



2012 FIELD PROGRAM SUMMARY
SOUTHERN ATHABASCA OIL SANDS AREA
REGIONAL GROUNDWATER MONITORING NETWORK

Report Prepared for:
Alberta Environment Sustainable Resources Development

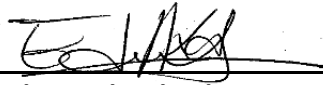
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April 2013
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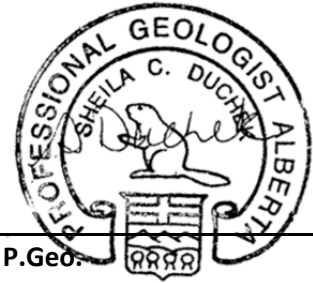
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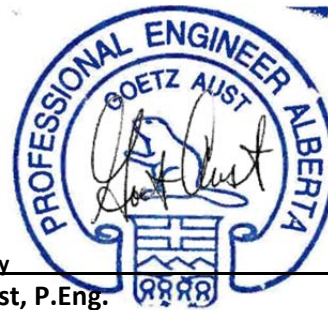
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**APEGA Permit to Practice
Permit No. P5540**

DISCLAIMER

We certify that this report is accurate and complete and accords with the information available during the site investigation. Information obtained during the site investigation or provided by third parties is believed to be accurate but is not guaranteed. We have exercised reasonable skill, care and diligence in assessing the information acquired during the preparation of this report.

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1 INTRODUCTION

Alberta Environment Sustainable Resource Development (ESRD) contracted Matrix Solutions Inc. to develop the regional groundwater monitoring well network for the Southern Athabasca Oil Sands (SAOS) area. The objective of the 2012 field program was to initiate the regional groundwater monitoring well network by drilling, completing and sampling groundwater monitoring wells at five selected network locations, shown on Figure 1. All regionally-significant aquifers, deemed present within the drift deposits at each well nest location, were considered as targets for well completion. This report provides details regarding the installation, monitoring and testing program and provides a summary of initial groundwater quality results for the SAOS network.

2 SCOPE OF WORK

The objective of the groundwater monitoring network installation program was to install groundwater monitoring wells in regionally-significant aquifers present within the drift at five selected locations. Well nests were located at 11-30-076-07 W4M, 08-27-080-09 W4M, 07-19-080-13 W4M, 07-36-077-15 W4M and 10-26-068-16 W4M.

Matrix completed the following scope of work:

- oversaw all fieldwork activities as the prime contractor
- conducted a pre-job safety meeting, with discussion of potential hazards and mitigative measures prior to initiating any site work
- conducted a ground disturbance program, which included completing an Alberta One-Call and supervising the locating and marking of all utilities and infrastructure near the work area
- supervised drilling of boreholes into the Quaternary/Tertiary aquifers at the selected monitoring well locations
- oversaw logging selected boreholes with electrical logging (e-Log) tools
- designed the monitoring well based on observed lithology and review of e-logs
- supervised well installation
- conducted well development through airlifting
- monitored groundwater wells, including measuring fluid levels
- completed hydraulic response testing
- collected groundwater samples for laboratory testing
- installed monitoring transducers to obtain hydrostatic pressures and temperature data
- supervised surveying each monitoring well for horizontal location and vertical elevation
- prepared a report to summarize field activities, well completion, sampling and testing results

3 PROGRAM METHODS

3.1 Disposition Reservation

A disposition reservation package was submitted and approved by the Alberta Land Disposition Branch prior to field activities for four monitoring well nest locations: 11-30-076-07 W4M (Conklin 76-07), 08-27-080-09 W4M (Waddell Creek 80-09), 07-19-080-13-W4M (Mariana Lakes 80-13) and 07-36-077-15 W4M (House Crossing 77-15). The package included a sketch of the proposed location and the Reservation/Notification application form. The respective disposition reservation boundaries are outlined on Figures 2 through to 4.

3.2 Surveying

Legal surveys of each well nest site, outlining the DRS (disposition reservation) land title boundaries were performed by Maltus Geomatics of Edmonton, AB at well nest locations 11-30-076-07 W4M (Conklin), 08-27-080-09 W4M (Waddell Creek), 07-19-080-13 W4M (Mariana Lakes) and 07-36-077-15 W4M (House Crossing). Maltus placed markers identifying DRS corners and boundaries, and provided survey markers for ground elevations. Ground elevations and the top of the monitoring well standpipes for wells at those locations with DRS land titles were surveyed by Matrix relative to the markers placed by Maltus, after the monitoring wells were installed. Vertical elevations were determined relative to metres above mean sea level and horizontal locations were relative to NAD 83 Universal Transverse Mercator (UTM) coordinates. The horizontal locations of the monitoring wells were determined using a hand-held Garmin geographic positioning system unit. Vertical elevations, obtained using a survey level and rod, had a ± 1 cm accuracy for tying elevations to the Maltus markers.

Ground elevations and the top of the monitoring well standpipes for wells located at the Plamondon 68-16 well pad were surveyed by Maltus and provided to Matrix.

3.3 Drilling and Completion

Matrix personnel were required to comply with legislated and Matrix health and safety standards.

Drilling and well completion for the monitoring network was conducted between October 16 and November 16, 2012. The monitoring wells were drilled and completed by Lakeland Drilling Ltd. of St. Paul, Alberta, who supplied and operated a mud-rotary drilling rig. Water well records, completed and submitted to ESRD by Lakeland Drilling, are provided in Appendix A. The boreholes were drilled with a 159 mm diameter bit. Five well nest locations were included within this phase of the SAOS monitoring network installation. Each well nest location had multiple completion intervals and every well nest location had one well completed across the uppermost water-bearing zone, which may have been the water table. The maximum depth of investigation was 164.6 m below ground surface (bgs; at the House Crossing 77-15). A waiver to drill past 150 m bgs was obtained from the Energy Resources Conservation Board for the House Crossing 77-15 location.

Matrix field personnel recorded lithology and collected drill cutting samples at 3 m intervals or less as each borehole was advanced. Drill cuttings were catalogued and described. Observations including lithology, texture, moisture, colour and well completion details are provided on geologic logs (Appendix B). After the maximum total depth of each borehole was reached, the boreholes were geophysically logged by Lakeland Drilling, using gamma ray, relative resistivity and spontaneous potential logging tools, as shown in Appendix B. These tools logged from the bottom to surface.

Monitoring well construction details are provided in Appendix B. The deeper boreholes (i.e., any well completed deeper than 10 m) were reamed with a 222 mm (8.75-inch) diameter bit from surface to depths below the screen bottom. The wells were completed by placing a 10 cm (4-inch) ID-slotted screen (0.051 mm, 0.02 inch slots) to the base of the borehole. The shallow wells were installed in 15 cm (6-inch) diameter boreholes by placing a 5 cm (2-inch) ID slotted screen (0.051 cm [0.02-inch] slots) in the base of the holes. The screens for the deep and shallow wells were constructed of Schedule 80 and 40 non-reactive PVCs, respectively. The screens were of varying lengths, depending upon geologic conditions; screen lengths are provided on the geologic logs in Appendix B. The annular spaces between the PVC screens and wellbores were backfilled with 10-20 screened sand. A bentonite seal of peltonite was placed above the sand. Bentonite grout (for the deeper wells) and bentonite chips (for the shallow wells) were placed in the borehole above the peltonite. Peltonite and bentonite (grout and chips) provide an adequate seal between the water-bearing zones and possible inflow of surface water. A metal surface casing with a locking cap was installed over the PVC casing above ground.

According to ESRD's request, the following naming convention was applied to each monitoring well: local area name - township - range - depth of screen bottom below ground surface.

3.4 Grain Size Analyses

Field grain size analyses were conducted to assist with selecting the screen slot size. Cutting samples were collected at regular intervals; these samples were washed, dried and Matrix conducted grain size analysis of targeted aquifers within drift deposits to obtain approximate values for mean grain sizes. Standard American Society for Testing and Materials (ASTM) sieves #10, 20, 30, 40, 60, 80, 100 and 120 were used to complete the testing. Results are provided in Appendix C.

3.5 Well Development

The purpose of development was to flush water and fine sediments introduced to the screened interval during drilling and completion. Development also removed fine-grained material from within the immediate borehole radius to improve flow into the screen slots. Following installation, the wells were developed by airlifting using an air compressor; air delivery was through a 19 mm (0.75-inch) flexible tubing installed to a depth above the screened interval. The compressor's air delivery capability was 14.2 m³/minute (500 cubic feet per minute). The wells were airlifted from above the completion zones.

Field parameters including electrical conductivity (EC), temperature, pH, turbidity and sand production were monitored during well development. Well development was conducted until the produced water was clean and clear with stable field parameter readings.

3.6 Groundwater Monitoring and Sampling

Groundwater monitoring, sampling and hydraulic conductivity testing was completed by Matrix personnel on October 26, and November 15 to 21, 2012.

Groundwater samples were subjected to field measurements of temperature, pH, DO, and EC. Groundwater samples were transferred into appropriate sample containers, placed in coolers with ice for the following laboratory analyses:

- routine (major ions and total dissolved solids [TDS])
- dissolved metals
- petroleum hydrocarbons (PHCs), including benzene, toluene, ethylbenzene and xylenes (BTEX) and PHCs fraction 1 (C₆-C₁₀, excluding BTEX) and fraction 2 (F2; C_{>10}-C₁₆)
- naphthenic acids
- total phenols
- polycyclic aromatic hydrocarbons (PAH)
- dissolved or total organic carbon (DOC or TOC)
- total ammonia
- faecal coliform

Preservatives were added to the metals, phenols, DOC, faecal coliform and naphthenic acids samples in the field. For the dissolved metal samples, water was filtered (using a 45 µm filter) prior to adding preservative. Samples were placed in bottles supplied by ALS Environmental and stored in coolers on ice. Samples were submitted to ALS in Calgary and Fort McMurray, Alberta. Copies of the laboratory reports and the chain-of-custody documents are included in Appendix D.

The 2012 groundwater sampling program results, which included field-measured and laboratory-tested parameters, are presented in Table 1 (Monitoring Well Summary), 2 (Field-measured Parameters), Table 3 (General and Inorganic Parameters), Table 4 (Dissolved Metals), Table 5 (Dissolved Hydrocarbons and Naphthenic Acids) and Table 6 (PAHs). Laboratory certified analytical results including the dates of analysis, analytical methods, and laboratory quality assurance/quality control procedures are included in Appendix D.

3.7 Regulatory Guidelines

Laboratory analytical results for groundwater were compared to the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* for coarse-grained soil in natural areas (Tier 1; AENV, 2010). The Tier 1

guidelines were selected based on land use and aquifer material type. According to the borehole logs and grain size analyses provided in Appendices A and B, the dominant texture was coarse-grained and therefore, the guidelines established for coarse-grained materials were applied. The surrounding land was generally natural forested area and, therefore, the site was classified as a natural area.

3.8 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted at the monitoring locations 11-30-076-07 W4M (Conklin 76-07), 08-27-080-09 W4M (Waddell Creek 80-09), 07-19-080-13 W4M (Mariana Lakes 80-13), 07-36-077-15 W4M (House Crossing 77-15) and 10-26-068-16 W4M (Plamondon 68-16) between October 13 and 21, 2012. Slug testing was conducted on all wells except at well Waddell Creek 80-09-149 (Waddell Creek 80-09), where a single well pumping test was conducted. Slug testing was conducted using a 1.0 m (or 1.5 m) PVC solid tube (slug) and an In-Situ Level TROLL 500™ (or WinSitu) pressure instrument with data recording capabilities. The pressure transducer was attached to a direct read cable to allow real time communication of downhole pressure readings. After installing the transducer within the screened interval, the slug was released to instantaneously displace water in the well. Pressure measurements were recorded at 1-second intervals during both the introduction and removal of the slug. Water levels were monitored until at least 80% recovery had been achieved.

At the Waddell Creek 80-09-149 test well, a 6-hour and 36-minute constant-rate pumping test was initiated at 10:50 am on October 22, 2012. Water levels were monitored at the same well during pumping and recovery. An average pumping rate of 5.78 m³/day was maintained throughout the test. Pump testing was conducted using a pump and an In-Situ Level TROLL 500™ pressure instrument with data recording capabilities. The pressure transducer was attached to a direct read cable to allow real time communication of downhole pressure readings and installed within the screened interval. Pressure measurements were recorded at 60 seconds intervals during both the pumping and recovery. Water levels were monitored until at least 80% recovery had been achieved. The pumping phase of the test was terminated at 5:26 pm on October 22, 2012. Recovery was monitored for over 21 hours; the recovery was completed at 3:53 pm on October 23, 2012.

Data recorded by the transducer during hydraulic conductivity testing was downloaded and reviewed. The data set was parsed for ease of interpretation and any data points that were inconsistent because of interpreted transducer malfunction or any points recorded during retrieval or installation of the transducer were culled.

Slug test analyses to determine aquifer parameters typically involves fitting type curves or best fit regression lines to time versus drawdown graphs. For this program, slug test analysis was facilitated using the software package AQTESOLV™ PRO 4.50 (HydroSOLVE 2007).

3.9 Instrumentation

After sampling and hydraulic conductivity testing, at least one pressure transducer was installed in each well as part of ongoing data collection of hydrostatic pressures and temperatures. Each monitoring well was instrumented with a non-vented, Level Troll 300 or 500 level logger equipped with data recording capabilities and manufactured by In-Situ Inc. Each Level Troll logger was set to record and store pressure measurements on an hourly interval beginning at the time of installation. Table 8 provides a summary of the installation details, including instrument details (make, model and serial numbers), installation depths and data recording frequency.

4 RESULTS

4.1 Conklin 76-7

Four boreholes (Conklin 76-07-6, Conklin 76-07-24, Conklin 76-07-41 and Conklin 76-07-67) were advanced at the Conklin 76-7, and installed as groundwater monitoring wells on October 23 and 24, 2012. Based on drill cuttings observations and geophysical logs (Appendix B), the interpreted aquifers were determined (Table A).

Table A Interpreted Aquifer Characteristics at Conklin 76-7 Well Pad

Location/Well name	Screened Interval (m bgs)	Interpreted Target Aquifer	Mean grain size (mm)
Conklin 76-07-6	3.0 - 6.1	Uppermost water-bearing units	0.32
Conklin 76-07-24	20.5 - 23.5	Sand River	0.34
Conklin 76-07-41	35.0 - 41.0	Ethel Lake	0.34
Conklin 76-07-67	61.0 - 67.0	Bonnyville Sand	0.31

4.1.1 Site Stratigraphy, Grain Size Results and Groundwater Levels

According to the geologic logs (Appendix B), the observed lithology at this well nest location was generally comprised of sand and clay till. The sands are well-sorted and rounded, fine to coarse brown and dark grey, loose and wet. Moisture content increased at a depth of 6 m bgs. Trace gravels and pebbles were noted throughout. A moderately- to highly-plastic, brown to dark brown, moist clay layer was observed at varying depths throughout Conklin 76-07-67 (the deepest well). Generally, the clay layer thickness varied from 1.6 to 14.3 m. The first groundwater-bearing zone was encountered at approximately 5 m bgs. The maximum depth investigated to was 68 m bgs and bedrock was not encountered.

On November 15, 2012, water levels were measured at wells Conklin 76-07-6, Conklin 76-07-24, Conklin 76-07-41 and Conklin 76-07-67. Groundwater was encountered at depths ranging from 2.07 m bgs (Conklin 76-07-6) to 5.93 m bgs (Conklin 76-07-24).

Vertical hydraulic gradients were calculated from hydraulic head elevations measured at each nested well. In November 2012, downward gradients (indicating recharge conditions) were apparent between Conklin 76-07-6 and Conklin 76-07-24; and Conklin 76-07-41 and Conklin 76-07-67. Upward gradients (indicating discharge conditions) were apparent between Conklin 76-07-24 and Conklin 76-07-41.

4.1.2 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted by Matrix at all four monitoring well locations. Test analysis was conducted by visually matching a type curve to the recorded data. Data was analyzed using the KGS slug test method (Hyder et al. 1994). The results are summarized in Table 1 and Appendix E. Based on these tests, the estimated hydraulic conductivity values (K) ranged from 6×10^{-6} m/s (Conklin 76-07-67) to 6×10^{-5} m/s (Conklin 76-07-24).

4.1.3 Groundwater Quality

The interpreted water types at the Conklin 76-07 included:

- Conklin 76-07-6: Ca+Mg+HCO₃
- Conklin 76-07-24: Ca+Mg+HCO₃
- Conklin 76-07-41: Ca+Mg+Na+HCO₃
- Conklin 76-07-67: Ca+Mg+Na+HCO₃

Field-measured pH values ranged from 6.3 (Conklin 76-07-6) to 7.6 (Conklin 76-07-24), and were all within the Tier 1 guideline range of 6.5 to 8.5 except at well Conklin 76-07-6 (6.3), which was below the Tier 1 range. Laboratory-measured pH values ranged from 6.97 (Conklin 76-07-6) to 7.92 (Conklin 76-07-41). Field-measured EC values ranged from 100 μ S/cm (Conklin 76-07-6) to 760 μ S/cm (Conklin 76-07-67). There are no specific Tier 1 guidelines for EC. Field-measured dissolved oxygen (DO) values ranged from 0.8 mg/L (Conklin 76-07-24) to 7.6 mg/L (Conklin 76-07-6). There are no specific Tier 1 guidelines for DO.

Groundwater samples collected from the monitoring wells were generally within Tier 1 guidelines for routine parameters, except for iron, manganese and ammonia-nitrogen concentrations. The analytical results are provided in Table 3.

The laboratory analytical results indicated that iron concentrations ranged from less than the minimum detection limit of < 0.010 mg/L; (Conklin 76-07-6) to 1.42 mg/L (Conklin 76-07-41), and were above the Tier 1 guideline of 0.3 mg/L at Conklin 76-07-24 and Conklin 76-07-41. Manganese concentrations exceeded the Tier 1 guidelines at two of the four sampling locations and ranged from 0.0065 mg/L

(Conklin 76-07-6) to 1.99 mg/L (Conklin 76-07-24). Ammonia-nitrogen concentrations exceeded Tier 1 guidelines of 0.017 mg/L at all locations except at Conklin 76-07-6. Ammonia-nitrogen concentrations ranged from less than the minimum detection limit of 0.05 mg/L (Conklin 76-07-6) to 2.72 mg/L (Conklin 76-07-67).

Dissolved metals concentrations met the Tier 1 guidelines, except for dissolved iron and dissolved manganese concentrations at wells Conklin 76-07-41 and Conklin 76-07-24.

In November 2012, all monitoring locations [except Conklin 76-07-67] yielded dissolved hydrocarbon, PAH and naphthenic acid concentrations that were below the minimum detection limits (Tables 5 and 6). Monitoring well Conklin 76-07-67 yielded a low level (above detection limits, but below guideline concentrations) dissolved naphthalene concentration (Table 6).

All faecal coliforms concentrations reported at the monitoring well network locations were below method detection limits (Table 7).

4.2 Waddell Creek 80-9

Four boreholes (Waddell Creek 80-09-9, Waddell Creek 80-09-21, Waddell Creek 80-09-117 and Waddell Creek 80-09-149) were advanced at Waddell Creek 80-09 and installed as groundwater monitoring wells between October 16 and 20, 2012. Based on drill cutting observations and geophysical logs (Appendix B), the interpreted aquifers were determined (Table B).

Table B Interpreted Aquifer Characteristics at Waddell Creek 80-9

Location/Well name	Screened Interval (m bgs)	Interpreted Target Aquifer)
Waddell Creek 80-09-9	6.1 - 9.2	Uppermost water-bearing units
Waddell Creek 80-09-21	17.0 - 20.5	Sand River
Waddell Creek 80-09-117	111.0 - 117.0	Ethel Lake
Waddell Creek 80-09-149	146.0 - 148.8	Bonnyville Sand

4.2.1 Site Stratigraphy and Groundwater Levels

According to the geologic logs (Appendix B), the observed lithology at this location was generally comprised of sand and clay till. The sands are well-sorted, sub-angular to sub-rounded, fine to coarse light brown, loose and wet. Moisture content increased at a depth of 8 m bgs. Trace gravels and pebbles were noted throughout. Traces of quartz and boulders were noted within the sandy zones. Moderately to highly-plastic, brown to dark grey clay layers were observed at borehole Waddell Creek 80-09-149 (the deepest well). Generally, the clay layer thickness varied from 6.1 to 20.7 m. The first groundwater-bearing zone was encountered at approximately 3 m bgs. The maximum depth of investigation was 149 m bgs and bedrock was not encountered.

The static water level during field sampling is shown in Table 7. On October 22, 2012, depths to groundwater ranged from 7.34 m bgs (Waddell Creek 80-09-9) to 33.09 m bgs (Waddell Creek 80-09-149). Vertical hydraulic gradients were calculated from hydraulic head elevations and in November 2012, downward gradients (indicating recharge conditions) were apparent between all wells.

4.2.2 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted by Matrix at all wells. Data was analyzed using the Dougherty Badu pumping test (Dougherty and Babu 1984), Hvorslev slug test (Hvorslev 1951) and KGS slug test methods (Hyder et al. 1994). The results are summarized in Table 1 and Appendix E. Based on these tests, the estimated hydraulic conductivity values (K) ranged from 1×10^{-6} m/s (Waddell Creek 80-09-149) to 5×10^{-4} m/s (Waddell Creek 80-09-117).

4.2.3 Groundwater Quality

The interpreted water types at Waddell Creek 80-09 included:

- Waddell Creek 80-09-9: Ca+Mg+HCO₃
- Waddell Creek 80-09-21: Ca+Mg+HCO₃
- Waddell Creek 80-09-117: Ca+Na+HCO₃
- Waddell Creek 80-09-149: Ca+Na+HCO₃

Field-measured pH values ranged from 7.3 (Waddell Creek 80-09-21) to 7.6 (Waddell Creek 80-09-9), and were all within the Tier 1 guideline range of 6.5 to 8.5. Laboratory-measured pH values ranged from 7.87 (Waddell Creek 80-09-21) to 8.05 (Waddell Creek 80-09-9). Field-measured EC values ranged from 510 μ S/cm (Waddell Creek 80-09-21) to 890 μ S/cm (Waddell Creek 80-09-9). Field-measured DO values ranged from 2.0 mg/L (Waddell Creek 80-09-149) to 6.8 mg/L (Waddell Creek 80-09-9). There are no specific Tier 1 guidelines for EC or DO.

Although most routine parameters were within the Tier 1 guidelines (Table 3), reported concentrations of dissolved iron, manganese, TDS, ammonia-nitrogen and phenol exceeded Tier 1 guidelines at one or more locations at Waddell Creek 80-09.

Laboratory analytical results indicated that dissolved iron concentrations ranged from less than the minimum detection limit of <0.030 mg/L (Waddell Creek 80-09-9) to 1.32 mg/L (Waddell Creek 80-09-149) and were above the Tier 1 guideline of 0.3 mg/L at all the monitored wells except Waddell Creek 80-09-9. Dissolved manganese and ammonia-nitrogen concentrations exceeded the Tier 1 guidelines at all sampling locations. The reported TDS concentrations ranged from 276 mg/L (Waddell Creek 80-09-21) to 537 mg/L (Waddell Creek 80-09-149) and exceeded the Tier 1 guidelines of 0.05 mg/L at Waddell Creek 80-09-149. Phenol concentrations were below the minimum detection limit (< 0.0010 mg/L) at two wells and above the Tier 1 guideline at the other two.

Dissolved metals concentrations met the Tier 1 guidelines, except for dissolved iron (Waddell Creek 80-09-149, Waddell Creek 80-09-117 and Waddell Creek 80-09-21), dissolved manganese (all wells), dissolved selenium (Waddell Creek 80-09-9) and dissolved uranium (Waddell Creek 80-09-9).

In October 2012, all monitoring locations, except Waddell Creek 80-09-149 yielded dissolved hydrocarbon and total naphthenic acid concentrations that were below the minimum detection limit (Table 5). Monitoring well Waddell Creek 80-09-149 yielded dissolved naphthalene concentration of 1.0 mg/L. There are no specific Tier 1 guidelines for naphthenic acid.

Concentrations of PAH constituents were below respective minimum detection limit, except for naphthalene, at Waddell Creek 80-09-9 and Waddell Creek 80-09-149 (Table 6).

4.3 Mariana Lakes 80-13

Four boreholes (Mariana Lakes 80-13-7, Mariana Lakes 80-13-52, Mariana Lakes 80-13-112 and Mariana Lakes 80-13-134) were drilled at Mariana Lakes 80-13 and installed as groundwater monitoring wells between October 27 and 31, 2012. Based on drill cuttings observations and geophysical logs (Appendix B), the interpreted aquifers were determined (Table C).

Table C Interpreted Aquifer Characteristics at Mariana Lakes 80-13

Location/Well name	Screened Interval (m bgs)	Interpreted Target Aquifer)
Mariana Lakes 80-13-50	43.0 - 49.5	Ethel Lake
Mariana Lakes 80-13-112	108.6 - 111.6	Bonnyville Sand
Mariana Lakes 80-13-134	130.5 - 133.5	Empress Terrace

4.3.1 Site Stratigraphy and Groundwater Levels

According to the geologic logs (Appendix B), the observed lithology at this location was generally comprised of sand and clay. The sands are poorly to well-sorted, sub angular to rounded, fine to coarse light brown, loose and wet. Moisture content increased at a depth of 6.48 m bgs. Gravels were noted at depth interval 51.8 to 57.9 m bgs and shale was noted at depth interval 137.2 to 140.2 m bgs. Rock fragments and some pebbles were noted throughout. Generally, brown to dark grey clay layers with varying thicknesses were observed at depth intervals 0 to 33.5, 38.6 to 41.1, 54.8 to 57.9 and 67.1 to 94.5 m bgs at borehole Mariana Lakes 80-13-134 (the deepest well). The first groundwater-bearing zone was encountered at approximately 5.9 m bgs. The maximum depth of investigation was 140.2 m bgs and shale was encountered at depth of 137.2 m bgs.

On November 17, 2012, depths to groundwater ranged from 5.67 m bgs (Mariana Lakes 80-13-8) to 45.18 m bgs (Mariana Lakes 80-13-134). Vertical hydraulic gradients were calculated from hydraulic head elevations and in November 2012, downward gradients (indicating recharge conditions) were apparent between all wells.

4.3.2 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted by Matrix at all locations. Data was analyzed using the Bouwer and Rice slug test (Bouwer and Rice 1976), and KGS slug test methods (Hyder et al. 1994); the results are summarized in Table 1 and Appendix E. Based on these tests, the estimated hydraulic conductivity values (K) ranged from 1×10^{-5} m/s (Mariana Lakes 80-13-52) to 2×10^{-4} m/s (Mariana Lakes 80-13-112).

4.3.3 Groundwater Quality

The interpreted water types at Mariana Lakes 80-13 included:

- Mariana Lakes 80-13-8: Ca+Mg+HCO₃
- Mariana Lakes 80-13-50: Ca+Mg+HCO₃
- Mariana Lakes 80-13-112: Na+Ca+HCO₃+SO₄
- Mariana Lakes 80-13-134: Na+Ca+HCO₃+SO₄

Field-measured pH values ranged from 7.0 (Mariana Lakes 80-13-7) to 7.5 (Mariana Lakes 80-13-112) and were all within the Tier 1 guideline range of 6.5 to 8.5. Laboratory-measured pH values ranged from 7.54 (Mariana Lakes 80-13-7) to 7.96 (Mariana Lakes 80-13-7). Field-measured EC values ranged from 440 μ S/cm (Mariana Lakes 80-13-7) to 850 μ S/cm (Mariana Lakes 80-13-112). Field-measured DO values ranged from 1.6 mg/L (Mariana Lakes 80-13-112) to 7.0 mg/L (Mariana Lakes 80-13-7). There are no specific Tier 1 guidelines for EC or DO.

Generally, the routine parameters were within the Tier 1 guidelines (Table 3). Reported concentrations of dissolved iron, dissolved manganese, TDS, ammonia-nitrogen and phenol concentrations were in excess of the Tier 1 guidelines from one well at Mariana Lakes 80-13.

The laboratory analytical results indicated dissolved manganese and ammonia-nitrogen concentrations exceeded the Tier 1 guidelines at all monitoring locations. The TDS concentrations from the two deepest monitoring wells (Mariana Lakes 80-13-112 and Mariana Lakes 80-13-134) both exceeded the Tier 1 guidelines. Dissolved iron concentrations at the two shallowest wells (Mariana Lakes 80-13-7 and Mariana Lakes 80-13-52) exceeded Tier 1 guidelines. Phenol concentrations ranged from less than the minimum detection limit of 0.001 mg/L (Mariana Lakes 80-13-112) to 0.005 mg/L (Mariana Lakes 80-13-7) and exceeded the Tier 1 guideline of 0.004 mg/L at wells Mariana Lakes 80-13-7.

Dissolved metals concentrations met the Tier 1 guidelines, except for dissolved arsenic (Mariana Lakes 80-13-52 and Mariana Lakes 80-13-134), dissolved iron (Mariana Lakes 80-13-7 and Mariana Lakes 80-13-52), dissolved manganese (all wells) and dissolved selenium (Mariana Lakes 80-13-7), which exceeded their respective Tier 1 guideline values.

In November 2012, all monitoring locations yielded dissolved hydrocarbon constituents and naphthenic acid concentrations that were below the minimum detection limit (Table 5).

Reported PAH concentrations were below the minimum detection limit except for acephthene and fluorine at Mariana Lakes 80-13-7 only and naphthalene at Mariana Lakes 80-13-7, Mariana Lakes 80-13-112 and Mariana Lakes 80-13-134 (Table 6). Only naphthalene concentrations at Mariana Lakes 80-13-7 (0.00237 mg/L) and exceeded the Tier 1 guidelines (0.0011 mg/L).

All faecal coliforms concentrations reported at Mariana Lakes 80-13-7 were below method detection limits (Table 7).

4.4 House Crossing 77-15

Three boreholes (House Crossing 77-15-82, House Crossing 77-15-126 and House Crossing 77-15-160) were drilled and completed as monitoring wells at House Crossing 77-15 between November 7 and 13, 2012. Monitoring wells House Crossing 77-15-8 and House Crossing 77-15-231 were previously installed as part of an Alberta Geological Survey research project (Lemay and Jean 2002). Monitoring wells House Crossing 77-15-8 and House Crossing 77-15-231 were previously identified as WR 99-1-8(WT) and WR 99-1-230 (Lemay and Jean 2002).

Based on the drill cuttings and geophysical logs (Appendix B), the interpreted aquifers were determined (Table D).

Table D Interpreted Aquifer Characteristics at House Crossing 77-15

Location/Well name	Screened Interval (m bgs)	Interpreted Target Aquifer)
House Crossing 77-15-8*	-	Uppermost water-bearing units
House Crossing 77-82	78.0 - 81.5	Ethel Lake
House Crossing 77-15-126	120.0 - 126.0	Bonnyville Sand
House Crossing 77-15-160	155.0 - 161.0	Muriel Lake
House Crossing 77-15-231*	227.69 - 230.73	Empress Channel

*- pre-existing wells.

4.4.1 Site Stratigraphy and Groundwater Levels

The two existing wells, House Crossing 77-15-8 and House Crossing 77-15-231, were installed at depths 8 and 231 m bgs in 2002. These were incorporated with the SAOS monitoring network to assess groundwater conditions within the Uppermost Water-bearing Zone and Empress Channel aquifers. According to the geologic logs (Appendix B), the observed lithology at this location was generally comprised of sand and clay till. The sands were sub-angular to sub-rounded, fine to coarse, loose and wet. Moisture content increased at a depth of 1.85 m bgs. Trace silt and interbedded sands were noted throughout. Generally, light to dark grey clay layer thicknesses varied from 3.1 to 70.7 m were observed

at borehole House Crossing 77-15-161. The first groundwater-bearing zone was encountered at approximately 1.85 m bgs. The maximum depth investigated (at this network) was 231 m bgs and bedrock was not encountered.

On November 19, 2012, water levels were measured at all wells and the depths to groundwater varied from 1.85 m bgs (House Crossing 77-15-8) to 69.01 m bgs (House Crossing 77-15-231). Vertical hydraulic gradients were calculated from hydraulic head elevations. In November 2012, downward gradients (indicating recharge conditions) were apparent between:

- House Crossing 77-15-8 and House Crossing 77-15-82
- House Crossing 77-15-126 and House Crossing 77-15-161
- House Crossing 77-15-161 and House Crossing 77-15-231

Upward gradients (indicating discharge conditions) were apparent between House Crossing 77-15-82 and House Crossing 77-15-126.

4.4.2 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted by Matrix at all monitoring wells. Data was analyzed using the Bouwer and Rice slug test (Bouwer and Rice 1976), and KGS slug test methods (Hyder et al. 1994). The results are summarized in Table 1 and Appendix E. Based on these tests, the estimated hydraulic conductivity values (K) ranged from 2×10^{-6} m/s (House Crossing 77-15-8) to 1×10^{-4} m/s (House Crossing 77-15-126).

4.4.3 Groundwater Quality

The interpreted water types at House Crossing 77-15 included:

- House Crossing 77-15-8: Ca+Mg+HCO₃
- House Crossing 77-15-82: Na+Ca+HCO₃
- House Crossing 77-15-126: Ca+Na+Mg+HCO₃
- House Crossing 77-15-161: Ca+Na+Mg+HCO₃
- House Crossing 77-15-231: Na+Ca+HCO₃

Field-measured pH values ranged from 7.3 (House Crossing 77-15-8) to 7.8 (House Crossing 77-15-82) and were all within the Tier 1 guideline range of 6.5 to 8.5. Laboratory-measured pH values ranged from 7.59 (House Crossing 77-15-8) to 8.12 (House Crossing-15-82). Field-measured EC values ranged from 610 μ S/cm (House Crossing 77-15-8) to 990 μ S/cm (House Crossing 77-15-82). Field-measured DO values ranged from 2.2 mg/L (House Crossing 77-15-8) to 7.5 mg/L (House Crossing 77-15-126). There are no specific Tier 1 guidelines for EC or DO.

Generally, groundwater samples from House Crossing 77-15 had reported concentrations within Tier 1 guidelines. All dissolved manganese and ammonia-nitrogen concentrations exceeded the Tier 1 guidelines at all sampling locations. Reported TDS and phenol concentrations at House Crossing 77-15-82 (556 and 0.071 mg/L, respectively) exceeded the Tier 1 guidelines. Dissolved iron concentrations at the shallowest monitoring well (House Crossing 77-15-8) also exceeded the Tier 1 guidelines.

Dissolved metals concentrations met the Tier 1 guidelines, except for dissolved arsenic (House Crossing 77-15-82 and House Crossing 77-15-126), dissolved boron (House Crossing 77-15-82), dissolved iron (House Crossing 77-15-8), and manganese (all wells), which exceeded their respective Tier 1 guideline values.

All monitoring locations yielded dissolved PHC constituents and naphthenic acid concentrations that were below the minimum detection limit except toluene concentrations measured at four of the five monitoring wells. However, all toluene concentrations were below the Tier 1 guideline value (Table 5).

Reported PAH concentrations constituents were below the minimum detection limit except naphthalene concentrations measured at three locations, although all concentrations were below the Tier 1 guidelines (Table 6). Naphthalene concentrations ranged from less than the minimum detection limit of 0.00005 mg/L (House Crossing 77-15-8 and House Crossing 77-15-231) to 0.000358 mg/L (House Crossing 77-15-161).

All faecal coliforms concentrations reported at House Crossing 77-15-8 and House Crossing 77-15-82 were below method detection limits (Table 7).

4.5 Plamondon 68-16

Four boreholes (Plamondon 68-16-7, Plamondon 68-16-39, Plamondon 68-16-51 and Plamondon 68-16-70) were advanced and installed as groundwater monitoring wells between November 14 and 16, 2012. Based on drill cutting observations and geophysical logs (Appendix B), the interpreted aquifers were determined (Table E).

Table E Interpreted Aquifer Characteristics at Plamondon 68-16

Location/Well name	Screened Interval (m bgs)	Interpreted Target Aquifer)
Plamondon 68-16-7	5.0 - 7.3	Uppermost water-bearing units
Plamondon 68-16-39	33.0 - 38.5	Bonyville Sand Upper
Plamondon 68-16-51	45.0 - 51.2	Bonyville Sand Lower
Plamondon 68-16-70	64.0 - 69.5	Empress Channel

4.5.1 Site Stratigraphy and Groundwater Levels

According to the geologic logs (Appendix B), the lithology at this location was generally comprised of sand and clay. The sands are poorly to well graded, sub-rounded, fine to coarse, and red to grey. Moisture content increased at a depth of 6.64 m bgs. Trace gravels were noted at the 8.5 to 56.4 m bgs depth interval. The dark grey clay unit varied in thickness from 2.2 to 11.9 m. The maximum depth of investigation was 73.1 m bgs and bedrock was not encountered.

On November 21, 2012, depths to groundwater varied from 6.64 m bgs (Plamondon 68-16-7) to 31.38 m bgs (Plamondon 68-16-51). Vertical hydraulic gradients were calculated from hydraulic head elevations. In November 2012, downward gradients (indicating recharge conditions) were apparent between Plamondon 68-16-7 and Plamondon 68-16-39; and Plamondon 68-16-39 and Plamondon 68-16-51. Upward gradients (indicating discharge conditions) were apparent between Plamondon 68-16-51 and Plamondon 68-16-70.

4.5.2 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted by Matrix at the all wells. Data was analyzed using the Bouwer and Rice slug test (Bouwer and Rice 1976) method; the results are summarized in Table 1 and Appendix E. Based on these tests, the estimated hydraulic conductivity values (K) ranged from 1×10^{-5} m/s (Plamondon 68-16-7) to 9×10^{-6} m/s (Plamondon 68-16-70).

4.5.3 Groundwater Quality

The interpreted water types at Plamondon 68-16 included:

- Plamondon 68-16-7: Na+Ca+HCO₃
- Plamondon 68-16-39: Na+Ca+HCO₃+SO₄
- Plamondon 68-16-51: Na+HCO₃
- Plamondon 68-16-70: Na+Cl+HCO₃

Field-measured pH values ranged from 8.0 (Plamondon 68-16-39 and Plamondon 68-16-51) to 8.4 (Plamondon 68-16-70) and were all within the Tier 1 guideline range of 6.5 to 8.5. Laboratory-measured pH values ranged from 8.09 (Plamondon 68-16-7) to 8.34 (Plamondon 68-16-70). Field-measured EC values ranged from 460 μ S/cm (Plamondon 68-16-7) to 15,180 μ S/cm (Plamondon 68-16-70). The field-measured EC values at the two deepest locations (Plamondon 68-16-51 and Plamondon 68-16-70) were higher than the laboratory-reported EC values and; therefore, should be confirmed. Field-measured DO values ranged from 1.0 mg/L (Plamondon 68-16-70) to 10.5 mg/L (Plamondon 68-16-7). There are no specific Tier 1 guidelines for EC or DO.

Reported concentrations for general routine parameters were generally within the Tier 1 guidelines. All monitoring wells yielded concentrations of sodium and TDS (except the shallowest well Plamondon

68-16-7) and ammonia-nitrogen in excess of Tier 1 guidelines. Chloride concentrations at Plamondon 68-16-70 (550 mg/L) exceeded the Tier 1 guideline.

Dissolved metals concentrations met the Tier 1 guidelines, except for dissolved antimony (Plamondon 68-16-7), dissolved arsenic (Plamondon 68-16-39, Plamondon 68-16-51 and Plamondon 68-16-70), dissolved chromium (Plamondon 68-16-70) and selenium (Plamondon 68-16-7).

All monitoring locations yielded dissolved PHC constituents and total naphthenic acid concentrations that were below the minimum detection limit, except toluene (Plamondon 68-16-7 and Plamondon 68-16-39), xylenes (Plamondon 68-16-7) and total naphthenic acids (Plamondon 68-16-51). All reported dissolved hydrocarbon and total naphthalene acids concentrations were below the respective Tier 1 guideline values (Table 5).

All reported PAH concentrations were below the minimum detection limits, except naphthalene concentrations measured at wells Plamondon 68-16-7, Plamondon 68-16-39 and Plamondon 68-16-51 (Table 6). However, all PAH concentrations were below the Tier 1 guideline line value of 0.0011 mg/L.

All faecal coliforms concentrations reported at Plamondon 68-16-7 were below method detection limits (Table 7).

5 SUMMARY

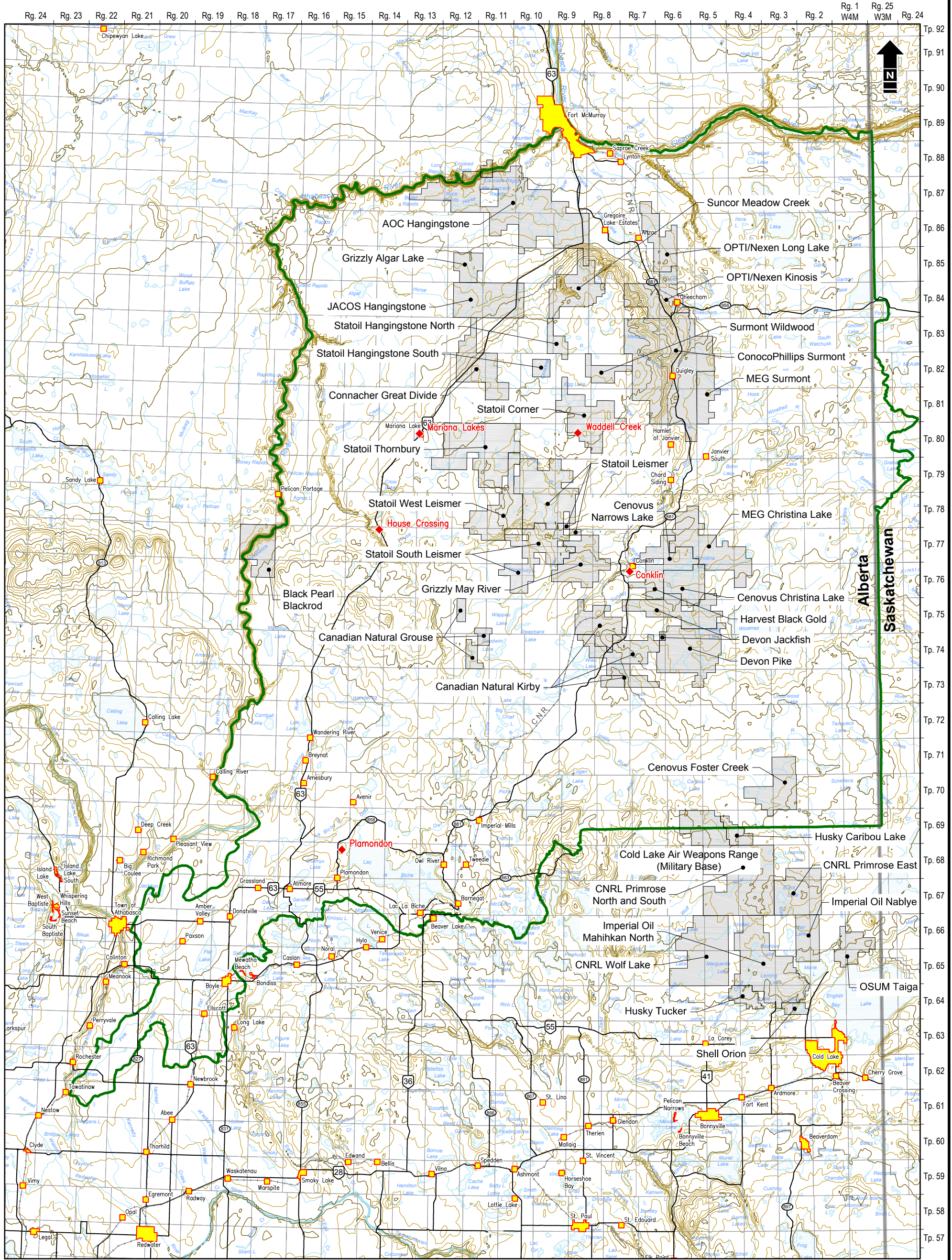
- This report provides details regarding the installation, development, monitoring, water quality and hydraulic response testing of 21 monitoring wells completed at 5 locations within the SAOS region,.
- The initial phase of constructing a regional monitoring network for the SAOS region included installing monitoring wells at 11-30-076-07 W4M (Conklin 76-07), 08-27-080-09 W4M (Waddell Creek 80-09), 07-19-080-13 W4M (Mariana Lakes 80-13), 07-36-077-15 W4M (House Crossing 77-15) and 10-26-068-16 W4M (Plamondon 68-16).
- Hydraulic conductivity values were estimated for each aquifer incorporated within the monitoring network, including the upper most water-bearing zone (6×10^{-5} to 9×10^{-5} m/s); the Bonnyville Sand Aquifer (1×10^{-6} to 2×10^{-4} m/s); the Ethel Lake Aquifer (8×10^{-6} to 5×10^{-4} m/s); Sand River Aquifer (6×10^{-5} to 3×10^{-4} m/s); the Empress Channel Aquifer (2×10^{-6} to 3×10^{-5} m/s); the Empress Terrace Aquifer (2×10^{-4}) and Muriel Lake Aquifer (3×10^{-5} m/s).
- The observed lithology was comprised of mainly clay and sand with trace gravels and pebbles.
- All analyzed general and inorganic parameters concentrations were within Tier 1 guidelines, except for sodium, iron, manganese, chloride, TDS, ammonia-nitrogen and phenol concentrations.
- Groundwater chemistry at all monitoring locations was similar and in general, included sodium+calcium+bicarbonate (Na+Ca+HCO₃) type water.
- All analyzed dissolved metal parameter concentrations were within Tier 1 guidelines, except for silver, arsenic, boron, chromium, iron, manganese and selenium.

- All analyzed dissolved hydrocarbons constituents and naphthenic acids concentrations were either below the laboratory detection limits or within Tier 1 guidelines.
- All analyzed PAHs constituents concentrations were either below the laboratory detection limits or within Tier 1 guidelines.
- Faecal coliforms were not detected in any groundwater samples collected in 2012.

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- South Athabasca Oil Sands Study Area (SAOS)
- 100 m Ground Surface Contour (masl)
- 25 m Ground Surface Contour (masl)
- Community
- Existing and Approved Oil Sands Producer's Lease
- Water Body / Watercourse
- Highway
- ◆ Well Pad Where SAOS Groundwater Monitoring Network was Installed in 2012

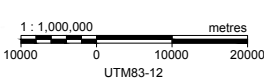


Alberta Environment and Sustainable Resource Development
SAOS Region

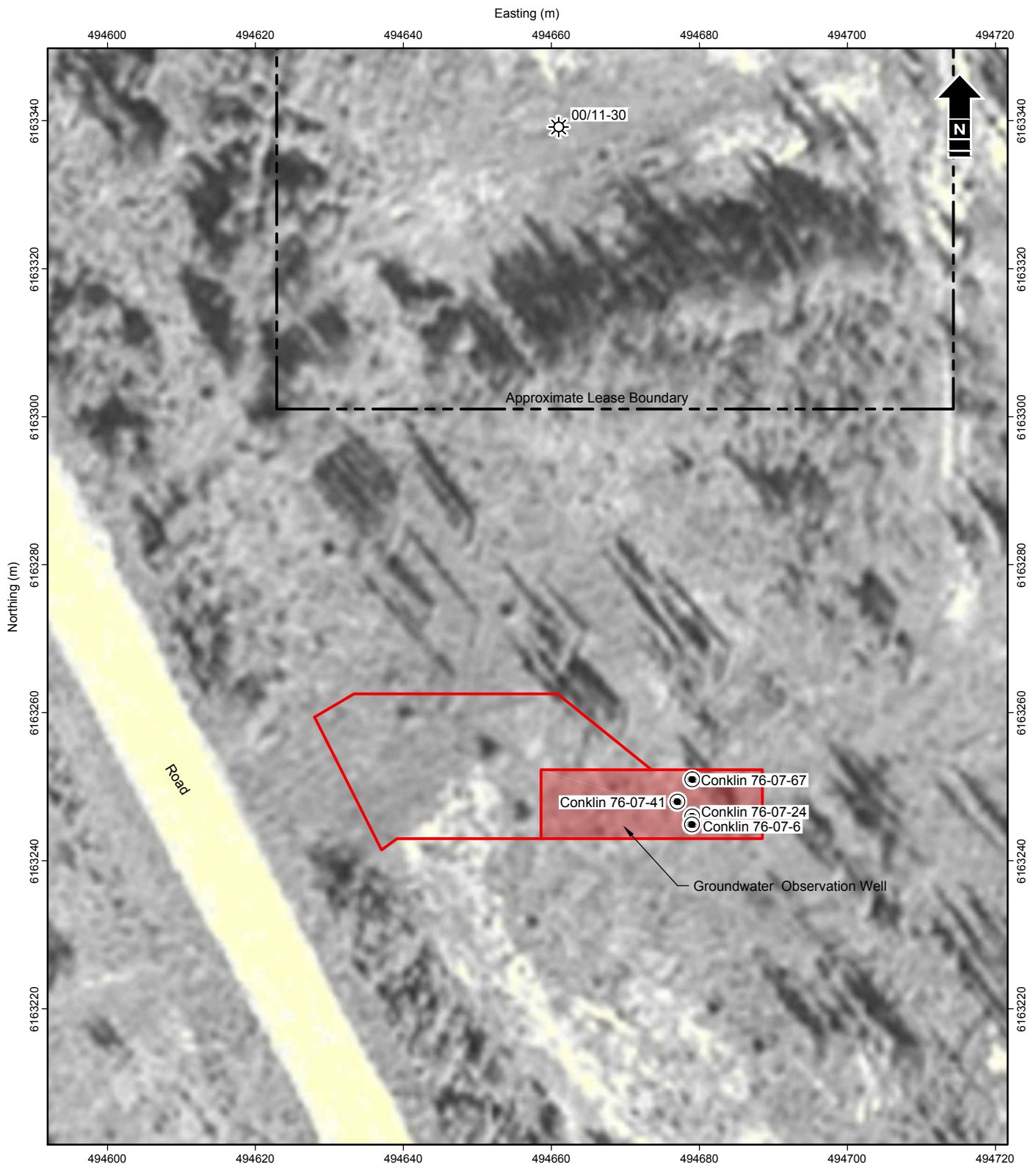
Southern Athabasca Oil Sands Region




Date: April 2013 Project: 16054-SP-502-12 Technical: E. Amankwah Reviewer: S. Duchek Drawn: R. Crescini

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Reference:



-  Well Centre
-  Monitoring Well
-  Outline of DRS 120018



Alberta Environment and Sustainable Resources Development
11-30-076-07 W4M

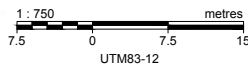
Site Plan for Conklin 76-7

Date: January 2013	Project: 16054-AP-12	Technical: E. Amankwah	Reviewer: S. Duchek	Drawn: R. Crescini
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Figure 2

Reference: September 15, 2008 aerial photograph obtained from Valtus Imagery Services.





-  Monitoring Well
-  Outline of DRS 000013



Alberta Environment and Sustainable Resources Development
08-27-080-09 W4M

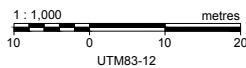
Site Plan for Waddell Creek 80-9

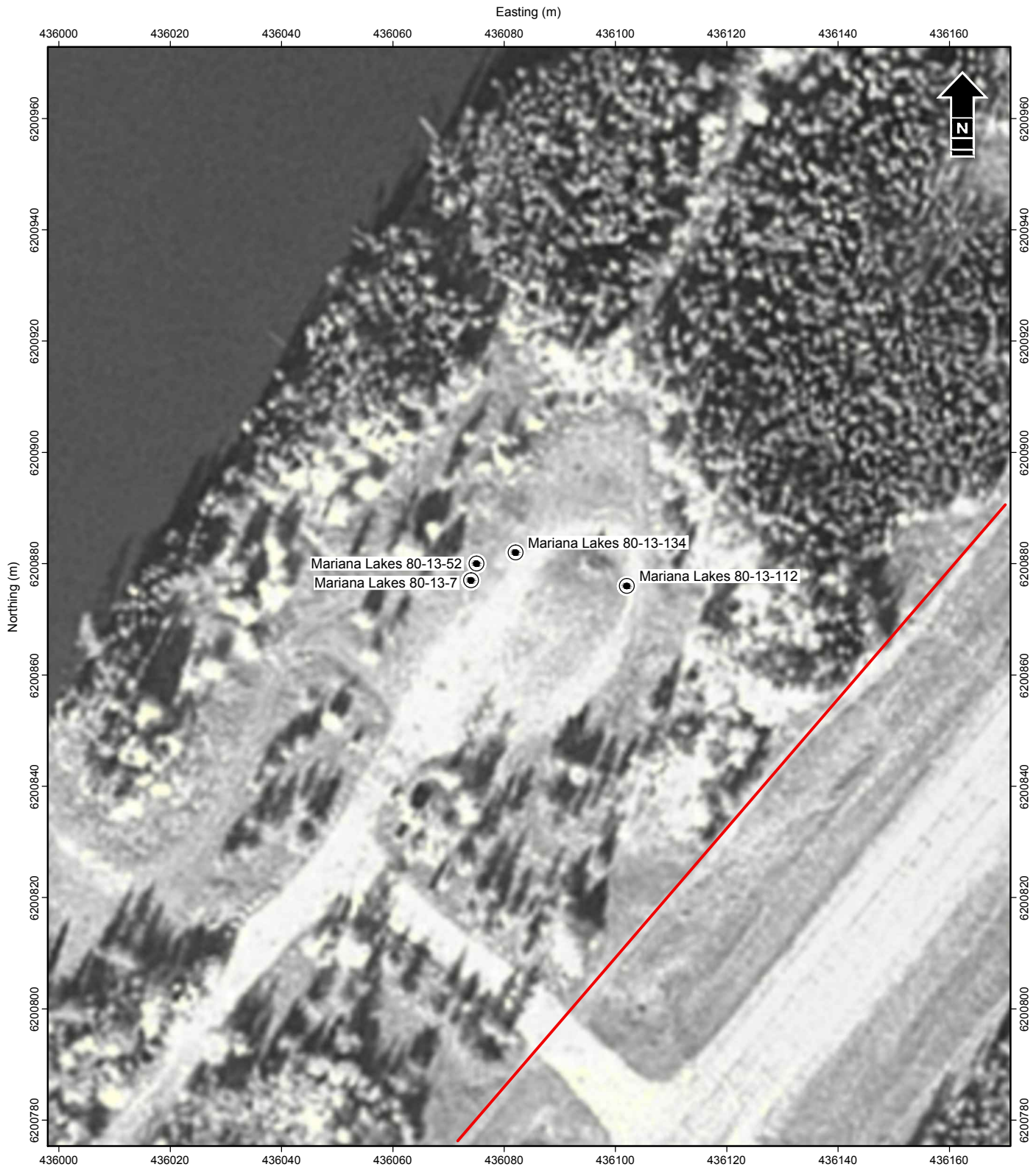
Date: January 2013	Project: 16054-AP-12	Technical: E. Amankwah	Reviewer: S. Duchek	Drawn: R. Crescini
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Figure 3

Reference: September 15, 2008 aerial photograph obtained from Valvus Imagery Services.





-  Monitoring Well
-  Outline of DRS 800103



Alberta Environment and Sustainable Resources Development
07-19-080-13 W4M

Site Plan for Mariana Lakes 80-13

Date: January 2013	Project: 16054-AP-12	Technical: E. Amankwah	Reviewer: S. Duchek	Drawn: R. Crescini
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Reference: July 15, 2006 - July 15, 2007 aerial photograph obtained from Valtus Imagery Services.



F:\16054\Drawing\2013\16054-AP-12.dwg - HouseRiver - Monday, April 29, 2013 5:59:24 AM - Rommel Crescini

- Well Centre
- Monitoring Well
- Outline of DRS 000014



Alberta Environment and Sustainable Resources Development
07-36-077-15 W4M

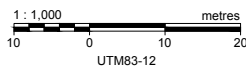
Site Plan for House Crossing 77-15

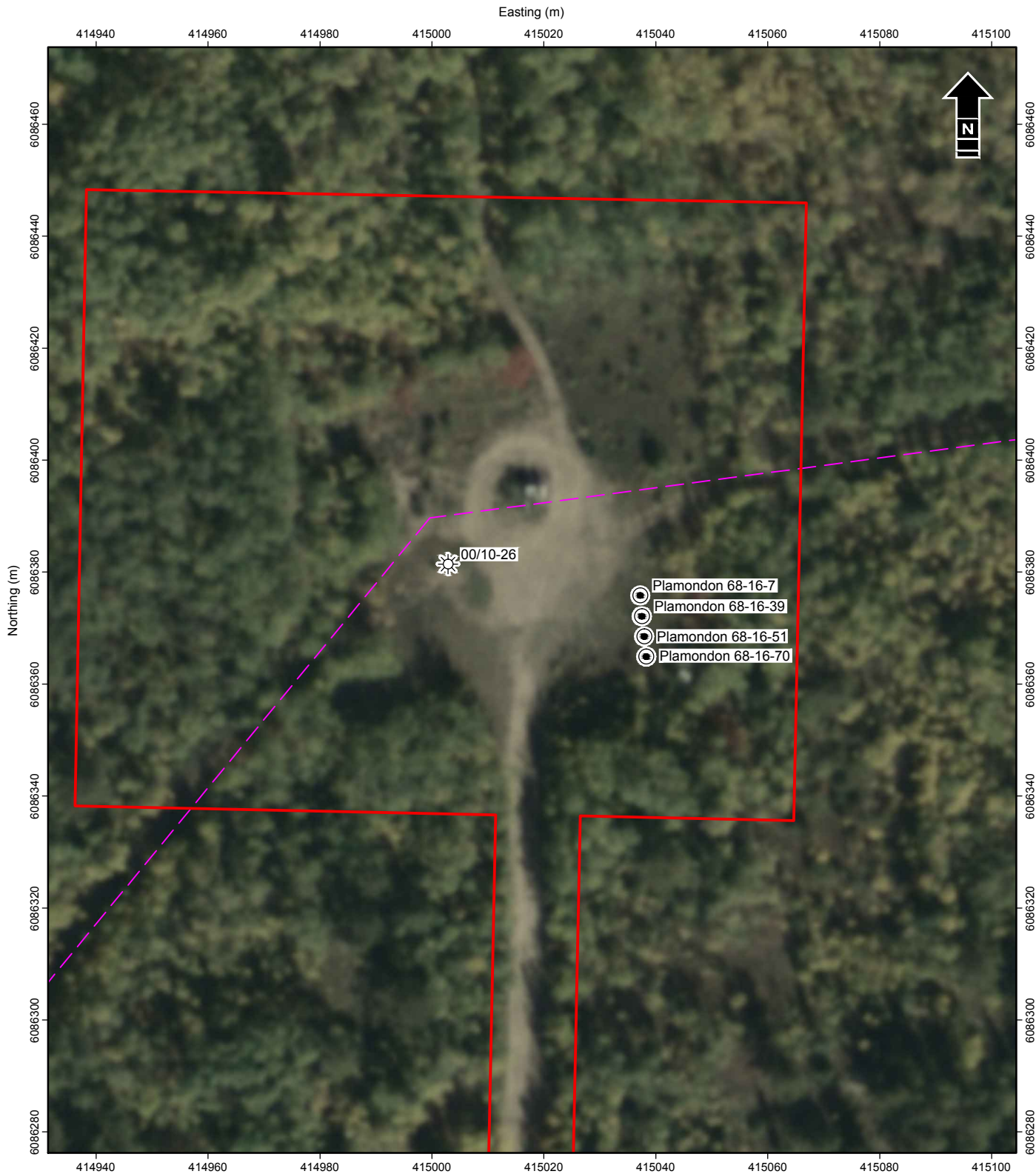
Date:	Project:	Technical:	Reviewer:	Drawn:
January 2013	16054-AP-12	E. Amankwah	S. Duchek	R. Crescini





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Figure 5

Reference: July 3 - Sept. 2, 2006 aerial photograph obtained from Valvus Imagery Services.





-  Well Centre
-  Monitoring Well
-  Buried Pipeline
-  Outline of MSL 11496



Alberta Environment and Sustainable Resources Development
10-26-068-16 W4M

Site Plan for Plamondon 68-16

Date:	January 2013	Project:	16054-AP-12	Technical:	E. Amankwah	Reviewer:	S. Duchek	Drawn:	R. Crescini
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Reference: July 13 - Sept. 2, 2006 aerial photograph obtained from Valtus Imagery Services.

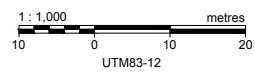


TABLE 1.

MONITORING WELL SUMMARY

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Elevation* (masl)					Depth (m)															Hydraulic Conductivity (m/s)	Method	Lithology of Screened Interval	
	Ground Surface	Top of Casing	Stick Up	22-Oct-12 [^]	15-Nov-12	17-Nov-12	19-Nov-12	21-Nov-12	Grnd. to Total Drilled	Grnd. to Top of Screen	Grnd. to Base of Screen	22-Oct-12 [^]		15-Nov-12		17-Nov-12		19-Nov-12		21-Nov-12				
				Water Level	Water Level	Water Level	Water Level	Water Level				Top of Casing to Water	Grnd. to Water	Top of Casing to Water	Grnd. to Water	Top of Casing to Water	Grnd. to Water	Top of Casing to Water	Grnd. to Water	Top of Casing to Water				Grnd. to Water
Conklin 76-07-6	575.31	576.09	0.78	---	573.24	---	---	---	6.1	3.0	6.1	---	---	2.85	2.07	---	---	---	---	---	---	2E-05	KGS	sand, clay
Conklin 76-07-24	575.21	576.01	0.80	---	569.28	---	---	---	24.4	20.5	23.5	---	---	6.73	5.93	---	---	---	---	---	---	6E-05	KGS	clay, sand, clay
Conklin 76-07-41	575.10	575.84	0.74	---	571.86	---	---	---	42.7	35.0	41.0	---	---	3.98	3.24	---	---	---	---	---	---	1E-05	KGS	sand
Conklin 76-07-67	575.04	575.78	0.74	---	571.32	---	---	---	68.0	61.0	67.0	---	---	4.46	3.72	---	---	---	---	---	---	6E-06	KGS	clay, sand
Waddell Creek 80-09-9	717.98	718.73	0.75	710.64	---	---	---	---	9.2	6.1	9.2	8.09	7.34	---	---	---	---	---	---	---	---	2E-05	KGS	sand
Waddell Creek 80-09-21	717.93	718.65	0.72	709.40	---	---	---	---	24.4	17.0	20.5	9.25	8.53	---	---	---	---	---	---	---	---	3E-04	H	sand
Waddell Creek 80-09-117	717.91	718.55	0.64	698.28	---	---	---	---	119.5	111	117	20.27	19.63	---	---	---	---	---	---	---	---	5E-04	H	sand
Waddell Creek 80-09-149	717.79	718.48	0.69	684.70	---	---	---	---	148.8	146	149	33.78	33.09	---	---	---	---	---	---	---	---	1E-06	D	clay
Mariana Lakes 80-13-7	692.90	693.51	0.61	---	---	687.03	---	---	7.6	4.6	7.6	---	---	---	---	6.48	5.87	---	---	---	---	3E-05	BR	clay and sand
Mariana Lakes 80-13-52	692.84	693.55	0.71	---	---	682.61	---	---	51.8	43.0	49.5	---	---	---	---	10.94	10.23	---	---	---	---	1E-05	BR	sand
Mariana Lakes 80-13-112	692.96	693.56	0.60	---	---	676.82	---	---	113.0	108	111	---	---	---	---	16.74	16.14	---	---	---	---	2E-04	KGS	clay
Mariana Lakes 80-13-134	692.89	693.51	0.62	---	---	647.71	---	---	140.2	131	134	---	---	---	---	45.80	45.18	---	---	---	---	2E-04	KGS	clay
House Crossing 77-15-8	662.60	663.61	1.01	---	---	---	661.76	---	---	5.5	8.5	---	---	---	---	---	---	1.85	0.84	---	---	2E-06	BR	---
House Crossing 77-15-82	662.51	663.18	0.67	---	---	---	597.23	---	85.3	78.0	81.5	---	---	---	---	---	---	65.95	65.28	---	---	8E-06	KGS	sand
House Crossing 77-15-126	662.48	663.16	0.68	---	---	---	610.66	---	128.0	120	126	---	---	---	---	---	---	52.50	51.82	---	---	1E-04	BR	sand
House Crossing 77-15-161	662.52	663.24	0.72	---	---	---	601.29	---	164.6	155	161	---	---	---	---	---	---	61.95	61.23	---	---	3E-05	BR	sand
House Crossing 77-15-231	662.46	663.21	0.75	---	---	---	594.20	---	231.0	223	231	---	---	---	---	---	---	69.01	68.26	---	---	6E-05	BR	---
Plamondon 68-16-7	577.92	578.64	0.72	---	---	---	---	572.00	9.7	5.0	7.3	---	---	---	---	---	---	---	---	6.64	5.92	1E-05	BR	sand, clay, sand
Plamondon 68-16-39	577.88	578.61	0.73	---	---	---	---	549.43	46.3	33.0	38.5	---	---	---	---	---	---	---	---	29.18	28.45	4E-05	BR	sand
Plamondon 68-16-51	577.86	578.57	0.71	---	---	---	---	547.19	52.4	45.0	51.2	---	---	---	---	---	---	---	---	31.38	30.67	2E-05	BR	sand
Plamondon 68-16-70	577.76	578.46	0.70	---	---	---	---	547.20	73.1	64.0	69.5	---	---	---	---	---	---	---	---	31.26	30.56	9E-05	BR	clay, sand, clay

Notes:

- * - elevations are geodetic
- masl - metres above sea level
-
- ^ - water levels taken on Oct 22-23
- H - Hvorslev analysis method (1951)
- B - Bouwer and Rice method (1976)
- KGS - Hyder et al method (1994)
- BR - Butler method (1998)
- D - Dougherty Badu analysis method (1984)

TABLE 2.**GROUNDWATER QUALITY RESULTS - FIELD MEASURED PARAMETERS**

Alberta Environment and Sustainable Resources Development (ESRD)
 Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Temp °C	Field pH	Field EC** µS/cm	Field DO mg/L
Conklin 76-07-6	15-Nov-12	16054121115104	5.4	6.3	100	7.6
Conklin 76-07-24	15-Nov-12	16054121115103	4.0	7.6	370	0.8
Conklin 76-07-41	15-Nov-12	16054121115102	4.2	7.4	750	1.0
Conklin 76-07-67	15-Nov-12	16054121115101	4.0	7.5	760	3.0
Waddell Creek 80-09-9	22-Oct-12	16054121022101	5.8	7.6	890	6.8
Waddell Creek 80-09-21	22-Oct-12	16054121022102	3.6	7.3	510	2.3
Waddell Creek 80-09-117	23-Oct-12	16054121023104	2.7	7.4	540	2.6
Waddell Creek 80-09-149	22-Oct-12	16054121022103	4.2	7.4	930	2.0
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	3.1	7.0	440	7.0
Mariana Lakes 80-13-7	19-Nov-12	16054121119301	3.1	7.0	440	7.0
Mariana Lakes 80-13-52	17-Nov-12	16054121117103	4.3	7.3	560	4.4
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	4.2	7.5	850	1.6
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	5.3	7.3	840	2.5
House Crossing 77-15-8	19-Nov-12	16054121119104	3.4	7.3	610	2.2
House Crossing 77-15-82	19-Nov-12	16054121119101	3.0	7.8	990	---
House Crossing 77-15-126	19-Nov-12	16054121119103	4.1	7.4	560	7.5
House Crossing 77-15-161	19-Nov-12	16054121119102	4.0	7.4	620	5.1
House Crossing 77-15-231	19-Nov-12	16054121119105	3.6	7.6	730	2.6
Plamondon 68-16-7	21-Nov-12	16054121121101	3.3	8.2	460	10.5
Plamondon 68-16-39	21-Nov-12	16054121121104	5.1	8.0	1550	3.9
Plamondon 68-16-51	21-Nov-12	16054121121103	5.8	8.0	9130	3.5
Plamondon 68-16-70	21-Nov-12	16054121121102	5.9	8.4	15180	1.0
Detection Limit			0.1	0.1	10	0.1
Alberta Tier 1 - Natural Areas*			NS	6.5-8.5^{P(AO)}	NS	NS

Notes:

--- - not analyzed

NS - guideline not specified

^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)^P - indicates guideline for Potable Groundwater exposure pathway

* - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)

** - field EC corrected to 25°C

Italics - indicates values do not meet applicable guidelines

TABLE 3.

GROUNDWATER QUALITY RESULTS - GENERAL PARAMETERS

Alberta Environment and Sustainable Resources Development (ESRD)
 Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Fe mg/L	Mn mg/L	Cl mg/L	SO ₄ mg/L	NO ₂ -N mg/L	NO ₃ -N mg/L	NO ₂ /NO ₃ -N mg/L	Total Alkalinity ^A mg/L	HCO ₃ mg/L	CO ₃ mg/L	Hardness ^A mg/L	TDS mg/L	NH ₃ -N mg/L	Phenol mg/L
Conklin 76-07-6	15-Nov-12	16054121115104	6.97	109	12	3.82	1.7	0.74	<0.010	0.0065	0.95	2.96	<0.050	0.242	0.242	49.9	60.9	<5.0	46	53.2	<0.050	0.0011
Conklin 76-07-24	15-Nov-12	16054121115103	7.9	391	47.8	14.5	12	3.6	0.747	0.199	<0.50	3.95	<0.050	<0.050	<0.071	228	279	<5.0	179	219	0.448	<0.0010
Conklin 76-07-41	15-Nov-12	16054121115102	7.92	775	73.6	24.2	51.8	5.46	1.42	0.0612	<0.50	10.6	<0.050	<0.050	<0.071	433	528	<5.0	283	425	2.19	<0.0010
Conklin 76-07-67	15-Nov-12	16054121115101	7.91	785	66.8	22.8	64.5	5.78	0.011	0.0422	0.62	9.39	<0.050	<0.050	<0.071	439	535	<5.0	261	433	2.72	<0.0010
Waddell Creek 80-09-9	22-Oct-12	16054121022101	8.05	829	120	44.4	8.5	3.67	<0.030	0.103	0.79	23.4	<0.050	0.951	0.951	479	584	<5.0	482	492	0.07	0.0611
Waddell Creek 80-09-21	22-Oct-12	16054121022102	7.87	488	68.4	18.9	9.2	2.7	0.363	0.374	1.2	17.5	<0.050	<0.050	<0.071	264	322	<5.0	249	276	0.163	<0.0010
Waddell Creek 80-09-117	23-Oct-12	16054121023104	7.96	697	61.4	16.6	73	4.22	1.2	0.181	0.25	26.4	<0.050	<0.050	<0.071	374	456	<5.0	222	406	1.5	<0.0010
Waddell Creek 80-09-149	22-Oct-12	16054121022103	7.97	878	84.5	24.2	87	7.89	1.32	0.116	0.61	50.5	<0.050	<0.050	<0.071	471	575	<5.0	311	537	1.87	0.0036
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	7.54	332	39.8	8.71	9.5	4.72	0.465	1.73	11.9	15.2	<0.050	<0.050	<0.071	134	164	<5.0	135	170	0.106	---
Mariana Lakes 80-13-7	19-Nov-12	16054121119301	---	---	48.5	10.5	9.25	3.74	0.064	2.13	---	---	---	---	---	---	---	---	160	---	---	0.005
Mariana Lakes 80-13-52	17-Nov-12	16054121117103	7.76	574	73.5	18.4	16.8	4.59	2.78	0.557	0.52	23.4	<0.050	<0.050	<0.071	297	362	<5.0	259	315	0.897	0.0022
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	7.96	885	67	16.9	84.1	7.01	<0.030	0.125	0.87	113	<0.050	<0.050	<0.071	377	460	<5.0	237	515	1.87	<0.0010
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	7.86	877	65.4	16.3	90.3	5.47	<0.030	0.447	2.34	117	<0.050	<0.050	<0.071	359	438	<5.0	230	512	1.58	0.0012
House Crossing 77-15-8	19-Nov-12	16054121119104	7.59	645	99.7	19.1	4	2.38	0.33	1.20	25.7	5.5	<0.050	<0.050	<0.071	311	379	<5.0	328	343	0.288	<0.0010
House Crossing 77-15-82	19-Nov-12	16054121119101	8.12	965	41.1	10.4	150	4.51	<0.030	0.116	23.8	78.5	<0.050	<0.050	<0.071	413	504	<5.0	145	556	1.39	0.0071
House Crossing 77-15-126	19-Nov-12	16054121119103	7.9	577	60.1	15.8	37.9	4.14	<0.030	0.41	3.84	16.7	<0.050	<0.050	<0.071	302	368	<5.0	215	320	1.31	<0.0010
House Crossing 77-15-161	19-Nov-12	16054121119102	7.96	646	65.2	17.3	46.8	4.09	<0.030	0.166	24.6	22.3	<0.050	<0.050	<0.071	296	361	<5.0	234	358	1.56	0.0033
House Crossing 77-15-231	19-Nov-12	16054121119105	7.97	780	57.4	16.4	89.8	6.31	<0.030	0.0936	6.75	36.6	<0.050	0.318	0.318	389	475	<5.0	211	448	1.79	<0.0010
Plamondon 68-16-7	21-Nov-12	16054121121101	8.09	324	21.4	6.61	48.1	1.42	<0.030	0.0297	2.79	31.1	<0.050	0.47	0.47	159	194	<5.0	81	209	0.088	0.0036
Plamondon 68-16-39	21-Nov-12	16054121121104	8.19	1560	58.1	21.8	304	3.36	<0.030	0.0456	3.88	455	<0.050	<0.050	<0.071	518	631	<5.0	235	1160	3.83	<0.0010
Plamondon 68-16-51	21-Nov-12	16054121121103	8.27	1160	25.8	9.32	268	2.43	0.041	0.0237	18.2	130	<0.050	<0.050	<0.071	560	683	<5.0	103	790	3.5	<0.0010
Plamondon 68-16-70	21-Nov-12	16054121121102	8.34	2550	27	10.4	633	3.88	0.079	0.038	550	107	<0.050	<0.050	<0.071	581	693	7.8	110	1680	2.77	<0.0010
Minimal Detection Limit			-	3	0.1	0.1	0.5	0.5	0.03	0.005	0.1	0.5	0.05	0.05	0.071	5	5	5	-	-	0.05	0.001
Alberta Tier 1 - Natural Areas*			6.5-8.5^{P(AO)}	NS	NS	NS	200^{P(AO)}	NS	0.3^{P(AO),A}	0.05^{P(AO)}	230^A	500^{P(AO)}	0.06^A	2.9^A	NS	NS	NS	NS	NS	500^{P(AO)}	0.017^{A,pH/T,**}	0.004^A

Notes:

- - not analyzed
- NS - not specified
- ^A - indicates guideline for Aquatic Life exposure pathway
- ^P - indicates guideline for Potable Groundwater exposure pathway
- ^{pH/T} - most stringent value, guideline pH and temperature dependant, see CCME factsheet for guideline information
- ^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- [^] - expressed as CaCO₃
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)
- ** - Alberta Environment Surface Water Quality Guidelines for Use in Alberta (AENV, 1999)
- Italics** - indicates values do not meet applicable guidelines

TABLE 4.

