Regional Groundwater Quality Study of the Beverly Channel in the Fort Saskatchewan Area - Phase II

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1.0 Introduction

Stantec Consulting Ltd. (Stantec) was retained by the Northeast Capital Industrial Association (NCIA) to complete Phase II of the Regional Groundwater Quality Project (RGQP). The RGQP is a multi-phased project intended to provide a framework for regional scale management of groundwater quality issues in the Fort Saskatchewan industrial area.

The project aligns well with the principles and recommendations outlined in the Provincial Government's water strategy, *Water for Life: Alberta's Strategy for Sustainability* (Alberta Environment, 2003). "Information and knowledge of our provincial water resource was clearly defined as the most critical element in our ability to manage water effectively" (Alberta Environment, 2003). Specifically, this project seeks to:

- Develop scientific knowledge of groundwater resources in the Fort Saskatchewan area;
- Gain understanding of emerging groundwater issues in the Fort Saskatchewan area; and,
- Provide tools required to make effective groundwater management decisions.

1.1 PROJECT OVERVIEW AND PHASE II SCOPE OF WORK

The NCIA RGQP will provide a detailed characterization of the extent, thickness, hydrochemistry, and flow regime of the Beverly Channel aquifer in the Fort Saskatchewan area. The Beverly Channel aquifer is a major preglacial buried valley aquifer that serves as a source of useable water for rural Albertans along its path.

The project has been subdivided into four phases to be completed over a four to five year span (NCIA, 2003). In brief summary, the four phases of the project are:

- **Phase I:** Development of a database for hydrogeological data storage and subsequent analysis. Spatial analysis of existing data to determine the location of data gaps. Recommendations for drilling locations required to address the aforementioned data gaps.
- **Phase II:** Development and implementation of a field drilling program to obtain geological, hydrogeological, and hydrochemical information in areas where data gaps were identified. Interpretation of existing and new data to develop a regional hydrogeologic framework for the project area.
- **Phase III:** Development of a numerical groundwater flow and contaminant transport model. Calibration and verification of the model. Determination of strategic locations for the permanent regional groundwater monitoring system using the model.
- **Phase IV:** Development and implementation of the regional groundwater monitoring system, long term monitoring strategy, and response plan.

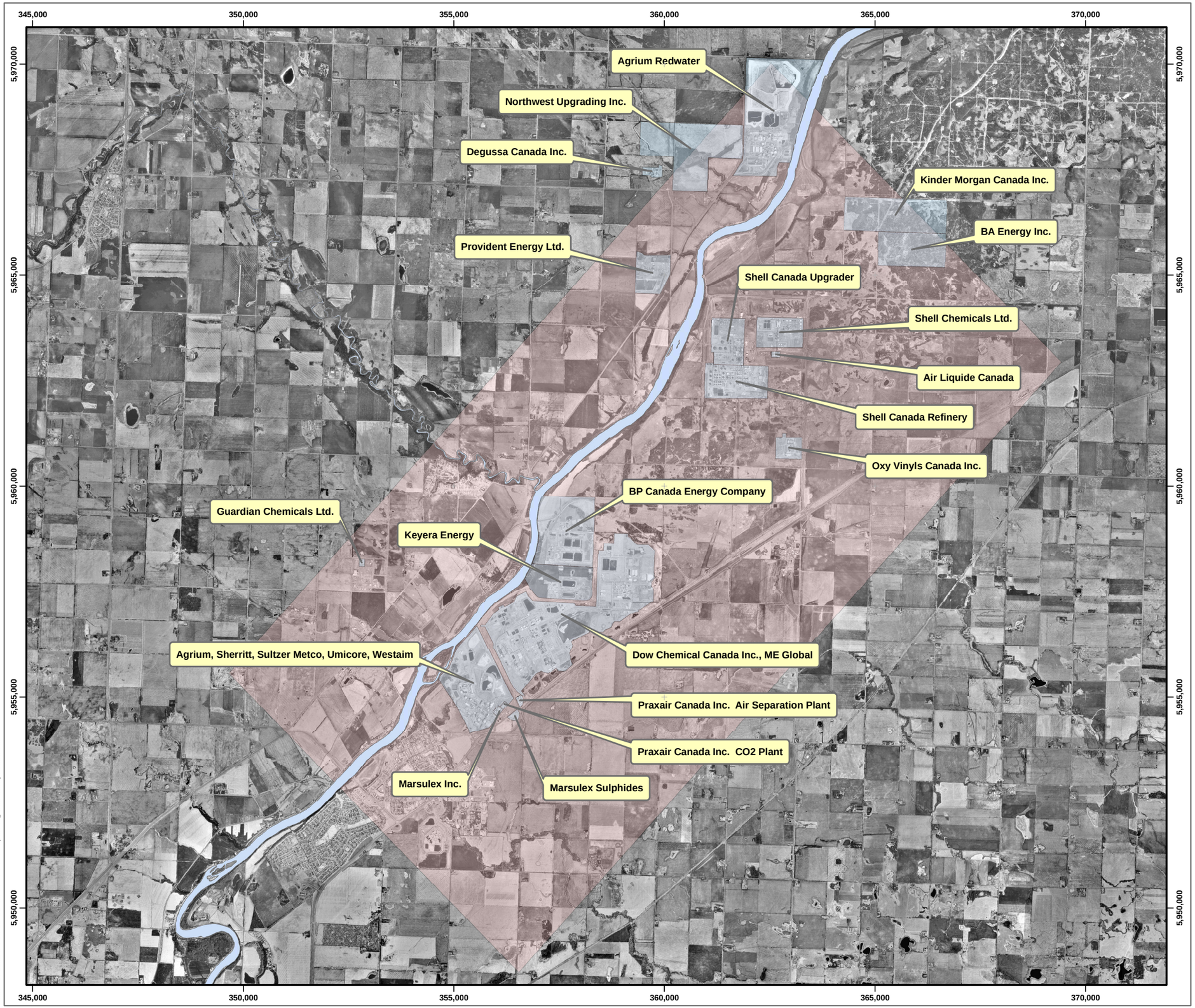
This report details work conducted under Phase II of the RGQP. The scope of work for Phase II included:

- Finalizing drilling locations based upon a field reconnaissance of the proposed locations and a review of the Phase I recommendations.
- Obtaining the required access agreements, licenses of occupation, road use agreements, and crossing agreements for each of the proposed drilling locations.
- Drilling of 10 test holes and installation of 12 monitoring / production wells.
- Geophysical logging and collection of sediment samples from all boreholes.
- Surveying of all test hole and monitoring well locations.
- Hydraulic testing of all new monitoring / production wells.
- Measurement of water levels and collection of groundwater samples from monitoring wells.
- Analysis of all field data to develop a hydrogeologic framework for the Study Area.
- Compilation of existing data from member companies and other sources to develop the hydrogeologic framework for the Study Area.
- Compilation of hydrochemistry data to characterize the distribution of parameter concentrations across the Study Area.
- Identification of potential sources of contamination.
- Preparation of this report.

1.2 NCIA RGQP STUDY AREA

Figure 1.1 presents a map of the Fort Saskatchewan area, highlighting the RGQP Study Area. The Study Area is approximately 195 km^2 in area and begins in the City of Fort Saskatchewan and extends northwest to the Agrium Redwater and Kinder Morgan Canada sites. The Study Area resides within the counties of Sturgeon (northwest of the North Saskatchewan River) and Strathcona (southeast of the North Saskatchewan River). The southwest margin of the Study Area resides within the City of Fort Saskatchewan.

The Study Area as presented in Figure 1.1 has been expanded relative to the Study Area defined in Phase I of the RGQP. The area has been expanded to the northeast to encompass the BA Energy and Kinder Morgan Canada sites.



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Legend

- Project_Area
- Member Company Plant Site

Note:

Scale: 1:90,000

0 1,000 2,000 3,000 4,000 5,000 6,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

1.1

Title

Study Area and Member Company Plant Sites

The location of the NCIA member companies' plant sites residing within the Study Area are also presented in Figure 1.1. At the time of this report a total of 21 industrial plant sites resided within the Study Area.

2.0 Background Information

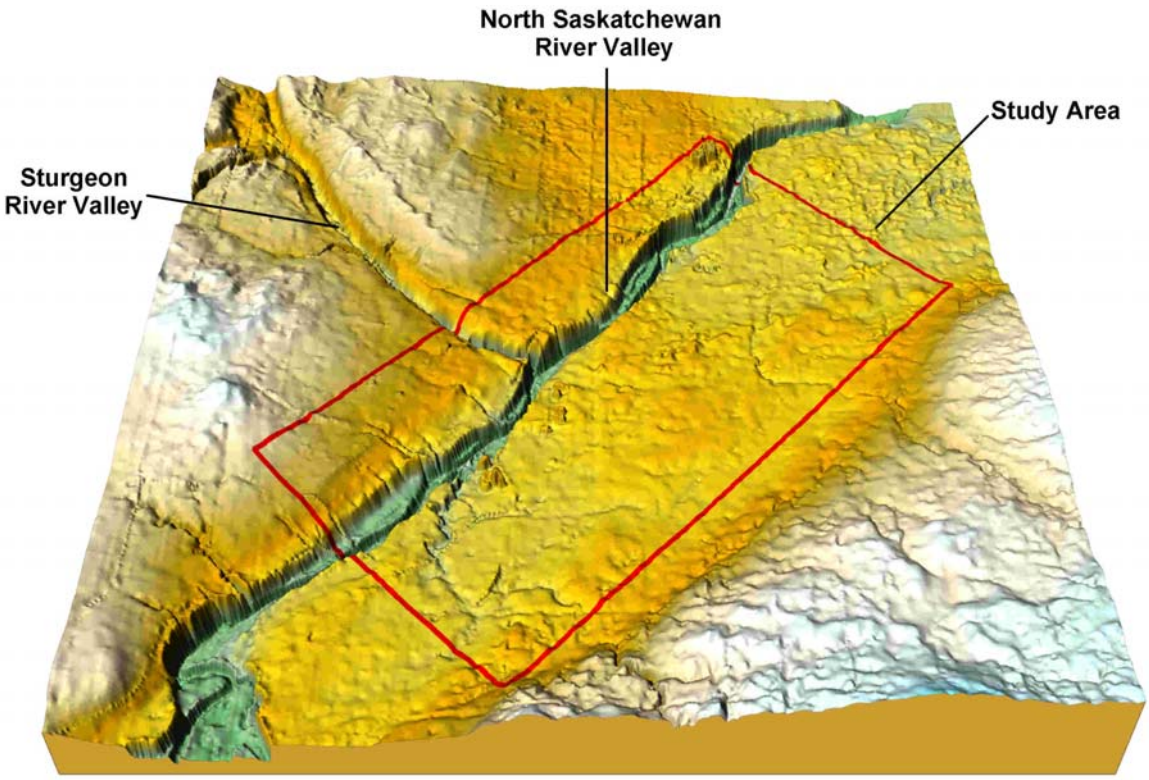
2.1 STUDY AREA SETTING

The RGQP Study Area resides within the Low Boreal Mixedwood and Aspen Parkland ecoregions of central Alberta. The Study Area is entirely within the North Saskatchewan River Basin. Average annual precipitation for the study area is estimated to be 478 mm per year for Strathcona County (Hydrogeological Consultants, 2001a) and approximately 471 mm per year for Sturgeon County (Hydrogeological Consultants, 2001b).

Surface topography of the Study Area is a reflection of preglacial, glacial, and recent morphological activity on geologic materials of varying erosional resistance. Regionally, major topographic features follow geological strike directions (Stein, 1976) as a series of northwest to southeast oriented ridges.

Figure 2.1 presents a three-dimensional view of the surface topography of the Study Area. The major topographic feature of the Study Area is the present day North Saskatchewan River valley, which is oriented in a southwest to northeast direction through the Study Area. The Sturgeon River valley also resides within the Study Area, entering from the west margin and flowing southeast to its confluence with the North Saskatchewan River.

Figure 2.1: Surface Topography of the Study Area



2.2 REGIONAL GEOLOGY

Upper Bedrock Formations

Upper bedrock in the Study Area consists of the Oldman Formation of the Belly River Group. The Oldman Formation has a maximum thickness of 120 m in Strathcona County (Hydrogeologic Consultants, 2001a) and consists of continental deposits, siltstone, sandstone, shale, and coal. Sandstone units in the upper 120 m of the Belly River Group form local aquifers that can be used as a source of water. There are numerous individual sandstone units with thicknesses ranging from 3 to 10 m within this upper zone; however, these units are generally not laterally continuous (Stein, 1976).

Quaternary Sediments

The Quaternary deposits in the Study Area consist of preglacial, lacustrine, aeolian, and fluvial deposits. The preglacial Beverly Channel, which has been infilled with gravel and sand deposits (Empress Formation), is the primary focus of this study.

The preglacial Empress Formation sands and gravels are interpreted to have been deposited in fast-flowing, braided streams collectively named the Beverly Channel. The Beverly Channel originates in the Rocky mountains and generally trends east towards its confluence with the

preglacial Helina valley near Cold Lake. In the Study Area, the Beverly Channel trends southwest-northeast and approximately follows the present day alignment of the North Saskatchewan River. The deposits in the Beverly Channel follow a commonly observed sedimentary sequence of gravel grading to sand and finally to silt and clay. Where the preglacial deposits are sufficiently thick, they are generally considered to be excellent aquifers due to their ability to transmit significant quantities of water.

Glacial till deposits are generally unsorted and unstratified deposits with silt and clay size grains surrounding distinctly larger grains of varying sizes. The till is often called clay till as it appears to be mostly composed of a clay matrix. Bayrock (2000), however, notes that the till is composed of approximately equal proportions of sand, silt and clay, with an overall gravel content of less than 10 percent. The colour contrast in the till unit is a result of weathering.

Glacial tills are often non-homogeneous with sandy or silty lenses commonly encountered. Small sandy-silty channels representing drainage pathways of glacial meltwater are also observed, but typically are not connected. Sand and gravel lenses in glacial tills can be utilized as aquifers in localized areas where only smaller quantities of water are required.

Lacustrine deposits are lake deposited materials generally consisting of clays with a smaller proportion of sands and silts. They are generally present in topographic lows. In the Fort Saskatchewan area, lacustrine clays associated with glacial Lake Edmonton are present in the area of the Beverly Channel, where the top of bedrock is low. In some areas, the lacustrine deposits are interpreted to have been deposited in supraglacial lakes and in others the deposits are interpreted to have been deposited in proglacial lakes (Shetsen, 1990). Such differentiation is not made herein.

Aeolian deposits are generally loose, fine to medium sands and silts present just below the topsoil over some of Fort Saskatchewan area. These deposits were formed by redeposition of glacial lake sediments by wind activity.

Fluvial deposits are generally gravel, sand, silt and clay present on the floors and terraces of river valleys. In the Study Area, recent fluvial deposits are present along the North Saskatchewan and Sturgeon River valleys.

3.0 Field Investigation Program

3.1 FIELD RECONNAISANCE

Stantec representatives conducted a field reconnaissance of the Study Area during the week of January 3, 2005. During the reconnaissance, proposed locations for drilling were established based upon land ownership, presence of underground or above ground utilities, drilling rig accessibility, and other field constraints. Approximate coordinates for each of the proposed drilling locations were obtained via handheld GPS and a temporary stake was placed at the proposed locations.

Various landowners, industry, and municipality representatives were also met during this time to conduct the reconnaissance and to initiate the required agreements for drilling of test holes and installation of monitoring wells. Land use agreements, land access agreements, road use agreements, licenses of occupation, and pipeline crossing agreements were negotiated and obtained by Stantec on behalf of NCIA.

Following acquisition of the required agreements for installation of test holes and monitoring wells, all drilling sites were cleared with Alberta One Call prior to the commencement of any drilling activities. Underground utilities were located and the appropriate setback distances were marked. Private underground utilities were also located and the required work and/or excavation permits were also obtained from the respective landowner prior to drilling activities.

3.2 TEST HOLE DRILLING

In order to further characterize the subsurface lithology in the study area, ten (10) test holes were drilled between January 17 and 21, 2005. The locations of the test holes are presented in Figure 3.1. All test holes were drilled by Lakeland Drilling Ltd. under the supervision of Stantec, using a mud rotary water well drilling rig. The drilling methodology employed the use of 159 mm tri-cone bits and a mud return circulation system. Surface casing was set where stability of the upper borehole walls was a concern. Drilling continued for several metres after the bedrock (shale and sandstone unit) was encountered to ensure that an adequate geophysical signature of the bedrock unit could be obtained.

Return cuttings were visually examined and characterized during drilling, and the depths of changes in lithology were logged. Borehole logs for the ten test holes are presented in Appendix A for reference. Sediment samples were collected at regular intervals for analysis of the fraction of organic content (FOC) and a granulometric (grain size) analysis. All test holes were immediately decommissioned following geophysical logging, using a high solids bentonite grout. The grout was mixed with fresh water in the specified proportions and was subsequently tremied downhole under pressure using the grout pump on the drilling rig.

3.3 MONITORING AND PRODUCTION WELL INSTALLATION

Twelve (12) monitoring/production wells were installed in the study area to allow for collection of groundwater samples for subsequent analysis. The locations of the monitoring/production wells are presented in Figure 3.1. One of the monitoring wells (MW-11) was previously installed for Shell Canada Ltd. and has been incorporated into this study. All monitoring/production wells were installed by Lakeland Drilling Ltd. under the supervision of Stantec, using a mud rotary water well drilling rig. The drilling methodology employed the use of either 159 mm (6 1/4”), 222 mm (8 3/4”), or 250 mm (9 7/8”) tri-cone bits and a mud return circulation system. The bit size varied depending upon the type of well completion (either monitoring well or production well). Again, surface casing was set where stability of the upper borehole walls was a concern, and drilling continued for several metres after bedrock was encountered.

Return cuttings were visually examined and characterized during drilling, and the depths of changes in lithology were logged. Borehole logs for the 12 monitoring wells are presented in Appendix A for reference. Sediment samples were collected at regular intervals for latter analysis of the fraction of organic content (FOC) and a granulometric (grain size) analysis.

Following drilling, monitoring wells were installed at 9 locations (MW-01, MW-02, MW-03, MW-05, MW-06, MW-08, MW-09, MW-12, and MW-13). The purpose of the monitoring wells was to allow for ongoing measurement of water levels in the Beverly Channel, and to allow for ongoing collection of groundwater samples for chemical analysis. Monitoring wells were constructed using 51 mm (2”) diameter, Schedule 80 PVC pipe with 0.020 slot screens. The length of the well screen varied depending upon the thickness of sands and gravels encountered at a particular location. Monitoring well completion details are also presented on the borehole logs in Appendix A.

Production wells were installed at 3 locations (MW-04, MW-07, and MW-10) following drilling. The purpose of the production wells was again to allow for ongoing measurement of water levels and collection of groundwater samples from the Beverly Channel, and to serve as a location where aquifer pumping tests could be conducted. Production wells were constructed using 152 mm (6”) diameter, Schedule 80 PVC pipe with 0.020 slot screens of varying length. Production well completion details are also presented on the borehole logs in Appendix A.

All monitoring and production wells were developed following completion by air lifting for several hours, or until the well was dry. All monitoring and production wells were completed with above ground stick ups and steel, lockable casing protectors. Additionally, two steel traffic bollards were installed to provide protection to the wellheads at most locations. Wellheads situated in pasture land were protected by cages constructed of tubular steel.

3.4 GEOPHYSICAL LOGGING

Geophysical logging of all test hole and monitoring well boreholes was conducted immediately following drilling of the borehole. E-logs for both resistivity and spontaneous potential were obtained at each borehole location.

Path: V:\1102\active\110217094\GIS\Final Report Figures\Test Hole and Monitoring Well Location.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site

NCIA Wells/Test Holes

- Monitoring Well
- Test Hole

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

3.1

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Location of NCIA Test Holes and Monitoring Wells

Each geophysical log was reviewed and interpreted to identify correlations between the observed geophysical response of the subsurface geological material and the lithological descriptions that were logged during drilling. Following interpretation of the geophysical logs, some of the lithological logs were adjusted to reflect the observed geophysical responses. For example, sequences of interbedded sands and clays were packaged together and collectively described as 'Clay Till'. In other cases the depths to changes in lithology were adjusted based upon the geophysical log, as the geophysical observations were deemed more accurate than the lithological observations.

Geophysical logs prepared for each of the boreholes are presented in Appendix B. The logs present the spontaneous potential logs, resistivity logs, and lithological descriptions for each borehole location.

3.5 SURVEYING OF TEST HOLES AND MONITORING WELLS

All test hole and monitoring well locations were surveyed by Stuart Weir & Co. on May 10, 2005. Horizontal coordinates were provided in the UTM, Zone 12 projection using the NAD83 datum. All elevations were geodetic.

Table 3.1 presents the surveyed coordinates for all monitoring wells and test holes installed during the field program.

Table 3.1: Surveyed Coordinates for Monitoring Wells and Test Holes

Identification	Type	Easting (m)	Northing (m)	Ground Elevation (mAMSL)	Top of Casing Elevation (mAMSL)	Stickup (m)
MW-01	Monitoring Well	350,335.04	5,951,040.45	617.52	618.04	0.52
MW-02	Monitoring Well	352,457.80	5,950,583.37	630.71	631.31	0.60
MW-03	Monitoring Well	353,030.21	5,952,940.90	623.79	624.43	0.64
MW-04	Monitoring Well	354,823.41	5,953,959.76	620.25	620.79	0.54
MW-05	Monitoring Well	354,293.74	5,954,889.46	624.28	624.89	0.61
MW-06	Monitoring Well	361,559.34	5,958,812.22	629.61	630.28	0.67
MW-07	Monitoring Well	359,089.70	5,959,604.24	630.41	631.01	0.60
MW-08	Monitoring Well	363,133.77	5,961,204.95	625.87	626.44	0.57
MW-09	Monitoring Well	361,003.46	5,962,032.28	624.06	624.73	0.67
MW-10	Monitoring Well	364,954.62	5,963,505.11	624.06	624.67	0.61
MW-11	Monitoring Well	362,564.36	5,965,300.71	624.49	625.16	0.67
MW-12	Monitoring Well	366,805.93	5,968,379.85	625.46	626.07	0.61
MW-13	Monitoring Well	365,292.72	5,968,147.12	625.65	626.28	0.63
TH-01	Test Hole	354,156.88	5,950,956.34	625.70		
TH-02	Test Hole	353,513.37	5,955,546.11	622.66		
TH-03	Test Hole	355,550.76	5,957,773.88	623.43		
TH-04	Test Hole	357,472.15	5,961,327.99	631.41		
TH-05	Test Hole	359,332.21	5,962,138.08	604.50		
TH-06	Test Hole	359,050.55	5,960,541.22	630.21		
TH-07	Test Hole	360,839.63	5,960,561.71	628.25		
TH-08	Test Hole	363,355.89	5,958,878.28	630.50		
TH-09	Test Hole	364,944.58	5,961,905.99	627.42		
TH-10	Test Hole	366,663.94	5,964,563.07	621.83		

3.6 RESPONSE TESTING OF MONITORING WELLS

Well response tests (recovery or slug tests) were conducted in all new monitoring wells to estimate the in-situ hydraulic conductivity of the geological materials adjacent to the screened interval prior to groundwater sampling.

The well response test procedure involved measurement of the initial static water level, installation of a pressure transducer and electronic data logger near the bottom of the well, lowering a solid slug of known volume below the static water level, allowing the water level to stabilize, and quickly removing the solid slug from the monitoring well. The removal of the solid slug caused a near instantaneous drop in the water level, and the pressure transducer and data logger recorded the water level recovery in the monitoring well.

Response test data were immediately reviewed in the field to determine if the general shape of the recovery curve was reasonable given the geologic materials present. Data were also checked to ensure that the level logger had not been disturbed during the removal of the slug. If anomalous results were noted during the preliminary review, the response test was conducted again until an acceptable data set had been obtained.

An acceptable data set could not be obtained from MW-13 for analysis. This was primarily due to the very rapid recovery (less than two seconds) of the water levels following removal of the slug. In addition, use of a submersible sampling pump at its maximum discharge rate did not create appreciable drawdown in the well that could be measured and analyzed as slug test data. Meaningful hydraulic testing at that location would likely require a larger diameter production well and a larger pump to conduct a more thorough pumping test.

The remaining response test data have been interpreted using the Hvorslev (1951) method. The response test data and analysis results are included in Appendix C for reference. Table 3.2 presents a summary of the hydraulic conductivity estimated for the new monitoring wells. Estimated hydraulic conductivities range from 6.9×10^{-5} to 9.5×10^{-4} m/s across the Study Area, with an average of 2.7×10^{-4} m/s. This average hydraulic conductivity is within the range expected of coarse sands and gravel deposits.

Table 3.2: Summary of Estimated Hydraulic Conductivities from Response Tests

Monitoring Well	Estimated Hydraulic Conductivity (m/s)
MW-01	6.83×10^{-5}
MW-02	1.78×10^{-4}
MW-03	2.21×10^{-4}
MW-05	1.75×10^{-4}
MW-06	1.50×10^{-4}
MW-08	9.45×10^{-4}
MW-09	4.13×10^{-4}
MW-11	1.50×10^{-4}
MW-12	1.41×10^{-4}
MW-13	N/A

3.7 PUMPING TESTS FOR PRODUCTION WELLS

Aquifer pumping tests were conducted at the three locations (MW-04, MW-07, and MW-10) where larger diameter production wells were installed. Following completion of the production wells, pressure transducers were set near the bottom of the well and were connected to a data logger at surface. Data loggers were set to collect measurements at one minute intervals.

Manual water level measurements were also taken to verify that the transducer and logger were functioning properly.

Initially, step drawdown tests were conducted to determine a suitable pumping rate for conducting the single well tests. Several discharge rates were tested at each location in an attempt to maximize the discharge rate without causing excessive drawdown in the well. Discharge rates were also decreased if it appeared as though the well capacity was being exceeded. Single well constant rate pumping tests were then conducted at each of the locations to estimate the aquifer transmissivity in the vicinity of the well.

Well MW-04 was pump tested at a constant rate of 196 m^3/day (36 USgal/min) for 2,907 minutes (~48 hours), following which the pump was turned off. Water level measurements then continued until the levels had recovered to static conditions. Although a 1 m thick layer of rafted shale above the sand and gravel unit was noted during drilling at this location (refer to the borehole log in Appendix A), it is unlikely that this would act as a confining layer over a larger area of the sands and gravels, and as such the aquifer was considered unconfined at the MW-04 location.

Well MW-07 was pump tested at a constant rate of 349 m^3/day (64 USgal/min) for 2,880 minutes (~48 hours), following which the pump was turned off. Water level measurements then continued until the levels had recovered to static conditions. Aquifer conditions remained confined throughout the course of the pump test at the MW-07 location.

Well MW-10 was pump tested at a constant rate of 343 m^3/day (63 USgal/min) for 2,876 minutes (~48 hours), following which the pump was turned off. Water level measurements then continued until the levels had recovered to static conditions. Aquifer conditions were unconfined throughout the course of the pump test at the MW-10 location.

Pumping test data was analyzed using the Jacob straight line method and automatic curve fitting software. Corrected drawdowns were calculated for unconfined aquifer conditions, as the transmissivity values would not be constant over the course of the pumping test. Pumping test analysis reports are included in Appendix D for reference. Table 3.3 presents a summary of the transmissivities and hydraulic conductivities calculated from the pump test data.

Table 3.3: Summary of Estimated Hydraulic Conductivities from Pump Tests

Monitoring Well	Estimated Transmissivity (m^2/s)	Estimated Hydraulic Conductivity (m/s)
MW-04	3.05×10^{-3}	1.57×10^{-4}
MW-07	7.01×10^{-3}	8.88×10^{-4}
MW-10	4.20×10^{-3}	2.61×10^{-4}

The estimated hydraulic conductivity values presented in Table 3.3 are in general agreement with those values estimated via well response testing (Table 3.2). The estimated hydraulic conductivities are also within the expected range for sand and gravel units.

3.8 GROUNDWATER SAMPLING AND WATER LEVEL MEASUREMENTS

Two groundwater sampling events have been conducted in the Spring and Fall of 2005. For the spring sampling event, a Stantec representative collected groundwater samples from all monitoring wells between March 7 and 11, 2005. For the Fall sampling event, groundwater samples from all monitoring wells were collected on November 16 and 17, 2005. The following procedures were used to collect groundwater samples:

- The depth to water level at each monitoring well was measured and recorded prior to purging.
- Each monitor well was purged of at least three well casing volumes, or until it was unable to produce water at the rate at which it was purged. Purging was conducted as part of the hydraulic testing process.
- Groundwater samples were collected using a Redi-Flo submersible sampling pump. Field measurements of pH, electrical conductivity (EC) and temperature were made at the time of sampling.
- A duplicate sample for Quality Control purposes was prepared in the field during the sampling event. The duplicate sample was prepared by rinsing a clean 4 L plastic container with formation water, collecting the required sample volume, and splitting the sample into two aliquots. One aliquot was identified under a blind number while the remaining sample was identified using a regular sample number. The laboratory was not informed of the nature of the blind number. The duplicate sample was obtained from monitoring well MW-09.
- A field blank was also prepared during groundwater sampling for Quality Control purposes. The blank was prepared by opening sample bottles in the field and filling them with distilled water. The purpose of a field blank is to detect impurities in the samples that may be introduced during groundwater sampling (i.e. airborne contaminants introduced during sampling).
- All sample bottles were labeled at the time of sample collection with the site number, date of collection, the sampling personnel involved, and the analyses required. Sample bottles were placed into a cooler with ice packs and delivered to Enviro-Test Laboratories in Edmonton at the end of each sampling day.

In addition to the water level measurements obtained during groundwater sampling in March 2005, two additional water level measurements were obtained at each of the new monitoring wells on May 4, 2005 and June 6, 2005. These additional water level measurements were

collected to verify that the original measurements were reflective of stabilized water levels following drilling and installation of the monitoring wells. Collection of the May 2005 water level measurement was also intended to coincide with semi-annual measurements being collected by NCIA member companies as part of their respective groundwater sampling programs. Water level measurements were also obtained during the November 2005 groundwater sampling event. Table 3.4 presents the water level measurements collected from the NCIA monitoring wells to date.

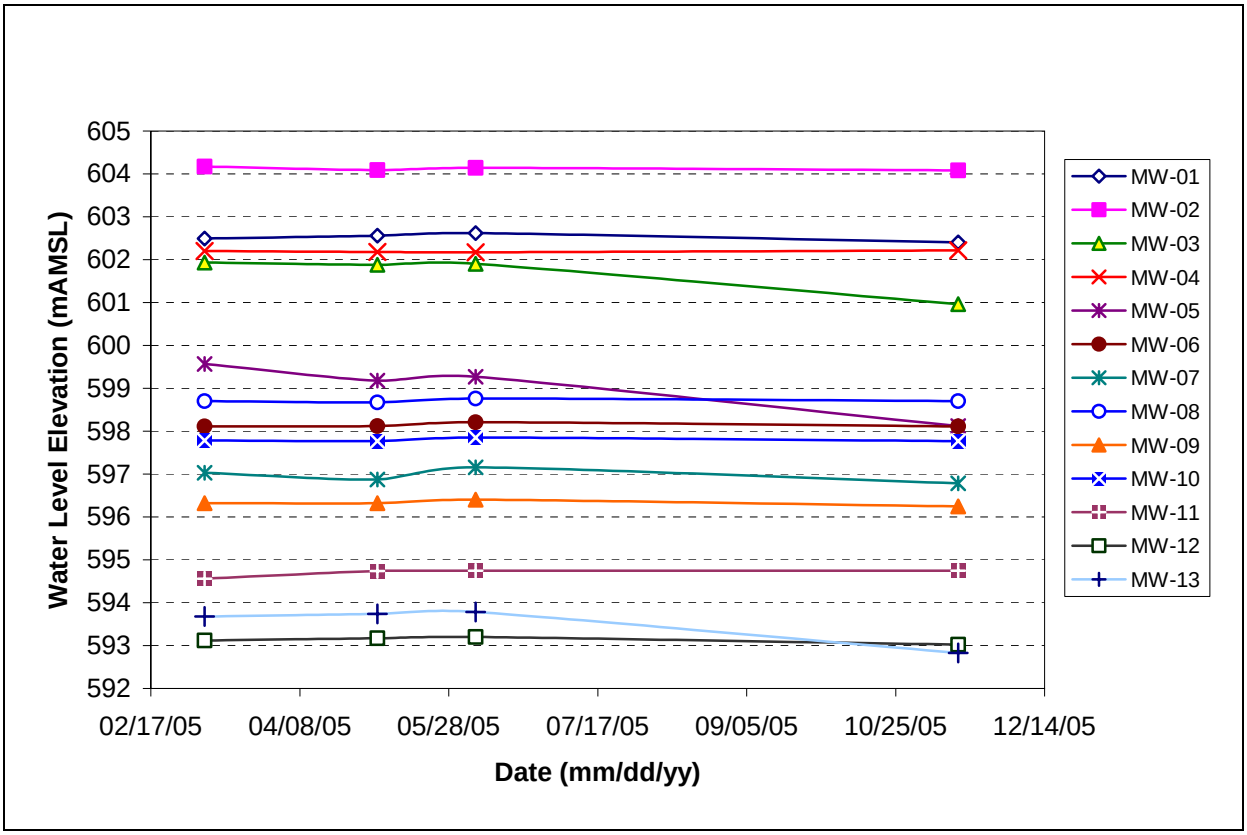
Table 3.4: Summary of Water Level Elevations

Well ID	Water Level Elevation (mAMSL) March 2005	Water Level Elevation (mAMSL) May 2005	Water Level Elevation (mAMSL) June 2005	Water Level Elevation (mAMSL) November 2005
MW-01	602.49	602.56	602.62	602.40
MW-02	604.17	604.09	604.14	604.08
MW-03	601.93	601.88	601.90	600.96
MW-04	602.20	602.18	602.17	602.22
MW-05	599.57	599.18	599.27	598.12
MW-06	598.11	598.12	598.21	598.12
MW-07	597.03	596.87	597.16	596.78
MW-08	598.70	598.67	598.76	598.70
MW-09	596.32	596.32	596.40	596.25
MW-10	597.78	597.77	597.85	597.77
MW-11	594.56	594.74	594.75	594.75
MW-12	593.12	593.17	593.20	593.02
MW-13	593.68	593.74	593.78	592.83

Figure 3.2 Presents a groundwater hydrograph for all 13 of the monitoring wells included in this study. Examination of the figure reveals that groundwater levels within the sands and gravels of the Beverly Channel have remained relatively stable for all monitoring wells over the time period between March and June, 2005. A slight decline in water level elevations (approximately 1 m) was noted for monitoring wells MW-03, MW-05, and MW-13 during the November, 2005 sampling event. The remaining monitoring wells did not exhibit this decline in water level elevations, and the November 2005 measurements were consistent with the measurements obtained in the Spring of 2005.

Continued collection of groundwater levels in the NCIA monitoring wells is recommended to determine longer term water level trends and to identify seasonal fluctuations in groundwater levels.

Figure 3.2: Groundwater Hydrograph for the NCIA Monitoring Wells



3.9 SEDIMENT ANALYSIS RESULTS

Sediment samples from the preglacial sands and gravels (Empress Formation) of the Beverly Channel were collected during drilling for analysis of the fraction organic content (FOC). FOC represents the proportion of the sediment sample that is organic in composition. FOC is an important parameter for conducting contaminant transport modeling, as it affects the attenuative capacity of a geologic material, or its ability to retard the movement of organic contaminants. Latter phases of the RGQP will require estimates of the FOC to facilitate numerical modeling exercises. Table 3.5 Presents the FOC analysis results. Laboratory reports are included in Appendix E for reference.

Table 3.5: Fraction Organic Content Analysis Results

Borehole ID	Approximate Sample Depth (mBGL)	FOC (%)
TH-01	27.4	3.8
TH-01	30.5	4.5
TH-02	6.1	0.7
TH-03	11.4	1.1
TH-04	13.7	1.2
TH-05	3.8	1.8
TH-06	42.7	5.5
TH-07	33.5	7.7
TH-08	29.9	2.4
TH-09	34.6	3.1
TH-10	35.1	4.5
TH-10	38.1	3.0
MW-01	17.5	12.0
MW-02	30.0	6.3
MW-03	26.2	3.8
MW-04	23.2	7.1
MW-05	28.2	4.1
MW-06	33.8	1.0
MW-06	37.3	4.3
MW-07	41.1	4.9
MW-08	36.0	5.4
MW-09	36.6	1.7
MW-10	37.3	3.4
MW-12	38.4	6.5
MW-13	39.2	3.4

FOC values ranged from 0.7 % to 12.0 % through the Study Area, with an average value of 4.1 %. This average value is within the range normally expected of surficial sediments. It was noted during drilling that coal fragments were observed in many of the sediment samples obtained. It is likely that the FOC values reflect the coal content in the Empress Formation sands and gravels.

In addition to the FOC analysis, granulometric (grain size) analysis was conducted on several sand and gravel samples collected from the Empress Formation to estimate the grain size characteristics of the preglacial sediments.

Following collection of sediment samples from the MW-04, MW-07, and MW-10 locations, each of the samples was visually examined to determine which of the samples would be composited to yield the samples to be submitted for analysis. Compositing of sediment samples was required to yield the required amount of sample to conduct a reliable grain size analysis. In addition, compositing of samples allowed for a more averaged representation of the grain size distribution over the entire Empress Formation, rather than characterizing the distribution at a limited depth interval. At the MW-10 location, a distinct change in lithology was noted between the Empress sand and the Empress gravel. As such, two composite samples from the MW-10 location (one for the sand and one for the gravel) were submitted for granulometric analysis. Table 3.6 presents the granulometric analysis results.

Table 3.6: Granulometric Analysis Results

	MW-04		MW-07		MW-10 Sand		MW-10 Gravel	
Sieve Size (mm)	% Retained	% Passing	% Retained	% Passing	% Retained	% Passing	% Retained	% Passing
25	0.1	99.9	0.0	100.0	0.0	100.0	0.0	100.0
12.5	19.4	80.5	0.0	100.0	0.0	100.0	1.0	99.0
9.5	11.1	69.4	0.4	99.6	0.9	99.1	3.6	95.4
4.75	22.7	46.7	10.2	89.4	2.5	96.6	30.3	65.1
2	17.6	29.1	33.4	56.0	4.0	92.6	30.1	35.0
0.075	24.4	4.7	49.6	6.4	86.9	5.7	30.7	4.3

Based upon the granulometric analysis results, a grain size distribution chart was created for the four composite samples tested. Figure 3.3 presents the grain size distribution chart developed from the analysis results. In accordance with the Unified Soil Classification System (USCS), all four of the samples can be considered to be coarse grained, since more than 50% of the sample were retained on the #200 sieve (0.075 mm opening). Three of the samples (MW-07, MW-10 Sand, and MW-10 Gravel) can be considered to be sands, since more than 50% of the sample passed the #4 sieve (4.75 mm opening). The MW-04 sample is the only sample considered to be a gravel as per the USCS.

The grain size distribution chart was visually examined to determine the D_{10}, D_{30}, and D_{60} values for each of the samples. The coefficient of uniformity (C_u) and the coefficient of curvature (C_c) were calculated based upon the D_{10}, D_{30}, and D_{60} values obtained from the chart. Table 3.7 presents the above mentioned coefficients calculated for each of the sediment samples analyzed.

Figure 3.3: Grain Size Distribution for Sediment Samples

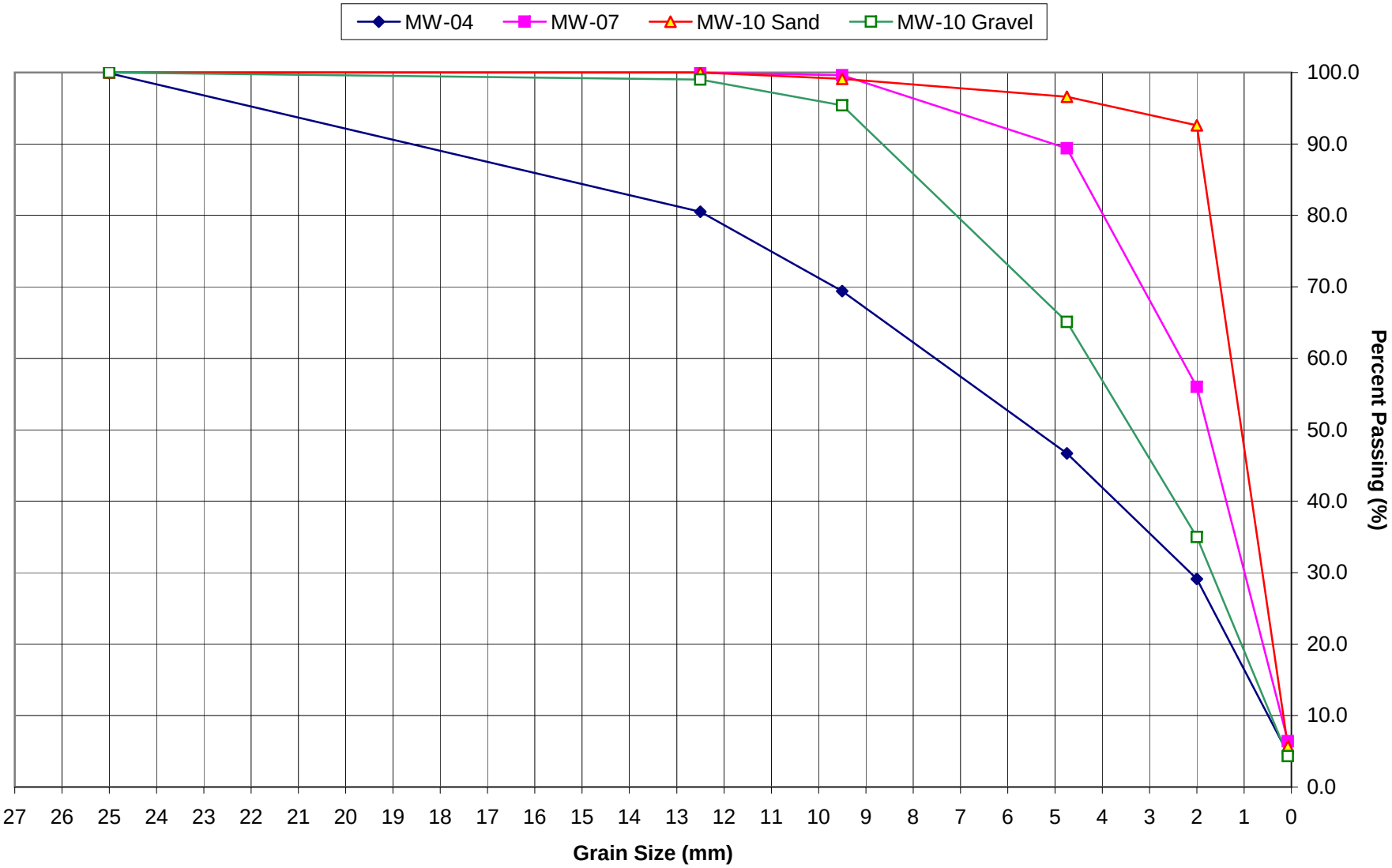


Table 3.7: Grain Size Coefficients for Sediment Samples

Sample	D_{10}	D_{30}	D_{60}	C_u	C_c
MW-04	0.5	2.2	7.6	15.2	1.3
MW-07	0.2	1.0	2.4	12.0	2.1
MW-10 Sand	0.2	0.8	1.4	7.0	2.3
MW-10 Gravel	0.4	1.7	4.4	11.0	1.6

Based upon the Cu and Cc coefficients presented in Table 3.7, all of the samples submitted for analysis can be considered to be well graded (or poorly sorted). The MW-10 Sand sample had the highest degree of uniformity (smallest Cu value) as was expected based upon visual examination of the sample.

3.10 GROUNDWATER ANALYSIS RESULTS

All groundwater samples were submitted to Enviro-Test Laboratories in Edmonton for analysis of general and bulk parameters, major ions, hydrocarbons, and dissolved metals. Laboratory analysis reports are included in Appendix E for reference.

Table 3.8 presents the analytical results for the 13 monitoring wells sampled during the Spring, 2005 sampling event. Table 3.9 presents the analytical results for the Fall, 2005 sampling event. Two sets of generic Tier 1 criteria were used for comparative purposes since the area under investigation is relatively close to the North Saskatchewan River, which is interpreted to be a regional groundwater discharge feature. As such, the *Canadian Environmental Quality Guidelines – Freshwater Aquatic Life* (CCME, 2004) were deemed relevant for comparative purposes. In addition, since the sands and gravels of the Beverly Channel are used for domestic purposes in areas potentially downgradient of the Project Area, the *Guidelines for Canadian Drinking Water Quality* (Health Canada, 2004) were also deemed relevant to this study.

Based on the analytical results presented in Table 3.8 and 3.9, several exceedances of the CCME (2004) and/or Health Canada (2004) guideline criteria were noted. Table 3.10 presents a summary of the analytical parameters that exceeded the CCME (2004) guidelines, Health Canada (2004) guidelines, or both.

Table 3.8: Groundwater Analysis Results - Spring 2005

Parameter	Detection Limit	CCME FAW[1] Criteria	GCDWQ[2] Criteria	MW-01	MW-02	MW-03	MW-04	MW-05	MW-06	MW-07	MW-08	MW-09	MW-10	MW-11	MW-12	MW-13	MW-09 Duplicate
General and Bulk Parameters																	
Ion Balance (%)				100	101	103	98.5	103	105	102	98.8	93.2	99.7	104	102	100	97.4
Total Dissolved Solids (mg/L)			≤500	442	**759**	**563**	**694**	499	**1100**	**2150**	**999**	**954**	**819**	**813**	**600**	460	**1010**
Hardness (mg/L as CaCO3)				338	424	413	510	353	670	1130	552	286	476	563	354	202	312
pH	0.1		6.5 - 8.5	7.7	7.7	7.4	7.5	7.6	7.5	7.5	7.7	7.9	7.7	7.7	7.9	8.1	7.9
Electrical Conductivity (µS/cm)	0.2			762	1210	937	1200	831	1580	2680	1470	1520	1270	1270	1000	784	1520
Total Alkalinity (mg/L as CaCO3)	5			364	422	362	375	330	459	544	486	513	514	526	521	435	515
Dissolved Organic Carbon (mg/L)	1			3	8	5	1	5	5	5	5	5	5	15	6	4	5
Routine and Major Ion Parameters																	
Chloride (mg/L)	1		≤250	4	13	31	137	15	4	13	3	5	<1	8	6	2	5
Fluoride (mg/L)	0.05		1.5	0.19	0.21	0.14	0.15	0.18	0.18	0.11	0.13	0.29	0.18	0.14	0.13	0.20	0.29
Calcium (mg/L)	0.5			94.6	113	106	142	96.2	171	287	147	71.6	131	150	95.7	53.7	79.1
Potassium (mg/L)	0.1			3.1	6.8	3.5	9.9	6.1	6.1	6.6	6.0	4.2	5.3	4.9	5.0	4.2	4.7
Magnesium (mg/L)	0.1			24.8	34.5	36.1	37.7	27.5	58.9	100	45.0	26.0	36.1	45.8	27.9	16.5	27.9
Sodium (mg/L)	1		≤200	40	111	56	57	51	138	**287**	137	**226**	117	92	106	112	**243**
Sulfate (mg/L)	0.5		≤500	57.4	227	113	81.4	105	451	**1130**	369	313	221	196	45.9	10.6	340
Iron (mg/L)	0.005	0.3	≤0.3	**1.02**	0.275	**3.19**	0.173	**1.14**	**2.92**	**10.4**	**5.66**	**1.11**	**5.29**	**6.89**	**2.78**	**0.818**	**1.07**
Manganese (mg/L)	0.001		≤0.05	**0.605**	**0.236**	**0.264**	**0.152**	**0.402**	**1.32**	**1.88**	**0.474**	**0.714**	**0.639**	**0.668**	**0.365**	**0.263**	**0.705**
Nitrate and Nitrite (mg/L as N)	0.1			<0.1	0.1	<0.1	0.8	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Nitrate (mg/L as N)	0.1	13	45	<0.1	0.1	<0.1	0.8	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Nitrite (mg/L as N)	0.05	0.06		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bicarbonate (mg/L)	5			444	514	442	458	403	560	664	593	626	628	642	636	531	628
Carbonate (mg/L)	5			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Hydroxide (mg/L)	5			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ammonia (mg/L as N)	0.05			0.39	1.75	0.38	<0.05	0.63	1.46	2.24	1.83	1.81	1.68	1.50	1.39	1.40	1.79
Orthophosphate (mg/L as P)	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hydrocarbon Parameters																	
Benzene (mg/L)	0.0005	0.37 - 0.002	0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Toluene (mg/L)	0.0005	0.09	≤0.024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene (mg/L)	0.0005		≤0.0024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Xylenes (mg/L)	0.0005		≤0.3	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
F1(mg/L)	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
F1-BTEX (mg/L)	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
F2 (mg/L)	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenols (mg/L)	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Metals																	
Silver (mg/L)	0.0002	0.0001		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Aluminum (mg/L)	0.01	0.005 - 0.1	0.1	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.14**	<0.01	<0.01	<0.01	<0.01	**0.12**
Arsenic (mg/L)	0.0004	0.005	0.025	0.0008	0.0025	0.0012	0.0011	0.0035	0.0042	0.0017	0.0042	0.0019	0.0030	0.0022	0.0022	0.0012	0.0019
Boron (mg/L)	0.002		5	0.053	0.120	0.128	0.101	0.140	0.148	0.366	0.244	0.339	0.209	0.189	0.234	0.258	0.332
Barium (mg/L)	0.0001		1	0.199	0.204	0.0744	0.0737	0.0618	0.0710	0.0733	0.0840	0.0608	0.0296	0.0494	0.153	0.389	0.0616
Beryllium (mg/L)	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bismuth (mg/L)	0.00005			<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Cadmium (mg/L)	0.0001	0.000017	0.005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (mg/L)	0.0001			0.0017	0.0008	0.0012	0.0007	0.0008	0.0012	0.0026	0.0008	0.0011	0.0003	0.0006	0.0008	0.0008	0.0012
Chromium (mg/L)	0.0004		0.05	0.0009	0.0013	0.0009	0.0018	0.0009	0.0035	0.0017	0.0011	0.0016	0.0012	0.0011	0.0038	0.0048	0.0012
Copper (mg/L)	0.0006	0.002-0.004	≤1.0	<0.0006	0.0015	<0.0006	0.0008	<0.0006	0.0011	0.0024	0.0010	0.0010	0.0007	<0.0006	<0.0006	<0.0006	0.0010
Mercury (mg/L)	0.0001		0.001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum (mg/L)	0.0001	0.073		0.0007	0.0046	0.0008	0.0005	0.0022	0.0014	0.0010	0.0012	0.0019	0.0009	0.0010	0.0015	0.0023	0.0019
Nickel (mg/L)	0.0001	0.025 - 0.15		0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	0.0009	0.0002
Lead (mg/L)	0.0001	0.001-0.007	0.01	0.0004	0.0004	<0.0001	0.0002	0.0002	0.0004	0.0004	0.0004	0.0001	0.0004	<0.0001	0.0004	0.0002	0.0003
Antimony (mg/L)	0.0004		0.006	0.0008	0.0010	0.0007	0.0009	0.0008	0.0009	0.0008	0.0006	0.0007	0.0007	0.0008	0.0008	0.0008	0.0007
Selenium (mg/L)	0.0004	0.001	0.006	<0.0004	0.0008	<0.0004	0.0006	0.0004	0.0005	0.0008	0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Tin (mg/L)	0.0002			<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Strontium (mg/L)	0.0001			0.579	1.03	0.811	0.561	0.710	1.20	2.49	1.40	0.843	1.29	1.27	0.915	0.570	0.841
Titanium (mg/L)	0.0003			0.0013	0.0012	0.0010	0.0007	0.0008	0.0008	0.0012	0.0008	0.0058	0.0008	0.0008	0.0011	0.0006	0.0059
Thallium (mg/L)	0.00005	0.0008		<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Uranium (mg/L)	0.0001		0.02	0.0026	0.0032	0.0007	0.0029	0.0014	0.0023	0.0018	0.0011	0.0019	0.0019	0.0012	0.0010	0.0008	0.0018
Vanadium (mg/L)	0.0001			0.0003	0.0017	<0.0001	<0.0001	0.0002	0.0002	<0.0001	<0.0001	0.0005	<0.0001	0.0001	<0.0001	<0.0001	0.0004
Zinc (mg/L)	0.002	0.03	≤5.0	0.004	0.004	0.003	0.004	0.003	0.004	0.006	0.003	0.003	0.003	0.004	0.010	0.005	0.004

Notes: 1. Canadian Environmental Quality Guidelines; Freshwater Aquatic Life (CCME, 2004)
2. Guidelines for Canadian Driking Water Quality (Health Canada, 2004)
BOLD Parameter Concentration Exceeds Health Canada, 2004 criteria
BOLD Parameter Concentration Exceeds Health Canada, 2004 and CCME, 2004 criteria

Table 3.9: Groundwater Analysis Results - Fall 2005

Parameter	Detection Limit	CCME FAW[1] Criteria	GCDWQ[2] Criteria	MW-01	MW-02	MW-03	MW-04	MW-05	MW-06	MW-07	MW-08	MW-09	MW-10	MW-11	MW-12	MW-13	MW-04 Duplicate
General and Bulk Parameters																	
Ion Balance (%)				97.6	98.4	98.1	98.2	95.4	101	102	95.9	98.0	93.8	93.4	92.7	92.2	98.1
Total Dissolved Solids (mg/L)			≤500	447	**894**	**573**	**726**	**522**	**1220**	**1990**	**862**	**984**	**814**	**809**	**651**	454	**731**
Hardness (mg/L as CaCO3)				347	523	410	532	370	584	1060	486	344	467	525	354	195	533
pH	0.1		6.5 - 8.5	7.9	7.9	7.8	7.8	7.9	8.0	7.7	7.5	8.1	7.5	7.4	7.4	7.8	7.9
Electrical Conductivity (µS/cm)	0.2			760	1400	949	1280	881	1780	2670	1310	1550	1260	1270	1020	782	1290
Total Alkalinity (mg/L as CaCO3)	5			370	471	365	368	346	526	546	450	524	520	536	584	440	371
Dissolved Organic Carbon (mg/L)	1			3	6	4	5	4	8	6	6	6	6	7	7	5	4
Routine and Major Ion Parameters																	
Chloride (mg/L)	1		≤250	4	38	35	157	21	13	16	4	7	3	16	8	4	157
Fluoride (mg/L)	0.05		1.5	0.13	0.11	0.10	0.12	0.11	0.15	0.08	0.11	0.22	0.12	0.09	0.07	0.14	0.12
Calcium (mg/L)	0.5			94.8	125	104	147	98.6	148	270	133	92.6	129	140	94.9	51.2	147
Potassium (mg/L)	0.1			2.3	7.2	3.0	9.5	6.9	5.0	5.5	5.2	3.9	5.0	4.5	5.2	3.4	9.7
Magnesium (mg/L)	0.1			26.9	51.3	36.4	40.0	30.1	52.0	94.8	37.4	27.3	35.2	42.5	28.5	16.2	40.4
Sodium (mg/L)	1		≤200	36	120	54	59	43	**211**	**268**	112	**227**	108	85	111	103	60
Sulfate (mg/L)	0.5		≤500	61.1	270	122	87.0	115	471	**1010**	300	312	222	199	52.5	12.5	89.0
Iron (mg/L)	0.005	0.3	≤0.3	**1.67**	0.085	**4.47**	0.104	**3.31**	**2.96**	**10.9**	**5.16**	**1.40**	**5.49**	**6.95**	**3.37**	**1.08**	0.105
Manganese (mg/L)	0.001		≤0.05	**0.662**	**0.671**	**0.239**	**0.053**	**0.531**	**0.943**	**1.83**	**0.384**	**0.752**	**0.642**	**0.628**	**0.402**	**0.243**	**0.053**
Nitrate and Nitrite (mg/L as N)	0.1			<0.1	<0.1	<0.1	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.2
Nitrate (mg/L as N)	0.1	13	45	<0.1	<0.1	<0.1	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.2
Nitrite (mg/L as N)	0.05	0.06		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bicarbonate (mg/L)	5			451	575	445	449	422	641	666	549	640	634	654	712	537	452
Carbonate (mg/L)	5			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Hydroxide (mg/L)	5			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ammonia (mg/L as N)	0.05			0.212	1.34	0.306	0.013	0.331	1.95	2.03	1.50	1.85	1.36	1.41	1.20	1.29	0.010
Orthophosphate (mg/L as P)	0.01			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hydrocarbon Parameters																	
Benzene (mg/L)	0.0005	0.37 - 0.002	0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Toluene (mg/L)	0.0005	0.09	≤0.024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene (mg/L)	0.0005		≤0.0024	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Xylenes (mg/L)	0.0005		≤0.3	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
F1(mg/L)	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
F1-BTEX (mg/L)	0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
F2 (mg/L)	0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenols (mg/L)	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Metals																	
Silver (mg/L)	0.0002	0.0001		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Aluminum (mg/L)	0.01	0.005 - 0.1	0.1	0.01	0.03	0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.02	<0.01	0.02	<0.01	0.07	0.01
Arsenic (mg/L)	0.0004	0.005	0.025	0.0009	0.0014	0.0014	0.0006	**0.0081**	0.0038	0.0019	0.0046	0.0018	0.0037	0.0025	0.0026	0.0016	0.0007
Boron (mg/L)	0.002		5	0.046	0.189	0.119	0.093	0.116	0.160	0.311	0.184	0.294	0.202	0.227	0.282	0.301	0.097
Barium (mg/L)	0.0001		1	0.143	0.152	0.0418	0.0809	0.0564	0.0557	0.0530	0.115	0.0520	0.0331	0.0466	0.182	0.413	0.0817
Beryllium (mg/L)	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bismuth (mg/L)	0.00005			<0.0001	<0.0001	0.00009	0.00007	0.00006	0.00006	0.00005	0.00009	<0.0001	<0.0001	0.00008	0.00006	<0.0001	0.00005
Cadmium (mg/L)	0.0001	0.000017	0.005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (mg/L)	0.0001			0.0015	0.0031	0.0008	0.0049	0.0010	0.0012	0.0020	0.0009	0.0023	0.0005	0.0007	0.0010	0.0033	0.0051
Chromium (mg/L)	0.0004		0.05	<0.0004	<0.0004	<0.0004	0.0007	<0.0004	<0.0004	<0.0004	0.0005	0.0006	<0.0004	0.0006	<0.0004	0.0007	0.0009
Copper (mg/L)	0.0006	0.002-0.004	≤1.0	0.0007	**0.0021**	0.0008	0.0012	0.0007	0.0012	0.0018	0.0010	0.0011	0.0009	0.0009	0.0008	0.0007	0.0012
Mercury (mg/L)	0.0001		0.001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001
Molybdenum (mg/L)	0.0001	0.073		0.0013	0.0148	0.0015	0.0030	0.0029	0.0015	0.0010	0.0025	0.0038	0.0010	0.0009	0.0013	0.0027	0.0028
Nickel (mg/L)	0.0001	0.025 - 0.15		0.0012	**0.0644**	0.0003	0.0140	0.0022	0.0004	<0.0001	<0.0001	0.0087	<0.0001	<0.0001	<0.0001	0.0015	0.0132
Lead (mg/L)	0.0001	0.001-0.007	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
Antimony (mg/L)	0.0004		0.006	0.0005	0.0006	0.0006	0.0007	0.0005	0.0005	0.0007	0.0005	0.0006	0.0006	0.0006	0.0005	0.0006	0.0006
Selenium (mg/L)	0.0004	0.001	0.006	<0.0004	0.0006	0.0005	0.0009	0.0004	0.0005	<0.0004	0.0005	0.0005	0.0006	<0.0004	<0.0004	0.0005	0.0009
Tin (mg/L)	0.0002			<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Strontium (mg/L)	0.0001			0.551	1.54	0.828	0.616	0.667	1.26	2.45	1.27	0.869	1.43	1.24	0.903	0.542	0.609
Titanium (mg/L)	0.0003			0.0012	0.0015	0.0019	0.0004	0.0009	0.0015	0.0009	0.0010	0.0038	0.0008	0.0010	0.0008	0.0006	0.0004
Thallium (mg/L)	0.00005	0.0008		<0.0001	0.00006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Uranium (mg/L)	0.0001		0.02	0.0023	0.0053	0.0007	0.0025	0.0008	0.0015	0.0017	0.0015	0.0015	0.0015	0.0012	0.0011	0.0009	0.0026
Vanadium (mg/L)	0.0001			0.0001	0.0005	<0.0001	<0.0001	0.0001	0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc (mg/L)	0.002	0.03	≤5.0	<0.002	<0.002	<0.002	0.029	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.032

Notes: 1. Canadian Environmental Quality Guidelines; Freshwater Aquatic Life (CCME, 2004)
2. Guidelines for Canadian Driking Water Quality (Health Canada, 2004)
BOLD Parameter Concentration Exceeds Health Canada, 2004 criteria
BOLD Parameter Concentration Exceeds Health Canada, 2004 and CCME, 2004 criteria

Table 3.10
Summary of Analytical Parameters Exceeding Guidelines

Well Identification	Parameters Exceeding CCME (2004)	Parameters Exceeding Health Canada (2004)
MW-01	Iron	Iron, Manganese
MW-02		TDS, Manganese
MW-03	Iron	TDS, Iron, Manganese
MW-04		TDS, Manganese
MW-05	Iron	Iron, Manganese
MW-06	Iron	TDS, Iron, Manganese
MW-07	Iron	TDS, Sodium, Sulphate, Iron, Manganese
MW-08	Iron	TDS, Iron, Manganese
MW-09	Iron, Aluminum	TDS, Sodium, Iron, Manganese, Aluminum
MW-10	Iron	TDS, Iron, Manganese
MW-11	Iron	TDS, Iron, Manganese
MW-12	Iron	TDS, Iron, Manganese
MW-13	Iron	Iron, Manganese

A more detailed discussion of the groundwater analysis results including a characterization of baseline groundwater quality in the Beverly Channel is included in Section 5 of this report.

Groundwater analysis results have also been plotted in a Piper Trilinear diagrams in order to provide a general characterization of groundwater quality of in the Beverly Channel. Figure 3.4 presents the Piper Trilinear diagram for the Spring 2005 sample event, while Figure 3.5 presents the Piper Trilinear diagram for the Fall 2005 sample event. Examination of Figures 3.4 and 3.5 reveals that typically, the cationic species are distributed between calcium, sodium, and magnesium ions. Anionic species are dominated by bicarbonate or sulphate ions, with chloride ions constituting a much smaller proportion of the TDS.

Figure 3.4: Piper Trilinear Diagram for Spring 2005

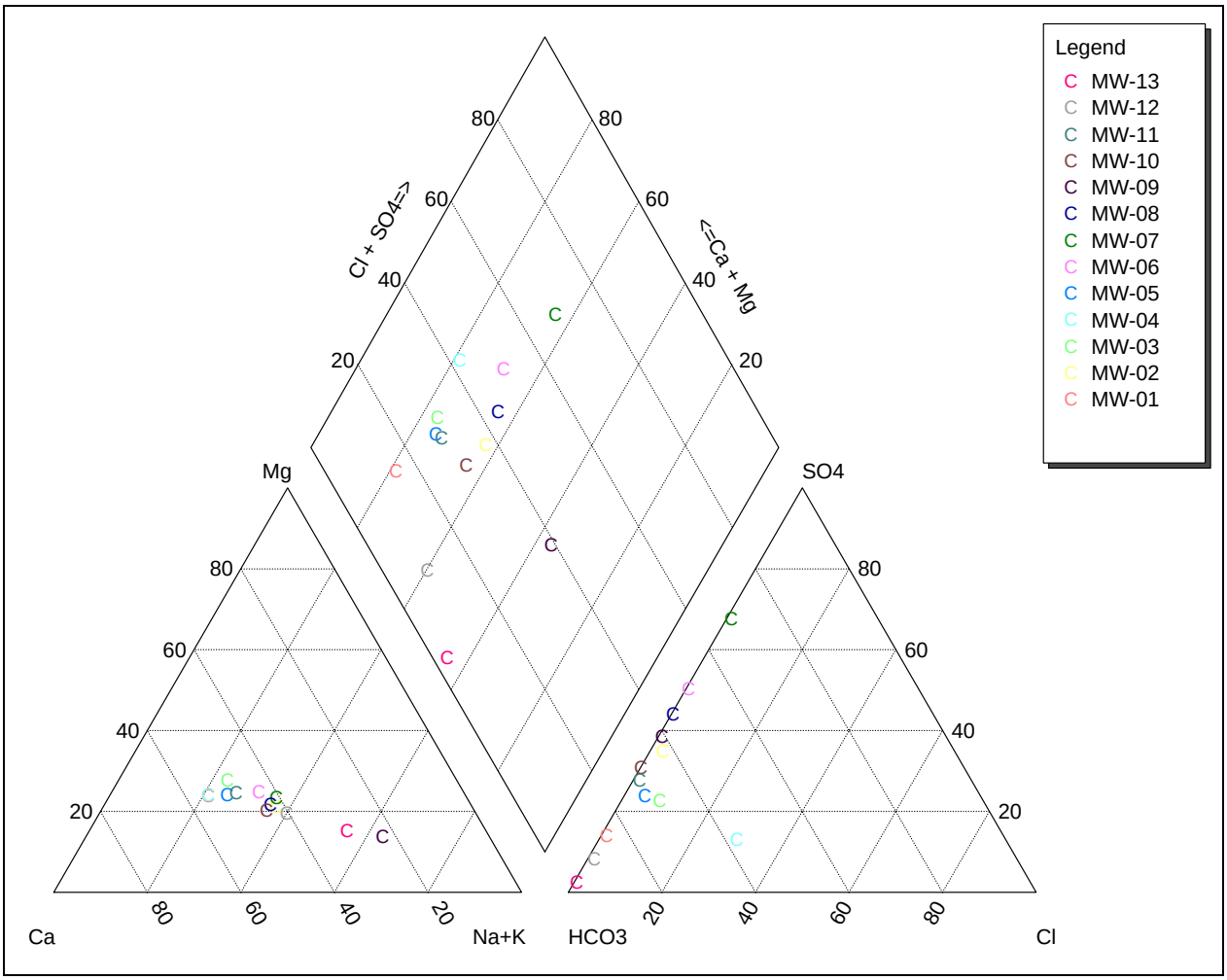
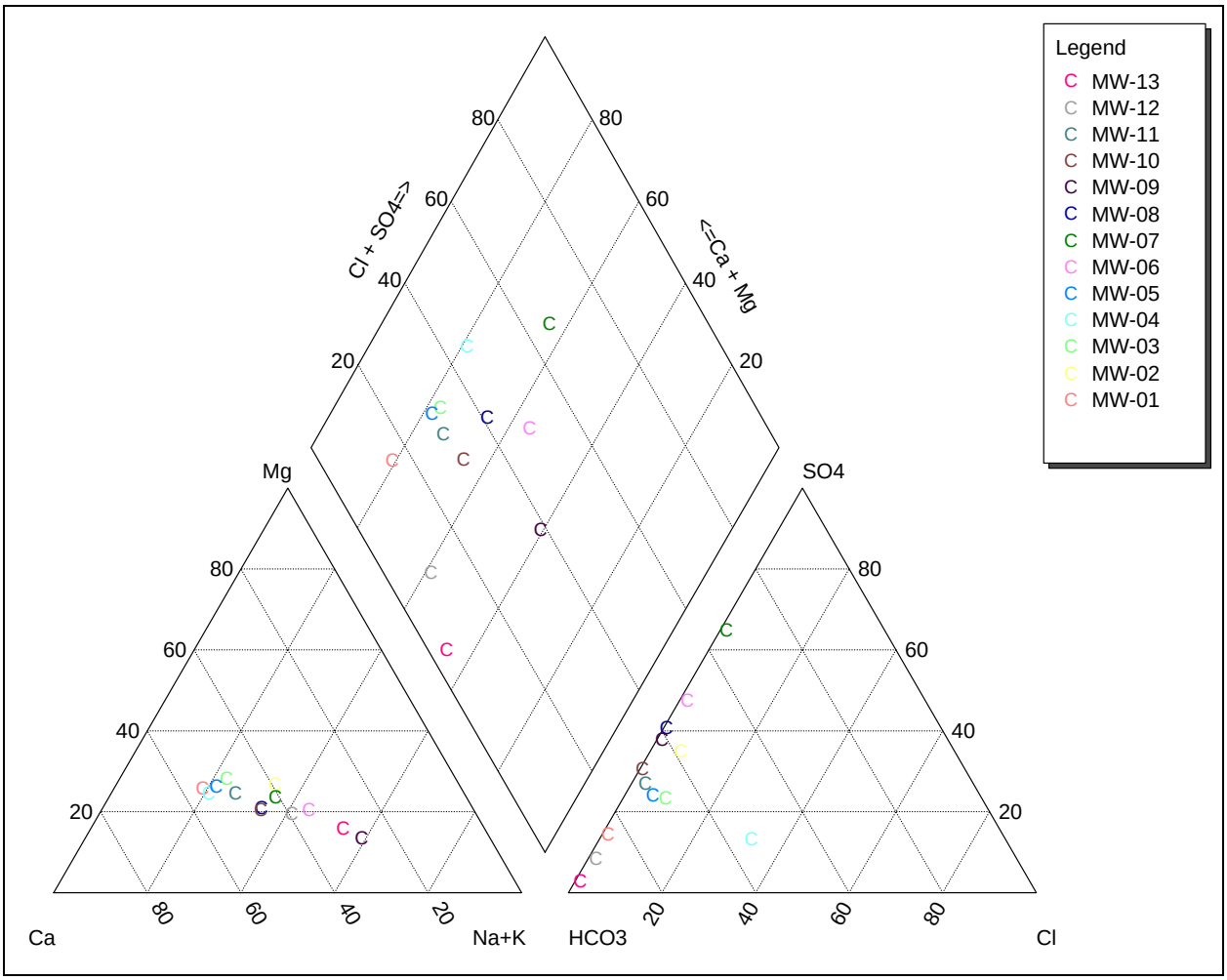


Figure 3.5: Piper Trilinear Diagram for Fall 2005



3.11 GROUNDWATER QA/QC

Reproducibility of analytical data was assessed by the relative percent difference (RPD) of the duplicate sample results. The relative percent difference is defined as:

$$RPD = \frac{(S - D)}{(S + D)/2} * 100$$

Where: RPD is the relative percent difference
S is the sample result
D is the duplicate result

Duplicate results for a sampling program are considered acceptable based on the following criteria:

- When duplicate results are greater than five times the parameter detection limit, the relative percent difference between the duplicate results should be less than or equal to 20% (Zeiner 1994). When the relative percent difference for an analyte is greater than the acceptance limit, the results of the field duplicates should be considered estimates.

