6th Line Municipal Class Environmental Assessment

County Road 27 to St John's Road
Town of Innisfil, ON

September 6, 2016

APPENDIX K: PRELIMINARY HYDROGEOLOGY ASSESSMENT

September 1, 2016 Project No. 1413283

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PRELIMINARY HYDROGEOLOGY ASSESSMENT, CLASS ENVIRONMENTAL ASSESSMENT STUDY FOR 6TH LINE (COUNTY ROAD 27 TO ST JOHN'S ROAD) – MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Introduction

As requested, we have undertaken a preliminary hydrogeological assessment in support of the Class Environmental Study for improvements to 6th Line from County Road 27 to St. John's Road in the Town of Innisfil (see Figure 1). The purpose of the review has been to identify hydrogeological constraints to the construction of the improvements and possible impacts related to the project on existing groundwater resources within the study area.

Project Background

Currently, 6th Line is a 2-lane road with a posted speed limit of 80 km/h. Based on predicted future uses, the segment of roadway between 20th Sideroad to St. John's Road (approximately 3 km in length, and including the planned Sleeping Lion Development) is anticipated to have future urbanized characteristics, while the segment from County Road 27 to 20th Sideroad (approximately 12 km in length, with mostly agricultural properties) will operate as a rural section.

Based on the recommendations from the 2013 Transportation Master Plan, and additional assessment conducted through this EA study, the Town is proposing to widen 6th Line, between 20th Sideroad and St. John's Road, from a 20 m 2-lane local rural road to a 26 m to 30 m wide 4-lane *urban major collector road*, and proposing to reconstruct 6th Line, between County Road 27 and 20th Sideroad, from a 20 m 2-lane local rural road to a 2-lane *rural arterial road* with paved shoulders and 30 m right-of-way protection.

The Town also plans to extend sewer and water servicing from St. John's Road to the 5th Sideroad.

In addition to confirming the cross section and preliminary conceptual design of the roadway, the study will review the need for the following corridor features:

- Bike lanes or multi-use trails;
- Potential need for a future interchange at Highway 400;
- New structure or structure widening over the existing GO rail line; and
- Intersection improvements.

Method of Investigation

Our method of investigation for this assessment consisted of a desk-top review of existing hydrogeological information supplemented with a windshield field reconnaissance of the study area. Based on the findings of the review, a groundwater impact assessment of the proposed road improvements on existing groundwater features and resources was completed.

The hydrogeological information reviewed as part of this assessment was as follows:

- Information contained in water well records for the study area available from the Ontario Ministry of the Environment and Climate Change (MOECC);
- Borehole information from concurrent Golder geotechnical investigations;
- Quaternary geological mapping for the study area available from the Ontario Geological survey;
- Topographic Mapping (National Topographic Survey Map 31D05, Barrie 1:50,000);
- Aerial photographs;
- Municipal source water protection area mapping and reports available on-line from the Government of Ontario, County of Simcoe, Town of Innisfil, and the South Georgian Bay Lake Simcoe Source Protection Region; and
- A limited “windshield reconnaissance” of the study area on May 28, 2015 along publically accessible roads to visually corroborate the background information reviewed.

The objectives of the corresponding groundwater impact assessment were to identify the following:

- General groundwater usage including aquifers, well types and locations;
- Areas of high water table and up-welling;
- Areas of groundwater recharge and discharge;
- Areas of high overburden permeability;
- Locations and usage of large volume wells; and
- Wells with known quality and quantity problems.

Based on the above information, an assessment was carried out to determine, to the extent possible based on the accessible information, the following:

- Areas of groundwater altered by physical intrusion and the likelihood of interception, drawdown, compaction and impoundment of groundwater;

- Areas of obstruction to groundwater recharge and discharge;
- Likelihood and significance of releases of contaminants to groundwater;
- Likelihood and significance of interference with wells; and
- Impacts of areas of high groundwater table on the project.

This groundwater assessment presents a generalized interpretation of hydrogeological conditions and has been based on available background information in addition to a limited windshield reconnaissance as outlined above. Hydrogeological conditions within the study area will vary locally and are subject to confirmation with actual site specific investigations including (but not limited to) boreholes, monitoring wells, test pits, groundwater hydraulic testing, chemical analysis, etc. Site specific investigations are normally completed at the detail design stage of a project.

Existing Conditions

Preferred Alignment

Currently, 6th Line is a 2-lane road with a posted speed of 80 km/h. Based on predicted future uses, the segment of roadway between 20th Sideroad to St. John's Road (approximately 3 km in length, and including the planned Sleeping Lion Development) is anticipated to have future urbanized characteristics, while the segment from County Road 27 to 20th Sideroad (approximately 12 km in length, with mostly agricultural properties) will operate as a rural section.

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- Bike lanes or multi-use trails;
- Potential need for a future interchange at Highway 400; and
- New structure or structure widening over the existing GO rail line.

Geology

Two hydrogeologic cross sections along 6th Line based on MOECC water well records are presented on Figures 2 and 3 following the text of this report. The ground surface shown on the sections is based on borehole or well elevations and is not intended to accurately represent the ground surface elevation in any one particular location.

The west portion of the study area from County Road 27 east, to between Highway 400 and the 10th Sideroad is a rolling upland area with ground surface elevations typically between 285 m above sea level (masl) and 295 masl. The ground surface then slopes down to the east from a point approximately 1 km west of the

10th Sideroad down to a low point at an approximate elevation of 250 masl associated with the Lover's Creek wetland located between the 10th Sideroad and Yonge Street. Approximately 1 km west of Yonge Street the ground surface rises to the east to a second upland area between 250 masl and 300 masl that extends easterly to approximately the Barrie GO Train track. East of the GO Train track to the project limits, the ground surface slopes gently to the east at an approximately elevation of 225 masl.

The west portion of the study area from County Road 27 easterly to a point approximately 400 m east of the 10th Sideroad is situated within the Nottawasaga River watershed and the Innisfil Creek sub-watershed. Groundwater and surface water is expected to ultimately discharge and flow via local tributaries and Innisfil Creek toward the Nottawasaga River located west of County Road 27. East of the watershed divide, surface water and regional groundwater flows to the east toward Lake Simcoe.

Based on topographic mapping and observations made during the windshield survey, areas of high water table (i.e., within 1 m of ground surface) were observed as follow:

- In the vicinity of stream crossings in the study area;
- In the vicinity of Highway 400 and extending approximately 500 m to the east and west;
- In the low lying area associated with the Lover's Creek wetland between the 10th Sideroad and Yonge Street;
- In the vicinity of a forested wetland area from about 500 m east of Yonge Street and extending approximately 1.2 km to the east; and
- East of the GO Train track to the project limits.

Ontario Geological Survey Quaternary geology mapping is summarized on Figure 4, Surficial Geology Map following the text of the report. Based on the Quaternary geology mapping, the majority of the west portion of the study area from County Road 27 east to approximately 500 m east of Highway 400, is underlain at surface by glacial deposits of till. An esker, likely consisting of relative coarse grained sand and gravel is mapped across the study area approximately 500 m to 600 m east of County Road 27. In places in the west portion of the study area, the till is overlain by deep-water glacial lake deposits of silt and clay. Between Highway 400 and the 10th Sideroad an area of ice contact sediments, likely consisting of relative coarse grained sand and gravel, is present in addition to till and deep water glacial lake silt and clay deposits. In the low lying area east of the 10th Sideroad associated with the Lover's Creek wetland, glacial lake shallow and deep water deposits are mapped. The shallow water deposits likely consist of silt to sand. The relatively high ground around Yonge Street is mapped as relatively coarse grained ice contact sediments and shallow water glacial lake deposits. From about 1.2 km west of the 20th Sideroad and east to the study area limits, glacial till deposits are mapped. A small area of ice contact sediments is mapped west of the 20th Sideroad and glacial lake sand deposits are mapped immediately east of the GO Train track associated with a remnant wave cut bluff and raised beach feature.

Geotechnical boreholes drilled by Golder east of the 20th Sideroad to the study area limit encountered glacial deposits of silty sand till, overlain in places by glacial lake deep water deposits of silt and clay.

Groundwater Recharge and Discharge

Based on the surficial geology of the study area, significant areas of groundwater recharge are expected to be associated with the mapped areas of ice contact deposits. In particular, significant groundwater recharge is expected associated with ice contact sediments in an area between 0.7 km and 1.7 km east of Highway 400.

As well, the upland area mapped as ice contact deposits around Yonge Street is also expected to be a significant groundwater recharge area. Groundwater recharge will also be occurring at a lower rate within the areas mapped as glacial lake shallow water deposits and glacial till if they are outside of the areas of high groundwater table noted above.

Groundwater discharge is expected to be limited primarily to the lower elevation stream and wetland areas in the study area. Wetland areas where more significant groundwater discharge potential may exist are:

- In the vicinity of Highway 400 and extending approximately 500 m to the east and west;
- In the low lying area associated with the Lover's Creek wetland between the 10th Sideroad and Yonge Street; and
- In the vicinity of a forested wetland area from about 500 m east of Yonge Street and extending approximately 1.2 km to the east.

Existing Groundwater Use

Based on a plot of MOECC water well records, water wells are in use throughout the study area typically associated with either residences and/or farm infrastructure. The water well records are attached in Appendix A. Plots of the well locations and hydrogeological cross-sections of the study area based on the well records are presented on Figures 3 and 4 following the text of this report.

A total of 91 wells were plotted within the study area from the water well records with approximately one third of the wells clustered in the area of St John's Road at the east limit of the study area. A summary of the well records is presented in Table 1 below. Typically, shallow unconfined overburden wells are under reported in the water well records and more shallow bored wells may be present than reported.

