING

Purge Volume: Well Vol. X 4064 = 16.24 litres
Avg. Flow Rate: _____ L/min. Start: 15.00 Finish: 15.15

Time	Volume Removed (L)	Temp. (°C)	pH (Units)	Cond. (uS/cm)	Redox (mV)	Diss. O ₂ (mg/L) or %	Water Level (m)	Remarks
15.02	1	8.2	7.36					
15.05	4	6.7	7.27				15.88	
15.08	8	5.7	7.12				15.90	
15.15	12	6.7	6.92				15.86	
15.17	16	5.5	6.98					
15.19	20	5.2	6.99				15.91	SAMPLE COLLECTED

Comments:

Odour: ☐ Yes ☐ No If yes _____
Sheen: ☐ Yes ☐ No If yes _____ Hydrocarbon-like ☐ OR Metallic-like ☐
Turbidity: Clear ||||| Very Silty

Analysis	Type	Container Size							Filtered		Preservatives
		40 mL	100 mL	250 mL	500 mL	1 L	2 L	4 L			
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No		
	<input type="checkbox"/> Plastic <input type="checkbox"/> Glass								<input type="checkbox"/> Yes <input type="checkbox"/> No		

SCN No. _____ Consumables: ☐ Waterra Tubing _____ ☐ HDPE/Teflon Tubing _____ ☐ Groundwater Filter _____
Field Dup. _____ ☐ Silicon Tubing _____ ☐ D.O. Ampoules _____

☒ Sampling

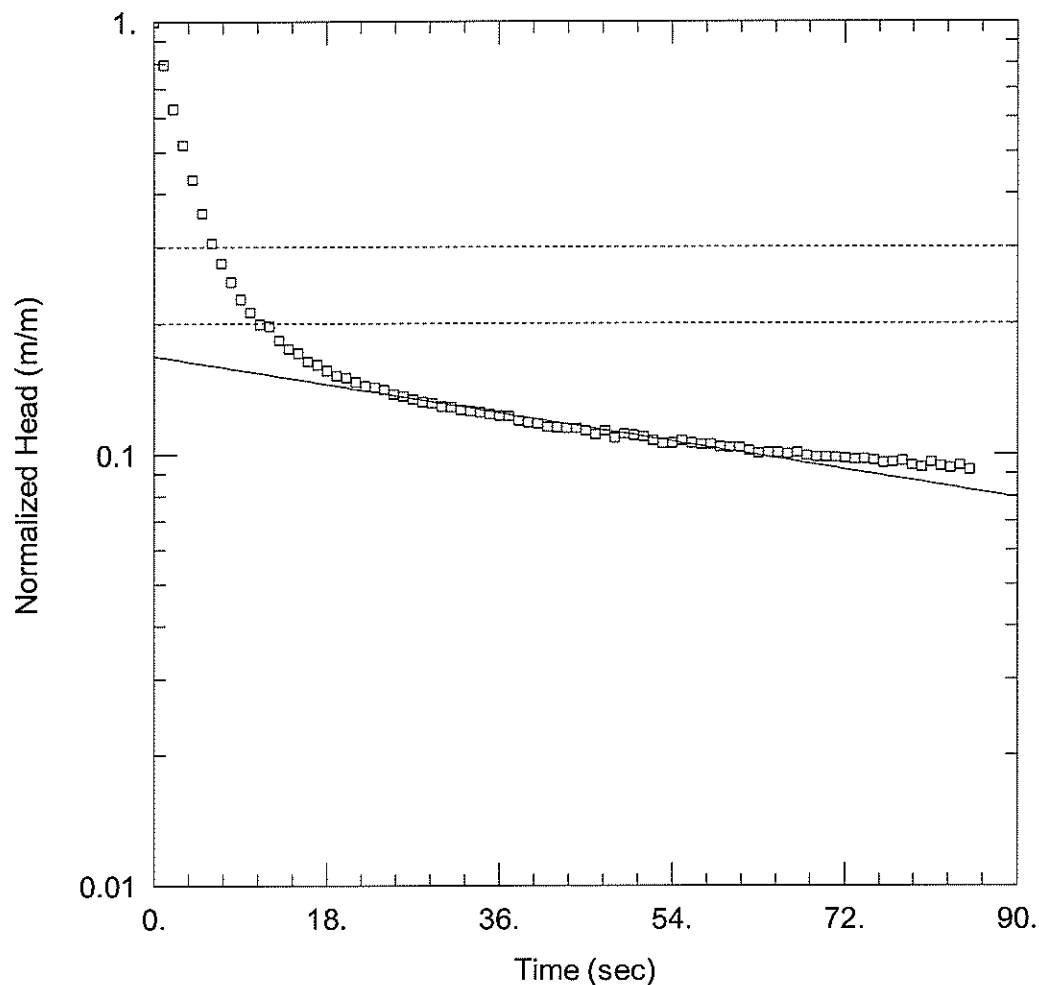
11-1436-0073 / 2900
A 370650
02 SEP 12
14.50

surface



APPENDIX D

Slug Test Data



WELL TEST ANALYSIS

Data Set: \\...\DC-MW12-01.aqt

Date: 10/26/12

Time: 14:40:04

PROJECT INFORMATION

Test Well: DC-MW12-01

Test Date: 02-September-12

AQUIFER DATA

Saturated Thickness: 2.35 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (New Well)

Initial Displacement: 0.545 m

Total Well Penetration Depth: 3.04 m

Casing Radius: 0.025 m

Static Water Column Height: 2.35 m

Screen Length: 3.04 m

Well Radius: 0.092 m

Gravel Pack Porosity: 0.3

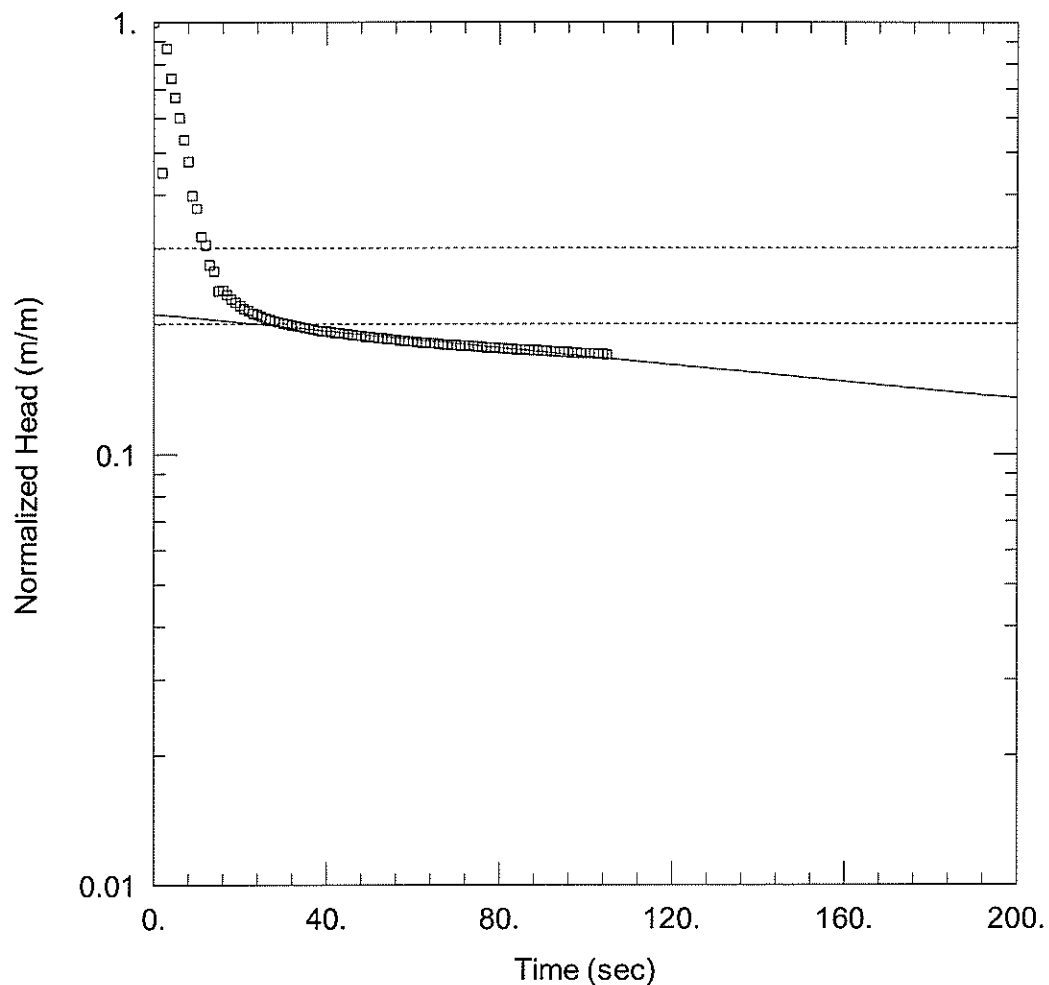
SOLUTION

Aquifer Model: Unconfined

$K = 1.374E-5$ m/sec

Solution Method: Bouwer-Rice

$y_0 = 0.09179$ m



WELL TEST ANALYSIS

Data Set: \\...\DC-MW12-02.aqt

Date: 10/26/12

Time: 14:40:56

PROJECT INFORMATION

Test Well: DC-MW12-02

Test Date: 02-September-12

AQUIFER DATA

Saturated Thickness: 2.21 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW12-02)

Initial Displacement: 0.817 m

Static Water Column Height: 2.21 m

Total Well Penetration Depth: 3.04 m

Screen Length: 3.04 m

Casing Radius: 0.025 m

Well Radius: 0.092 m

Gravel Pack Porosity: 0.3

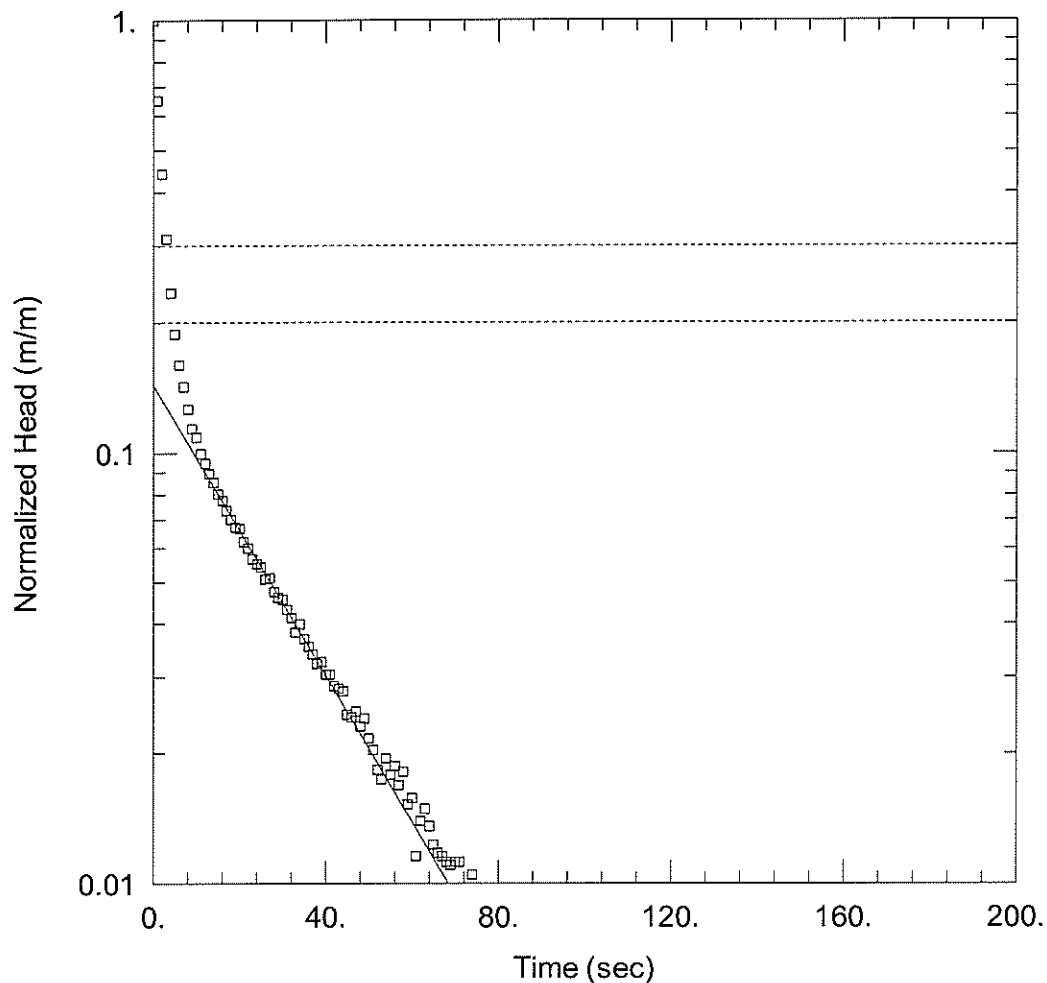
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 3.91E-6$ m/sec

$y_0 = 0.1724$ m



WELL TEST ANALYSIS

Data Set: \\...\DC-MW12-03.aqt

Date: 10/26/12

Time: 14:42:19

PROJECT INFORMATION

Test Well: DC-MW12-03

Test Date: 02-September-12

AQUIFER DATA

Saturated Thickness: 1. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW12-03)

Initial Displacement: 0.545 m

Total Well Penetration Depth: 3.04 m

Casing Radius: 0.025 m

Static Water Column Height: 1.96 m

Screen Length: 3.04 m

Well Radius: 0.096 m

Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined

$K = 0.0001405$ m/sec

Solution Method: Bouwer-Rice

$y_0 = 0.07822$ m

☒ Rising Head

☒ Falling Head

MONITORING WELL INFORMATION

EQUIPMENT LIST

☒ Slug

Mass: kilograms

Length: 1.0 meters

Diameter: 0.0375 meters

☐

Bailer

Water column height: _____ meters

Inside diameter: _____ meters

and/or Volume of water removed: _____ litres

Pressure transducer serial #: 6051050342

Sampling Interval: _____ seconds or minutes (circle one)

Start time: 15:25 Finish time: 16:58

[illegible]

☐ Rising Head
☒ Falling Head

MONITORING WELL INFORMATION

EQUIPMENT LIST

SINGLE-WELL RESPONSE TEST

[illegible]



APPENDIX E

Analytical Reports and Chain of Custody Forms

Table E-1
Results of Water Analyses - Metals
[YTG Landfill Monitoring, Drury Creek, Yukon]

	SCN Location QA/QC Date	Drinking Water CSR - DW	Aquatic Life CSR-AW (freshwater)	Notes	L1203640-11 DC-MW12-01	L1203640-10 DC-MW12-02	L1203640-9 DC-MW12-03	L1203640-12 DC SURFACE
					01-SEP-12 (Number 3)	01-SEP-12 (Number 2)	01-SEP-12 (Number 1)	02-SEP-12
Parameters								
pH (field)					7.3	7.14	6.99	7.88
Temperature °C					5.2	5.40	5.20	13.20
Conductivity (uS/cm)					-	-	-	-
Dissolved Oxygen (mg/L)					-	-	-	-
Laboratory Parameters								
pH (laboratory)					7.82	7.82	7.22	8.23
Hardness (as CaCO3)					437	600	489	120
total dissolved solids					510	828	627	157
Aggregate Organics								
COD					<20	196	153	<20
dissolved organic carbon					1.25	2.20	3.40	2.39
Dissolved Metals								
aluminum		0.2			<0.010	<0.010	<0.010	<0.010
antimony		0.006	0.2		<0.00050	<0.00050	<0.00050	<0.00050
arsenic		0.025	0.05		0.00402	0.00095	0.00177	0.00033
barium		1	10		0.107	0.117	0.118	0.068
beryllium			0.053		<0.0050	<0.0050	<0.0050	<0.0050
bismuth					<0.20	<0.20	<0.20	<0.20
boron		5			<0.10	<0.10	<0.10	<0.10
cadmium		0.005	0.0001 - 0.0006	H	<0.00020	<0.00020	<0.00020	<0.00020
calcium					92.0	113	118	32.6
chromium		0.05	0.010 ^{VI} , 0.090 ^{III}	V	<0.0020	<0.0020	<0.0020	<0.0020
cobalt			0.009		<0.010	<0.010	<0.010	<0.010
copper		1	0.020 - 0.090	H	<0.0010	<0.0010	<0.0010	<0.0010
iron		0.3			0.121	<0.030	0.392	<0.030
lead		0.01	0.040 - 0.160	H	<0.00050	<0.00050	<0.00050	<0.00050
lithium					<0.010	0.011	<0.010	<0.010
magnesium		100			50.4	77.4	47.2	9.28
manganese		0.05			0.175	0.0875	0.0911	<0.0020
mercury		0.001	0.001		<0.00020	<0.00020	<0.00020	<0.00020
molybdenum		0.25	10		<0.030	<0.030	<0.030	<0.030
nickel			0.250 - 1.5	H	<0.050	<0.050	<0.050	<0.050
phosphorus					<0.30	<0.30	<0.30	<0.30
potassium					2.99	4.53	3.30	0.80
selenium		0.01	0.01		<0.0010	<0.0010	<0.0010	<0.0010
silicon					6.52	6.37	6.93	3.80
silver			0.0005 - 0.015	H	<0.010	<0.010	<0.010	<0.010
sodium		200			8.4	30.4	16.2	<2.0
strontium					0.833	1.08	0.838	0.139
thallium			0.003		<0.20	<0.20	<0.20	<0.20
tin					<0.030	<0.030	<0.030	<0.030
titanium			1		<0.010	<0.010	<0.010	<0.010
uranium		0.1	3		0.0131	0.0185	0.00907	0.00161
vanadium					<0.030	<0.030	<0.030	<0.030
zinc		5	0.075 - 2.4	H	<0.050	<0.050	<0.050	<0.050
Other Inorganics								
bicarbonate (CaCO3)					445	499	488	111
carbonate (CaCO3)					<2.0	<2.0	<2.0	<2.0
hydroxide (CaCO3)					<2.0	<2.0	<2.0	<2.0
total alkalinity (CaCO3)					445	499	488	111
ammonia			1.31 - 18.5	pH	0.0409	0.180	0.128	<0.0050
chloride		250			<2.5	61.9	18.0	<0.50
fluoride		1.5	2 - 3	H	<0.10	<0.20	<0.10	0.047
nitrate (as N)		10	400		0.089	0.921	2.12	0.0567
nitrite (as N)		3.2	0.2 - 2	Cl	<0.0050	0.012	<0.0050	<0.0010
total Kjeldahl nitrogen					0.83	7.13	3.57	0.113
sulphate		500	1000		65.7	129	79.3	26.0

Notes:

All concentrations in milligrams per litre (mg/L), unless otherwise noted.