- When at least one of the duplicate results is less than or equal to five times the parameter detection limit, the absolute difference (AD) between the results should be less than or equal to the detection limit. When the absolute difference for an analyte is greater than the acceptance limit, the results of the field duplicates should be considered estimates.

Tables 3.11 and 3.12 present the calculated RPD for each of the analytical parameters and indicate whether or not the above criteria were met. For the Spring 2005 sampling event, the only parameter to fail the QA/QC test was lead, and as such the reported lead concentrations for the Spting 2005 sampling event should be considered estimates. For the Fall 2005 sampling event, all parameters met the above QA/QC criteria.

Table 3.11: Calculated RPD and QA/QC Test Results - Spring 2005

Parameter	Detection Limit	MW-09	MW-09 Duplicate	RPD	QA/QC Test
General and Bulk Parameters					
Ion Balance (%)		93.2	97.4	-4.4	Pass
Total Dissolved Solids (mg/L)		954	1010	-5.7	Pass
Hardness (mg/L as CaCO3)		286	312	-8.7	Pass
pH	0.1	7.9	7.9	0.0	Pass
Electrical Conductivity (µS/cm)	0.2	1520	1520	0.0	Pass
Total Alkalinity (mg/L as CaCO3)	5	513	515	-0.4	Pass
Dissolved Organic Carbon (mg/L)	1	5	5	0.0	Pass
Routine and Major Ion Parameters					
Chloride (mg/L)	1	5	5	0.0	Pass
Fluoride (mg/L)	0.05	0.29	0.29	0.0	Pass
Calcium (mg/L)	0.5	71.6	79.1	-10.0	Pass
Potassium (mg/L)	0.1	4.2	4.7	-11.2	Pass
Magnesium (mg/L)	0.1	26	27.9	-7.1	Pass
Sodium (mg/L)	1	226	243	-7.2	Pass
Sulfate (mg/L)	0.5	313	340	-8.3	Pass
Iron (mg/L)	0.005	1.11	1.07	3.7	Pass
Manganese (mg/L)	0.001	0.714	0.705	1.3	Pass
Nitrate and Nitrite (mg/L as N)	0.1	0.1	0.1	0.0	Pass
Nitrate (mg/L as N)	0.1	0.1	0.1	0.0	Pass
Nitrite (mg/L as N)	0.05	<0.05	<0.05	N/A	N/A
Bicarbonate (mg/L)	5	626	628	-0.3	Pass
Carbonate (mg/L)	5	<5	<5	N/A	N/A
Hydroxide (mg/L)	5	<5	<5	N/A	N/A
Ammonia (mg/L as N)	0.05	1.81	1.79	1.1	Pass
Orthophosphate (mg/L as P)	0.01	<0.001	<0.001	N/A	N/A
Hydrocarbon Parameters					
Benzene (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
Toluene (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
Ethylbenzene (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
Xylenes (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
F1(mg/L)	0.1	<0.1	<0.1	N/A	N/A
F1-BTEX (mg/L)	0.1	<0.1	<0.1	N/A	N/A
F2 (mg/L)	0.05	<0.05	<0.05	N/A	N/A
Phenols (mg/L)	0.001	<0.001	<0.001	N/A	N/A
Dissolved Metals					
Silver (mg/L)	0.0002	<0.0002	<0.0002	N/A	N/A
Aluminum (mg/L)	0.01	0.14	0.12	15.4	Pass
Arsenic (mg/L)	0.0004	0.0019	0.0019	0.0	Pass
Boron (mg/L)	0.002	0.339	0.332	2.1	Pass
Barium (mg/L)	0.0001	0.0608	0.0616	-1.3	Pass
Beryllium (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
Bismuth (mg/L)	0.00005	<0.00005	<0.00005	N/A	N/A
Cadmium (mg/L)	0.0001	<0.0001	<0.0001	N/A	N/A
Cobalt (mg/L)	0.0001	0.0011	0.0012	-8.7	Pass
Chromium (mg/L)	0.0004	0.0016	0.0012	28.6	Pass
Copper (mg/L)	0.0006	0.001	0.001	0.0	Pass
Mercury (mg/L)	0.0001	<0.0001	<0.0001	N/A	N/A
Molybdenum (mg/L)	0.0001	0.0019	0.0019	0.0	Pass
Nickel (mg/L)	0.0001	0.0002	0.0002	0.0	Pass
Lead (mg/L)	0.0001	0.0001	0.0003	-100.0	Fail
Antimony (mg/L)	0.0004	0.0007	0.0007	0.0	Pass
Selenium (mg/L)	0.0004	<0.0004	<0.0004	N/A	N/A
Tin (mg/L)	0.0002	<0.0002	<0.0002	N/A	N/A
Strontium (mg/L)	0.0001	0.843	0.841	0.2	Pass
Titanium (mg/L)	0.0003	0.0058	0.0059	-1.7	Pass
Thallium (mg/L)	0.00005	<0.00005	<0.00005	N/A	N/A
Uranium (mg/L)	0.0001	0.0019	0.0018	5.4	Pass
Vanadium (mg/L)	0.0001	0.0005	0.0004	22.2	Pass
Zinc (mg/L)	0.002	0.003	0.004	-28.6	Pass

Table 3.12: Calculated RPD and QA/QC Test Results - Fall 2005

Parameter	Detection Limit	MW-04	MW-04 Duplicate	RPD	QA/QC Test
General and Bulk Parameters					
Ion Balance (%)		98.2	98.1	0.1	Pass
Total Dissolved Solids (mg/L)		726	731	-0.7	Pass
Hardness (mg/L as CaCO3)		532	533	-0.2	Pass
pH	0.1	7.8	7.9	-1.3	Pass
Electrical Conductivity (µS/cm)	0.2	1280	1290	-0.8	Pass
Total Alkalinity (mg/L as CaCO3)	5	368	371	-0.8	Pass
Dissolved Organic Carbon (mg/L)	1	5	4	22.2	Pass
Routine and Major Ion Parameters					
Chloride (mg/L)	1	157	157	0.0	Pass
Fluoride (mg/L)	0.05	0.12	0.12	0.0	Pass
Calcium (mg/L)	0.5	147	147	0.0	Pass
Potassium (mg/L)	0.1	9.5	9.7	-2.1	Pass
Magnesium (mg/L)	0.1	40	40.4	-1.0	Pass
Sodium (mg/L)	1	59	60	-1.7	Pass
Sulfate (mg/L)	0.5	87	89	-2.3	Pass
Iron (mg/L)	0.005	0.104	0.105	-1.0	Pass
Manganese (mg/L)	0.001	0.053	0.053	0.0	Pass
Nitrate and Nitrite (mg/L as N)	0.1	1.2	1.2	0.0	Pass
Nitrate (mg/L as N)	0.1	1.2	1.2	0.0	Pass
Nitrite (mg/L as N)	0.05	<0.05	<0.05	N/A	N/A
Bicarbonate (mg/L)	5	449	452	-0.7	Pass
Carbonate (mg/L)	5	<5	<5	N/A	N/A
Hydroxide (mg/L)	5	<5	<5	N/A	N/A
Ammonia (mg/L as N)	0.05	0.013	0.01	26.1	Pass
Orthophosphate (mg/L as P)	0.01	<0.001	<0.001	N/A	N/A
Hydrocarbon Parameters					
Benzene (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
Toluene (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
Ethylbenzene (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
Xylenes (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
F1(mg/L)	0.1	<0.1	<0.1	N/A	N/A
F1-BTEX (mg/L)	0.1	<0.1	<0.1	N/A	N/A
F2 (mg/L)	0.05	<0.05	<0.05	N/A	N/A
Phenols (mg/L)	0.001	<0.001	<0.001	N/A	N/A
Dissolved Metals					
Silver (mg/L)	0.0002	<0.0002	<0.0002	N/A	N/A
Aluminum (mg/L)	0.01	<0.01	0.01	N/A	N/A
Arsenic (mg/L)	0.0004	0.0006	0.0007	-15.4	Pass
Boron (mg/L)	0.002	0.093	0.097	-4.2	Pass
Barium (mg/L)	0.0001	0.0809	0.0817	-1.0	Pass
Beryllium (mg/L)	0.0005	<0.0005	<0.0005	N/A	N/A
Bismuth (mg/L)	0.00005	0.00007	0.00005	33.3	Pass
Cadmium (mg/L)	0.0001	<0.0001	<0.0001	N/A	N/A
Cobalt (mg/L)	0.0001	0.0049	0.0051	-4.0	Pass
Chromium (mg/L)	0.0004	0.0007	0.0009	-25.0	Pass
Copper (mg/L)	0.0006	0.0012	0.0012	0.0	Pass
Mercury (mg/L)	0.0001	0.0002	0.0001	66.7	Pass
Molybdenum (mg/L)	0.0001	0.003	0.0028	6.9	Pass
Nickel (mg/L)	0.0001	0.014	0.0132	5.9	Pass
Lead (mg/L)	0.0001	<0.0001	<0.0001	N/A	N/A
Antimony (mg/L)	0.0004	0.0007	0.0006	15.4	Pass
Selenium (mg/L)	0.0004	0.0009	0.0009	0.0	Pass
Tin (mg/L)	0.0002	<0.0002	<0.0002	N/A	N/A
Strontium (mg/L)	0.0001	0.616	0.609	1.1	Pass
Titanium (mg/L)	0.0003	0.0004	0.0004	0.0	Pass
Thallium (mg/L)	0.00005	<0.00005	<0.00005	N/A	N/A
Uranium (mg/L)	0.0001	0.0025	0.0026	-3.9	Pass
Vanadium (mg/L)	0.0001	<0.0001	<0.0001	N/A	N/A
Zinc (mg/L)	0.002	0.029	0.032	-9.8	Pass

4.0 Regional Hydrogeologic Interpretation

4.1 DEVELOPMENT OF THE CONCEPTUAL HYDROGEOLOGIC FRAMEWORK

The conceptual hydrogeologic framework for the Study Area was developed through a review of borehole logs and geophysical logs compiled for this study. A preliminary set of data was compiled by collecting borehole information that was within or near the Study Area. Borehole information from NCIA member companies, the AENV water well database, and geophysical logs on record with AENV were used in compiling the preliminary data set. Data collected over the course of the Phase II field investigation program was also compiled.

The preliminary data set was then screened to cull the records that were of little or no value to this study. Such records included water well records with no lithology descriptions, geophysical logs that began in bedrock units (and were thus "too deep"), records of questionable quality, borehole records that did not reach bedrock (and were thus "too shallow"), and records with poor or irresolvable spatial control.

Additional queries were run on the AENV water well records to identify records with "Sand" or "Sand and Gravel" within their lithological descriptions, as it was likely that these records would pertain to the Empress Formation sands and gravels. Records with "Shale" or "Sandstone" within their lithological descriptions were also identified so that they could be used to define the bedrock topography. The resulting screened data set became the basis for subsequent development of the hydrogeological framework for the Study Area. Figure 4.1 presents the locations of the data points used in the development of the hydrogeological framework. The formation isopach and structure contour maps presented in the following sections were based on these data points where information was available for the given formation.

Well coordinates for the AENV water well records were adjusted based upon the orthorectified well positions (where available) reported in the PFRA Regional Groundwater Assessment reports for Strathcona and Sturgeon counties (Hydrogeological Consultants, 2001a and 2001b). For example, the well coordinates were moved from the center of the quarter section reported in the AENV water well database to a location adjacent to a homestead as identified on an airphoto.

Locations for cross sections were then chosen for the Study Area. In total, 12 geological cross sections were developed. Two of the sections (A-A' and B-B') were oriented longitudinally or parallel to the thalweg of the Beverly Channel. The remaining ten sections (1-1' thru 10-10') were oriented transverse or normal to the thalweg of the Beverly Channel. The location of all geological cross sections is presented in Figure 4.2.

During the development of the geological cross sections, each of the boreholes' lithology descriptions were reviewed in order to make stratigraphic correlations between boreholes on a particular cross section. In some cases the lithology descriptions were re-interpreted in order to define reasonable stratigraphic correlations. For example, a lithological description reported as

"Clay with rocks" would have been re-interpreted as "Clay Till" where appropriate. In other cases, a lithological description of "Sand" would have been re-interpreted as "Sandstone" when its elevation was below the interpreted bedrock surface.

A digital elevation model (DEM) (Altalis, 2004) was utilized during the development of the geological cross sections. A regular grid of DEM points was first created via kriging, and the resulting grid was sliced using the coordinates of the boreholes within a particular section. The result was an approximate ground surface elevation line for each of the cross sections that could be used, rather than simply connecting lines between boreholes. In this manner, topographical features like the North Saskatchewan River valley could be more accurately represented on the cross sections. The DEM was also used to obtain ground level elevations at AENV water well record locations, as the DEM was deemed more accurate than the "estimated elevation" reported in the AENV water well database.

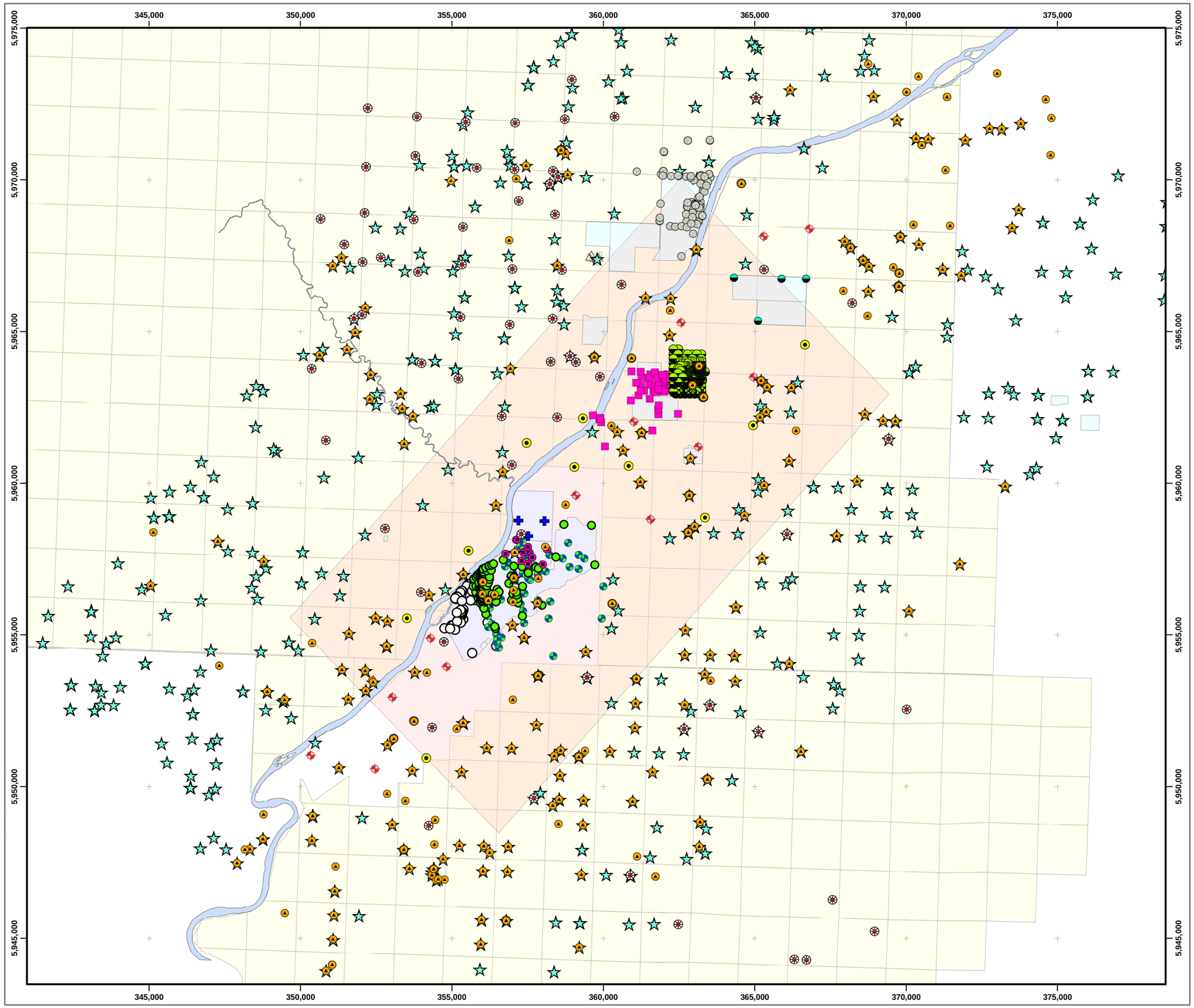
A quaternary geology map (Shetsen, 1990) was utilized at times when an independent interpretation of the surficial deposits was desired to corroborate the geological interpretations developed in this study. For example, when a borehole record ambiguously reported "Clay" at surface, it was not always immediately clear if the "Clay" in question was in fact a lacustrine clay or a glacial clay till. In such cases, a quaternary geology map was utilized to assist the development of the current interpretation.

Figures 4.3 thru 4.14 present the geological cross sections developed for this study. It should be noted that the cross sections are regional in scale, traversing distances of up to 26 km. As such, some of the local scale geological nuances or heterogeneities may not be entirely represented in the cross sections. Once the geological sections were developed, a table of geological 'picks' was created for subsequent analysis and contouring. Structure elevation contours and isopach contours were created through interpolation of the data points in this table.

4.2 BEDROCK TOPOGRAPHY

Figure 4.15 presents the bedrock structure contours for the Study Area. Bedrock elevations vary from 580 mAMSL near the Shell Chemicals plant site to 650 mAMSL in the northwest corner of the Study Area, with the Beverly Channel being the dominant topographical feature. The Beverly Channel is generally oriented in a southwest – northeast direction in the Study area and is generally parallel to the North Saskatchewan River. The thalweg of the valley appears to be situated southeast of the North Saskatchewan River. Northwest banks of the Beverly Channel appear to be steeper than the southwest banks.

Figure 4.16 presents a three dimensional representation of the bedrock surface in the Study Area. Areas lower in elevation are represented by shades of green and grade upwards to the highest areas represented by shades of blue.



Path: V:\1102\active\110217094\GIS\Final Report Figures\Geological Data Points.mxd

Legend

- Study Area
- Member Company Plant Site
- NCIA Monitoring Well
- NCIA Test Hole
- Shell Canada Boreholes
- Sherritt, Agrium, Sulzer, Umicore, Westaim
- Dow Wells
- Keyera Energy Boreholes
- BA Energy / Kinder Morgan Canada Wells
- BP Canada Wells
- Shell Chemicals Boreholes
- Degussa Wells
- AENV Wells with Shale/Sandstone
- AENV E-Logs
- AENV Wells with Sand/Gravel
- Agrium Redwater Wells

Scale: 1:125,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA
Northeast Capital Industrial Association

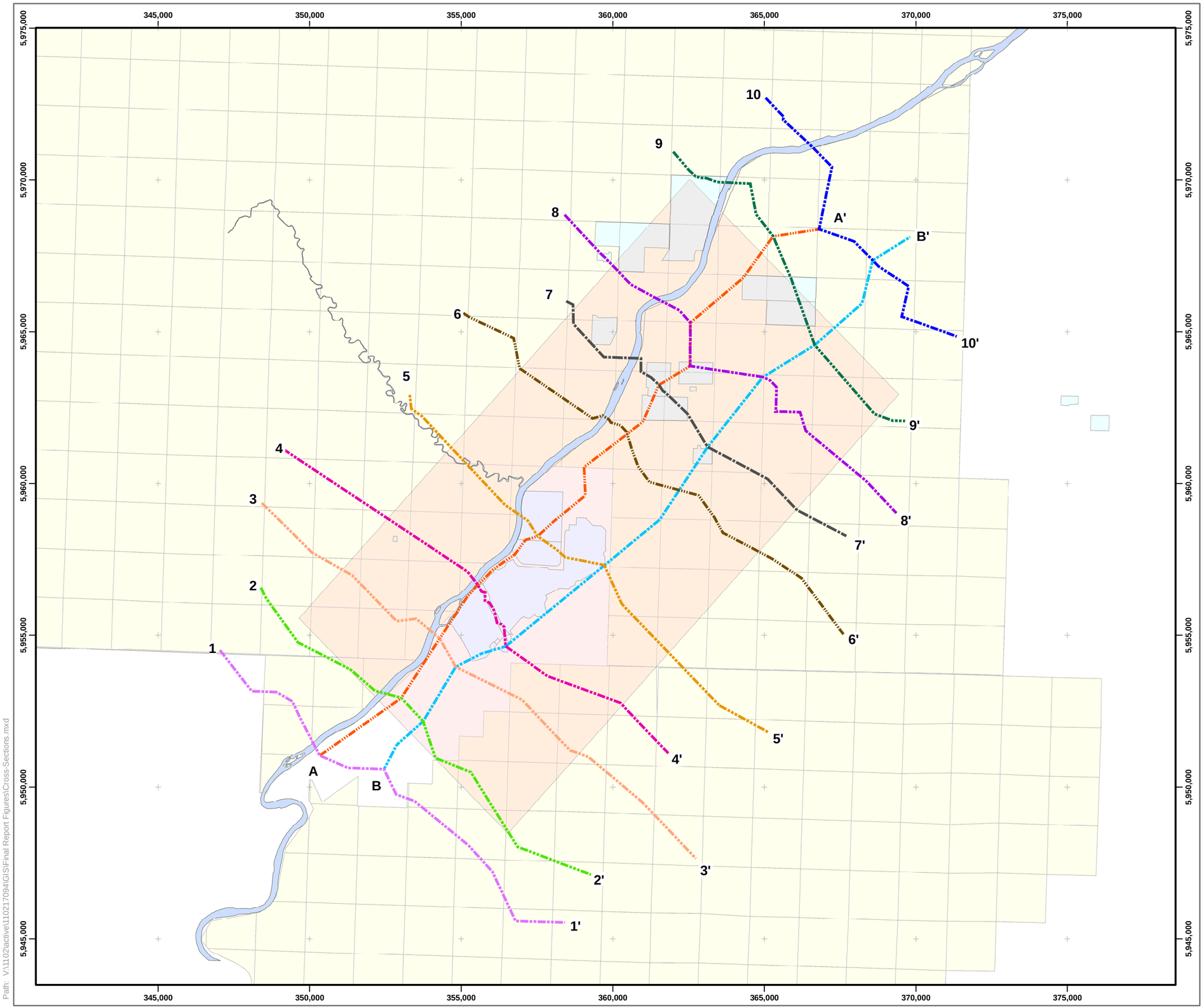
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.1

Title

Location of Data Points Used for Geological Interpretation



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Stantec

Legend

- Project_Area
- Member Company Plant Site
- Cross Section AA
- Cross Section BB
- Cross Section 1
- Cross Section 2
- Cross Section 3
- Cross Section 4
- Cross Section 5
- Cross Section 6
- Cross Section 7
- Cross Section 8
- Cross Section 9
- Cross Section 10

Note:

Scale: 1:125,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA
Northeast Capital Industrial Association

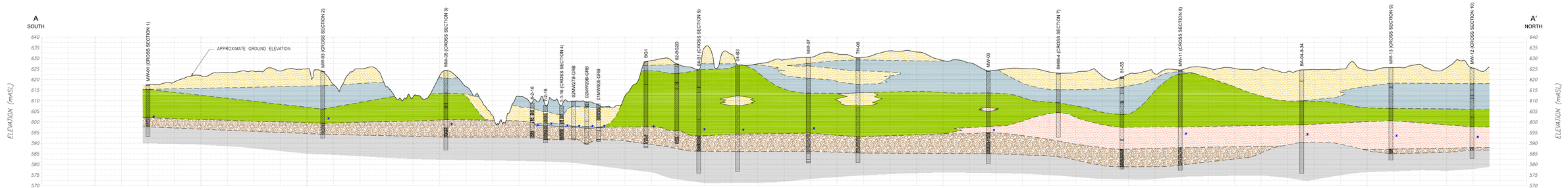
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.2

Title

Location of Geological Cross Sections



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2006-09-25 13:21PM By: tiley

September, 2005
1102-110947000

Stantec

Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL
GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT	CLAY UNIT	CLAY TILL UNIT	PRE-GLACIAL DEPOSITS	BEDROCK UNIT
SAND	CLAY	CLAY TILL	SAND	SHALE/SILTSTONE/ SANDSTONE
SAND/GRAVEL			SAND AND GRAVEL	

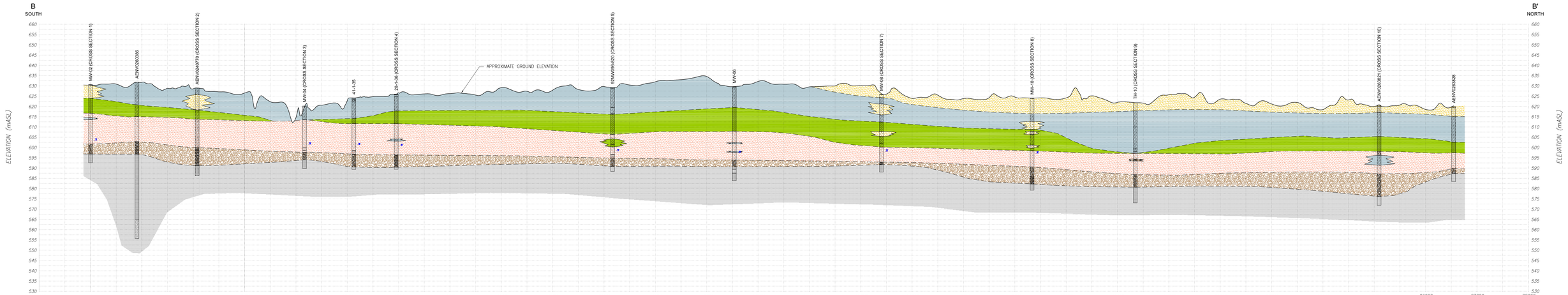
Scale

1:30000 H
1:750 V
0 300 900 1500m
0 7.5 22.5 37.5m

Client/Project
NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.3

Title
Geological
Cross Section A-A'



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2006-09-25 12:36PM By: tiley

November, 2005
1102-110947000

Stantec

Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL
GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT: SAND; SAND/GRAVEL
CLAY UNIT: CLAY
CLAY TILL UNIT: CLAY TILL
PRE-GLACIAL DEPOSITS: SAND; SAND AND GRAVEL
BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

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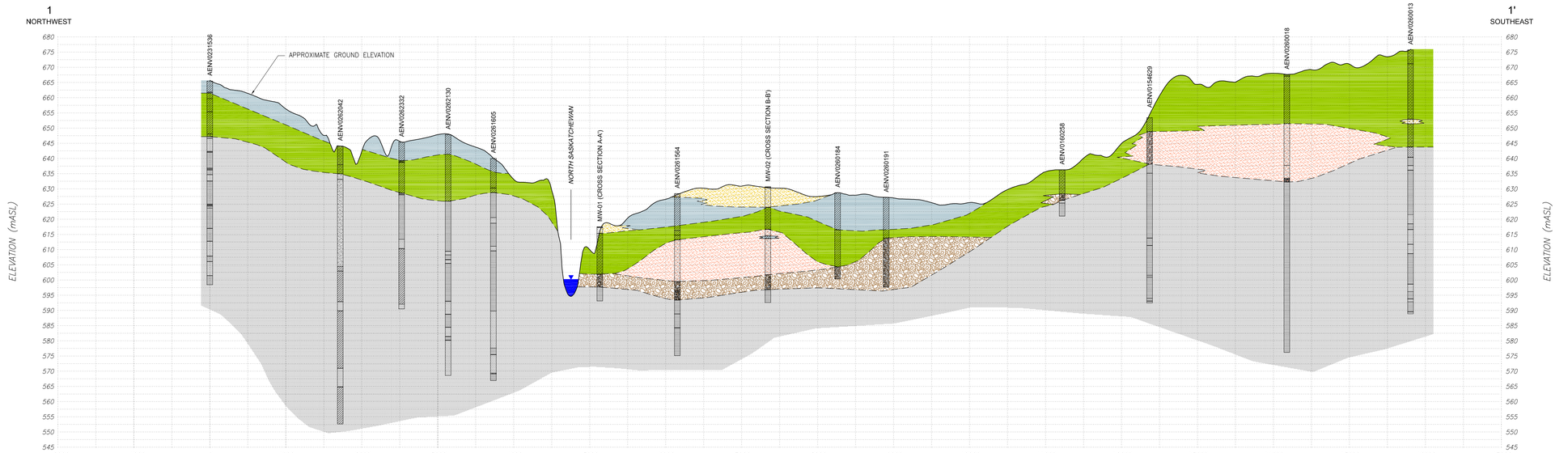
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.4

Title
Geological
Cross Section B-B'



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September, 2005
1102-17094/600

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Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL

Stratigraphy

SURFICIAL UNIT: SAND; SAND/GRAVEL
CLAY UNIT: CLAY
CLAY TILL UNIT: CLAY TILL
PRE-GLACIAL DEPOSITS: SAND; SAND AND GRAVEL
BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

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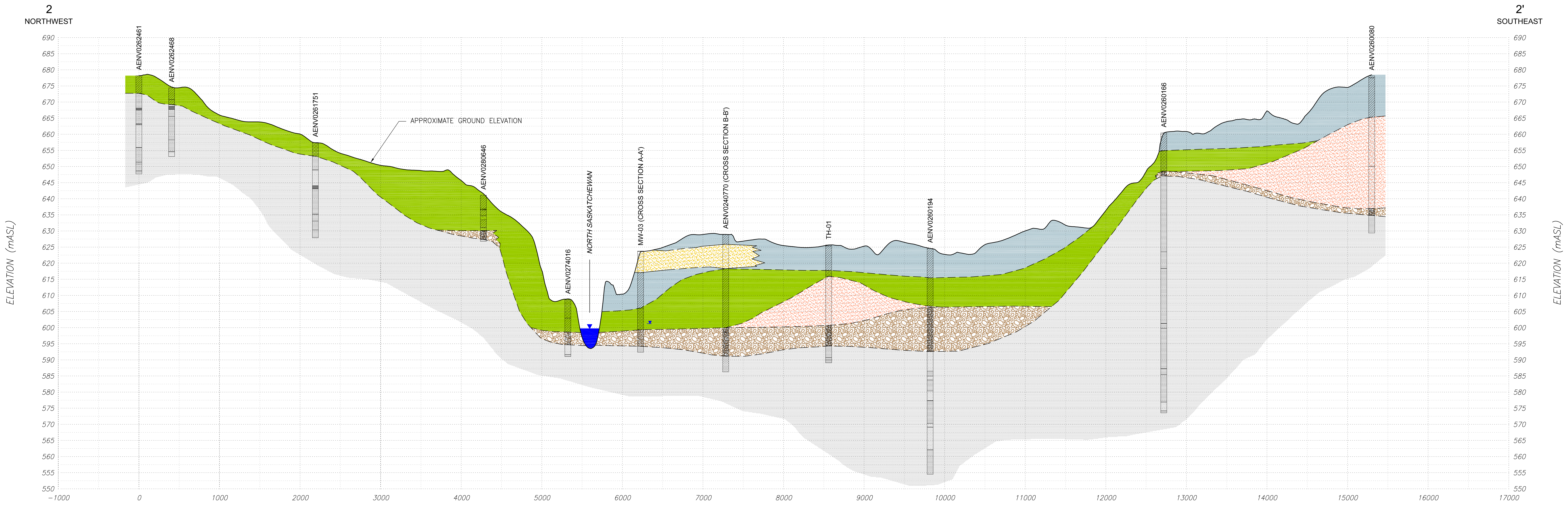
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.5

Title
Geological
Cross Section 1-1'



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2006-10-19 01:27PM By: ttieu

November, 2005
1102-17094/600

Stantec

Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL
GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT
SAND
SAND/GRAVEL

CLAY UNIT
CLAY

CLAY TILL UNIT
CLAY TILL

PRE-GLACIAL DEPOSITS
SAND
SAND AND GRAVEL

BEDROCK UNIT
SHALE/SILTSTONE/ SANDSTONE

Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

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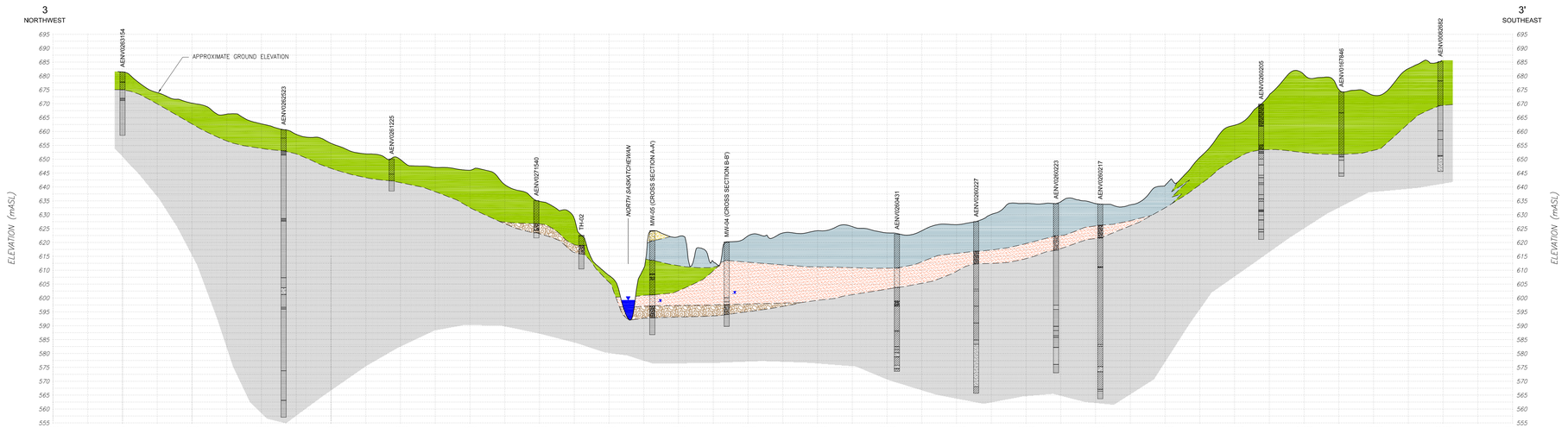
NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.6

Title
Geological
Cross Section 2-2'



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November, 2005
1102-170941000

Stantec

Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL
GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT: SAND; SAND/GRAVEL
CLAY UNIT: CLAY
CLAY TILL UNIT: CLAY TILL
PRE-GLACIAL DEPOSITS: SAND; SAND AND GRAVEL
BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

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NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.7

Title
Geological
Cross Section 3-3'

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2006-10-19 01:29PM By: ttieu

November, 2005
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Legend

TOPSOIL/ ORGANICS · GRAVEL · SAND & GRAVEL · SAND · SILT · CLAY · TILL · SANDSTONE · SHALE · SILTSTONE · BEDROCK · COAL · GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT: SAND, SAND/GRAVEL

CLAY UNIT: CLAY

CLAY TILL UNIT: CLAY TILL

PRE-GLACIAL DEPOSITS: SAND, SAND AND GRAVEL

BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

Scale

1:30000 H — 0, 300, 900, 1500m
1:750 V — 0, 7.5, 22.5, 37.5m

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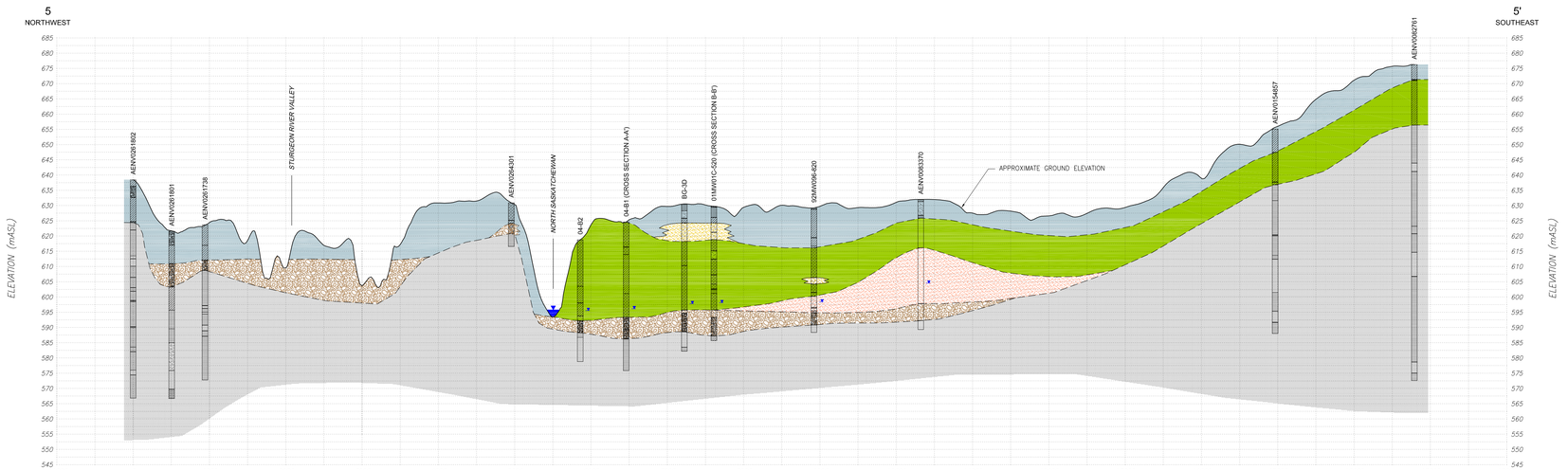
NCIA
Northeast Capital Industrial Association
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.8

Title
Geological Cross Section 4-4'



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2006-08-25, 12:27PM By: tlieu

November, 2005
1102-17094/600

Stantec

Legend

TOPSOIL/ ORGANICS, GRAVEL, SAND & GRAVEL, SAND, SILT, CLAY, TILL, SANDSTONE, SHALE, SILTSTONE, BEDROCK, COAL, GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT: SAND, SAND/GRAVEL
CLAY UNIT: CLAY
CLAY TILL UNIT: CLAY TILL
PRE-GLACIAL DEPOSITS: SAND, SAND AND GRAVEL
BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

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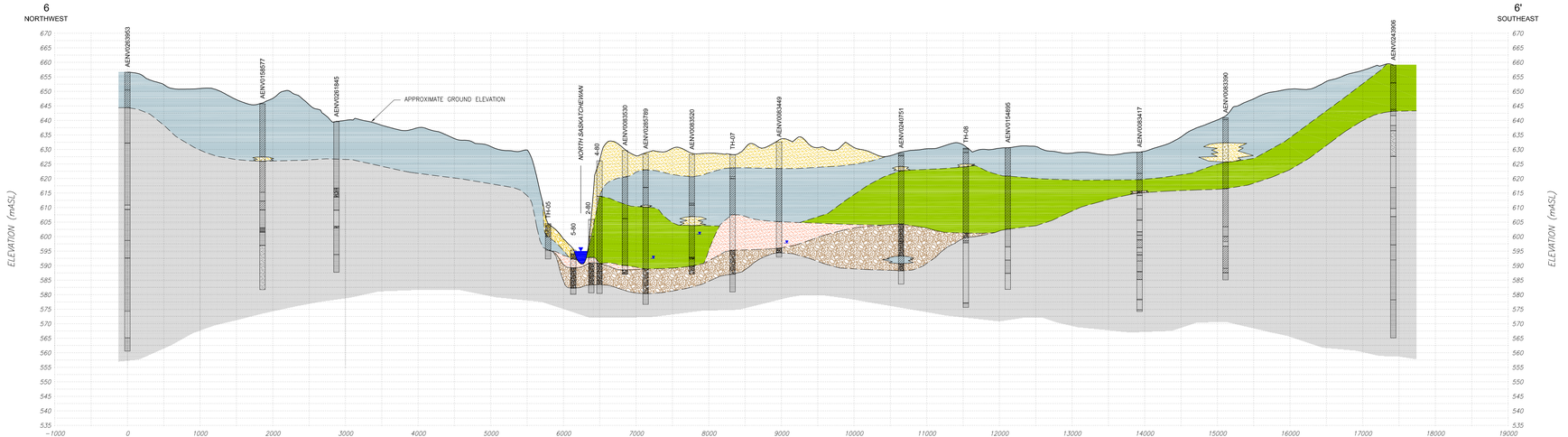
NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.9

Title
Geological
Cross Section 5-5'



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Stantec

Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL
GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT: SAND; SAND/GRAVEL
CLAY UNIT: CLAY
CLAY TILL UNIT: CLAY TILL
PRE-GLACIAL DEPOSITS: SAND; SAND AND GRAVEL
BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

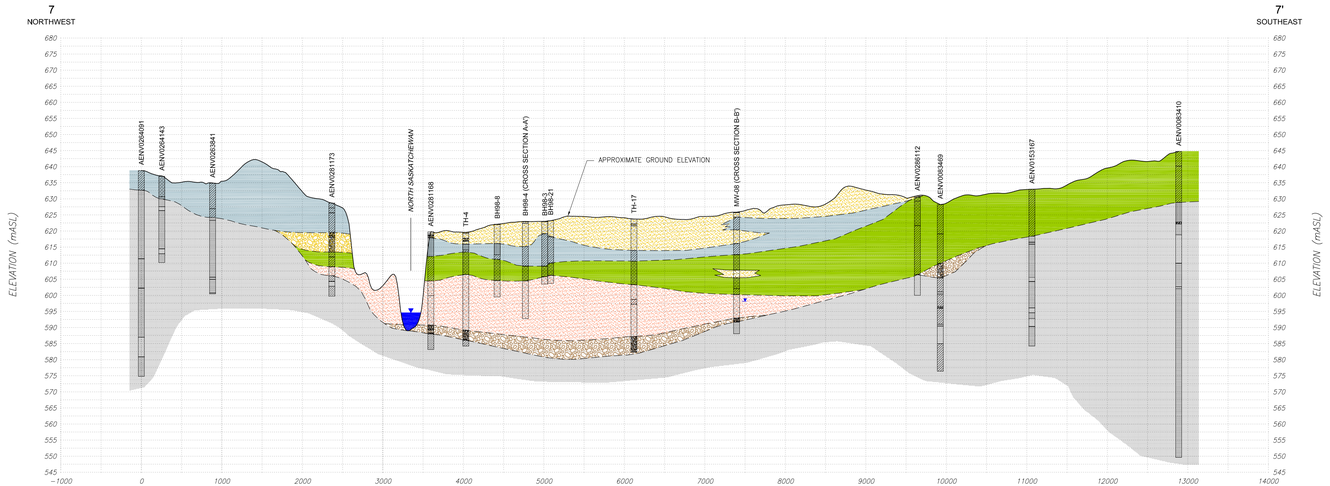
Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

Client/Project
NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.10

Title
Geological
Cross Section 6-6'



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2006-08-25 10:33PM By: tlay

November, 2006
1102-17094/1600

Stantec

Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL
GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT: SAND; SAND/GRAVEL
CLAY UNIT: CLAY
CLAY TILL UNIT: CLAY TILL
PRE-GLACIAL DEPOSITS: SAND; SAND AND GRAVEL
BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

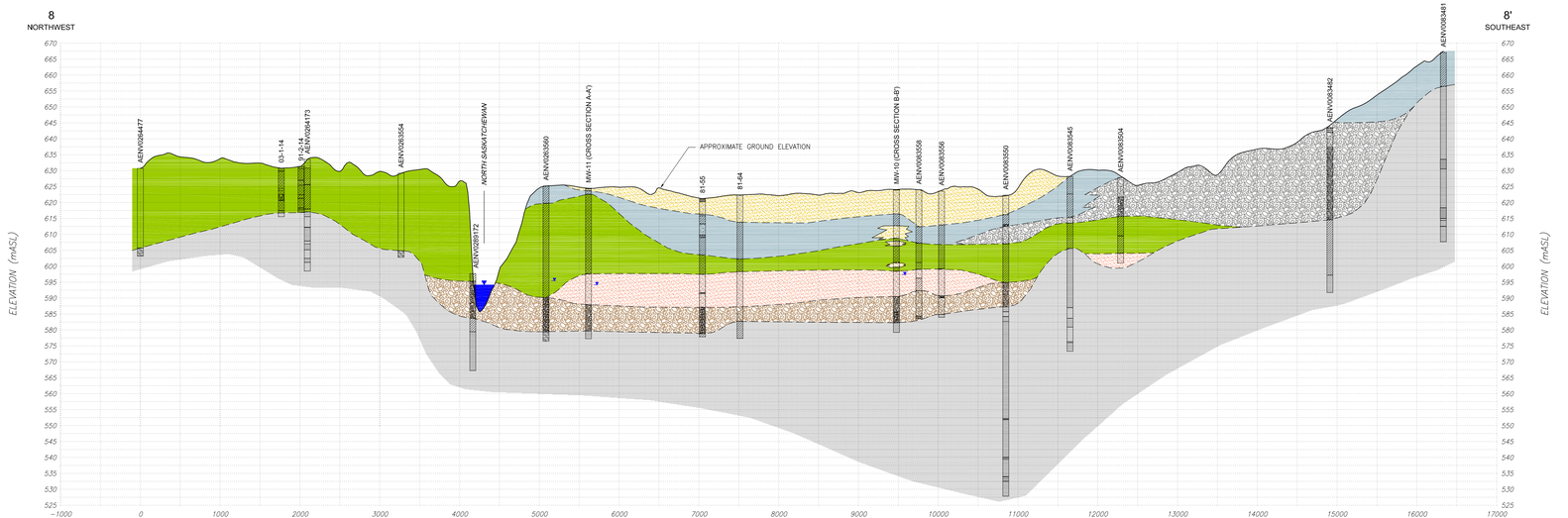
Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

Client/Project
NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.11

Title
Geological
Cross Section 7-7'



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2006-08-25 12:33PM By: tiley

November, 2005
1102-117094/600

Stantec

Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL
GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT: SAND; SAND/GRAVEL
CLAY UNIT: CLAY
CLAY TILL UNIT: CLAY TILL; SAND AND GRAVEL
PRE-GLACIAL DEPOSITS: SAND; SAND AND GRAVEL
BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

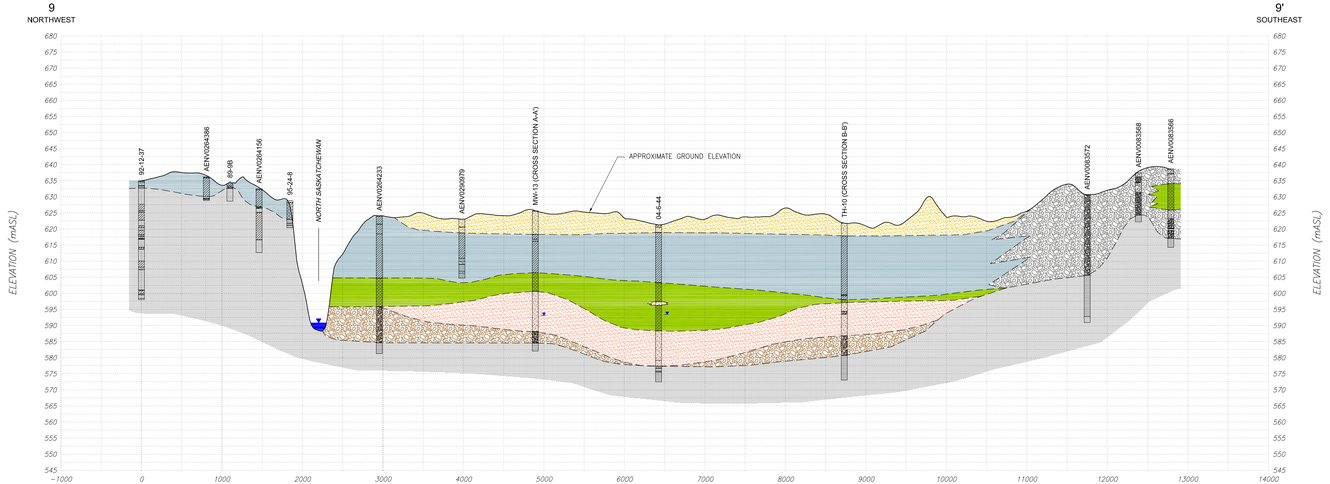
Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

Client/Project
NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.12

Title
Geological
Cross Section 8-8'



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2006-08-25 12:30PM By: tlau

November, 2005
1102-17094/600

Stantec

Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL
GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT: SAND; SAND/GRAVEL
CLAY UNIT: CLAY
CLAY TILL UNIT: CLAY TILL; SAND AND GRAVEL
PRE-GLACIAL DEPOSITS: SAND; SAND AND GRAVEL
BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

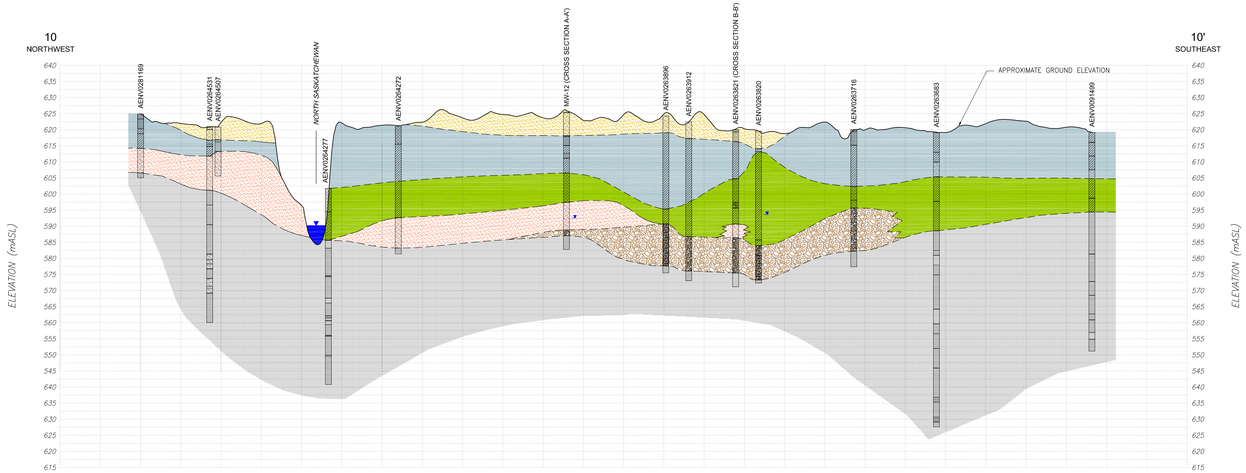
Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

Client/Project
NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.13

Title
Geological
Cross Section 9-9'



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2006-08-25 12:29PM By: tlieu

November, 2006
1102-11094/600

Stantec

Legend

TOPSOIL/ ORGANICS
GRAVEL
SAND & GRAVEL
SAND
SILT
CLAY
TILL
SANDSTONE
SHALE
SILTSTONE
BEDROCK
COAL
GROUNDWATER LEVEL

Stratigraphy

SURFICIAL UNIT: SAND; SAND/GRAVEL
CLAY UNIT: CLAY
CLAY TILL UNIT: CLAY TILL
PRE-GLACIAL DEPOSITS: SAND; SAND AND GRAVEL
BEDROCK UNIT: SHALE/SILTSTONE/ SANDSTONE

Scale

1:30000 H 0 300 900 1500m
1:750 V 0 7.5 22.5 37.5m

Client/Project
NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
4.14

Title
Geological
Cross Section 10-10'

Path: V:\1102\active\110217094\GIS\Final Report Figures\Bedrock Structure Contours.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site
- Bedrock Structure Contour

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

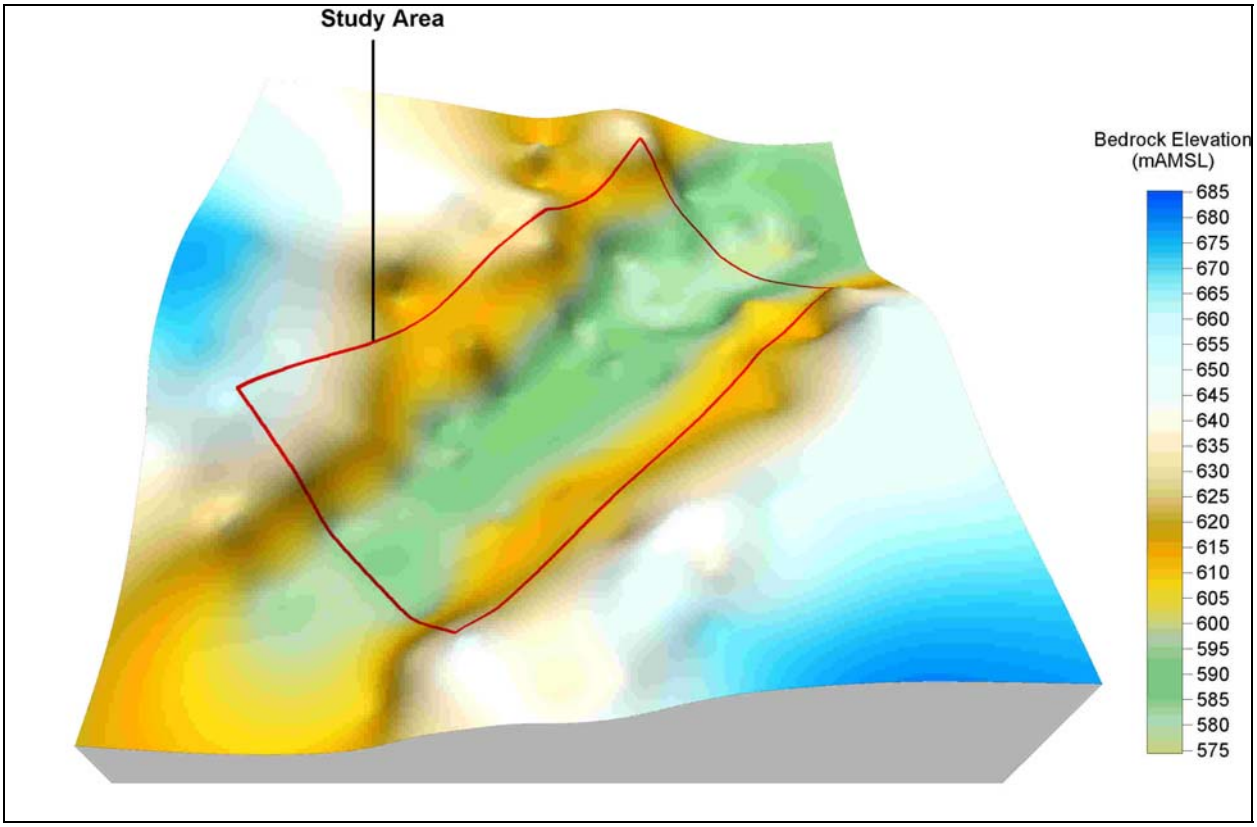
Figure No.

4.15

Title

Bedrock Structure Contours (mAMSL)

Figure 4.16: Three Dimensional Representation of the Bedrock Surface in the Study Area



4.3 EMPRESS FORMATION SAND AND GRAVEL

The Empress Formation sand and gravel unit was relatively continuous over the Study Area, as indicated on cross sections A-A' and B-B' (Figures 4.3 and 4.4). Figure 4.17 presents an Empress Formation isopach contour map for the Study Area. Of particular importance is the zero edge contour line, which is subsequently used to define the extent of the Beverly Channel sand and gravel deposits. Thickness of the Empress Formation varied from zero to a maximum thickness in excess of 20 m in areas of bedrock lows. Such areas included areas near the Shell Scotford complex, and areas near the southern limits of the Sherritt Fort Saskatchewan facility.

In developing the isopach contours, both the preglacial sand unit and the preglacial sand and gravel unit were packaged together and the total combined thickness was reported. This approach was deemed appropriate since over much of the study area, the two units are in direct contact with each other and are expected to behave hydraulically as one unit (albeit with some vertical anisotropy). Also, in some areas a clear distinction between the sand and the sand and gravel unit was not observed.

In some of the cross sections, a sand and gravel unit directly overlying bedrock was noted outside of the main channel of the Beverly valley (refer to southeast portions of the transverse cross sections). These sands and gravels are interpreted to have been deposited in an upper terrace of the Beverly Channel. The isopach map presented in Figure 4.17 does not include these upper sands and gravels, as they occur at a higher elevation and may not be in direct communication with the sands and gravels within the main channel.

A structure elevation contour map of the Empress Formation sands and gravels is presented in Figure 4.18. Top elevations of the sands and gravels vary from 590 mAMSL in central regions of the Study Area near the North Saskatchewan River to 620 mAMSL in southeastern regions of the Study Area.

4.4 GLACIAL TILL DEPOSITS

Glacial till deposits were identified throughout the Study Area and in some instances formed the surficial unit at ground level (refer to southeast portions of the transverse cross sections). Till deposits were most often reported to be predominantly clay in their lithological descriptions, but at times were reported to be silty and sandy. Sand lenses up to 5 m in thickness were also commonly reported. At some locations the clay till unit was absent (for example, refer to the middle of cross section 3-3').

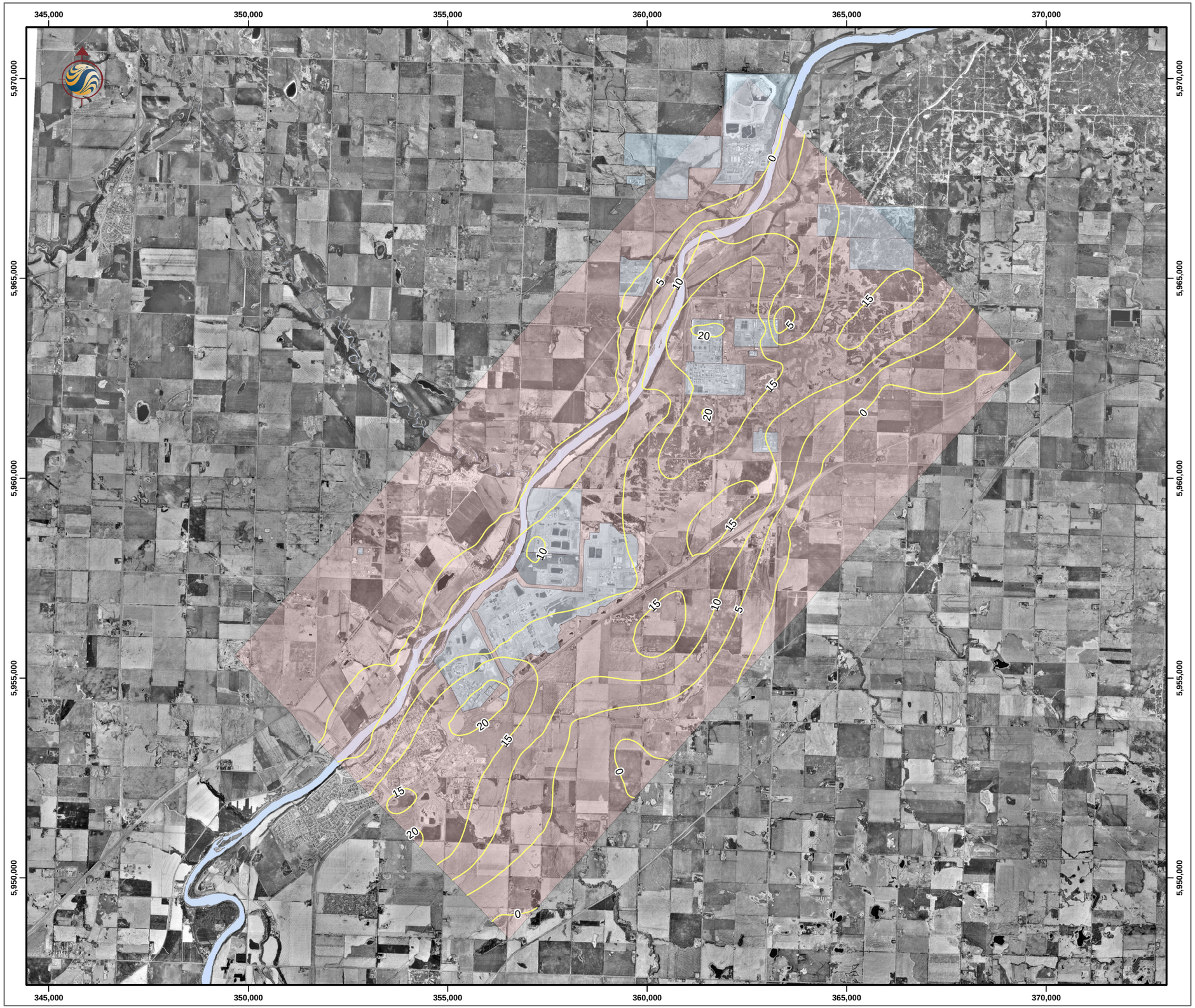
Figure 4.19 presents an isopach map for the glacial till unit, indicating the variability in its thickness across the Study Area. The thickness of the glacial till unit varied from more than 30 m in the vicinity of the Keyera Energy site to areas of zero thickness (absent) in the North Saskatchewan River valley and localized areas in the southeastern and northeastern regions of the Study Area.

Figure 4.20 presents a structure contour map for the glacial till deposits. In general, top elevation of the glacial till unit varies from 625 mAMSL in the vicinity of the Keyera Energy site, to 590 mAMSL in the North Saskatchewan River valley. Structure contours have been clipped in areas where the glacial till was not present. Also, in areas near the North Saskatchewan River, the DEM for the Study Area was utilized to reflect the presence of the river valley.

The top surface of the glacial till unit was generally gently undulating, but in localized areas was moderately undulating. Areas with steeper undulations (for example, near borehole 81-55 in cross section A-A') are interpreted to have been eroded subsequent to deposition. Glacial till deposits were generally found to be directly underlain by the Empress Formation sands and gravels where present, or by bedrock where the sands and gravels were absent.

4.5 LACUSTRINE SEDIMENTS

Lacustrine deposits were identified throughout the Study Area and in some instances formed the surficial unit at ground level (refer to the southern half of cross section B-B'). Lacustrine deposits were most often reported to be clay in their lithological descriptions. Occasional sand and/or silt lenses were reported within the lacustrine sediments at some locations.



Path: V:\1102\active\110217094\GIS\Final Report Figures\Empress Isopach Contours.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site
- Empress Formation Isopach

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA Northeast Capital Industrial Association

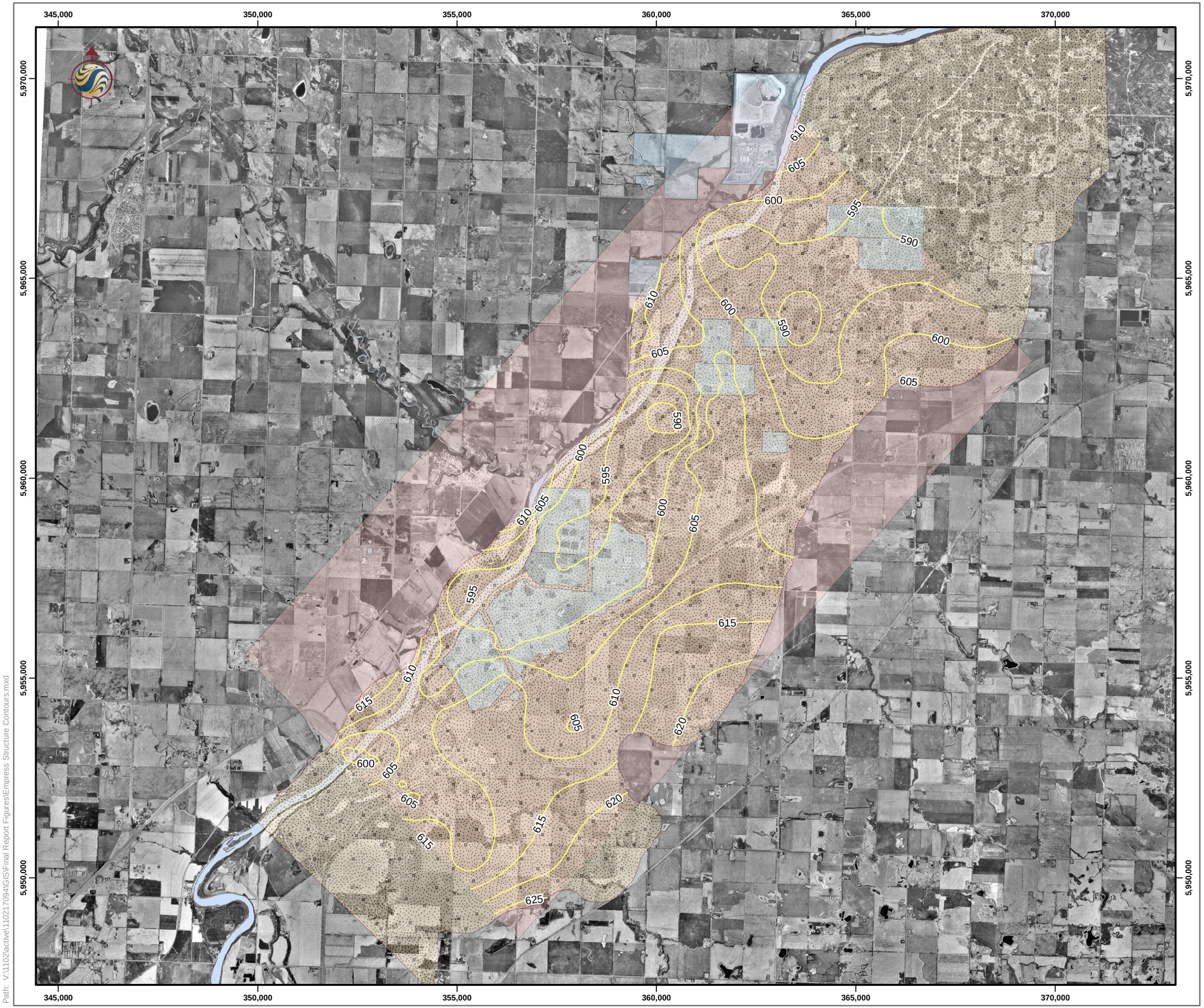
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.17

Title

Empress Formation Isopach Contours (m)



Path: V:\1102\active\110217094\GIS\Final Report Figures\Empress Structure Contours.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Empress Structure Contour

Note: The isopach contours depicted in this figure do not include preglacial sands and gravels from preglacial tributary channels nor preglacial sands and gravels on upper terraces of the Beverly Channel.

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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NCIA
Northeast Capital Industrial Association

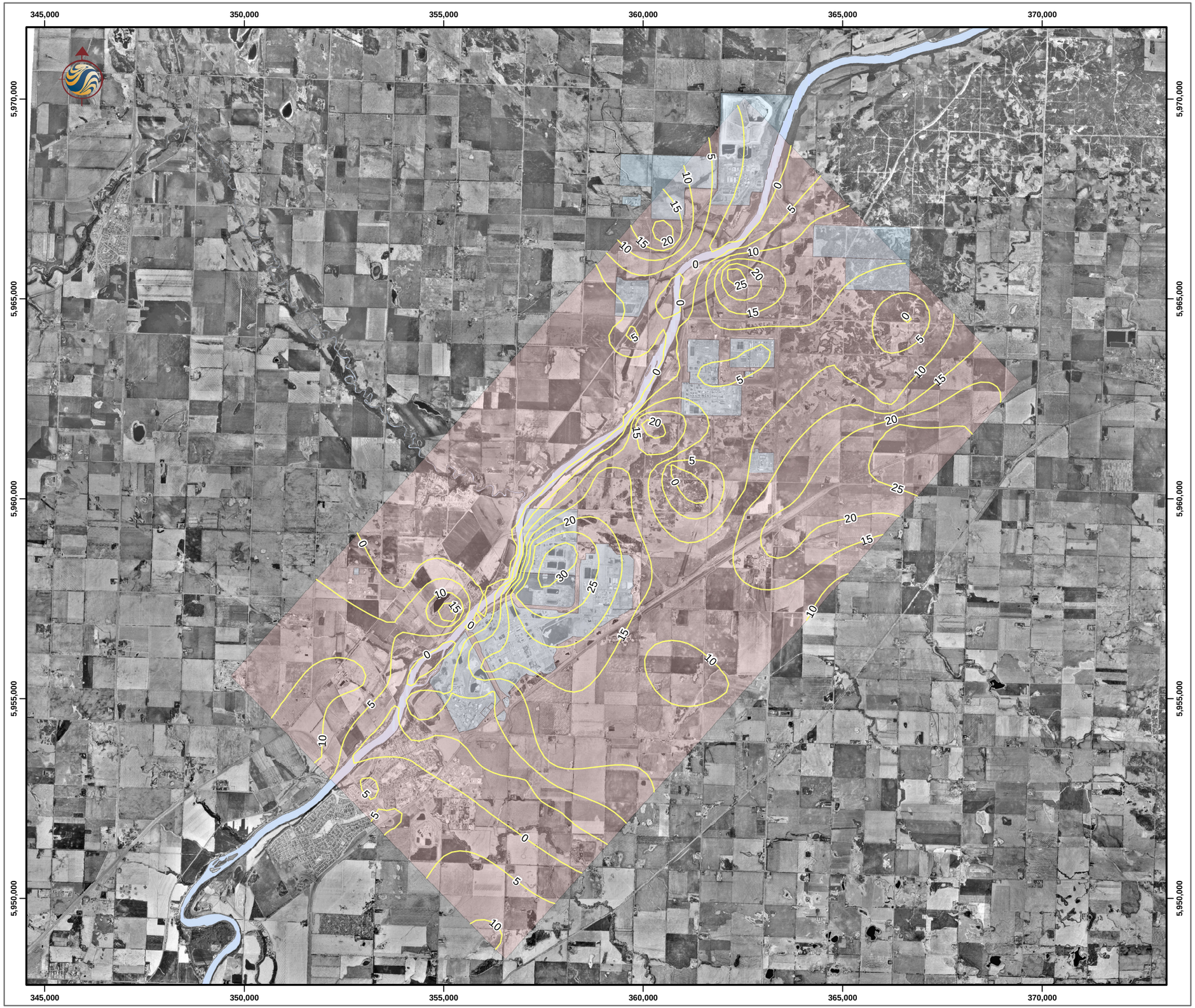
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.18

Title

Empress Formation Structure Contours (mAMSL)



Path: V:\1102\active\110217094\GIS\Final Report Figures\Glacial Till Isopach Contours.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site
- Glacial Till Isopach

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.19

Title

Glacial Till Isopach Contours (m)

Path: V:\1102\active\110217094\GIS\Final Report Figures\Glacial Till Structure Contours.mxd

Stantec

Legend

- Study Area
- Glacial Till Extent
- Glacial Till Structure Contours (mAMSL)

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.20

Title

Glacial Till Structure Contours (mAMSL)

At certain locations, the lacustrine sediments appeared to be interfingered with the surficial aeolian sand unit (for example, refer to boreholes MW-07 and TH-06 on cross section A-A'). The lacustrine sediments were generally underlain by glacial till, except in areas where the till had been eroded (refer to boreholes TH-07 and AENV0038449 on cross section 6-6'). In such instances the lacustrine sediments were generally found to be directly underlain by the Empress Formation sands and gravels where present, or by bedrock where the sands and gravels were absent.