Table 1: Summary of MOECC Recorded Wells

Characteristic	Number of Wells (91 total)
Uncased/bored or driven wells	32
Cased/drilled wells	59
Shallow wells <10 m deep	16
Medium depth wells 10 m-50 m deep	55
Deep Wells >50 m deep	20
Overburden Aquifers	88
Bedrock Aquifers	3
Static water level <3 m below ground	44
Static water level >3 m below ground	47
Static water level above ground (flowing)	3
Pumping Test Rate Range (L/min)	5-227
Average Pumping Test Rate Range (L/min)	47

In the west portion of the study area west of 10th Sideroad, most of the wells are drilled through the surface glacial till confining layer into a confined aquifer typically encountered at elevations between 270 masl and 285 masl.

In the low area between 10th Sideroad and Yonge Street, relatively deep drilled wells have been installed into a confined aquifer below 230 masl. In addition to the deep wells, there are also some shallow water table wells that are less than 10 m deep. In the vicinity of Yonge Street wells of varying depths use the unconfined aquifer associated with the surficial sand and gravel deposits that extend to a depth of approximately 270 masl. Recorded water levels within the unconfined aquifer are typically about 285 masl or at least 5 m below ground surface. East of the 20th Sideroad, most wells are drilled through the surface till confining layer into either a shallow confined aquifer between approximately 205 masl and 215 masl or a deep confined aquifer between 170 masl and 180 masl.

Approximately 18 per cent of the wells are relatively shallow and less than 10 m deep. Most of the shallow wells are associated either with the relatively coarse grained ice contact sediments at ground surface and use water from the associated unconfined water table aquifer in those areas or are located in areas suspected of having a relatively high water table.

The geology reported in the well records is generally consistent with the published mapping. Bedrock was recorded in three of the wells at depths of 78 m, 136 m and 148 m below ground surface. Well pumping tests report pumping rates typical of residential well yield demands between 5 L/min and 227 L/min. The water quality, where reported in the records, was “fresh” for all but three of the wells. The other three wells reported salt, sulphur or mineral water quality.

Source Water Protection

Based on mapping available on-line from the County of Simcoe and Town of Innisfil, there are no wellhead protection areas or municipal wells within the study area. A review of the South Georgian Bay Lake Simcoe Source Protection Region, Approved Source Protection Plan as amended May 14, 2015 and on-line source water protection mapping from the Government of Ontario (http://www.applications.ene.gov.on.ca/swp) indicates the study area has no source water protection vulnerable areas. As such, risk management plans for the threats identified in the Approved Source Protection Plan are not expected to be required.

Groundwater Impact Assessment

The groundwater impact assessment is based on similar transportation construction projects with consideration of the potential works to be undertaken. Construction activities associated with the 6th Line improvements are expected to consist of widening of a portion of the road to four lanes, flattening of the road profile as necessary to meet minimum design standards, construction of trunk sewers and water mains, drainage improvements, construction of structures for stream crossings and the possible reconstruction of an existing grade separated rail crossing for the GO Train track. With respect to the flattening of the road profile, road profiles are laid out to match existing wherever possible as long as the existing profile meets minimum standards. Most physical interaction with groundwater is expected to be as a result of deep excavations below the water table. Most excavation activities for the widening of the road and drainage improvements are anticipated to be shallow; however, deeper excavations may be necessary for culvert, bridge and buried utility and sewer construction. In future, once final designs are selected, the potential impact of the proposed construction works should be reassessed and further investigation and monitoring carried out as necessary at the detail design phase of the project.

Physical Alteration of Existing Groundwater Regime

Based on potential construction works and the hydrogeologic conditions, potential physical alterations to the groundwater regime include:

- Profile lowering, drainage improvements, and trunk sewer and water main construction have the potential to permanently dewater or lower the local water table, particularly in the areas of high water table;
- Bridge and culvert construction may cause temporary impact to local groundwater discharge to water courses; however, this impact is expected to be negligible post-construction once water table conditions equilibrate around the new structures;
- Impacts associated with any positive dewatering implemented during construction. The measured impacts and effective radius of influence from the dewatering will be dependent on the hydrogeologic conditions. The impacts associated with the construction dewatering activities are expected to be temporary only; and,
- Construction of structures near surface water crossings where groundwater baseflow may provide a significant contribution to the overall flow.

Impact on Groundwater Recharge and Discharge

A reduction in groundwater recharge to the subsurface will occur as a result of the widening of the road and construction of impermeable surfaces. It is expected that new impermeable surface associated with the 6th Line improvements will reduce the overall recharge within the study area, particularly in the areas identified as having significant groundwater recharge. The areas of significant groundwater recharge are associated with ice contact sediments in an area between 0.7 km and 1.7 km east of Highway 400 and the upland area mapped as ice contact deposits around Yonge Street.

Recharge lost to impermeable surfaces can in part be mitigated by direction of runoff to ground surfaces, by the construction of permeable pavements or by other low-impact development infiltration techniques. The effectiveness of any of these measures should be assessed through direct investigation during the detail design phase of the project.

Based on the relatively large regional areas from which the local watersheds and aquifers derive recharge and, the effect of the potential reduction in overall groundwater recharge is not expected to be significant. It is unlikely that the potential reduction in recharge would produce a measurable effect on groundwater recharge and discharge functions, including baseflow in streams and water well supply quantity.

Discharge functions within the Study Area may be reduced depending on the final design of the proposed works. In particular, the construction of trunk sewers, water mains and drainage improvements have the potential to cut-off groundwater flow with relatively lower permeability trench backfill. In addition these improvements may intercept and divert groundwater flow along granular pipe bedding material. The risk of these effects is expected to be highest in areas of high water table as identified above. These effects can be mitigated through matching the hydraulic characteristics of the trench backfill to the surrounding native soil and by the placement of trench plugs to block the preferential migration of groundwater along the granular pipe bedding.

Discharge functions at bridge or culvert construction locations may be impacted temporarily during construction activities; however, this impact is expected to be negligible post-construction once water table conditions equilibrate around the new structures.

Water Well Interference

Typically the most susceptible wells to either quantity or quality interference related to roadway construction activities are the shallow overburden wells using the water table aquifer in close proximity to the construction. Typically shallow unconfined overburden wells are under reported in the water well records and more shallow bored wells may be present than reported. Based on the well records approximately 16 shallow bored wells are present throughout the study area. Most of the shallow wells are associated either with the relatively coarse grained ice contact sediments at ground surface and use water from the associated unconfined water table aquifer in those areas or are located in areas suspected of having a relatively high water table.

Most of the remaining wells within the study area are deeper drilled wells which use confined aquifers at depth. These deeper drilled wells are expected to be protected from the physical interference effects of construction.

It is expected that the greatest potential for well interference would be associated with deep excavations below the water table, deep sewer installations and/or construction dewatering. We anticipate that deep excavations and/or dewatering may be needed for construction of bridges, culverts and trunk sewers and water mains. As such potential for temporary interference effects exist in shallow wells in the immediate vicinity of these activities. Should dewatering or deep excavation be required it is recommended that a door-to-door water well survey be conducted within 500 m of locations at which the dewatering or deep excavation may occur. This pre-construction survey would ensure that conditions of the domestic water supply wells are documented prior to construction in the event there is an impact to the water supply. The pre-construction survey should be followed by monitoring of water levels in selected wells during dewatering activities to confirm any decline in water level within the domestic water supply wells.

Profile lowering, ditch relocations, embankments, and drainage improvements which intersect the water table may result in permanent water table lowering in the vicinity of the construction. If deep excavations or permanent service installations below the water table are to be carried out, then some long term lowering of the water table in the vicinity of these installations may result. This may result in a corresponding reduction in the groundwater supplies in nearby shallow wells. If such design features are anticipated, the actual soil and groundwater conditions in those areas should be assessed along with a door-to-door water well survey to identify wells, if any, which may potentially be impacted.

It should be noted that any pumping of water above 50,000 Litres per day requires a Permit to Take Water from the MOECC.

Potential for Groundwater Contamination

Shallow wells located near the study area may be susceptible to impact by de-icing salt application, especially those wells using the shallow unconfined aquifers associated with the mapped ice contact deposits east of Highway 400 and in the vicinity of Yonge Street. Deeper wells using confined aquifers are protected from impact by the presence of a relatively fine grained confining layer between the ground surface and the aquifer being used.

Chloride, which is highly mobile in the subsurface, is a major constituent of road salt. Chloride at high concentrations (greater than 250 mg/L) may produce a noticeable impact on the taste of water. Sodium, which is the other major constituent of road salt, is less mobile in the subsurface, but elevated concentrations may be of concern to persons suffering from hypertension or other medical conditions. Given the expanded road, the increase in traffic and the corresponding likely increase in the application of de-icing salt there is potential for

impact on well water quality as a result of the 6th Line improvements especially shallow bored wells and those wells using the shallow unconfined aquifers associated with the mapped ice contact deposits east of Highway 400 and in the vicinity of Yonge Street.

Because of the mobility of road salt constituents, mitigation of road salt impacts is difficult. However, where practical, road salt application within the right-of-way should be at the minimum levels tolerable. It is recommended that a monitoring program to establish baseline water quality in shallow wells be implemented prior to construction.

Mobile vehicle re-fuelling during construction presents a risk of impact to local wells as a result of accidental releases of fuel. It is our opinion that shallow wells are the most susceptible to fuel impacts. In general, only large volume releases (i.e., greater than 100 L) are likely to have an adverse impact on local water well supplies. This risk can be minimized or managed by allowing re-fuelling only in designated areas, preferably situated on a paved, impermeable surface and by having an emergency response plan in place to clean up all releases of fuel.