Standards from the Yukon Contaminated Sites Regulation (CSR), from the Environment Act (O.I.C. 2002/171) its associated Schedules.

Land Use abbreviations: AW (Aquatic Life).

H = standard is Hardness dependent

CL = standard is chloride dependent

pH = standard is pH dependent

V= Standard is valence dependent VI refers to chromium VI and III refers to chromium III

T = standard varies with temperature

MCS = Most Conservative Standard

FDA = field duplicate available

FD = field duplicate

QA/QC = quality assurance/quality control

SCN = sample control number

Italics indicates standard is below detection limit.

COC = Chain of Custody

* = Samples tested for dissolved metals were unfiltered



GOLDER ASSOCIATES LTD.
ATTN: Andrea Badger
201B, 170 Titanium Way
Whitehorse YT Y1A 0G1

Date Received: 04-SEP-12
Report Date: 17-SEP-12 12:37 (MT)
Version: FINAL

Client Phone: 867-633-6076

Certificate of Analysis

Lab Work Order #: L1203640
Project P.O. #: NOT SUBMITTED
Job Reference: 11-1436-0073/1100, 2500, 2800
C of C Numbers:
Legal Site Desc:

Amber Springer
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1203640-1 Ground Water 31-AUG-12 10:50 RR NUMBER 1	L1203640-2 Ground Water 31-AUG-12 13:20 RR NUMBER 2	L1203640-3 surface water 01-SEP-12 11:10 RR SURFACE	L1203640-4 Ground Water 31-AUG-12 15:30 FA-MW12-01	L1203640-5 Ground Water 31-AUG-12 17:40 FA-MW12-03
Grouping	Analyte					
WATER						
Physical Tests	Hardness (as CaCO ₃) (mg/L)	3910	3320	739	853	731
	pH (pH)	7.36	7.38	8.42	7.40	7.27
	Total Dissolved Solids (mg/L)	5590	4580	1330	1140	993
	Turbidity (NTU)	319	12500	198	393	169
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO ₃) (mg/L)	496	321	115	505	540
	Alkalinity, Carbonate (as CaCO ₃) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO ₃) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO ₃) (mg/L)	496	321	115	505	540
	Ammonia, Total (as N) (mg/L)	0.169	0.484	0.0354	0.370	0.205
	Chloride (Cl) (mg/L)	62	54	30.7	94.9	<5.0 ^{DLA}
	Fluoride (F) (mg/L)	<0.40 ^{DLA}	<0.40 ^{DLA}	<0.20 ^{DLA}	<0.20 ^{DLA}	<0.20 ^{DLA}
	Nitrate (as N) (mg/L)	1.02 ^{DLA}	1.27 ^{DLA}	<0.050 ^{DLA}	<0.050 ^{DLA}	<0.050 ^{DLA}
	Nitrite (as N) (mg/L)	<0.020 ^{DLA}	<0.020 ^{DLA}	<0.010 ^{DLA}	<0.010 ^{DLA}	<0.010 ^{DLA}
	Total Kjeldahl Nitrogen (mg/L)	1.10	7.23	2.02	0.875	0.366
	Sulfate (SO ₄) (mg/L)	3370	2830	804	347	306
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	19.0	14.8	26.1	8.44	3.66
Dissolved Metals	Dissolved Metals Filtration Location	FIELD ^{DLA}	FIELD ^{DLA}	LAB	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.050 ^{DLA}	<0.050 ^{DLA}	<0.010	<0.010	<0.010
	Antimony (Sb)-Dissolved (mg/L)	<0.0025 ^{DLA}	<0.0025 ^{DLA}	0.00077	0.00059	<0.00050
	Arsenic (As)-Dissolved (mg/L)	0.00091 ^{DLA}	0.00070 ^{DLA}	0.00587	0.00604	0.00373
	Barium (Ba)-Dissolved (mg/L)	<0.10 ^{DLA}	<0.10 ^{DLA}	0.044	0.162	0.108
	Beryllium (Be)-Dissolved (mg/L)	<0.010 ^{DLA}	<0.010 ^{DLA}	<0.0050	<0.0050	<0.0050
	Bismuth (Bi)-Dissolved (mg/L)	<0.40 ^{DLA}	<0.40 ^{DLA}	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.50 ^{DLA}	<0.50 ^{DLA}	<0.10	<0.10	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	<0.0010 ^{DLA}	<0.0010 ^{DLA}	<0.00020	<0.00020	<0.00020
	Calcium (Ca)-Dissolved (mg/L)	459 ^{DLA}	445 ^{DLA}	96.3	164	156
	Chromium (Cr)-Dissolved (mg/L)	<0.010 ^{DLA}	<0.010 ^{DLA}	<0.0020	<0.0020	<0.0020
	Cobalt (Co)-Dissolved (mg/L)	<0.020 ^{DLA}	<0.020 ^{DLA}	<0.010	<0.010	0.016
	Copper (Cu)-Dissolved (mg/L)	<0.0050 ^{DLA}	<0.0050 ^{DLA}	<0.0010	<0.0010	<0.0010
	Iron (Fe)-Dissolved (mg/L)	<0.060 ^{DLA}	<0.060 ^{DLA}	<0.030	5.72	10.5
	Lead (Pb)-Dissolved (mg/L)	<0.0025 ^{DLA}	<0.0025 ^{DLA}	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.029	0.024	0.012	0.011	0.011
	Magnesium (Mg)-Dissolved (mg/L)	672	537	121	108	83.0
	Manganese (Mn)-Dissolved (mg/L)	2.00	3.52	0.0053	0.474	3.89
	Mercury (Hg)-Dissolved (mg/L)	<0.00020 ^{DLA}	<0.00020 ^{DLA}	<0.00020	<0.00020	<0.00020
	Molybdenum (Mo)-Dissolved (mg/L)	<0.060 ^{DLA}	<0.060 ^{DLA}	<0.030	<0.030	<0.030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1203640-6 Ground Water 31-AUG-12 18:15 FA-MW12-04	L1203640-7 Ground Water 31-AUG-12 15:30 FA-MW12-05	L1203640-8 Surface Water 02-SEP-12 12:00 FA SURFACE	L1203640-9 Ground Water 01-SEP-12 15:20 DC NUMBER 1	L1203640-10 Ground Water 01-SEP-12 16:20 DC NUMBER 2
Grouping	Analyte					
WATER						
Physical Tests	Hardness (as CaCO ₃) (mg/L)	740	844	54.5	489	600
	pH (pH)	6.96	7.39	7.12	7.22	7.82
	Total Dissolved Solids (mg/L)	1420	1140	131	627	828
	Turbidity (NTU)	1290	539	16.3	3240	13900
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO ₃) (mg/L)	383	523	43.4	488	499
	Alkalinity, Carbonate (as CaCO ₃) (mg/L)	<2.0	<1.0	<1.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO ₃) (mg/L)	<2.0	<1.0	<1.0	<2.0	<2.0
	Alkalinity, Total (as CaCO ₃) (mg/L)	383	523	43.4	488	499
	Ammonia, Total (as N) (mg/L)	1.49	0.387	0.0138	0.128	0.180
	Chloride (Cl) (mg/L)	349	99.5	14.3	18.0	61.9
	Fluoride (F) (mg/L)	<0.40 ^{DLA}	<0.20 ^{DLA}	0.112	<0.10 ^{DLA}	<0.20 ^{DLA}
	Nitrate (as N) (mg/L)	<0.10 ^{DLA}	<0.050 ^{DLA}	<0.0050	2.12 ^{DLA}	0.921
	Nitrite (as N) (mg/L)	<0.020 ^{DLA}	<0.010 ^{DLA}	<0.0010	<0.0050 ^{DLA}	0.012
	Total Kjeldahl Nitrogen (mg/L)	3.73	1.01	2.38	3.57	7.13
	Sulfate (SO ₄) (mg/L)	163	339	<0.50	79.3	129
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	11.9	7.85	22.0	3.40	2.20
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	LAB	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.010	<0.010	0.012	<0.010	<0.010
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	0.00059	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	0.0140	0.00629	0.00060	0.00177	0.00095
	Barium (Ba)-Dissolved (mg/L)	1.12	0.166	0.050	0.118	0.117
	Beryllium (Be)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Calcium (Ca)-Dissolved (mg/L)	201	161	12.5	118	113
	Chromium (Cr)-Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Cobalt (Co)-Dissolved (mg/L)	0.012	<0.010	<0.010	<0.010	<0.010
	Copper (Cu)-Dissolved (mg/L)	<0.0010	<0.0010	0.0012	<0.0010	<0.0010
	Iron (Fe)-Dissolved (mg/L)	48.3	5.99	0.032	0.392	<0.030
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)	<0.010	0.011	<0.010	<0.010	0.011
	Magnesium (Mg)-Dissolved (mg/L)	58.1	107	5.66	47.2	77.4
	Manganese (Mn)-Dissolved (mg/L)	4.24	0.477	<0.0020	0.0911	0.0875
	Mercury (Hg)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Molybdenum (Mo)-Dissolved (mg/L)	<0.030	<0.030	<0.030	<0.030	<0.030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L1203640-11 Ground Water 01-SEP-12 17:15 DC NUMBER 3	L1203640-12 Surface Water 02-SEP-12 14:50 DC SURFACE			
Grouping	Analyte						
WATER							
Physical Tests	Hardness (as CaCO ₃) (mg/L)	437	120				
	pH (pH)	7.82	8.23				
	Total Dissolved Solids (mg/L)	510	157				
	Turbidity (NTU)	2170	2.89				
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO ₃) (mg/L)	445	111				
	Alkalinity, Carbonate (as CaCO ₃) (mg/L)	<2.0	<2.0				
	Alkalinity, Hydroxide (as CaCO ₃) (mg/L)	<2.0	<2.0				
	Alkalinity, Total (as CaCO ₃) (mg/L)	445	111				
	Ammonia, Total (as N) (mg/L)	0.0409	<0.0050				
	Chloride (Cl) (mg/L)	<2.5 ^{DLA}	<0.50				
	Fluoride (F) (mg/L)	<0.10 ^{DLA}	0.047				
	Nitrate (as N) (mg/L)	0.089	0.0567				
	Nitrite (as N) (mg/L)	<0.0050 ^{DLA}	<0.0010				
	Total Kjeldahl Nitrogen (mg/L)	0.83	0.113				
	Sulfate (SO ₄) (mg/L)	65.7	26.0				
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.25	2.39				
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	<0.010	<0.010				
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050				
	Arsenic (As)-Dissolved (mg/L)	0.00402	0.00033				
	Barium (Ba)-Dissolved (mg/L)	0.107	0.068				
	Beryllium (Be)-Dissolved (mg/L)	<0.0050	<0.0050				
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20				
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10				
	Cadmium (Cd)-Dissolved (mg/L)	<0.00020	<0.00020				
	Calcium (Ca)-Dissolved (mg/L)	92.0	32.6				
	Chromium (Cr)-Dissolved (mg/L)	<0.0020	<0.0020				
	Cobalt (Co)-Dissolved (mg/L)	<0.010	<0.010				
	Copper (Cu)-Dissolved (mg/L)	<0.0010	<0.0010				
	Iron (Fe)-Dissolved (mg/L)	0.121	<0.030				
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050				
	Lithium (Li)-Dissolved (mg/L)	<0.010	<0.010				
	Magnesium (Mg)-Dissolved (mg/L)	50.4	9.28				
	Manganese (Mn)-Dissolved (mg/L)	0.175	<0.0020				
	Mercury (Hg)-Dissolved (mg/L)	<0.00020	<0.00020				
	Molybdenum (Mo)-Dissolved (mg/L)	<0.030	<0.030				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1203640-1 Ground Water 31-AUG-12 10:50 RR NUMBER 1	L1203640-2 Ground Water 31-AUG-12 13:20 RR NUMBER 2	L1203640-3 surface water 01-SEP-12 11:10 RR SURFACE	L1203640-4 Ground Water 31-AUG-12 15:30 FA-MW12-01	L1203640-5 Ground Water 31-AUG-12 17:40 FA-MW12-03
Grouping	Analyte					
WATER						
Dissolved Metals	Nickel (Ni)-Dissolved (mg/L)	<0.10 ^{DLA}	<0.10 ^{DLA}	<0.050	<0.050	<0.050
	Phosphorus (P)-Dissolved (mg/L)	<0.60 ^{DLA}	<0.60 ^{DLA}	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	8.84	8.16	14.4	4.46	3.81
	Selenium (Se)-Dissolved (mg/L)	0.0060	<0.0050 ^{DLA}	<0.0010	<0.0010	<0.0010
	Silicon (Si)-Dissolved (mg/L)	7.67	5.96	3.36	6.78	8.82
	Silver (Ag)-Dissolved (mg/L)	<0.020 ^{DLA}	<0.020 ^{DLA}	<0.010	<0.010	<0.010
	Sodium (Na)-Dissolved (mg/L)	44.3	68.9	84.7	31.4	7.8
	Strontium (Sr)-Dissolved (mg/L)	1.34	1.62	0.571	0.803	0.452
	Thallium (Tl)-Dissolved (mg/L)	<0.40 ^{DLA}	<0.40 ^{DLA}	<0.20	<0.20	<0.20
	Tin (Sn)-Dissolved (mg/L)	<0.060 ^{DLA}	<0.060 ^{DLA}	<0.030	<0.030	<0.030
	Titanium (Ti)-Dissolved (mg/L)	<0.020 ^{DLA}	<0.020 ^{DLA}	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.0709	0.0346	0.00042	0.0135	0.0289
	Vanadium (V)-Dissolved (mg/L)	<0.060 ^{DLA}	<0.060 ^{DLA}	<0.030	<0.030	<0.030
	Zinc (Zn)-Dissolved (mg/L)	<0.25 ^{DLA}	<0.25 ^{DLA}	<0.050	<0.050	<0.050
Aggregate Organics	COD (mg/L)	75	270	91	59	27
Volatile Organic Compounds	Benzene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bromodichloromethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Bromoform (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Carbon Tetrachloride (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Chlorobenzene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Dibromochloromethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Chloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Chloroform (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Chloromethane (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	1,2-Dichlorobenzene (mg/L)	<0.00070	<0.00070	<0.00070	<0.00070	<0.00070
	1,3-Dichlorobenzene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,4-Dichlorobenzene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,1-Dichloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,2-Dichloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,1-Dichloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	cis-1,2-Dichloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	trans-1,2-Dichloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,3-Dichloropropene (cis & trans) (mg/L)	<0.0014	<0.0014	<0.0014	<0.0014	<0.0014
	Dichloromethane (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	1,2-Dichloropropane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	cis-1,3-Dichloropropylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1203640-6 Ground Water 31-AUG-12 18:15 FA-MW12-04	L1203640-7 Ground Water 31-AUG-12 15:30 FA-MW12-05	L1203640-8 Surface Water 02-SEP-12 12:00 FA SURFACE	L1203640-9 Ground Water 01-SEP-12 15:20 DC NUMBER 1	L1203640-10 Ground Water 01-SEP-12 16:20 DC NUMBER 2
Grouping	Analyte					
WATER						
Dissolved Metals	Nickel (Ni)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	11.6	4.52	4.38	3.30	4.53
	Selenium (Se)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)-Dissolved (mg/L)	6.06	6.72	0.440	6.93	6.37
	Silver (Ag)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Sodium (Na)-Dissolved (mg/L)	97.7	32.3	3.9	16.2	30.4
	Strontium (Sr)-Dissolved (mg/L)	0.789	0.818	0.0598	0.838	1.08
	Thallium (Tl)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	Tin (Sn)-Dissolved (mg/L)	<0.030	<0.030	<0.030	<0.030	<0.030
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00711	0.0138	<0.00010	0.00907	0.0185
	Vanadium (V)-Dissolved (mg/L)	<0.030	<0.030	<0.030	<0.030	<0.030
	Zinc (Zn)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Aggregate Organics	COD (mg/L)	167	64	86	153	196
Volatile Organic Compounds	Benzene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bromodichloromethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Bromoform (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Carbon Tetrachloride (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Chlorobenzene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Dibromochloromethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Chloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Chloroform (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Chloromethane (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	1,2-Dichlorobenzene (mg/L)	<0.00070	<0.00070	<0.00070	<0.00070	<0.00070
	1,3-Dichlorobenzene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,4-Dichlorobenzene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,1-Dichloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,2-Dichloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,1-Dichloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	cis-1,2-Dichloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	trans-1,2-Dichloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	1,3-Dichloropropene (cis & trans) (mg/L)	<0.0014	<0.0014	<0.0014	<0.0014	<0.0014
	Dichloromethane (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	1,2-Dichloropropane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	cis-1,3-Dichloropropylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L1203640-11 Ground Water 01-SEP-12 17:15 DC NUMBER 3	L1203640-12 Surface Water 02-SEP-12 14:50 DC SURFACE			
Grouping	Analyte						
WATER							
Dissolved Metals	Nickel (Ni)-Dissolved (mg/L)		<0.050	<0.050			
	Phosphorus (P)-Dissolved (mg/L)		<0.30	<0.30			
	Potassium (K)-Dissolved (mg/L)		2.99	0.80			
	Selenium (Se)-Dissolved (mg/L)		<0.0010	<0.0010			
	Silicon (Si)-Dissolved (mg/L)		6.52	3.80			
	Silver (Ag)-Dissolved (mg/L)		<0.010	<0.010			
	Sodium (Na)-Dissolved (mg/L)		8.4	<2.0			
	Strontium (Sr)-Dissolved (mg/L)		0.833	0.139			
	Thallium (Tl)-Dissolved (mg/L)		<0.20	<0.20			
	Tin (Sn)-Dissolved (mg/L)		<0.030	<0.030			
	Titanium (Ti)-Dissolved (mg/L)		<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)		0.0131	0.00161			
	Vanadium (V)-Dissolved (mg/L)		<0.030	<0.030			
	Zinc (Zn)-Dissolved (mg/L)		<0.050	<0.050			
Aggregate Organics	COD (mg/L)		<20	<20			
Volatile Organic Compounds	Benzene (mg/L)		<0.00050	<0.00050			
	Bromodichloromethane (mg/L)		<0.0010	<0.0010			
	Bromoform (mg/L)		<0.0010	<0.0010			
	Carbon Tetrachloride (mg/L)		<0.00050	<0.00050			
	Chlorobenzene (mg/L)		<0.0010	<0.0010			
	Dibromochloromethane (mg/L)		<0.0010	<0.0010			
	Chloroethane (mg/L)		<0.0010	<0.0010			
	Chloroform (mg/L)		<0.0010	<0.0010			
	Chloromethane (mg/L)		<0.0050	<0.0050			
	1,2-Dichlorobenzene (mg/L)		<0.00070	<0.00070			
	1,3-Dichlorobenzene (mg/L)		<0.0010	<0.0010			
	1,4-Dichlorobenzene (mg/L)		<0.0010	<0.0010			
	1,1-Dichloroethane (mg/L)		<0.0010	<0.0010			
	1,2-Dichloroethane (mg/L)		<0.0010	<0.0010			
	1,1-Dichloroethylene (mg/L)		<0.0010	<0.0010			
	cis-1,2-Dichloroethylene (mg/L)		<0.0010	<0.0010			
	trans-1,2-Dichloroethylene (mg/L)		<0.0010	<0.0010			
	1,3-Dichloropropene (cis & trans) (mg/L)		<0.0014	<0.0014			
	Dichloromethane (mg/L)		<0.0050	<0.0050			
	1,2-Dichloropropane (mg/L)		<0.0010	<0.0010			
	cis-1,3-Dichloropropylene (mg/L)		<0.0010	<0.0010			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1203640-1	L1203640-2	L1203640-3	L1203640-4	L1203640-5
		Description	Ground Water	Ground Water	surface water	Ground Water	Ground Water
		Sampled Date	31-AUG-12	31-AUG-12	01-SEP-12	31-AUG-12	31-AUG-12
		Sampled Time	10:50	13:20	11:10	15:30	17:40
		Client ID	RR NUMBER 1	RR NUMBER 2	RR SURFACE	FA-MW12-01	FA-MW12-03
Grouping	Analyte						
WATER							
Volatile Organic Compounds	trans-1,3-Dichloropropylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Ethylbenzene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	Methyl t-butyl ether (MTBE) (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	Styrene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	1,1,1,2-Tetrachloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	1,1,2,2-Tetrachloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Tetrachloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Toluene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	1,1,1-Trichloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	1,1,2-Trichloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Trichloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Trichlorofluoromethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Vinyl Chloride (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	ortho-Xylene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	meta- & para-Xylene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	Xylenes (mg/L)	<0.00075	<0.00075	<0.00075	<0.00075	<0.00075	
	Surrogate: 4-Bromofluorobenzene (SS) (%)	90.0	87.2	87.9	86.9	86.5	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	92.0	92.0	91.4	92.1	93.3	
Hydrocarbons	EPH10-19 (mg/L)	0.35	0.49	<0.25	<0.25	<0.25	
	EPH19-32 (mg/L)	0.32	0.28	<0.25	<0.25	<0.25	
	LEPH (mg/L)	0.35	0.49	<0.25	<0.25	<0.25	
	HEPH (mg/L)	0.32	0.28	<0.25	<0.25	<0.25	
	Volatile Hydrocarbons (VH6-10) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	
	VPH (C6-C10) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	118.2	80.1	94.0	85.8	85.3	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Acenaphthylene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Acridine (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Anthracene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Benz(a)anthracene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Benzo(a)pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
	Benzo(b)fluoranthene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Benzo(g,h,i)perylene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Benzo(k)fluoranthene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Chrysene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Dibenz(a,h)anthracene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L1203640-6 Ground Water 31-AUG-12 18:15 FA-MW12-04	L1203640-7 Ground Water 31-AUG-12 15:30 FA-MW12-05	L1203640-8 Surface Water 02-SEP-12 12:00 FA SURFACE	L1203640-9 Ground Water 01-SEP-12 15:20 DC NUMBER 1	L1203640-10 Ground Water 01-SEP-12 16:20 DC NUMBER 2
Grouping	Analyte						
WATER							
Volatile Organic Compounds	trans-1,3-Dichloropropylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Ethylbenzene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	Methyl t-butyl ether (MTBE) (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	Styrene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	1,1,1,2-Tetrachloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	1,1,2,2-Tetrachloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Tetrachloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Toluene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	1,1,1-Trichloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	1,1,2-Trichloroethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Trichloroethylene (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Trichlorofluoromethane (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	
	Vinyl Chloride (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	ortho-Xylene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	meta- & para-Xylene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
	Xylenes (mg/L)	<0.00075	<0.00075	<0.00075	<0.00075	<0.00075	
	Surrogate: 4-Bromofluorobenzene (SS) (%)	87.9	86.3	86.5	84.5	84.9	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	91.5	92.2	91.8	91.5	91.7	
Hydrocarbons	EPH10-19 (mg/L)	<0.25	<0.25	0.27	<0.25	<0.25	
	EPH19-32 (mg/L)	<0.25	<0.25	0.29	<0.25	<0.25	
	LEPH (mg/L)	<0.25	<0.25	0.27	<0.25	<0.25	
	HEPH (mg/L)	<0.25	<0.25	0.29	<0.25	<0.25	
	Volatile Hydrocarbons (VH6-10) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	
	VPH (C6-C10) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	89.1	86.6	101.7	76.6	78.5	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Acenaphthylene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Acridine (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Anthracene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Benz(a)anthracene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Benzo(a)pyrene (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
	Benzo(b)fluoranthene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Benzo(g,h,i)perylene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Benzo(k)fluoranthene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Chrysene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Dibenz(a,h)anthracene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L1203640-11 Ground Water 01-SEP-12 17:15 DC NUMBER 3	L1203640-12 Surface Water 02-SEP-12 14:50 DC SURFACE			
Grouping	Analyte						
WATER							
Volatile Organic Compounds	trans-1,3-Dichloropropylene (mg/L)	<0.0010	<0.0010				
	Ethylbenzene (mg/L)	<0.00050	<0.00050				
	Methyl t-butyl ether (MTBE) (mg/L)	<0.00050	<0.00050				
	Styrene (mg/L)	<0.00050	<0.00050				
	1,1,1,2-Tetrachloroethane (mg/L)	<0.0010	<0.0010				
	1,1,2,2-Tetrachloroethane (mg/L)	<0.0010	<0.0010				
	Tetrachloroethylene (mg/L)	<0.0010	<0.0010				
	Toluene (mg/L)	<0.00050	<0.00050				
	1,1,1-Trichloroethane (mg/L)	<0.0010	<0.0010				
	1,1,2-Trichloroethane (mg/L)	<0.0010	<0.0010				
	Trichloroethylene (mg/L)	<0.0010	<0.0010				
	Trichlorofluoromethane (mg/L)	<0.0010	<0.0010				
	Vinyl Chloride (mg/L)	<0.0010	<0.0010				
	ortho-Xylene (mg/L)	<0.00050	<0.00050				
	meta- & para-Xylene (mg/L)	<0.00050	<0.00050				
	Xylenes (mg/L)	<0.00075	<0.00075				
	Surrogate: 4-Bromofluorobenzene (SS) (%)	84.8	86.3				
	Surrogate: 1,4-Difluorobenzene (SS) (%)	90.8	91.0				
Hydrocarbons	EPH10-19 (mg/L)	<0.25	<0.25				
	EPH19-32 (mg/L)	<0.25	<0.25				
	LEPH (mg/L)	<0.25	<0.25				
	HEPH (mg/L)	<0.25	<0.25				
	Volatile Hydrocarbons (VH6-10) (mg/L)	<0.10	<0.10				
	VPH (C6-C10) (mg/L)	<0.10	<0.10				
	Surrogate: 3,4-Dichlorotoluene (SS) (%)	80.0	91.4				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000050	<0.000050				
	Acenaphthylene (mg/L)	<0.000050	<0.000050				
	Acridine (mg/L)	<0.000050	<0.000050				
	Anthracene (mg/L)	<0.000050	<0.000050				
	Benz(a)anthracene (mg/L)	<0.000050	<0.000050				
	Benzo(a)pyrene (mg/L)	<0.000010	<0.000010				
	Benzo(b)fluoranthene (mg/L)	<0.000050	<0.000050				
	Benzo(g,h,i)perylene (mg/L)	<0.000050	<0.000050				
	Benzo(k)fluoranthene (mg/L)	<0.000050	<0.000050				
	Chrysene (mg/L)	<0.000050	<0.000050				
	Dibenz(a,h)anthracene (mg/L)	<0.000050	<0.000050				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1203640-1	L1203640-2	L1203640-3	L1203640-4	L1203640-5
		Description	Ground Water	Ground Water	surface water	Ground Water	Ground Water
		Sampled Date	31-AUG-12	31-AUG-12	01-SEP-12	31-AUG-12	31-AUG-12
		Sampled Time	10:50	13:20	11:10	15:30	17:40
		Client ID	RR NUMBER 1	RR NUMBER 2	RR SURFACE	FA-MW12-01	FA-MW12-03
Grouping	Analyte						
WATER							
Polycyclic Aromatic Hydrocarbons	Fluoranthene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Fluorene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Naphthalene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Phenanthrene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Pyrene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Quinoline (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Surrogate: Acenaphthene d10 (%)	86.8	86.3	85.9	82.8	88.0	
	Surrogate: Acridine d9 (%)	87.8	86.6	88.4	85.1	89.1	
	Surrogate: Chrysene d12 (%)	80.5	80.1	84.1	81.3	87.0	
	Surrogate: Naphthalene d8 (%)	84.2	90.9	82.0	80.1	86.4	
	Surrogate: Phenanthrene d10 (%)	89.3	88.8	90.4	87.0	92.8	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1203640-6	L1203640-7	L1203640-8	L1203640-9	L1203640-10
		Description	Ground Water	Ground Water	Surface Water	Ground Water	Ground Water
		Sampled Date	31-AUG-12	31-AUG-12	02-SEP-12	01-SEP-12	01-SEP-12
		Sampled Time	18:15	15:30	12:00	15:20	16:20
		Client ID	FA-MW12-04	FA-MW12-05	FA SURFACE	DC NUMBER 1	DC NUMBER 2
Grouping	Analyte						
WATER							
Polycyclic Aromatic Hydrocarbons	Fluoranthene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Fluorene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Naphthalene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Phenanthrene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Pyrene (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Quinoline (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
	Surrogate: Acenaphthene d10 (%)	88.1	86.4	89.8	92.7	88.0	
	Surrogate: Acridine d9 (%)	91.9	90.2	91.2	95.1	90.7	
	Surrogate: Chrysene d12 (%)	84.0	84.7	81.7	86.8	85.3	
	Surrogate: Naphthalene d8 (%)	90.9	85.4	85.8	91.2	86.3	
	Surrogate: Phenanthrene d10 (%)	91.5	91.8	91.8	97.3	93.4	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
WATER						
Polycyclic Aromatic Hydrocarbons	Fluoranthene (mg/L)	<0.000050	<0.000050			
	Fluorene (mg/L)	<0.000050	<0.000050			
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000050	<0.000050			
	Naphthalene (mg/L)	<0.000050	<0.000050			
	Phenanthrene (mg/L)	<0.000050	<0.000050			
	Pyrene (mg/L)	<0.000050	<0.000050			
	Quinoline (mg/L)	<0.000050	<0.000050			
	Surrogate: Acenaphthene d10 (%)	96.3	89.3			
	Surrogate: Acridine d9 (%)	98.2	91.5			
	Surrogate: Chrysene d12 (%)	91.9	85.0			
	Surrogate: Naphthalene d8 (%)	93.6	87.0			
	Surrogate: Phenanthrene d10 (%)	100.8	94.5			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Aluminum (Al)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Antimony (Sb)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Cadmium (Cd)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Chromium (Cr)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Lead (Pb)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Selenium (Se)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Zinc (Zn)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Aluminum (Al)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Antimony (Sb)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Boron (B)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Chromium (Cr)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Copper (Cu)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Lead (Pb)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Zinc (Zn)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Fluoride (F)	DLA	L1203640-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Nitrite (as N)	DLA	L1203640-1, -10, -11, -12, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Beryllium (Be)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Cobalt (Co)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Iron (Fe)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Molybdenum (Mo)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Nickel (Ni)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Phosphorus (P)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Silver (Ag)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Thallium (Tl)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Tin (Sn)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Titanium (Ti)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Vanadium (V)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Cadmium (Cd)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Chromium (Cr)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Lead (Pb)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Duplicate	Zinc (Zn)-Dissolved	DLA	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Boron (B)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Boron (B)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Arsenic (As)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Boron (B)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9