GROUNDWATER QUALITY RESULTS - DISSOLVED METALS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L
Conklin 76-07-6	15-Nov-12	16054121115104	<0.01	<0.0004	<0.0004	0.0316	<0.0005	0.0117	<0.0001	<0.0004	0.0001	<0.0006	<0.01	<0.0001	0.0065	<0.0001	0.0002	0.0018	<0.0004	<0.0002	0.05	<0.00005	<0.0002	<0.0003	<0.0001	0.00012	0.0012
Conklin 76-07-24	15-Nov-12	16054121115103	<0.01	<0.0004	0.0049	0.129	<0.0005	0.0787	<0.0001	<0.0004	0.0005	<0.0006	0.75	<0.0001	0.199	<0.0001	0.0038	0.0007	<0.0004	<0.0002	0.391	<0.00005	<0.0002	<0.0003	0.00011	0.00024	0.0025
Conklin 76-07-41	15-Nov-12	16054121115102	<0.01	<0.0004	<0.0004	0.0905	<0.0005	0.236	<0.0001	<0.0004	0.0002	<0.0006	1.42	<0.0001	0.0612	<0.0001	0.0011	0.0002	<0.0004	<0.0002	0.639	<0.00005	<0.0002	<0.0003	<0.0001	0.00001	0.0012
Conklin 76-07-67	15-Nov-12	16054121115101	<0.01	<0.0004	<0.0004	0.0799	<0.0005	0.262	<0.0001	<0.0004	0.0002	<0.0006	0.01	<0.0001	0.0422	<0.0001	0.0006	0.0004	<0.0004	<0.0002	0.636	<0.00005	<0.0002	<0.0003	0.0002	0.00011	0.0034
Waddell Creek 80-09-9	22-Oct-12	16054121022101	<0.005	<0.0001	0.0004	0.133	<0.0005	0.071	<0.00005	<0.0005	0.0008	0.00176	<0.03	<0.0001	0.103	<0.00005	0.0031	0.0023	0.0031	<0.00001	0.294	<0.0001	<0.0001	<0.001	0.0146	<0.001	<0.005
Waddell Creek 80-09-21	22-Oct-12	16054121022102	<0.005	<0.0001	0.0033	0.117	<0.0005	0.047	<0.00005	<0.0005	0.0020	<0.0001	0.36	<0.0001	0.374	<0.00005	0.0040	0.0019	<0.001	<0.00001	0.236	<0.0001	<0.0001	<0.001	0.00232	<0.001	<0.005
Waddell Creek 80-09-117	23-Oct-12	16054121023104	<0.005	<0.0001	0.0003	0.0551	<0.0005	0.282	<0.00005	<0.0005	0.0005	<0.0001	1.20	<0.0001	0.181	<0.00005	0.0055	0.0008	<0.001	<0.00001	0.427	<0.0001	<0.0001	<0.001	0.00015	<0.001	<0.005
Waddell Creek 80-09-149	22-Oct-12	16054121022103	<0.005	<0.0001	0.0004	0.0463	<0.0005	0.245	<0.00005	<0.0005	0.0005	0.00031	1.32	<0.0001	0.116	<0.00005	0.0096	0.0033	<0.001	<0.00001	0.814	<0.0001	<0.0001	<0.001	0.000064	<0.001	<0.005
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	---	---	---	---	---	---	---	---	---	---	0.47	---	1.73	---	---	---	---	---	---	---	---	---	---	---	---
Mariana Lakes 80-13-7	19-Nov-12	16054121119301	0.03	<0.0004	0.0014	0.179	<0.0005	0.0847	<0.0001	<0.0004	0.0097	<0.0006	0.06	0.0001	2.13	<0.0001	0.0030	0.0187	0.00711	<0.0002	0.254	<0.00005	<0.0002	0.00035	0.00148	0.00027	0.0090
Mariana Lakes 80-13-52	17-Nov-12	16054121117103	<0.01	<0.0004	0.0096	0.0773	<0.0005	0.162	<0.0001	<0.0004	0.0013	<0.0006	2.78	<0.0001	0.557	<0.0001	0.0089	0.0020	<0.0004	<0.0002	0.484	<0.00005	<0.0002	<0.0003	0.00023	<0.0001	0.0021
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	<0.01	<0.0004	0.0033	0.0391	<0.0005	0.44	<0.0001	<0.0004	0.0002	<0.0006	<0.03	<0.0001	0.125	<0.0001	0.0149	0.0005	<0.0004	<0.0002	0.737	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0034
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	<0.01	<0.0004	0.0062	0.0552	<0.0005	0.574	<0.0001	<0.0004	0.0009	<0.0006	<0.03	<0.0001	0.447	<0.0001	0.0291	0.0040	<0.0004	<0.0002	0.605	<0.00005	<0.0002	<0.0003	0.00207	0.00089	0.0045
House Crossing 77-15-8	19-Nov-12	16054121119104	<0.01	<0.0004	0.0035	0.22	<0.0005	0.0538	<0.0001	<0.0004	0.0010	0.00078	0.33	0.0023	1.20	<0.0001	0.0046	0.0025	<0.0004	<0.0002	0.411	<0.00005	<0.0002	<0.0003	0.00049	<0.0001	0.0152
House Crossing 77-15-82	19-Nov-12	16054121119101	0.01	0.00075	0.0374	0.0357	<0.0005	0.801	<0.0001	<0.0004	0.0005	0.00233	<0.03	<0.0001	0.116	<0.0001	0.0376	0.0025	<0.0004	<0.0002	0.345	<0.00005	0.0005	<0.0003	0.00017	0.00031	0.0055
House Crossing 77-15-126	19-Nov-12	16054121119103	<0.01	<0.0004	0.0072	0.0433	<0.0005	0.209	<0.0001	<0.0004	0.0001	<0.0006	<0.03	<0.0001	0.41	<0.0001	0.0106	0.0010	<0.0004	<0.0002	0.403	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0039
House Crossing 77-15-161	19-Nov-12	16054121119102	<0.01	<0.0004	0.0037	0.0562	<0.0005	0.189	<0.0001	<0.0004	0.0002	<0.0006	<0.03	<0.0001	0.166	<0.0001	0.0073	0.0007	<0.0004	<0.0002	0.418	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0070
House Crossing 77-15-231	19-Nov-12	16054121119105	<0.01	<0.0004	0.0038	0.094	<0.0005	0.34	<0.0001	<0.0004	0.0003	0.00195	<0.03	<0.0001	0.0936	<0.0001	0.0076	0.0025	<0.0004	<0.0002	0.582	<0.00005	<0.0002	<0.0003	0.00014	<0.0001	0.0103
Plamondon 68-16-7	21-Nov-12	16054121121101	0.0088	0.00714	0.0045	0.063	<0.0005	0.033	<0.00005	<0.0005	0.0004	0.00203	<0.03	<0.0001	0.0297	<0.00005	0.0125	0.0016	0.0043	<0.00001	0.159	<0.0001	<0.0001	<0.001	0.00736	<0.001	<0.005
Plamondon 68-16-39	21-Nov-12	16054121121104	<0.005	0.00053	0.0273	0.0847	<0.0005	0.594	<0.00005	<0.0005	0.0006	0.00047	<0.03	<0.0001	0.0456	<0.00005	0.0111	0.0017	<0.001	<0.00001	0.636	<0.0001	0.00014	<0.001	0.000638	<0.001	<0.005
Plamondon 68-16-51	21-Nov-12	16054121121103	<0.005	0.00019	0.0766	0.178	<0.0005	0.353	<0.00005	<0.0005	0.0006	0.00059	0.04	<0.0001	0.0237	<0.00005	0.0021	0.0015	<0.001	<0.00001	0.285	<0.0001	0.00021	<0.001	0.000465	0.0011	0.005
Plamondon 68-16-70	21-Nov-12	16054121121102	<0.005	0.00014	0.0857	0.324	<0.0005	0.677	<0.00005	0.00106	0.0008	<0.0001	0.08	<0.0001	0.038	<0.00005	0.0112	0.0036	<0.001	<0.00001	0.453	<0.0001	<0.0001	<0.001	0.000176	<0.001	<0.005
Minimal Detection Limit			0.005	0.0001	0.0001	0.00005	0.0005	0.01	0.00005	0.0004	0.0001	0.0001	0.03	0.0001	0.005	0.00005	0.00005	0.0005	0.0004	0.00001	0.0001	0.00005	0.0001	0.00003	0.00001	0.0001	0.001
Alberta Tier 1 - Natural Areas*			0.005^a-0.1^{b,A**}	0.006^{P(MAC)}	0.005^A	1^{P(MAC)}	NS	1.5^A	H^A	0.001^{Ad}	NS	0.007^{Ac}	0.3^{P(AO),A}	H^A	0.05^{P(AO)}	0.000005^{Ac}	NS	H^A	0.001^A	0.0001^A	NS	NS	NS	NS	0.02^{P(MAC)}	NS	0.03^A

Notes:

- - not analyzed
- NS - guideline not specified
- ^a - value if pH <6.5
- ^b - value if pH ≥6.5
- ^c - Chronic aquatic life guideline from Alberta Environment Surface Water Quality Guidelines for Use in Alberta (AENV, 1999)
- ^d - indicates guideline level for Cr(VI); guideline level for Cr(III) = 0.0089 mg/L
- ^A - indicates guideline for Aquatic Life exposure pathway
- ^P - indicates guideline for Potable Groundwater exposure pathway
- ^H - dependent on hardness value
- ^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- ^{MAC} - maximum acceptable concentration based on health effects from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)
- ** - Alberta Environment Surface Water Quality Guidelines for Use in Alberta (AENV, 1999)
- [^] - Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, accessed on line July 2012)
- Italics** - indicates values do not meet applicable guidelines

TABLE 5.**GROUNDWATER QUALITY RESULTS - DISSOLVED HYDROCARBONS & NAPHTHENIC ACIDS**

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	F1 ^{††} C ₆ -C ₁₀ mg/L	F2 C _{>10} -C ₁₆ mg/L	Naphthenic Acids mg/L
Conklin 76-07-6	15-Nov-12	16054121115104	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Conklin 76-07-24	15-Nov-12	16054121115103	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Conklin 76-07-41	15-Nov-12	16054121115102	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Conklin 76-07-67	15-Nov-12	16054121115101	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Waddell Creek 80-09-9	22-Oct-12	16054121022101	<0.00050	<0.00050	<0.00050	<0.00050	<0.10	<0.25	<1.0
Waddell Creek 80-09-21	22-Oct-12	16054121022102	<0.00050	<0.00050	<0.00050	<0.00050	<0.10	<0.25	<1.0
Waddell Creek 80-09-117	23-Oct-12	16054121023104	<0.00050	<0.00050	<0.00050	<0.00050	<0.10	<0.25	<1.0
Waddell Creek 80-09-149	22-Oct-12	16054121022103	<0.00050	<0.00050	<0.00050	<0.00050	<0.10	<0.25	1.0
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Mariana Lakes 80-13-52	17-Nov-12	16054121117103	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
House Crossing 77-15-8	19-Nov-12	16054121119104	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
House Crossing 77-15-82	19-Nov-12	16054121119101	<0.00050	0.00738	<0.00050	<0.00071	<0.10	<0.25	<1.0
House Crossing 77-15-126	19-Nov-12	16054121119103	<0.00050	0.00092	<0.00050	<0.00071	<0.10	<0.25	<1.0
House Crossing 77-15-161	19-Nov-12	16054121119102	<0.00050	0.00124	<0.00050	<0.00071	<0.10	<0.25	<1.0
House Crossing 77-15-231	19-Nov-12	16054121119105	<0.00050	0.00051	<0.00050	<0.00071	<0.10	<0.25	<1.0
Plamondon 68-16-7	21-Nov-12	16054121121101	<0.00050	0.00055	<0.00050	0.00056	<0.10	<0.25	<1.0
Plamondon 68-16-39	21-Nov-12	16054121121104	<0.00050	0.00062	<0.00050	<0.00050	<0.10	<0.25	<1.0
Plamondon 68-16-51	21-Nov-12	16054121121103	<0.00050	<0.00050	<0.00050	<0.00050	<0.10	<0.25	<1.0
Plamondon 68-16-70	21-Nov-12	16054121121102	<0.00050	<0.00050	<0.00050	<0.00050	<0.10	<0.25	1.4
Minimal Detection Limit			0.0005	0.0005	0.0005	0.0005	0.1	0.25	1
Alberta Tier 1 - Fine Grained Soils - Natural Areas*			0.005^{P(MAC)}	0.024^{P(AO)}	0.0024^{P(AO)}	0.3^{P(AO)}	2.2^P	1.1^P	NS

Notes:

- ^P - indicates guideline for Potable Groundwater exposure pathway
^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
^{MAC} - maximum acceptable concentration based on health effects from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
^{NS} - guideline not specified
* - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)
^{††} - F1 excludes BTEX
Italics - indicates values do not meet applicable guidelines

TABLE 6.

GROUNDWATER QUALITY RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Sample Point	Sample Date	MSI Sample Number	Acenaphthene mg/L	Acenaphthylene mg/L	Anthracene mg/L	Benzo[a]anthracene** mg/L	Benzo[b,j]fluoranthene** mg/L	Benzo[k]fluoranthene** mg/L	Benzo[g,h,i]perylene** mg/L	Benzo[a]pyrene** mg/L	Chrysene** mg/L	Dibenz[a,h]anthracene** mg/L	Fluoranthene mg/L	Fluorene mg/L	Indeno[1,2,3-c,d]pyrene** mg/L	Naphthalene mg/L	Phenanthrene mg/L	Pyrene mg/L	Benzo[a]pyrene TPE** mg/L
Conklin 76-07-6	15-Nov-12	16054121115104	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Conklin 76-07-24	15-Nov-12	16054121115103	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Conklin 76-07-41	15-Nov-12	16054121115102	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Conklin 76-07-67	15-Nov-12	16054121115101	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-9	22-Oct-12	16054121022101	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00869	<0.00005	<0.00002	ND
Waddell Creek 80-09-21	22-Oct-12	16054121022102	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-117	23-Oct-12	16054121023104	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00038	<0.00005	<0.00002	ND
Waddell Creek 80-09-149	22-Oct-12	16054121022103	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00124	<0.00005	<0.00002	ND
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	0.000032	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	0.000056	<0.00001	0.00237	<0.00005	<0.00002	ND
Mariana Lakes 80-13-52	17-Nov-12	16054121117103	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00013	<0.00005	<0.00002	ND
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00026	<0.00005	<0.00002	ND
House Crossing 77-15-8	19-Nov-12	16054121119104	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
House Crossing 77-15-82	19-Nov-12	16054121119101	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00032	<0.00005	<0.00002	ND
House Crossing 77-15-126	19-Nov-12	16054121119103	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00012	<0.00005	<0.00002	ND
House Crossing 77-15-161	19-Nov-12	16054121119102	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00036	<0.00005	<0.00002	ND
House Crossing 77-15-231	19-Nov-12	16054121119105	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Plamondon 68-16-7	21-Nov-12	16054121121101	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00089	<0.00005	<0.00002	ND
Plamondon 68-16-39	21-Nov-12	16054121121104	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00016	<0.00005	<0.00002	ND
Plamondon 68-16-51	21-Nov-12	16054121121103	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00016	<0.00005	<0.00002	ND
Plamondon 68-16-70	21-Nov-12	16054121121102	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00002	ND
Minimal Detection Limit			0.00005	0.00005	0.00001	0.00001	0.00005	0.00005	0.00005	0.00001	0.00005	0.00005	0.00002	0.00005	0.00050	0.00005	0.00005	0.00002	-
AB Tier 1 - Fine Grained Soils - Natural Areas*			0.0058^A	0.046^A	0.000012^A	0.000018^A	0.00048^A	0.00048^A	0.00021^A	0.000017^A	0.0014^A	0.00028^A	0.00004^A	0.003^A	0.00023^A	0.0011^A	0.0004^A	0.000025^A	0.00001^P

Notes:

- ND - not detected
- ^A - indicates guideline for Aquatic Life exposure pathway
- ^P - indicates guideline for Potable Groundwater exposure pathway
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)
- ** - Equivalent Benzo[a]pyrene concentrations based on relative carcinogenic potency
- ** - Carcinogenic PAHs
- Italics* - indicates values do not meet applicable guidelines

TABLE 7.**GROUNDWATER QUALITY RESULTS - FAECAL COLIFORMS**

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Sample Point	Sample Date	MSI Sample Number	Faecal Coliforms CFU / 100 mL
Conklin 76-07-6	15-Nov-12	16054121115104	<1
Mariana Lakes 80-13-7	19-Nov-12	16054121119301	<1
House Crossing 77-15-8	19-Nov-12	16054121119104	<1
House Crossing 77-15-82	19-Nov-12	16054121119101	<1
Plamondon 68-16-7	21-Nov-12	16054121121101	<1
Minimal Detection Limit			1
Canadian Drinking Water Guidelines*			0

Notes:

CFU - colony forming uni

* - Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)

Italics - indicates values do not meet drinking water guidelines, resampling is recommended to confirm the presence of Coliforms

TABLE 8.**WELL INSTRUMENTATION**

Alberta Environment and Sustainable Resources Development (ESRD)
 Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Transducer Model and Serial Number	Installation Depth mbTOC/masl	Data collection Interval	Data to be Collected
Conklin 76-7-6	Insitu Level Troll 500, 323483	6 mb TOC	Every 1 hour	Temperature and hydrostatic pressure
Conklin 76-7-25	Insitu Level Troll 500, 316637	12 mb TOC	Every 1 hour	Temperature and hydrostatic pressure
Conklin 76-7-43	Insitu Level Troll 500, 323437	9 mb TOC	Every 1 hour	Temperature and hydrostatic pressure
Conklin 76-7-68	Insitu Level Troll 500, 323669	9 mb TOC	Every 1 hour	Temperature and hydrostatic pressure
Conklin 76-7-68	Nautilus 85, 12101	66 mb TOC	Every 30 minutes	Temperature
Waddell Creek 80-09-9	Insitu Level Troll 500, 196585	12 mb TOC	Every 1 hour	Temperature and hydrostatic pressure
Waddell Creek 80-09-24	Insitu Level Troll 300, 140632	14 mb TOC	Every 1 hour	Temperature and hydrostatic pressure
Waddell Creek 80-09-24	Insitu Level Troll 500, 323388	709.4 masl	Every 1 hour	Temperature and hydrostatic pressure
Waddell Creek 80-09-118	Insitu Level Troll 300, 140632	25 mb TOC	Every 1 hour	Temperature and hydrostatic pressure
Waddell Creek 80-09-118	Insitu Level Troll 500, 323430	698.28 masl	Every 1 hour	Temperature and hydrostatic pressure
Waddell Creek 80-09-149	Insitu Level Troll 500, 138011	38 mb TOC	Every 1 hour	Temperature and hydrostatic pressure
Waddell Creek 80-09-149	Insitu Level Troll 500, 323460	684.70 masl	Every 1 hour	Temperature and hydrostatic pressure
Mariana Lakes 80-13-7	Insitu Level Troll 500, 324221	7 mb TOC	Every 1 hour	Temperature and hydrostatic pressure
Mariana Lakes 80-13-52	Insitu Level Troll 500, 323486	16 mbTOC	Every 1 hour	Temperature and hydrostatic pressure
Mariana Lakes 80-13-112	Insitu Level Troll 500, 316938	22 mTOC	Every 1 hour	Temperature and hydrostatic pressure
Mariana Lakes 80-13-140	Insitu Level Troll 500, 323493	55 mbTOC	Every 1 hour	Temperature and hydrostatic pressure
Mariana Lakes 80-13-140	Nautilus 85, 12103	51 mbTOC	Every 30 minutes	Temperature
House River 77-15-81	Insitu Level Troll 500, 323641	71 mbTOC	Every 1 hour	Temperature and hydrostatic pressure
House River 77-15-126	Insitu Level Troll 500, 324212	57 mbTOC	Every 1 hour	Temperature and hydrostatic pressure
House River 77-15-161	Insitu Level Troll 500, 324222	68 mbTOC	Every 1 hour	Temperature and hydrostatic pressure
House River 77-15-161	Hobo TidbiT 10232015, 10232017, 10232016	68, 156, 159 mbTOC, respectively	Every 30 minutes	Temperature
Plamondon 68-16-7	Insitu Level Troll 500, 324215	7 mbTOC	Every 1 hour	Temperature and hydrostatic pressure
Plamondon 68-16-38	Insitu Level Troll 500, 324219	34 mbTOC	Every 1 hour	Temperature and hydrostatic pressure
Plamondon 68-16-51	Insitu Level Troll 500, 324220	35 mbTOC	Every 1 hour	Temperature and hydrostatic pressure
Plamondon 68-16-69	Insitu Level Troll 500, 325524	35 mbTOC	Every 1 hour	Temperature and hydrostatic pressure
Plamondon 68-16-69	Nautilus 85, 12191	69 mbTOC	Every 30 minutes	Temperature

APPENDIX A
WATER WELL RECORDS

GIC Well ID 1421366
 GoA Well Tag No.
 Drilling Company Well ID Conklin 76-07-6
 Date Report Received 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location		<i>1/4 or LSD</i> 11	<i>SEC</i> 30	<i>TWP</i> 76	<i>RGE</i> 7	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ ft from _____					Latitude <u>55.615579</u> Longitude <u>-111.082987</u>					Elevation <u>1887.50</u> ft	
_____ ft from _____					How Location Obtained Not Verified					How Elevation Obtained Surveyed GPS <1m	

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Imperial
Depth from ground level (ft)	Water Bearing	Lithology Description	
15.09	Yes	Sand	
20.00		Clay	

Yield Test Summary			Measurement in Imperial
<i>Recommended Pump Rate</i> _____ igpm			
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)	
2012/11/15		9.35	

Well Completion				Measurement in Imperial
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
20.00 ft	20.00 ft	2012/10/24	2012/10/24	
Borehole				
Diameter (in)	From (ft)	To (ft)		
6.25	0.00	20.00		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
Size OD : _____ in	Size OD : <u>2.00</u> in			
Wall Thickness : _____ in	Wall Thickness : <u>0.218</u> in			
Bottom at : _____ ft	Top at : <u>-2.20</u> ft			
Bottom at : <u>10.00</u> ft				
Perforations				
From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length(in)	Hole or Slot Interval(in)
Perforated by				
Annular Seal Bentonite Chips/Tablets				
Placed from <u>0.00</u> ft to <u>8.00</u> ft				
Amount <u>4.00</u> Bags				
Other Seals				
Type		At (ft)		
Screen Type Plastic				
Size OD : <u>2.00</u> in				
From (ft)	To (ft)	Slot Size (in)		
10.00	20.00	0.020		
Attachment <u>Attached To Casing</u>				
Top Fittings <u>Threaded</u>		Bottom Fittings <u>Plug</u>		
Pack				
Type <u>Sand</u>		Grain Size <u>10-20</u>		
Amount <u>7.00</u> Bags				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2013/02/12

GIC Well ID 1421366
 GoA Well Tag No.
 Drilling Company Well ID Conklin 76-07-6
 Date Report Received 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial	
Owner Name AESRD		Address #111, 4999 - 98 AVE				Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location		<i>1/4 or LSD</i> 11	<i>SEC</i> 30	<i>TWP</i> 76	<i>RGE</i> 7	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ ft from _____					Latitude <u>55.615579</u> Longitude <u>-111.082987</u>					Elevation <u>1887.50</u> ft	
_____ ft from _____					How Location Obtained Not Verified					How Elevation Obtained Surveyed GPS <1m	

Additional Information										Measurement in Imperial	
<i>Distance From Top of Casing to Ground Level</i> _____ 26.38 in											
<i>Is Artesian Flow</i> _____					<i>Is Flow Control Installed</i> _____						
<i>Rate</i> _____ igpm					<i>Describe</i> _____						
<i>Recommended Pump Rate</i> _____ igpm					<i>Pump Installed</i> _____		<i>Depth</i> _____ ft				
<i>Recommended Pump Intake Depth (From TOC)</i> _____ ft					<i>Type</i> _____		<i>Make</i> _____		<i>H.P.</i> _____		<i>Model (Output Rating)</i> _____
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i> _____					<i>Depth</i> _____ ft		<i>Well Disinfected Upon Completion</i> <u>Yes</u>				
<i>Gas</i> _____					<i>Depth</i> _____ ft		<i>Geophysical Log Taken</i> _____				
					<i>Submitted to ESRD</i> _____						
<i>Additional Comments on Well</i>					<i>Sample Collected for Potability</i> _____			<i>Submitted to ESRD</i> _____			

Yield Test			Taken From Top of Casing	Measurement in Imperial
<i>Test Date</i> 2012/11/15	<i>Start Time</i> 11:00 AM	<i>Static Water Level</i> 9.35 ft	<i>Depth to water level</i>	
			Drawdown (ft)	Elapsed Time Minutes:Sec
			_____	_____
Method of Water Removal				
<i>Type</i> _____				
<i>Removal Rate</i> _____ igpm				
<i>Depth Withdrawn From</i> _____ ft				
<i>If water removal period was < 2 hours, explain why</i>				

Water Diverted for Drilling		
<i>Water Source</i>	<i>Amount Taken</i>	<i>Diversion Date & Time</i>
_____	_____ ig	_____

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421365
 GoA Well Tag No.
 Drilling Company Well ID Conklin 76-07-24
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3
Location		<i>1/4 or LSD</i> 11	<i>SEC</i> 30	<i>TWP</i> 76	<i>RGE</i> 7	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)					
_____ m from _____					Latitude <u>55.615579</u> Longitude <u>-111.082987</u>			Elevation <u>575.21</u> m		
_____ m from _____					How Location Obtained			How Elevation Obtained		
					Not Verified			Surveyed GPS <1m		

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
4.60		Pebbly Sand	
20.70		Gray Clay	
22.90	Yes	Sand	
24.38		Clay	

Yield Test Summary			Measurement in Metric
<i>Recommended Pump Rate</i> _____		<i>L/min</i>	
<i>Test Date</i>	<i>Water Removal Rate (L/min)</i>	<i>Static Water Level (m)</i>	
2012/11/15		2.05	

Well Completion				Measurement in Metric
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
24.38 m	23.47 m	2012/10/23	2012/10/24	
Borehole				
<i>Diameter (cm)</i>	<i>From (m)</i>	<i>To (m)</i>		
15.88	0.00	24.38		
22.23	0.00	24.38		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
<i>Size OD :</i> _____	<i>cm</i>	<i>Size OD :</i> _____	<i>cm</i>	
<i>Wall Thickness :</i> _____	<i>cm</i>	<i>Wall Thickness :</i> _____	<i>cm</i>	
<i>Bottom at :</i> _____	<i>m</i>	<i>Top at :</i> _____	<i>m</i>	
		<i>Bottom at :</i> _____	<i>m</i>	
Perforations				
<i>From (m)</i>	<i>To (m)</i>	<i>Diameter or Slot Width (cm)</i>	<i>Slot Length (cm)</i>	<i>Hole or Slot Interval (cm)</i>
<i>Perforated by</i>				
Annular Seal Bentonite Slurry				
<i>Placed from</i> _____		<i>0.00 m to 19.51 m</i>		
<i>Amount</i> _____		<i>5.00 Bags</i>		
Other Seals				
<i>Type</i>		<i>At (m)</i>		
Screen Type Plastic				
<i>Size OD :</i> _____				
<i>10.16 cm</i>				
<i>From (m)</i>	<i>To (m)</i>	<i>Slot Size (cm)</i>		
20.42	23.47	0.051		
<i>Attachment</i> <u>Attached To Casing</u>				
<i>Top Fittings</i> <u>Threaded</u>		<i>Bottom Fittings</i> <u>Plug</u>		
Pack				
<i>Type</i> <u>Sand</u>		<i>Grain Size</i> <u>10-20</u>		
<i>Amount</i> _____		<i>13.00 Bags</i>		

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

GIC Well ID 1421365
 GoA Well Tag No.
 Drilling Company Well ID Conklin 76-07-24
 Date Report Received 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE				Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location		<i>1/4 or LSD</i> 11	<i>SEC</i> 30	<i>TWP</i> 76	<i>RGE</i> 7	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>55.615579</u> Longitude <u>-111.082987</u>					Elevation <u>575.21</u> m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Not Verified					Surveyed GPS <1m	

Additional Information										Measurement in Metric	
<i>Distance From Top of Casing to Ground Level</i> _____ 67.01 cm											
<i>Is Artesian Flow</i> _____					<i>Is Flow Control Installed</i> _____						
<i>Rate</i> _____ L/min					<i>Describe</i> _____						
<i>Recommended Pump Rate</i> _____ L/min					<i>Pump Installed</i> _____		<i>Depth</i> _____ m				
<i>Recommended Pump Intake Depth (From TOC)</i> _____ m					<i>Type</i> _____	<i>Make</i> _____	<i>H.P.</i> _____	<i>Model (Output Rating)</i> _____			
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i> _____					<i>Depth</i> _____ m		<i>Well Disinfected Upon Completion</i> <u>Yes</u>				
<i>Gas</i> _____					<i>Depth</i> _____ m		<i>Geophysical Log Taken</i> _____				
					<i>Submitted to ESRD</i> _____						
<i>Additional Comments on Well</i>					<i>Sample Collected for Potability</i> _____			<i>Submitted to ESRD</i> _____			

Yield Test				Taken From Top of Casing	Measurement in Metric
<i>Test Date</i> 2012/11/15	<i>Start Time</i> 11:00 AM	<i>Static Water Level</i> 2.05 m		<i>Depth to water level</i>	
			Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
			_____	_____	_____
Method of Water Removal					
<i>Type</i> _____					
<i>Removal Rate</i> _____ L/min					
<i>Depth Withdrawn From</i> _____ m					
<i>If water removal period was < 2 hours, explain why</i>					

Water Diverted for Drilling			
<i>Water Source</i> DITCH	<i>Amount Taken</i> 9092.18	L	<i>Diversion Date & Time</i> 2012/10/23 10:00 AM

Contractor Certification			
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER		<i>Certification No</i> 5449Q	
<i>Company Name</i> LAKELAND DRILLING LTD.		<i>Copy of Well report provided to owner</i> Yes	<i>Date approval holder signed</i> 2013/02/12

GIC Well ID 1421364
 GoA Well Tag No.
 Drilling Company Well ID Conklin 76-07-41
 Date Report Received 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial		
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA		Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i> 11	<i>SEC</i> 30	<i>TWP</i> 76	<i>RGE</i> 7	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>			
Measured from Boundary of _____ ft from _____ _____ ft from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.615579</u> Longitude <u>-111.082987</u>			Elevation <u>1886.81</u> ft				
					How Location Obtained Not Verified			How Elevation Obtained Surveyed GPS <1m				

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Imperial
Depth from ground level (ft)	Water Bearing	Lithology Description	
9.84		Sand	
49.87		Clay	
66.93		Interbedded Clay & Sand	
80.05		Fine Grained Sand	
109.91		Dark Gray Clay	
129.92	Yes	Medium Grained Sand	
137.14	Yes	Fine Grained Sand	
140.00		Clay	

Yield Test Summary			Measurement in Imperial
<i>Recommended Pump Rate</i> _____ igpm			
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)	
2012/11/15		13.05	

Well Completion				Measurement in Imperial
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
140.00 ft	135.00 ft	2012/10/23	2012/10/23	
Borehole				
Diameter (in)	From (ft)	To (ft)		
6.25	0.00	140.00		
8.75	0.00	140.00		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
<i>Size OD :</i> _____ in	<i>Size OD :</i> _____ 4.00 in			
<i>Wall Thickness :</i> _____ in	<i>Wall Thickness :</i> _____ 0.337 in			
<i>Bottom at :</i> _____ ft	<i>Top at :</i> _____ -2.20 ft			
		<i>Bottom at :</i> _____ 115.00 ft		
Perforations				
From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length(in)	Hole or Slot Interval(in)
<i>Perforated by</i>				
Annular Seal Bentonite Slurry				
<i>Placed from</i> _____ 0.00 ft <i>to</i> _____ 112.00 ft				
<i>Amount</i> _____ 8.00 Bags				
<i>Other Seals</i>				
Type		At (ft)		
Screen Type Plastic				
<i>Size OD :</i> _____ 4.00 in				
From (ft)	To (ft)	Slot Size (in)		
115.00	135.00	0.020		
<i>Attachment</i> Attached To Casing				
<i>Top Fittings</i> Threaded		<i>Bottom Fittings</i> Plug		
Pack				
<i>Type</i> Sand		<i>Grain Size</i> 10-20		
<i>Amount</i> _____ 18.00 Bags				

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> Yes
	<i>Date approval holder signed</i> 2013/02/12

GIC Well ID 1421364
 GoA Well Tag No.
 Drilling Company Well ID Conklin 76-07-41
 Date Report Received 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Imperial
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i> 11	<i>SEC</i> 30	<i>TWP</i> 76	<i>RGE</i> 7	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of _____ ft from _____ _____ ft from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.615579</u> Longitude <u>-111.082987</u> How Location Obtained Not Verified			Elevation <u>1886.81</u> ft How Elevation Obtained Surveyed GPS <1m		

Additional Information										Measurement in Imperial	
Distance From Top of Casing to Ground Level <u>26.38</u> in					Is Artesian Flow _____					Is Flow Control Installed _____	Describe _____
Rate _____ igpm		Recommended Pump Rate _____ igpm		Recommended Pump Intake Depth (From TOC) _____ ft		Pump Installed _____		Depth _____ ft		Type _____ Make _____ H.P. _____ Model (Output Rating) _____	
Did you Encounter Saline Water (>4000 ppm TDS) _____			Depth _____ ft		Well Disinfected Upon Completion <u>Yes</u>		Geophysical Log Taken _____		Submitted to ESRD _____		
Gas _____			Depth _____ ft		Sample Collected for Potability _____		Submitted to ESRD _____		Additional Comments on Well _____		

Yield Test				Taken From Top of Casing	Measurement in Imperial
Test Date 2012/11/15	Start Time 11:00 AM	Static Water Level 13.05 ft		<i>Depth to water level</i>	
			Drawdown (ft)	Elapsed Time Minutes:Sec	Recovery (ft)
Method of Water Removal					
Type _____					
Removal Rate _____ igpm					
Depth Withdrawn From _____ ft					
If water removal period was < 2 hours, explain why _____					

Water Diverted for Drilling		
Water Source DITCH	Amount Taken 2000.00 ig	Diversion Date & Time 2012/10/23 10:00 AM

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421363
 GoA Well Tag No.
 Drilling Company Well ID Conklin 76-07-67
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA		Postal Code T6B 2X3
Location	<i>1/4 or LSD</i> 11	<i>SEC</i> 30	<i>TWP</i> 76	<i>RGE</i> 7	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.615579</u> Longitude <u>-111.082987</u>			Elevation <u>575.04</u> m			
					How Location Obtained Not Verified			How Elevation Obtained Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
3.00		Fine Grained Sand	
6.10		Sand	
9.10		Clay	
12.20		Sand & Clay	
20.40		Clay	
22.90		Sand	
25.60		Clay	
27.40		Silt	
34.10		Clay	
38.10		Sand	
45.70		Silty Sand	
58.50		Clay	
59.70		Sand	
61.30		Clay	
67.10	Yes	Sand	
69.19		Clay	

Yield Test Summary			Measurement in Metric
<i>Recommended Pump Rate</i> _____ L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/11/15		4.46	

Well Completion				Measurement in Metric
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
69.19 m	66.75 m	2012/10/22	2012/10/23	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	69.19		
22.23	0.00	68.28		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
<i>Size OD :</i> _____ cm			<i>Size OD :</i> <u>10.16</u> cm	
<i>Wall Thickness :</i> _____ cm			<i>Wall Thickness :</i> <u>0.856</u> cm	
<i>Bottom at :</i> _____ m			<i>Top at :</i> <u>-0.67</u> m	
		<i>Bottom at :</i> <u>60.66</u> m		
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
<i>Perforated by</i>				
Annular Seal Bentonite Chips/Tablets				
<i>Placed from</i> <u>0.00</u> m to <u>59.44</u> m				
<i>Amount</i> <u>16.00</u> Bags				
Other Seals				
		Type	At (m)	
Screen Type Plastic				
<i>Size OD :</i> <u>10.16</u> cm				
From (m)	To (m)	Slot Size (cm)		
60.66	66.75	0.051		
<i>Attachment</i> <u>Attached To Casing</u>				
<i>Top Fittings</i> <u>Threaded</u>		<i>Bottom Fittings</i> <u>Plug</u>		
Pack				
<i>Type</i> <u>Sand</u>		<i>Grain Size</i> <u>10-20</u>		
<i>Amount</i> <u>20.00</u> Bags				

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> Yes
	<i>Date approval holder signed</i> 2013/02/12

GIC Well ID 1421363
 GoA Well Tag No.
 Drilling Company Well ID Conklin 76-07-67
 Date Report Received 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE				Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location		<i>1/4 or LSD</i> 11	<i>SEC</i> 30	<i>TWP</i> 76	<i>RGE</i> 7	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>55.615579</u> Longitude <u>-111.082987</u>					Elevation <u>575.04</u> m	
_____ m from _____					How Location Obtained Not Verified					How Elevation Obtained Surveyed GPS <1m	

Additional Information										Measurement in Metric	
<i>Distance From Top of Casing to Ground Level</i> _____ 67.01 cm											
<i>Is Artesian Flow</i> _____					<i>Is Flow Control Installed</i> _____						
<i>Rate</i> _____ L/min					<i>Describe</i> _____						
<i>Recommended Pump Rate</i> _____ L/min					<i>Pump Installed</i> _____		<i>Depth</i> _____ m				
<i>Recommended Pump Intake Depth (From TOC)</i> _____ m					<i>Type</i> _____		<i>Make</i> _____		<i>H.P.</i> _____		<i>Model (Output Rating)</i> _____
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i> _____					<i>Depth</i> _____ m		<i>Well Disinfected Upon Completion</i> <u>Yes</u>				
<i>Gas</i> _____					<i>Depth</i> _____ m		<i>Geophysical Log Taken</i> <u>Electric, Gamma</u>				
					<i>Submitted to ESRD</i>						
<i>Additional Comments on Well</i>					<i>Sample Collected for Potability</i> _____			<i>Submitted to ESRD</i> _____			

Yield Test				Taken From Top of Casing	Measurement in Metric	
<i>Test Date</i> 2012/11/15	<i>Start Time</i> 11:00 AM	<i>Static Water Level</i> 4.46 m		<i>Depth to water level</i>		
				Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
				_____	_____	_____
Method of Water Removal						
<i>Type</i> _____						
<i>Removal Rate</i> _____ L/min						
<i>Depth Withdrawn From</i> _____ m						
<i>If water removal period was < 2 hours, explain why</i>						

Water Diverted for Drilling		
<i>Water Source</i> DITCH	<i>Amount Taken</i> 9092.18 L	<i>Diversion Date & Time</i> 2012/10/22 10:00 AM

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421359
 GoA Well Tag No.
 Drilling Company Well ID Waddell Creek 80-09
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i>	<i>SEC</i>	<i>TWP</i>	<i>RGE</i>	<i>W of MER</i>	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
	8	27	80	9	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation			
_____ m from _____				Latitude <u>55.960330</u> Longitude <u>-111.313673</u>				_____ 218.84 m _____			
_____ m from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
3.00		Brown Clay	
6.10	Yes	Medium Grained Sand	
9.14	Yes	Coarse Grained Sand	

Yield Test Summary			Measurement in Metric
<i>Recommended Pump Rate</i>		<i>L/min</i>	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/10/22		2.47	

Well Completion				Measurement in Metric
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
9.14 m	9.14 m	2012/10/20	2012/10/20	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	9.14		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
<i>Size OD :</i>	<i>cm</i>	<i>Size OD :</i>	<i>cm</i>	
			5.08 cm	
<i>Wall Thickness :</i>	<i>cm</i>	<i>Wall Thickness :</i>	<i>cm</i>	
			0.554 cm	
<i>Bottom at :</i>	<i>m</i>	<i>Top at :</i>	<i>m</i>	
			-0.67 m	
		<i>Bottom at :</i>	<i>m</i>	
			3.05 m	
Perforations				
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)
<i>Perforated by</i>				
Annular Seal Bentonite Chips/Tablets				
<i>Placed from</i>		<i>0.00 m</i>	<i>to</i>	<i>3.00 m</i>
<i>Amount</i>		<i>3.00 Bags</i>		
<i>Other Seals</i>				
<i>Type</i>		<i>At (m)</i>		
Screen Type Plastic				
<i>Size OD :</i> 5.08 cm				
From (m)	To (m)	Slot Size (cm)		
6.10	9.14	0.051		
<i>Attachment</i> Attached To Casing				
<i>Top Fittings</i> Threaded		<i>Bottom Fittings</i> Plug		
Pack				
<i>Type</i> Sand		<i>Grain Size</i> 10-20		
<i>Amount</i>		<i>9.00 Bags</i>		

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> Yes
	<i>Date approval holder signed</i> 2013/02/12

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GIC Well ID 1421359
 GoA Well Tag No.
 Drilling Company Well ID Waddell Creek 80-09
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA		Postal Code T6B 2X3
Location	<i>1/4 or LSD</i> 8	<i>SEC</i> 27	<i>TWP</i> 80	<i>RGE</i> 9	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
Measured from Boundary of _____ m from _____ _____ m from _____				GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.960330</u> Longitude <u>-111.313673</u>				Elevation <u>218.84</u> m How Elevation Obtained Surveyed GPS <1m			
Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level <u>67.01</u> cm					Is Artesian Flow _____						
Is Flow Control Installed _____					Describe _____						
Recommended Pump Rate _____ L/min			Pump Installed _____			Depth _____ m			Recommended Pump Intake Depth (From TOC) _____ m		
Type _____			Make _____			H.P. _____			Model (Output Rating) _____		
Did you Encounter Saline Water (>4000 ppm TDS) _____				Depth _____ m		Well Disinfected Upon Completion <u>Yes</u>					
Gas _____				Depth _____ m		Geophysical Log Taken _____					
						Submitted to ESRD _____					
Additional Comments on Well _____				Sample Collected for Potability _____		Submitted to ESRD _____					

Yield Test			Taken From Top of Casing	Measurement in Metric
Test Date 2012/10/22	Start Time 11:00 AM	Static Water Level 2.47 m	<i>Depth to water level</i>	
			Drawdown (m)	Elapsed Time Minutes:Sec
			Recovery (m)	
Method of Water Removal				
Type _____				
Removal Rate _____ L/min				
Depth Withdrawn From _____ m				
If water removal period was < 2 hours, explain why _____				

Water Diverted for Drilling		
Water Source DITCH	Amount Taken 9092.18 L	Diversion Date & Time 2012/10/20 10:00 AM

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2013/02/12

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GIC Well ID 1421358
 GoA Well Tag No.
 Drilling Company Well ID Waddell Creek 80-09
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	8	27	80	9	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation			
_____ m from _____				Latitude <u>55.960330</u> Longitude <u>-111.313673</u>				_____ 218.83 m _____			
_____ m from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
3.00		Clay & Sand	
6.10		Clay & Gravel	
9.10		Coarse Grained Gravel	
12.20		Clay	
15.20		Clay & Gravel	
21.30		Sand	
24.38		Clay	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate			L/min
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/10/22		2.82	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
24.38 m	20.42 m	2012/10/20	2012/10/20	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	24.38		
22.23	0.00	23.77		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
Size OD :	_____ cm	Size OD :	_____ 10.16 cm	
Wall Thickness :	_____ cm	Wall Thickness :	_____ 0.856 cm	
Bottom at :	_____ m	Top at :	_____ -0.67 m	
		Bottom at :	_____ 17.37 m	
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
Perforated by				
Annular Seal Bentonite Slurry				
Placed from _____ 0.00 m to _____ 16.76 m				
Amount _____ 8.00 Bags				
Other Seals				
Type		At (m)		
Screen Type Plastic				
Size OD : _____ 10.16 cm				
From (m)	To (m)	Slot Size (cm)		
17.37	20.42	0.051		
Attachment <u>Attached To Casing</u>				
Top Fittings <u>Threaded</u>		Bottom Fittings <u>Plug</u>		
Pack				
Type <u>Sand</u>		Grain Size <u>10-20</u>		
Amount _____ 15.00 Bags				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2013/02/12

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GIC Well ID 1421358
 GoA Well Tag No.
 Drilling Company Well ID Waddell Creek 80-09
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA		Postal Code T6B 2X3
Location	<i>1/4 or LSD</i> 8	<i>SEC</i> 27	<i>TWP</i> 80	<i>RGE</i> 9	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
Measured from Boundary of _____ m from _____ _____ m from _____				GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.960330</u> Longitude <u>-111.313673</u>				Elevation <u>218.83</u> m How Elevation Obtained Surveyed GPS <1m			
Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level <u>67.01</u> cm					Is Artesian Flow _____						
Rate _____ L/min					Is Flow Control Installed _____ Describe _____						
Recommended Pump Rate _____ L/min			Pump Installed _____			Depth _____ m			Recommended Pump Intake Depth (From TOC) _____ m		
Type _____			Make _____			H.P. _____			Model (Output Rating) _____		
Did you Encounter Saline Water (>4000 ppm TDS) _____				Depth _____ m		Well Disinfected Upon Completion <u>Yes</u>					
Gas _____				Depth _____ m		Geophysical Log Taken <u>Electric, Gamma</u> Submitted to ESRD					
Additional Comments on Well _____						Sample Collected for Potability _____			Submitted to ESRD _____		

Yield Test			Taken From Top of Casing	Measurement in Metric
Test Date 2012/10/22	Start Time 11:00 AM	Static Water Level 2.82 m	<i>Depth to water level</i>	
			Drawdown (m)	Elapsed Time Minutes:Sec
			_____	_____
			_____	_____
Method of Water Removal				
Type _____				
Removal Rate _____ L/min				
Depth Withdrawn From _____ m				
If water removal period was < 2 hours, explain why _____				

Water Diverted for Drilling		
Water Source DITCH	Amount Taken 9092.18 L	Diversion Date & Time 2012/10/20 10:00 AM

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2013/02/12

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GIC Well ID 1421357
 GoA Well Tag No.
 Drilling Company Well ID Waddell Creek 80-09
 -117
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	8	27	80	9	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation			
_____ m from _____				Latitude <u>55.960330</u> Longitude <u>-111.313673</u>				_____ 717.91 m _____			
_____ m from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
3.00		Clay & Gravel	
6.40		Brown Clay	
8.20		Sand	
39.60		Dark Gray Clay	
48.80		Clay & Sand	
57.90		Clay	
67.10		Clay & Sand	
97.50		Dark Gray Clay	
119.48		Sand	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate		_____ L/min	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/10/22		6.18	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
119.48 m	117.04 m	2012/10/18	2012/10/19	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	119.48		
22.23	0.00	118.26		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
Size OD :	_____ cm	Size OD :	_____ 10.16 cm	
Wall Thickness :	_____ cm	Wall Thickness :	_____ 0.856 cm	
Bottom at :	_____ m	Top at :	_____ -0.67 m	
		Bottom at :	_____ 117.04 m	
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
Perforated by				
Annular Seal Bentonite Slurry				
Placed from _____ 0.00 m to _____ 108.81 m				
Amount _____ 23.00 Bags				
Other Seals				
Type		At (m)		
Screen Type Plastic				
Size OD : _____ 10.16 cm				
From (m)	To (m)	Slot Size (cm)		
110.95	117.04	0.051		
Attachment <u>Attached To Casing</u>				
Top Fittings <u>Threaded</u>		Bottom Fittings <u>Plug</u>		
Pack				
Type <u>Sand</u>		Grain Size <u>10-20</u>		
Amount _____ 21.00 Bags				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2013/02/12

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GIC Well ID 1421357
 GoA Well Tag No.
 Drilling Company Well ID Waddell Creek 80-09
 -117
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	8	27	80	9	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation			
_____ m from _____				Latitude <u>55.960330</u> Longitude <u>-111.313673</u>				_____ 717.91 m			
_____ m from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			
Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level _____ 67.00 cm											
Is Artesian Flow _____					Is Flow Control Installed _____						
Rate _____ L/min					Describe _____						
Recommended Pump Rate _____ L/min				Pump Installed _____		Depth _____ m					
Recommended Pump Intake Depth (From TOC) _____ m				Type _____		Make _____		H.P. _____		Model (Output Rating) _____	
Did you Encounter Saline Water (>4000 ppm TDS) _____				Depth _____ m		Well Disinfected Upon Completion <u>Yes</u>					
Gas _____				Depth _____ m		Geophysical Log Taken <u>Electric, Gamma</u>					
								Submitted to ESRD			
				Sample Collected for Potability _____				Submitted to ESRD _____			
Additional Comments on Well											

Yield Test			Taken From Top of Casing	Measurement in Metric
Test Date 2012/10/22	Start Time 11:00 AM	Static Water Level 6.18 m	Depth to water level	
			Drawdown (m)	Recovery (m)
			Elapsed Time Minutes:Sec	
Method of Water Removal				
Type _____				
Removal Rate _____ L/min				
Depth Withdrawn From _____ m				
<i>If water removal period was < 2 hours, explain why</i>				

Water Diverted for Drilling		
Water Source DITCH	Amount Taken 9092.18 L	Diversion Date & Time 2012/10/18 10:00 AM

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2013/02/12

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GIC Well ID 1421370
 GoA Well Tag No.
 Drilling Company Well ID Mariana Lake 80-13-8
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA		Postal Code T6B 2X3
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	7	19	80	13	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)							
_____ m from _____				Latitude <u>55.946008</u> Longitude <u>-112.025321</u>				Elevation <u>692.90</u> m			
_____ m from _____				How Location Obtained Not Verified				How Elevation Obtained Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
3.00		Silty Sand	
4.60	Yes	Fine Grained Sand & Clay	
7.60	Yes	Fine Grained Clay & Sand	
7.92		Gray Till	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate		L/min	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/11/15		6.48	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
7.92 m	7.62 m	2012/10/31	2012/10/31	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	7.92		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
Size OD :	_____ cm	Size OD :	_____ 5.08 cm	
Wall Thickness :	_____ cm	Wall Thickness :	_____ 0.391 cm	
Bottom at :	_____ m	Top at :	_____ -0.67 m	
		Bottom at :	_____ 4.57 m	
Perforations				
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)
Perforated by				
Annular Seal Bentonite Chips/Tablets				
Placed from <u>0.00</u> m to <u>4.27</u> m				
Amount <u>4.00</u> Bags				
Other Seals				
Type		At (m)		
Screen Type Plastic				
Size OD : <u>5.08</u> cm				
From (m)	To (m)	Slot Size (cm)		
4.57	7.62	0.051		
Attachment <u>Attached To Casing</u>				
Top Fittings <u>Threaded</u>		Bottom Fittings <u>Plug</u>		
Pack				
Type <u>Sand</u>		Grain Size <u>10-20</u>		
Amount <u>5.00</u> Bags				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2013/02/12

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GIC Well ID 1421370
 GoA Well Tag No.
 Drilling Company Well ID Mariana Lake 80-13-8
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA		Postal Code T6B 2X3
Location	<i>1/4 or LSD</i> 7	<i>SEC</i> 19	<i>TWP</i> 80	<i>RGE</i> 13	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
Measured from Boundary of _____ m from _____ _____ m from _____				GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.946008</u> Longitude <u>-112.025321</u>				Elevation <u>692.90</u> m How Elevation Obtained Surveyed GPS <1m			
Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level <u>67.01</u> cm											
Is Artesian Flow _____					Is Flow Control Installed _____						
Rate _____ L/min					Describe _____						
Recommended Pump Rate _____ L/min					Pump Installed _____		Depth _____ m				
Recommended Pump Intake Depth (From TOC) _____ m					Type _____		Make _____		H.P. _____		
Model (Output Rating) _____											
Did you Encounter Saline Water (>4000 ppm TDS) _____					Depth _____ m		Well Disinfected Upon Completion <u>Yes</u>				
Gas _____					Depth _____ m		Geophysical Log Taken _____				
Submitted to ESRD _____											
Additional Comments on Well _____					Sample Collected for Potability _____			Submitted to ESRD _____			

Yield Test			Taken From Top of Casing	Measurement in Metric
Test Date	Start Time	Static Water Level	<i>Depth to water level</i>	
2012/11/15	11:00 AM	6.48 m		
			Drawdown (m)	Recovery (m)
			Elapsed Time	
			Minutes:Sec	
Method of Water Removal				
Type _____				
Removal Rate _____ L/min				
Depth Withdrawn From _____ m				
If water removal period was < 2 hours, explain why _____				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2013/02/12

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GIC Well ID 1421369
 GoA Well Tag No.
 Drilling Company Well ID Mariana Lake 80-13-50
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA		Postal Code T6B 2X3
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	7	19	80	13	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation			
_____ m from _____				Latitude <u>55.946008</u> Longitude <u>-112.025321</u>				Elevation <u>692.84</u> m			
_____ m from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
9.10		Clay	
12.20		Clay & Sand	
15.20		Clay	
21.30		Clay & Sand	
36.60		Clay	
38.10		Sand & Clay	
39.60		Medium Grained Sand	
41.10		Coarse Grained Sand	
50.60	Yes	Fine Grained Sand	
51.21		Till	
51.82		Unknown	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate		L/min	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/11/15		10.94	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
51.82 m	49.38 m	2012/10/31	2012/10/31	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	51.82		
22.23	0.00	51.82		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
Size OD :	_____ cm	Size OD :	_____ 10.16 cm	
Wall Thickness :	_____ cm	Wall Thickness :	_____ 0.856 cm	
Bottom at :	_____ m	Top at :	_____ -0.67 m	
		Bottom at :	_____ 43.28 m	
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
Perforated by				
Annular Seal Bentonite Slurry				
Placed from <u>0.00</u> m to <u>42.06</u> m				
Amount <u>10.00</u> Bags				
Other Seals				
Type		At (m)		
Screen Type Plastic				
Size OD : <u>10.16</u> cm				
From (m)	To (m)	Slot Size (cm)		
43.28	49.38	0.051		
Attachment <u>Attached To Casing</u>				
Top Fittings <u>Threaded</u>		Bottom Fittings <u>Plug</u>		
Pack				
Type <u>Sand</u>		Grain Size <u>10-20</u>		
Amount <u>20.00</u> Bags				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421369
 GoA Well Tag No. Mariana Lake 80-13-50
 Drilling Company Well ID 2013/02/26
 Date Report Received

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	7	19	80	13	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)							
_____ m from _____				Latitude <u>55.946008</u> Longitude <u>-112.025321</u>				Elevation <u>692.84</u> m			
_____ m from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			
Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level <u>67.01</u> cm											
Is Artesian Flow _____					Is Flow Control Installed _____						
Rate _____ L/min					Describe _____						
Recommended Pump Rate _____ L/min			Pump Installed _____			Depth _____ m					
Recommended Pump Intake Depth (From TOC) _____ m			Type _____			Make _____ H.P. _____			Model (Output Rating) _____		
Did you Encounter Saline Water (>4000 ppm TDS) _____				Depth _____ m		Well Disinfected Upon Completion <u>Yes</u>					
Gas _____				Depth _____ m		Geophysical Log Taken _____					
				Submitted to ESRD _____							
Additional Comments on Well _____				Sample Collected for Potability _____				Submitted to ESRD _____			

Yield Test			Taken From Top of Casing	Measurement in Metric
Test Date	Start Time	Static Water Level	Depth to water level	
2012/11/15	11:00 AM	10.94 m		
			Drawdown (m)	Recovery (m)
			Elapsed Time	
			Minutes:Sec	
Method of Water Removal				
Type _____				
Removal Rate _____ L/min				
Depth Withdrawn From _____ m				
If water removal period was < 2 hours, explain why _____				

Water Diverted for Drilling			
Water Source	Amount Taken	Diversion Date & Time	
DITCH	9092.18 L	2012/10/31 10:00 AM	

Contractor Certification			
Name of Journeyman responsible for drilling/construction of well		Certification No	
DARELL LEPPER		5449Q	
Company Name		Copy of Well report provided to owner	Date approval holder signed
LAKELAND DRILLING LTD.		Yes	2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421368
 GoA Well Tag No.
 Drilling Company Well ID Mariana Lake 80-13-111
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	7	19	80	13	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation			
_____ m from _____				Latitude <u>55.946008</u> Longitude <u>-112.025321</u>				_____ 692.96 m _____			
_____ m from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
9.10		Brown Clay	
27.40		Gray Clay	
33.50		Fine Grained Sand	
36.60		Dark Gray Clay	
38.10		Coarse Grained Sand	
42.70		Sand & Clay	
44.20		Dark Gray Clay	
51.80		Medium Grained Sand	
56.40		Clay	
57.90		Sand & Clay	
61.00		Fine Grained Sand	
79.20		Dark Gray Clay	
82.30		Fine Grained Clay & Sand	
107.90		Clay	
108.81	Yes	Sand	
112.78		Dark Gray Clay	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate		L/min	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/11/15		16.74	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
112.78 m	110.95 m	2012/10/29	2012/10/30	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	112.78		
22.23	0.00	112.78		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
Size OD :	_____ cm	Size OD :	_____ 10.16 cm	
Wall Thickness :	_____ cm	Wall Thickness :	_____ 0.856 cm	
Bottom at :	_____ m	Top at :	_____ -0.67 m	
		Bottom at :	_____ 107.90 m	
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
Perforated by				
Annular Seal Bentonite Slurry				
Placed from		to		
_____ 0.00 m		_____ 105.46 m		
Amount		_____ 20.00 Bags		
Other Seals				
Type		At (m)		
Screen Type Plastic				
Size OD : _____ 10.16 cm				
From (m)	To (m)	Slot Size (cm)		
107.90	110.95	0.051		
Attachment Attached To Casing				
Top Fittings Threaded		Bottom Fittings Plug		
Pack				
Type Sand		Grain Size 10-20		
Amount		_____ 13.00 Bags		

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421368
 GoA Well Tag No.
 Drilling Company Well ID Mariana Lake 80-13-111
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric
<i>Owner Name</i> AESRD		<i>Address</i> #111, 4999 - 98 AVE			<i>Town</i> EDMONTON		<i>Province</i> ALBERTA		<i>Country</i> CANADA	<i>Postal Code</i> T6B 2X3
<i>Location</i>										
<i>1/4 or LSD</i> 7	<i>SEC</i> 19	<i>TWP</i> 80	<i>RGE</i> 13	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
<i>Measured from Boundary of</i>					<i>GPS Coordinates in Decimal Degrees (NAD 83)</i>					
_____ m from _____		_____ m from _____		Latitude <u>55.946008</u>		Longitude <u>-112.025321</u>		Elevation <u>692.96</u> m		
					How Location Obtained Not Verified		How Elevation Obtained Surveyed GPS <1m			
Additional Information										Measurement in Metric
<i>Distance From Top of Casing to Ground Level</i> _____ 67.01 cm										
<i>Is Artesian Flow</i> _____					<i>Is Flow Control Installed</i> _____					
<i>Rate</i> _____ L/min					<i>Describe</i> _____					
<i>Recommended Pump Rate</i> _____ L/min				<i>Pump Installed</i> _____		<i>Depth</i> _____ m				
<i>Recommended Pump Intake Depth (From TOC)</i> _____ m				<i>Type</i> _____		<i>Make</i> _____		<i>H.P.</i> _____		<i>Model (Output Rating)</i> _____
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i> _____				<i>Depth</i> _____ m		<i>Well Disinfected Upon Completion</i> <u>Yes</u>				
<i>Gas</i> _____				<i>Depth</i> _____ m		<i>Geophysical Log Taken</i> _____				
										<i>Submitted to ESRD</i> _____
<i>Additional Comments on Well</i>										<i>Sample Collected for Potability</i> _____
										<i>Submitted to ESRD</i> _____

Yield Test				Taken From Top of Casing	Measurement in Metric
<i>Test Date</i> 2012/11/15	<i>Start Time</i> 11:00 AM	<i>Static Water Level</i> 16.74 m		<i>Depth to water level</i>	
				Drawdown (m)	Elapsed Time Minutes:Sec
					Recovery (m)
<i>Method of Water Removal</i>					
<i>Type</i> _____					
<i>Removal Rate</i> _____ L/min					
<i>Depth Withdrawn From</i> _____ m					
<i>If water removal period was < 2 hours, explain why</i>					

Water Diverted for Drilling		
<i>Water Source</i> DITCH	<i>Amount Taken</i> 9092.18 L	<i>Diversion Date & Time</i> 2012/10/29 10:00 AM

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> Yes
	<i>Date approval holder signed</i> 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421367
 GoA Well Tag No.
 Drilling Company Well ID Mariana Lake 80-13-134
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA		Postal Code T6B 2X3
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	7	19	80	13	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)							
_____ m from _____				Latitude <u>55.946008</u> Longitude <u>-112.025321</u>				Elevation <u>692.89</u> m			
_____ m from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
33.50		Clay	
36.60		Clay & Sand	
38.10		Fine Grained Sand	
39.60		Medium Grained Sand	
41.10		Dark Gray Clay	
44.20		Sand & Clay	
51.80		Sand	
54.80		Gravel	
57.90		Clay	
64.00		Sand	
67.10		Sand & Clay	
94.50		Clay	
97.50		Sand	
112.20		Clay	
118.90		Sand	
137.20		Dark Gray Clay	
140.21		Shale	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate		_____ L/min	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/11/15		45.80	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
140.21 m	133.50 m	2012/10/27	2012/10/29	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	140.21		
22.23	0.00	135.64		

Surface Casing (if applicable)		Well Casing/Liner	
Plastic		Plastic	
Size OD :	_____ cm	Size OD :	10.16 cm
Wall Thickness :	_____ cm	Wall Thickness :	0.856 cm
Bottom at :	_____ m	Top at :	-0.67 m
		Bottom at :	130.45 m

Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)

Perforated by _____

Annular Seal Bentonite Slurry
 Placed from 0.00 m to 129.24 m
 Amount 28.00 Bags

Other Seals

Type	At (m)

Screen Type Plastic
 Size OD : 10.16 cm

From (m)	To (m)	Slot Size (cm)
130.45	133.50	0.051

Attachment Attached To Casing
 Top Fittings Threaded Bottom Fittings Plug

Pack

Type Sand Grain Size 10-20
 Amount 19.00 Bags

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421367
 GoA Well Tag No.
 Drilling Company Well ID Mariana Lake 80-13-134
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric
<i>Owner Name</i> AESRD		<i>Address</i> #111, 4999 - 98 AVE			<i>Town</i> EDMONTON		<i>Province</i> ALBERTA		<i>Country</i> CANADA	<i>Postal Code</i> T6B 2X3
<i>Location</i>										
<i>1/4 or LSD</i> 7	<i>SEC</i> 19	<i>TWP</i> 80	<i>RGE</i> 13	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
<i>Measured from Boundary of</i>					<i>GPS Coordinates in Decimal Degrees (NAD 83)</i>					
_____ m from _____					<i>Latitude</i> 55.946008		<i>Longitude</i> -112.025321		<i>Elevation</i> 692.89 m	
_____ m from _____					<i>How Location Obtained</i>					<i>How Elevation Obtained</i>
					Not Verified					Surveyed GPS <1m
Additional Information										Measurement in Metric
<i>Distance From Top of Casing to Ground Level</i> 67.01 cm										
<i>Is Artesian Flow</i>					<i>Is Flow Control Installed</i>					
<i>Rate</i> _____ L/min					<i>Describe</i> _____					
<i>Recommended Pump Rate</i>			<i>L/min</i>		<i>Pump Installed</i>		<i>Depth</i>		<i>m</i>	
<i>Recommended Pump Intake Depth (From TOC)</i>			<i>m</i>		<i>Type</i>	<i>Make</i>	<i>H.P.</i>	<i>Model (Output Rating)</i>		
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i>					<i>Depth</i> _____ m		<i>Well Disinfected Upon Completion</i> Yes			
<i>Gas</i>					<i>Depth</i> _____ m		<i>Geophysical Log Taken</i> Electric, Gamma			
					<i>Submitted to ESRD</i>					
<i>Additional Comments on Well</i>					<i>Sample Collected for Potability</i>			<i>Submitted to ESRD</i>		

Yield Test				Taken From Top of Casing	Measurement in Metric
<i>Test Date</i> 2012/11/15	<i>Start Time</i> 11:00 AM	<i>Static Water Level</i> 45.80 m		<i>Depth to water level</i>	
				Drawdown (m)	Elapsed Time Minutes:Sec
					Recovery (m)
<i>Method of Water Removal</i>					
<i>Type</i> _____					
<i>Removal Rate</i>			<i>L/min</i>		
<i>Depth Withdrawn From</i>			<i>m</i>		
<i>If water removal period was < 2 hours, explain why</i>					

Water Diverted for Drilling		
<i>Water Source</i> DITCH	<i>Amount Taken</i> 9092.18 L	<i>Diversion Date & Time</i> 2012/10/27 10:00 AM

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> Yes
	<i>Date approval holder signed</i> 2013/02/12

GIC Well ID 1270140
 GoA Well Tag No.
 Drilling Company Well ID
 Date Report Received

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric
Owner Name AEUB / AGS		Address 4999-98 AVE			Town EDMONTON		Province AB	Country CA	Postal Code	
Location	<i>1/4 or LSD</i> 7	<i>SEC</i> 36	<i>TWP</i> 77	<i>RGE</i> 15	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.714397</u> Longitude <u>-112.187915</u> How Location Obtained Hand held autonomous GPS 20-30m			Elevation _____ m How Elevation Obtained Not Obtained		

Drilling Information	
Method of Drilling Rotary	Type of Work Piezometer
Proposed Well Use Investigation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
0.91		Till	
1.22		Muskeg	
1.83		Silty Muskeg	
3.66		Sand & Silt	
5.18		Silt	
7.01		Coarse Grained Sand	
8.53		Till	

Yield Test Summary			Measurement in Metric
<i>Recommended Pump Rate</i> _____ L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	

Well Completion				Measurement in Metric
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
8.53 m		2000/11/16	2000/11/16	
Borehole				
Diameter (cm)		From (m)	To (m)	
Surface Casing (if applicable)			Well Casing/Liner	
Plastic			Plastic	
Size OD : <u>6.05 cm</u>			Size OD : <u>6.05 cm</u>	
Wall Thickness : <u>0.635 cm</u>			Wall Thickness : <u>0.635 cm</u>	
Bottom at : <u>5.49 m</u>			Top at : <u>5.49 m</u>	
			Bottom at : <u>8.53 m</u>	
Perforations				
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)
5.49	8.53	0.051		5.08
Perforated by Machine				
Annular Seal Bentonite Chips/Tablets				
Placed from <u>0.00 m</u> to <u>3.96 m</u>				
Amount _____				
Other Seals				
Type			At (m)	
Screen Type				
Size OD : _____ cm				
From (m)		To (m)		Slot Size (cm)
Attachment _____				
Top Fittings _____			Bottom Fittings _____	
Pack				
Type <u>Frac Sand</u>			Grain Size <u>20-40</u>	
Amount <u>150.00</u> Unknown				

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> KELLY TOPILKA	<i>Certification No</i> 11299A
<i>Company Name</i> ELK POINT DRILLING CORP.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i>

GIC Well ID 1270140
 GoA Well Tag No.
 Drilling Company Well ID
 Date Report Received

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name AEUB / AGS		Address 4999-98 AVE			Town EDMONTON		Province AB	Country CA	Postal Code		
Location	<i>1/4 or LSD</i> 7	<i>SEC</i> 36	<i>TWP</i> 77	<i>RGE</i> 15	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
Measured from Boundary of _____ m from _____ _____ m from _____				GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.714397</u> Longitude <u>-112.187915</u> How Location Obtained Hand held autonomous GPS 20-30m				Elevation _____ m How Elevation Obtained Not Obtained			

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level _____ cm					Is Artesian Flow _____						Is Flow Control Installed _____
Rate _____ L/min		L/min		Describe _____							
Recommended Pump Rate _____ L/min			Pump Installed _____			Depth _____ m					
Recommended Pump Intake Depth (From TOC) _____ m			Type _____		Make _____		H.P. _____		Model (Output Rating) _____		
Did you Encounter Saline Water (>4000 ppm TDS) _____				Depth _____ m		Well Disinfected Upon Completion _____					
Gas _____				Depth _____ m		Geophysical Log Taken <u>Electric</u> Submitted to ESRD					
Additional Comments on Well WR 1 - 8 WT 55 42 51.83139 N 112 11 16.49312 W				Sample Collected for Potability _____				Submitted to ESRD _____			

Yield Test			Taken From Ground Level	Measurement in Metric
<i>Test Date</i>	<i>Start Time</i>	<i>Static Water Level</i> _____ m		
Method of Water Removal				
Type _____				
Removal Rate _____ L/min				
Depth Withdrawn From _____ m				
If water removal period was < 2 hours, explain why				

Water Diverted for Drilling		
<i>Water Source</i>	<i>Amount Taken</i> _____ L	<i>Diversion Date & Time</i>

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> KELLY TOPILKA	<i>Certification No</i> 11299A
<i>Company Name</i> ELK POINT DRILLING CORP.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i>

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421373
 GoA Well Tag No.
 Drilling Company Well ID House River 77-15-82
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Imperial	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i>	<i>SEC</i>	<i>TWP</i>	<i>RGE</i>	<i>W of MER</i>	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
	7	36	77	15	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation			
_____ ft from _____				Latitude <u>55.713401</u> Longitude <u>-112.189210</u>				_____ 2173.59 ft			
_____ ft from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Imperial
Depth from ground level (ft)	Water Bearing	Lithology Description	
5.91		Muskeg	
17.06		Sand	
187.99		Clay	
193.90		Sand	
255.91		Clay	
270.01	Yes	Sand	
277.89		Clay & Sand	
280.00		Sand	

Yield Test Summary			Measurement in Imperial
Recommended Pump Rate		_____ igpm	
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)	
2012/11/15		216.37	

Well Completion				Measurement in Imperial
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
280.00 ft	267.00 ft	2012/11/11	2012/11/12	
Borehole				
Diameter (in)	From (ft)	To (ft)		
6.25	0.00	280.00		
8.75	0.00	272.00		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
Size OD :	_____ in	Size OD :	_____ 4.00 in	
Wall Thickness :	_____ in	Wall Thickness :	_____ 0.337 in	
Bottom at :	_____ ft	Top at :	_____ -2.20 ft	
		Bottom at :	_____ 257.00 ft	
Perforations				
From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length(in)	Hole or Slot Interval(in)
Perforated by				
Annular Seal Bentonite Slurry				
Placed from		to		
_____ 0.00 ft		_____ 255.00 ft		
Amount		_____ 14.00 Bags		
Other Seals				
Type		At (ft)		
Screen Type Plastic				
Size OD :		_____ 4.00 in		
From (ft)	To (ft)	Slot Size (in)		
257.00	267.00	0.010		
Attachment Attached To Casing				
Top Fittings		Bottom Fittings		
_____ Threaded		_____ Plug		
Pack				
Type		Grain Size		
_____ Sand		_____ 10-20		
Amount		_____ 9.00 Bags		

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421373
 GoA Well Tag No.
 Drilling Company Well ID House River 77-15-82
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Imperial		
<i>Owner Name</i> AESRD		<i>Address</i> #111, 4999 - 98 AVE			<i>Town</i> EDMONTON		<i>Province</i> ALBERTA		<i>Country</i> CANADA	<i>Postal Code</i> T6B 2X3		
<i>Location</i>												
<i>1/4 or LSD</i> 7	<i>SEC</i> 36	<i>TWP</i> 77	<i>RGE</i> 15	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>				
<i>Measured from Boundary of</i> _____ ft from _____ _____ ft from _____					<i>GPS Coordinates in Decimal Degrees (NAD 83)</i> Latitude <u>55.713401</u> Longitude <u>-112.189210</u>			<i>Elevation</i> <u>2173.59 ft</u> <i>How Elevation Obtained</i> Surveyed GPS <1m				
<i>Additional Information</i>										Measurement in Imperial		
<i>Distance From Top of Casing to Ground Level</i> _____ 26.38 in				<i>Is Artesian Flow</i> _____							<i>Is Flow Control Installed</i> _____	
<i>Rate</i> _____ igpm				<i>Describe</i> _____								
<i>Recommended Pump Rate</i> _____ igpm				<i>Pump Installed</i> _____		<i>Depth</i> _____ ft						
<i>Recommended Pump Intake Depth (From TOC)</i> _____ ft				<i>Type</i> _____		<i>Make</i> _____		<i>H.P.</i> _____		<i>Model (Output Rating)</i> _____		
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i> _____				<i>Depth</i> _____ ft		<i>Well Disinfected Upon Completion</i> <u>Yes</u>						
<i>Gas</i> _____				<i>Depth</i> _____ ft		<i>Geophysical Log Taken</i> _____						
						<i>Submitted to ESRD</i> _____						
<i>Additional Comments on Well</i>				<i>Sample Collected for Potability</i> _____		<i>Submitted to ESRD</i> _____						

Yield Test			Taken From Top of Casing	Measurement in Imperial
<i>Test Date</i> 2012/11/15	<i>Start Time</i> 11:00 AM	<i>Static Water Level</i> 216.37 ft	<i>Depth to water level</i>	
			Drawdown (ft)	Elapsed Time Minutes:Sec
			_____	_____
<i>Method of Water Removal</i>				
<i>Type</i> _____				
<i>Removal Rate</i> _____ igpm				
<i>Depth Withdrawn From</i> _____ ft				
<i>If water removal period was < 2 hours, explain why</i>				

Water Diverted for Drilling		
<i>Water Source</i> DITCH	<i>Amount Taken</i> 2000.00 ig	<i>Diversion Date & Time</i> 2012/11/11 10:00 AM

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421372
 GoA Well Tag No.
 Drilling Company Well ID House River 77-15-126
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	7	36	77	15	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)				Elevation			
_____ m from _____				Latitude <u>55.713401</u> Longitude <u>-112.189210</u>				_____ 662.48 m			
_____ m from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
2.40		Muskeg	
15.80		Clay	
78.00		Clay & Silt	
85.30		Sand & Clay	
88.00		Fine Grained Sand	
89.60		Clay	
92.00		Sand	
93.20		Clay	
94.10		Sand	
97.50		Clay & Sand	
105.40		Clay	
111.90		Sand	
113.90		Clay	
120.70		Clay	
128.02	Yes	Fine Grained Sand	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate		_____ L/min	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/11/15		52.50	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
128.02 m	126.00 m	2012/11/10	2012/11/11	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	128.02		
22.23	0.00	128.02		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
Size OD :	_____ cm	Size OD :	_____ 10.16 cm	
Wall Thickness :	_____ cm	Wall Thickness :	_____ 0.856 cm	
Bottom at :	_____ m	Top at :	_____ -0.67 m	
		Bottom at :	_____ 120.00 m	
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
Perforated by				
Annular Seal Bentonite Slurry				
Placed from _____ 0.00 m to _____ 118.87 m				
Amount _____ 21.00 Bags				
Other Seals				
Type		At (m)		
Screen Type Plastic				
Size OD : _____ 10.16 cm				
From (m)	To (m)	Slot Size (cm)		
120.00	126.00	0.020		
Attachment <u>Attached To Casing</u>				
Top Fittings <u>Threaded</u>		Bottom Fittings <u>Plug</u>		
Pack				
Type <u>Sand</u>		Grain Size <u>10-20</u>		
Amount _____ 18.00 Bags				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421372
 GoA Well Tag No.
 Drilling Company Well ID House River 77-15-126
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
<i>Owner Name</i> AESRD		<i>Address</i> #111, 4999 - 98 AVE			<i>Town</i> EDMONTON		<i>Province</i> ALBERTA		<i>Country</i> CANADA	<i>Postal Code</i> T6B 2X3	
<i>Location</i>	<i>1/4 or LSD</i> 7	<i>SEC</i> 36	<i>TWP</i> 77	<i>RGE</i> 15	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
<i>Measured from Boundary of</i> _____ m from _____ _____ m from _____					<i>GPS Coordinates in Decimal Degrees (NAD 83)</i> Latitude <u>55.713401</u> Longitude <u>-112.189210</u> <i>How Location Obtained</i> Not Verified					<i>Elevation</i> <u>662.48 m</u> <i>How Elevation Obtained</i> Surveyed GPS <1m	
Additional Information										Measurement in Metric	
<i>Distance From Top of Casing to Ground Level</i> _____ 67.01 cm					<i>Is Artesian Flow</i> _____						
<i>Rate</i> _____ L/min					<i>Is Flow Control Installed</i> _____ <i>Describe</i> _____						
<i>Recommended Pump Rate</i> _____ L/min			<i>Recommended Pump Intake Depth (From TOC)</i> _____ m			<i>Pump Installed</i> _____		<i>Depth</i> _____ m		<i>Model (Output Rating)</i> _____	
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i> _____					<i>Depth</i> _____ m		<i>Well Disinfected Upon Completion</i> <u>Yes</u>				
<i>Gas</i> _____					<i>Depth</i> _____ m		<i>Geophysical Log Taken</i> _____ <i>Submitted to ESRD</i> _____				
<i>Additional Comments on Well</i>					<i>Sample Collected for Potability</i> _____			<i>Submitted to ESRD</i> _____			

Yield Test			Taken From Top of Casing	Measurement in Metric
<i>Test Date</i> 2012/11/15	<i>Start Time</i> 11:00 AM	<i>Static Water Level</i> 52.50 m	<i>Depth to water level</i>	
			Drawdown (m)	Elapsed Time Minutes:Sec
			_____	_____
<i>Method of Water Removal</i>				
<i>Type</i> _____				
<i>Removal Rate</i> _____ L/min				
<i>Depth Withdrawn From</i> _____ m				
<i>If water removal period was < 2 hours, explain why</i>				

Water Diverted for Drilling		
<i>Water Source</i> DITCH	<i>Amount Taken</i> 9092.18 L	<i>Diversion Date & Time</i> 2012/11/10 10:00 AM

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421371
 GoA Well Tag No.
 Drilling Company Well ID House River 77-15-161
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Imperial	
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i>	<i>SEC</i>	<i>TWP</i>	<i>RGE</i>	<i>W of MER</i>	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
	7	36	77	15	4						
Measured from Boundary of				GPS Coordinates in Decimal Degrees (NAD 83)							
_____ ft from _____				Latitude <u>55.713401</u> Longitude <u>-112.189210</u>				Elevation <u>2173.62</u> ft			
_____ ft from _____				How Location Obtained				How Elevation Obtained			
				Not Verified				Surveyed GPS <1m			

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Imperial
Depth from ground level (ft)	Water Bearing	Lithology Description	
19.03		Clay	
23.95		Sand	
255.91		Clay	
267.06		Clay & Sand	
295.93		Sand & Clay	
306.10		Sand	
346.46		Clay	
354.99		Sand	
369.09		Clay	
381.89		Sand	
392.06		Clay	
404.86		Sand	
433.73		Clay	
481.96		Fine Grained Sand	
500.00		Clay	
535.11	Yes	Sand	
540.00		Clay	

Yield Test Summary			Measurement in Imperial
<i>Recommended Pump Rate</i> _____ igpm			
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)	
2012/11/15		203.24	

Well Completion				Measurement in Imperial
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
540.00 ft	530.00 ft	2012/11/06	2012/11/09	
Borehole				
Diameter (in)	From (ft)	To (ft)		
6.25	0.00	540.00		
8.75	0.00	535.00		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
<i>Size OD :</i> _____ in			<i>Size OD :</i> <u>4.00</u> in	
<i>Wall Thickness :</i> _____ in			<i>Wall Thickness :</i> <u>0.337</u> in	
<i>Bottom at :</i> _____ ft			<i>Top at :</i> <u>-2.20</u> ft	
		<i>Bottom at :</i> <u>510.00</u> ft		
Perforations				
From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length(in)	Hole or Slot Interval(in)
<i>Perforated by</i>				
Annular Seal Bentonite Slurry				
<i>Placed from</i> <u>0.00</u> ft to <u>499.00</u> ft				
<i>Amount</i> <u>28.00</u> Bags				
<i>Other Seals</i>				
Type		At (ft)		
Screen Type Plastic				
<i>Size OD :</i> <u>4.00</u> in				
From (ft)	To (ft)	Slot Size (in)		
510.00	530.00	0.020		
<i>Attachment</i> <u>Attached To Casing</u>				
<i>Top Fittings</i> <u>Threaded</u>		<i>Bottom Fittings</i> <u>Plug</u>		
Pack				
<i>Type</i> <u>Sand</u>		<i>Grain Size</i> <u>10-20</u>		
<i>Amount</i> <u>18.00</u> Bags				

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421371
 GoA Well Tag No.
 Drilling Company Well ID House River 77-15-161
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Imperial	
Owner Name AESRD	Address #111, 4999 - 98 AVE					Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i> 7	<i>SEC</i> 36	<i>TWP</i> 77	<i>RGE</i> 15	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
Measured from Boundary of _____ ft from _____ _____ ft from _____			GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.713401</u> Longitude <u>-112.189210</u>				Elevation <u>2173.62</u> ft		How Elevation Obtained Surveyed GPS <1m		
Additional Information										Measurement in Imperial	
Distance From Top of Casing to Ground Level <u>26.38</u> in					Is Artesian Flow _____		Is Flow Control Installed _____		Rate _____ igpm		Describe _____
Recommended Pump Rate _____ igpm			Pump Installed _____		Depth _____ ft		Recommended Pump Intake Depth (From TOC) _____ ft		Type _____ Make _____ H.P. _____		Model (Output Rating) _____
Did you Encounter Saline Water (>4000 ppm TDS) _____			Depth _____ ft		Well Disinfected Upon Completion <u>Yes</u>		Gas _____		Depth _____ ft		Geophysical Log Taken <u>Electric, Gamma</u> Submitted to ESRD
Additional Comments on Well _____						Sample Collected for Potability _____		Submitted to ESRD _____			

Yield Test			Taken From Top of Casing	Measurement in Imperial
Test Date 2012/11/15	Start Time 11:00 AM	Static Water Level 203.24 ft	<i>Depth to water level</i>	
			Drawdown (ft)	Recovery (ft)
			Elapsed Time Minutes:Sec	
Method of Water Removal				
Type _____				
Removal Rate _____ igpm				
Depth Withdrawn From _____ ft				
If water removal period was < 2 hours, explain why _____				

Water Diverted for Drilling		
Water Source DITCH	Amount Taken 2000.00 ig	Diversion Date & Time 2012/11/06 10:00 AM

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1270149
 GoA Well Tag No.
 Drilling Company Well ID
 Date Report Received

Well Identification and Location										Measurement in Metric
Owner Name AEUB / AGS		Address 4999-98 AVE			Town EDMONTON		Province AB	Country CA	Postal Code	
Location	<i>1/4 or LSD</i> 07	<i>SEC</i> 36	<i>TWP</i> 77	<i>RGE</i> 15	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>55.713510</u> Longitude <u>-112.187810</u> How Location Obtained Not Verified			Elevation _____ m How Elevation Obtained Not Obtained		

Drilling Information	
Method of Drilling Rotary	Type of Work Piezometer
Proposed Well Use Investigation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
1.22		Fill	
6.10		Fine Grained Sand	
76.81		Gray Till	
80.77		Sand	
89.00		Till	
93.27		Sand	
104.85		Till	
107.29		Sand	
110.34		Till	
117.65		Gray Silt	
119.48		Clay	
131.06		Sand & Silt	
148.74		Clay & Silt	
163.37		Sand & Gravel	
191.41		Clay & Silt	
209.70		Sand & Silt	
215.80		Sand & Gravel	
223.11		Silt	
224.94		Clay	
231.04		Silt & Rocks	

Yield Test Summary			Measurement in Metric
<i>Recommended Pump Rate</i> _____ L/min			
<i>Test Date</i>	<i>Water Removal Rate (L/min)</i>		<i>Static Water Level (m)</i>

Well Completion				Measurement in Metric
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
231.04 m		2000/11/14	2000/11/14	
Borehole				
Diameter (cm)		From (m)	To (m)	
Surface Casing (if applicable)		Well Casing/Liner		
Plastic		Plastic		
Size OD : <u>6.05 cm</u>		Size OD : <u>6.05 cm</u>		
Wall Thickness : <u>0.635 cm</u>		Wall Thickness : <u>0.635 cm</u>		
Bottom at : <u>227.69 m</u>		Top at : <u>227.69 m</u>		
		Bottom at : <u>230.73 m</u>		
Perforations				
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)
227.69	230.73	0.051		5.08
Perforated by Machine				
Annular Seal Bentonite Chips/Tablets				
Placed from <u>0.00 m</u> to <u>226.16 m</u>				
Amount _____				
Other Seals				
Type		At (m)		
Screen Type				
Size OD : _____ cm				
From (m)		To (m)		Slot Size (cm)
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
Pack				
Type <u>Frac Sand</u>		Grain Size <u>20-40</u>		
Amount <u>350.00 Pounds</u>				

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> KELLY TOPILKA	<i>Certification No</i> 11299A
<i>Company Name</i> ELK POINT DRILLING CORP.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i>

GIC Well ID 1270149
 GoA Well Tag No.
 Drilling Company Well ID
 Date Report Received

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name AEUB / AGS		Address 4999-98 AVE			Town EDMONTON		Province AB	Country CA	Postal Code		
Location	<i>1/4 or LSD</i> 07	<i>SEC</i> 36	<i>TWP</i> 77	<i>RGE</i> 15	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>55.713510</u>		Longitude <u>-112.187810</u>		Elevation _____ m		
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Not Verified					Not Obtained	

Additional Information										Measurement in Metric
<i>Distance From Top of Casing to Ground Level</i> _____ cm										
<i>Is Artesian Flow</i> _____					<i>Is Flow Control Installed</i> _____					
<i>Rate</i> _____ L/min					<i>Describe</i> _____					
<i>Recommended Pump Rate</i> _____ L/min					<i>Pump Installed</i> _____		<i>Depth</i> _____ m			
<i>Recommended Pump Intake Depth (From TOC)</i> _____ m					<i>Type</i> _____	<i>Make</i> _____	<i>H.P.</i> _____	<i>Model (Output Rating)</i> _____		
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i> _____					<i>Depth</i> _____ m		<i>Well Disinfected Upon Completion</i> _____			
<i>Gas</i> _____					<i>Depth</i> _____ m		<i>Geophysical Log Taken</i> <u>Electric</u>			
					<i>Submitted to ESRD</i> _____					
<i>Additional Comments on Well</i>					<i>Sample Collected for Potability</i> _____			<i>Submitted to ESRD</i> _____		