Impact of High Water Table

Areas of high water table may affect construction progress and technique particularly in areas of relatively coarser, non-cohesive silt, sand and gravel soils which may in turn increase the potential for well interference. Based on topography, geology and field observations there is the potential for a high water table to be present within the study area as follows:

- In the vicinity of Highway 400 and extending approximately 500 m to the east and west;
- In the low lying area associated with the Lover's Creek wetland between the 10th Sideroad and Yonge Street;
- In the vicinity of a forested wetland area from about 500 m east of Yonge Street and extending approximately 1.2 km to the east; and
- East of the GO Train track to the project limits.

The shallow geology of these areas, based on the Quaternary geology mapping is expected to be relatively fine grained with the exception of the forested wetland area 500 m east of Yonge Street, where relatively sandier soils may be present. The design of subsurface structures relative to saturated permeable units will require direct investigation of soil conditions at the detail design stage of the project to determine the degree of dewatering that may be required. The presence of relatively fine grained soils may not significantly impact the proposed construction, however, if coarse grained units are intersected, construction techniques may require modification. Intrusive investigations to be undertaken as part of the trunk sewer and water main detail design and bridge and culvert detail design will assess the subsurface units, high water table and potential impact on the construction project. Excavation and construction below the water table in saturated sandy soils may present challenges, including the need for de-watering. Construction de-watering in excess of 50,000 Litres per day requires a Permit to Take Water from the MOECC and it is recommended that a pre-construction survey of wells within 500 m of any construction dewatering be completed as part of the construction phase of the project.

Summary

Based on the review of available published information, our windshield reconnaissance, and the expected construction activities, there is potential for impact to groundwater resources as a result of:

- Construction de-watering;
- Reduction in groundwater recharge associated with expanded pavement surfaces;
- Installation of sewers, water mains, culvert and bridge foundations and drainage improvements below the water table; and
- Increased use of road salt over a larger area associated with the expanded road and increased traffic.

It is recommended that the potential impacts be re-assessed along with more detailed site specific hydrogeological data at the detail design stage of the project and appropriate mitigation measures incorporated into the design. Based on the findings of the re-assessment, Permits to Take Water for construction should be applied for and a pre-construction survey and baseline water quality assessment be implemented as necessary prior to construction.

We trust that this report meets your requirements. Should you have any questions please contact the undersigned.

Yours truly,

GOLDER ASSOCIATES LTD.

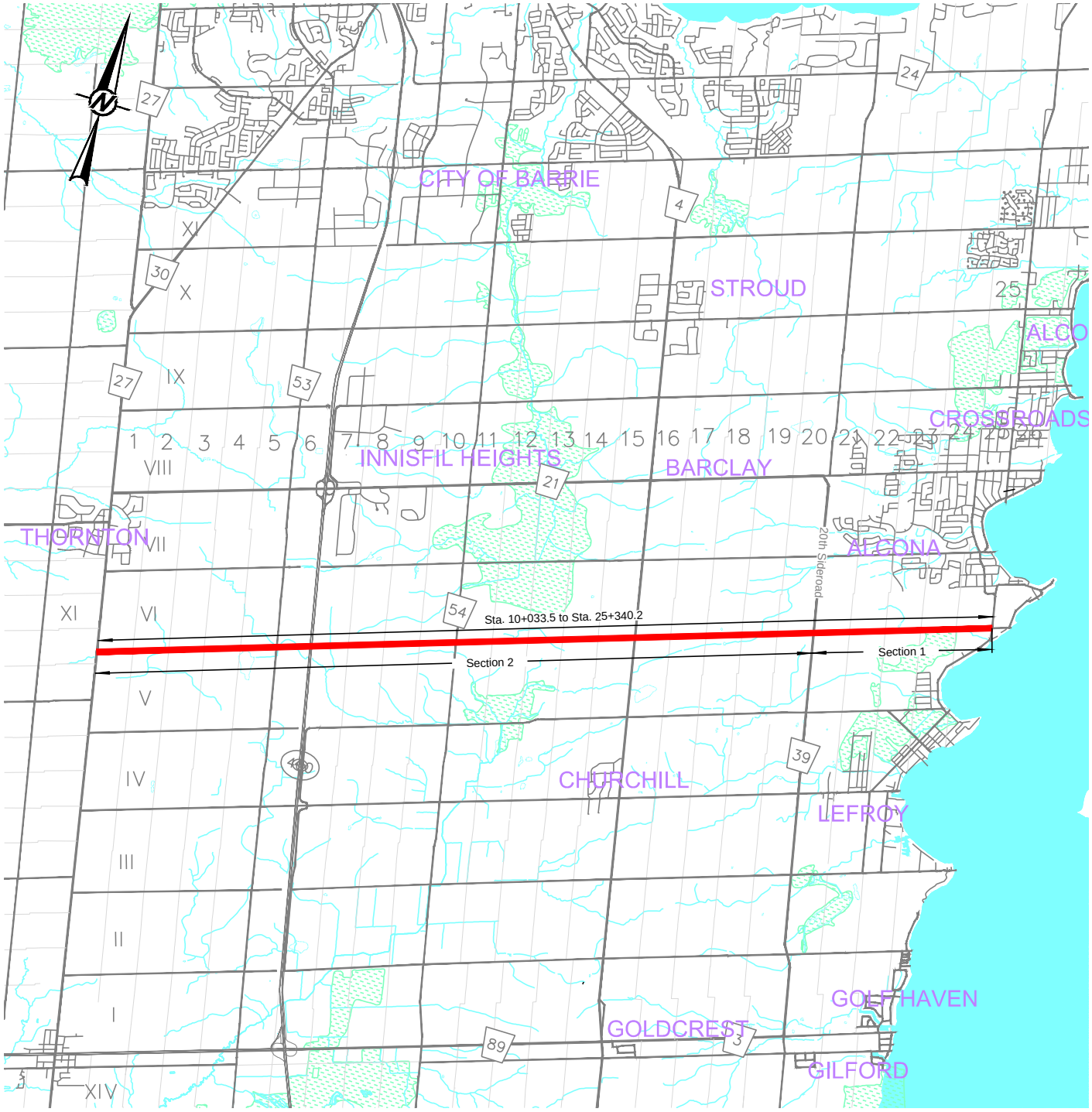
Shawn Lytle, P.Geo.
Senior Hydrogeologist, Principal

SDL/plc/mp

Attachments: Figure 1: Key Plan
Figure 2: Stratigraphic Section West
Figure 3: Stratigraphic Section East
Figure 4: Surficial Geology Map

Appendix A Water Well Records

FIGURES



0 2,000 4,000 6,000

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LEGEND

- Road
- Site Location
- Watercourse
- Water Area, Permanent
- Wetland, Permanent

REFERENCE

Datum is UTM NAD 83 Zone 17
OBM Features ESRI Geography Network

CLIENT
TOWN OF INNISFIL

PROJECT
6th LINE FROM COUNTY ROAD 27 TO ST. JOHN'S ROAD, INNISFIL, ONTARIO

TITLE
KEY PLAN

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-09-01
PREPARED	STB
DESIGN	
REVIEW	SDL
APPROVED	SDL

PROJECT No.	Phase	Rev.	Figure
141-3283	-	AA	1

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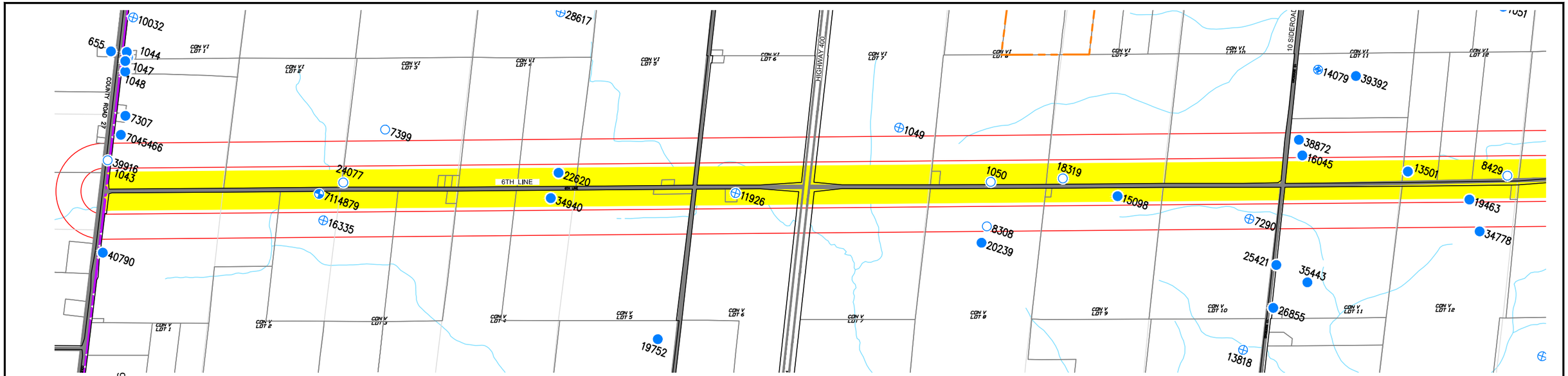