Figure 4.21 presents an isopach contour map for the lacustrine unit. In general, the thickness of the lacustrine clay unit varied from zero (absent) to greater than 15 m. Areas where the lacustrine unit was absent included areas near the North Saskatchewan River and localized areas in northeastern areas of the Study Area. Areas where the lacustrine unit was greater than 15 m in thickness included central regions of the Study Area and in regions northwest of the North Saskatchewan River.

Figure 4.22 presents the structure contour map for the lacustrine unit. Top elevations of the lacustrine unit varied from 645 mAMSL in the topographically high regions of the Study Area to 595 mAMSL in the North Saskatchewan River Valley. In areas where the lacustrine unit was the surficial geological unit, the DEM for the Study Area was used to better approximate the top elevations.

4.6 SURFICIAL DEPOSITS

Aeolian deposits formed the surficial unit over much of the Study Area. These deposits were generally reported to be clean, loosely packed, fine to medium grained sands. Aeolian deposits were identified at surface close to the North Saskatchewan River valley (refer to cross section A-A') or in northeastern portions of the Study Area. As was previously mentioned, the aeolian deposits appeared to be interfingered with the lacustrine deposits at certain locations.

Fluvial deposits also formed the surficial unit in regions of the Study Area. Such areas include floodplain areas of the North Saskatchewan River valley. Fluvial deposits also include preglacial deposits that have been subsequently reworked and redeposited in the North Saskatchewan River Valley.

Figure 4.23 presents an isopach contour map for the surficial deposits. This map should be utilized with caution as the thicknesses presented do not differentiate between aeolian or fluvial deposits. The map simply represents the thickness of undifferentiated surficial deposits (exclusive of the more readily mappable lacustrine and glacial till units described above) present regardless of lithology or interpreted depositional origin. Areas with a zero thickness (absent) represent areas where either the clay till or lacustrine unit form the surficial unit.

Figure 4.24 presents a structure contour map for the undifferentiated surficial deposits. In effect, the structure contour map for the surficial deposits is synonymous with a contour map of ground surface topography. As such, the DEM for the Study Area was utilized to develop the structure contours for the surficial deposits.

4.7 VERTICAL MOVEMENT OF GROUNDWATER

The potential for vertical movement of groundwater was assessed through examination of water level elevations at monitoring well nests in the Study Area. Monitoring well nests enable the assessment of vertical groundwater movement by measuring the groundwater elevations at varying depths at the same location. Vertical hydraulic gradients can then be examined to determine if recharge (downward movement of groundwater) or discharge (upward movement of groundwater) conditions exist.

Table 4.1 presents the water level elevations for 8 selected monitoring well nests in the study area. Examination of the water level elevations indicates that vertical hydraulic gradients between all geological units at all locations are downward directed (recharge conditions), since the water level elevations decrease with increasing depth below ground. For example, the BA Energy 04-1 and 04-6 well nests indicate that vertical gradients are downward through the surficial aeolian sands into the lacustrine clay unit. In turn, vertical gradients are downward through the lacustrine clay unit to the Empress sands and gravels.

Path: V:\1102\active\110217094\GIS\Final Report Figures\Lacustrine Unit Isopach Contours.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site
- Lacustrine Unit Isopach

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.21

Title

Lacustrine Unit Isopach Contours (m)

Path: V:\1102\active\110217094\GIS\Final Report Figures\Lacustrine Unit Structure Contours.mxd

Stantec

Legend

- Study Area
- Lacustrine Unit Extent
- Lacustrine Unit Structure Contours (mAMSL)

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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NCIA
Northeast Capital Industrial Association

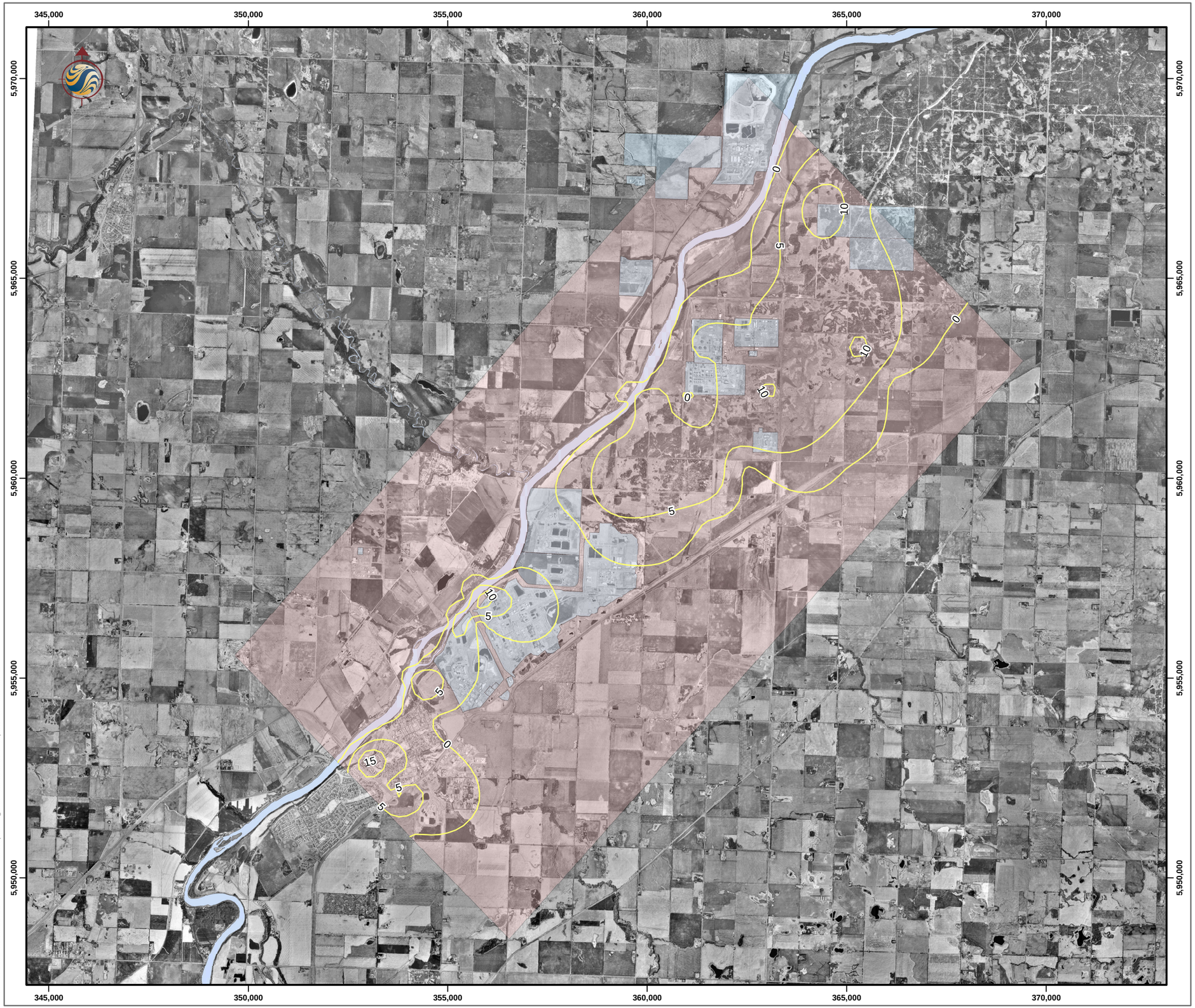
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.22

Title

Lacustrine Unit Structure Contours (mAMSL)



Path: V:\1102\active\110217094\GIS\Final Report Figures\Surficial Unit Isopach Contours.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site
- Surficial Unit Isopach

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA
Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.23

Title

Surficial Unit Isopach Contours (m)

Path: V:\1102\active\110217094\GIS\Final Report Figures\Surficial Unit Structure Contours.mxd

Stantec

Legend

- Study Area
- Surficial Unit extent
- Surficial Unit Structure Contours (mAMSL)

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA
Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.24

Title

Surficial Unit Structure Contours (mAMSL)

Table 4.1: Water Level Elevations at Select Well Nests

Owner	Well ID	Completion Lithology	Date	Approximate Well Depth (m)	Elevation (mAMSL)
BA Energy	04-1-7	Surficial Sand	21-Sep-04	7	621.39
BA Energy	04-1-18	Lacustrine Clay	21-Sep-04	18	619.06
BA Energy	04-1-37	Empress Sands and Gravels	21-Sep-04	37	594.50
BA Energy	04-6-5	Surficial Sand	21-Sep-04	5	620.09
BA Energy	04-6-18	Lacustrine Clay	21-Sep-04	18	616.22
BA Energy	04-6-44	Empress Sands and Gravels	21-Sep-04	44	594.07
BA Energy	04-9-6	Surficial Sand	21-Sep-04	6	621.16
BA Energy	04-9-21	Clay Till	21-Sep-04	21	615.08
BA Energy	04-9-34	Empress Sands and Gravels	21-Sep-04	34	594.20
Shell Scotford Upgrader	04-10-8	Clay Till	3-Nov-04	8	620.87
Shell Scotford Upgrader	04-10-20	Clay Till	3-Nov-04	20	611.07
Shell Scotford Upgrader	04-10-44	Empress Sands and Gravels	3-Nov-04	44	594.57
Marsulex Sulphides	28-1-4	Lacustrine Clay	2-May-05	4	625.12
Marsulex Sulphides	28-1-9	Clay Till	2-May-05	9	623.76
Marsulex Sulphides	28-1-15	Clay Till	2-May-05	15	612.25
Marsulex Sulphides	28-1-36	Empress Sands and Gravels	2-May-05	36	600.67
Agrium	12-2-6	Lacustrine Clay	17-May-05	6	624.22
Agrium	12-2-30	Empress Sands and Gravels	17-May-05	30	600.28
Dow Chemical	01MW05A-370	Lacustrine Clay	Fall 2003	6	628.20
Dow Chemical	01MW05B-370	Till	Fall 2003	26	614.29
Dow Chemical	01MW05C-370	Empress Sands and Gravels	Fall 2003	41	598.34
Dow Chemical	01MW18A-GRB	Lacustrine Clay	Fall 2003	8	622.89
Dow Chemical	01MW18B-GRB	Till	Fall 2003	15	618.49
Dow Chemical	01MW18C-GRB	Empress Sands and Gravels	Fall 2003	37	599.60

Similarly, the BA Energy 04-9 well nest indicates downward hydraulic gradients between the surficial sand unit and the clay till unit, as well as between the clay till unit and the Empress sands and gravels.

The Shell Scotford 04-10 well nest indicates downward hydraulic gradients through the clay till unit. Monitoring well 04-10-20 is completed 12 m deeper into the clay till than monitoring well 04-10-8, and decreasing groundwater elevations with increasing depth in the clay till also indicates downward vertical gradients in the clay till unit. Vertical gradients between the clay till and Empress sands and gravels are also downward at this well nest.

The Marsulex Sulphides 28-1 well nest exhibits downward vertical gradients between the lacustrine clay unit and the clay till unit, and between the clay till unit and the Empress sands and gravels. Similar patterns of vertical gradients were also noted at the Agrium and Dow Chemical well nests.

Based upon the examination of vertical gradients obtained at well nests in the Study Area, the vertical movement of groundwater is generally downward through the aeolian sands, downward through the lacustrine clay unit, and downward through the glacial till unit providing recharge to the sands and gravels of the Empress Formation. Some localized exceptions are possible where major topographical features exist (i.e. river valleys or wetland areas) but generally groundwater gradients are expected to be downward. The Empress Formation is generally considered to be under recharge conditions over the entire Study Area, except in areas near the North Saskatchewan River where discharge conditions are generally expected.

It should be noted that vertical gradients represent a driving potential for vertical fluid flow through geologic materials, and do not necessarily imply that significant quantities of groundwater are being transmitted through the various units. Actual groundwater fluxes are also dependent upon the hydraulic conductivity of the geological material.

Further characterization of groundwater fluxes and flowpaths will be possible during the numerical modeling exercise to be conducted in Phase III of the RGQP. Particle tracking exercises will also be possible through use of the model, and will provide better representation of vertical groundwater flowpaths.

4.8 EMPRESS FORMATION GROUNDWATER FLOW REGIME

In order to characterize the groundwater flow regime within the Empress Formation sands and gravels of the Beverly Channel, a potentiometric surface was developed for the Study Area. Groundwater elevations measured in wells completed in the sands and gravels were compiled. Only data available for May 2005 were used in the development of the potentiometric surface. Application of this criteria did sacrifice some areal coverage of the data (as historical water levels were not used), however, it was deemed prudent to utilize only the most recent data to avoid problems associated with incorporating water levels measured from different points in time.

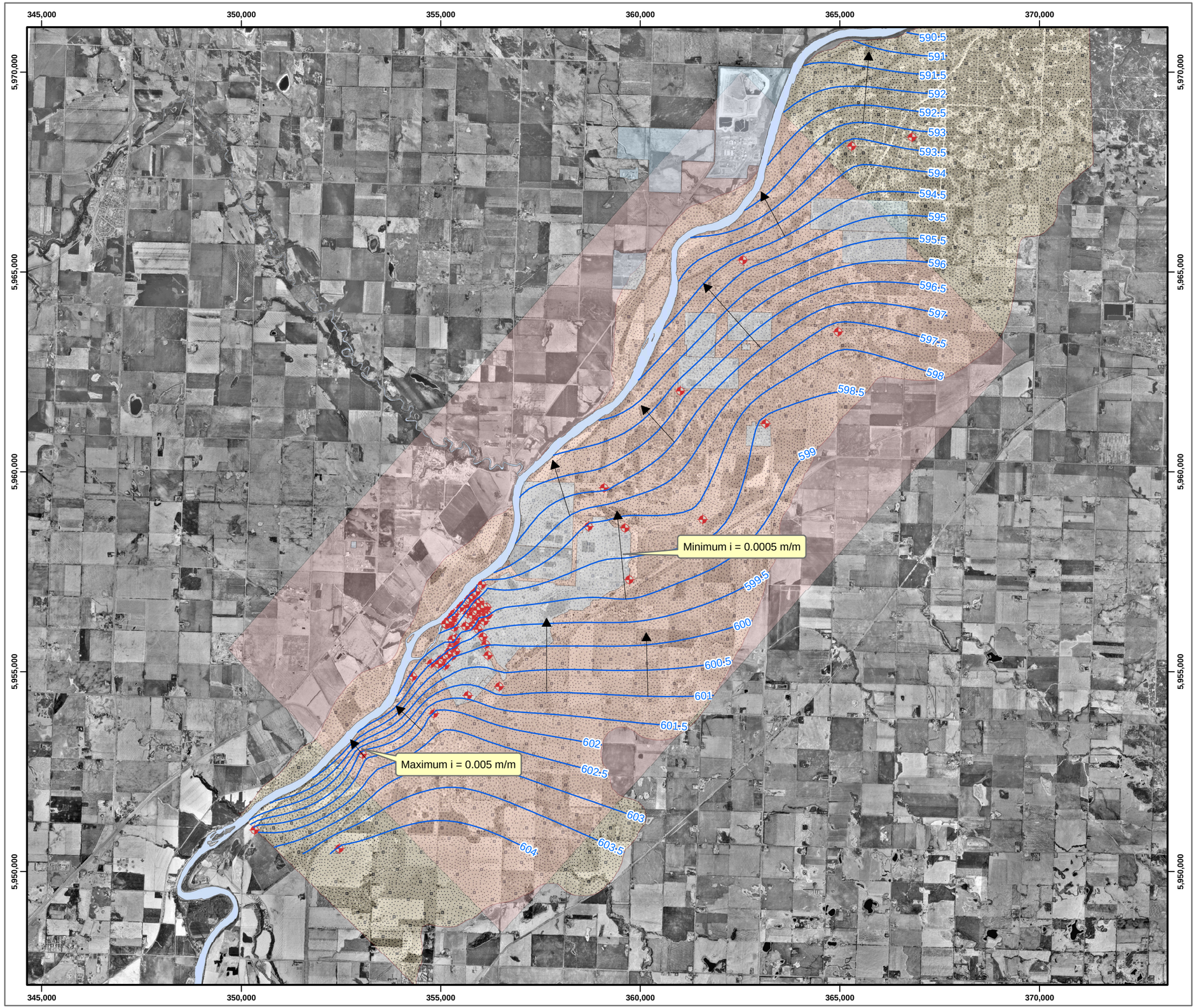
In addition to groundwater elevations, the North Saskatchewan River stage elevations were incorporated in the development of the potentiometric surface. River stage elevations measured at three points across the study area (by the highway 15 bridge in Fort Saskatchewan, by the Shell Canada water intake, and by the Agrium Redwater plant site) were

utilized to derive a hydraulic slope for the North Saskatchewan River in the Study Area. Knowledge of the hydraulic slope and water level hydrographs obtained from an Environment Canada hydrometric station were then used to interpolate the river stage elevations at 87 points in the Study Area. These points were then used during gridding of the groundwater elevations to develop the potentiometric surface.

Figure 4.25 presents the potentiometric surface for the sands and gravels of the Beverly Channel. Groundwater elevations are the highest in the southwest portions of the Study Area, and are the lowest in the northeast portions of the Study Area. Interpreted groundwater flow directions are also indicated in Figure 4.25. Generally, groundwater appears to flow from eastern areas of the Beverly Channel towards the North Saskatchewan River. In some localized areas groundwater appears to be moving in a northerly direction, but again turns more northwesterly as is moves closer to the river.

Potentiometric gradients vary from a minimum gradient of 0.0005 m/m in the eastern portions of the Dow Chemical site to a maximum gradient of 0.005 m/m in the City of Fort Saskatchewan. Based upon the average hydraulic conductivity calculated from well response tests and pump tests (Sections 3.6 and 3.7) conducted over the Phase II field investigation, linear groundwater flow velocities within the Empress sands and gravels are estimated to be between 16 and 160 m/yr in the Study Area.

Numerical groundwater modeling to be conducted in Phase III of the project will provide a more detailed representation of groundwater flowpaths and velocities in the Beverly Channel. The characterization presented herein is derived based upon basic analytical models and results from the field investigation program. Numerical modeling will allow for a characterization of the groundwater flow regime under static conditions and under transient conditions. Hypothetical changes to stresses or boundary conditions in the groundwater flow system could then be simulated to determine their effects.



Path: V:\1102\active\11021709\4GIS\Final Report Figures\Empress Water Levels.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Empress Water Levels Data Point
- Empress Water Levels Clipped to River
- Direction of Groundwater Flow

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA
Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

4.25

Title

Empress Formation Water Levels May, 2005 (mAMSL)

5.0 Beverly Channel Groundwater Chemistry

5.1 BASELINE GROUNDWATER QUALITY

Baseline groundwater quality in the Empress Formation sands and gravels was estimated based upon analytical results from the Spring and Fall, 2005 sampling events. Only data from the 13 NCIA monitoring wells were used to establish baseline conditions, since the data quality has been confirmed for these wells and they are anticipated to be more representative of conditions in unimpacted areas of the Beverly Channel.

General statistics (count, max, min, average) for each chemical parameter were calculated and are presented in Table 5.1 The count represents the number of data records (above the method detection limit) available for the parameter. Since there are 13 NCIA monitoring wells that were sampled twice, the total possible number of measurements for a particular parameter is 26. Parameters with a count less than 26 indicates that some of the analysis results were below the detection limit. Parameters with a count of 0 reflect that all of the analysis results were below the detection limit.

In order to characterize baseline groundwater quality in the Beverly Channel, two average parameter concentrations were calculated and are presented in Table 5.1. The first average (presented in the second column from the right) was calculated as an arithmetic average of all analysis results that had detectable parameter concentrations. Since this calculation does not account for analytical results less than the detection limit, this estimate likely overestimates baseline concentrations.

The second average that was calculated (presented in the right most column) includes all sample results and numerically includes parameter results less than the detection limit as one half of the detection limit. As such, average concentrations calculated by the second method are lower than the first where analysis results less than the detection limit existed. This average will be utilized to characterize the baseline groundwater quality in the Empress Formation sands and gravels. In cases where the data count is zero (no detection in any sample), the baseline concentration will be characterized as non-detectable.

Three analytical parameters had baseline concentrations above their respective GCDWQ guideline concentration. These parameters included TDS, iron, and manganese. A TDS concentration in excess of the drinking water guidelines is common for raw, untreated groundwater in Alberta. Similarly, manganese concentrations in groundwater often naturally exceed the drinking water guidelines. It should be noted that drinking water quality guidelines set criteria for water quality at the point of consumption, and as such raw groundwater quality exceeding the criteria should not necessarily exclude it from being a domestic water source provided that treatment measures are in place. Baseline iron concentrations also appear to exceed the drinking water guidelines, however criteria for iron are based on aesthetic objectives (to prevent staining of laundry and/or plumbing fixtures) rather than for potential adverse health effects.

Hydrocarbon parameters (benzene, toluene, ethylbenzene, xylenes, hydrocarbon fraction F1, and hydrocarbon fraction F2) were not detected in any of the monitoring wells during either the Spring or Fall, 2005 sampling events. As such, baseline concentrations of hydrocarbon parameters are expected to be non-detectable (under current standard method detection limits).

5.2 CURRENT GROUNDWATER QUALITY DISTRIBUTION

The distribution of various chemical parameter concentrations in the Beverly Channel was examined through the development of chemical contour maps. These maps present isoconcentration contours (lines representing points of equivalent chemical concentration) in the Beverly Channel and provide insight into the distribution of chemical concentrations throughout the sands and gravels of the Empress Formation.

Data used to generate the maps included the groundwater analytical results from the NCIA monitoring wells presented in Section 3.10. Also included were the most recent post-2004 data records from NCIA member companies that were available for wells completed within the Beverly Channel. Only post-2004 data were used from the NCIA member companies, as it was deemed more prudent to include only data that was reflective of current conditions. In some instances this criteria sacrificed areal coverage of the data, as older data from some of the wells (which were not more recently sampled) were screened from the data set.

Data from the AENV water well database were also used, as such information was required to provide adequate data coverage outside the immediate vicinity of the plant site areas. This data was not subjected to the post-2004 screening criteria, since it was assumed that groundwater chemistry in areas outside of the plant sites was relatively stable over time.

Analytical parameter suites for groundwater vary between NCIA member companies in accordance with their respective EPEA Approval conditions. As such, the areal coverage of the chemistry data varied by analytical parameter. In turn, a variable number of data points were used for contouring depending on the parameter being contoured. The locations of the data points used for a particular parameter are indicated on the respective isoconcentration map. Due consideration to the distribution of these data points should be given during examination of the maps to understand areas that are better constrained with data than others.

Once the chemistry data set had been compiled, the data was gridded using a geostatistical approach called kriging. Kriging is a flexible gridding method that allows one to create a regular grid of data points from a data set that was originally irregularly distributed. Once grids were created for each of the analytical parameters, contour lines were then generated. The data point locations have also been binned and colour coded by concentration to aid in the interpretation of the various maps.

Table 5.1: Summary of Baseline Groundwater Quality

Parameter	Detection Limit	CCME FAW[1] Criteria	GCDWQ[2] Criteria	Count	Min	Max	Average	MDL/2 Average
General and Bulk Parameters								
Ion Balance (%)				26	92.2	105	99	99
Total Dissolved Solids (mg/L)			≤500	26	442	2150	**838**	**838**
Hardness (mg/L as CaCO3)				26	195	1130	480	480
pH	0.1		6.5 - 8.5	26	7.4	8.1	7.7	7.7
Electrical Conductivity (µS/cm)	0.2			26	760	2680	1286	1286
Total Alkalinity (mg/L as CaCO3)	5			26	330	584	458	458
Dissolved Organic Carbon (mg/L)	1			26	1	15	6	6
Routine and Major Ion Parameters								
Chloride (mg/L)	1		≤250	25	2	157	23	22
Fluoride (mg/L)	0.05		1.5	26	0.07	0.29	0.15	0.15
Calcium (mg/L)	0.5			26	51.2	287	126.4	126.4
Potassium (mg/L)	0.1			26	2.3	9.9	5.3	5.3
Magnesium (mg/L)	0.1			26	16.2	100	39.8	39.8
Sodium (mg/L)	1		≤200	26	36	287	118	118
Sulfate (mg/L)	0.5		≤500	26	10.6	1130	252	252
Iron (mg/L)	0.005	0.3	≤0.3	26	0.085	10.9	**3.41**	**3.41**
Manganese (mg/L)	0.001		≤0.05	26	0.053	1.88	**0.61**	**0.61**
Nitrate and Nitrite (mg/L as N)	0.1			10	0.1	1.2	0.3	0.1
Nitrate (mg/L as N)	0.1	13	45	10	0.1	1.2	0.3	0.1
Nitrite (mg/L as N)	0.05	0.06		0	0	0	N/A	0.025
Bicarbonate (mg/L)	5			26	403	712	558	558
Carbonate (mg/L)	5			0	0	0	N/A	2.5
Hydroxide (mg/L)	5			0	0	0	N/A	2.5
Ammonia (mg/L as N)	0.05			25	0.013	2.24	1.25	1.20
Orthophosphate (mg/L as P)	0.01			0	0	0	N/A	0.005
Hydrocarbon Parameters								
Benzene (mg/L)	0.0005	0.37 - 0.002	0.005	0	0	0	N/A	0.00025
Toluene (mg/L)	0.0005	0.09	≤0.024	0	0	0	N/A	0.00025
Ethylbenzene (mg/L)	0.0005		≤0.0024	0	0	0	N/A	0.00025
Xylenes (mg/L)	0.0005		≤0.3	0	0	0	N/A	0.00025
F1(mg/L)	0.1			0	0	0	N/A	0.05
F1-BTEX (mg/L)	0.1			0	0	0	N/A	0.05
F2 (mg/L)	0.05			0	0	0	N/A	0.025
Phenols (mg/L)	0.001			0	0	0	N/A	0.0005
Dissolved Metals								
Silver (mg/L)	0.0002	0.0001		0	0	0	N/A	0.0001
Aluminum (mg/L)	0.01	0.005 - 0.1	0.1	10	0.01	0.14	0.04	0.02
Arsenic (mg/L)	0.0004	0.005	0.025	26	0.0006	0.0081	0.0025	0.0025
Boron (mg/L)	0.002		5	26	0.046	0.366	0.194	0.194
Barium (mg/L)	0.0001		1	26	0.0296	0.413	0.1134	0.1134
Beryllium (mg/L)	0.0005			0	0	0	N/A	0.00025
Bismuth (mg/L)	0.00005			8	0.00005	0.00009	0.00007	0.00004
Cadmium (mg/L)	0.0001	0.000017	0.005	0	0	0	N/A	0.00005
Cobalt (mg/L)	0.0001			26	0.0003	0.0049	0.0014	0.0014
Chromium (mg/L)	0.0004		0.05	18	0.0005	0.0048	0.0015	0.0011
Copper (mg/L)	0.0006	0.002-0.004	≤1.0	20	0.0007	0.0024	0.0011	0.0009
Mercury (mg/L)	0.0001		0.001	3	0.0001	0.0002	0.0001	0.0001
Molybdenum (mg/L)	0.0001	0.073		26	0.0005	0.0148	0.0022	0.0022
Nickel (mg/L)	0.0001	0.025 - 0.15		11	0.0002	0.0644	0.0086	0.0037
Lead (mg/L)	0.0001	0.001-0.007	0.01	12	0.0001	0.0004	0.0003	0.0002
Antimony (mg/L)	0.0004		0.006	26	0.0005	0.001	0.0007	0.0007
Selenium (mg/L)	0.0004	0.001	0.006	15	0.0004	0.0009	0.0006	0.0004
Tin (mg/L)	0.0002			0	0	0	N/A	0.0001
Strontium (mg/L)	0.0001			26	0.542	2.49	1.071	1.071
Titanium (mg/L)	0.0003			26	0.0004	0.0058	0.0013	0.0013
Thallium (mg/L)	0.00005	0.0008		0	0	0	N/A	0.000025
Uranium (mg/L)	0.0001		0.02	26	0.0007	0.0053	0.0017	0.0017
Vanadium (mg/L)	0.0001			11	0.0001	0.0017	0.0004	0.0002
Zinc (mg/L)	0.002	0.03	≤5.0	14	0.003	0.029	0.006	0.004

Notes: 1. Canadian Environmental Quality Guidelines; Freshwater Aquatic Life (CCME, 2004)
2. Guidelines for Canadian Driking Water Quality (Health Canada, 2004)

BOLD Concentration Exceeds Health Canada, 2004 criteria

BOLD Concentration Exceeds Health Canada, 2004 and CCME, 2004 criteria

In some cases where the chemical concentrations varied over several orders of magnitude, logarithmic transformations were applied to the data prior to gridding. Once the data was gridded, an inverse logarithmic transformation was then applied to the grid to transform the data back to regular concentrations. This procedure was found to provide more realistic grids of chemical concentrations and minimized the problem of 'overshooting' where chemical concentrations were changing over orders of magnitude.

The following sections discuss the current distribution of parameter concentrations across the Study Area. Causal association between elevated parameter concentrations and potential sources of contamination has not presented, as in general such details are discussed much more thoroughly in the related environmental assessment reports or in the Annual Groundwater Monitoring Reports prepared by NCIA member companies.

5.2.1 Total Dissolved Solids (TDS)

Figure 5.1 presents TDS concentration contours for the Empress Formation in the Study Area. In general, TDS concentrations appear to be above baseline concentrations (~840 mg/L) over the central regions of the Study Area. TDS concentrations ranged from 334 to 60,400 mg/L with the highest reported concentrations occurring around the Agrium Fort Saskatchewan facility and the northwest corner of the Dow Chemical property. TDS concentrations appeared to trend to lower concentrations near a localized area around Kinder Morgan Canada and BA Energy in the northeast portions of the Study Area.

5.2.2 Electrical Conductivity (EC)

Figure 5.2 presents EC concentration contours for the Empress Formation in the Study Area. EC concentrations were above baseline concentrations (~1,300 µs/cm) in central regions of the Study Area near the North Saskatchewan River. Values of EC ranged between 586 to 59,500 µs/cm. The highest values were observed within the Agrium Fort Saskatchewan facility. The majority of the Study Area had EC values ranging from 1,000 to 2,500 µs/cm. The lowest observed values were in the northeast portion of the study area.

5.2.3 Dissolved Organic Carbon (DOC)

Figure 5.3 presents DOC concentration contours for the Empress Formation in the Study Area. DOC concentrations ranged from <1 to 79.5 mg/L with a localized high concentrated around the northwest corner of the Dow Chemical site. In the majority of the Study Area, DOC concentrations were similar to baseline concentrations (~6 mg/L).

5.2.4 Alkalinity

Figure 5.4 presents alkalinity concentration contours for the Empress Formation in the Study Area. Alkalinity concentrations ranged from 314 to 12,200 mg/L across the Study Area. The highest values were reported in the Agrium Fort Saskatchewan plant site. There was little

variability elsewhere in the study area with values generally ranging from 400 to 500 mg/L. This is in agreement with the estimated baseline concentration of ~460 mg/L.

5.2.5 Arsenic

Figure 5.5 presents arsenic concentration contours for the Empress Formation in the Study Area. Arsenic concentrations ranged between <0.0002 to 0.13 mg/L Highest concentrations were reported in the Agrium Fort Saskatchewan plant site. Arsenic values were generally low in most of the remaining Study Area. Baseline concentration of arsenic estimated from the NCIA monitoring well network is ~0.0025 mg/L.

5.2.6 Bicarbonate

Figure 5.6 presents bicarbonate concentration contours for the Empress Formation in the Study Area. Bicarbonate concentration ranged from 14,900 mg/L around the Agrium Fort Saskatchewan facility to a low of 205 mg/L within the Kinder Morgan Canada site. Concentrations in the remaining Study Area ranged from 300 to 500 mg/L. Baseline bicarbonate concentration was estimated to be ~560 mg/L.

5.2.7 Boron

Figure 5.7 presents boron concentration contours for the Empress Formation in the Study Area. Boron values were low throughout the study area ranging from 0.053 to 0.600 mg/L. Several localized highs were reported in the Agrium and Sherritt Fort Saskatchewan plant sites and in one of the NCIA wells (MW-07) in the central portion of the study area. Baseline concentration of boron was estimated to be ~0.19 mg/L.

5.2.8 Barium

Figure 5.8 presents barium concentration contours for the Empress Formation in the Study Area. Baseline barium concentration was estimated to be ~0.11 mg/L based upon data from the NCIA monitoring well network. Concentrations of barium were between 0.0075 and 0.86 mg/L in the Study Area. Barium concentration was generally higher in the northeast portion of the Study Area around the Kinder Morgan Canada and BA Energy sites, where most values were greater than 0.1 mg/L. A localized high was also observed along the west side of the Agrium Fort Saskatchewan facility.

5.2.9 Calcium

Figure 5.9 presents calcium concentration contours for the Empress Formation in the Study Area. Most of the Study Area has calcium concentrations between 50 and 200 mg/L. Concentrations below 5 mg/L were observed along the southeast edge of the study area. Localized highs with a maximum of 767 mg/L were situated around the Dow Chemical and Agrium Fort Saskatchewan facilities. Baseline concentrations estimated from the NCIA monitoring well network were estimated to be ~130 mg/L.

5.2.10 Chloride

Figure 5.10 presents chloride concentration contours for the Empress Formation in the Study Area. Baseline concentration of chloride was estimated to be ~22 mg/L based upon the NCIA monitoring well network. Chloride concentrations ranged from <1 to 4,420 mg/L across the Study Area. The highest concentrations were reported in the Agrium Fort Saskatchewan and Dow Chemical sites. One of the NCIA monitoring wells (MW-04) appeared to have an elevated chloride concentration of 137 mg/L and 157 mg/L in the Spring and Fall of 2005, respectively. It is possible that the elevated chloride in MW-04 is related to the influence of higher salinity groundwater discharging upwards from underlying bedrock formations. Much of the northeast portion of the Study Area had concentrations below 10 mg/L with a local high just outside the northeast boundary of the Study Area. Another high occurred in the southwest area with values up to 561 mg/L.

5.2.11 Chromium

Figure 5.11 presents chromium concentration contours for the Empress Formation in the Study Area. Chromium concentration ranged from <0.0005 to 0.03 mg/L across the Study Area. All values were below 0.005 mg/L except within the Agrium Fort Saskatchewan site. Baseline chromium concentration was estimated to be ~0.001 mg/L based upon analysis results from the NCIA monitoring well network.

5.2.12 Fluoride

Figure 5.12 presents fluoride concentration contours for the Empress Formation in the Study Area. Concentrations of fluoride showed little variability throughout the Study Area ranging from 0.11 to 0.29 mg/L. No trend was observed in the fluoride values. Baseline fluoride concentration was estimated to be ~0.15 mg/L based upon data collected from the NCIA monitoring well network.

5.2.13 Iron

Figure 5.13 presents iron concentration contours for the Empress Formation in the Study Area. High iron concentrations were reported in the Agrium Fort Saskatchewan site and along the west edge of the Dow Chemical site. A maximum concentration of 68.1 mg/L occurred on the western edge of the Dow Chemical site. The remainder of the Study Area had concentrations below 10 mg/L with a low of 0.006 mg/L. Baseline concentration of iron was estimated to be ~3.4 mg/L, exceeding the GCDWQ.

5.2.14 Magnesium

Figure 5.14 presents magnesium concentration contours for the Empress Formation in the Study Area. Magnesium concentrations were below 100 mg/L in all of the Study Area except beneath the Agrium Fort Saskatchewan site where it reached a maximum of 676 mg/L.

Baseline concentration of magnesium was estimated to be ~40 mg/L based upon data collected from the NCIA monitoring well network.

5.2.15 Manganese

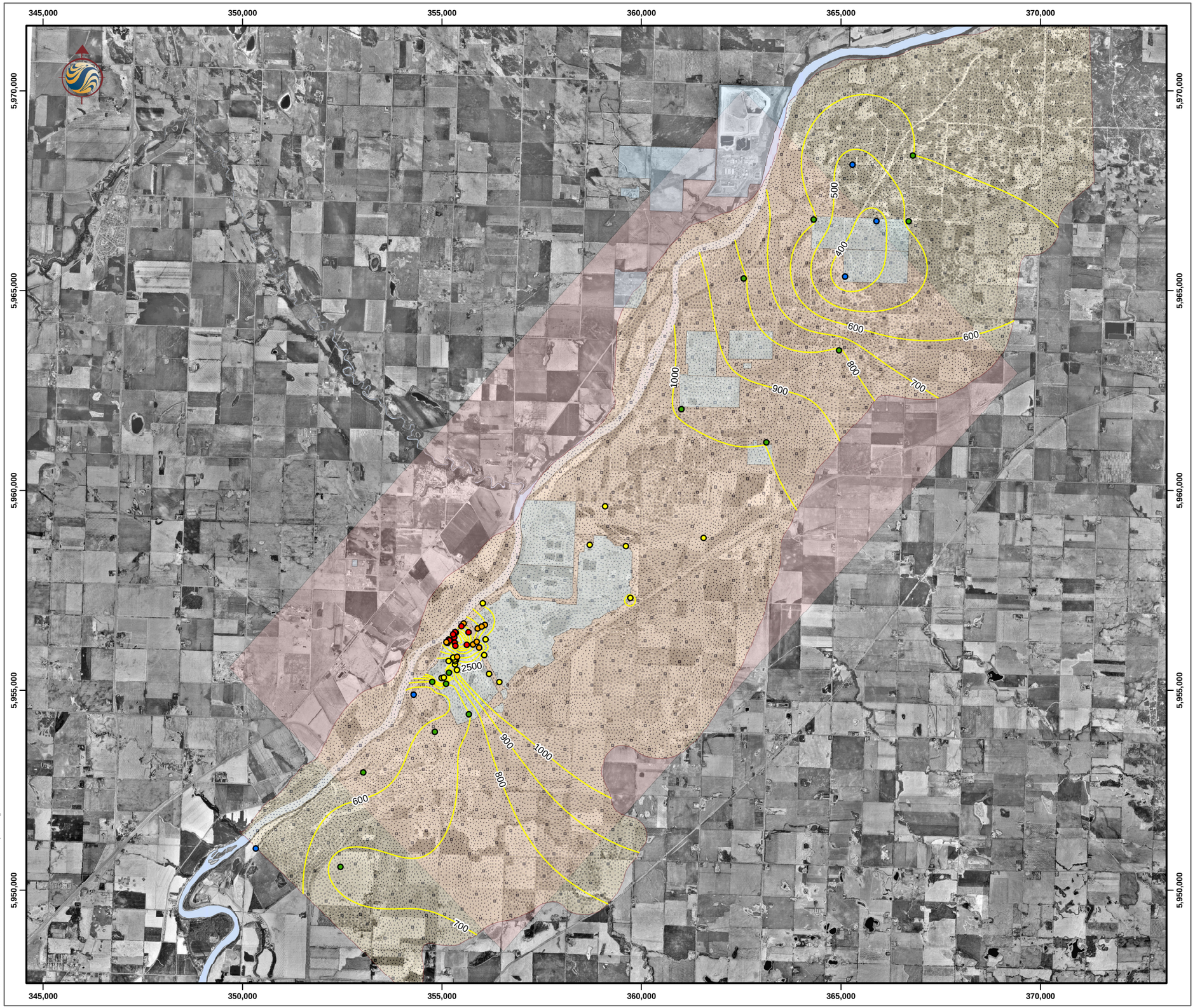
Figure 5.15 presents manganese concentration contours for the Empress Formation in the Study Area. Concentrations of manganese throughout the Study Area ranged from 0.144 to 11.0 mg/L. The highest concentrations were reported in the Agrium Fort Saskatchewan site. The central portion of the study area also shows higher concentrations between 0.5 and 1.88 mg/L. The lowest concentrations, below 0.5 mg/L, were observed in the northeast and southwest portions of the Study Area. Baseline manganese concentration was estimated to be ~0.61 mg/L based upon analysis results from the NCIA monitoring well network.

5.2.16 Sodium

Figure 5.16 presents sodium concentration contours for the Empress Formation in the Study Area. The concentration of sodium was very high around the Agrium Fort Saskatchewan and Dow Chemical facilities, reaching a maximum of 2,790 mg/L. Concentrations in the remainder of the Study Area were below 400 mg/L with a minimum of 14 mg/L, and generally varied between 100 to 200 mg/L. Baseline sodium concentration was estimated to be ~118 mg/L based upon data collected from the NCIA monitoring well network.

5.2.17 Sulphates

Figure 5.17 presents sulphate concentration contours for the Empress Formation in the Study Area. Sulphate concentrations up to 38,800 mg/L have been reported in the Agrium Fort Saskatchewan site. High concentrations, of up to 15,700 mg/L, have also been reported near the west side of the Dow Chemical site. A higher than normal value of 1,130 mg/L was also observed in an NCIA monitoring well (MW-07) located north of these properties. Values were below 500 mg/L in the rest of the Study Area. Baseline sulphate concentration was estimated to be ~252 mg/L based upon analysis results from the NCIA monitoring well network.



Path: V:\1102active\10217094\GIS\Final Report Figures\TDS.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- TDS Concentration (mg/L)

TDS Data Points (mg/L)

- <500
- 500 - 1,000
- 1,000 - 3,000
- 3,000 - 20,000
- 20,000 - 60,000

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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Northeast Capital Industrial Association

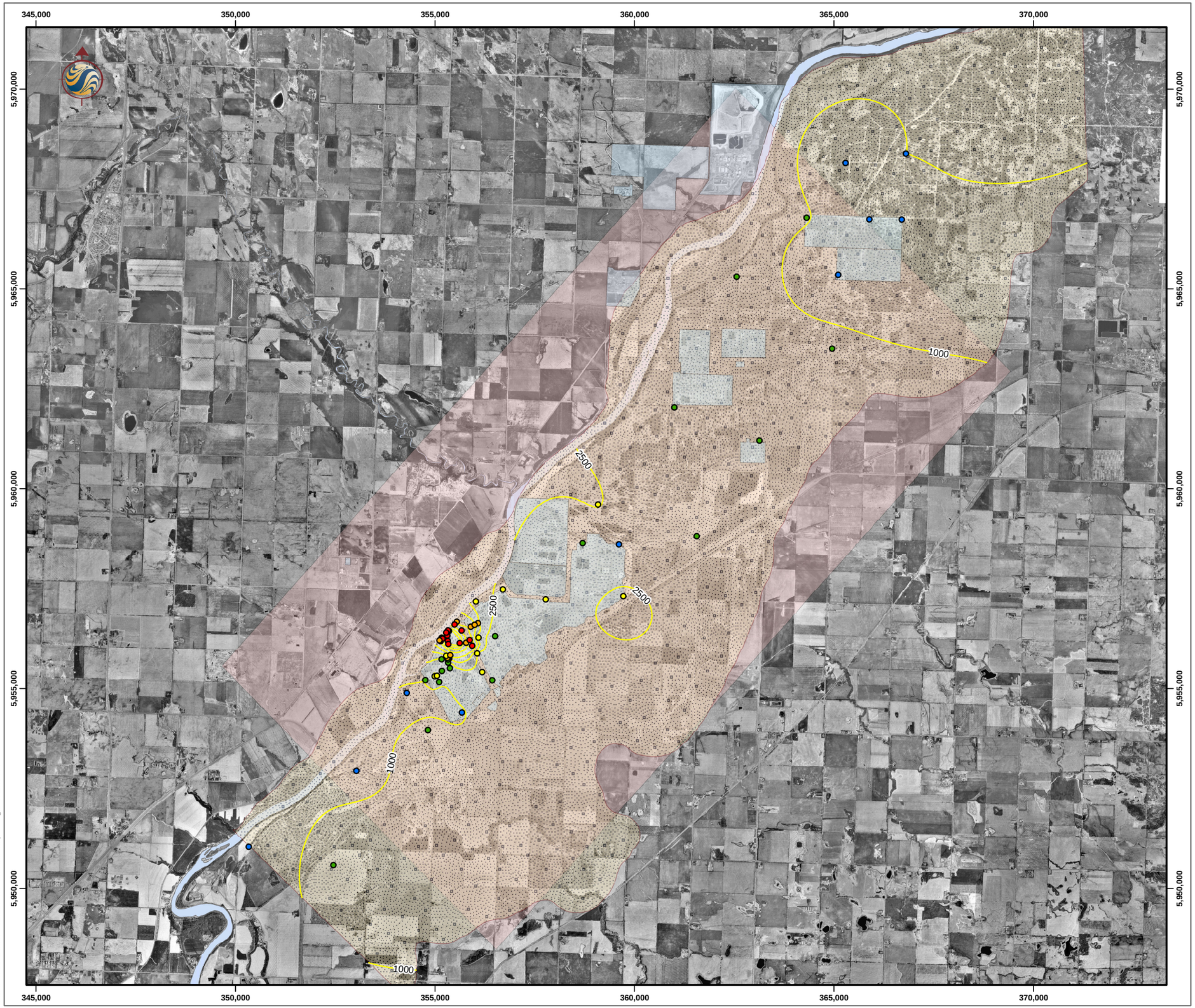
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.1

Title

Total Dissolved Solids (TDS)



Path: V:\1102active\110217094\GIS\Final Report Figures\EC.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Electrical Conductivity (EC) (µs/cm)

EC Data Points (µs/cm)

- <1,000
- 1,000 - 2,000
- 2,000 - 4,000
- 4,000 - 20,000
- 20,000 - 60,000

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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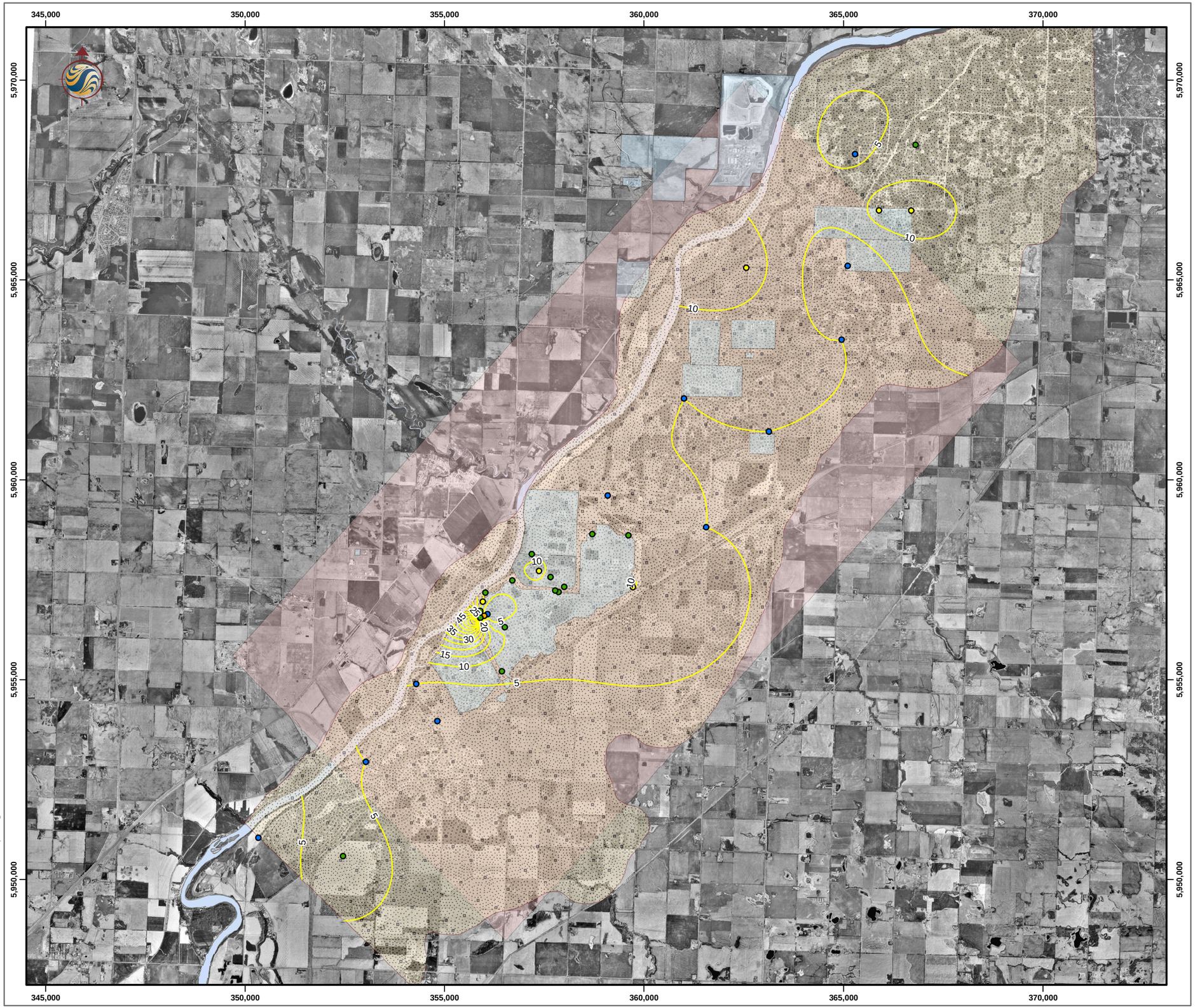
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.2

Title

Electrical Conductivity (EC)



Path: V:\11102active\110217694\GIS\Final Report Figures\DOC.mxd

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- DOC Concentration (mg/L)

DOC Data Points (mg/L)

- 1 - 5
- 5 - 10
- 10 - 20
- 20 - 40
- 40 - 80

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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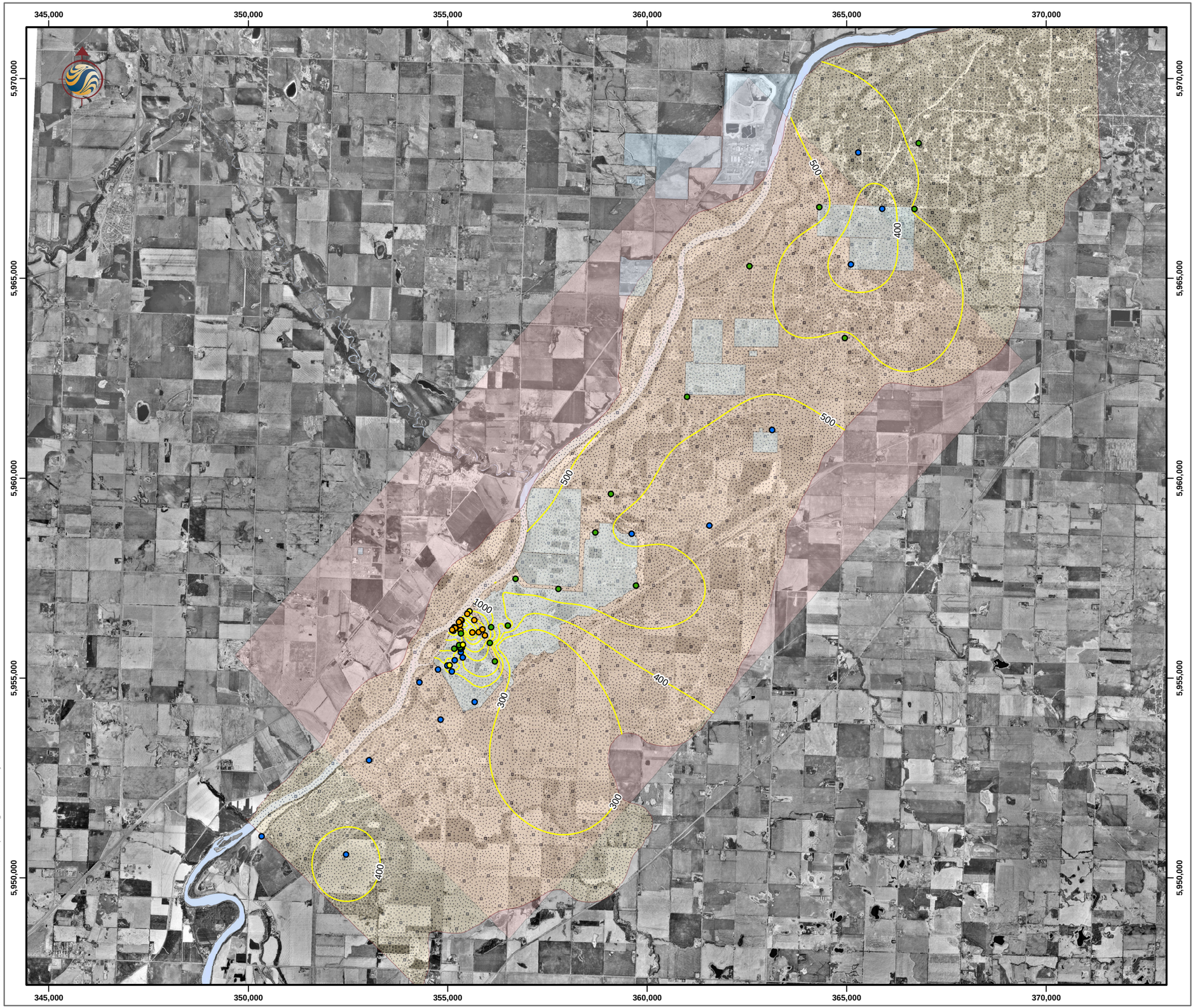
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.3

Title

Dissolved Organic Carbon (DOC)



Path: V:\1102\active\110217094\GIS\Final Report Figures\Alkalinity.mxd

Stantec

Legend

- Study Area
- Alkalinity (mg/L)
- Member Company Plant Site
- Beverly Channel Extent

Alkalinity Data Points (mg/L)

- <500.0000
- 500 - 1,000
- 1,000 - 2,000
- 2,000 - 5,0000
- 5,0000- 15,000

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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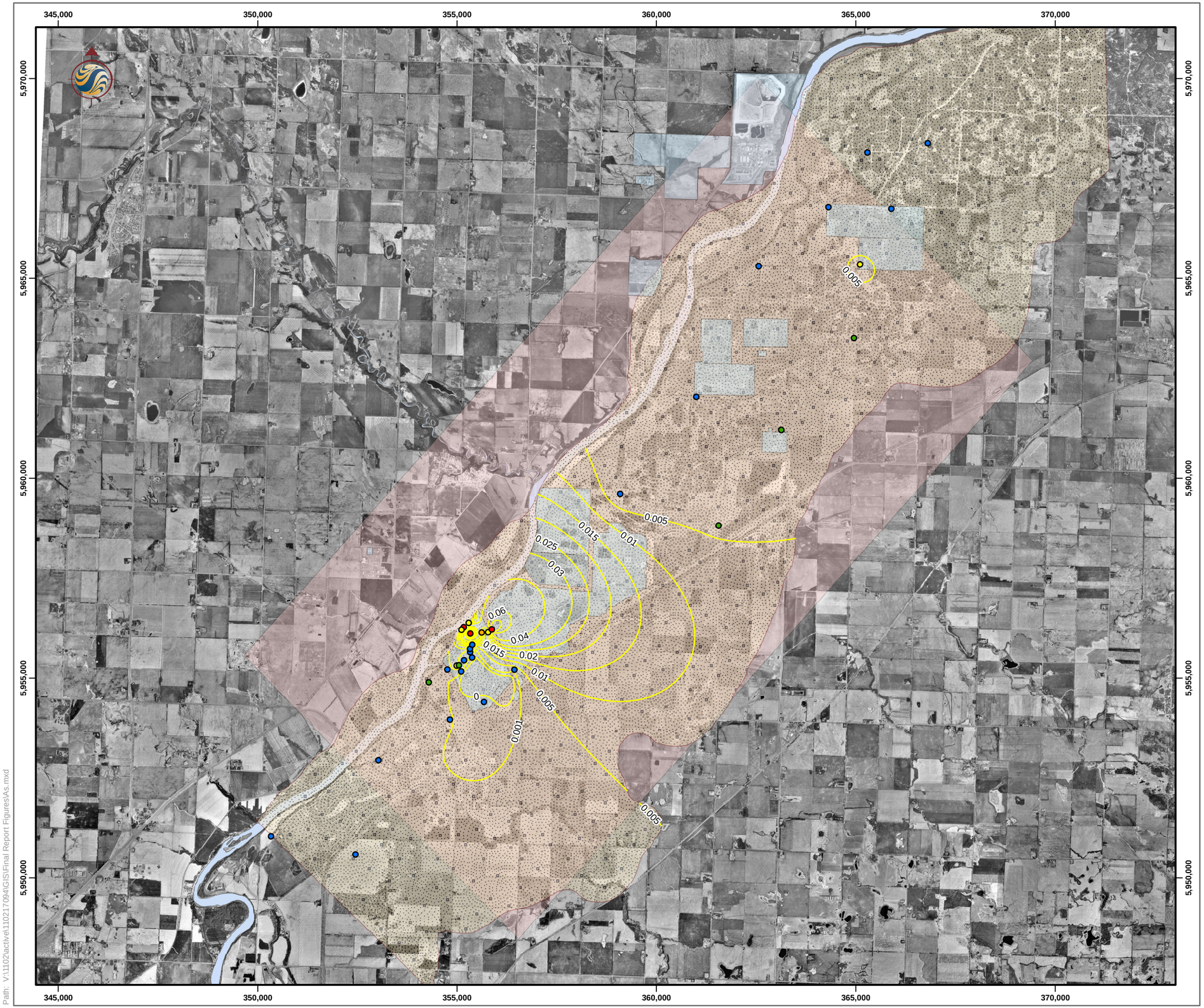
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.4

Title

Alkalinity



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Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Arsenic Concentration (mg/L)

Arsenic Data Points (mg/L)

- <0.0025
- 0.0025 - 0.0050
- 0.0050 - 0.0100
- 0.0100 - 0.0500
- 0.0500 - 0.1500

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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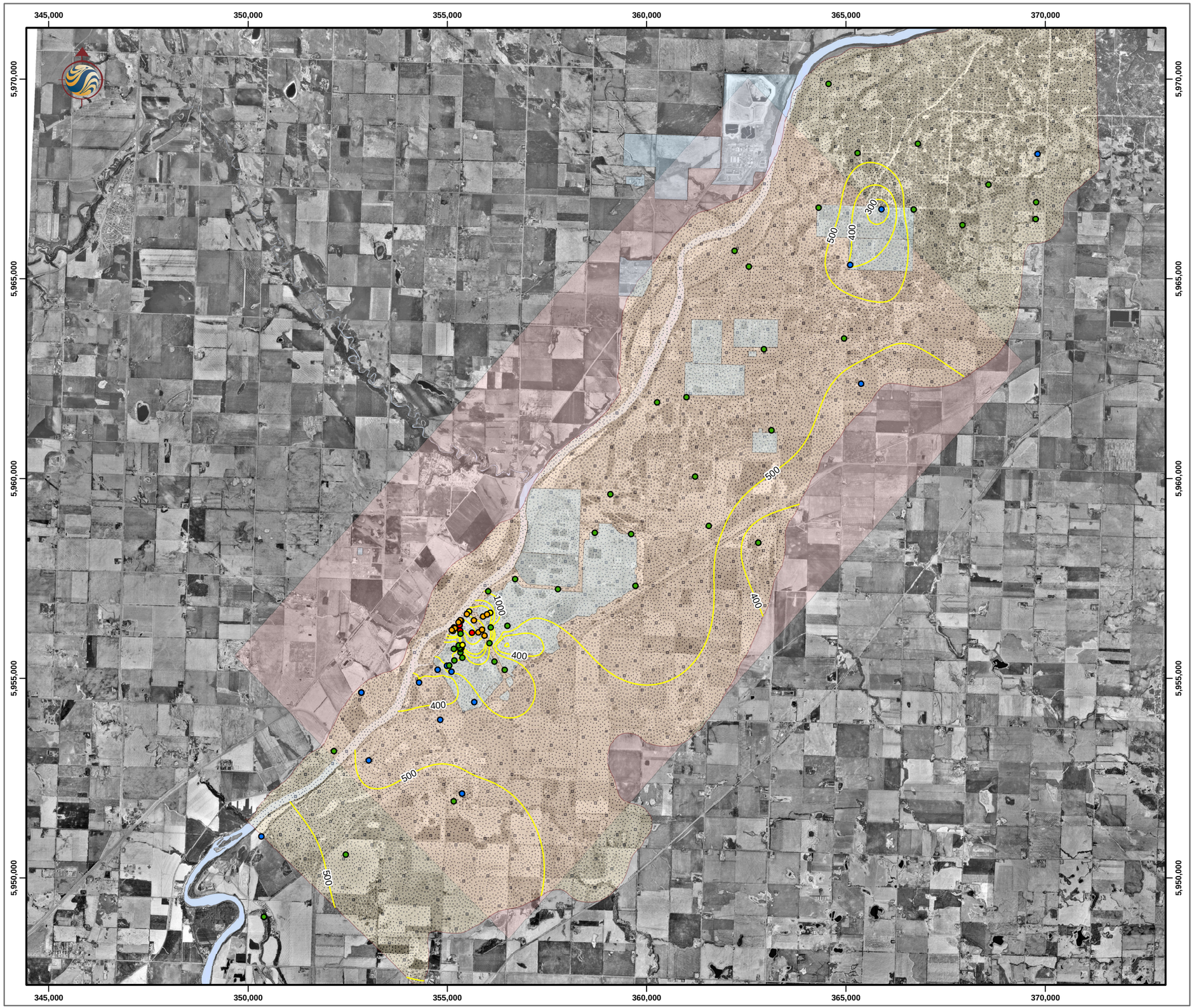
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.5

Title

Arsenic



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Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- HCO3 Concentration (mg/L)

HCO3 Data Points (mg/L)

- <500
- 500 - 1,500
- 1,500 - 3,000
- 3,000 - 10,000
- 10,000 - 15,000

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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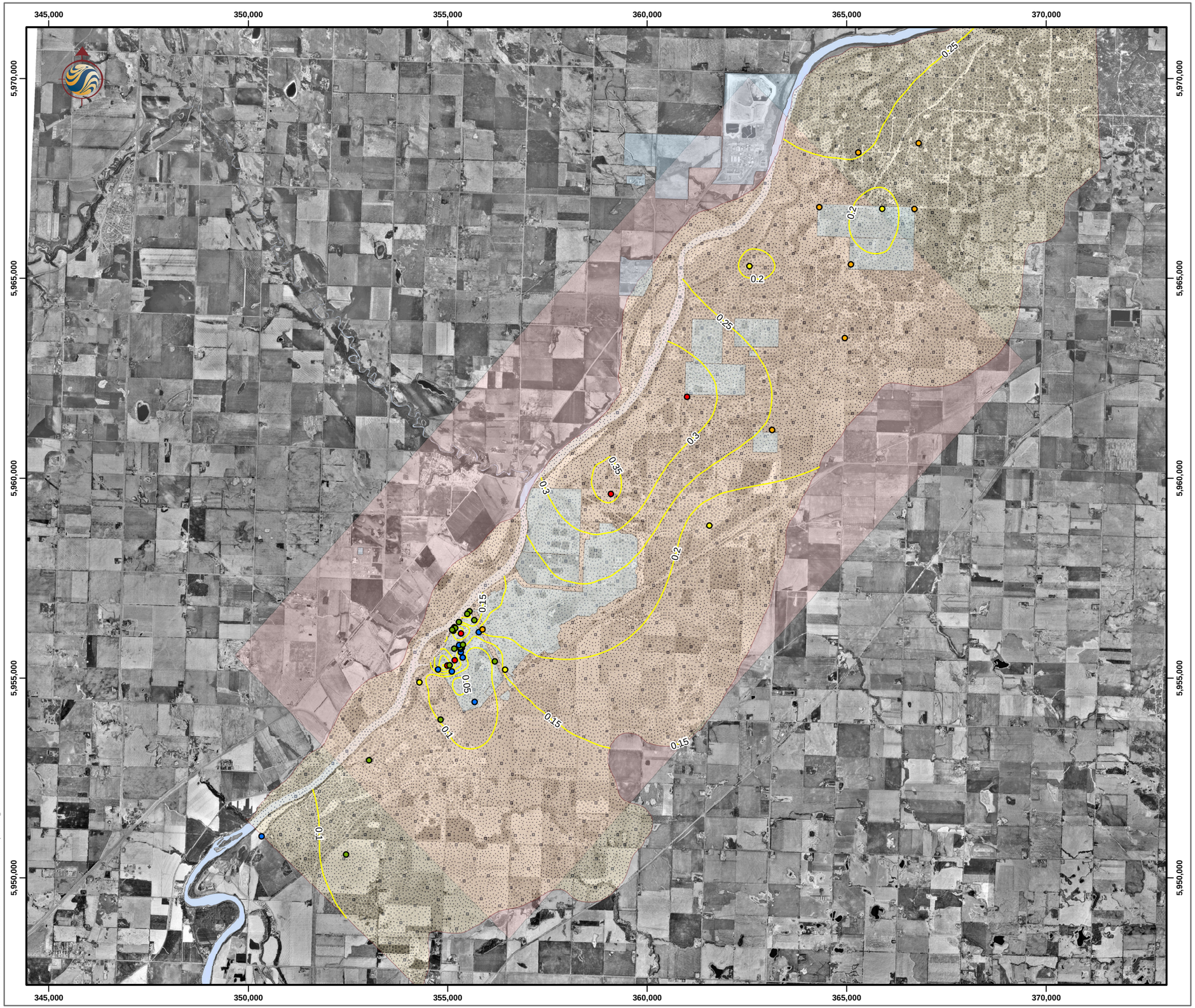
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.6

Title

Bicarbonate



Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Boron Concentration (mg/L)

Boron Data Points (mg/L)

- 0.053 - 0.080
- 0.080 - 0.130
- 0.130 - 0.200
- 0.200 - 0.300
- 0.300 - 0.600

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.7

Title

Boron

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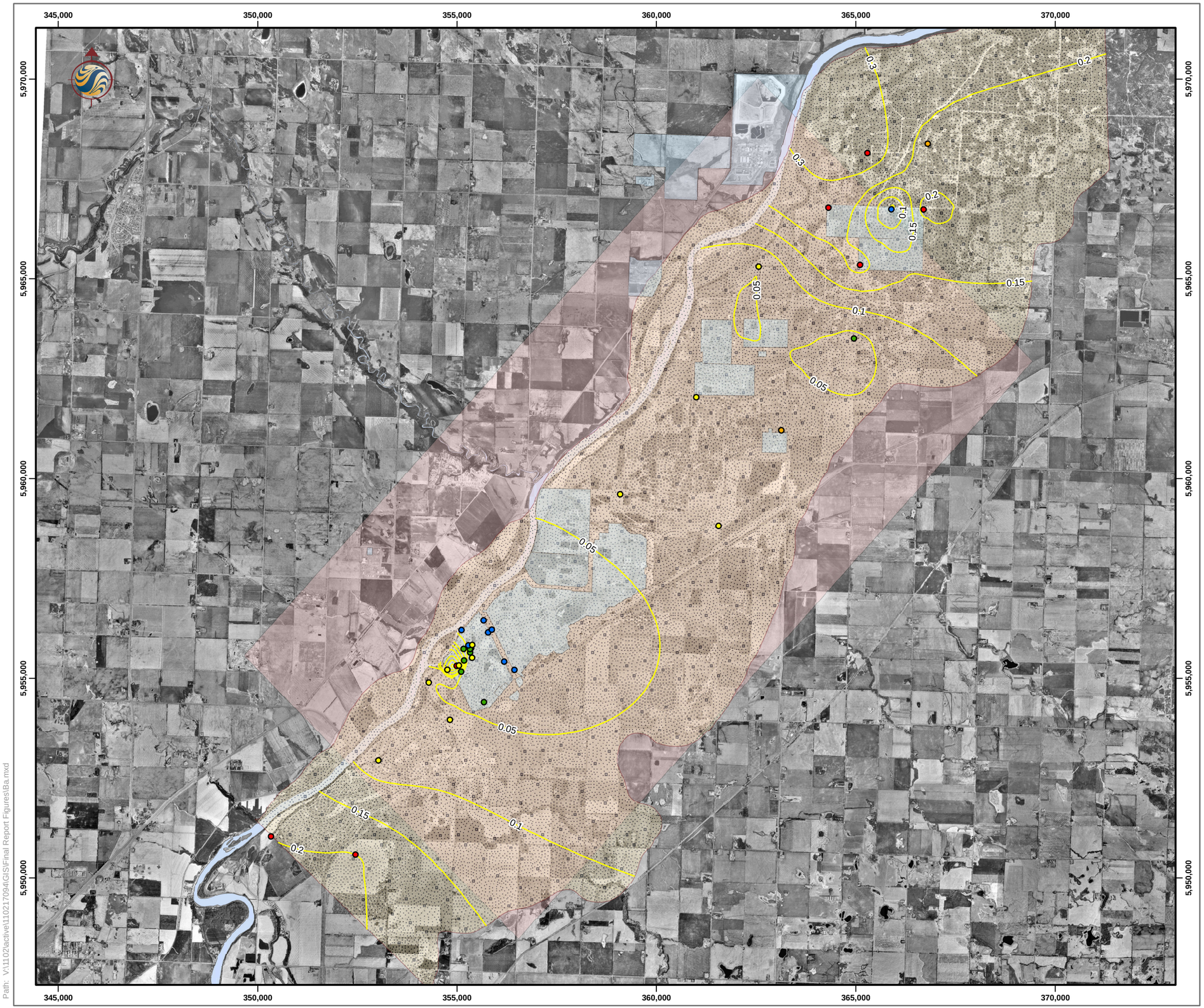

