



July 2018

HYDROGEOLOGICAL ASSESSMENT REPORT

Ninth Line (Regional Road 13) Transportation Corridor Improvements from Dundas Street (Regional Road 5) to 407 Express Toll Route Regional Municipality of Halton, Ontario

Submitted to:

CIMA+
3027 Harvester Road, Suite 400
Burlington, ON
L7N 3G7

REPORT



Report Number: 1648031 (6000)

Distribution:

1 E-Copy - CIMA+
1 E-Copy - Golder Associates Ltd.





Table of Contents

1.0 INTRODUCTION.....	1
2.0 GEOLOGY AND HYDROGEOLOGY CONDITIONS.....	1
2.1 Physiography.....	1
2.2 Subsurface Conditions.....	2
2.2.1 Groundwater Conditions	2
2.3 Groundwater Use.....	3
2.4 Aquifer Vulnerability.....	6
2.5 Groundwater Quality.....	6
3.0 IMPACT ASSESSMENT.....	7
4.0 SUMMARY.....	8
5.0 DETAILED DESIGN CONSIDERATIONS	8
6.0 REFERENCES.....	9

TABLES

Table 1: Summary of Hydraulic Conductivities.....	3
Table 2: MOECC Water Well Records Located within 500 m of Project Site	3

FIGURES

Figure 1: Site Location

Figure 2: Surficial Geology

Figure 3: Borehole and Ministry of the Environment and Climate Change (MOECC) Well Locations

Figure 4: Summary of Boreholes

APPENDICES

APPENDIX A

Water Quality Results



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by CIMA+ to provide a hydrogeological assessment as part of the Class Environmental Assessment for the Ninth Line (Regional Road 13) Transportation Corridor Improvements from Dundas Street (Regional Road 5) to 407 Express Toll Route. The project activities will include the widening of the existing 3.8 km long section of Ninth Line from two to four lanes, and establishment of bike lanes, with a proposed right of way of 35 metres (m), in the Town of Oakville and Town of Milton (Figure 1). For the purposes of the hydrogeology assessment, a 500 m buffer was considered around the Ninth Line alignment and is referred to as the project site study area.

In the site study area the east side of Ninth Line is predominantly agricultural and also contains baseball diamonds and a tennis club, two natural areas associated with Joshua's Creek and a provincially significant wetland (North Oakville Milton East Wetland Complex). A commercial area is located in the southeast corner of the site study area, south of Dundas Street between Ninth Line and Highway 403. The west side of Ninth Line contains a cemetery and funeral home, a school with a sports field, agricultural lands, and residential properties. Also present on the west side is a marsh, deciduous swamp and forest and old field cultural meadows.

2.0 GEOLOGY AND HYDROGEOLOGY CONDITIONS

2.1 Physiography

In southern Ontario, the Niagara Escarpment, usually manifested as a steep cliff face, is one of the most dominant physiographic features extending from the Niagara River to the Bruce Peninsula and continuing through to the Manitoulin Islands. The project site is located below the Niagara Escarpment and within the western portion of the South Slope physiographic region as defined by Chapman and Putnam (1984). The South Slope extends east from the Niagara Escarpment to the Trent River and covers an area of approximately 2,435 km². In the vicinity of the site study area, the South Slope includes the Trafalgar Moraine and an adjacent fluted till plain. The Trafalgar Moraine is 27 km long and 4 km wide and is comprised of reddish clayey till (Wildfield Till) up to 16.5 m thick containing shale fragments from the underlying Queenston Shale Formation (Chapman and Putnam, 1984; Eyles 2010). The Halton Till forms a core directly below the crest of the moraine, but is not present in the subsurface everywhere across the moraine (Eyles, 2010). The South Slope contains a variety of soils developed upon tills which are more sandy in the east and clayey in the west. In general, the South Slope rises to a maximum elevation of approximately 305 metres above sea level (masl), however within the vicinity of the site study area, the elevation ranges from approximately 185 masl to 170 masl.

The site study area lies within the Joshua's Creek watershed where small tributaries drain the Trafalgar Moraine and portions of the provincially significant North Oakville-Milton East Wetland Complex (PSW complex). The upper reaches of the creek, in the vicinity of the project site, are generally intermittent draining agricultural and recreational lands and a cemetery. While, south of the QEW (outside the site study area) the creek has permanent flow in a well-defined valley. The PSW complex comprises a grouping of small, isolated wetlands with diverse species and vegetation communities (MNR, 2009) (Figure 1).



2.2 Subsurface Conditions

The bedrock in the site study area is comprised of Upper Ordovician age maroon coloured shales with interbeds of grey-green shale, limestone and calcareous siltstones of the Queenston Formation (Thurston, et. al., 1992). The Queenston Formation is overlain by glacio-lacustrine derived silty to clayey till with lesser till deposits of silt and clay near the northwest end of the alignment. Modern alluvial deposits are associated with larger stream courses (Thurston, et. al, 1992) (Figure 2).

As part of the Class EA, a geotechnical investigation program was carried out by Golder on June 6 and 7, 2017 during which time 27 boreholes were drilled to depths of 1.52 to 6.10 m below the ground surface that are distributed along the proposed road widening corridor (Figure 3). The details of this investigation were presented under a separate cover entitled, "Geotechnical Explorations and Testing, Ninth Line (Regional Road 13) Transportation Corridor Improvements from Dundas Street (Regional Road 5) to 407 Express Toll Route, Regional Municipality of Halton, Ontario" dated August 2017. Stratigraphic boundaries are shown on Figure 4 are inferred from non-continuous sampling and observations of drilling resistance, and therefore represent transitions between soil types rather than exact planes of geological change. The subsoil conditions are expected to vary between and beyond the borehole locations. Based on the geotechnical investigation, the following stratigraphic units were identified:

Fill and Buried Topsoil: Layers of silty clay fill containing various amounts of topsoil and ranging from 150 mm to 580 mm thick and layers of buried topsoil ranging from 120 mm to 1,200 mm in thickness was encountered.

Silty Clay: Silty clay was encountered in all boreholes beneath the fill and/or buried topsoil. At some locations, cobbles were noted in the boreholes.

Silty Sand and Sandy Silt: Sandy silt was encountered in BH111, BH116 and BH122 at depths of 3.96, 2.7 and 2.5 mbgs. The thickness of the sandy silt varied from 0.92 m in BH111, 1 m in BH122 to 2.5 m in BH116. In BH116, the sandy silt layer was underlain by silty sand whereas the sandy silt layer was underlain by shale bedrock at BH-111 and BH122.