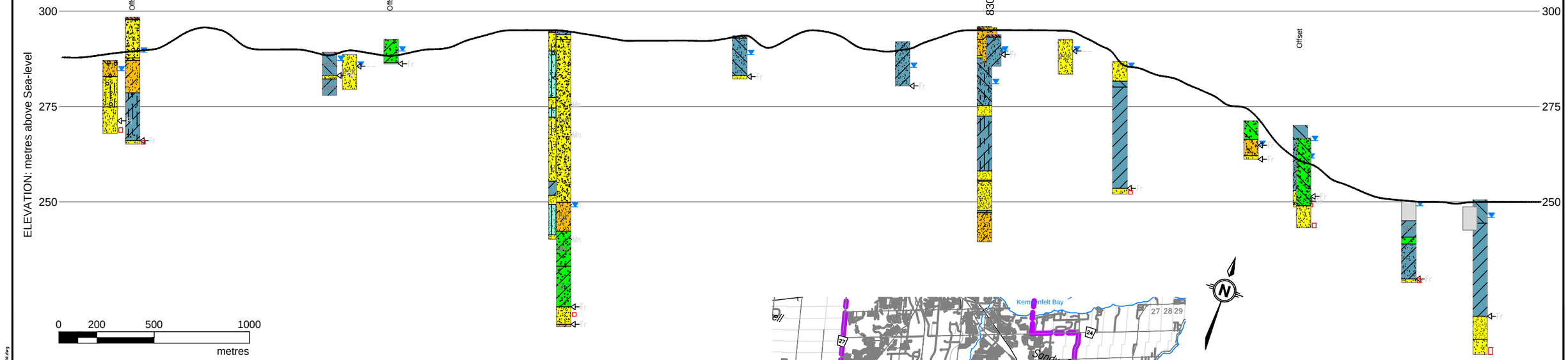

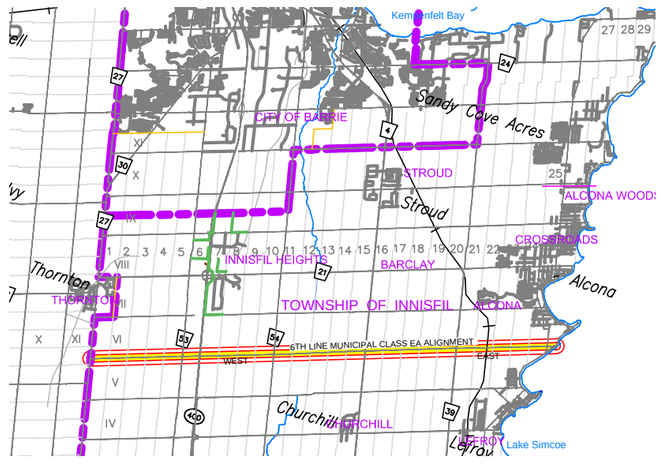

LEGEND:

PLAN

- CLASS EA 6TH LINE ALIGNMENT
- DUG OR BORED WELL <10 M
- DEEP BORED WELL >10 M
- DRILLED OVERBURDEN WELL
- TEST OR OBSERVATION WELL
- DRILLED BEDROCK WELL
- SANDPOINT WELL
- MUNICIPAL / PUBLIC SUPPLY WELL

STRATIGRAPHIC PATTERN

- Unoxidized CLAY, Blue, Grey, White, or Undefined CLAY
- Oxidized CLAY, Brown, Red, Yellow
- SILT
- SAND
- STONES, Rounded GRAVEL, PEBBLES
- GRAVEL
- BOULDER
- TILL
- SHALE

GENERIC MATERIALS

- UNKNOWN OR PR. DUG
- PEAT/LOAM
- SANDS & GRAVELS
- GRANULAR TILL
- SILT
- SILT CLAYEY
- CLAY
- TILL

SECTION SYMBOLS

- SCREEN
- RECORDED STATIC WATER LEVEL
- WATER PRODUCING ZONE
- 2453 MOE RECORDED PRIVATE WELL

REFERENCES:

1. MAPPING BASED ON COUNTY OF SIMCOE ASSESSMENT FABRIC 2007
2. ONTARIO BASE MAPPING
3. MINISTRY WATER WELL RECORDS, QUEEN'S PRINTER 2012

PROJECT
6TH LINE (COUNTY ROAD 27 TO ST. JOHN'S ROAD)
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
RFP #: P-14-71

TITLE
STRATIGRAPHIC SECTION WEST

Golder Associates
Barrie, Ontario, Canada

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REVIEW	SDL	2016-09-01			

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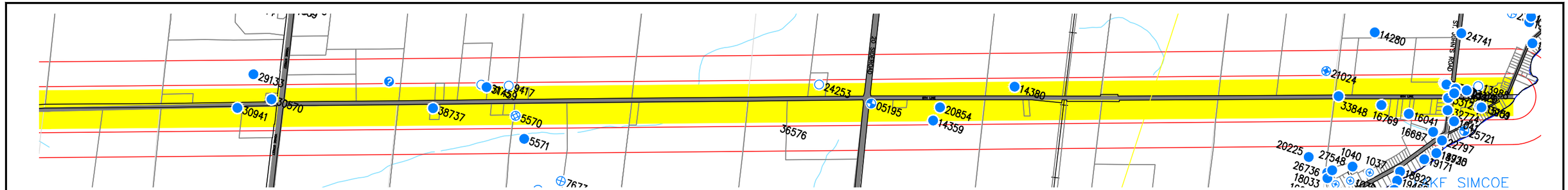

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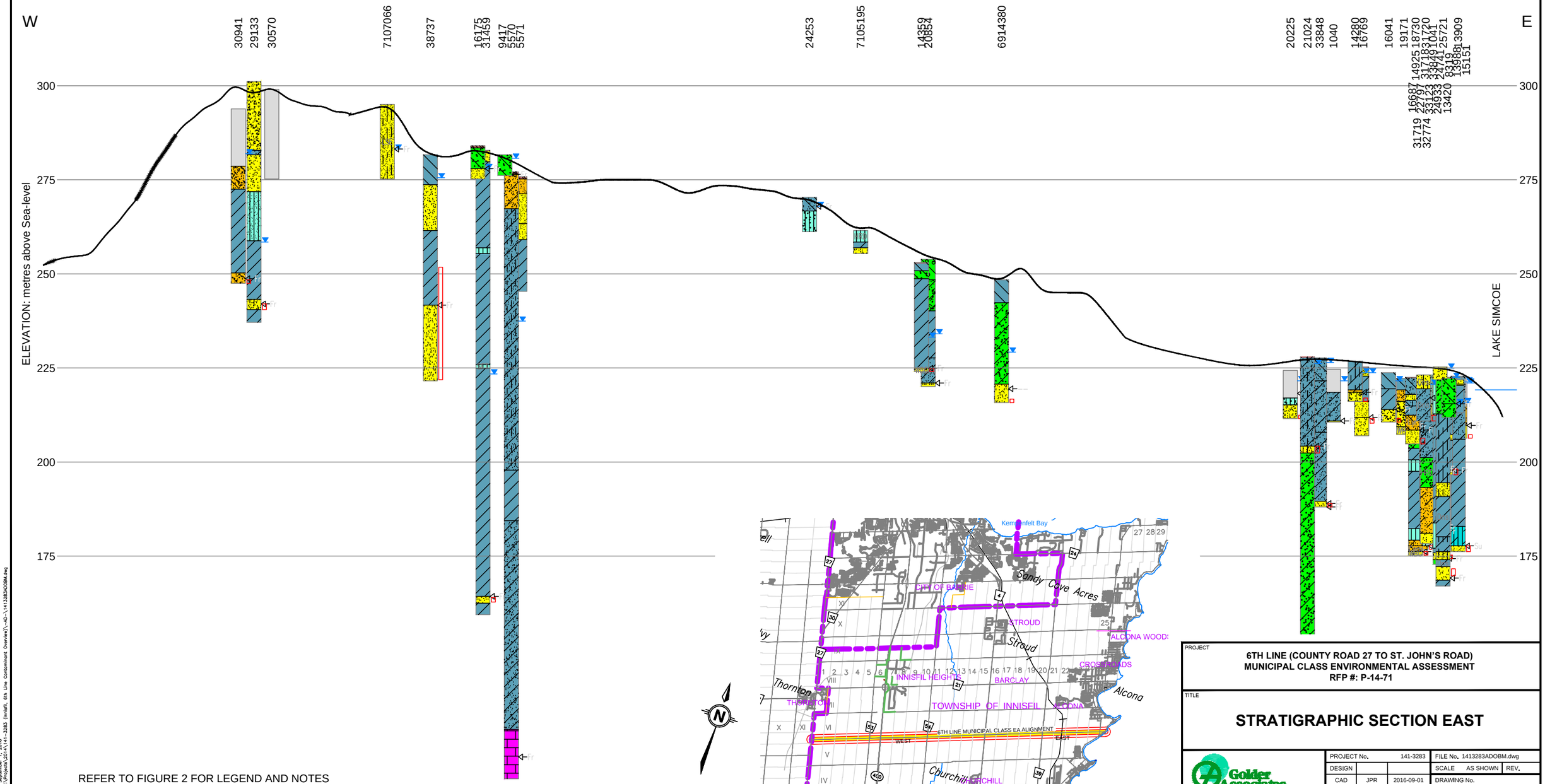

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REFER TO FIGURE 2 FOR LEGEND AND NOTES

PROJECT

6TH LINE (COUNTY ROAD 27 TO ST. JOHN'S ROAD)
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
RFP #: P-14-71