Yield Test			Taken From Ground Level	Measurement in Metric
<i>Test Date</i>	<i>Start Time</i>	<i>Static Water Level</i>		
		_____ m		
Method of Water Removal				
<i>Type</i> _____				
<i>Removal Rate</i> _____ L/min				
<i>Depth Withdrawn From</i> _____ m				
<i>If water removal period was < 2 hours, explain why</i>				

Water Diverted for Drilling		
<i>Water Source</i>	<i>Amount Taken</i>	<i>Diversion Date & Time</i>
	_____ L	

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> KELLY TOPILKA	<i>Certification No</i> 11299A
<i>Company Name</i> ELK POINT DRILLING CORP.	<i>Copy of Well report provided to owner</i> _____ <i>Date approval holder signed</i>

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421377
 GoA Well Tag No.
 Drilling Company Well ID Plamondon 68-16-7
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric
Owner Name AESRD		Address #111, 4999 - 98			Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i> 10	<i>SEC</i> 26	<i>TWP</i> 68	<i>RGE</i> 16	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>54.916464</u> Longitude <u>-112.328605</u>			Elevation <u>577.92</u> m		
					How Location Obtained Not Verified			How Elevation Obtained Surveyed GPS <1m		

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
6.70	Yes	Sand	
7.00		Clay	
7.92	Yes	Sand	

Yield Test Summary			Measurement in Metric
<i>Recommended Pump Rate</i> _____ L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/11/16		6.64	

Well Completion				Measurement in Metric
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
7.92 m	7.32 m	2012/11/16	2012/11/16	
Borehole				
<i>Diameter (cm)</i>	<i>From (m)</i>	<i>To (m)</i>		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
<i>Size OD :</i> _____ cm			<i>Size OD :</i> <u>5.08</u> cm	
<i>Wall Thickness :</i> _____ cm			<i>Wall Thickness :</i> <u>0.554</u> cm	
<i>Bottom at :</i> _____ m			<i>Top at :</i> <u>-0.67</u> m	
		<i>Bottom at :</i> <u>4.27</u> m		
Perforations				
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)
<i>Perforated by</i>				
Annular Seal Bentonite Chips/Tablets				
<i>Placed from</i> <u>0.00</u> m		<i>to</i> <u>3.96</u> m		
<i>Amount</i> <u>8.00</u> Bags				
<i>Other Seals</i>				
<i>Type</i>		<i>At (m)</i>		
Screen Type Plastic				
<i>Size OD :</i> <u>5.08</u> cm				
From (m)	To (m)	Slot Size (cm)		
4.27	7.32	0.051		
<i>Attachment</i> Attached To Casing _____				
<i>Top Fittings</i> <u>Threaded</u>		<i>Bottom Fittings</i> <u>Plug</u>		
Pack				
<i>Type</i> <u>Sand</u>		<i>Grain Size</i> <u>10-20</u>		
<i>Amount</i> <u>12.00</u> Bags				

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> Yes
	<i>Date approval holder signed</i> 2013/01/12

GIC Well ID 1421377
 GoA Well Tag No.
 Drilling Company Well ID Plamondon 68-16-7
 Date Report Received 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric
Owner Name AESRD		Address #111, 4999 - 98			Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i> 10	<i>SEC</i> 26	<i>TWP</i> 68	<i>RGE</i> 16	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>54.916464</u> Longitude <u>-112.328605</u> How Location Obtained Not Verified			Elevation <u>577.92</u> m How Elevation Obtained Surveyed GPS <1m		

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level <u>67.01</u> cm					Is Artesian Flow _____					Is Flow Control Installed _____
Rate _____ L/min		_____ L/min		Describe _____		_____				
Recommended Pump Rate _____ L/min		Pump Installed _____		Depth _____ m		_____				
Recommended Pump Intake Depth (From TOC) _____ m		Type _____		Make _____		H.P. _____		Model (Output Rating) _____		
Did you Encounter Saline Water (>4000 ppm TDS) _____			Depth _____ m		Well Disinfected Upon Completion <u>Yes</u>					
Gas _____			Depth _____ m		Geophysical Log Taken _____ Submitted to ESRD _____					
Additional Comments on Well _____					Sample Collected for Potability _____		Submitted to ESRD _____			

Yield Test			Taken From Top of Casing	Measurement in Metric
Test Date 2012/11/16	Start Time 11:00 AM	Static Water Level 6.64 m	<i>Depth to water level</i>	
			Drawdown (m)	Elapsed Time Minutes:Sec
			_____	_____
			_____	_____
Method of Water Removal				
Type _____				
Removal Rate _____ L/min		_____		
Depth Withdrawn From _____ m				
If water removal period was < 2 hours, explain why _____				

Water Diverted for Drilling		
Water Source _____	Amount Taken _____ L	Diversion Date & Time _____

Contractor Certification			
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER		Certification No 5449Q	
Company Name LAKELAND DRILLING LTD.		Copy of Well report provided to owner Yes	Date approval holder signed 2013/01/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421376
 GoA Well Tag No.
 Drilling Company Well ID Plamondon 68-16-39
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA	Postal Code T6B 2X3
Location		<i>1/4 or LSD</i> 10	<i>SEC</i> 26	<i>TWP</i> 68	<i>RGE</i> 16	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)					
_____ m from _____					Latitude <u>54.916464</u> Longitude <u>-112.328605</u>			Elevation <u>577.88</u> m		
_____ m from _____					How Location Obtained Not Verified			How Elevation Obtained Surveyed GPS <1m		

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
6.70		Sand	
7.00		Clay	
7.90		Sand	
14.00		Clay	
15.80		Sand	
23.70		Clay & Gravel	
24.00		Sand	
32.60		Clay	
38.70	Yes	Sand	
40.23		Clay	

Yield Test Summary			Measurement in Metric
<i>Recommended Pump Rate</i> _____		<i>L/min</i>	
<i>Test Date</i>	<i>Water Removal Rate (L/min)</i>	<i>Static Water Level (m)</i>	
2012/11/16		29.18	

Well Completion				Measurement in Metric
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
40.23 m	38.71 m	2012/11/16	2012/11/16	
Borehole				
<i>Diameter (cm)</i>	<i>From (m)</i>	<i>To (m)</i>		
15.88	0.00	40.23		
22.23	0.00	40.23		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
<i>Size OD :</i> _____	<i>cm</i>	<i>Size OD :</i> _____	<i>10.16 cm</i>	
<i>Wall Thickness :</i> _____	<i>cm</i>	<i>Wall Thickness :</i> _____	<i>0.856 cm</i>	
<i>Bottom at :</i> _____	<i>m</i>	<i>Top at :</i> _____	<i>-0.67 m</i>	
		<i>Bottom at :</i> _____	<i>32.61 m</i>	
Perforations				
<i>From (m)</i>	<i>To (m)</i>	<i>Diameter or Slot Width (cm)</i>	<i>Slot Length (cm)</i>	<i>Hole or Slot Interval (cm)</i>
<i>Perforated by</i>				
Annular Seal Bentonite Slurry				
<i>Placed from</i> _____		<i>0.00 m to 30.78 m</i>		
<i>Amount</i> _____		<i>9.00 Bags</i>		
<i>Other Seals</i>				
	<i>Type</i>	<i>At (m)</i>		
Screen Type Plastic				
<i>Size OD :</i> _____ <i>10.16 cm</i>				
<i>From (m)</i>	<i>To (m)</i>	<i>Slot Size (cm)</i>		
32.61	38.71	0.051		
<i>Attachment</i> <u>Attached To Casing</u>				
<i>Top Fittings</i> <u>Threaded</u>		<i>Bottom Fittings</i> <u>Plug</u>		
Pack				
<i>Type</i> <u>Sand</u>		<i>Grain Size</i> <u>10-20</u>		
<i>Amount</i> _____		<i>16.00 Bags</i>		

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

GIC Well ID 1421376
 GoA Well Tag No.
 Drilling Company Well ID Plamondon 68-16-39
 Date Report Received 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE				Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location	1/4 or LSD 10	SEC 26	TWP 68	RGE 16	W of MER 4	Lot	Block	Plan	Additional Description		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>54.916464</u> Longitude <u>-112.328605</u>					Elevation <u>577.88 m</u>	
_____ m from _____					How Location Obtained Not Verified					How Elevation Obtained Surveyed GPS <1m	

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level <u>67.01 cm</u>											
Is Artesian Flow _____					Is Flow Control Installed _____						
Rate _____ L/min					Describe _____						
Recommended Pump Rate _____ L/min					Pump Installed _____		Depth _____ m				
Recommended Pump Intake Depth (From TOC) _____ m					Type _____	Make _____	H.P. _____	Model (Output Rating) _____			
Did you Encounter Saline Water (>4000 ppm TDS) _____					Depth _____ m		Well Disinfected Upon Completion <u>Yes</u>				
Gas _____					Depth _____ m		Geophysical Log Taken _____				
					Submitted to ESRD _____						
Additional Comments on Well _____					Sample Collected for Potability _____		Submitted to ESRD _____				

Yield Test				Taken From Top of Casing	Measurement in Metric
Test Date 2012/11/16	Start Time 11:00 AM	Static Water Level 29.18 m		<i>Depth to water level</i>	
				Drawdown (m)	Elapsed Time Minutes:Sec
					Recovery (m)
Method of Water Removal					
Type _____					
Removal Rate _____ L/min					
Depth Withdrawn From _____ m					
If water removal period was < 2 hours, explain why _____					

Water Diverted for Drilling		
Water Source DITCH	Amount Taken 9092.18 L	Diversion Date & Time 2012/11/16 10:00 AM

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well DARELL LEPPER	Certification No 5449Q
Company Name LAKELAND DRILLING LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421375
 GoA Well Tag No.
 Drilling Company Well ID Plamondon 68-16-51
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric		
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA		Country CANADA		Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i> 10	<i>SEC</i> 26	<i>TWP</i> 68	<i>RGE</i> 16	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>			
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>54.916464</u> Longitude <u>-112.328605</u> How Location Obtained Not Verified					Elevation <u>577.86</u> m How Elevation Obtained Surveyed GPS <1m		

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
6.70		Sand	
7.60		Clay	
9.10		Sand	
14.90		Clay	
15.80		Sand	
20.70		Clay	
21.60		Sand	
23.80		Clay	
24.40		Sand	
32.30		Clay	
38.40		Sand	
42.10		Clay	
43.60		Sand	
44.50		Clay	
51.20	Yes	Sand	
52.43		Clay	

Yield Test Summary			Measurement in Metric
<i>Recommended Pump Rate</i>		<i>L/min</i>	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/11/15		31.38	

Well Completion				Measurement in Metric
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
52.43 m	51.21 m	2012/11/15	2012/11/15	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	51.82		
22.23	0.00	51.82		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
<i>Size OD :</i>	_____ cm	<i>Size OD :</i>	_____ 10.16 cm	
<i>Wall Thickness :</i>	_____ cm	<i>Wall Thickness :</i>	_____ 0.856 cm	
<i>Bottom at :</i>	_____ m	<i>Top at :</i>	_____ -0.67 m	
		<i>Bottom at :</i>	_____ 45.11 m	
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
<i>Perforated by</i>				
Annular Seal Bentonite Slurry				
<i>Placed from</i>		<i>0.00 m to 44.20 m</i>		
<i>Amount</i>		<i>10.00 Bags</i>		
Other Seals				
<i>Type</i>		<i>At (m)</i>		
Screen Type Plastic				
<i>Size OD :</i>		<i>10.16 cm</i>		
From (m)	To (m)	Slot Size (cm)		
45.11	51.21	0.051		
<i>Attachment</i> <u>Attached To Casing</u>				
<i>Top Fittings</i> <u>Threaded</u>		<i>Bottom Fittings</i> <u>Plug</u>		
Pack				
<i>Type</i> <u>Sand</u>		<i>Grain Size</i> <u>10-20</u>		
<i>Amount</i>		<i>18.00 Bags</i>		

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

GIC Well ID 1421375
 GoA Well Tag No.
 Drilling Company Well ID Plamondon 68-16-51
 Date Report Received 2013/02/26

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE				Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location		<i>1/4 or LSD</i> 10	<i>SEC</i> 26	<i>TWP</i> 68	<i>RGE</i> 16	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>54.916464</u> Longitude <u>-112.328605</u>					Elevation <u>577.86 m</u>	
_____ m from _____					How Location Obtained Not Verified					How Elevation Obtained Surveyed GPS <1m	

Additional Information										Measurement in Metric
<i>Distance From Top of Casing to Ground Level</i> _____ 67.01 cm										
<i>Is Artesian Flow</i> _____					<i>Is Flow Control Installed</i> _____					
<i>Rate</i> _____ L/min					<i>Describe</i> _____					
<i>Recommended Pump Rate</i> _____ L/min					<i>Pump Installed</i> _____		<i>Depth</i> _____ m			
<i>Recommended Pump Intake Depth (From TOC)</i> _____ m					<i>Type</i> _____	<i>Make</i> _____	<i>H.P.</i> _____	<i>Model (Output Rating)</i> _____		
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i> _____					<i>Depth</i> _____ m		<i>Well Disinfected Upon Completion</i> <u>Yes</u>			
<i>Gas</i> _____					<i>Depth</i> _____ m		<i>Geophysical Log Taken</i> _____			
					<i>Submitted to ESRD</i> _____					
<i>Additional Comments on Well</i>					<i>Sample Collected for Potability</i> _____			<i>Submitted to ESRD</i> _____		

Yield Test				Taken From Top of Casing	Measurement in Metric	
<i>Test Date</i> 2012/11/15	<i>Start Time</i> 11:00 AM	<i>Static Water Level</i> 31.38 m		<i>Depth to water level</i>		
				Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
				_____	_____	_____
Method of Water Removal						
<i>Type</i> _____						
<i>Removal Rate</i> _____ L/min						
<i>Depth Withdrawn From</i> _____ m						
<i>If water removal period was < 2 hours, explain why</i>						

Water Diverted for Drilling		
<i>Water Source</i> DITCH	<i>Amount Taken</i> 9092.18 L	<i>Diversion Date & Time</i> 2012/11/15 10:00 AM

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421374
 GoA Well Tag No.
 Drilling Company Well ID Plamondon 68-16-70
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric
Owner Name AESRD		Address #111, 4999 - 98 AVE			Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location	<i>1/4 or LSD</i> 10	<i>SEC</i> 26	<i>TWP</i> 68	<i>RGE</i> 16	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>54.916464</u> Longitude <u>-112.328605</u>			Elevation <u>577.76</u> m		
					How Location Obtained Not Verified			How Elevation Obtained Surveyed GPS <1m		

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work New Well
Proposed Well Use Observation	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
6.70		Sand	
7.30		Clay & Sand	
8.50		Sand	
14.90		Clay	
15.50		Sand	
17.70		Clay	
20.40		Sand	
32.30		Clay	
38.70		Sand	
43.60		Clay	
50.90		Sand	
54.50		Clay	
56.40		Sand	
64.60		Clay	
69.50	Yes	Sand	
73.15		Shale	

Yield Test Summary			Measurement in Metric
<i>Recommended Pump Rate</i> _____		<i>L/min</i>	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2012/11/15		31.26	

Well Completion				Measurement in Metric
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>	
73.15 m	69.49 m	2012/11/14	2012/11/15	
Borehole				
Diameter (cm)	From (m)	To (m)		
15.88	0.00	73.15		
22.23	0.00	70.71		
Surface Casing (if applicable)		Well Casing/Liner		
		Plastic		
<i>Size OD :</i> _____	<i>cm</i>	<i>Size OD :</i> _____		<i>10.16 cm</i>
<i>Wall Thickness :</i> _____	<i>cm</i>	<i>Wall Thickness :</i> _____		<i>0.856 cm</i>
<i>Bottom at :</i> _____	<i>m</i>	<i>Top at :</i> _____		<i>-0.67 m</i>
		<i>Bottom at :</i> _____		
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
<i>Perforated by</i>				
Annular Seal Bentonite Slurry				
<i>Placed from</i> <u>0.00 m</u> <i>to</i> <u>62.79 m</u>				
<i>Amount</i> <u>13.00</u> <i>Bags</i>				
Other Seals				
Type		At (m)		
Screen Type Plastic				
<i>Size OD :</i> <u>10.16</u> <i>cm</i>				
From (m)	To (m)	Slot Size (cm)		
63.40	69.49	0.051		
<i>Attachment</i> <u>Attached To Casing</u>				
<i>Top Fittings</i> <u>Threaded</u>		<i>Bottom Fittings</i> <u>Plug</u>		
Pack				
<i>Type</i> <u>Sand</u>		<i>Grain Size</i> <u>10-20</u>		
<i>Amount</i> <u>18.00</u> <i>Bags</i>				

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> Yes
	<i>Date approval holder signed</i> 2013/02/12

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 1421374
 GoA Well Tag No.
 Drilling Company Well ID Plamondon 68-16-70
 Date Report Received 2013/02/26

Well Identification and Location										Measurement in Metric	
Owner Name AESRD		Address #111, 4999 - 98 AVE				Town EDMONTON		Province ALBERTA	Country CANADA	Postal Code T6B 2X3	
Location		<i>1/4 or LSD</i> 10	<i>SEC</i> 26	<i>TWP</i> 68	<i>RGE</i> 16	<i>W of MER</i> 4	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>	
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>54.916464</u> Longitude <u>-112.328605</u>					Elevation <u>577.76</u> m	
_____ m from _____					How Location Obtained Not Verified					How Elevation Obtained Surveyed GPS <1m	

Additional Information										Measurement in Metric	
<i>Distance From Top of Casing to Ground Level</i> _____ 67.01 cm											
<i>Is Artesian Flow</i> _____					<i>Is Flow Control Installed</i> _____						
<i>Rate</i> _____ L/min					<i>Describe</i> _____						
<i>Recommended Pump Rate</i> _____ L/min					<i>Pump Installed</i> _____		<i>Depth</i> _____ m				
<i>Recommended Pump Intake Depth (From TOC)</i> _____ m					<i>Type</i> _____	<i>Make</i> _____	<i>H.P.</i> _____	<i>Model (Output Rating)</i> _____			
<i>Did you Encounter Saline Water (>4000 ppm TDS)</i> _____					<i>Depth</i> _____ m		<i>Well Disinfected Upon Completion</i> <u>Yes</u>				
<i>Gas</i> _____					<i>Depth</i> _____ m		<i>Geophysical Log Taken</i> <u>Electric, Gamma</u>				
					<i>Submitted to ESRD</i>						
<i>Additional Comments on Well</i>					<i>Sample Collected for Potability</i> _____			<i>Submitted to ESRD</i> _____			

Yield Test				Taken From Top of Casing	Measurement in Metric
<i>Test Date</i> 2012/11/15	<i>Start Time</i> 11:00 AM	<i>Static Water Level</i> 31.26 m		<i>Depth to water level</i>	
				Drawdown (m)	Elapsed Time Minutes:Sec
				_____	_____
				_____	_____
Method of Water Removal					
<i>Type</i> _____					
<i>Removal Rate</i> _____ L/min					
<i>Depth Withdrawn From</i> _____ m					
<i>If water removal period was < 2 hours, explain why</i>					

Water Diverted for Drilling		
<i>Water Source</i> DITCH	<i>Amount Taken</i> 9092.18 L	<i>Diversion Date & Time</i> 2012/11/14 10:00 AM

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> DARELL LEPPER	<i>Certification No</i> 5449Q
<i>Company Name</i> LAKELAND DRILLING LTD.	<i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i> Yes 2013/02/12

APPENDIX B
GEOLOGIC LOGS

Company: **Environment Sustainable Resource Development**
 Well Name: **Conklin 76-07-9 (MW-2D)**
 Site/Location: **11-30-076-07 W4M**
 Project No.(MSI): **16054-502**
 Drilling Observed by: **D. Diaz/K. Harrer**
 Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
 DrillerRig: **Lakeland Drilling Ltd.**
 Drilling Method: **Mud Rotary**
 Ground Elev: **575.31 masl**
 TOC Elev: **576.09 masl**

Northing: **6163246**
 Easting: **12U 494676**
 Total Depth: **6.1m**
 Boring Diameter: **8 3/4" (222m)**
 Casing Diameter: **2" Sched 40 PVC (51mm)**
 Logging Company: **Lakeland Drilling Ltd.**

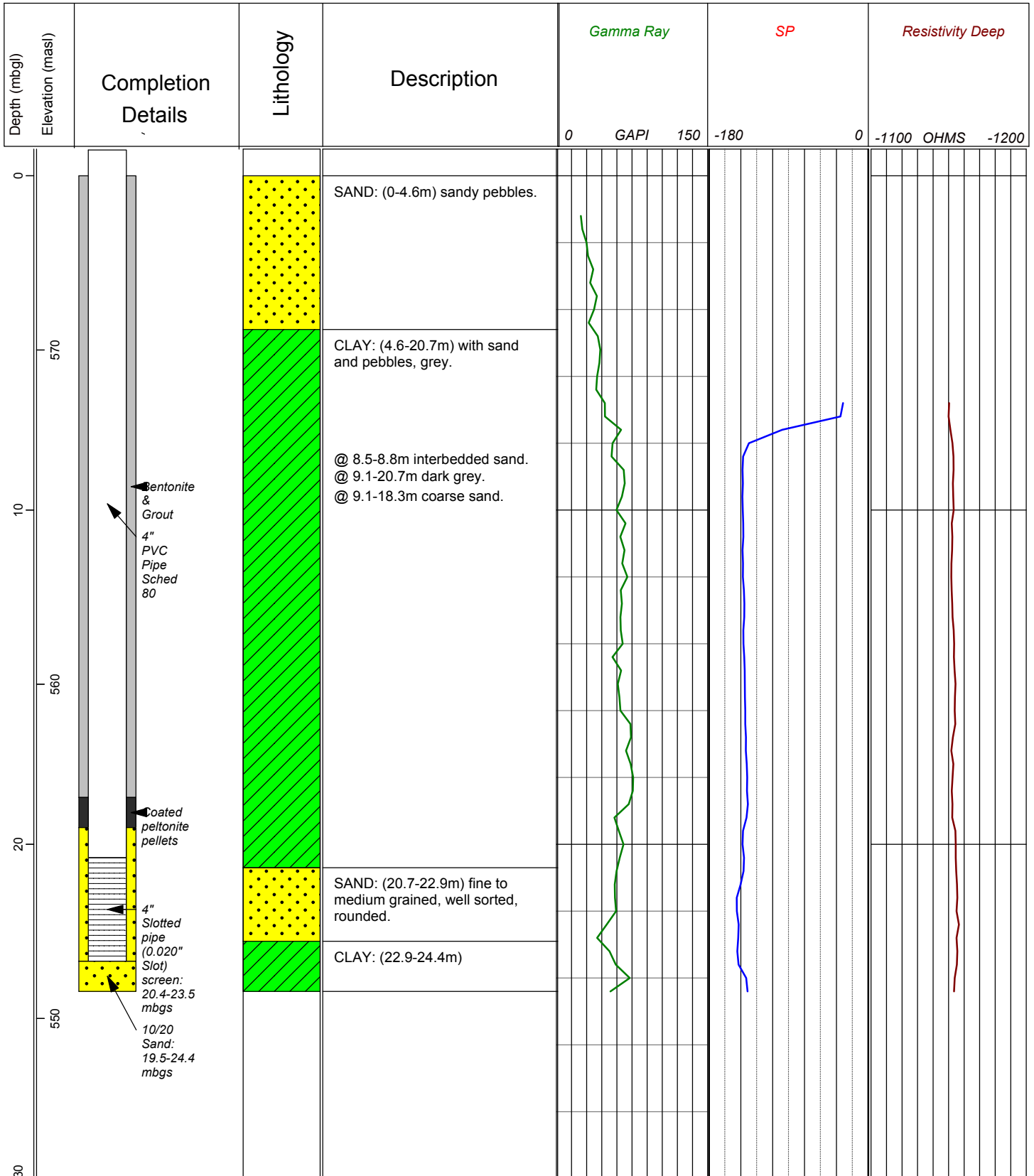
Depth (mbgl) Elevation (masl)	Completion Details	Lithology	Description	Gamma Ray		
				0	GAPI	150
576 0			SAND: (0-4.6m) sandy pebbles.			
575 1						
574 2			CLAY: (4.6-6.1m) with sand and pebbles, grey.			
573 3						
572 4			Pilot hole TD = 6.1m			
571 5						
570 6						
569 7						
568 8						
567 9						
566 10						

NOTE: Logging data was taken from the CONKLIN 76-07-67 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Conklin 76-07-24 (MW2C)**
Site/Location: **11-30-076-07 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **D. Diaz/K. Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **575.21 masl**
TOC Elev: **576.01 masl**

Northing: **6163246**
Easting: **12U 494679**
Total Depth: **24.4m**
Boring Diameter: **8 3/4" (222m)**
Casing Diameter: **4" Sched 80 PVC (101mm)**
Logging Company: **Lakeland Drilling Ltd.**

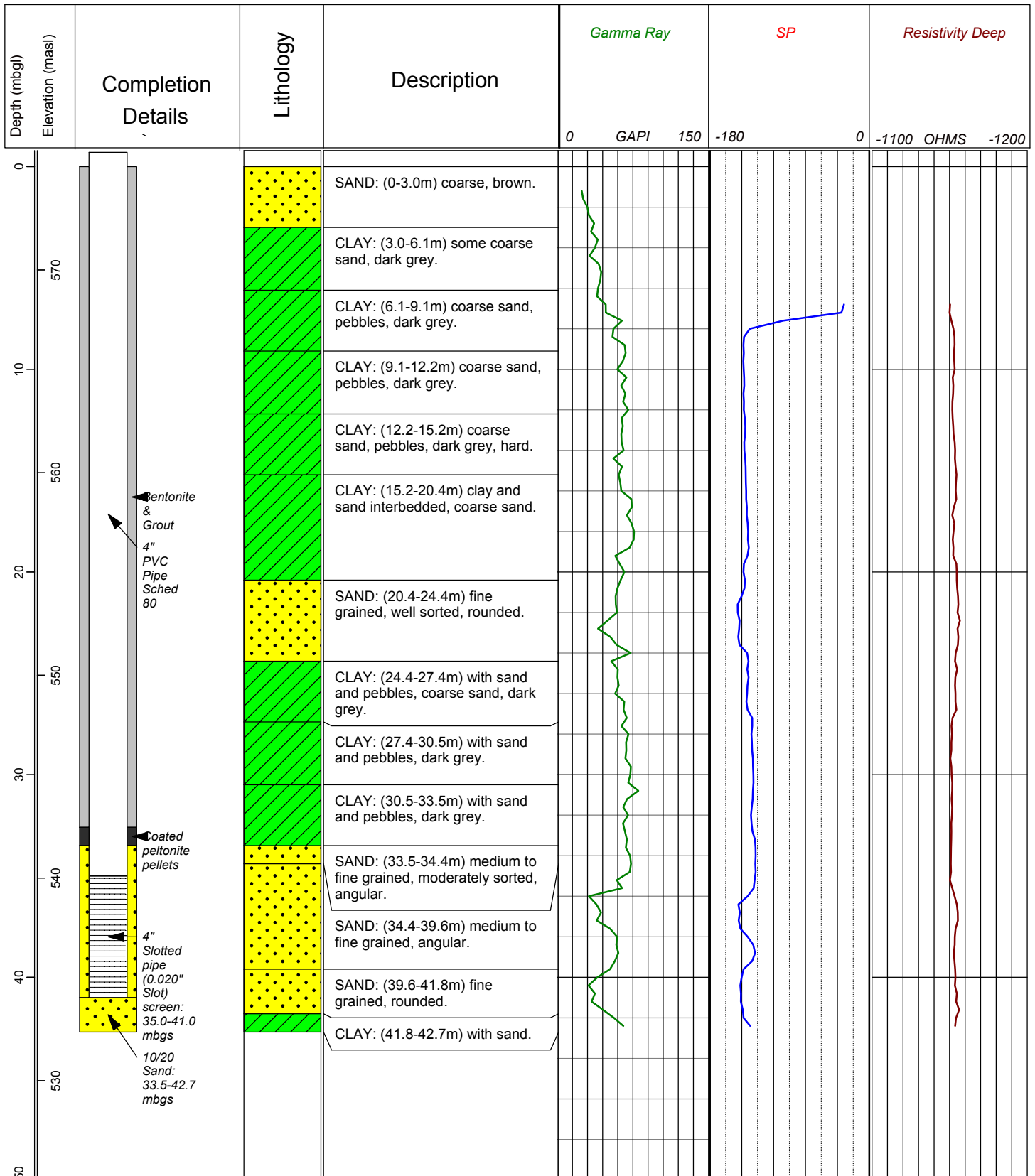


NOTE: Pilot hole diameter was 159 mm from surface to 24.4 mbgs. The borehole was then reamed to a diameter of 222 mm from surface to a depth of 24.4 mbgs. Elogging data was taken from the CONKLIN 76-07-67 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Conklin 76-7-41 (MW2B)**
Site/Location: **11-30-076-07 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **D. Diaz/K. Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **575.10 masl**
TOC Elev: **575.84 masl**

Northing: **6163248**
Easting: **12U 494677**
Total Depth: **42.7m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

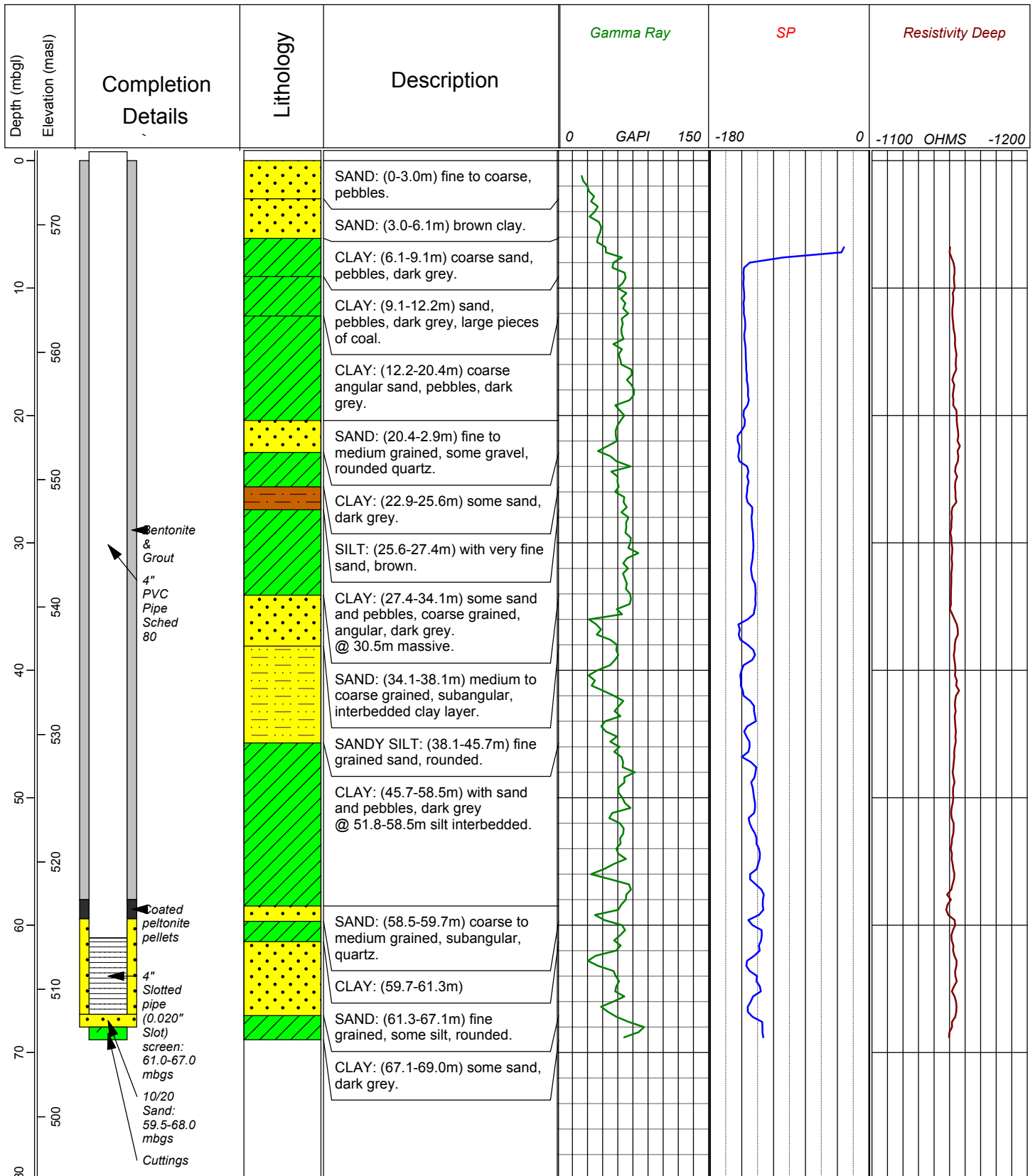


NOTE: Pilot hole diameter was 159 mm from surface to 42.7 mbgs. The borehole was then reamed to a diameter of 222 mm from surface to a depth of 42.7 mbgs.

Company: **Environment Sustainable Resource Development**
Well Name: **Conklin 76-07-67 (MW2A)**
Site/Location: **11-30-076-07 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **D. Diaz/K. Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **575.04 masl**
TOC Elev: **575.78 masl**

Northing: **6163251**
Easting: **12U 494679**
Total Depth: **68.0m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

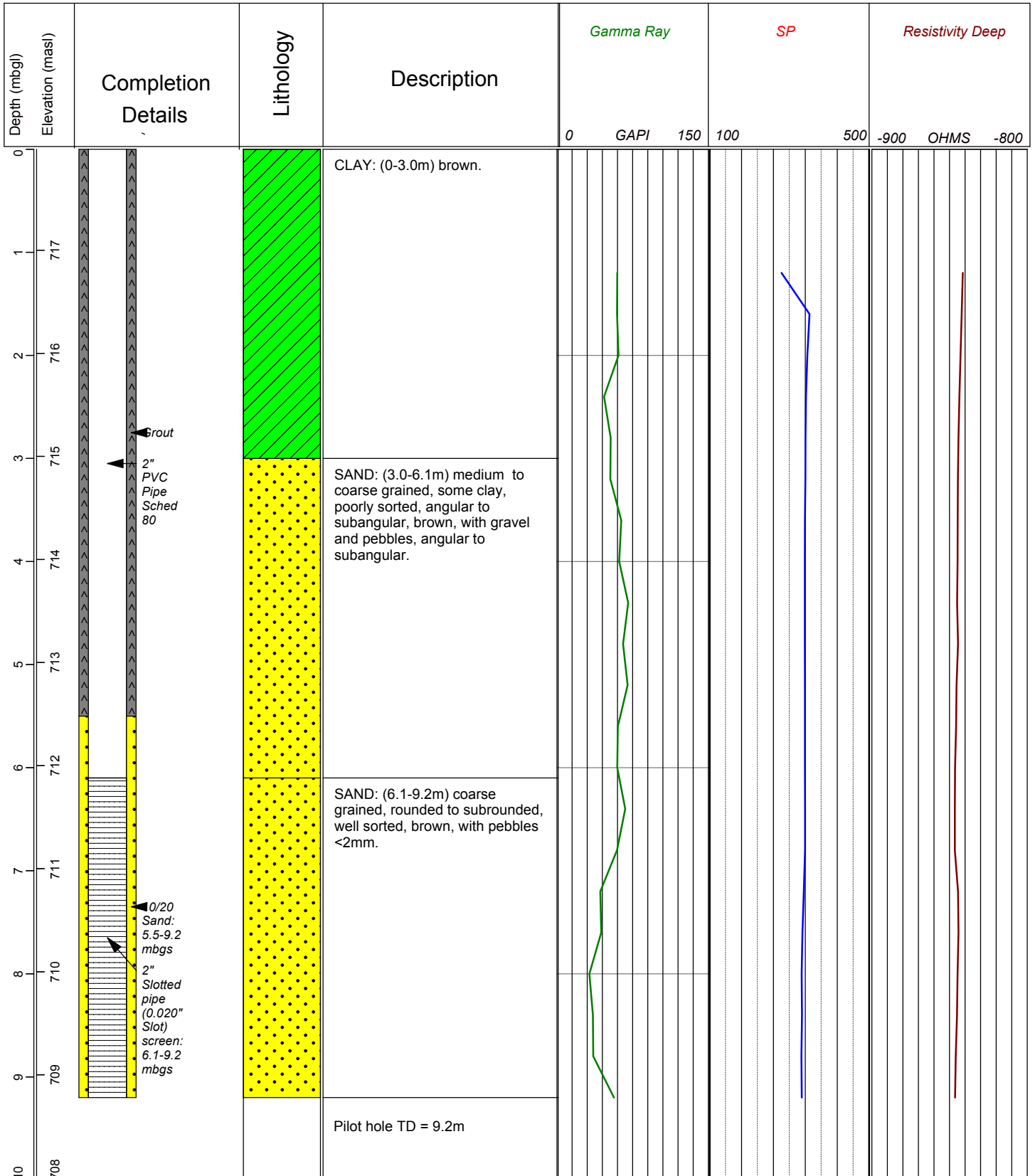


NOTE: Pilot hole diameter was 159 mm and drilled from surface to 69.0m. The borehole was reamed to a diameter of 222 mm from surface to a depth of 68.0m

Company: **Environment Sustainable Resource Development**
Well Name: **Waddell Creek 80-09-9 (MW6D)**
Site/Location: **08-27-080-09 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **Kim Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
Driller/Rig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **716.87 masl**
TOC Elev: **718.73 masl**

Northing: **6201643**
Easting: **12U 480312**
Total Depth: **9.2m**
Boring Diameter: **6 1/4" (159 mm)**
Casing Diameter: **2" Sched 40 PVC (51 mm)**
Logging Company: **Lakeland Drilling Ltd.**

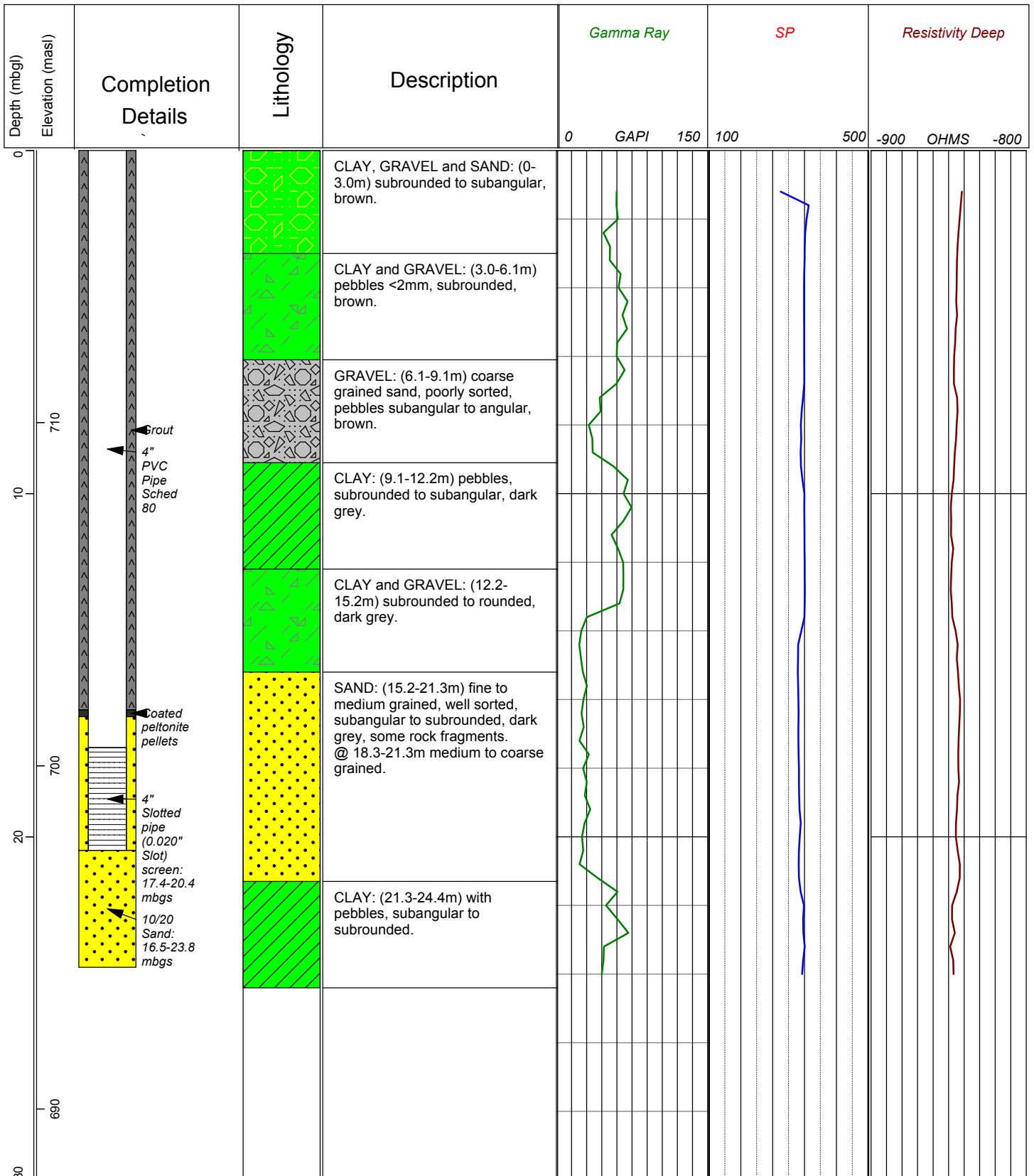


NOTE: Logging data taken from the WADDELL CREEK 80-09-149 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Waddell Creek 80-09-21 (MW6C)**
Site/Location: **08-27-080-09 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **Kim Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **716.87 masl**
TOC Elev: **718.65 masl**

Northing: **6201642**
Easting: **12U 480312**
Total Depth: **24.4m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

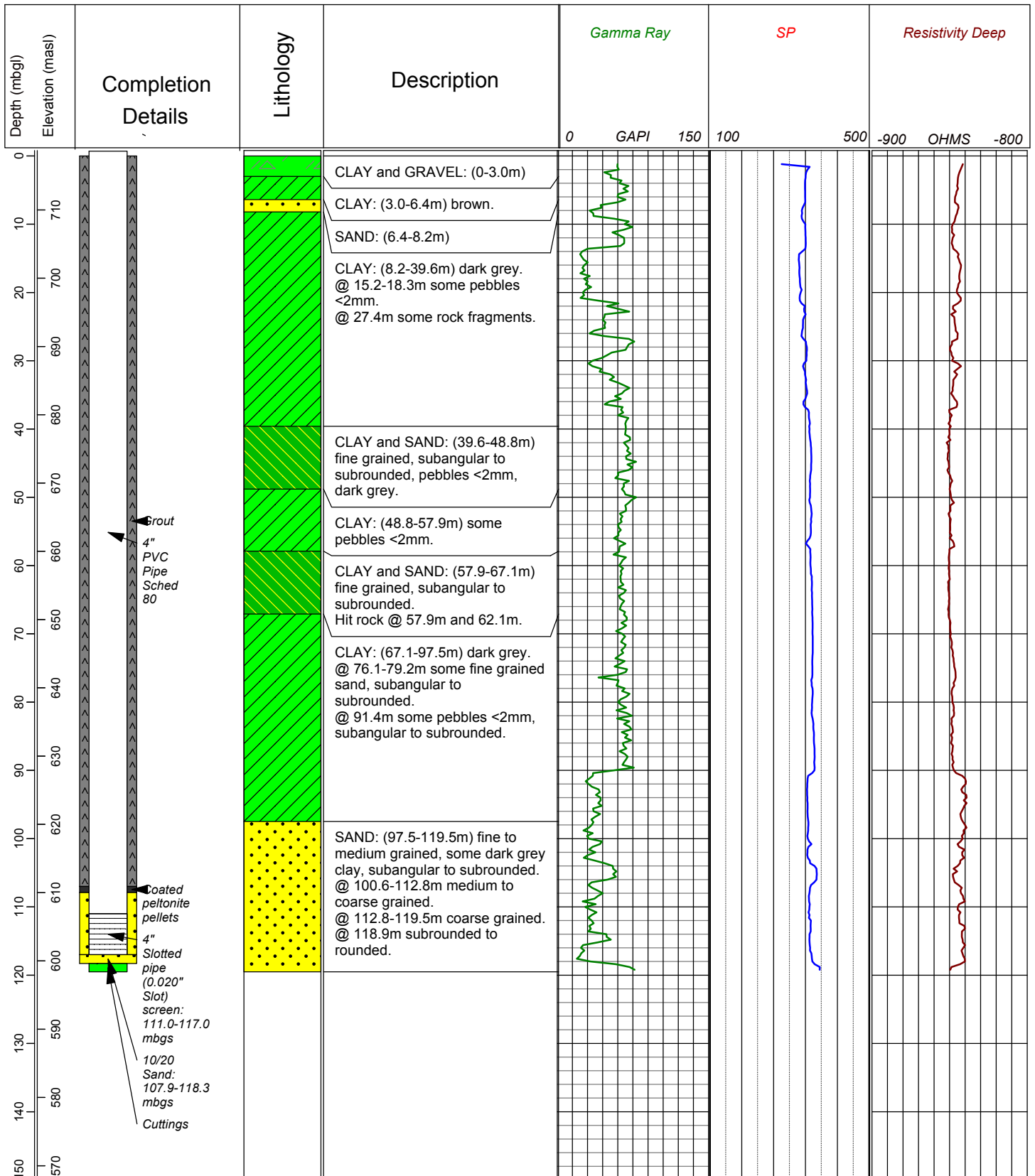


NOTE: Pilot hole diameter was 159 mm and drilled from surface to 23.8 mbgs. The borehole was reamed to a diameter of 222 mm from surface to a depth of 23.8 mbgs. Elogging data taken from the WADDELL CREEK 80-09-149 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Waddell Creek 80-09-117 (MW6B)**
Site/Location: **08-27-080-09 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **Kim Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **717.91 masl**
TOC Elev: **718.55 masl**

Northing: **6201642**
Easting: **12U 480305**
Total Depth: **119.5m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

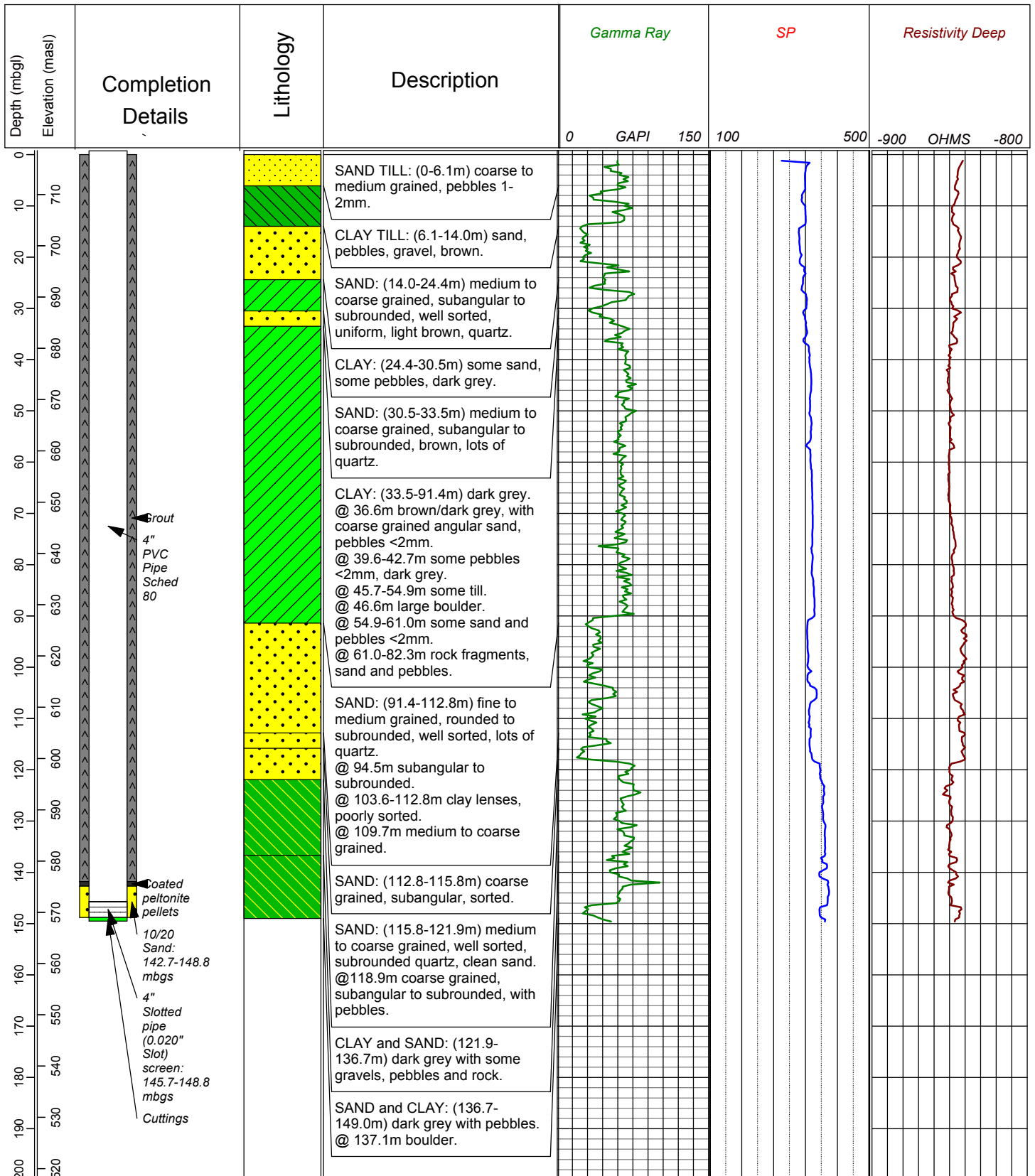


NOTE: Pilot hole diameter was 159 mm and drilled from surface to 119.5 mbgs. The borehole was reamed to a diameter of 222 mm from surface to a depth of 118.3 mbgs. Logging data taken from the WADDELL CREEK 80-09-149 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Waddell Creek 80-09-149 (MW6A)**
Site/Location: **08-27-080-09 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **D. Diaz/Kim Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **717.79 masl**
TOC Elev: **718.48 masl**

Northing: **621642**
Easting: **12U 480307**
Total Depth: **148.8m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

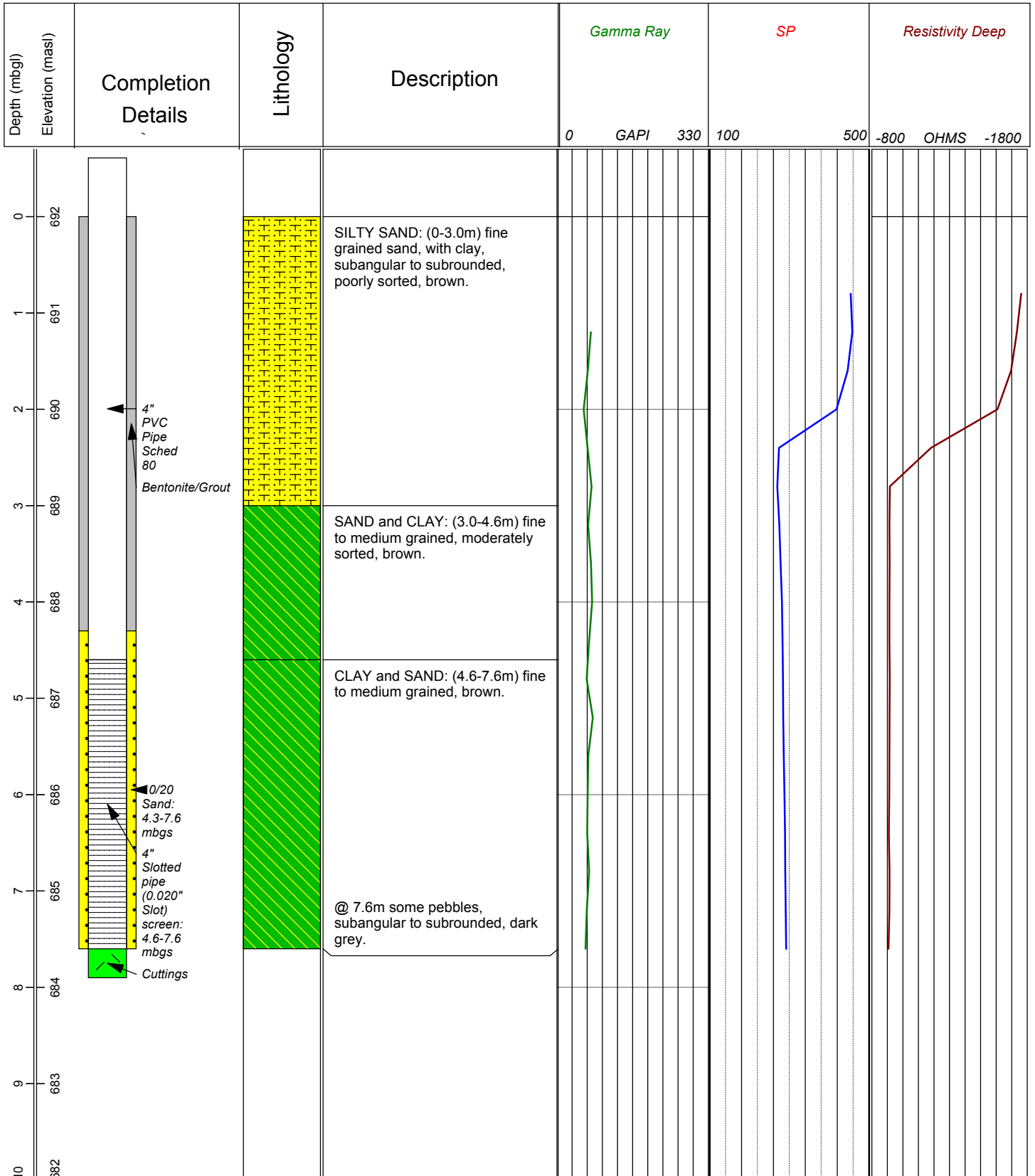


NOTE: Pilot hole diameter was 159 mm and drilled from surface to 149.0m. The borehole was reamed to a diameter of 222 mm from surface to a depth of 148.8m.

Company: **Environment Sustainable Resource Development**
Well Name: **Mariana Lakes 80-13-8 (MW12D)**
Site/Location: **07-19-080-13 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **K. Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **692.90 masl**
TOC Elev: **693.51 masl**

Northing: **6200877**
Easting: **12U 436074**
Total Depth: **7.6m**
Boring Diameter: **6 1/4" (159 mm)**
Casing Diameter: **2" Sched 40 PVC (51 mm)**
Logging Company: **Lakeland Drilling Ltd.**

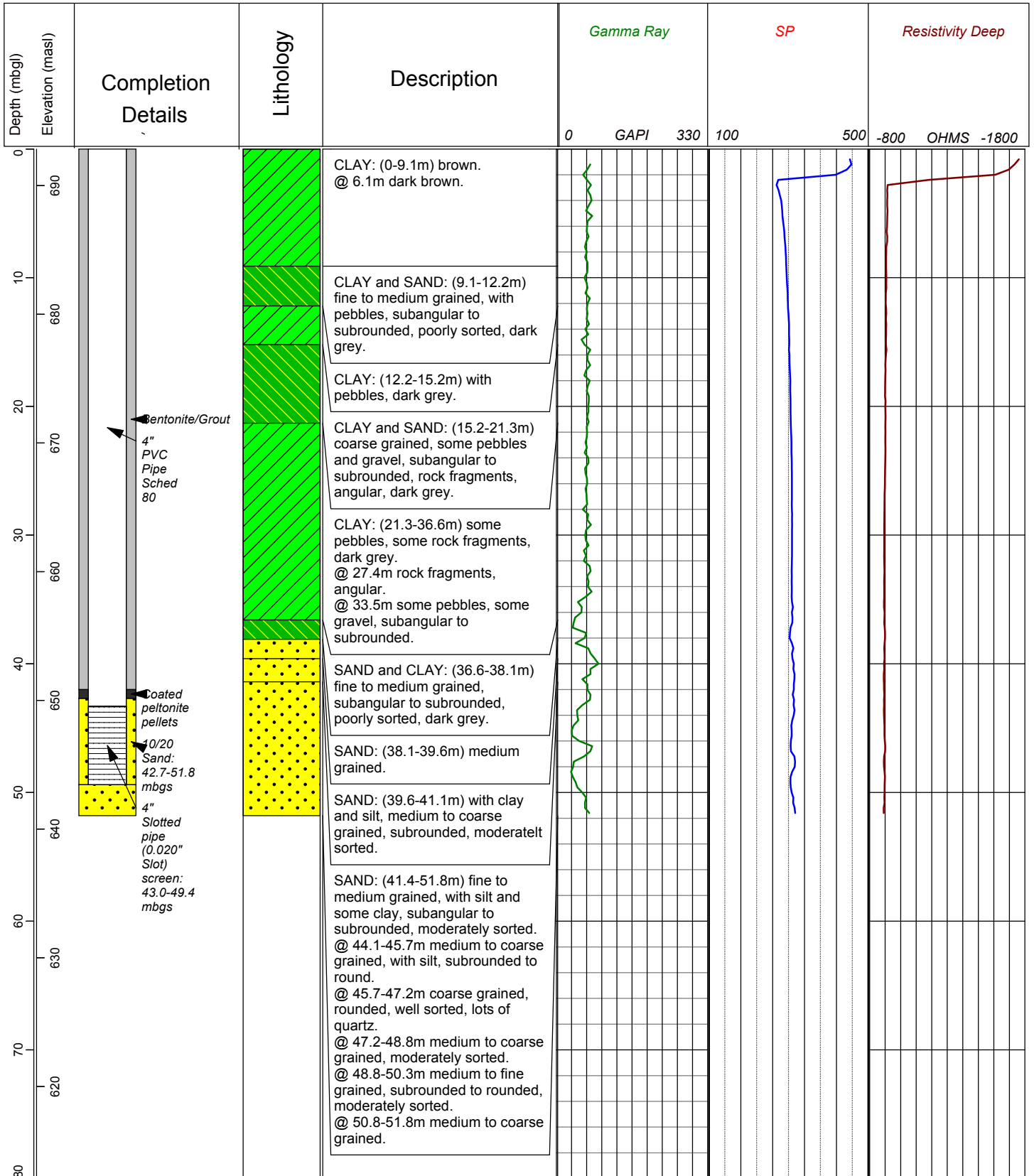


NOTE: Logging data was taken from the MARIANA LAKES 80-13-134.

Company: **Environment Sustainable Resource Development**
Well Name: **Mariana Lakes 80-13-50 (MW12C)**
Site/Location: **07-19-080-13 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **K. Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **692.84 masl**
TOC Elev: **693.55 masl**

Northing: **6200880**
Easting: **12U 436075**
Total Depth: **51.8m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

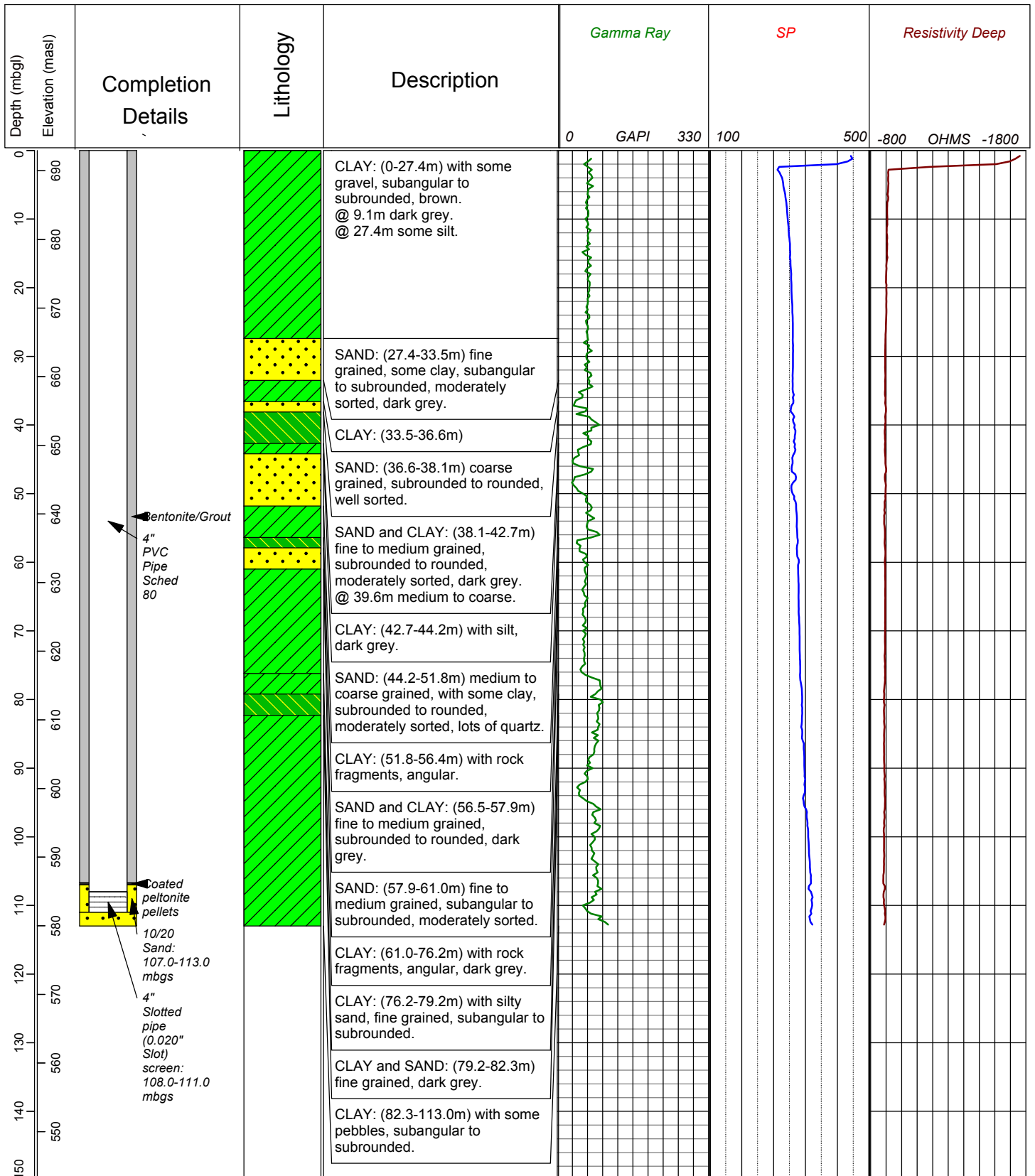


NOTE: Pilot hole diameter was 159 mm from surface to a depth of 51.8 mbgs. The borehole was then reamed to a diameter of 222 mm from surface to a depth of 49.4 mbgs. Logging data was taken from the MARIANA LAKES 80-13-134 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Mariana Lakes 80-13-112 (MW12B)**
Site/Location: **07-19-080-13 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **K. Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **692.96masl**
TOC Elev: **693.56 masl**

Northing: **6200876**
Easting: **12U 436102**
Total Depth: **113.0m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

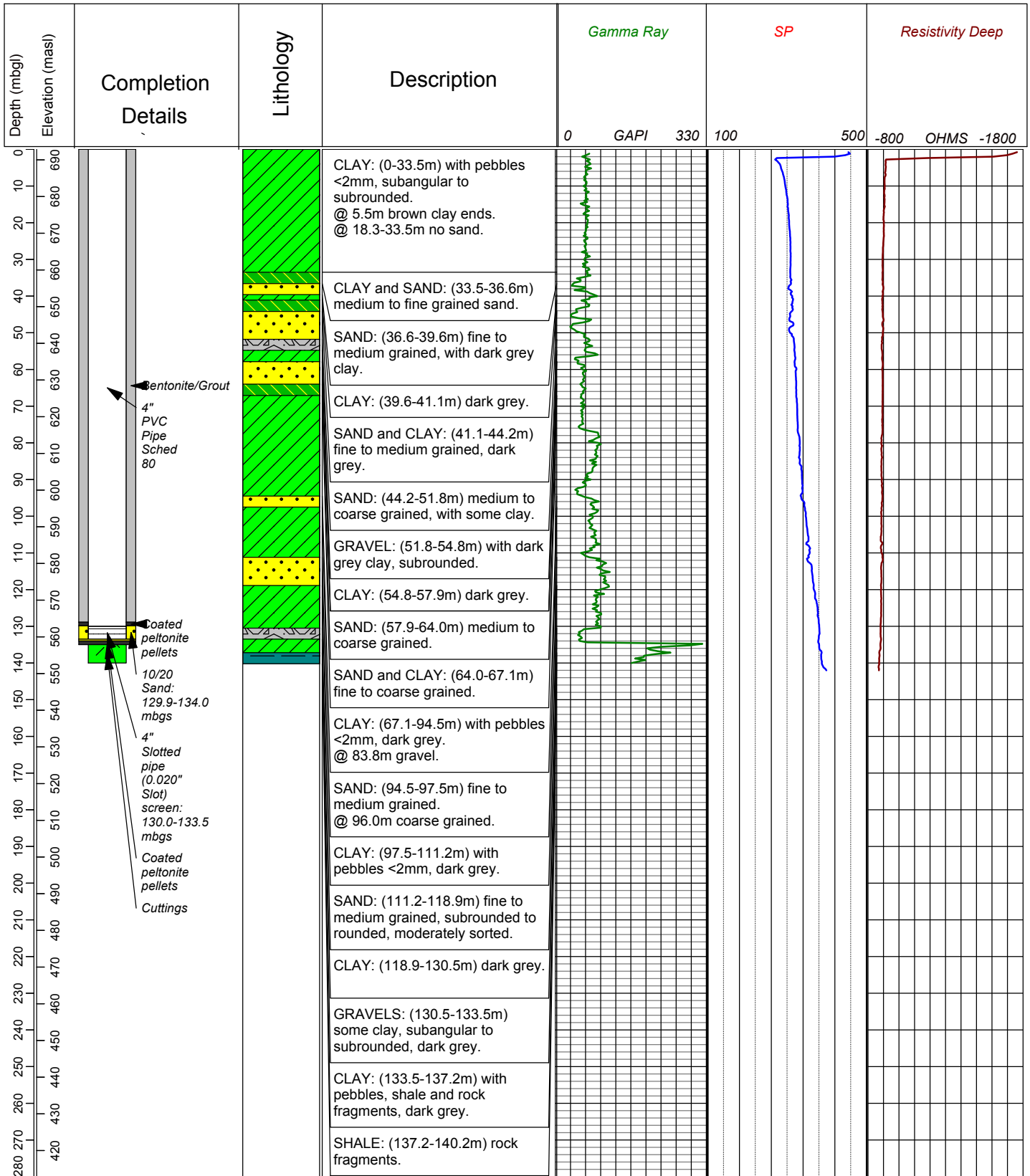


NOTE: Pilot hole diameter was 159 mm from surface to a depth of 113.0 mbgs. The borehole was then reamed to a diameter of 222 mm from surface to a depth of 111.0 mbgs. Elogging data was taken from the MARIANA LAKES 80-13-134 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Mariana Lakes 80-13-134 (MW12A)**
Site/Location: **07-19-080-13 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **K. Harrer**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **692.89 masl**
TOC Elev: **693.51 masl**

Northing: **6200882**
Easting: **12U 436082**
Total Depth: **140.2m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

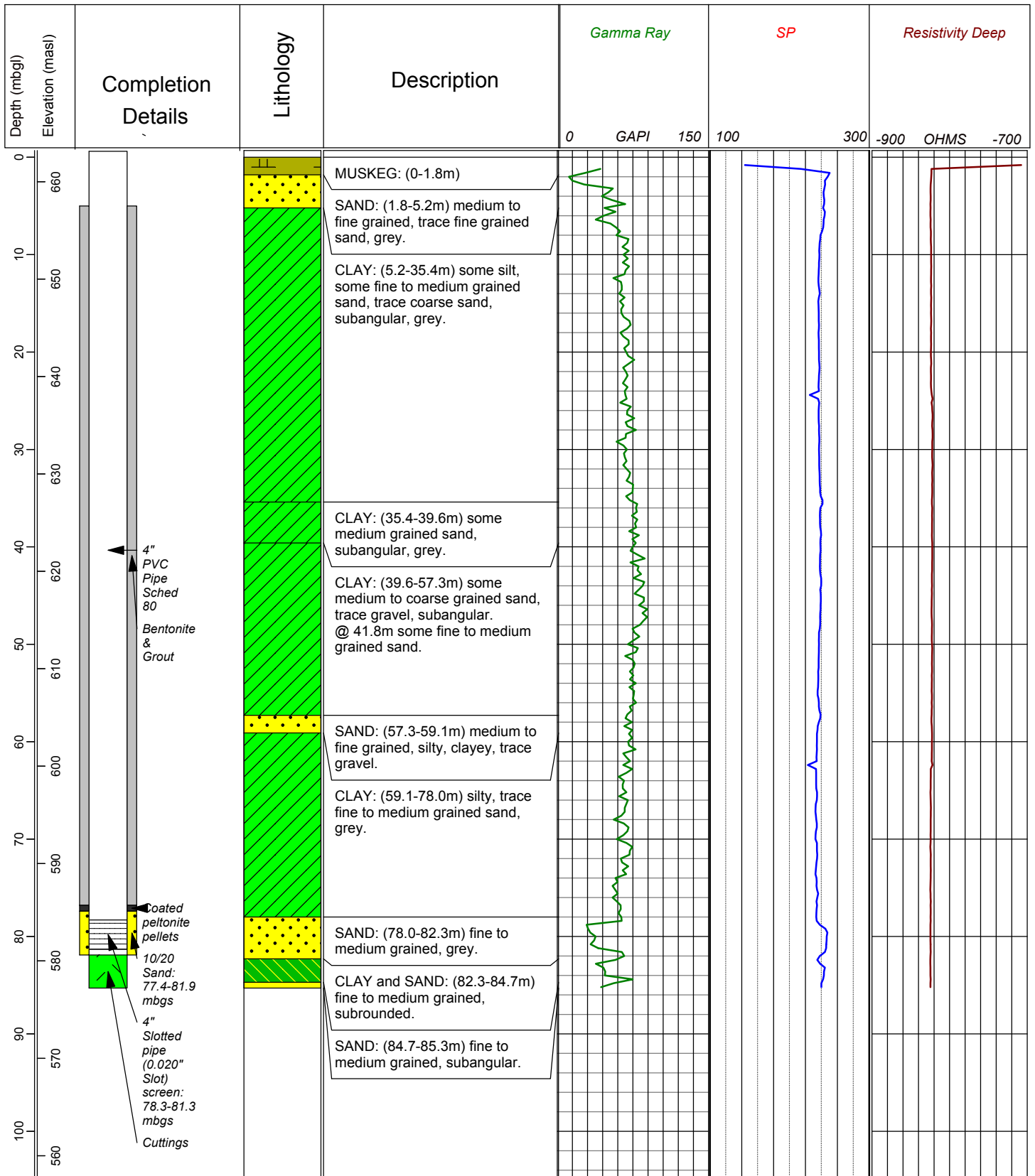


NOTE: Pilot hole diameter was 159 mm from surface to a depth of 140.0 mbgs. The borehole was then reamed to a diameter of 222 mm from surface to a depth of 135.0 mbgs.