Reference Information

	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1203640-1, -10, -11, -12, -2, -4, -5, -6, -7, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-PCT-VA	Water	Alkalinity by Auto. Titration	APHA 2320 "Alkalinity"
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ALK-PCT-VA	Water	Alkalinity by Auto. Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320
This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.			
OR			
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-CL-IC-WR	Water	Chloride by Ion Chromatography	EPA 300.1
This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.			
ANIONS-F-IC-WR	Water	Fluoride by Ion Chromatography	EPA 300.1
This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.			
ANIONS-NO2-IC-WR	Water	Nitrite Nitrogen by Ion Chromatography	EPA 300.1
This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003. Nitrate is detected by UV absorbance.			
ANIONS-NO3-IC-WR	Water	Nitrate Nitrogen by Ion Chromatography	EPA 300.1
This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003. Nitrate is detected by UV absorbance.			
ANIONS-SO4-IC-WR	Water	Sulphate by Ion Chromatography	EPA 300.1
This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
COD-COL-VA	Water	Chemical Oxygen Demand by Colorimetric	APHA 5220 D. CHEMICAL OXYGEN DEMAND
This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.			
EPH-SF-FID-VA	Water	EPH in Water by GCFID	BCMOE EPH GCFID
This analysis is carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Extractable Petroleum Hydrocarbons in Water by GC/FID" (Version 2.1, July 1999). The procedure involves extraction of the entire water sample with dichloromethane. The extract is then solvent exchanged to toluene and analysed by capillary column gas chromatography with flame ionization detection (GC/FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-DIS-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS	EPA SW-846 3005A & EPA 245.7

Reference Information

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

LEPH/HEPH-CALC-VA Water LEPHs and HEPHs BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in water. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Acenaphthene, Acridine, Anthracene, Fluorene, Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, and Pyrene are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Water by GC/FID" (Version 2.1, July 20, 1999).

MET-DIS-ICP-VA Water Dissolved Metals in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-DIS-LOW-MS-VA Water Dissolved Metals in Water by ICPMS(Low) EPA SW-846 3005A/6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures involves preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

PAH-SF-MS-VA Water PAH in Water by GCMS EPA 3510, 8270

The entire water sample is extracted with dichloromethane, prior to analysis by gas chromatography with mass spectrometric detection (GC/MS). Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

PAH-SURR-MS-VA Water PAH Surrogates for Waters EPA 3510, 8270

Analysed as per the corresponding PAH test method. Known quantities of surrogate compounds are added prior to analysis to each sample to demonstrate analytical accuracy.

PH-MAN-WR Water pH by Meter APHA 4500-H (B)

"This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode."

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TURBIDITY-WR Water Turbidity by Nephelometer APHA 2130

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

VH-HSFID-VA Water VH in Water by Headspace GC/FID B.C. MIN. OF ENV. LAB. MAN. (2009)

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Compounds eluting between n-hexane and n-decane are measured and summed together using flame-ionization detection.

VH-SURR-FID-VA Water VH Surrogates for Waters B.C. MIN. OF ENV. LAB. MAN. (2009)

VOC-HSMS-VA Water VOCs in water by Headspace GCMS EPA8260B, 5021

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

VOC7-HSMS-VA Water BTEX/MTBE/Styrene by Headspace GCMS EPA8260B, 5021

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

VOC7/VOC-SURR-MS-VA Water VOC7 and/or VOC Surrogates for Waters EPA8260B, 5021

VPH-CALC-VA Water VPH is VH minus select aromatics BC MOE LABORATORY MANUAL (2005)

Reference Information

These results are determined according to the British Columbia Ministry of Environment Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water". The concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and, in solids, Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10).

XYLENES-CALC-VA Water Sum of Xylene Isomer Concentrations CALCULATION

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WR	ALS ENVIRONMENTAL - WHITEHORSE, YUKON, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 1 of 25

Client: GOLDER ASSOCIATES LTD.