Bedrock: Bedrock identified as shale of the Queenston Formation was identified in BH-111 beneath the sandy silt at a depth of 4.88 mbgs. BH-122 was terminated at auger refusal, possibly on bedrock at a depth of 3.5 mbgs.

2.2.1 Groundwater Conditions

MOECC water well records within the site study area indicate that groundwater levels in the overburden materials ranged from approximately 1.8 mbgs to 5.2 mbgs, and groundwater in the bedrock occurred at depths ranging from 3.7 mbgs to 68.3 mbgs (see Section 2.3).

During the geotechnical investigation, boreholes drilled along Ninth Line were completed in the overburden materials comprised of silty clay, silty sand, and sandy silt. The geotechnical report noted that all boreholes were dry with the exception of BH-111, BH-112 and BH116. Groundwater, likely from water perched on the low permeability silty clay, was noted in BH-111 at a depth of approximately 0.6 m and the subbase in BH-112 (occurring at 0.39 mbgs to 0.59 mbgs) was noted to be wet. During drilling, wet conditions were noted to occur in BH116 near the sand silt/silty sand interface at a depth of approximately 5.2 m. A 5.04 cm diameter well was installed in BH-116 with 1.5 m length of slotted PVC screen installed from a depth of 4.6 m to the bottom of the



HYDROGEOLOGICAL ASSESSMENT REPORT NINTH LINE TRANSPORTATION CORRIDOR IMPROVEMENTS

hole at 6.1 m. A groundwater level was taken prior to well development on August 29, 2017 (2.98 mbgs). Following well development, a datalogger set at 1-hour intervals was installed in BH-116 to measure water level fluctuations over time. A manual groundwater level measurement was also taken on August 31, 2017 (2.97 mbgs). However, it should be noted that these groundwater level measurements may still be recovering and therefore may not represent fully stabilized conditions and that seasonal fluctuations should also be anticipated to occur.

A single well response test was completed on monitoring well BH-116 on August 31, 2017 to determine the hydraulic conductivity of the material in which it is screened (i.e. silty sand containing trace amounts of clay). Additionally, hydraulic conductivities were also derived from three representative grain size samples and analysed via the Hazen Method (Hazen, 1911). Table 1 below provides a summary of hydraulic conductivities derived from both methods of analysis.

Table 1: Summary of Hydraulic Conductivities

Borehole/Sample ID	Soil Type	Methods	Hydraulic Conductivity (m/s)
BH-116	Silty Sand	Rising head test	4.50E-06
Sample 16B	Silty Sand	Grain size - Hazen	1.40E-06
Sample	Silty Clay	Grain size - Hazen	1.60E-09

2.3 Groundwater Use

Available sources of groundwater are limited east of the Niagara Escarpment as the various tills are considered as aquitards however, lenses of sand and gravel may exist within the till that yield more water. The Queenston shale underlying the till is also characterized as an aquitard. However, it is often weathered in the upper portion near the overburden–bedrock contact and the fractures can often transmit water at sufficient rates to yield water to wells.

Based on a review of the MOECC water well record database, there are 48 water well records within the site study area (Figure 3). The wells were drilled between 1955 and 2016 to depths ranging from 3.1 mbgs to 68.3 mbgs. Bedrock was encountered at depths ranging from 1.8 mbgs to 19.8 mbgs. Of the 48 well records, 23 are listed as water supply wells, 20 are listed as monitoring wells or monitoring well nests and 5 are listed as abandoned. It should be noted that MOECC well ID 2803675 that was drilled as a water supply well in 1971 was decommissioned in 2014 and the abandoned well listed under MOECC well ID 7242327. Of the 48 well records, 20 are listed as having produced fresh water, one as producing mineral water and another as producing sulphur water. The water quality at the remaining wells was not provided in the MOECC water well record database. Data for the 48 identified well records are provided in Table 2 below.

Table 2: MOECC Water Well Records Located within 500 m of Project Site

WELL ID	DATE COMPLETED	WELL DEPTH (mbgs)	DEPTH TO BEDROCK (m)	STATIC WATER LEVEL (mbgs)	WELL TYPE	ELEVATION (masl)	WATER FOUND DEPTH (mbgs)	TYPE OF WATER	WELL USE
2802102	9/4/1955	22.9	16.8	7.6	Bedrock	170.1	21.3	Fresh	Water Supply - Domestic
2802103	7/22/1967	23.8	21	1.5	Bedrock	182.0	23.8	Fresh	Water Supply - Domestic



HYDROGEOLOGICAL ASSESSMENT REPORT NINTH LINE TRANSPORTATION CORRIDOR IMPROVEMENTS

WELL ID	DATE COMPLETED	WELL DEPTH (mbgs)	DEPTH TO BEDROCK (m)	STATIC WATER LEVEL (mbgs)	WELL TYPE	ELEVATION (masl)	WATER FOUND DEPTH (mbgs)	TYPE OF WATER	WELL USE
2802187	8/11/1958	22.3	11	11.9	Bedrock	183.7	22.3	Mineral	Water Supply - Domestic
2802189	9/23/1949	40.2	15.2	0.9	Bedrock	181.7	40.2	Fresh	Water Supply - Domestic
2802190	7/30/1953	12.2	0	1.8	Overburden	186.0	12.2	Fresh	Water Supply - Domestic
2802191	10/15/1955	18.3	1.8	3.4	Bedrock	180.4	14.0	Fresh	Water Supply - Domestic
2802192	5/18/1959	16.2	14.6	4.3	Bedrock	179.3	15.5	Fresh	Water Supply - Domestic
2802193	11/25/1964	22.9	19.8	5.5	Bedrock	182.0	9.4	Fresh	Water Supply - Domestic
2802284	6/29/1953	68.3	2.4	15.2	Bedrock	172.1	68.3	Sulphur	Water Supply - Commercial
2802290	9/14/1967	25.9	7	6.1	Bedrock	162.9	21.0	Fresh	Water Supply - Domestic
2805872	4/24/1982	33.5	6.7	3.7	Bedrock	175.3	29.9	Fresh	Water Supply - Domestic
2806336	7/29/1985	21.3	15.2	4.6	Bedrock	165.2	15.8	Fresh	Water Supply - Commercial
2806585	2/6/1987	19.8	0	5.2	Overburden	186.1	5.2	Fresh	Water Supply - Domestic
2807995	4/25/1992	28.3	10.7	2.7	Bedrock	165.8	20.7	Fresh	Water Supply - Domestic
2808197	11/1/1993	12.2	5.2	5.5	Bedrock	173.0	7.6	-	Water Supply - Domestic
2808207 ¹	12/2/1993	0	0	0	-	173.0	-	-	Abandoned-Supply
2808467	5/8/1996	30.5	7.9	0	Bedrock	165.6	-	-	Abandoned-Supply
4908839	8/14/2001	14.6	9.8	3.7	Bedrock	171.8	3.7	Fresh	Water Supply - Domestic
2809638	9/6/2002	36.9	6.7	4	Bedrock	177.2	24.7	Fresh	Water Supply - Commercial
2809720 ¹	12/19/2002	0	0	0	-	170.3	-	-	Abandoned - Domestic
2809841	10/27/2003	33.8	10.4	2.4	Bedrock	173.1	19.8	Fresh	Water Supply - Commercial
7052843	10/1/2007	28.6	0	2.5	Overburden / Bedrock	172.1	26.0	Fresh	Water Supply - Commercial
7159400	11/8/2010	21.3	0	1.2	Bedrock	161.9	10.7	Fresh	Water Supply
7185694	7/25/2012	39.6	0	5.8	Bedrock	171.2	39.6	Fresh	Water Supply - Public
7188855 ²	6/26/2012	0	0	0	Overburden	181.5	-	-	Observation/ Monitoring
7192972 ²	6/14/2012	0	0	0	Overburden	183.9	-	-	Observation/ Monitoring
7206523	7/13/2013	3.7	0	0	Overburden	179.8	-	-	Observation/ Monitoring
7216576 ²	8/2/2013	0	0	0	Overburden	176.3	-	-	Observation/ Monitoring