Company: **Environment Sustainable Resource Development**
Well Name: **House Crossing 77-15-82 (MW13C)**
Site/Location: **07-36-077-15 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **M. Szumilak/K. Taschuk**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **663.00 masl**
TOC Elev: **663.18 masl**

Northing: **6174927**
Easting: **12U 425368**
Total Depth: **85.3m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

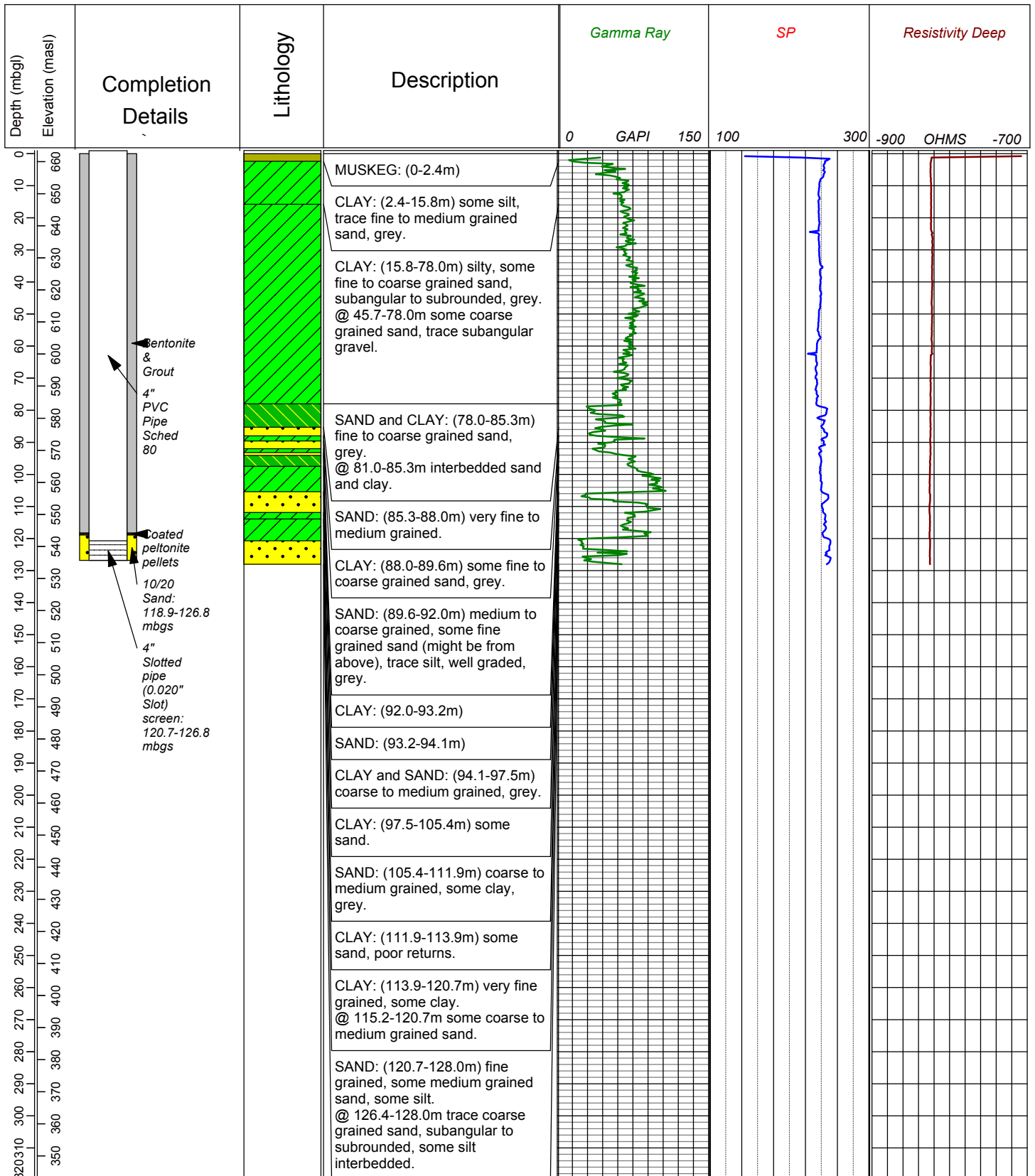


NOTE: Pilot hole diameter was 159 mm from surface to a depth of 85.38 mbgs. The borehole was reamed to a diameter of 222 mm from surface to 81.9 mbgs. Elogging data taken from the HOUSE CROSSING 77-15-161 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **House Crossing 77-15-126 (MW13B)**
Site/Location: **07-36-077-15 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **M. Szumilak/K. Taschuk**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **662.48 masl**
TOC Elev: **663.16 masl**

Northing: **6174940**
Easting: **12U 425387**
Total Depth: **128.0m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

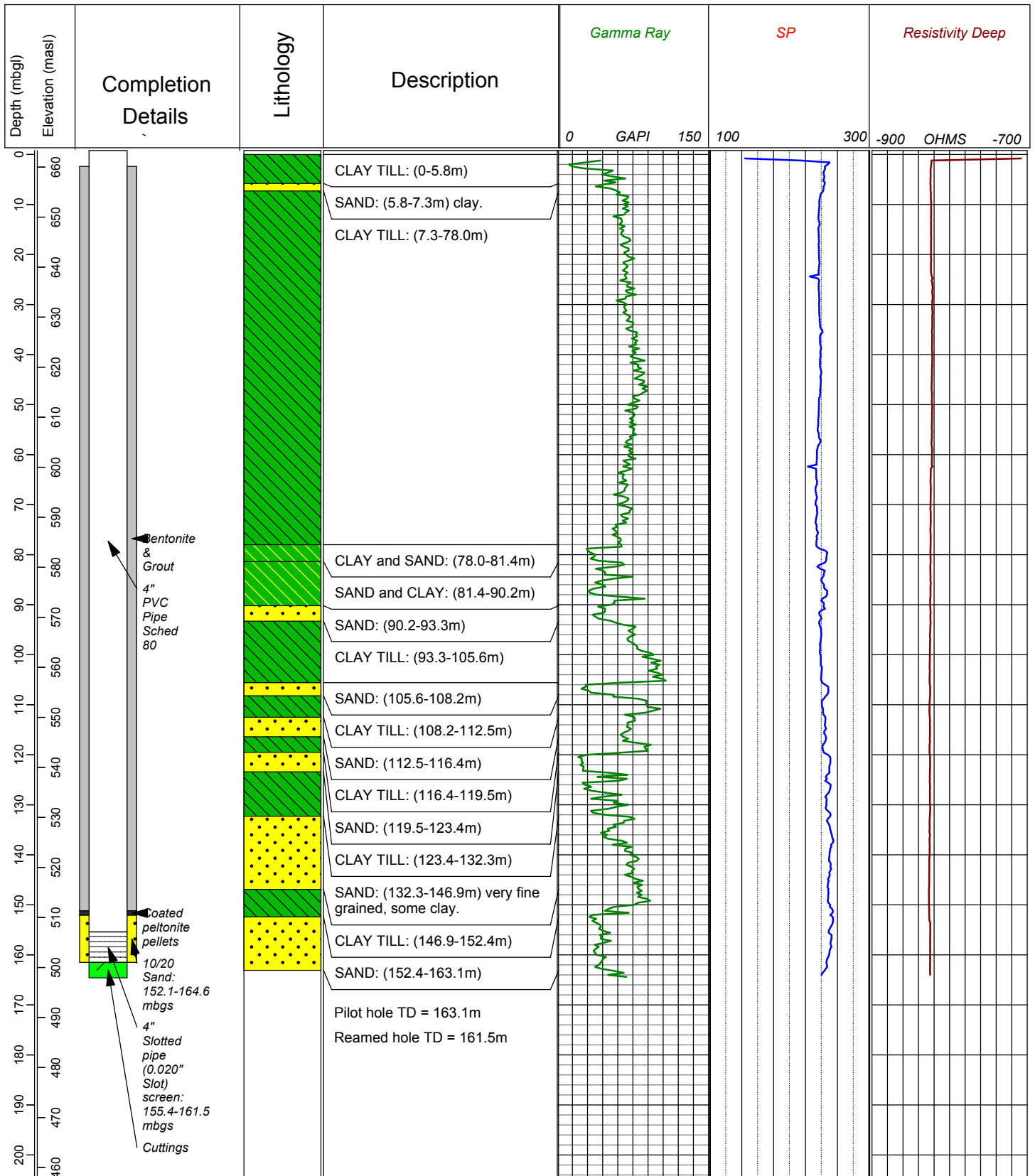


NOTE: Pilot hole diameter was 159 mm from surface to 126.8 mbgs. The borehole was reamed to a diameter of 222 mm from surface to 126.8 mbgs. Logging data taken from the HOUSE CROSSING 77-15-161 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **House Crossing 77-15-161 (MW13A)**
Site/Location: **07-36-077-15 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **M. Szumilak/K. Taschuk**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **662.52 masl**
TOC Elev: **663.24 masl**

Northing: **6174939**
Easting: **12U 425382**
Total Depth: **164.6m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

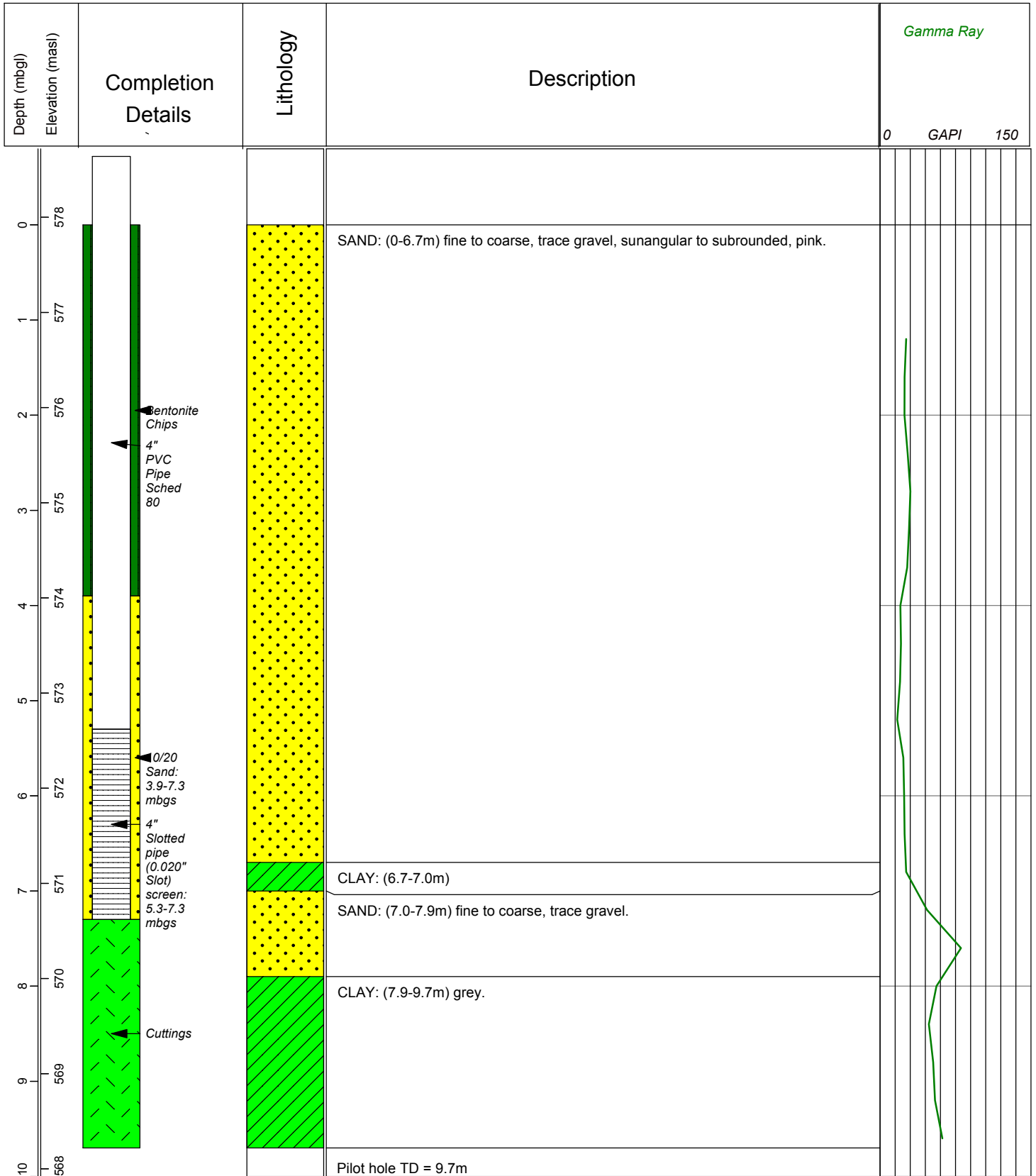


NOTE:

Company: **Environment Sustainable Resource Development**
Well Name: **Plamondon 68-16-7 (MW18D)**
Site/Location: **10-26-068-16 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **M. Szumilak/K. Taschuk**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **577.92 masl**
TOC Elev: **578.64 masl**

Northing: **6086373**
Easting: **12U 415039**
Total Depth: **9.7m**
Boring Diameter: **6 1/4" (159 mm)**
Casing Diameter: **2" Sched 80 PVC (51 mm)**
Logging Company: **Lakeland Drilling Ltd.**

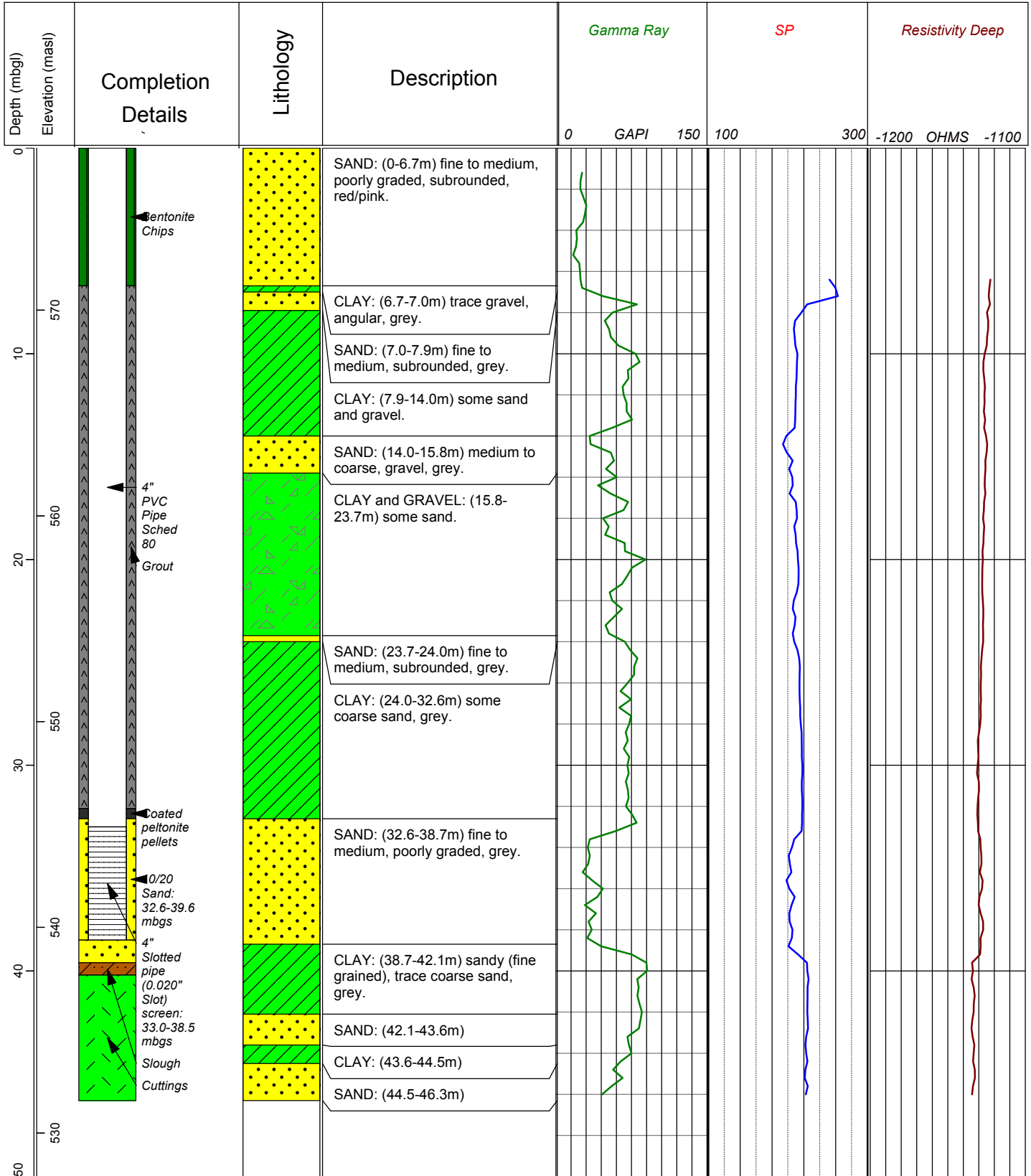


NOTE: Logging data was taken from the PLAMONDON 68-16-70 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Plamondon 68-16-39 (MW18C)**
Site/Location: **10-26-068-16 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **M. Szumilak/K. Taschuk**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **577.88 masl**
TOC Elev: **578.61 masl**

Northing: **6086377**
Easting: **12U 415037**
Total Depth: **46.3m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

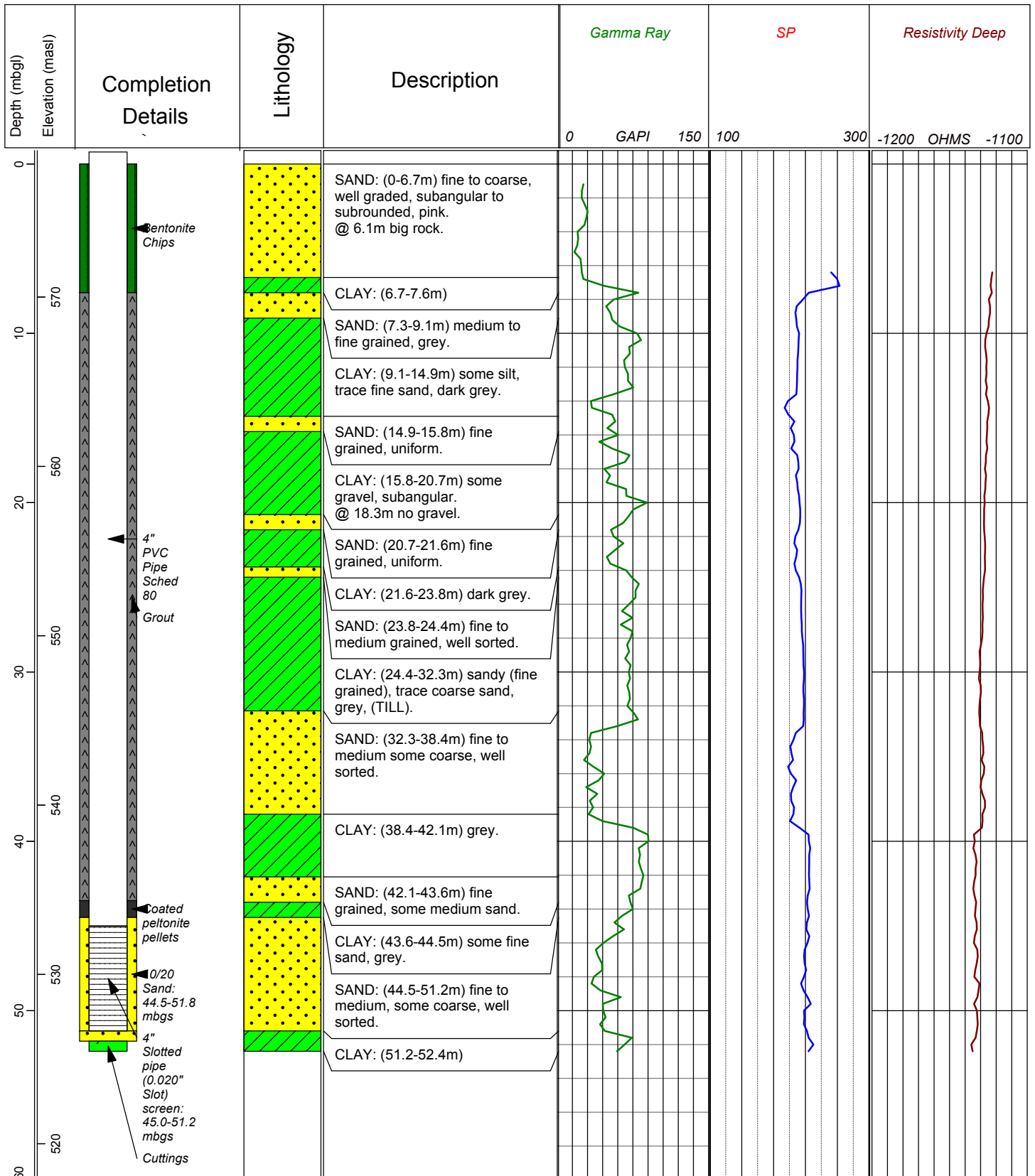


NOTE: Pilot hole diameter was 159 mm from surface to 46.3 mbgs. The borehole was reamed to a diameter of 222 mm from surface to a depth of 40.2 mbgs. Elogging data taken from the PLAMONDON 68-16-70 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Plamondon 68-16-51 (MW18B)**
Site/Location: **10-26-068-16 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **M. Szumilak/K. Taschuk**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **577.86 masl**
TOC Elev: **578.57 masl**

Northing: **6086372**
Easting: **12U 415036**
Total Depth: **52.4m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

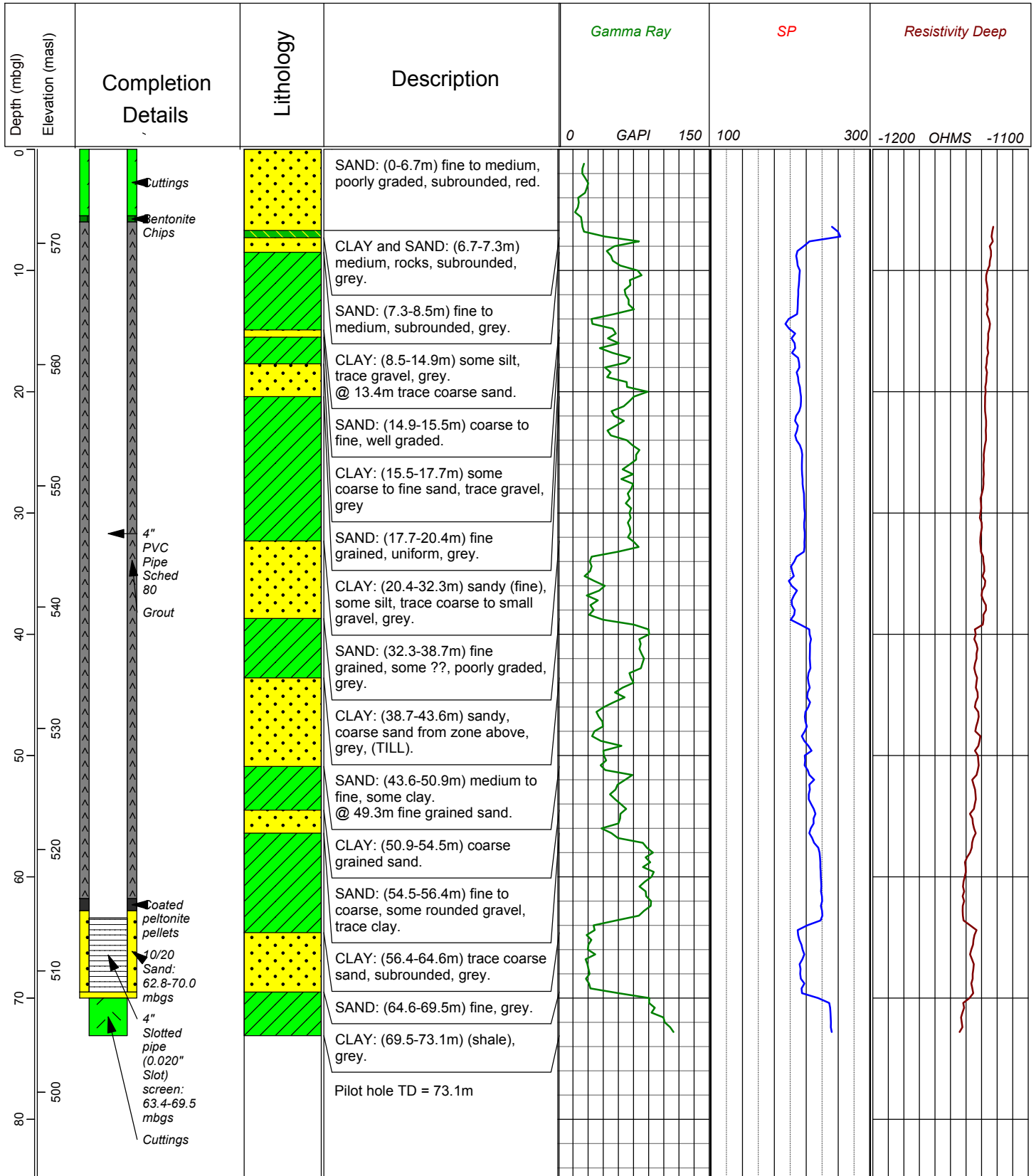


NOTE: Pilot hole diameter was 159 mm from surface to a depth of 52.4 mbgs. The borehole was reamed to a diameter of 222 mm from surface to a depth of 51.8 mbgs. Elogging data taken from the PLAMONDON 68-16-70 borehole.

Company: **Environment Sustainable Resource Development**
Well Name: **Plamondon 68-16-69 (MW18A)**
Site/Location: **10-26-068-16 W4M**
Project No.(MSI): **16054-502**
Drilling Observed by: **M. Szumilak/K. Taschuk**
Sampling Method: **Grab**

Waterwell Driller: **Darrel Lepper**
DrillerRig: **Lakeland Drilling Ltd.**
Drilling Method: **Mud Rotary**
Ground Elev: **577.76 masl**
TOC Elev: **578.46 masl**

Northing: **6086365**
Easting: **12U 415039**
Total Depth: **73.1m**
Boring Diameter: **8 3/4" (222 mm)**
Casing Diameter: **4" Sched 80 PVC (101 mm)**
Logging Company: **Lakeland Drilling Ltd.**

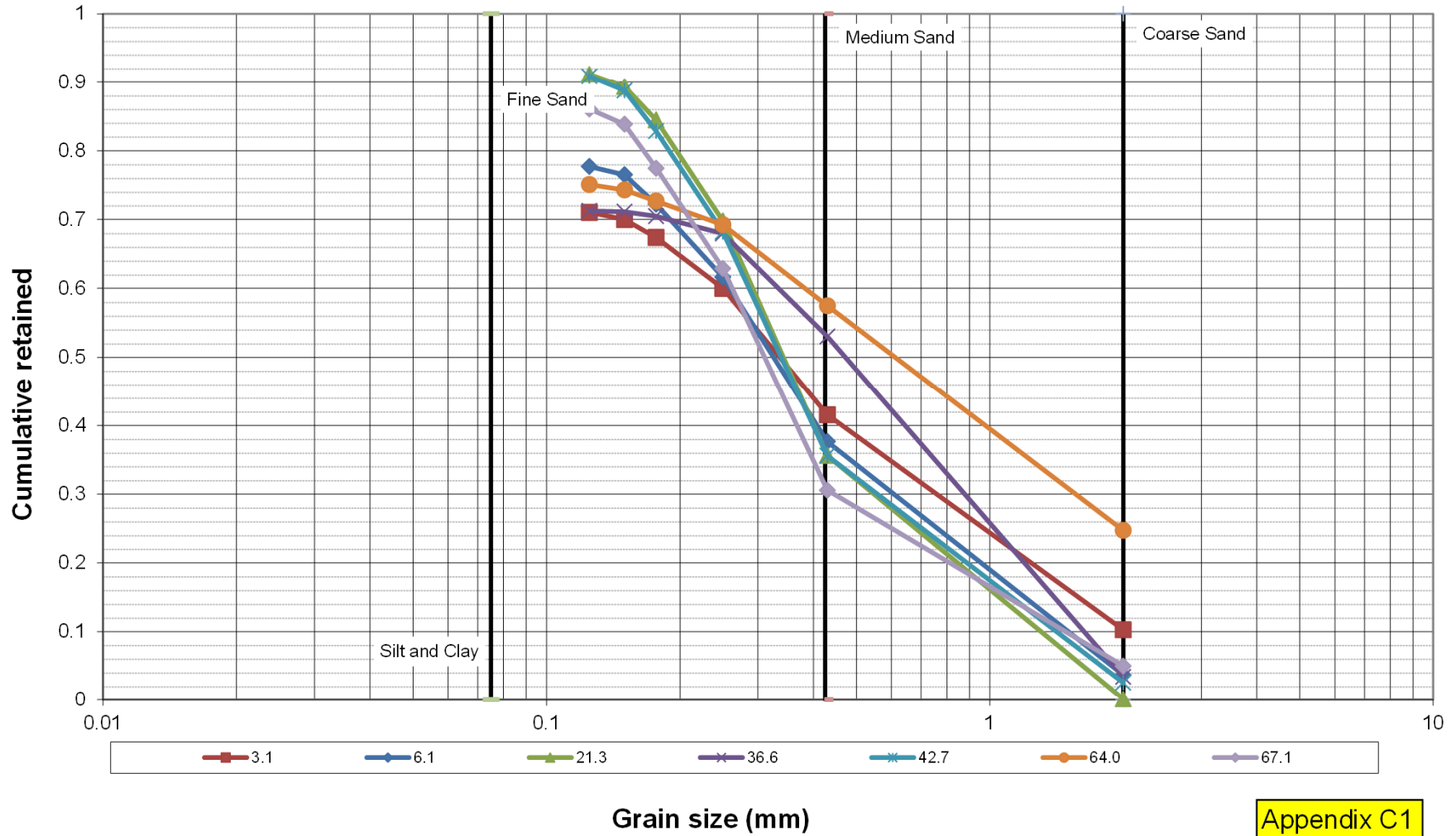


NOTE:

APPENDIX C

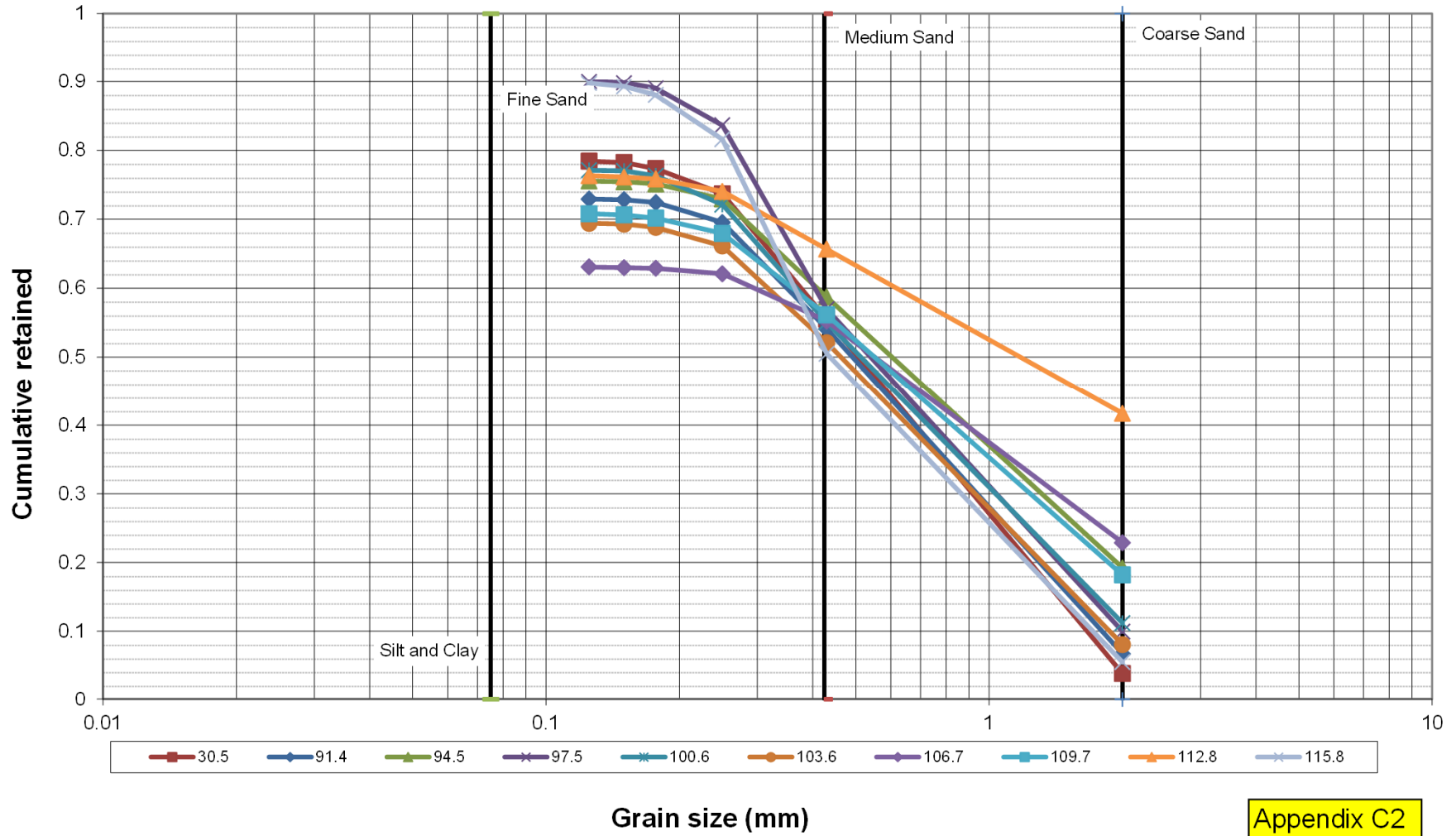
FIELD GRAIN SIZE ANALYSIS RESULTS

Grain Size Analysis SAOS-AESRD Conklin 76-07-67 - 11-30-076-07 W4M



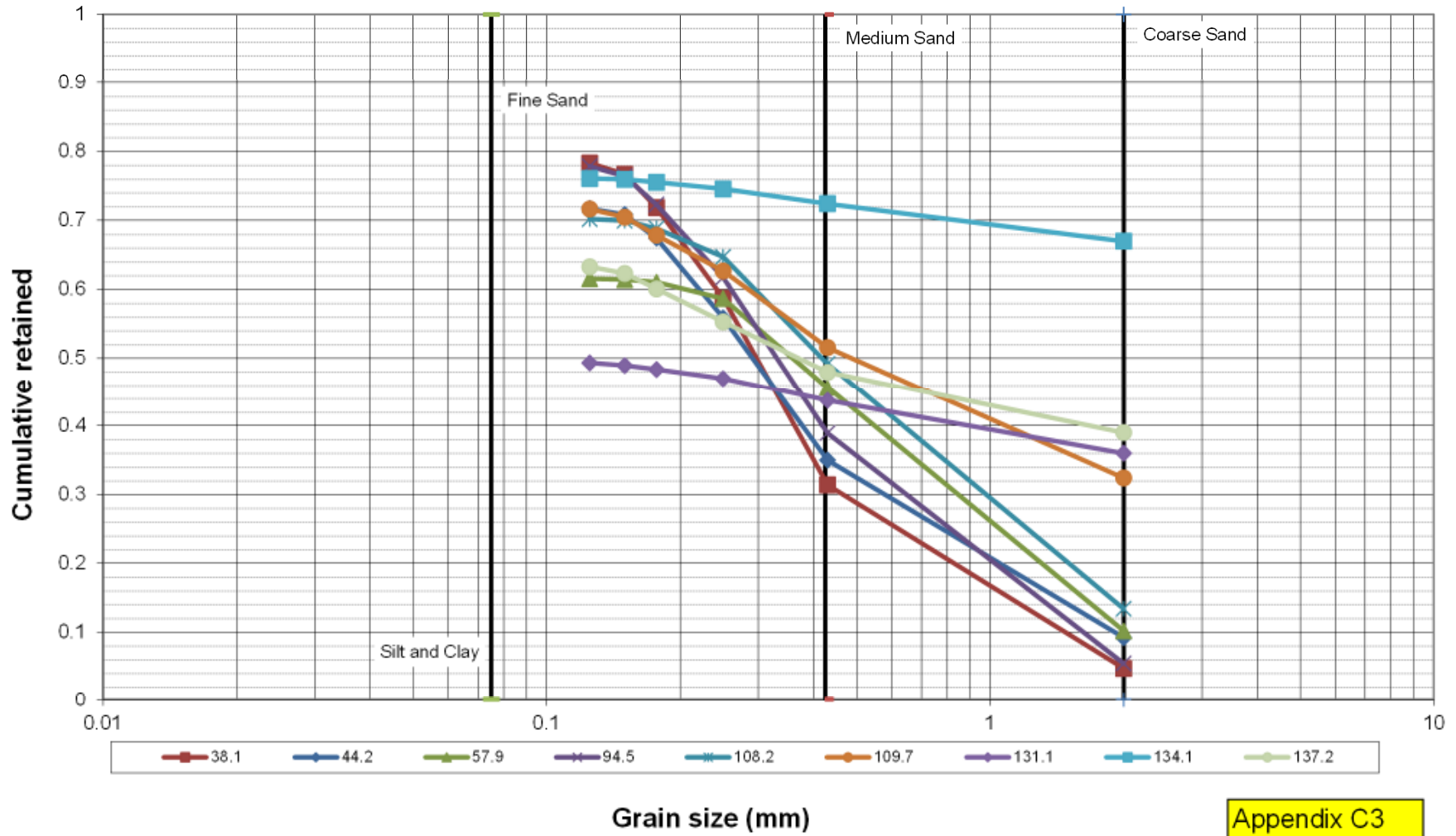
Appendix C1

Grain Size Analysis SAOS-AESRD Waddell Creek 80-09-149 - 08-27-080-09 W4M



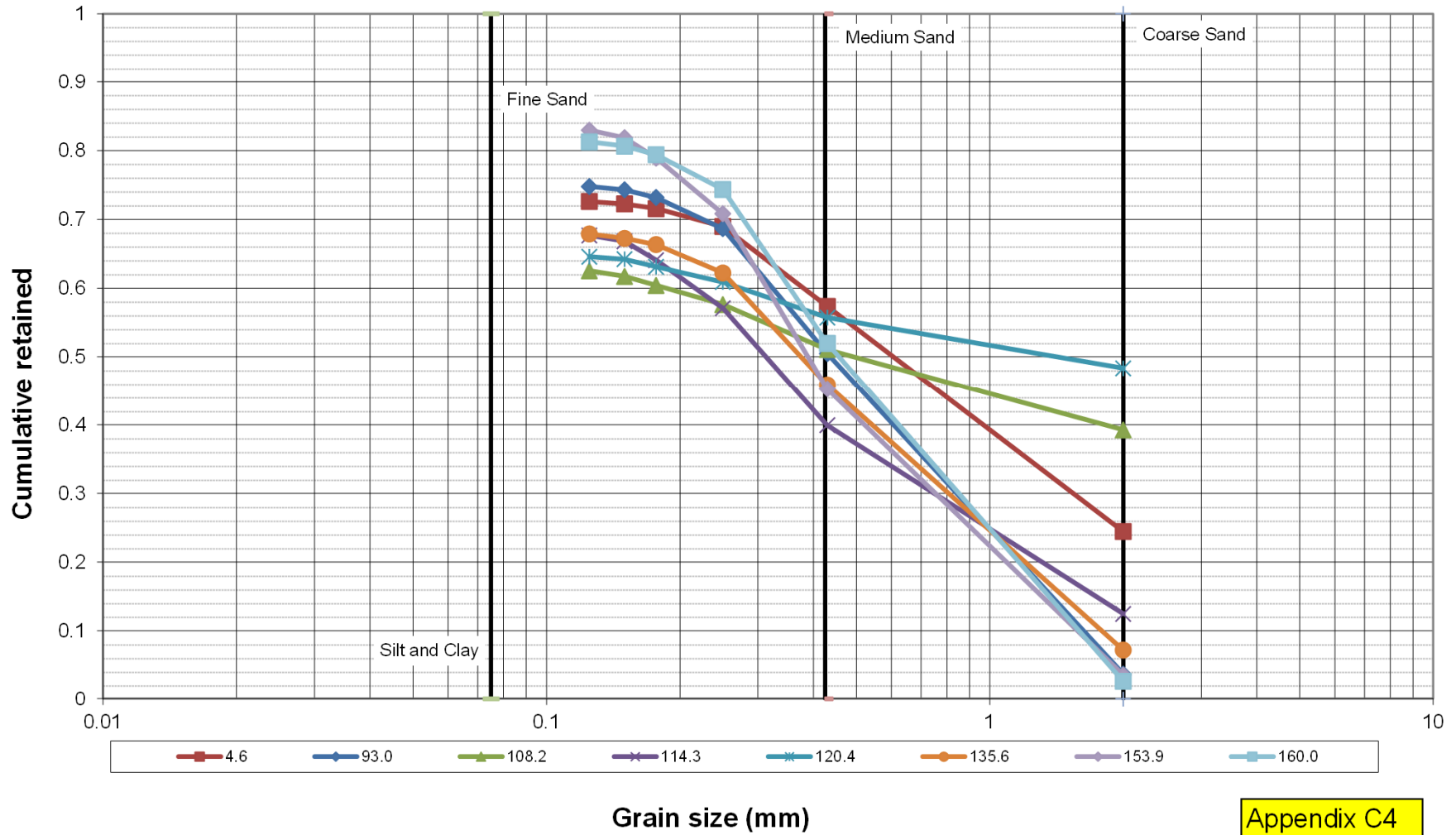
Appendix C2

Grain Size Analysis SAOS-AESRD Mariana Lakes 80-13-13 (MW12A) - 07-19-080-13 W4M



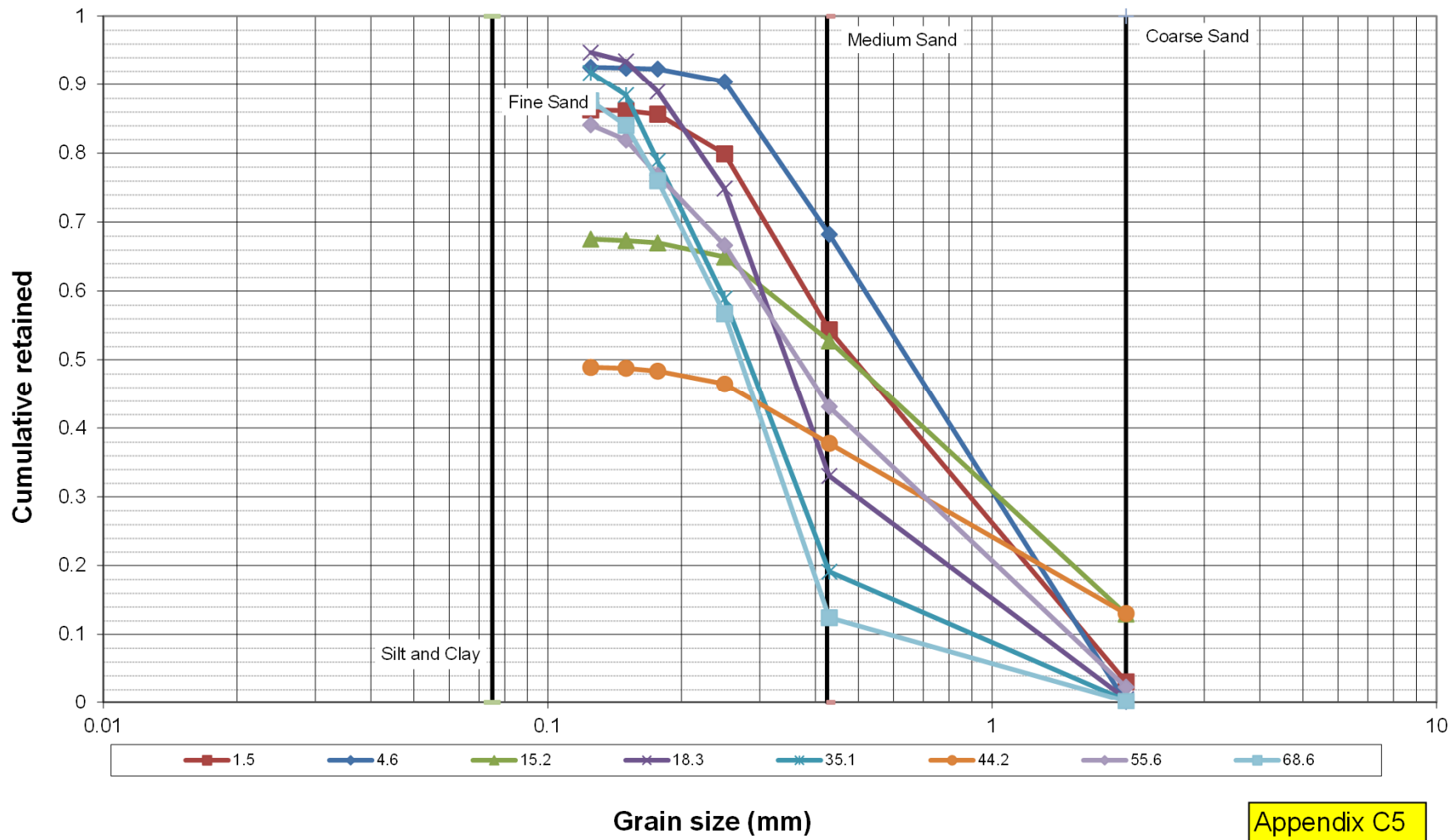
Appendix C3

Grain Size Analysis Performed Onsite
SAOS-AESRD
House Crossing 77-15-161 - 07-36-077-15 W4M



Appendix C4

**Grain Size Analysis Performed Onsite
SAOS-AESRD
Plamondon 68-16-70 - 10-26-068-16 W4M**



Appendix C5

APPENDIX D
ANALYTICAL RESULTS



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 26-OCT-12
Report Date: 05-NOV-12 09:45 (MT)
Version: FINAL

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1229314
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 SAOS 8-27-80-09 W4
C of C Numbers: 060413
Legal Site Desc: 8-27-80-09 W4

Monica Gibson
Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1229314-1 16054121022101									
Sampled By: GK/KH on 22-OCT-12 @ 14:15									
Matrix: WATER									
BTX, F1, F2, F3, F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Toluene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
o-xylene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Xylenes	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F1(C6-C10)	<0.10	-		0.10	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F1-BTEX	<0.10	-		0.10	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
F3 (C16-C34)	0.36	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
Dissolved Metals - Matrix									
Dissolved Mercury in Water by CVAFS									
Mercury (Hg)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-NOV-12	R2467699
Dissolved Metals by ICPMS									
Aluminum (Al)-Dissolved	<0.0050	-		0.0050	mg/L	-		31-OCT-12	R2466058
Antimony (Sb)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Arsenic (As)-Dissolved	0.00040	+/-0.00003		0.00010	mg/L	0		31-OCT-12	R2466058
Barium (Ba)-Dissolved	0.133	-		0.000050	mg/L	-		31-OCT-12	R2466058
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Bismuth (Bi)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Boron (B)-Dissolved	0.071	-		0.010	mg/L	-		31-OCT-12	R2466058
Cadmium (Cd)-Dissolved	<0.000050	-		0.000050	mg/L	-		31-OCT-12	R2466058
Chromium (Cr)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Cobalt (Co)-Dissolved	0.00082	+/-0.00008		0.00010	mg/L	0		31-OCT-12	R2466058
Copper (Cu)-Dissolved	0.00176	-		0.00010	mg/L	-		31-OCT-12	R2466058
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Molybdenum (Mo)-Dissolved	0.00305	-		0.000050	mg/L	-		31-OCT-12	R2466058
Nickel (Ni)-Dissolved	0.00233	-		0.00050	mg/L	-		31-OCT-12	R2466058
Selenium (Se)-Dissolved	0.0031	-		0.0010	mg/L	-		31-OCT-12	R2466058
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		31-OCT-12	R2466058
Strontium (Sr)-Dissolved	0.294	-		0.00010	mg/L	-		31-OCT-12	R2466058
Titanium (Ti)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Thallium (Tl)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Tin (Sn)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Uranium (U)-Dissolved	0.0146	-		0.000010	mg/L	-		31-OCT-12	R2466058
Vanadium (V)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Zinc (Zn)-Dissolved	<0.0050	-		0.0050	mg/L	-		31-OCT-12	R2466058
Miscellaneous Parameters									
Ammonia, Total (as N)	0.070	-		0.050	mg/L	-		02-NOV-12	R2467872
Dissolved Organic Carbon	11.3	+/-1.2		1.0	mg/L	0		31-OCT-12	R2467814
Naphthenic Acids	<1.0	-		1.0	mg/L	-	04-NOV-12	04-NOV-12	R2468364
Phenols (4AAP)	0.0611	+/-0.0060	RRV	0.0010	mg/L	0		02-NOV-12	R2467775
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Acenaphthylene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Anthracene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Fluoranthene	<0.000020	-		0.000020	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Fluorene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1229314-1 16054121022101 Sampled By: GK/KH on 22-OCT-12 @ 14:15 Matrix: WATER									
PAH & Carcinogenic PAH List									
Naphthalene	0.00869	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Phenanthrene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Pyrene	<0.000020	-		0.000020	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(k)fluoranthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(b&j)fluoranthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(g,h,i)perylene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(a)pyrene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Chrysene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Indeno(1,2,3-cd)pyrene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
B(A)P Total Potency Equivalent	<0.000039	-		0.000039	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Surr: d10-Acenaphthene	82.3	-		N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Surr: d10-Phenanthrene	86.0	-		N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Surr: d12-Chrysene	81.0	-		N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Routine Water Analysis									
Chloride (Cl)									
Chloride (Cl)	0.79	+/-0.09		0.10	mg/L	0		27-OCT-12	R2463940
Dissolved Metals by ICPOES									
Calcium (Ca)-Dissolved	120	-		0.10	mg/L	-		31-OCT-12	R2465991
Iron (Fe)-Dissolved	<0.030	-		0.030	mg/L	-		31-OCT-12	R2465991
Magnesium (Mg)-Dissolved	44.4	-		0.10	mg/L	-		31-OCT-12	R2465991
Manganese (Mn)-Dissolved	0.103	-		0.0050	mg/L	-		31-OCT-12	R2465991
Potassium (K)-Dissolved	3.67	-		0.50	mg/L	-		31-OCT-12	R2465991
Sodium (Na)-Dissolved	8.5	-		1.0	mg/L	-		31-OCT-12	R2465991
Ion Balance Calculation									
Ion Balance	99.6	-			%	-		02-NOV-12	
TDS (Calculated)	492	-			mg/L	-		02-NOV-12	
Hardness (as CaCO3)	482	-			mg/L	-		02-NOV-12	
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.951	-		0.071	mg/L	-		01-NOV-12	
Nitrate-N									
Nitrate (as N)	0.951	+/-0.060		0.050	mg/L	0		27-OCT-12	R2463940
Nitrite-N									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-OCT-12	R2463940
Sulfate (SO4)									
Sulfate (SO4)	23.4	+/-1.3		0.50	mg/L	0		27-OCT-12	R2463940
pH, Conductivity and Total Alkalinity									
pH	8.05	-		0.10	pH	-		26-OCT-12	R2463619
Conductivity (EC)	829	-		3.0	uS/cm	-		26-OCT-12	R2463619
Bicarbonate (HCO3)	584	-		5.0	mg/L	-		26-OCT-12	R2463619
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		26-OCT-12	R2463619
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-OCT-12	R2463619
Alkalinity, Total (as CaCO3)	479	-		5.0	mg/L	-		26-OCT-12	R2463619
L1229314-2 16054121022102 Sampled By: GK/KH on 22-OCT-12 @ 17:35 Matrix: WATER									
BTX, F1, F2, F3, F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Toluene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1229314-2 16054121022102									
Sampled By: GK/KH on 22-OCT-12 @ 17:35									
Matrix: WATER									
BTEX and F1 (C6-C10)									
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
o-xylene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Xylenes	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F1(C6-C10)	<0.10	-		0.10	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F1-BTEX	<0.10	-		0.10	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
Dissolved Metals - Matrix									
Dissolved Mercury in Water by CVAFS									
Mercury (Hg)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-NOV-12	R2467699
Dissolved Metals by ICPMS									
Aluminum (Al)-Dissolved	<0.0050	-		0.0050	mg/L	-		31-OCT-12	R2466058
Antimony (Sb)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Arsenic (As)-Dissolved	0.00331	+/-0.00020		0.00010	mg/L	0		31-OCT-12	R2466058
Barium (Ba)-Dissolved	0.117	-		0.000050	mg/L	-		31-OCT-12	R2466058
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Bismuth (Bi)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Boron (B)-Dissolved	0.047	-		0.010	mg/L	-		31-OCT-12	R2466058
Cadmium (Cd)-Dissolved	<0.000050	-		0.000050	mg/L	-		31-OCT-12	R2466058
Chromium (Cr)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Cobalt (Co)-Dissolved	0.00198	+/-0.00020		0.00010	mg/L	0		31-OCT-12	R2466058
Copper (Cu)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Molybdenum (Mo)-Dissolved	0.00396	-		0.000050	mg/L	-		31-OCT-12	R2466058
Nickel (Ni)-Dissolved	0.00187	-		0.00050	mg/L	-		31-OCT-12	R2466058
Selenium (Se)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		31-OCT-12	R2466058
Strontium (Sr)-Dissolved	0.236	-		0.00010	mg/L	-		31-OCT-12	R2466058
Titanium (Ti)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Thallium (Tl)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Tin (Sn)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Uranium (U)-Dissolved	0.00232	-		0.000010	mg/L	-		31-OCT-12	R2466058
Vanadium (V)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Zinc (Zn)-Dissolved	<0.0050	-		0.0050	mg/L	-		31-OCT-12	R2466058
Miscellaneous Parameters									
Ammonia, Total (as N)	0.163	-		0.050	mg/L	-		02-NOV-12	R2467872
Dissolved Organic Carbon	5.3	+/-0.7		1.0	mg/L	0		31-OCT-12	R2467814
Naphthenic Acids	<1.0	-		1.0	mg/L	-	04-NOV-12	04-NOV-12	R2468364
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		02-NOV-12	R2467775
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Acenaphthylene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Anthracene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Fluoranthene	<0.000020	-		0.000020	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Fluorene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Naphthalene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Phenanthrene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Pyrene	<0.000020	-		0.000020	mg/L	-	26-OCT-12	26-OCT-12	R2464184

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1229314-2 16054121022102 Sampled By: GK/KH on 22-OCT-12 @ 17:35 Matrix: WATER									
PAH & Carcinogenic PAH List									
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(k)fluoranthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(b&j)fluoranthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(g,h,i)perylene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(a)pyrene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Chrysene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Indeno(1,2,3-cd)pyrene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
B(A)P Total Potency Equivalent	<0.000039	-		0.000039	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Surr: d10-Acenaphthene	95.5	-		N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Surr: d10-Phenanthrene	98.4	-		N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Surr: d12-Chrysene	91.8	-		N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Routine Water Analysis									
Chloride (Cl)									
Chloride (Cl)	1.20	+/-0.11		0.10	mg/L	0		27-OCT-12	R2463940
Dissolved Metals by ICPOES									
Calcium (Ca)-Dissolved	68.4	-		0.10	mg/L	-		31-OCT-12	R2465991
Iron (Fe)-Dissolved	0.363	-		0.030	mg/L	-		31-OCT-12	R2465991
Magnesium (Mg)-Dissolved	18.9	-		0.10	mg/L	-		31-OCT-12	R2465991
Manganese (Mn)-Dissolved	0.374	-		0.0050	mg/L	-		31-OCT-12	R2465991
Potassium (K)-Dissolved	2.70	-		0.50	mg/L	-		31-OCT-12	R2465991
Sodium (Na)-Dissolved	9.2	-		1.0	mg/L	-		31-OCT-12	R2465991
Ion Balance Calculation									
Ion Balance	96.0	-			%	-		02-NOV-12	
TDS (Calculated)	276	-			mg/L	-		02-NOV-12	
Hardness (as CaCO3)	249	-			mg/L	-		02-NOV-12	
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		01-NOV-12	
Nitrate-N									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-OCT-12	R2463940
Nitrite-N									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-OCT-12	R2463940
Sulfate (SO4)									
Sulfate (SO4)	17.5	+/-1.0		0.50	mg/L	0		27-OCT-12	R2463940
pH, Conductivity and Total Alkalinity									
pH	7.87	-		0.10	pH	-		26-OCT-12	R2463619
Conductivity (EC)	488	-		3.0	uS/cm	-		26-OCT-12	R2463619
Bicarbonate (HCO3)	322	-		5.0	mg/L	-		26-OCT-12	R2463619
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		26-OCT-12	R2463619
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-OCT-12	R2463619
Alkalinity, Total (as CaCO3)	264	-		5.0	mg/L	-		26-OCT-12	R2463619
L1229314-3 16054121022103 Sampled By: GK/KH on 22-OCT-12 @ 17:20 Matrix: WATER									
BTX, F1, F2, F3, F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Toluene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
o-xylene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1229314-3 16054121022103									
Sampled By: GK/KH on 22-OCT-12 @ 17:20									
Matrix: WATER									
BTEX and F1 (C6-C10)									
Xylenes	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F1(C6-C10)	<0.10	-		0.10	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F1-BTEX	<0.10	-		0.10	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
Dissolved Metals - Matrix									
Dissolved Mercury in Water by CVAFS									
Mercury (Hg)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-NOV-12	R2467699
Dissolved Metals by ICPMS									
Aluminum (Al)-Dissolved	<0.0050	-		0.0050	mg/L	-		31-OCT-12	R2466058
Antimony (Sb)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Arsenic (As)-Dissolved	0.00038	+/-0.00003		0.00010	mg/L	0		31-OCT-12	R2466058
Barium (Ba)-Dissolved	0.0463	-		0.000050	mg/L	-		31-OCT-12	R2466058
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Bismuth (Bi)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Boron (B)-Dissolved	0.245	-		0.010	mg/L	-		31-OCT-12	R2466058
Cadmium (Cd)-Dissolved	<0.000050	-		0.000050	mg/L	-		31-OCT-12	R2466058
Chromium (Cr)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Cobalt (Co)-Dissolved	0.00046	+/-0.00005		0.00010	mg/L	0		31-OCT-12	R2466058
Copper (Cu)-Dissolved	0.00031	-		0.00010	mg/L	-		31-OCT-12	R2466058
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Molybdenum (Mo)-Dissolved	0.00958	-		0.000050	mg/L	-		31-OCT-12	R2466058
Nickel (Ni)-Dissolved	0.00331	-		0.00050	mg/L	-		31-OCT-12	R2466058
Selenium (Se)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		31-OCT-12	R2466058
Strontium (Sr)-Dissolved	0.814	-		0.00010	mg/L	-		31-OCT-12	R2466058
Titanium (Ti)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Thallium (Tl)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Tin (Sn)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Uranium (U)-Dissolved	0.000064	-		0.000010	mg/L	-		31-OCT-12	R2466058
Vanadium (V)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Zinc (Zn)-Dissolved	<0.0050	-		0.0050	mg/L	-		31-OCT-12	R2466058
Miscellaneous Parameters									
Ammonia, Total (as N)	1.87	-	DLA	0.25	mg/L	-		02-NOV-12	R2467872
Dissolved Organic Carbon	7.9	+/-0.9		1.0	mg/L	0		31-OCT-12	R2467814
Naphthenic Acids	1.0	+/-0.4		1.0	mg/L	0	04-NOV-12	04-NOV-12	R2468364
Phenols (4AAP)	0.0036	+/-0.0009		0.0010	mg/L	0		02-NOV-12	R2467775
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Acenaphthylene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Anthracene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Fluoranthene	<0.000020	-		0.000020	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Fluorene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Naphthalene	0.00124	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Phenanthrene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Pyrene	<0.000020	-		0.000020	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(k)fluoranthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(b&j)fluoranthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1229314-3 16054121022103 Sampled By: GK/KH on 22-OCT-12 @ 17:20 Matrix: WATER									
PAH & Carcinogenic PAH List									
Benzo(g,h,i)perylene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(a)pyrene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Chrysene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Indeno(1,2,3-cd)pyrene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
B(A)P Total Potency Equivalent	<0.000039	-		0.000039	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Surr: d10-Acenaphthene	86.4	-		N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Surr: d10-Phenanthrene	89.7	-		N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Surr: d12-Chrysene	87.0	-		N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Routine Water Analysis									
Chloride (Cl)									
Chloride (Cl)	0.61	+/-0.08		0.10	mg/L	0		27-OCT-12	R2463940
Dissolved Metals by ICPOES									
Calcium (Ca)-Dissolved	84.5	-		0.10	mg/L	-		31-OCT-12	R2465991
Iron (Fe)-Dissolved	1.32	-		0.030	mg/L	-		31-OCT-12	R2465991
Magnesium (Mg)-Dissolved	24.2	-		0.10	mg/L	-		31-OCT-12	R2465991
Manganese (Mn)-Dissolved	0.116	-		0.0050	mg/L	-		31-OCT-12	R2465991
Potassium (K)-Dissolved	7.89	-		0.50	mg/L	-		31-OCT-12	R2465991
Sodium (Na)-Dissolved	87.0	-		1.0	mg/L	-		31-OCT-12	R2465991
Ion Balance Calculation									
Ion Balance	98.4	-			%	-		02-NOV-12	
TDS (Calculated)	537	-			mg/L	-		02-NOV-12	
Hardness (as CaCO3)	311	-			mg/L	-		02-NOV-12	
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		01-NOV-12	
Nitrate-N									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-OCT-12	R2463940
Nitrite-N									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-OCT-12	R2463940
Sulfate (SO4)									
Sulfate (SO4)	50.5	+/-2.8		0.50	mg/L	0		27-OCT-12	R2463940
pH, Conductivity and Total Alkalinity									
pH	7.97	-		0.10	pH	-		26-OCT-12	R2463619
Conductivity (EC)	878	-		3.0	uS/cm	-		26-OCT-12	R2463619
Bicarbonate (HCO3)	575	-		5.0	mg/L	-		26-OCT-12	R2463619
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		26-OCT-12	R2463619
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-OCT-12	R2463619
Alkalinity, Total (as CaCO3)	471	-		5.0	mg/L	-		26-OCT-12	R2463619
L1229314-4 16054121023104 Sampled By: GK/KH on 23-OCT-12 @ 17:40 Matrix: WATER									
BTX, F1, F2, F3, F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Toluene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
o-xylene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
Xylenes	<0.00050	-		0.00050	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F1(C6-C10)	<0.10	-		0.10	mg/L	-	30-OCT-12	01-NOV-12	R2466075
F1-BTEX	<0.10	-		0.10	mg/L	-	30-OCT-12	01-NOV-12	R2466075

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1229314-4 16054121023104									
Sampled By: GK/KH on 23-OCT-12 @ 17:40									
Matrix: WATER									
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	26-OCT-12	26-OCT-12	R2463939
Dissolved Metals - Matrix									
Dissolved Mercury in Water by CVAFS									
Mercury (Hg)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-NOV-12	R2467699
Dissolved Metals by ICPMS									
Aluminum (Al)-Dissolved	<0.0050	-		0.0050	mg/L	-		31-OCT-12	R2466058
Antimony (Sb)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Arsenic (As)-Dissolved	0.00034	+/-0.00002		0.00010	mg/L	0		31-OCT-12	R2466058
Barium (Ba)-Dissolved	0.0551	-		0.000050	mg/L	-		31-OCT-12	R2466058
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Bismuth (Bi)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Boron (B)-Dissolved	0.282	-		0.010	mg/L	-		31-OCT-12	R2466058
Cadmium (Cd)-Dissolved	<0.000050	-		0.000050	mg/L	-		31-OCT-12	R2466058
Chromium (Cr)-Dissolved	<0.00050	-		0.00050	mg/L	-		31-OCT-12	R2466058
Cobalt (Co)-Dissolved	0.00051	+/-0.00005		0.00010	mg/L	0		31-OCT-12	R2466058
Copper (Cu)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Molybdenum (Mo)-Dissolved	0.00549	-		0.000050	mg/L	-		31-OCT-12	R2466058
Nickel (Ni)-Dissolved	0.00084	-		0.00050	mg/L	-		31-OCT-12	R2466058
Selenium (Se)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		31-OCT-12	R2466058
Strontium (Sr)-Dissolved	0.427	-		0.00010	mg/L	-		31-OCT-12	R2466058
Titanium (Ti)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Thallium (Tl)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Tin (Sn)-Dissolved	<0.00010	-		0.00010	mg/L	-		31-OCT-12	R2466058
Uranium (U)-Dissolved	0.000150	-		0.000010	mg/L	-		31-OCT-12	R2466058
Vanadium (V)-Dissolved	<0.0010	-		0.0010	mg/L	-		31-OCT-12	R2466058
Zinc (Zn)-Dissolved	<0.0050	-		0.0050	mg/L	-		31-OCT-12	R2466058
Miscellaneous Parameters									
Ammonia, Total (as N)	1.50	-	DLA	0.25	mg/L	-		02-NOV-12	R2467872
Dissolved Organic Carbon	6.2	+/-0.7		1.0	mg/L	0		31-OCT-12	R2467814
Naphthenic Acids	<1.0	-		1.0	mg/L	-	04-NOV-12	04-NOV-12	R2468364
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		02-NOV-12	R2467775
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Acenaphthylene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Anthracene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Fluoranthene	<0.000020	-		0.000020	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Fluorene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Naphthalene	0.000384	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Phenanthrene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Pyrene	<0.000020	-		0.000020	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(k)fluoranthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(b&j)fluoranthene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(g,h,i)perylene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Benzo(a)pyrene	<0.000010	-		0.000010	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Chrysene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1229314-4 16054121023104									
Sampled By: GK/KH on 23-OCT-12 @ 17:40									
Matrix: WATER									
PAH & Carcinogenic PAH List									
	Indeno(1,2,3-cd)pyrene	<0.000050	-	0.000050	mg/L	-	26-OCT-12	26-OCT-12	R2464184
	B(A)P Total Potency Equivalent	<0.000039	-	0.000039	mg/L	-	26-OCT-12	26-OCT-12	R2464184
Surr:	d10-Acenaphthene	94.0	-	N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Surr:	d10-Phenanthrene	98.8	-	N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Surr:	d12-Chrysene	94.1	-	N/A	%	-	26-OCT-12	26-OCT-12	R2464184
Routine Water Analysis									
Chloride (Cl)									
	Chloride (Cl)	0.25	+/-0.08	0.10	mg/L	0		27-OCT-12	R2463940
Dissolved Metals by ICPOES									
	Calcium (Ca)-Dissolved	61.4	-	0.10	mg/L	-		31-OCT-12	R2465991
	Iron (Fe)-Dissolved	1.20	-	0.030	mg/L	-		31-OCT-12	R2465991
	Magnesium (Mg)-Dissolved	16.6	-	0.10	mg/L	-		31-OCT-12	R2465991
	Manganese (Mn)-Dissolved	0.181	-	0.0050	mg/L	-		31-OCT-12	R2465991
	Potassium (K)-Dissolved	4.22	-	0.50	mg/L	-		31-OCT-12	R2465991
	Sodium (Na)-Dissolved	73.0	-	1.0	mg/L	-		31-OCT-12	R2465991
Ion Balance Calculation									
	Ion Balance	97.4	-		%	-		02-NOV-12	
	TDS (Calculated)	406	-		mg/L	-		02-NOV-12	
	Hardness (as CaCO3)	222	-		mg/L	-		02-NOV-12	
Nitrate+Nitrite									
	Nitrate and Nitrite (as N)	<0.071	-	0.071	mg/L	-		01-NOV-12	
Nitrate-N									
	Nitrate (as N)	<0.050	-	0.050	mg/L	-		27-OCT-12	R2463940
Nitrite-N									
	Nitrite (as N)	<0.050	-	0.050	mg/L	-		27-OCT-12	R2463940
Sulfate (SO4)									
	Sulfate (SO4)	26.4	+/-1.5	0.50	mg/L	0		27-OCT-12	R2463940
pH, Conductivity and Total Alkalinity									
	pH	7.96	-	0.10	pH	-		26-OCT-12	R2463619
	Conductivity (EC)	697	-	3.0	uS/cm	-		26-OCT-12	R2463619
	Bicarbonate (HCO3)	456	-	5.0	mg/L	-		26-OCT-12	R2463619
	Carbonate (CO3)	<5.0	-	5.0	mg/L	-		26-OCT-12	R2463619
	Hydroxide (OH)	<5.0	-	5.0	mg/L	-		26-OCT-12	R2463619
	Alkalinity, Total (as CaCO3)	374	-	5.0	mg/L	-		26-OCT-12	R2463619

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
BTX,F1-CL	Water	BTEX and F1 (C6-C10)		EPA 5030/8015& 8260-P&T GC-MS/FID
C-DIS-ORG-CL	Water	Dissolved Organic Carbon		APHA 5310 C-Instrumental
CL-CL	Water	Chloride (Cl)		APHA 4110 B-Ion Chromatography
Inorganic Anions by ion chromatography (IC) in water and aqueous extracts of soils.				
F2,F3,F4-CL	Water	F2, F3, F4		EPA 3510/8000-GC-FID
HG-DIS-CVAFS-CL	Water	Dissolved Mercury in Water by CVAFS		EPA SW-846 3005A & EPA 245.7
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).				
IONBALANCE-CL	Water	Ion Balance Calculation		APHA 1030E
MET-DIS-ICP-CL	Water	Dissolved Metals 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-CL	Water	Dissolved Metals by ICPMS		EPA SW-846 3005A/6020A
N2N3-CALC-CL	Water	Nitrate+Nitrite		CALCULATION
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR,Syn crude,1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH4-CL	Water	Ammonia-N		APHA 4500 NH3F-Colorimetry
Ammonia is determined using the Phenate colorimetric method. Result includes both ionized (NH4+) and un-ionized (NH3) ammonia present in the sample.				
NO2-CL	Water	Nitrite-N		APHA 4110 B-Ion Chromatography
NO3-IC-CL	Water	Nitrate-N		APHA 4110 B-Ion Chromatography
PAH-ABT1-CL	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-CL	Water	pH, Conductivity and Total Alkalinity		APHA 4500H,2510,2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed) pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode. Alkalinity measurement is based on the sample's capacity to neutralize acid Conductivity measurement is based on the sample's capacity to convey an electric current				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-CL	Water	Sulfate (SO4)		APHA 4110 B-Ion Chromatography

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference 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
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Reference Information

Chain of Custody Numbers:

060413

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

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.



Environmental

Quality Control Report

Workorder: L1229314

Report Date: 05-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX,F1-CL		Water						
Batch	R2466075							
WG1577497-2	DUP	L1226698-1						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-OCT-12
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-OCT-12
Ethylbenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-OCT-12
o-xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-OCT-12
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-OCT-12
Xylenes		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-OCT-12
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	30-OCT-12
WG1577497-4	LCS							
Benzene			105.3		%		70-130	31-OCT-12
Toluene			93.9		%		70-130	31-OCT-12
Ethylbenzene			87.2		%		70-130	31-OCT-12
o-xylene			88.1		%		70-130	31-OCT-12
m+p-Xylene			95.8		%		70-130	31-OCT-12
Xylenes			93.4		%		70-130	31-OCT-12
F1(C6-C10)			100.1		%		70-130	31-OCT-12
WG1577497-1	MB							
Benzene			<0.00050		mg/L		0.0005	30-OCT-12
Toluene			<0.00050		mg/L		0.0005	30-OCT-12
Ethylbenzene			<0.00050		mg/L		0.0005	30-OCT-12
o-xylene			<0.00050		mg/L		0.0005	30-OCT-12
m+p-Xylene			<0.00050		mg/L		0.0005	30-OCT-12
Xylenes			<0.00050		mg/L		0.0005	30-OCT-12
F1(C6-C10)			<0.10		mg/L		0.1	30-OCT-12
WG1577497-3	MS	L1226698-2						
Benzene			110.9		%		50-150	30-OCT-12
Toluene			93.0		%		50-150	30-OCT-12
Ethylbenzene			84.6		%		50-150	30-OCT-12
o-xylene			92.0		%		50-150	30-OCT-12
m+p-Xylene			97.7		%		50-150	30-OCT-12
Xylenes			96.0		%		50-150	30-OCT-12
F1(C6-C10)			97.1		%		50-150	30-OCT-12

C-DIS-ORG-CL **Water**



Quality Control Report

Workorder: L1229314

Report Date: 05-NOV-12

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-CL		Water						
Batch	R2467814							
WG1579419-3	DUP	L1226538-2						
Dissolved Organic Carbon		16.9	17.0		mg/L	0.6	20	31-OCT-12
WG1579419-5	DUP	L1226027-8						
Dissolved Organic Carbon		3.9	4.1		mg/L	4.6	20	31-OCT-12
WG1579419-2	LCS							
Dissolved Organic Carbon			98.3		%		80-120	31-OCT-12
WG1579419-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	31-OCT-12
CL-CL		Water						
Batch	R2463940							
WG1575332-3	DUP	L1228663-12						
Chloride (Cl)		19.2	19.2		mg/L	0.1	20	26-OCT-12
WG1575332-4	DUP	L1229463-1						
Chloride (Cl)		8.84	8.83		mg/L	0.1	20	26-OCT-12
WG1575332-5	DUP	L1229625-1						
Chloride (Cl)		14.2	14.2		mg/L	0.2	20	27-OCT-12
WG1575332-6	DUP	L1229314-4						
Chloride (Cl)		0.25	0.24		mg/L	0.8	20	27-OCT-12
WG1575332-7	DUP	L1229834-6						
Chloride (Cl)		325	325		mg/L	0.2	20	27-OCT-12
WG1575332-2	LCS							
Chloride (Cl)			102.5		%		85-115	26-OCT-12
WG1575332-1	MB							
Chloride (Cl)			<0.10		mg/L		0.1	26-OCT-12
F2,F3,F4-CL		Water						
Batch	R2463939							
WG1575201-3	DUP	L1229314-2						
F2 (>C10-C16)		<0.25	<0.25	RPD-NA	mg/L	N/A	35	26-OCT-12
F3 (C16-C34)		<0.25	<0.25	RPD-NA	mg/L	N/A	35	26-OCT-12
F4 (C34-C50)		<0.25	<0.25	RPD-NA	mg/L	N/A	35	26-OCT-12
WG1575201-2	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	26-OCT-12
F3 (C16-C34)			<0.25		mg/L		0.25	26-OCT-12
F4 (C34-C50)			<0.25		mg/L		0.25	26-OCT-12
WG1575201-4	MS	L1229314-4						
F2 (>C10-C16)			100.1		%		50-150	26-OCT-12
F3 (C16-C34)			100.1		%		50-150	26-OCT-12



Quality Control Report

Workorder: L1229314

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2,F3,F4-CL		Water						
Batch	R2463939							
WG1575201-4 MS		L1229314-4						
F4 (C34-C50)			100.1		%		50-150	26-OCT-12
HG-DIS-CVAFS-CL		Water						
Batch	R2467699							
WG1579224-4 CRM		LCS-DIS						
Mercury (Hg)-Dissolved			106.2		%		85-115	02-NOV-12
WG1579224-10 DUP		L1229758-1						
Mercury (Hg)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-NOV-12
WG1579224-11 DUP		L1226715-19						
Mercury (Hg)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-NOV-12
WG1579224-5 DUP		L1226427-9						
Mercury (Hg)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-NOV-12
WG1579224-6 DUP		L1225453-1						
Mercury (Hg)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-NOV-12
WG1579224-8 DUP		L1227666-5						
Mercury (Hg)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-NOV-12
WG1579224-9 DUP		L1230438-1						
Mercury (Hg)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-NOV-12
WG1579224-1 MB								
Mercury (Hg)-Dissolved			<0.000050		mg/L		0.00005	02-NOV-12
MET-DIS-ICP-CL		Water						
Batch	R2465991							
WG1577660-6 DUP		L1229975-1						
Calcium (Ca)-Dissolved		15.3	15.1		mg/L	1.3	25	31-OCT-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	25	31-OCT-12
Magnesium (Mg)-Dissolved		6.60	6.62		mg/L	0.3	25	31-OCT-12
Manganese (Mn)-Dissolved		0.0167	0.0164		mg/L	1.8	25	31-OCT-12
Potassium (K)-Dissolved		2.55	2.63		mg/L	3.1	25	31-OCT-12
Sodium (Na)-Dissolved		226	231		mg/L	2.4	25	31-OCT-12
WG1577660-7 DUP		L1230481-6						
Calcium (Ca)-Dissolved		<0.10	<0.10	RPD-NA	mg/L	N/A	25	31-OCT-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	25	31-OCT-12
Magnesium (Mg)-Dissolved		<0.10	<0.10	RPD-NA	mg/L	N/A	25	31-OCT-12
Manganese (Mn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	25	31-OCT-12
Potassium (K)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	25	31-OCT-12



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-ICP-CL								
	Water							
Batch	R2465991							
WG1577660-7	DUP	L1230481-6						
Sodium (Na)-Dissolved		<1.0	<1.0	RPD-NA	mg/L	N/A	25	31-OCT-12
WG1577660-1	MB							
Calcium (Ca)-Dissolved			<0.10		mg/L		0.1	31-OCT-12
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	31-OCT-12
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	31-OCT-12
Manganese (Mn)-Dissolved			<0.0050		mg/L		0.005	31-OCT-12
Potassium (K)-Dissolved			<0.50		mg/L		0.5	31-OCT-12
Sodium (Na)-Dissolved			<1.0		mg/L		1	31-OCT-12
MET-DIS-LOW-MS-CL								
	Water							
Batch	R2466058							
WG1577742-3	CRM	CVS						
Aluminum (Al)-Dissolved			99.5		%		80-120	31-OCT-12
Antimony (Sb)-Dissolved			101.6		%		80-120	31-OCT-12
Arsenic (As)-Dissolved			97.3		%		80-120	31-OCT-12
Barium (Ba)-Dissolved			99.0		%		80-120	31-OCT-12
Beryllium (Be)-Dissolved			104.0		%		80-120	31-OCT-12
Bismuth (Bi)-Dissolved			108.1		%		80-120	31-OCT-12
Boron (B)-Dissolved			101.6		%		80-120	31-OCT-12
Cadmium (Cd)-Dissolved			103.9		%		80-120	31-OCT-12
Chromium (Cr)-Dissolved			99.6		%		80-120	31-OCT-12
Cobalt (Co)-Dissolved			100.2		%		80-120	31-OCT-12
Copper (Cu)-Dissolved			98.7		%		80-120	31-OCT-12
Lead (Pb)-Dissolved			108.4		%		80-120	31-OCT-12
Molybdenum (Mo)-Dissolved			100.7		%		80-120	31-OCT-12
Nickel (Ni)-Dissolved			101.5		%		80-120	31-OCT-12
Selenium (Se)-Dissolved			100.7		%		80-120	31-OCT-12
Silver (Ag)-Dissolved			105.7		%		80-120	31-OCT-12
Strontium (Sr)-Dissolved			101.3		%		80-120	31-OCT-12
Titanium (Ti)-Dissolved			100.9		%		80-120	31-OCT-12
Thallium (Tl)-Dissolved			109.8		%		80-120	31-OCT-12
Tin (Sn)-Dissolved			101.0		%		80-120	31-OCT-12
Uranium (U)-Dissolved			101.8		%		80-120	31-OCT-12
Vanadium (V)-Dissolved			100.8		%		80-120	31-OCT-12
Zinc (Zn)-Dissolved			97.3		%		80-120	31-OCT-12



Quality Control Report

Workorder: L1229314

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-CL								
	Water							
Batch	R2466058							
WG1577742-4	DUP	L1229975-1						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	31-OCT-12
Antimony (Sb)-Dissolved		0.00035	0.00036		mg/L	0.4	20	31-OCT-12
Arsenic (As)-Dissolved		0.00046	0.00048		mg/L	3.7	25	31-OCT-12
Barium (Ba)-Dissolved		0.883	0.904		mg/L	2.3	20	31-OCT-12
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	31-OCT-12
Bismuth (Bi)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	25	31-OCT-12
Boron (B)-Dissolved		0.092	0.092		mg/L	0.1	20	31-OCT-12
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	31-OCT-12
Chromium (Cr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	31-OCT-12
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Copper (Cu)-Dissolved		0.00621	0.00616		mg/L	0.8	20	31-OCT-12
Lead (Pb)-Dissolved		0.00027	0.00026		mg/L	1.7	20	31-OCT-12
Molybdenum (Mo)-Dissolved		0.00162	0.00162		mg/L	0.2	25	31-OCT-12
Nickel (Ni)-Dissolved		0.00250	0.00248		mg/L	0.8	20	31-OCT-12
Selenium (Se)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	31-OCT-12
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	31-OCT-12
Strontium (Sr)-Dissolved		0.369	0.371		mg/L	0.3	20	31-OCT-12
Titanium (Ti)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	25	31-OCT-12
Thallium (Tl)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Uranium (U)-Dissolved		0.000149	0.000146		mg/L	2.3	25	31-OCT-12
Vanadium (V)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	31-OCT-12
Zinc (Zn)-Dissolved		0.0200	0.0198		mg/L	1.1	20	31-OCT-12
WG1577742-5	DUP	L1226229-15						
Aluminum (Al)-Dissolved		0.0067	0.0073		mg/L	8.2	20	31-OCT-12
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Arsenic (As)-Dissolved		0.00044	0.00042		mg/L	3.7	25	31-OCT-12
Barium (Ba)-Dissolved		0.0711	0.0679		mg/L	4.6	20	31-OCT-12
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	31-OCT-12
Bismuth (Bi)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	25	31-OCT-12
Boron (B)-Dissolved		0.013	0.016		mg/L	18	20	31-OCT-12
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	31-OCT-12
Chromium (Cr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	31-OCT-12



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-CL								
	Water							
Batch	R2466058							
WG1577742-5	DUP	L1226229-15						
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Copper (Cu)-Dissolved		0.00060	0.00058		mg/L	3.5	20	31-OCT-12
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Molybdenum (Mo)-Dissolved		0.000881	0.00104		mg/L	17	25	31-OCT-12
Nickel (Ni)-Dissolved		0.00050	0.00051		mg/L	1.1	20	31-OCT-12
Selenium (Se)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	31-OCT-12
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	31-OCT-12
Strontium (Sr)-Dissolved		0.305	0.357		mg/L	16	20	31-OCT-12
Titanium (Ti)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	25	31-OCT-12
Thallium (Tl)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Uranium (U)-Dissolved		0.000512	0.000592		mg/L	15	25	31-OCT-12
Vanadium (V)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	31-OCT-12
Zinc (Zn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	31-OCT-12
WG1577742-6	DUP	L1229834-6						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	31-OCT-12
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Arsenic (As)-Dissolved		0.00022	0.00022		mg/L	2.9	25	31-OCT-12
Barium (Ba)-Dissolved		0.731	0.722		mg/L	1.2	20	31-OCT-12
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	31-OCT-12
Bismuth (Bi)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	25	31-OCT-12
Boron (B)-Dissolved		0.045	0.045		mg/L	0.6	20	31-OCT-12
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	31-OCT-12
Chromium (Cr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	31-OCT-12
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Copper (Cu)-Dissolved		0.00143	0.00138		mg/L	3.7	20	31-OCT-12
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Molybdenum (Mo)-Dissolved		0.000387	0.000405		mg/L	4.7	25	31-OCT-12
Nickel (Ni)-Dissolved		0.00110	0.00100		mg/L	9.6	20	31-OCT-12
Selenium (Se)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	31-OCT-12
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	31-OCT-12
Strontium (Sr)-Dissolved		1.70	1.67		mg/L	1.5	20	31-OCT-12
Titanium (Ti)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	25	31-OCT-12



Quality Control Report

Workorder: L1229314

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-CL								
	Water							
Batch	R2466058							
WG1577742-6	DUP	L1229834-6						
Thallium (Tl)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	31-OCT-12
Uranium (U)-Dissolved		0.0166	0.0168		mg/L	1.3	25	31-OCT-12
Vanadium (V)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	31-OCT-12
Zinc (Zn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	31-OCT-12
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2468364							
WG1579944-3	DUP	L1226051-2						
Naphthenic Acids		3.3	3.2		mg/L	2.3	30	04-NOV-12
WG1579944-5	DUP	L1226051-24						
Naphthenic Acids		2.0	1.7		mg/L	16	30	04-NOV-12
WG1579944-6	LCS							
Naphthenic Acids			99.8		%		70-130	04-NOV-12
WG1579944-1	MB							
Naphthenic Acids			<1.0		mg/L		1	04-NOV-12
WG1579944-2	MS	L1226051-4						
Naphthenic Acids			64.1		%		50-150	04-NOV-12
WG1579944-4	MS	L1226051-23						
Naphthenic Acids			50.3		%		50-150	04-NOV-12
NH4-CL								
	Water							
Batch	R2467872							
WG1579420-4	DUP	L1226520-1						
Ammonia, Total (as N)		0.493	0.499		mg/L	1.1	20	02-NOV-12
WG1579420-6	DUP	L1229314-1						
Ammonia, Total (as N)		0.070	0.076		mg/L	8.3	20	02-NOV-12
WG1579420-7	DUP	L1229314-3						
Ammonia, Total (as N)		1.87	1.76		mg/L	6.2	20	02-NOV-12
WG1579420-2	LCS							
Ammonia, Total (as N)			107.2		%		85-115	02-NOV-12
WG1579420-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	02-NOV-12
WG1579420-5	MS	L1226520-3						
Ammonia, Total (as N)			105.7		%		75-125	02-NOV-12
NO2-CL								
	Water							



Quality Control Report

Workorder: L1229314

Report Date: 05-NOV-12

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-CL		Water						
Batch	R2463940							
WG1575332-3	DUP	L1228663-12						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	26-OCT-12
WG1575332-4	DUP	L1229463-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	26-OCT-12
WG1575332-5	DUP	L1229625-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-OCT-12
WG1575332-6	DUP	L1229314-4						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-OCT-12
WG1575332-7	DUP	L1229834-6						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-OCT-12
WG1575332-2	LCS		97.4		%		85-115	26-OCT-12
Nitrite (as N)								
WG1575332-1	MB		<0.050		mg/L		0.05	26-OCT-12
Nitrite (as N)								
NO3-IC-CL		Water						
Batch	R2463940							
WG1575332-3	DUP	L1228663-12						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	26-OCT-12
WG1575332-4	DUP	L1229463-1						
Nitrate (as N)		3.48	3.48		mg/L	0.1	20	26-OCT-12
WG1575332-6	DUP	L1229314-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-OCT-12
WG1575332-7	DUP	L1229834-6						
Nitrate (as N)		2.93	2.93		mg/L	0.0	20	27-OCT-12
WG1575332-2	LCS		103.6		%		85-115	26-OCT-12
Nitrate (as N)								
WG1575332-1	MB		<0.050		mg/L		0.05	26-OCT-12
Nitrate (as N)								
PAH-ABT1-CL		Water						
Batch	R2464184							
WG1575218-1	LCS							
Acenaphthene			77.7		%		60-130	26-OCT-12
Acenaphthylene			81.1		%		60-130	26-OCT-12
Anthracene			90.0		%		60-130	26-OCT-12
Fluoranthene			90.2		%		60-130	26-OCT-12
Fluorene			82.6		%		60-130	26-OCT-12
Naphthalene			73.5		%		50-130	26-OCT-12



Quality Control Report

Workorder: L1229314

Report Date: 05-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-CL		Water						
Batch	R2464184							
WG1575218-1	LCS							
Phenanthrene			86.0		%		60-130	26-OCT-12
Pyrene			87.3		%		60-130	26-OCT-12
Benzo(a)anthracene			89.6		%		60-130	26-OCT-12
Benzo(k)fluoranthene			90.8		%		60-130	26-OCT-12
Benzo(b&j)fluoranthene			89.5		%		60-130	26-OCT-12
Benzo(g,h,i)perylene			92.7		%		60-130	26-OCT-12
Benzo(a)pyrene			89.2		%		60-130	26-OCT-12
Chrysene			90.2		%		60-130	26-OCT-12
Dibenzo(a,h)anthracene			91.4		%		60-130	26-OCT-12
Indeno(1,2,3-cd)pyrene			89.2		%		60-130	26-OCT-12
WG1575218-2	MB							
Acenaphthene			<0.000050		mg/L		0.00005	26-OCT-12
Acenaphthylene			<0.000050		mg/L		0.00005	26-OCT-12
Anthracene			<0.000010		mg/L		0.00001	26-OCT-12
Fluoranthene			<0.000020		mg/L		0.00002	26-OCT-12
Fluorene			<0.000050		mg/L		0.00005	26-OCT-12
Naphthalene			<0.000050		mg/L		0.00005	26-OCT-12
Phenanthrene			<0.000050		mg/L		0.00005	26-OCT-12
Pyrene			<0.000020		mg/L		0.00002	26-OCT-12
Benzo(a)anthracene			<0.000010		mg/L		0.00001	26-OCT-12
Benzo(k)fluoranthene			<0.000050		mg/L		0.00005	26-OCT-12
Benzo(b&j)fluoranthene			<0.000050		mg/L		0.00005	26-OCT-12
Benzo(g,h,i)perylene			<0.000050		mg/L		0.00005	26-OCT-12
Benzo(a)pyrene			<0.000010		mg/L		0.00001	26-OCT-12
Chrysene			<0.000050		mg/L		0.00005	26-OCT-12
Dibenzo(a,h)anthracene			<0.000050		mg/L		0.00005	26-OCT-12
Indeno(1,2,3-cd)pyrene			<0.000050		mg/L		0.00005	26-OCT-12
Surrogate: d10-Acenaphthene			92.7		%		60-130	26-OCT-12
Surrogate: d10-Phenanthrene			95.0		%		60-130	26-OCT-12
Surrogate: d12-Chrysene			95.7		%		60-130	26-OCT-12

PH/EC/ALK-CL **Water**



Quality Control Report

Workorder: L1229314

Report Date: 05-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-CL		Water						
Batch	R2463619							
WG1574962-2	DUP	L1229056-1						
pH		7.10	7.11	J	pH	0.01	0.2	26-OCT-12
Conductivity (EC)		1970	1980		uS/cm	0.2	10	26-OCT-12
Bicarbonate (HCO3)		1190	1180		mg/L	0.9	20	26-OCT-12
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	26-OCT-12
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	26-OCT-12
Alkalinity, Total (as CaCO3)		975	966		mg/L	0.9	20	26-OCT-12
WG1574962-3	DUP	L1229314-1						
pH		8.05	8.05	J	pH	0.00	0.2	26-OCT-12
Conductivity (EC)		829	834		uS/cm	0.6	10	26-OCT-12
Bicarbonate (HCO3)		584	584		mg/L	0.1	20	26-OCT-12
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	26-OCT-12
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	26-OCT-12
Alkalinity, Total (as CaCO3)		479	479		mg/L	0.1	20	26-OCT-12
WG1574962-1	LCS							
pH			7.00		pH		6.9-7.1	26-OCT-12
Conductivity (EC)			99.2		%		90-110	26-OCT-12
Alkalinity, Total (as CaCO3)			97.0		%		85-115	26-OCT-12
PHENOLS-4AAP-ED		Water						
Batch	R2467775							
WG1579399-3	LCS							
Phenols (4AAP)			94.0		%		85-115	02-NOV-12
WG1579399-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	02-NOV-12
SO4-CL		Water						
Batch	R2463940							
WG1575332-3	DUP	L1228663-12						
Sulfate (SO4)		84.9	85.1		mg/L	0.2	20	26-OCT-12
WG1575332-4	DUP	L1229463-1						
Sulfate (SO4)		4.36	4.35		mg/L	0.3	20	26-OCT-12
WG1575332-5	DUP	L1229625-1						
Sulfate (SO4)		895	895		mg/L	0.1	20	27-OCT-12
WG1575332-6	DUP	L1229314-4						
Sulfate (SO4)		26.4	26.4		mg/L	0.1	20	27-OCT-12
WG1575332-7	DUP	L1229834-6						
Sulfate (SO4)		29.2	29.1		mg/L	0.5	20	27-OCT-12



Quality Control Report

Workorder: L1229314

Report Date: 05-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-CL	Water							
Batch	R2463940							
WG1575332-2	LCS							
Sulfate (SO4)			104.8		%		85-115	26-OCT-12
WG1575332-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	26-OCT-12

Quality Control Report

Workorder: L1229314

Report Date: 05-NOV-12

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

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.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1229314

Report Date: 05-NOV-12

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate-N	1	22-OCT-12 14:15	27-OCT-12 16:15	48	122	hours	EHTR
	2	22-OCT-12 17:35	27-OCT-12 16:15	48	119	hours	EHTR
	3	22-OCT-12 17:20	27-OCT-12 16:15	48	119	hours	EHTR
	4	23-OCT-12 17:40	27-OCT-12 16:15	48	95	hours	EHTR
Nitrite-N	1	22-OCT-12 14:15	27-OCT-12 16:15	48	122	hours	EHTR
	2	22-OCT-12 17:35	27-OCT-12 16:15	48	119	hours	EHTR
	3	22-OCT-12 17:20	27-OCT-12 16:15	48	119	hours	EHTR
	4	23-OCT-12 17:40	27-OCT-12 16:15	48	95	hours	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 L1229314 were received on 26-OCT-12 06:00.