201B, 170 Titanium Way

Whitehorse YT Y1A 0G1

Contact: Andrea Badger

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-PCT-VA		Water						
Batch	R2431168							
WG1540768-10 CRM		VA-ALK-PCT-CONTROL						
Alkalinity, Total (as CaCO ₃)			105.0		%		85-115	06-SEP-12
WG1540768-11 CRM		VA-ALK-PCT-CONTROL						
Alkalinity, Total (as CaCO ₃)			105.0		%		85-115	06-SEP-12
WG1540768-12 CRM		VA-ALK-PCT-CONTROL						
Alkalinity, Total (as CaCO ₃)			104.7		%		85-115	06-SEP-12
WG1540768-13 CRM		VA-ALK-PCT-CONTROL						
Alkalinity, Total (as CaCO ₃)			104.9		%		85-115	06-SEP-12
WG1540768-14 CRM		VA-ALK-PCT-CONTROL						
Alkalinity, Total (as CaCO ₃)			102.3		%		85-115	06-SEP-12
WG1540768-15 CRM		VA-ALK-PCT-CONTROL						
Alkalinity, Total (as CaCO ₃)			105.5		%		85-115	06-SEP-12
WG1540768-16 CRM		VA-ALK-PCT-CONTROL						
Alkalinity, Total (as CaCO ₃)			105.7		%		85-115	06-SEP-12
WG1540768-9 CRM		VA-ALK-PCT-CONTROL						
Alkalinity, Total (as CaCO ₃)			104.8		%		85-115	06-SEP-12
WG1540768-1 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
WG1540768-2 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
WG1540768-3 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
WG1540768-4 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
WG1540768-5 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 2 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-PCT-VA		Water						
Batch R2431168								
WG1540768-5 MB								
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
WG1540768-6 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
WG1540768-7 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
WG1540768-8 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	06-SEP-12
Batch R2434619								
WG1543738-2 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
WG1543738-3 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
WG1543738-4 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Bicarbonate (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Carbonate (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Hydroxide (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12
WG1543738-5 MB								
Alkalinity, Total (as CaCO ₃)			<1.0		mg/L		1	11-SEP-12



Workorder: L1203640

Page 3 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-PCT-VA		Water						
Batch	R2434619							
WG1543738-5	MB							
Alkalinity, Bicarbonate (as CaCO3)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Carbonate (as CaCO3)			<1.0		mg/L		1	11-SEP-12
Alkalinity, Hydroxide (as CaCO3)			<1.0		mg/L		1	11-SEP-12
ALK-SCR-VA		Water						
Batch	R2430884							
WG1540548-2	CRM	VA-ALKL-CONTROL						
Alkalinity, Total (as CaCO3)			94.8		%		85-115	05-SEP-12
WG1540548-5	CRM	VA-ALKM-CONTROL						
Alkalinity, Total (as CaCO3)			105.3		%		85-115	05-SEP-12
WG1540548-13	DUP	L1203640-10						
Alkalinity, Total (as CaCO3)			499	499	mg/L	0.1	20	05-SEP-12
WG1540548-1	MB							
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	05-SEP-12
WG1540548-4	MB							
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	05-SEP-12
WG1540548-7	MB							
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	05-SEP-12
ANIONS-CL-IC-WR		Water						
Batch	R2434365							
WG1544199-3	DUP	L1203640-1						
Chloride (Cl)			62	61	mg/L	0.9	20	04-SEP-12
WG1544199-2	LCS							
Chloride (Cl)				101.2	%		85-115	04-SEP-12
WG1544199-6	LCS							
Chloride (Cl)				101.4	%		85-115	04-SEP-12
WG1544199-1	MB							
Chloride (Cl)				<0.50	mg/L		0.5	04-SEP-12
WG1544199-5	MB							
Chloride (Cl)				<0.50	mg/L		0.5	04-SEP-12
WG1544199-4	MS	L1203640-8						
Chloride (Cl)				99.5	%		75-125	04-SEP-12
WG1544199-8	MS	L1203929-2						
Chloride (Cl)				101.4	%		75-125	04-SEP-12
ANIONS-F-IC-WR		Water						

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 4 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-F-IC-WR		Water						
Batch	R2434365							
WG1544199-3	DUP	L1203640-1						
Fluoride (F)		<0.40	<0.40	RPD-NA	mg/L	N/A	20	04-SEP-12
WG1544199-2	LCS							
Fluoride (F)			90.3		%		85-115	04-SEP-12
WG1544199-6	LCS							
Fluoride (F)			93.4		%		85-115	04-SEP-12
WG1544199-1	MB							
Fluoride (F)			<0.020		mg/L		0.02	04-SEP-12
WG1544199-5	MB							
Fluoride (F)			<0.020		mg/L		0.02	04-SEP-12
WG1544199-4	MS	L1203640-8						
Fluoride (F)			97.6		%		75-125	04-SEP-12
WG1544199-8	MS	L1203929-2						
Fluoride (F)			86.1		%		75-125	04-SEP-12
ANIONS-NO2-IC-WR		Water						
Batch	R2434365							
WG1544199-3	DUP	L1203640-1						
Nitrite (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	04-SEP-12
WG1544199-2	LCS							
Nitrite (as N)			100.9		%		85-115	04-SEP-12
WG1544199-6	LCS							
Nitrite (as N)			102.3		%		85-115	04-SEP-12
WG1544199-1	MB							
Nitrite (as N)			<0.0010		mg/L		0.001	04-SEP-12
WG1544199-5	MB							
Nitrite (as N)			<0.0010		mg/L		0.001	04-SEP-12
WG1544199-4	MS	L1203640-8						
Nitrite (as N)			102.3		%		75-125	04-SEP-12
WG1544199-8	MS	L1203929-2						
Nitrite (as N)			93.5		%		75-125	04-SEP-12
ANIONS-NO3-IC-WR		Water						
Batch	R2434365							
WG1544199-3	DUP	L1203640-1						
Nitrate (as N)		1.02	1.02		mg/L	0.3	20	04-SEP-12
WG1544199-2	LCS							
Nitrate (as N)			102.0		%		85-115	04-SEP-12
WG1544199-6	LCS							
Nitrate (as N)			102.5		%		85-115	04-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 5 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-NO3-IC-WR								
Batch R2434365								
WG1544199-1 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	04-SEP-12
WG1544199-5 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	04-SEP-12
WG1544199-4 MS		L1203640-8						
Nitrate (as N)			101.4		%		75-125	04-SEP-12
WG1544199-8 MS		L1203929-2						
Nitrate (as N)			101.5		%		75-125	04-SEP-12
ANIONS-SO4-IC-WR								
Batch R2434365								
WG1544199-3 DUP		L1203640-1						
Sulfate (SO4)		3370	3370		mg/L	0.1	20	04-SEP-12
WG1544199-2 LCS								
Sulfate (SO4)			102.6		%		85-115	04-SEP-12
WG1544199-6 LCS								
Sulfate (SO4)			102.8		%		85-115	04-SEP-12
WG1544199-1 MB								
Sulfate (SO4)			<0.50		mg/L		0.5	04-SEP-12
WG1544199-5 MB								
Sulfate (SO4)			<0.50		mg/L		0.5	04-SEP-12
WG1544199-4 MS		L1203640-8						
Sulfate (SO4)			102.4		%		75-125	04-SEP-12
WG1544199-8 MS		L1203929-2						
Sulfate (SO4)			102.6		%		75-125	04-SEP-12
CARBONS-DOC-VA								
Batch R2431932								
WG1541373-2 CRM		VA-DOC-C-CAFFEINE						
Dissolved Organic Carbon			94.6		%		80-120	06-SEP-12
WG1541373-4 CRM		VA-DOC-C-CAFFEINE						
Dissolved Organic Carbon			93.8		%		80-120	06-SEP-12
WG1541373-6 CRM		VA-DOC-C-CAFFEINE						
Dissolved Organic Carbon			87.0		%		80-120	06-SEP-12
WG1541373-8 CRM		VA-DOC-C-CAFFEINE						
Dissolved Organic Carbon			89.0		%		80-120	06-SEP-12
WG1541373-9 DUP		L1203640-10						
Dissolved Organic Carbon		2.20	2.02		mg/L	8.5	20	06-SEP-12
WG1541373-1 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	06-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 6 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CARBONS-DOC-VA								
Water								
Batch	R2431932							
WG1541373-3 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	06-SEP-12
WG1541373-5 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	06-SEP-12
WG1541373-7 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	06-SEP-12
WG1541373-11 MS		L1204272-5						
Dissolved Organic Carbon			91.6		%		70-130	06-SEP-12
Batch	R2433044							
WG1542922-3 DUP		L1203640-8						
Dissolved Organic Carbon		22.0	22.1		mg/L	0.3	20	09-SEP-12
WG1542922-1 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	09-SEP-12
COD-COL-VA								
Water								
Batch	R2430967							
WG1540889-2 LCS								
COD			103.9		%		85-115	06-SEP-12
WG1540889-6 LCS								
COD			103.3		%		85-115	06-SEP-12
WG1540889-1 MB								
COD			<20		mg/L		20	06-SEP-12
WG1540889-5 MB								
COD			<20		mg/L		20	06-SEP-12
WG1540889-4 MS		L1203698-2						
COD			103.1		%		75-125	06-SEP-12
EPH-SF-FID-VA								
Water								
Batch	R2430872							
WG1541190-1 MB								
EPH10-19			<0.25		mg/L		0.25	10-SEP-12
EPH19-32			<0.25		mg/L		0.25	10-SEP-12
Batch	R2432840							
WG1541190-3 MB								
EPH10-19			<0.25		mg/L		0.25	10-SEP-12
EPH19-32			<0.25		mg/L		0.25	10-SEP-12
HG-DIS-CVAFS-VA								
Water								