HYDROGEOLOGICAL ASSESSMENT REPORT

NINTH LINE TRANSPORTATION CORRIDOR IMPROVEMENTS

WELL ID	DATE COMPLETED	WELL DEPTH (mbgs)	DEPTH TO BEDROCK (m)	STATIC WATER LEVEL (mbgs)	WELL TYPE	ELEVATION (masl)	WATER FOUND DEPTH (mbgs)	TYPE OF WATER	WELL USE
7216579 ²	8/3/2013	0	0	0	Overburden	176.2	-	-	Observation/ Monitoring
7216580 ²	8/2/2013	0	0	0	Overburden	174.1	-	-	Observation/ Monitoring
7216588 ²	8/7/2013	0	0	0	Overburden	181.4	-	-	Observation/ Monitoring
7242327 ¹	12/2/2014	0	0	0	Overburden	162.8	-	-	Abandoned - Supply
7242918 ²	5/21/2015	0	0	0	Overburden	182.6	-	-	Observation/ Monitoring
7243201	5/16/2015	15.3	0	0	Overburden	162.2	-	-	Observation/ Monitoring
7243202	5/16/2015	15.3	0	0	Overburden	162.1	-	-	Observation/ Monitoring
7243203	5/16/2015	10.7	0	0	Overburden	160.4	-	-	Observation/ Monitoring
7243204	5/16/2015	15.3	0	0	Overburden	160.4	-	-	Observation/ Monitoring
7243205	5/16/2015	14.3	0	0	Overburden	160.4	-	-	Observation/ Monitoring
7244636	6/30/2015	6.1	0	0	Overburden	182.1	-	-	Observation/ Monitoring
7244637	6/30/2015	4.6	0	0	Overburden	183.5	-	-	Observation/ Monitoring
7244638	6/30/2015	6.1	0	0	Overburden	180.8	-	-	Observation/ Monitoring
7244639	6/30/2015	6.1	0	0	Overburden	180.6	-	-	Observation/ Monitoring
7247223	7/24/2015	6.1	0	0	Overburden	171.2	-	-	Observation/ Monitoring
7267299 ²	5/2/2013	0	0	0	Overburden	181.7	-	-	Observation/ Monitoring
7267217 ²	1/19/2015	0	0	0	Overburden	161.6	-	-	Observation/ Monitoring
7274177	9/27/2016	21.6	0	3.7	Bedrock	180.1	20.4	Fresh	Water Supply - Public
2803675	12/2/1971	8.5	6.1	3	Bedrock	162.8	7.6	-	Water Supply - Domestic
7114667 ¹	10/29/2008	0	0	0	-	184.8	-	-	Abandoned - Domestic

Notes:

"—" indicates no data provided

¹ well abandonment record.

² observation/monitoring well cluster. Individual well depths not listed.

Based upon Sustainable Halton Water and Wastewater Master Plan (2011), there is a water main that runs along Ninth Line from Dundas Street West to Burnhamthorpe Road, and west along Burnhamthorpe. The water service areas in Oakville are categorized by four primary pressure zone (O1 to O4). Any water supplied to properties within the site study area would be obtained from the Eighth Line Pumping Station with storage and pressure



control provided by the Zone 4 elevated tank located on Burnhamthorpe Road. There is no municipal groundwater taking for potable water within the site study area.

The MOECC permit to take water database identifies one active permit (PTTW No. 8524-A4YMRK) approximately 500 m south west of the project site (Figure 3). The permit is for construction dewatering at a rate of 7,000,000 L/day.

2.4 Aquifer Vulnerability

The Assessment Report for the Halton Region Source Protection Area (HRSPA) have delineated areas with respect to vulnerability where pollutants or human activities can affect the quality of the water resources (HRSPA, 2015). Upon our review, there were no highly vulnerable aquifers, well head protection areas or groundwater recharge areas were located within the site study area.

2.5 Groundwater Quality

Of the 48 MOECC water well records within the site study area, 19 are listed as having produced fresh water, one as producing mineral water and another as producing sulphur water. The water quality at the remaining 25 wells was not provided in the MOECC water well record database.

On August 31, 2017 a groundwater sample was collected from monitoring well BH-116 and submitted to Maxxam Analytics (Maxxam) for analysis. Groundwater samples were tested for inorganics, metals, nutrients, pesticides and microbiology. The analytical results are provided in Appendix A.

Given that temporary construction dewatering may be required as a part of the road works activities and that this water may need to be discharged to the environment and/or the sewer systems, the water quality results were compared to the Halton Region Sewer Use By-law (By-law No. 2-03) dated January 2003 and where possible compared to the Provincial Water Quality Objectives (PWQOs) dated January 1994. The water quality data is indicative of a hard water mineralized with naturally occurring substances consisting primarily of calcium, magnesium, sodium, sulphate and chloride. The concentration of chloride (790 mg/L) appears elevated, and may be the result of road salt used for de-icing roads.