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Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Barium Concentration (mg/L)

Barium Data Points (mg/L)

- <0.020
- 0.020 - 0.040
- 0.040 - 0.080
- 0.080 - 0.160
- 0.160 - 0.900

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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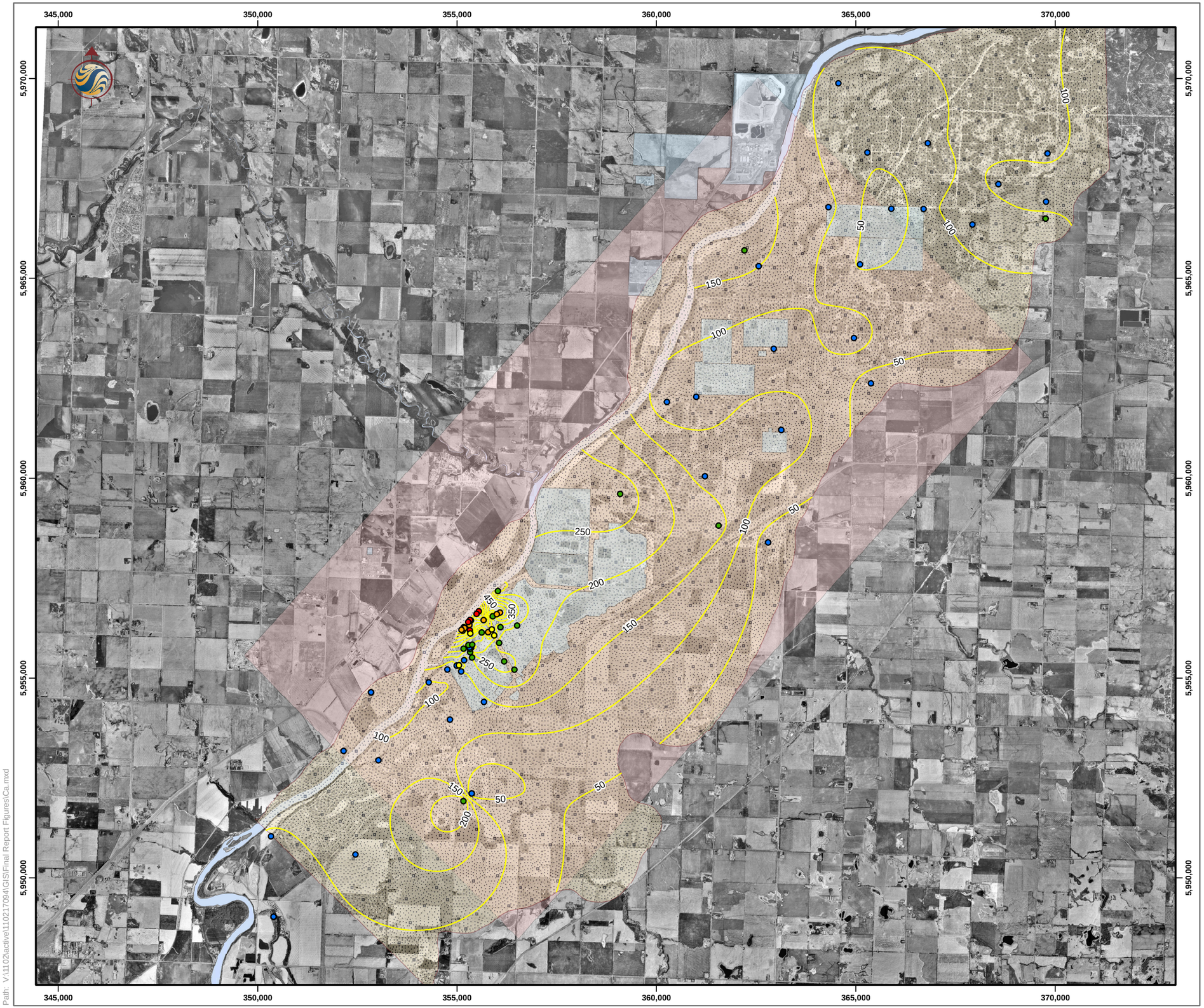
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.8

Title

Barium



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Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Calcium Concentration (mg/L)

Calcium Data Points (mg/L)

- <150
- 150 - 300
- 300 - 450
- 450 - 600
- 600 - 750

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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Northeast Capital Industrial Association

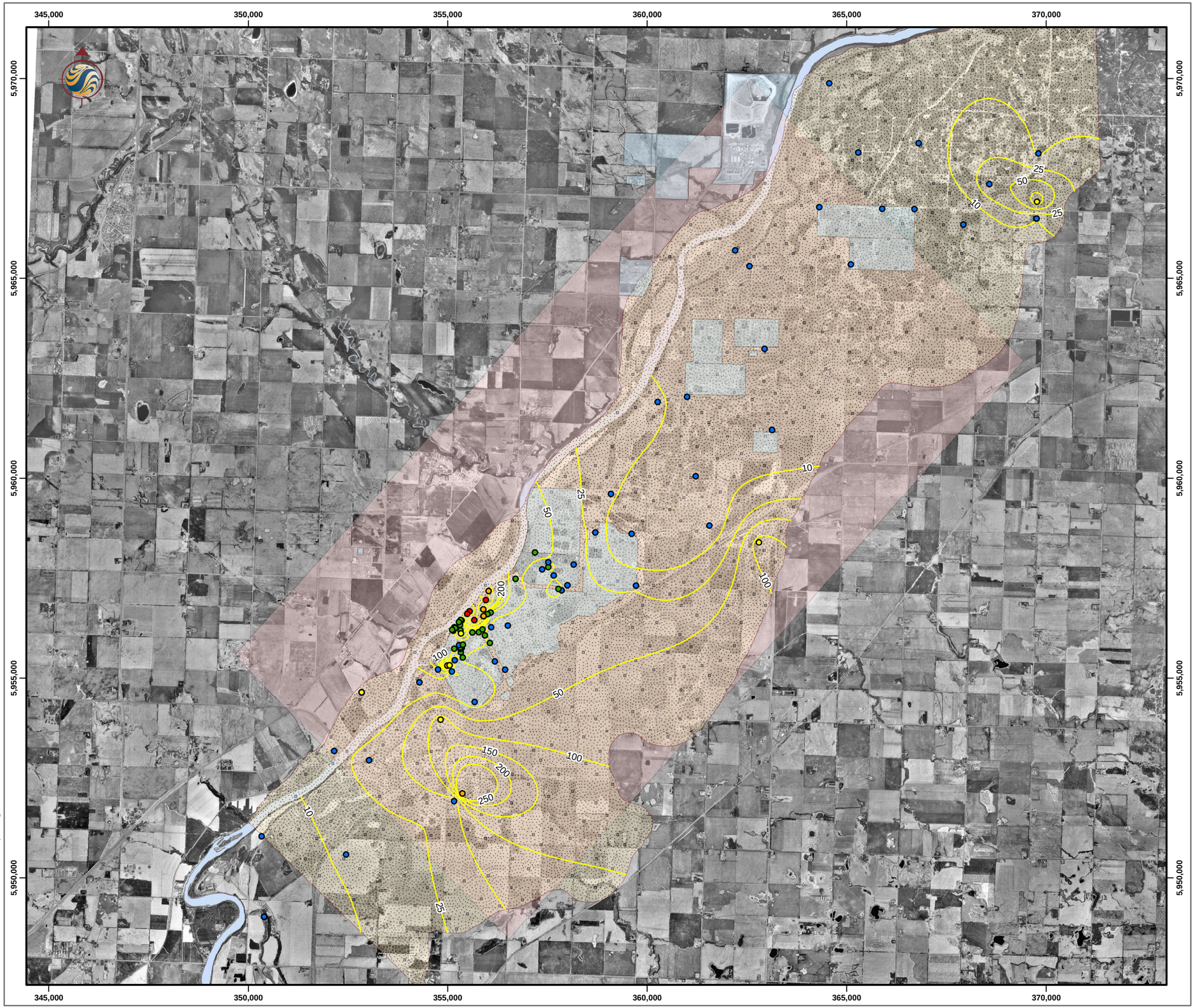
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.9

Title

Calcium



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Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Chloride Concentration (mg/L)

Chloride Data Points (mg/L)

- <50
- 50 - 100
- 100 - 300
- 300 - 1,000
- 1,000 - 5,000

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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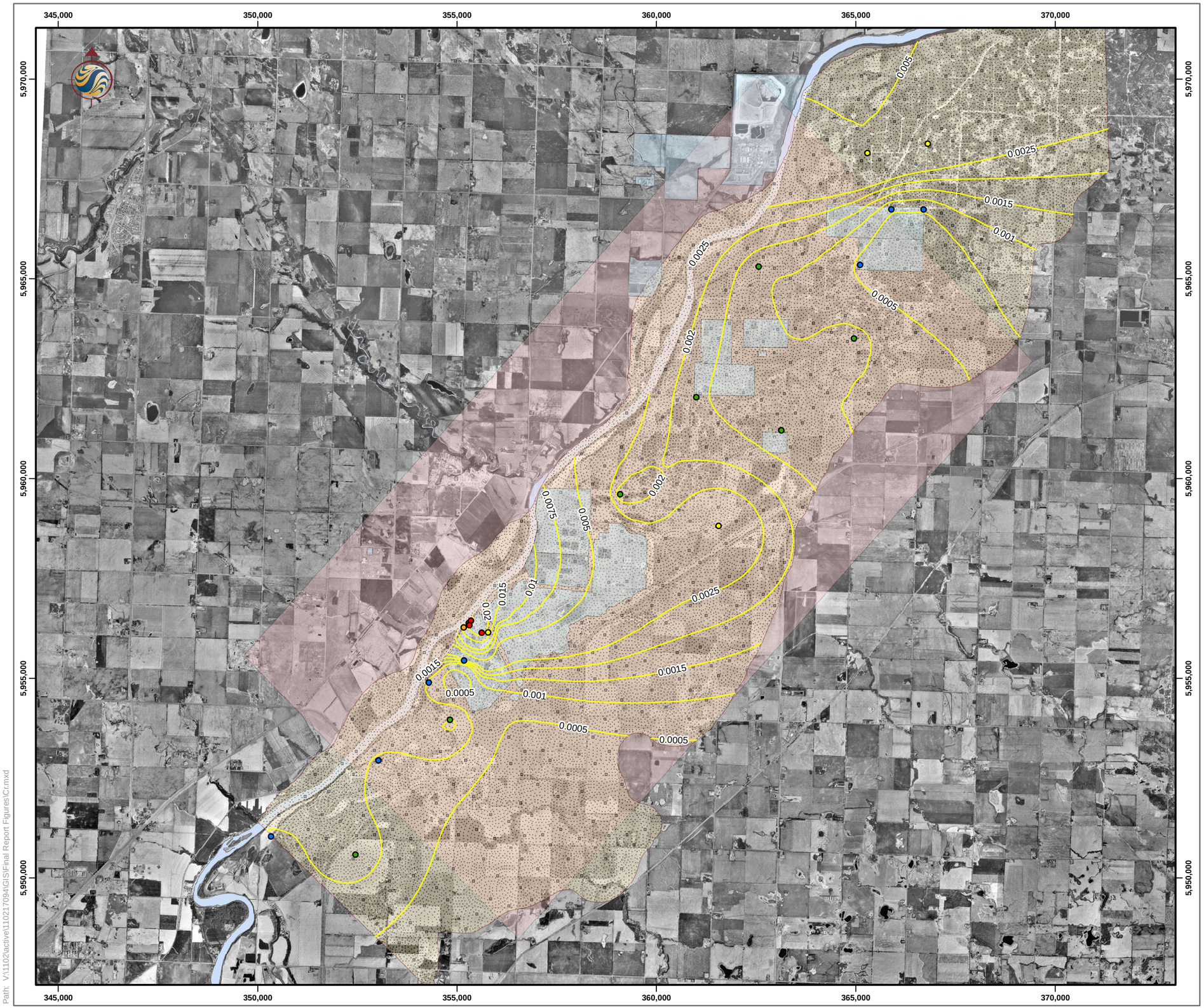
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.10

Title

Chloride



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Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Chromium Concentration (mg/L)

Chromium Data Points (mg/L)

- <0.001
- 0.001 - 0.003
- 0.003 - 0.006
- 0.006 - 0.009
- 0.009 - 0.030

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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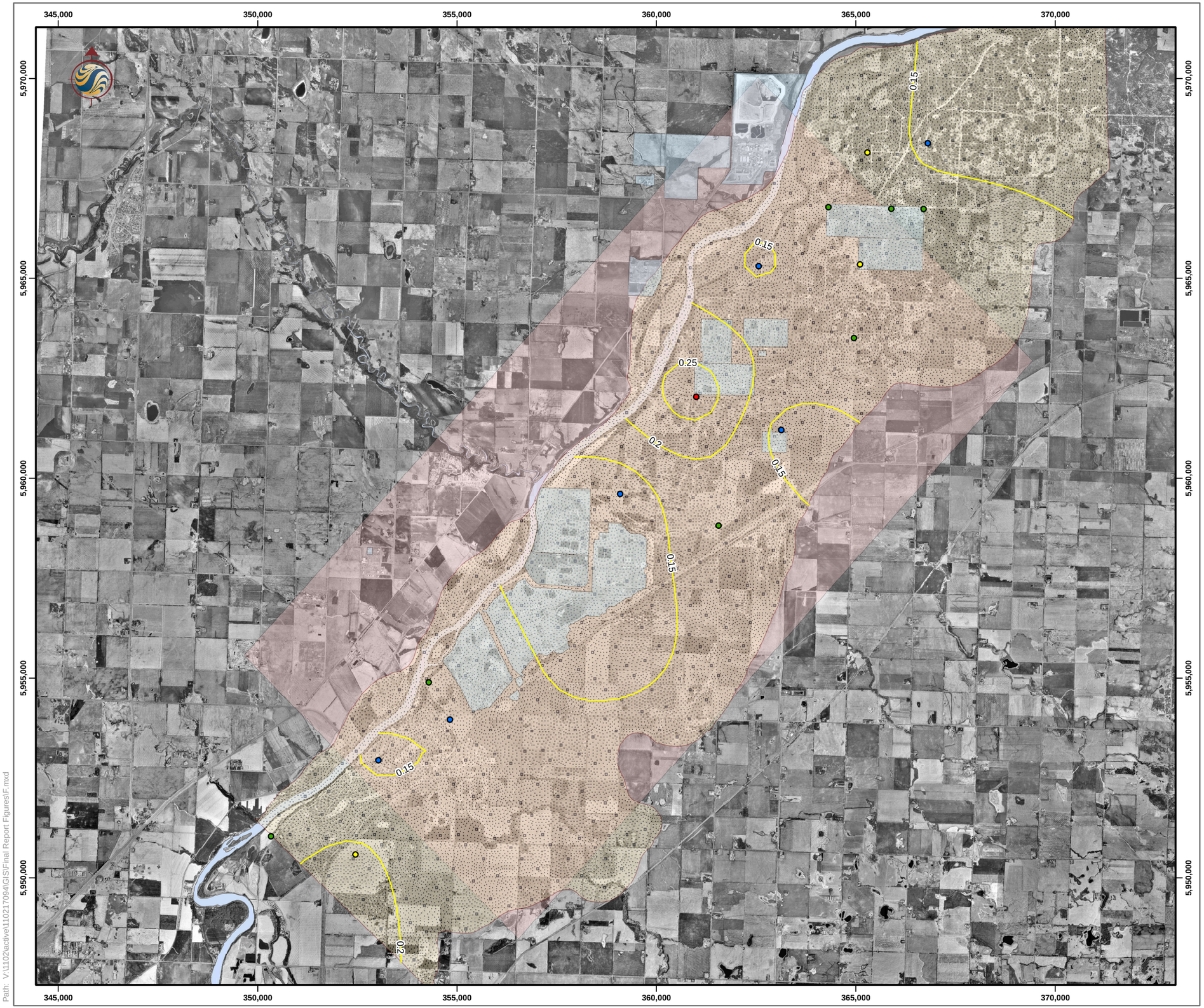
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.11

Title

Chromium



Stantec

Legend

- Study Area
- Fluoride Concentration (mg/L)
- Member Company Plant Site
- Beverly Channel Extent

Fluoride Data Points (mg/L)

- <0.15
- 0.15 - 0.20
- 0.20 - 0.25
- 0.25- 0.30

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

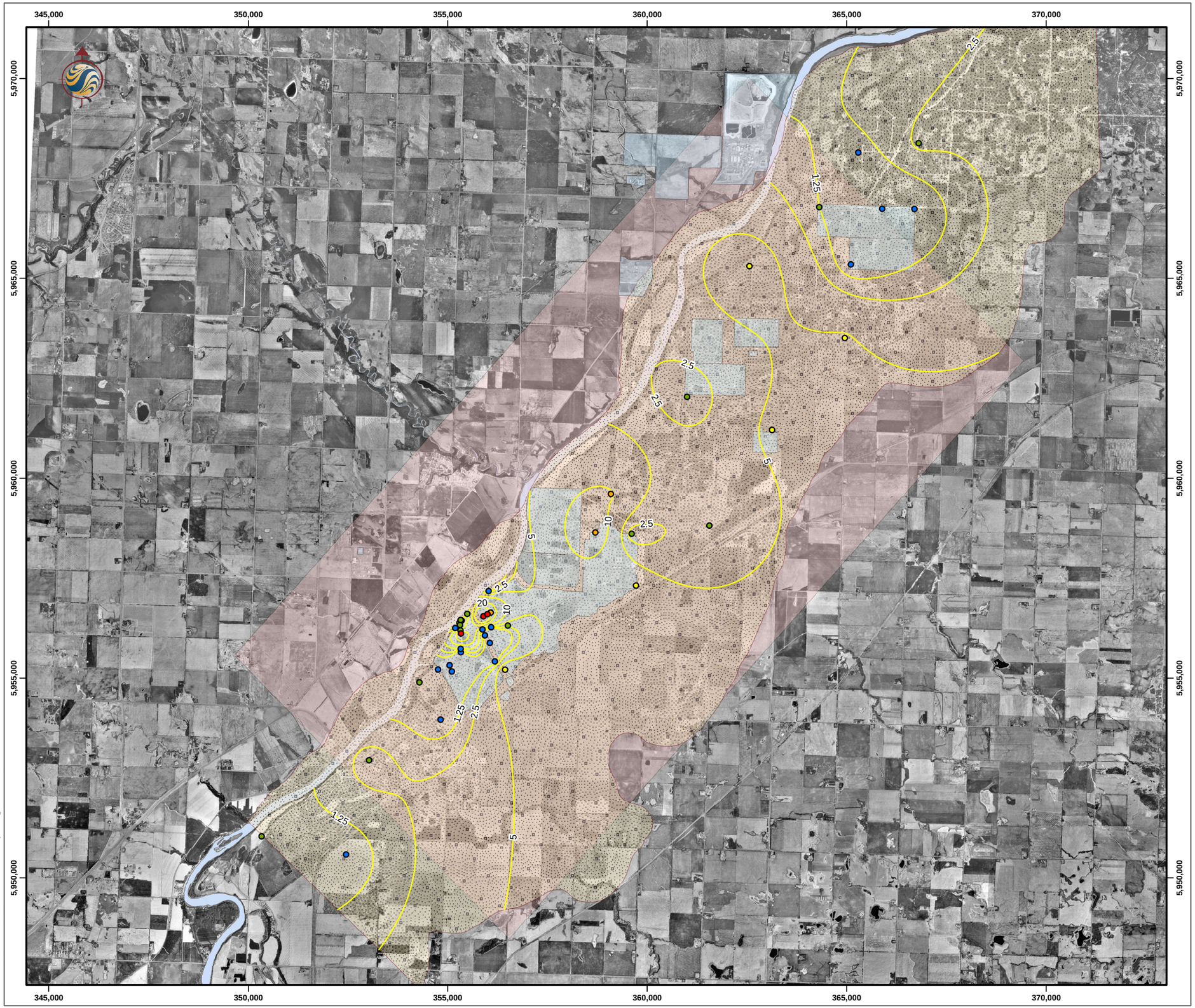
Figure No.

5.12

Title

Fluoride

Path: V:\1102active\110217094\GIS\Final Report Figures\F.mxd



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Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Iron Concentration (mg/L)

Iron Data Points (mg/L)

- <1.0
- 1.0 - 5.0
- 5.0 - 10.0
- 10.0 - 30.0
- 30.0 - 70.0

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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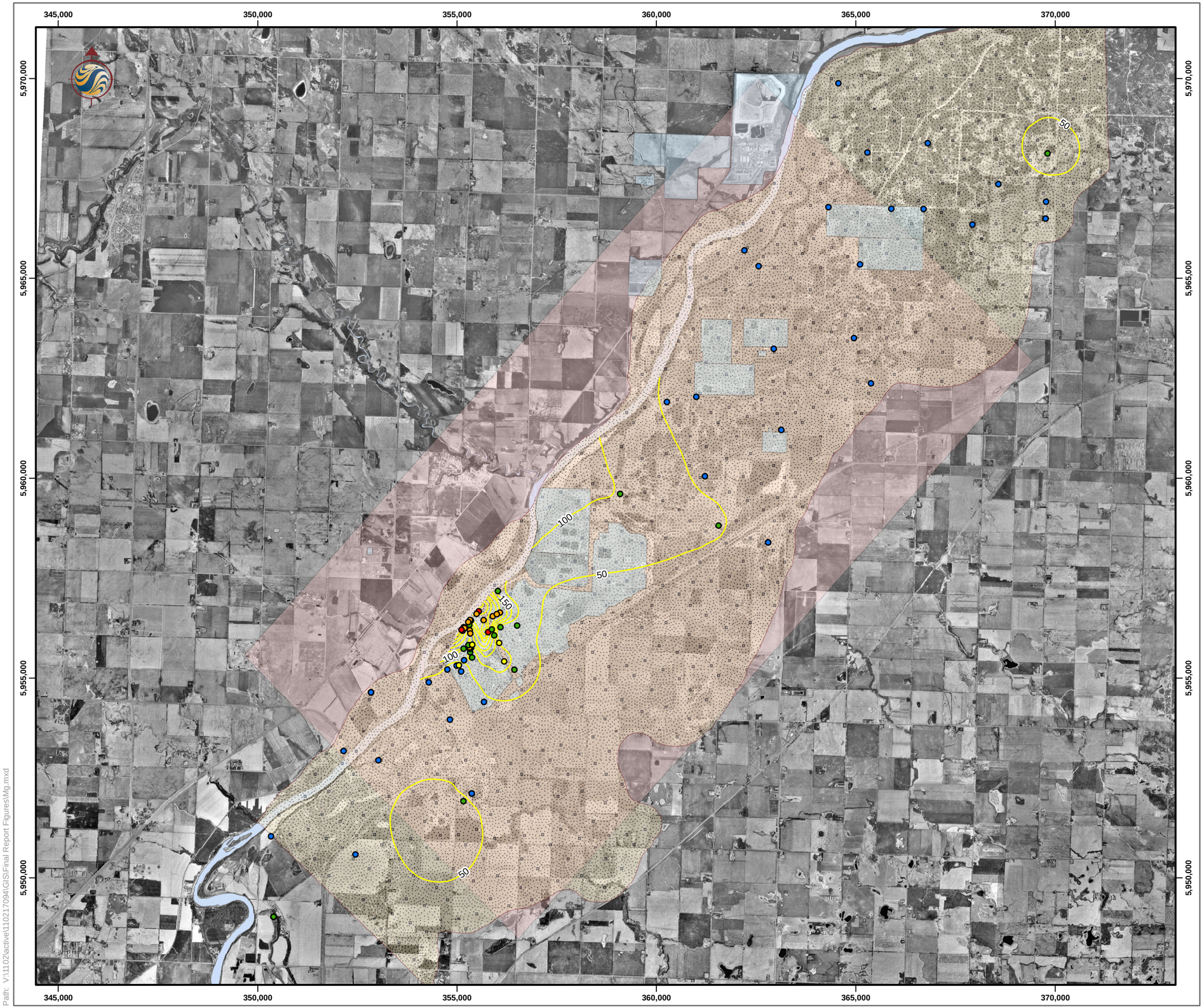
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.13

Title

Iron



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Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Magnesium Concentration (mg/L)

Magnesium Data Points (mg/L)

- <50
- 50 - 100
- 100 - 150
- 150 - 500
- 500 - 1,000

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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Northeast Capital Industrial Association

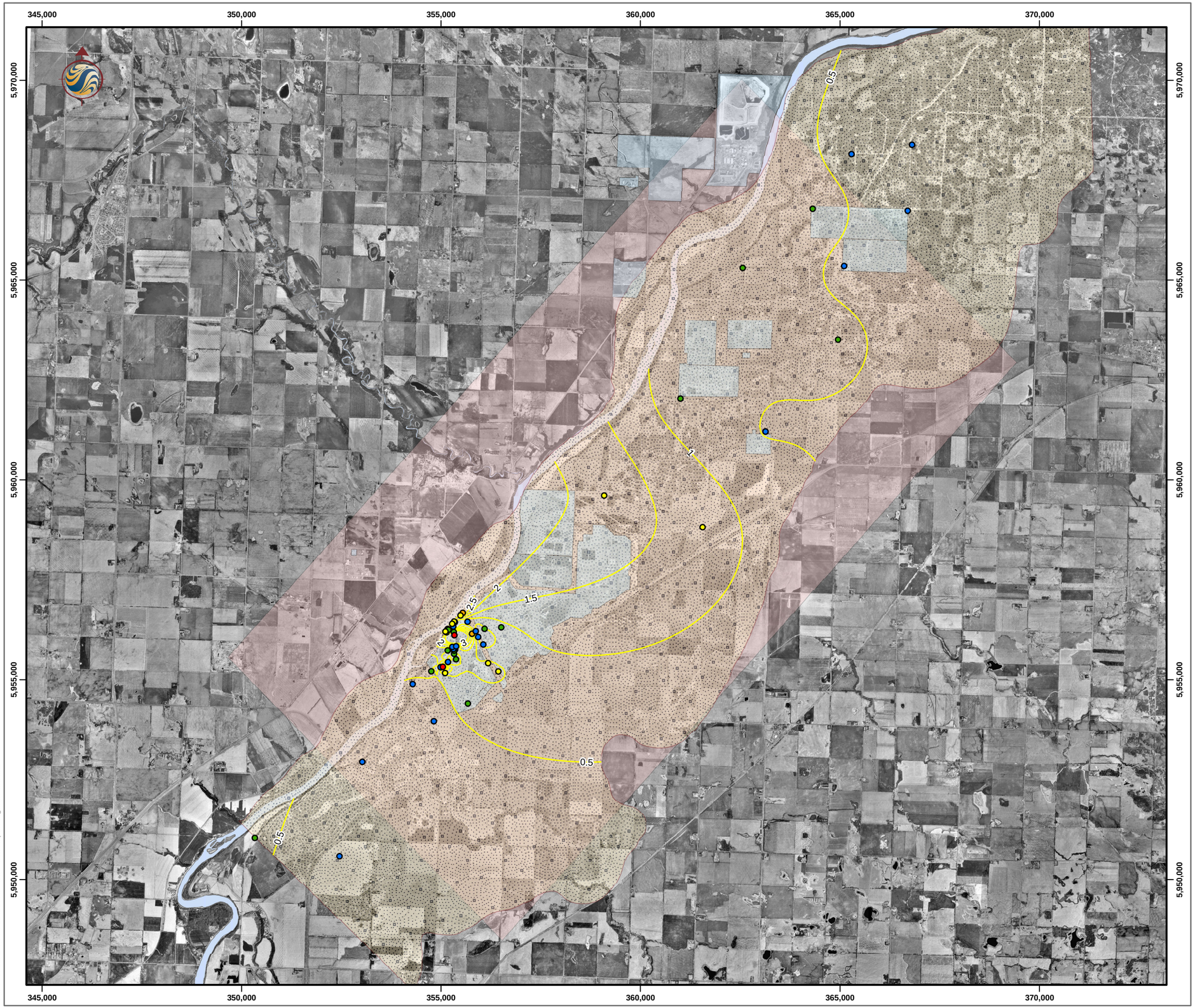
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.14

Title

Magnesium



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Stantec

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Manganese Concentration (mg/L)

Manganese Data Points (mg/L)

- <0.50
- 0.50 - 1.00
- 1.00 - 2.00
- 2.00 - 5.00
- 5.00 - 15.00

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA
Northeast Capital Industrial Association

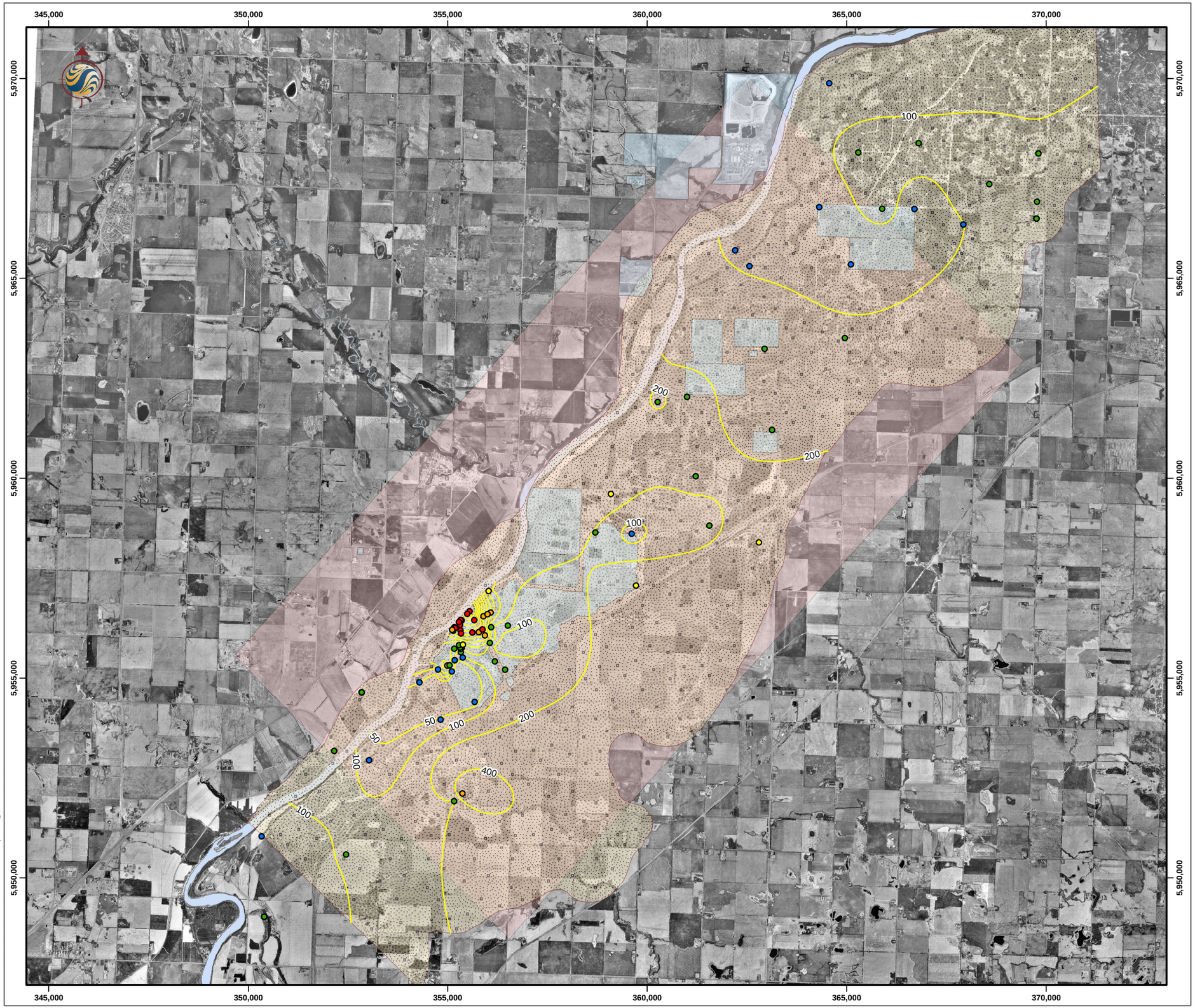
REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.15

Title

Manganese



Path: V:\11102active\110217094\GIS\Final Report Figures\Na.mxd

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Sodium Concentration (mg/L)

Sodium Data Points (mg/L)

- <100
- 100 - 250
- 250 - 500
- 500 - 1,000
- 1,000 - 3,000

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.16

Title

Sodium

Path: V:\1102\active\110217094\GIS\Final Report Figures\SO4.mxd

Legend

- Study Area
- Member Company Plant Site
- Beverly Channel Extent
- Sulphate Concentration (mg/L)

Sulphate Data Points (mg/L)

- <50
- 50 - 250
- 250 - 1,000
- 1,000 - 5,000
- 5,000 - 40,000

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

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REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

5.17

Title

Sulphates

6.0 Potential Sources of Contamination

Potential sources of contamination were identified for the Study Area in order to facilitate contaminant transport modeling in Phase III of the RGQP. The location of potential sources of contamination will be required to develop modeling scenarios aimed to determine the potential fate of contaminants inadvertently released near surface.

Only the major, longer term potential sources of contamination were identified in this study. Locations of minor surficial spills or pipeline breaks were not included, as these contamination events were viewed as being primarily incidental and random in nature. This does not necessarily preclude such events from being modeled in latter phases of the RGQP.

Potential sources of contamination were identified though a survey completed by NCIA member companies. Respondents were requested to identify potential sources on their respective plant sites. In cases where a response was unavailable, a review of an airphoto of the plant site was conducted and potential sources were identified in the Geographical Information System (GIS).

Figure 6.1 presents a map of the Study Area, indicating the potential sources of contamination identified to date. This map is not intended to be a comprehensive presentation of the location of all contaminant spills or releases. In latter phases of the project where contaminant transport simulations are conducted, the potential sources of contamination and historical sources can be reviewed to develop different release scenarios aimed to determine the fate of the contaminants and potentially impacted receptors in the Study Area. This map should be reviewed and updated before running the contaminant transport simulations to reflect new industrial developments that are currently proposed or under construction.

It should also be noted that the majority of the industrial facilities in the NCIA Study Area operate under an EPEA Approval that typically contain terms and conditions pertaining to groundwater monitoring programs. Specific details including monitoring well details, analytical parameters, and sampling frequencies are stated in these conditions. At the end of each year, an Annual Groundwater Monitoring Report is prepared by each EPEA Approval holder and is subsequently submitted to AENV for review and comment. Groundwater management issues related to contamination are highlighted in the annual reports and through dialogue with AENV, remedial and/or risk management measures are developed and implemented.

Path: V:\1102\active\110217094\GIS\Final Report Figures\Potential Contamination Sources.mxd

Stantec

Legend

- Study Area
- Member Company Plant Site

Potential Sources of Contamination

- Pond
- Tanks
- Waste Management

Note:

Scale: 1:95,000

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000

Distance in Metres

Projection: UTM Zone 12
Datum : NAD83

Client / Project

NCIA Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY OF THE BEVERLY CHANNEL IN THE FORT SASKATCHEWAN AREA

Figure No.

6.1

Title

Location of Potential Sources of Contamination

7.0 Findings and Recommendations

7.1 FINDINGS

Development of the conceptual hydrogeological model presented in Section 4 has revealed that the quaternary stratigraphy of the Study Area is quite complex, due to interfingering of glacial tills and lacustrine clays, potential glacial outwash features, progressive/transgressive sequences within the lacustrine clays, and subcropping of various units.

Bedrock elevations vary from 580 mAMSL near the Shell Chemicals plant site to 650 mAMSL in the northwest corner of the Study Area, with the Beverly Channel being the dominant topographical feature. Northwest banks of the Beverly Channel appear to be steeper than the southwest banks.

The Empress Formation sand and gravel unit was relatively continuous over the Study Area, as indicated on cross sections A-A' and B-B' (Figures 4.3 and 4.4). Thickness of the Empress Formation varied from zero to a maximum thickness in excess of 20 m in areas of bedrock lows.

Generally, groundwater in the Empress Formation sands and gravels appears to flow from eastern areas of the Beverly Channel towards the North Saskatchewan River. In some localized areas groundwater appears to be moving in a northerly direction, but again turns more northwesterly as is moves closer to the river.

Horizontal potentiometric gradients vary from a minimum gradient of 0.0005 m/m in the eastern portions of the Dow Chemical site to a maximum gradient of 0.005 m/m in the City of Fort Saskatchewan. Based upon the average hydraulic conductivity calculated from well response tests and pump tests (Sections 3.6 and 3.7) conducted over the Phase II field investigation, average linear groundwater flow velocities within the Empress sands and gravels are estimated to be between 16 and 160 m/yr in the Study Area.

Based upon the analytical results from groundwater samples collected from the NCIA monitoring well network, the groundwater within the Empress Formation sands and gravels is moderately fresh, with an average TDS of 840 mg/L. The groundwater can also be considered hard, with an average hardness of 480 mg/L arising primarily from calcium and magnesium ions. Dissolved organic content is quite low, with an average concentration of 6 mg/L.

Use of the river stage elevation points in the development of the potentiometric surface creates a presupposition that the Empress Formation sands and gravels are directly connected throughout the entire reach of the North Saskatchewan River in the Study Area. In actuality, this may be somewhat of an overstatement. However, simply ignoring the presence of the river will also create an unrealistic potentiometric surface since the hydraulic influence of the North Saskatchewan River as a regional groundwater discharge feature will in turn be ignored. More realistically, the truth likely lies in between these two extremes, where the river is connected in certain areas and not connected in others.

7.2 RECOMMENDATIONS

It is recommended that ongoing groundwater sampling and analysis of the NCIA monitoring wells continue in the Fall of 2006. An additional round of samples were obtained in the Spring of 2006. Analysis results were pending at the time of this report. Groundwater sampling should be conducted twice per year and parameters to be analyzed should be the same as those presented in Section 3.10. By the end of 2006, an adequate "baseline" set of hydrochemistry data will have been established (four rounds of sampling), following which the need for continued analysis of all parameters can be re-evaluated. More rigorous statistical testing and analysis of the data should be conducted once the baseline data set is obtained. Such testing should include tests for normality and identification of data outliers, following which the baseline concentrations should be recalculated based upon the screened data.

A detailed water level data set will be required for calibration of the groundwater flow model in Phase III of the RGQP. Efforts should be made to coordinate water level measurements at all NCIA member companies' respective sites (those with Empress Formation wells) so that water level measurements are obtained for a single point in time. In this manner a data set of water levels that are all measured within a one to two week period would be established. This would allow for the greatest degree of data coverage over the Study Area, and would minimize the need to exclude data because of temporal restrictions.

A more detailed analysis of river stage fluctuations and groundwater levels in the Beverly Channel should be conducted once a longer term data set reflecting seasonal variations has been established (by the end of 2006). Additional groundwater monitoring points near the river may also be required to better characterize the ground water / surface water interactions in the Study Area. Such information would assist the verification of boundary conditions used in the numerical model to simulate the influences of the North Saskatchewan river on the groundwater flow system.

Caution should be taken during implementation of the numerical model to avoid oversimplifying the stratigraphy in the Study area to a simple "layer cake" approach. Zoning of individual model layers should be considered to allow for varying hydraulic properties of a given geological unit over the Study Area. Subcropping and interfingering of geological units may also be better represented in the numerical model through zoning of model layers.

A multi-well pumping test with observation wells should be conducted in the Study Area to better constrain the aquifer storativity parameters in the numerical model. In this manner, a better understanding of both the time-drawdown and distance-drawdown relationships for the Empress Formation will be attained.

Data collection and management is an ongoing challenge for this project. Future updates of the database management system (DMS) should be coordinated with each of the NCIA member companies' analytical laboratory for greater efficiency. The DMS is able to directly import electronic versions of laboratory reports. Maximizing the amount of data received in a consistent manner is paramount to the efficiency of DMS updates. It may be possible for

laboratories to submit preliminary analysis reports to the NCIA member company for review and verification. The final electronic reports could then be sent to a central location for direct import into the DMS.

It is recommended that the DMS be linked to a web-based portal for access by NCIA member companies and other stakeholders. The vision would be for an internet address to be provided to stakeholders along with different passwords reflecting varying access levels. Stakeholders would then only require a internet connection and browser to access the data. Various database queries commonly used would be set up such that the user simply has to click on the query to get the data. Data could also be exported and downloaded for external analysis if required. This type of web-based solution is advantageous since it simplifies implementation of a database system over many different types of computers of varying specifications. Further, maintenance of the system is centralized, thereby maintaining better security and integrity of the data stored within the system.

8.0 Stantec Quality Management Program

This report, entitled **"Regional Groundwater Quality Study of the Beverly Channel in the Fort Saskatchewan Area – Phase II"**, was produced by:

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This report was approved for transmittal by:

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Geoenvironmental Engineer

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APPENDIX A
BOREHOLE LOGS

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-01
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:354156.88 N:5950956.34	ELEVATION: 625.70 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
0.0		ORGANIC SOIL; frozen/black					BACKFILLED WITH GROUT	625.0
1.0		CLAY; brown, silty		TH01				624.0
2.0								623.0
3.0				TH01				622.0
4.0								621.0
5.0				TH01				620.0
6.0		CLAY TILL; brown, sandy clay, some silt, some pebbles						619.0
7.0				TH01				618.0
8.0								617.0
9.0				TH01				616.0
10.0								615.0
11.0				TH01				614.0
12.0		SAND; loose, brown, medium grained speckled sand						613.0
13.0				TH01				612.0
14.0								611.0
15.0				TH01				610.0
16.0		- at 15.9 m becomes coarse grained						609.0
17.0				TH01				608.0
18.0		- at 17.4 m hit a rock, returns to sand						607.0
19.0				TH01				606.0
20.0								605.0
21.0		CLAY TILL; brown, sandy clay		TH01				604.0
22.0								603.0
23.0		GRAVEL; clean, coarse gravel		TH01				602.0
24.0								601.0
25.0				TH01				

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Edmonton, Alberta

LOGGED BY: H. LOVETT	COMPLETION DEPTH: 36.6 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/17/05
Fig. No: 17094	Page 1 of 2

05/11/12 10:27AM (PETION-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-01
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:354156.88 N:5950956.34	ELEVATION: 625.70 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
25.0		– at 25 m high drill stem chatter, possible gravel						600.0
26.0				TH01				599.0
27.0								598.0
28.0				TH01				597.0
29.0								596.0
30.0				TH01				595.0
31.0								594.0
32.0				TH01				593.0
33.0		SHALE; blue/grey, dense						592.0
34.0								591.0
35.0		SANDSTONE; hard, grey, compact, dense						590.0
36.0		SHALE; light grey, dense					-35.6 m	589.0
37.0		END OF HOLE 36.6 m						588.0
38.0								587.0
39.0								586.0
40.0								585.0
41.0								584.0
42.0								583.0
43.0								582.0
44.0								581.0
45.0								580.0
46.0								579.0
47.0								578.0
48.0								577.0
49.0								576.0
50.0								

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Edmonton, Alberta

LOGGED BY: H. LOVETT	COMPLETION DEPTH: 36.6 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/17/05
Fig. No: 17094	Page 2 of 2

05/11/14 10:27AM (PELICAN-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-02
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:353513.37 N:5955546.11	ELEVATION: 622.66 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	LITHOLOGY	SAMPLE NO	WELL COMPLETION DATA	ELEVATION(m)
0.0	ORGANIC SOIL; black/brown, pebbles		BACKFILLED WITH BENTONITE	622.0
1.0	CLAY; sandy, brown, some pebbles			621.0
2.0		TH02		620.0
3.0		TH02		619.0
4.0	SAND AND GRAVEL; light brown, medium to coarse grained sand and gravel	TH02		618.0
5.0	– at 3.7 m large rocks – at 3.7 m lots of chatter, rig moved off hole, had to re-position			617.0
6.0		TH02		616.0
7.0	– at 4.6 m less gravel, coarse sand CLAY; sandy, brown	TH02		615.0
8.0	SHALE; blue grey, dense			614.0
9.0		TH02		613.0
10.0				612.0
11.0		TH02	–11.6 m	611.0
12.0		TH02		610.0
13.0	END OF HOLE 12.2 m			609.0
14.0				608.0
15.0				607.0
16.0				606.0
17.0				605.0
18.0				604.0
19.0				603.0
20.0				602.0
21.0				601.0
22.0				600.0
23.0				599.0
24.0				598.0
25.0				

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 12.2 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/18/05
Fig. No: 17094	Page 1 of 1

05/11/14 10:28AM (PETGR-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-03
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:355550.76 N:5957773.88	ELEVATION: 623.43 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
0.0		FILL; brown, sand, some rocks and pebbles					BACKFILLED WITH GROUT	623.0
1.0								622.0
2.0				TH03				621.0
3.0				TH03				620.0
4.0		GRAVEL; loose CLAY; brown, sandy		TH03				619.0
5.0		- at 5.2 m changes to dark brown clay						618.0
6.0				TH03				617.0
7.0								616.0
8.0		CLAY TILL; grey, silty clay, pebbles		TH03				615.0
9.0				TH03				614.0
10.0								613.0
11.0		SAND AND GRAVEL; brown, medium grained sand with some gravel		TH03				612.0
12.0				TH03				611.0
13.0								610.0
14.0		SHALE; blue grey		TH03				609.0
15.0				TH03				608.0
16.0								607.0
17.0				TH03				606.0
18.0				TH03				605.0
19.0								604.0
20.0				TH03				603.0
21.0				TH03				602.0
22.0								601.0
23.0				TH03				600.0
24.0								599.0
25.0				TH03				

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Edmonton, Alberta

LOGGED BY: H. LOVETT	COMPLETION DEPTH: 36.6 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/18/05
Fig. No: 17094	Page 1 of 2

05/11/14 10:32AM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-03
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:355550.76 N:5957773.88	ELEVATION: 623.43 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
25.0								598.0
26.0				TH03				
		SANDSTONE; grey, hard, lots of chatter						597.0
27.0		– grey, dense		TH03				
		SHALE; dense						596.0
28.0								595.0
29.0				TH03				
		– becomes sandy at 29.3 m						594.0
30.0				TH03				
								593.0
31.0								592.0
32.0								
		SANDSTONE; grey, hard (lots of chatter), compact, dense						591.0
33.0								590.0
		SHALE; grey, dense, sandy						
34.0								589.0
35.0								588.0
36.0								587.0
37.0		END OF HOLE 36.6 m						586.0
38.0								585.0
39.0								584.0
40.0								583.0
41.0								582.0
42.0								581.0
43.0								580.0
44.0								579.0
45.0								578.0
46.0								577.0
47.0								576.0
48.0								575.0
49.0								574.0
50.0								

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 36.6 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/13/05
Fig. No: 17094	Page 2 of 2

06/11/14 10:32AM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-05
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:359332.21 N:5962138.08	ELEVATION: 604.50 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
0.0	SAND AND GRAVEL; loose, brown, coarse sand and gravel					BACKFILLED WITH BENTONITE AND DRILL CUTTINGS	604.0
1.0			TH05				603.0
2.0							602.0
3.0			TH05			-3.4 m	601.0
4.0							600.0
5.0	CLAY; grey/blue, silty		TH05				599.0
6.0							598.0
7.0			TH05				597.0
8.0							596.0
9.0			TH05				595.0
10.0	SHALE; blue grey, dense						594.0
11.0			TH05				593.0
12.0			TH05				592.0
13.0	END OF HOLE 12.2 m						591.0
14.0							590.0
15.0							589.0
16.0							588.0
17.0							587.0
18.0							586.0
19.0							585.0
20.0							584.0
21.0							583.0
22.0							582.0
23.0							581.0
24.0							580.0
25.0							

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 12.2 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/19/05
Fig. No: 17094	Page 1 of 1

05/10/26 10:11AM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-06
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:359050.55 N:5960541.22	ELEVATION: 630.21 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
0.0		ORGANIC SOIL; black, frozen					BACKFILLED WITH GROUT	630.0
1.0		SAND; silty, brown, fine to medium grained, silty						629.0
2.0		CLAY TILL; brown, sandy, some pebbles						628.0
3.0		SAND; brown, medium grained		TH06				627.0
4.0		- turns grey at 3.1 m						626.0
5.0								625.0
6.0				TH06				624.0
7.0								623.0
8.0		CLAY TILL; brown, sandy						622.0
9.0				TH06				621.0
10.0								620.0
11.0		SAND; brown, medium grained						619.0
12.0				TH06				618.0
13.0		CLAY; grey, sandy, some silt						617.0
14.0								616.0
15.0				TH06				615.0
16.0								614.0
17.0		SAND; grey, fine grained, very silty, cemented						613.0
18.0				TH06				612.0
19.0								611.0
20.0								610.0
21.0				TH06				609.0
22.0		CLAY; grey, silty, sandy clay						608.0
23.0								607.0
24.0								606.0
25.0				TH06				

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 49.4 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/21/05
Fig. No: 17094	Page 1 of 2

05/11/14 10:45AM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-06
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:359050.55 N:5960541.22	ELEVATION: 630.21 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
25.0								605.0
26.0								604.0
27.0				TH06				603.0
28.0		– at 28.0 m rock						602.0
29.0								601.0
30.0				TH06				600.0
31.0								599.0
32.0								598.0
33.0								597.0
34.0				TH06				596.0
35.0								595.0
36.0								594.0
37.0		SAND AND GRAVEL; coarse grained sand and gravel, coal mix		TH06				593.0
38.0								592.0
39.0								591.0
40.0				TH06				590.0
41.0								589.0
42.0								588.0
43.0				TH06				587.0
44.0								586.0
45.0								585.0
46.0		SHALE; grey, dense		TH06				584.0
47.0								583.0
48.0								582.0
49.0				TH06				581.0
50.0		END OF HOLE 49.4 m						

Stantec Consulting Ltd. Edmonton, Alberta	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 49.4 m
	REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/21/05
	Fig. No: 17094	Page 2 of 2

05/11/14 10:46AM (PELICH-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-07
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:360839.63 N:5960561.71	ELEVATION: 628.25 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
0.0		ORGANIC SOIL; black					BACKFILLED WITH GROUT	628.0
1.0		SAND; brown, medium grained						627.0
2.0				TH07				626.0
3.0				TH07				625.0
4.0				TH07				624.0
5.0		– at 4.6 m turns to dark grey brown						623.0
6.0		CLAY; grey, silty		TH07				622.0
7.0								621.0
8.0		SAND; brown, grey, fine to medium grained		TH07				620.0
9.0		CLAY; grey, silty		TH07				619.0
10.0				TH07				618.0
11.0								617.0
12.0				TH07				616.0
13.0								615.0
14.0				TH07				614.0
15.0								613.0
16.0				TH07				612.0
17.0								611.0
18.0		– at 18.3 m clay becomes more sandy		TH07				610.0
19.0								609.0
20.0				TH07				608.0
21.0		SAND; grey, fine grained, silty, cemented						607.0
22.0				TH07				606.0
23.0								605.0
24.0				TH07				604.0
25.0								

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 47.2 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/19/05
Fig. No: 17094	Page 1 of 2

05/11/4 10:47AM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-07
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:360839.63 N:5960561.71	ELEVATION: 628.25 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
25.0				TH07				603.0
26.0								602.0
27.0				TH07				601.0
28.0								600.0
29.0				TH07				599.0
30.0								598.0
31.0				TH07				597.0
32.0								596.0
33.0		SAND AND GRAVEL; coarse grained sand, drill stem chatter, gravel and coal		TH07				595.0
34.0								594.0
35.0				TH07				593.0
36.0								592.0
37.0				TH07				591.0
38.0								590.0
39.0				TH07				589.0
40.0								588.0
41.0				TH07				587.0
42.0		SHALE; grey, dense						586.0
43.0				TH07				585.0
44.0								584.0
45.0								583.0
46.0							-45.7 m	582.0
47.0								581.0
48.0		END OF HOLE 47.2 m						580.0
49.0								579.0
50.0								

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LOGGED BY: H. LOVETT | COMPLETION DEPTH: 47.2 m
REVIEWED BY: D. YOSHISAKA | COMPLETE: 01/19/05
Fig. No: 17094 |

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-08
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:363355.89 N:5958878.28	ELEVATION: 630.50 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
0.0		ORGANIC SOIL; frozen, black					BACKFILLED WITH GROUT	630.0
1.0		SILT; light brown, some clay		TH08				629.0
2.0		CLAY; light brown, silty, some pebbles		TH08				628.0
3.0				TH08				627.0
4.0				TH08				626.0
5.0				TH08				625.0
6.0		SAND; brown, fine to medium grained, speckled with black		TH08				624.0
7.0		CLAY TILL; brown, sandy, some silt and pebbles, some coal chips		TH08				623.0
8.0				TH08				622.0
9.0				TH08				621.0
10.0				TH08				620.0
11.0		- at 10.7 m turns grey		TH08				619.0
12.0				TH08				618.0
13.0				TH08				617.0
14.0				TH08				616.0
15.0				TH08				615.0
16.0				TH08				614.0
17.0				TH08				613.0
18.0				TH08				612.0
19.0				TH08				611.0
20.0				TH08				610.0
21.0				TH08				609.0
22.0				TH08				608.0
23.0				TH08				607.0
24.0				TH08				606.0
25.0								

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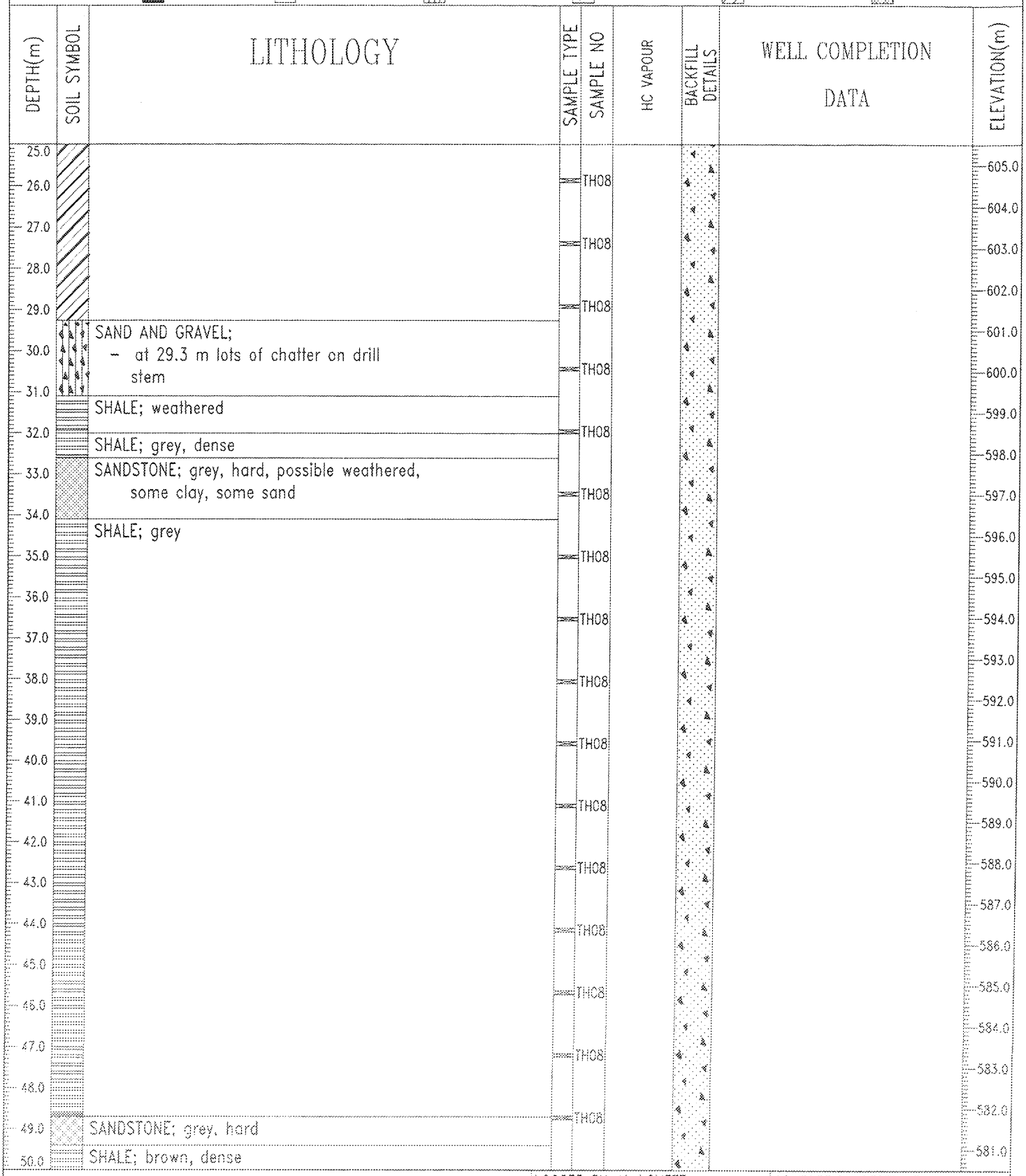
LOGGED BY: H. LOVETT	COMPLETION DEPTH: 54.9 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/20/05
Fig. No: 17094	Page 1 of 3

05/11/14 10:55:54M (PETLOG-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-08
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:363355.89 N:5958878.28	ELEVATION: 630.50 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND



Stantec Consulting Ltd. Edmonton, Alberta	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 54.9 m
	REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/20/05
	Fig. No: 17094	Page 2 of 3

05/11/14 10:55AM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-08
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:363355.89 N:5958878.28	ELEVATION: 630.50 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
50.0				TH08				580.0
51.0								579.0
52.0				TH08				578.0
53.0								577.0
54.0				TH08				576.0
55.0		END OF HOLE 54.9 m		TH08				575.0
56.0								574.0
57.0								573.0
58.0								572.0
59.0								571.0
60.0								570.0
61.0								569.0
62.0								568.0
63.0								567.0
64.0								566.0
65.0								565.0
66.0								564.0
67.0								563.0
68.0								562.0
69.0								561.0
70.0								560.0
71.0								559.0
72.0								558.0
73.0								557.0
74.0								556.0
75.0								

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LOGGED BY: H. LOVETT | COMPLETION DEPTH: 54.9 m
REVIEWED BY: D. YOSHISAKA | COMPLETE: 01/20/05
Fig. No: 17094 | Page 3 of 3

05/11/14 10:56AM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-09
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:364944.58 N:5961905.99	ELEVATION: 627.42 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
0.0		ORGANIC SOIL; frozen, black					BACKFILLED WITH GROUT	627.0
1.0		SAND; light brown, medium grained						626.0
2.0								625.0
3.0								624.0
4.0								623.0
5.0		– at 4.3 m turns dark brown, silty, some clay						622.0
6.0								621.0
7.0								620.0
8.0								619.0
9.0								618.0
10.0								617.0
11.0								616.0
12.0		CLAY TILL; grey, brown, sandy, silty						615.0
13.0								614.0
14.0								613.0
15.0								612.0
16.0								611.0
17.0								610.0
18.0								609.0
19.0								608.0
20.0								607.0
21.0								606.0
22.0								605.0
23.0								604.0
24.0								603.0
25.0								

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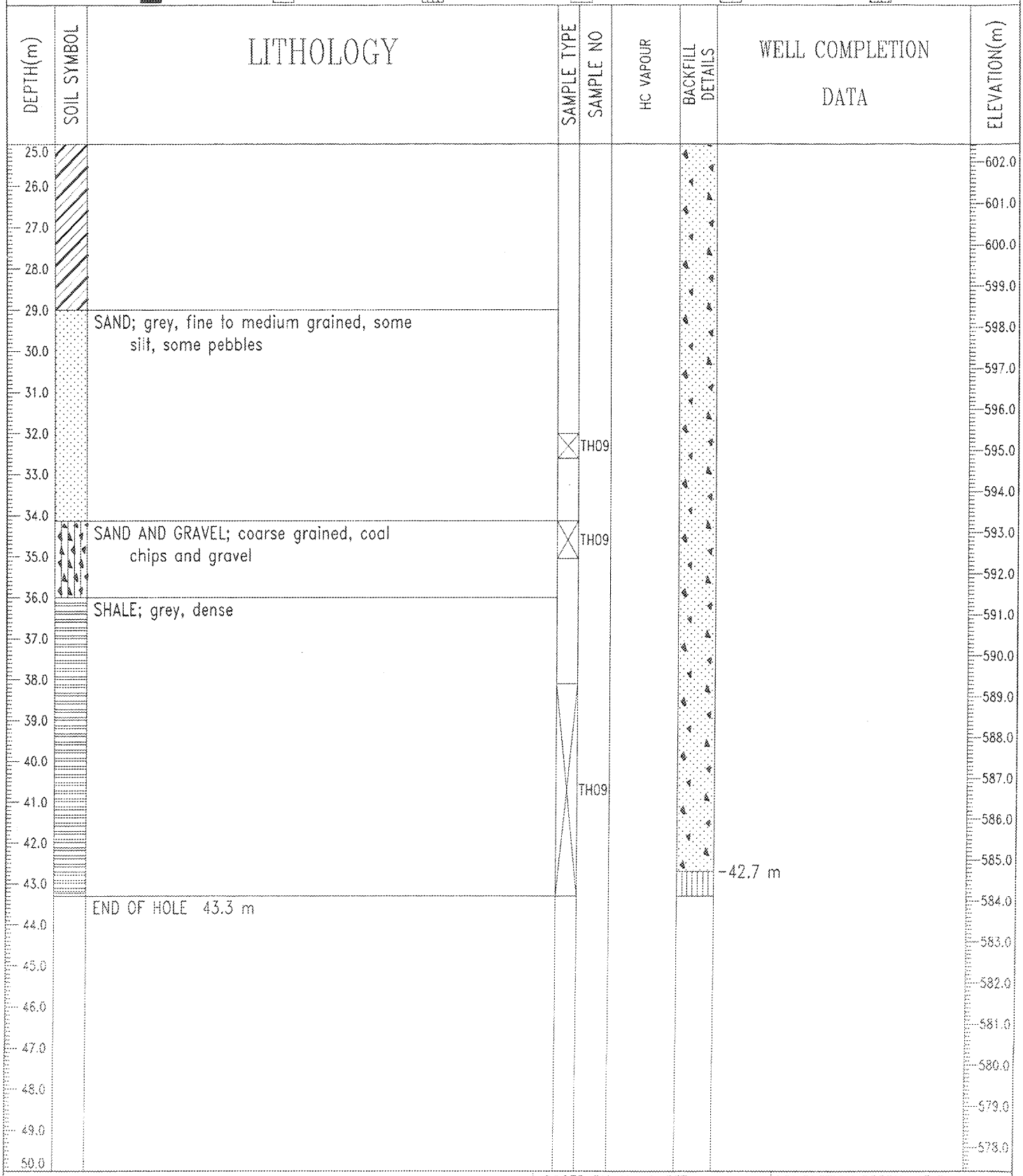
LOGGED BY: H. LOVETT	COMPLETION DEPTH: 43.3 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/21/05
Fig. No: 17094	Page 1 of 2

05/11/14 10:57AM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-09
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:364944.58 N:5961905.99	ELEVATION: 627.42 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND



Stantec Consulting Ltd. Edmonton, Alberta	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 43.3 m
	REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/21/05
	Fig. No: 17094	Page 2 of 2

05/11/14 10:57AM (PETTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-10
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:366663.94 N:5964563.07	ELEVATION: 621.83 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
0.0		SAND; brown, medium grained		TH10			BACKFILLED WITH GROUT	621.0
1.0								
2.0								620.0
3.0				TH10				619.0
4.0		CLAY; dark brown, sandy, turns grey with depth, very silty, fine grained sand and clay mix						618.0
5.0				TH10				617.0
6.0								616.0
7.0				TH10				615.0
8.0								614.0
9.0				TH10				613.0
10.0								612.0
11.0				TH10				611.0
12.0								610.0
13.0				TH10				609.0
14.0								608.0
15.0				TH10				607.0
16.0								606.0
17.0				TH10				605.0
18.0								604.0
19.0				TH10				603.0
20.0								602.0
21.0				TH10				601.0
22.0								600.0
23.0		SAND; grey, medium to coarse grained, some pebbles		TH10				599.0
24.0		CLAY; grey, silty, some sand						598.0
25.0		CLAY TILL; grey brown, sandy till, some pebbles		TH10				597.0

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 47.2 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/19/05
Fig. No: 17094	Page 1 of 2

05/11/14 11:00AM (PETCOM-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: TH-10
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/300
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:366663.94 N:5964563.07	ELEVATION: 621.83 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	BACKFILL DETAILS	WELL COMPLETION DATA	ELEVATION(m)
25.0		SAND; grey		TH10				596.0
26.0								595.0
27.0				TH10				
28.0		SAND AND GRAVEL; grey, fine to medium grained sand, gravel speckled black						594.0
29.0				TH10				593.0
30.0		SAND; grey, fine to medium grained, some silt, speckled black						592.0
31.0				TH10				591.0
32.0								590.0
33.0				TH10				589.0
34.0								588.0
35.0				TH10				587.0
36.0								586.0
37.0				TH10				585.0
38.0		SAND AND GRAVEL; coarse grained sand and gravel						584.0
39.0				TH10				583.0
40.0								582.0
41.0		SHALE; grey, dense		TH10				581.0
42.0								580.0
43.0				TH10				579.0
44.0								578.0
45.0								577.0
46.0								576.0
47.0								575.0
48.0								574.0
49.0		END OF HOLE 48.8 m						573.0
50.0								572.0

Stantec Consulting Ltd.
Edmonton, Alberta

LOGGED BY: H. LOVETT	COMPLETION DEPTH: 47.2 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/19/05
Fig. No: 17094	Page 2 of 2

05/11/14 11:06AM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-01
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:350335.04 N:5951040.45	ELEVATION: 617.52 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL COMPLETION DATA	ELEVATION(m)
0.0	ORGANIC SOIL; frozen, black				STICKUP (0.52 m)	617.0
1.0	SAND; brown, fine to medium grained, some clay				-51 mm PVC CASING	616.0
2.0						615.0
3.0	CLAY;					614.0
4.0	CLAY TILL; brown, sandy clay, some pebbles					613.0
5.0					-TOC ELEVATION: 618.04 m	612.0
6.0			MW1			611.0
7.0	- at 6.7 m turns grey					610.0
8.0						609.0
9.0						608.0
10.0					-BOREHOLE DIAMETER = 159 mm	607.0
11.0						606.0
12.0			MW1			605.0
13.0						604.0
14.0					-14.0 m	603.0
15					-14.3 m	602.0
	- at 15.5 m drill stem chatter				-15.5 m	
16.0	SAND AND GRAVEL; coarse grained sand, gravel, lots of coal, wood chips					601.0
17.0			MW1		-51 mm 0.020 SLOT PVC SCREEN	600.0
18.0						599.0
19.0			MW1			598.0
20.0	SHALE; grey, dense				-19.8 m	597.0
21.0			MW1			596.0
22.0						595.0
23.0						594.0
24.0					-24.4 m	593.0
25.0	END OF HOLE 24.4 m					

Stantec Consulting Ltd. Edmonton, Alberta	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 24.4 m
	REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/24/05
	Fig. No: 17094	Page 1 of 1

05/11/04 02:28PM (PEUGH-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-02
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:352457.80 N:5950583.37	ELEVATION: 630.71 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		ORGANIC SOIL; frozen, black					STICKUP (0.60 m)	630.0
1.0		SAND; brown, medium grained					-51 mm PVC CASING	
2.0							-TOC ELEVATION: 631.31 m	629.0
3.0							-BOREHOLE DIAMETER = 159 mm	628.0
4.0								627.0
5.0								626.0
6.0								625.0
7.0		CLAY TILL; brown, sandy clay, silty, some pebbles, coal chips						624.0
8.0								623.0
9.0								622.0
10.0								621.0
11.0								620.0
12.0								619.0
13.0								618.0
14.0		SAND; brown, grey, speckled medium grained sand						617.0
15.0								616.0
16.0								615.0
17.0		CLAY; brown, sandy						614.0
18.0		SAND; grey, medium speckled sand		MW2				613.0
19.0								612.0
20.0								611.0
21.0								610.0
22.0								609.0
23.0								608.0
24.0				MW2				607.0
25.0								606.0

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 38.1 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/24/05
Fig. No: 17094	Page 1 of 2

05/11/04 02:28PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-02
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:352457.80 N:5950583.37	ELEVATION: 630.71 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
25.0								605.0
26.0							-25.9 m	
27.0		SAND AND GRAVEL; coarse grained sand and gravel, coal chips, wood					-26.2 m	604.0
28.0								603.0
29.0		- at 29.0 m lots of chatter on drill stem						602.0
30.0				MW2			-51 mm 0.020 SLOT PVC SCREEN	601.0
31.0								600.0
32.0								599.0
33.0								598.0
34.0		SHALE; grey, dense					-33.8 m	597.0
35.0								596.0
36.0				MW2				595.0
37.0								594.0
38.0		END OF HOLE 38.1 m					-38.1 m	593.0
39.0								592.0
40.0								591.0
41.0								590.0
42.0								589.0
43.0								588.0
44.0								587.0
45.0								586.0
46.0								585.0
47.0								584.0
48.0								583.0
49.0								582.0
50.0								581.0