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 7 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-DIS-CVAFS-VA		Water						
Batch	R2431074							
WG1540537-1 MB								
Mercury (Hg)-Dissolved			<0.000050		mg/L		0.00005	06-SEP-12
Batch	R2431952							
WG1540537-17 DUP		L1203640-1						
Mercury (Hg)-Dissolved		<0.00020	<0.000050	RPD-NA	mg/L	N/A	20	07-SEP-12
WG1540537-19 DUP		L1203640-10						
Mercury (Hg)-Dissolved		<0.00020	<0.000050	RPD-NA	mg/L	N/A	20	07-SEP-12
WG1542219-2 LCS								
Mercury (Hg)-Dissolved			88.6		%		80-120	07-SEP-12
WG1541038-1 MB								
Mercury (Hg)-Dissolved			<0.000050		mg/L		0.00005	07-SEP-12
WG1542219-1 MB								
Mercury (Hg)-Dissolved			<0.000050		mg/L		0.00005	07-SEP-12
WG1540537-18 MS		L1203640-2						
Mercury (Hg)-Dissolved			85.6		%		70-130	07-SEP-12
WG1540537-20 MS		L1203640-12						
Mercury (Hg)-Dissolved			83.3		%		70-130	07-SEP-12
Batch	R2433082							
WG1540537-32 MS		L1204697-1						
Mercury (Hg)-Dissolved			76.8		%		70-130	10-SEP-12
WG1540537-38 MS		L1204824-3						
Mercury (Hg)-Dissolved			83.5		%		70-130	10-SEP-12
MET-DIS-ICP-VA		Water						
Batch	R2430733							
WG1540537-2 CRM		VA-HIGH-WATRM						
Beryllium (Be)-Dissolved			98.8		%		80-120	04-SEP-12
Bismuth (Bi)-Dissolved			101.3		%		80-120	04-SEP-12
Cobalt (Co)-Dissolved			95.8		%		80-120	04-SEP-12
Iron (Fe)-Dissolved			99.5		%		80-120	04-SEP-12
Lithium (Li)-Dissolved			101.5		%		80-120	04-SEP-12
Molybdenum (Mo)-Dissolved			99.2		%		80-120	04-SEP-12
Nickel (Ni)-Dissolved			97.1		%		80-120	04-SEP-12
Phosphorus (P)-Dissolved			101.9		%		80-120	04-SEP-12
Silicon (Si)-Dissolved			106.2		%		80-120	04-SEP-12
Silver (Ag)-Dissolved			100.4		%		80-120	04-SEP-12
Sodium (Na)-Dissolved			97.3		%		80-120	04-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 8 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-ICP-VA		Water						
Batch	R2430733							
WG1540537-2 CRM		VA-HIGH-WATRM						
Strontium (Sr)-Dissolved			98.3		%		80-120	04-SEP-12
Thallium (Tl)-Dissolved			98.7		%		80-120	04-SEP-12
Tin (Sn)-Dissolved			98.8		%		80-120	04-SEP-12
Titanium (Ti)-Dissolved			104.7		%		80-120	04-SEP-12
Vanadium (V)-Dissolved			99.1		%		80-120	04-SEP-12
WG1540537-1 MB								
Beryllium (Be)-Dissolved			<0.0050		mg/L		0.005	04-SEP-12
Bismuth (Bi)-Dissolved			<0.20		mg/L		0.2	04-SEP-12
Cobalt (Co)-Dissolved			<0.010		mg/L		0.01	04-SEP-12
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	04-SEP-12
Lithium (Li)-Dissolved			<0.010		mg/L		0.01	04-SEP-12
Molybdenum (Mo)-Dissolved			<0.030		mg/L		0.03	04-SEP-12
Nickel (Ni)-Dissolved			<0.050		mg/L		0.05	04-SEP-12
Phosphorus (P)-Dissolved			<0.30		mg/L		0.3	04-SEP-12
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	04-SEP-12
Silver (Ag)-Dissolved			<0.010		mg/L		0.01	04-SEP-12
Sodium (Na)-Dissolved			<2.0		mg/L		2	04-SEP-12
Strontium (Sr)-Dissolved			<0.0050		mg/L		0.005	04-SEP-12
Thallium (Tl)-Dissolved			<0.20		mg/L		0.2	04-SEP-12
Tin (Sn)-Dissolved			<0.030		mg/L		0.03	04-SEP-12
Titanium (Ti)-Dissolved			<0.010		mg/L		0.01	04-SEP-12
Vanadium (V)-Dissolved			<0.030		mg/L		0.03	04-SEP-12
Batch	R2431723							
WG1541038-4 CRM		VA-HIGH-WATRM						
Beryllium (Be)-Dissolved			91.6		%		80-120	06-SEP-12
Bismuth (Bi)-Dissolved			96.5		%		80-120	06-SEP-12
Cobalt (Co)-Dissolved			91.7		%		80-120	06-SEP-12
Iron (Fe)-Dissolved			96.5		%		80-120	06-SEP-12
Lithium (Li)-Dissolved			96.5		%		80-120	06-SEP-12
Molybdenum (Mo)-Dissolved			93.3		%		80-120	06-SEP-12
Nickel (Ni)-Dissolved			94.8		%		80-120	06-SEP-12
Phosphorus (P)-Dissolved			97.3		%		80-120	06-SEP-12
Silicon (Si)-Dissolved			98.4		%		80-120	06-SEP-12
Silver (Ag)-Dissolved			94.5		%		80-120	06-SEP-12
Sodium (Na)-Dissolved			96.5		%		80-120	06-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 9 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-ICP-VA		Water						
Batch	R2431723							
WG1541038-4 CRM		VA-HIGH-WATRM						
Strontium (Sr)-Dissolved			96.1		%		80-120	06-SEP-12
Thallium (Tl)-Dissolved			94.4		%		80-120	06-SEP-12
Tin (Sn)-Dissolved			95.2		%		80-120	06-SEP-12
Titanium (Ti)-Dissolved			100.4		%		80-120	06-SEP-12
Vanadium (V)-Dissolved			94.7		%		80-120	06-SEP-12
WG1541038-1 MB								
Beryllium (Be)-Dissolved			<0.0050		mg/L		0.005	06-SEP-12
Bismuth (Bi)-Dissolved			<0.20		mg/L		0.2	06-SEP-12
Cobalt (Co)-Dissolved			<0.010		mg/L		0.01	06-SEP-12
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	06-SEP-12
Lithium (Li)-Dissolved			<0.010		mg/L		0.01	06-SEP-12
Molybdenum (Mo)-Dissolved			<0.030		mg/L		0.03	06-SEP-12
Nickel (Ni)-Dissolved			<0.050		mg/L		0.05	06-SEP-12
Phosphorus (P)-Dissolved			<0.30		mg/L		0.3	06-SEP-12
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	06-SEP-12
Silver (Ag)-Dissolved			<0.010		mg/L		0.01	06-SEP-12
Sodium (Na)-Dissolved			<2.0		mg/L		2	06-SEP-12
Strontium (Sr)-Dissolved			<0.0050		mg/L		0.005	06-SEP-12
Thallium (Tl)-Dissolved			<0.20		mg/L		0.2	06-SEP-12
Tin (Sn)-Dissolved			<0.030		mg/L		0.03	06-SEP-12
Titanium (Ti)-Dissolved			<0.010		mg/L		0.01	06-SEP-12
Vanadium (V)-Dissolved			<0.030		mg/L		0.03	06-SEP-12
Batch	R2432807							
WG1540537-40 MS		L1203761-10						
Iron (Fe)-Dissolved			95.5		%		70-130	09-SEP-12
Sodium (Na)-Dissolved			106.4		%		70-130	09-SEP-12
Titanium (Ti)-Dissolved			106.1		%		70-130	09-SEP-12
Batch	R2433031							
WG1540537-19 DUP		L1203640-10						
Beryllium (Be)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	09-SEP-12
Bismuth (Bi)-Dissolved		<0.20	<0.20	RPD-NA	mg/L	N/A	20	09-SEP-12
Cobalt (Co)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	09-SEP-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	09-SEP-12
Lithium (Li)-Dissolved		0.011	0.012		mg/L	6.7	20	09-SEP-12
Molybdenum (Mo)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	09-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 10 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-ICP-VA		Water						
Batch	R2433031							
WG1540537-19 DUP		L1203640-10						
Nickel (Ni)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	09-SEP-12
Phosphorus (P)-Dissolved		<0.30	<0.30	RPD-NA	mg/L	N/A	20	09-SEP-12
Silicon (Si)-Dissolved		6.37	6.29		mg/L	1.3	20	09-SEP-12
Silver (Ag)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	09-SEP-12
Sodium (Na)-Dissolved		30.4	30.4		mg/L	0.1	20	09-SEP-12
Strontium (Sr)-Dissolved		1.08	1.07		mg/L	0.6	20	09-SEP-12
Thallium (Tl)-Dissolved		<0.20	<0.20	RPD-NA	mg/L	N/A	20	09-SEP-12
Tin (Sn)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	09-SEP-12
Titanium (Ti)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	09-SEP-12
Vanadium (V)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	09-SEP-12
WG1540537-20 MS		L1203640-12						
Iron (Fe)-Dissolved			95.0		%		70-130	09-SEP-12
Sodium (Na)-Dissolved			103.6		%		70-130	09-SEP-12
Titanium (Ti)-Dissolved			103.6		%		70-130	09-SEP-12
Batch	R2433107							
WG1540537-32 MS		L1204697-1						
Iron (Fe)-Dissolved			92.6		%		70-130	10-SEP-12
Sodium (Na)-Dissolved			98.5		%		70-130	10-SEP-12
Titanium (Ti)-Dissolved			100.3		%		70-130	10-SEP-12
WG1540537-38 MS		L1204824-3						
Iron (Fe)-Dissolved			97.4		%		70-130	10-SEP-12
Sodium (Na)-Dissolved			N/A	MS-B	%		-	10-SEP-12
Titanium (Ti)-Dissolved			101.4		%		70-130	10-SEP-12
Batch	R2433175							
WG1540537-31 MS		L1204708-2						
Iron (Fe)-Dissolved			93.1		%		70-130	07-SEP-12
Sodium (Na)-Dissolved			92.1		%		70-130	07-SEP-12
Titanium (Ti)-Dissolved			100.3		%		70-130	07-SEP-12
WG1541038-5 MS		L1204276-3						
Iron (Fe)-Dissolved			88.9		%		70-130	07-SEP-12
Sodium (Na)-Dissolved			86.6		%		70-130	07-SEP-12
Titanium (Ti)-Dissolved			97.4		%		70-130	07-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 11 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-ICP-VA		Water						
Batch	R2433700							
WG1540537-10 MS		L1204272-13						
Iron (Fe)-Dissolved			96.2		%		70-130	10-SEP-12
Sodium (Na)-Dissolved			102.5		%		70-130	10-SEP-12
Titanium (Ti)-Dissolved			103.2		%		70-130	10-SEP-12
WG1540537-8 MS		L1204272-3						
Iron (Fe)-Dissolved			95.3		%		70-130	10-SEP-12
Sodium (Na)-Dissolved			101.9		%		70-130	10-SEP-12
Titanium (Ti)-Dissolved			101.8		%		70-130	10-SEP-12
Batch	R2434379							
WG1540537-17 DUP		L1203640-1						
Beryllium (Be)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	11-SEP-12
Bismuth (Bi)-Dissolved		<0.40	<0.40	RPD-NA	mg/L	N/A	20	11-SEP-12
Cobalt (Co)-Dissolved		<0.020	<0.020	RPD-NA	mg/L	N/A	20	11-SEP-12
Iron (Fe)-Dissolved		<0.060	<0.060	RPD-NA	mg/L	N/A	20	11-SEP-12
Lithium (Li)-Dissolved		0.029	0.028		mg/L	1.5	20	11-SEP-12
Molybdenum (Mo)-Dissolved		<0.060	<0.060	RPD-NA	mg/L	N/A	20	11-SEP-12
Nickel (Ni)-Dissolved		<0.10	<0.10	RPD-NA	mg/L	N/A	20	11-SEP-12
Phosphorus (P)-Dissolved		<0.60	<0.60	RPD-NA	mg/L	N/A	20	11-SEP-12
Silicon (Si)-Dissolved		7.67	7.55		mg/L	1.6	20	11-SEP-12
Silver (Ag)-Dissolved		<0.020	<0.020	RPD-NA	mg/L	N/A	20	11-SEP-12
Sodium (Na)-Dissolved		44.3	42.9		mg/L	3.2	20	11-SEP-12
Strontium (Sr)-Dissolved		1.34	1.30		mg/L	3.1	20	11-SEP-12
Thallium (Tl)-Dissolved		<0.40	<0.40	RPD-NA	mg/L	N/A	20	11-SEP-12
Tin (Sn)-Dissolved		<0.060	<0.060	RPD-NA	mg/L	N/A	20	11-SEP-12
Titanium (Ti)-Dissolved		<0.020	<0.020	RPD-NA	mg/L	N/A	20	11-SEP-12
Vanadium (V)-Dissolved		<0.060	<0.060	RPD-NA	mg/L	N/A	20	11-SEP-12
MET-DIS-LOW-MS-VA		Water						
Batch	R2431675							
WG1540537-1 MB								
Aluminum (Al)-Dissolved			<0.0030		mg/L		0.003	06-SEP-12
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	06-SEP-12
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	06-SEP-12
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	06-SEP-12
Boron (B)-Dissolved			<0.010		mg/L		0.01	06-SEP-12
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	06-SEP-12
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	06-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 12 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-VA		Water						
Batch R2431675								
WG1540537-1 MB								
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	06-SEP-12
Copper (Cu)-Dissolved			<0.00050		mg/L		0.0005	06-SEP-12
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	06-SEP-12
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	06-SEP-12
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	06-SEP-12
Potassium (K)-Dissolved			<0.050		mg/L		0.05	06-SEP-12
Selenium (Se)-Dissolved			<0.0010		mg/L		0.001	06-SEP-12
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	06-SEP-12
Zinc (Zn)-Dissolved			<0.0030		mg/L		0.003	06-SEP-12
WG1541038-1 MB								
Aluminum (Al)-Dissolved			<0.0030		mg/L		0.003	06-SEP-12
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	06-SEP-12
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	06-SEP-12
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	06-SEP-12
Boron (B)-Dissolved			<0.010		mg/L		0.01	06-SEP-12
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	06-SEP-12
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	06-SEP-12
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	06-SEP-12
Copper (Cu)-Dissolved			<0.00050		mg/L		0.0005	06-SEP-12
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	06-SEP-12
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	06-SEP-12
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	06-SEP-12
Potassium (K)-Dissolved			<0.050		mg/L		0.05	06-SEP-12
Selenium (Se)-Dissolved			<0.0010		mg/L		0.001	06-SEP-12
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	06-SEP-12
Zinc (Zn)-Dissolved			<0.0030		mg/L		0.003	06-SEP-12
Batch R2432716								
WG1540537-19 DUP		L1203640-10						
Aluminum (Al)-Dissolved		<0.010	<0.0030	RPD-NA	mg/L	N/A	20	08-SEP-12
Antimony (Sb)-Dissolved		<0.00050	0.00020		mg/L	6.7	20	08-SEP-12
Arsenic (As)-Dissolved		0.00095	0.00101		mg/L	5.8	20	08-SEP-12
Barium (Ba)-Dissolved		0.117	0.114		mg/L	2.2	20	08-SEP-12
Boron (B)-Dissolved		<0.10	0.033		mg/L	5.3	20	08-SEP-12
Cadmium (Cd)-Dissolved		<0.00020	0.000057		mg/L	3.3	20	08-SEP-12
Calcium (Ca)-Dissolved		113	117		mg/L	3.4	20	08-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 13 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-VA		Water						
Batch	R2432716							
WG1540537-19	DUP	L1203640-10						
Chromium (Cr)-Dissolved		<0.0020	<0.00050	RPD-NA	mg/L	N/A	20	08-SEP-12
Copper (Cu)-Dissolved		<0.0010	0.00061		mg/L	1.0	20	08-SEP-12
Lead (Pb)-Dissolved		<0.00050	<0.000050	RPD-NA	mg/L	N/A	20	08-SEP-12
Magnesium (Mg)-Dissolved		77.4	75.7		mg/L	2.2	20	08-SEP-12
Manganese (Mn)-Dissolved		0.0875	0.0887		mg/L	1.4	20	08-SEP-12
Potassium (K)-Dissolved		4.53	4.56		mg/L	0.8	20	08-SEP-12
Selenium (Se)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	08-SEP-12
Uranium (U)-Dissolved		0.0185	0.0184		mg/L	0.6	20	08-SEP-12
Zinc (Zn)-Dissolved		<0.050	<0.0030	RPD-NA	mg/L	N/A	20	08-SEP-12
Batch	R2433051							
WG1540537-2	CRM	VA-HIGH-WATRM						
Aluminum (Al)-Dissolved			99.9		%		80-120	07-SEP-12
Antimony (Sb)-Dissolved			106.5		%		80-120	07-SEP-12
Arsenic (As)-Dissolved			103.0		%		80-120	07-SEP-12
Barium (Ba)-Dissolved			102.9		%		80-120	07-SEP-12
Boron (B)-Dissolved			93.2		%		80-120	07-SEP-12
Cadmium (Cd)-Dissolved			102.5		%		80-120	07-SEP-12
Calcium (Ca)-Dissolved			99.7		%		80-120	07-SEP-12
Chromium (Cr)-Dissolved			103.6		%		80-120	07-SEP-12
Copper (Cu)-Dissolved			98.8		%		80-120	07-SEP-12
Lead (Pb)-Dissolved			101.9		%		80-120	07-SEP-12
Magnesium (Mg)-Dissolved			100.1		%		80-120	07-SEP-12
Manganese (Mn)-Dissolved			98.8		%		80-120	07-SEP-12
Potassium (K)-Dissolved			97.3		%		80-120	07-SEP-12
Selenium (Se)-Dissolved			101.9		%		80-120	07-SEP-12
Uranium (U)-Dissolved			103.4		%		80-120	07-SEP-12
Zinc (Zn)-Dissolved			98.7		%		80-120	07-SEP-12
WG1541038-4	CRM	VA-HIGH-WATRM						
Aluminum (Al)-Dissolved			98.0		%		80-120	07-SEP-12
Antimony (Sb)-Dissolved			103.9		%		80-120	07-SEP-12
Arsenic (As)-Dissolved			99.4		%		80-120	07-SEP-12
Barium (Ba)-Dissolved			96.2		%		80-120	07-SEP-12
Boron (B)-Dissolved			88.1		%		80-120	07-SEP-12
Cadmium (Cd)-Dissolved			100.1		%		80-120	07-SEP-12
Calcium (Ca)-Dissolved			95.8		%		80-120	07-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 14 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-VA Water								
Batch	R2433051							
WG1541038-4 CRM		VA-HIGH-WATRM						
Chromium (Cr)-Dissolved			99.9		%		80-120	07-SEP-12
Copper (Cu)-Dissolved			95.4		%		80-120	07-SEP-12
Lead (Pb)-Dissolved			95.1		%		80-120	07-SEP-12
Magnesium (Mg)-Dissolved			94.9		%		80-120	07-SEP-12
Manganese (Mn)-Dissolved			96.7		%		80-120	07-SEP-12
Potassium (K)-Dissolved			96.5		%		80-120	07-SEP-12
Selenium (Se)-Dissolved			98.2		%		80-120	07-SEP-12
Uranium (U)-Dissolved			96.2		%		80-120	07-SEP-12
Zinc (Zn)-Dissolved			93.9		%		80-120	07-SEP-12
Batch	R2433805							
WG1540537-38 MS		L1204824-3						
Aluminum (Al)-Dissolved			93.0		%		70-130	10-SEP-12
Antimony (Sb)-Dissolved			100.4		%		70-130	10-SEP-12
Arsenic (As)-Dissolved			106.2		%		70-130	10-SEP-12
Barium (Ba)-Dissolved			N/A	MS-B	%		-	10-SEP-12
Boron (B)-Dissolved			N/A	MS-B	%		-	10-SEP-12
Cadmium (Cd)-Dissolved			98.8		%		70-130	10-SEP-12
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	10-SEP-12
Chromium (Cr)-Dissolved			91.9		%		70-130	10-SEP-12
Copper (Cu)-Dissolved			90.4		%		70-130	10-SEP-12
Lead (Pb)-Dissolved			87.0		%		70-130	10-SEP-12
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	10-SEP-12
Manganese (Mn)-Dissolved			91.3		%		70-130	10-SEP-12
Potassium (K)-Dissolved			N/A	MS-B	%		-	10-SEP-12
Selenium (Se)-Dissolved			98.5		%		70-130	10-SEP-12
Uranium (U)-Dissolved			90.5		%		70-130	10-SEP-12
Zinc (Zn)-Dissolved			92.6		%		70-130	10-SEP-12
Batch	R2433912							
WG1540537-17 DUP		L1203640-1						
Aluminum (Al)-Dissolved		<0.050	<0.015	RPD-NA	mg/L	N/A	20	11-SEP-12
Antimony (Sb)-Dissolved		<0.0025	<0.00050	RPD-NA	mg/L	N/A	20	11-SEP-12
Arsenic (As)-Dissolved		0.00091	0.00094		mg/L	3.7	20	11-SEP-12
Barium (Ba)-Dissolved		<0.10	0.0280		mg/L	2.9	20	11-SEP-12
Boron (B)-Dissolved		<0.50	<0.050	RPD-NA	mg/L	N/A	20	11-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 15 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-VA		Water						
Batch	R2433912							
WG1540537-17 DUP		L1203640-1						
Cadmium (Cd)-Dissolved		<0.0010	0.00055		mg/L	7.7	20	11-SEP-12
Calcium (Ca)-Dissolved		459	444		mg/L	3.3	20	11-SEP-12
Chromium (Cr)-Dissolved		<0.010	<0.0025	RPD-NA	mg/L	N/A	20	11-SEP-12
Copper (Cu)-Dissolved		<0.0050	<0.0025	RPD-NA	mg/L	N/A	20	11-SEP-12
Lead (Pb)-Dissolved		<0.0025	<0.00025	RPD-NA	mg/L	N/A	20	11-SEP-12
Magnesium (Mg)-Dissolved		672	645		mg/L	4.1	20	11-SEP-12
Manganese (Mn)-Dissolved		2.00	1.98		mg/L	0.9	20	11-SEP-12
Potassium (K)-Dissolved		8.84	8.63		mg/L	2.3	20	11-SEP-12
Selenium (Se)-Dissolved		0.0060	0.0060		mg/L	1.0	20	11-SEP-12
Uranium (U)-Dissolved		0.0709	0.0721		mg/L	1.7	20	11-SEP-12
Zinc (Zn)-Dissolved		<0.25	<0.015	RPD-NA	mg/L	N/A	20	11-SEP-12
WG1540537-20 MS		L1203640-12						
Aluminum (Al)-Dissolved			99.7		%		70-130	11-SEP-12
Antimony (Sb)-Dissolved			106.9		%		70-130	11-SEP-12
Arsenic (As)-Dissolved			106.8		%		70-130	11-SEP-12
Barium (Ba)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Boron (B)-Dissolved			92.3		%		70-130	11-SEP-12
Cadmium (Cd)-Dissolved			103.4		%		70-130	11-SEP-12
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Chromium (Cr)-Dissolved			96.8		%		70-130	11-SEP-12
Copper (Cu)-Dissolved			103.2		%		70-130	11-SEP-12
Lead (Pb)-Dissolved			101.1		%		70-130	11-SEP-12
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Manganese (Mn)-Dissolved			103.2		%		70-130	11-SEP-12
Potassium (K)-Dissolved			101.5		%		70-130	11-SEP-12
Selenium (Se)-Dissolved			104.5		%		70-130	11-SEP-12
Uranium (U)-Dissolved			102.5		%		70-130	11-SEP-12
Zinc (Zn)-Dissolved			97.8		%		70-130	11-SEP-12
Batch	R2433950							
WG1540537-32 MS		L1204697-1						
Aluminum (Al)-Dissolved			100.6		%		70-130	11-SEP-12
Antimony (Sb)-Dissolved			111.6		%		70-130	11-SEP-12
Arsenic (As)-Dissolved			110.5		%		70-130	11-SEP-12
Barium (Ba)-Dissolved			N/A	MS-B	%		-	11-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 16 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-VA								
Water								
Batch	R2433950							
WG1540537-32 MS		L1204697-1						
Boron (B)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Cadmium (Cd)-Dissolved			98.9		%		70-130	11-SEP-12
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Chromium (Cr)-Dissolved			97.2		%		70-130	11-SEP-12
Copper (Cu)-Dissolved			94.2		%		70-130	11-SEP-12
Lead (Pb)-Dissolved			92.9		%		70-130	11-SEP-12
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Manganese (Mn)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Potassium (K)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Selenium (Se)-Dissolved			114.1		%		70-130	11-SEP-12
Uranium (U)-Dissolved			92.7		%		70-130	11-SEP-12
Zinc (Zn)-Dissolved			93.2		%		70-130	11-SEP-12
Batch	R2434404							
WG1540537-12 MS		L1204732-3						
Aluminum (Al)-Dissolved			91.5		%		70-130	11-SEP-12
Antimony (Sb)-Dissolved			98.9		%		70-130	11-SEP-12
Arsenic (As)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Barium (Ba)-Dissolved			97.8		%		70-130	11-SEP-12
Boron (B)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Cadmium (Cd)-Dissolved			101.7		%		70-130	11-SEP-12
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Chromium (Cr)-Dissolved			95.1		%		70-130	11-SEP-12
Copper (Cu)-Dissolved			89.7		%		70-130	11-SEP-12
Lead (Pb)-Dissolved			95.2		%		70-130	11-SEP-12
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Manganese (Mn)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Potassium (K)-Dissolved			89.5		%		70-130	11-SEP-12
Selenium (Se)-Dissolved			106.9		%		70-130	11-SEP-12
Uranium (U)-Dissolved			N/A	MS-B	%		-	11-SEP-12
Zinc (Zn)-Dissolved			91.2		%		70-130	11-SEP-12
NH3-F-VA	Water							

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 17 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-VA								
Batch R2432042								
WG1541509-10 CRM		VA-NH3-F						
Ammonia, Total (as N)			97.9		%		85-115	07-SEP-12
WG1541509-2 CRM		VA-NH3-F						
Ammonia, Total (as N)			102.4		%		85-115	07-SEP-12
WG1541509-4 CRM		VA-NH3-F						
Ammonia, Total (as N)			100.1		%		85-115	07-SEP-12
WG1541509-6 CRM		VA-NH3-F						
Ammonia, Total (as N)			88.8		%		85-115	07-SEP-12
WG1541509-8 CRM		VA-NH3-F						
Ammonia, Total (as N)			97.6		%		85-115	07-SEP-12
WG1541509-1 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	07-SEP-12
WG1541509-3 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	07-SEP-12
WG1541509-5 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	07-SEP-12
WG1541509-7 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	07-SEP-12
WG1541509-9 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	07-SEP-12
WG1541509-12 MS		L1203418-30						
Ammonia, Total (as N)			105.5		%		75-125	07-SEP-12
Batch R2432481								
WG1542715-10 CRM		VA-NH3-F						
Ammonia, Total (as N)			106.2		%		85-115	09-SEP-12
WG1542715-2 CRM		VA-NH3-F						
Ammonia, Total (as N)			101.1		%		85-115	09-SEP-12
WG1542715-4 CRM		VA-NH3-F						
Ammonia, Total (as N)			99.2		%		85-115	09-SEP-12
WG1542715-6 CRM		VA-NH3-F						
Ammonia, Total (as N)			99.0		%		85-115	09-SEP-12
WG1542715-8 CRM		VA-NH3-F						
Ammonia, Total (as N)			101.7		%		85-115	09-SEP-12
WG1542715-1 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	09-SEP-12
WG1542715-3 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	09-SEP-12
WG1542715-5 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	09-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 18 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-VA								
Water								
Batch	R2432481							
WG1542715-7 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	09-SEP-12
WG1542715-9 MB								
Ammonia, Total (as N)			<0.0050		mg/L		0.005	09-SEP-12
WG1542715-12 MS		L1205539-1						
Ammonia, Total (as N)			97.8		%		75-125	09-SEP-12
WG1542715-14 MS		L1203698-9						
Ammonia, Total (as N)			106.4		%		75-125	09-SEP-12
PAH-SF-MS-VA								
Water								
Batch	R2431312							
WG1541190-2 LCS								
Acenaphthene			96.8		%		60-130	07-SEP-12
Acenaphthylene			95.7		%		60-130	07-SEP-12
Acridine			97.0		%		60-130	07-SEP-12
Anthracene			102.4		%		60-130	07-SEP-12
Benz(a)anthracene			92.9		%		60-130	07-SEP-12
Benzo(a)pyrene			94.5		%		60-130	07-SEP-12
Benzo(b)fluoranthene			96.9		%		60-130	07-SEP-12
Benzo(g,h,i)perylene			94.9		%		60-130	07-SEP-12
Benzo(k)fluoranthene			104.2		%		60-130	07-SEP-12
Chrysene			96.5		%		60-130	07-SEP-12
Dibenz(a,h)anthracene			100.6		%		60-130	07-SEP-12
Fluoranthene			99.8		%		60-130	07-SEP-12
Fluorene			97.4		%		60-130	07-SEP-12
Indeno(1,2,3-c,d)pyrene			98.3		%		60-130	07-SEP-12
Naphthalene			89.9		%		50-130	07-SEP-12
Phenanthrene			102.4		%		60-130	07-SEP-12
Pyrene			99.0		%		60-130	07-SEP-12
Quinoline			95.0		%		60-130	07-SEP-12
WG1541190-1 MB								
Acenaphthene			<0.000050		mg/L		0.00005	07-SEP-12
Acenaphthylene			<0.000050		mg/L		0.00005	07-SEP-12
Acridine			<0.000050		mg/L		0.00005	07-SEP-12
Anthracene			<0.000050		mg/L		0.00005	07-SEP-12
Benz(a)anthracene			<0.000050		mg/L		0.00005	07-SEP-12
Benzo(a)pyrene			<0.000010		mg/L		0.00001	07-SEP-12