The water quality sample met the Halton Region Sewer Use By-Law Table 1 limits for sanitary sewers and combined sewer discharge. In addition, there were no detections of pesticides or polychlorinated biphenyls (PCBs). The water quality sample also met the criteria for discharge to Halton Region storm sewers. In order to determine if the groundwater could be discharged to ground surface or surface water features, groundwater quality was also compared to PWQO. There were no exceedances of PWQO criteria, however it should be noted that the laboratory detection limits for a number of the pesticides exceeded the PWQO criteria. The laboratory indicated that the extremely low criteria for pesticides provided in the PWQO are not achievable.



3.0 IMPACT ASSESSMENT

During construction, the potential effects of the proposed project construction activities on groundwater quality and quantity include:

- Changes to existing groundwater flow regime, quantity and /or quality due to culvert excavations and construction dewatering to work in these excavations,
- Changes in water quality due to disturbance of pre-existing soil and /or groundwater contamination, if present.
- Changes in groundwater due to project activities during construction may also affect the amount of groundwater baseflow discharged to nearby watercourses and natural environment features (e.g., vegetation, fish and fish habitat, and wetlands).

The widening of Ninth Line will require the upgrade and/or installation of ten culvert crossings. Based on the depth to water and the inferred depths to the sandy silt/sand silty sand layers, three of the ten culvert crossings may require temporary construction dewatering to enable installation of the culverts. These are culvert crossings CC7, CC8 and CC9 (see Figure 3).

Excavations for culverts CC7, CC8 and CC9 could potentially intersect the groundwater table and construction dewatering may be required to lower the groundwater table down to the depth of the bottom of the excavation. This may temporarily alter the direction of groundwater level and flow directly adjacent to the excavation. For the purposes of this effects assessment, it has been conservatively assumed that the groundwater table is at ground surface. In addition, although the length of the excavations may vary dependent on conditions encountered during construction, for the purposes of this assessment it has been assumed that the dimensions for the culvert excavations that may require dewatering are as follows:

- Culvert CC7: 3 m deep by 4.0 m wide by 55 m long
- Culvert CC8: 3 m deep by 3.5 m wide by 55 m long
- Culvert CC9: 5 m deep by 3.5 m wide by 55 m long

Based on current understanding of the geology and hydrogeology in the study area, and the relatively shallow extent of the trench excavation, it is anticipated that drawdown of the groundwater table associated with dewatering of the soil will be limited to a radius of influence of approximately 75 m of each excavation. Following completion of dewatering and backfilling of the excavations, the recovery of the groundwater table and flow direction within these permeable features to preconstruction conditions is expected.

There are no MOECC private water supply wells listed as being within 75 m of the culverts where dewatering would likely be required therefore no potential impact to private water wells is anticipated. For excavations at the other culvert locations, construction dewatering may not be required other than for control of precipitation. If construction dewatering of excavations is required at a rate greater than 50,000 L/day, a PTTW or Environmental Activity and Sector Registry (EASR) will be required from the MOECC.

During construction, areas of soil contamination may be encountered given the past and current land uses such as salt for de-icing of roads during winter months. It should be noted that the vulnerability of the modern alluvial deposits located within the project site study area to groundwater contamination was rated as medium. Although under PWQO, there is no concentration criteria for chloride, the concentration of chloride in the groundwater



HYDROGEOLOGICAL ASSESSMENT REPORT

NINTH LINE TRANSPORTATION CORRIDOR IMPROVEMENTS

sample taken from BH-116 was 790 mg/L. Salt used for road-de-icing has the potential to accumulate in shallow soils. If soil contamination (salt or other contaminants) is encountered during construction, these areas of soil contamination may contribute to groundwater contamination if disturbed during construction. Soil and groundwater containment and disposal measures should be implemented, where required. If changes in groundwater quality were to occur, it is anticipated that groundwater quality would return to baseline conditions following the implementation of mitigation measures, such as containment and removal of contaminated soils. If it is determined that a PTTW is required, then a search of potentially contaminated sites should be conducted to determine if any other type of contaminants are present within the potential radius of influence of dewatering activities.

There is a PSW (North Oakville-Milton East Wetland Complex) at the location of the proposed culvert CC7 that may be affected by construction dewatering activities. Groundwater baseflow may be seasonally important to nearby water bodies and natural environment features, including vegetation, fish and fish habitat, and wetlands. The effects on groundwater quantity associated with the excavations is anticipated to be local to the comparatively shallow trench (approximately 3 m deep). It is anticipated that trench excavation will be carried out as quickly as possible. It is predicted that there will be limited temporal effects on groundwater levels and quantity as a result of the temporary construction activities. Therefore, no effect on groundwater baseflow delivered to adjacent water bodies and natural environment features is anticipated. In addition discharge locations should be carefully selected to avoid the potential for adverse effects on the natural environment to occur.

4.0 SUMMARY

The following summarizes the results of the hydrogeology assessment for the Ninth Line road widening project:

- The site study area does not occur within a groundwater recharge area, well head protection area or highly vulnerable aquifer.
- The site study area is underlain by silty clay, silty sand and sand silt indicative of the Wildfield and/or Halton Till.
- Based on the water quality sample taken from BH-116, groundwater quality is hard and mineralized with naturally occurring substances such as calcium, magnesium, sodium, sulphate and chloride. Elevated sodium (290 mg/L) may be indicative of road salt contamination.
- Based on this hydrogeology assessment, construction dewatering may be required for the installation of culverts during the Ninth Line road widening project. If construction dewatering of excavations is required at a rate greater than 50,000 L/day, a PTTW or Environmental Activity and Sector Registry (EASR) will be required from the MOECC.

5.0 DETAILED DESIGN CONSIDERATIONS

The following should be considered during the detailed design stage of the project:

- Location-specific boreholes should be drilled to confirm groundwater seepage conditions at each of the culvert locations as outlined in the geotechnical report (Golder, 2017a). Monitoring wells should be considered at the location of the proposed culverts CC#7, CC#8 and CC#9. Samples of the overburden



HYDROGEOLOGICAL ASSESSMENT REPORT NINTH LINE TRANSPORTATION CORRIDOR IMPROVEMENTS

material should be submitted to the laboratory for grain size sampling and single well response tests conducted to determine the hydraulic conductivity of the subsurface materials at these locations.