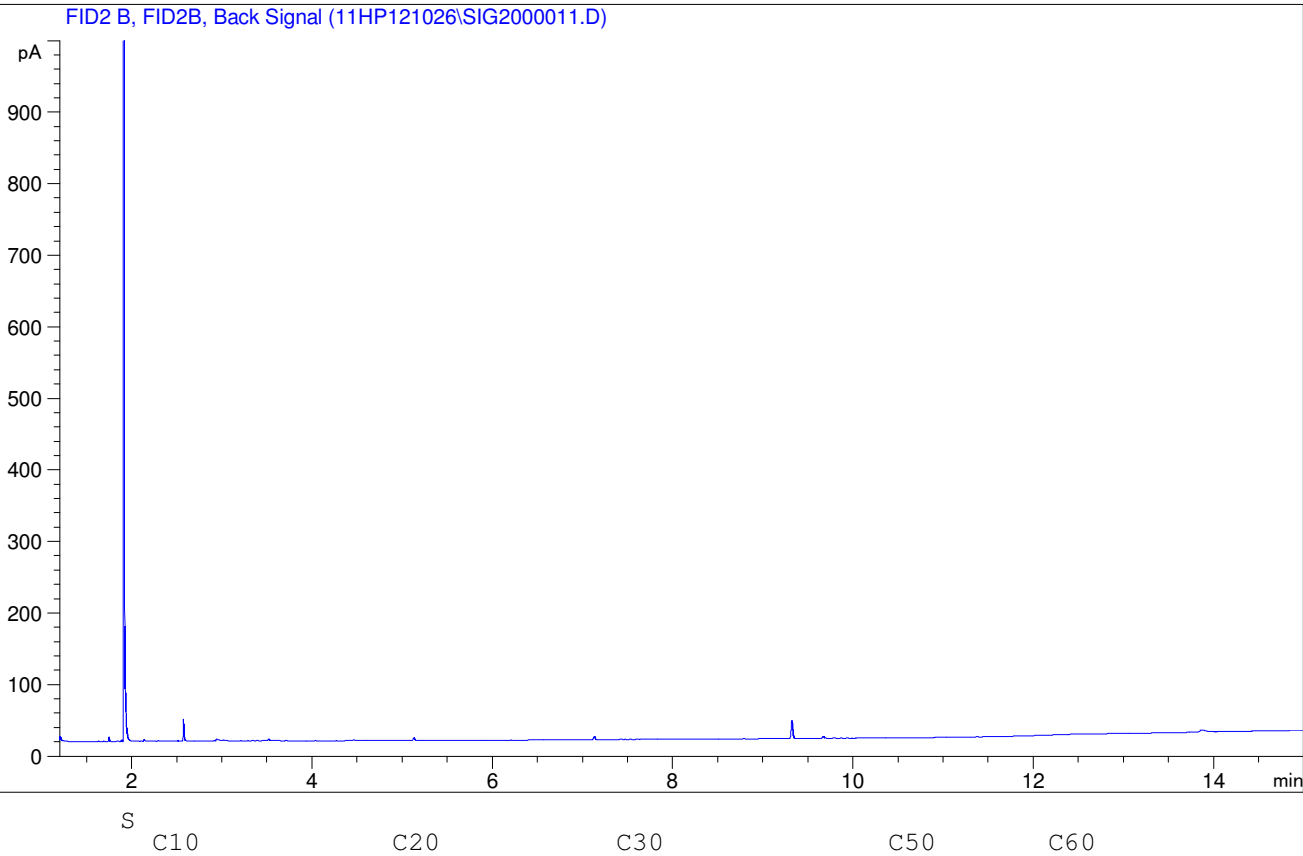
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where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

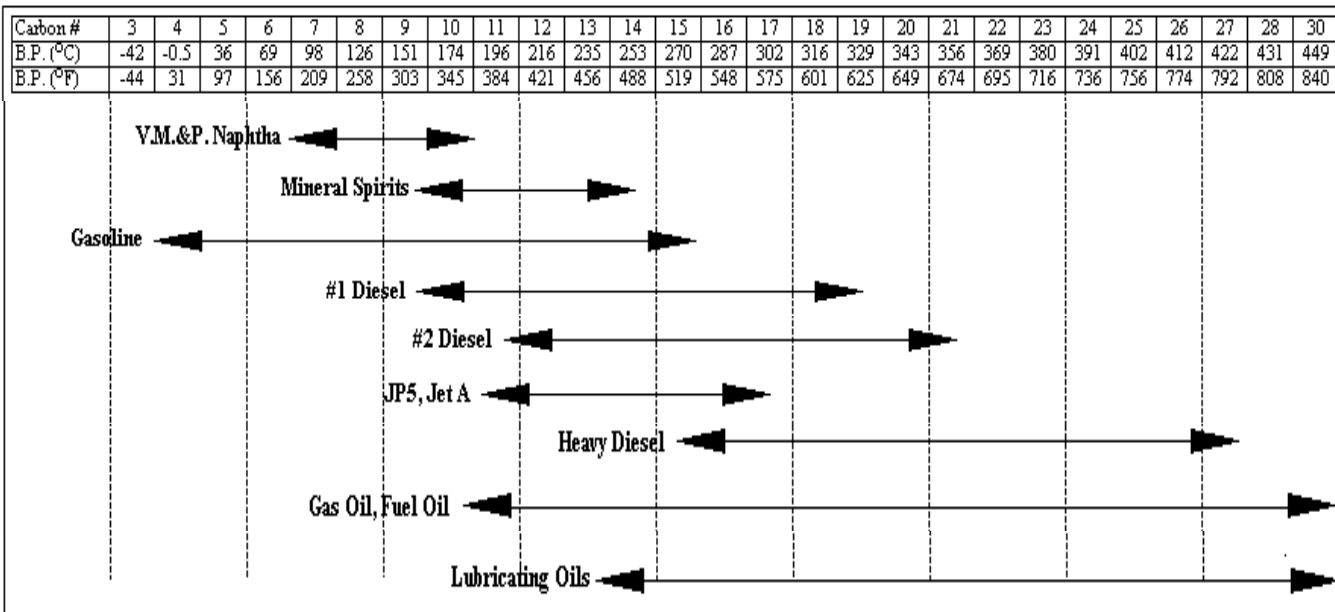


Sample ID: L1229314-1 V10 F234
 Injection Date: 10/26/2012
 Injection Time: 9:05:44 PM
 Instrument ID: Instrument 1
 Operator: Organics



S=Surrogate

Boiling Point Distribution Range for Petroleum Based Fuel Products



Adapted from: Drews, A.W., ED. Manual on Hydrocarbon Analysis, 4th ed.; American Society for Testing and Materials: Philadelphia, PA., 1989: p XVIII.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 17-NOV-12
Report Date: 04-DEC-12 11:19 (MT)
Version: FINAL REV. 2

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1238813
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 MR2
C of C Numbers: 039753
Legal Site Desc:

Comments:

04-DEC-12: 04-Dec-12. Added Acenaphthylene to all samples



Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238813-1 16054121115101									
Sampled By: GK/EA on 15-NOV-12 @ 18:54									
Matrix: H2O									
BTEX & F1-F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Toluene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
Diss. Metals in Water by ICPOES/MS & Hg									
Diss. Metals in Water by ICPOES (Low)									
Calcium (Ca)-Dissolved	66.8	+/-9.2		0.50	mg/L	0		23-NOV-12	R2481323
Iron (Fe)-Dissolved	0.011	+/-0.008		0.010	mg/L	0		23-NOV-12	R2481323
Magnesium (Mg)-Dissolved	22.8	+/-3.3		0.10	mg/L	0		23-NOV-12	R2481323
Manganese (Mn)-Dissolved	0.0422	+/-0.0057		0.0020	mg/L	0		23-NOV-12	R2481323
Potassium (K)-Dissolved	5.78	+/-0.89		0.10	mg/L	0		23-NOV-12	R2481323
Sodium (Na)-Dissolved	64.5	+/-9.2		0.50	mg/L	0		23-NOV-12	R2481323
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.262	+/-0.032		0.0020	mg/L	0		27-NOV-12	R2485185
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.0799	+/-0.0069		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00023	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.00060	+/-0.00007		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00036	+/-0.00005		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.636	+/-0.047		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	0.00020	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Vanadium (V)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0034	+/-0.0005		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		26-NOV-12	R2485002
Miscellaneous Parameters									
Ammonia, Total (as N)	2.72	-		0.050	mg/L	-		22-NOV-12	R2480898
Dissolved Organic Carbon	7.7	+/-1.0		1.0	mg/L	0		23-NOV-12	R2482405

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238813-1 16054121115101									
Sampled By: GK/EA on 15-NOV-12 @ 18:54									
Matrix: H2O									
Naphthenic Acids	<1.0	-		1.0	mg/L	-	21-NOV-12	22-NOV-12	R2481843
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		22-NOV-12	R2481530
CCME PAHs									
Naphthalene	0.000050	+/-0.000028		0.000050	mg/L	-22.9%	24-NOV-12	26-NOV-12	R2485358
Quinoline	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acenaphthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acridine	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Chrysene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Surr: Nitrobenzene d5	93.0	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	106.1	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: p-Terphenyl d14	122.5	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	0.62	+/-0.07		0.50	mg/L	0		17-NOV-12	R2477611
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	66.8	+/-10		0.50	mg/L	0		23-NOV-12	R2481323
Iron (Fe)-Dissolved	<0.030	-		0.030	mg/L	-		23-NOV-12	R2481323
Magnesium (Mg)-Dissolved	22.8	+/-4.1		0.10	mg/L	0		23-NOV-12	R2481323
Manganese (Mn)-Dissolved	0.0422	+/-0.0062		0.0050	mg/L	0		23-NOV-12	R2481323
Potassium (K)-Dissolved	5.78	+/-1.1		0.50	mg/L	0		23-NOV-12	R2481323
Sodium (Na)-Dissolved	64.5	+/-10		1.0	mg/L	0		23-NOV-12	R2481323
Ion Balance Calculation									
Ion Balance	93.1	-			%	-		26-NOV-12	
TDS (Calculated)	433	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	261	-			mg/L	-		26-NOV-12	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		17-NOV-12	R2477611
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		20-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		17-NOV-12	R2477611
Sulfate by IC									
Sulfate (SO4)	9.39	+/-0.43		0.50	mg/L	0		17-NOV-12	R2477611
pH, Conductivity and Total Alkalinity									
pH	7.91	+/-0.04		0.10	pH	0		17-NOV-12	R2475537
Conductivity (EC)	785	+/-26		0.20	uS/cm	0		17-NOV-12	R2475537
Bicarbonate (HCO3)	535	-		5.0	mg/L	-		17-NOV-12	R2475537
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		17-NOV-12	R2475537

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238813-1 16054121115101 Sampled By: GK/EA on 15-NOV-12 @ 18:54 Matrix: H2O									
pH, Conductivity and Total Alkalinity									
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		17-NOV-12	R2475537
Alkalinity, Total (as CaCO3)	439	+/-16		5.0	mg/L	0		17-NOV-12	R2475537
L1238813-2 16054121115102 Sampled By: GK/EA on 15-NOV-12 @ 18:01 Matrix: H2O									
BTEX & F1-F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Toluene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
Diss. Metals in Water by ICPOES/MS & Hg									
Diss. Metals in Water by ICPOES (Low)									
Calcium (Ca)-Dissolved	73.6	+/-10		0.50	mg/L	0		23-NOV-12	R2481323
Iron (Fe)-Dissolved	1.42	+/-0.21		0.010	mg/L	0		23-NOV-12	R2481323
Magnesium (Mg)-Dissolved	24.2	+/-3.5		0.10	mg/L	0		23-NOV-12	R2481323
Manganese (Mn)-Dissolved	0.0612	+/-0.0083		0.0020	mg/L	0		23-NOV-12	R2481323
Potassium (K)-Dissolved	5.46	+/-0.84		0.10	mg/L	0		23-NOV-12	R2481323
Sodium (Na)-Dissolved	51.8	+/-7.4		0.50	mg/L	0		23-NOV-12	R2481323
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.236	+/-0.029		0.0020	mg/L	0		27-NOV-12	R2485185
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.0905	+/-0.0079		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00020	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.00110	+/-0.00012		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00016	+/-0.00004		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.639	+/-0.047		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238813-2 16054121115102									
Sampled By: GK/EA on 15-NOV-12 @ 18:01									
Matrix: H2O									
Dissolved Metals in Water by CRC ICPMS									
Zinc (Zn)-Dissolved	0.0012	+/-0.0003		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		26-NOV-12	R2485002
Miscellaneous Parameters									
Ammonia, Total (as N)	2.19	-		0.050	mg/L	-		22-NOV-12	R2480898
Dissolved Organic Carbon	6.6	+/-0.9		1.0	mg/L	0		23-NOV-12	R2482405
Naphthenic Acids	<1.0	-		1.0	mg/L	-	21-NOV-12	22-NOV-12	R2481843
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		22-NOV-12	R2481530
CCME PAHs									
Naphthalene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Quinoline	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acenaphthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acridine	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Chrysene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Surr: Nitrobenzene d5	78.3	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	80.7	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: p-Terphenyl d14	114.2	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		17-NOV-12	R2477611
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	73.6	+/-11		0.50	mg/L	0		23-NOV-12	R2481323
Iron (Fe)-Dissolved	1.42	+/-0.24		0.030	mg/L	0		23-NOV-12	R2481323
Magnesium (Mg)-Dissolved	24.2	+/-4.3		0.10	mg/L	0		23-NOV-12	R2481323
Manganese (Mn)-Dissolved	0.0612	+/-0.0090		0.0050	mg/L	0		23-NOV-12	R2481323
Potassium (K)-Dissolved	5.46	+/-0.99		0.50	mg/L	0		23-NOV-12	R2481323
Sodium (Na)-Dissolved	51.8	+/-8.4		1.0	mg/L	0		23-NOV-12	R2481323
Ion Balance Calculation									
Ion Balance	92.6	-			%	-		26-NOV-12	
TDS (Calculated)	425	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	283	-			mg/L	-		26-NOV-12	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		17-NOV-12	R2477611
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		20-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		17-NOV-12	R2477611

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238813-2 16054121115102 Sampled By: GK/EA on 15-NOV-12 @ 18:01 Matrix: H2O									
Sulfate by IC									
Sulfate (SO4)	10.6	+/-0.48		0.50	mg/L	0		17-NOV-12	R2477611
pH, Conductivity and Total Alkalinity									
pH	7.92	+/-0.04		0.10	pH	0		17-NOV-12	R2475537
Conductivity (EC)	775	+/-26		0.20	uS/cm	0		17-NOV-12	R2475537
Bicarbonate (HCO3)	528	-		5.0	mg/L	-		17-NOV-12	R2475537
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		17-NOV-12	R2475537
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		17-NOV-12	R2475537
Alkalinity, Total (as CaCO3)	433	+/-16		5.0	mg/L	0		17-NOV-12	R2475537
L1238813-3 16054121115103 Sampled By: GK/EA on 15-NOV-12 @ 19:46 Matrix: H2O									
BTEX & F1-F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Toluene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
Diss. Metals in Water by ICPOES/MS & Hg									
Diss. Metals in Water by ICPOES (Low)									
Calcium (Ca)-Dissolved	47.8	+/-6.6		0.50	mg/L	0		23-NOV-12	R2481323
Iron (Fe)-Dissolved	0.747	+/-0.11		0.010	mg/L	0		23-NOV-12	R2481323
Magnesium (Mg)-Dissolved	14.5	+/-2.1		0.10	mg/L	0		23-NOV-12	R2481323
Manganese (Mn)-Dissolved	0.199	+/-0.027		0.0020	mg/L	0		23-NOV-12	R2481323
Potassium (K)-Dissolved	3.60	+/-0.56		0.10	mg/L	0		23-NOV-12	R2481323
Sodium (Na)-Dissolved	12.0	+/-1.7		0.50	mg/L	0		23-NOV-12	R2481323
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.0787	+/-0.0095		0.0020	mg/L	0		27-NOV-12	R2485185
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	0.00487	+/-0.00051		0.00040	mg/L	0		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.129	+/-0.011		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00050	+/-0.00005		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.00382	+/-0.00040		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00071	+/-0.00007		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238813-3 16054121115103									
Sampled By: GK/EA on 15-NOV-12 @ 19:46									
Matrix: H2O									
Dissolved Metals in Water by CRC ICPMS									
Strontium (Sr)-Dissolved	0.391	+/-0.029		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		27-NOV-12	R2485185
Vanadium (V)-Dissolved	0.00024	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0025	+/-0.0004		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		26-NOV-12	R2485002
Miscellaneous Parameters									
Ammonia, Total (as N)	0.448	-		0.050	mg/L	-		22-NOV-12	R2480898
Dissolved Organic Carbon	3.3	+/-0.6		1.0	mg/L	0		23-NOV-12	R2482405
Naphthenic Acids	<1.0	-		1.0	mg/L	-	21-NOV-12	22-NOV-12	R2481843
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		22-NOV-12	R2481530
CCME PAHs									
Naphthalene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Quinoline	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acenaphthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acridine	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Chrysene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Surr: Nitrobenzene d5	57.2	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	85.2	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: p-Terphenyl d14	126.0	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		17-NOV-12	R2477611
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	47.8	+/-7.2		0.50	mg/L	0		23-NOV-12	R2481323
Iron (Fe)-Dissolved	0.747	+/-0.12		0.030	mg/L	0		23-NOV-12	R2481323
Magnesium (Mg)-Dissolved	14.5	+/-2.6		0.10	mg/L	0		23-NOV-12	R2481323
Manganese (Mn)-Dissolved	0.199	+/-0.030		0.0050	mg/L	0		23-NOV-12	R2481323
Potassium (K)-Dissolved	3.60	+/-0.67		0.50	mg/L	0		23-NOV-12	R2481323
Sodium (Na)-Dissolved	12.0	+/-1.9		1.0	mg/L	0		23-NOV-12	R2481323
Ion Balance Calculation									
Ion Balance	90.8	-			%	-		26-NOV-12	
TDS (Calculated)	219	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	179	-			mg/L	-		26-NOV-12	

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238813-3 16054121115103 Sampled By: GK/EA on 15-NOV-12 @ 19:46 Matrix: H2O									
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		17-NOV-12	R2477611
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		20-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		17-NOV-12	R2477611
Sulfate by IC									
Sulfate (SO4)	3.95	+/-0.21		0.50	mg/L	0		17-NOV-12	R2477611
pH, Conductivity and Total Alkalinity									
pH	7.90	+/-0.04		0.10	pH	0		17-NOV-12	R2475537
Conductivity (EC)	391	+/-13		0.20	uS/cm	0		17-NOV-12	R2475537
Bicarbonate (HCO3)	279	-		5.0	mg/L	-		17-NOV-12	R2475537
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		17-NOV-12	R2475537
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		17-NOV-12	R2475537
Alkalinity, Total (as CaCO3)	228	+/-8.9		5.0	mg/L	0		17-NOV-12	R2475537
L1238813-4 16054121115104 Sampled By: GK/EA on 15-NOV-12 @ 20:54 Matrix: H2O									
BTEX & F1-F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Toluene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	19-NOV-12	20-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	19-NOV-12	20-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
Diss. Metals in Water by ICPOES/MS & Hg									
Diss. Metals in Water by ICPOES (Low)									
Calcium (Ca)-Dissolved	12.0	+/-1.7		0.50	mg/L	0		23-NOV-12	R2481323
Iron (Fe)-Dissolved	<0.010	-		0.010	mg/L	-		23-NOV-12	R2481323
Magnesium (Mg)-Dissolved	3.82	+/-0.55		0.10	mg/L	0		23-NOV-12	R2481323
Manganese (Mn)-Dissolved	0.0065	+/-0.0012		0.0020	mg/L	0		23-NOV-12	R2481323
Potassium (K)-Dissolved	0.74	+/-0.17		0.10	mg/L	0		23-NOV-12	R2481323
Sodium (Na)-Dissolved	1.73	+/-0.28		0.50	mg/L	0		23-NOV-12	R2481323
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.0117	+/-0.0015		0.0020	mg/L	0		27-NOV-12	R2485185
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.0316	+/-0.0027		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		27-NOV-12	R2485185

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238813-4 16054121115104									
Sampled By: GK/EA on 15-NOV-12 @ 20:54									
Matrix: H2O									
Dissolved Metals in Water by CRC ICPMS									
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.00024	+/-0.00003		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00176	+/-0.00015		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.0500	+/-0.0037		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Vanadium (V)-Dissolved	0.00012	+/-0.00001		0.00010	mg/L	0		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0012	+/-0.0003		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		26-NOV-12	R2485002
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		22-NOV-12	R2480898
Dissolved Organic Carbon	3.0	+/-0.6		1.0	mg/L	0		23-NOV-12	R2482405
MF - Fecal Coliforms	See Attached	-				-		17-NOV-12	
Naphthenic Acids	<1.0	-		1.0	mg/L	-	21-NOV-12	22-NOV-12	R2481843
Phenols (4AAP)	0.0011	+/-0.0009		0.0010	mg/L	0		22-NOV-12	R2481530
CCME PAHs									
Naphthalene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Quinoline	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acenaphthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acridine	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Chrysene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Surr: Nitrobenzene d5	65.8	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	75.9	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: p-Terphenyl d14	125.6	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	0.95	+/-0.07		0.50	mg/L	0		17-NOV-12	R2477611
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	12.0	+/-1.8		0.50	mg/L	0		23-NOV-12	R2481323
Iron (Fe)-Dissolved	<0.030	-		0.030	mg/L	-		23-NOV-12	R2481323
Magnesium (Mg)-Dissolved	3.82	+/-0.68		0.10	mg/L	0		23-NOV-12	R2481323

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238813-4 16054121115104									
Sampled By: GK/EA on 15-NOV-12 @ 20:54									
Matrix: H2O									
Dissolved Metals in Water by ICPOES									
Manganese (Mn)-Dissolved	0.0065	+/-0.0011		0.0050	mg/L	0		23-NOV-12	R2481323
Potassium (K)-Dissolved	0.74	+/-0.19		0.50	mg/L	0		23-NOV-12	R2481323
Sodium (Na)-Dissolved	1.7	+/-0.3		1.0	mg/L	0		23-NOV-12	R2481323
Ion Balance Calculation									
Ion Balance	91.3	-			%	-		26-NOV-12	
TDS (Calculated)	53.2	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	45.7	-			mg/L	-		26-NOV-12	
Nitrate as N by IC									
Nitrate (as N)	0.242	+/-0.019		0.050	mg/L	0		17-NOV-12	R2477611
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.242	-		0.071	mg/L	-		20-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		17-NOV-12	R2477611
Sulfate by IC									
Sulfate (SO4)	2.96	+/-0.17		0.50	mg/L	0		17-NOV-12	R2477611
pH, Conductivity and Total Alkalinity									
pH	6.97	+/-0.04		0.10	pH	0		17-NOV-12	R2475537
Conductivity (EC)	109	+/-3.6		0.20	uS/cm	0		17-NOV-12	R2475537
Bicarbonate (HCO3)	60.9	-		5.0	mg/L	-		17-NOV-12	R2475537
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		17-NOV-12	R2475537
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		17-NOV-12	R2475537
Alkalinity, Total (as CaCO3)	49.9	+/-3.1		5.0	mg/L	0		17-NOV-12	R2475537
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments:

04-DEC-12: 04-Dec-12. Added Acenaphthylene to all samples

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 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 may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTX,F1-ED	Water	BTEX and F1 (C6-C10)	EPA 5021	EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
FCC-MF-PB	Water	Fecal Coliform Count-MF		APHA 9222D MF
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
MET-D-ICP-ED	Water	Dissolved Metals in Water by ICPOES		APHA 3120 B-ICP-OES
MET-D-L-ICP-ED	Water	Diss. Metals in Water by ICPOES (Low)		APHA 3120 B-ICP-OES
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
PAH-CCME-ED	Water	CCME PAHs		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference 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
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA
PB	PBR LABORATORIES

Chain of Custody Numbers:

039753

Reference Information

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

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: L1238813

Report Date: 04-DEC-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2485185							
WG1592081-2 CRM		ED-HIGH-WATRM						
Boron (B)-Dissolved			94.6		%		80-120	26-NOV-12
WG1592081-1 MB								
Boron (B)-Dissolved			<0.0020		mg/L		0.002	26-NOV-12
BTX,F1-ED		Water						
Batch	R2477531							
WG1588308-7 DUP		L1238813-4						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	20-NOV-12
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	20-NOV-12
Ethylbenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	20-NOV-12
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	20-NOV-12
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	20-NOV-12
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	20-NOV-12
WG1588308-2 LCS								
Benzene			96.5		%		70-130	20-NOV-12
Toluene			87.1		%		70-130	20-NOV-12
Ethylbenzene			75.2		%		70-130	20-NOV-12
o-Xylene			78.6		%		70-130	20-NOV-12
m+p-Xylene			79.3		%		70-130	20-NOV-12
WG1588308-3 LCS								
F1(C6-C10)			84.3		%		70-130	20-NOV-12
WG1588308-1 MB								
Benzene			<0.00050		mg/L		0.0005	20-NOV-12
Toluene			<0.00050		mg/L		0.0005	20-NOV-12
Ethylbenzene			<0.00050		mg/L		0.0005	20-NOV-12
o-Xylene			<0.00050		mg/L		0.0005	20-NOV-12
m+p-Xylene			<0.00050		mg/L		0.0005	20-NOV-12
F1(C6-C10)			<0.10		mg/L		0.1	20-NOV-12
C-DIS-ORG-ED		Water						
Batch	R2482405							
WG1591210-3 CVS								
Dissolved Organic Carbon			105.4		%		80-160	23-NOV-12
WG1591210-2 LCS								
Dissolved Organic Carbon			94.5		%		80-120	23-NOV-12
WG1591210-1 MB								
Dissolved Organic Carbon			<1.0		mg/L		1	23-NOV-12



Quality Control Report

Workorder: L1238813

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2477611							
WG1587734-3	DUP	L1238761-20						
Chloride (Cl)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	17-NOV-12
WG1587734-5	DUP	L1238699-6						
Chloride (Cl)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	17-NOV-12
WG1587734-2	LCS							
Chloride (Cl)			101.4		%		85-115	17-NOV-12
WG1587734-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	17-NOV-12
WG1587734-4	MS	L1238761-20						
Chloride (Cl)			103.2		%		75-125	17-NOV-12
WG1587734-6	MS	L1238699-6						
Chloride (Cl)			111.1		%		75-125	17-NOV-12
F2,F3,F4-ED		Water						
Batch	R2479643							
WG1589710-2	LCS							
F2 (>C10-C16)			107.8		%		65-135	20-NOV-12
F3 (C16-C34)			105.2		%		65-135	20-NOV-12
F4 (C34-C50)			97.0		%		65-135	20-NOV-12
WG1589710-1	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	20-NOV-12
F3 (C16-C34)			<0.25		mg/L		0.25	20-NOV-12
F4 (C34-C50)			<0.25		mg/L		0.25	20-NOV-12
HG-D-CVAA-ED		Water						
Batch	R2485002							
WG1592063-12	DUP	L1239950-12						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-6	DUP	L1238851-11						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-8	DUP	L1238851-33						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-2	LCS							
Mercury (Hg)-Dissolved			93.7		%		80-120	26-NOV-12
WG1592063-3	LCSD	WG1592063-2						
Mercury (Hg)-Dissolved		93.7	95.0		%	1.4	20	26-NOV-12
WG1592063-1	MB							
Mercury (Hg)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
WG1592063-11	MS	L1238851-11						



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-CVAA-ED								
	Water							
Batch	R2485002							
WG1592063-11 MS		L1238851-11						
Mercury (Hg)-Dissolved			111.8		%		70-130	26-NOV-12
WG1592063-13 MS		L1239950-12						
Mercury (Hg)-Dissolved			115.0		%		70-130	26-NOV-12
WG1592063-7 MS		L1238851-11						
Mercury (Hg)-Dissolved			115.2		%		70-130	26-NOV-12
WG1592063-9 MS		L1238851-33						
Mercury (Hg)-Dissolved			108.6		%		70-130	26-NOV-12
MET-D-CCMS-ED								
	Water							
Batch	R2485185							
WG1592081-2 CRM		ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			99.5		%		80-120	26-NOV-12
Antimony (Sb)-Dissolved			96.8		%		80-120	26-NOV-12
Arsenic (As)-Dissolved			100.9		%		80-120	26-NOV-12
Barium (Ba)-Dissolved			107.1		%		80-120	26-NOV-12
Beryllium (Be)-Dissolved			99.9		%		80-120	26-NOV-12
Bismuth (Bi)-Dissolved			101.0		%		80-120	26-NOV-12
Cadmium (Cd)-Dissolved			108.0		%		80-120	26-NOV-12
Chromium (Cr)-Dissolved			98.0		%		80-120	26-NOV-12
Cobalt (Co)-Dissolved			100.2		%		80-120	26-NOV-12
Copper (Cu)-Dissolved			97.3		%		80-120	26-NOV-12
Lead (Pb)-Dissolved			104.6		%		80-120	26-NOV-12
Molybdenum (Mo)-Dissolved			100.1		%		80-120	26-NOV-12
Nickel (Ni)-Dissolved			101.2		%		80-120	26-NOV-12
Selenium (Se)-Dissolved			103.0		%		80-120	26-NOV-12
Silver (Ag)-Dissolved			94.8		%		80-120	26-NOV-12
Strontium (Sr)-Dissolved			103.2		%		80-120	26-NOV-12
Thallium (Tl)-Dissolved			104.5		%		80-120	26-NOV-12
Titanium (Ti)-Dissolved			101.6		%		80-120	26-NOV-12
Tin (Sn)-Dissolved			101.7		%		80-120	26-NOV-12
Uranium (U)-Dissolved			108.8		%		80-120	26-NOV-12
Vanadium (V)-Dissolved			102.1		%		80-120	26-NOV-12
Zinc (Zn)-Dissolved			103.4		%		80-120	26-NOV-12
WG1592081-7 DUP		L1239197-6						
Aluminum (Al)-Dissolved		<0.0050	<0.0010	RPD-NA	mg/L	N/A	20	27-NOV-12



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2485185							
WG1592081-7	DUP	L1239197-6						
Antimony (Sb)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Arsenic (As)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Barium (Ba)-Dissolved		0.0083	0.00125	J	mg/L	0.00708	0.01	27-NOV-12
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Cadmium (Cd)-Dissolved		<0.00010	0.000013	RPD-NA	mg/L	N/A	20	27-NOV-12
Chromium (Cr)-Dissolved		<0.0050	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Copper (Cu)-Dissolved		<0.0010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Lead (Pb)-Dissolved		<0.00010	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Molybdenum (Mo)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Nickel (Ni)-Dissolved		<0.0020	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Selenium (Se)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Silver (Ag)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	27-NOV-12
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Uranium (U)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Zinc (Zn)-Dissolved		<0.0030	0.0014	RPD-NA	mg/L	N/A	20	27-NOV-12
WG1592081-8	DUP	L1239197-7						
Aluminum (Al)-Dissolved		<0.0050	0.0043		mg/L	1.6	20	27-NOV-12
Antimony (Sb)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Arsenic (As)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Barium (Ba)-Dissolved		<0.0050	0.000543	J	mg/L	0.000170	0.01	27-NOV-12
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Cadmium (Cd)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Chromium (Cr)-Dissolved		<0.0050	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Copper (Cu)-Dissolved		<0.0010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Lead (Pb)-Dissolved		<0.00010	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Molybdenum (Mo)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2485185							
WG1592081-8	DUP	L1239197-7						
Nickel (Ni)-Dissolved		<0.0020	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Selenium (Se)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Silver (Ag)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Strontium (Sr)-Dissolved		0.00048	0.00047		mg/L	4.1	20	27-NOV-12
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	27-NOV-12
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Uranium (U)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Zinc (Zn)-Dissolved		<0.0030	0.0012		mg/L	19	20	27-NOV-12
WG1592081-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	26-NOV-12
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	26-NOV-12
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	26-NOV-12
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	26-NOV-12
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	26-NOV-12
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	26-NOV-12
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	26-NOV-12

MET-D-ICP-ED **Water**



Quality Control Report

Workorder: L1238813

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-ICP-ED		Water						
Batch	R2481323							
WG1590287-2	CRM	EU-H-4_OPTWATER						
Calcium (Ca)-Dissolved			97.4		%		80-120	22-NOV-12
Iron (Fe)-Dissolved			102.1		%		80-120	22-NOV-12
Magnesium (Mg)-Dissolved			99.0		%		80-120	22-NOV-12
Manganese (Mn)-Dissolved			102.9		%		80-120	22-NOV-12
Potassium (K)-Dissolved			98.3		%		80-120	22-NOV-12
Sodium (Na)-Dissolved			97.0		%		80-120	22-NOV-12
WG1590287-10	DUP	L1239197-2						
Calcium (Ca)-Dissolved		112	116		mg/L	3.2	20	23-NOV-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	23-NOV-12
Magnesium (Mg)-Dissolved		31.5	32.6		mg/L	3.6	20	23-NOV-12
Manganese (Mn)-Dissolved		0.418	0.432		mg/L	3.3	20	23-NOV-12
Potassium (K)-Dissolved		4.01	4.20		mg/L	4.5	20	23-NOV-12
Sodium (Na)-Dissolved		39.5	39.4		mg/L	0.1	20	23-NOV-12
WG1590287-3	DUP	L1238380-2						
Calcium (Ca)-Dissolved		39.7	39.3		mg/L	1.0	20	22-NOV-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	22-NOV-12
Magnesium (Mg)-Dissolved		16.5	16.1		mg/L	2.3	20	22-NOV-12
Manganese (Mn)-Dissolved		0.208	0.203		mg/L	2.2	20	22-NOV-12
Potassium (K)-Dissolved		1.01	1.00		mg/L	1.0	20	22-NOV-12
Sodium (Na)-Dissolved		53.8	57.3		mg/L	6.4	20	22-NOV-12
WG1590287-5	DUP	L1238761-36						
Calcium (Ca)-Dissolved		157	162		mg/L	3.3	20	22-NOV-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	22-NOV-12
Magnesium (Mg)-Dissolved		43.4	45.0		mg/L	3.8	20	22-NOV-12
Manganese (Mn)-Dissolved		0.493	0.508		mg/L	3.0	20	22-NOV-12
Potassium (K)-Dissolved		7.16	7.66		mg/L	6.7	20	22-NOV-12
Sodium (Na)-Dissolved		85.3	86.7		mg/L	1.7	20	22-NOV-12
WG1590287-6	DUP	L1238797-10						
Calcium (Ca)-Dissolved		115	114		mg/L	1.1	20	22-NOV-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	22-NOV-12
Magnesium (Mg)-Dissolved		37.6	36.1		mg/L	4.0	20	22-NOV-12
Manganese (Mn)-Dissolved		0.296	0.290		mg/L	2.1	20	22-NOV-12
Potassium (K)-Dissolved		6.72	6.28		mg/L	6.7	20	22-NOV-12
Sodium (Na)-Dissolved		20.3	19.0		mg/L	6.7	20	22-NOV-12



Quality Control Report

Workorder: L1238813

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-ICP-ED		Water						
Batch	R2481323							
WG1590287-7	DUP	L1238851-21						
Calcium (Ca)-Dissolved		71.1	72.7		mg/L	2.1	20	23-NOV-12
Iron (Fe)-Dissolved		3.85	3.97		mg/L	3.1	20	23-NOV-12
Magnesium (Mg)-Dissolved		26.6	27.4		mg/L	3.1	20	23-NOV-12
Manganese (Mn)-Dissolved		0.306	0.315		mg/L	2.6	20	23-NOV-12
Potassium (K)-Dissolved		1.55	1.56		mg/L	0.7	20	23-NOV-12
Sodium (Na)-Dissolved		130	130		mg/L	0.2	20	23-NOV-12
WG1590287-8	DUP	L1238876-12						
Calcium (Ca)-Dissolved		84.7	81.8		mg/L	3.5	20	23-NOV-12
Iron (Fe)-Dissolved		1.83	1.82		mg/L	0.5	20	23-NOV-12
Magnesium (Mg)-Dissolved		27.5	26.9		mg/L	2.3	20	23-NOV-12
Manganese (Mn)-Dissolved		0.0876	0.0879		mg/L	0.4	20	23-NOV-12
Potassium (K)-Dissolved		5.30	5.40		mg/L	1.9	20	23-NOV-12
Sodium (Na)-Dissolved		107	111		mg/L	3.6	20	23-NOV-12
WG1590287-9	DUP	L1238943-1						
Calcium (Ca)-Dissolved		30.6	31.3		mg/L	2.0	20	23-NOV-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	23-NOV-12
Magnesium (Mg)-Dissolved		13.5	14.0		mg/L	3.4	20	23-NOV-12
Manganese (Mn)-Dissolved		0.0524	0.0535		mg/L	2.1	20	23-NOV-12
Potassium (K)-Dissolved		2.92	3.00		mg/L	2.8	20	23-NOV-12
Sodium (Na)-Dissolved		201	205		mg/L	2.2	20	23-NOV-12
WG1590287-1	MB							
Calcium (Ca)-Dissolved			<0.50		mg/L		0.5	22-NOV-12
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	22-NOV-12
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	22-NOV-12
Manganese (Mn)-Dissolved			<0.0050		mg/L		0.005	22-NOV-12
Potassium (K)-Dissolved			<0.50		mg/L		0.5	22-NOV-12
Sodium (Na)-Dissolved			<1.0		mg/L		1	22-NOV-12
MET-D-L-ICP-ED		Water						
Batch	R2481323							
WG1590287-2	CRM	EU-H-4_OPTWATER						
Calcium (Ca)-Dissolved			97.4		%		80-120	22-NOV-12
Iron (Fe)-Dissolved			102.1		%		80-120	22-NOV-12
Magnesium (Mg)-Dissolved			99.0		%		80-120	22-NOV-12
Manganese (Mn)-Dissolved			102.9		%		80-120	22-NOV-12



Quality Control Report

Workorder: L1238813

Report Date: 04-DEC-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-ICP-ED		Water						
Batch	R2481323							
WG1590287-2 CRM		EU-H-4_OPTWATER						
Potassium (K)-Dissolved			98.3		%		80-120	22-NOV-12
Sodium (Na)-Dissolved			97.0		%		80-120	22-NOV-12
WG1590287-10 DUP		L1239197-2						
Calcium (Ca)-Dissolved		112	116		mg/L	3.2	20	23-NOV-12
Iron (Fe)-Dissolved		<0.020	0.010	J	mg/L	0.003	0.02	23-NOV-12
Magnesium (Mg)-Dissolved		31.5	32.6		mg/L	3.6	20	23-NOV-12
Manganese (Mn)-Dissolved		0.418	0.432		mg/L	3.3	20	23-NOV-12
Potassium (K)-Dissolved		4.01	4.20		mg/L	4.5	20	23-NOV-12
Sodium (Na)-Dissolved		39.5	39.4		mg/L	0.1	20	23-NOV-12
WG1590287-4 DUP		L1238795-4						
Calcium (Ca)-Dissolved		203	204		mg/L	0.4	20	22-NOV-12
Iron (Fe)-Dissolved		<0.020	<0.010	RPD-NA	mg/L	N/A	20	22-NOV-12
Magnesium (Mg)-Dissolved		71.5	71.4		mg/L	0.2	20	22-NOV-12
Manganese (Mn)-Dissolved		0.200	0.202		mg/L	1.1	20	22-NOV-12
Potassium (K)-Dissolved		5.49	5.75		mg/L	4.6	20	22-NOV-12
Sodium (Na)-Dissolved		77.5	77.1		mg/L	0.5	20	22-NOV-12
WG1590287-1 MB								
Calcium (Ca)-Dissolved			<0.20		mg/L		0.2	22-NOV-12
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	22-NOV-12
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	22-NOV-12
Manganese (Mn)-Dissolved			<0.0020		mg/L		0.002	22-NOV-12
Potassium (K)-Dissolved			<0.10		mg/L		0.1	22-NOV-12
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	22-NOV-12
NAPHTHENIC-ACID-FM		Water						
Batch	R2481843							
WG1589674-3 DUP		L1238328-2						
Naphthenic Acids		<1.0	<1.0	RPD-NA	mg/L	N/A	30	22-NOV-12
WG1589674-6 LCS								
Naphthenic Acids			78.5		%		70-130	22-NOV-12
WG1589674-1 MB								
Naphthenic Acids			<1.0		mg/L		1	22-NOV-12
WG1589674-4 MB								
Naphthenic Acids			<1.0		mg/L		1	22-NOV-12
WG1589674-2 MS		L1236876-1						
Naphthenic Acids			80.0		%		50-150	22-NOV-12



Quality Control Report

Workorder: L1238813

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed	
NAPHTHENIC-ACID-FM Water									
Batch	R2481843								
WG1589674-5	MS	L1237569-1							
Naphthenic Acids			60.8		%		50-150	22-NOV-12	
NH3-CFA-ED Water									
Batch	R2480898								
WG1590134-3	DUP	L1238943-3							
Ammonia, Total (as N)			0.486	0.494	mg/L	1.6	20	22-NOV-12	
WG1590134-5	DUP	L1239272-3							
Ammonia, Total (as N)			<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-NOV-12
WG1590134-7	DUP	L1239838-2							
Ammonia, Total (as N)			<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-NOV-12
WG1590134-8	DUP	L1240644-1							
Ammonia, Total (as N)			1.15	1.14	mg/L	1.3	20	22-NOV-12	
WG1590134-2	LCS								
Ammonia, Total (as N)				103.2	%		85-115	22-NOV-12	
WG1590134-1	MB								
Ammonia, Total (as N)				<0.050	mg/L		0.05	22-NOV-12	
WG1590134-4	MS	L1239257-2							
Ammonia, Total (as N)				113.9	%		75-125	22-NOV-12	
WG1590134-6	MS	L1238813-4							
Ammonia, Total (as N)				103.9	%		75-125	22-NOV-12	
NO2-IC-ED Water									
Batch	R2477611								
WG1587734-3	DUP	L1238761-20							
Nitrite (as N)			<0.050	<0.050	RPD-NA	mg/L	N/A	20	17-NOV-12
WG1587734-5	DUP	L1238699-6							
Nitrite (as N)			<0.050	<0.050	RPD-NA	mg/L	N/A	20	17-NOV-12
WG1587734-2	LCS								
Nitrite (as N)				99.6	%		85-115	17-NOV-12	
WG1587734-1	MB								
Nitrite (as N)				<0.050	mg/L		0.05	17-NOV-12	
WG1587734-4	MS	L1238761-20							
Nitrite (as N)				99.8	%		75-125	17-NOV-12	
WG1587734-6	MS	L1238699-6							
Nitrite (as N)				106.7	%		75-125	17-NOV-12	
NO3-IC-ED Water									



Quality Control Report

Workorder: L1238813

Report Date: 04-DEC-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		Water						
Batch	R2477611							
WG1587734-3	DUP	L1238761-20						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	17-NOV-12
WG1587734-5	DUP	L1238699-6						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	17-NOV-12
WG1587734-2	LCS							
Nitrate (as N)			100.9		%		85-115	17-NOV-12
WG1587734-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	17-NOV-12
WG1587734-4	MS	L1238761-20						
Nitrate (as N)			100.3		%		75-125	17-NOV-12
WG1587734-6	MS	L1238699-6						
Nitrate (as N)			107.7		%		75-125	17-NOV-12
PAH-CCME-ED		Water						
Batch	R2485358							
WG1591093-3	LCS							
Naphthalene			85.0		%		50-130	26-NOV-12
Quinoline			90.8		%		40-140	26-NOV-12
Acenaphthene			86.8		%		60-130	26-NOV-12
Fluorene			91.8		%		60-130	26-NOV-12
Phenanthrene			95.7		%		60-130	26-NOV-12
Anthracene			91.3		%		60-130	26-NOV-12
Acridine			94.2		%		40-140	26-NOV-12
Fluoranthene			99.8		%		60-130	26-NOV-12
Pyrene			100.3		%		60-130	26-NOV-12
Benzo(a)anthracene			119.6		%		60-130	26-NOV-12
Chrysene			116.5		%		60-130	26-NOV-12
Benzo(b&j)fluoranthene			121.8		%		60-130	26-NOV-12
Benzo(k)fluoranthene			120.8		%		60-130	26-NOV-12
Benzo(a)pyrene			119.7		%		60-130	26-NOV-12
Indeno(1,2,3-cd)pyrene			126.7		%		60-130	26-NOV-12
Dibenzo(a,h)anthracene			117.3		%		60-130	26-NOV-12
Benzo(g,h,i)perylene			123.1		%		60-130	26-NOV-12
Acenaphthylene			85.4		%		60-130	26-NOV-12
WG1591093-2	MB							
Naphthalene			<0.000050		mg/L		0.00005	26-NOV-12
Quinoline			<0.000020		mg/L		0.00002	26-NOV-12



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-CCME-ED		Water						
Batch	R2485358							
WG1591093-2	MB							
Acenaphthene			<0.000020		mg/L		0.00002	26-NOV-12
Fluorene			<0.000020		mg/L		0.00002	26-NOV-12
Phenanthrene			<0.000050		mg/L		0.00005	26-NOV-12
Anthracene			<0.000010		mg/L		0.00001	26-NOV-12
Acridine			<0.000020		mg/L		0.00002	26-NOV-12
Fluoranthene			<0.000020		mg/L		0.00002	26-NOV-12
Pyrene			<0.000020		mg/L		0.00002	26-NOV-12
Benzo(a)anthracene			<0.000010		mg/L		0.00001	26-NOV-12
Chrysene			<0.000020		mg/L		0.00002	26-NOV-12
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	26-NOV-12
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	26-NOV-12
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	26-NOV-12
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	26-NOV-12
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	26-NOV-12
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	26-NOV-12
Acenaphthylene			<0.000020		mg/L		0.00002	26-NOV-12
Surrogate: Nitrobenzene d5			76.5		%		40-130	26-NOV-12
Surrogate: 2-Fluorobiphenyl			72.6		%		40-130	26-NOV-12
Surrogate: p-Terphenyl d14			126.8		%		40-130	26-NOV-12
PH/EC/ALK-ED		Water						
Batch	R2475537							
WG1587570-6	DUP	L1238699-6						
pH		5.52	5.51	J	pH	0.01	0.2	17-NOV-12
Conductivity (EC)		0.53	0.51		uS/cm	3.6	10	17-NOV-12
Bicarbonate (HCO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	17-NOV-12
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	17-NOV-12
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	17-NOV-12
Alkalinity, Total (as CaCO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	6.5	17-NOV-12
WG1587570-7	DUP	L1238761-19						
pH		7.72	7.70	J	pH	0.02	0.2	17-NOV-12
Conductivity (EC)		1230	1240		uS/cm	0.2	10	17-NOV-12
Bicarbonate (HCO3)		657	656		mg/L	0.2	25	17-NOV-12
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	17-NOV-12
Hydroxide (OH)		<5.0	<5.0					



Quality Control Report

Workorder: L1238813

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2475537							
WG1587570-7	DUP	L1238761-19						
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	17-NOV-12
Alkalinity, Total (as CaCO3)		539	538		mg/L	0.2	6.5	17-NOV-12
WG1587570-2	LCS							
Conductivity (EC)			99.0		%		90-110	17-NOV-12
WG1587570-3	LCS							
pH			7.01		pH		6.9-7.1	17-NOV-12
WG1587570-4	LCS							
Alkalinity, Total (as CaCO3)			101.0		%		85-115	17-NOV-12
WG1587570-5	LCS							
Conductivity (EC)			96.2		%		90-110	17-NOV-12
WG1587570-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	17-NOV-12
Carbonate (CO3)			<5.0		mg/L		5	17-NOV-12
Hydroxide (OH)			<5.0		mg/L		5	17-NOV-12
Alkalinity, Total (as CaCO3)			<5.0		mg/L		5	17-NOV-12
PHENOLS-4AAP-ED		Water						
Batch	R2481530							
WG1590692-4	DUP	L1238761-4						
Phenols (4AAP)		0.0122	0.0123		mg/L	0.8	15	22-NOV-12
WG1590692-5	DUP	L1235531-1						
Phenols (4AAP)		0.0035	0.0039		mg/L	11	15	22-NOV-12
WG1590692-3	LCS							
Phenols (4AAP)			94.0		%		85-115	22-NOV-12
WG1590692-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	22-NOV-12
SO4-IC-ED		Water						
Batch	R2477611							
WG1587734-3	DUP	L1238761-20						
Sulfate (SO4)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	17-NOV-12
WG1587734-5	DUP	L1238699-6						
Sulfate (SO4)		<0.50	1.35	J	mg/L	0.32	1	17-NOV-12
WG1587734-2	LCS							
Sulfate (SO4)			102.3		%		85-115	17-NOV-12
WG1587734-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	17-NOV-12
WG1587734-4	MS	L1238761-20						



Environmental

Quality Control Report

Workorder: L1238813

Report Date: 04-DEC-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-ED	Water							
Batch	R2477611							
WG1587734-4	MS	L1238761-20						
Sulfate (SO4)			104.6		%		75-125	17-NOV-12
WG1587734-6	MS	L1238699-6						
Sulfate (SO4)			111.4		%		75-125	17-NOV-12

Quality Control Report

Workorder: L1238813

Report Date: 04-DEC-12

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

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.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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.



ALS 121120-23 (12-FDJ)

CONFIDENTIAL ANALYSIS REPORT

REPORT #: 121120-23

WO #: 12-FDJ

PO #: L1238813

CLIENT: ALS Laboratory Group - Edmonton
9936-67 Avenue
Edmonton, AB
T6E 0P5

ATTENTION: ALS-ED Reporting
Tel: (780) 413-5227
Fax: (780) 437-2311

SAMPLE DESCRIPTION: Water Sample

DATE AND TIME OF SAMPLE COLLECTION: November 15, 2012

DATE AND TIME OF SAMPLE RECEIPT: November 17, 2012/14:21

SAMPLE TEMPERATURE WHEN RECEIVED: 11.1° Celsius

TEST PERFORMED: Fecal Coliform by MF

TEST START DATE: November 17, 2012/15:00

DATE COMPLETED: November 18, 2012

CERTIFICATE OF ANALYSIS: See Page 2

QUALITY CONTROL DATA: See Attached Appendix 1

The report shall not be reproduced, except in full, without the written authority of PBR Laboratories Inc.

Certificate of Analysis

PBR ID	Sample #	Client ID	Lot #	Test	Protocol	Quantity Analyzed	*DF	Result	Units	Note
12-FDJ-01	L1238813-4	16054121115104		Fecal Coliform by MF	APHA-9222D	100 ml		<1	CFU/100ml	1

*DF - Dilution Factor used for analysis

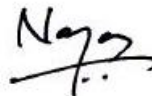
Notes

- 1 CFU = Colony Forming Unit.
- <1 = No counts were detected based on the volume/dilution analyzed.

The reported results apply only to the items tested.



Sineetha Syrus (Analyst)
Date: Nov 20 2012



Approved By: Narayan Pokharel, Ph.D.
Date: Nov 20 2012



PIBR
Laboratories Inc.

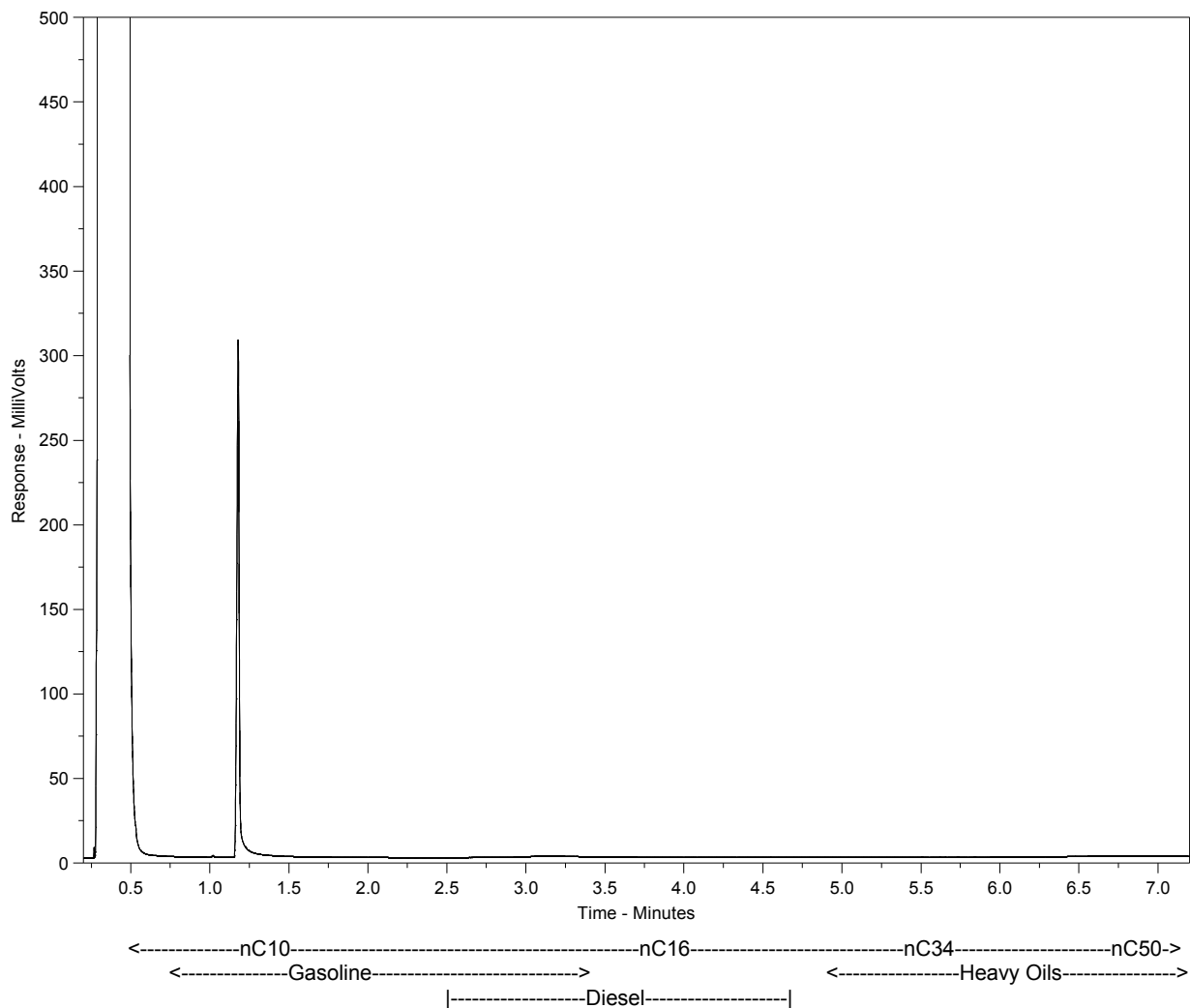
ALS 121120-23 (12-FDJ)

APPENDIX 1

Quality Control Data for Fecal Coliform by MF (APHA-9222D)

Controls	Organism/Medium	Result
Sterility (media)	m-FC	Pass
Negative	Staphylococcus aureus	Pass
Positive	Escherichia coli	Pass

ALS Sample ID: L1238813-1
Client ID: 16054121115101

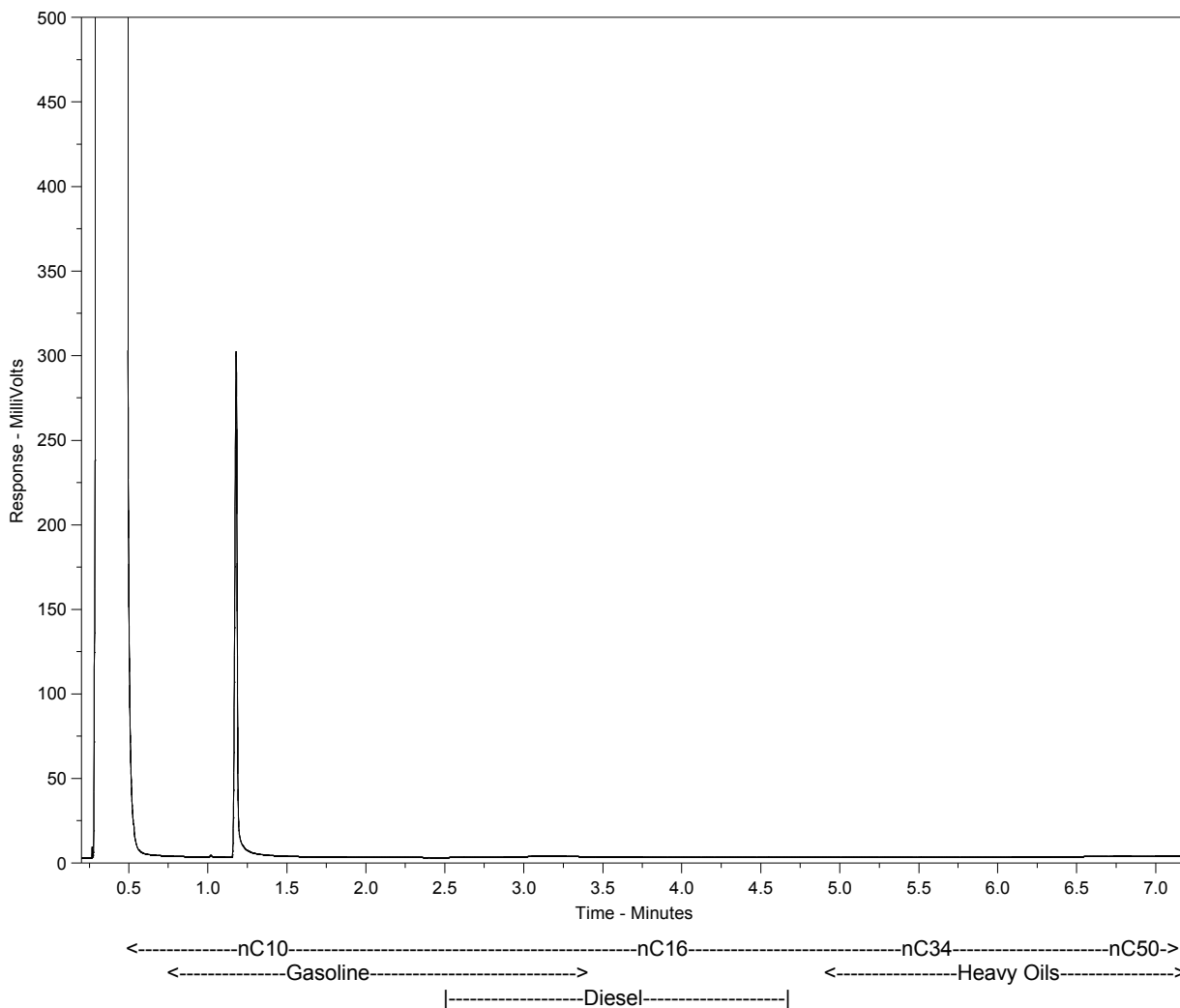


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1238813-2
Client ID: 16054121115102

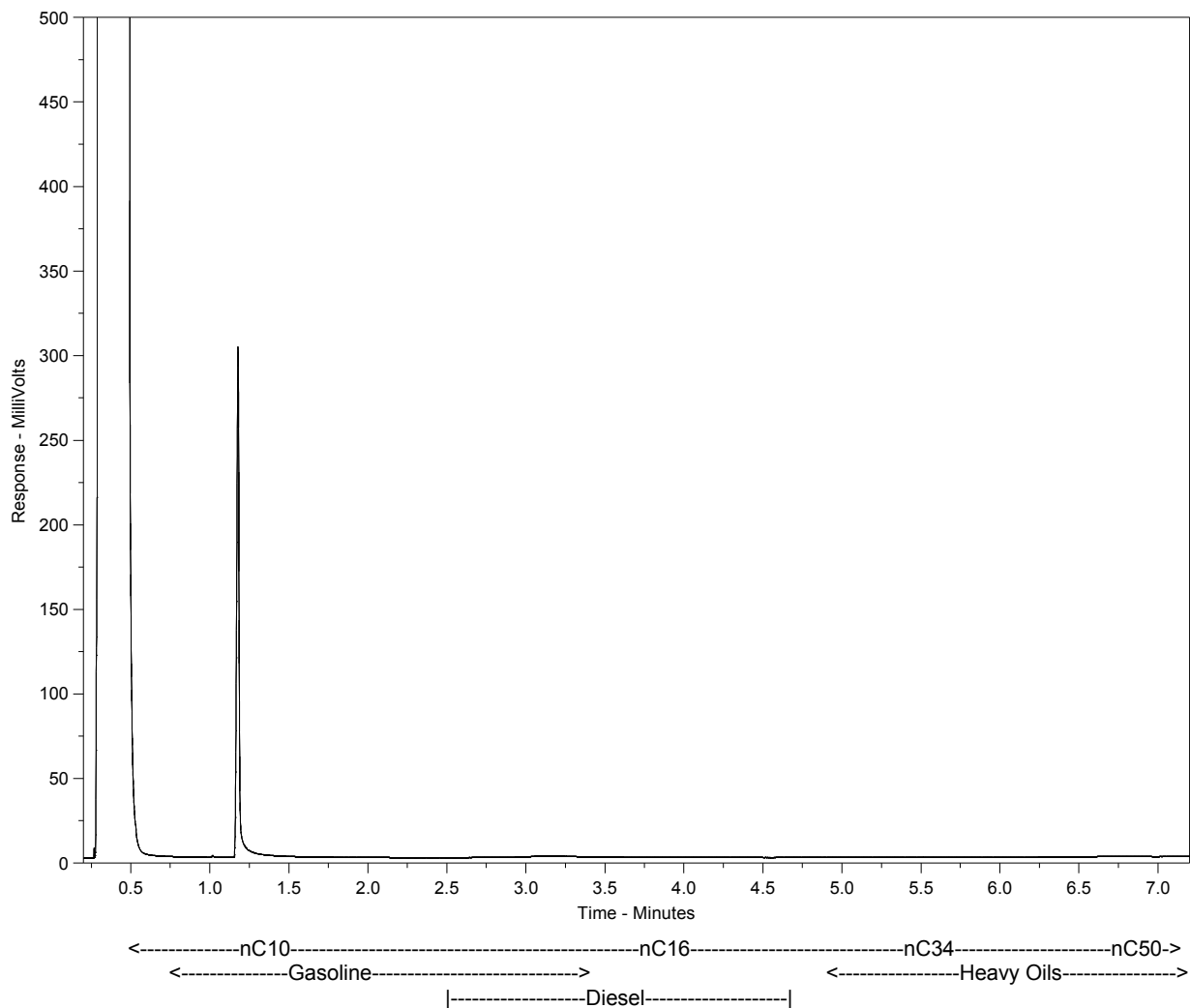


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1238813-3
Client ID: 16054121115103

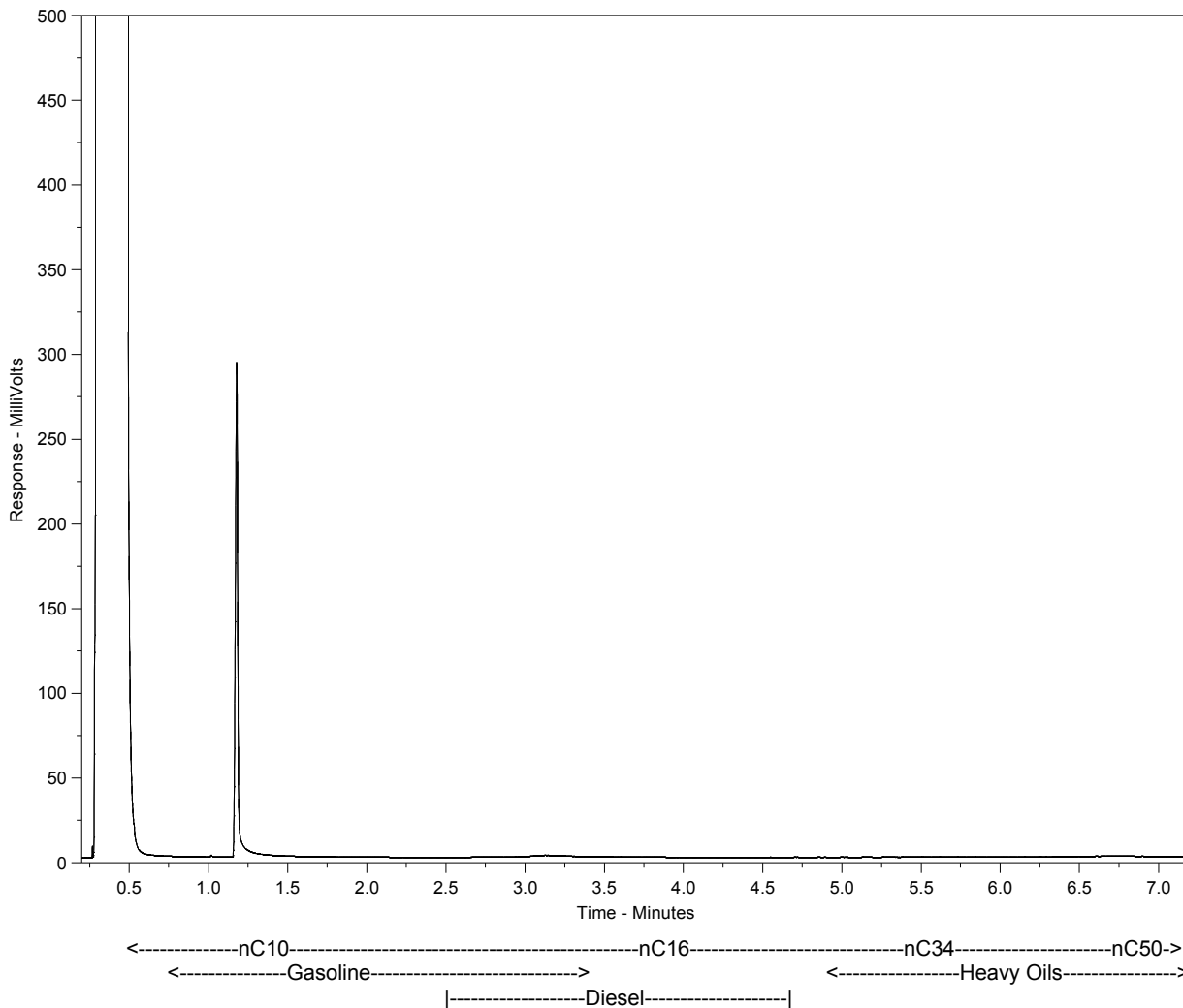


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1238813-4
 Client ID: 16054121115104



The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 19-NOV-12
Report Date: 27-NOV-12 16:08 (MT)
Version: FINAL

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1238968
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 MARIANA LAKE
C of C Numbers: m060417
Legal Site Desc:



Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238968-1 16054121117101									
Sampled By: gk,ea on 17-NOV-12 @ 15:50									
Matrix: water									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Toluene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
EthylBenzene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Styrene	<0.0010	-		0.0010	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
Diss Metals + Hg in water, unique report									
Diss. Metals in Water by ICPMS (Low)									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	0.00620	+/-0.00042		0.00040	mg/L	0		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.0552	+/-0.0053		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Boron (B)-Dissolved	0.574	+/-0.058		0.0020	mg/L	0		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00090	+/-0.00007		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.0291	+/-0.0021		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00404	+/-0.00024		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.605	+/-0.042		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	0.00207	+/-0.00022		0.00010	mg/L	0		27-NOV-12	R2485185
Vanadium (V)-Dissolved	0.00089	+/-0.00013		0.00010	mg/L	0		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0045	+/-0.0007		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		26-NOV-12	R2485002
Miscellaneous Parameters									
Ammonia, Total (as N)	1.58	-		0.050	mg/L	-		22-NOV-12	R2480898
Dissolved Organic Carbon	6.8	+/-0.9		1.0	mg/L	0		23-NOV-12	R2482405
Naphthenic Acids	<1.0	-		1.0	mg/L	-	21-NOV-12	22-NOV-12	R2481843
Phenols (4AAP)	0.0012	+/-0.0009		0.0010	mg/L	0		22-NOV-12	R2481530
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238968-2 16054121117102									
Sampled By: gk,ea on 17-NOV-12 @ 20:00									
Matrix: water									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Toluene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
EthylBenzene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Styrene	<0.0010	-		0.0010	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
Miscellaneous Parameters									
Ammonia, Total (as N)	0.106	-		0.050	mg/L	-		22-NOV-12	R2480898
Naphthenic Acids	<1.0	-		1.0	mg/L	-	21-NOV-12	22-NOV-12	R2481843
PAH & Carcinogenic PAH List									
Acenaphthene	0.000032	+/-0.000021		0.000020	mg/L	0	24-NOV-12	26-NOV-12	R2485358
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluorene	0.000056	+/-0.000028		0.000020	mg/L	0	24-NOV-12	26-NOV-12	R2485358
Naphthalene	0.00237	+/-0.00059		0.000050	mg/L	0	24-NOV-12	26-NOV-12	R2485358
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Surr: Nitrobenzene d5	55.4	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	62.6	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: p-Terphenyl d14	88.9	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	11.9	+/-0.39		0.50	mg/L	0		21-NOV-12	R2482822
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	39.8	+/-6.0		0.50	mg/L	0		25-NOV-12	R2482902
Iron (Fe)-Dissolved	0.465	+/-0.079		0.030	mg/L	0		25-NOV-12	R2482902
Magnesium (Mg)-Dissolved	8.71	+/-1.5		0.10	mg/L	0		25-NOV-12	R2482902
Manganese (Mn)-Dissolved	1.73	+/-0.26		0.0050	mg/L	0		25-NOV-12	R2482902
Potassium (K)-Dissolved	4.72	+/-0.86		0.50	mg/L	0		25-NOV-12	R2482902
Sodium (Na)-Dissolved	9.5	+/-1.5		1.0	mg/L	0		25-NOV-12	R2482902
Ion Balance Calculation									
Ion Balance	97.1	-			%	-		26-NOV-12	
TDS (Calculated)	170	-			mg/L	-		26-NOV-12	

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238968-2 16054121117102 Sampled By: gk,ea on 17-NOV-12 @ 20:00 Matrix: water									
Ion Balance Calculation									
Hardness (as CaCO3)	135	-			mg/L	-		26-NOV-12	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		26-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Sulfate by IC									
Sulfate (SO4)	15.2	+/-0.67		0.50	mg/L	0		21-NOV-12	R2482822
pH, Conductivity and Total Alkalinity									
pH	7.54	+/-0.04		0.10	pH	0		20-NOV-12	R2477613
Conductivity (EC)	332	+/-11		0.20	uS/cm	0		20-NOV-12	R2477613
Bicarbonate (HCO3)	164	-		5.0	mg/L	-		20-NOV-12	R2477613
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		20-NOV-12	R2477613
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		20-NOV-12	R2477613
Alkalinity, Total (as CaCO3)	134	+/-5.7		5.0	mg/L	0		20-NOV-12	R2477613
L1238968-3 16054121117103 Sampled By: gk,ea on 17-NOV-12 @ 17:36 Matrix: water									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Toluene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
EthylBenzene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Styrene	<0.0010	-		0.0010	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
Diss Metals + Hg in water, unique report									
Diss. Metals in Water by ICPMS (Low)									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	0.00958	+/-0.00066		0.00040	mg/L	0		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.0773	+/-0.0074		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Boron (B)-Dissolved	0.162	+/-0.016		0.0020	mg/L	0		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00133	+/-0.00009		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.00886	+/-0.00063		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00202	+/-0.00012		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238968-3 16054121117103									
Sampled By: gk,ea on 17-NOV-12 @ 17:36									
Matrix: water									
Diss. Metals in Water by ICPMS (Low)									
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.484	+/-0.033		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	0.00023	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0021	+/-0.0004		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		26-NOV-12	R2485002
Miscellaneous Parameters									
Ammonia, Total (as N)	0.897	-		0.050	mg/L	-		22-NOV-12	R2480898
Dissolved Organic Carbon	6.7	+/-0.9		1.0	mg/L	0		23-NOV-12	R2482405
Naphthenic Acids	<1.0	-		1.0	mg/L	-	21-NOV-12	22-NOV-12	R2481843
Phenols (4AAP)	0.0022	+/-0.0009		0.0010	mg/L	0		22-NOV-12	R2481530
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Naphthalene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)pyrene	<0.000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Surr: Nitrobenzene d5	76.4	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	81.4	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: p-Terphenyl d14	125.0	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	0.52	+/-0.07		0.50	mg/L	0		21-NOV-12	R2482822
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	73.5	+/-11		0.50	mg/L	0		25-NOV-12	R2482902
Iron (Fe)-Dissolved	2.78	+/-0.46		0.030	mg/L	0		25-NOV-12	R2482902
Magnesium (Mg)-Dissolved	18.4	+/-3.3		0.10	mg/L	0		25-NOV-12	R2482902
Manganese (Mn)-Dissolved	0.557	+/-0.083		0.0050	mg/L	0		25-NOV-12	R2482902
Potassium (K)-Dissolved	4.59	+/-0.84		0.50	mg/L	0		25-NOV-12	R2482902
Sodium (Na)-Dissolved	16.8	+/-2.7		1.0	mg/L	0		25-NOV-12	R2482902
Ion Balance Calculation									
Ion Balance	94.7	-			%	-		26-NOV-12	
TDS (Calculated)	315	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	259	-			mg/L	-		26-NOV-12	

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238968-3 16054121117103 Sampled By: gk,ea on 17-NOV-12 @ 17:36 Matrix: water									
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		26-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Sulfate by IC									
Sulfate (SO4)	23.4	+/-1.0		0.50	mg/L	0		21-NOV-12	R2482822
pH, Conductivity and Total Alkalinity									
pH	7.76	+/-0.04		0.10	pH	0		20-NOV-12	R2477613
Conductivity (EC)	574	+/-19		0.20	uS/cm	0		20-NOV-12	R2477613
Bicarbonate (HCO3)	362	-		5.0	mg/L	-		20-NOV-12	R2477613
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		20-NOV-12	R2477613
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		20-NOV-12	R2477613
Alkalinity, Total (as CaCO3)	297	+/-11		5.0	mg/L	0		20-NOV-12	R2477613
L1238968-4 16054121117104 Sampled By: gk,ea on 17-NOV-12 @ 19:45 Matrix: water									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Toluene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
EthylBenzene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Styrene	<0.0010	-		0.0010	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	20-NOV-12	21-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	20-NOV-12	21-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	20-NOV-12	20-NOV-12	R2479643
Diss Metals + Hg in water, unique report									
Diss. Metals in Water by ICPMS (Low)									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	0.00329	+/-0.00023		0.00040	mg/L	0		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.0391	+/-0.0037		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Boron (B)-Dissolved	0.440	+/-0.044		0.0020	mg/L	0		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00023	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.0149	+/-0.0011		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00050	+/-0.00003		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.737	+/-0.051		0.00010	mg/L	0		27-NOV-12	R2485185

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238968-4 16054121117104									
Sampled By: gk,ea on 17-NOV-12 @ 19:45									
Matrix: water									
Diss. Metals in Water by ICPMS (Low)									
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0034	+/-0.0005		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		26-NOV-12	R2485002
Miscellaneous Parameters									
Ammonia, Total (as N)	1.87	-		0.050	mg/L	-		22-NOV-12	R2480898
Dissolved Organic Carbon	7.3	+/-1.0		1.0	mg/L	0		23-NOV-12	R2482405
Naphthenic Acids	<1.0	-		1.0	mg/L	-	21-NOV-12	22-NOV-12	R2481843
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		22-NOV-12	R2481530
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Naphthalene	0.000126	+/-0.000049		0.000050	mg/L	0	24-NOV-12	26-NOV-12	R2485358
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	24-NOV-12	26-NOV-12	R2485358
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	24-NOV-12	26-NOV-12	R2485358
Surr: Nitrobenzene d5	50.3	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	60.8	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Surr: p-Terphenyl d14	116.3	-		N/A	%	-	24-NOV-12	26-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	0.87	+/-0.07	RRV	0.50	mg/L	0		21-NOV-12	R2482822
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	67.0	+/-10	RRV	0.50	mg/L	0		25-NOV-12	R2482902
Iron (Fe)-Dissolved	<0.030	-	RRV	0.030	mg/L	-		25-NOV-12	R2482902
Magnesium (Mg)-Dissolved	16.9	+/-3.0	RRV	0.10	mg/L	0		25-NOV-12	R2482902
Manganese (Mn)-Dissolved	0.125	+/-0.019	RRV	0.0050	mg/L	0		25-NOV-12	R2482902
Potassium (K)-Dissolved	7.01	+/-1.3	RRV	0.50	mg/L	0		25-NOV-12	R2482902
Sodium (Na)-Dissolved	84.1	+/-14	RRV	1.0	mg/L	0		25-NOV-12	R2482902
Ion Balance Calculation									
Ion Balance	87.8	-	BL:INT		%	-		26-NOV-12	
TDS (Calculated)	515	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	237	-			mg/L	-		26-NOV-12	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1238968-4 16054121117104									
Sampled By: gk,ea on 17-NOV-12 @ 19:45									
Matrix: water									
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		26-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Sulfate by IC									
Sulfate (SO4)	113	+/-4.7	RRV	0.50	mg/L	0		21-NOV-12	R2482822
pH, Conductivity and Total Alkalinity									
pH	7.96	+/-0.04		0.10	pH	0		20-NOV-12	R2477613
Conductivity (EC)	885	+/-29		0.20	uS/cm	0		20-NOV-12	R2477613
Bicarbonate (HCO3)	460	-		5.0	mg/L	-		20-NOV-12	R2477613
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		20-NOV-12	R2477613
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		20-NOV-12	R2477613
Alkalinity, Total (as CaCO3)	377	+/-14		5.0	mg/L	0		20-NOV-12	R2477613
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Sulfate (SO4)	MS-B	

Sample Parameter Qualifier Key:

Qualifier	Description
BL:INT	Balance Reviewed: Interference Or Non-Measured Component
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)	EPA 5021	EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-ICP-ED	Water	Dissolved Metals in Water by ICPOES		APHA 3120 B-ICP-OES
MET-D-L-MS-ED	Water	Diss. Metals in Water by ICPMS (Low)		SW 846 - 6020-ICPMS
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994

Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.

NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
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This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.

NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
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This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.

SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
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** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference 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
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

m060417

Reference Information

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

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.



Environmental

Quality Control Report

Workorder: L1238968

Report Date: 27-NOV-12

Page 1 of 13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED		Water						
Batch	R2477531							
WG1589108-4	DUP	L1238968-3						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	21-NOV-12
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	21-NOV-12
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	21-NOV-12
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	21-NOV-12
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	21-NOV-12
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	21-NOV-12
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	21-NOV-12
WG1589108-2	LCS							
Benzene			89.9		%		70-130	21-NOV-12
Toluene			82.2		%		70-130	21-NOV-12
EthylBenzene			72.2		%		70-130	21-NOV-12
o-Xylene			72.8		%		70-130	21-NOV-12
m+p-Xylene			71.6		%		70-130	21-NOV-12
Styrene			85.8		%		70-130	21-NOV-12
WG1589108-3	LCS							
F1(C6-C10)			101.6		%		70-130	21-NOV-12
WG1589108-1	MB							
Benzene			<0.00050		mg/L		0.0005	21-NOV-12
Toluene			<0.00050		mg/L		0.0005	21-NOV-12
EthylBenzene			<0.00050		mg/L		0.0005	21-NOV-12
o-Xylene			<0.00050		mg/L		0.0005	21-NOV-12
m+p-Xylene			<0.00050		mg/L		0.0005	21-NOV-12
Styrene			<0.0010		mg/L		0.001	21-NOV-12
F1(C6-C10)			<0.10		mg/L		0.1	21-NOV-12
WG1589108-5	MS	L1238968-3						
Benzene			89.3		%		50-150	21-NOV-12
Toluene			83.3		%		50-150	21-NOV-12
EthylBenzene			71.1		%		50-150	21-NOV-12
o-Xylene			73.1		%		50-150	21-NOV-12
m+p-Xylene			74.4		%		50-150	21-NOV-12
Styrene			84.3		%		50-150	21-NOV-12
WG1589108-6	MS	L1238968-3						
F1(C6-C10)			79.8		%		50-150	21-NOV-12
C-DIS-ORG-ED		Water						



Quality Control Report

Workorder: L1238968

Report Date: 27-NOV-12

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-ED		Water						
Batch	R2482405							
WG1591210-3	CVS							
Dissolved Organic Carbon			105.4		%		80-160	23-NOV-12
WG1591210-2	LCS							
Dissolved Organic Carbon			94.5		%		80-120	23-NOV-12
WG1591210-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	23-NOV-12
CL-IC-ED		Water						
Batch	R2482822							
WG1589577-3	DUP	L1239756-3						
Chloride (Cl)		34.9	34.9		mg/L	0.2	20	21-NOV-12
WG1589577-7	DUP	L1239587-1						
Chloride (Cl)		0.68	0.68		mg/L	1.2	20	21-NOV-12
WG1589577-2	LCS							
Chloride (Cl)			99.4		%		85-115	21-NOV-12
WG1589577-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	21-NOV-12
WG1589577-4	MS	L1239756-3						
Chloride (Cl)			94.2		%		75-125	21-NOV-12
WG1589577-8	MS	L1239587-1						
Chloride (Cl)			105.7		%		75-125	21-NOV-12
F2,F3,F4-ED		Water						
Batch	R2479643							
WG1589710-2	LCS							
F2 (>C10-C16)			107.8		%		65-135	20-NOV-12
F3 (C16-C34)			105.2		%		65-135	20-NOV-12
F4 (C34-C50)			97.0		%		65-135	20-NOV-12
WG1589710-1	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	20-NOV-12
F3 (C16-C34)			<0.25		mg/L		0.25	20-NOV-12
F4 (C34-C50)			<0.25		mg/L		0.25	20-NOV-12
HG-D-CVAA-ED		Water						
Batch	R2485002							
WG1592063-12	DUP	L1239950-12						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-6	DUP	L1238851-11						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-8	DUP	L1238851-33						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-CVAA-ED		Water						
Batch	R2485002							
WG1592063-8	DUP	L1238851-33						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-2	LCS							
Mercury (Hg)-Dissolved			93.7		%		80-120	26-NOV-12
WG1592063-3	LCSD	WG1592063-2						
Mercury (Hg)-Dissolved		93.7	95.0		%	1.4	20	26-NOV-12
WG1592063-1	MB							
Mercury (Hg)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
WG1592063-11	MS	L1238851-11						
Mercury (Hg)-Dissolved			111.8		%		70-130	26-NOV-12
WG1592063-13	MS	L1239950-12						
Mercury (Hg)-Dissolved			115.0		%		70-130	26-NOV-12
WG1592063-7	MS	L1238851-11						
Mercury (Hg)-Dissolved			115.2		%		70-130	26-NOV-12
WG1592063-9	MS	L1238851-33						
Mercury (Hg)-Dissolved			108.6		%		70-130	26-NOV-12
MET-D-ICP-ED		Water						
Batch	R2482902							
WG1590969-2	CRM	EU-H-4_OPTWATER						
Calcium (Ca)-Dissolved			93.8		%		80-120	23-NOV-12
Iron (Fe)-Dissolved			94.9		%		80-120	23-NOV-12
Magnesium (Mg)-Dissolved			93.4		%		80-120	23-NOV-12
Manganese (Mn)-Dissolved			96.0		%		80-120	23-NOV-12
Potassium (K)-Dissolved			90.9		%		80-120	23-NOV-12
Sodium (Na)-Dissolved			99.0		%		80-120	23-NOV-12
WG1590969-3	DUP	L1236640-17						
Calcium (Ca)-Dissolved		119	120		mg/L	0.6	20	25-NOV-12
Iron (Fe)-Dissolved		5.68	5.80		mg/L	2.0	20	25-NOV-12
Magnesium (Mg)-Dissolved		42.9	43.9		mg/L	2.2	20	25-NOV-12
Manganese (Mn)-Dissolved		0.178	0.181		mg/L	1.7	20	25-NOV-12
Potassium (K)-Dissolved		5.94	5.74		mg/L	3.3	20	25-NOV-12
Sodium (Na)-Dissolved		41.8	42.2		mg/L	0.8	20	25-NOV-12
WG1590969-4	DUP	L1239084-5						
Calcium (Ca)-Dissolved		53.1	49.8		mg/L	6.3	20	25-NOV-12
Iron (Fe)-Dissolved		0.341	0.314		mg/L	8.5	20	25-NOV-12
Magnesium (Mg)-Dissolved		10.8	9.98		mg/L	7.5	20	25-NOV-12



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-ICP-ED		Water						
Batch	R2482902							
WG1590969-4	DUP	L1239084-5						
Manganese (Mn)-Dissolved		0.150	0.140		mg/L	7.0	20	25-NOV-12
Potassium (K)-Dissolved		1.28	1.14		mg/L	12	20	25-NOV-12
Sodium (Na)-Dissolved		19.9	18.4		mg/L	7.8	20	25-NOV-12
WG1590969-5	DUP	L1239950-8						
Calcium (Ca)-Dissolved		65.9	68.8		mg/L	4.3	20	25-NOV-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	25-NOV-12
Magnesium (Mg)-Dissolved		28.6	29.0		mg/L	1.5	20	25-NOV-12
Manganese (Mn)-Dissolved		0.0920	0.0934		mg/L	1.5	20	25-NOV-12
Potassium (K)-Dissolved		3.01	3.12		mg/L	3.6	20	25-NOV-12
Sodium (Na)-Dissolved		317	330		mg/L	4.2	20	25-NOV-12
WG1590969-6	DUP	L1240064-2						
Calcium (Ca)-Dissolved		65.2	63.9		mg/L	2.1	20	25-NOV-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	25-NOV-12
Magnesium (Mg)-Dissolved		17.3	17.2		mg/L	0.6	20	25-NOV-12
Manganese (Mn)-Dissolved		0.166	0.164		mg/L	0.8	20	25-NOV-12
Potassium (K)-Dissolved		4.09	4.07		mg/L	0.5	20	25-NOV-12
Sodium (Na)-Dissolved		46.8	44.4		mg/L	5.5	20	25-NOV-12
WG1590969-1	MB							
Calcium (Ca)-Dissolved			<0.50		mg/L		0.5	23-NOV-12
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	23-NOV-12
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	23-NOV-12
Manganese (Mn)-Dissolved			<0.0050		mg/L		0.005	23-NOV-12
Potassium (K)-Dissolved			<0.50		mg/L		0.5	23-NOV-12
Sodium (Na)-Dissolved			<1.0		mg/L		1	23-NOV-12
MET-D-L-MS-ED		Water						
Batch	R2485185							
WG1592081-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			99.5		%		80-120	26-NOV-12
Antimony (Sb)-Dissolved			96.8		%		80-120	26-NOV-12
Arsenic (As)-Dissolved			100.9		%		80-120	26-NOV-12
Barium (Ba)-Dissolved			107.1		%		80-120	26-NOV-12
Beryllium (Be)-Dissolved			99.9		%		80-120	26-NOV-12
Bismuth (Bi)-Dissolved			101.0		%		80-120	26-NOV-12
Boron (B)-Dissolved			94.6		%		80-120	26-NOV-12



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-MS-ED		Water						
Batch	R2485185							
WG1592081-2 CRM	ED-HIGH-WATRM							
Cadmium (Cd)-Dissolved			108.0		%		80-120	26-NOV-12
Chromium (Cr)-Dissolved			98.0		%		80-120	26-NOV-12
Cobalt (Co)-Dissolved			100.2		%		80-120	26-NOV-12
Copper (Cu)-Dissolved			97.3		%		80-120	26-NOV-12
Lead (Pb)-Dissolved			104.6		%		80-120	26-NOV-12
Molybdenum (Mo)-Dissolved			100.1		%		80-120	26-NOV-12
Nickel (Ni)-Dissolved			101.2		%		80-120	26-NOV-12
Selenium (Se)-Dissolved			103.0		%		80-120	26-NOV-12
Silver (Ag)-Dissolved			94.8		%		80-120	26-NOV-12
Strontium (Sr)-Dissolved			103.2		%		80-120	26-NOV-12
Thallium (Tl)-Dissolved			104.5		%		80-120	26-NOV-12
Tin (Sn)-Dissolved			101.7		%		80-120	26-NOV-12
Titanium (Ti)-Dissolved			101.6		%		80-120	26-NOV-12
Uranium (U)-Dissolved			108.8		%		80-120	26-NOV-12
Vanadium (V)-Dissolved			102.1		%		80-120	26-NOV-12
Zinc (Zn)-Dissolved			103.4		%		80-120	26-NOV-12
WG1592081-6 DUP		L1238968-1						
Aluminum (Al)-Dissolved		<0.010	<0.0050	RPD-NA	mg/L	N/A	20	27-NOV-12
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	27-NOV-12
Arsenic (As)-Dissolved		0.00620	0.00625		mg/L	0.8	20	27-NOV-12
Barium (Ba)-Dissolved		0.0552	0.0569		mg/L	2.9	20	27-NOV-12
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Boron (B)-Dissolved		0.574	0.532		mg/L	7.5	20	27-NOV-12
Cadmium (Cd)-Dissolved		<0.00010	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	27-NOV-12
Cobalt (Co)-Dissolved		0.00090	0.00087		mg/L	3.4	20	27-NOV-12
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	27-NOV-12
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Molybdenum (Mo)-Dissolved		0.0291	0.0279		mg/L	3.9	20	27-NOV-12
Nickel (Ni)-Dissolved		0.00404	0.00410		mg/L	1.6	20	27-NOV-12
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	27-NOV-12
Silver (Ag)-Dissolved		<0.00020	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-MS-ED								
	Water							
Batch	R2485185							
WG1592081-6	DUP	L1238968-1						
Strontium (Sr)-Dissolved		0.605	0.569		mg/L	6.0	20	27-NOV-12
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	27-NOV-12
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	27-NOV-12
Uranium (U)-Dissolved		0.00207	0.00183		mg/L	12	20	27-NOV-12
Vanadium (V)-Dissolved		0.00089	0.00084		mg/L	6.4	20	27-NOV-12
Zinc (Zn)-Dissolved		0.0045	0.0045		mg/L	0.0	20	27-NOV-12
WG1592081-1	MB							
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	26-NOV-12
Antimony (Sb)-Dissolved			<0.00040		mg/L		0.0004	26-NOV-12
Arsenic (As)-Dissolved			<0.00040		mg/L		0.0004	26-NOV-12
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	26-NOV-12
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Boron (B)-Dissolved			<0.0020		mg/L		0.002	26-NOV-12
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Chromium (Cr)-Dissolved			<0.00040		mg/L		0.0004	26-NOV-12
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Copper (Cu)-Dissolved			<0.00060		mg/L		0.0006	26-NOV-12
Lead (Pb)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Molybdenum (Mo)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Selenium (Se)-Dissolved			<0.00040		mg/L		0.0004	26-NOV-12
Silver (Ag)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Tin (Sn)-Dissolved			<0.00020		mg/L		0.0002	26-NOV-12
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	26-NOV-12
Uranium (U)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	26-NOV-12

NAPHTHENIC-ACID-FM **Water**



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2481843							
WG1589674-3	DUP	L1238328-2						
Naphthenic Acids		<1.0	<1.0	RPD-NA	mg/L	N/A	30	22-NOV-12
WG1589674-6	LCS							
Naphthenic Acids			78.5		%		70-130	22-NOV-12
WG1589674-1	MB							
Naphthenic Acids			<1.0		mg/L		1	22-NOV-12
WG1589674-4	MB							
Naphthenic Acids			<1.0		mg/L		1	22-NOV-12
WG1589674-2	MS	L1236876-1						
Naphthenic Acids			80.0		%		50-150	22-NOV-12
WG1589674-5	MS	L1237569-1						
Naphthenic Acids			60.8		%		50-150	22-NOV-12
NH3-CFA-ED								
	Water							
Batch	R2480898							
WG1590134-3	DUP	L1238943-3						
Ammonia, Total (as N)		0.486	0.494		mg/L	1.6	20	22-NOV-12
WG1590134-5	DUP	L1239272-3						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-NOV-12
WG1590134-7	DUP	L1239838-2						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-NOV-12
WG1590134-8	DUP	L1240644-1						
Ammonia, Total (as N)		1.15	1.14		mg/L	1.3	20	22-NOV-12
WG1590134-2	LCS							
Ammonia, Total (as N)			103.2		%		85-115	22-NOV-12
WG1590134-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	22-NOV-12
WG1590134-4	MS	L1239257-2						
Ammonia, Total (as N)			113.9		%		75-125	22-NOV-12
WG1590134-6	MS	L1238813-4						
Ammonia, Total (as N)			103.9		%		75-125	22-NOV-12
NO2-IC-ED								
	Water							
Batch	R2482822							
WG1589577-3	DUP	L1239756-3						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-7	DUP	L1239587-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-2	LCS							
Nitrite (as N)			97.4		%		85-115	21-NOV-12



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED		Water						
Batch	R2482822							
WG1589577-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	21-NOV-12
WG1589577-4	MS	L1239756-3						
Nitrite (as N)			87.4		%		75-125	21-NOV-12
WG1589577-8	MS	L1239587-1						
Nitrite (as N)			99.1		%		75-125	21-NOV-12
NO3-IC-ED		Water						
Batch	R2482822							
WG1589577-3	DUP	L1239756-3						
Nitrate (as N)			<0.050	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-5	DUP	L1239950-18						
Nitrate (as N)			<0.050	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-7	DUP	L1239587-1						
Nitrate (as N)			0.756		mg/L	2.7	20	21-NOV-12
WG1589577-2	LCS							
Nitrate (as N)			99.5		%		85-115	21-NOV-12
WG1589577-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	21-NOV-12
WG1589577-4	MS	L1239756-3						
Nitrate (as N)			96.8		%		75-125	21-NOV-12
WG1589577-6	MS	L1239950-18						
Nitrate (as N)			97.9		%		75-125	21-NOV-12
WG1589577-8	MS	L1239587-1						
Nitrate (as N)			106.3		%		75-125	21-NOV-12
PAH-ABT1-ED		Water						
Batch	R2485358							
WG1591093-3	LCS							
Acenaphthene			86.8		%		60-130	26-NOV-12
Acenaphthylene			85.3		%		60-130	26-NOV-12
Anthracene			91.7		%		60-130	26-NOV-12
Fluoranthene			99.8		%		60-130	26-NOV-12
Fluorene			91.7		%		60-130	26-NOV-12
Naphthalene			85.0		%		50-130	26-NOV-12
Phenanthrene			95.7		%		60-130	26-NOV-12
Pyrene			100.3		%		60-130	26-NOV-12
Benzo(a)anthracene			119.6		%		60-130	26-NOV-12
Benzo(k)fluoranthene			120.8		%		60-130	26-NOV-12



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED								
	Water							
Batch	R2485358							
WG1591093-3	LCS							
Benzo(b&j)fluoranthene			121.8		%		60-130	26-NOV-12
Benzo(g,h,i)perylene			123.1		%		60-130	26-NOV-12
Benzo(a)pyrene			119.8		%		60-130	26-NOV-12
Chrysene			116.5		%		60-130	26-NOV-12
Dibenzo(a,h)anthracene			117.3		%		60-130	26-NOV-12
Indeno(1,2,3-cd)pyrene			125.4		%		60-130	26-NOV-12
WG1591093-2	MB							
Acenaphthene			<0.000020		mg/L		0.00002	26-NOV-12
Acenaphthylene			<0.000020		mg/L		0.00002	26-NOV-12
Anthracene			<0.000010		mg/L		0.00001	26-NOV-12
Fluoranthene			<0.000020		mg/L		0.00002	26-NOV-12
Fluorene			<0.000020		mg/L		0.00002	26-NOV-12
Naphthalene			<0.000050		mg/L		0.00005	26-NOV-12
Phenanthrene			<0.000050		mg/L		0.00005	26-NOV-12
Pyrene			<0.000020		mg/L		0.00002	26-NOV-12
Benzo(a)anthracene			<0.000010		mg/L		0.00001	26-NOV-12
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	26-NOV-12
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	26-NOV-12
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	26-NOV-12
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	26-NOV-12
Chrysene			<0.000020		mg/L		0.00002	26-NOV-12
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	26-NOV-12
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	26-NOV-12
Surrogate: Nitrobenzene d5			76.5		%		40-130	26-NOV-12
Surrogate: 2-Fluorobiphenyl			72.6		%		40-130	26-NOV-12
Surrogate: p-Terphenyl d14			126.8		%		40-130	26-NOV-12
PH/EC/ALK-ED								
	Water							
Batch	R2477613							
WG1588612-6	DUP	L1239048-2						
pH		7.69	7.72	J	pH	0.03	0.2	20-NOV-12
Conductivity (EC)		1740	1740		uS/cm	0.1	10	20-NOV-12
Bicarbonate (HCO3)		769	774		mg/L	0.6	25	20-NOV-12
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	20-NOV-12
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	20-NOV-12



Quality Control Report

Workorder: L1238968

Report Date: 27-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2477613							
WG1588612-6	DUP	L1239048-2						
Alkalinity, Total (as CaCO3)		631	635		mg/L	0.6	6.5	20-NOV-12
WG1588612-2	LCS							
Conductivity (EC)			100.1		%		90-110	20-NOV-12
WG1588612-3	LCS							
pH			7.04		pH		6.9-7.1	20-NOV-12
WG1588612-4	LCS							
Alkalinity, Total (as CaCO3)			101.5		%		85-115	20-NOV-12
WG1588612-5	LCS							
Conductivity (EC)			97.4		%		90-110	20-NOV-12
WG1588612-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	20-NOV-12
Carbonate (CO3)			<5.0		mg/L		5	20-NOV-12
Hydroxide (OH)			<5.0		mg/L		5	20-NOV-12
Alkalinity, Total (as CaCO3)			<5.0		mg/L		5	20-NOV-12
PHENOLS-4AAP-ED		Water						
Batch	R2481530							
WG1590692-4	DUP	L1238761-4						
Phenols (4AAP)		0.0122	0.0123		mg/L	0.8	15	22-NOV-12
WG1590692-5	DUP	L1235531-1						
Phenols (4AAP)		0.0035	0.0039		mg/L	11	15	22-NOV-12
WG1590692-3	LCS							
Phenols (4AAP)			94.0		%		85-115	22-NOV-12
WG1590692-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	22-NOV-12
SO4-IC-ED		Water						
Batch	R2482822							
WG1589577-3	DUP	L1239756-3						
Sulfate (SO4)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-7	DUP	L1239587-1						
Sulfate (SO4)		150	150		mg/L	0.2	20	21-NOV-12
WG1589577-2	LCS							
Sulfate (SO4)			100.2		%		85-115	21-NOV-12
WG1589577-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	21-NOV-12
WG1589577-4	MS	L1239756-3						
Sulfate (SO4)			103.2		%		75-125	21-NOV-12

Quality Control Report

Workorder: L1238968

Report Date: 27-NOV-12

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

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: L1238968

Report Date: 27-NOV-12

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	17-NOV-12 15:50	21-NOV-12 08:00	48	88	hours	EHTL
	2	17-NOV-12 20:00	21-NOV-12 08:00	48	84	hours	EHTL
	3	17-NOV-12 17:36	21-NOV-12 08:00	48	86	hours	EHTL
	4	17-NOV-12 19:45	21-NOV-12 08:00	48	84	hours	EHTL
Nitrite as N by IC							
	1	17-NOV-12 15:50	21-NOV-12 08:00	48	88	hours	EHTL
	2	17-NOV-12 20:00	21-NOV-12 08:00	48	84	hours	EHTL
	3	17-NOV-12 17:36	21-NOV-12 08:00	48	86	hours	EHTL
	4	17-NOV-12 19:45	21-NOV-12 08:00	48	84	hours	EHTL

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).

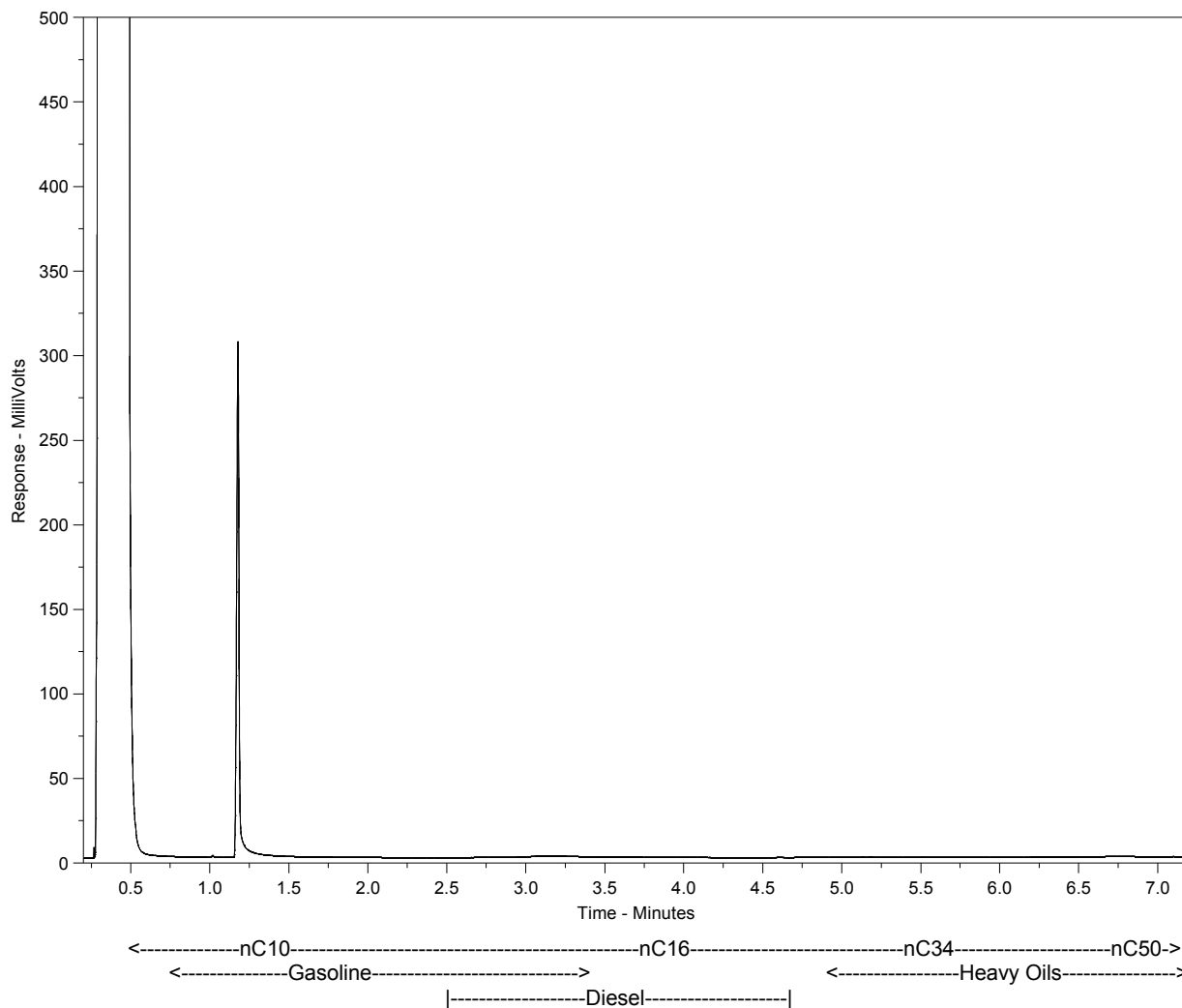
Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1238968 were received on 19-NOV-12 09:56.

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.

ALS Sample ID: L1238968-1
 Client ID: 16054121117101

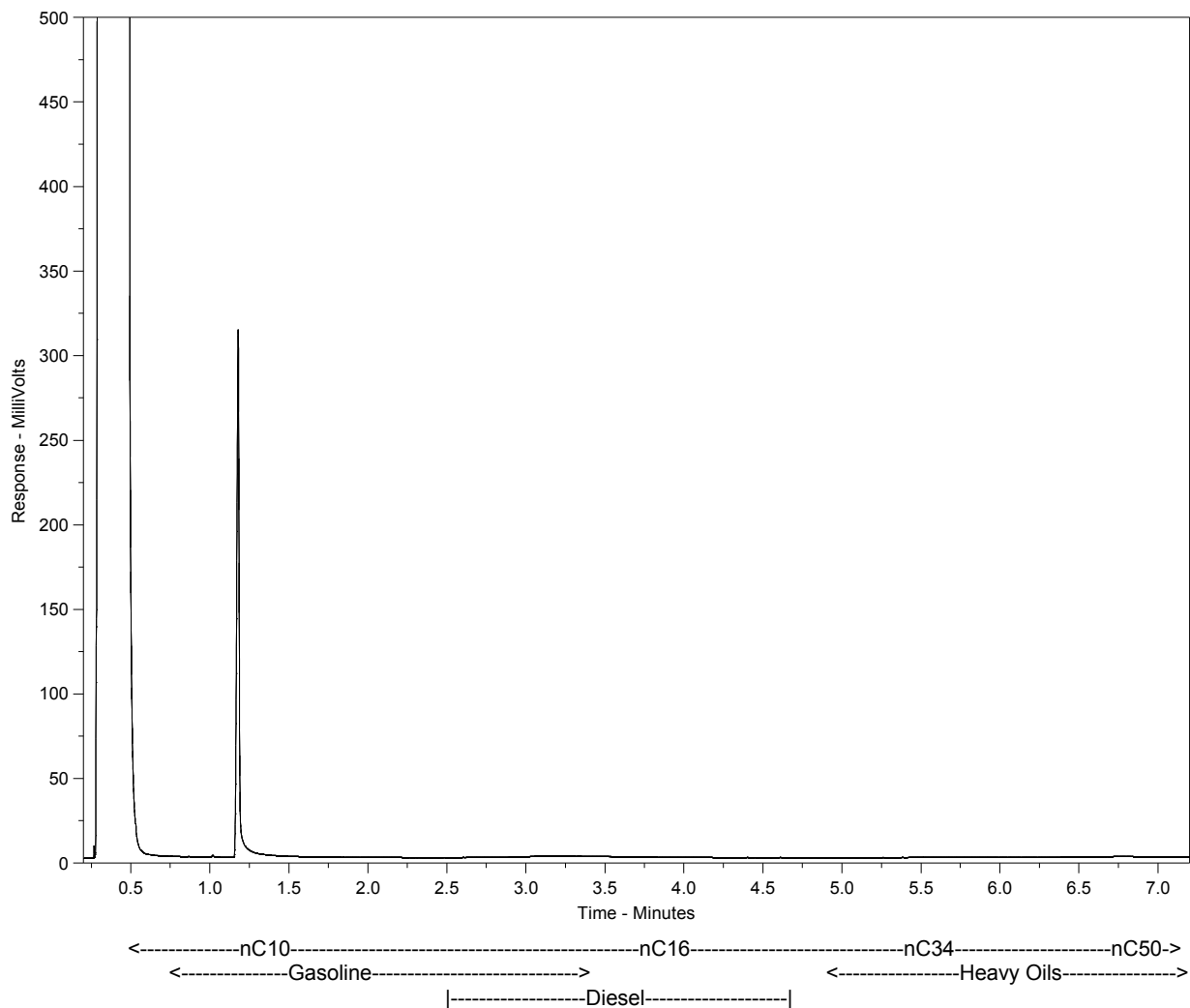


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1238968-2
Client ID: 16054121117102

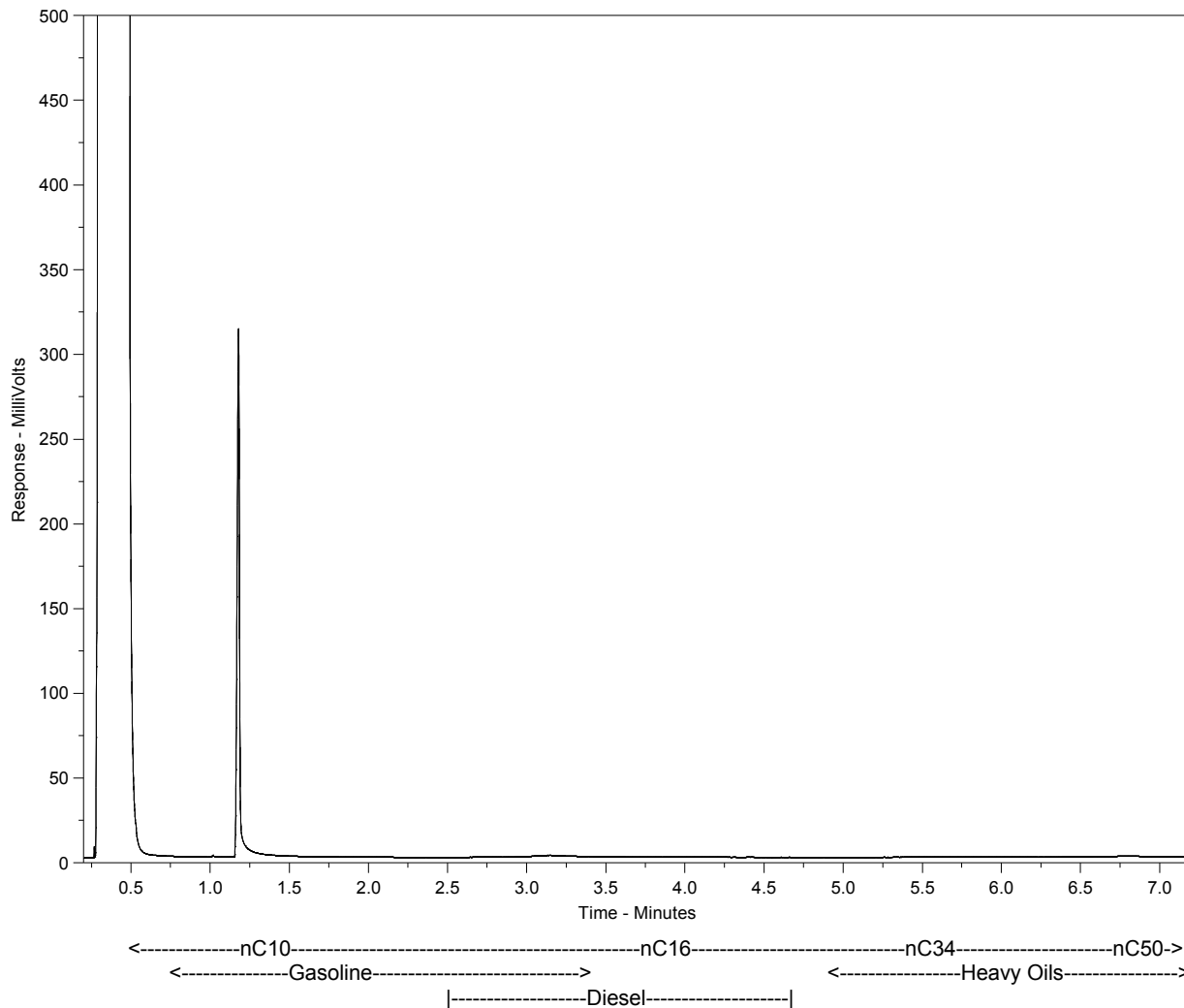


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1238968-3
 Client ID: 16054121117103

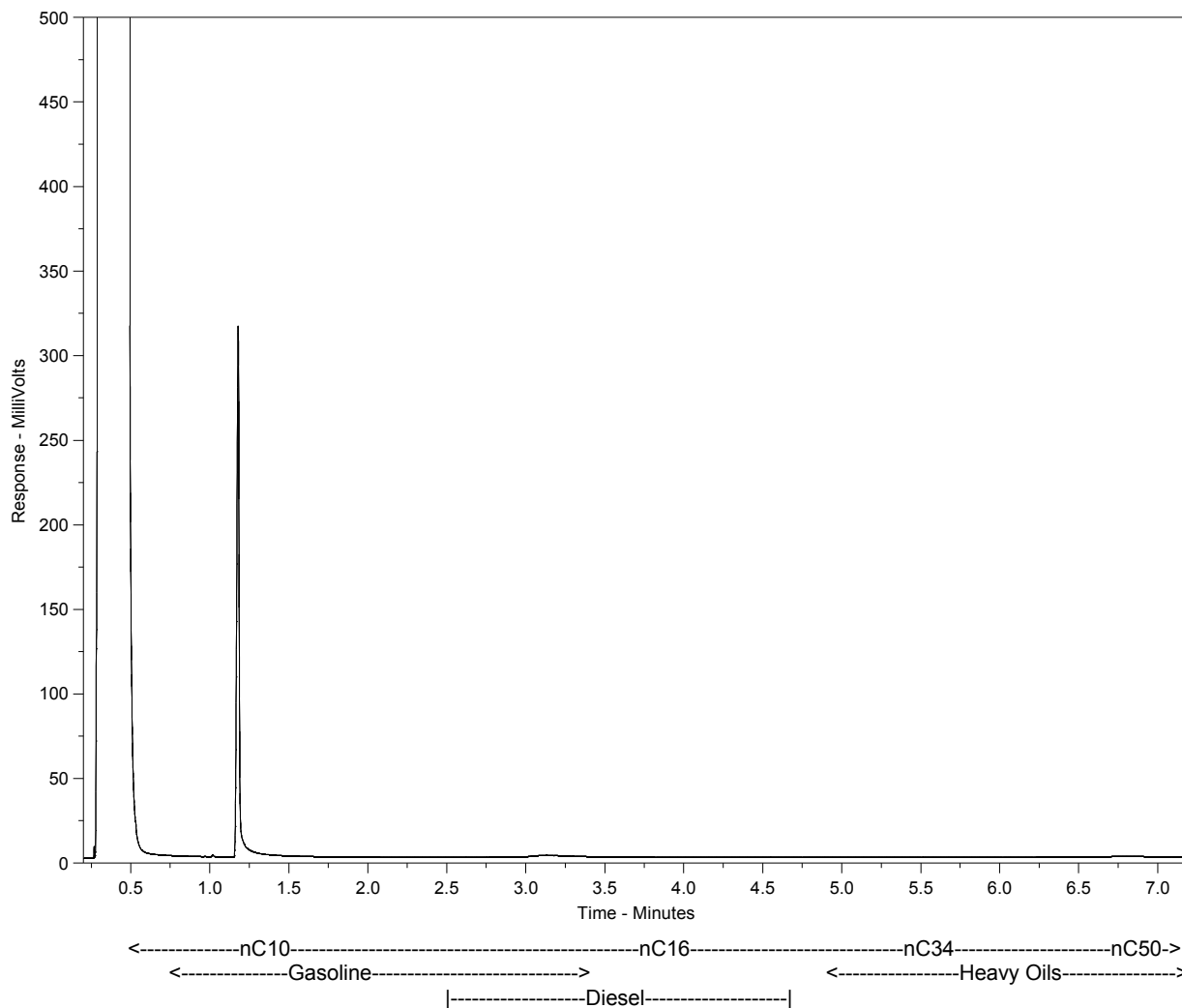


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1238968-4
Client ID: 16054121117104



The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 21-NOV-12
Report Date: 27-NOV-12 16:08 (MT)
Version: FINAL

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1240063
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 MW12 MGRIGNA LAKE
C of C Numbers:
Legal Site Desc: 80-13 W4M


Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240063-1 16054121119301									
Sampled By: GK/EA on 19-NOV-12 @ 11:00									
Matrix: WATER									
Diss. Metals in Water by ICPOES/MS & Hg									
Diss. Metals in Water by ICPOES (Low)									
Calcium (Ca)-Dissolved	48.5	+/-6.7		0.50	mg/L	0		25-NOV-12	R2482902
Iron (Fe)-Dissolved	0.064	+/-0.013		0.010	mg/L	0		25-NOV-12	R2482902
Magnesium (Mg)-Dissolved	10.5	+/-1.5		0.10	mg/L	0		25-NOV-12	R2482902
Manganese (Mn)-Dissolved	2.13	+/-0.29		0.0020	mg/L	0		25-NOV-12	R2482902
Potassium (K)-Dissolved	3.74	+/-0.59		0.10	mg/L	0		25-NOV-12	R2482902
Sodium (Na)-Dissolved	9.25	+/-1.3		0.50	mg/L	0		25-NOV-12	R2482902
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.0847	+/-0.010		0.0020	mg/L	0		27-NOV-12	R2485185
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.030	+/-0.005		0.010	mg/L	0		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	0.00137	+/-0.00014		0.00040	mg/L	0		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.179	+/-0.016		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00968	+/-0.00091		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.00303	+/-0.00032		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.0187	+/-0.0015		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	0.00711	+/-0.0012		0.00040	mg/L	0		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.254	+/-0.019		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	0.00035	+/-0.00018		0.00030	mg/L	0		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	0.00148	+/-0.00015		0.00010	mg/L	0		27-NOV-12	R2485185
Vanadium (V)-Dissolved	0.00027	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0090	+/-0.0011		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		26-NOV-12	R2485002
Miscellaneous Parameters									
Dissolved Organic Carbon	6.9	+/-0.9		1.0	mg/L	0		23-NOV-12	R2482405
MF - Fecal Coliforms	See Attached	-				-		23-NOV-12	
Phenols (4AAP)	0.0050	+/-0.0010		0.0010	mg/L	0		23-NOV-12	R2483086

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 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 may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
FCC-MF-PB	Water	Fecal Coliform Count-MF		APHA 9222D MF
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
MET-D-L-ICP-ED	Water	Diss. Metals in Water by ICPOES (Low)		APHA 3120 B-ICP-OES
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC

This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference 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
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
PB	PBR LABORATORIES

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

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.



Environmental

Quality Control Report

Workorder: L1240063

Report Date: 27-NOV-12

Page 1 of 6

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2485185							
WG1592081-2 CRM		ED-HIGH-WATRM						
Boron (B)-Dissolved			94.6		%		80-120	26-NOV-12
WG1592081-1 MB			<0.0020		mg/L		0.002	26-NOV-12
C-DIS-ORG-ED		Water						
Batch	R2482405							
WG1591210-3 CVS			105.4		%		80-160	23-NOV-12
Dissolved Organic Carbon								
WG1591210-2 LCS			94.5		%		80-120	23-NOV-12
Dissolved Organic Carbon								
WG1591210-1 MB			<1.0		mg/L		1	23-NOV-12
Dissolved Organic Carbon								
HG-D-CVAA-ED		Water						
Batch	R2485002							
WG1592063-12 DUP		L1239950-12						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-6 DUP		L1238851-11						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-8 DUP		L1238851-33						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-2 LCS			93.7		%		80-120	26-NOV-12
Mercury (Hg)-Dissolved								
WG1592063-3 LCSD		WG1592063-2						
Mercury (Hg)-Dissolved		93.7	95.0		%	1.4	20	26-NOV-12
WG1592063-1 MB			<0.00010		mg/L		0.0001	26-NOV-12
Mercury (Hg)-Dissolved								
WG1592063-11 MS		L1238851-11						
Mercury (Hg)-Dissolved			111.8		%		70-130	26-NOV-12
WG1592063-13 MS		L1239950-12						
Mercury (Hg)-Dissolved			115.0		%		70-130	26-NOV-12
WG1592063-7 MS		L1238851-11						
Mercury (Hg)-Dissolved			115.2		%		70-130	26-NOV-12
WG1592063-9 MS		L1238851-33						
Mercury (Hg)-Dissolved			108.6		%		70-130	26-NOV-12
MET-D-CCMS-ED		Water						



Quality Control Report

Workorder: L1240063

Report Date: 27-NOV-12

Page 2 of 6

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2485185							
WG1592081-2 CRM		ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			99.5		%		80-120	26-NOV-12
Antimony (Sb)-Dissolved			96.8		%		80-120	26-NOV-12
Arsenic (As)-Dissolved			100.9		%		80-120	26-NOV-12
Barium (Ba)-Dissolved			107.1		%		80-120	26-NOV-12
Beryllium (Be)-Dissolved			99.9		%		80-120	26-NOV-12
Bismuth (Bi)-Dissolved			101.0		%		80-120	26-NOV-12
Cadmium (Cd)-Dissolved			108.0		%		80-120	26-NOV-12
Chromium (Cr)-Dissolved			98.0		%		80-120	26-NOV-12
Cobalt (Co)-Dissolved			100.2		%		80-120	26-NOV-12
Copper (Cu)-Dissolved			97.3		%		80-120	26-NOV-12
Lead (Pb)-Dissolved			104.6		%		80-120	26-NOV-12
Molybdenum (Mo)-Dissolved			100.1		%		80-120	26-NOV-12
Nickel (Ni)-Dissolved			101.2		%		80-120	26-NOV-12
Selenium (Se)-Dissolved			103.0		%		80-120	26-NOV-12
Silver (Ag)-Dissolved			94.8		%		80-120	26-NOV-12
Strontium (Sr)-Dissolved			103.2		%		80-120	26-NOV-12
Thallium (Tl)-Dissolved			104.5		%		80-120	26-NOV-12
Titanium (Ti)-Dissolved			101.6		%		80-120	26-NOV-12
Tin (Sn)-Dissolved			101.7		%		80-120	26-NOV-12
Uranium (U)-Dissolved			108.8		%		80-120	26-NOV-12
Vanadium (V)-Dissolved			102.1		%		80-120	26-NOV-12
Zinc (Zn)-Dissolved			103.4		%		80-120	26-NOV-12
WG1592081-7 DUP		L1239197-6						
Aluminum (Al)-Dissolved		<0.0050	<0.0010	RPD-NA	mg/L	N/A	20	27-NOV-12
Antimony (Sb)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Arsenic (As)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Barium (Ba)-Dissolved		0.0083	0.00125	J	mg/L	0.00708	0.01	27-NOV-12
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Cadmium (Cd)-Dissolved		<0.00010	0.000013	RPD-NA	mg/L	N/A	20	27-NOV-12
Chromium (Cr)-Dissolved		<0.0050	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Copper (Cu)-Dissolved		<0.0010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12



Quality Control Report

Workorder: L1240063

Report Date: 27-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2485185							
WG1592081-7	DUP	L1239197-6						
Lead (Pb)-Dissolved		<0.00010	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Molybdenum (Mo)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Nickel (Ni)-Dissolved		<0.0020	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Selenium (Se)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Silver (Ag)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	27-NOV-12
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Uranium (U)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Zinc (Zn)-Dissolved		<0.0030	0.0014	RPD-NA	mg/L	N/A	20	27-NOV-12
WG1592081-8	DUP	L1239197-7						
Aluminum (Al)-Dissolved		<0.0050	0.0043		mg/L	1.6	20	27-NOV-12
Antimony (Sb)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Arsenic (As)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Barium (Ba)-Dissolved		<0.0050	0.000543	J	mg/L	0.000170	0.01	27-NOV-12
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Cadmium (Cd)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Chromium (Cr)-Dissolved		<0.0050	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Copper (Cu)-Dissolved		<0.0010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Lead (Pb)-Dissolved		<0.00010	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Molybdenum (Mo)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Nickel (Ni)-Dissolved		<0.0020	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Selenium (Se)-Dissolved		<0.00040	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Silver (Ag)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Strontium (Sr)-Dissolved		0.00048	0.00047		mg/L	4.1	20	27-NOV-12
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	27-NOV-12
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Uranium (U)-Dissolved		<0.00010	<0.000010	RPD-NA	mg/L	N/A	20	27-NOV-12
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12



Quality Control Report

Workorder: L1240063

Report Date: 27-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2485185							
WG1592081-8	DUP	L1239197-7						
Zinc (Zn)-Dissolved		<0.0030	0.0012		mg/L	19	20	27-NOV-12
WG1592081-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	26-NOV-12
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	26-NOV-12
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	26-NOV-12
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	26-NOV-12
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	26-NOV-12
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	26-NOV-12
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	26-NOV-12
MET-D-L-ICP-ED								
	Water							
Batch	R2482902							
WG1590969-2	CRM	EU-H-4_OPTWATER						
Calcium (Ca)-Dissolved			93.8		%		80-120	23-NOV-12
Iron (Fe)-Dissolved			94.9		%		80-120	23-NOV-12
Magnesium (Mg)-Dissolved			93.4		%		80-120	23-NOV-12
Manganese (Mn)-Dissolved			96.0		%		80-120	23-NOV-12
Potassium (K)-Dissolved			90.9		%		80-120	23-NOV-12
Sodium (Na)-Dissolved			99.0		%		80-120	23-NOV-12
WG1590969-1	MB							
Calcium (Ca)-Dissolved			<0.20		mg/L		0.2	23-NOV-12



Quality Control Report

Workorder: L1240063

Report Date: 27-NOV-12

Page 5 of 6

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-ICP-ED		Water						
Batch	R2482902							
WG1590969-1	MB							
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	23-NOV-12
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	23-NOV-12
Manganese (Mn)-Dissolved			<0.0020		mg/L		0.002	23-NOV-12
Potassium (K)-Dissolved			<0.10		mg/L		0.1	23-NOV-12
Sodium (Na)-Dissolved			<0.50		mg/L		0.5	23-NOV-12
PHENOLS-4AAP-ED		Water						
Batch	R2483086							
WG1591458-4	DUP	L1236640-10						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	23-NOV-12
WG1591458-5	DUP	L1236640-18						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	23-NOV-12
WG1591458-6	DUP	L1240064-5						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	23-NOV-12
WG1591458-3	LCS							
Phenols (4AAP)			93.2		%		85-115	23-NOV-12
WG1591458-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	23-NOV-12

Quality Control Report

Workorder: L1240063

Report Date: 27-NOV-12

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

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.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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.



ALS 121123-18 (12-FEX)

CONFIDENTIAL ANALYSIS REPORT

REPORT #: 121123-18

WO #: 12-FEX

PO #: L1240063

CLIENT: ALS Laboratory Group - Edmonton
9936-67 Avenue
Edmonton, AB
T6E 0P5

ATTENTION: ALS-ED Reporting
Tel: (780) 413-5227
Fax: (780) 437-2311

SAMPLE DESCRIPTION: Water Sample

DATE AND TIME OF SAMPLE COLLECTION: November 19, 2012

DATE AND TIME OF SAMPLE RECEIPT: November 21, 2012/13:50

SAMPLE TEMPERATURE WHEN RECEIVED: 11.3° Celsius

TEST PERFORMED: Fecal Coliform by MF

TEST START DATE: November 21, 2012/14:20

DATE COMPLETED: November 23, 2012

CERTIFICATE OF ANALYSIS: See Page 2

QUALITY CONTROL DATA: See Attached Appendix 1

The report shall not be reproduced, except in full, without the written authority of PBR Laboratories Inc.

Certificate of Analysis

PBR ID	Sample #	Client ID	Lot #	Test	Protocol	Quantity Analyzed	*DF	Result	Units	Note
12-FEX-01	L1240063-1	16054121119105		Fecal Coliform by MF	APHA-9222D	100 ml		<1	CFU/100ml	1

*DF - Dilution Factor used for analysis

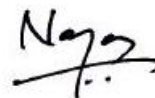
Notes

- 1 CFU = Colony Forming Unit.
- <1 = No counts were detected based on the volume/dilution analyzed.

The reported results apply only to the items tested.



Rose Rosairo (Analyst)
Date: Nov 23 2012



Approved By: Narayan Pokharel, Ph.D.
Date: Nov 23 2012



PIBR
Laboratories Inc.

ALS 121123-18 (12-FEX)

APPENDIX 1

Quality Control Data for Fecal Coliform by MF (APHA-9222D)

Controls	Organism/Medium	Result
Sterility (media)	m-FC	Pass
Negative	Staphylococcus aureus	Pass
Positive	Escherichia coli	Pass



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 21-NOV-12
Report Date: 29-NOV-12 16:04 (MT)
Version: FINAL

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1240064
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 WANDERING RIVER
C of C Numbers:
Legal Site Desc: 10-7-36-77-15 W4M



Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240064-1 16054121119101									
Sampled By: GK/EA on 19-NOV-12 @ 17:30									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Toluene	0.00738	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
EthylBenzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Styrene	<0.0010	-		0.0010	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
F3 (C16-C34)	0.46	+/-0.14		0.25	mg/L	0	22-NOV-12	22-NOV-12	R2482442
F4 (C34-C50)	0.37	+/-0.13		0.25	mg/L	0	22-NOV-12	22-NOV-12	R2482442
Diss Metals + Hg in water, unique report									
Diss. Metals in Water by ICPMS (Low)									
Aluminum (Al)-Dissolved	0.010	+/-0.002		0.010	mg/L	+6%		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	0.00075	+/-0.00006		0.00040	mg/L	0		27-NOV-12	R2485185
Arsenic (As)-Dissolved	0.0374	+/-0.0026		0.00040	mg/L	0		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.0357	+/-0.0034		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Boron (B)-Dissolved	0.801	+/-0.081		0.0020	mg/L	0		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	0		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00054	+/-0.00004		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	0.00233	+/-0.00019		0.00060	mg/L	0		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.0376	+/-0.0027		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00254	+/-0.00015		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.345	+/-0.024		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	0.00050	+/-0.00006		0.00020	mg/L	0		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	0.00017	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Vanadium (V)-Dissolved	0.00031	+/-0.00005		0.00010	mg/L	0		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0055	+/-0.0008		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485722
Miscellaneous Parameters									
Ammonia, Total (as N)	1.39	-		0.050	mg/L	-		23-NOV-12	R2482148
Dissolved Organic Carbon	10.4	+/-1.3		1.0	mg/L	0		26-NOV-12	R2484543
MF - Fecal Coliforms	See Attached	-				-		23-NOV-12	
Naphthenic Acids	<1.0	-		1.0	mg/L	-	26-NOV-12	26-NOV-12	R2485183
Phenols (4AAP)	0.0071	+/-0.0011		0.0010	mg/L	0		23-NOV-12	R2483086
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240064-2 16054121119102									
Sampled By: GK/EA on 19-NOV-12 @ 17:50									
Matrix: WATER									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Toluene	0.00124	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
EthylBenzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Styrene	<0.0010	-		0.0010	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
Diss Metals + Hg in water, unique report									
Diss. Metals in Water by ICPMS (Low)									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	0.00374	+/-0.00026		0.00040	mg/L	0		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.0562	+/-0.0053		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Boron (B)-Dissolved	0.189	+/-0.019		0.0020	mg/L	0		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00018	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.00733	+/-0.00052		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00073	+/-0.00004		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.418	+/-0.029		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0070	+/-0.0010		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485722
Miscellaneous Parameters									
Ammonia, Total (as N)	1.56	-		0.050	mg/L	-		23-NOV-12	R2482148
Dissolved Organic Carbon	5.2	+/-0.8		1.0	mg/L	0		26-NOV-12	R2484543
Naphthenic Acids	<1.0	-		1.0	mg/L	-	26-NOV-12	26-NOV-12	R2485183
Phenols (4AAP)	0.0033	+/-0.0009		0.0010	mg/L	0		23-NOV-12	R2483086
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240064-2 16054121119102 Sampled By: GK/EA on 19-NOV-12 @ 17:50 Matrix: WATER									
PAH & Carcinogenic PAH List									
Naphthalene	0.000358	+/-0.00010		0.000050	mg/L	0	26-NOV-12	27-NOV-12	R2485358
Phenanthrene	<0.000050	-		0.000050	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(a)pyrene	<0.000050	-		0.000005	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Chrysene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.000050	-		0.000005	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Surr: Nitrobenzene d5	55.1	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	71.5	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Surr: p-Terphenyl d14	127.1	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	24.6	+/-0.79		0.50	mg/L	0		21-NOV-12	R2482822
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	65.2	+/-9.8		0.50	mg/L	0		25-NOV-12	R2482902
Iron (Fe)-Dissolved	<0.030	-		0.030	mg/L	-		25-NOV-12	R2482902
Magnesium (Mg)-Dissolved	17.3	+/-3.1		0.10	mg/L	0		25-NOV-12	R2482902
Manganese (Mn)-Dissolved	0.166	+/-0.025		0.0050	mg/L	0		25-NOV-12	R2482902
Potassium (K)-Dissolved	4.09	+/-0.75		0.50	mg/L	0		25-NOV-12	R2482902
Sodium (Na)-Dissolved	46.8	+/-7.6		1.0	mg/L	0		25-NOV-12	R2482902
Ion Balance Calculation									
Ion Balance	97.9	-			%	-		26-NOV-12	
TDS (Calculated)	358	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	234	-			mg/L	-		26-NOV-12	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		26-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Sulfate by IC									
Sulfate (SO4)	22.3	+/-0.96		0.50	mg/L	0		21-NOV-12	R2482822
pH, Conductivity and Total Alkalinity									
pH	7.96	+/-0.04		0.10	pH	0		21-NOV-12	R2479303
Conductivity (EC)	646	+/-22		0.20	uS/cm	0		21-NOV-12	R2479303
Bicarbonate (HCO3)	361	-		5.0	mg/L	-		21-NOV-12	R2479303
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		21-NOV-12	R2479303
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		21-NOV-12	R2479303
Alkalinity, Total (as CaCO3)	296	+/-11		5.0	mg/L	0		21-NOV-12	R2479303
L1240064-3 16054121119103 Sampled By: GK/EA on 19-NOV-12 @ 18:30 Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240064-3 16054121119103									
Sampled By: GK/EA on 19-NOV-12 @ 18:30									
Matrix: WATER									
BTEX, Styrene and F1 (C6-C10)									
Toluene	0.00092	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
EthylBenzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Styrene	<0.0010	-		0.0010	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
Diss Metals + Hg in water, unique report									
Diss. Metals in Water by ICPMS (Low)									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	0.00717	+/-0.00049		0.00040	mg/L	0		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.0433	+/-0.0041		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Boron (B)-Dissolved	0.209	+/-0.021		0.0020	mg/L	0		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00014	+/-0.00002		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		27-NOV-12	R2485185
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.0106	+/-0.00075		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00103	+/-0.00006		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.403	+/-0.028		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0039	+/-0.0006		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485722
Miscellaneous Parameters									
Ammonia, Total (as N)	1.31	-		0.050	mg/L	-		23-NOV-12	R2482148
Dissolved Organic Carbon	5.9	+/-0.8		1.0	mg/L	0		26-NOV-12	R2484543
Naphthenic Acids	<1.0	-		1.0	mg/L	-	26-NOV-12	26-NOV-12	R2485183
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		23-NOV-12	R2483086
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Naphthalene	0.000116	+/-0.000047		0.000050	mg/L	0	26-NOV-12	27-NOV-12	R2485358

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240064-3 16054121119103 Sampled By: GK/EA on 19-NOV-12 @ 18:30 Matrix: WATER									
PAH & Carcinogenic PAH List									
Phenanthrene	<0.000050	-		0.000050	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	26-NOV-12	27-NOV-12	R2485358
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	26-NOV-12	27-NOV-12	R2485358
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Surr: Nitrobenzene d5	76.0	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	81.9	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Surr: p-Terphenyl d14	111.2	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	3.84	+/-0.15		0.50	mg/L	0		21-NOV-12	R2482822
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	60.1	+/-9.0		0.50	mg/L	0		25-NOV-12	R2482902
Iron (Fe)-Dissolved	<0.030	-		0.030	mg/L	-		25-NOV-12	R2482902
Magnesium (Mg)-Dissolved	15.8	+/-2.8		0.10	mg/L	0		25-NOV-12	R2482902
Manganese (Mn)-Dissolved	0.410	+/-0.061		0.0050	mg/L	0		25-NOV-12	R2482902
Potassium (K)-Dissolved	4.14	+/-0.76		0.50	mg/L	0		25-NOV-12	R2482902
Sodium (Na)-Dissolved	37.9	+/-6.1		1.0	mg/L	0		25-NOV-12	R2482902
Ion Balance Calculation									
Ion Balance	94.8	-			%	-		26-NOV-12	
TDS (Calculated)	320	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	215	-			mg/L	-		26-NOV-12	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		26-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Sulfate by IC									
Sulfate (SO4)	16.7	+/-0.73		0.50	mg/L	0		21-NOV-12	R2482822
pH, Conductivity and Total Alkalinity									
pH	7.90	+/-0.04		0.10	pH	0		21-NOV-12	R2479303
Conductivity (EC)	577	+/-19		0.20	uS/cm	0		21-NOV-12	R2479303
Bicarbonate (HCO3)	368	-		5.0	mg/L	-		21-NOV-12	R2479303
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		21-NOV-12	R2479303
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		21-NOV-12	R2479303
Alkalinity, Total (as CaCO3)	302	+/-11		5.0	mg/L	0		21-NOV-12	R2479303
L1240064-4 16054121119104 Sampled By: GK/EA on 19-NOV-12 @ 18:50 Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Toluene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240064-4 16054121119104									
Sampled By: GK/EA on 19-NOV-12 @ 18:50									
Matrix: WATER									
BTEX, Styrene and F1 (C6-C10)									
EthylBenzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Styrene	<0.0010	-		0.0010	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
Diss Metals + Hg in water, unique report									
Diss. Metals in Water by ICPMS (Low)									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		27-NOV-12	R2485185
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Arsenic (As)-Dissolved	0.00346	+/-0.00024		0.00040	mg/L	0		27-NOV-12	R2485185
Barium (Ba)-Dissolved	0.220	+/-0.021		0.00010	mg/L	0		27-NOV-12	R2485185
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2485185
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Boron (B)-Dissolved	0.0538	+/-0.0054		0.0020	mg/L	0		27-NOV-12	R2485185
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Cobalt (Co)-Dissolved	0.00100	+/-0.00007		0.00010	mg/L	0		27-NOV-12	R2485185
Copper (Cu)-Dissolved	0.00078	+/-0.00008		0.00060	mg/L	0		27-NOV-12	R2485185
Lead (Pb)-Dissolved	0.00230	+/-0.00027		0.00010	mg/L	0		27-NOV-12	R2485185
Molybdenum (Mo)-Dissolved	0.00458	+/-0.00033		0.00010	mg/L	0		27-NOV-12	R2485185
Nickel (Ni)-Dissolved	0.00250	+/-0.00015		0.00010	mg/L	0		27-NOV-12	R2485185
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		27-NOV-12	R2485185
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Strontium (Sr)-Dissolved	0.411	+/-0.028		0.00010	mg/L	0		27-NOV-12	R2485185
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2485185
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		27-NOV-12	R2485185
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		27-NOV-12	R2485185
Uranium (U)-Dissolved	0.00049	+/-0.00005		0.00010	mg/L	0		27-NOV-12	R2485185
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485185
Zinc (Zn)-Dissolved	0.0152	+/-0.0021		0.0010	mg/L	0		27-NOV-12	R2485185
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		26-NOV-12	R2485002
Miscellaneous Parameters									
Ammonia, Total (as N)	0.288	-		0.050	mg/L	-		23-NOV-12	R2482148
Dissolved Organic Carbon	7.5	+/-1.0		1.0	mg/L	0		23-NOV-12	R2482405
MF - Fecal Coliforms	See Attached	-				-		23-NOV-12	
Naphthenic Acids	<1.0	-		1.0	mg/L	-	26-NOV-12	26-NOV-12	R2485183
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		23-NOV-12	R2483086
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Naphthalene	<0.000050	-		0.000050	mg/L	-	26-NOV-12	27-NOV-12	R2485358

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240064-4 16054121119104 Sampled By: GK/EA on 19-NOV-12 @ 18:50 Matrix: WATER									
PAH & Carcinogenic PAH List									
Phenanthrene	<0.000050	-		0.000050	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Pyrene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	26-NOV-12	27-NOV-12	R2485358
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	26-NOV-12	27-NOV-12	R2485358
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Surr: Nitrobenzene d5	86.9	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	89.4	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Surr: p-Terphenyl d14	129.9	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	25.7	+/-0.82		0.50	mg/L	0		21-NOV-12	R2482822
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	99.7	+/-15		0.50	mg/L	0		25-NOV-12	R2482902
Iron (Fe)-Dissolved	0.330	+/-0.057		0.030	mg/L	0		25-NOV-12	R2482902
Magnesium (Mg)-Dissolved	19.1	+/-3.4		0.10	mg/L	0		25-NOV-12	R2482902
Manganese (Mn)-Dissolved	1.20	+/-0.18		0.0050	mg/L	0		25-NOV-12	R2482902
Potassium (K)-Dissolved	2.38	+/-0.45		0.50	mg/L	0		25-NOV-12	R2482902
Sodium (Na)-Dissolved	4.0	+/-0.7		1.0	mg/L	0		25-NOV-12	R2482902
Ion Balance Calculation									
Ion Balance	96.5	-			%	-		26-NOV-12	
TDS (Calculated)	343	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	328	-			mg/L	-		26-NOV-12	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		26-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Sulfate by IC									
Sulfate (SO4)	5.50	+/-0.27		0.50	mg/L	0		21-NOV-12	R2482822
pH, Conductivity and Total Alkalinity									
pH	7.59	+/-0.04		0.10	pH	0		21-NOV-12	R2479303
Conductivity (EC)	645	+/-22		0.20	uS/cm	0		21-NOV-12	R2479303
Bicarbonate (HCO3)	379	-		5.0	mg/L	-		21-NOV-12	R2479303
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		21-NOV-12	R2479303
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		21-NOV-12	R2479303
Alkalinity, Total (as CaCO3)	311	+/-12		5.0	mg/L	0		21-NOV-12	R2479303
L1240064-5 16054121119105 Sampled By: GK/EA on 19-NOV-12 @ 19:30 Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Toluene	0.00051	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240064-5 16054121119105									
Sampled By: GK/EA on 19-NOV-12 @ 19:30									
Matrix: WATER									
BTEX, Styrene and F1 (C6-C10)									
EthylBenzene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
o-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Styrene	<0.0010	-		0.0010	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1(C6-C10)	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F1-BTEX	<0.10	-		0.10	mg/L	-	21-NOV-12	22-NOV-12	R2477531
Xylenes	<0.00071	-		0.00071	mg/L	-	21-NOV-12	22-NOV-12	R2477531
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	22-NOV-12	22-NOV-12	R2482442
Diss Metals + Hg in water, unique report									
Diss. Metals in Water by ICPMS (Low)									
Aluminum (Al)-Dissolved	<0.010	-		0.010	mg/L	-		28-NOV-12	R2486183
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		28-NOV-12	R2486183
Arsenic (As)-Dissolved	0.00382	+/-0.00026		0.00040	mg/L	0		28-NOV-12	R2486183
Barium (Ba)-Dissolved	0.0940	+/-0.0089		0.00010	mg/L	0		28-NOV-12	R2486183
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		28-NOV-12	R2486183
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		28-NOV-12	R2486183
Boron (B)-Dissolved	0.340	+/-0.034		0.0020	mg/L	0		28-NOV-12	R2486183
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		28-NOV-12	R2486183
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		28-NOV-12	R2486183
Cobalt (Co)-Dissolved	0.00028	+/-0.00002		0.00010	mg/L	0		28-NOV-12	R2486183
Copper (Cu)-Dissolved	0.00195	+/-0.00016		0.00060	mg/L	0		28-NOV-12	R2486183
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	0		28-NOV-12	R2486183
Molybdenum (Mo)-Dissolved	0.00758	+/-0.00054		0.00010	mg/L	0		28-NOV-12	R2486183
Nickel (Ni)-Dissolved	0.00252	+/-0.00015		0.00010	mg/L	0		28-NOV-12	R2486183
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		28-NOV-12	R2486183
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		28-NOV-12	R2486183
Strontium (Sr)-Dissolved	0.582	+/-0.040		0.00010	mg/L	0		28-NOV-12	R2486183
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		28-NOV-12	R2486183
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		28-NOV-12	R2486183
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		28-NOV-12	R2486183
Uranium (U)-Dissolved	0.00014	+/-0.00002		0.00010	mg/L	0		28-NOV-12	R2486183
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		28-NOV-12	R2486183
Zinc (Zn)-Dissolved	0.0103	+/-0.0015		0.0010	mg/L	0		28-NOV-12	R2486183
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2485722
Miscellaneous Parameters									
Ammonia, Total (as N)	1.79	-		0.050	mg/L	-		23-NOV-12	R2482148
Dissolved Organic Carbon	7.9	+/-1.0		1.0	mg/L	0		26-NOV-12	R2484543
Naphthenic Acids	<1.0	-		1.0	mg/L	-	26-NOV-12	26-NOV-12	R2485183
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		23-NOV-12	R2483086
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Anthracene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Fluoranthene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Fluorene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Naphthalene	<0.000050	-		0.000050	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Phenanthrene	<0.000050	-		0.000050	mg/L	-	26-NOV-12	27-NOV-12	R2485358

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240064-5 16054121119105									
Sampled By: GK/EA on 19-NOV-12 @ 19:30									
Matrix: WATER									
PAH & Carcinogenic PAH List									
Pyrene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Chrysene	<0.000020	-		0.000020	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	26-NOV-12	27-NOV-12	R2485358
Surr: Nitrobenzene d5	92.8	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Surr: 2-Fluorobiphenyl	95.1	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Surr: p-Terphenyl d14	115.4	-		N/A	%	-	26-NOV-12	27-NOV-12	R2485358
Routine Water: major ions, Fe & Mn									
Chloride by IC									
Chloride (Cl)	6.75	+/-0.23		0.50	mg/L	0		21-NOV-12	R2482822
Dissolved Metals in Water by ICPOES									
Calcium (Ca)-Dissolved	57.4	+/-8.6		0.50	mg/L	0		25-NOV-12	R2482902
Iron (Fe)-Dissolved	<0.030	-		0.030	mg/L	-		25-NOV-12	R2482902
Magnesium (Mg)-Dissolved	16.4	+/-2.9		0.10	mg/L	0		25-NOV-12	R2482902
Manganese (Mn)-Dissolved	0.0936	+/-0.014		0.0050	mg/L	0		25-NOV-12	R2482902
Potassium (K)-Dissolved	6.31	+/-1.1		0.50	mg/L	0		25-NOV-12	R2482902
Sodium (Na)-Dissolved	89.8	+/-15		1.0	mg/L	0		25-NOV-12	R2482902
Ion Balance Calculation									
Ion Balance	96.0	-			%	-		26-NOV-12	
TDS (Calculated)	448	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	211	-			mg/L	-		26-NOV-12	
Nitrate as N by IC									
Nitrate (as N)	0.318	+/-0.024		0.050	mg/L	0		21-NOV-12	R2482822
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.318	-		0.071	mg/L	-		26-NOV-12	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		21-NOV-12	R2482822
Sulfate by IC									
Sulfate (SO4)	36.6	+/-1.6		0.50	mg/L	0		21-NOV-12	R2482822
pH, Conductivity and Total Alkalinity									
pH	7.97	+/-0.04		0.10	pH	0		21-NOV-12	R2479303
Conductivity (EC)	779	+/-26		0.20	uS/cm	0		21-NOV-12	R2479303
Bicarbonate (HCO3)	475	-		5.0	mg/L	-		21-NOV-12	R2479303
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		21-NOV-12	R2479303
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		21-NOV-12	R2479303
Alkalinity, Total (as CaCO3)	389	+/-14		5.0	mg/L	0		21-NOV-12	R2479303

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Sulfate (SO4)	MS-B	
Matrix Spike	Dissolved Organic Carbon	MS-B	

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)	EPA 5021	EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
FCC-MF-PB	Water	Fecal Coliform Count-MF		APHA 9222D MF
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-ICP-ED	Water	Dissolved Metals in Water by ICPOES		APHA 3120 B-ICP-OES
MET-D-L-MS-ED	Water	Diss. Metals in Water by ICPMS (Low)		SW 846 - 6020-ICPMS
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994

Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.

NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
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This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.

NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
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This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.

SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
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** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference 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
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA
PB	PBR LABORATORIES

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

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.