Workorder: L1203640

Report Date: 17-SEP-12

Page 19 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-SF-MS-VA		Water						
Batch	R2431312							
WG1541190-1 MB								
	Benzo(b)fluoranthene		<0.000050		mg/L		0.00005	07-SEP-12
	Benzo(g,h,i)perylene		<0.000050		mg/L		0.00005	07-SEP-12
	Benzo(k)fluoranthene		<0.000050		mg/L		0.00005	07-SEP-12
	Chrysene		<0.000050		mg/L		0.00005	07-SEP-12
	Dibenz(a,h)anthracene		<0.000050		mg/L		0.00005	07-SEP-12
	Fluoranthene		<0.000050		mg/L		0.00005	07-SEP-12
	Fluorene		<0.000050		mg/L		0.00005	07-SEP-12
	Indeno(1,2,3-c,d)pyrene		<0.000050		mg/L		0.00005	07-SEP-12
	Naphthalene		<0.000050		mg/L		0.00005	07-SEP-12
	Phenanthrene		<0.000050		mg/L		0.00005	07-SEP-12
	Pyrene		<0.000050		mg/L		0.00005	07-SEP-12
	Quinoline		<0.000050		mg/L		0.00005	07-SEP-12
Batch	R2431882							
WG1541190-3 MB								
	Acenaphthene		<0.000050		mg/L		0.00005	12-SEP-12
	Acenaphthylene		<0.000050		mg/L		0.00005	12-SEP-12
	Acridine		<0.000050		mg/L		0.00005	12-SEP-12
	Anthracene		<0.000050		mg/L		0.00005	12-SEP-12
	Benz(a)anthracene		<0.000050		mg/L		0.00005	12-SEP-12
	Benzo(a)pyrene		<0.000010		mg/L		0.00001	12-SEP-12
	Benzo(b)fluoranthene		<0.000050		mg/L		0.00005	12-SEP-12
	Benzo(g,h,i)perylene		<0.000050		mg/L		0.00005	12-SEP-12
	Benzo(k)fluoranthene		<0.000050		mg/L		0.00005	12-SEP-12
	Chrysene		<0.000050		mg/L		0.00005	12-SEP-12
	Dibenz(a,h)anthracene		<0.000050		mg/L		0.00005	12-SEP-12
	Fluoranthene		<0.000050		mg/L		0.00005	12-SEP-12
	Fluorene		<0.000050		mg/L		0.00005	12-SEP-12
	Indeno(1,2,3-c,d)pyrene		<0.000050		mg/L		0.00005	12-SEP-12
	Naphthalene		<0.000050		mg/L		0.00005	12-SEP-12
	Phenanthrene		<0.000050		mg/L		0.00005	12-SEP-12
	Pyrene		<0.000050		mg/L		0.00005	12-SEP-12
	Quinoline		<0.000050		mg/L		0.00005	12-SEP-12
PH-MAN-WR		Water						



Workorder: L1203640

Page 20 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-MAN-WR		Water						
Batch	R2432843							
WG1541397-1	LCS							
pH			100.0		%		70-130	06-SEP-12
TDS-VA		Water						
Batch	R2432580							
WG1542235-2	LCS							
Total Dissolved Solids			101.6		%		85-115	07-SEP-12
WG1542235-5	LCS							
Total Dissolved Solids			102.1		%		85-115	07-SEP-12
WG1542235-8	LCS							
Total Dissolved Solids			100.9		%		85-115	07-SEP-12
WG1542235-1	MB							
Total Dissolved Solids			<10		mg/L		10	07-SEP-12
WG1542235-4	MB							
Total Dissolved Solids			<10		mg/L		10	07-SEP-12
WG1542235-7	MB							
Total Dissolved Solids			<10		mg/L		10	07-SEP-12
TKN-F-VA		Water						
Batch	R2433109							
WG1540620-3	DUP	L1203640-12						
Total Kjeldahl Nitrogen		0.113	0.108		mg/L	3.7	20	10-SEP-12
WG1540620-2	LCS							
Total Kjeldahl Nitrogen			101.7		%		75-125	10-SEP-12
WG1540620-5	LCS							
Total Kjeldahl Nitrogen			101.6		%		75-125	10-SEP-12
WG1540620-1	MB							
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	10-SEP-12
WG1540620-4	MB							
Total Kjeldahl Nitrogen			<0.050		mg/L		0.05	10-SEP-12
TURBIDITY-WR		Water						
Batch	R2433599							
WG1542241-3	DUP	L1203640-10						
Turbidity		13900	13800		NTU	0.7	15	07-SEP-12
WG1542241-2	LCS							
Turbidity			104.4		%		85-115	07-SEP-12
WG1542241-1	MB							
Turbidity			<0.10		NTU		0.1	07-SEP-12
VH-HSFID-VA		Water						



Workorder: L1203640

Page 21 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VH-HSFID-VA		Water						
Batch	R2427652							
WG1542764-2		LCS						
Volatile Hydrocarbons (VH6-10)			86.9		%		70-130	12-SEP-12
WG1542764-1		MB						
Volatile Hydrocarbons (VH6-10)			<0.10		mg/L		0.1	12-SEP-12
VOC-HSMS-VA		Water						
Batch	R2426011							
WG1542764-2		LCS						
Bromodichloromethane			85.2		%		70-130	09-SEP-12
Bromoform			77.5		%		70-130	09-SEP-12
Carbon Tetrachloride			93.6		%		70-130	09-SEP-12
Chlorobenzene			91.8		%		70-130	09-SEP-12
Dibromochloromethane			87.3		%		70-130	09-SEP-12
Chloroethane			88.7		%		60-140	09-SEP-12
Chloroform			87.3		%		70-130	09-SEP-12
Chloromethane			78.3		%		60-140	09-SEP-12
1,2-Dichlorobenzene			93.7		%		70-130	09-SEP-12
1,3-Dichlorobenzene			100.3		%		70-130	09-SEP-12
1,4-Dichlorobenzene			98.5		%		70-130	09-SEP-12
1,1-Dichloroethane			84.8		%		70-130	09-SEP-12
1,2-Dichloroethane			81.2		%		70-130	09-SEP-12
1,1-Dichloroethylene			75.3		%		70-130	09-SEP-12
cis-1,2-Dichloroethylene			86.4		%		70-130	09-SEP-12
trans-1,2-Dichloroethylene			84.5		%		70-130	09-SEP-12
Dichloromethane			79.1		%		60-140	09-SEP-12
1,2-Dichloropropane			86.5		%		70-130	09-SEP-12
cis-1,3-Dichloropropylene			78.7		%		70-130	09-SEP-12
trans-1,3-Dichloropropylene			82.0		%		70-130	09-SEP-12
1,1,1,2-Tetrachloroethane			91.2		%		70-130	09-SEP-12
1,1,2,2-Tetrachloroethane			74.6		%		70-130	09-SEP-12
Tetrachloroethylene			99.1		%		70-130	09-SEP-12
1,1,1-Trichloroethane			92.2		%		70-130	09-SEP-12
1,1,2-Trichloroethane			89.8		%		70-130	09-SEP-12
Trichloroethylene			92.0		%		70-130	09-SEP-12
Trichlorofluoromethane			100.8		%		60-140	09-SEP-12
Vinyl Chloride			90.0		%		60-140	09-SEP-12
WG1542764-1		MB						

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 22 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-HSMS-VA		Water						
Batch R2426011								
WG1542764-1 MB								
Bromodichloromethane			<0.0010		mg/L		0.001	09-SEP-12
Bromoform			<0.0010		mg/L		0.001	09-SEP-12
Carbon Tetrachloride			<0.00050		mg/L		0.0005	09-SEP-12
Chlorobenzene			<0.0010		mg/L		0.001	09-SEP-12
Dibromochloromethane			<0.0010		mg/L		0.001	09-SEP-12
Chloroethane			<0.0010		mg/L		0.001	09-SEP-12
Chloroform			<0.0010		mg/L		0.001	09-SEP-12
Chloromethane			<0.0050		mg/L		0.005	09-SEP-12
1,2-Dichlorobenzene			<0.00070		mg/L		0.0007	09-SEP-12
1,3-Dichlorobenzene			<0.0010		mg/L		0.001	09-SEP-12
1,4-Dichlorobenzene			<0.0010		mg/L		0.001	09-SEP-12
1,1-Dichloroethane			<0.0010		mg/L		0.001	09-SEP-12
1,2-Dichloroethane			<0.0010		mg/L		0.001	09-SEP-12
1,1-Dichloroethylene			<0.0010		mg/L		0.001	09-SEP-12
cis-1,2-Dichloroethylene			<0.0010		mg/L		0.001	09-SEP-12
trans-1,2-Dichloroethylene			<0.0010		mg/L		0.001	09-SEP-12
Dichloromethane			<0.0050		mg/L		0.005	09-SEP-12
1,2-Dichloropropane			<0.0010		mg/L		0.001	09-SEP-12
cis-1,3-Dichloropropylene			<0.0010		mg/L		0.001	09-SEP-12
trans-1,3-Dichloropropylene			<0.0010		mg/L		0.001	09-SEP-12
1,1,1,2-Tetrachloroethane			<0.0010		mg/L		0.001	09-SEP-12
1,1,2,2-Tetrachloroethane			<0.0010		mg/L		0.001	09-SEP-12
Tetrachloroethylene			<0.0010		mg/L		0.001	09-SEP-12
1,1,1-Trichloroethane			<0.0010		mg/L		0.001	09-SEP-12
1,1,2-Trichloroethane			<0.0010		mg/L		0.001	09-SEP-12
Trichloroethylene			<0.0010		mg/L		0.001	09-SEP-12
Trichlorofluoromethane			<0.0010		mg/L		0.001	09-SEP-12
Vinyl Chloride			<0.0010		mg/L		0.001	09-SEP-12
VOC7-HSMS-VA		Water						
Batch R2426011								
WG1542764-2 LCS								
Benzene			87.1		%		70-130	09-SEP-12
Ethylbenzene			100.3		%		70-130	09-SEP-12
Methyl t-butyl ether (MTBE)			92.9		%		70-130	09-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 23 of 25

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC7-HSMS-VA		Water						
Batch	R2426011							
WG1542764-2	LCS							
Styrene			96.5		%		70-130	09-SEP-12
Toluene			95.3		%		70-130	09-SEP-12
meta- & para-Xylene			101.4		%		70-130	09-SEP-12
ortho-Xylene			98.7		%		70-130	09-SEP-12
WG1542764-1	MB							
Benzene			<0.00050		mg/L		0.0005	09-SEP-12
Ethylbenzene			<0.00050		mg/L		0.0005	09-SEP-12
Methyl t-butyl ether (MTBE)			<0.00050		mg/L		0.0005	09-SEP-12
Styrene			<0.00050		mg/L		0.0005	09-SEP-12
Toluene			<0.00050		mg/L		0.0005	09-SEP-12
meta- & para-Xylene			<0.00050		mg/L		0.0005	09-SEP-12
ortho-Xylene			<0.00050		mg/L		0.0005	09-SEP-12

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 24 of 25

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1203640

Report Date: 17-SEP-12

Page 25 of 25

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH by Meter							
	1	31-AUG-12 10:50	06-SEP-12 16:57	24	150	hours	EHTR
	2	31-AUG-12 13:20	06-SEP-12 16:57	24	148	hours	EHTR
	3	01-SEP-12 11:10	06-SEP-12 16:57	24	126	hours	EHTR
	4	31-AUG-12 15:30	06-SEP-12 16:57	24	145	hours	EHTR
	5	31-AUG-12 17:40	06-SEP-12 16:57	24	143	hours	EHTR
	6	31-AUG-12 18:15	06-SEP-12 16:57	24	143	hours	EHTR
	7	31-AUG-12 15:30	06-SEP-12 16:57	24	145	hours	EHTR
	8	02-SEP-12 12:00	06-SEP-12 16:57	24	101	hours	EHTR
	9	01-SEP-12 15:20	06-SEP-12 16:57	24	122	hours	EHTR
	10	01-SEP-12 16:20	06-SEP-12 16:57	24	121	hours	EHTR
	11	01-SEP-12 17:15	06-SEP-12 16:57	24	120	hours	EHTR
	12	02-SEP-12 14:50	06-SEP-12 16:57	24	98	hours	EHTR

Anions and Nutrients

Nitrate Nitrogen by Ion Chromatography

1	31-AUG-12 10:50	04-SEP-12 15:20	3	4	days	EHTR
2	31-AUG-12 13:20	04-SEP-12 15:20	3	4	days	EHTR
4	31-AUG-12 15:30	04-SEP-12 15:20	3	4	days	EHTR
5	31-AUG-12 17:40	04-SEP-12 15:20	3	4	days	EHTR
6	31-AUG-12 18:15	04-SEP-12 15:20	3	4	days	EHTR
7	31-AUG-12 15:30	04-SEP-12 15:20	3	4	days	EHTR

Nitrite Nitrogen by Ion Chromatography

1	31-AUG-12 10:50	04-SEP-12 15:20	3	4	days	EHTR
2	31-AUG-12 13:20	04-SEP-12 15:20	3	4	days	EHTR
4	31-AUG-12 15:30	04-SEP-12 15:20	3	4	days	EHTR
5	31-AUG-12 17:40	04-SEP-12 15:20	3	4	days	EHTR
6	31-AUG-12 18:15	04-SEP-12 15:20	3	4	days	EHTR
7	31-AUG-12 15:30	04-SEP-12 15:20	3	4	days	EHTR

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.

Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1203640 were received on 04-SEP-12 10:10.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

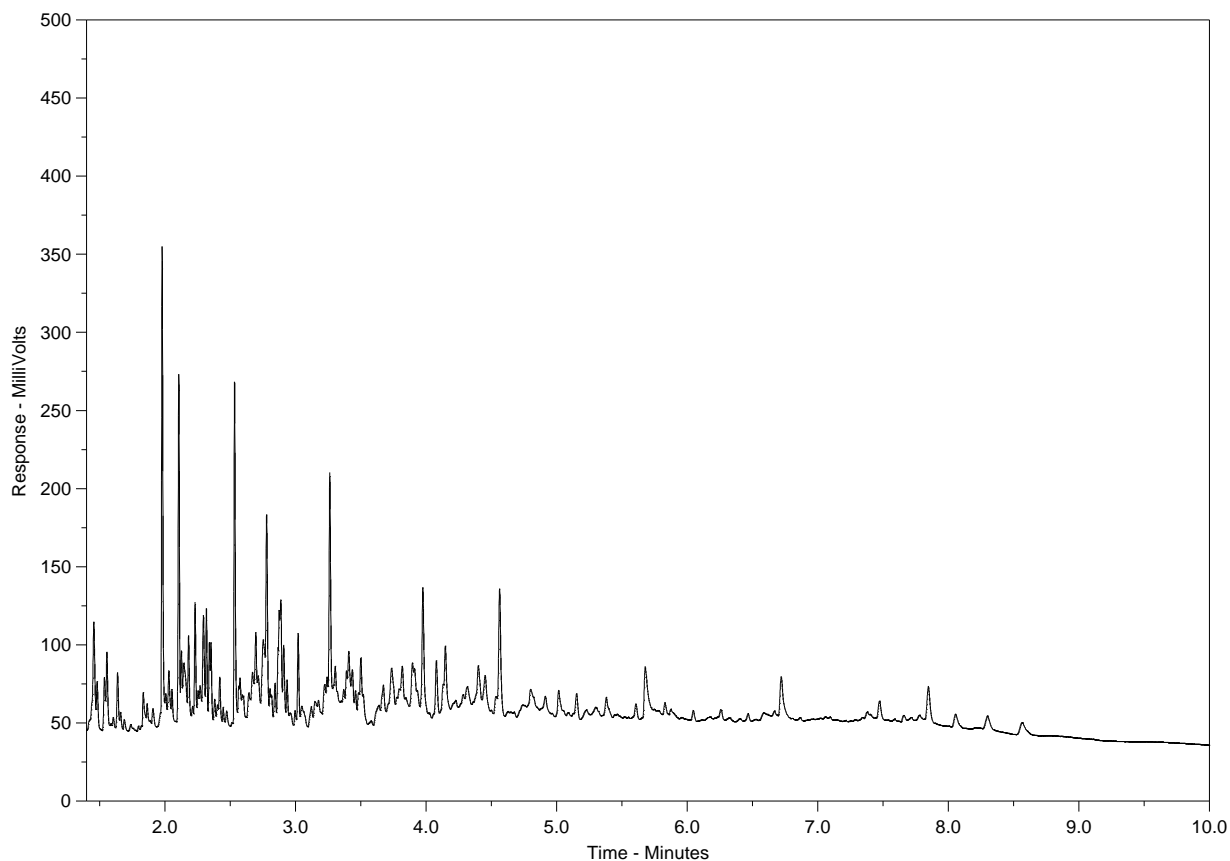
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-1
Client Sample ID: RR NUMBER 1