TITLE

STRATIGRAPHIC SECTION EAST

Golder Associates
Barrie, Ontario, Canada

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REVIEW	SDL	2016-09-01		

PLOT DATE: September 1, 2016
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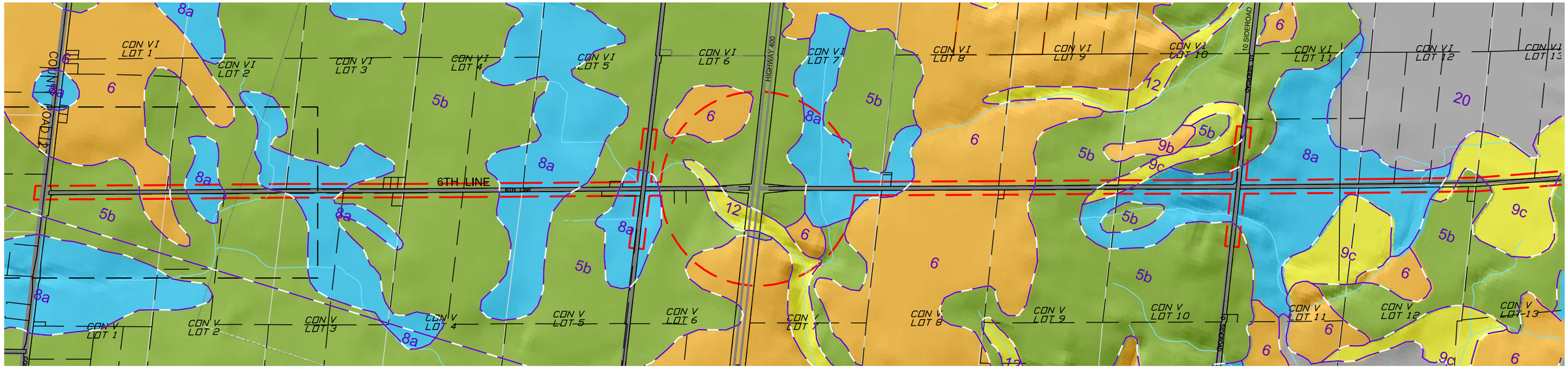
SURFICIAL GEOLOGY - COUNTY ROAD 27 TO CONCESSION 5 LOT 13 INNISFIL



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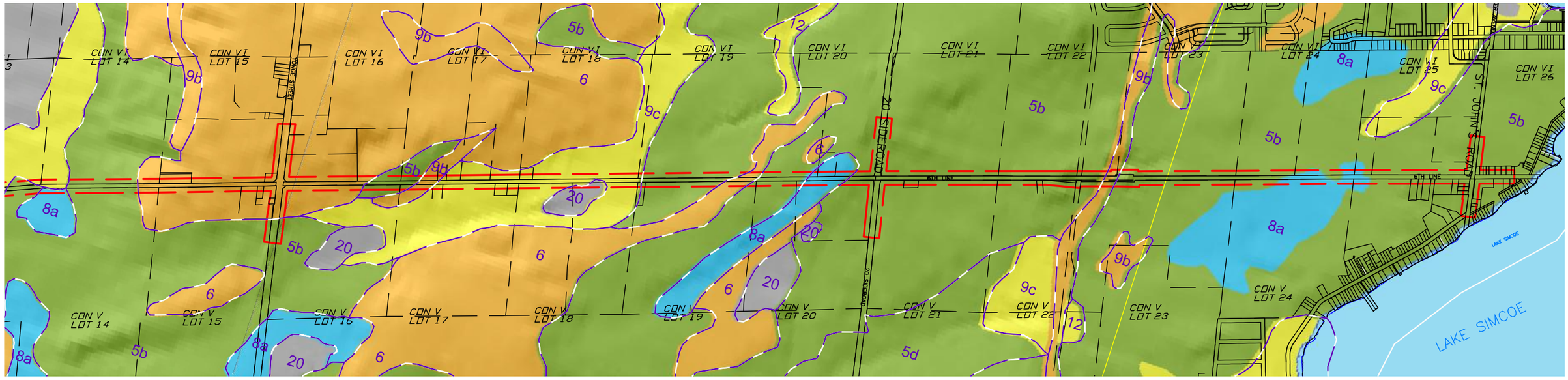
SURFICIAL GEOLOGY - CONCESSION 5 LOT 13 INNISFIL TO ST JOHN'S ROAD



LEGEND

Study Area

	20	Organic Deposits
	12	Fluvial Sand
	9b	Glaciolacustrine Sand Deposits
	9c	Glaciolacustrine Silt & Sand Deposits
	8a	Glaciolacustrine Deep Water Deposits
	6	Ice Contact Sediments, Eskers
	5d	Fine Grained Till
	5b	Ablation Till

0 100 250 500 1000

SCALE 1:20000 metres

REFERENCES:

1. QUATERNARY MAPPING OGS, QUEEN'S PRINTER 2006
2. LOT FABRIC, GEOGRAPHIC AND ROAD BASE, COUNTY OF SIMCOE GIS

PROJECT

6TH LINE (COUNTY ROAD 27 TO ST. JOHN'S ROAD)
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
RFP #: P-14-71

TITLE

SURFICIAL GEOLOGY MAP

Golder Associates
Barrie, Ontario, Canada

PROJECT No.		141-3283	FILE No.	1413283ADQUAT.dwg	
DESIGN			SCALE	AS SHOWN	REV.
CAD	JPR	2016-09-01	DRAWING No.		
CHECK	SDL	2016-09-01		4	
REVIEW	SDL	2016-09-01			

PLOT DATE: September 1, 2016
FILENAME: I:\Projects\2014\141-3283 (Install, 6th Line Contaminant Overview)\~AD~\1413283ADQUAT.dwg

APPENDIX A

Water Well Records

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
1035	5 25	May-46	616506 4904802	224.9					NR				4404 JT	WS DO	**MOE# 5701035** 0.0
1036	5 25	Aug-46	616579 4904845	224.9					NR				4404 JT	WS DO	**MOE# 5701036** 0.0
1037	5 25	Aug-46	616663 4904917	224.9					NR				4404 JT	WS DO	**MOE# 5701037** 0.0
1039	5 25	Jun-49	616512 4904804	224.9	10.7	Fr			-0.6				5451 JT	WS DO	**MOE# 5701039** 0.0 GRVL FILL 0.6 MSND 4.6 CLAY 8.5 GRVL 10.7
1040	5 25	Oct-58	616568 4904919	224.6	13.7	Fr			3.0				3107 CT	WS DO	**MOE# 5701040** 0.0 PRDG 6.1 CLAY MSND GRVL 13.7 GRVL 14.0
1041	5 25	Mar-60	616999 4905307	221.9	24.4	Fr	23.5	-0.9	1.8	64	120	22.9	2514 CT	WS DO	**MOE# 5701041** 0.0 TPSL 0.3 BRWN CLAY 2.1 BLUE CLAY 18.9 FSND 22.9 MSND GRVL 24.4
1043	6 1	Apr-59	602383 4900954	300.5	9.1	Fr			9.1				1308 BR	WS ST	**MOE# 5701043** 0.0 PRDG 9.1 QSND 12.2
1049	6 7	Jun-65	606268 4902159	291.1	11.6	Fr			6.7	14			4608 BR	WS ST	**MOE# 5701049** 0.0 CLAY MSND 11.6
1050	6 8	Mar-65	606802 4902062	295.0	5.2	Fr			4.3	9			4608 BR	WS ST	**MOE# 5701050** 0.0 TPSL 0.6 CLAY MSND 8.2
5570	5 18	Sep-68	612585 4903860	277.1	155.4	Fr			39.6	9		121.9	2514 CT	AS NU	**MOE# 5705570** 0.0 FILL 0.3 MUCK 0.6 MSND CLAY GRVL 9.8 CLAY MSND SILT 79.2 CLAY 92.7 CLAY MSND GRVL 148.1 LMSN SHLE SNDS 161.2
5571	5 18	Sep-68	612472 4903641	280.4					NR				2514 CT	AS -	**MOE# 5705571** 0.0 FILL 0.3 TPSL 0.6 BRWN FSND CLAY 4.6 YLLW FSND 12.5 GREY FSND 16.8 CLAY 30.5
5818	5 18	Sep-68	612812 4903521	274.0	2.7	Fr			2.7				4608 BR	WS DO	**MOE# 5705818** 0.0 MSND 5.5
5829	5 18	Sep-68	612562 4903491	281.3	6.1	Fr			6.1				4608 BR	WS DO	**MOE# 5705829** 0.0 MSND 9.1
5830	5 18	Sep-68	612712 4903521	277.1	2.7	Fr			2.4				4608 BR	WS DO	**MOE# 5705830** 0.0 MSND 5.2
7290	5 10	Jun-70	608152 4902271	271.6	10.1 6.4	Fr Fr			6.4		60	9.1	4608 BR	WS DO	**MOE# 5707290** 0.0 BRWN CLAY STNS 4.9 BRWN MSND CLAY STNS 9.1 GREY MSND 10.1
7307	6 1	Jun-70	602412 4900971	300.8	32.3	Fr	32.3	-0.9	9.1	9	1440	25.9	3645 CT	WS DO	**MOE# 5707307** 0.0 TPSL 0.6 MSND GRVL 10.7 GRVL 11.3 CSND CLAY 19.8 HPAN 32.3 MSND 33.2
7399	6 3	Jul-70	603722 4901321	285.3	6.4	Fr			3.0	23	60	5.2	4608 BR	WS DO	**MOE# 5707399** 0.0 BLCK TPSL 0.3 GREY CLAY STNS 6.1 GREY MSND 6.4
7673	5 18	Nov-70	612662 4903571	276.8	10.7	Fr			4.6	27	60	7.0	4608 BR	WS DO	**MOE# 5707673** 0.0 GREY MSND 10.7