Environmental

Quality Control Report

Workorder: L1240064

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED		Water						
Batch	R2477531							
WG1589956-4	DUP	L1240064-3						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	22-NOV-12
Toluene		0.00092	0.00090		mg/L	2.0	30	22-NOV-12
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	22-NOV-12
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	22-NOV-12
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	22-NOV-12
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	22-NOV-12
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	22-NOV-12
WG1589956-2	LCS							
Benzene			96.0		%		70-130	22-NOV-12
Toluene			79.3		%		70-130	22-NOV-12
EthylBenzene			70.2		%		70-130	22-NOV-12
o-Xylene			71.7		%		70-130	22-NOV-12
m+p-Xylene			72.9		%		70-130	22-NOV-12
Styrene			78.9		%		70-130	22-NOV-12
WG1589956-3	LCS							
F1(C6-C10)			84.2		%		70-130	22-NOV-12
WG1589956-1	MB							
Benzene			<0.00050		mg/L		0.0005	22-NOV-12
Toluene			<0.00050		mg/L		0.0005	22-NOV-12
EthylBenzene			<0.00050		mg/L		0.0005	22-NOV-12
o-Xylene			<0.00050		mg/L		0.0005	22-NOV-12
m+p-Xylene			<0.00050		mg/L		0.0005	22-NOV-12
Styrene			<0.0010		mg/L		0.001	22-NOV-12
F1(C6-C10)			<0.10		mg/L		0.1	22-NOV-12
WG1589956-5	MS	L1240064-3						
Benzene			98.7		%		50-150	22-NOV-12
Toluene			83.2		%		50-150	22-NOV-12
EthylBenzene			72.6		%		50-150	22-NOV-12
o-Xylene			73.9		%		50-150	22-NOV-12
m+p-Xylene			76.7		%		50-150	22-NOV-12
Styrene			83.7		%		50-150	22-NOV-12
WG1589956-6	MS	L1240064-3						
F1(C6-C10)			94.8		%		50-150	22-NOV-12
C-DIS-ORG-ED	Water							



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-ED		Water						
Batch	R2482405							
WG1591210-3	CVS							
Dissolved Organic Carbon			105.4		%		80-160	23-NOV-12
WG1591210-2	LCS							
Dissolved Organic Carbon			94.5		%		80-120	23-NOV-12
WG1591210-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	23-NOV-12
Batch	R2484543							
WG1592231-3	CVS							
Dissolved Organic Carbon			104.9		%		80-160	26-NOV-12
WG1592231-4	DUP	L1235547-16						
Dissolved Organic Carbon		22.9	22.4		mg/L	2.4	20	26-NOV-12
WG1592231-8	DUP	L1240454-19						
Dissolved Organic Carbon		4.2	4.1		mg/L	3.0	20	26-NOV-12
WG1592231-2	LCS							
Dissolved Organic Carbon			94.2		%		80-120	26-NOV-12
WG1592231-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	26-NOV-12
WG1592231-5	MS	L1235547-16						
Dissolved Organic Carbon			N/A	MS-B	%		-	26-NOV-12
WG1592231-9	MS	L1240454-19						
Dissolved Organic Carbon			91.2		%		70-130	26-NOV-12
CL-IC-ED		Water						
Batch	R2482822							
WG1589577-3	DUP	L1239756-3						
Chloride (Cl)		34.9	34.9		mg/L	0.2	20	21-NOV-12
WG1589577-7	DUP	L1239587-1						
Chloride (Cl)		0.68	0.68		mg/L	1.2	20	21-NOV-12
WG1589577-2	LCS							
Chloride (Cl)			99.4		%		85-115	21-NOV-12
WG1589577-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	21-NOV-12
WG1589577-4	MS	L1239756-3						
Chloride (Cl)			94.2		%		75-125	21-NOV-12
WG1589577-8	MS	L1239587-1						
Chloride (Cl)			105.7		%		75-125	21-NOV-12
F2,F3,F4-ED		Water						



Environmental

Quality Control Report

Workorder: L1240064

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed	
F2,F3,F4-ED		Water							
Batch	R2482442								
WG1591228-2	LCS								
F2 (>C10-C16)			97.1		%		65-135	22-NOV-12	
F3 (C16-C34)			98.0		%		65-135	22-NOV-12	
F4 (C34-C50)			94.7		%		65-135	22-NOV-12	
WG1591228-1	MB								
F2 (>C10-C16)			<0.25		mg/L		0.25	22-NOV-12	
F3 (C16-C34)			<0.25		mg/L		0.25	22-NOV-12	
F4 (C34-C50)			<0.25		mg/L		0.25	22-NOV-12	
WG1591228-3	MS	L1239855-3							
F2 (>C10-C16)			97.4		%		50-150	22-NOV-12	
F3 (C16-C34)			100.0		%		50-150	22-NOV-12	
F4 (C34-C50)			96.6		%		50-150	22-NOV-12	
HG-D-CVAA-ED		Water							
Batch	R2485002								
WG1592063-12	DUP	L1239950-12							
Mercury (Hg)-Dissolved			<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-6	DUP	L1238851-11							
Mercury (Hg)-Dissolved			<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-8	DUP	L1238851-33							
Mercury (Hg)-Dissolved			<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-NOV-12
WG1592063-2	LCS								
Mercury (Hg)-Dissolved			93.7		%		80-120	26-NOV-12	
WG1592063-3	LCSD	WG1592063-2							
Mercury (Hg)-Dissolved			93.7	95.0	%	1.4	20	26-NOV-12	
WG1592063-1	MB								
Mercury (Hg)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12	
WG1592063-11	MS	L1238851-11							
Mercury (Hg)-Dissolved			111.8		%		70-130	26-NOV-12	
WG1592063-13	MS	L1239950-12							
Mercury (Hg)-Dissolved			115.0		%		70-130	26-NOV-12	
WG1592063-7	MS	L1238851-11							
Mercury (Hg)-Dissolved			115.2		%		70-130	26-NOV-12	
WG1592063-9	MS	L1238851-33							
Mercury (Hg)-Dissolved			108.6		%		70-130	26-NOV-12	



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-CVAA-ED		Water						
Batch	R2485722							
WG1592711-7	DUP	L1236640-13						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
WG1592711-9	DUP	L1240454-8						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
WG1592711-5	LCS							
Mercury (Hg)-Dissolved			88.0		%		80-120	27-NOV-12
WG1592711-6	LCSD	WG1592711-5						
Mercury (Hg)-Dissolved		88.0	86.3		%	2.0	20	27-NOV-12
Mercury (Hg)-Dissolved		88.0	86.3		%	2.0	20	27-NOV-12
WG1592711-4	MB							
Mercury (Hg)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12
WG1592711-10	MS	L1240454-8						
Mercury (Hg)-Dissolved			94.3		%		70-130	27-NOV-12
WG1592711-8	MS	L1236640-13						
Mercury (Hg)-Dissolved			89.2		%		70-130	27-NOV-12
MET-D-ICP-ED		Water						
Batch	R2482902							
WG1590969-2	CRM	EU-H-4_OPTWATER						
Calcium (Ca)-Dissolved			93.8		%		80-120	23-NOV-12
Iron (Fe)-Dissolved			94.9		%		80-120	23-NOV-12
Magnesium (Mg)-Dissolved			93.4		%		80-120	23-NOV-12
Manganese (Mn)-Dissolved			96.0		%		80-120	23-NOV-12
Potassium (K)-Dissolved			90.9		%		80-120	23-NOV-12
Sodium (Na)-Dissolved			99.0		%		80-120	23-NOV-12
WG1590969-3	DUP	L1236640-17						
Calcium (Ca)-Dissolved		119	120		mg/L	0.6	20	25-NOV-12
Iron (Fe)-Dissolved		5.68	5.80		mg/L	2.0	20	25-NOV-12
Magnesium (Mg)-Dissolved		42.9	43.9		mg/L	2.2	20	25-NOV-12
Manganese (Mn)-Dissolved		0.178	0.181		mg/L	1.7	20	25-NOV-12
Potassium (K)-Dissolved		5.94	5.74		mg/L	3.3	20	25-NOV-12
Sodium (Na)-Dissolved		41.8	42.2		mg/L	0.8	20	25-NOV-12
WG1590969-4	DUP	L1239084-5						
Calcium (Ca)-Dissolved		53.1	49.8		mg/L	6.3	20	25-NOV-12
Iron (Fe)-Dissolved		0.341	0.314		mg/L	8.5	20	25-NOV-12
Magnesium (Mg)-Dissolved		10.8	9.98		mg/L	7.5	20	25-NOV-12
Manganese (Mn)-Dissolved		0.150	0.140		mg/L	7.0	20	25-NOV-12



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-ICP-ED		Water						
Batch	R2482902							
WG1590969-4	DUP	L1239084-5						
Potassium (K)-Dissolved		1.28	1.14		mg/L	12	20	25-NOV-12
Sodium (Na)-Dissolved		19.9	18.4		mg/L	7.8	20	25-NOV-12
WG1590969-5	DUP	L1239950-8						
Calcium (Ca)-Dissolved		65.9	68.8		mg/L	4.3	20	25-NOV-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	25-NOV-12
Magnesium (Mg)-Dissolved		28.6	29.0		mg/L	1.5	20	25-NOV-12
Manganese (Mn)-Dissolved		0.0920	0.0934		mg/L	1.5	20	25-NOV-12
Potassium (K)-Dissolved		3.01	3.12		mg/L	3.6	20	25-NOV-12
Sodium (Na)-Dissolved		317	330		mg/L	4.2	20	25-NOV-12
WG1590969-6	DUP	L1240064-2						
Calcium (Ca)-Dissolved		65.2	63.9		mg/L	2.1	20	25-NOV-12
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	25-NOV-12
Magnesium (Mg)-Dissolved		17.3	17.2		mg/L	0.6	20	25-NOV-12
Manganese (Mn)-Dissolved		0.166	0.164		mg/L	0.8	20	25-NOV-12
Potassium (K)-Dissolved		4.09	4.07		mg/L	0.5	20	25-NOV-12
Sodium (Na)-Dissolved		46.8	44.4		mg/L	5.5	20	25-NOV-12
WG1590969-1	MB	L1240064-2						
Calcium (Ca)-Dissolved			<0.50		mg/L		0.5	23-NOV-12
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	23-NOV-12
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	23-NOV-12
Manganese (Mn)-Dissolved			<0.0050		mg/L		0.005	23-NOV-12
Potassium (K)-Dissolved			<0.50		mg/L		0.5	23-NOV-12
Sodium (Na)-Dissolved			<1.0		mg/L		1	23-NOV-12
MET-D-L-MS-ED		Water						
Batch	R2485185							
WG1592081-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			99.5		%		80-120	26-NOV-12
Antimony (Sb)-Dissolved			96.8		%		80-120	26-NOV-12
Arsenic (As)-Dissolved			100.9		%		80-120	26-NOV-12
Barium (Ba)-Dissolved			107.1		%		80-120	26-NOV-12
Beryllium (Be)-Dissolved			99.9		%		80-120	26-NOV-12
Bismuth (Bi)-Dissolved			101.0		%		80-120	26-NOV-12
Boron (B)-Dissolved			94.6		%		80-120	26-NOV-12
Cadmium (Cd)-Dissolved			108.0		%		80-120	26-NOV-12



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-MS-ED		Water						
Batch	R2485185							
WG1592081-2 CRM	ED-HIGH-WATRM							
Chromium (Cr)-Dissolved			98.0		%		80-120	26-NOV-12
Cobalt (Co)-Dissolved			100.2		%		80-120	26-NOV-12
Copper (Cu)-Dissolved			97.3		%		80-120	26-NOV-12
Lead (Pb)-Dissolved			104.6		%		80-120	26-NOV-12
Molybdenum (Mo)-Dissolved			100.1		%		80-120	26-NOV-12
Nickel (Ni)-Dissolved			101.2		%		80-120	26-NOV-12
Selenium (Se)-Dissolved			103.0		%		80-120	26-NOV-12
Silver (Ag)-Dissolved			94.8		%		80-120	26-NOV-12
Strontium (Sr)-Dissolved			103.2		%		80-120	26-NOV-12
Thallium (Tl)-Dissolved			104.5		%		80-120	26-NOV-12
Tin (Sn)-Dissolved			101.7		%		80-120	26-NOV-12
Titanium (Ti)-Dissolved			101.6		%		80-120	26-NOV-12
Uranium (U)-Dissolved			108.8		%		80-120	26-NOV-12
Vanadium (V)-Dissolved			102.1		%		80-120	26-NOV-12
Zinc (Zn)-Dissolved			103.4		%		80-120	26-NOV-12
WG1592081-6 DUP		L1238968-1						
Aluminum (Al)-Dissolved		<0.010	<0.0050	RPD-NA	mg/L	N/A	20	27-NOV-12
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	27-NOV-12
Arsenic (As)-Dissolved		0.00620	0.00625		mg/L	0.8	20	27-NOV-12
Barium (Ba)-Dissolved		0.0552	0.0569		mg/L	2.9	20	27-NOV-12
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Boron (B)-Dissolved		0.574	0.532		mg/L	7.5	20	27-NOV-12
Cadmium (Cd)-Dissolved		<0.00010	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	27-NOV-12
Cobalt (Co)-Dissolved		0.00090	0.00087		mg/L	3.4	20	27-NOV-12
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	27-NOV-12
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Molybdenum (Mo)-Dissolved		0.0291	0.0279		mg/L	3.9	20	27-NOV-12
Nickel (Ni)-Dissolved		0.00404	0.00410		mg/L	1.6	20	27-NOV-12
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	27-NOV-12
Silver (Ag)-Dissolved		<0.00020	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Strontium (Sr)-Dissolved		0.605	0.569		mg/L	6.0	20	27-NOV-12



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-MS-ED								
	Water							
Batch	R2485185							
WG1592081-6	DUP	L1238968-1						
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	27-NOV-12
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	27-NOV-12
Uranium (U)-Dissolved		0.00207	0.00183		mg/L	12	20	27-NOV-12
Vanadium (V)-Dissolved		0.00089	0.00084		mg/L	6.4	20	27-NOV-12
Zinc (Zn)-Dissolved		0.0045	0.0045		mg/L	0.0	20	27-NOV-12
WG1592081-1	MB							
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	26-NOV-12
Antimony (Sb)-Dissolved			<0.00040		mg/L		0.0004	26-NOV-12
Arsenic (As)-Dissolved			<0.00040		mg/L		0.0004	26-NOV-12
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	26-NOV-12
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Boron (B)-Dissolved			<0.0020		mg/L		0.002	26-NOV-12
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Chromium (Cr)-Dissolved			<0.00040		mg/L		0.0004	26-NOV-12
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Copper (Cu)-Dissolved			<0.00060		mg/L		0.0006	26-NOV-12
Lead (Pb)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Molybdenum (Mo)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Selenium (Se)-Dissolved			<0.00040		mg/L		0.0004	26-NOV-12
Silver (Ag)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	26-NOV-12
Tin (Sn)-Dissolved			<0.00020		mg/L		0.0002	26-NOV-12
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	26-NOV-12
Uranium (U)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	26-NOV-12
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	26-NOV-12
Batch	R2486183							
WG1592721-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			101.7		%		80-120	27-NOV-12
Antimony (Sb)-Dissolved			103.1		%		80-120	27-NOV-12
Arsenic (As)-Dissolved			101.5		%		80-120	27-NOV-12



Quality Control Report

Workorder: L1240064

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-MS-ED		Water						
Batch	R2486183							
WG1592721-2 CRM	ED-HIGH-WATRM							
Barium (Ba)-Dissolved			100.6		%		80-120	27-NOV-12
Beryllium (Be)-Dissolved			103.4		%		80-120	27-NOV-12
Bismuth (Bi)-Dissolved			98.7		%		80-120	27-NOV-12
Boron (B)-Dissolved			100.5		%		80-120	27-NOV-12
Cadmium (Cd)-Dissolved			106.3		%		80-120	27-NOV-12
Chromium (Cr)-Dissolved			103.1		%		80-120	27-NOV-12
Cobalt (Co)-Dissolved			101.4		%		80-120	27-NOV-12
Copper (Cu)-Dissolved			101.4		%		80-120	27-NOV-12
Lead (Pb)-Dissolved			104.2		%		80-120	27-NOV-12
Molybdenum (Mo)-Dissolved			102.4		%		80-120	27-NOV-12
Nickel (Ni)-Dissolved			105.3		%		80-120	27-NOV-12
Selenium (Se)-Dissolved			113.3		%		80-120	27-NOV-12
Silver (Ag)-Dissolved			93.2		%		80-120	27-NOV-12
Strontium (Sr)-Dissolved			104.9		%		80-120	27-NOV-12
Thallium (Tl)-Dissolved			106.0		%		80-120	27-NOV-12
Tin (Sn)-Dissolved			101.1		%		80-120	27-NOV-12
Titanium (Ti)-Dissolved			98.8		%		80-120	27-NOV-12
Uranium (U)-Dissolved			101.4		%		80-120	27-NOV-12
Vanadium (V)-Dissolved			103.6		%		80-120	27-NOV-12
Zinc (Zn)-Dissolved			105.1		%		80-120	27-NOV-12
WG1592721-1 MB								
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	27-NOV-12
Antimony (Sb)-Dissolved			<0.00040		mg/L		0.0004	27-NOV-12
Arsenic (As)-Dissolved			<0.00040		mg/L		0.0004	27-NOV-12
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	27-NOV-12
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	27-NOV-12
Boron (B)-Dissolved			<0.0020		mg/L		0.002	27-NOV-12
Cadmium (Cd)-Dissolved			<0.000050		mg/L		0.00005	27-NOV-12
Chromium (Cr)-Dissolved			<0.00040		mg/L		0.0004	27-NOV-12
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12
Copper (Cu)-Dissolved			<0.00060		mg/L		0.0006	27-NOV-12
Lead (Pb)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12
Molybdenum (Mo)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12



Quality Control Report

Workorder: L1240064

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-L-MS-ED		Water						
Batch	R2486183							
WG1592721-1 MB								
Selenium (Se)-Dissolved			<0.00040		mg/L		0.0004	27-NOV-12
Silver (Ag)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	27-NOV-12
Tin (Sn)-Dissolved			<0.00020		mg/L		0.0002	27-NOV-12
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	27-NOV-12
Uranium (U)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	27-NOV-12
NAPHTHENIC-ACID-FM		Water						
Batch	R2485183							
WG1592031-3 DUP		L1238118-2						
Naphthenic Acids		39.0	35.6		mg/L	9.0	30	26-NOV-12
WG1592031-4 LCS								
Naphthenic Acids			110.6		%		70-130	26-NOV-12
WG1592031-1 MB								
Naphthenic Acids			<1.0		mg/L		1	26-NOV-12
WG1592031-2 MS		L1238118-1						
Naphthenic Acids			90.0		%		50-150	26-NOV-12
NH3-CFA-ED		Water						
Batch	R2482148							
WG1590889-10 DUP		L1241200-1						
Ammonia, Total (as N)		0.852	0.805		mg/L	5.6	20	23-NOV-12
WG1590889-11 DUP		L1240064-5						
Ammonia, Total (as N)		1.79	1.76		mg/L	1.2	20	23-NOV-12
WG1590889-9 DUP		L1240454-15						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	23-NOV-12
WG1590889-2 LCS								
Ammonia, Total (as N)			101.7		%		85-115	23-NOV-12
WG1590889-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	23-NOV-12
WG1590889-7 MS		L1237205-3						
Ammonia, Total (as N)			101.0		%		75-125	23-NOV-12
WG1590889-8 MS		L1240446-2						
Ammonia, Total (as N)			96.5		%		75-125	23-NOV-12
NO2-IC-ED		Water						



Quality Control Report

Workorder: L1240064

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED		Water						
Batch	R2482822							
WG1589577-3	DUP	L1239756-3						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-7	DUP	L1239587-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-2	LCS							
Nitrite (as N)			97.4		%		85-115	21-NOV-12
WG1589577-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	21-NOV-12
WG1589577-4	MS	L1239756-3						
Nitrite (as N)			87.4		%		75-125	21-NOV-12
WG1589577-8	MS	L1239587-1						
Nitrite (as N)			99.1		%		75-125	21-NOV-12
NO3-IC-ED		Water						
Batch	R2482822							
WG1589577-3	DUP	L1239756-3						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-5	DUP	L1239950-18						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-7	DUP	L1239587-1						
Nitrate (as N)		0.756	0.777		mg/L	2.7	20	21-NOV-12
WG1589577-2	LCS							
Nitrate (as N)			99.5		%		85-115	21-NOV-12
WG1589577-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	21-NOV-12
WG1589577-4	MS	L1239756-3						
Nitrate (as N)			96.8		%		75-125	21-NOV-12
WG1589577-6	MS	L1239950-18						
Nitrate (as N)			97.9		%		75-125	21-NOV-12
WG1589577-8	MS	L1239587-1						
Nitrate (as N)			106.3		%		75-125	21-NOV-12
PAH-ABT1-ED		Water						
Batch	R2485358							
WG1591987-3	LCS							
Acenaphthene			83.2		%		60-130	27-NOV-12
Acenaphthylene			81.4		%		60-130	27-NOV-12
Anthracene			89.8		%		60-130	27-NOV-12
Fluoranthene			100.0		%		60-130	27-NOV-12



Quality Control Report

Workorder: L1240064

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED		Water						
Batch	R2485358							
WG1591987-3	LCS							
Fluorene			87.6		%		60-130	27-NOV-12
Naphthalene			69.0		%		50-130	27-NOV-12
Phenanthrene			93.3		%		60-130	27-NOV-12
Pyrene			101.5		%		60-130	27-NOV-12
Benzo(a)anthracene			118.2		%		60-130	27-NOV-12
Benzo(k)fluoranthene			119.1		%		60-130	27-NOV-12
Benzo(b&j)fluoranthene			120.2		%		60-130	27-NOV-12
Benzo(g,h,i)perylene			100.0		%		60-130	27-NOV-12
Benzo(a)pyrene			116.0		%		60-130	27-NOV-12
Chrysene			116.6		%		60-130	27-NOV-12
Dibenzo(a,h)anthracene			92.5		%		60-130	27-NOV-12
Indeno(1,2,3-cd)pyrene			108.7		%		60-130	27-NOV-12
WG1591987-2	MB							
Acenaphthene			<0.000020		mg/L		0.00002	27-NOV-12
Acenaphthylene			<0.000020		mg/L		0.00002	27-NOV-12
Anthracene			<0.000010		mg/L		0.00001	27-NOV-12
Fluoranthene			<0.000020		mg/L		0.00002	27-NOV-12
Fluorene			<0.000020		mg/L		0.00002	27-NOV-12
Naphthalene			<0.000050		mg/L		0.00005	27-NOV-12
Phenanthrene			<0.000050		mg/L		0.00005	27-NOV-12
Pyrene			<0.000020		mg/L		0.00002	27-NOV-12
Benzo(a)anthracene			<0.000010		mg/L		0.00001	27-NOV-12
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	27-NOV-12
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	27-NOV-12
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	27-NOV-12
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	27-NOV-12
Chrysene			<0.000020		mg/L		0.00002	27-NOV-12
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	27-NOV-12
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	27-NOV-12
Surrogate: Nitrobenzene d5			91.7		%		40-130	27-NOV-12
Surrogate: 2-Fluorobiphenyl			82.6		%		40-130	27-NOV-12
Surrogate: p-Terphenyl d14			120.6		%		40-130	27-NOV-12

PH/EC/ALK-ED **Water**



Quality Control Report

Workorder: L1240064

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2479303							
WG1589559-9	DUP	L1240064-1						
pH		8.12	8.12	J	pH	0.00	0.2	21-NOV-12
Conductivity (EC)		965	962		uS/cm	0.3	10	21-NOV-12
Bicarbonate (HCO3)		504	504		mg/L	0.0	25	21-NOV-12
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	21-NOV-12
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	21-NOV-12
Alkalinity, Total (as CaCO3)		413	413		mg/L	0.0	6.5	21-NOV-12
WG1589559-2	LCS							
Conductivity (EC)			99.8		%		90-110	21-NOV-12
WG1589559-3	LCS							
pH			7.04		pH		6.9-7.1	21-NOV-12
WG1589559-4	LCS							
Alkalinity, Total (as CaCO3)			101.4		%		85-115	21-NOV-12
WG1589559-5	LCS							
Conductivity (EC)			97.1		%		90-110	21-NOV-12
WG1589559-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	21-NOV-12
Carbonate (CO3)			<5.0		mg/L		5	21-NOV-12
Hydroxide (OH)			<5.0		mg/L		5	21-NOV-12
Alkalinity, Total (as CaCO3)			<5.0		mg/L		5	21-NOV-12
PHENOLS-4AAP-ED		Water						
Batch	R2483086							
WG1591458-4	DUP	L1236640-10						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	23-NOV-12
WG1591458-5	DUP	L1236640-18						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	23-NOV-12
WG1591458-6	DUP	L1240064-5						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	23-NOV-12
WG1591458-3	LCS							
Phenols (4AAP)			93.2		%		85-115	23-NOV-12
WG1591458-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	23-NOV-12
SO4-IC-ED		Water						
Batch	R2482822							
WG1589577-3	DUP	L1239756-3						
Sulfate (SO4)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	21-NOV-12
WG1589577-7	DUP	L1239587-1						



Quality Control Report

Workorder: L1240064

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-ED		Water						
Batch	R2482822							
WG1589577-7	DUP	L1239587-1						
Sulfate (SO4)		150	150		mg/L	0.2	20	21-NOV-12
WG1589577-2	LCS							
Sulfate (SO4)			100.2		%		85-115	21-NOV-12
WG1589577-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	21-NOV-12
WG1589577-4	MS	L1239756-3						
Sulfate (SO4)			103.2		%		75-125	21-NOV-12
WG1589577-8	MS	L1239587-1						
Sulfate (SO4)			N/A	MS-B	%		-	21-NOV-12

Quality Control Report

Workorder: L1240064

Report Date: 29-NOV-12

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

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.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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.



ALS 121123-17 (12-FEW)

CONFIDENTIAL ANALYSIS REPORT

REPORT #: 121123-17

WO #: 12-FEW

PO #: L1240064

CLIENT: ALS Laboratory Group - Edmonton
9936-67 Avenue
Edmonton, AB
T6E 0P5

ATTENTION: ALS-ED Reporting
Tel: (780) 413-5227
Fax: (780) 437-2311

SAMPLE DESCRIPTION: Water Samples

DATE AND TIME OF SAMPLE COLLECTION: November 19, 2012

DATE AND TIME OF SAMPLE RECEIPT: November 21, 2012/13:50

SAMPLE TEMPERATURE WHEN RECEIVED: 12.8° Celsius

TEST PERFORMED: Fecal Coliform by MF

TEST START DATE: November 21, 2012/14:20

DATE COMPLETED: November 23, 2012

CERTIFICATE OF ANALYSIS: See Page 2

QUALITY CONTROL DATA: See Attached Appendix 1

The report shall not be reproduced, except in full, without the written authority of PBR Laboratories Inc.

Certificate of Analysis

PBR ID	Sample #	Client ID	Lot #	Test	Protocol	Quantity Analyzed	*DF	Result	Units	Note
12-FEW-01	L1240064-1	16054121119101		Fecal Coliform by MF	APHA-9222D	100 ml		<1	CFU/100ml	1
12-FEW-02	L1240064-4	16054121119104		Fecal Coliform by MF	APHA-9222D	100 ml		<1	CFU/100ml	1

*DF - Dilution Factor used for analysis

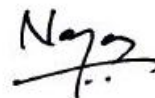
Notes

- 1 CFU = Colony Forming Unit.
- <1 = No counts were detected based on the volume/dilution analyzed.

The reported results apply only to the items tested.



Rose Rosairo (Analyst)
Date: Nov 23 2012



Approved By: Narayan Pokharel, Ph.D.
Date: Nov 23 2012



PIBR
Laboratories Inc.

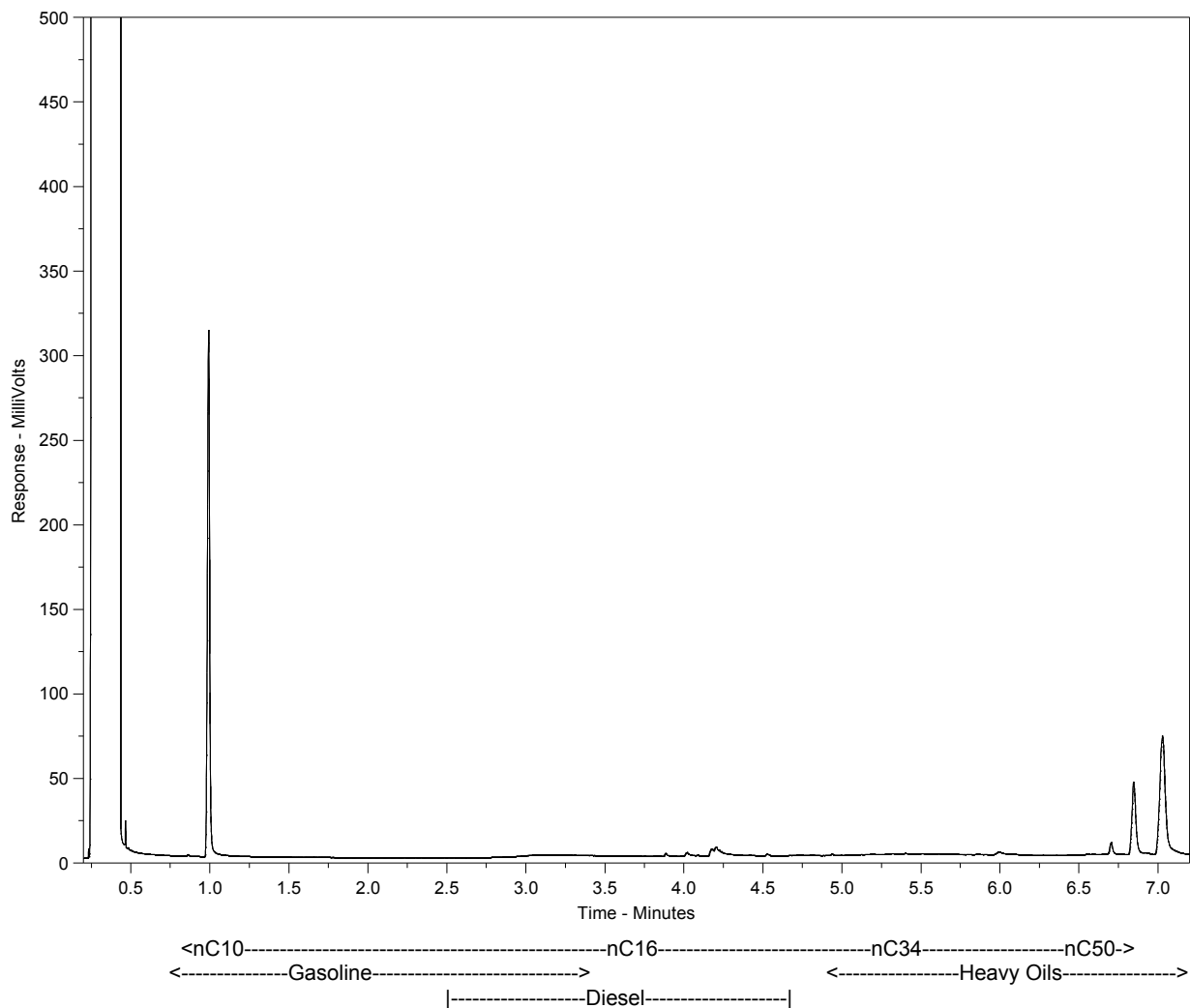
ALS 121123-17 (12-FEW)

APPENDIX 1

Quality Control Data for Fecal Coliform by MF (APHA-9222D)

Controls	Organism/Medium	Result
Sterility (media)	m-FC	Pass
Negative	Staphylococcus aureus	Pass
Positive	Escherichia coli	Pass

ALS Sample ID: L1240064-1
Client ID: 16054121119101

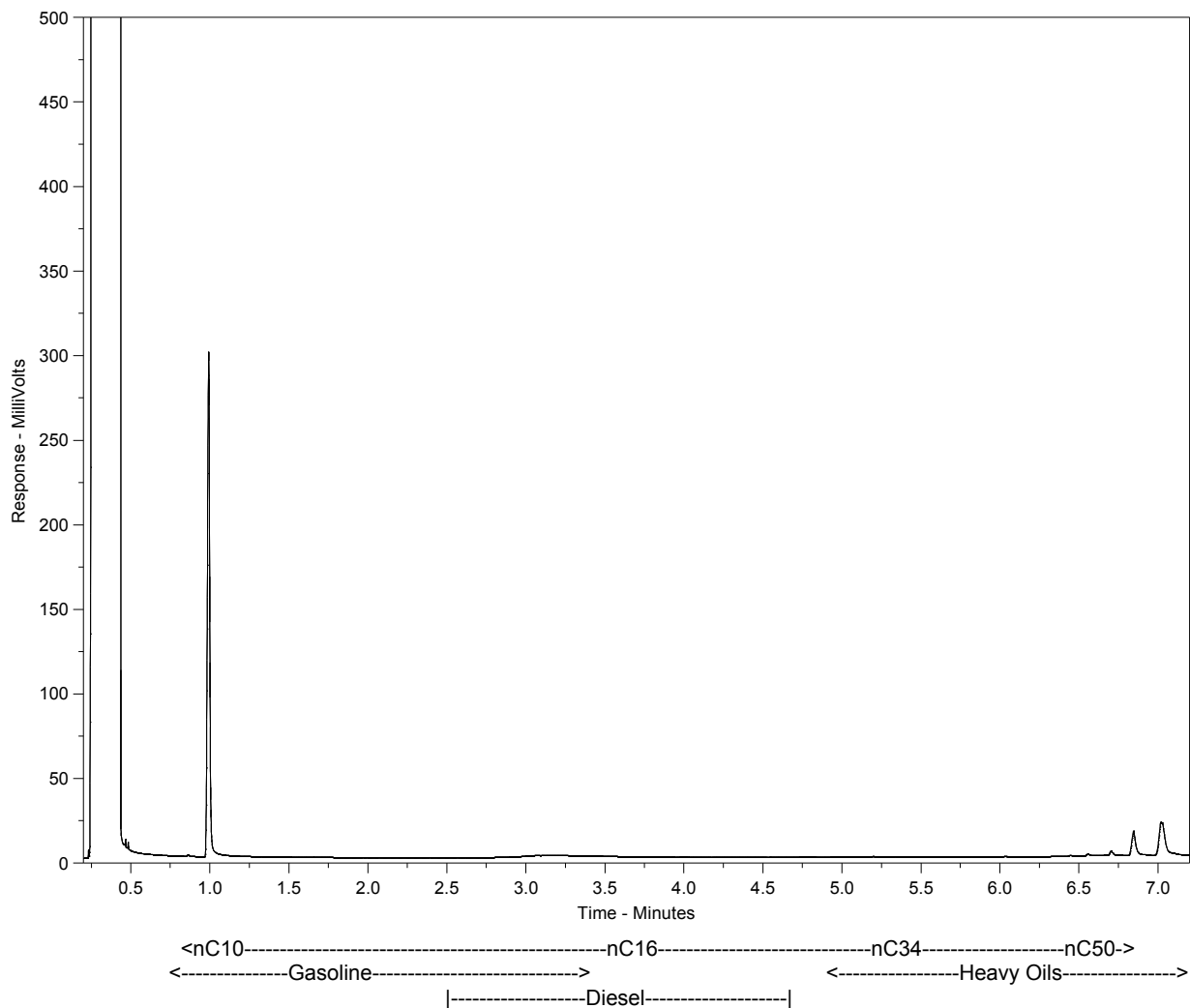


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1240064-2
Client ID: 16054121119102

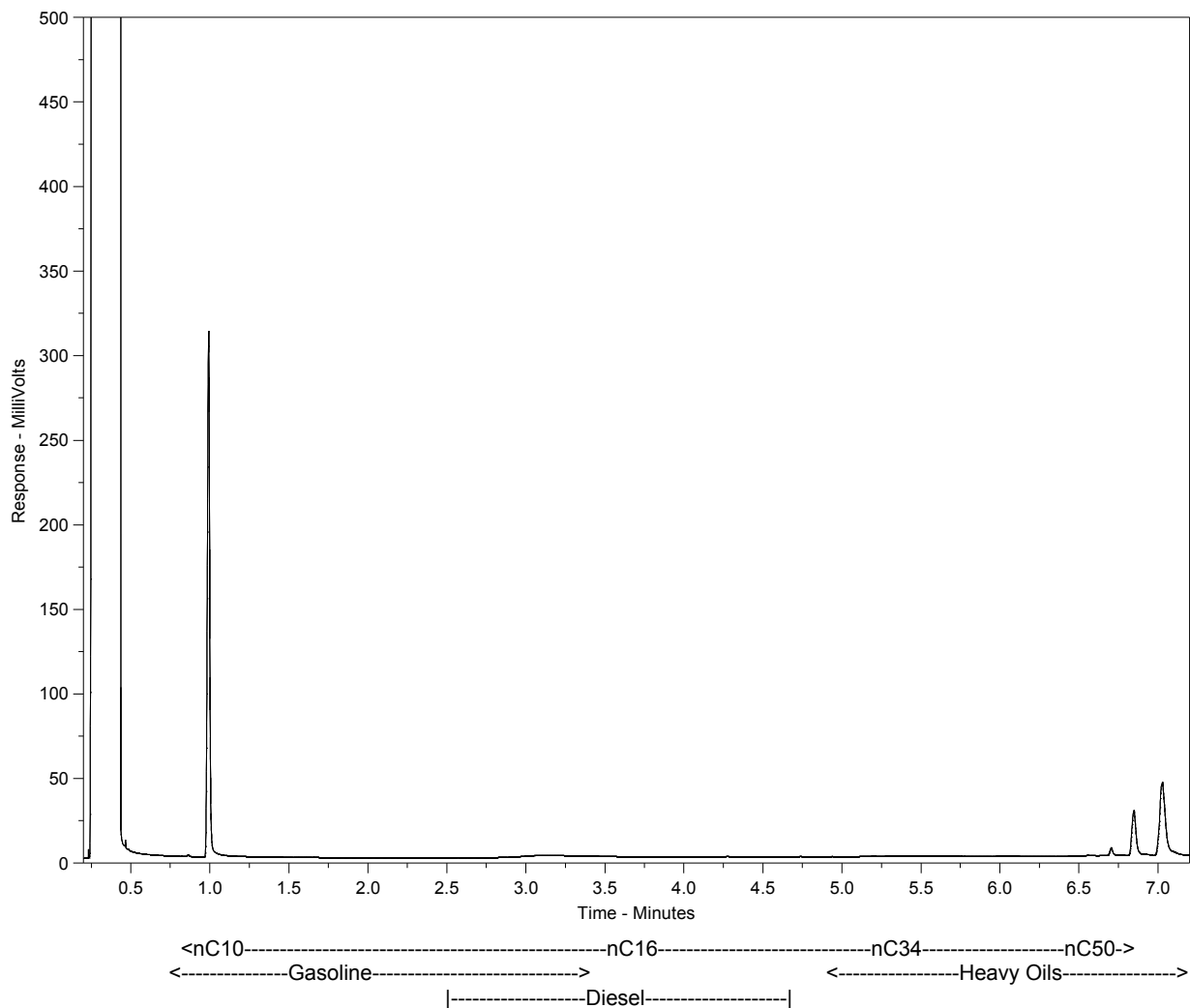


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1240064-3
Client ID: 16054121119103

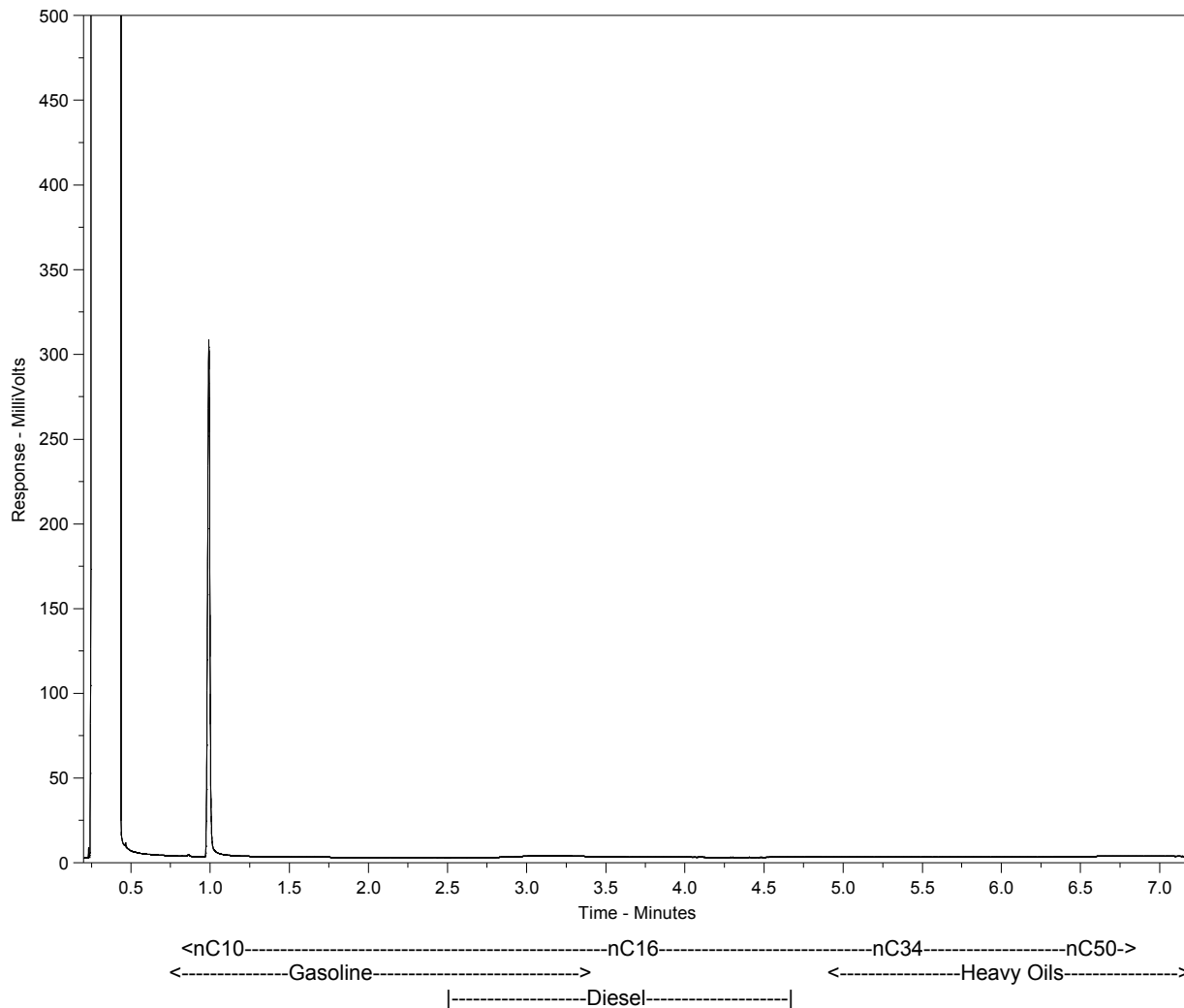


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1240064-4
Client ID: 16054121119104

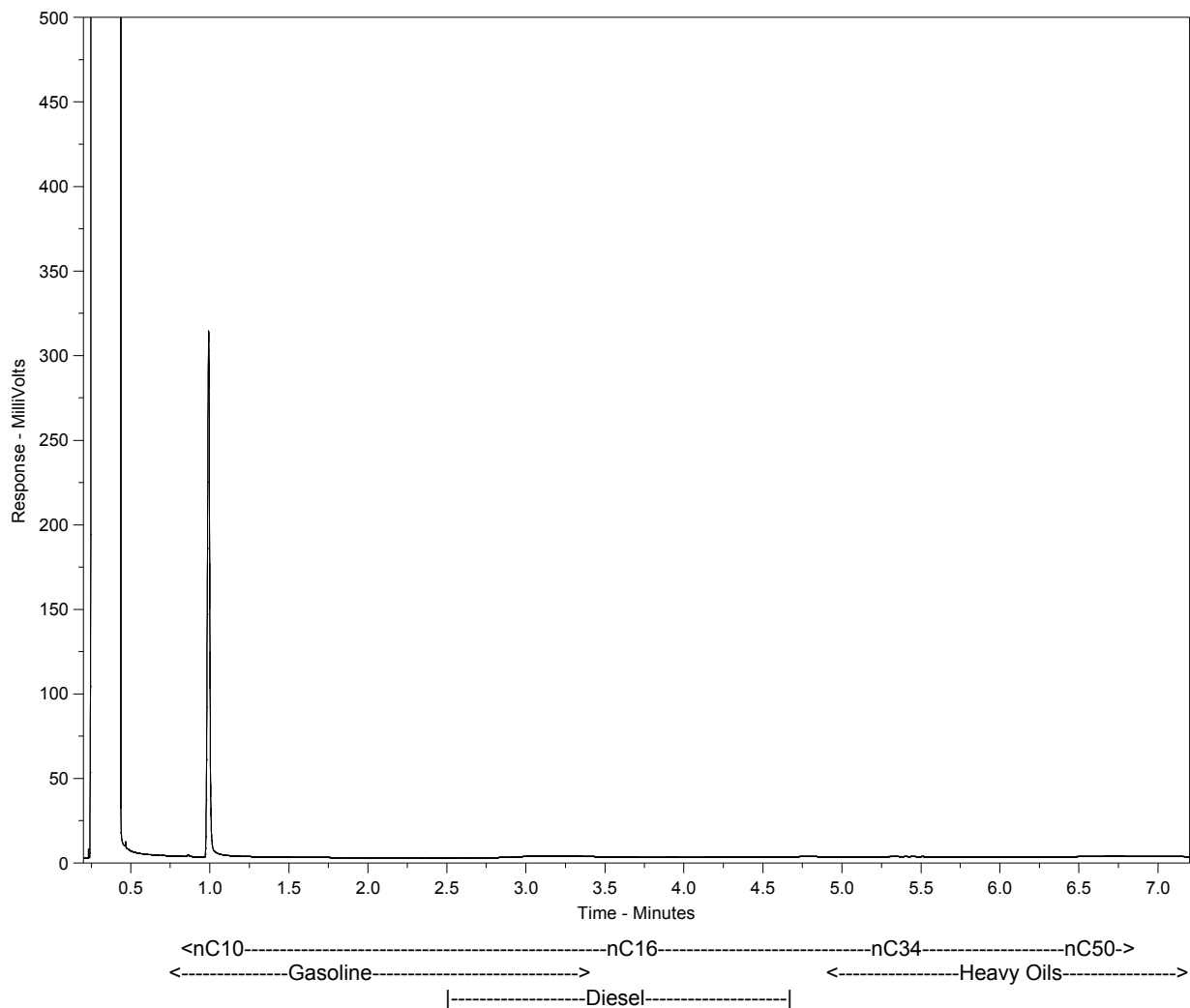


The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.

ALS Sample ID: L1240064-5
Client ID: 16054121119105



The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

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

Note: This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method (December 2007 version). Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 22-NOV-12
Report Date: 29-NOV-12 09:32 (MT)
Version: FINAL

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1240614
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 PLAMONDON 68-16
C of C Numbers: M060418
Legal Site Desc: PLAMONDON 68-16

Monica Gibson
Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240614-1 16054121121101									
Sampled By: GK/EA on 21-NOV-12 @ 12:25									
Matrix: WATER									
BTX, F1, F2, F3, F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
Toluene	0.00055	+/-0.00020		0.00050	mg/L	0	22-NOV-12	23-NOV-12	R2482463
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
o-xylene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
Xylenes	0.00056	+/-0.00032		0.00050	mg/L	0	22-NOV-12	23-NOV-12	R2482463
F1(C6-C10)	<0.10	-		0.10	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F1-BTEX	<0.10	-		0.10	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
Dissolved Metals - Matrix									
Dissolved Mercury in Water by CVAFS									
Mercury (Hg)-Dissolved	<0.000050	-		0.000050	mg/L	-		28-NOV-12	R2487136
Dissolved Metals by ICPMS									
Aluminum (Al)-Dissolved	0.0088	-		0.0050	mg/L	-		27-NOV-12	R2487263
Antimony (Sb)-Dissolved	0.00714	-		0.00010	mg/L	-		27-NOV-12	R2487263
Arsenic (As)-Dissolved	0.00445	+/-0.00028		0.00010	mg/L	0		27-NOV-12	R2487263
Barium (Ba)-Dissolved	0.0630	-		0.000050	mg/L	-		27-NOV-12	R2487263
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Bismuth (Bi)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Boron (B)-Dissolved	0.033	-		0.010	mg/L	-		27-NOV-12	R2487263
Cadmium (Cd)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2487263
Chromium (Cr)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Cobalt (Co)-Dissolved	0.00035	+/-0.00003		0.00010	mg/L	0		27-NOV-12	R2487263
Copper (Cu)-Dissolved	0.00203	-		0.00010	mg/L	-		27-NOV-12	R2487263
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Molybdenum (Mo)-Dissolved	0.0125	-		0.000050	mg/L	-		27-NOV-12	R2487263
Nickel (Ni)-Dissolved	0.00155	-		0.00050	mg/L	-		27-NOV-12	R2487263
Selenium (Se)-Dissolved	0.0043	-		0.0010	mg/L	-		27-NOV-12	R2487263
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		27-NOV-12	R2487263
Strontium (Sr)-Dissolved	0.159	-		0.00010	mg/L	-		27-NOV-12	R2487263
Titanium (Ti)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Thallium (Tl)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Tin (Sn)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Uranium (U)-Dissolved	0.00736	-		0.000010	mg/L	-		27-NOV-12	R2487263
Vanadium (V)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Zinc (Zn)-Dissolved	<0.0050	-		0.0050	mg/L	-		27-NOV-12	R2487263
Miscellaneous Parameters									
Ammonia, Total (as N)	0.088	-		0.050	mg/L	-		23-NOV-12	R2483401
Dissolved Organic Carbon	5.7	+/-0.7		1.0	mg/L	0		22-NOV-12	R2486552
Naphthenic Acids	<1.0	-		1.0	mg/L	-	28-NOV-12	28-NOV-12	R2487833
Phenols (4AAP)	0.0036	+/-0.0009		0.0010	mg/L	0		27-NOV-12	R2486691
Fecal Coliforms	See Attached	-		1	CFU/100mL	-		22-NOV-12	
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Acenaphthylene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	24-NOV-12	R2484384

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240614-1 16054121121101 Sampled By: GK/EA on 21-NOV-12 @ 12:25 Matrix: WATER									
PAH & Carcinogenic PAH List									
Fluorene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Naphthalene	0.000890	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(k)fluoranthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(b&j)fluoranthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(g,h,i)perylene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(a)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Chrysene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Indeno(1,2,3-cd)pyrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
B(A)P Total Potency Equivalent	<0.000039	-		0.000039	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Surr: d10-Acenaphthene	88.3	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Surr: d10-Phenanthrene	89.8	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Surr: d12-Chrysene	84.0	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Routine Water Analysis									
Chloride (Cl)									
Chloride (Cl)	2.79	+/-0.19		0.10	mg/L	0		22-NOV-12	R2482026
Dissolved Metals by ICPOES									
Calcium (Ca)-Dissolved	21.4	-		0.050	mg/L	-		25-NOV-12	R2483783
Iron (Fe)-Dissolved	<0.030	-		0.030	mg/L	-		25-NOV-12	R2483783
Magnesium (Mg)-Dissolved	6.61	-		0.10	mg/L	-		25-NOV-12	R2483783
Manganese (Mn)-Dissolved	0.0297	-		0.0050	mg/L	-		25-NOV-12	R2483783
Potassium (K)-Dissolved	1.42	-		0.50	mg/L	-		25-NOV-12	R2483783
Sodium (Na)-Dissolved	48.1	-		1.0	mg/L	-		25-NOV-12	R2483783
Ion Balance Calculation									
Ion Balance	95.1	-			%	-		25-NOV-12	
TDS (Calculated)	209	-			mg/L	-		25-NOV-12	
Hardness (as CaCO3)	80.7	-			mg/L	-		25-NOV-12	
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.470	-		0.071	mg/L	-		23-NOV-12	
Nitrate-N									
Nitrate (as N)	0.470	+/-0.032		0.050	mg/L	0		22-NOV-12	R2482026
Nitrite-N									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		22-NOV-12	R2482026
Sulfate (SO4)									
Sulfate (SO4)	31.1	+/-1.8		0.50	mg/L	0		22-NOV-12	R2482026
pH, Conductivity and Total Alkalinity									
pH	8.09	-		0.10	pH	-		23-NOV-12	R2482225
Conductivity (EC)	324	-		3.0	uS/cm	-		23-NOV-12	R2482225
Bicarbonate (HCO3)	194	-		5.0	mg/L	-		23-NOV-12	R2482225
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		23-NOV-12	R2482225
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		23-NOV-12	R2482225
Alkalinity, Total (as CaCO3)	159	-		5.0	mg/L	-		23-NOV-12	R2482225
L1240614-2 16054121121102 Sampled By: GK/EA on 21-NOV-12 @ 09:30 Matrix: WATER									
BTX, F1, F2, F3, F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240614-2 16054121121102									
Sampled By: GK/EA on 21-NOV-12 @ 09:30									
Matrix: WATER									
BTEX and F1 (C6-C10)									
Toluene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
o-xylene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
Xylenes	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F1(C6-C10)	<0.10	-		0.10	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F1-BTEX	<0.10	-		0.10	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
Dissolved Metals - Matrix									
Dissolved Mercury in Water by CVAFS									
Mercury (Hg)-Dissolved	<0.000050	-		0.000050	mg/L	-		28-NOV-12	R2487136
Dissolved Metals by ICPMS									
Aluminum (Al)-Dissolved	<0.0050	-		0.0050	mg/L	-		27-NOV-12	R2487263
Antimony (Sb)-Dissolved	0.00014	-		0.00010	mg/L	-		27-NOV-12	R2487263
Arsenic (As)-Dissolved	0.0857	+/-0.0054		0.00010	mg/L	0		27-NOV-12	R2487263
Barium (Ba)-Dissolved	0.324	-		0.000050	mg/L	-		27-NOV-12	R2487263
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Bismuth (Bi)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Boron (B)-Dissolved	0.677	-		0.010	mg/L	-		27-NOV-12	R2487263
Cadmium (Cd)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2487263
Chromium (Cr)-Dissolved	0.00106	-		0.00050	mg/L	-		27-NOV-12	R2487263
Cobalt (Co)-Dissolved	0.00075	+/-0.00007		0.00010	mg/L	0		27-NOV-12	R2487263
Copper (Cu)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Molybdenum (Mo)-Dissolved	0.0112	-		0.000050	mg/L	-		27-NOV-12	R2487263
Nickel (Ni)-Dissolved	0.00361	-		0.00050	mg/L	-		27-NOV-12	R2487263
Selenium (Se)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		27-NOV-12	R2487263
Strontium (Sr)-Dissolved	0.453	-		0.00010	mg/L	-		27-NOV-12	R2487263
Titanium (Ti)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Thallium (Tl)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Tin (Sn)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Uranium (U)-Dissolved	0.000176	-		0.000010	mg/L	-		27-NOV-12	R2487263
Vanadium (V)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Zinc (Zn)-Dissolved	<0.0050	-		0.0050	mg/L	-		27-NOV-12	R2487263
Miscellaneous Parameters									
Ammonia, Total (as N)	2.77	-	DLA	0.50	mg/L	-		26-NOV-12	R2484586
Dissolved Organic Carbon	20.7	+/-2.0		1.0	mg/L	0		22-NOV-12	R2486552
Naphthenic Acids	1.4	+/-0.4		1.0	mg/L	0	28-NOV-12	28-NOV-12	R2487833
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2486691
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Acenaphthylene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Fluorene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Naphthalene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240614-2 16054121121102									
Sampled By: GK/EA on 21-NOV-12 @ 09:30									
Matrix: WATER									
PAH & Carcinogenic PAH List									
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(k)fluoranthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(b&j)fluoranthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(g,h,i)perylene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(a)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Chrysene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Indeno(1,2,3-cd)pyrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
B(A)P Total Potency Equivalent	<0.000039	-		0.000039	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Surr: d10-Acenaphthene	89.3	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Surr: d10-Phenanthrene	84.1	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Surr: d12-Chrysene	83.1	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Routine Water Analysis									
Chloride (Cl)									
Chloride (Cl)	550	+/-32		0.10	mg/L	0		22-NOV-12	R2482026
Dissolved Metals by ICPOES									
Calcium (Ca)-Dissolved	27.0	-		0.050	mg/L	-		25-NOV-12	R2483783
Iron (Fe)-Dissolved	0.079	-		0.030	mg/L	-		25-NOV-12	R2483783
Magnesium (Mg)-Dissolved	10.4	-		0.10	mg/L	-		25-NOV-12	R2483783
Manganese (Mn)-Dissolved	0.0380	-		0.0050	mg/L	-		25-NOV-12	R2483783
Potassium (K)-Dissolved	3.88	-		0.50	mg/L	-		25-NOV-12	R2483783
Sodium (Na)-Dissolved	633	-		1.0	mg/L	-		25-NOV-12	R2483783
Ion Balance Calculation									
Ion Balance	102	-			%	-		26-NOV-12	
TDS (Calculated)	1680	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	110	-			mg/L	-		26-NOV-12	
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		23-NOV-12	
Nitrate-N									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		22-NOV-12	R2482026
Nitrite-N									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		22-NOV-12	R2482026
Sulfate (SO4)									
Sulfate (SO4)	107	+/-5.9		0.50	mg/L	0		22-NOV-12	R2482026
pH, Conductivity and Total Alkalinity									
pH	8.34	-		0.10	pH	-		23-NOV-12	R2482225
Conductivity (EC)	2550	-		3.0	uS/cm	-		23-NOV-12	R2482225
Bicarbonate (HCO3)	693	-		5.0	mg/L	-		23-NOV-12	R2482225
Carbonate (CO3)	7.8	-		5.0	mg/L	-		23-NOV-12	R2482225
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		23-NOV-12	R2482225
Alkalinity, Total (as CaCO3)	581	-		5.0	mg/L	-		23-NOV-12	R2482225
L1240614-3 16054121121103									
Sampled By: GK/EA on 21-NOV-12 @ 11:10									
Matrix: WATER									
BTX, F1, F2, F3, F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
Toluene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
o-xylene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240614-3 16054121121103									
Sampled By: GK/EA on 21-NOV-12 @ 11:10									
Matrix: WATER									
BTEX and F1 (C6-C10)									
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
Xylenes	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F1(C6-C10)	<0.10	-		0.10	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F1-BTEX	<0.10	-		0.10	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
Dissolved Metals - Matrix									
Dissolved Mercury in Water by CVAFS									
Mercury (Hg)-Dissolved	<0.000050	-		0.000050	mg/L	-		28-NOV-12	R2487136
Dissolved Metals by ICPMS									
Aluminum (Al)-Dissolved	<0.0050	-		0.0050	mg/L	-		27-NOV-12	R2487263
Antimony (Sb)-Dissolved	0.00019	-		0.00010	mg/L	-		27-NOV-12	R2487263
Arsenic (As)-Dissolved	0.0766	+/-0.0048		0.00010	mg/L	0		27-NOV-12	R2487263
Barium (Ba)-Dissolved	0.178	-		0.000050	mg/L	-		27-NOV-12	R2487263
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Bismuth (Bi)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Boron (B)-Dissolved	0.353	-		0.010	mg/L	-		27-NOV-12	R2487263
Cadmium (Cd)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2487263
Chromium (Cr)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Cobalt (Co)-Dissolved	0.00060	+/-0.00006		0.00010	mg/L	0		27-NOV-12	R2487263
Copper (Cu)-Dissolved	0.00059	-		0.00010	mg/L	-		27-NOV-12	R2487263
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Molybdenum (Mo)-Dissolved	0.00207	-		0.000050	mg/L	-		27-NOV-12	R2487263
Nickel (Ni)-Dissolved	0.00145	-		0.00050	mg/L	-		27-NOV-12	R2487263
Selenium (Se)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		27-NOV-12	R2487263
Strontium (Sr)-Dissolved	0.285	-		0.00010	mg/L	-		27-NOV-12	R2487263
Titanium (Ti)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Thallium (Tl)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Tin (Sn)-Dissolved	0.00021	-		0.00010	mg/L	-		27-NOV-12	R2487263
Uranium (U)-Dissolved	0.000465	-		0.000010	mg/L	-		27-NOV-12	R2487263
Vanadium (V)-Dissolved	0.0011	-		0.0010	mg/L	-		27-NOV-12	R2487263
Zinc (Zn)-Dissolved	0.0050	+/-0.0013		0.0050	mg/L	0		27-NOV-12	R2487263
Miscellaneous Parameters									
Ammonia, Total (as N)	3.50	-	DLA	0.50	mg/L	-		26-NOV-12	R2484586
Dissolved Organic Carbon	12.7	+/-1.3		1.0	mg/L	0		22-NOV-12	R2486552
Naphthenic Acids	<1.0	-		1.0	mg/L	-	28-NOV-12	28-NOV-12	R2487833
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2486691
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Acenaphthylene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Fluorene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Naphthalene	0.000158	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(k)fluoranthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240614-3 16054121121103 Sampled By: GK/EA on 21-NOV-12 @ 11:10 Matrix: WATER									
PAH & Carcinogenic PAH List									
Benzo(b&j)fluoranthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(g,h,i)perylene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(a)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Chrysene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Indeno(1,2,3-cd)pyrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
B(A)P Total Potency Equivalent	<0.000039	-		0.000039	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Surr: d10-Acenaphthene	87.0	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Surr: d10-Phenanthrene	86.1	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Surr: d12-Chrysene	87.4	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Routine Water Analysis									
Chloride (Cl)									
Chloride (Cl)	18.2	+/-1.1		0.10	mg/L	0		22-NOV-12	R2482026
Dissolved Metals by ICPOES									
Calcium (Ca)-Dissolved	25.8	-		0.050	mg/L	-		25-NOV-12	R2483783
Iron (Fe)-Dissolved	0.041	-		0.030	mg/L	-		25-NOV-12	R2483783
Magnesium (Mg)-Dissolved	9.32	-		0.10	mg/L	-		25-NOV-12	R2483783
Manganese (Mn)-Dissolved	0.0237	-		0.0050	mg/L	-		25-NOV-12	R2483783
Potassium (K)-Dissolved	2.43	-		0.50	mg/L	-		25-NOV-12	R2483783
Sodium (Na)-Dissolved	268	-		1.0	mg/L	-		25-NOV-12	R2483783
Ion Balance Calculation									
Ion Balance	97.3	-			%	-		26-NOV-12	
TDS (Calculated)	790	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	103	-			mg/L	-		26-NOV-12	
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		23-NOV-12	
Nitrate-N									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		22-NOV-12	R2482026
Nitrite-N									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		22-NOV-12	R2482026
Sulfate (SO4)									
Sulfate (SO4)	130	+/-7.1		0.50	mg/L	0		22-NOV-12	R2482026
pH, Conductivity and Total Alkalinity									
pH	8.27	-		0.10	pH	-		23-NOV-12	R2482225
Conductivity (EC)	1160	-		3.0	uS/cm	-		23-NOV-12	R2482225
Bicarbonate (HCO3)	683	-		5.0	mg/L	-		23-NOV-12	R2482225
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		23-NOV-12	R2482225
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		23-NOV-12	R2482225
Alkalinity, Total (as CaCO3)	560	-		5.0	mg/L	-		23-NOV-12	R2482225
L1240614-4 16054121121104 Sampled By: GK/EA on 21-NOV-12 @ 11:42 Matrix: WATER									
BTX, F1, F2, F3, F4									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
Toluene	0.00062	+/-0.00021		0.00050	mg/L	0	22-NOV-12	23-NOV-12	R2482463
Ethylbenzene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
o-xylene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
Xylenes	<0.00050	-		0.00050	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F1(C6-C10)	<0.10	-		0.10	mg/L	-	22-NOV-12	23-NOV-12	R2482463

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240614-4 16054121121104									
Sampled By: GK/EA on 21-NOV-12 @ 11:42									
Matrix: WATER									
BTEX and F1 (C6-C10)									
F1-BTEX	<0.10	-		0.10	mg/L	-	22-NOV-12	23-NOV-12	R2482463
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	22-NOV-12	23-NOV-12	R2484443
Dissolved Metals - Matrix									
Dissolved Mercury in Water by CVAFS									
Mercury (Hg)-Dissolved	<0.000050	-		0.000050	mg/L	-		28-NOV-12	R2487136
Dissolved Metals by ICPMS									
Aluminum (Al)-Dissolved	<0.0050	-		0.0050	mg/L	-		27-NOV-12	R2487263
Antimony (Sb)-Dissolved	0.00053	-		0.00010	mg/L	-		27-NOV-12	R2487263
Arsenic (As)-Dissolved	0.0273	+/-0.0017		0.00010	mg/L	0		27-NOV-12	R2487263
Barium (Ba)-Dissolved	0.0847	-		0.000050	mg/L	-		27-NOV-12	R2487263
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Bismuth (Bi)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Boron (B)-Dissolved	0.594	-		0.010	mg/L	-		27-NOV-12	R2487263
Cadmium (Cd)-Dissolved	<0.000050	-		0.000050	mg/L	-		27-NOV-12	R2487263
Chromium (Cr)-Dissolved	<0.00050	-		0.00050	mg/L	-		27-NOV-12	R2487263
Cobalt (Co)-Dissolved	0.00062	+/-0.00006		0.00010	mg/L	0		27-NOV-12	R2487263
Copper (Cu)-Dissolved	0.00047	-		0.00010	mg/L	-		27-NOV-12	R2487263
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Molybdenum (Mo)-Dissolved	0.0111	-		0.000050	mg/L	-		27-NOV-12	R2487263
Nickel (Ni)-Dissolved	0.00170	-		0.00050	mg/L	-		27-NOV-12	R2487263
Selenium (Se)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		27-NOV-12	R2487263
Strontium (Sr)-Dissolved	0.636	-		0.00010	mg/L	-		27-NOV-12	R2487263
Titanium (Ti)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Thallium (Tl)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-NOV-12	R2487263
Tin (Sn)-Dissolved	0.00014	-		0.00010	mg/L	-		27-NOV-12	R2487263
Uranium (U)-Dissolved	0.000638	-		0.000010	mg/L	-		27-NOV-12	R2487263
Vanadium (V)-Dissolved	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2487263
Zinc (Zn)-Dissolved	<0.0050	-		0.0050	mg/L	-		27-NOV-12	R2487263
Miscellaneous Parameters									
Ammonia, Total (as N)	3.83	-	DLA	0.50	mg/L	-		26-NOV-12	R2484586
Dissolved Organic Carbon	11.3	+/-1.2		1.0	mg/L	0		22-NOV-12	R2486552
Naphthenic Acids	<1.0	-		1.0	mg/L	-	28-NOV-12	28-NOV-12	R2487833
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		27-NOV-12	R2486691
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Acenaphthylene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Fluoranthene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Fluorene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Naphthalene	0.000106	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Phenanthrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Pyrene	<0.000020	-		0.000020	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(k)fluoranthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(b&j)fluoranthene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(g,h,i)perylene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Benzo(a)pyrene	<0.000010	-		0.000010	mg/L	-	24-NOV-12	24-NOV-12	R2484384

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1240614-4 16054121121104									
Sampled By: GK/EA on 21-NOV-12 @ 11:42									
Matrix: WATER									
PAH & Carcinogenic PAH List									
Chrysene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Indeno(1,2,3-cd)pyrene	<0.000050	-		0.000050	mg/L	-	24-NOV-12	24-NOV-12	R2484384
B(A)P Total Potency Equivalent	<0.000039	-		0.000039	mg/L	-	24-NOV-12	24-NOV-12	R2484384
Surr: d10-Acenaphthene	83.5	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Surr: d10-Phenanthrene	87.6	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Surr: d12-Chrysene	83.4	-		N/A	%	-	24-NOV-12	24-NOV-12	R2484384
Routine Water Analysis									
Chloride (Cl)									
Chloride (Cl)	3.88	+/-0.25		0.10	mg/L	0		22-NOV-12	R2482026
Dissolved Metals by ICPOES									
Calcium (Ca)-Dissolved	58.1	-		0.050	mg/L	-		25-NOV-12	R2483783
Iron (Fe)-Dissolved	<0.030	-		0.030	mg/L	-		25-NOV-12	R2483783
Magnesium (Mg)-Dissolved	21.8	-		0.10	mg/L	-		25-NOV-12	R2483783
Manganese (Mn)-Dissolved	0.0456	-		0.0050	mg/L	-		25-NOV-12	R2483783
Potassium (K)-Dissolved	3.36	-		0.50	mg/L	-		25-NOV-12	R2483783
Sodium (Na)-Dissolved	304	-		1.0	mg/L	-		25-NOV-12	R2483783
Ion Balance Calculation									
Ion Balance	91.7	-			%	-		26-NOV-12	
TDS (Calculated)	1160	-			mg/L	-		26-NOV-12	
Hardness (as CaCO3)	235	-			mg/L	-		26-NOV-12	
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		23-NOV-12	
Nitrate-N									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		22-NOV-12	R2482026
Nitrite-N									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		22-NOV-12	R2482026
Sulfate (SO4)									
Sulfate (SO4)	455	+/-25		0.50	mg/L	0		22-NOV-12	R2482026
pH, Conductivity and Total Alkalinity									
pH	8.19	-		0.10	pH	-		23-NOV-12	R2482225
Conductivity (EC)	1560	-		3.0	uS/cm	-		23-NOV-12	R2482225
Bicarbonate (HCO3)	631	-		5.0	mg/L	-		23-NOV-12	R2482225
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		23-NOV-12	R2482225
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		23-NOV-12	R2482225
Alkalinity, Total (as CaCO3)	518	-		5.0	mg/L	-		23-NOV-12	R2482225

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Ammonia, Total (as N)	DLA	
Duplicate	Ammonia, Total (as N)	DLA	

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
BTX,F1-CL	Water	BTEX and F1 (C6-C10)		EPA 5030/8015& 8260-P&T GC-MS/FID
C-DIS-ORG-CL	Water	Dissolved Organic Carbon		APHA 5310 C-Instrumental
CL-CL	Water	Chloride (Cl)		APHA 4110 B-Ion Chromatography
Inorganic Anions by ion chromatography (IC) in water and aqueous extracts of soils.				
COLIFORM-BC	Water	Total & Fecal Coliforms		ANALYSIS PERFORMED BY BIOCHEM
F2,F3,F4-CL	Water	F2, F3, F4		EPA 3510/8000-GC-FID
HG-DIS-CVAFS-CL	Water	Dissolved Mercury in Water by CVAFS		EPA SW-846 3005A & EPA 245.7
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).				
IONBALANCE-CL	Water	Ion Balance Calculation		APHA 1030E
MET-DIS-ICP-CL	Water	Dissolved Metals 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-CL	Water	Dissolved Metals by ICPMS		EPA SW-846 3005A/6020A
N2N3-CALC-CL	Water	Nitrate+Nitrite		CALCULATION
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR,Syncrude,1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH4-CL	Water	Ammonia-N		APHA 4500 NH3F-Colorimetry
Ammonia is determined using the Phenate colorimetric method. Result includes both ionized (NH4+) and un-ionized (NH3) ammonia present in the sample.				
NO2-CL	Water	Nitrite-N		APHA 4110 B-Ion Chromatography
NO3-IC-CL	Water	Nitrate-N		APHA 4110 B-Ion Chromatography
PAH-ABT1-CL	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-CL	Water	pH, Conductivity and Total Alkalinity		APHA 4500H,2510,2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed) pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode. Alkalinity measurement is based on the sample's capacity to neutralize acid Conductivity measurement is based on the sample's capacity to convey an electric current				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-CL	Water	Sulfate (SO4)		APHA 4110 B-Ion Chromatography

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
methods may incorporate modifications from the specified reference 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
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
BC	Bio-Chem Consulting - Calgary, Alberta, Canada
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M060418

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

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.



Environmental

Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

Page 1 of 11

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX,F1-CL		Water						
Batch	R2482463							
WG1591110-2	LCS							
Benzene			105.8		%		70-130	23-NOV-12
Toluene			100.4		%		70-130	23-NOV-12
Ethylbenzene			94.6		%		70-130	23-NOV-12
o-xylene			96.6		%		70-130	23-NOV-12
m+p-Xylene			97.9		%		70-130	23-NOV-12
Xylenes			97.7		%		70-130	23-NOV-12
F1(C6-C10)			106.3		%		70-130	23-NOV-12
WG1591110-1	MB							
Benzene			<0.00050		mg/L		0.0005	22-NOV-12
Toluene			<0.00050		mg/L		0.0005	22-NOV-12
Ethylbenzene			<0.00050		mg/L		0.0005	22-NOV-12
o-xylene			<0.00050		mg/L		0.0005	22-NOV-12
m+p-Xylene			<0.00050		mg/L		0.0005	22-NOV-12
Xylenes			<0.00050		mg/L		0.0005	22-NOV-12
F1(C6-C10)			<0.10		mg/L		0.1	22-NOV-12
C-DIS-ORG-CL		Water						
Batch	R2486552							
WG1593073-3	DUP	L1239818-1						
Dissolved Organic Carbon		5.3	5.4		mg/L	1.5	20	22-NOV-12
WG1593073-4	DUP	L1240301-1						
Dissolved Organic Carbon		1.3	1.4		mg/L	3.0	20	22-NOV-12
WG1593073-2	LCS							
Dissolved Organic Carbon			97.3		%		80-120	22-NOV-12
WG1593073-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	22-NOV-12
CL-CL		Water						
Batch	R2482026							
WG1590958-3	DUP	L1239818-8						
Chloride (Cl)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	22-NOV-12
WG1590958-4	DUP	L1240293-2						
Chloride (Cl)		42.5	42.0		mg/L	1.3	20	22-NOV-12
WG1590958-2	LCS							
Chloride (Cl)			99.0		%		85-115	22-NOV-12
WG1590958-1	MB							
Chloride (Cl)			<0.10		mg/L		0.1	22-NOV-12



Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

Page 2 of 11

Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2,F3,F4-CL		Water						
Batch	R2484443							
WG1591785-2	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	23-NOV-12
F3 (C16-C34)			<0.25		mg/L		0.25	23-NOV-12
F4 (C34-C50)			<0.25		mg/L		0.25	23-NOV-12
WG1591785-3	MS	WG1591785-2						
F2 (>C10-C16)			78.6		%		50-150	23-NOV-12
F3 (C16-C34)			78.6		%		50-150	23-NOV-12
F4 (C34-C50)			78.6		%		50-150	23-NOV-12
WG1591785-4	MSD	WG1591785-3						
F2 (>C10-C16)			78.6		%	7.0	50	23-NOV-12
F3 (C16-C34)			78.6		%	7.0	50	23-NOV-12
F4 (C34-C50)			78.6		%	7.0	50	23-NOV-12
HG-DIS-CVAFS-CL		Water						
Batch	R2487136							
WG1593489-2	CRM	LCS-DIS						
Mercury (Hg)-Dissolved			113.7		%		85-115	28-NOV-12
WG1593489-3	DUP	L1241661-6						
Mercury (Hg)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	28-NOV-12
WG1593489-1	MB							
Mercury (Hg)-Dissolved			<0.000050		mg/L		0.00005	28-NOV-12
MET-DIS-ICP-CL		Water						
Batch	R2483783							
WG1591881-4	CRM	QCS-A						
Calcium (Ca)-Dissolved			119.3		%		80-120	25-NOV-12
Iron (Fe)-Dissolved			104.2		%		85-115	25-NOV-12
Magnesium (Mg)-Dissolved			91.2		%		85-115	25-NOV-12
Manganese (Mn)-Dissolved			99.5		%		85-115	25-NOV-12
Potassium (K)-Dissolved			101.1		%		85-115	25-NOV-12
Sodium (Na)-Dissolved			101.8		%		85-115	25-NOV-12
WG1591881-1	MB							
Calcium (Ca)-Dissolved			<0.10		mg/L		0.1	25-NOV-12
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	25-NOV-12
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	25-NOV-12
Manganese (Mn)-Dissolved			<0.0050		mg/L		0.005	25-NOV-12
Potassium (K)-Dissolved			<0.50		mg/L		0.5	25-NOV-12
Sodium (Na)-Dissolved			<1.0		mg/L		1	25-NOV-12



Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-CL								
	Water							
Batch	R2487263							
WG1592987-2 CRM		CVS						
Aluminum (Al)-Dissolved			98.5		%		80-120	27-NOV-12
Antimony (Sb)-Dissolved			94.7		%		80-120	27-NOV-12
Arsenic (As)-Dissolved			99.8		%		80-120	27-NOV-12
Barium (Ba)-Dissolved			101.8		%		80-120	27-NOV-12
Beryllium (Be)-Dissolved			98.4		%		80-120	27-NOV-12
Bismuth (Bi)-Dissolved			96.7		%		80-120	27-NOV-12
Boron (B)-Dissolved			98.1		%		80-120	27-NOV-12
Cadmium (Cd)-Dissolved			103.4		%		80-120	27-NOV-12
Chromium (Cr)-Dissolved			99.1		%		80-120	27-NOV-12
Cobalt (Co)-Dissolved			100.3		%		80-120	27-NOV-12
Copper (Cu)-Dissolved			99.3		%		80-120	27-NOV-12
Lead (Pb)-Dissolved			99.4		%		80-120	27-NOV-12
Molybdenum (Mo)-Dissolved			98.0		%		80-120	27-NOV-12
Nickel (Ni)-Dissolved			101.7		%		80-120	27-NOV-12
Selenium (Se)-Dissolved			99.9		%		80-120	27-NOV-12
Silver (Ag)-Dissolved			96.6		%		80-120	27-NOV-12
Strontium (Sr)-Dissolved			104.5		%		80-120	27-NOV-12
Titanium (Ti)-Dissolved			99.8		%		80-120	27-NOV-12
Thallium (Tl)-Dissolved			101.1		%		80-120	27-NOV-12
Tin (Sn)-Dissolved			95.2		%		80-120	27-NOV-12
Uranium (U)-Dissolved			90.6		%		80-120	27-NOV-12
Vanadium (V)-Dissolved			97.4		%		80-120	27-NOV-12
Zinc (Zn)-Dissolved			95.3		%		80-120	27-NOV-12
WG1592987-4 DUP		L1241078-5						
Aluminum (Al)-Dissolved		<0.025	<0.025	RPD-NA	mg/L	N/A	20	27-NOV-12
Antimony (Sb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Arsenic (As)-Dissolved		0.00075	0.00066		mg/L	13	25	27-NOV-12
Barium (Ba)-Dissolved		0.0574	0.0555		mg/L	3.3	20	27-NOV-12
Beryllium (Be)-Dissolved		<0.0025	<0.0025	RPD-NA	mg/L	N/A	20	27-NOV-12
Bismuth (Bi)-Dissolved		<0.0025	<0.0025	RPD-NA	mg/L	N/A	25	27-NOV-12
Boron (B)-Dissolved		0.159	0.164		mg/L	3.0	20	27-NOV-12
Cadmium (Cd)-Dissolved		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	27-NOV-12
Chromium (Cr)-Dissolved		<0.0025	<0.0025	RPD-NA	mg/L	N/A	20	27-NOV-12



Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-CL								
	Water							
Batch	R2487263							
WG1592987-4	DUP	L1241078-5						
Cobalt (Co)-Dissolved		0.00347	0.00353		mg/L	1.5	20	27-NOV-12
Copper (Cu)-Dissolved		0.00074	0.00069		mg/L	6.8	20	27-NOV-12
Lead (Pb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Molybdenum (Mo)-Dissolved		0.00167	0.00170		mg/L	1.5	25	27-NOV-12
Nickel (Ni)-Dissolved		0.0129	0.0129		mg/L	0.0	20	27-NOV-12
Selenium (Se)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	27-NOV-12
Silver (Ag)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	27-NOV-12
Strontium (Sr)-Dissolved		1.61	1.64		mg/L	2.4	20	27-NOV-12
Titanium (Ti)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	25	27-NOV-12
Thallium (Tl)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Tin (Sn)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Uranium (U)-Dissolved		0.0109	0.0109		mg/L	0.1	25	27-NOV-12
Vanadium (V)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	27-NOV-12
Zinc (Zn)-Dissolved		<0.025	<0.025	RPD-NA	mg/L	N/A	20	27-NOV-12
WG1592987-5	DUP	L1241109-4						
Aluminum (Al)-Dissolved		0.054	0.054		mg/L	1.6	20	27-NOV-12
Antimony (Sb)-Dissolved		0.0013	0.0014		mg/L	3.5	20	27-NOV-12
Arsenic (As)-Dissolved		0.0057	0.0056		mg/L	1.5	25	27-NOV-12
Barium (Ba)-Dissolved		0.389	0.394		mg/L	1.2	20	27-NOV-12
Beryllium (Be)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	27-NOV-12
Bismuth (Bi)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	25	27-NOV-12
Boron (B)-Dissolved		3.79	3.77		mg/L	0.6	20	27-NOV-12
Cadmium (Cd)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Chromium (Cr)-Dissolved		0.0225	0.0223		mg/L	0.7	20	27-NOV-12
Cobalt (Co)-Dissolved		0.0083	0.0083		mg/L	0.0	20	27-NOV-12
Copper (Cu)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	27-NOV-12
Lead (Pb)-Dissolved		0.0021	0.0021		mg/L	3.2	20	27-NOV-12
Molybdenum (Mo)-Dissolved		0.00246	0.00250		mg/L	1.6	25	27-NOV-12
Nickel (Ni)-Dissolved		0.0489	0.0498		mg/L	1.8	20	27-NOV-12
Selenium (Se)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	27-NOV-12
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Strontium (Sr)-Dissolved		2.08	2.02		mg/L	2.9	20	27-NOV-12
Titanium (Ti)-Dissolved		<0.010	0.010	RPD-NA	mg/L	N/A	25	27-NOV-12



Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-LOW-MS-CL								
	Water							
Batch	R2487263							
WG1592987-5	DUP	L1241109-4						
Thallium (Tl)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	27-NOV-12
Tin (Sn)-Dissolved		0.0075	0.0077		mg/L	3.2	20	27-NOV-12
Uranium (U)-Dissolved		0.00013	0.00015		mg/L	10	25	27-NOV-12
Vanadium (V)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	27-NOV-12
Zinc (Zn)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-NOV-12
WG1592987-6	DUP	L1241814-6						
Aluminum (Al)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-NOV-12
Antimony (Sb)-Dissolved		0.0070	0.0073		mg/L	3.5	20	27-NOV-12
Arsenic (As)-Dissolved		0.182	0.185		mg/L	1.7	25	27-NOV-12
Barium (Ba)-Dissolved		4.06	4.08		mg/L	0.5	20	27-NOV-12
Beryllium (Be)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	27-NOV-12
Bismuth (Bi)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	25	27-NOV-12
Boron (B)-Dissolved		1.65	1.70		mg/L	2.9	20	27-NOV-12
Cadmium (Cd)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	27-NOV-12
Chromium (Cr)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	27-NOV-12
Cobalt (Co)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	27-NOV-12
Copper (Cu)-Dissolved		<0.0010	0.0010	RPD-NA	mg/L	N/A	20	27-NOV-12
Lead (Pb)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	27-NOV-12
Molybdenum (Mo)-Dissolved		0.00747	0.00750		mg/L	0.4	25	27-NOV-12
Nickel (Ni)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	27-NOV-12
Selenium (Se)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	27-NOV-12
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	27-NOV-12
Strontium (Sr)-Dissolved		1.29	1.32		mg/L	2.4	20	27-NOV-12
Titanium (Ti)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	25	27-NOV-12
Thallium (Tl)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	27-NOV-12
Tin (Sn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	27-NOV-12
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	25	27-NOV-12
Vanadium (V)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	27-NOV-12
Zinc (Zn)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-NOV-12
WG1592987-1	MB							
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	27-NOV-12
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	27-NOV-12



Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

Page 7 of 11

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH4-CL		Water						
Batch R2483401								
WG1591518-2	LCS							
Ammonia, Total (as N)			101.2		%		85-115	23-NOV-12
WG1591518-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	23-NOV-12
WG1591518-4	MS	L1239246-7						
Ammonia, Total (as N)			94.0		%		75-125	23-NOV-12
Batch R2484586								
WG1592235-4	DUP	L1239844-1						
Ammonia, Total (as N)		27.9	25.9		mg/L	7.5	20	26-NOV-12
WG1592235-5	DUP	L1239844-2						
Ammonia, Total (as N)		141	132		mg/L	6.6	20	26-NOV-12
WG1592235-7	DUP	L1240629-2						
Ammonia, Total (as N)		0.088	0.081		mg/L	8.4	20	26-NOV-12
WG1592235-2	LCS							
Ammonia, Total (as N)			100.3		%		85-115	26-NOV-12
WG1592235-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	26-NOV-12
WG1592235-6	MS	L1239844-3						
Ammonia, Total (as N)			90.6		%		75-125	26-NOV-12
NO2-CL		Water						
Batch R2482026								
WG1590958-3	DUP	L1239818-8						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-NOV-12
WG1590958-4	DUP	L1240293-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-NOV-12
WG1590958-2	LCS							
Nitrite (as N)			101.1		%		85-115	22-NOV-12
WG1590958-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	22-NOV-12
NO3-IC-CL		Water						
Batch R2482026								
WG1590958-3	DUP	L1239818-8						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	22-NOV-12
WG1590958-4	DUP	L1240293-2						
Nitrate (as N)		1.25	1.24		mg/L	1.0	20	22-NOV-12
WG1590958-2	LCS							
Nitrate (as N)			100.3		%		85-115	22-NOV-12
WG1590958-1	MB							



Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

Page 8 of 11

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-CL	Water							
Batch	R2482026							
WG1590958-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	22-NOV-12
PAH-ABT1-CL	Water							
Batch	R2484384							
WG1592046-2 LCS								
Acenaphthene			75.4		%		60-130	24-NOV-12
Acenaphthylene			80.2		%		60-130	24-NOV-12
Anthracene			83.5		%		60-130	24-NOV-12
Fluoranthene			87.7		%		60-130	24-NOV-12
Fluorene			79.1		%		60-130	24-NOV-12
Naphthalene			76.7		%		50-130	24-NOV-12
Phenanthrene			82.2		%		60-130	24-NOV-12
Pyrene			85.8		%		60-130	24-NOV-12
Benzo(a)anthracene			83.7		%		60-130	24-NOV-12
Benzo(k)fluoranthene			84.5		%		60-130	24-NOV-12
Benzo(b&j)fluoranthene			98.0		%		60-130	24-NOV-12
Benzo(g,h,i)perylene			88.5		%		60-130	24-NOV-12
Benzo(a)pyrene			83.7		%		60-130	24-NOV-12
Chrysene			89.4		%		60-130	24-NOV-12
Dibenzo(a,h)anthracene			89.2		%		60-130	24-NOV-12
Indeno(1,2,3-cd)pyrene			88.6		%		60-130	24-NOV-12
WG1592046-1 MB								
Acenaphthene			<0.000050		mg/L		0.00005	24-NOV-12
Acenaphthylene			<0.000050		mg/L		0.00005	24-NOV-12
Anthracene			<0.000010		mg/L		0.00001	24-NOV-12
Fluoranthene			<0.000020		mg/L		0.00002	24-NOV-12
Fluorene			<0.000050		mg/L		0.00005	24-NOV-12
Naphthalene			<0.000050		mg/L		0.00005	24-NOV-12
Phenanthrene			<0.000050		mg/L		0.00005	24-NOV-12
Pyrene			<0.000020		mg/L		0.00002	24-NOV-12
Benzo(a)anthracene			<0.000010		mg/L		0.00001	24-NOV-12
Benzo(k)fluoranthene			<0.000050		mg/L		0.00005	24-NOV-12
Benzo(b&j)fluoranthene			<0.000050		mg/L		0.00005	24-NOV-12
Benzo(g,h,i)perylene			<0.000050		mg/L		0.00005	24-NOV-12



Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-CL		Water						
Batch	R2484384							
WG1592046-1	MB							
Benzo(a)pyrene			<0.000010		mg/L		0.00001	24-NOV-12
Chrysene			<0.000050		mg/L		0.00005	24-NOV-12
Dibenzo(a,h)anthracene			<0.000050		mg/L		0.00005	24-NOV-12
Indeno(1,2,3-cd)pyrene			<0.000050		mg/L		0.00005	24-NOV-12
Surrogate: d10-Acenaphthene			74.5		%		60-130	24-NOV-12
Surrogate: d10-Phenanthrene			99.2		%		60-130	24-NOV-12
Surrogate: d12-Chrysene			84.3		%		60-130	24-NOV-12
PH/EC/ALK-CL		Water						
Batch	R2482225							
WG1591085-2	DUP	L1240018-1						
pH		7.73	7.75	J	pH	0.03	0.2	22-NOV-12
Conductivity (EC)		1040	1040		uS/cm	0.1	10	22-NOV-12
Bicarbonate (HCO3)		708	714		mg/L	0.8	20	22-NOV-12
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	22-NOV-12
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	22-NOV-12
Alkalinity, Total (as CaCO3)		581	586		mg/L	0.8	20	22-NOV-12
WG1591085-3	DUP	L1240293-2						
pH		7.97	7.99	J	pH	0.02	0.2	23-NOV-12
Conductivity (EC)		760	760		uS/cm	0.0	10	23-NOV-12
Bicarbonate (HCO3)		156	151		mg/L	2.9	20	23-NOV-12
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	23-NOV-12
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	23-NOV-12
Alkalinity, Total (as CaCO3)		128	124		mg/L	2.9	20	23-NOV-12
WG1591085-1	LCS							
pH			7.05		pH		6.9-7.1	22-NOV-12
Conductivity (EC)			92.4		%		90-110	22-NOV-12
Alkalinity, Total (as CaCO3)			93.5		%		85-115	22-NOV-12
PHENOLS-4AAP-ED		Water						
Batch	R2486691							
WG1592920-4	DUP	L1235534-1						
Phenols (4AAP)		0.0060	0.0069		mg/L	14	15	27-NOV-12
WG1592920-5	DUP	L1241078-1						
Phenols (4AAP)		<0.0010	0.0012	RPD-NA	mg/L	N/A	15	27-NOV-12
WG1592920-3	LCS							



Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PHENOLS-4AAP-ED	Water							
Batch	R2486691							
WG1592920-3	LCS							
Phenols (4AAP)			89.6		%		85-115	27-NOV-12
WG1592920-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	27-NOV-12
SO4-CL	Water							
Batch	R2482026							
WG1590958-3	DUP	L1239818-8						
Sulfate (SO4)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	22-NOV-12
WG1590958-4	DUP	L1240293-2						
Sulfate (SO4)		239	236		mg/L	1.2	20	22-NOV-12
WG1590958-2	LCS							
Sulfate (SO4)			101.6		%		85-115	22-NOV-12
WG1590958-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	22-NOV-12

Quality Control Report

Workorder: L1240614

Report Date: 29-NOV-12

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

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
DLA	Detection Limit Adjusted For required dilution
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

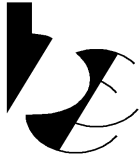
Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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.



Bio-Chem Consulting Services Ltd.

Analytical Test Report

Test Report #: BC18944A

Revision #: 0

Issue Date: 28-Nov-12

Client: ALS Laboratory Group (ETL)

Code:

Contact: Monica Gibson

Job #: L1240614

P.O.#: L1240614

Address: Bay 7 - 1313 44 Avenue NE

Calgary AB

T2E 6L5

Internal Project #: BC18944

Sampled By: Not Specified

Sample Location: Not Specified

Sample Date: 21-Nov-12

Date Received: 22-Nov-12

Analytical	# of Pages
Microbiology	1
QC Report	1
Total (incl. Cover)	3

Comments: None.

Approved By: _____

Michael Busse, B.Sc.