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

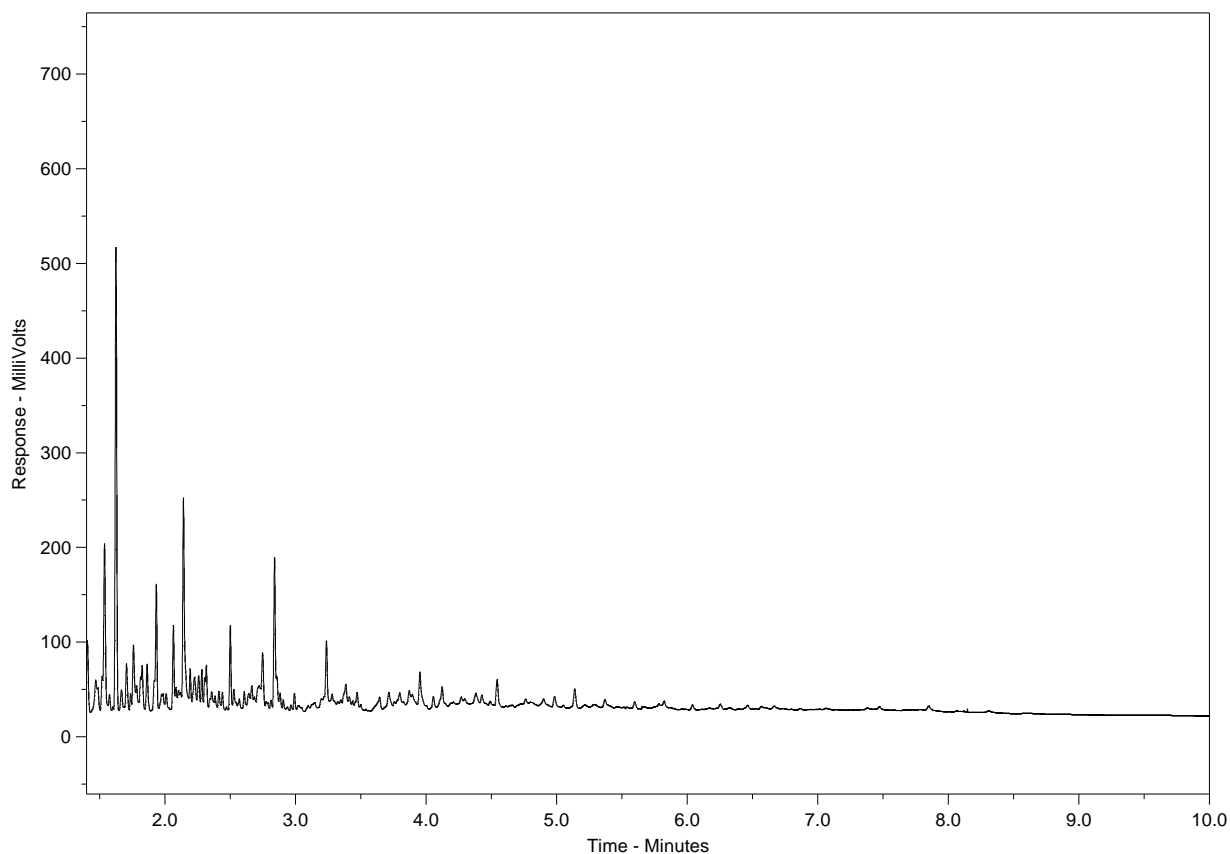
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-2
Client Sample ID: RR NUMBER 2



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

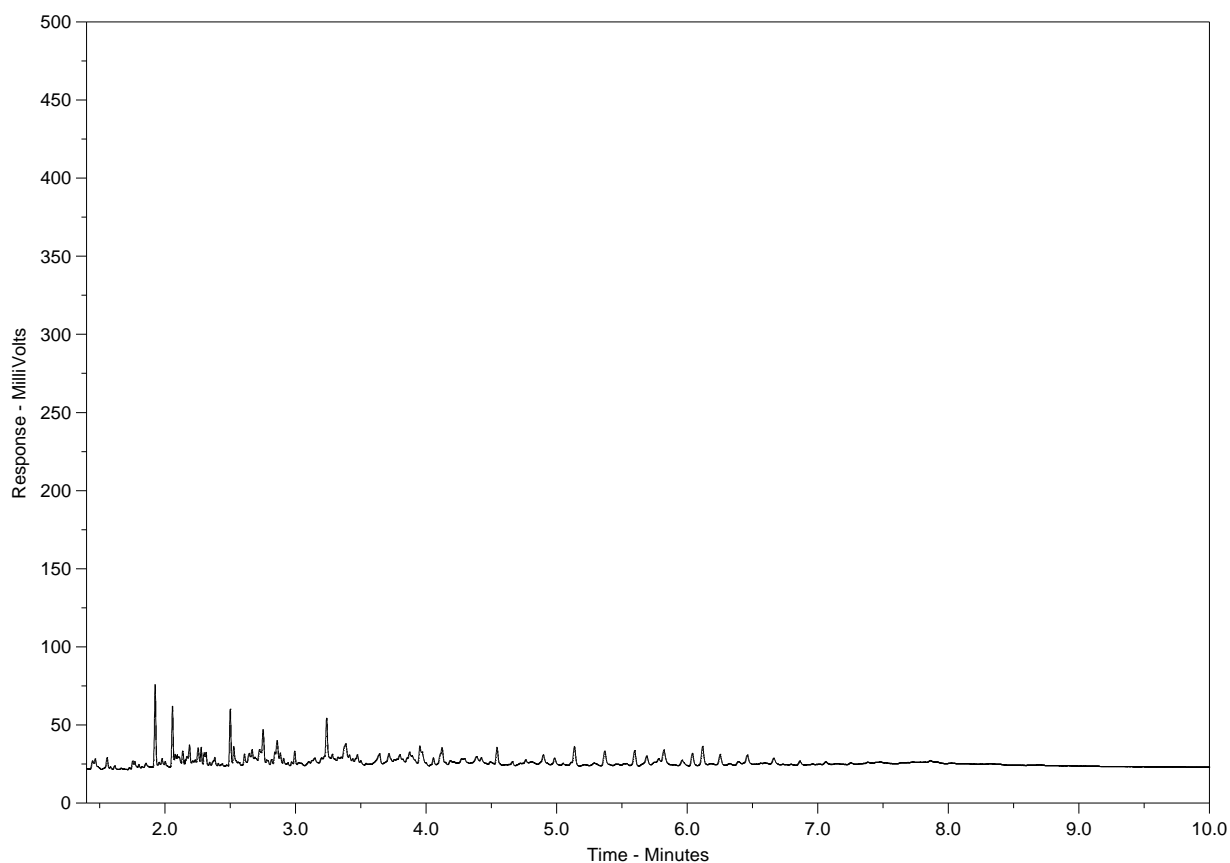
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-3
Client Sample ID: RR SURFACE



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

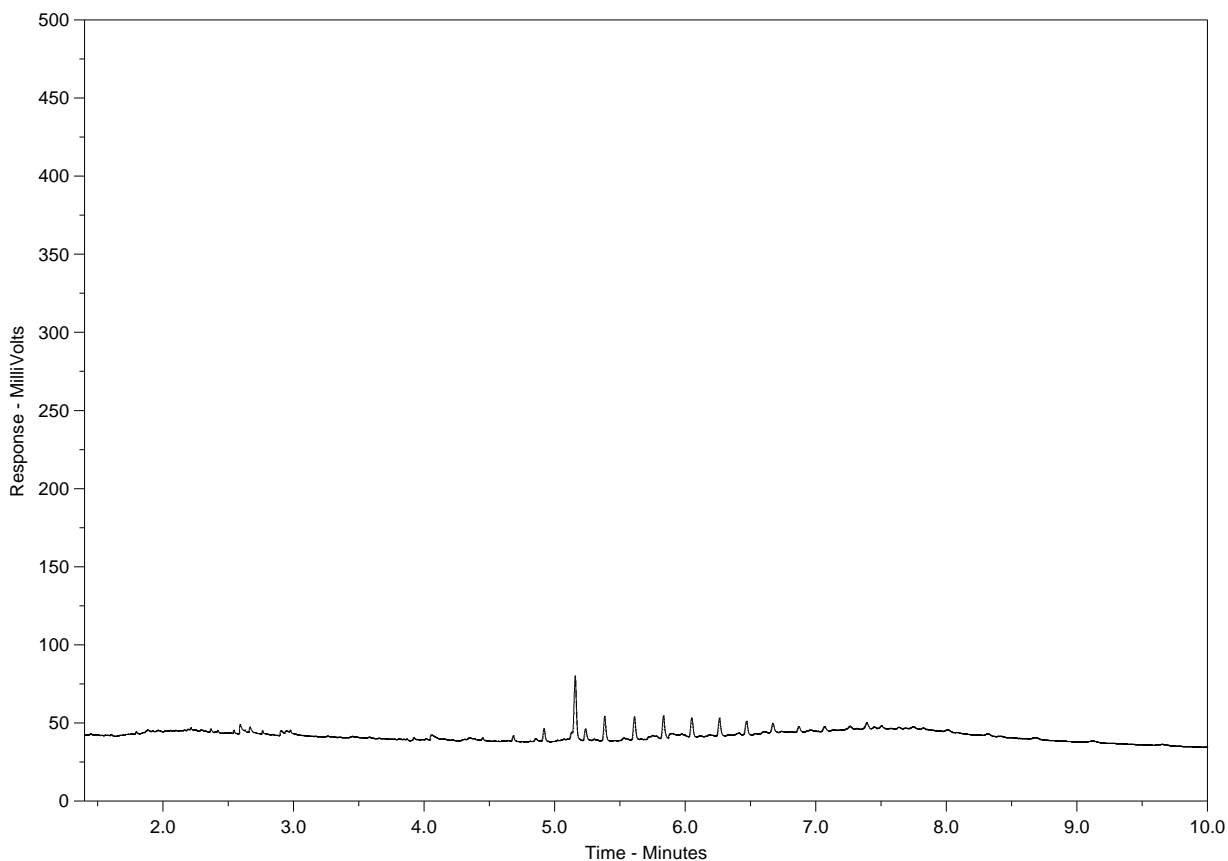
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-4
Client Sample ID: FA-MW12-01



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

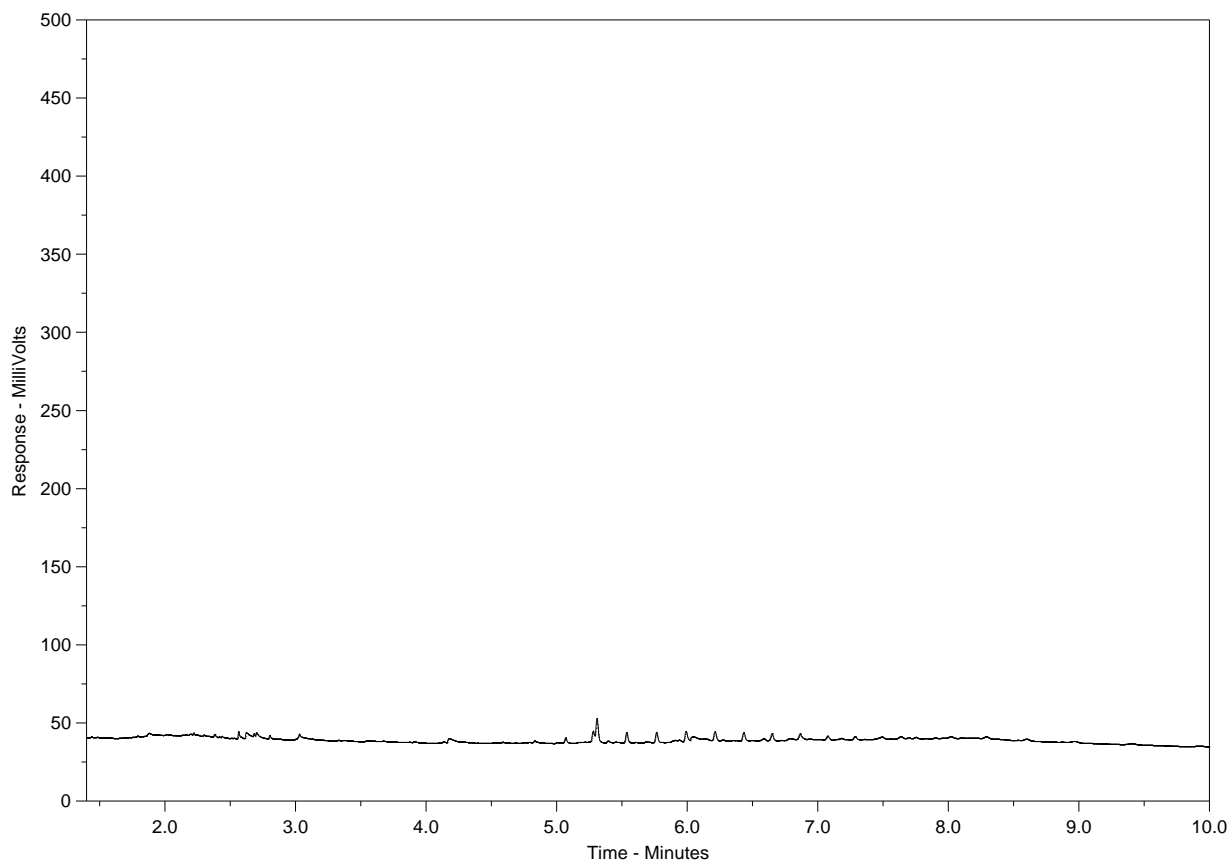
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-5
Client Sample ID: FA-MW12-03



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

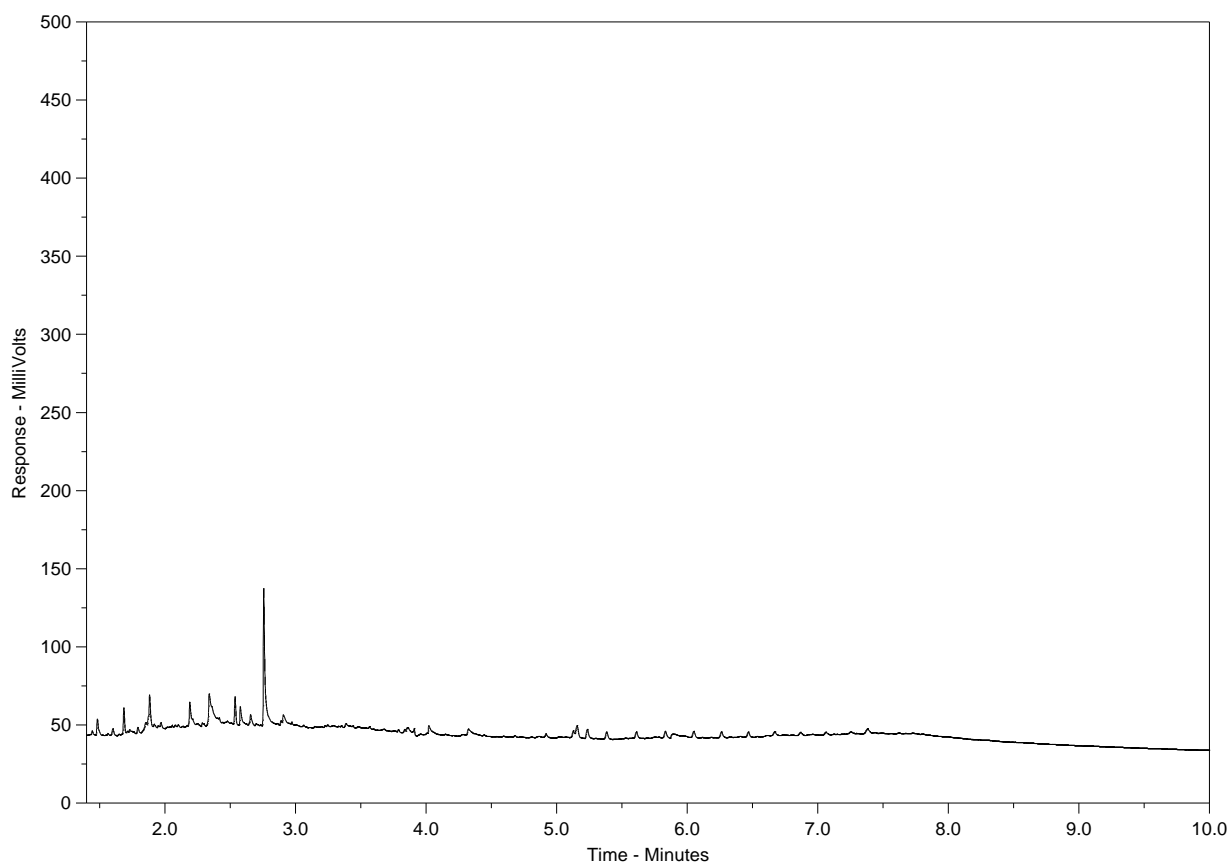
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-6
Client Sample ID: FA-MW12-04



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

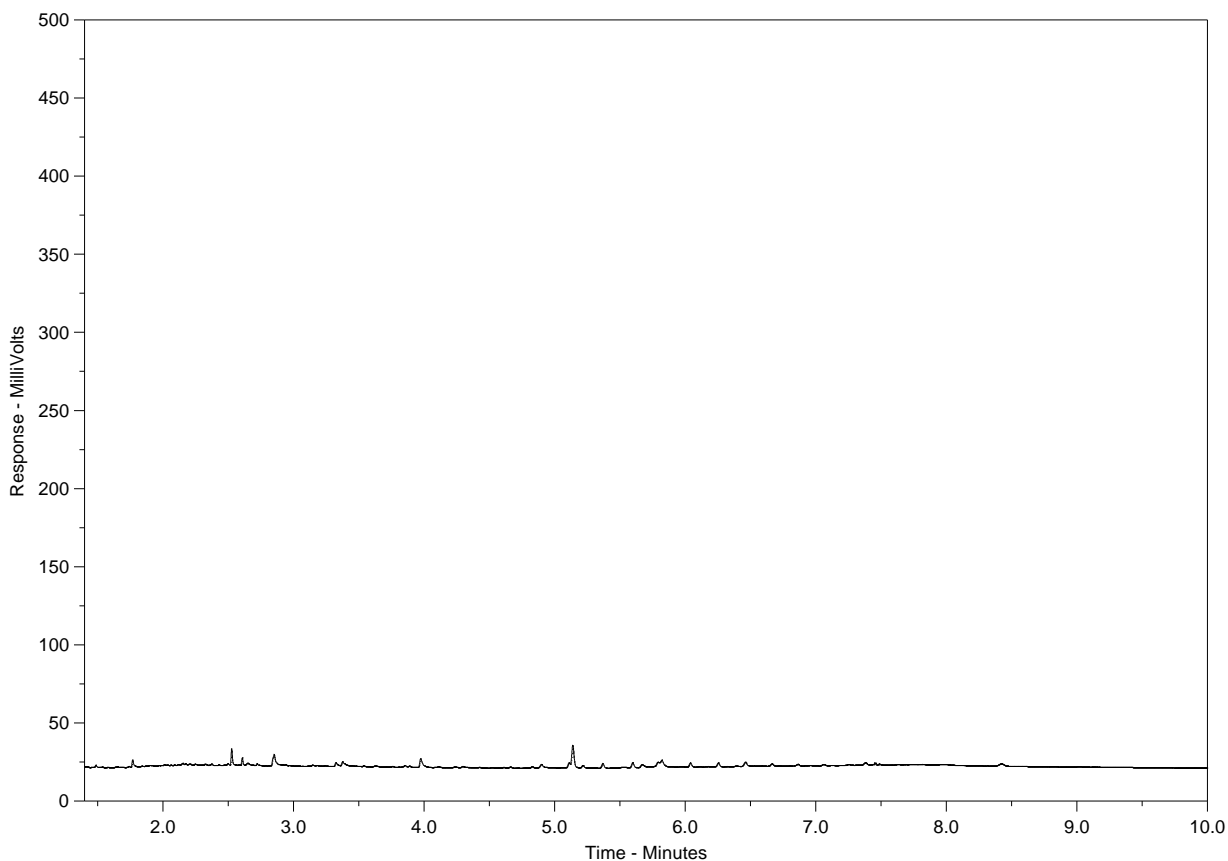
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-7
Client Sample ID: FA-MW12-05