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
8308	5 8	Sep-71	606862 4901811	295.7	6.4	Fr			6.4	18	60	8.2	4608 BR	WS ST	**MOE# 5708308** 0.0 GREY MSND CLAY 9.1
8319	6 26	Sep-71	617032 4905481	222.2	6.7	Fr			6.7	23	60	8.5	4608 BR	WS DO	**MOE# 5708319** 0.0 BRWN CLAY STNS 6.7 GREY CLAY STNS 10.4
8429	6 12	Nov-71	609362 4902901	250.2	5.2	Fr			5.5	14	60	7.3	4608 BR	WS DO	**MOE# 5708429** 0.0 GREY CLAY GRVL 8.5
9417	6 18	Oct-72	612330 4903946	281.6	5.2	Fr			0.9	23	60	3.4	4608 BR	WS DO	**MOE# 5709417 TAG#ASSMNT** 0.0 BRWN CLAY STNS 5.5
11926	5 6	Aug-74	605562 4901571	293.5	10.7	Fr			4.9				3109 BR	WS DO	**MOE# 5711926** 0.0 TPSL 0.6 BRWN CLAY SNDY 10.4 FSND 11.3
13215	6 15	Jun-76	610912 4904021	306.3					NR				1204 CT	AS -	**MOE# 5713215** 0.0 BRWN SAND CLAY DRTY 12.8 BRWN CLAY 17.4 BRWN SAND SILT 35.1 GREY CLAY 44.2 GREY CLAY SLTY 73.2
13420	6 25	Nov-75	617012 4905481	222.5	24.7	Fr	24.4	-1.5	FLW	14	120	21.3	3203 CT	WS DO	**MOE# 5713420** 0.0 BRWN SAND CLAY 1.8 GREY CLAY SAND 15.2 GREY SAND 16.8 GREY CLAY 24.7 GREY SAND 25.9
13422	6 26	Nov-75	617212 4905921	224.0	27.1	Fr	28.3	-1.2	3.7	23	60	12.8	3203 CT	WS DO	**MOE# 5713422** 0.0 BRWN CLAY 4.3 GREY CLAY SAND STNS 15.5 GREY SAND CLAY 16.5 GREY CLAY 27.1 GREY FSND 29.6
13501	6 12	Aug-76	608862 4902761	250.2	20.4	Fr	20.4	-0.9	1.2	14	100	17.7	1222 CT	WS DO	**MOE# 5713501** 0.0 PRDG 5.2 GREY CLAY SOFT 9.4 GREY CLAY GRVL STNS 11.3 GREY CLAY SAND 20.4 GREY CSND 21.3
13909	5 26	Nov-76	617102 4905421	222.8	45.1	Su	45.1	-1.5	1.5	36	60	24.4	1222 CT	WS DO	**MOE# 5713909** 0.0 BRWN CLAY SOFT 2.1 GREY CLAY SAND SOFT 16.8 GREY CLAY 39.9 GREY SILT CLAY 45.1 GREY FSND 46.6
13988	6 26	Jul-76	617062 4905521	221.9					6.1				4608 BR	WS DO	**MOE# 5713988** 0.0 SAND 1.2 GRVL 1.5 GREY CLAY 8.8
14026	6 26	Nov-76	617212 4905951	224.0	30.2	Fr	30.2	-1.2	3.0	14	150	30.8	2514 CT	WS DO	**MOE# 5714026** 0.0 TPSL DKCL 0.3 BRWN SAND BLDR 0.9 GREY SILT CLAY SAND 30.2 GREY FSND 31.4 GREY SAND SILT CLAY 31.4

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
14079	6 11	Feb-77	608252 4903121	262.4			62.8	-3.0	26.8	45			2801 RC	TH MU	**MOE# 5714079** 0.0 BRWN CLAY GRVL PCKD 1.8 GREY CLAY GRVL SNDY 19.5 GREY CLAY HARD 25.0 GREY FSND FGVL CLAY 30.8 GREY CLAY HARD 36.3 GREY CLAY FSND LYRD 39.0 GREY CLAY GRVL LYRD 45.1 BRWN SAND CLAY PCKD 52.4 GREY CLAY HARD 60.4 GREY SAND DRTY PCKD 69.8 GREY CLAY SOFT 84.7 GREY CLAY SNDY 90.8 GREY CLAY GRVL LYRD 110.6 GREY CLAY GRVL HARD 113.4 SAND GRVL CMTD 114.0 GREY CLAY GRVL SNDY 133.5 GREY SAND GRVL CMTD 136.6 LMSN 138.4
14280	6 25	Apr-77	616462 4905621	226.8	8.2	Fr	9.8	0.0	3.0	27	60	7.6	3660 CT	WS DO	**MOE# 5714280** 0.0 GREY CLAY SILT 7.6 GREY SAND CLAY 8.2 BRWN SAND GRVL 10.7
14359	5 21	Dec-76	614412 4904471	253.6	28.0	Fr	28.0	-0.9	19.8	9	270	24.4	3135 CT	WS DO	**MOE# 5714359** 0.0 TPSL 0.3 YLLW CLAY 2.1 BRWN CLAY GRVL STNS 4.3 GREY CLAY 28.0 SAND GRVL WBRG 29.0 SAND GRVL CLAY 29.0
14925	5 25	Aug-77	616962 4905121	221.9	2.4	-			4.3				4608 BR	WS DO	**MOE# 5714925** 0.0 SAND 1.2 GRVL 1.5 GREY CLAY 7.3
15151	5 25	May-76	617112 4905421	222.5	12.8	Fr	15.2	-0.9	1.5	45	60	9.1	3660 CT	WS DO	**MOE# 5715151** 0.0 PRDG 6.1 GREY SAND CLAY 12.8 BRWN SAND 16.2
16041	5 25	Jun-78	616526 4904884	223.7	9.8	Fr	12.2	-0.9	2.1	50	60	6.4	3203 CT	WS DO	**MOE# 5716041** 0.0 BRWN CLAY 4.3 GREY CLAY 9.8 GREY SAND GRVL 13.1
16045	6 11	Sep-78	608312 4902671	267.3	15.2	Fr	22.3	-1.2	0.6	114	60	7.6	3203 CT	WS DO	**MOE# 5716045** 0.0 BRWN CLAY STNS SAND 17.7 BRWN SAND 23.5
16175	6 17	Apr-79	612112 4903921	284.1	6.1	Fr			6.1		360		3109 BR	WS DO	**MOE# 5716175** 0.0 TPSL 0.6 BRWN CLAY STNY 6.1 FSND 8.8
16335	5 2	Jul-79	603486 4900848	289.3	6.1	Fe			2.1		90	9.1	4919 BR	WS DO	**MOE# 5716335** 0.0 BRWN TPSL HARD 0.3 BRWN CLAY HARD 6.1 BRWN SAND LOOS 7.0 GREY CLAY CMTD 11.3
16628	6 26	Mar-80	617262 4905821	223.1	11.0	Fr	12.2	-0.9	2.4	18	60	7.3	3203 CT	WS DO	**MOE# 5716628** 0.0 BRWN CLAY SAND BLDR 4.3 BRWN TILL CLAY SAND 11.0 GREY GRVL SAND CLAY 12.2 BRWN SAND 13.1
16687	5 25	Aug-79	616912 4905221	222.5	14.0	Fr	16.2	-1.5	1.2	68	90	11.9	2514 CT	WS DO	**MOE# 5716687** 0.0 BLCK TPSL 0.3 BRWN CLAY SAND STNS 4.6 SAND 6.1 BRWN CLAY SILT SAND 7.6 GREY CLAY 10.1 BRWN SAND CLAY LYRD 14.0 YLLW FSND 17.7
16769	5 25	Jun-80	616612 4905271	225.2	13.4	Fr	13.7	-1.2	1.5	68	60	9.1	3660 RC	WS DO	**MOE# 5716769** 0.0 BLCK TPSL 0.3 BRWN SAND 2.4 GREY CLAY 9.1 BRWN FSND 13.4 BRWN MSND 18.3