Technical Supervisor, Analytical Services Division

-
- 1) THIS REPORT MAY NOT BE REPRODUCED IN PART WITHOUT THE EXPRESSED WRITTEN CONSENT OF THE LABORATORY.
 - 2) ANY REMAINING SAMPLES WILL BE DISPOSED OF 30 DAYS FOLLOWING ANALYSIS. CONTACT THE LABORATORY IF ADDITIONAL SAMPLE STORAGE TIME IS REQUIRED.
 - 3) ALL LABORATORY ANALYSES INCORPORATE STANDARD QC PROTOCOLS; HOWEVER, UNSIGNED TEST REPORTS ARE PRELIMINARY AND UNOFFICIAL. IF REQUIRED, PLEASE CONTACT TECHNICAL SUPERVISOR FOR QC DATA REPORTS.
 - 4) REPORTED TEST RESULTS RELATE ONLY TO THE SAMPLES AS RECEIVED BY THE LABORATORY.
 - 5) BIO-CHEM CONSULTING SERVICES LTD. ASSUMES NO LIABILITY FOR THE USE OR INTERPRETATION OF THE TEST RESULTS.
 - 6) WHERE APPLICABLE, ESTIMATION OF THE MEASUREMENT UNCERTAINTY IS AVAILABLE ON REQUEST.
-

#118, 339 - 50TH Avenue S.E.

Calgary, Alberta T2G-2B3

Telephone: (403) 253-7026

Fax: (403) 253-7072

E-mail: reporting@bio-chemconsulting.com

www.bio-chemconsulting.com



Bio-Chem Consulting Services Ltd.

CERTIFICATE OF ANALYSIS Microbiology Report

B.C. Report No. : BC18944A Rev. 0
Sub-Contracted: No
Client Job No.: L1240614

Date Analyzed: 22-Nov-12
Page Issue Date: 28-Nov-12

Sample #	Sample Description	Fecal Coliforms (MPN/100mL)				Detection Limit
1	L1240614-1 16054121121101	< 1				1

Comments:
None.

PROJECT QUALITY CONTROL REPORT

PROJECT NUMBER BC18944A-QC

PRINTED November 28, 2012

DESCRIPTION The following information is a summary of the quality control results for the test sample(s) included in the associated Test Report. Also included is a list of the applicable laboratory test methods and their regional, national, and/or international sources. Please contact the laboratory if you have any comments or questions regarding the information contained herein.

SAMPLE #
1

ASSOCIATED BATCH NUMBERS
1211156

QUALITY CONTROL RESULTS - Microbiology

Batch Number: 1211156 Matrix: Water Package: TCC/FCC-MPN-H
Testing: Presumptive – Coliforms by MPN

QC Type	Expected	Result	Pass/Fail	Qualifier
+C	Growth, Acid, Gas	Growth, Acid, Gas	P	
MB	No growth, No acid, No gas	No growth, No acid, No gas	P	

Batch Number: 1211156 Matrix: Water Package: FCC-MPN-H
Testing: Confirmation – Fecal Coliforms by MPN

QC Type	Expected	Result	Pass/Fail	Qualifier
+C	Growth, Gas	Growth, Gas	P	
MB	No growth, No gas	No growth, No gas	P	

MB: Method Blank; +C: Positive Control; -C: Negative Control

IN-HOUSE TEST METHOD
Total and Fecal Coliforms by MPN

ID NUMBER
RTM-M003

BASED ON REFERENCE
SM 9221B, E

CSSS: Canadian Society of Soil Science
ISO: International Organization for Standardization
MFHPB: HPB Microbiological Analysis of Food

NACE: National Association of Corrosion Engineers
SM: Standard Methods
SSSA: Soil Science Society of America, Methods of Soil Analysis, Book Series 5

APPENDIX E

HYDRAULIC RESPONSE TESTING RESULTS

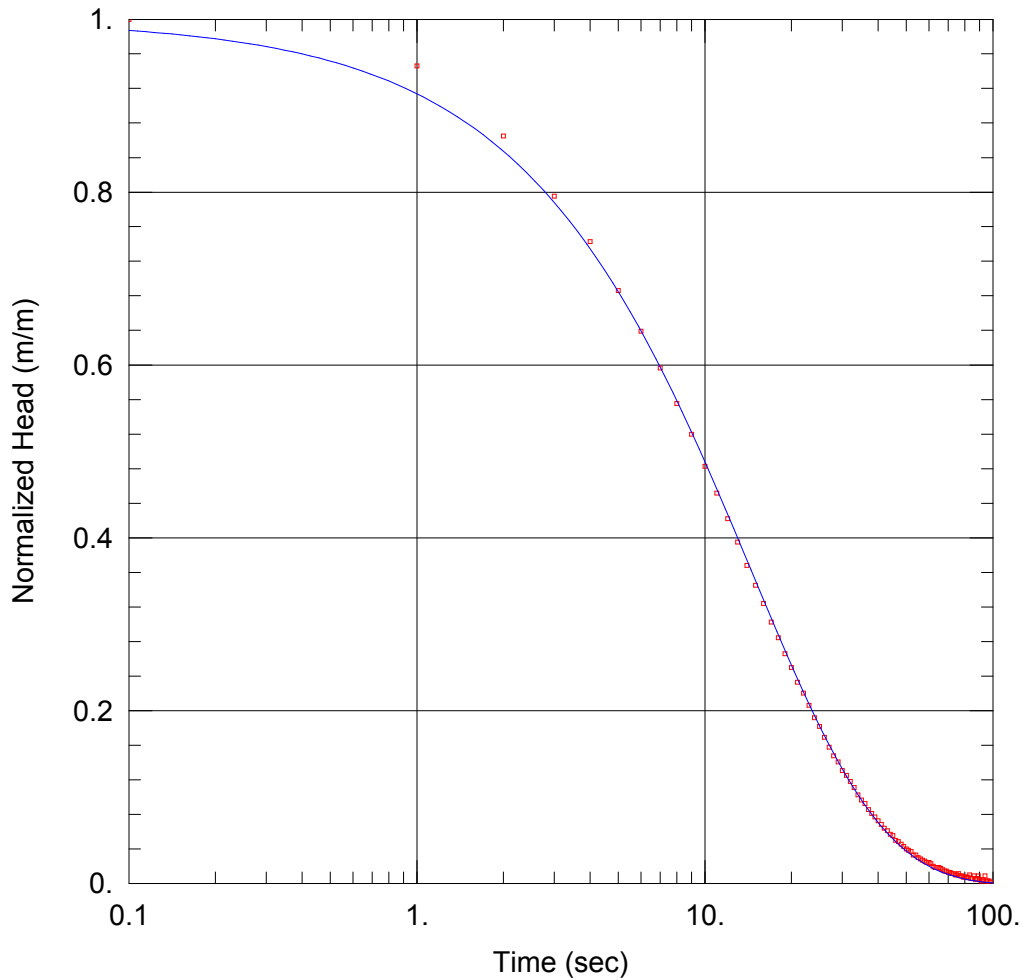
Conklin 76-7-6 Well: SlugOut Run 2 K-Test Analysis

Prepared By:
E. Amankwah/.J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
11-30-076-7 W4M



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 3.065E-5 m/sec Ss = 5.501E-6 m⁻¹
Kz/Kr = 0.1

AQUIFER DATA

Saturated Thickness: 3.15 m

WELL DATA (Conklin 76-7-6)

Initial Displacement: 0.704 m
Static Water Column Height: 3.15 m
Total Well Penetration Depth: 3.15 m
Screen Length: 3.1 m
Casing Radius: 0.0254 m
Well Radius: 0.0762 m



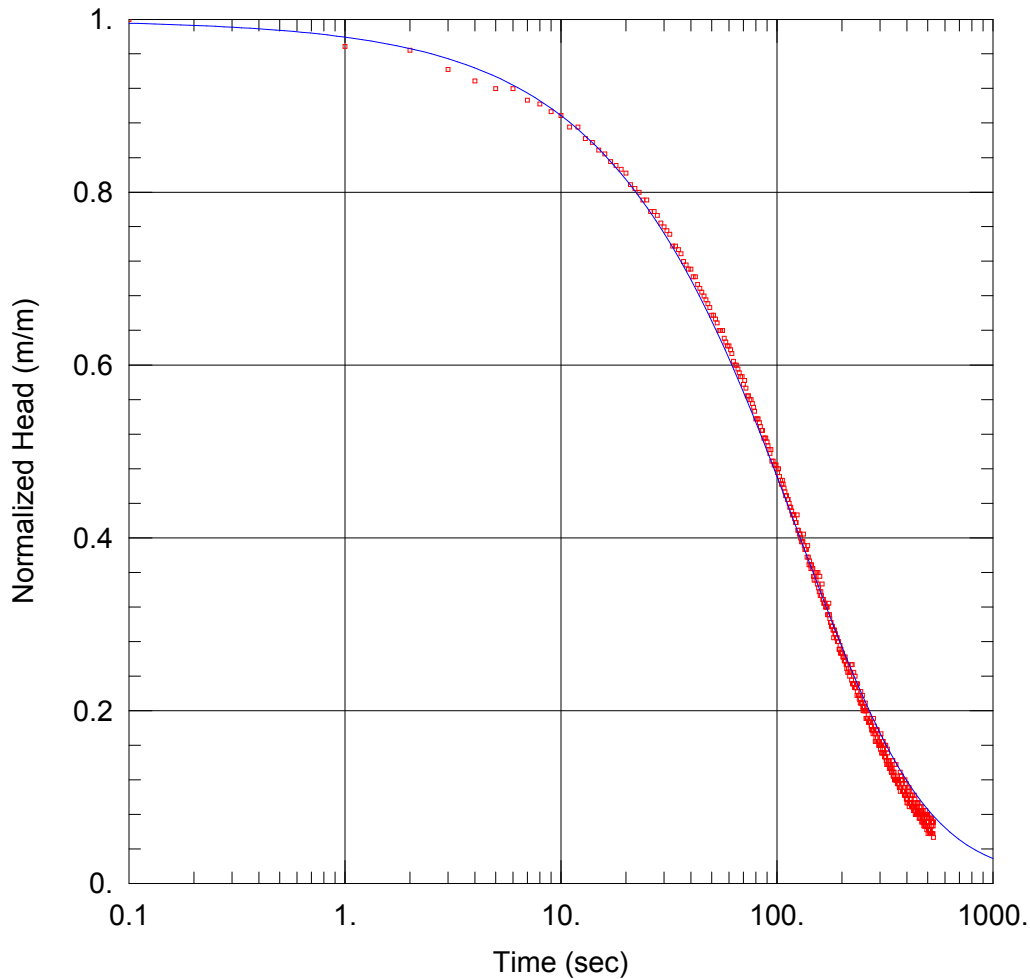
Conklin 76-7-24 Well: SlugOut Run 2 K-Test Analysis

Prepared By:
E. Amankwah/.J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
11-30-076-7 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

$K_r = 1.162E-5$ m/sec $S_s = 0.0001094$ m⁻¹
 $K_z/K_r = 0.6166$

AQUIFER DATA

Saturated Thickness: 3 m

WELL DATA (Conklin 76-7-24)

Initial Displacement: 0.225 m
Static Water Column Height: 18.27 m
Total Well Penetration Depth: 3 m
Screen Length: 3 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m



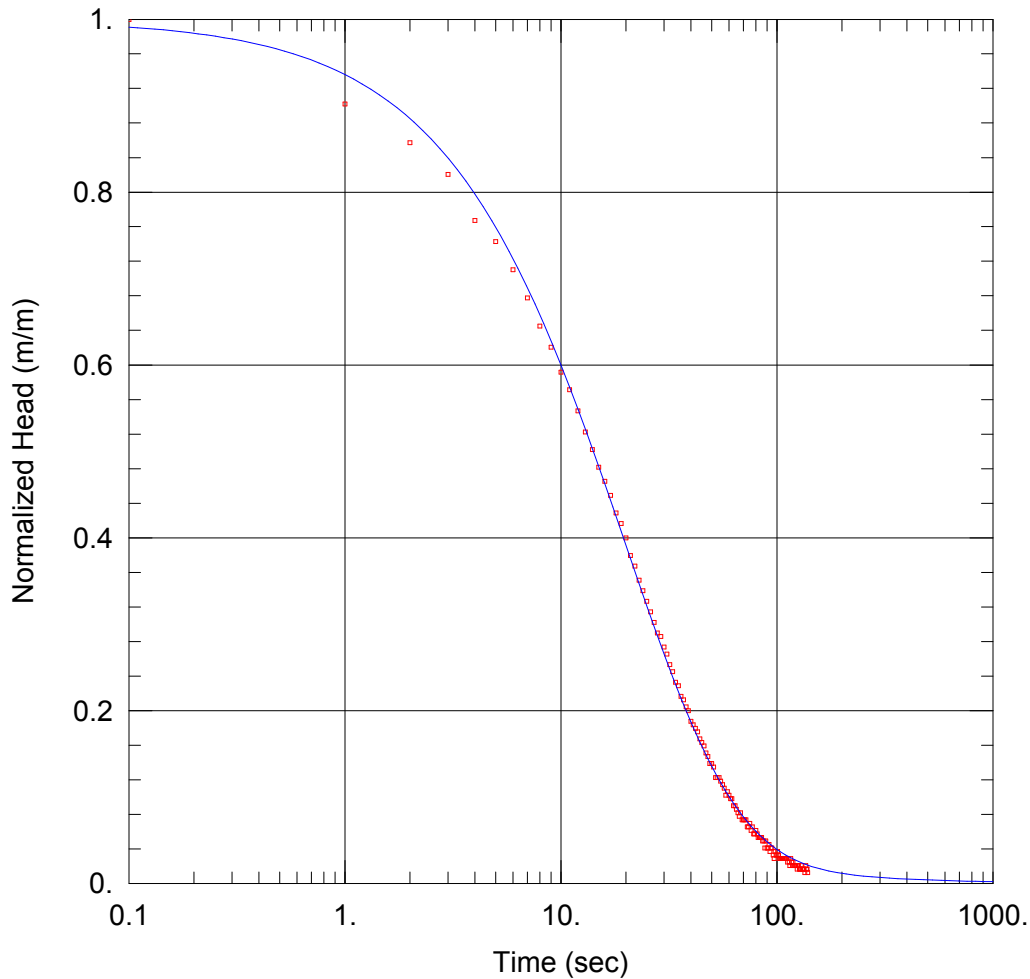
Conklin 76-7-41 Well: SlugOut Run 1 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
11-30-076-7 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 6.063E-5 m/sec Ss = 7.819E-7 m⁻¹
Kz/Kr = 0.6695

AQUIFER DATA

Saturated Thickness: 6.1 m

WELL DATA (Conklin 76-7-41)

Initial Displacement: 0.245 m
Static Water Column Height: 39.02 m
Total Well Penetration Depth: 6.1 m
Screen Length: 6.1 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m



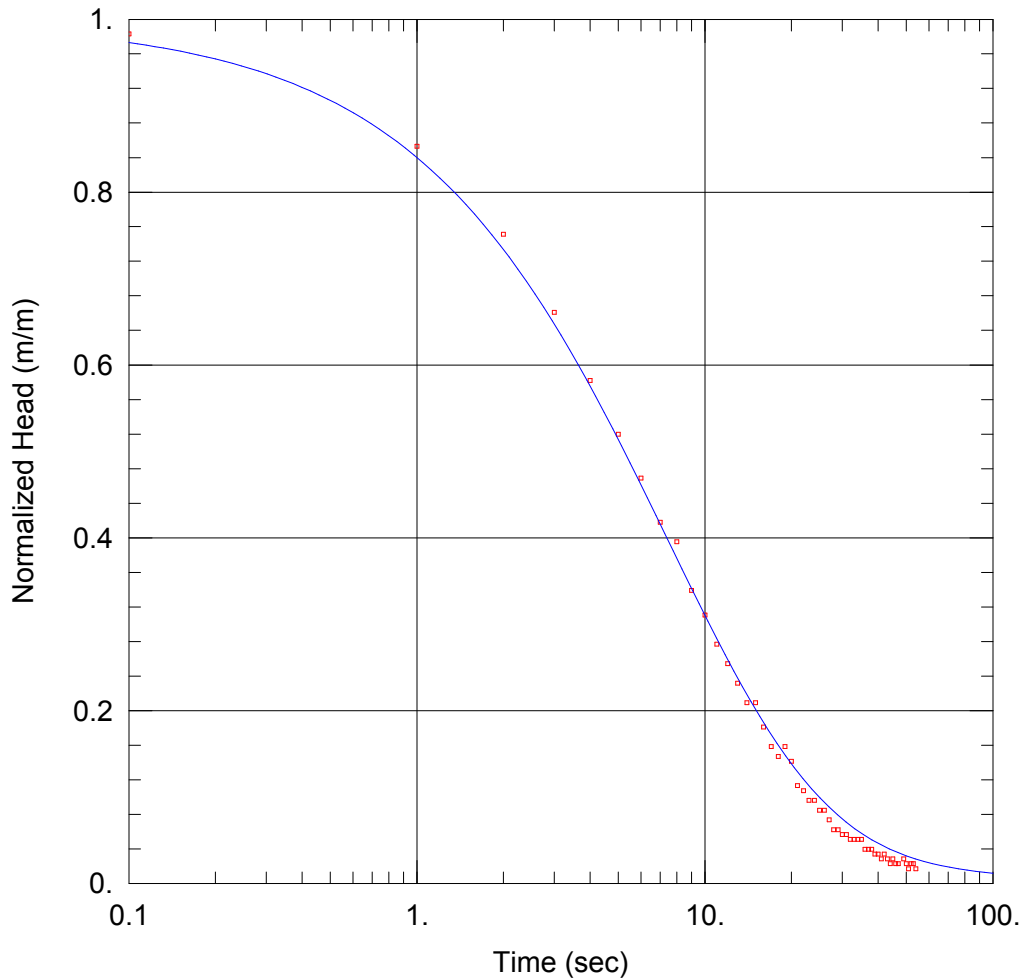
Conklin 76-7-67 Well: SlugOut Run 2 K-Test Analysis

Prepared By:
E. Amankwah/.J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
11-30-076-7 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

$K_r = 0.0001126$ m/sec $S_s = 2.141E-5$ m⁻¹
 $K_z/K_r = 0.8261$

AQUIFER DATA

Saturated Thickness: 6.1 m

WELL DATA (Conklin 76-7-67)

Initial Displacement: 0.177 m
Static Water Column Height: 63.54 m
Total Well Penetration Depth: 6.1 m
Screen Length: 6.1 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m



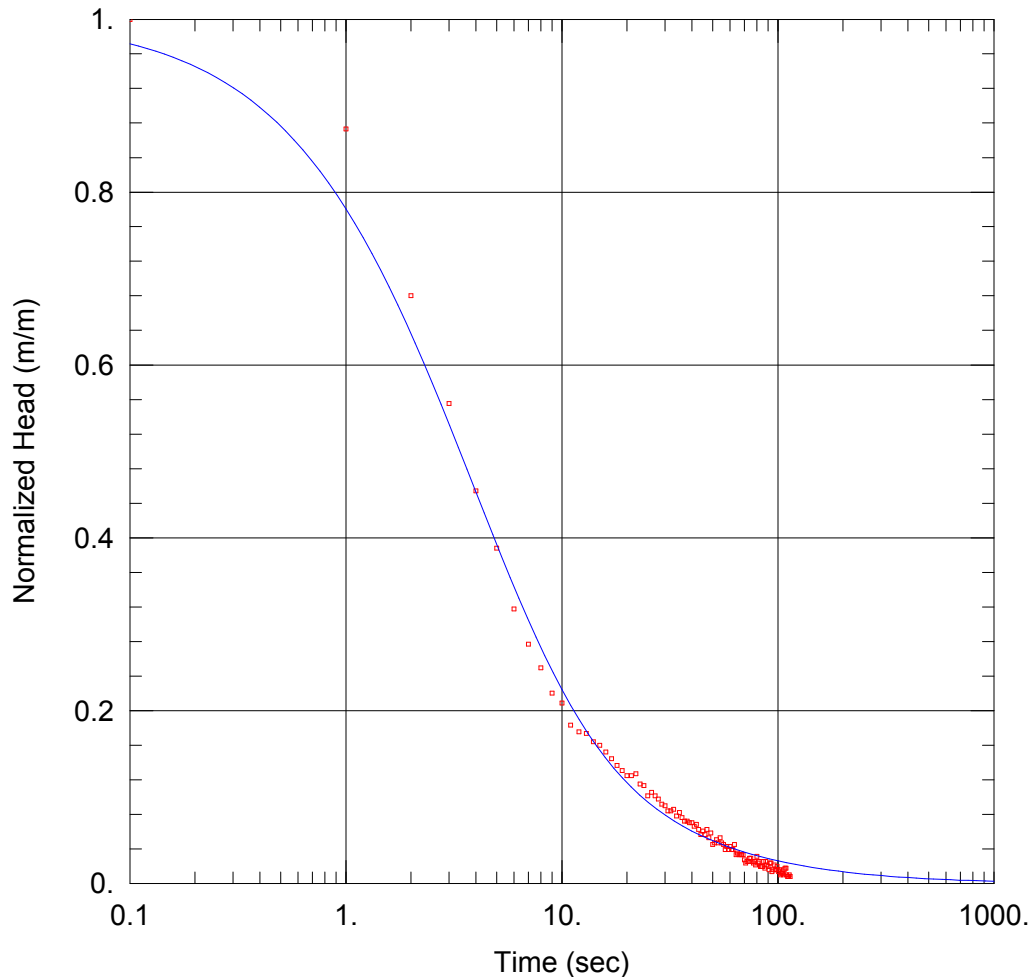
Waddell Creek 80-9-9 Well: SlugOut Run 1 K-Test Analysis

Prepared By:
E. Amankwah/J.Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
08-27-080-9 W4M



SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model w/skin

$K_r = 2.438E-5$ m/sec

$S_s = 0.1098$ m⁻¹

$K_z/K_r = 1.$

$K_r' = 1.258E-5$ m/sec

$S_s' = 1.081E-10$ m⁻¹

$K_z/K_r' = 0.7255$

AQUIFER DATA

Saturated Thickness: 1.82 m

WELL DATA (Waddell Creek 80-9-9)

Initial Displacement: 0.513 m

Static Water Column Height: 1.82 m

Total Well Penetration Depth: 1.82 m

Screen Length: 1.82 m

Casing Radius: 0.0254 m

Well Radius: 0.0795 m

Well Skin Radius: 0.1 m



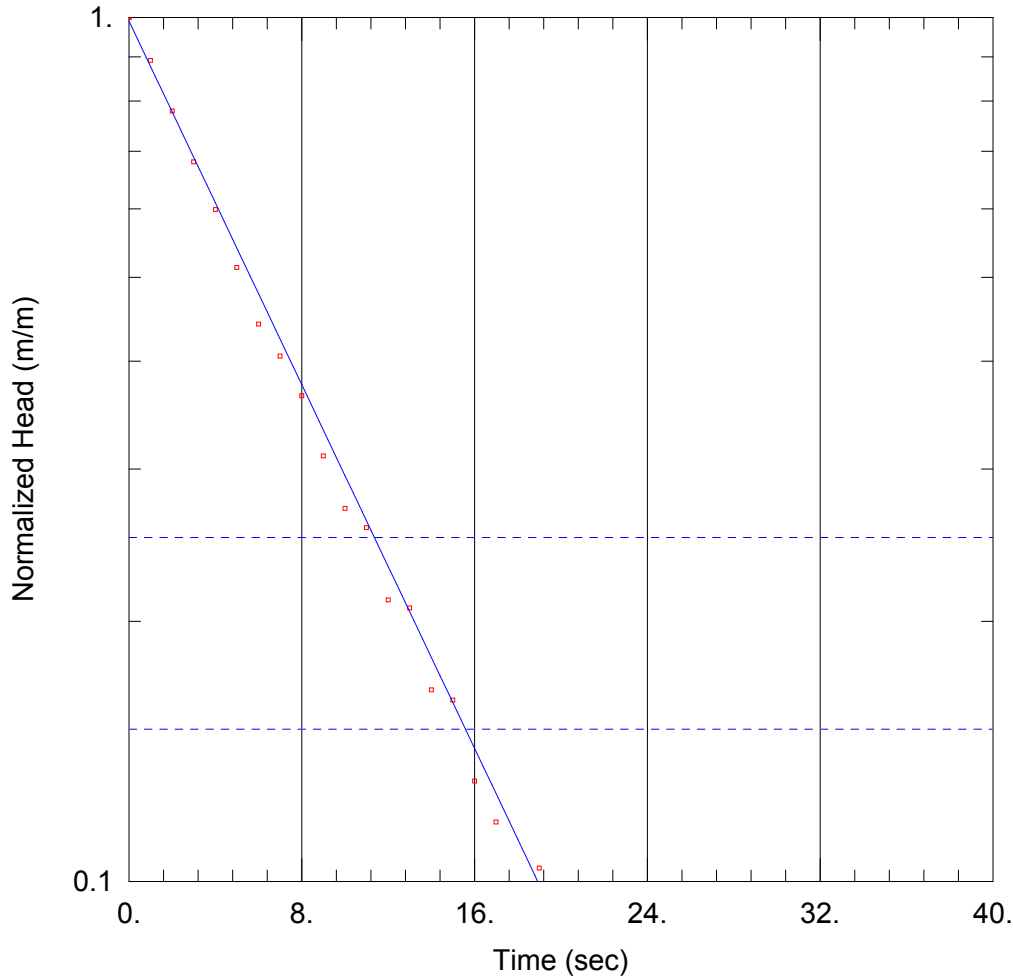
Waddell Creek 80-9-21 Well: SlugOut Run 1 K-Test Analysis

Prepared By:
E. Amankwah/J.Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
08-27-080-9 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 0.0002678 m/sec y0 = 0.2198 m

AQUIFER DATA

Saturated Thickness: 6.1 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (Waddell Creek 80-9-21)

Initial Displacement: 0.222 m
Static Water Column Height: 11.9 m
Total Well Penetration Depth: 6.1 m
Screen Length: 3 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m



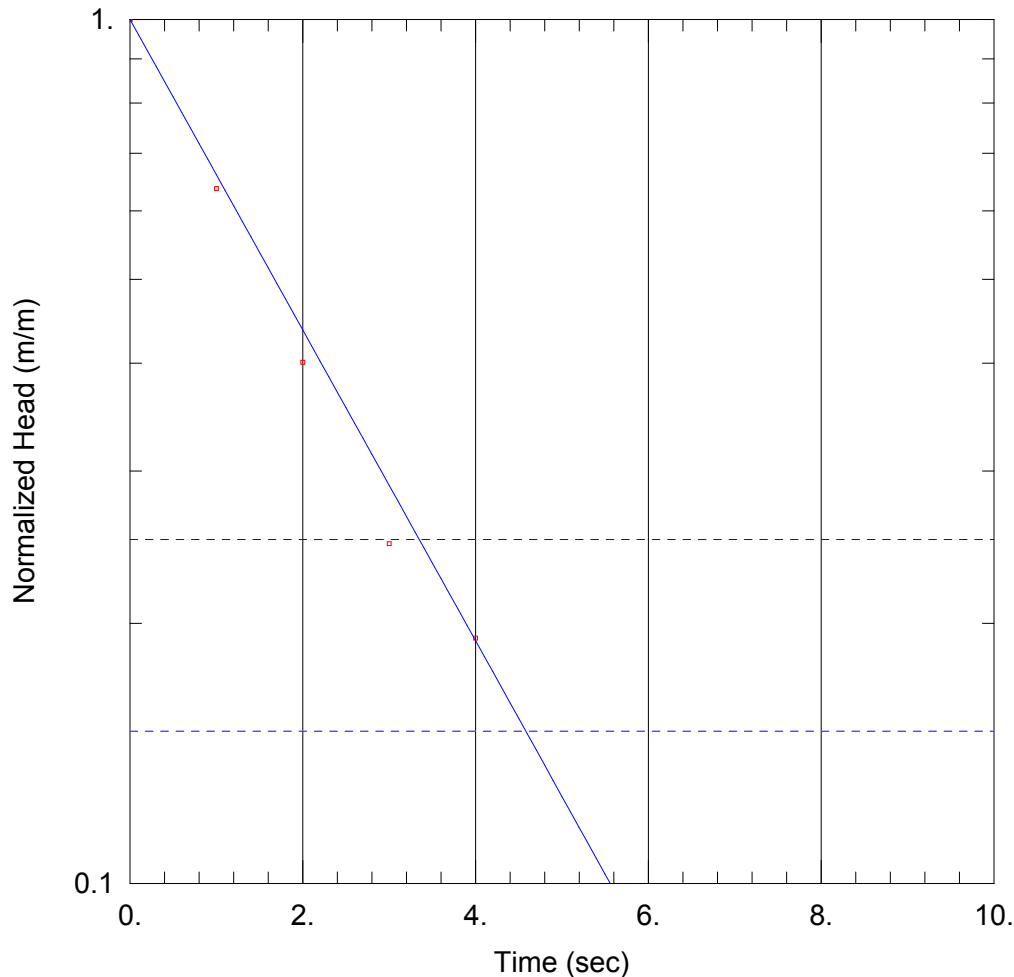
Waddell Creek 80-9-117 Well: SlugIn Run 1 K-Test Analysis

Prepared By:
E. Amankwah/J.Xhemala 1212

Prepared For:
ESRD

Project:
16054-502

Location:
08-27-080-9 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 0.0005123 m/sec $y_0 = \underline{0.182}$ m

AQUIFER DATA

Saturated Thickness: 27.2 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (Waddell Creek 80-9-117)

Initial Displacement: 0.182 m
Static Water Column Height: 97.53 m
Total Well Penetration Depth: 27.2 m
Screen Length: 6.1 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m



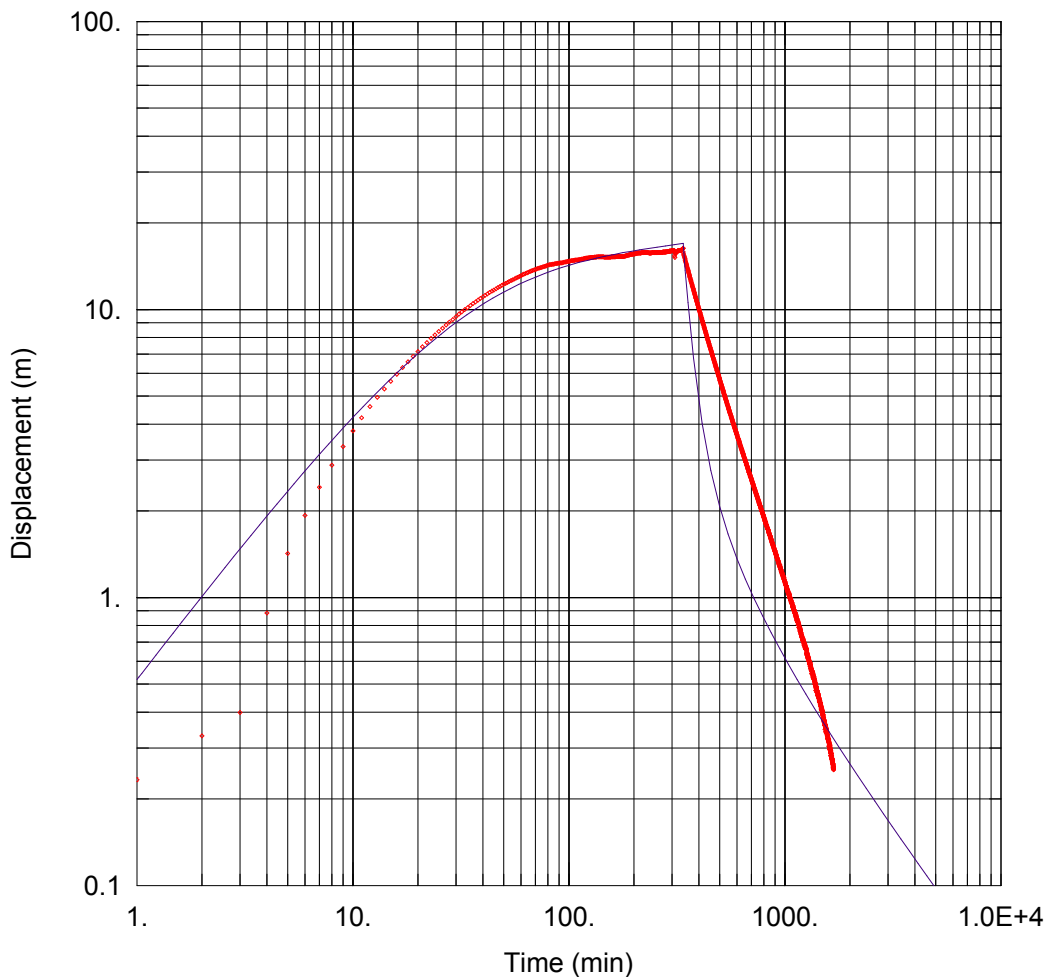
Waddell Creek 80-09-149 Well: Single Well Pumping Test

Prepared By:
J. Xhemalaj 2012

Prepared For:
ESRD

Project:
16054-502

Location:
08-27-080-09 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: Dougherty-Babu

T = 0.335 m²/day S = 1.558E-6
Kz/Kr = 1. Sw = -0.5963
r(w) = 0.3474 m r(c) = 0.04875 m

AQUIFER DATA

Saturated Thickness: 3.1 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Wadell Creek 80-09-149	0	0

Observation Wells

Well Name	X (m)	Y (m)
• Wadell Creek 80-09-149	0	0



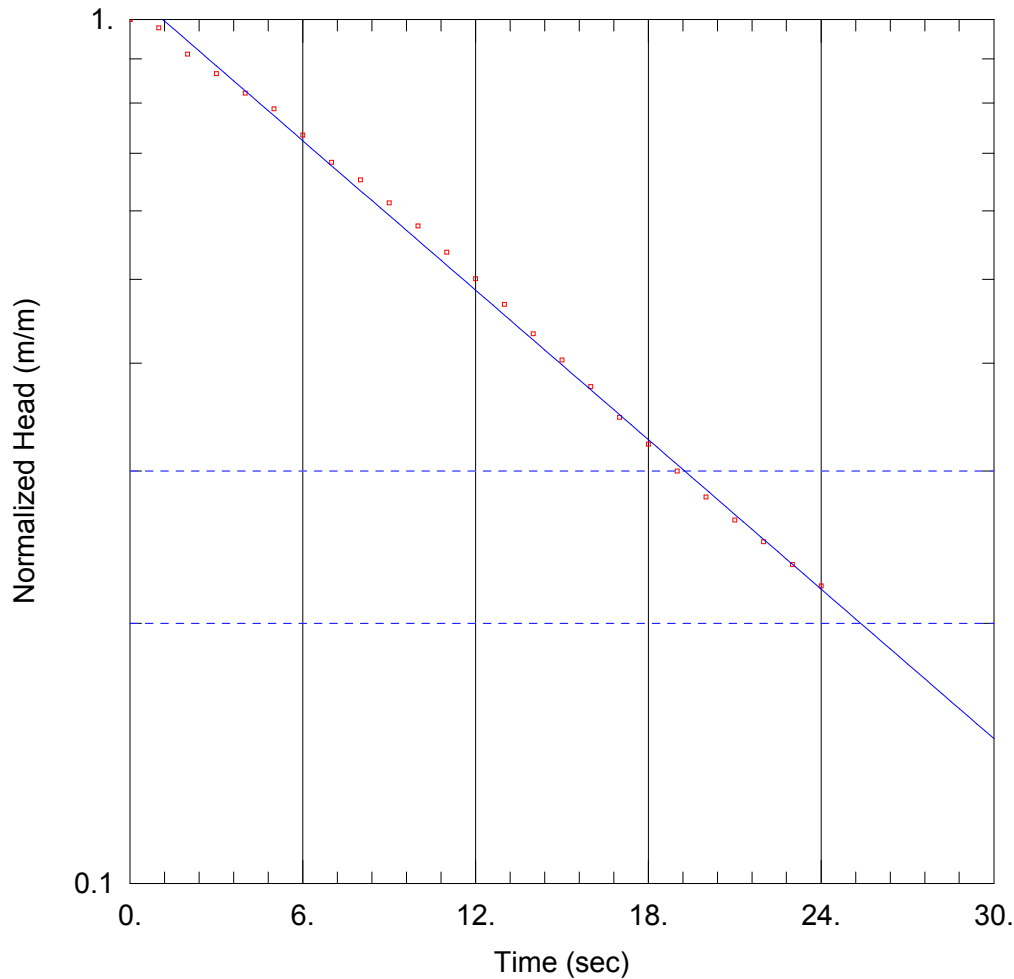
Mariana Lakes 80-13-7 Well: SlugOut Run1 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
07-19-080-13 W4M



SOLUTION

Aquifer Model: Unconfined
 Solution Method: Bouwer-Rice
 $K = 0.0001643$ m/sec $y_0 = 0.5854$ m

AQUIFER DATA

Saturated Thickness: 2.25 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (Mariana Lakes 80-13-7)

Initial Displacement: 0.543 m
 Static Water Column Height: 2.25 m
 Total Well Penetration Depth: 2.25 m
 Screen Length: 1.52 m
 Casing Radius: 0.0254 m
 Well Radius: 0.0762 m
 Gravel Pack Porosity: 0.3



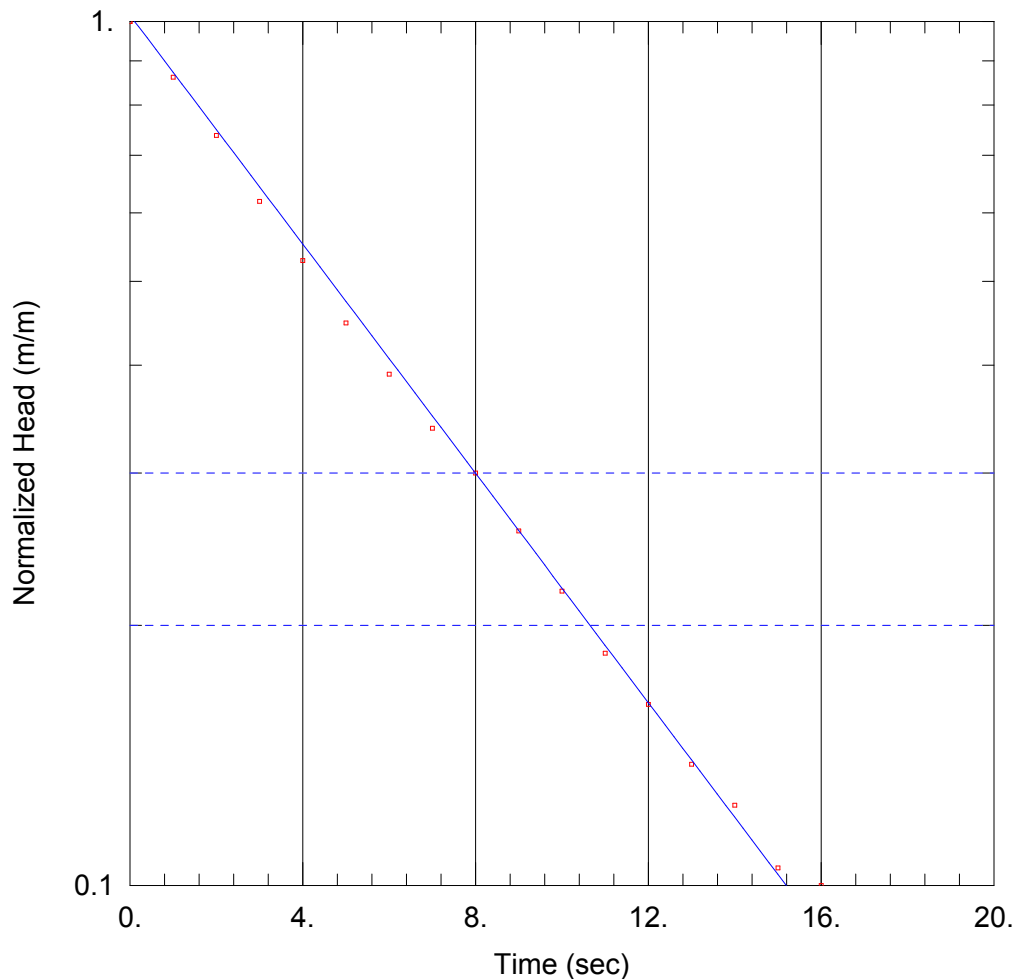
Mariana Lakes 80-13-52 Well: SlugOut Run 2 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
07-19-080-13 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

$K = 0.000168$ m/sec $y_0 = 0.2136$ m

AQUIFER DATA

Saturated Thickness: 41.06 m Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA (Mariana Lakes 80-13-52)

Initial Displacement: 0.21 m
Static Water Column Height: 41.06 m
Total Well Penetration Depth: 41.06 m
Screen Length: 6.1 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m



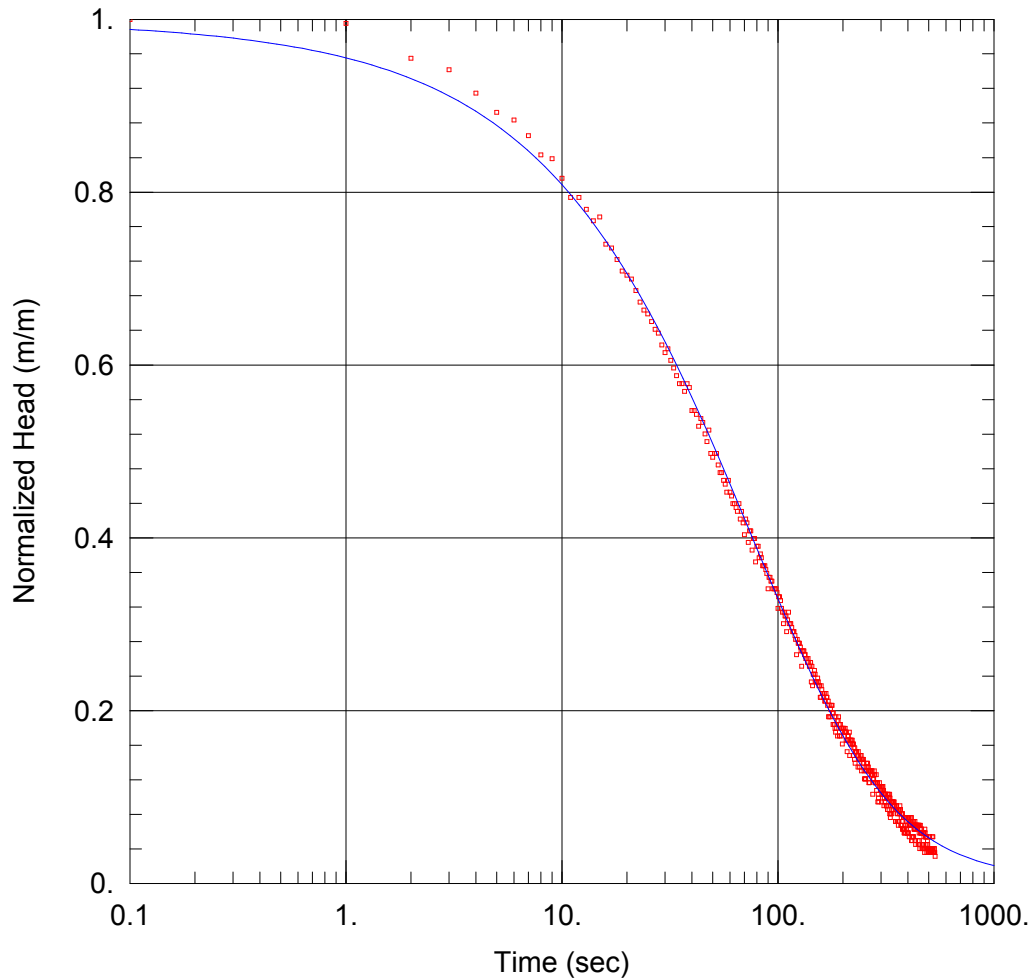
Mariana Lakes 80-13-112 Well: Slugout Run 1 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
07-19-080-13 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

$K_r = 1.328E-5$ m/sec $S_s = 0.0009385$ m⁻¹
 $K_z/K_r = 0.1$

AQUIFER DATA

Saturated Thickness: 3 m

WELL DATA (Mariana Lakes 80-13-112)

Initial Displacement: 0.223 m
Static Water Column Height: 95.26 m
Total Well Penetration Depth: 3 m
Screen Length: 3 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m
Gravel Pack Porosity: 0.3



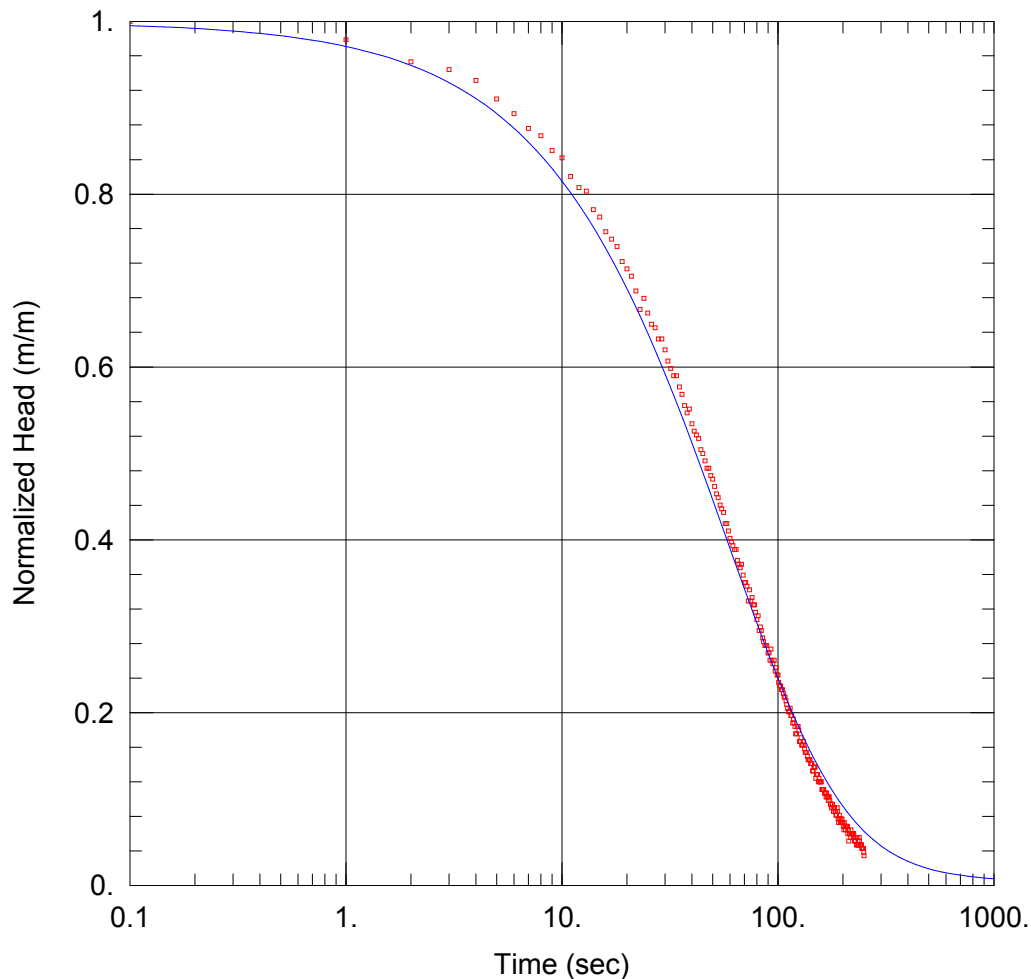
Mariana Lakes 80-13-134 Well: SlugOut Run 1 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
07-19-080-13 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

$K_r = 2.836E-5$ m/sec $S_s = 1.273E-5$ m⁻¹
 $K_z/K_r = 0.1$

AQUIFER DATA

Saturated Thickness: 3.5 m

WELL DATA (Mariana Lakes 80-13-134)

Initial Displacement: 0.234 m
Static Water Column Height: 94.2 m
Total Well Penetration Depth: 3.5 m
Screen Length: 3.5 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m
Gravel Pack Porosity: 0.3



ENVIRONMENT & ENGINEERING

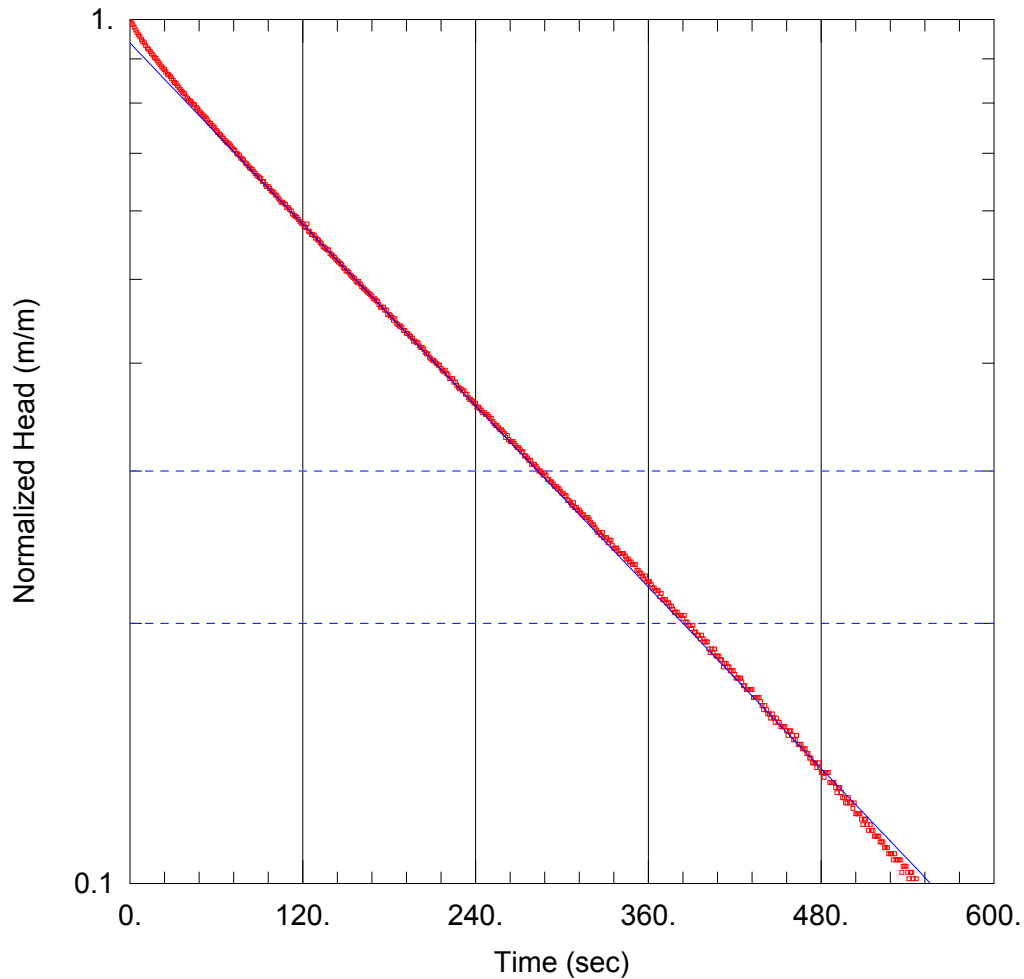
House Crossing 77-15-8 Well: SlugOut Run 2 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
07-36-077-15 W4M



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

$K = 1.848E-6$ m/sec $y_0 = 0.5381$ m

AQUIFER DATA

Saturated Thickness: 7.05 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (House Crossing 77-15-8)

Initial Displacement: 0.573 m
Static Water Column Height: 7.05 m
Total Well Penetration Depth: 7.05 m
Screen Length: 3. m
Casing Radius: 0.0254 m
Well Radius: 0.0762 m



ENVIRONMENT & ENGINEERING

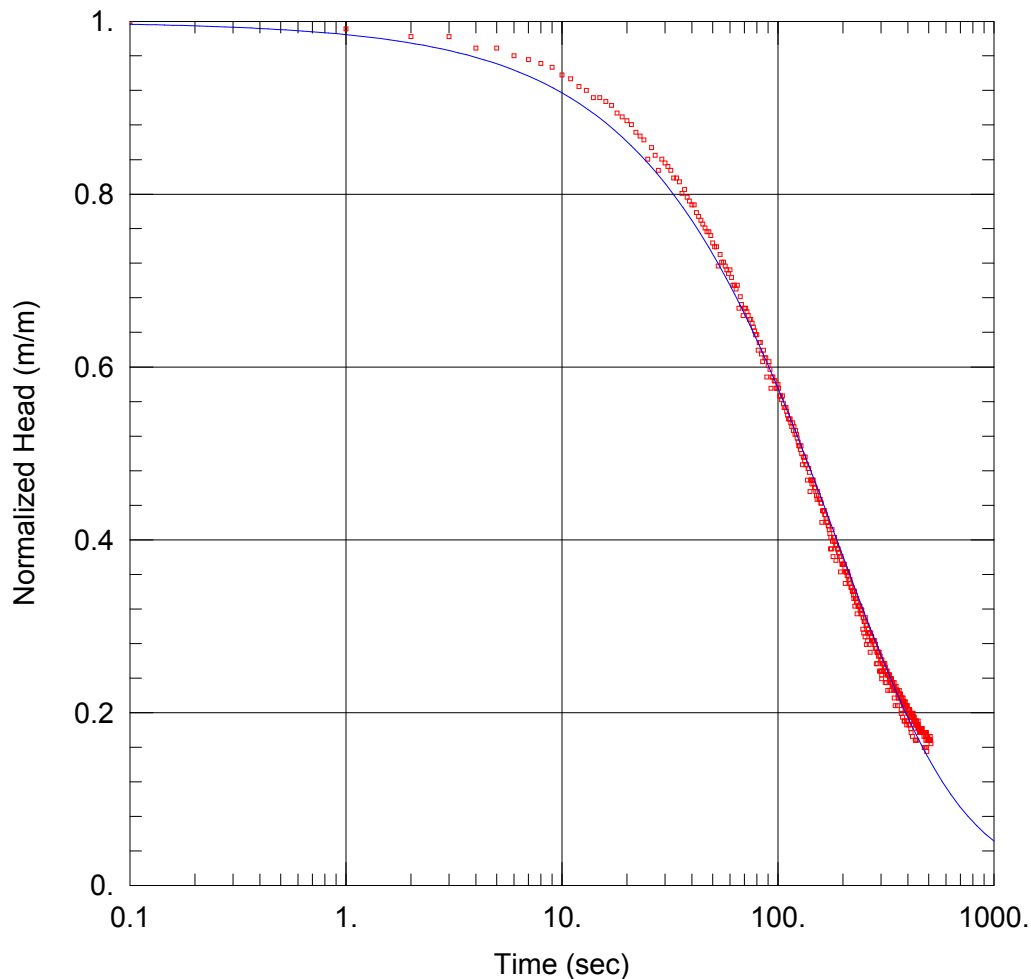
House Crossing 77-15-82 Well: SlugInRun2 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
07-36-077-15 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

$K_r = 8.108E-6$ m/sec $S_s = 9.492E-5$ m⁻¹
 $K_z/K_r = 0.1$

AQUIFER DATA

Saturated Thickness: 3 m

WELL DATA (House Crossing 77-15-82)

Initial Displacement: 0.226 m
Static Water Column Height: 15.05 m
Total Well Penetration Depth: 3 m
Screen Length: 3 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m
Gravel Pack Porosity: 0.3



ENVIRONMENT & ENGINEERING

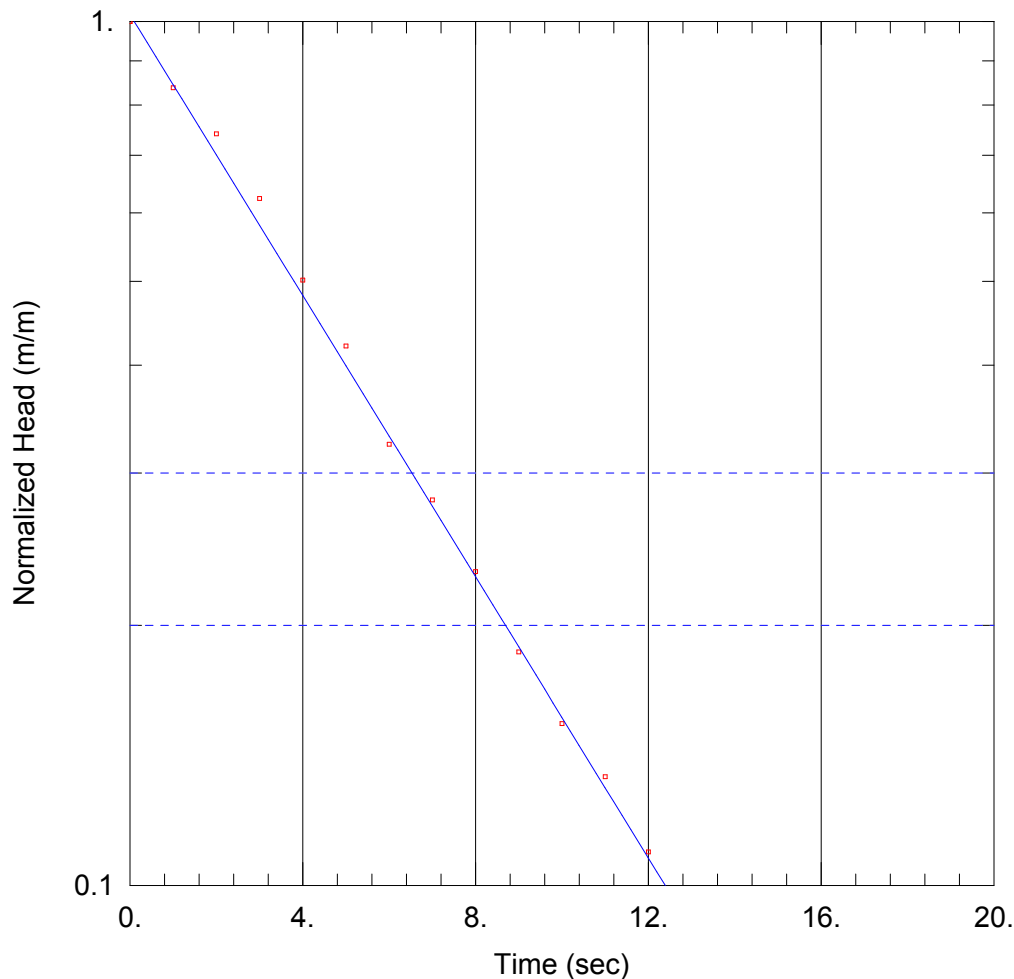
House Crossing 77-15-126: SlugOutRun 2 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 12122

Prepared For:
ESRD

Project:
16054-502

Location:
07-36-077-15 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

$K = 0.0001216$ m/sec $y_0 = 0.2516$ m

AQUIFER DATA

Saturated Thickness: 6.1 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (House Crossing 77-15-126)

Initial Displacement: 0.247 m
Static Water Column Height: 73.5 m
Total Well Penetration Depth: 6.1 m
Screen Length: 6.1 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m



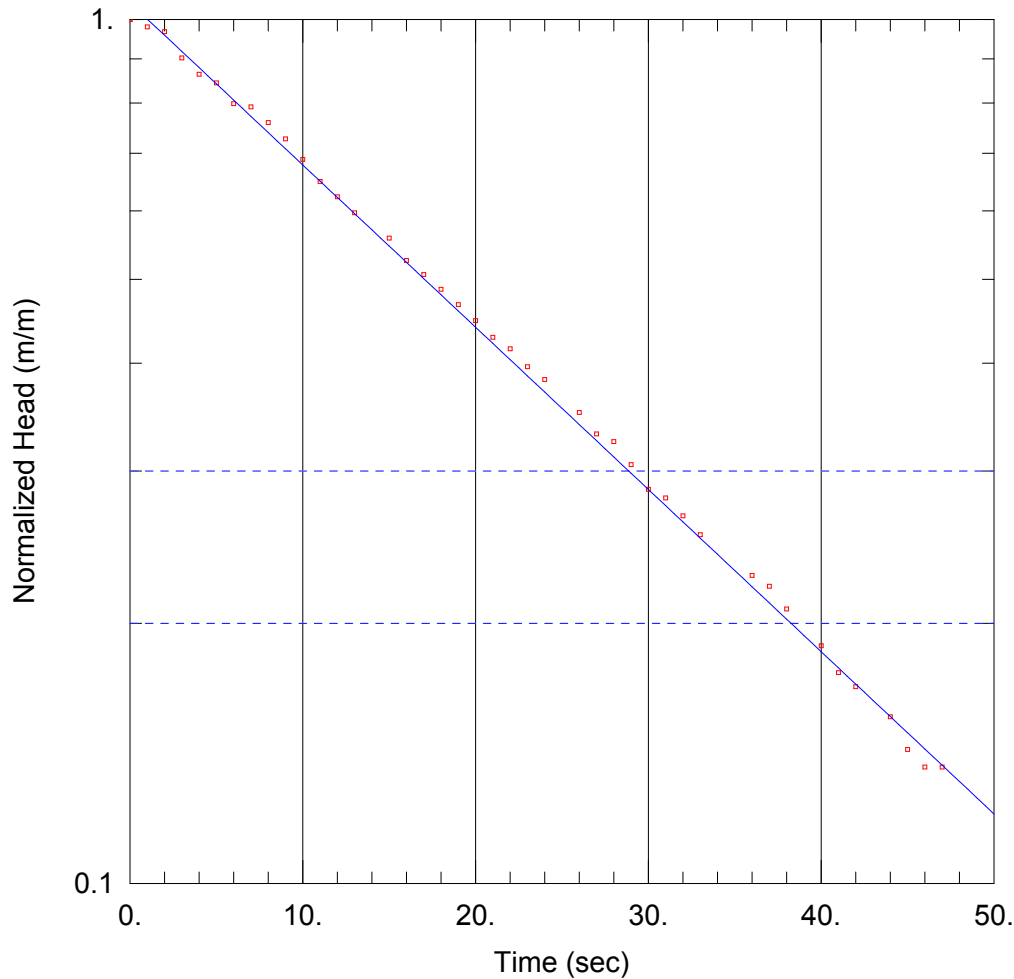
House Crossing 77-15-161 Well: SlugOut Run1 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
07-36-077-15 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

$K = 2.807E-5$ m/sec $y_0 = 0.161$ m

AQUIFER DATA

Saturated Thickness: 6.1 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (House Crossing 77-15-161)

Initial Displacement: 0.154 m
Static Water Column Height: 99.05 m
Total Well Penetration Depth: 6.1 m
Screen Length: 6.1 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m
Gravel Pack Porosity: 0.3



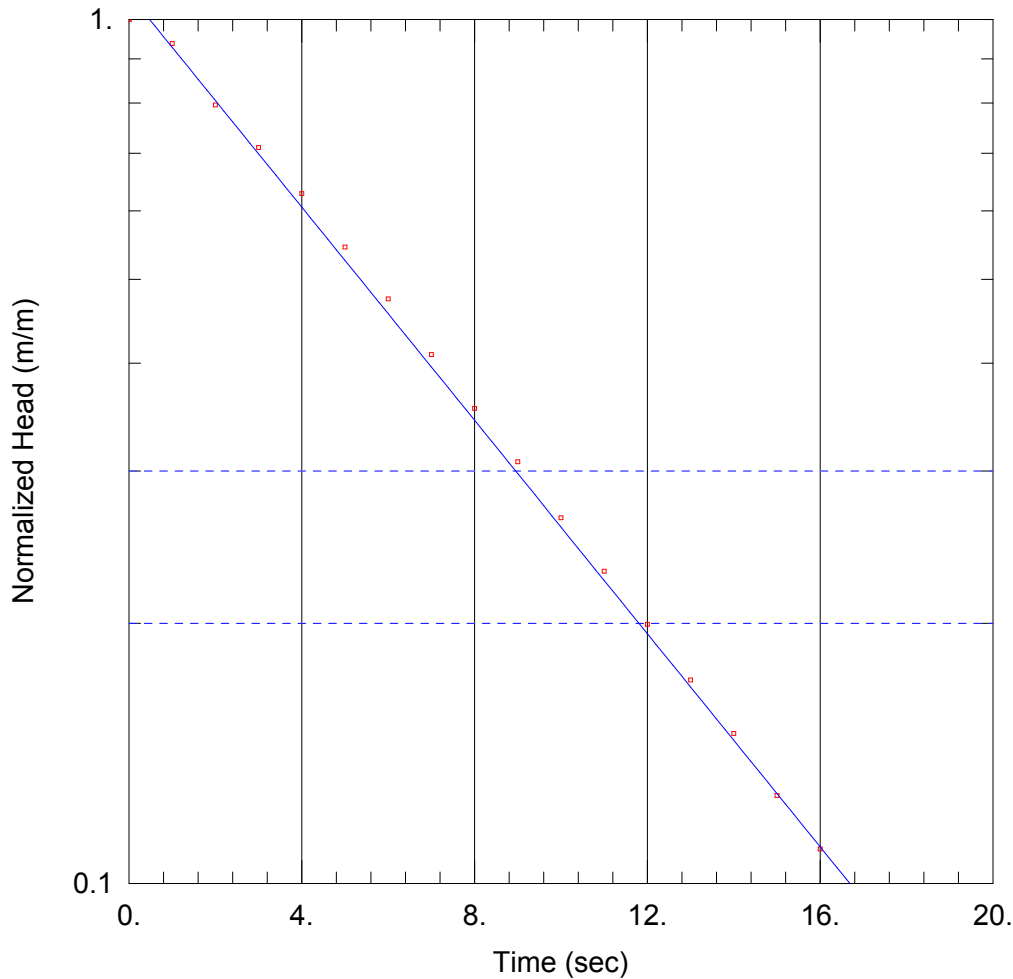
House Crossing 77-15-231 Well: SlugIn K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
07-36-077-15 W4M



SOLUTION

Aquifer Model: Confined
 Solution Method: Bouwer-Rice
 $K = 5.906E-5$ m/sec $y_0 = 0.7029$ m

AQUIFER DATA

Saturated Thickness: 3.04 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (House Crossing 77-15-231)

Initial Displacement: 0.657 m
 Static Water Column Height: 161. m
 Total Well Penetration Depth: 3.04 m
 Screen Length: 3.04 m
 Casing Radius: 0.03 m
 Well Radius: 0.0762 m



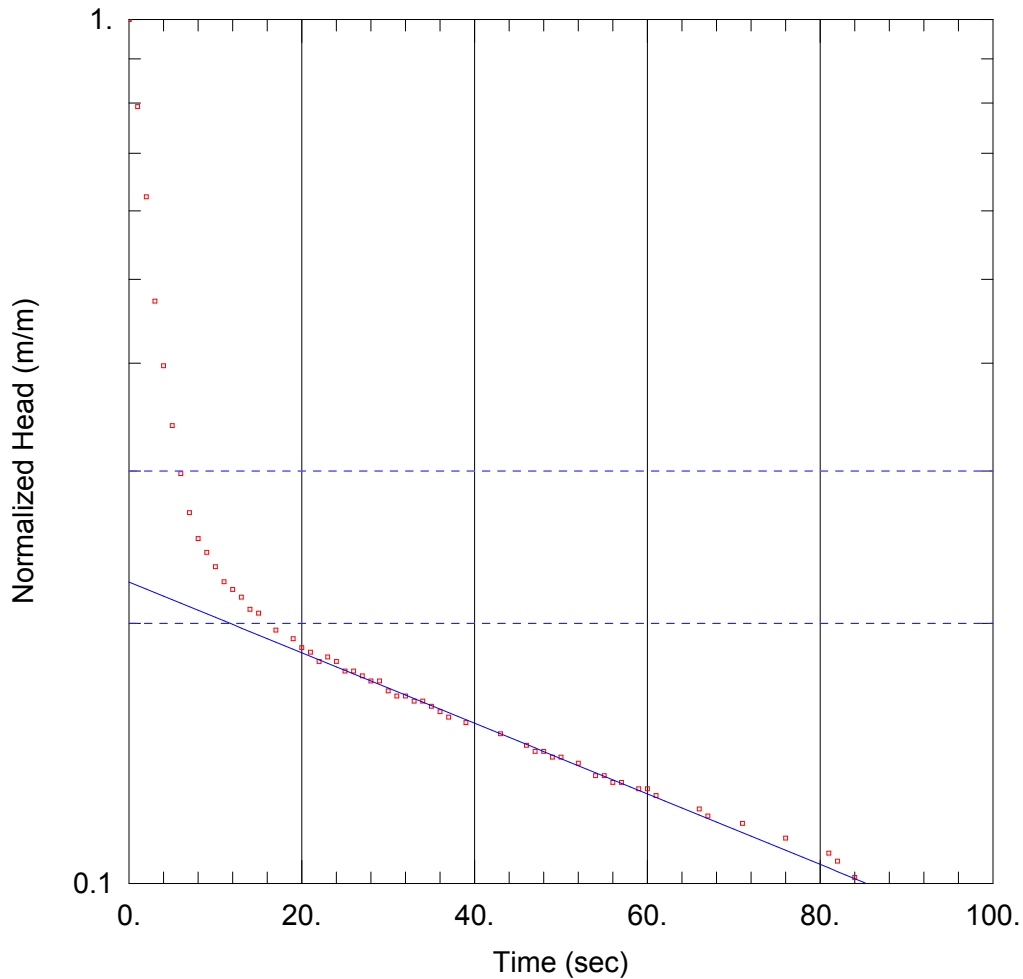
Plamondon 68-16-7 Well: SlugOut Run2 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
10-26-068-16 W4M



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

$K = 1.365E-5$ m/sec $y_0 = 0.09887$ m

AQUIFER DATA

Saturated Thickness: 1.78 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (Plamondon 68-16-7)

Initial Displacement: 0.443 m
Static Water Column Height: 1.78 m
Total Well Penetration Depth: 1.78 m
Screen Length: 1.78 m
Casing Radius: 0.0254 m
Well Radius: 0.0762 m
Gravel Pack Porosity: 0.3

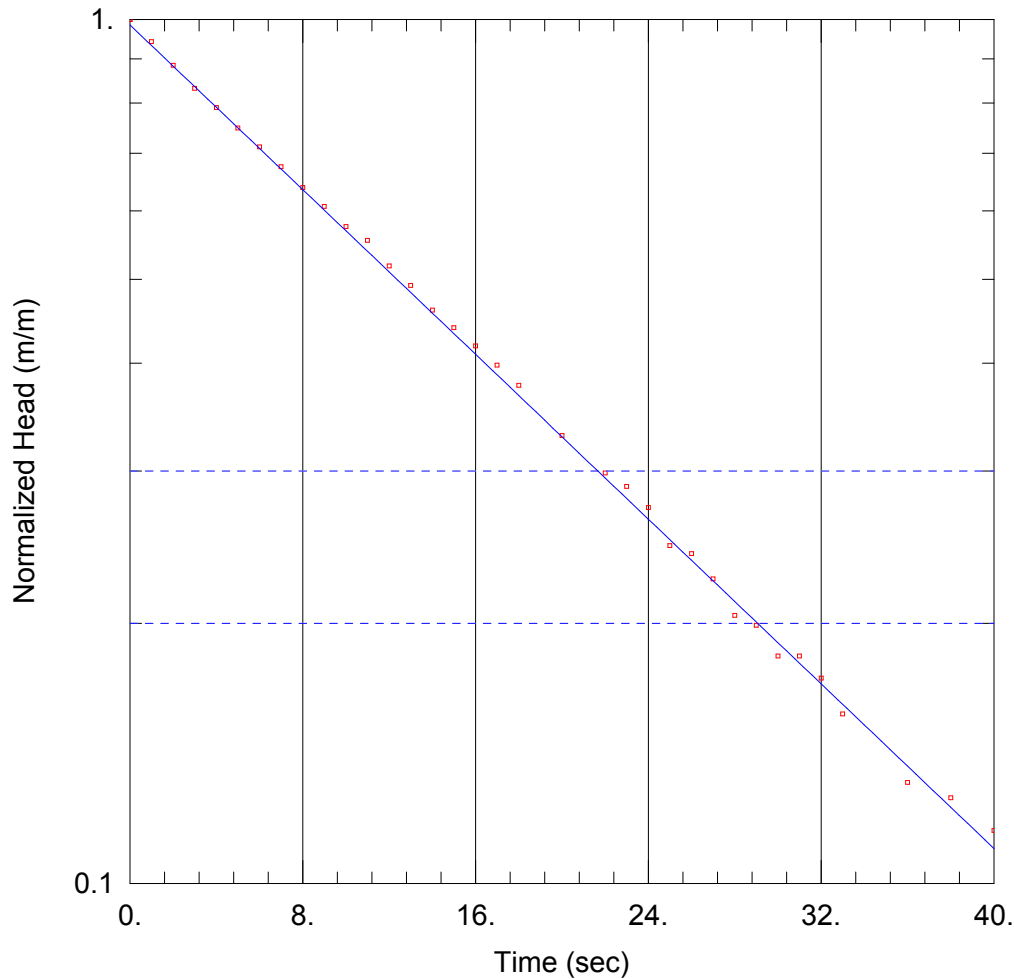
Plamondon 68-16-39 Well: SlugOutRun2 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
10-26-068-16 W4M



SOLUTION

Aquifer Model: Confined
 Solution Method: Bouwer-Rice
 $K = 3.56E-5$ m/sec $y_0 = 0.1881$ m

AQUIFER DATA

Saturated Thickness: 6.1 m Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA (Plamondon 68-16-39)

Initial Displacement: 0.191 m
 Static Water Column Height: 9.55 m
 Total Well Penetration Depth: 6.1 m
 Screen Length: 6.1 m
 Casing Radius: 0.0508 m
 Well Radius: 0.1111 m



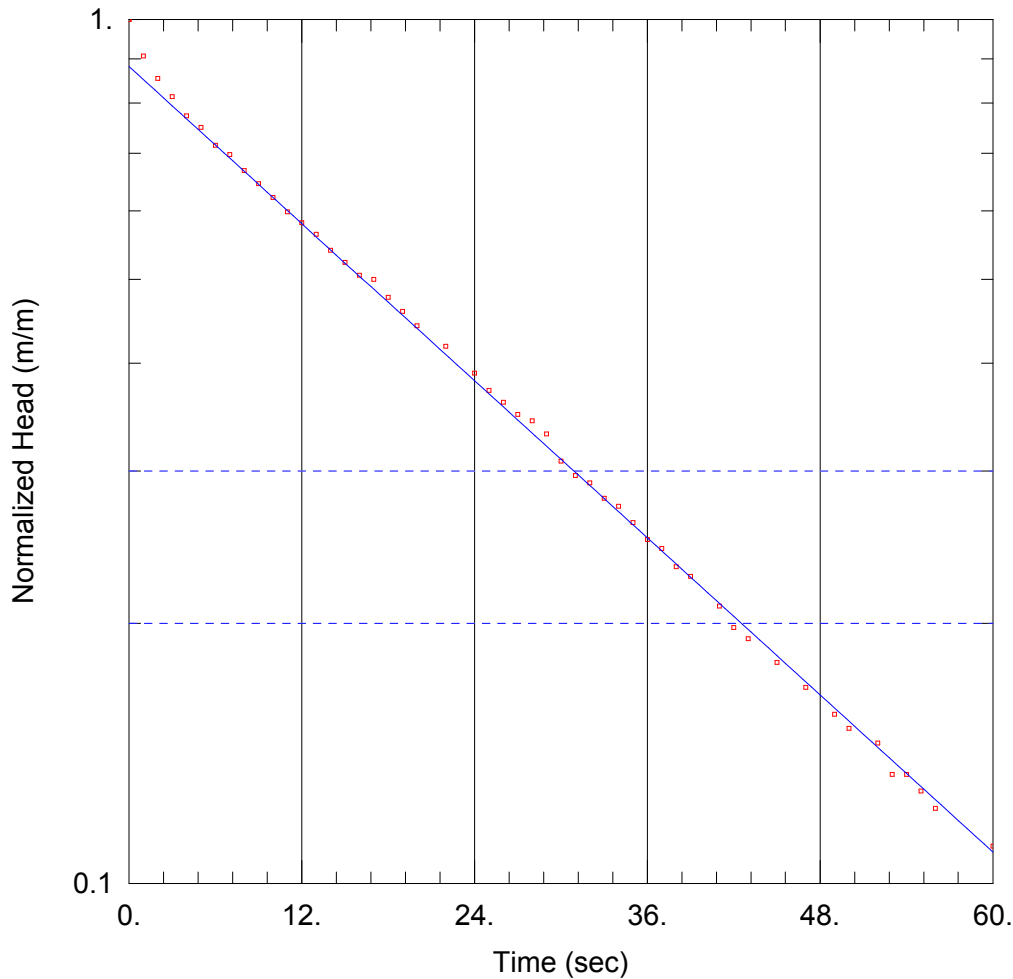
Plamondon 68-16-51 Well: SlugOutRun2 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
10-26-068-16 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

$K = 2.265E-5$ m/sec $y_0 = 0.1517$ m

AQUIFER DATA

Saturated Thickness: 6.1 m Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA (Plamondon 68-16-51)

Initial Displacement: 0.172 m
Static Water Column Height: 19.82 m
Total Well Penetration Depth: 6.1 m
Screen Length: 6.1 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m



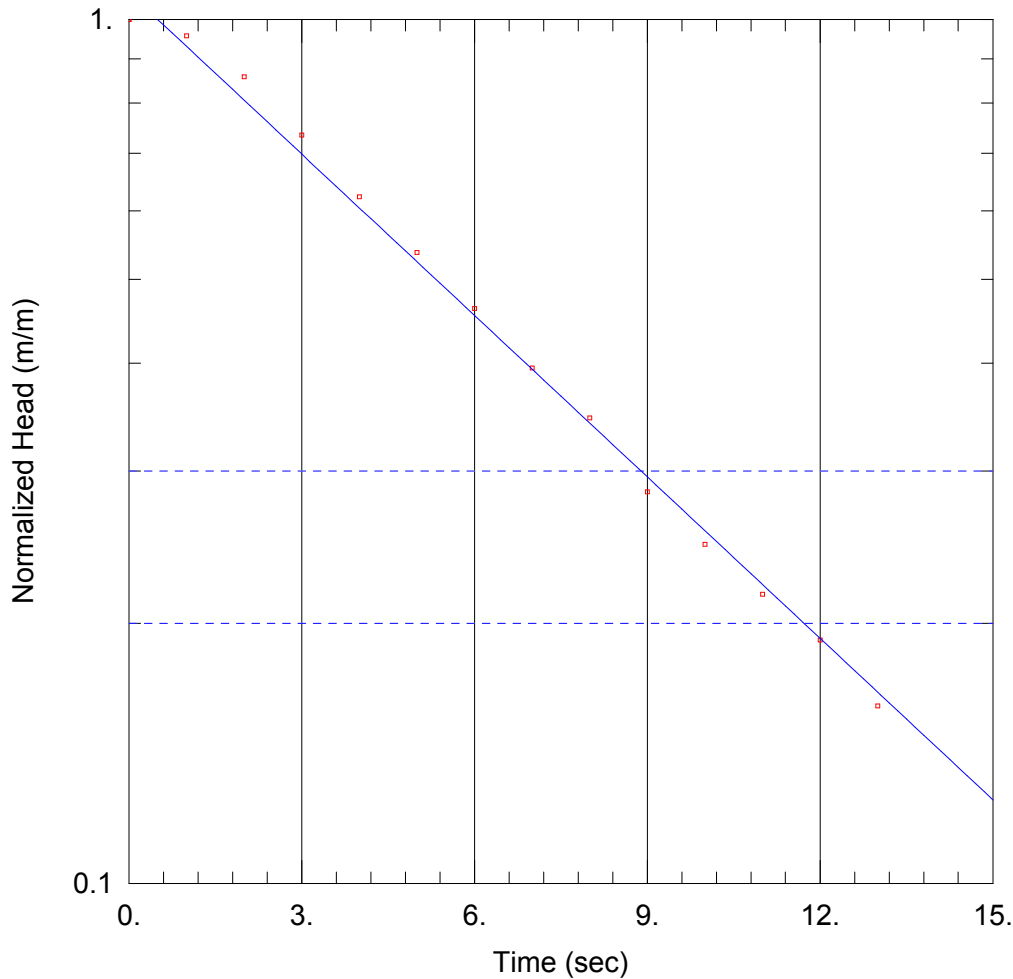
Plamondon 68-16-70 Well: SlugOut Run2 K-Test Analysis

Prepared By:
E. Amankwah/J. Xhemalaj 1212

Prepared For:
ESRD

Project:
16054-502

Location:
10-26-068-16 W4M



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

$K = 9.311E-5$ m/sec $y_0 = 0.174$ m

AQUIFER DATA

Saturated Thickness: 6.1 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (Plamondon 68-16-70)

Initial Displacement: 0.162 m
Static Water Column Height: 38.24 m
Total Well Penetration Depth: 6.1 m
Screen Length: 6.1 m
Casing Radius: 0.0508 m
Well Radius: 0.1111 m