- Groundwater samples should be taken at the three culvert locations (CC#7, CC#8 and CC#9) for comparison to the Halton Region Sewer Use By-law and the MOECC PWQO to determine the suitability for discharge to the storm or sanitary sewer or to ground surface. In considering discharge to groundwater, the proximity of the culverts to the provincially significant North Oakville-Milton East Wetland Complex and surface water features should be considered as discharge to ground within 30 m of a water body is not allowed. Discharge locations should therefore be carefully selected to avoid the potential for adverse effects on the natural environment to occur.
- Although there were no detections of pesticides or polychlorinated biphenyls (PCBs) in the groundwater sample collected from well BH-116, considering the current and past land use in the area, a database search of potentially contaminating sites should be conducted.
- An assessment of dewatering requirements during construction of the culverts should be considered and if construction dewatering of excavations is required at a rate greater than 50,000 L/day, a PTTW or Environmental Activity and Sector Registry (EASR) should be obtained from the MOECC. The PTTW/EASR application should include:
 - An assessment of potential impacts to groundwater, surface water and natural environment receptors.
 - A detailed discharge plan should be prepared for water pumped from the excavations.
 - A monitoring plan and mitigation measures to address potential impacts should also be provided.
- As per the stormwater management report (Golder, 2017b) it is our understanding that Conservation Halton is considering the use of infiltration trenches. If such trenches are to be used, then the potential impact of infiltration on groundwater receptors would have to be assessed prior to construction.

6.0 REFERENCES

AECOM, 2011. Halton Region Sustainable Halton Water and Wastewater Master Plan.

Chapman, L.J. and Putnam, D.F., 1984. The Physiography of Southern Ontario, Ontario Geological Survey, Special Volume 2, 270 p. Accompanied by Map P. 2715 (coloured), scale 1:600 000.

Eyles, N., Eyles, C., Menzies, J. and Boyce, J. 2010. End moraine construction by incremental till deposition below the Laurentide Ice Sheet: Southern Ontario, Canada. *Boreas*, 10.1111/j.1502-3885.2010.00171.x. ISSN 0300-9483.

Golder Associates Ltd., 2017a. Geotechnical Explorations and Testing. Ninth Line (Regional Road 13) Transportation Corridor Improvements from Dundas Street (Regional Road 5) to 407 Express Toll Route, Regional Municipality of Halton, Ontario.

Golder Associated Ltd., 2017b. Ninth Line Stormwater Management Report.



HYDROGEOLOGICAL ASSESSMENT REPORT NINTH LINE TRANSPORTATION CORRIDOR IMPROVEMENTS

Halton-Hamilton Source Protection Region, 2015. Assessment Report for the Halton Region Source Protection Area, Version 3.3.

Hazen, A. 1911. "Discussion of 'Dams on sand foundations' by A.C. Koenig." Trans. Am. Soc. Civ. Eng., 73, 199-203.

MOECC, 1994. Water Management Policies Guidelines Provincial Water Quality Objectives (PWQO), July 1994.

MNRF, 2009. Provincially Significant North Oakville – Milton East Wetland Complex.

Regional Municipality of Halton, 2003. By-Law No. 2-03,

Thurston, P.C., H.R. Williams, R.H. Sutcliffe and G.M. Scott, 1992. Geology of Ontario, Ontario Geological Survey, Special Volume 4, Part 2.



HYDROGEOLOGICAL ASSESSMENT REPORT NINTH LINE TRANSPORTATION CORRIDOR IMPROVEMENTS

Report Signature Page

GOLDER ASSOCIATES LTD.

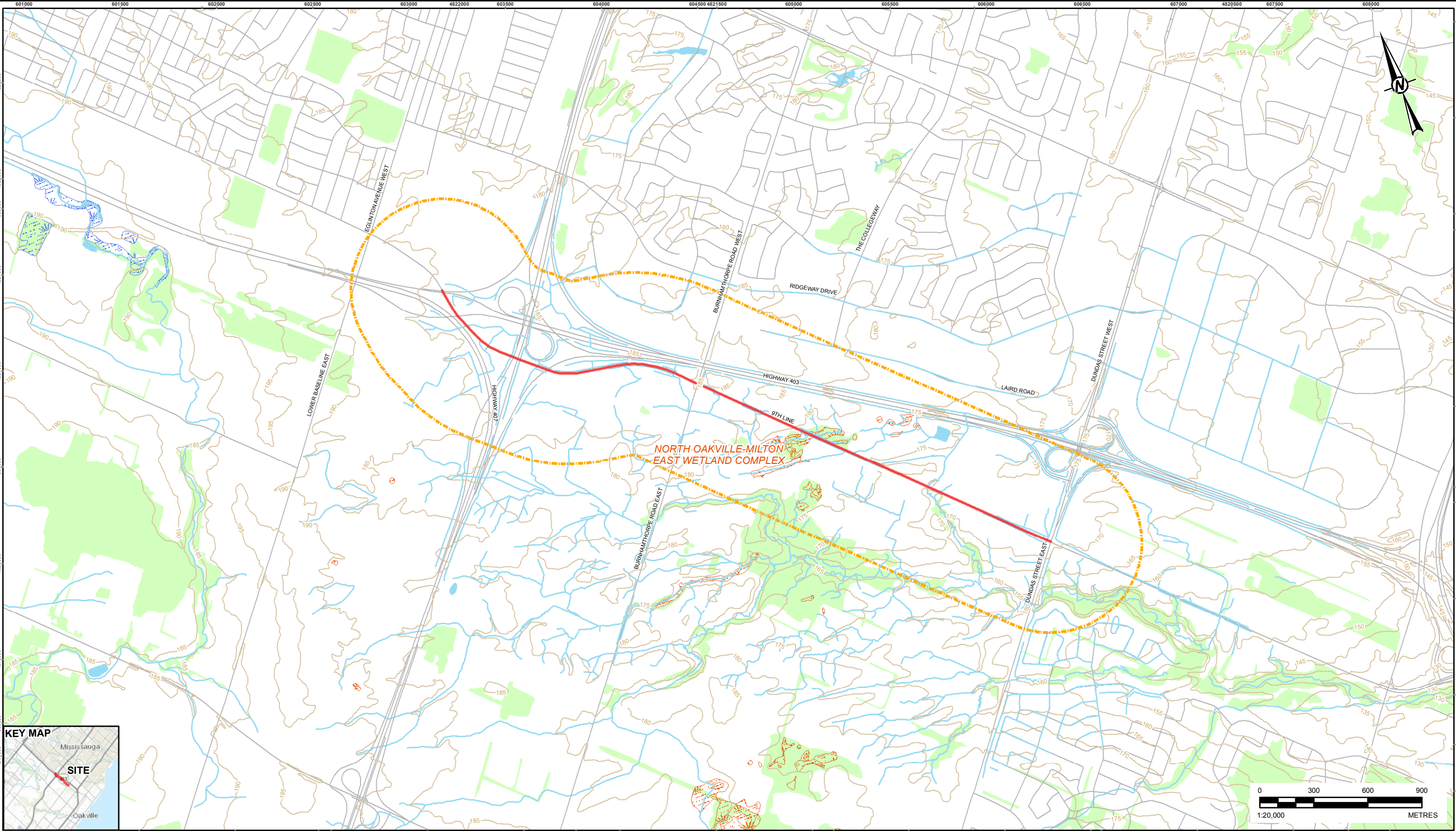
Sharon Wood, M.Sc., P.Geo.
Hydrogeologist