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
18033	5 25	Jun-81	616462 4904821	224.3	9.1	Fr	10.7	-0.9	2.4	45	90	6.1	3135 CT	WS DO	**MOE# 5718033** 0.0 TPSL 0.3 CLAY 9.1 SAND 11.6
18319	6 9	Aug-82	607240 4902188	293.8	3.0	-			3.0		30	8.5	4919 BR	WS DO	**MOE# 5718319** 0.0 BRWN TPSL HARD 0.3 BRWN SAND PCKD 9.1
18730	5 25	Nov-83	616962 4905121	221.9	45.7	Fr	45.7	-0.9	2.4	45	120	29.0	3660 CT	WS DO	**MOE# 5718730** 0.0 BRWN SAND FILL 0.9 GREY CLAY STNS 18.3 BLUE CLAY 21.3 GREY SILT 24.4 GREY CLAY 39.6 GREY SILT 42.7 GREY SAND CLAY 44.2 GREY GRVL CMTD 45.7 GREY CGVL LOOS WBRG 46.6
18822	5 25	Dec-83	616812 4904971	222.8	43.6	Fr	43.6	-1.2	4.3	32	120	43.3	2514 CT	WS DO	**MOE# 5718822** 0.0 BRWN CLAY 2.4 GREY CLAY SILT BLDR 7.0 GREY CLAY SILT SAND 25.0 GREY CLAY 39.3 GREY SILT SAND HARD 43.6 GREY MSND SILT 44.8
19171	5 25	May-84	616912 4905071	222.2	12.8	Fr	14.0	-0.9	1.8	18	120	12.2	3660 CT	WS DO	**MOE# 5719171** 0.0 BRWN CLAY 3.0 GREY SAND CLAY 6.1 GREY GRVL SAND 12.8 BRWN CSND WBRG 14.9
19463	5 12	Nov-84	609212 4902721	249.9					NR				3413 BR	WS DO	**MOE# 5719463** 0.0 PRDG 6.1
19466	5 25	Oct-84	616812 4904921	222.5	45.7	Fr	46.0	-0.9	3.0	50	120	24.4	3660 CT	WS DO	**MOE# 5719466** 0.0 BRWN CLAY 3.0 BLUE CLAY 45.7 GREY MSND 46.9
19747	5 25	Dec-84	616812 4904871	222.5	45.1	Fr	45.1	-0.9	2.7	91	60	23.8	2514 CT	WS DO	**MOE# 5719747** 0.0 SAND FILL 1.5 BRWN CLAY BLDR 2.4 GREY CLAY GRVL BLDR 21.3 GREY FSND VERY 22.9 GREY CLAY 37.8 GREY SILT FSND VERY 45.1 BLCK CSND SILT 46.0 GREY CLAY 46.0
19915	6 15	Jun-85	610962 4904021	305.4			72.8	-0.9	48.8	68	120		4816 RC	WS DO	**MOE# 5719915** 0.0 BRWN SAND 11.0 BRWN CLAY 16.8 CLAY SAND LYRD 19.8 BRWN MSND 33.5 GREY CLAY 36.0 GREY SILT CLAY 50.3 SILT CLAY 71.0 GREY CSND 75.0 SILT CLAY 79.2
20225	5 24	Mar-85	616335 4904898	224.3	6.1	Fr	11.9	-0.9	2.7	91	90	9.1	2514 CT	WS DO	**MOE# 5720225** 0.0 PRDG 7.3 GREY SILT STNS 9.1 GREY MSND CSND 12.8
20239	5 8	Aug-85	606902 4901689	296.0					14.9	227	120	14.9	4816 RC	WS ST	**MOE# 5720239 TAG#ASSMNT** 0.0 TPSL 0.6 BRWN SAND CLAY 3.4 BRWN SAND CLAY STNS 7.6 SAND GRVL 8.2 BRWN CLAY SAND SLTY 20.7 FSND 23.5 GREY CLAY SILT 37.8 FSND 40.2 CLAY 40.5 FSND MSND 48.2 CLAY 48.8 MSND CLAY FSND 56.4
20644	6 15	Aug-85	610800 4903945	305.7	6.1	Sa			3.0		30	11.9	4919 BR	WS DO	**MOE# 5720644** 0.0 BRWN TPSL HARD 0.3 BRWN SAND PCKD 12.2

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
20854	5 22	Aug-85	614425 4904548	253.9	32.9	Fr			19.8	45	180	24.4	4778 CT	WS DO	**MOE# 5720854** 0.0 BRWN CLAY BLDR 5.5 BLUE CLAY GRVL SAND 13.7 BLUE CLAY 26.2 BLUE CLAY CMTD SAND 32.9 MSND CSND 33.8
21024	6 24	Jun-86	616869 4905537	228.0	23.8	Fr	23.8	-1.8	1.8	27	150	21.3	2514 RC	WS -	**MOE# 5721024** 0.0 GREY FILL 0.3 GREY CLAY SNDY SILT 23.8 GREY SAND SILT 25.6 GREY CLAY STNS 75.3 GREY CLAY GRVL STNS 75.6 GREY CLAY 78.0 GREY LMSN ROCK 78.3
21809	6 15	Mar-86	611020 4904001	304.5	12.2	Fr			12.2	5	120	18.3	3413 BR	WS DO	**MOE# 5721809** 0.0 BRWN SAND 13.4 BLUE CLAY 18.3 BRWN SAND 19.5
21934	6 15	Jun-87	610999 4904005	304.8	77.1	Fr	76.2	-0.9	47.2	114	135	61.0	1583 RC	WS ST	**MOE# 5721934** 0.0 BRWN TPSL SAND 3.0 BRWN SAND 26.8 GREY SILT CLAY 33.2 GREY CLAY SILT 56.4 GREY CLAY HARD 71.6 MSND 77.7 GREY CLAY 79.2
22620	6 4	Aug-87	604652 4901386	294.1	76.8 72.2	Fr Fr	73.8	-0.9	46.0	91	120		2662 CT	WS DO	**MOE# 5722620** 0.0 TPSL 0.3 GREY CLAY SAND 0.9 GRVL STNS 2.1 SAND GRVL CMTD 44.8 SAND CLAY CMTD 52.4 GREY CLAY GRVL HARD 61.6 GREY CLAY GRVL SOFT 72.2 MSND CSND 76.8 FSND CLAY 77.4
22797	5 25	Dec-87	616970 4905195	221.9	44.2	Fr	44.2	-0.9	1.8	45	90	32.6	2513 CT	WS DO	**MOE# 5722797** 0.0 TPSL 0.3 BRWN CLAY SAND BLDR 2.4 GREY CLAY SILT SAND 36.6 BLUE SILT SAND 44.2 CSND CLAY 45.1
23742	6 3	Aug-88	610976 4904062	306.0	79.6	-	79.2	-0.9	45.7	18	240	78.0	2662 RA	WS DO	**MOE# 5723742 TAG#ASSMNT** 0.0 BRWN SAND 15.2 GREY SAND SLTY 32.9 GREY CLAY SNDY 79.6 GREY SAND DRTY 80.2
23870	6 26	Aug-88	617112 4905939	224.3	6.1	-			9.1	45	60	11.0	4919 BR	WS DO	**MOE# 5723870** 0.0 BRWN SAND PCKD 11.6
23882	6 3	Jun-88	611885 4903900	292.9	6.1	-			6.1	91	60	11.0	4919 BR	WS DO	**MOE# 5723882** 0.0 BRWN TPSL HARD 0.3 BRWN CLAY HARD 6.1 BRWN SAND LOOS 11.6
24077	6 3	Aug-88	603328 4900902	288.6	3.0	-			3.0	45	60	8.5	4919 BR	WS DO	**MOE# 5724077** 0.0 BRWN SAND PCKD 9.1
24253	6 5	Nov-88	613788 4904466	270.4	2.4	Fr			2.4				3030 BR	WS DO	**MOE# 5724253** 0.0 BRWN CLAY SNDY 3.7 BLUE SILT STNS 9.1
24741	7 17	Mar-89	616893 4905758	225.2	50.9	Fr	50.0	-0.9	0.3	23	150	39.6	1583 CT	WS DO	**MOE# 5724741** 0.0 BRWN SAND 4.6 GREY SILT 12.5 GREY CLAY SILT 41.5 SILT FGRD 48.2 GREY CLAY 49.4 GREY MSND 51.2 GREY CLAY GRVL 52.4

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
24933	5 25	May-89	616954 4905474	222.5	24.4	Fr	22.6	-1.8	4.6	23	120		1583 CT	WS DO	**MOE# 5724933** 0.0 SAND FILL 0.6 GREY CLAY GRVL 10.7 SILT CLAY 19.8 GREY CLAY 22.3 GREY SILT SAND 24.7 SILT CLAY 25.9
25421	5 11	Aug-89	608360 4902086	260.6	23.2	Fr	21.9	-1.2	-0.6	23	120		1583 CT	WS DO	**MOE# 5725421** 0.0 BRWN SAND CLAY 2.7 GRVL CLAY 18.0 GRVL SILT 23.8
25721	6 25	Aug-89	617065 4905278	221.9	52.7	Fr	50.3	-1.8	3.0	136	1470	7.3	1583 RC	OW NU	**MOE# 5725721** 0.0 GREY CLAY GRVL STNS 9.1 GREY CLAY SILT 27.4 FSND SILT VERY 31.1 GREY CLAY VERY DNSE 41.8 GREY CLAY SILT 45.7 GREY FSND DRTY 47.9 GREY CLAY VERY DNSE 49.7 GREY CSND 53.3 GREY CLAY 54.9
25919	6 16	Oct-89	611046 4904186	305.1	70.1	Fr	70.1	-1.2	44.2	64	75	51.8	2513 CT	WS DO	**MOE# 5725919 TAG#ASSMNT** 0.0 YLLW SAND 7.9 YLLW CLAY SAND 8.5 YLLW SAND 25.9 GREY SILT FSND VERY 48.8 GREY CLAY 67.1 GREY SILT SAND 70.1 BLCK SAND SILT 71.3
26736	5 25	Jun-90	616452 4904850	224.3	9.1	Fr	12.8	-1.8	3.0	91	120		3108 RC	WS DO	**MOE# 5726736** 0.0 BLCK MUCK 0.6 BRWN CLAY SAND GRVL 4.0 BLUE CLAY SAND GRVL 9.1 BLUE SAND 12.5 BLCK SAND 14.9
27548	5 25	Jul-90	616473 4904870	224.3	18.3	-			6.1	45	60	12.2	4919 BR	WS DO	**MOE# 5727548** 0.0 BRWN TPSL HARD 0.3 BRWN CLAY HARD 12.2 GREY CLAY SAND LYRD 24.1
29133	6 15	May-92	610964 4903605	302.7	59.1	Fr	59.1	-1.5	42.7	23	60	57.9	2513 CT	WS DO	**MOE# 5729133** 0.0 YLLW SAND GRVL 18.3 GREY CLAY SAND 19.5 YLLW SAND 29.3 GREY SILT FSND VERY 42.4 GREY CLAY 57.9 SAND SILT 60.7 GREY CLAY 64.0
30570	5 15	Nov-93	611094 4903510	299.3					NR				2662 CT	AQ NU	**MOE# 5730570** 0.0 23.8
30941	5 15	Jun-94	610939 4903390	299.0	45.1	Fr	45.4	-0.9	11.9	9	180	44.2	2514 CT	WS DO	**MOE# 5730941** 0.0 PRDG 15.2 BRWN SAND GRVL CLAY 21.3 GREY CLAY 43.6 BRWN SAND GRVL CLAY 46.3
31459	6 17	Apr-95	612142 4903917	282.9	118.6	Fr	118.9	-1.2	59.4	68	300	74.7	6870 RC	WS DO	**MOE# 5731459** 0.0 BLCK TPSL 0.3 GREY SAND 3.0 GREY CLAY 25.9 SILT 27.4 GREY CLAY 57.0 SILT SOFT 57.9 GREY CLAY 118.6 BRWN SAND 120.4 GREY CLAY 123.4
31718	6 25	Jun-95	616896 4905485	223.1	7.6	Fr	10.7	-1.5	2.4	9	1440	10.7	6875 BR	DW NU	**MOE# 5731718** 0.0 GREY SILT SAND DNSE 7.6 GREY SAND SLTY DNSE 10.7 GREY SILT SAND DNSE 12.2
31719	6 25	Jun-95	616888 4905486	223.1	6.1	Fr	10.7	-1.5	2.4	5	1440	10.7	6875 BR	DW NU	**MOE# 5731719** 0.0 BRWN SAND SLTY DNSE 3.7 GREY CLAY SAND DNSE 12.2