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

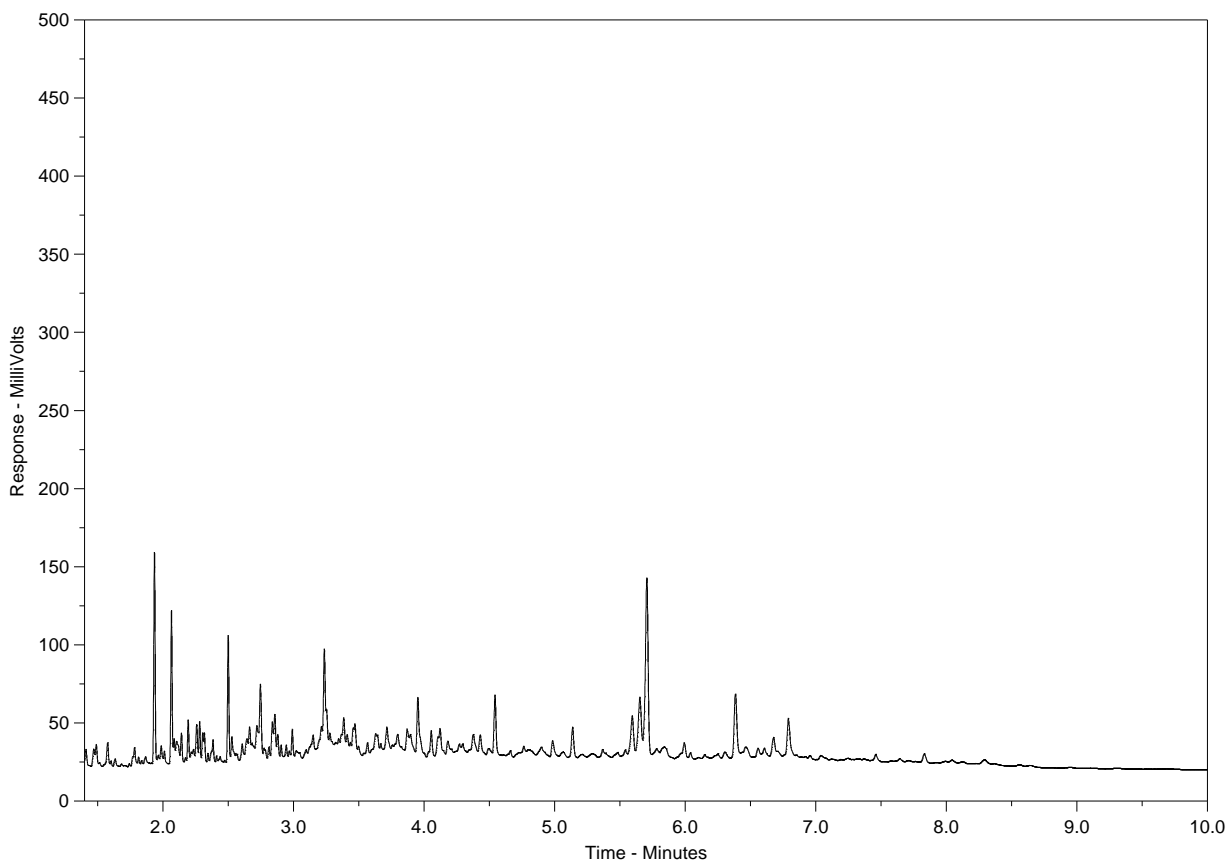
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-8
Client Sample ID: FA SURFACE



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

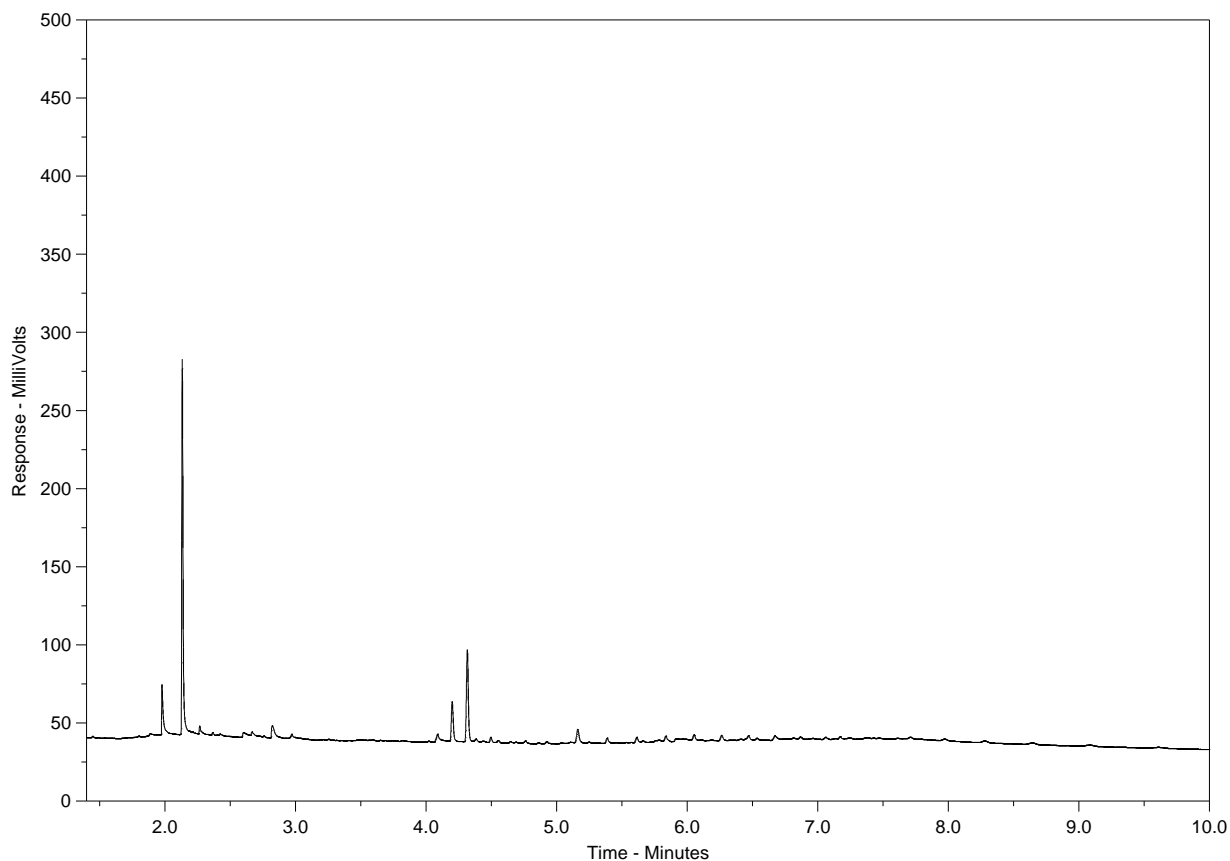
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-9
Client Sample ID: DC NUMBER 1



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

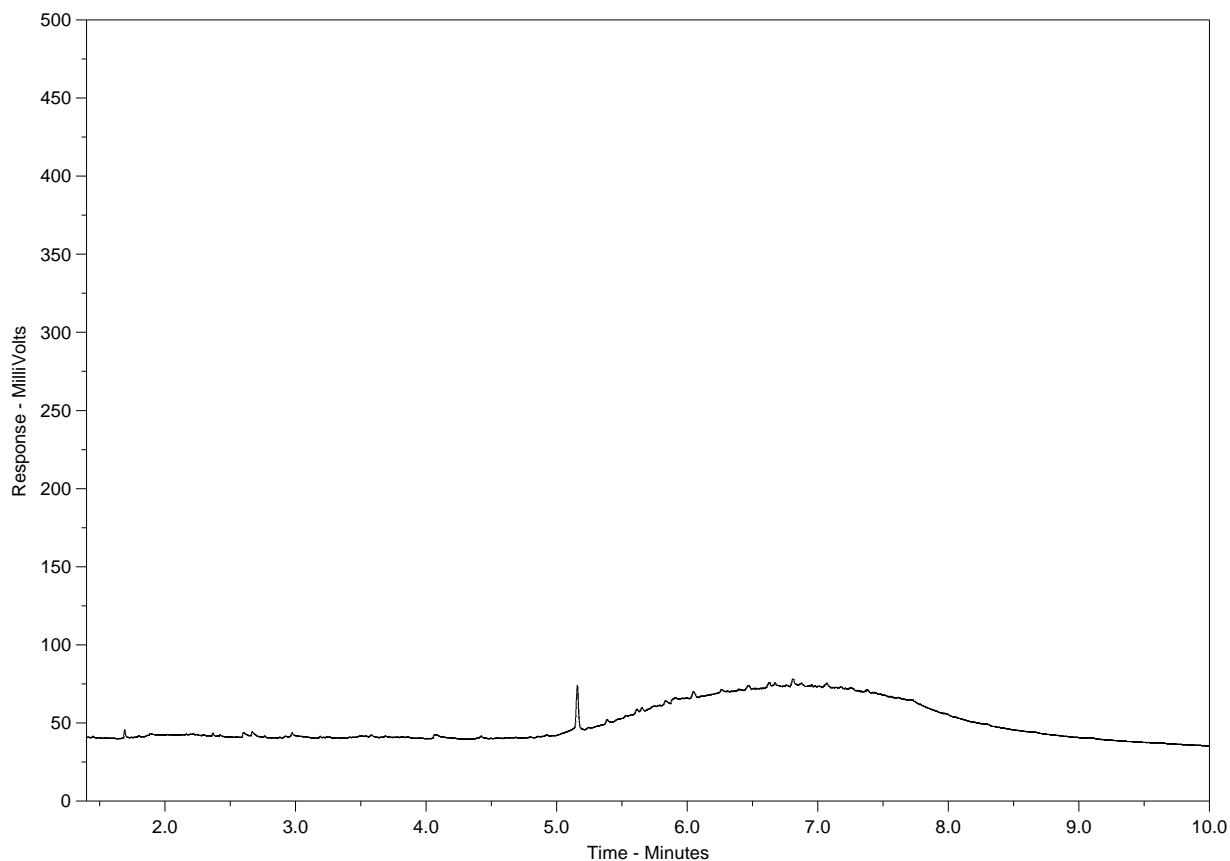
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-10
Client Sample ID: DC NUMBER 2



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

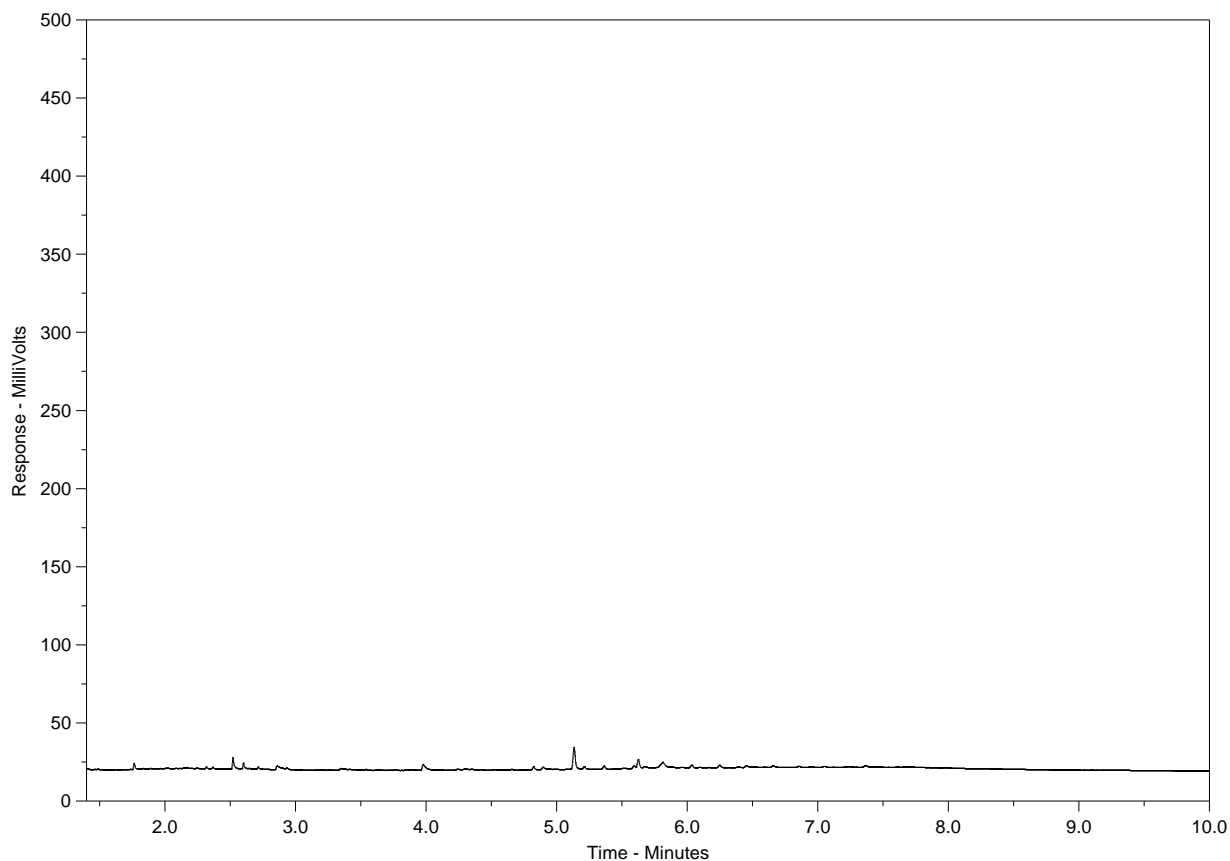
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-11
Client Sample ID: DC NUMBER 3



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

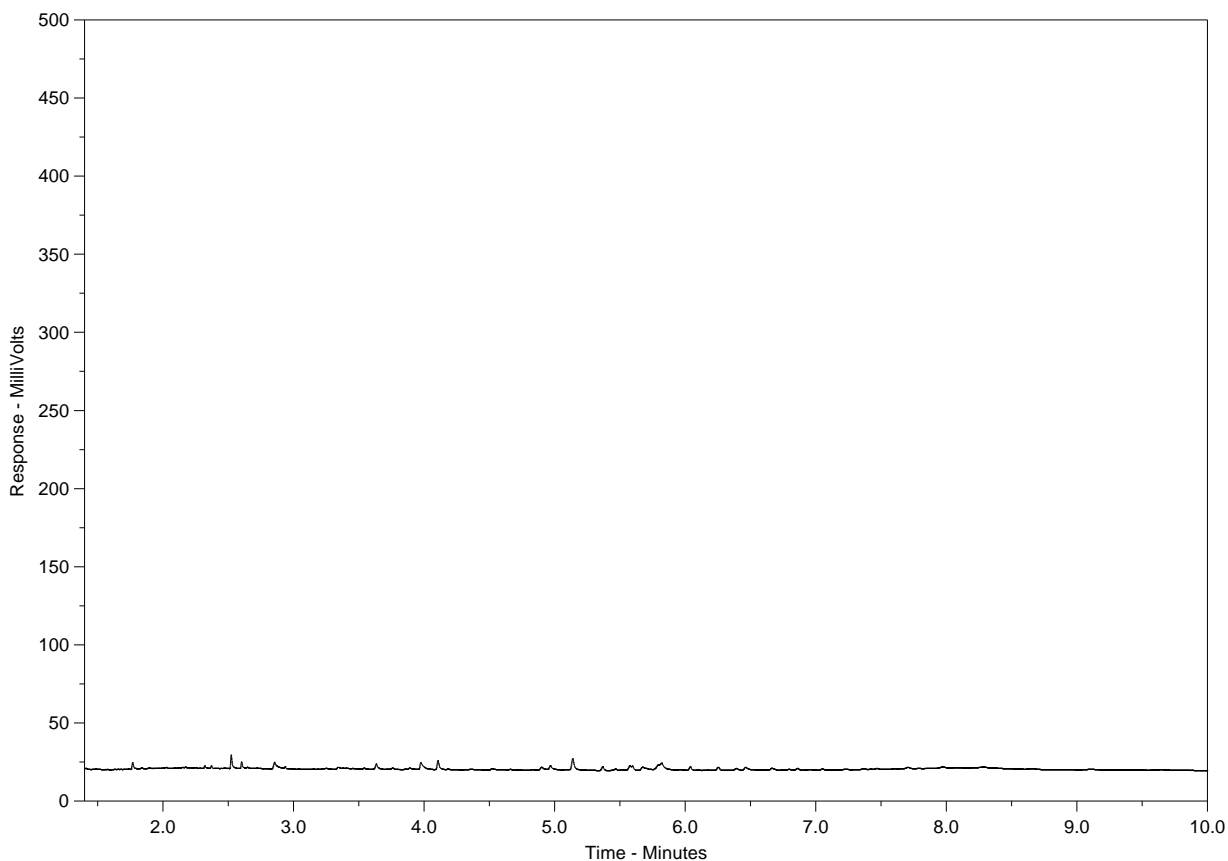
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report



ALS Sample ID: L1203640-12
Client Sample ID: DC SURFACE



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
<div><div>← Gasoline →</div><div>← Diesel / Jet Fuels →</div><div>← Motor Oils / Lube Oils / Grease →</div></div>		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
500 - 4260 Still Creek Drive
Burnaby, British Columbia, V5C 6C6
Canada
T: +1 (604) 296 4200