Phyllis McCrindle, M.Sc., P.Geo.
Senior Hydrogeologist, Associate

SW/PMMC/rh/ka

Golder, Golder Associates and the GA globe design are trademarks of Golder Associates Corporation.

\\golder.gds\gal\whitby\active\2016\3 proj\1648031 cima_reg\halton_ninth\lnoakv\hydrogeology\1648031 rpt ninth line hydrogeo final 2018jul05.docx



- LEGEND**
- ROAD
 - WATERCOURSE
 - CONTOUR
 - NINTH LINE ALIGNMENT
 - WETLAND
 - PROvincially SIGNIFICANT WETLAND
 - WATERBODY
 - WOODED AREA
 - SITE STUDY AREA

REFERENCES

BASE DATA - MNRF LIO, OBTAINED 2017; MOECC, OBTAINED 2017
IMAGERY - PROVIDED BY THE REGION OF HALTON, 2016; ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,
AEROGRIID, IGN, AND THE GIS USER COMMUNITY
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM
ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEEN'S PRINTER 2017
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17

CLIENT
REGION OF HALTON

CONSULTANT



YYYY-MM-DD	2017-09-25
PREPARED	JR
DESIGN	JR/MM
REVIEW	SW
APPROVED	PMMC

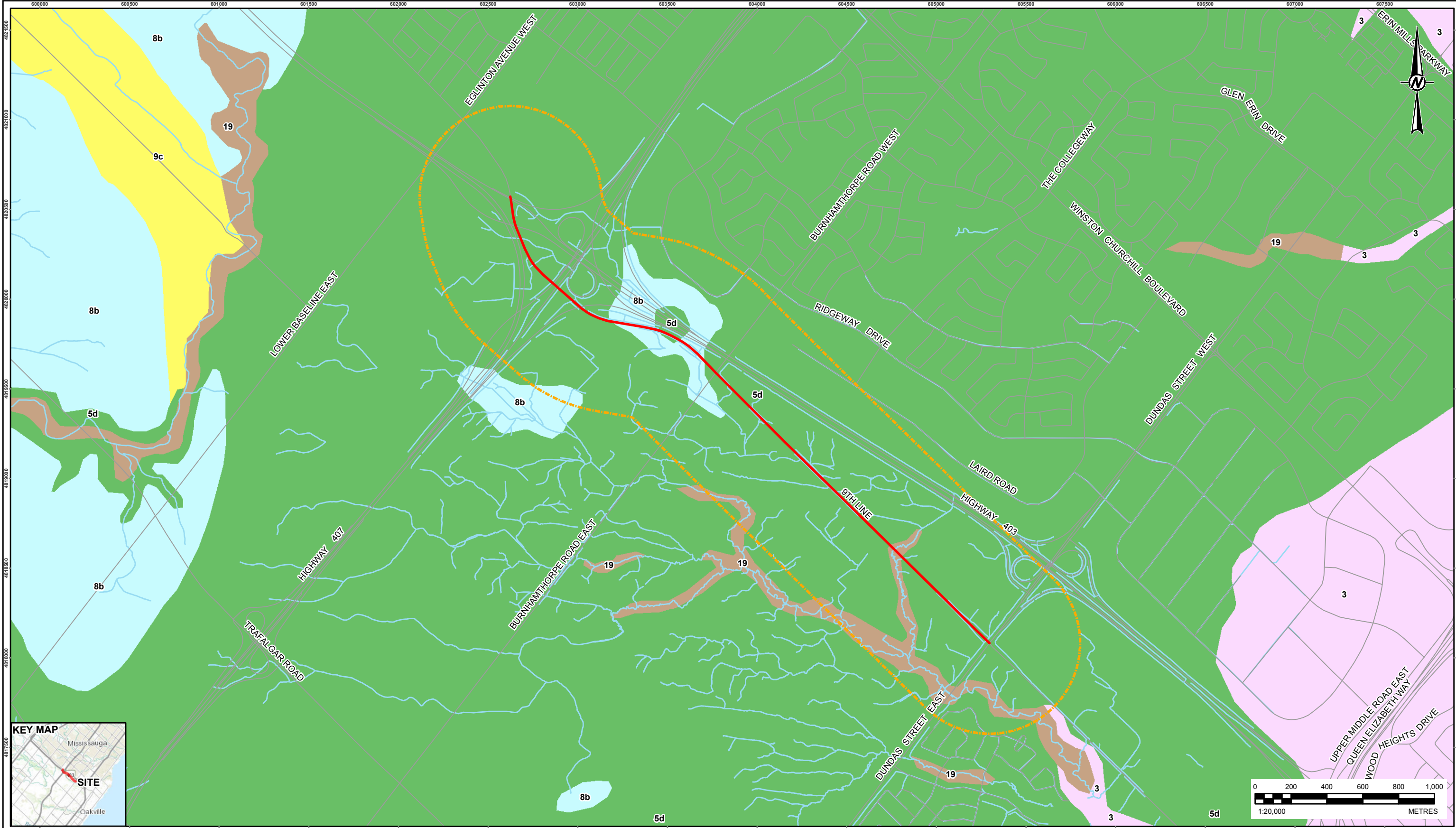
PROJECT
HYDROGEOLOGY ASSESSMENT REPORT FOR
HALTON 9TH LINE

TITLE
SITE STUDY AREA

PROJECT NO.	PHASE	REV.	FIGURE
1648031	0005	A	1

S:\Clients\Region of Halton\North Line_Oakville\03_PROJ\1648031\005_VisualSurvey\1648031-0005-CH-0002.mxd

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:



LEGEND

- WATERCOURSE
- NINTH LINE ALIGNMENT
- SITE STUDY AREA

SURFICIAL GEOLOGY

- 3: PALEOZOIC BEDROCK
- 5D: GLACIOLACUSTRINE-DERIVED SILTY TO CLAYEY TILL
- 8B: INTERBEDDED FLOW TILL, RAINOUT DEPOSITS AND SILT AND CLAY
- 9C: FORESHORE-BASINAL DEPOSITS
- 19: MODERN ALLUVIAL DEPOSITS

REFERENCES
BASE DATA - MNRF LIO, OBTAINED 2017; MOECC, OBTAINED 2017
IMAGERY - PROVIDED BY THE REGION OF HALTON, 2016; ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS,
USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM
ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEEN'S PRINTER 2017
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17

CLIENT
REGION OF HALTON

CONSULTANT

YYYY-MM-DD	2017-09-25
PREPARED	JR
DESIGN	JR/MM
REVIEW	SW
APPROVED	PMMC

PROJECT
HYDROGEOLOGY ASSESSMENT REPORT FOR
HALTON 9TH LINE

TITLE
SURFICIAL GEOLOGY

PROJECT NO. 1648031	PHASE 0005	REV. A	FIGURE 2
------------------------	---------------	-----------	--------------------

S:\Clients\Region of Halton\Ninth Line_Oakville\03_PROJ\1648031\00_PROD\0005_WellsSurvey\1648031-0005-CH-0001.mxd

28mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:



KEY MAP

LEGEND

- ABANDONED SUPPLY OR OTHER WELL
- MONITORING WELL, TEST HOLE, OBSERVATION WELL
- WATER SUPPLY WELL
- PERMIT TO TAKE WATER (DEWATERING CONSTRUCTION)
- BOREHOLE
- WATERCOURSE
- CULVERT
- NINTH LINE ALIGNMENT
- SITE STUDY AREA

REFERENCES

BASE DATA - MNRF LIO, OBTAINED 2017; MOECC, OBTAINED 2017
IMAGERY - PROVIDED BY THE REGION OF HALTON, 2016; ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS,
AEROGRIID, IGN, AND THE GIS USER COMMUNITY
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM
ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEEN'S PRINTER 2017
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17

NOTES

ALL LOCATIONS ARE APPROXIMATE.

CLIENT
REGION OF HALTON

CONSULTANT

YYYY-MM-DD	2017-09-25
PREPARED	JR
DESIGN	JR/MM
REVIEW	SW
APPROVED	PMCC

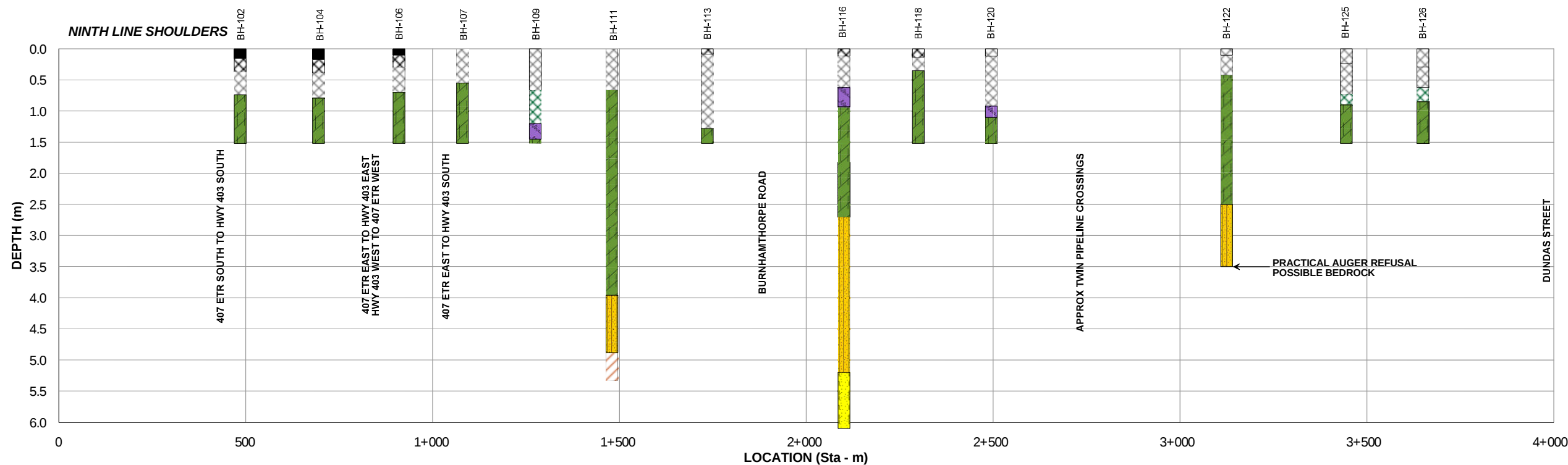
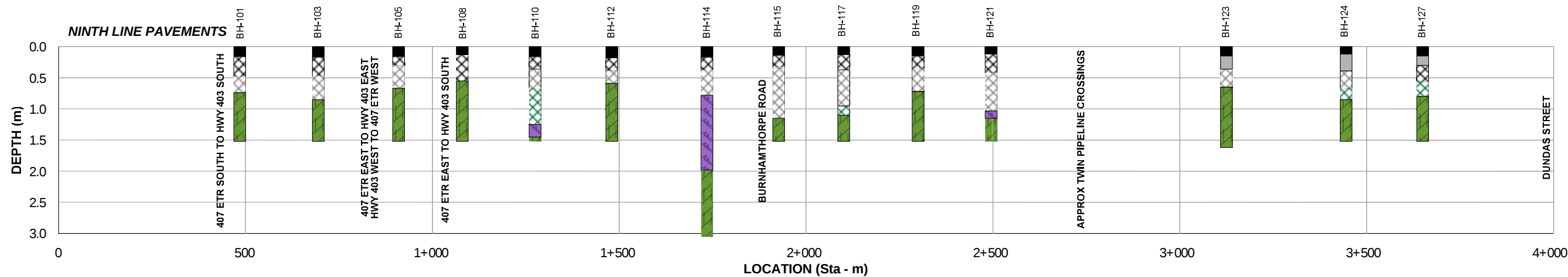
PROJECT
HYDROGEOLOGY ASSESSMENT REPORT FOR
HALTON 9TH LINE

TITLE
**MINISTRY OF THE ENVIRONMENT AND CLIMATE CHANGE
BOREHOLE AND (MOECC) WELL LOCATIONS**

PROJECT NO. 1648031	PHASE 0005	REV. A
------------------------	---------------	-----------

FIGURE
3

N:\Active\PROJECTS - other offices\Whiteby\2016\1648031\Ninth Line Pavement\1648013-4000-R01004.drf



ASPHALT	GRANULAR BASE	SILTY CLAY FILL	SILTY SAND	TOPSOIL
CONCRETE	GRANULAR SUBBASE	SILTY CLAY	SANDY SILT	BEDROCK

NOTES:
DRAWING IS SCHEMATIC ONLY. FOR DETAILS, SEE LOCATION PLAN, FIGURE 1, AND TABLE I. DRAWING TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

Reference:

Golder Associates Ltd., 2017. Geotechnical Explorations and Testing. Ninth Line (Regional Road 13) Transportation Corridor Improvements from Dundas Street (Regional Road 5) to 407 Express Toll Route, Regional Municipality of Halton, Ontario.