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 38.1 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/24/05
Fig. No: 17094	Page 2 of 2

05/11/04 02:28PM (PELTGN-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-03
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:353030.21 N:5952940.90	ELEVATION: 623.79 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		ORGANIC SOIL; frozen, black, grass mat, some fill beneath					STICKUP (0.64 m)	623.0
1.0		SAND; brown, fine to medium grained					-51 mm PVC CASING	
2.0								622.0
3.0							-3.1 m	621.0
4.0								620.0
5.0							-TOC ELEVATION: 624.43 m	619.0
6.0							-BOREHOLE DIAMETER = 159 mm	618.0
7.0		CLAY; grey, silty		MW3				617.0
8.0				MW3				616.0
9.0								615.0
10.0								614.0
11								613.0
12.0								612.0
13.0								611.0
14.0								610.0
15.0								609.0
16.0								608.0
17.0				MW3				607.0
18.0		CLAY TILL; grey silty clay, some sand and pebbles						606.0
19.0								605.0
20.0								604.0
21.0								603.0
22.0								602.0
23.0							-22.9 m	601.0
24.0							-23.5 m	600.0
25.0		SAND AND GRAVEL; coarse grained sand						599.0

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 31.4 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/25/05
Fig. No: 17094	Page 1 of 2

05/11/04 02:28PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-03
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:353030.21 N:5952940.90	ELEVATION: 623.79 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
25.0		with coal and gravel					-25.0 m	598.0
26.0				MW3				
27.0				MW3				597.0
28.0							-51 mm 0.020 SLOT PVC SCREEN	596.0
29.0								595.0
30.0		SHALE; grey, dense		MW3			-29.6 m	594.0
31.0							-31.4 m	593.0
32.0		END OF HOLE 31.4 m						592.0
33.0								591.0
34.0								590.0
35.0								589.0
36.0								588.0
37.0								587.0
38.0								586.0
39.0								585.0
40.0								584.0
41.0								583.0
42.0								582.0
43.0								581.0
44.0								580.0
45.0								579.0
46.0								578.0
47.0								577.0
48.0								576.0
49.0								575.0
50.0								574.0

Stantec Consulting Ltd.	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 31.4 m
Edmonton, Alberta	REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/25/05
	Fig. No: 17094	Page 2 of 2

05/11/04 02:28PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-04
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:354823.41 N:5953959.76	ELEVATION: 620.25 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		ORGANIC SOIL; black, frozen					STICKUP (0.54 m)	620.0
1.0		CLAY; grey, sandy					-152 mm PVC CASING	619.0
2.0							-1.5 m	618.0
3.0							-TOC ELEVATION: 620.79 m	617.0
4.0							-BOREHOLE DIAMETER = 222 mm	616.0
5.0								615.0
6.0								614.0
7.0		SAND; brown, fine to coarse grained, pebbles, black speckles		MW4				613.0
8.0								612.0
9.0								611.0
10.0								610.0
11.0								609.0
12.0								608.0
13.0								607.0
14.0								606.0
15.0								605.0
16.0								604.0
17.0		- at 16.8 m finer grained brown sand						603.0
18.0							-18.3 m	602.0
19.0		- at 18.3 m back to medium to coarse grained grey/brown sand					-19.5 m	601.0
20.0								600.0
21.0		SHALE; grey, clay		MW4				599.0
22.0		SAND; grey, medium to coarse grained		MW4			-21.6 m	598.0
23.0		SAND AND GRAVEL; grey, coarse grained sand and gravel, wood fibers		MW4				597.0
24.0								596.0
25.0							-155 mm 0.020 SLOT PVC SCREEN	

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 30.5 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/25/05
Fig. No: 17094	Page 1 of 2

05/11/04 02:32PM (PETION-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-04
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:354823.41 N:5953959.76	ELEVATION: 620.25 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
25.0								595.0
26.0		SHALE; grey					-26.2 m	594.0
27.0								593.0
28.0								592.0
29.0								591.0
30.0				MW4				590.0
31.0		END OF HOLE 30.5 m					-30.5 m	589.0
32.0								588.0
33.0								587.0
34.0								586.0
35.0								585.0
36.0								584.0
37.0								583.0
38.0								582.0
39.0								581.0
40.0								580.0
41.0								579.0
42.0								578.0
43.0								577.0
44.0								576.0
45.0								575.0
46.0								574.0
47.0								573.0
48.0								572.0
49.0								571.0
50.0								

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 30.5 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/25/05
Fig. No: 17094	Page 2 of 2

05/11/04 02:52PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-05
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:354293.74 N:5954889.46	ELEVATION: 624.28 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		TOPSOIL; frozen, black, some organics					STICKUP (0.61 m)	624.0
1.0		SAND; brown, fine to medium grained					-51 mm PVC CASING	623.0
2.0								622.0
3.0							-3.1 m	621.0
4.0		CLAY; brown, soft, silty					-TOC ELEVATION: 624.89 m	
5.0							-BOREHOLE DIAMTER = 159 mm	620.0
6.0								619.0
7.0		- from 7.3 to 10.7 m blue, silty clay						618.0
8.0								617.0
9.0								616.0
10.0								615.0
11.0		TILL; blue, silty clay, small gravel, multi colored						614.0
12.0								613.0
13.0								612.0
14.0								611.0
15.0								610.0
16.0		GRAVEL; large gravel, multi colored, tower shakes						609.0
17.0		TILL; sandy, sandy clay, fine grained, small gravel, grey						608.0
18.0		SAND AND GRAVEL; grey, medium to coarse grained sand, small gravel						607.0
19.0		CLAY TILL; sandy, grey, fine grained sandy clay till		MW5				606.0
20.0								605.0
21.0								604.0
22.0							-22.6 m	603.0
23.0		- well cemented from 23.2 to 25.0 m					-23.2 m	602.0
24.0								601.0
25.0				MW5				600.0

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 37.5 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 02/03/05
Fig. No: 17094	Page 1 of 2

05/11/04 02:29PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-05
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:354293.74 N:5954889.46	ELEVATION: 624.28 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
25.0								599.0
26.0		SAND; grey, salt and pepper color, fine to medium grained sand		MW5				598.0
27.0							-26.8 m	597.0
28.0		GRAVEL; small to large gravel, multi colored, sand and gravel mixed alot		MW			-28.4 m	596.0
29.0								595.0
30.0							-51 mm 0.020 SLOT PVC SCREEN	594.0
31.0							-31.4 m	593.0
32.0		SHALE; grey, dense						592.0
33.0								591.0
34.0								590.0
35.0								589.0
36.0								588.0
37.0								587.0
38.0		END OF HOLE 37.5 m					-37.5 m	586.0
39.0								585.0
40.0								584.0
41.0								583.0
42.0								582.0
43.0								581.0
44.0								580.0
45.0								579.0
46.0								578.0
47.0								577.0
48.0								576.0
49.0								575.0
50.0								

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 37.5 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 02/03/05
Fig. No: 17094	Page 2 of 2

05/11/04 02:29PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-06
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:361559.34 N:5958812.22	ELEVATION: 629.61 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		TOPSOIL; black/brown, frozen, organics					STICKUP (0.67 m)	629.0
1.0		CLAY; sandy, light brown, fine grained					-51 mm PVC CASING	
2.0								628.0
3.0		- at 3.1 m turns grey, silty					-3.1 m	627.0
4.0				MW6			-TOC ELEVATION: 630.28 m	626.0
5.0							-BOREHOLE DIAMETER = 159 mm	625.0
6.0								624.0
7.0				MW6				623.0
8.0		CLAY TILL; grey, silty, clay, some rocks and pebbles						622.0
9.0								621.0
10.0								620.0
11.0								619.0
12.0								618.0
13.0								617.0
14.0		- at 13.7 m becomes more sandy, firm						616.0
15.0								615.0
16.0								614.0
17.0								613.0
18.0								612.0
19.0								611.0
20.0								610.0
21.0								609.0
22.0								608.0
23.0		SAND; grey, black speckled, medium grained, some silt						607.0
24.0		CLAY; grey, sandy, silty		MW6				606.0
25.0		SAND;						605.0

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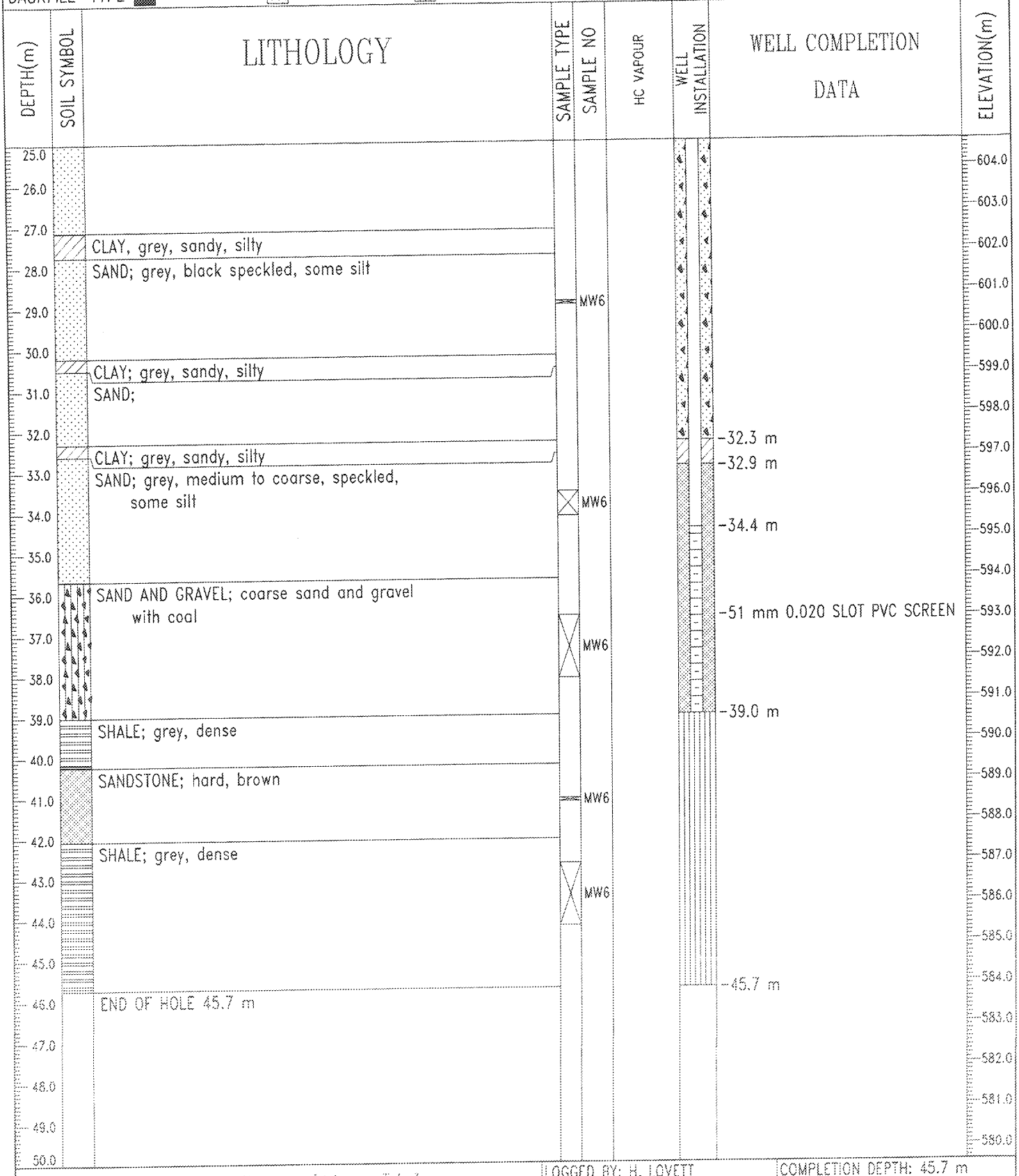
LOGGED BY: H. LOVETT	COMPLETION DEPTH: 45.7 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/31/05
Fig. No: 17094	Page 1 of 2

05/11/04 02:42PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-06
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:361559.34 N:5958812.22	ELEVATION: 629.61 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND



Stantec Consulting Ltd. Edmonton, Alberta	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 45.7 m
	REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/31/05
	Fig. No: 17094	Page 2 of 2

05/11/04 02:42PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-07
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:359089.70 N:5959604.24	ELEVATION: 630.41 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		SAND; brown, medium to coarse grained sand and gravel					STICKUP (0.60 m) -152 mm PVC CASING	630.0
1.0								629.0
2.0								628.0
3.0		CLAY; grey, sandy					-TOC ELEVATION: 631.01 m -BOREHOLE DIAMETER = 222 mm	627.0
4.0		SAND; grey, fine grained						626.0
5.0								625.0
6.0								624.0
7.0								623.0
8.0								622.0
9.0								621.0
10.0		CLAY; grey, sandy						620.0
11.0								619.0
12.0								618.0
13.0		SAND; grey, fine grained						617.0
14.0								616.0
15.0								615.0
16.0								614.0
17.0		CLAY TILL; grey, sandy clay with pebbles						613.0
18.0								612.0
19.0								611.0
20.0								610.0
21.0								609.0
22.0								608.0
23.0								607.0
24.0								606.0
25.0								

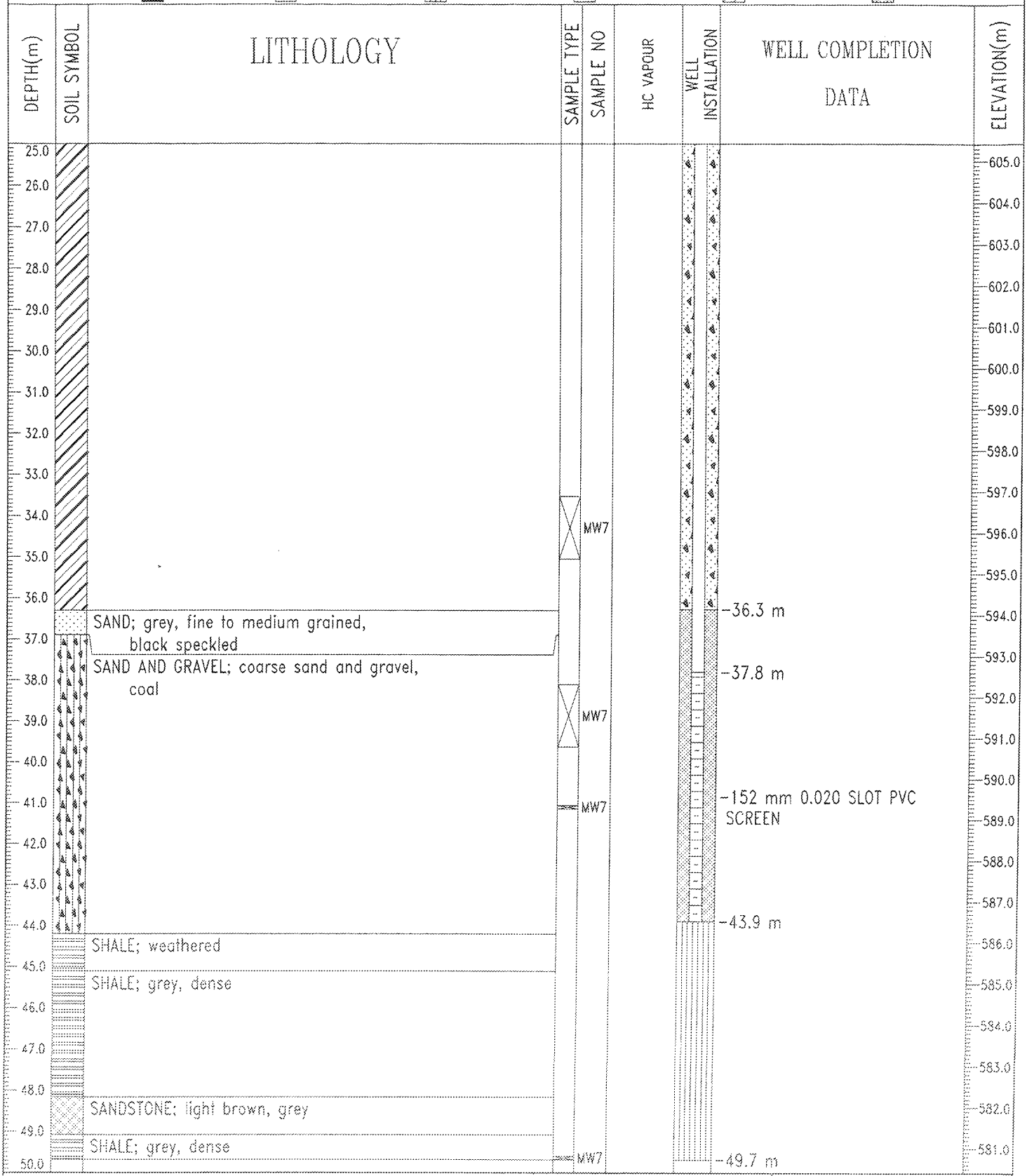
Stantec Consulting Ltd. Edmonton, Alberta	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 49.7 m
	REVIEWED BY: D. YOSHISAKA	COMPLETE: 02/14/05
	Fig. No: 17094	Page 1 of 2

05/11/04 02:47PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-07
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:359089.70 N:5959604.24	ELEVATION: 630.41 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND



Stantec Consulting Ltd. Edmonton, Alberta	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 49.7 m
	REVIEWED BY: D. YOSHISAKA	COMPLETE: 02/14/05
	Fig. No: 17094	Page 2 of 2

05/11/04 02:47PM (PETIGM-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-08
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:363133.77 N:5961204.95	ELEVATION: 625.87 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		TOPSOIL; black, roots, grasses					STICKUP (0.57 m)	625.0
1.0		SAND; brown/black grains, fine to medium grained					-51 mm PVC CASING	
2.0		CLAY; brown/grey, silty						624.0
3.0							-3.1 m	623.0
4.0							-TOC ELEVATION: 626.44 m	622.0
5.0		SAND; silty, brown, very fine grained					-BOREHOLE DIAMETER = 159 mm	621.0
6.0								620.0
7.0								619.0
8.0								618.0
9.0								617.0
10.0		CLAY; blue/grey, silty						616.0
11.0								615.0
12.0								614.0
13.0								613.0
14.0		CLAY TILL; blue clay, sandy						612.0
15.0								611.0
16.0								610.0
17.0								609.0
18.0								608.0
19.0		SAND; coarse grained, grey/brown						607.0
20.0		CLAY TILL; blue clay, small gravel, sandy						606.0
21.0								605.0
22.0				MW8				604.0
23.0								603.0
24.0		SHALE; rafted						602.0
25.0								601.0

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Edmonton Alberta

LOGGED BY: H. LOVETT	COMPLETION DEPTH: 37.8 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 02/03/05
Fig. No: 17094	Page 1 of 2

05/11/04 02:28PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-08
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:363133.77 N:5961204.95	ELEVATION: 625.87 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
25.0								600.0
26.0		SAND; fine to medium grained, grey, black specks						599.0
27.0								598.0
28.0				MW8			-28.0 m	597.0
29.0							-28.7 m	596.0
30.0				MW8			-30.5 m	595.0
31.0		GRAVEL; brown/black, small gravel, coal chunks						594.0
32.0							-51 mm 0.020 SLOT PVC SCREEN	593.0
33.0				MW8			-33.5 m	592.0
34.0								591.0
35.0		SHALE; grey, dense						590.0
36.0				MW8				589.0
37.0								588.0
38.0		END OF HOLE 37.8 m					-37.8 m	587.0
39.0								586.0
40.0								585.0
41.0								584.0
42.0								583.0
43.0								582.0
44.0								581.0
45.0								580.0
46.0								579.0
47.0								578.0
48.0								577.0
49.0								576.0
50.0								

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Edmonton, Alberta

LOGGED BY: H. LOVETT	COMPLETION DEPTH: 37.8 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 02/03/05
Fig. No: 17094	Page 2 of 2

05/11/04 05:29PM (PELTGR-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-09
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:361003.46 N:5962032.28	ELEVATION: 624.06 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		ORGANIC SOIL; frozen, black					STICKUP (0.67 m)	624.0
1.0		CLAY; silty, light brown, some sand, some pebbles					-51 mm PVC CASING	623.0
2.0								622.0
3.0		- at 3.1 m turns darker brown					-TOC ELEVATION: 624.73 m	621.0
4.0							-BOREHOLE DIAMETER = 159 mm	620.0
5.0								619.0
6.0								618.0
7.0								617.0
8.0								616.0
9.0								615.0
10.0								614.0
11.0		CLAY TILL; grey, silty, some pebbles						613.0
12.0								612.0
13.0								611.0
14.0								610.0
15.0		- at 14.6 m becomes sandy						609.0
16.0								608.0
17.0								607.0
18.0		SAND; grey, fine to medium grained, some clay and coal						606.0
19.0		CLAY TILL; grey, fine to medium grained sand and pebbles						605.0
20.0								604.0
21.0								603.0
22.0								602.0
23.0								601.0
24.0								600.0
25.0								

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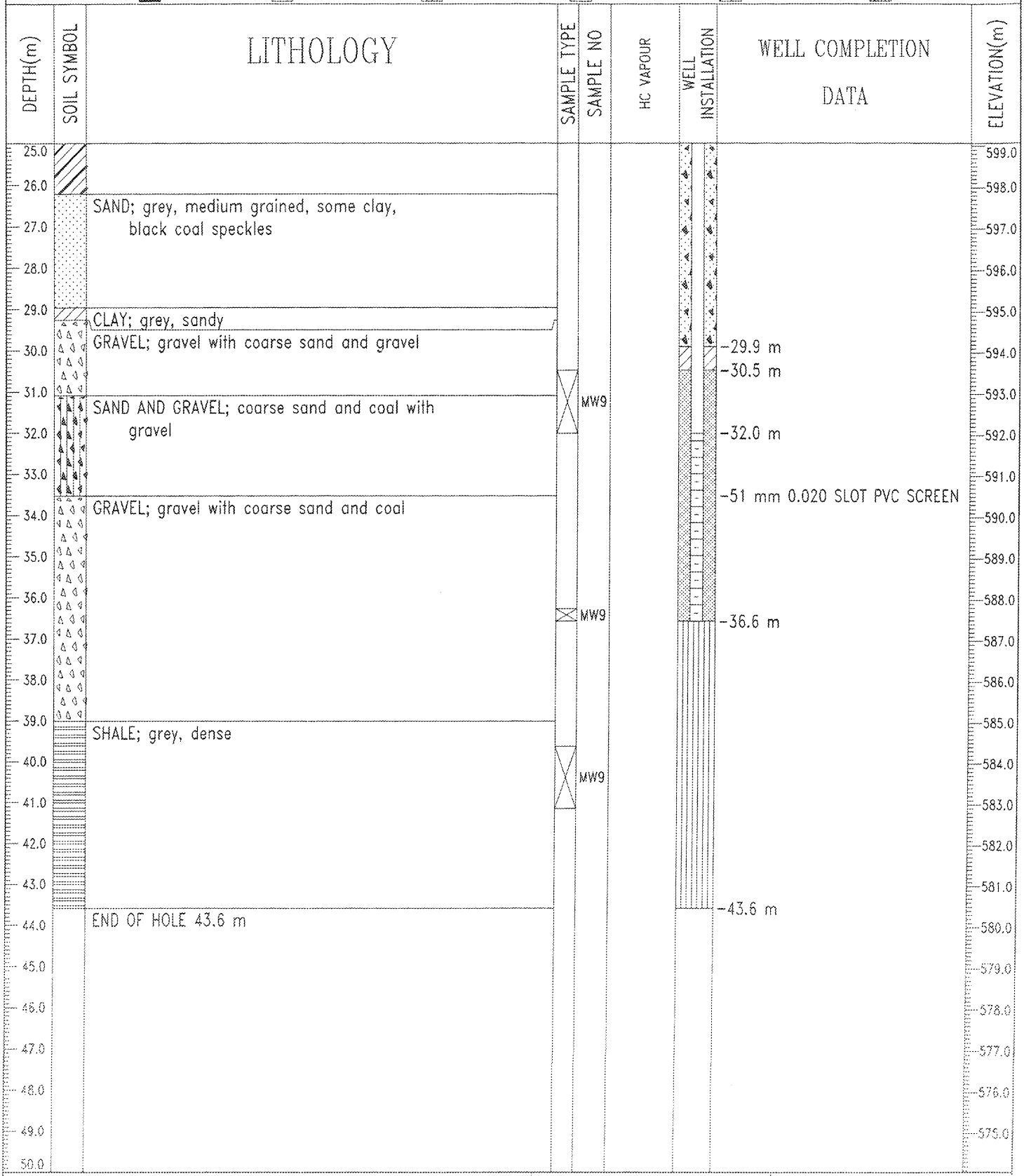
LOGGED BY: H. LOVETT	COMPLETION DEPTH: 43.6 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/28/05
Fig. No: 17094	Page 1 of 2

05/11/04 02:30PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-09
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:361003.46 N:5962032.28	ELEVATION: 624.06 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND



Stantec Consulting Ltd. Edmonton, Alberta	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 43.6 m
	REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/28/05
	Fig. No: 17094	Page 2 of 2

05/11/04 02:30PM (PETOR-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-10
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:364,954.62 N:5,963,505.11	ELEVATION: 624.06 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		TOPSOIL; brown, frozen, sandy					STICKUP (0.61 m)	624.0
1.0		SAND; brown, fine to medium grained					-152 mm PVC CASING	623.0
2.0								622.0
3.0		- at 3.1 m turns grey, some silt					-3.0 m	621.0
4.0							-TOC ELEVATION: 624.67 m	620.0
5.0							-BOREHOLE DIAMETER = 200 mm	619.0
6.0								618.0
7.0								617.0
8.0		CLAY; grey, silty						616.0
9.0								615.0
10.0								614.0
11.0								613.0
12.0		SAND; grey, fine grained						612.0
13.0								611.0
14.0								610.0
15.0								609.0
16.0		CLAY TILL; grey, silty						608.0
17.0		SILT; sandy, grey, fine grained sand and silt						607.0
18.0		CLAY TILL; grey, silty						606.0
19.0								605.0
20.0								604.0
21.0								603.0
22.0								602.0
23.0		SAND; grey, fine grained, some silt						601.0
24.0								600.0
25.0		CLAY; grey, silty, harder						

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LOGGED BY: H. LOVETT | COMPLETION DEPTH: 44.8 m
REVIEWED BY: D. YOSHISAKA | COMPLETE: 01/26/05
Fig. No: 17094 |

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-10
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:364,954.62 N:5,963,505.11	ELEVATION: 624.06 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	LITHOLOGY	SAMPLE TYPE / SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
25.0						599.0
26.0	SAND; cemented, grey, black speckled					598.0
27.0						597.0
28.0		MW10				596.0
29.0						595.0
30.0					-30.2 m	594.0
31.0					-31.4 m	593.0
32.0						592.0
33.0						591.0
34.0	SAND AND GRAVEL; coarse grained sand and gravel, coal	MW10			-SHALE BASKET	590.0
35.0						589.0
36.0					-35.7 m	588.0
37.0		MW10			-152 mm 0.020 SLOT PVC SCREEN	587.0
38.0						586.0
39.0	GRAVEL; mostly gravel, lots of drill stem chatter, some sand					585.0
40.0						584.0
41.0						583.0
42.0	SHALE; grey, dense				-41.8 m	582.0
43.0		MW10				581.0
44.0						580.0
45.0	END OF HOLE 44.8 m				-44.8 m	579.0
46.0						578.0
47.0						577.0
48.0						576.0
49.0						575.0
50.0						

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 44.8 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/26/05
Fig. No: 17094	Page 2 of 2

08/08/3 11:08AM (PELTON-1)

CLIENT: NCIA	DRILLING COMPANY: SPT DRILLING LTD.	BOREHOLE NO: MW-11
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: N:5,965,300.71 E:362,564.36	ELEVATION: 624.491 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	LITHOLOGY	WELL COMPLETION DATA	ELEVATION(m)
0.0	TOPSOIL; soft, black, organic silty soil	-STICKUP (0.67 m)	624.0
	SAND; loose, brown, fine to medium grained	-51 mm PVC CASING	
1.0	CLAY; firm, brown, orange, grey, silty, no pebbles		623.0
2.0	CLAY TILL; firm, brown, sandy clay, grey, silt strands, some orange oxidation, some coal, pebbles		622.0
3.0		-3.0 m	621.0
4.0			
5.0		-BOREHOLE DIAMETER 160 mm	620.0
6.0	- at 5.5 m turns grey		619.0
7.0	- at 6.4 m damp to moist		618.0
8.0			617.0
9.0			616.0
10.0			615.0
11.0			614.0
12.0			613.0
13.0			612.0
14.0			611.0
15.0			610.0
16.0	- from 15.2 to 17.7 m lots of sand, coarse grained, speckled, larger rocks mixed with clay, wet		609.0
17.0			608.0
18.0	- at 17.7 m returns to firm, grey clay till		607.0
19.0	- at 18.9 m small band of coarse grained sand then returns to grey		606.0
20.0			605.0

SAMPLE TYPE | SAMPLE NO | HC VAPOUR | SLOTTED PIEZOMETER

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LOGGED BY: H. LOVETT	COMPLETION DEPTH: 44.2 m
REVIEWED BY: H. LOVETT	COMPLETE: 09/24/04
Fig. No: 17094	Page 1 of 3

08/08/29 11:03AM (PELTON-1)

CLIENT: NCIA	DRILLING COMPANY: SPT DRILLING LTD.	BOREHOLE NO: MW-11
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: N:5,965,300.71 E:362,564.36	ELEVATION: 624.491 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	SLOTTED PIEZOMETER	WELL COMPLETION DATA	ELEVATION(m)
20.0		clay till						604.0
21.0								603.0
22.0								602.0
23.0								601.0
24.0								600.0
25.0								599.0
26.0								598.0
27.0		SAND; loose, fine to medium grained, wet						597.0
28.0								596.0
29.0								595.0
30.0								594.0
31.0								593.0
32.0								592.0
33.0								591.0
34.0								590.0
35.0							-35.1 m	589.0
36.0								588.0
37.0		SAND AND GRAVEL; loose, grey, wet, large gravel						587.0
38.0							-38.1 m	586.0
39.0								585.0
40.0								

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Edmonton, Alberta

LOGGED BY: H. LOVETT | COMPLETION DEPTH: 44.2 m
REVIEWED BY: H. LOVETT | COMPLETE: 09/24/04
Fig. No: 17094

CLIENT: NCIA	DRILLING COMPANY: SPT DRILLING LTD.	BOREHOLE NO: MW-11
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: N:5,965,300.71 E:362,564.36	ELEVATION: 624.491 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	SLOTTED PIEZOMETER	WELL COMPLETION DATA	ELEVATION(m)
40.0								584.0
41.0							-51 mm 0.010 SLOT PVC SCREEN	583.0
42.0								582.0
43.0								581.0
44.0							-44.2 m	580.0
45.0		SHALE; dark grey, dry						579.0
46.0								578.0
47.0							-47.2 m	577.0
48.0		END OF HOLE 47.2 m NOTE: ON COMPLETION -backfill borehole with 10/20 grade sand to 44.2 mBGL MONITOR WELL INSTALLED -blue steel casing protector with lock added -above ground PVC stickup (0.67 mAGL) ON SEPTEMBER 24, 2004 -water level at 29.84 mBGL ON SEPTEMBER 28, 2004 -water level at 29.83 mBGL LOCAL COORDINATES: N:5242.77 E:2786.27 NOTE: -Originally installed for Shell Scotford Upgrader 04-10-44						576.0
49.0								575.0
50.0								574.0
51.0								573.0
52.0								572.0
53.0								571.0
54.0								570.0
55.0								569.0
56.0								568.0
57.0								567.0
58.0								566.0
59.0								565.0
60.0								

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Edmonton, Alberta

LOGGED BY: H. LOVETT | COMPLETION DEPTH: 44.2 m
REVIEWED BY: H. LOVETT | COMPLETE: 09/24/04
Fig. No: 17094 |

08/08/29 11:12AM (PETTOR-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-12
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:366805.93 N:5968379.85	ELEVATION: 625.46 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	SOIL SYMBOL	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0		MOSS; frozen, green, some organics					STICKUP (0.61 m)	625.0
1.0		SAND; brown, fine to medium grained					-51 mm PVC CASING	624.0
2.0								623.0
3.0							-3.1 m	622.0
4.0							-TOC ELEVATION: 626.07 m	621.0
5.0							-BOREHOLE DIAMETER = 159 mm	620.0
6.0								619.0
7.0								618.0
8.0		CLAY; grey, silty						617.0
9.0		SILT; grey						616.0
10.0								615.0
11.0		CLAY; grey, silty						614.0
12.0								613.0
13.0		SILT; grey						612.0
14.0								611.0
15.0		CLAY; grey, silty						610.0
16.0								609.0
17.0								608.0
18.0								607.0
19.0		CLAY TILL; grey, sandy, clay, some silt, some pebbles						606.0
20.0								605.0
21.0								604.0
22.0								603.0
23.0								602.0
24.0								601.0
25.0								

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Edmonton, Alberta

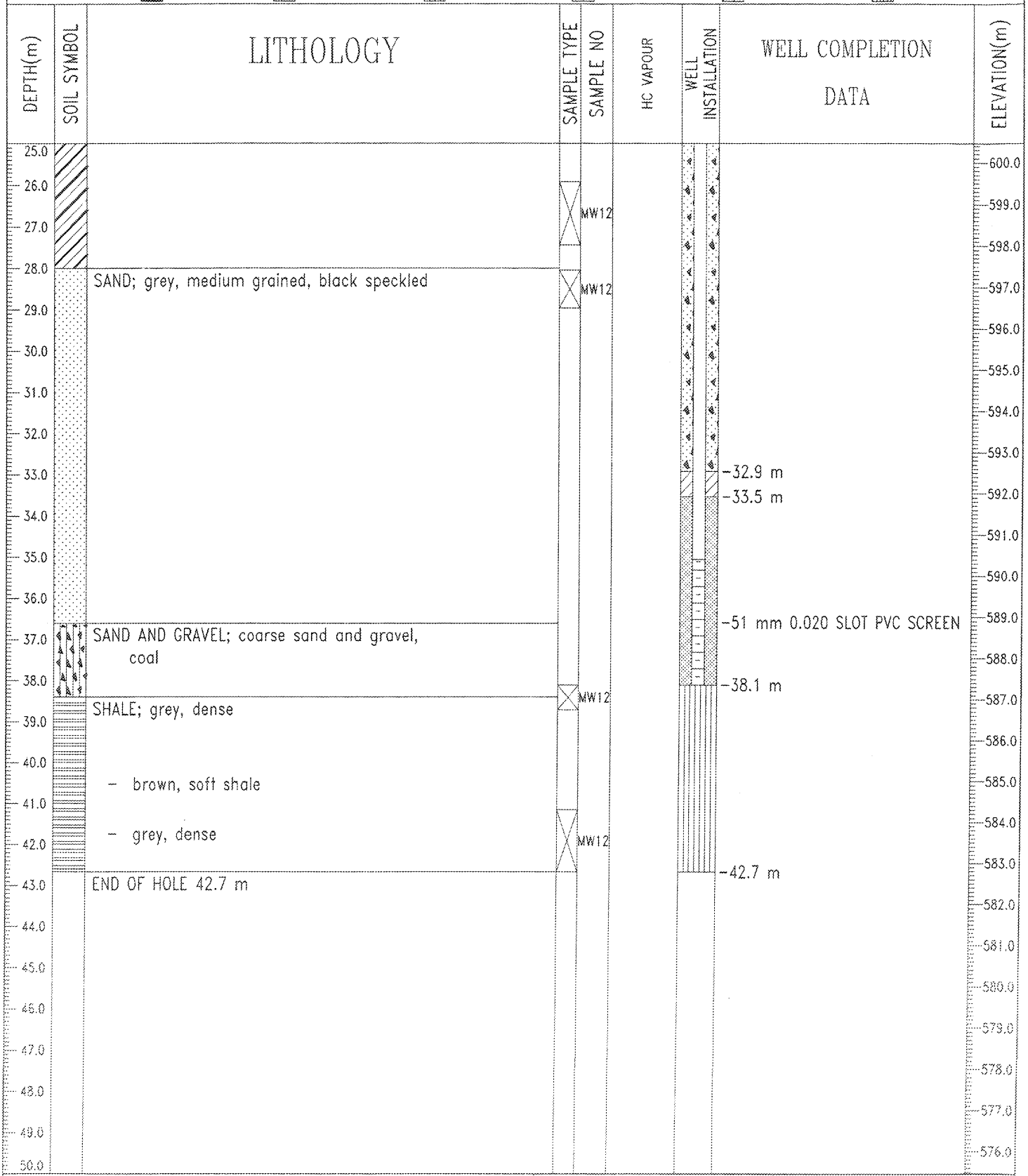
LOGGED BY: H. LOVETT	COMPLETION DEPTH: 42.7 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/02/05
Fig. No: 17094	Page 1 of 2

05/11/04 02:04PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-12
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:366805.93 N:5968379.85	ELEVATION: 625.46 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND



Stantec Consulting Ltd. Edmonton, Alberta	LOGGED BY: H. LOVETT	COMPLETION DEPTH: 42.7 m
	REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/02/05
	Fig. No: 17094	Page 2 of 2

05/11/04 02:30PM (PELICH-L)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-13
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:365292.72 N:5968147.12	ELEVATION: 625.65 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	LITHOLOGY	SAMPLE TYPE	SAMPLE NO	HC VAPOUR	WELL INSTALLATION	WELL COMPLETION DATA	ELEVATION(m)
0.0	PEAT MOSS;					STICKUP (0.63 m)	625.0
1.0	SAND; brown, fine to medium grained					-51 mm PVC CASING	
2.0							624.0
3.0						-3.1 m	623.0
4.0						-TOC ELEVATION: 626.28 m	622.0
5.0						-BOREHOLE DIAMETER = 159 mm	621.0
6.0							620.0
7.0							619.0
8.0	CLAY; brown grey, silty						618.0
9.0	SAND; brown, grey, fine to medium grained, some clay						617.0
10.0	CLAY; grey, silty						616.0
11.0							615.0
12.0							614.0
13.0							613.0
14.0							612.0
15.0							611.0
16.0							610.0
17.0							609.0
18.0							608.0
19.0	CLAY TILL; grey, sandy (fine to medium grained), clay with pebbles - at 19.8 m rock		MW13				607.0
20.0							606.0
21.0							605.0
22.0							604.0
23.0							603.0
24.0							602.0
25.0							601.0

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Edmonton, Alberta

LOGGED BY: H. LOVETT	COMPLETION DEPTH: 43.6 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/02/05
Fig. No: 17094	Page 1 of 2

05/11/04 02:48PM (PELTON-1)

CLIENT: NCIA	FIELD PERSONNEL: H. LOVETT	BOREHOLE NO: MW-13
PROJECT: BEVERLY CHANNEL INVESTIGATION	DRILLING METHOD: MUD ROTARY	PROJECT NO: 1102-17094/400
LOCATION: FORT SASKATCHEWAN, AB	COORDINATES: E:365292.72 N:5968147.12	ELEVATION: 625.65 (m)

SAMPLE TYPE: SHELBY TUBE | NO RECOVERY | GRAB | SPT | A-CASING | CORE

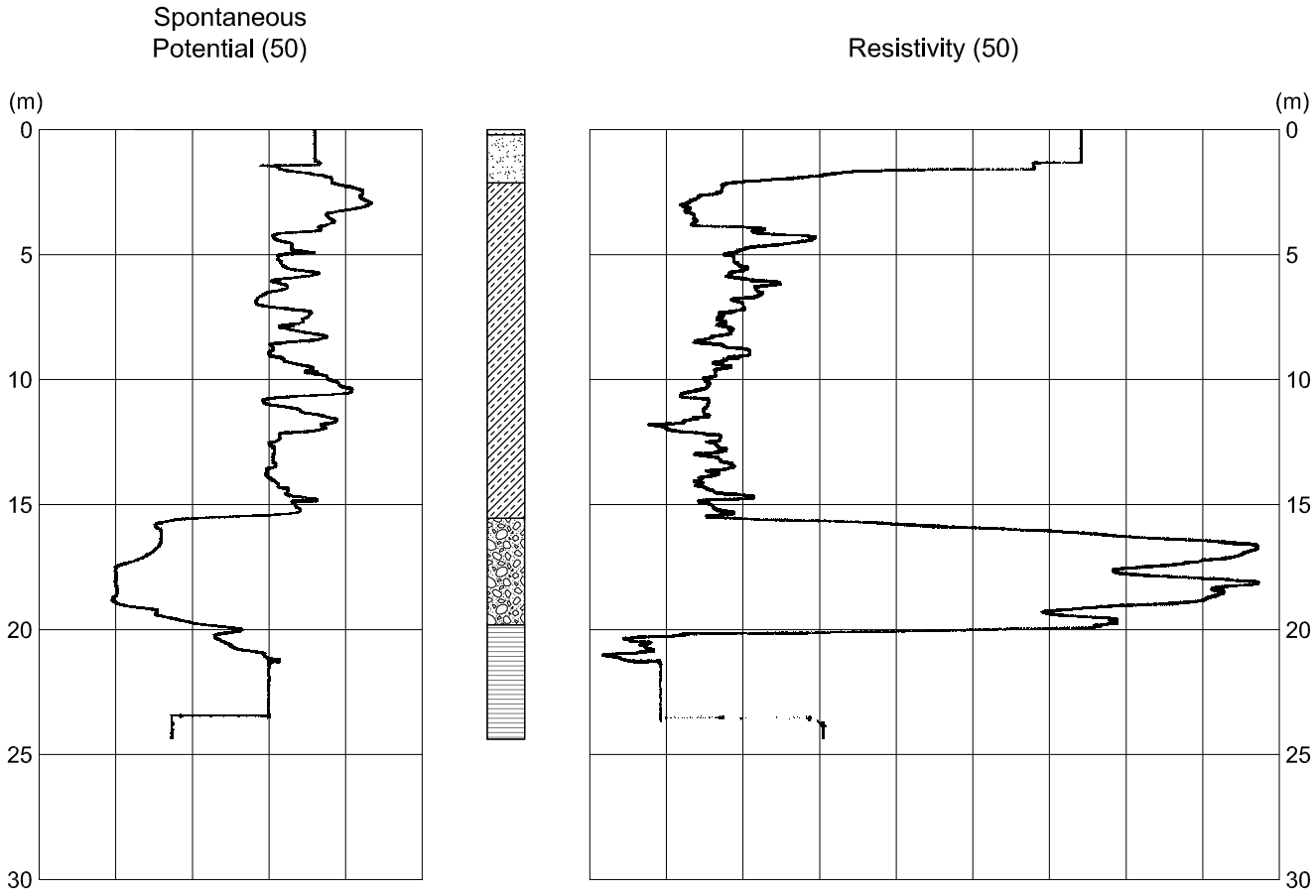
BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | PELTONITE | SAND

DEPTH(m)	LITHOLOGY	SAMPLE NO	WELL COMPLETION DATA	ELEVATION(m)
25.0	SAND; cemented, grey, black speckled, medium grained			600.0
26.0				
27.0		MW13		599.0
28.0				598.0
29.0				597.0
30.0				596.0
31.0				595.0
32.0				594.0
33.0				593.0
34.0				592.0
35.0				591.0
36.0	– at 36.3 m coarse grained sand	MW13	-35.4 m -36.0 m	590.0
37.0				589.0
38.0	GRAVEL; coarse sand – at 37.5 m drill stem chatter		-37.5 m -51 mm 0.020 SLOT PVC SCREEN	588.0
39.0				587.0
40.0				586.0
41.0		MW13	-40.5 m	585.0
42.0	SHALE; grey, dense	MW13		584.0
43.0				583.0
44.0	END OF HOLE 43.6 m		-43.6 m	582.0
45.0				581.0
46.0				580.0
47.0				579.0
48.0				578.0
49.0				577.0
50.0				576.0

Stantec Consulting Ltd.
Edmonton, Alberta

LOGGED BY: H. LOVETT	COMPLETION DEPTH: 43.6 m
REVIEWED BY: D. YOSHISAKA	COMPLETE: 01/02/05
Fig. No: 17094	Page 2 of 2

APPENDIX B
GEOPHYSICAL LOGS



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2005-11-22 10:19AM By: ttieu

November, 2005
1102-17094/800

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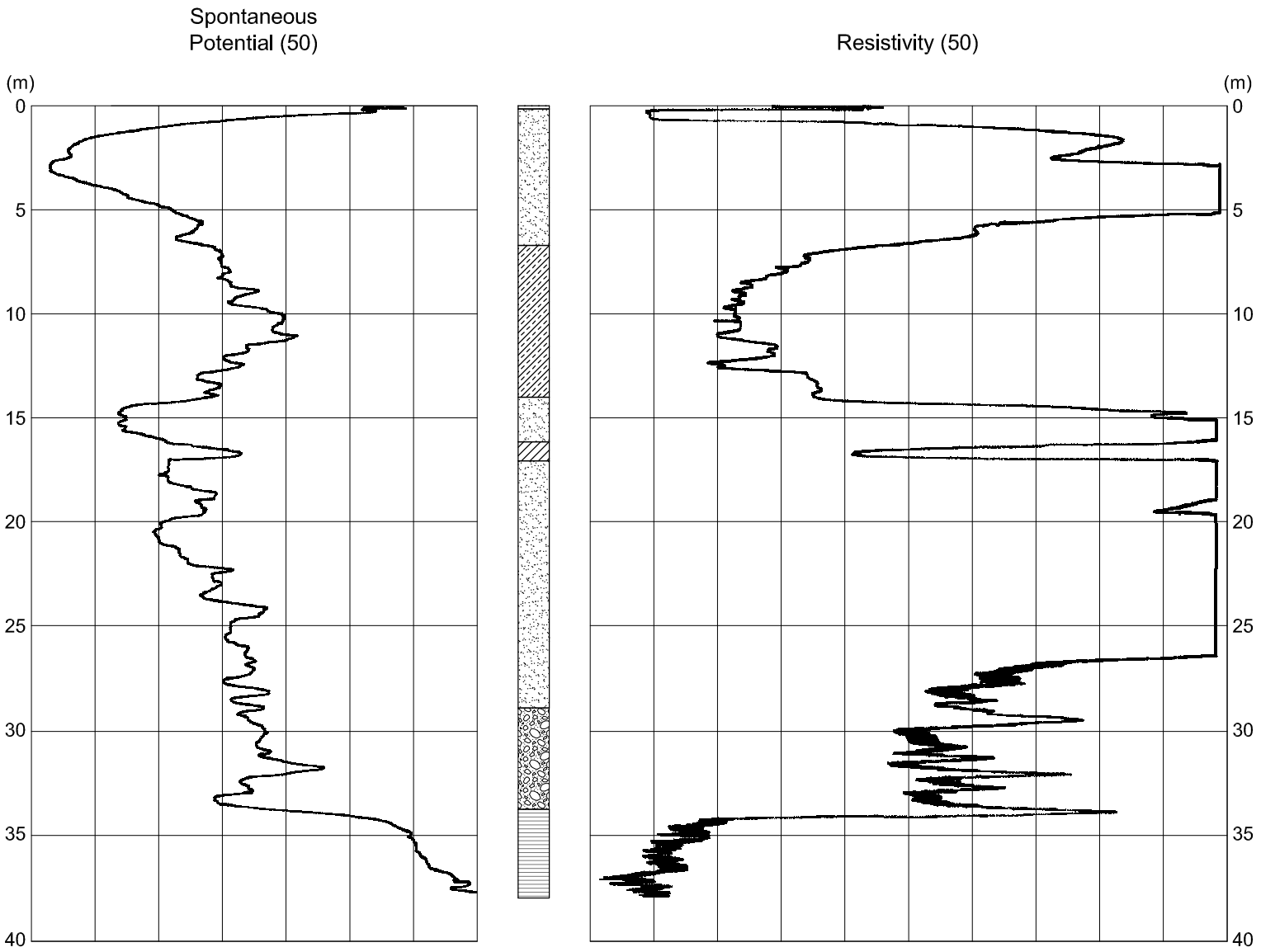
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.

B-1

Title

Geophysical Logs
Borehole MW-01



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2005-11-22 10:21AM By: ttieu

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1102-17094/800

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Figure No.

B-2

Title

Geophysical Logs
Borehole MW-02

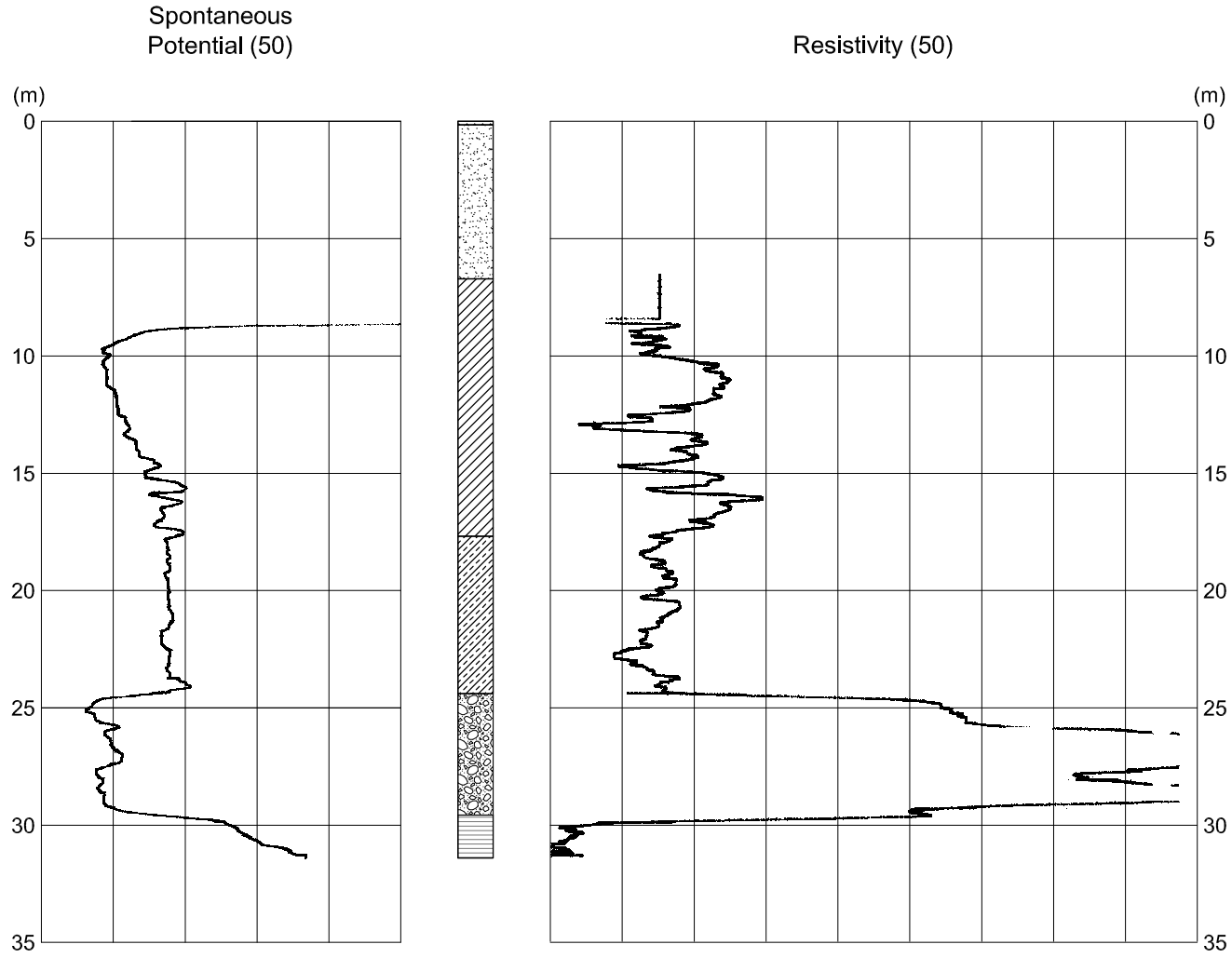

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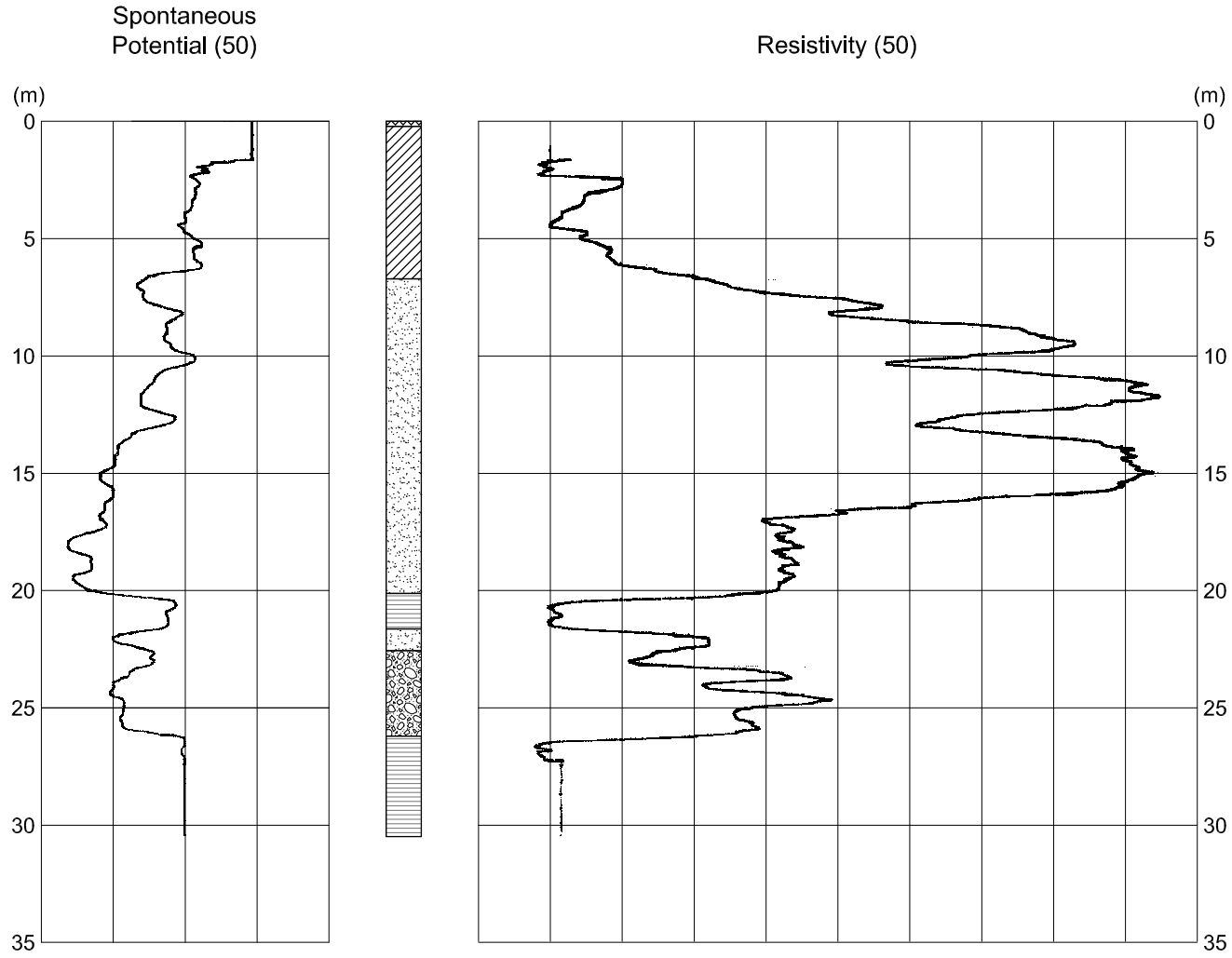
Figure No.

B-3

Title

Geophysical Logs
Borehole MW-03



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2005-11-22 10:20AM By: ttieu

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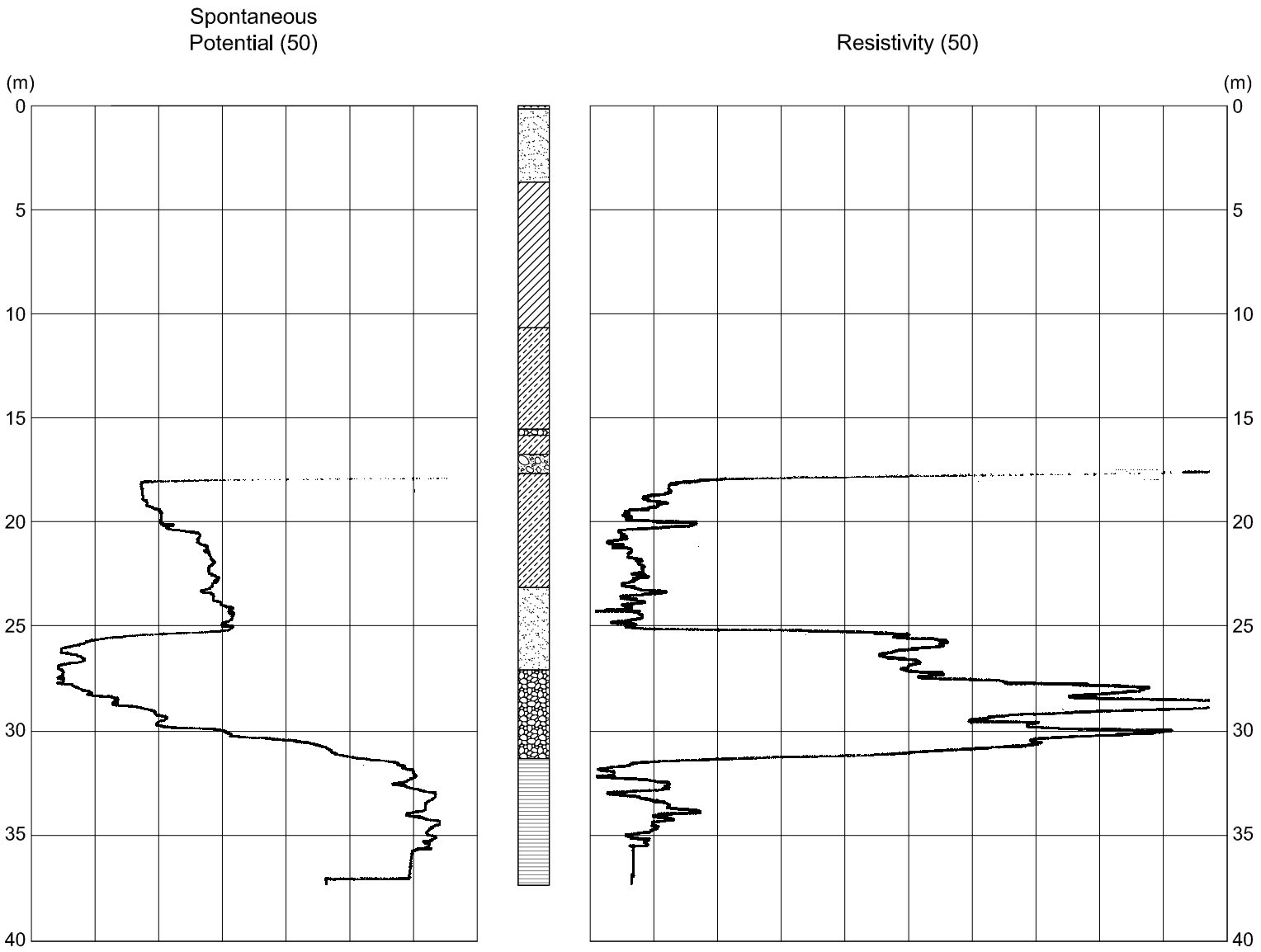
Figure No.

B-4

Title

Geophysical Logs
Borehole MW-04



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2005-11-22 10:20AM By: ttieu

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Figure No.

B-5

Title

Geophysical Logs
Borehole MW-05

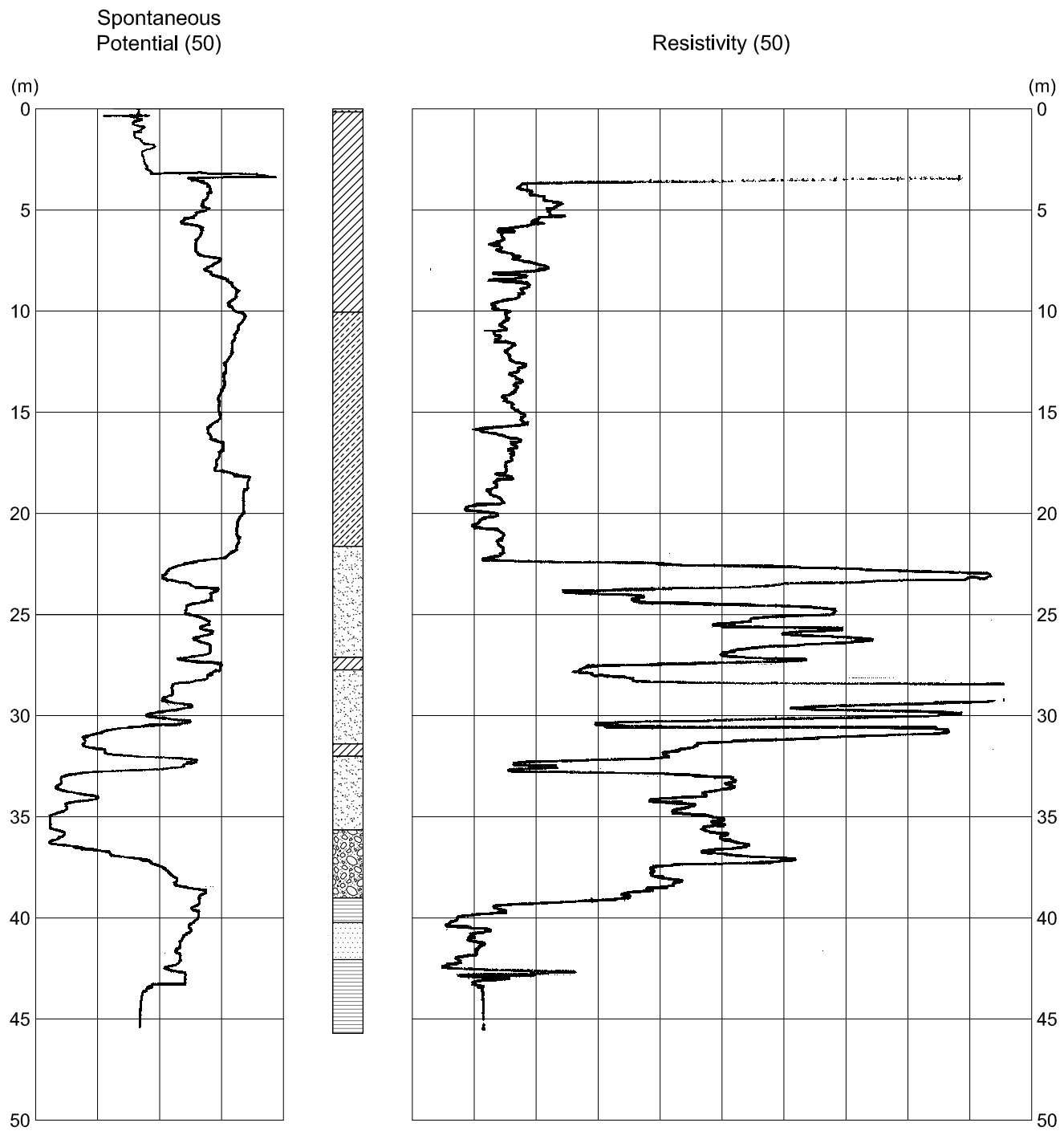

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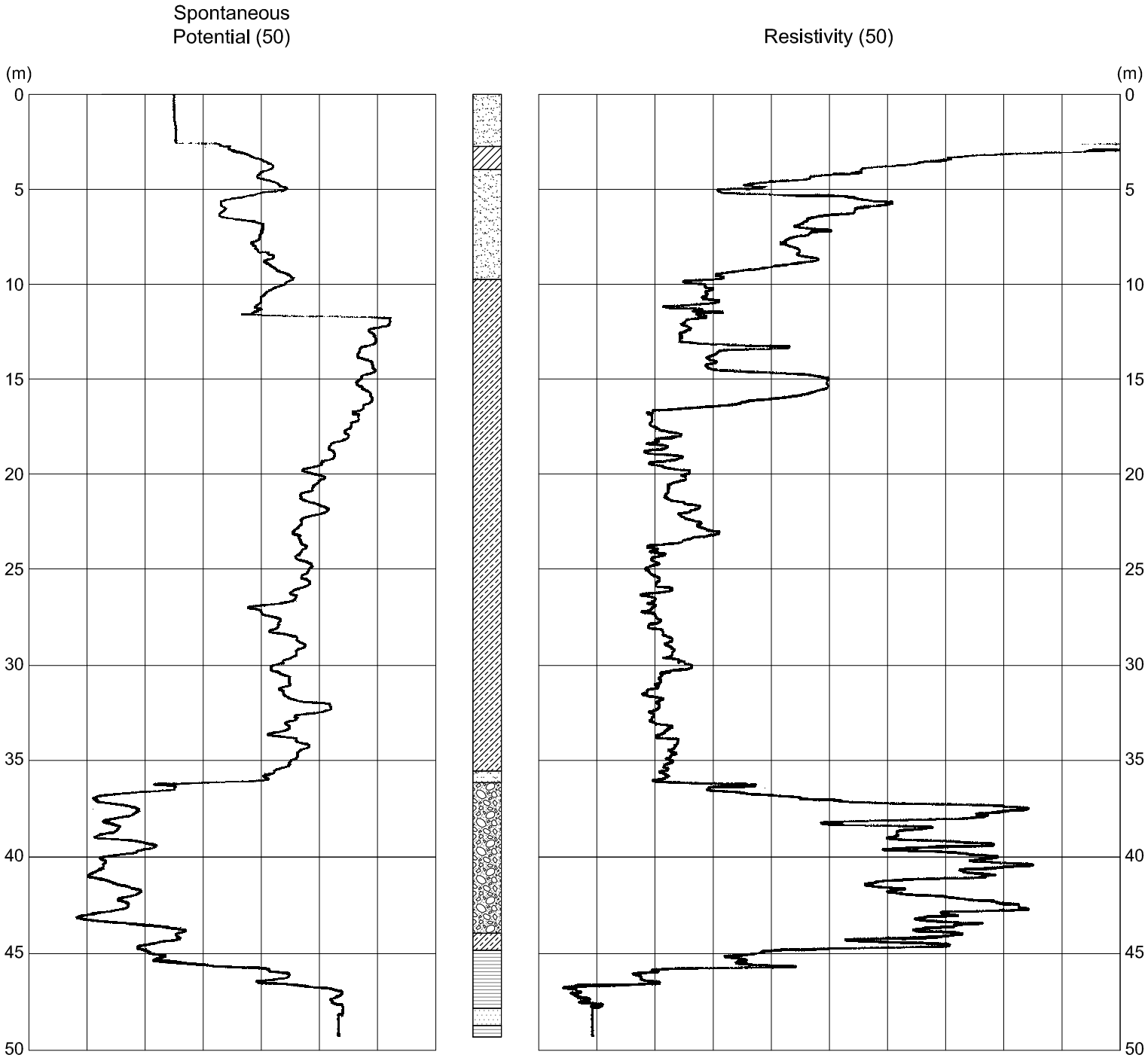
Figure No.

B-6

Title

Geophysical Logs
Borehole MW-06



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1102-17094/800

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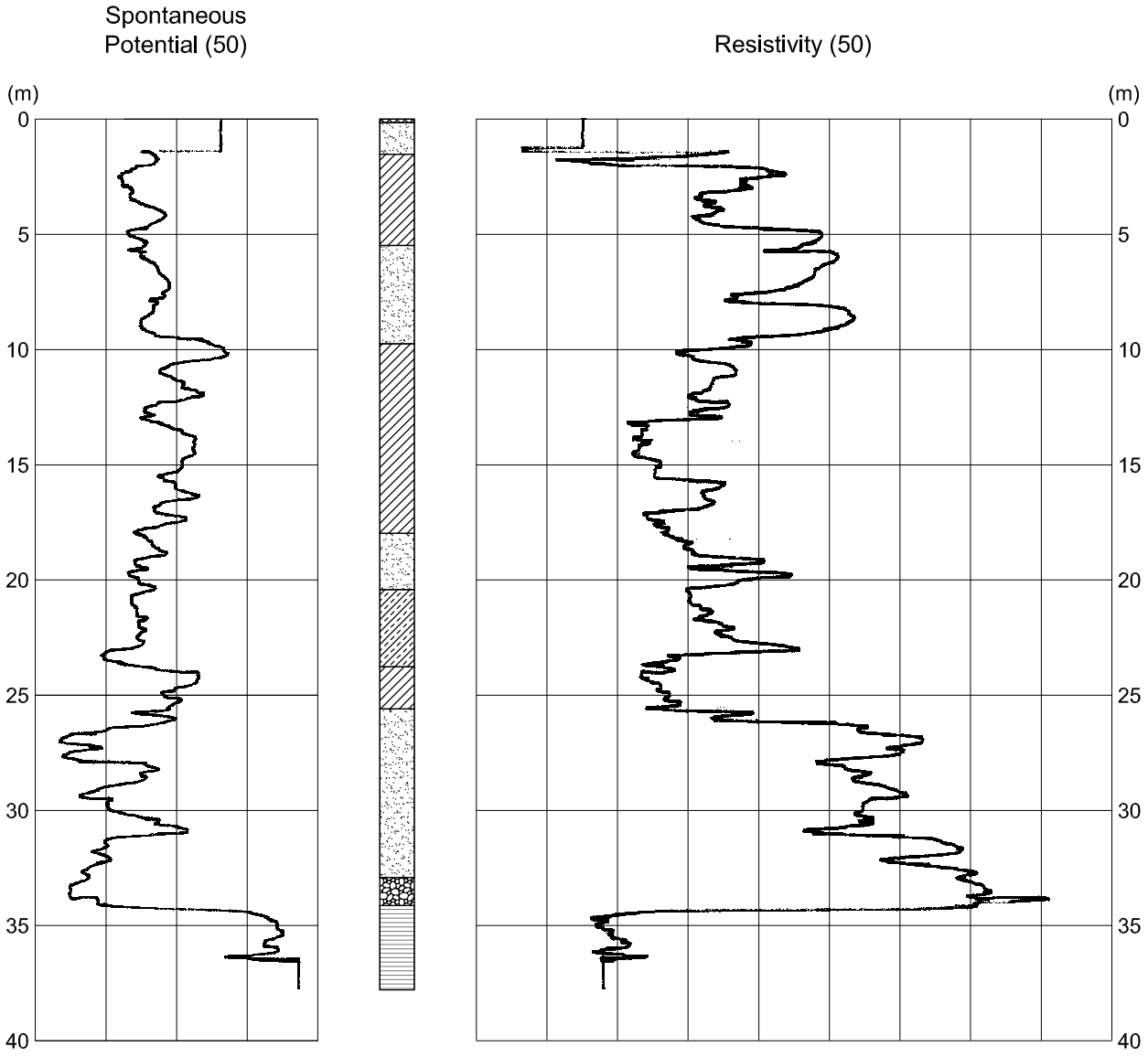
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.