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
31720	6 25	Jun-95	616902 4905480	223.1	7.6	Fr	10.7	-1.5	2.4		1440	10.7	6875 BR	DW NU	**MOE# 5731720** 0.0 BRWN SAND SLTY FILL 4.6 GREY CLAY SAND TILL 7.6 GREY SILT FSND 10.1 GREY CLAY STNS TILL 12.2
32774	5 4	May-97	616949 4905354	221.9	29.9	Fr	30.8	-0.9	1.8	64	240	10.4	6782 CT	WS DO	**MOE# 5732774** 0.0 BRWN CLAY SAND 3.7 GREY SAND GRVL 8.5 GREY CLAY SAND 29.6 GREY CSND MGRD 32.3
33123	5 1	Sep-97	616932 4905416	222.2	42.4	Fr	42.4	-0.9	3.4	73	180	12.5	6782 CT	WS DO	**MOE# 5733123** 0.0 BRWN CLAY SAND GRVL 4.0 GREY CLAY SAND GRVL 21.0 GREY CLAY GRVL HARD 29.0 GREY FGVL CLAY 41.1 GREY FGVL 43.9
33848	6 25	Oct-98	616985 4905463	227.7	39.6 38.7	Fr Fr	38.7	-0.9	1.2	23	150	36.6	2514 CT	WS DO	**MOE# 5733848** 0.0 BRWN CLAY SAND FILL 0.6 BRWN CLAY SAND SNDY 6.1 GREY CLAY SAND GRVL 19.8 GREY CLAY SAND SNDY 38.1 GREY SAND 39.6
33849	6 25	Oct-98	616954 4905449	222.2	40.5 39.6	Fr Fr	39.6	-0.9	1.2	55	120	33.5	2514 CT	WS DO	**MOE# 5733849** 0.0 BRWN CLAY SAND FILL 0.6 BRWN CLAY SAND SNDY 7.6 GREY CLAY SAND GRVL 21.3 GREY CLAY SAND GRVL 39.0 GREY SAND 40.5
34778	5 12	Nov-99	609314 4902580	250.5	30.5	Fr	38.7	-1.8	4.6	91	60	38.7	3413 RA	WS DO	**MOE# 5734778** 0.0 BRWN CLAY 6.1 GREY CLAY 30.5 GREY FSND 36.6 GREY CSND 40.5
34940	5 5	Jan-00	605039 4901389	292.6	54.9 45.7 27.4 27.4 27.4 27.4	Mn Mn Mn Mn Mn Mn	53.3	-1.5	6.4	91	60	39.6	2513 CT	WS DO	**MOE# 5734940 TAG#ASSMNT** 0.0 BRWN TPSL 0.6 BRWN SAND SLTY BLDR 5.5 GREY SILT SAND BLDR 17.7 GREY CSND SILT 20.4 GREY SILT SAND 22.9 GREY SAND SLTY 39.6 GREY CLAY 43.3 GREY FSND 45.7 GREY SILT FSND 53.6 GREY SAND 54.9
35443	5 11	Jul-00	608597 4902182	250.2	74.7	Fr	75.0	-1.2	9.1	36	90	54.9	6409 CT	WS DO	**MOE# 5735443** 0.0 BLCK TPSL 0.3 BRWN CLAY STNS TPSL 5.8 BRWN CLAY GRVL LYRD 9.8 BLUE CLAY 12.2 GREY GRVL CLAY 12.5 BRWN CLAY 27.1 BRWN GRVL CLAY VERY 27.7 BLUE CLAY 50.0 GREY CLAY SILT VERY 54.3 BLUE TILL 73.2 RED CLAY SOFT 74.7 BRWN SAND SOFT 76.2
38243	5 17	Oct-03	612273 4903850	278.3	4.9	Fr			0.9	68	2880	30.5	3413 BR	WS DO	**MOE# 5738243 TAG#ASSMNT** 0.0 BRWN CLAY 4.9 BRWN CSND STNS 8.2
38737	5 17	Mar-04	611910 4903726	292.3	39.9	Fr	29.9	-29.9	6.1	23	1440	18.0	3413 RA	WS DO	**MOE# 5738737 TAG#A002741** 0.0 BRWN CLAY 7.9 BRWN SAND 20.1 GREY CLAY 39.9 GREY SAND 60.0
38872	6 11	Jun-04	608270 4902743	270.1	19.8	Fr	20.4	-0.9	8.5	68	60	11.6	1851 CT	WS DO	**MOE# 5738872 TAG#A011993** 0.0 BRWN CLAY 3.7 GREY CLAY SAND 17.1 BRWN SAND 20.1 BRWN CGVL 21.3

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
39392	6 11	Oct-04	608450 4903151	255.7	28.3	Fr	28.3	-2.1	FLW	77	120	29.9	1851 CT	WS DO	**MOE# 5739392 TAG#A012019** 0.0 TPSL 0.3 BRWN CLAY 4.6 GREY CLAY 27.4 GREY SAND CLAY LYRD 28.3 BRWN SAND GRVL WBRG 30.5 BRWN CLAY 31.1
39916	11 12	Jun-05	602272 4900841	292.0					3.4				7219 AB	AB NU	**MOE# 5739916 TAG#A027033** 0.0
40790	5 1	Apr-06	602520 4900256	289.3	15.8	Fr	17.7	-1.2	2.7	45	60	10.1	2513 CT	WS DO	**MOE# 5740790 TAG#A015092** 0.0 TPSL 0.3 BRWN SAND CLAY BLDR 4.3 GREY SAND SILT BLDR 12.2 YLLW SAND 19.2
14380	6 22	Dec-77	614762 4904771	250.5	29.0	-	31.7	-0.9	19.2	68	120	25.3	3108 CT	WS DO	**MOE# 6914380** 0.0 BRWN CLAY 6.1 BLUE CLAY GVLY 27.7 BLUE SAND 32.6
7045466	6 1	May-07	602420 4900869	300.5					6.7				7219 -	AB -	**MOE# 7045466 TAG#A053257** 0.0
5195		Nov-07	614077 4904456	261.5					NR				6809 BR	OW MO	**MOE# 7105195 TAG#A062232** 0.0 BRWN SILT HARD 3.0 GREY CLAY 4.6 BRWN SAND 6.1
7066	6 16	May-08	611649 4903788	295.0	11.9	Fr			11.9				7383 -	TH TH	**MOE# 7107066 TAG#A072185** 0.0 BRWN FSND SILT LOOS 19.8
7114879		Oct-08	603498 4900896	287.4					NR				7241 OTH	TH TH	**MOE# 7114879** 0.0
7125285	6 14	May-09	611007 4904033	306.3	73.2	Fr	72.2	-1.2	44.2	45	60	48.5	2514 CT	WS DO	**MOE# 7125285 TAG#A032089** 0.0 BRWN SAND GRVL LOOS 7.6 GREY GRVL CLAY DNSE 26.2 GREY CLAY SAND PCKD 41.1 GREY SAND GRVL LYRD 73.5
7125831	6 15	Jun-09	610885 4903993	306.9	77.1	Un			46.3	41	60	47.5	5528 RC	WS PU	**MOE# 7125831 TAG#A070533** 0.0 BRWN SAND 10.7 GREY CLAY SILT LYRD 21.9 BRWN CLAY 24.4 GREY SILT 53.9 BRWN SAND SILT 55.2 GREY CLAY 75.9 GREY MSND 78.6 GREY CLAY SILT 80.8
7141649		Feb-10	611197 4904130	303.6			15.8	-1.5	NR				7215 RC	TH TH	**MOE# 7141649 TAG#A095337** 0.0 BRWN SAND LOOS 15.2 BRWN SAND SILT WBRG 17.4

QUALITY:		TYPE:		USE:				METHOD :	
Fr	Fresh	WS	Water Supply	CO	Comercial	NU	Not Used	CT	Cable Tool
Mn	Mineral	AQ	Abandoned Quality	DO	Domestic	IR	Irrigation	JT	Jetting
Sa	Salty	AS	Abandoned Supply	MU	Municipal	AL	Alteration	RC	Rotary Conventional
Su	Sulphur	AB	Abandonment Record	PU	Public	RP	Replacement	RA	Rotary Air
--	Unrecorded	TH	Test Hole or Observation	ST	Stock	-	Not Recorded	BR	Boring

Easting and Northings UTM NAD 83 Zone 17, Translated from Recorded UTM NAD, subject to Field Verified Location or Improved Location Accuracy.