B-7

Title

Geophysical Logs
Borehole MW-07



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2005-11-22 09:58AM By: ttieu

November, 2005
1102-17094/800

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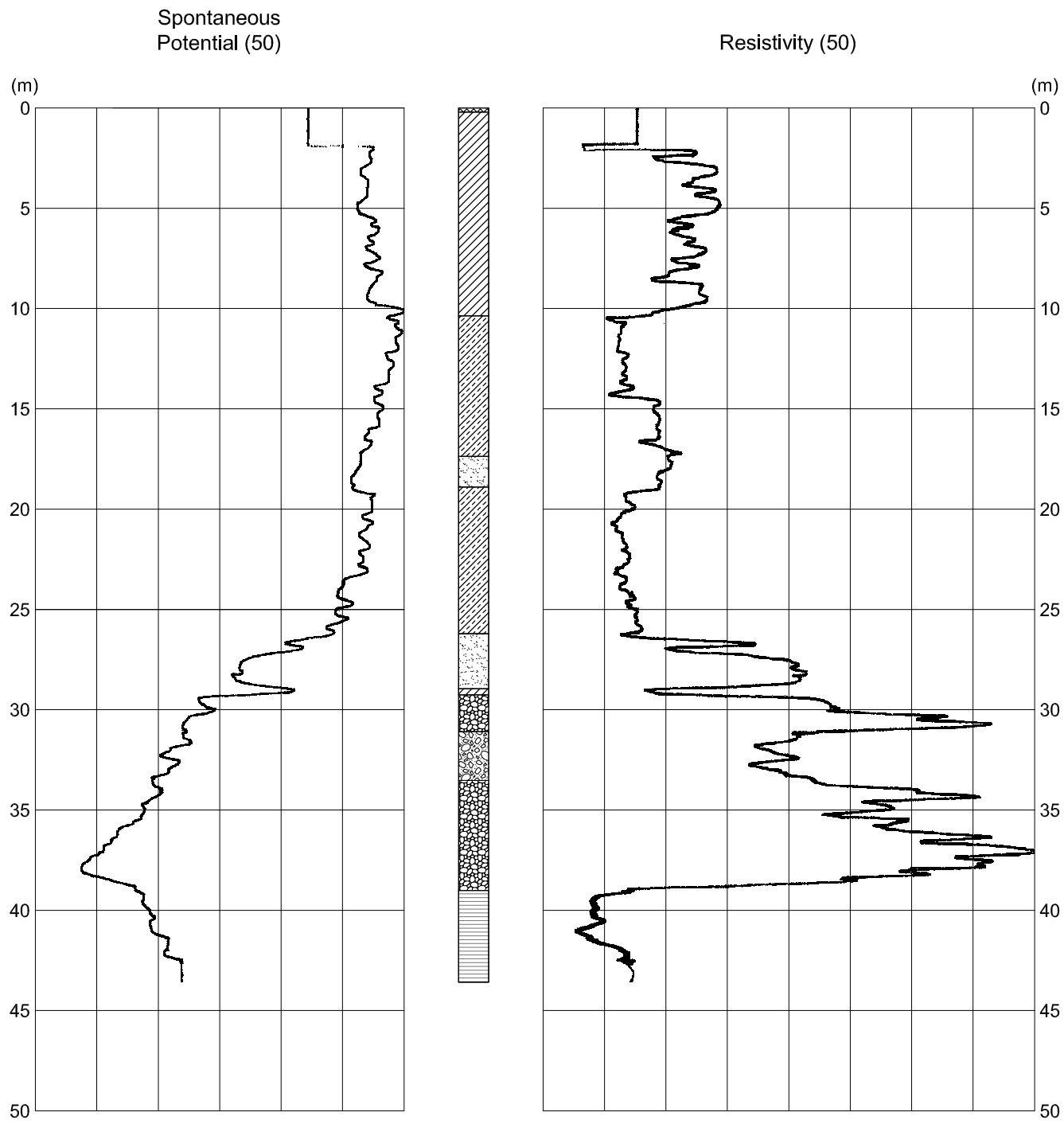
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
B-8

Title
Geophysical Logs
Borehole MW-08



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November, 2005
1102-17094/800

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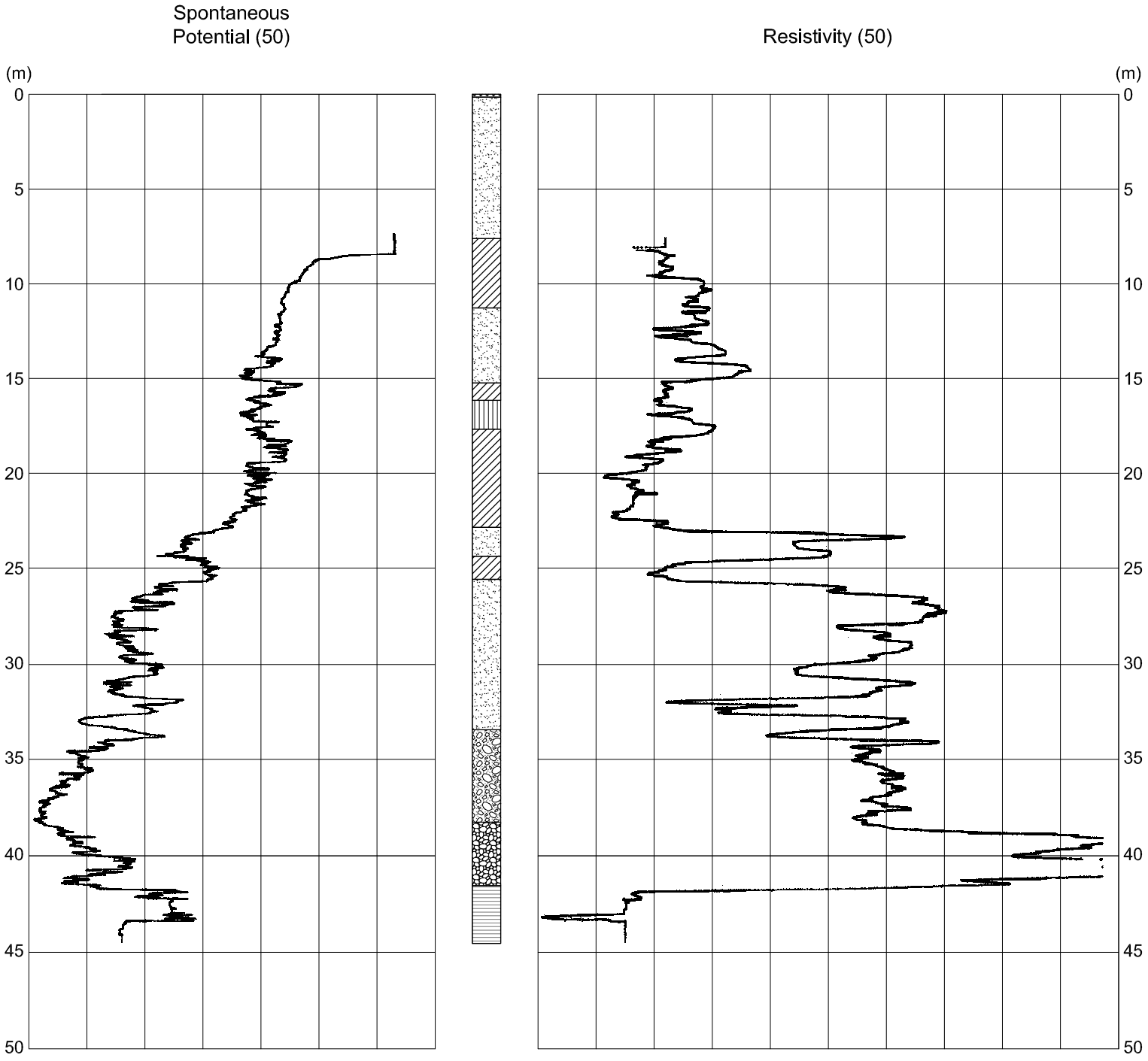
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.

B-9

Title

Geophysical Logs
Borehole MW-09



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1102-17094/800

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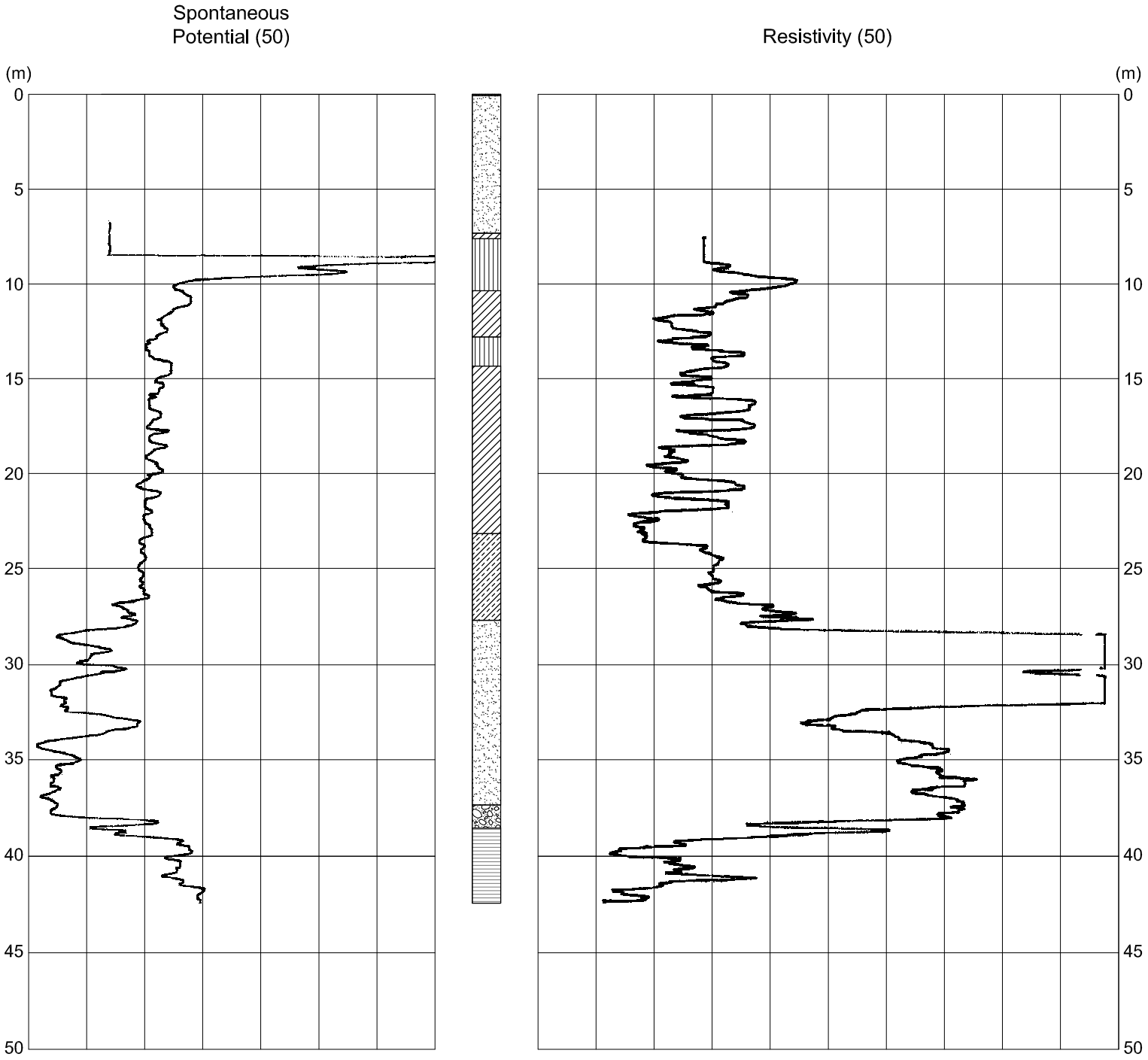
Figure No.
B-10

Title
Geophysical Logs
Borehole MW-10



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2005-11-22 10:25AM By: ttieu

November, 2005
1102-17094/800

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Northeast Capital Industrial Association

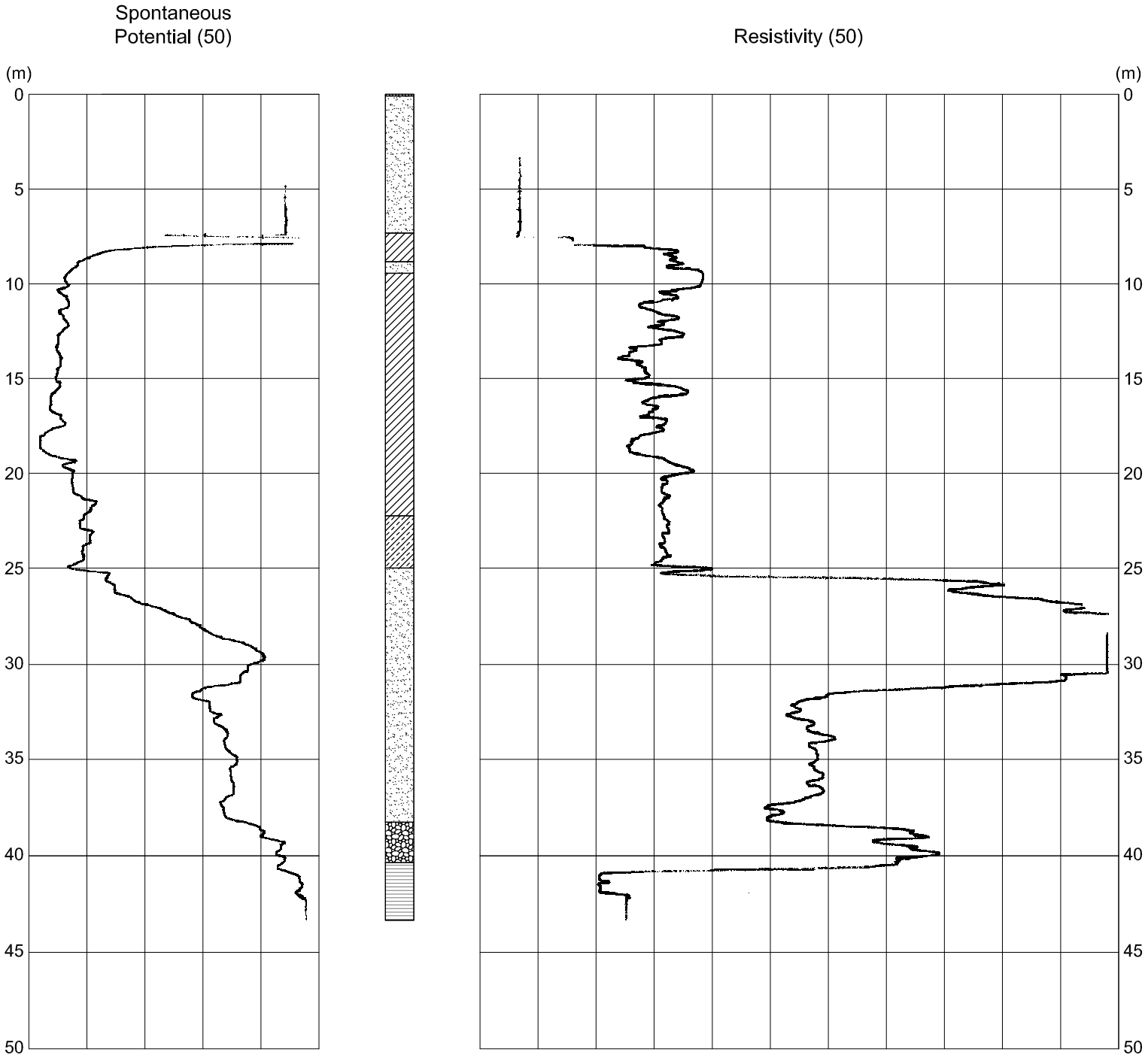
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.

B-11

Title

Geophysical Logs
Borehole MW-12



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1102-17094/800

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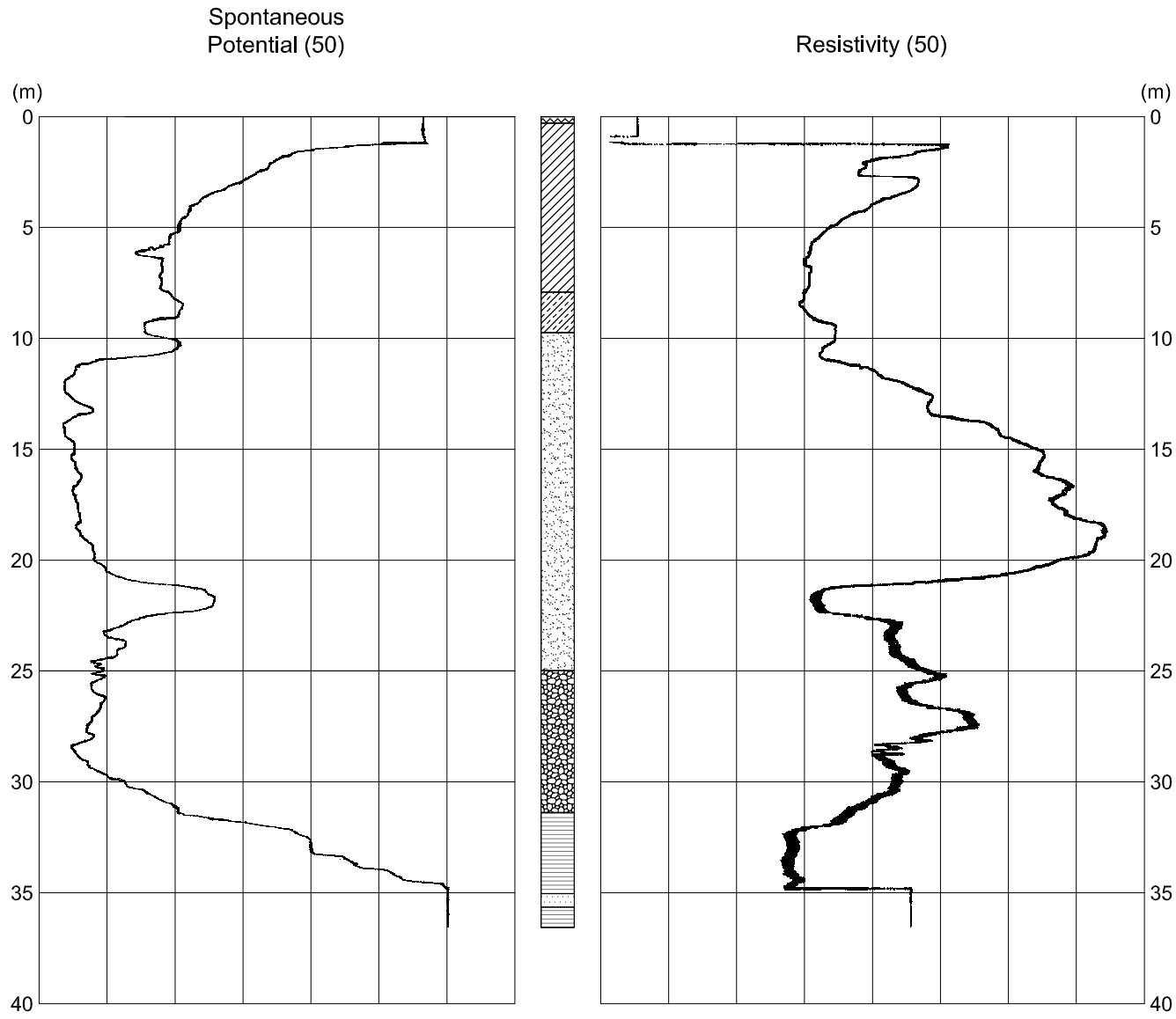
Figure No.

B-12

Title

Geophysical Logs
Borehole MW-13



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2005-11-22 10:24AM By: ttieu

November, 2005
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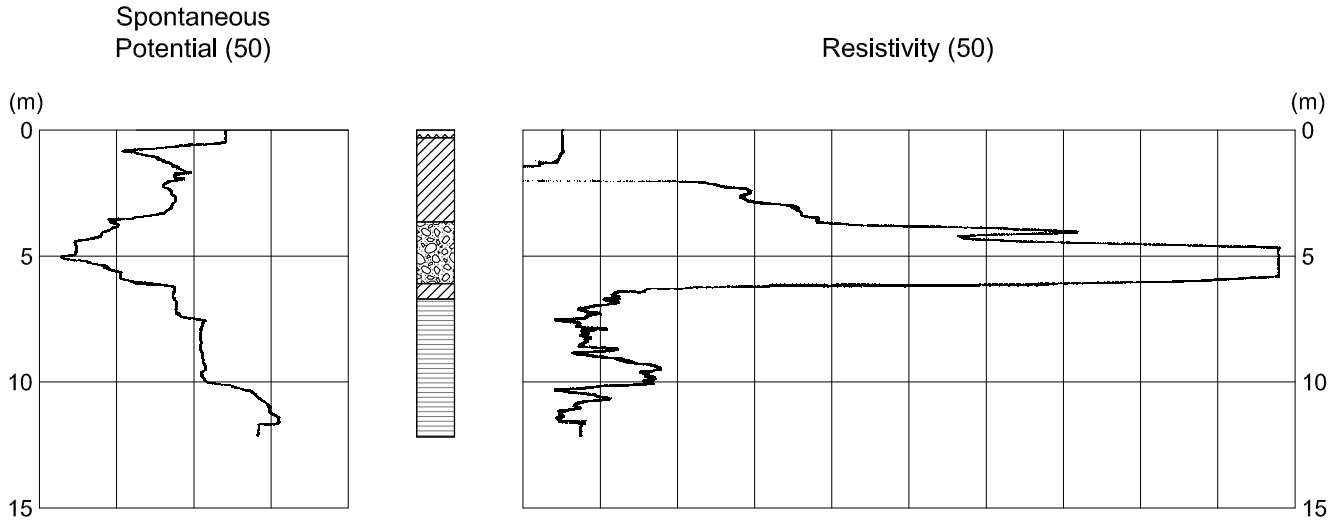
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.

B-13

Title

Geophysical Logs
Borehole TH-01



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2005-11-22 10:24AM By: ttieu

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1102-17094/800

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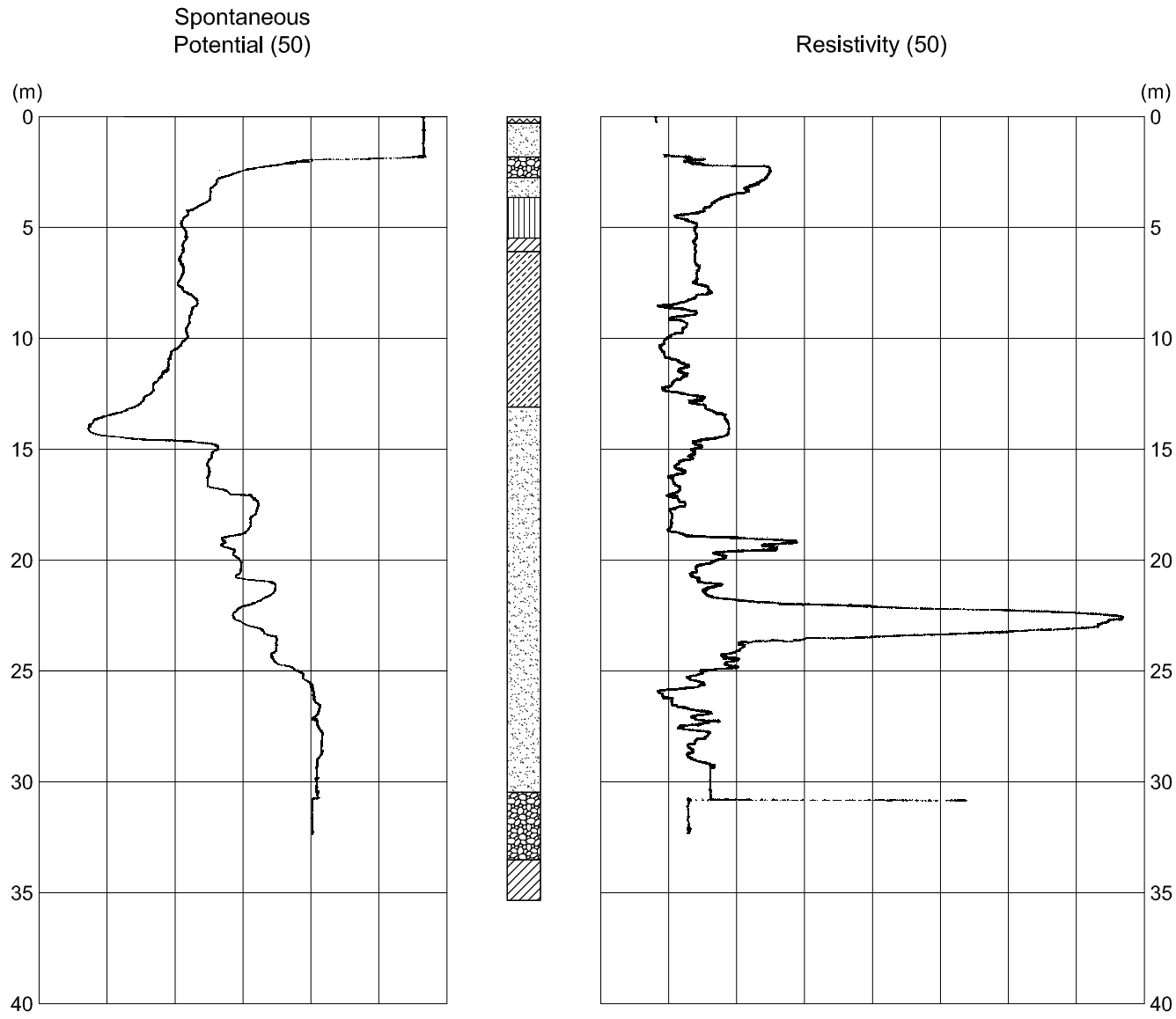
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.

B-14

Title

Geophysical Logs
Borehole TH-02



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2005-11-22 10:23AM By: ttieu

November, 2005
1102-17094/800

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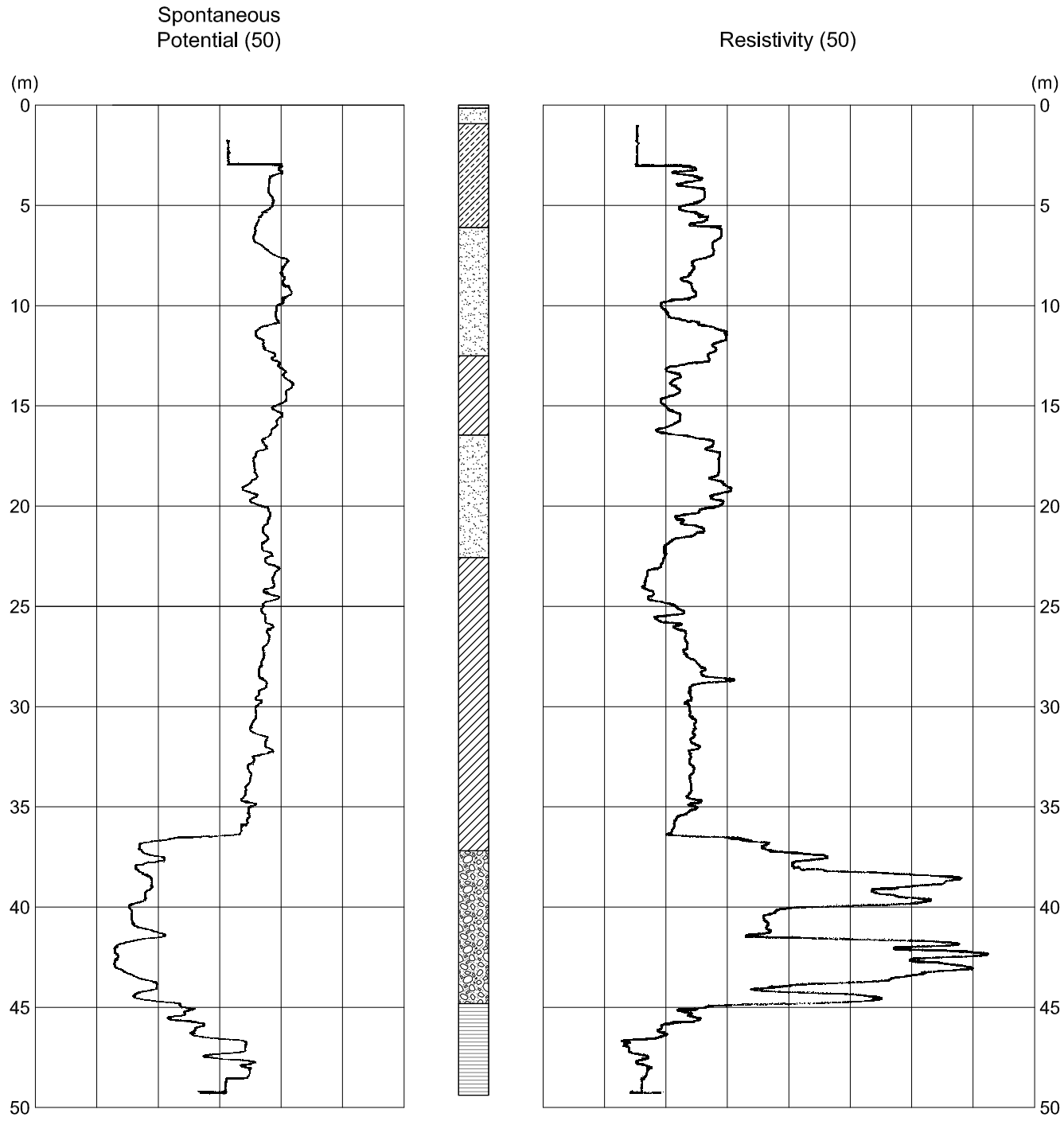
Figure No.

B-15

Title

Geophysical Logs
Borehole TH-04



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2005-11-22 10:23AM By: ttieu

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1102-17094/800

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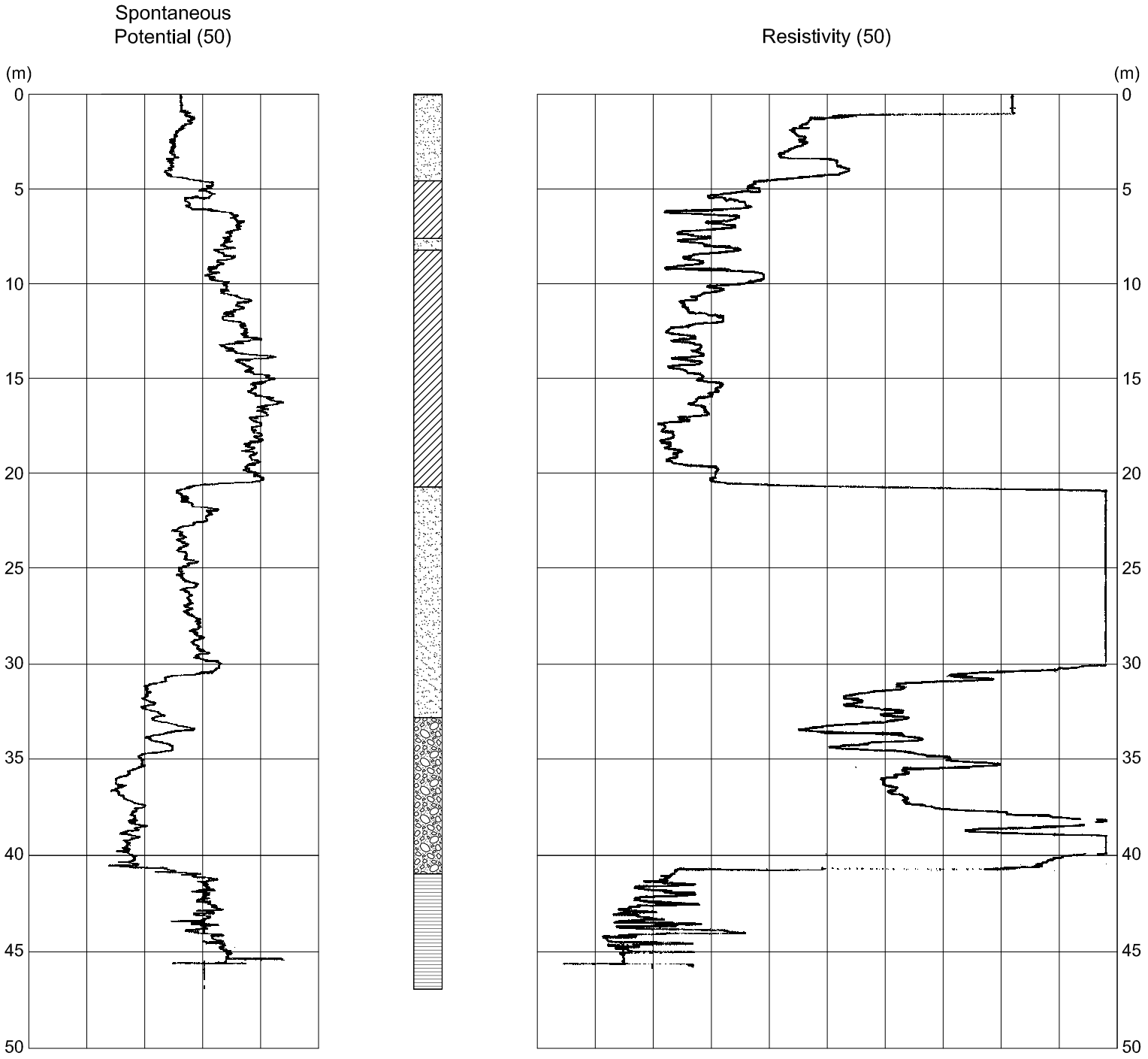
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
B-16

Title
Geophysical Logs
Borehole TH-06



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November, 2005
1102-17094/800

Stantec

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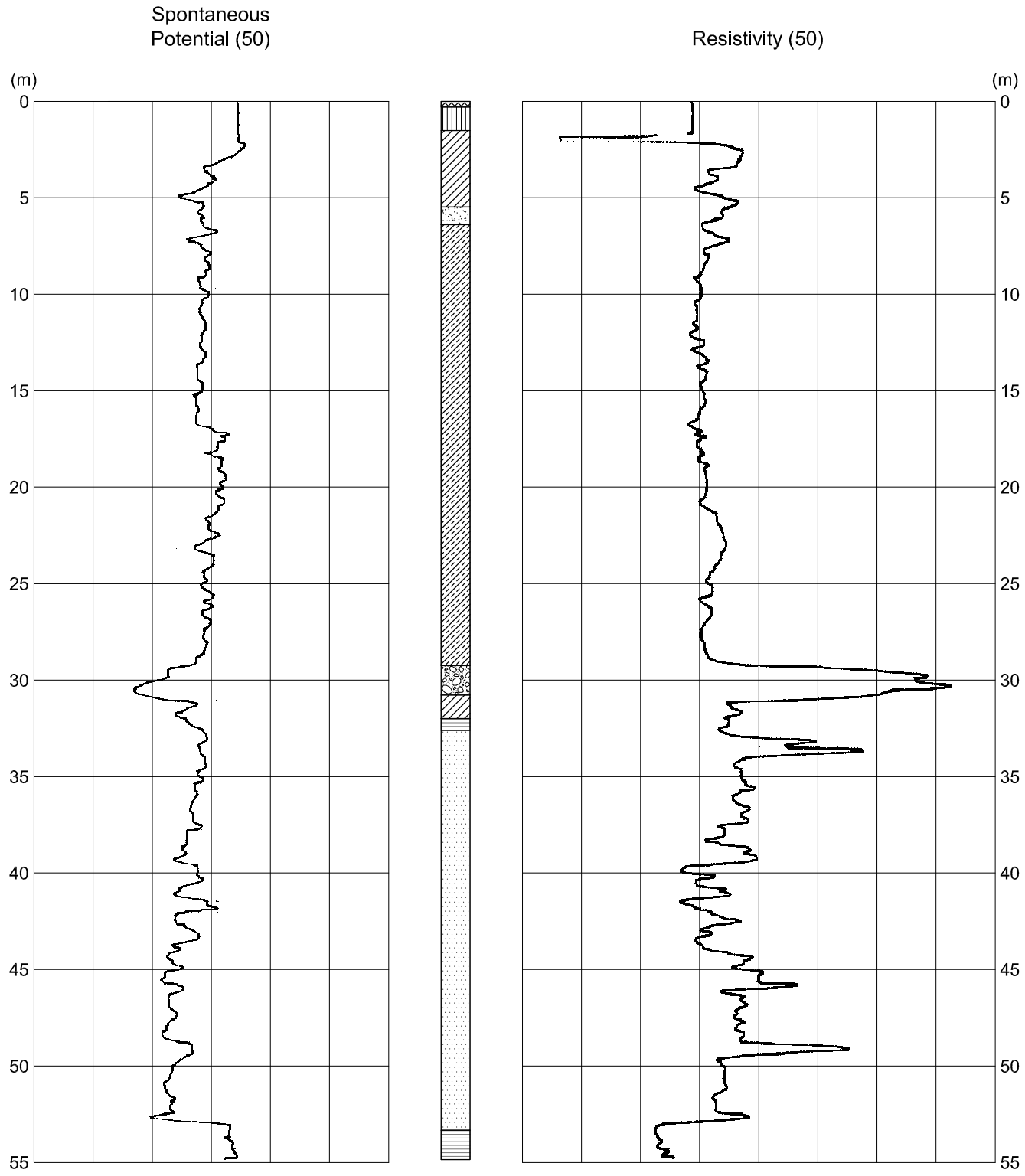
NCIA
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.
B-17

Title
Geophysical Logs
Borehole TH-07



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November, 2005
1102-17094/800

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NCIA
Northeast Capital Industrial Association

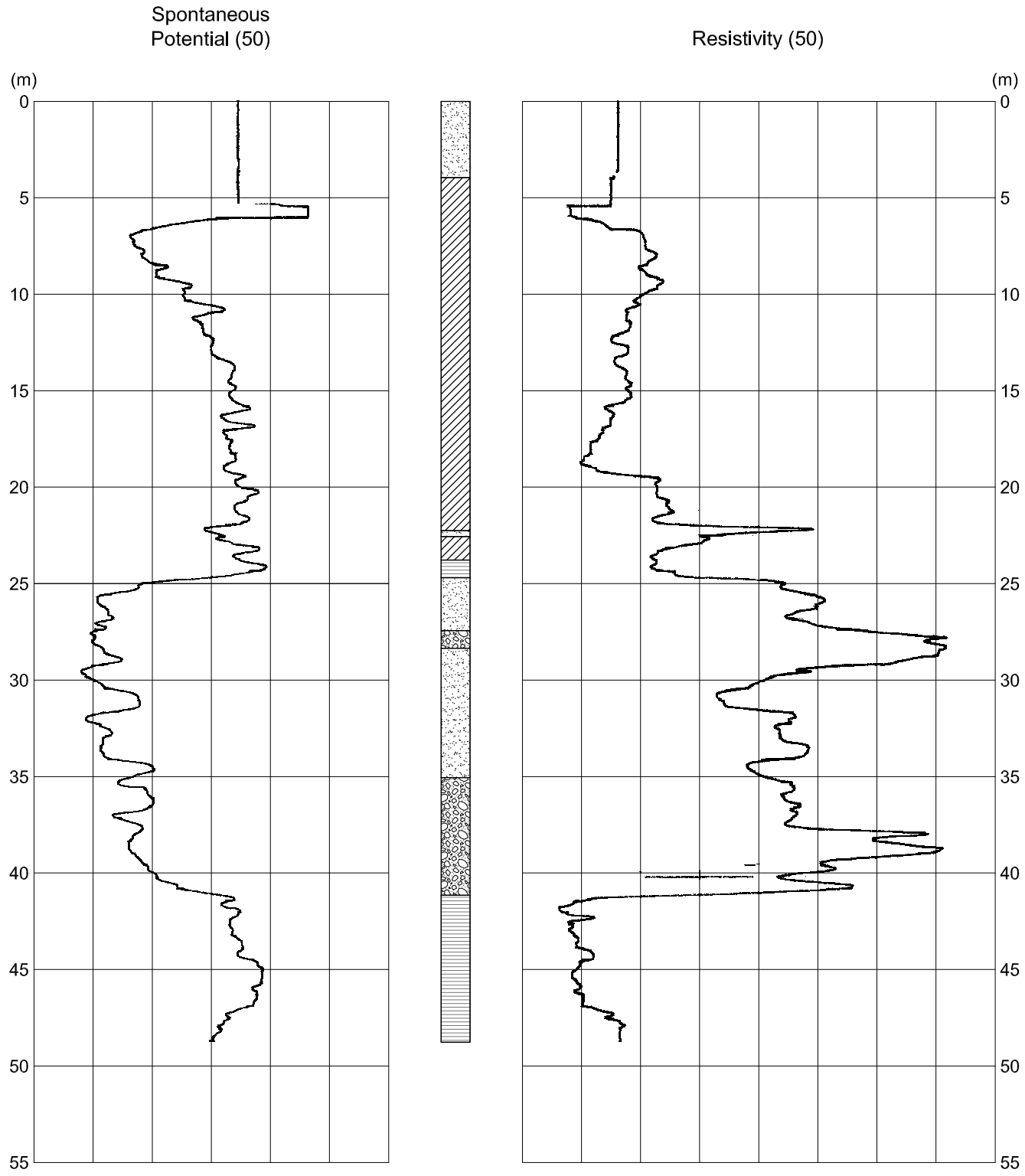
REGIONAL GROUNDWATER QUALITY STUDY

Figure No.

B-18

Title

Geophysical Logs
Borehole TH-08



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2005-11-22 10:22AM By: ttieu

November, 2005
1102-17094/800

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NCIA
Northeast Capital Industrial Association

REGIONAL GROUNDWATER QUALITY STUDY

Figure No.

B-19

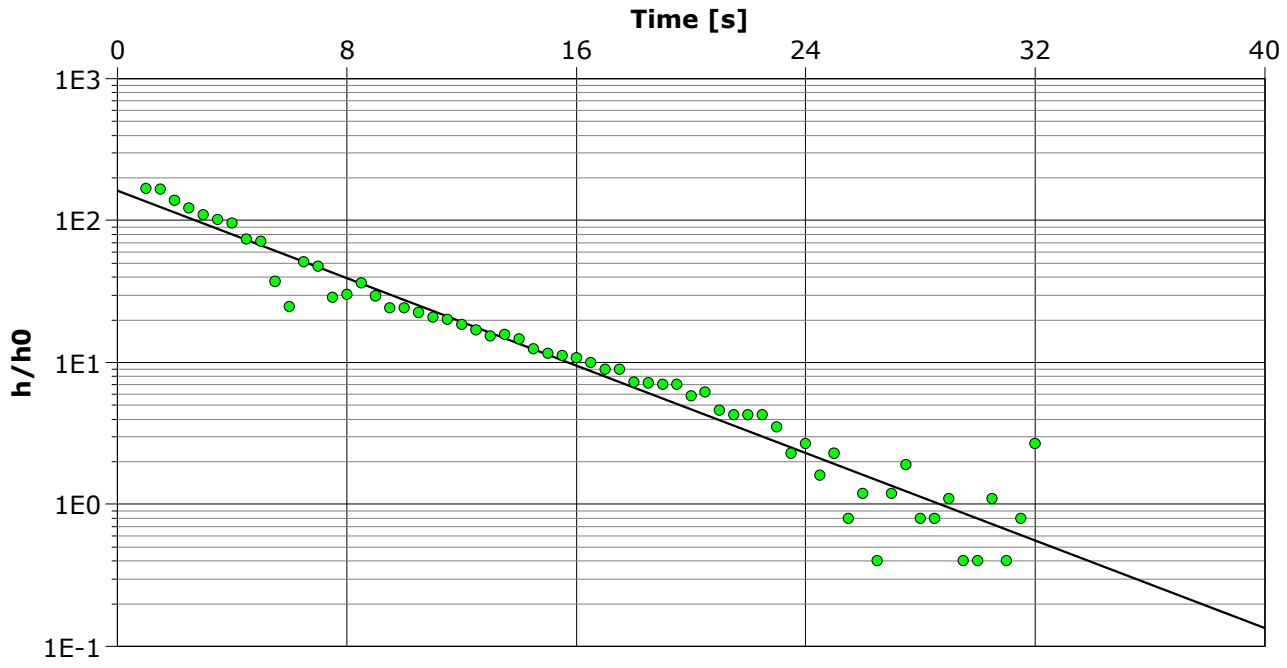
Title

Geophysical Logs
Borehole TH-10

APPENDIX C
WELL RESPONSE TEST ANALYSIS

Stantec Consulting Ltd. 10160-112 Street Edmonton, AB T5K 2L6	**Slug Test Analysis Report**
	Project: Regional Groundwater Study
	Number: 1102 - 17094
	Client: Northeast Capital Industrial Association

Location: Fort Saskatchewan, AB	Slug Test: MW-01	Test Well: MW-01
Test conducted by: C. Rondeau		Test date: 11/18/05
Analysis performed by: D. Yoshisaka	Hvorslev Analysis	Date: 7/18/05
Aquifer Thickness: 4300.00 mm		

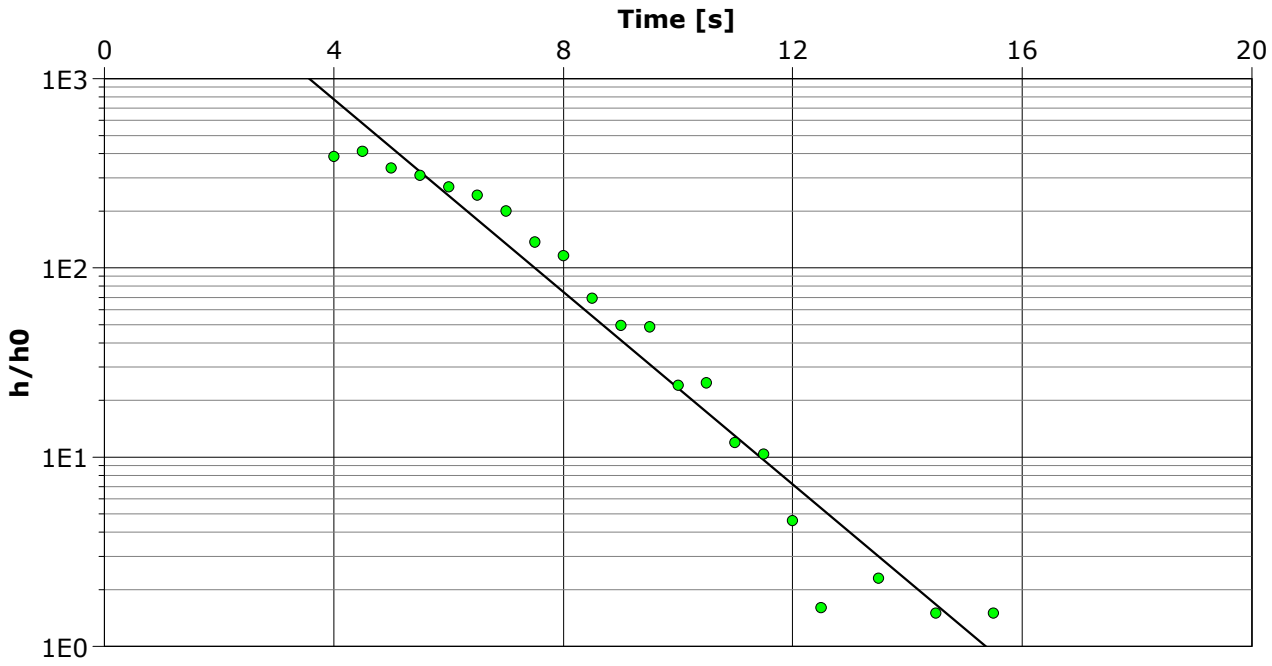


Calculation after Hvorslev

Observation well	K [m/s]	
MW-01	6.83×10^{-5}	

Stantec Consulting Ltd. **10160-112 Street** **Edmonton, AB T5K 2L6**	**Slug Test Analysis Report** Project: Regional Groundwater Study Number: 1102 - 17094 Client: Northeast Capital Industrial Association

Location: Fort Saskatchewan	Slug Test: MW-02	Test Well: MW-02
Test conducted by: C. Rondeau		Test date: 11/18/05
Analysis performed by: D. Yoshisaka	Hvorslev Analysis	Date: 7/18/05
Aquifer Thickness: 16700.00 mm		

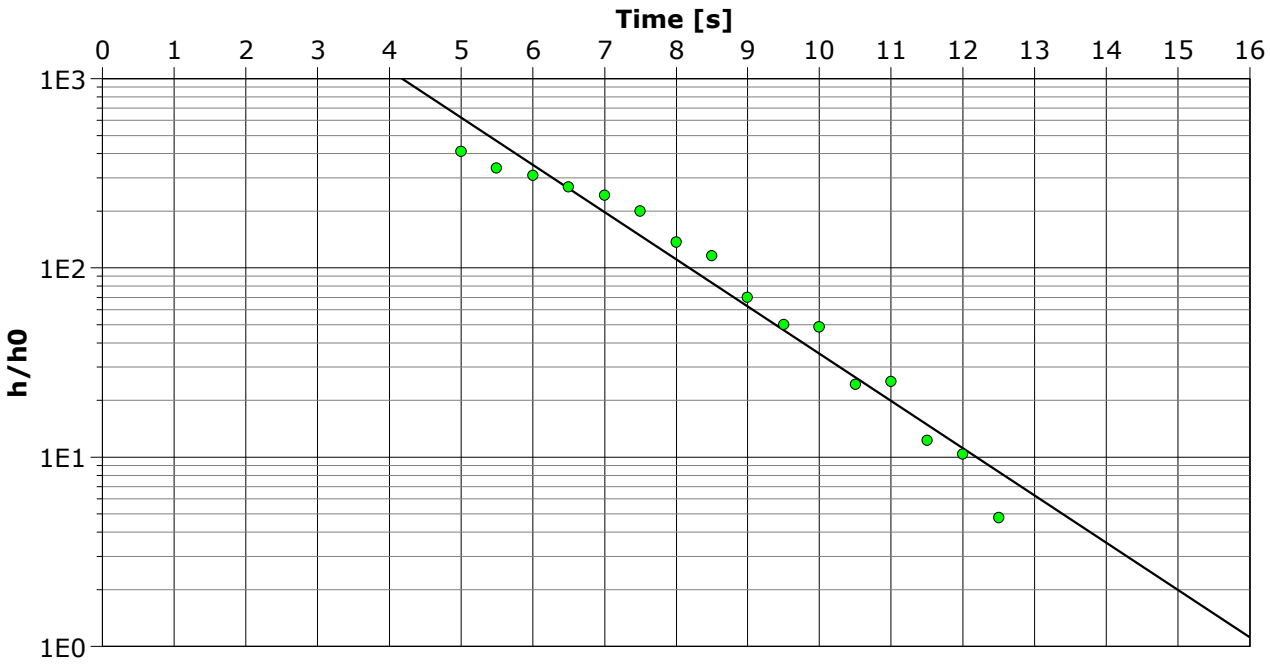


Calculation after Hvorslev

Observation well	K [m/s]	
MW-02	1.78×10^{-4}	

Stantec Consulting Ltd. 10160-112 Street Edmonton, AB T5K 2L6	**Slug Test Analysis Report**
	Project: Regional Groundwater Study
	Number: 1102 - 17094
	Client: Northeast Capital Industrial Association

Location: Fort Saskatchewan	Slug Test: MW-03	Test Well: MW-03
Test conducted by: C. Rondeau		Test date: 11/18/05
Analysis performed by: D. Yoshisaka	Hvorslev Analysis	Date: 7/18/05
Aquifer Thickness: 5200.00 mm		

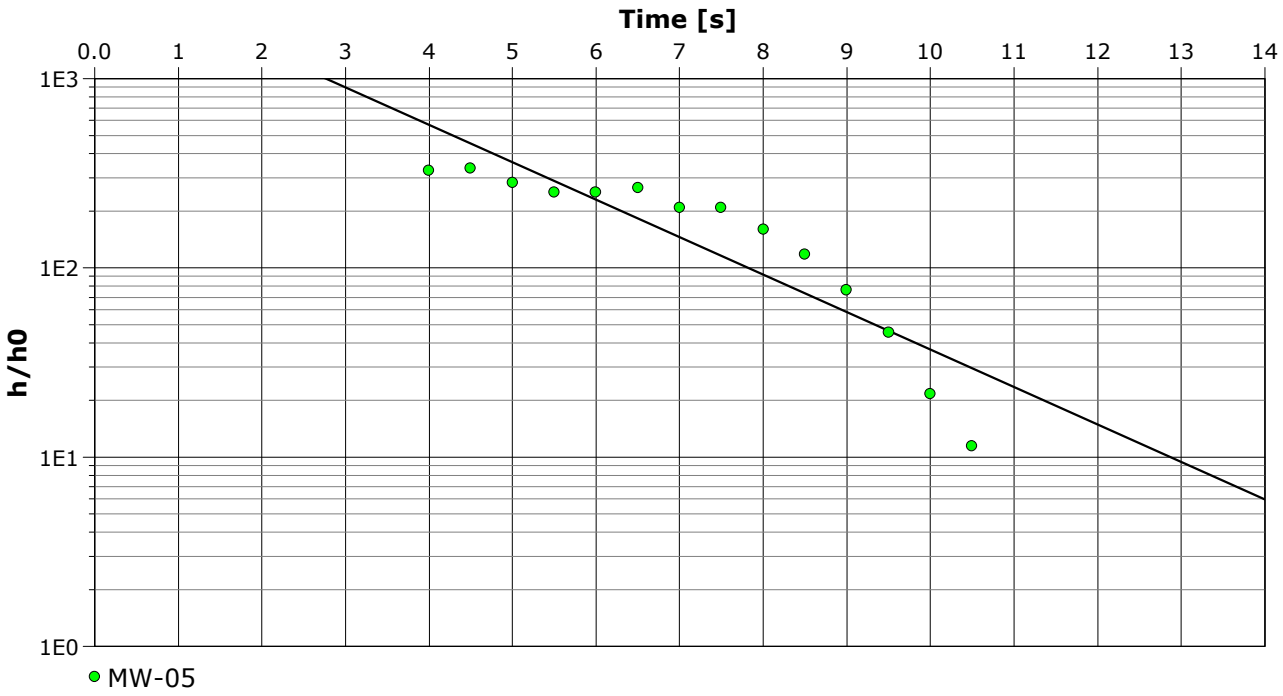


Calculation after Hvorslev

Observation well	K [m/s]	
MW-03	2.21×10^{-4}	

Stantec Consulting Ltd. **10160-112 Street** **Edmonton, AB T5K 2L6**	**Slug Test Analysis Report**	
	Project: Regional Groundwater Study	
	Number: 1102 - 17094	
	Client: Northeast Capital Industrial Association	

Location: Fort Saskatchewan	Slug Test: MW-05	Test Well: MW-05
Test conducted by: C. Rondeau		Test date: 11/18/05
Analysis performed by: D. Yoshisaka	Hvorslev Analysis	Date: 7/18/05
Aquifer Thickness: 5900.00 mm		

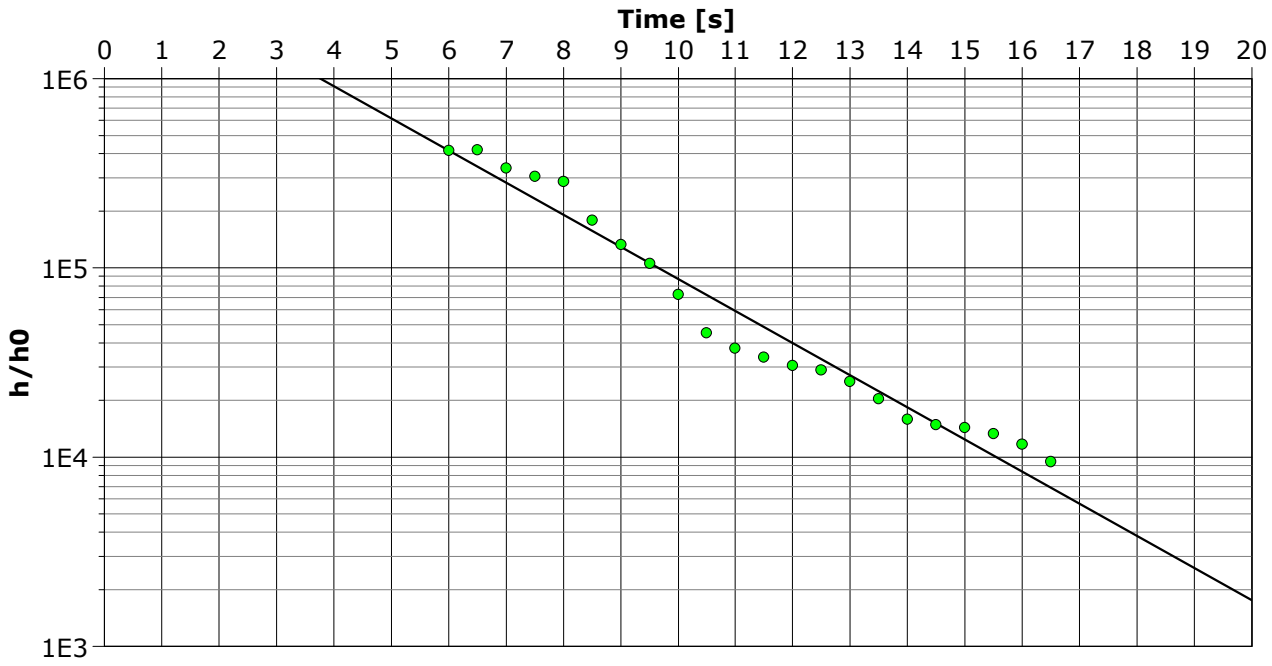


Calculation after Hvorslev

Observation well	K [m/s]	
MW-05	1.75×10^{-4}	

Stantec Consulting Ltd. 10160-112 Street Edmonton, AB T5K 2L6	**Slug Test Analysis Report**
	Project: Regional Groundwater Study
	Number: 1102 - 17094
	Client: Northeast Capital Industrial Association

Location: Fort Saskatchewan	Slug Test: MW-06	Test Well: MW-06
Test conducted by: C. Rondeau		Test date: 7/18/05
Analysis performed by: D. Yoshisaka	Hvorslev Analysis	Date: 7/18/05
Aquifer Thickness: 6400.00 mm		

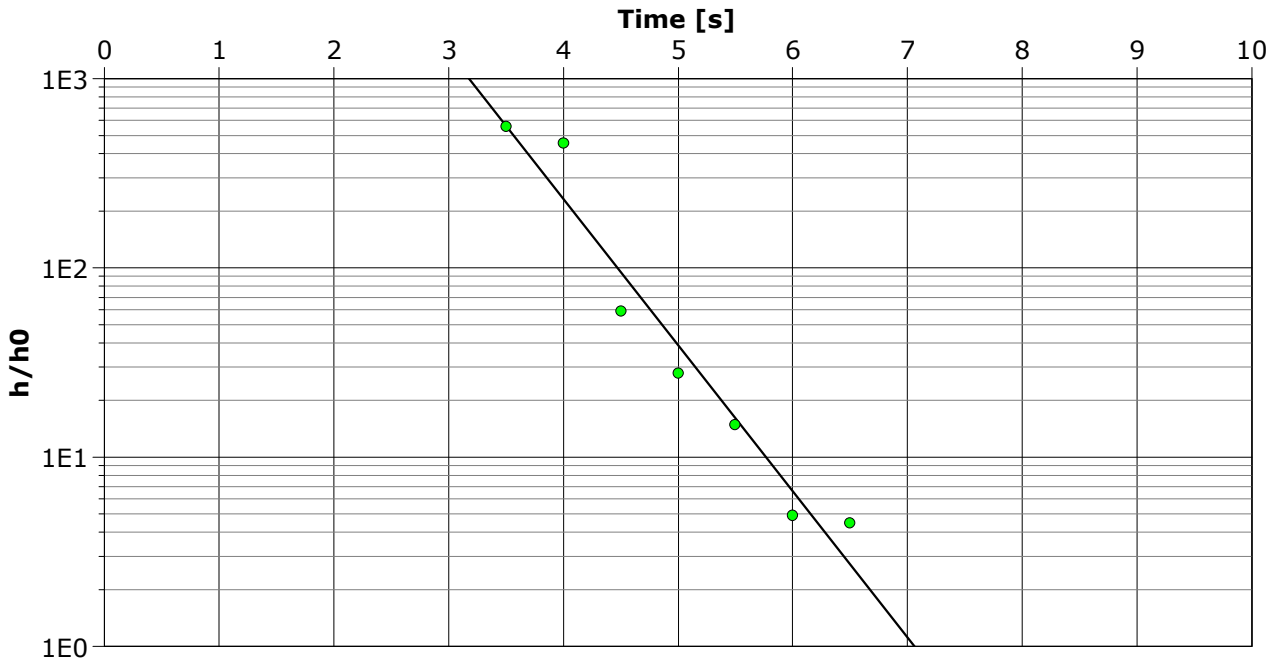


Calculation after Hvorslev

Observation well	K [m/s]	
MW-06	1.50×10^{-4}	

Stantec Consulting Ltd. **10160-112 Street** **Edmonton, AB T5K 2L6**	**Slug Test Analysis Report**	
	Project: Regional Groundwater Study	
	Number: 1102 - 17094	
	Client: Northeast Capital Industrial Association	

Location: Fort Saskatchewan	Slug Test: MW-08	Test Well: MW-08
Test conducted by: C. Rondeau		Test date: 11/18/05
Analysis performed by: D. Yoshisaka	Hvorslev Analysis	Date: 7/18/05
Aquifer Thickness: 8500.00 mm		

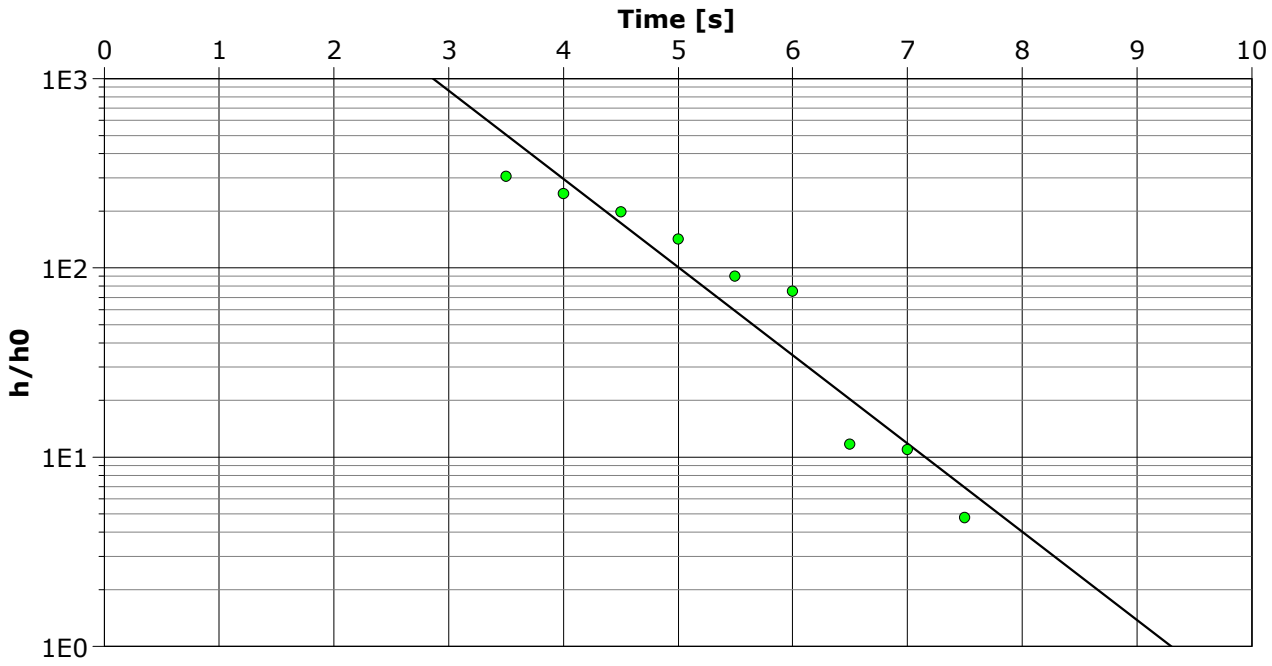


Calculation after Hvorslev

Observation well	K [m/s]	
MW-08	9.45×10^{-4}	

Stantec Consulting Ltd. 10160-112 Street Edmonton, AB T5K 2L6	**Slug Test Analysis Report**
	Project: Regional Groundwater Study
	Number: 1102 - 17094
	Client: Northeast Capital Industrial Association

Location: Fort Saskatchewan	Slug Test: MW-09	Test Well: MW-09
Test conducted by: C. Rondeau		Test date: 11/18/05
Analysis performed by: D. Yoshisaka	Hvorslev Analysis	Date: 7/18/05
Aquifer Thickness: 12800.00 mm		

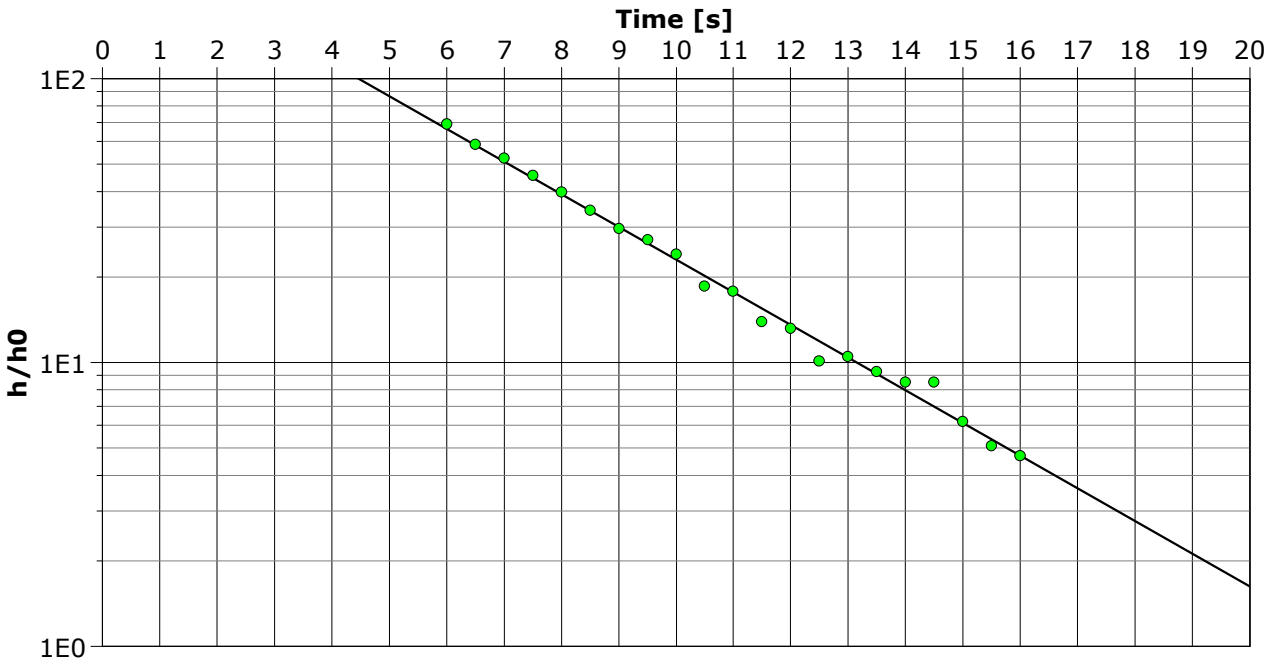


Calculation after Hvorslev

Observation well	K [m/s]	
MW-09	4.13×10^{-4}	

Stantec Consulting Ltd. **10160-112 Street** **Edmonton, AB T5K 2L6**	**Slug Test Analysis Report**	
	Project: Regional Groundwater Study	
	Number: 1102 - 17094	
	Client: Northeast Capital Industrial Association	

Location: Fort Saskatchewan	Slug Test: MW-12	Test Well: MW-12
Test conducted by: C. Rondeau		Test date: 11/18/05
Analysis performed by: D. Yoshisaka	Hvorslev Analysis	Date: 7/18/05
Aquifer Thickness: 10400.00 mm		



Calculation after Hvorslev

Observation well	K [m/s]	
MW-12	1.41×10^{-4}	

APPENDIX D
PUMP TEST ANALYSIS

Stantec Consulting Ltd.
10160-112 Street
Edmonton, AB T5K 2L6

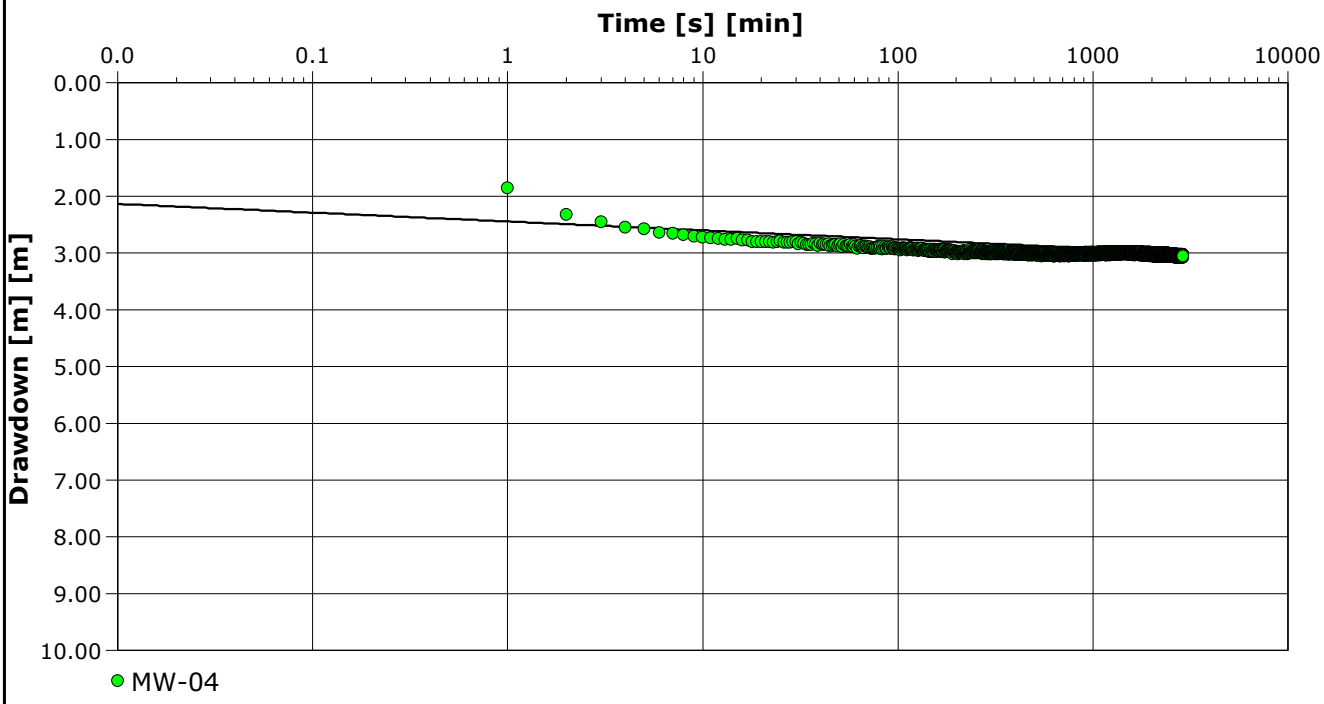
Pumping Test Analysis Report

Project: Regional Groundwater Investigation

Number: 1102 - 17094

Client: Northeast Capital Industrial Association

Location: Fort Saskatchewan, AB	Pumping Test: MW-04 Pumping Test	Pumping well: MW-04
Test conducted by: Lakeland Drilling		Test date: 8/27/05
Analysis performed by: Dan Yoshisaka	Jacob Straight Line	Date: 8/27/05
Aquifer Thickness: 19.50 m	Discharge rate: 196.23574688256 [m³/d]	

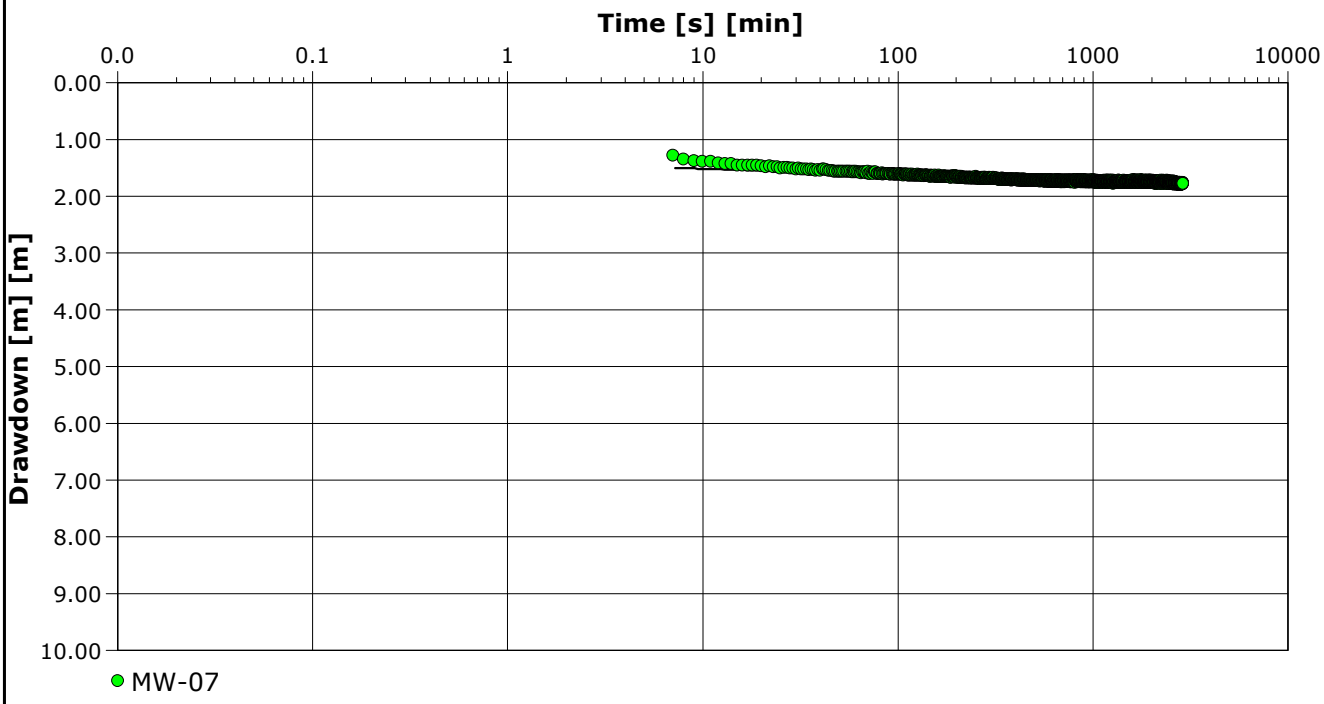


Calculation after Theis with Jacob Correction

Observation well	Transmissivity [m²/s]	K [m/s]	Storage coefficient	Radial distance to PW [m]	
MW-04	3.05×10^{-3}	1.57×10^{-4}	1.11×10^{-15}	0.08	

Stantec Consulting Ltd. 10160-112 Street Edmonton, AB T5K 2L6	**Pumping Test Analysis Report**
	Project: Regional Groundwater Investigation
	Number: 1102 - 17094
	Client: Northeast Capital Industrial Association

Location: Fort Saskatchewan, AB	Pumping Test: MW-07 Pumping Test	Pumping well: MW-07
Test conducted by: Lakeland Drilling		Test date: 2/22/05
Analysis performed by: Dan Yoshisaka	Jacob Straight Line	Date: 8/27/05
Aquifer Thickness: 7.90 m	Discharge rate: 348.86355001344 [m³/d]	

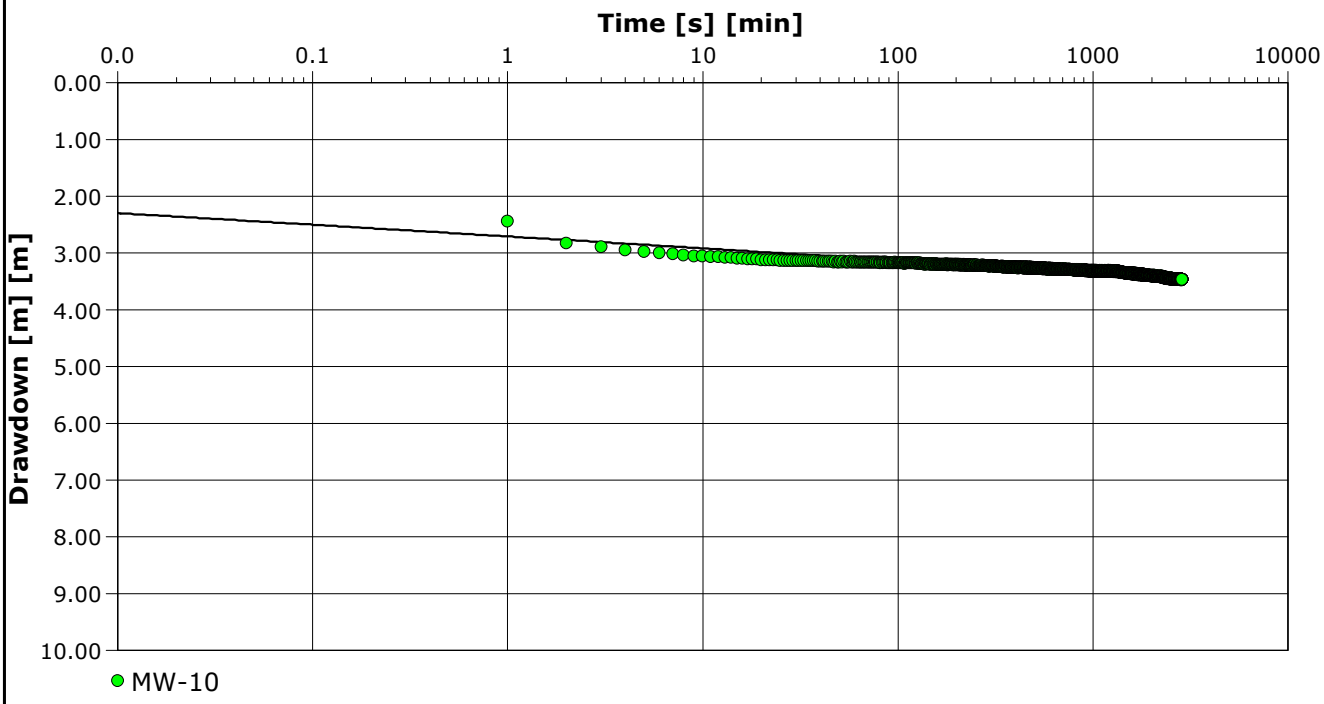


Calculation after Theis

Observation well	Transmissivity [m²/s]	K [m/s]	Storage coefficient	Radial distance to PW [m]	
MW-07	7.01×10^{-3}	8.88×10^{-4}	6.85×10^{-12}	0.08	

Stantec Consulting Ltd. 10160-112 Street Edmonton, AB T5K 2L6	**Pumping Test Analysis Report**
	Project: Regional Groundwater Investigation
	Number: 1102 - 17094
	Client: Northeast Capital Industrial Association

Location: Fort Saskatchewan, AB	Pumping Test: MW-10 Pumping Test	Pumping well: MW-10
Test conducted by: Lakeland Drilling		Test date: 8/18/05
Analysis performed by: Dan Yoshisaka	Jacob Straight Line	Date: 8/19/05
Aquifer Thickness: 16.10 m	Discharge rate: 343.41255704448 [m³/d]	



Calculation after Theis with Jacob Correction

Observation well	Transmissivity [m²/s]	K [m/s]	Storage coefficient	Radial distance to PW [m]	
MW-10	4.20×10^{-3}	2.61×10^{-4}	4.78×10^{-13}	0.08	

APPENDIX E
LABORATORY ANALYSIS REPORTS

ANALYTICAL REPORT

STANTEC CONSULTING LTD
ATTN: DAN YOSHISAKA/ C.CALVERT
Reported On: 28-AUG-06 01:46 PM

7 FL NORTH TOWER 10160 112 STREET

EDMONTON AB T5K 2L6

Lab Work Order #: **L250357** **Date Received:** **07-MAR-05**

Project P.O. #:
Job Reference: 1102-17094
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

ROY JONES
General Manager

For any questions about this report please contact your Account Manager:

RACHEL JONES

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L250357-1 MW1 FT SASK								
Sampled By: C.CALVERT on 07-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
Toluene	<0.0005		0.0005	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
EthylBenzene	<0.0005		0.0005	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
Xylenes	<0.0005		0.0005	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
F1(C6-C10)	<0.1		0.1	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
F1-BTEX	<0.1		0.1	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
F2 (>C10-C16)	<0.05		0.05	mg/L	09-MAR-05	09-MAR-05	AMB	R266681
Ammonia-N	0.39		0.05	mg/L		09-MAR-05	SHC	R266489
Dissolved Organic Carbon	3		1	mg/L		10-MAR-05	JZ	R266644
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Orthophosphate (PO4-P)	<0.01		0.01	mg/L		08-MAR-05	TL	R266216
Phenols (4AAP)	<0.001		0.001	mg/L		10-MAR-05	RJK	R266787
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	4		1	mg/L		09-MAR-05	TL	R266512
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Aluminum (Al)	0.02		0.01	mg/L		09-MAR-05	JY	R266793
Arsenic (As)	0.0008		0.0004	mg/L		09-MAR-05	JY	R266793
Boron (B)	0.053		0.002	mg/L		09-MAR-05	JY	R266793
Barium (Ba)	0.199		0.0001	mg/L		09-MAR-05	JY	R266793
Beryllium (Be)	<0.0005		0.0005	mg/L		09-MAR-05	JY	R266793
Bismuth (Bi)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Cadmium (Cd)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Cobalt (Co)	0.0017		0.0001	mg/L		09-MAR-05	JY	R266793
Chromium (Cr)	0.0009		0.0004	mg/L		09-MAR-05	JY	R266793
Copper (Cu)	<0.0006		0.0006	mg/L		09-MAR-05	JY	R266793
Molybdenum (Mo)	0.0007		0.0001	mg/L		09-MAR-05	JY	R266793
Nickel (Ni)	0.0004		0.0001	mg/L		09-MAR-05	JY	R266793
Lead (Pb)	0.0004		0.0001	mg/L		09-MAR-05	JY	R266793
Antimony (Sb)	0.0008		0.0004	mg/L		09-MAR-05	JY	R266793
Selenium (Se)	<0.0004		0.0004	mg/L		09-MAR-05	JY	R266793
Tin (Sn)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Strontium (Sr)	0.579		0.0001	mg/L		09-MAR-05	JY	R266793
Titanium (Ti)	0.0013		0.0003	mg/L		09-MAR-05	JY	R266793
Thallium (Tl)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Uranium (U)	0.0026		0.0001	mg/L		09-MAR-05	JY	R266793
Vanadium (V)	0.0003		0.0001	mg/L		09-MAR-05	JY	R266793
Zinc (Zn)	0.004		0.002	mg/L		09-MAR-05	JY	R266793
Fluoride (F)	0.19		0.05	mg/L		09-MAR-05	PTT	R266402
ICP metals and SO4 for routine water								
Calcium (Ca)	94.6		0.5	mg/L		09-MAR-05	EOC	R266515
Potassium (K)	3.1		0.1	mg/L		09-MAR-05	EOC	R266515
Magnesium (Mg)	24.8		0.1	mg/L		09-MAR-05	EOC	R266515
Sodium (Na)	40		1	mg/L		09-MAR-05	EOC	R266515
Sulfate (SO4)	57.4		0.5	mg/L		09-MAR-05	EOC	R266515
Ion Balance Calculation								
Ion Balance	100			%		12-MAR-05		
TDS (Calculated)	442			mg/L		12-MAR-05		
Hardness (as CaCO3)	338			mg/L		12-MAR-05		
Iron (Fe)-Dissolved	1.02		0.005	mg/L		09-MAR-05	HAS	R266751

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L250357-1 MW1 FT SASK								
Sampled By: C.CALVERT on 07-MAR-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Manganese (Mn)-Dissolved	0.605		0.001	mg/L		09-MAR-05	HAS	R266751
Nitrate+Nitrite-N	<0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	<0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.7		0.1	pH		09-MAR-05	PTT	R266402
Conductivity (EC)	762		0.2	uS/cm		09-MAR-05	PTT	R266402
Bicarbonate (HCO3)	444		5	mg/L		09-MAR-05	PTT	R266402
Carbonate (CO3)	<5		5	mg/L		09-MAR-05	PTT	R266402
Hydroxide (OH)	<5		5	mg/L		09-MAR-05	PTT	R266402
Alkalinity, Total (as CaCO3)	364		5	mg/L		09-MAR-05	PTT	R266402
L250357-2 MW2 FT SASK								
Sampled By: C.CALVERT on 07-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
Toluene	<0.0005		0.0005	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
EthylBenzene	<0.0005		0.0005	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
Xylenes	<0.0005		0.0005	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
F1(C6-C10)	<0.1		0.1	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
F1-BTEX	<0.1		0.1	mg/L	09-MAR-05	09-MAR-05	SCM	R266634
F2 (>C10-C16)	<0.05		0.05	mg/L	09-MAR-05	09-MAR-05	AMB	R266681
Ammonia-N	1.75		0.05	mg/L		09-MAR-05	SHC	R266489
Dissolved Organic Carbon	8		1	mg/L		10-MAR-05	JZ	R266644
Mercury (Hg)-Dissolved	0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Orthophosphate (PO4-P)	<0.01		0.01	mg/L		08-MAR-05	TL	R266216
Phenols (4AAP)	<0.001		0.001	mg/L		10-MAR-05	RJK	R266787
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	13		1	mg/L		09-MAR-05	TL	R266512
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002	RAMB	0.0002	mg/L		09-MAR-05	JY	R266793
Aluminum (Al)	0.02		0.01	mg/L		09-MAR-05	JY	R266793
Arsenic (As)	0.0025		0.0004	mg/L		09-MAR-05	JY	R266793
Boron (B)	0.120		0.002	mg/L		09-MAR-05	JY	R266793
Barium (Ba)	0.204		0.0001	mg/L		09-MAR-05	JY	R266793
Beryllium (Be)	<0.0005		0.0005	mg/L		09-MAR-05	JY	R266793
Bismuth (Bi)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Cadmium (Cd)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Cobalt (Co)	0.0008		0.0001	mg/L		09-MAR-05	JY	R266793
Chromium (Cr)	0.0013		0.0004	mg/L		09-MAR-05	JY	R266793
Copper (Cu)	0.0015		0.0006	mg/L		09-MAR-05	JY	R266793
Molybdenum (Mo)	0.0046		0.0001	mg/L		09-MAR-05	JY	R266793
Nickel (Ni)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Lead (Pb)	0.0004		0.0001	mg/L		09-MAR-05	JY	R266793
Antimony (Sb)	0.0010		0.0004	mg/L		09-MAR-05	JY	R266793
Selenium (Se)	0.0008		0.0004	mg/L		09-MAR-05	JY	R266793
Tin (Sn)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Strontium (Sr)	1.03		0.0001	mg/L		09-MAR-05	JY	R266793
Titanium (Ti)	0.0012		0.0003	mg/L		09-MAR-05	JY	R266793

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L250357-2 MW2 FT SASK								
Sampled By: C.CALVERT on 07-MAR-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Thallium (Tl)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Uranium (U)	0.0032		0.0001	mg/L		09-MAR-05	JY	R266793
Vanadium (V)	0.0017		0.0001	mg/L		09-MAR-05	JY	R266793
Zinc (Zn)	0.004		0.002	mg/L		09-MAR-05	JY	R266793
Fluoride (F)	0.21		0.05	mg/L		09-MAR-05	PTT	R266402
ICP metals and SO4 for routine water								
Calcium (Ca)	113		0.5	mg/L		09-MAR-05	EOC	R266515
Potassium (K)	6.8		0.1	mg/L		09-MAR-05	EOC	R266515
Magnesium (Mg)	34.5		0.1	mg/L		09-MAR-05	EOC	R266515
Sodium (Na)	111		1	mg/L		09-MAR-05	EOC	R266515
Sulfate (SO4)	227		0.5	mg/L		09-MAR-05	EOC	R266515
Ion Balance Calculation								
Ion Balance	101			%		12-MAR-05		
TDS (Calculated)	759			mg/L		12-MAR-05		
Hardness (as CaCO3)	424			mg/L		12-MAR-05		
Iron (Fe)-Dissolved	0.275		0.005	mg/L		09-MAR-05	HAS	R266751
Manganese (Mn)-Dissolved	0.236		0.001	mg/L		09-MAR-05	HAS	R266751
Nitrate+Nitrite-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.7		0.1	pH		09-MAR-05	PTT	R266402
Conductivity (EC)	1210		0.2	uS/cm		09-MAR-05	PTT	R266402
Bicarbonate (HCO3)	514		5	mg/L		09-MAR-05	PTT	R266402
Carbonate (CO3)	<5		5	mg/L		09-MAR-05	PTT	R266402
Hydroxide (OH)	<5		5	mg/L		09-MAR-05	PTT	R266402
Alkalinity, Total (as CaCO3)	422		5	mg/L		09-MAR-05	PTT	R266402

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

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
RAMB	Result Adjusted For Method Blank

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
BTX,F1-ED	Water	BTEX and F1 (C6-C10)	EPA 5030	EPA 5030/8015&8260-P&T GC-MS & FID
C-DIS-ORG-CL	Water	Dissolved Organic Carbon		APHA 5310 C-Instrumental
CL-ED	Water	Chloride (Cl)		APHA 4500 Cl E-Colorimetry
ETL-ROUTINE-ICP-ED	Water	ICP metals and SO4 for routine water		APHA 3120 B-ICP-OES
F-ED	Water	Fluoride (F)		APHA 4500 F-C-Electrode
F2-ED	Water	F2 (>C10-C16)		EPA 3510/8000-GC-FID
FE-DIS-ED	Water	Iron (Fe)-Dissolved		EPA 200.7
HG-DIS-LOW-ED	Water	Mercury (Hg)-Dissolved		EPA 6020
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET1-DIS-LOW-ED	Water	Dissolved Trace Metals (Low Level)		EPA 6020
MN-DIS-ED	Water	Manganese (Mn)-Dissolved		EPA 200.7
N2N3-ED	Water	Nitrate+Nitrite-N		APHA 4500 NO3H-Colorimetry
NH4-ED	Water	Ammonia-N		APHA4500NH3F Colorimetry
NO2-ED	Water	Nitrite-N		APHA 4500 NO2B-Colorimetry
NO3-ED	Water	Nitrate-N		APHA 4500 NO3H-Colorimetry
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
PHENOLS-CL	Water	Phenols (4AAP)		EPA 9066-Colorimetric
PO4-ED	Water	Orthophosphate (PO4-P)		APHA 4500 P B,E-Auto-Colorimetry

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

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	Laboratory Definition Code	Laboratory Location
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA	ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Reference Information

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - 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.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ANALYTICAL REPORT

STANTEC CONSULTING LTD
ATTN: DAN YOSHISAKA
Reported On: 28-AUG-06 01:46 PM

7 FL NORTH TOWER, 10160 112 STREET

EDMONTON AB T5K 2L6

Lab Work Order #: **L250798** **Date Received:** **09-MAR-05**

Project P.O. #:
Job Reference: 1102-17094
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

ROY JONES
General Manager

For any questions about this report please contact your Account Manager:

RACHEL JONES

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L250798-1 MW3 FT.SASK								
Sampled By: C.CALVERT on 08-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
Toluene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
EthylBenzene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
Xylenes	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
F1(C6-C10)	<0.1		0.1	mg/L		10-MAR-05	CTL	R266725
F1-BTEX	<0.1		0.1	mg/L		10-MAR-05	CTL	R266725
F2 (>C10-C16)	<0.05		0.05	mg/L	10-MAR-05	10-MAR-05	AAT	R266928
Ammonia-N	0.38		0.05	mg/L		10-MAR-05	SHC	R266822
Dissolved Organic Carbon	5		1	mg/L		14-MAR-05	JZ	R267571
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Orthophosphate (PO4-P)	<0.01		0.01	mg/L		09-MAR-05	TL	R266536
Phenols (4AAP)	<0.001		0.001	mg/L		11-MAR-05	RJK	R267205
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	31		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Aluminum (Al)	<0.01		0.01	mg/L		09-MAR-05	JY	R266793
Arsenic (As)	0.0012		0.0004	mg/L		09-MAR-05	JY	R266793
Boron (B)	0.128		0.002	mg/L		09-MAR-05	JY	R266793
Barium (Ba)	0.0744		0.0001	mg/L		09-MAR-05	JY	R266793
Beryllium (Be)	<0.0005		0.0005	mg/L		09-MAR-05	JY	R266793
Bismuth (Bi)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Cadmium (Cd)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Cobalt (Co)	0.0012		0.0001	mg/L		09-MAR-05	JY	R266793
Chromium (Cr)	0.0009		0.0004	mg/L		09-MAR-05	JY	R266793
Copper (Cu)	<0.0006		0.0006	mg/L		09-MAR-05	JY	R266793
Molybdenum (Mo)	0.0008		0.0001	mg/L		09-MAR-05	JY	R266793
Nickel (Ni)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Lead (Pb)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Antimony (Sb)	0.0007		0.0004	mg/L		09-MAR-05	JY	R266793
Selenium (Se)	<0.0004		0.0004	mg/L		09-MAR-05	JY	R266793
Tin (Sn)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Strontium (Sr)	0.811		0.0001	mg/L		09-MAR-05	JY	R266793
Titanium (Ti)	0.0010		0.0003	mg/L		09-MAR-05	JY	R266793
Thallium (Tl)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Uranium (U)	0.0007		0.0001	mg/L		09-MAR-05	JY	R266793
Vanadium (V)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Zinc (Zn)	0.003		0.002	mg/L		09-MAR-05	JY	R266793
Fluoride (F)	0.14		0.05	mg/L		11-MAR-05	PTT	R267158
ICP metals and SO4 for routine water								
Calcium (Ca)	106		0.5	mg/L		10-MAR-05	EOC	R266876
Potassium (K)	3.5		0.1	mg/L		10-MAR-05	EOC	R266876
Magnesium (Mg)	36.1		0.1	mg/L		10-MAR-05	EOC	R266876
Sodium (Na)	56		1	mg/L		10-MAR-05	EOC	R266876
Sulfate (SO4)	113		0.5	mg/L		10-MAR-05	EOC	R266876
Ion Balance Calculation								
Ion Balance	103			%		12-MAR-05		
TDS (Calculated)	563			mg/L		12-MAR-05		
Hardness (as CaCO3)	413			mg/L		12-MAR-05		
Iron (Fe)-Dissolved	3.19		0.005	mg/L		09-MAR-05	HAS	R266751

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L250798-1 MW3 FT.SASK								
Sampled By: C.CALVERT on 08-MAR-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Manganese (Mn)-Dissolved	0.264		0.001	mg/L		09-MAR-05	HAS	R266751
Nitrate+Nitrite-N	<0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	<0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.4		0.1	pH		11-MAR-05	PTT	R267158
Conductivity (EC)	937		0.2	uS/cm		11-MAR-05	PTT	R267158
Bicarbonate (HCO3)	442		5	mg/L		11-MAR-05	PTT	R267158
Carbonate (CO3)	<5		5	mg/L		11-MAR-05	PTT	R267158
Hydroxide (OH)	<5		5	mg/L		11-MAR-05	PTT	R267158
Alkalinity, Total (as CaCO3)	362		5	mg/L		11-MAR-05	PTT	R267158
L250798-2 MW4 FT.SASK								
Sampled By: C.CALVERT on 08-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
Toluene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
EthylBenzene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
Xylenes	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
F1(C6-C10)	<0.1		0.1	mg/L		10-MAR-05	CTL	R266725
F1-BTEX	<0.1		0.1	mg/L		10-MAR-05	CTL	R266725
F2 (>C10-C16)	<0.05		0.05	mg/L	10-MAR-05	10-MAR-05	AAT	R266928
Ammonia-N	<0.05		0.05	mg/L		10-MAR-05	SHC	R266822
Dissolved Organic Carbon	1		1	mg/L		14-MAR-05	JZ	R267571
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Orthophosphate (PO4-P)	<0.01		0.01	mg/L		09-MAR-05	TL	R266536
Phenols (4AAP)	<0.001		0.001	mg/L		11-MAR-05	RJK	R267205
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	137		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002	RAMB	0.0002	mg/L		09-MAR-05	JY	R266793
Aluminum (Al)	<0.01		0.01	mg/L		09-MAR-05	JY	R266793
Arsenic (As)	0.0011		0.0004	mg/L		09-MAR-05	JY	R266793
Boron (B)	0.101		0.002	mg/L		09-MAR-05	JY	R266793
Barium (Ba)	0.0737		0.0001	mg/L		09-MAR-05	JY	R266793
Beryllium (Be)	<0.0005		0.0005	mg/L		09-MAR-05	JY	R266793
Bismuth (Bi)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Cadmium (Cd)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Cobalt (Co)	0.0007		0.0001	mg/L		09-MAR-05	JY	R266793
Chromium (Cr)	0.0018		0.0004	mg/L		09-MAR-05	JY	R266793
Copper (Cu)	0.0008		0.0006	mg/L		09-MAR-05	JY	R266793
Molybdenum (Mo)	0.0005		0.0001	mg/L		09-MAR-05	JY	R266793
Nickel (Ni)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Lead (Pb)	0.0002		0.0001	mg/L		09-MAR-05	JY	R266793
Antimony (Sb)	0.0009		0.0004	mg/L		09-MAR-05	JY	R266793
Selenium (Se)	0.0006		0.0004	mg/L		09-MAR-05	JY	R266793
Tin (Sn)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Strontium (Sr)	0.561		0.0001	mg/L		09-MAR-05	JY	R266793
Titanium (Ti)	0.0007		0.0003	mg/L		09-MAR-05	JY	R266793

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L250798-2 MW4 FT.SASK								
Sampled By: C.CALVERT on 08-MAR-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Thallium (Tl)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Uranium (U)	0.0029		0.0001	mg/L		09-MAR-05	JY	R266793
Vanadium (V)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Zinc (Zn)	0.004		0.002	mg/L		09-MAR-05	JY	R266793
Fluoride (F)	0.15		0.05	mg/L		11-MAR-05	PTT	R267158
ICP metals and SO4 for routine water								
Calcium (Ca)	142		0.5	mg/L		10-MAR-05	EOC	R266876
Potassium (K)	9.9		0.1	mg/L		10-MAR-05	EOC	R266876
Magnesium (Mg)	37.7		0.1	mg/L		10-MAR-05	EOC	R266876
Sodium (Na)	57		1	mg/L		10-MAR-05	EOC	R266876
Sulfate (SO4)	81.4		0.5	mg/L		10-MAR-05	EOC	R266876
Ion Balance Calculation								
Ion Balance	98.5			%		12-MAR-05		
TDS (Calculated)	694			mg/L		12-MAR-05		
Hardness (as CaCO3)	510			mg/L		12-MAR-05		
Iron (Fe)-Dissolved	0.173		0.005	mg/L		09-MAR-05	HAS	R266751
Manganese (Mn)-Dissolved	0.152		0.001	mg/L		09-MAR-05	HAS	R266751
Nitrate+Nitrite-N	0.8		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	0.8		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.5		0.1	pH		11-MAR-05	PTT	R267158
Conductivity (EC)	1200		0.2	uS/cm		11-MAR-05	PTT	R267158
Bicarbonate (HCO3)	458		5	mg/L		11-MAR-05	PTT	R267158
Carbonate (CO3)	<5		5	mg/L		11-MAR-05	PTT	R267158
Hydroxide (OH)	<5		5	mg/L		11-MAR-05	PTT	R267158
Alkalinity, Total (as CaCO3)	375		5	mg/L		11-MAR-05	PTT	R267158
L250798-3 MW5 FT.SASK								
Sampled By: C.CALVERT on 08-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
Toluene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
EthylBenzene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
Xylenes	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
F1(C6-C10)	<0.1		0.1	mg/L		10-MAR-05	CTL	R266725
F1-BTEX	<0.1		0.1	mg/L		10-MAR-05	CTL	R266725
F2 (>C10-C16)	<0.05		0.05	mg/L	10-MAR-05	10-MAR-05	AAT	R266928
Ammonia-N	0.63		0.05	mg/L		10-MAR-05	SHC	R266822
Dissolved Organic Carbon	5		1	mg/L		14-MAR-05	JZ	R267571
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Orthophosphate (PO4-P)	<0.01		0.01	mg/L		09-MAR-05	TL	R266536
Phenols (4AAP)	<0.001		0.001	mg/L		11-MAR-05	RJK	R267205
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	15		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Aluminum (Al)	<0.01		0.01	mg/L		09-MAR-05	JY	R266793

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L250798-3 MW5 FT.SASK								
Sampled By: C.CALVERT on 08-MAR-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Arsenic (As)	0.0035		0.0004	mg/L		09-MAR-05	JY	R266793
Boron (B)	0.140		0.002	mg/L		09-MAR-05	JY	R266793
Barium (Ba)	0.0618		0.0001	mg/L		09-MAR-05	JY	R266793
Beryllium (Be)	<0.0005		0.0005	mg/L		09-MAR-05	JY	R266793
Bismuth (Bi)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Cadmium (Cd)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Cobalt (Co)	0.0008		0.0001	mg/L		09-MAR-05	JY	R266793
Chromium (Cr)	0.0009		0.0004	mg/L		09-MAR-05	JY	R266793
Copper (Cu)	<0.0006		0.0006	mg/L		09-MAR-05	JY	R266793
Molybdenum (Mo)	0.0022		0.0001	mg/L		09-MAR-05	JY	R266793
Nickel (Ni)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Lead (Pb)	0.0002		0.0001	mg/L		09-MAR-05	JY	R266793
Antimony (Sb)	0.0008		0.0004	mg/L		09-MAR-05	JY	R266793
Selenium (Se)	0.0004		0.0004	mg/L		09-MAR-05	JY	R266793
Tin (Sn)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Strontium (Sr)	0.710		0.0001	mg/L		09-MAR-05	JY	R266793
Titanium (Ti)	0.0008		0.0003	mg/L		09-MAR-05	JY	R266793
Thallium (Tl)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Uranium (U)	0.0014		0.0001	mg/L		09-MAR-05	JY	R266793
Vanadium (V)	0.0002		0.0001	mg/L		09-MAR-05	JY	R266793
Zinc (Zn)	0.003		0.002	mg/L		09-MAR-05	JY	R266793
Fluoride (F)	0.18		0.05	mg/L		11-MAR-05	PTT	R267158
ICP metals and SO4 for routine water								
Calcium (Ca)	96.2		0.5	mg/L		10-MAR-05	EOC	R266876
Potassium (K)	6.1		0.1	mg/L		10-MAR-05	EOC	R266876
Magnesium (Mg)	27.5		0.1	mg/L		10-MAR-05	EOC	R266876
Sodium (Na)	51		1	mg/L		10-MAR-05	EOC	R266876
Sulfate (SO4)	105		0.5	mg/L		10-MAR-05	EOC	R266876
Ion Balance Calculation								
Ion Balance	103			%		12-MAR-05		
TDS (Calculated)	499			mg/L		12-MAR-05		
Hardness (as CaCO3)	353			mg/L		12-MAR-05		
Iron (Fe)-Dissolved	1.14		0.005	mg/L		09-MAR-05	HAS	R266751
Manganese (Mn)-Dissolved	0.402		0.001	mg/L		09-MAR-05	HAS	R266751
Nitrate+Nitrite-N	<0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	<0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.6		0.1	pH		11-MAR-05	PTT	R267158
Conductivity (EC)	831		0.2	uS/cm		11-MAR-05	PTT	R267158
Bicarbonate (HCO3)	403		5	mg/L		11-MAR-05	PTT	R267158
Carbonate (CO3)	<5		5	mg/L		11-MAR-05	PTT	R267158
Hydroxide (OH)	<5		5	mg/L		11-MAR-05	PTT	R267158
Alkalinity, Total (as CaCO3)	330		5	mg/L		11-MAR-05	PTT	R267158
L250798-4 MW6 FT.SASK								
Sampled By: C.CALVERT on 08-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
Toluene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L250798-4 MW6 FT.SASK								
Sampled By: C.CALVERT on 08-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
EthylBenzene	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
Xylenes	<0.0005		0.0005	mg/L		10-MAR-05	CTL	R266725
F1(C6-C10)	<0.1		0.1	mg/L		10-MAR-05	CTL	R266725
F1-BTEX	<0.1		0.1	mg/L		10-MAR-05	CTL	R266725
F2 (>C10-C16)	<0.05		0.05	mg/L	10-MAR-05	10-MAR-05	AAT	R266928
Ammonia-N	1.46		0.05	mg/L		10-MAR-05	SHC	R266822
Dissolved Organic Carbon	5		1	mg/L		11-MAR-05	HSC	R267238
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Orthophosphate (PO4-P)	<0.01		0.01	mg/L		09-MAR-05	TL	R266536
Phenols (4AAP)	<0.001		0.001	mg/L		11-MAR-05	RJK	R267205
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	4		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Aluminum (Al)	<0.01		0.01	mg/L		09-MAR-05	JY	R266793
Arsenic (As)	0.0042		0.0004	mg/L		09-MAR-05	JY	R266793
Boron (B)	0.148		0.002	mg/L		09-MAR-05	JY	R266793
Barium (Ba)	0.0710		0.0001	mg/L		09-MAR-05	JY	R266793
Beryllium (Be)	<0.0005		0.0005	mg/L		09-MAR-05	JY	R266793
Bismuth (Bi)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Cadmium (Cd)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Cobalt (Co)	0.0012		0.0001	mg/L		09-MAR-05	JY	R266793
Chromium (Cr)	0.0035		0.0004	mg/L		09-MAR-05	JY	R266793
Copper (Cu)	0.0011		0.0006	mg/L		09-MAR-05	JY	R266793
Molybdenum (Mo)	0.0014		0.0001	mg/L		09-MAR-05	JY	R266793
Nickel (Ni)	<0.0001		0.0001	mg/L		09-MAR-05	JY	R266793
Lead (Pb)	0.0004		0.0001	mg/L		09-MAR-05	JY	R266793
Antimony (Sb)	0.0009		0.0004	mg/L		09-MAR-05	JY	R266793
Selenium (Se)	0.0005		0.0004	mg/L		09-MAR-05	JY	R266793
Tin (Sn)	<0.0002		0.0002	mg/L		09-MAR-05	JY	R266793
Strontium (Sr)	1.20		0.0001	mg/L		09-MAR-05	JY	R266793
Titanium (Ti)	0.0008		0.0003	mg/L		09-MAR-05	JY	R266793
Thallium (Tl)	<0.00005		0.00005	mg/L		09-MAR-05	JY	R266793
Uranium (U)	0.0023		0.0001	mg/L		09-MAR-05	JY	R266793
Vanadium (V)	0.0002		0.0001	mg/L		09-MAR-05	JY	R266793
Zinc (Zn)	0.004		0.002	mg/L		09-MAR-05	JY	R266793
Fluoride (F)	0.18		0.05	mg/L		11-MAR-05	PTT	R267158
ICP metals and SO4 for routine water								
Calcium (Ca)	171		0.5	mg/L		10-MAR-05	EOC	R266876
Potassium (K)	6.1		0.1	mg/L		10-MAR-05	EOC	R266876
Magnesium (Mg)	58.9		0.1	mg/L		10-MAR-05	EOC	R266876
Sodium (Na)	138		1	mg/L		10-MAR-05	EOC	R266876
Sulfate (SO4)	451		0.5	mg/L		10-MAR-05	EOC	R266876
Ion Balance Calculation								
Ion Balance	105			%		12-MAR-05		
TDS (Calculated)	1100			mg/L		12-MAR-05		
Hardness (as CaCO3)	670			mg/L		12-MAR-05		
Iron (Fe)-Dissolved	2.92		0.005	mg/L		09-MAR-05	HAS	R266751
Manganese (Mn)-Dissolved	1.32		0.001	mg/L		09-MAR-05	HAS	R266751

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L250798-4 MW6 FT.SASK								
Sampled By: C.CALVERT on 08-MAR-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Nitrate+Nitrite-N	<0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	<0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.5		0.1	pH		11-MAR-05	PTT	R267158
Conductivity (EC)	1580		0.2	uS/cm		11-MAR-05	PTT	R267158
Bicarbonate (HCO3)	560		5	mg/L		11-MAR-05	PTT	R267158
Carbonate (CO3)	<5		5	mg/L		11-MAR-05	PTT	R267158
Hydroxide (OH)	<5		5	mg/L		11-MAR-05	PTT	R267158
Alkalinity, Total (as CaCO3)	459		5	mg/L		11-MAR-05	PTT	R267158

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

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
RAMB	Result Adjusted For Method Blank

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
BTX,F1-ED	Water	BTEX and F1 (C6-C10)	EPA 5030	EPA 5030/8015&8260-P&T GC-MS & FID
C-DIS-ORG-CL	Water	Dissolved Organic Carbon		APHA 5310 C-Instrumental
CL-ED	Water	Chloride (Cl)		APHA 4500 Cl E-Colorimetry
ETL-ROUTINE-ICP-ED	Water	ICP metals and SO4 for routine water		APHA 3120 B-ICP-OES
F-ED	Water	Fluoride (F)		APHA 4500 F-C-Electrode
F2-ED	Water	F2 (>C10-C16)		EPA 3510/8000-GC-FID
FE-DIS-ED	Water	Iron (Fe)-Dissolved		EPA 200.7
HG-DIS-LOW-ED	Water	Mercury (Hg)-Dissolved		EPA 6020
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET1-DIS-LOW-ED	Water	Dissolved Trace Metals (Low Level)		EPA 6020
MN-DIS-ED	Water	Manganese (Mn)-Dissolved		EPA 200.7
N2N3-ED	Water	Nitrate+Nitrite-N		APHA 4500 NO3H-Colorimetry
NH4-ED	Water	Ammonia-N		APHA4500NH3F Colorimetry
NO2-ED	Water	Nitrite-N		APHA 4500 NO2B-Colorimetry
NO3-ED	Water	Nitrate-N		APHA 4500 NO3H-Colorimetry
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
PHENOLS-CL	Water	Phenols (4AAP)		EPA 9066-Colorimetric
PO4-ED	Water	Orthophosphate (PO4-P)		APHA 4500 P B,E-Auto-Colorimetry

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

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	Laboratory Definition Code	Laboratory Location
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA	ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Reference Information

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - 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.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ANALYTICAL REPORT

STANTEC CONSULTING LTD
ATTN: DAN YOSHISAKA
7 FL NORTH TOWER 10160 112 STREET
EDMONTON AB T5K 2L6

Reported On: 28-AUG-06 01:51 PM
Revision: 1

Lab Work Order #: **L251208** **Date Received:** **10-MAR-05**

Project P.O. #:
Job Reference: 1102-17094
Legal Site Desc:
CofC Numbers:

Other Information:

Comments: Revised Report: Rechecks requested for BTEX, F1 and SO4 on L251208-1, benzene, toluene and xylene values were edited due to sample carry over on original sample set, all other values confirmed 29-MAR-05.

ROY JONES
General Manager

For any questions about this report please contact your Account Manager:

RACHEL JONES

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251208-1 MW7 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Toluene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
EthylBenzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Xylenes	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1(C6-C10)	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1-BTEX	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F2 (>C10-C16)	<0.05		0.05	mg/L	11-MAR-05	11-MAR-05	AMB	R267270
Ammonia-N	2.24		0.005	mg/L		11-MAR-05	SHC	R267157
Dissolved Organic Carbon	5		1	mg/L		15-MAR-05	JZ	R267803
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		10-MAR-05	SHC	R267330
Phenols (4AAP)	<0.001		0.001	mg/L		16-MAR-05	RH	R268345
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	13		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Aluminum (Al)	<0.01		0.01	mg/L		11-MAR-05	JY	R267165
Arsenic (As)	0.0017		0.0004	mg/L		11-MAR-05	JY	R267165
Boron (B)	0.366		0.002	mg/L		11-MAR-05	JY	R267165
Barium (Ba)	0.0733		0.0001	mg/L		11-MAR-05	JY	R267165
Beryllium (Be)	<0.0005		0.0005	mg/L		11-MAR-05	JY	R267165
Bismuth (Bi)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Cadmium (Cd)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Cobalt (Co)	0.0026		0.0001	mg/L		11-MAR-05	JY	R267165
Chromium (Cr)	0.0017		0.0004	mg/L		11-MAR-05	JY	R267165
Copper (Cu)	0.0024		0.0006	mg/L		11-MAR-05	JY	R267165
Molybdenum (Mo)	0.0010		0.0001	mg/L		11-MAR-05	JY	R267165
Nickel (Ni)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Lead (Pb)	0.0004		0.0001	mg/L		11-MAR-05	JY	R267165
Antimony (Sb)	0.0008		0.0004	mg/L		11-MAR-05	JY	R267165
Selenium (Se)	0.0008		0.0004	mg/L		11-MAR-05	JY	R267165
Tin (Sn)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Strontium (Sr)	2.49		0.0001	mg/L		11-MAR-05	JY	R267165
Titanium (Ti)	0.0012		0.0003	mg/L		11-MAR-05	JY	R267165
Thallium (Tl)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Uranium (U)	0.0018		0.0001	mg/L		11-MAR-05	JY	R267165
Vanadium (V)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Zinc (Zn)	0.006		0.002	mg/L		11-MAR-05	JY	R267165
Fluoride (F)	0.11		0.05	mg/L		12-MAR-05	PTT	R267544
ICP metals and SO4 for routine water								
Calcium (Ca)	287		0.5	mg/L		11-MAR-05	EOC	R267118
Potassium (K)	6.6		0.1	mg/L		11-MAR-05	EOC	R267118
Magnesium (Mg)	100		0.1	mg/L		11-MAR-05	EOC	R267118
Sodium (Na)	287		1	mg/L		11-MAR-05	EOC	R267118
Sulfate (SO4)	1130		0.5	mg/L		11-MAR-05	EOC	R267118
Ion Balance Calculation								
Ion Balance	102			%		14-MAR-05		
TDS (Calculated)	2150			mg/L		14-MAR-05		
Hardness (as CaCO3)	1130			mg/L		14-MAR-05		
Iron (Fe)-Dissolved	10.4		0.005	mg/L		11-MAR-05	HAS	R267197

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251208-1 MW7 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Manganese (Mn)-Dissolved	1.88		0.001	mg/L		11-MAR-05	HAS	R267197
Nitrate+Nitrite-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.5		0.1	pH		12-MAR-05	PTT	R267544
Conductivity (EC)	2680		0.2	uS/cm		12-MAR-05	PTT	R267544
Bicarbonate (HCO3)	664		5	mg/L		12-MAR-05	PTT	R267544
Carbonate (CO3)	<5		5	mg/L		12-MAR-05	PTT	R267544
Hydroxide (OH)	<5		5	mg/L		12-MAR-05	PTT	R267544
Alkalinity, Total (as CaCO3)	544		5	mg/L		12-MAR-05	PTT	R267544
L251208-2 MW8 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Toluene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
EthylBenzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Xylenes	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1(C6-C10)	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1-BTEX	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F2 (>C10-C16)	<0.05		0.05	mg/L	11-MAR-05	11-MAR-05	AMB	R267270
Ammonia-N	1.83		0.005	mg/L		11-MAR-05	SHC	R267157
Dissolved Organic Carbon	5		1	mg/L		15-MAR-05	JZ	R267803
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		10-MAR-05	SHC	R267330
Phenols (4AAP)	<0.001		0.001	mg/L		16-MAR-05	RH	R268345
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	3		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Aluminum (Al)	<0.01		0.01	mg/L		11-MAR-05	JY	R267165
Arsenic (As)	0.0042		0.0004	mg/L		11-MAR-05	JY	R267165
Boron (B)	0.244		0.002	mg/L		11-MAR-05	JY	R267165
Barium (Ba)	0.0840		0.0001	mg/L		11-MAR-05	JY	R267165
Beryllium (Be)	<0.0005		0.0005	mg/L		11-MAR-05	JY	R267165
Bismuth (Bi)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Cadmium (Cd)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Cobalt (Co)	0.0008		0.0001	mg/L		11-MAR-05	JY	R267165
Chromium (Cr)	0.0011		0.0004	mg/L		11-MAR-05	JY	R267165
Copper (Cu)	0.0010		0.0006	mg/L		11-MAR-05	JY	R267165
Molybdenum (Mo)	0.0012		0.0001	mg/L		11-MAR-05	JY	R267165
Nickel (Ni)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Lead (Pb)	0.0004		0.0001	mg/L		11-MAR-05	JY	R267165
Antimony (Sb)	0.0006		0.0004	mg/L		11-MAR-05	JY	R267165
Selenium (Se)	0.0004		0.0004	mg/L		11-MAR-05	JY	R267165
Tin (Sn)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Strontium (Sr)	1.40		0.0001	mg/L		11-MAR-05	JY	R267165
Titanium (Ti)	0.0008		0.0003	mg/L		11-MAR-05	JY	R267165

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251208-2 MW8 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Thallium (Tl)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Uranium (U)	0.0011		0.0001	mg/L		11-MAR-05	JY	R267165
Vanadium (V)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Zinc (Zn)	0.003		0.002	mg/L		11-MAR-05	JY	R267165
Fluoride (F)	0.13		0.05	mg/L		12-MAR-05	PTT	R267544
ICP metals and SO4 for routine water								
Calcium (Ca)	147		0.5	mg/L		11-MAR-05	EOC	R267118
Potassium (K)	6.0		0.1	mg/L		11-MAR-05	EOC	R267118
Magnesium (Mg)	45.0		0.1	mg/L		11-MAR-05	EOC	R267118
Sodium (Na)	137		1	mg/L		11-MAR-05	EOC	R267118
Sulfate (SO4)	369		0.5	mg/L		11-MAR-05	EOC	R267118
Ion Balance Calculation								
Ion Balance	98.8			%		14-MAR-05		
TDS (Calculated)	999			mg/L		14-MAR-05		
Hardness (as CaCO3)	552			mg/L		14-MAR-05		
Iron (Fe)-Dissolved	5.66		0.005	mg/L		11-MAR-05	HAS	R267197
Manganese (Mn)-Dissolved	0.474		0.001	mg/L		11-MAR-05	HAS	R267197
Nitrate+Nitrite-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.7		0.1	pH		12-MAR-05	PTT	R267544
Conductivity (EC)	1470		0.2	uS/cm		12-MAR-05	PTT	R267544
Bicarbonate (HCO3)	593		5	mg/L		12-MAR-05	PTT	R267544
Carbonate (CO3)	<5		5	mg/L		12-MAR-05	PTT	R267544
Hydroxide (OH)	<5		5	mg/L		12-MAR-05	PTT	R267544
Alkalinity, Total (as CaCO3)	486		5	mg/L		12-MAR-05	PTT	R267544
L251208-3 MW9 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Toluene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
EthylBenzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Xylenes	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1(C6-C10)	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1-BTEX	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F2 (>C10-C16)	<0.05		0.05	mg/L	11-MAR-05	11-MAR-05	AMB	R267270
Ammonia-N	1.81		0.005	mg/L		11-MAR-05	SHC	R267157
Dissolved Organic Carbon	5		1	mg/L		15-MAR-05	JZ	R267803
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		10-MAR-05	SHC	R267330
Phenols (4AAP)	<0.001		0.001	mg/L		16-MAR-05	RH	R268345
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	5		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Aluminum (Al)	0.14		0.01	mg/L		11-MAR-05	JY	R267165

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251208-3 MW9 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Arsenic (As)	0.0019		0.0004	mg/L		11-MAR-05	JY	R267165
Boron (B)	0.339		0.002	mg/L		11-MAR-05	JY	R267165
Barium (Ba)	0.0608		0.0001	mg/L		11-MAR-05	JY	R267165
Beryllium (Be)	<0.0005		0.0005	mg/L		11-MAR-05	JY	R267165
Bismuth (Bi)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Cadmium (Cd)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Cobalt (Co)	0.0011		0.0001	mg/L		11-MAR-05	JY	R267165
Chromium (Cr)	0.0016		0.0004	mg/L		11-MAR-05	JY	R267165
Copper (Cu)	0.0010		0.0006	mg/L		11-MAR-05	JY	R267165
Molybdenum (Mo)	0.0019		0.0001	mg/L		11-MAR-05	JY	R267165
Nickel (Ni)	0.0002		0.0001	mg/L		11-MAR-05	JY	R267165
Lead (Pb)	0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Antimony (Sb)	0.0007		0.0004	mg/L		11-MAR-05	JY	R267165
Selenium (Se)	<0.0004		0.0004	mg/L		11-MAR-05	JY	R267165
Tin (Sn)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Strontium (Sr)	0.843		0.0001	mg/L		11-MAR-05	JY	R267165
Titanium (Ti)	0.0058		0.0003	mg/L		11-MAR-05	JY	R267165
Thallium (Tl)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Uranium (U)	0.0019		0.0001	mg/L		11-MAR-05	JY	R267165
Vanadium (V)	0.0005		0.0001	mg/L		11-MAR-05	JY	R267165
Zinc (Zn)	0.003		0.002	mg/L		11-MAR-05	JY	R267165
Fluoride (F)	0.29		0.05	mg/L		12-MAR-05	PTT	R267544
ICP metals and SO4 for routine water								
Calcium (Ca)	71.6		0.5	mg/L		11-MAR-05	EOC	R267118
Potassium (K)	4.2		0.1	mg/L		11-MAR-05	EOC	R267118
Magnesium (Mg)	26.0		0.1	mg/L		11-MAR-05	EOC	R267118
Sodium (Na)	226		1	mg/L		11-MAR-05	EOC	R267118
Sulfate (SO4)	313		0.5	mg/L		11-MAR-05	EOC	R267118
Ion Balance Calculation								
Ion Balance	93.2			%		14-MAR-05		
TDS (Calculated)	954			mg/L		14-MAR-05		
Hardness (as CaCO3)	286			mg/L		14-MAR-05		
Iron (Fe)-Dissolved	1.11		0.005	mg/L		11-MAR-05	HAS	R267197
Manganese (Mn)-Dissolved	0.714		0.001	mg/L		11-MAR-05	HAS	R267197
Nitrate+Nitrite-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.9		0.1	pH		12-MAR-05	PTT	R267544
Conductivity (EC)	1520		0.2	uS/cm		12-MAR-05	PTT	R267544
Bicarbonate (HCO3)	626		5	mg/L		12-MAR-05	PTT	R267544
Carbonate (CO3)	<5		5	mg/L		12-MAR-05	PTT	R267544
Hydroxide (OH)	<5		5	mg/L		12-MAR-05	PTT	R267544
Alkalinity, Total (as CaCO3)	513		5	mg/L		12-MAR-05	PTT	R267544
L251208-4 MW10 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Toluene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251208-4 MW10 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
EthylBenzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Xylenes	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1(C6-C10)	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1-BTEX	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F2 (>C10-C16)	<0.05		0.05	mg/L	11-MAR-05	11-MAR-05	AMB	R267270
Ammonia-N	1.68		0.005	mg/L		11-MAR-05	SHC	R267157
Dissolved Organic Carbon	5		1	mg/L		15-MAR-05	JZ	R267803
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		10-MAR-05	SHC	R267330
Phenols (4AAP)	<0.001		0.001	mg/L		16-MAR-05	RH	R268345
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	<1		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Aluminum (Al)	<0.01		0.01	mg/L		11-MAR-05	JY	R267165
Arsenic (As)	0.0030		0.0004	mg/L		11-MAR-05	JY	R267165
Boron (B)	0.209		0.002	mg/L		11-MAR-05	JY	R267165
Barium (Ba)	0.0296		0.0001	mg/L		11-MAR-05	JY	R267165
Beryllium (Be)	<0.0005		0.0005	mg/L		11-MAR-05	JY	R267165
Bismuth (Bi)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Cadmium (Cd)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Cobalt (Co)	0.0003		0.0001	mg/L		11-MAR-05	JY	R267165
Chromium (Cr)	0.0012		0.0004	mg/L		11-MAR-05	JY	R267165
Copper (Cu)	0.0007		0.0006	mg/L		11-MAR-05	JY	R267165
Molybdenum (Mo)	0.0009		0.0001	mg/L		11-MAR-05	JY	R267165
Nickel (Ni)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Lead (Pb)	0.0004		0.0001	mg/L		11-MAR-05	JY	R267165
Antimony (Sb)	0.0007		0.0004	mg/L		11-MAR-05	JY	R267165
Selenium (Se)	<0.0004		0.0004	mg/L		11-MAR-05	JY	R267165
Tin (Sn)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Strontium (Sr)	1.29		0.0001	mg/L		11-MAR-05	JY	R267165
Titanium (Ti)	0.0008		0.0003	mg/L		11-MAR-05	JY	R267165
Thallium (Tl)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Uranium (U)	0.0019		0.0001	mg/L		11-MAR-05	JY	R267165
Vanadium (V)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Zinc (Zn)	0.003		0.002	mg/L		11-MAR-05	JY	R267165
Fluoride (F)	0.18		0.05	mg/L		12-MAR-05	PTT	R267544
ICP metals and SO4 for routine water								
Calcium (Ca)	131		0.5	mg/L		11-MAR-05	EOC	R267118
Potassium (K)	5.3		0.1	mg/L		11-MAR-05	EOC	R267118
Magnesium (Mg)	36.1		0.1	mg/L		11-MAR-05	EOC	R267118
Sodium (Na)	117		1	mg/L		11-MAR-05	EOC	R267118
Sulfate (SO4)	221		0.5	mg/L		11-MAR-05	EOC	R267118
Ion Balance Calculation								
Ion Balance	99.7			%		14-MAR-05		
TDS (Calculated)	819			mg/L		14-MAR-05		
Hardness (as CaCO3)	476			mg/L		14-MAR-05		
Iron (Fe)-Dissolved	5.29		0.005	mg/L		11-MAR-05	HAS	R267197
Manganese (Mn)-Dissolved	0.639		0.001	mg/L		11-MAR-05	HAS	R267197

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251208-4 MW10 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Nitrate+Nitrite-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.7		0.1	pH		12-MAR-05	PTT	R267544
Conductivity (EC)	1270		0.2	uS/cm		12-MAR-05	PTT	R267544
Bicarbonate (HCO3)	628		5	mg/L		12-MAR-05	PTT	R267544
Carbonate (CO3)	<5		5	mg/L		12-MAR-05	PTT	R267544
Hydroxide (OH)	<5		5	mg/L		12-MAR-05	PTT	R267544
Alkalinity, Total (as CaCO3)	514		5	mg/L		12-MAR-05	PTT	R267544
L251208-5 MW190 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Toluene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
EthylBenzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Xylenes	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1(C6-C10)	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1-BTEX	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F2 (>C10-C16)	<0.05		0.05	mg/L	11-MAR-05	11-MAR-05	AMB	R267270
Ammonia-N	1.79		0.005	mg/L		11-MAR-05	SHC	R267157
Dissolved Organic Carbon	5		1	mg/L		15-MAR-05	JZ	R267803
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		10-MAR-05	SHC	R267330
Phenols (4AAP)	<0.001		0.001	mg/L		16-MAR-05	RH	R268345
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	5		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Aluminum (Al)	0.12		0.01	mg/L		11-MAR-05	JY	R267165
Arsenic (As)	0.0019		0.0004	mg/L		11-MAR-05	JY	R267165
Boron (B)	0.332		0.002	mg/L		11-MAR-05	JY	R267165
Barium (Ba)	0.0616		0.0001	mg/L		11-MAR-05	JY	R267165
Beryllium (Be)	<0.0005		0.0005	mg/L		11-MAR-05	JY	R267165
Bismuth (Bi)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Cadmium (Cd)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Cobalt (Co)	0.0012		0.0001	mg/L		11-MAR-05	JY	R267165
Chromium (Cr)	0.0012		0.0004	mg/L		11-MAR-05	JY	R267165
Copper (Cu)	0.0010		0.0006	mg/L		11-MAR-05	JY	R267165
Molybdenum (Mo)	0.0019		0.0001	mg/L		11-MAR-05	JY	R267165
Nickel (Ni)	0.0002		0.0001	mg/L		11-MAR-05	JY	R267165
Lead (Pb)	0.0003		0.0001	mg/L		11-MAR-05	JY	R267165
Antimony (Sb)	0.0007		0.0004	mg/L		11-MAR-05	JY	R267165
Selenium (Se)	<0.0004		0.0004	mg/L		11-MAR-05	JY	R267165
Tin (Sn)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Strontium (Sr)	0.841		0.0001	mg/L		11-MAR-05	JY	R267165
Titanium (Ti)	0.0059		0.0003	mg/L		11-MAR-05	JY	R267165
Thallium (Tl)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251208-5 MW190 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Uranium (U)	0.0018		0.0001	mg/L		11-MAR-05	JY	R267165
Vanadium (V)	0.0004		0.0001	mg/L		11-MAR-05	JY	R267165
Zinc (Zn)	0.004		0.002	mg/L		11-MAR-05	JY	R267165
Fluoride (F)	0.29		0.05	mg/L		13-MAR-05	PTT	R267544
ICP metals and SO4 for routine water								
Calcium (Ca)	79.1		0.5	mg/L		11-MAR-05	EOC	R267118
Potassium (K)	4.7		0.1	mg/L		11-MAR-05	EOC	R267118
Magnesium (Mg)	27.9		0.1	mg/L		11-MAR-05	EOC	R267118
Sodium (Na)	243		1	mg/L		11-MAR-05	EOC	R267118
Sulfate (SO4)	340		0.5	mg/L		11-MAR-05	EOC	R267118
Ion Balance Calculation								
Ion Balance	97.4			%		14-MAR-05		
TDS (Calculated)	1010			mg/L		14-MAR-05		
Hardness (as CaCO3)	312			mg/L		14-MAR-05		
Iron (Fe)-Dissolved	1.07		0.005	mg/L		11-MAR-05	HAS	R267197
Manganese (Mn)-Dissolved	0.705		0.001	mg/L		11-MAR-05	HAS	R267197
Nitrate+Nitrite-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	7.9		0.1	pH		13-MAR-05	PTT	R267544
Conductivity (EC)	1520		0.2	uS/cm		13-MAR-05	PTT	R267544
Bicarbonate (HCO3)	628		5	mg/L		13-MAR-05	PTT	R267544
Carbonate (CO3)	<5		5	mg/L		13-MAR-05	PTT	R267544
Hydroxide (OH)	<5		5	mg/L		13-MAR-05	PTT	R267544
Alkalinity, Total (as CaCO3)	515		5	mg/L		13-MAR-05	PTT	R267544
L251208-6 05-99-1 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Toluene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
EthylBenzene	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
Xylenes	<0.0005		0.0005	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1(C6-C10)	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F1-BTEX	<0.1		0.1	mg/L	10-MAR-05	10-MAR-05	SCM	R267069
F2 (>C10-C16)	<0.05		0.05	mg/L	11-MAR-05	11-MAR-05	AMB	R267270
Ammonia-N	0.050		0.005	mg/L		15-MAR-05	SHC	R268068
Dissolved Organic Carbon	2		1	mg/L		15-MAR-05	JZ	R267803
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		10-MAR-05	SHC	R267330
Phenols (4AAP)	<0.001		0.001	mg/L		16-MAR-05	RH	R268345
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	<1		1	mg/L		10-MAR-05	JTV	R266925
Dissolved Trace Metals (Low Level)								
Silver (Ag)	0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Aluminum (Al)	<0.01		0.01	mg/L		11-MAR-05	JY	R267165
Arsenic (As)	<0.0004		0.0004	mg/L		11-MAR-05	JY	R267165

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251208-6 05-99-1 FT. SASK								
Sampled By: C. CALVERT on 09-MAR-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Boron (B)	0.004		0.002	mg/L		11-MAR-05	JY	R267165
Barium (Ba)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Beryllium (Be)	<0.0005		0.0005	mg/L		11-MAR-05	JY	R267165
Bismuth (Bi)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Cadmium (Cd)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Cobalt (Co)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Chromium (Cr)	<0.0004		0.0004	mg/L		11-MAR-05	JY	R267165
Copper (Cu)	0.0015		0.0006	mg/L		11-MAR-05	JY	R267165
Molybdenum (Mo)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Nickel (Ni)	0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Lead (Pb)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Antimony (Sb)	0.0008		0.0004	mg/L		11-MAR-05	JY	R267165
Selenium (Se)	<0.0004		0.0004	mg/L		11-MAR-05	JY	R267165
Tin (Sn)	<0.0002		0.0002	mg/L		11-MAR-05	JY	R267165
Strontium (Sr)	0.0002		0.0001	mg/L		11-MAR-05	JY	R267165
Titanium (Ti)	<0.0003		0.0003	mg/L		11-MAR-05	JY	R267165
Thallium (Tl)	<0.00005		0.00005	mg/L		11-MAR-05	JY	R267165
Uranium (U)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Vanadium (V)	<0.0001		0.0001	mg/L		11-MAR-05	JY	R267165
Zinc (Zn)	<0.002		0.002	mg/L		11-MAR-05	JY	R267165
Fluoride (F)	0.05		0.05	mg/L		13-MAR-05	PTT	R267544
ICP metals and SO4 for routine water								
Calcium (Ca)	<0.5		0.5	mg/L		11-MAR-05	EOC	R267118
Potassium (K)	<0.1		0.1	mg/L		11-MAR-05	EOC	R267118
Magnesium (Mg)	<0.1		0.1	mg/L		11-MAR-05	EOC	R267118
Sodium (Na)	1		1	mg/L		11-MAR-05	EOC	R267118
Sulfate (SO4)	0.8		0.5	mg/L		11-MAR-05	EOC	R267118
Ion Balance Calculation								
Ion Balance	Low EC			%		14-MAR-05		
TDS (Calculated)	2			mg/L		14-MAR-05		
Hardness (as CaCO3)	<1			mg/L		14-MAR-05		
Iron (Fe)-Dissolved	0.012		0.005	mg/L		11-MAR-05	HAS	R267197
Manganese (Mn)-Dissolved	<0.001		0.001	mg/L		11-MAR-05	HAS	R267197
Nitrate+Nitrite-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrate-N	0.1		0.1	mg/L		10-MAR-05	JTV	R267313
Nitrite-N	<0.05		0.05	mg/L		10-MAR-05	JTV	R267313
pH, Conductivity and Total Alkalinity								
pH	6.5		0.1	pH		13-MAR-05	PTT	R267544
Conductivity (EC)	6.8		0.2	uS/cm		13-MAR-05	PTT	R267544
Bicarbonate (HCO3)	<5		5	mg/L		13-MAR-05	PTT	R267544
Carbonate (CO3)	<5		5	mg/L		13-MAR-05	PTT	R267544
Hydroxide (OH)	<5		5	mg/L		13-MAR-05	PTT	R267544
Alkalinity, Total (as CaCO3)	<5		5	mg/L		13-MAR-05	PTT	R267544

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

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
BTX,F1-ED	Water	BTEX and F1 (C6-C10)	EPA 5030	EPA 5030/8015&8260-P&T GC-MS & FID
C-DIS-ORG-CL	Water	Dissolved Organic Carbon		APHA 5310 C-Instrumental
CL-ED	Water	Chloride (Cl)		APHA 4500 Cl E-Colorimetry
ETL-ROUTINE-ICP-ED	Water	ICP metals and SO4 for routine water		APHA 3120 B-ICP-OES
F-ED	Water	Fluoride (F)		APHA 4500 F-C-Electrode
F2-ED	Water	F2 (>C10-C16)		EPA 3510/8000-GC-FID
FE-DIS-ED	Water	Iron (Fe)-Dissolved		EPA 200.7
HG-DIS-LOW-ED	Water	Mercury (Hg)-Dissolved		EPA 6020
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET1-DIS-LOW-ED	Water	Dissolved Trace Metals (Low Level)		EPA 6020
MN-DIS-ED	Water	Manganese (Mn)-Dissolved		EPA 200.7
N2N3-ED	Water	Nitrate+Nitrite-N		APHA 4500 NO3H-Colorimetry
NH4-LOW-ED	Water	Ammonia-N		APHA 4500 NH3F-Colorimetry
NO2-ED	Water	Nitrite-N		APHA 4500 NO2B-Colorimetry
NO3-ED	Water	Nitrate-N		APHA 4500 NO3H-Colorimetry
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
PHENOLS-CL	Water	Phenols (4AAP)		EPA 9066-Colorimetric
PO4-LOW-ED	Water	Orthophosphate (PO4-P)		APHA 4500 P B,E-Auto-Colorimetry

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

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	Laboratory Definition Code	Laboratory Location
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA	ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Reference Information

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - 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.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ANALYTICAL REPORT

STANTEC CONSULTING LTD
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EDMONTON AB T5K 2L6

Reported On: 28-AUG-06 01:58 PM
Revision: 1

Lab Work Order #: L251495 **Date Received:** 11-MAR-05

Project P.O. #:
Job Reference: 1102-17094
Legal Site Desc:
CofC Numbers: 167529

Other Information:

Comments:

ROY JONES
General Manager

For any questions about this report please contact your Account Manager:

RACHEL JONES

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251495-1 MW11 FT.SASK								
Sampled By: C.CALVERT on 10-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
Toluene	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
EthylBenzene	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
Xylenes	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
F1(C6-C10)	<0.1		0.1	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
F1-BTEX	<0.1		0.1	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
F2 (>C10-C16)	<0.05		0.05	mg/L	14-MAR-05	14-MAR-05	MKE	R267796
Ammonia-N	1.50		0.005	mg/L		15-MAR-05	SHC	R267820
Dissolved Organic Carbon	15		1	mg/L		15-MAR-05	JZ	R267803
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		11-MAR-05	SHC	R267335
Phenols (4AAP)	<0.001		0.001	mg/L		16-MAR-05	RH	R268345
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	8		1	mg/L		15-MAR-05	MOR	R267986
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		14-MAR-05	MX	R267887
Aluminum (Al)	<0.01		0.01	mg/L		14-MAR-05	MX	R267887
Arsenic (As)	0.0022		0.0004	mg/L		14-MAR-05	MX	R267887
Boron (B)	0.189		0.002	mg/L		14-MAR-05	MX	R267887
Barium (Ba)	0.0494		0.0001	mg/L		14-MAR-05	MX	R267887
Beryllium (Be)	<0.0005		0.0005	mg/L		14-MAR-05	MX	R267887
Bismuth (Bi)	<0.00005		0.00005	mg/L		14-MAR-05	MX	R267887
Cadmium (Cd)	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Cobalt (Co)	0.0006		0.0001	mg/L		14-MAR-05	MX	R267887
Chromium (Cr)	0.0011		0.0004	mg/L		14-MAR-05	MX	R267887
Copper (Cu)	<0.0006		0.0006	mg/L		14-MAR-05	MX	R267887
Molybdenum (Mo)	0.0010		0.0001	mg/L		14-MAR-05	MX	R267887
Nickel (Ni)	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Lead (Pb)	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Antimony (Sb)	0.0008		0.0004	mg/L		14-MAR-05	MX	R267887
Selenium (Se)	<0.0004		0.0004	mg/L		14-MAR-05	MX	R267887
Tin (Sn)	<0.0002		0.0002	mg/L		14-MAR-05	MX	R267887
Strontium (Sr)	1.27		0.0001	mg/L		14-MAR-05	MX	R267887
Titanium (Ti)	0.0008		0.0003	mg/L		14-MAR-05	MX	R267887
Thallium (Tl)	<0.00005		0.00005	mg/L		14-MAR-05	MX	R267887
Uranium (U)	0.0012		0.0001	mg/L		14-MAR-05	MX	R267887
Vanadium (V)	0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Zinc (Zn)	0.004		0.002	mg/L		14-MAR-05	MX	R267887
Fluoride (F)	0.14		0.05	mg/L		13-MAR-05	PTT	R267544
ICP metals and SO4 for routine water								
Calcium (Ca)	150		0.5	mg/L		14-MAR-05	EOC	R267610
Potassium (K)	4.9		0.1	mg/L		14-MAR-05	EOC	R267610
Magnesium (Mg)	45.8		0.1	mg/L		14-MAR-05	EOC	R267610
Sodium (Na)	92		1	mg/L		14-MAR-05	EOC	R267610
Sulfate (SO4)	196		0.5	mg/L		14-MAR-05	EOC	R267610
Ion Balance Calculation								
Ion Balance	104			%		15-MAR-05		
TDS (Calculated)	813			mg/L		15-MAR-05		
Hardness (as CaCO3)	563			mg/L		15-MAR-05		
Iron (Fe)-Dissolved	6.89		0.005	mg/L		14-MAR-05	HAS	R267572

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251495-1 MW11 FT.SASK								
Sampled By: C.CALVERT on 10-MAR-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Manganese (Mn)-Dissolved	0.668		0.001	mg/L		14-MAR-05	HAS	R267572
Nitrate+Nitrite-N	0.1		0.1	mg/L		12-MAR-05	JTV	R267299
Nitrate-N	0.1		0.1	mg/L		12-MAR-05	JTV	R267299
Nitrite-N	<0.05		0.05	mg/L		12-MAR-05	JTV	R267299
pH, Conductivity and Total Alkalinity								
pH	7.7		0.1	pH		13-MAR-05	PTT	R267544
Conductivity (EC)	1270		0.2	uS/cm		13-MAR-05	PTT	R267544
Bicarbonate (HCO3)	642		5	mg/L		13-MAR-05	PTT	R267544
Carbonate (CO3)	<5		5	mg/L		13-MAR-05	PTT	R267544
Hydroxide (OH)	<5		5	mg/L		13-MAR-05	PTT	R267544
Alkalinity, Total (as CaCO3)	526		5	mg/L		13-MAR-05	PTT	R267544
L251495-2 MW12 FT.SASK								
Sampled By: C.CALVERT on 10-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
Toluene	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
EthylBenzene	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
Xylenes	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
F1(C6-C10)	<0.1		0.1	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
F1-BTEX	<0.1		0.1	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
F2 (>C10-C16)	<0.05		0.05	mg/L	14-MAR-05	14-MAR-05	MKE	R267796
Ammonia-N	1.39		0.005	mg/L		15-MAR-05	SHC	R267820
Dissolved Organic Carbon	6		1	mg/L		15-MAR-05	JZ	R267803
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		11-MAR-05	SHC	R267335
Phenols (4AAP)	<0.001		0.001	mg/L		16-MAR-05	RH	R268345
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	6		1	mg/L		15-MAR-05	MOR	R267986
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002	RAMB	0.0002	mg/L		14-MAR-05	MX	R267887
Aluminum (Al)	<0.01		0.01	mg/L		14-MAR-05	MX	R267887
Arsenic (As)	0.0022		0.0004	mg/L		14-MAR-05	MX	R267887
Boron (B)	0.234		0.002	mg/L		14-MAR-05	MX	R267887
Barium (Ba)	0.153		0.0001	mg/L		14-MAR-05	MX	R267887
Beryllium (Be)	<0.0005		0.0005	mg/L		14-MAR-05	MX	R267887
Bismuth (Bi)	<0.00005		0.00005	mg/L		14-MAR-05	MX	R267887
Cadmium (Cd)	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Cobalt (Co)	0.0008		0.0001	mg/L		14-MAR-05	MX	R267887
Chromium (Cr)	0.0038		0.0004	mg/L		14-MAR-05	MX	R267887
Copper (Cu)	<0.0006		0.0006	mg/L		14-MAR-05	MX	R267887
Molybdenum (Mo)	0.0015		0.0001	mg/L		14-MAR-05	MX	R267887
Nickel (Ni)	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Lead (Pb)	0.0004		0.0001	mg/L		14-MAR-05	MX	R267887
Antimony (Sb)	0.0008		0.0004	mg/L		14-MAR-05	MX	R267887
Selenium (Se)	<0.0004		0.0004	mg/L		14-MAR-05	MX	R267887
Tin (Sn)	<0.0002		0.0002	mg/L		14-MAR-05	MX	R267887
Strontium (Sr)	0.915		0.0001	mg/L		14-MAR-05	MX	R267887
Titanium (Ti)	0.0011		0.0003	mg/L		14-MAR-05	MX	R267887

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251495-2 MW12 FT.SASK								
Sampled By: C.CALVERT on 10-MAR-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Thallium (Tl)	<0.00005		0.00005	mg/L		14-MAR-05	MX	R267887
Uranium (U)	0.0010		0.0001	mg/L		14-MAR-05	MX	R267887
Vanadium (V)	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Zinc (Zn)	0.010		0.002	mg/L		14-MAR-05	MX	R267887
Fluoride (F)	0.13		0.05	mg/L		13-MAR-05	PTT	R267544
ICP metals and SO4 for routine water								
Calcium (Ca)	95.7		0.5	mg/L		14-MAR-05	EOC	R267610
Potassium (K)	5.0		0.1	mg/L		14-MAR-05	EOC	R267610
Magnesium (Mg)	27.9		0.1	mg/L		14-MAR-05	EOC	R267610
Sodium (Na)	106		1	mg/L		14-MAR-05	EOC	R267610
Sulfate (SO4)	45.9		0.5	mg/L		14-MAR-05	EOC	R267610
Ion Balance Calculation								
Ion Balance	102			%		15-MAR-05		
TDS (Calculated)	600			mg/L		15-MAR-05		
Hardness (as CaCO3)	354			mg/L		15-MAR-05		
Iron (Fe)-Dissolved	2.78		0.005	mg/L		14-MAR-05	HAS	R267572
Manganese (Mn)-Dissolved	0.365		0.001	mg/L		14-MAR-05	HAS	R267572
Nitrate+Nitrite-N	0.1		0.1	mg/L		12-MAR-05	JTV	R267299
Nitrate-N	0.1		0.1	mg/L		12-MAR-05	JTV	R267299
Nitrite-N	<0.05		0.05	mg/L		12-MAR-05	JTV	R267299
pH, Conductivity and Total Alkalinity								
pH	7.9		0.1	pH		13-MAR-05	PTT	R267544
Conductivity (EC)	1000		0.2	uS/cm		13-MAR-05	PTT	R267544
Bicarbonate (HCO3)	636		5	mg/L		13-MAR-05	PTT	R267544
Carbonate (CO3)	<5		5	mg/L		13-MAR-05	PTT	R267544
Hydroxide (OH)	<5		5	mg/L		13-MAR-05	PTT	R267544
Alkalinity, Total (as CaCO3)	521		5	mg/L		13-MAR-05	PTT	R267544
L251495-3 MW13 FT.SASK								
Sampled By: C.CALVERT on 10-MAR-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
Toluene	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
EthylBenzene	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
Xylenes	<0.0005		0.0005	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
F1(C6-C10)	<0.1		0.1	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
F1-BTEX	<0.1		0.1	mg/L	10-MAR-05	14-MAR-05	EMP	R267272
F2 (>C10-C16)	<0.05		0.05	mg/L	14-MAR-05	14-MAR-05	MKE	R267796
Ammonia-N	1.40		0.005	mg/L		15-MAR-05	SHC	R267820
Dissolved Organic Carbon	4		1	mg/L		15-MAR-05	JZ	R267803
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		11-MAR-05	SHC	R267335
Phenols (4AAP)	<0.001		0.001	mg/L		16-MAR-05	RH	R268345
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	2		1	mg/L		15-MAR-05	MOR	R267986
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002	RAMB	0.0002	mg/L		14-MAR-05	MX	R267887
Aluminum (Al)	<0.01		0.01	mg/L		14-MAR-05	MX	R267887

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L251495-3 MW13 FT.SASK								
Sampled By: C.CALVERT on 10-MAR-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Arsenic (As)	0.0012		0.0004	mg/L		14-MAR-05	MX	R267887
Boron (B)	0.258		0.002	mg/L		14-MAR-05	MX	R267887
Barium (Ba)	0.389		0.0001	mg/L		14-MAR-05	MX	R267887
Beryllium (Be)	<0.0005		0.0005	mg/L		14-MAR-05	MX	R267887
Bismuth (Bi)	<0.00005		0.00005	mg/L		14-MAR-05	MX	R267887
Cadmium (Cd)	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Cobalt (Co)	0.0008		0.0001	mg/L		14-MAR-05	MX	R267887
Chromium (Cr)	0.0048		0.0004	mg/L		14-MAR-05	MX	R267887
Copper (Cu)	<0.0006		0.0006	mg/L		14-MAR-05	MX	R267887
Molybdenum (Mo)	0.0023		0.0001	mg/L		14-MAR-05	MX	R267887
Nickel (Ni)	0.0009		0.0001	mg/L		14-MAR-05	MX	R267887
Lead (Pb)	0.0002		0.0001	mg/L		14-MAR-05	MX	R267887
Antimony (Sb)	0.0008		0.0004	mg/L		14-MAR-05	MX	R267887
Selenium (Se)	<0.0004		0.0004	mg/L		14-MAR-05	MX	R267887
Tin (Sn)	<0.0002		0.0002	mg/L		14-MAR-05	MX	R267887
Strontium (Sr)	0.570		0.0001	mg/L		14-MAR-05	MX	R267887
Titanium (Ti)	0.0006		0.0003	mg/L		14-MAR-05	MX	R267887
Thallium (Tl)	<0.00005		0.00005	mg/L		14-MAR-05	MX	R267887
Uranium (U)	0.0008		0.0001	mg/L		14-MAR-05	MX	R267887
Vanadium (V)	<0.0001		0.0001	mg/L		14-MAR-05	MX	R267887
Zinc (Zn)	0.005		0.002	mg/L		14-MAR-05	MX	R267887
Fluoride (F)	0.20		0.05	mg/L		13-MAR-05	PTT	R267544
ICP metals and SO4 for routine water								
Calcium (Ca)	53.7		0.5	mg/L		14-MAR-05	EOC	R267610
Potassium (K)	4.2		0.1	mg/L		14-MAR-05	EOC	R267610
Magnesium (Mg)	16.5		0.1	mg/L		14-MAR-05	EOC	R267610
Sodium (Na)	112		1	mg/L		14-MAR-05	EOC	R267610
Sulfate (SO4)	10.6		0.5	mg/L		14-MAR-05	EOC	R267610
Ion Balance Calculation								
Ion Balance	100			%		15-MAR-05		
TDS (Calculated)	460			mg/L		15-MAR-05		
Hardness (as CaCO3)	202			mg/L		15-MAR-05		
Iron (Fe)-Dissolved	0.818		0.005	mg/L		14-MAR-05	HAS	R267572
Manganese (Mn)-Dissolved	0.263		0.001	mg/L		14-MAR-05	HAS	R267572
Nitrate+Nitrite-N	0.1		0.1	mg/L		12-MAR-05	JTV	R267299
Nitrate-N	0.1		0.1	mg/L		12-MAR-05	JTV	R267299
Nitrite-N	<0.05		0.05	mg/L		12-MAR-05	JTV	R267299
pH, Conductivity and Total Alkalinity								
pH	8.1		0.1	pH		13-MAR-05	PTT	R267544
Conductivity (EC)	784		0.2	uS/cm		13-MAR-05	PTT	R267544
Bicarbonate (HCO3)	531		5	mg/L		13-MAR-05	PTT	R267544
Carbonate (CO3)	<5		5	mg/L		13-MAR-05	PTT	R267544
Hydroxide (OH)	<5		5	mg/L		13-MAR-05	PTT	R267544
Alkalinity, Total (as CaCO3)	435		5	mg/L		13-MAR-05	PTT	R267544

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

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
RAMB	Result Adjusted For Method Blank

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
BTX,F1-ED	Water	BTEX and F1 (C6-C10)	EPA 5030	EPA 5030/8015&8260-P&T GC-MS & FID
C-DIS-ORG-CL	Water	Dissolved Organic Carbon		APHA 5310 C-Instrumental
CL-ED	Water	Chloride (Cl)		APHA 4500 Cl E-Colorimetry
ETL-ROUTINE-ICP-ED	Water	ICP metals and SO4 for routine water		APHA 3120 B-ICP-OES
F-ED	Water	Fluoride (F)		APHA 4500 F-C-Electrode
F2-ED	Water	F2 (>C10-C16)		EPA 3510/8000-GC-FID
FE-DIS-ED	Water	Iron (Fe)-Dissolved		EPA 200.7
HG-DIS-LOW-ED	Water	Mercury (Hg)-Dissolved		EPA 6020
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET1-DIS-LOW-ED	Water	Dissolved Trace Metals (Low Level)		EPA 6020
MN-DIS-ED	Water	Manganese (Mn)-Dissolved		EPA 200.7
N2N3-ED	Water	Nitrate+Nitrite-N		APHA 4500 NO3H-Colorimetry
NH4-LOW-ED	Water	Ammonia-N		APHA 4500 NH3F-Colorimetry
NO2-ED	Water	Nitrite-N		APHA 4500 NO2B-Colorimetry
NO3-ED	Water	Nitrate-N		APHA 4500 NO3H-Colorimetry
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
PHENOLS-CL	Water	Phenols (4AAP)		EPA 9066-Colorimetric
PO4-LOW-ED	Water	Orthophosphate (PO4-P)		APHA 4500 P B,E-Auto-Colorimetry

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

167529

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	Laboratory Definition Code	Laboratory Location
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA	ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Reference Information

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - 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.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ANALYTICAL REPORT

STANTEC CONSULTING LTD
ATTN: HEIDI LOVETT/ D. YOSHISAKA
Reported On: 28-AUG-06 01:44 PM

7 FL NORTH TOWER, 10160 112 STREET

EDMONTON AB T5K 2L6

Lab Work Order #: **L266644** **Date Received:** **11-MAY-05**

Project P.O. #:
Job Reference: 1102-17094
Legal Site Desc:
CofC Numbers: 159821, 160067, 163300

Other Information:

Comments:

ROY JONES
General Manager

For any questions about this report please contact your Account Manager:

RACHEL JONES

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L266644-1	TH-01 (80'-100')								
Sampled By:	CLIENT on 17-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	3.8		0	%		17-MAY-05	SR	R284466
L266644-2	TH-01 (100')								
Sampled By:	CLIENT on 17-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	4.5		0	%		17-MAY-05	SR	R284466
L266644-3	TH-02 (20')								
Sampled By:	CLIENT on 18-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	0.7		0	%		17-MAY-05	SR	R284466
L266644-4	TH-03 (32'-43')								
Sampled By:	CLIENT on 18-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	1.1		0	%		17-MAY-05	SR	R284466
L266644-5	TH-04 (45')								
Sampled By:	CLIENT on 18-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	1.2		0	%		17-MAY-05	SR	R284466
L266644-6	TH-05 (10'-15')								
Sampled By:	CLIENT on 19-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	1.8		0	%		17-MAY-05	SR	R284466
L266644-7	TH-06 (140')								
Sampled By:	CLIENT on 21-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	5.5		0	%		17-MAY-05	SR	R284466
L266644-8	TH-07 (110')								
Sampled By:	CLIENT on 19-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	7.7		0	%		17-MAY-05	SR	R284466
L266644-9	TH-08 (96'-100')								
Sampled By:	CLIENT on 20-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	2.4		0	%		17-MAY-05	SR	R284782
L266644-10	TH-09 (112'-115')								
Sampled By:	CLIENT on 21-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	3.1		0	%		17-MAY-05	SR	R284782

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L266644-11 TH10 (115') Sampled By: CLIENT on 20-JAN-05 Matrix: SOIL								
Loss On Ignition @ 420 C	4.5		0	%		17-MAY-05	SR	R284782
L266644-12 TH10 (125') Sampled By: CLIENT on 20-JAN-05 Matrix: SOIL								
Loss On Ignition @ 420 C	3.0		0	%		17-MAY-05	SR	R284782
L266644-13 MW1 (55'-60') Sampled By: CLIENT on 24-JAN-05 Matrix: SOIL								
Loss On Ignition @ 420 C	12.0		0	%		17-MAY-05	SR	R284782
L266644-14 MW2 (97'-100') Sampled By: CLIENT on 24-JAN-05 Matrix: SOIL								
Loss On Ignition @ 420 C	6.3		0	%		17-MAY-05	SR	R284782
L266644-15 MW3 (85'-87') Sampled By: CLIENT on 25-JAN-05 Matrix: SOIL								
Loss On Ignition @ 420 C	3.8		0	%		17-MAY-05	SR	R284782
L266644-16 MW4 (74'-80') Sampled By: CLIENT on 25-JAN-05 Matrix: SOIL								
Loss On Ignition @ 420 C	7.1		0	%		17-MAY-05	SR	R284782
L266644-17 MW5 (90'-95') Sampled By: CLIENT on 03-FEB-05 Matrix: SOIL								
Loss On Ignition @ 420 C	4.1		0	%		17-MAY-05	SR	R284782
L266644-18 MW6 (110'-112') Sampled By: CLIENT on 31-JAN-05 Matrix: SOIL								
Loss On Ignition @ 420 C	1.0		0	%		17-MAY-05	SR	R284782
Special Request	See Attached					02-JUN-05	NW	R289609
L266644-19 MW6 (120'-125') Sampled By: CLIENT on 31-JAN-05 Matrix: SOIL								
Loss On Ignition @ 420 C	4.3		0	%		17-MAY-05	SR	R284782
L266644-20 MW7 (135') Sampled By: CLIENT on 14-FEB-05 Matrix: SOIL								
Loss On Ignition @ 420 C	4.9		0	%		17-MAY-05	SR	R284782

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L266644-21	MW8 (112'-124')								
Sampled By:	CLIENT on 03-FEB-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	5.4		0	%		17-MAY-05	SR	R284782
L266644-22	MW9 (120')								
Sampled By:	CLIENT on 28-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	1.7		0	%		17-MAY-05	SR	R284782
L266644-23	MW10 (120'-125')								
Sampled By:	CLIENT on 26-JAN-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	3.4		0	%		17-MAY-05	SR	R284782
L266644-24	MW12 (125'-127')								
Sampled By:	CLIENT on 02-FEB-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	6.5		0	%		17-MAY-05	SR	R284782
L266644-25	MW13 (127'-130')								
Sampled By:	CLIENT on 01-FEB-05								
Matrix:	SOIL								
	Loss On Ignition @ 420 C	3.4		0	%		17-MAY-05	SR	R284782
L266644-26	TH-01 AND TH-05 COMPOSITE								
Sampled By:	CLIENT on 01-FEB-05								
Matrix:	SOIL								
	Special Request	See Attached					02-JUN-05	NW	R289609
L266644-27	TH-08 AND TH10 COMPOSITE								
Sampled By:	CLIENT on 01-FEB-05								
Matrix:	SOIL								
	Special Request	See Attached					02-JUN-05	NW	R289609
L266644-28	MW3 AND MW5 COMPOSITE								
Sampled By:	CLIENT on 01-FEB-05								
Matrix:	SOIL								
	Special Request	See Attached					02-JUN-05	NW	R289609

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

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
LOI-420-ED	Soil	Loss on Ignition @ 420 C		McKeague 1978, Method 3.81

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

159821 160067 163300

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	Laboratory Definition Code	Laboratory Location
ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA		

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - 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.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

Enviro-Test Laboratories

A DIVISION OF CHEMSPEC ANALYTICAL SERVICES LIMITED

819 - 58th Street East, Saskatoon, SK., S7K 6X5 Phone: 306-668-8370 Fax: 306-668-8383

Sieve Analysis Report

Date: 22-Nov-05

Client: **STANTEC CONSULTING LTD~EDM**
ATTN: DAN YOSHISAKA
7 FL NORTH TOWER 10160 112 STREET
EDMONTON, AB

Project: **11027261**

Lab #	Client ID	Sieve Analysis (Note that sieve sizes are in mm)						
		> 25 wt %	25-12.5 wt %	12.5-9.5 wt %	9.5-4.75 wt %	4.75-2 wt %	2-0.075 wt %	< 0.075 wt %
L340963-14	COMPOSITE MW-04A	0.1	19.4	11.1	22.7	17.6	24.4	4.8

Lab File Number L340963

Enviro-Test Laboratories

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7 FL NORTH TOWER 10160 112 STREET
EDMONTON, AB

Project: **11027261**

Lab #	Client ID	**Sieve Analysis (Note that sieve sizes are in mm)**						
		> 25 wt %	25-12.5 wt %	12.5-9.5 wt %	9.5-4.75 wt %	4.75-2 wt %	2-0.075 wt %	< 0.075 wt %
L340963-15	COMPOSITE MW-07A	0.0	0.0	0.4	10.2	33.4	49.6	6.5

Lab File Number L340963

Enviro-Test Laboratories

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Sieve Analysis Report

Date: 22-Nov-05

Client: **STANTEC CONSULTING LTD~EDM**
ATTN: DAN YOSHISAKA
7 FL NORTH TOWER 10160 112 STREET
EDMONTON, AB

Project: **11027261**

Lab #	Client ID	**Sieve Analysis (Note that sieve sizes are in mm)**						
		> 25 wt %	25-12.5 wt %	12.5-9.5 wt %	9.5-4.75 wt %	4.75-2 wt %	2-0.075 wt %	< 0.075 wt %
L340963-16	COMPOSITE MW-10A (E10-E12)	0.0	0.0	0.9	2.5	4.0	86.9	5.7

Lab File Number L340963

Enviro-Test Laboratories

Sieve Analysis Report

A DIVISION OF CHEMSPEC ANALYTICAL SERVICES LIMITED
819 - 58th Street East, Saskatoon, SK., S7K 6X5 Phone: 306-668-8370 Fax: 306-668-8383

Date: 22-Nov-05

Client: **STANTEC CONSULTING LTD~EDM**
ATTN: DAN YOSHISAKA
7 FL NORTH TOWER 10160 112 STREET
EDMONTON, AB

Project: **11027261**

Lab #	Client ID	**Sieve Analysis (Note that sieve sizes are in mm)**						
		> 25 wt %	25-12.5 wt %	12.5-9.5 wt %	9.5-4.75 wt %	4.75-2 wt %	2-0.075 wt %	< 0.075 wt %
L340963-17	COMPOSITE MW-10A (E13-E15)	0.0	1.0	3.6	30.3	30.1	30.7	4.3

Lab File Number L340963

ANALYTICAL REPORT

STANTEC CONSULTING LTD
ATTN: DAN YOSHISAKA
7 FL NORTH TOWER 10160 112 STREET

EDMONTON AB T5K 2L6

Reported On: 28-AUG-06 02:35 PM
Revision: 1

Lab Work Order #: L341571 **Date Received:** 17-NOV-05

Project P.O. #:
Job Reference: 1102-17326
Legal Site Desc:
CofC Numbers: 242701

Other Information:

Comments: ADDITIONAL 24-NOV-05 10:34

ROY JONES
General Manager

For any questions about this report please contact your Account Manager:

RACHEL JONES

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-1 MW1								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Toluene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
EthylBenzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Xylenes	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1(C6-C10)	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1-BTEX	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F2 (>C10-C16)	<0.05		0.05	mg/L	22-NOV-05	22-NOV-05	JNW	R349333
Ammonia-N	0.212		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	3		1	mg/L		21-NOV-05	ZOW	R348667
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		18-NOV-05	SHC	R348160
Phenols (4AAP)	<0.001		0.001	mg/L		25-NOV-05	GCM	R350453
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	4		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	0.01		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0009		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.046		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.143		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0015		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0007		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0013		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	0.0012		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	0.551		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0012		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0023		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.13		0.05	mg/L		19-NOV-05	PTT	R348217
ICP metals and SO4 for routine water								
Calcium (Ca)	94.8		0.5	mg/L		18-NOV-05	EOC	R348054
Potassium (K)	2.3		0.5	mg/L		18-NOV-05	EOC	R348054
Magnesium (Mg)	26.9		0.1	mg/L		18-NOV-05	EOC	R348054
Sodium (Na)	36		1	mg/L		18-NOV-05	EOC	R348054
Sulfate (SO4)	61.1		0.5	mg/L		18-NOV-05	EOC	R348054
Ion Balance Calculation								
Ion Balance	97.6			%		19-NOV-05		
TDS (Calculated)	447			mg/L		19-NOV-05		
Hardness (as CaCO3)	347			mg/L		19-NOV-05		
Iron (Fe)-Dissolved	1.67		0.005	mg/L		18-NOV-05	HAS	R348125

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-1 MW1								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Manganese (Mn)-Dissolved	0.662		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrate-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrite-N	<0.05		0.05	mg/L		18-NOV-05	TL	R348038
pH, Conductivity and Total Alkalinity								
pH	7.9		0.1	pH		19-NOV-05	PTT	R348217
Conductivity (EC)	760		0.2	uS/cm		19-NOV-05	PTT	R348217
Bicarbonate (HCO3)	451		5	mg/L		19-NOV-05	PTT	R348217
Carbonate (CO3)	<5		5	mg/L		19-NOV-05	PTT	R348217
Hydroxide (OH)	<5		5	mg/L		19-NOV-05	PTT	R348217
Alkalinity, Total (as CaCO3)	370		5	mg/L		19-NOV-05	PTT	R348217
L341571-2 MW2								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Toluene	<0.0005	RAMB	0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
EthylBenzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Xylenes	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1(C6-C10)	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1-BTEX	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F2 (>C10-C16)	<0.05		0.05	mg/L	22-NOV-05	22-NOV-05	JNW	R349333
Ammonia-N	1.34		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	6		1	mg/L		21-NOV-05	ZOW	R348667
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		18-NOV-05	SHC	R348160
Phenols (4AAP)	<0.001		0.001	mg/L		25-NOV-05	GCM	R350453
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	38		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	0.03		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0014		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.189		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.152		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0031		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	<0.0004		0.0004	mg/L		22-NOV-05	HLA	R349504
Copper (Cu)	0.0021		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0148		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	0.0644		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	1.54		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0015		0.0003	mg/L		18-NOV-05	CLL	R348119

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-2 MW2								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Thallium (Tl)	0.00006		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0053		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	0.0005		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.11		0.05	mg/L		19-NOV-05	PTT	R348217
ICP metals and SO4 for routine water								
Calcium (Ca)	125		0.5	mg/L		18-NOV-05	EOC	R348054
Potassium (K)	7.2		0.5	mg/L		18-NOV-05	EOC	R348054
Magnesium (Mg)	51.3		0.1	mg/L		18-NOV-05	EOC	R348054
Sodium (Na)	120		1	mg/L		18-NOV-05	EOC	R348054
Sulfate (SO4)	270		0.5	mg/L		18-NOV-05	EOC	R348054
Ion Balance Calculation								
Ion Balance	98.4			%		19-NOV-05		
TDS (Calculated)	894			mg/L		19-NOV-05		
Hardness (as CaCO3)	523			mg/L		19-NOV-05		
Iron (Fe)-Dissolved	0.085		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.671		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrate-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrite-N	<0.05		0.05	mg/L		18-NOV-05	TL	R348038
pH, Conductivity and Total Alkalinity								
pH	7.9		0.1	pH		19-NOV-05	PTT	R348217
Conductivity (EC)	1400		0.2	uS/cm		19-NOV-05	PTT	R348217
Bicarbonate (HCO3)	575		5	mg/L		19-NOV-05	PTT	R348217
Carbonate (CO3)	<5		5	mg/L		19-NOV-05	PTT	R348217
Hydroxide (OH)	<5		5	mg/L		19-NOV-05	PTT	R348217
Alkalinity, Total (as CaCO3)	471		5	mg/L		19-NOV-05	PTT	R348217
L341571-3 MW3								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Toluene	<0.0005	RAMB	0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
EthylBenzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Xylenes	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1(C6-C10)	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1-BTEX	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F2 (>C10-C16)	<0.05		0.05	mg/L	22-NOV-05	22-NOV-05	JNW	R349333
Ammonia-N	0.306		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	4		1	mg/L		21-NOV-05	ZOW	R348667
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		18-NOV-05	SHC	R348160
Phenols (4AAP)	<0.001		0.001	mg/L		25-NOV-05	GCM	R350453
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	35		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	0.01		0.01	mg/L		18-NOV-05	CLL	R348119

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-3 MW3								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Arsenic (As)	0.0014		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.119		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.0418		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	0.00009		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0008		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0008		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0015		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	0.0003		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	0.828		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0019		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0007		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.10		0.05	mg/L		19-NOV-05	PTT	R348217
ICP metals and SO4 for routine water								
Calcium (Ca)	104		0.5	mg/L		18-NOV-05	EOC	R348054
Potassium (K)	3.0		0.5	mg/L		18-NOV-05	EOC	R348054
Magnesium (Mg)	36.4		0.1	mg/L		18-NOV-05	EOC	R348054
Sodium (Na)	54		1	mg/L		18-NOV-05	EOC	R348054
Sulfate (SO4)	122		0.5	mg/L		18-NOV-05	EOC	R348054
Ion Balance Calculation								
Ion Balance	98.1			%		19-NOV-05		
TDS (Calculated)	573			mg/L		19-NOV-05		
Hardness (as CaCO3)	410			mg/L		19-NOV-05		
Iron (Fe)-Dissolved	4.47		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.239		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrate-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrite-N	<0.05		0.05	mg/L		18-NOV-05	TL	R348038
pH, Conductivity and Total Alkalinity								
pH	7.8		0.1	pH		19-NOV-05	PTT	R348217
Conductivity (EC)	949		0.2	uS/cm		19-NOV-05	PTT	R348217
Bicarbonate (HCO3)	445		5	mg/L		19-NOV-05	PTT	R348217
Carbonate (CO3)	<5		5	mg/L		19-NOV-05	PTT	R348217
Hydroxide (OH)	<5		5	mg/L		19-NOV-05	PTT	R348217
Alkalinity, Total (as CaCO3)	365		5	mg/L		19-NOV-05	PTT	R348217
L341571-4 MW4								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Toluene	<0.0005	RAMB	0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-4 MW4								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
EthylBenzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Xylenes	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1(C6-C10)	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1-BTEX	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F2 (>C10-C16)	<0.05		0.05	mg/L	22-NOV-05	22-NOV-05	JNW	R349333
Ammonia-N	0.013		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	5		1	mg/L		21-NOV-05	ZOW	R348667
Mercury (Hg)-Dissolved	0.0002		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		18-NOV-05	SHC	R348160
Phenols (4AAP)	<0.001		0.001	mg/L		25-NOV-05	GCM	R350453
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	157		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002	RAMB	0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	<0.01		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.093		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.0809		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	0.00007		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0049		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	0.0007		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0012		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0030		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	0.0140		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0007		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0009		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	0.616		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0004		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0025		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	0.029		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.12		0.05	mg/L		19-NOV-05	PTT	R348217
ICP metals and SO4 for routine water								
Calcium (Ca)	147		0.5	mg/L		18-NOV-05	EOC	R348054
Potassium (K)	9.5		0.5	mg/L		18-NOV-05	EOC	R348054
Magnesium (Mg)	40.0		0.1	mg/L		18-NOV-05	EOC	R348054
Sodium (Na)	59		1	mg/L		18-NOV-05	EOC	R348054
Sulfate (SO4)	87.0		0.5	mg/L		18-NOV-05	EOC	R348054
Ion Balance Calculation								
Ion Balance	98.2			%		19-NOV-05		
TDS (Calculated)	726			mg/L		19-NOV-05		
Hardness (as CaCO3)	532			mg/L		19-NOV-05		
Iron (Fe)-Dissolved	0.104		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.053		0.001	mg/L		18-NOV-05	HAS	R348125

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-4 MW4								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Nitrate+Nitrite-N	1.2		0.1	mg/L		18-NOV-05	TL	R348038
Nitrate-N	1.2		0.1	mg/L		18-NOV-05	TL	R348038
Nitrite-N	<0.05		0.05	mg/L		18-NOV-05	TL	R348038
pH, Conductivity and Total Alkalinity								
pH	7.8		0.1	pH		19-NOV-05	PTT	R348217
Conductivity (EC)	1280		0.2	uS/cm		19-NOV-05	PTT	R348217
Bicarbonate (HCO3)	449		5	mg/L		19-NOV-05	PTT	R348217
Carbonate (CO3)	<5		5	mg/L		19-NOV-05	PTT	R348217
Hydroxide (OH)	<5		5	mg/L		19-NOV-05	PTT	R348217
Alkalinity, Total (as CaCO3)	368		5	mg/L		19-NOV-05	PTT	R348217
L341571-5 MW5								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Toluene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
EthylBenzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Xylenes	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1(C6-C10)	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1-BTEX	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F2 (>C10-C16)	<0.05		0.05	mg/L	22-NOV-05	22-NOV-05	JNW	R349333
Ammonia-N	0.331		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	4		1	mg/L		21-NOV-05	ZOW	R348667
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		18-NOV-05	SHC	R348160
Phenols (4AAP)	<0.001		0.001	mg/L		25-NOV-05	GCM	R350453
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	21		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	<0.01		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0081		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.116		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.0564		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	0.00006		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0010		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0007		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0029		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	0.0022		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	0.667		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0009		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-5 MW5								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Uranium (U)	0.0008		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.11		0.05	mg/L		19-NOV-05	PTT	R348217
ICP metals and SO4 for routine water								
Calcium (Ca)	98.6		0.5	mg/L		18-NOV-05	EOC	R348054
Potassium (K)	6.9		0.5	mg/L		18-NOV-05	EOC	R348054
Magnesium (Mg)	30.1		0.1	mg/L		18-NOV-05	EOC	R348054
Sodium (Na)	43		1	mg/L		18-NOV-05	EOC	R348054
Sulfate (SO4)	115		0.5	mg/L		18-NOV-05	EOC	R348054
Ion Balance Calculation								
Ion Balance	95.4			%		19-NOV-05		
TDS (Calculated)	522			mg/L		19-NOV-05		
Hardness (as CaCO3)	370			mg/L		19-NOV-05		
Iron (Fe)-Dissolved	3.31		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.531		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrate-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrite-N	<0.05		0.05	mg/L		18-NOV-05	TL	R348038
pH, Conductivity and Total Alkalinity								
pH	7.9		0.1	pH		19-NOV-05	PTT	R348217
Conductivity (EC)	881		0.2	uS/cm		19-NOV-05	PTT	R348217
Bicarbonate (HCO3)	422		5	mg/L		19-NOV-05	PTT	R348217
Carbonate (CO3)	<5		5	mg/L		19-NOV-05	PTT	R348217
Hydroxide (OH)	<5		5	mg/L		19-NOV-05	PTT	R348217
Alkalinity, Total (as CaCO3)	346		5	mg/L		19-NOV-05	PTT	R348217
L341571-6 MW6								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Toluene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
EthylBenzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Xylenes	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1(C6-C10)	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1-BTEX	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F2 (>C10-C16)	<0.05		0.05	mg/L	22-NOV-05	22-NOV-05	JNW	R349333
Ammonia-N	1.95		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	8		1	mg/L		21-NOV-05	ZOW	R348667
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		18-NOV-05	SHC	R348160
Phenols (4AAP)	<0.001		0.001	mg/L		25-NOV-05	GCM	R350453
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	13		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	0.01		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0038		0.0004	mg/L		18-NOV-05	CLL	R348119

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-6 MW6								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Boron (B)	0.160		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.0557		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	0.00006		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0012		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0012		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0015		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	0.0004		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	1.26		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0015		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0015		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.15		0.05	mg/L		19-NOV-05	PTT	R348217
ICP metals and SO4 for routine water								
Calcium (Ca)	148		0.5	mg/L		18-NOV-05	EOC	R348054
Potassium (K)	5.0		0.5	mg/L		18-NOV-05	EOC	R348054
Magnesium (Mg)	52.0		0.1	mg/L		18-NOV-05	EOC	R348054
Sodium (Na)	211		1	mg/L		18-NOV-05	EOC	R348054
Sulfate (SO4)	471		0.5	mg/L		18-NOV-05	EOC	R348054
Ion Balance Calculation								
Ion Balance	101			%		19-NOV-05		
TDS (Calculated)	1220			mg/L		19-NOV-05		
Hardness (as CaCO3)	584			mg/L		19-NOV-05		
Iron (Fe)-Dissolved	2.96		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.943		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrate-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrite-N	<0.05		0.05	mg/L		18-NOV-05	TL	R348038
pH, Conductivity and Total Alkalinity								
pH	8.0		0.1	pH		19-NOV-05	PTT	R348217
Conductivity (EC)	1780		0.2	uS/cm		19-NOV-05	PTT	R348217
Bicarbonate (HCO3)	641		5	mg/L		19-NOV-05	PTT	R348217
Carbonate (CO3)	<5		5	mg/L		19-NOV-05	PTT	R348217
Hydroxide (OH)	<5		5	mg/L		19-NOV-05	PTT	R348217
Alkalinity, Total (as CaCO3)	526		5	mg/L		19-NOV-05	PTT	R348217
L341571-7 MW7								
Sampled By: JR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Toluene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
EthylBenzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-7 MW7								
Sampled By: JR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Xylenes	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1(C6-C10)	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1-BTEX	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F2 (>C10-C16)	<0.05		0.05	mg/L	22-NOV-05	22-NOV-05	JNW	R349333
Ammonia-N	2.03		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	6		1	mg/L		21-NOV-05	ZOW	R348667
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		18-NOV-05	SHC	R348160
Phenols (4AAP)	<0.001		0.001	mg/L		25-NOV-05	GCM	R350453
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	16		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	<0.01		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0019		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.311		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.0530		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0020		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0018		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0010		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0007		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	2.45		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0009		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0017		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.08		0.05	mg/L		19-NOV-05	PTT	R348217
ICP metals and SO4 for routine water								
Calcium (Ca)	270		0.5	mg/L		18-NOV-05	EOC	R348054
Potassium (K)	5.5		0.5	mg/L		18-NOV-05	EOC	R348054
Magnesium (Mg)	94.8		0.1	mg/L		18-NOV-05	EOC	R348054
Sodium (Na)	268		1	mg/L		18-NOV-05	EOC	R348054
Sulfate (SO4)	1010		0.5	mg/L		18-NOV-05	EOC	R348054
Ion Balance Calculation								
Ion Balance	102			%		19-NOV-05		
TDS (Calculated)	1990			mg/L		19-NOV-05		
Hardness (as CaCO3)	1060			mg/L		19-NOV-05		
Iron (Fe)-Dissolved	10.9		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	1.83		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-7 MW7								
Sampled By: JR on 17-NOV-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Nitrate-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrite-N	<0.05		0.05	mg/L		18-NOV-05	TL	R348038
pH, Conductivity and Total Alkalinity								
pH	7.7		0.1	pH		19-NOV-05	PTT	R348217
Conductivity (EC)	2670		0.2	uS/cm		19-NOV-05	PTT	R348217
Bicarbonate (HCO3)	666		5	mg/L		19-NOV-05	PTT	R348217
Carbonate (CO3)	<5		5	mg/L		19-NOV-05	PTT	R348217
Hydroxide (OH)	<5		5	mg/L		19-NOV-05	PTT	R348217
Alkalinity, Total (as CaCO3)	546		5	mg/L		19-NOV-05	PTT	R348217
L341571-8 MW9								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Toluene	<0.0005	RAMB	0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
EthylBenzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Xylenes	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1(C6-C10)	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1-BTEX	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F2 (>C10-C16)	<0.05		0.05	mg/L	22-NOV-05	22-NOV-05	JNW	R349333
Ammonia-N	1.85		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	6		1	mg/L		21-NOV-05	ZOW	R348667
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		18-NOV-05	SHC	R348160
Phenols (4AAP)	<0.001		0.001	mg/L		25-NOV-05	GCM	R350453
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	7		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	0.02		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0018		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.294		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.0520		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0023		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0011		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0038		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	0.0087		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	0.869		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0038		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0015		0.0001	mg/L		18-NOV-05	CLL	R348119

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-8 MW9								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Vanadium (V)	0.0002		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.22		0.05	mg/L		19-NOV-05	PTT	R348217
ICP metals and SO4 for routine water								
Calcium (Ca)	92.6		0.5	mg/L		18-NOV-05	EOC	R348054
Potassium (K)	3.9		0.5	mg/L		18-NOV-05	EOC	R348054
Magnesium (Mg)	27.3		0.1	mg/L		18-NOV-05	EOC	R348054
Sodium (Na)	227		1	mg/L		18-NOV-05	EOC	R348054
Sulfate (SO4)	312		0.5	mg/L		18-NOV-05	EOC	R348054
Ion Balance Calculation								
Ion Balance	98.0			%		19-NOV-05		
TDS (Calculated)	984			mg/L		19-NOV-05		
Hardness (as CaCO3)	344			mg/L		19-NOV-05		
Iron (Fe)-Dissolved	1.40		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.752		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrate-N	<0.1		0.1	mg/L		18-NOV-05	TL	R348038
Nitrite-N	<0.05		0.05	mg/L		18-NOV-05	TL	R348038
pH, Conductivity and Total Alkalinity								
pH	8.1		0.1	pH		19-NOV-05	PTT	R348217
Conductivity (EC)	1550		0.2	uS/cm		19-NOV-05	PTT	R348217
Bicarbonate (HCO3)	640		5	mg/L		19-NOV-05	PTT	R348217
Carbonate (CO3)	<5		5	mg/L		19-NOV-05	PTT	R348217
Hydroxide (OH)	<5		5	mg/L		19-NOV-05	PTT	R348217
Alkalinity, Total (as CaCO3)	524		5	mg/L		19-NOV-05	PTT	R348217
L341571-9 MW14								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Toluene	<0.0005	RAMB	0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
EthylBenzene	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
Xylenes	<0.0005		0.0005	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1(C6-C10)	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F1-BTEX	<0.1		0.1	mg/L	21-NOV-05	21-NOV-05	EJA	R348988
F2 (>C10-C16)	<0.05		0.05	mg/L	22-NOV-05	22-NOV-05	JNW	R349333
Ammonia-N	0.010		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	4		1	mg/L		21-NOV-05	ZOW	R348667
Mercury (Hg)-Dissolved	0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		18-NOV-05	SHC	R348160
Phenols (4AAP)	<0.001		0.001	mg/L		25-NOV-05	GCM	R350453
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	157		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	0.01		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0007		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.097		0.002	mg/L		18-NOV-05	CLL	R348119

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341571-9 MW14								
Sampled By: CR on 17-NOV-05								
Matrix: GROUND WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Barium (Ba)	0.0817		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0051		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	0.0009		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0012		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0028		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	0.0132		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0009		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	0.609		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0004		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0026		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	0.032		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.12		0.05	mg/L		19-NOV-05	PTT	R348217
ICP metals and SO4 for routine water								
Calcium (Ca)	147		0.5	mg/L		18-NOV-05	EOC	R348054
Potassium (K)	9.7		0.5	mg/L		18-NOV-05	EOC	R348054
Magnesium (Mg)	40.4		0.1	mg/L		18-NOV-05	EOC	R348054
Sodium (Na)	60		1	mg/L		18-NOV-05	EOC	R348054
Sulfate (SO4)	89.0		0.5	mg/L		18-NOV-05	EOC	R348054
Ion Balance Calculation								
Ion Balance	98.1			%		19-NOV-05		
TDS (Calculated)	731			mg/L		19-NOV-05		
Hardness (as CaCO3)	533			mg/L		19-NOV-05		
Iron (Fe)-Dissolved	0.105		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.053		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	1.2		0.1	mg/L		18-NOV-05	TL	R348038
Nitrate-N	1.2		0.1	mg/L		18-NOV-05	TL	R348038
Nitrite-N	<0.05		0.05	mg/L		18-NOV-05	TL	R348038
pH, Conductivity and Total Alkalinity								
pH	7.9		0.1	pH		19-NOV-05	PTT	R348217
Conductivity (EC)	1290		0.2	uS/cm		19-NOV-05	PTT	R348217
Bicarbonate (HCO3)	452		5	mg/L		19-NOV-05	PTT	R348217
Carbonate (CO3)	<5		5	mg/L		19-NOV-05	PTT	R348217
Hydroxide (OH)	<5		5	mg/L		19-NOV-05	PTT	R348217
Alkalinity, Total (as CaCO3)	371		5	mg/L		19-NOV-05	PTT	R348217

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

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
RAMB	Result Adjusted For Method Blank

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
BTX,F1-ED	Water	BTEX and F1 (C6-C10)	EPA 5030	EPA 5030/8015&8260-P&T GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-ED	Water	Chloride (Cl)		APHA 4500 Cl E-Colorimetry
ETL-ROUTINE-ICP-ED	Water	ICP metals and SO4 for routine water		APHA 3120 B-ICP-OES
F-ED	Water	Fluoride (F)		APHA 4500 F-C-Electrode
F2-ED	Water	F2 (>C10-C16)		EPA 3510/8000-GC-FID
FE-DIS-ED	Water	Iron (Fe)-Dissolved		EPA 200.7
HG-DIS-LOW-ED	Water	Mercury (Hg)-Dissolved		EPA 6020
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET1-DIS-LOW-ED	Water	Dissolved Trace Metals (Low Level)		EPA 6020
MN-DIS-ED	Water	Manganese (Mn)-Dissolved		EPA 200.7
N2N3-ED	Water	Nitrate+Nitrite-N		APHA 4500 NO3H-Colorimetry
NH4-LOW-ED	Water	Ammonia-N		APHA 4500 NH3F-Colorimetry
NO2-ED	Water	Nitrite-N		APHA 4500 NO2B-Colorimetry
NO3-ED	Water	Nitrate-N		APHA 4500 NO3H-Colorimetry
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
PHENOLS-CL	Water	Phenols (4AAP)		EPA 9066-Colorimetric
PO4-LOW-ED	Water	Orthophosphate (PO4-P)		APHA 4500 P B,E-Auto-Colorimetry

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

242701

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	Laboratory Definition Code	Laboratory Location
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA	ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Reference Information

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - 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.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

Enviro-Test LABORATORIES

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

CANADA TOLL FREE 1-800-668-9878

WWW.ENVIROTEST.COM

COC # 242701

Pg. 1 of 1

DATE: 17-Nov-05

LAB WORK ORDER # L341571

REPORT TO:

COMPANY: Stantec Consulting

CONTACT: D. Yoshisaka

ADDRESS: 10160-112 ST
Edmonton AB

PHONE: 917-7200 FAX: 917-7249

CELLPHONE: (780) 995-3024

INVOICE TO: SAME Y / N

COMPANY:

CONTACT:

ADDRESS:

PHONE: FAX:

REPORT DISTRIBUTION ALL FINAL RESULTS WILL BE MAILED

EMAIL___ FAX___

EMAIL 1: croncleau@stantec.com

EMAIL 2: dyoshisaka@stantec.com

DIGITAL EMAIL:

SELECT: pdf___ digital___ both ✓

INDICATE BOTTLES: FILTERED/PRESERVED (F/P)

JOB # 110217326

PO/AFE:

LSD:

QUOTE # 8889

SERVICE REQUESTED

✓ REGULAR SERVICE (DEFAULT)

PRIORITY SERVICE (50% SURCHARGE)

EMERGENCY SERVICE (100% SURCHARGE)

ANALYSIS REQUEST

SAMPLE ID	SAMPLING LOCATION	SAMPLED BY / DATE / TIME	SAMPLING METHOD	SAMPLE TYPE	PLSE SEE QUOTE	HAZARDOUS ?	NUMBER OF CONTAINERS	HIGHLY CONTAMINATED ?	LAB SAMPLE #
MW1		CR / 17-Nov-05	GRAB	GW	✓	?	7	?	
MW2		↓	↓	↓	✓	↓	↓	↓	
MW3		↓	↓	↓	✓	↓	↓	↓	
MW4		↓	↓	↓	✓	↓	↓	↓	
MW5		↓	↓	↓	✓	↓	↓	↓	
MW6		↓	↓	↓	✓	↓	↓	↓	
MW7		JR / 17-Nov-05	↓	↓	✓	↓	8	↓	
MW9		CR / 17-Nov-05	↓	↓	✓	↓	7	↓	
MW14		↓	↓	↓	✓	↓	↓	↓	

GUIDELINES / REGULATIONS

SPECIAL INSTRUCTIONS / NATURE OF HAZARDOUS MATERIAL

PLSE FILTER AND PRESERVE DOC AND METALS ASAP

SAMPLE CONDITION

FROZEN / COLD / AMBIENT

MEAN TEMPERATURE

Failure to complete all portions of this form may delay analysis. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the reverse of the white report copy.

RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME:	SAMPLE CONDITION ACCEPTABLE UPON RECEIPT ? (Y/N)
Christine Rondeau	17-Nov-05 / 1745	[illegible] 17-Nov-05 / 17:45		
RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME:	

REFER TO BACK PAGE FOR SAMPLING INFORMATION & REGIONAL LOCATIONS WHITE - REPORT COPY, PINK - FILE COPY, YELLOW - CLIENT COPY

GENF04.01

3250232S-03003

ANALYTICAL REPORT

STANTEC CONSULTING LTD
ATTN: CHRISTINE RONDEAU
Reported On: 28-AUG-06 02:39 PM

7 FL NORTH TOWER 10160 112 STREET

EDMONTON AB T5K 2L6

Lab Work Order #: **L341145** **Date Received:** **16-NOV-05**

Project P.O. #:
Job Reference: 1102-17326
Legal Site Desc:
CofC Numbers: 229384

Other Information:

Comments:

ROY JONES
General Manager

For any questions about this report please contact your Account Manager:

RACHEL JONES

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341145-1 MW8								
Sampled By: CR on 15-NOV-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Toluene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
EthylBenzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Xylenes	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1(C6-C10)	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1-BTEX	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F2 (>C10-C16)	<0.05		0.05	mg/L	18-NOV-05	19-NOV-05	MKE	R348401
Ammonia-N	1.50		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	6		1	mg/L		18-NOV-05	ZOW	R347879
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		17-NOV-05	SHC	R347664
Phenols (4AAP)	<0.001		0.001	mg/L		21-NOV-05	APH	R348867
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	4		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	<0.01		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0046		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.184		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.115		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	0.00009		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0009		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0010		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0025		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	1.27		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0010		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0015		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.11		0.05	mg/L		17-NOV-05	PTT	R347844
ICP metals and SO4 for routine water								
Calcium (Ca)	133		0.5	mg/L		17-NOV-05	AHY	R347526
Potassium (K)	5.2		0.5	mg/L		17-NOV-05	AHY	R347526
Magnesium (Mg)	37.4		0.1	mg/L		17-NOV-05	AHY	R347526
Sodium (Na)	112		1	mg/L		17-NOV-05	AHY	R347526
Sulfate (SO4)	300		0.5	mg/L		17-NOV-05	AHY	R347526
Ion Balance Calculation								
Ion Balance	95.9			%		18-NOV-05		
TDS (Calculated)	862			mg/L		18-NOV-05		
Hardness (as CaCO3)	486			mg/L		18-NOV-05		
Iron (Fe)-Dissolved	5.16		0.005	mg/L		18-NOV-05	HAS	R348125

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341145-1 MW8								
Sampled By: CR on 15-NOV-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Manganese (Mn)-Dissolved	0.384		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrate-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrite-N	<0.05		0.05	mg/L		17-NOV-05	TL	R347373
pH, Conductivity and Total Alkalinity								
pH	7.5		0.1	pH		17-NOV-05	PTT	R347844
Conductivity (EC)	1310		0.2	uS/cm		17-NOV-05	PTT	R347844
Bicarbonate (HCO3)	549		5	mg/L		17-NOV-05	PTT	R347844
Carbonate (CO3)	<5		5	mg/L		17-NOV-05	PTT	R347844
Hydroxide (OH)	<5		5	mg/L		17-NOV-05	PTT	R347844
Alkalinity, Total (as CaCO3)	450		5	mg/L		17-NOV-05	PTT	R347844
L341145-2 MW10								
Sampled By: CR on 16-NOV-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Toluene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
EthylBenzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Xylenes	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1(C6-C10)	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1-BTEX	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F2 (>C10-C16)	<0.05		0.05	mg/L	18-NOV-05	19-NOV-05	MKE	R348401
Ammonia-N	1.36		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	6		1	mg/L		18-NOV-05	ZOW	R347879
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		17-NOV-05	SHC	R347664
Phenols (4AAP)	<0.001		0.001	mg/L		21-NOV-05	APH	R348867
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	3		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	<0.01		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0037		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.202		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.0331		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0005		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0009		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0010		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	1.43		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0008		0.0003	mg/L		18-NOV-05	CLL	R348119

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341145-2 MW10								
Sampled By: CR on 16-NOV-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0015		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.12		0.05	mg/L		17-NOV-05	PTT	R347844
ICP metals and SO4 for routine water								
Calcium (Ca)	129		0.5	mg/L		17-NOV-05	AHY	R347526
Potassium (K)	5.0		0.5	mg/L		17-NOV-05	AHY	R347526
Magnesium (Mg)	35.2		0.1	mg/L		17-NOV-05	AHY	R347526
Sodium (Na)	108		1	mg/L		17-NOV-05	AHY	R347526
Sulfate (SO4)	222		0.5	mg/L		17-NOV-05	AHY	R347526
Ion Balance Calculation								
Ion Balance	93.8			%		18-NOV-05		
TDS (Calculated)	814			mg/L		18-NOV-05		
Hardness (as CaCO3)	467			mg/L		18-NOV-05		
Iron (Fe)-Dissolved	5.49		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.642		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrate-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrite-N	<0.05		0.05	mg/L		17-NOV-05	TL	R347373
pH, Conductivity and Total Alkalinity								
pH	7.5		0.1	pH		17-NOV-05	PTT	R347844
Conductivity (EC)	1260		0.2	uS/cm		17-NOV-05	PTT	R347844
Bicarbonate (HCO3)	634		5	mg/L		17-NOV-05	PTT	R347844
Carbonate (CO3)	<5		5	mg/L		17-NOV-05	PTT	R347844
Hydroxide (OH)	<5		5	mg/L		17-NOV-05	PTT	R347844
Alkalinity, Total (as CaCO3)	520		5	mg/L		17-NOV-05	PTT	R347844
L341145-3 MW11								
Sampled By: CR on 16-NOV-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Toluene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
EthylBenzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Xylenes	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1(C6-C10)	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1-BTEX	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F2 (>C10-C16)	<0.05		0.05	mg/L	18-NOV-05	19-NOV-05	MKE	R348401
Ammonia-N	1.41		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	7		1	mg/L		18-NOV-05	ZOW	R347879
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		17-NOV-05	SHC	R347664
Phenols (4AAP)	<0.001		0.001	mg/L		21-NOV-05	APH	R348867
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	16		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	0.02		0.01	mg/L		18-NOV-05	CLL	R348119

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341145-3 MW11								
Sampled By: CR on 16-NOV-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Arsenic (As)	0.0025		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.227		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.0466		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	0.00008		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0007		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0009		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0009		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	1.24		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0010		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0012		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.09		0.05	mg/L		17-NOV-05	PTT	R347844
ICP metals and SO4 for routine water								
Calcium (Ca)	140		0.5	mg/L		17-NOV-05	AHY	R347526
Potassium (K)	4.5		0.5	mg/L		17-NOV-05	AHY	R347526
Magnesium (Mg)	42.5		0.1	mg/L		17-NOV-05	AHY	R347526
Sodium (Na)	85		1	mg/L		17-NOV-05	AHY	R347526
Sulfate (SO4)	199		0.5	mg/L		17-NOV-05	AHY	R347526
Ion Balance Calculation								
Ion Balance	93.4			%		18-NOV-05		
TDS (Calculated)	809			mg/L		18-NOV-05		
Hardness (as CaCO3)	525			mg/L		18-NOV-05		
Iron (Fe)-Dissolved	6.95		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.628		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrate-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrite-N	<0.05		0.05	mg/L		17-NOV-05	TL	R347373
pH, Conductivity and Total Alkalinity								
pH	7.4		0.1	pH		17-NOV-05	PTT	R347844
Conductivity (EC)	1270		0.2	uS/cm		17-NOV-05	PTT	R347844
Bicarbonate (HCO3)	654		5	mg/L		17-NOV-05	PTT	R347844
Carbonate (CO3)	<5		5	mg/L		17-NOV-05	PTT	R347844
Hydroxide (OH)	<5		5	mg/L		17-NOV-05	PTT	R347844
Alkalinity, Total (as CaCO3)	536		5	mg/L		17-NOV-05	PTT	R347844
L341145-4 MW12								
Sampled By: CR on 16-NOV-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Toluene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341145-4 MW12								
Sampled By: CR on 16-NOV-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
EthylBenzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Xylenes	<0.0005	RAMB	0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1(C6-C10)	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1-BTEX	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F2 (>C10-C16)	<0.05		0.05	mg/L	18-NOV-05	19-NOV-05	MKE	R348401
Ammonia-N	1.20		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	7		1	mg/L		18-NOV-05	ZOW	R347879
Mercury (Hg)-Dissolved	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		17-NOV-05	SHC	R347664
Phenols (4AAP)	<0.001		0.001	mg/L		21-NOV-05	APH	R348867
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	8		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	<0.01		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0026		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.282		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.182		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	0.00006		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0010		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0008		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0013		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	<0.0004		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	0.903		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0008		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Uranium (U)	0.0011		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.07		0.05	mg/L		17-NOV-05	PTT	R347844
ICP metals and SO4 for routine water								
Calcium (Ca)	94.9		0.5	mg/L		19-NOV-05	EOC	R348314
Potassium (K)	5.2		0.5	mg/L		19-NOV-05	EOC	R348314
Magnesium (Mg)	28.5		0.1	mg/L		19-NOV-05	EOC	R348314
Sodium (Na)	111		1	mg/L		19-NOV-05	EOC	R348314
Sulfate (SO4)	52.5		0.5	mg/L		19-NOV-05	EOC	R348314
Ion Balance Calculation								
Ion Balance	92.7			%		21-NOV-05		
TDS (Calculated)	651			mg/L		21-NOV-05		
Hardness (as CaCO3)	354			mg/L		21-NOV-05		
Iron (Fe)-Dissolved	3.37		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.402		0.001	mg/L		18-NOV-05	HAS	R348125

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341145-4 MW12								
Sampled By: CR on 16-NOV-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Nitrate+Nitrite-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrate-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrite-N	<0.05		0.05	mg/L		17-NOV-05	TL	R347373
pH, Conductivity and Total Alkalinity								
pH	7.4		0.1	pH		17-NOV-05	PTT	R347844
Conductivity (EC)	1020		0.2	uS/cm		17-NOV-05	PTT	R347844
Bicarbonate (HCO3)	712		5	mg/L		17-NOV-05	PTT	R347844
Carbonate (CO3)	<5		5	mg/L		17-NOV-05	PTT	R347844
Hydroxide (OH)	<5		5	mg/L		17-NOV-05	PTT	R347844
Alkalinity, Total (as CaCO3)	584		5	mg/L		17-NOV-05	PTT	R347844
L341145-5 MW13								
Sampled By: CR on 16-NOV-05								
Matrix: WATER								
BTEX, F1 (C6-C10) and F2 (>C10-C16)								
BTEX and F1 (C6-C10)								
Benzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Toluene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
EthylBenzene	<0.0005		0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
Xylenes	<0.0005	RAMB	0.0005	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1(C6-C10)	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F1-BTEX	<0.1		0.1	mg/L	19-NOV-05	19-NOV-05	DCD	R348357
F2 (>C10-C16)	<0.05		0.05	mg/L	18-NOV-05	19-NOV-05	MKE	R348401
Ammonia-N	1.29		0.005	mg/L		22-NOV-05	KMY	R349097
Dissolved Organic Carbon	5		1	mg/L		18-NOV-05	ZOW	R347879
Mercury (Hg)-Dissolved	0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Orthophosphate (PO4-P)	<0.001		0.001	mg/L		17-NOV-05	SHC	R347664
Phenols (4AAP)	<0.001		0.001	mg/L		21-NOV-05	APH	R348867
Major Ions & Trace Dissolved Metals								
Chloride (Cl)	4		1	mg/L		18-NOV-05	WYA	R348059
Dissolved Trace Metals (Low Level)								
Silver (Ag)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Aluminum (Al)	0.07		0.01	mg/L		18-NOV-05	CLL	R348119
Arsenic (As)	0.0016		0.0004	mg/L		18-NOV-05	CLL	R348119
Boron (B)	0.301		0.002	mg/L		18-NOV-05	CLL	R348119
Barium (Ba)	0.413		0.0001	mg/L		18-NOV-05	CLL	R348119
Beryllium (Be)	<0.0005		0.0005	mg/L		18-NOV-05	CLL	R348119
Bismuth (Bi)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119
Cadmium (Cd)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Cobalt (Co)	0.0033		0.0001	mg/L		18-NOV-05	CLL	R348119
Chromium (Cr)	0.0007		0.0004	mg/L		18-NOV-05	CLL	R348119
Copper (Cu)	0.0007		0.0006	mg/L		18-NOV-05	CLL	R348119
Molybdenum (Mo)	0.0027		0.0001	mg/L		18-NOV-05	CLL	R348119
Nickel (Ni)	0.0015		0.0001	mg/L		18-NOV-05	CLL	R348119
Lead (Pb)	0.0002		0.0001	mg/L		18-NOV-05	CLL	R348119
Antimony (Sb)	0.0006		0.0004	mg/L		18-NOV-05	CLL	R348119
Selenium (Se)	0.0005		0.0004	mg/L		18-NOV-05	CLL	R348119
Tin (Sn)	<0.0002		0.0002	mg/L		18-NOV-05	CLL	R348119
Strontium (Sr)	0.542		0.0001	mg/L		18-NOV-05	CLL	R348119
Titanium (Ti)	0.0006		0.0003	mg/L		18-NOV-05	CLL	R348119
Thallium (Tl)	<0.00005		0.00005	mg/L		18-NOV-05	CLL	R348119

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L341145-5 MW13								
Sampled By: CR on 16-NOV-05								
Matrix: WATER								
Major Ions & Trace Dissolved Metals								
Dissolved Trace Metals (Low Level)								
Uranium (U)	0.0009		0.0001	mg/L		18-NOV-05	CLL	R348119
Vanadium (V)	<0.0001		0.0001	mg/L		18-NOV-05	CLL	R348119
Zinc (Zn)	<0.002		0.002	mg/L		18-NOV-05	CLL	R348119
Fluoride (F)	0.14		0.05	mg/L		17-NOV-05	PTT	R347844
ICP metals and SO4 for routine water								
Calcium (Ca)	51.2		0.5	mg/L		17-NOV-05	AHY	R347526
Potassium (K)	3.4		0.5	mg/L		17-NOV-05	AHY	R347526
Magnesium (Mg)	16.2		0.1	mg/L		17-NOV-05	AHY	R347526
Sodium (Na)	103		1	mg/L		17-NOV-05	AHY	R347526
Sulfate (SO4)	12.5		0.5	mg/L		17-NOV-05	AHY	R347526
Ion Balance Calculation								
Ion Balance	92.2			%		18-NOV-05		
TDS (Calculated)	454			mg/L		18-NOV-05		
Hardness (as CaCO3)	195			mg/L		18-NOV-05		
Iron (Fe)-Dissolved	1.08		0.005	mg/L		18-NOV-05	HAS	R348125
Manganese (Mn)-Dissolved	0.243		0.001	mg/L		18-NOV-05	HAS	R348125
Nitrate+Nitrite-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrate-N	<0.1		0.1	mg/L		17-NOV-05	TL	R347373
Nitrite-N	<0.05		0.05	mg/L		17-NOV-05	TL	R347373
pH, Conductivity and Total Alkalinity								
pH	7.8		0.1	pH		17-NOV-05	PTT	R347844
Conductivity (EC)	782		0.2	uS/cm		17-NOV-05	PTT	R347844
Bicarbonate (HCO3)	537		5	mg/L		17-NOV-05	PTT	R347844
Carbonate (CO3)	<5		5	mg/L		17-NOV-05	PTT	R347844
Hydroxide (OH)	<5		5	mg/L		17-NOV-05	PTT	R347844
Alkalinity, Total (as CaCO3)	440		5	mg/L		17-NOV-05	PTT	R347844

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

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
RAMB	Result Adjusted For Method Blank

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
BTX,F1-ED	Water	BTEX and F1 (C6-C10)	EPA 5030	EPA 5030/8015&8260-P&T GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-ED	Water	Chloride (Cl)		APHA 4500 Cl E-Colorimetry
ETL-ROUTINE-ICP-ED	Water	ICP metals and SO4 for routine water		APHA 3120 B-ICP-OES
F-ED	Water	Fluoride (F)		APHA 4500 F-C-Electrode
F2-ED	Water	F2 (>C10-C16)		EPA 3510/8000-GC-FID
FE-DIS-ED	Water	Iron (Fe)-Dissolved		EPA 200.7
HG-DIS-LOW-ED	Water	Mercury (Hg)-Dissolved		EPA 6020
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET1-DIS-LOW-ED	Water	Dissolved Trace Metals (Low Level)		EPA 6020
MN-DIS-ED	Water	Manganese (Mn)-Dissolved		EPA 200.7
N2N3-ED	Water	Nitrate+Nitrite-N		APHA 4500 NO3H-Colorimetry
NH4-LOW-ED	Water	Ammonia-N		APHA 4500 NH3F-Colorimetry
NO2-ED	Water	Nitrite-N		APHA 4500 NO2B-Colorimetry
NO3-ED	Water	Nitrate-N		APHA 4500 NO3H-Colorimetry
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
PHENOLS-CL	Water	Phenols (4AAP)		EPA 9066-Colorimetric
PO4-LOW-ED	Water	Orthophosphate (PO4-P)		APHA 4500 P B,E-Auto-Colorimetry

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

229384

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	Laboratory Definition Code	Laboratory Location
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA	ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

Reference Information

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - 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.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

Enviro-Test LABORATORIES

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

CANADA TOLL FREE 1-800-668-9878

WWW.ENVIROTEST.COM

COC # 229384

Pg. 1 of 1

DATE: 16-Nov-05

LAB WORK ORDER # L3411415

REPORT TO:

COMPANY: STANTEC

CONTACT: G. RONDEAU - D. YOSHISAKA

ADDRESS: 10160-112 ST
EDMONTON AB T5K 2L6

PHONE: 917-7000 FAX: 917-7249

CELLPHONE:

REPORT DISTRIBUTION ALL FINAL RESULTS WILL BE MAILED

EMAIL ✓ FAX

EMAIL 1: dyoshisaka@stantec.com

EMAIL 2: grondeau@stantec.com

DIGITAL EMAIL:

SELECT: pdf digital both ✓

SERVICE REQUESTED

- ✓ REGULAR SERVICE (DEFAULT)
- PRIORITY SERVICE (50% SURCHARGE)
- EMERGENCY SERVICE (100% SURCHARGE)

INVOICE TO: SAME Y / N

COMPANY:

CONTACT:

ADDRESS:

PHONE: FAX:

JOB # 110217326

PO/AFE:

LSD:

QUOTE #

ANALYSIS REQUEST

INDICATE BOTTLES: FILTERED/PRESERVED (F/P)

SAMPLE ID	SAMPLING LOCATION	SAMPLED BY / DATE / TIME	SAMPLING METHOD	SAMPLE TYPE	PLSE SEE QUOTE	HAZARDOUS?	NUMBER OF CONTAINERS	HIGHLY CONTAMINATED?	LAB SAMPLE #
MW8		CR / 15-Nov-05	GRAB	GW	✓	N	6	N	
MW10		CR/16-Nov-05	↓	↓	✓	↓	↓	↓	
MW11		↓	↓	↓	✓	↓	↓	↓	
MW12		↓	↓	↓	✓	↓	↓	↓	
MW13		↓	↓	↓	✓	↓	↓	↓	

GUIDELINES / REGULATIONS

SPECIAL INSTRUCTIONS / NATURE OF HAZARDOUS MATERIAL

SAMPLE CONDITION

- FROZEN
- COLD
- AMBIENT

MEAN TEMPERATURE

Failure to complete all portions of this form may delay analysis. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the reverse of the white report copy.

RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME:	SAMPLE CONDITION ACCEPTABLE UPON RECEIPT ? (Y/N)
[signature]	16-Nov-05 18:26	CD 16 Nov 05	18:25	
RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME:	

REFER TO BACK PAGE FOR SAMPLING INFORMATION & REGIONAL LOCATIONS WHITE - REPORT COPY, PINK - FILE COPY, YELLOW - CLIENT COPY

GENF04.01

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