PROJECT					
HYDROGEOLOGY ASSESSMENT REPORT FOR HALTON 9TH LINE					
TITLE					
SUMMARY OF BOREHOLES					
	PROJECT No.		1648031	FILE No.	1648013-4000-R01004
	DRAWN		MEB	JUN 9-17	SCALE AS SHOWN
	CHECK		REV. 0		
	FIGURE 4				



HYDROGEOLOGICAL ASSESSMENT REPORT NINTH LINE TRANSPORTATION CORRIDOR IMPROVEMENTS

APPENDIX A

Water Quality Results

Your Project #: 1648031
Your C.O.C. #: 627156-01-01

Attention: Sharon Wood

Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2017/09/18
Report #: R4718430
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B719404

Received: 2017/08/31, 13:30

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	1	N/A	2017/09/07	CAM SOP-00448	SM 22 2320 B m
Biochemical Oxygen Demand (BOD)	1	2017/09/02	2017/09/07	CAM SOP-00427	SM 22 5210B m
Carbonaceous BOD	1	2017/09/02	2017/09/07	CAM SOP-00427	SM 22 5210B m
Chloride by Automated Colourimetry	1	N/A	2017/09/05	CAM SOP-00463	EPA 325.2 m
Conductivity	1	N/A	2017/09/07	CAM SOP-00414	SM 22 2510 m
Total Cyanide	1	2017/09/01	2017/09/01	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2017/09/06	2017/09/07	CAM SOP-00449	SM 22 4500-F C m
Hardness (calculated as CaCO ₃)	1	N/A	2017/09/06	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Mercury in Water by CVAA	1	2017/09/07	2017/09/07	CAM SOP-00453	EPA 7470A m
Mercury	1	2017/09/06	2017/09/07	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/09/06	CAM SOP-00447	EPA 6020B m
E.coli, (CFU/100mL)	1	N/A	2017/08/31	CAM SOP-00552	MOE LSB E3371
Total Ammonia-N	1	N/A	2017/09/06	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO ₃) and Nitrite (NO ₂) in Water (1)	1	N/A	2017/09/01	CAM SOP-00440	SM 22 4500-NO3I/NO2B
Animal and Vegetable Oil & Grease	1	N/A	2017/09/02	CAM SOP-00326	EPA1664B m, SM5520B m
Total Oil and Grease	1	2017/09/02	2017/09/02	CAM SOP-00326	EPA1664B m, SM5520A m
OC Pesticides (Selected) & PCB (2)	1	2017/09/01	2017/09/02	CAM SOP-00307	EPA 8081A/8082B m
OC Pesticides Summed Parameters	1	N/A	2017/09/01	CAM SOP-00307	EPA 8081A/8082B m
GC/MS Analysis of OP Pesticides.	1	2017/09/08	2017/09/08	CAM SOP-00301	EPA 8270 m
PAH Compounds in Water by GC/MS (SIM)	1	2017/09/06	2017/09/07	CAM SOP-00318	EPA 8270D m
pH	1	N/A	2017/09/07	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/09/06	CAM SOP-00444	OMOE E3179 m
Field pH (3)	1	N/A	2017/09/01		Field pH Meter
Orthophosphate	1	N/A	2017/09/05	CAM SOP-00461	EPA 365.1 m
Sulphate by Automated Colourimetry	1	N/A	2017/09/05	CAM SOP-00464	EPA 375.4 m
Field Temperature (3)	1	N/A	2017/09/01		Field Thermometer
Total Kjeldahl Nitrogen in Water	1	2017/09/02	2017/09/05	CAM SOP-00938	OMOE E3516 m
Total Organic Carbon (TOC) (4)	1	N/A	2017/09/02	CAM SOP-00446	SM 22 5310B m

Your Project #: 1648031
Your C.O.C. #: 627156-01-01

Attention: Sharon Wood

Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2017/09/18
Report #: R4718430
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B7I9404

Received: 2017/08/31, 13:30

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date	Date	Laboratory Method	Reference
		Extracted	Analyzed		
TPH (Heavy Oil) (5)	1	2017/09/02	2017/09/02	CAM SOP-00326	EPA1664B m, SM5520F m
Total Suspended Solids	1	2017/09/02	2017/09/02	CAM SOP-00428	SM 22 2540D m
Turbidity	1	N/A	2017/09/02	CAM SOP-00417	SM 22 2130 B m
Un-ionized Ammonia	1	2017/08/31	2017/09/07		
Volatile Organic Compounds in Water	1	N/A	2017/09/05	CAM SOP-00226	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(2) Chlordane (Total) = Alpha Chlordane + Gamma Chlordane

(3) This is a field test, therefore, the results relate to items that were not analysed at Maxxam Analytics Inc.

(4) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

(5) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Your Project #: 1648031
Your C.O.C. #: 627156-01-01

Attention: Sharon Wood

Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2017/09/18
Report #: R4718430
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B719404
Received: 2017/08/31, 13:30

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: EGitej@maxxam.ca

Phone# (905)817-5829

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

HALTON SANITARY & COMBINED SEWER (2-03)

Maxxam ID					FAV311		
Sampling Date					2017/08/31 11:30		
COC Number					627156-01-01		
	UNITS	Criteria	Criteria B	Criteria-2	BH-116	RDL	QC Batch
Calculated Parameters							
Total Animal/Vegetable Oil and Grease	mg/L	150	-	-	<0.50	0.50	5144525
Inorganics							
Total Carbonaceous BOD	mg/L	300	-	-	<2	2	5148322
Fluoride (F-)	mg/L	10	-	-	0.21	0.10	5152347
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	-	0.59	0.10	5148627
pH	pH	6.0:10.0	6.5:8.5	6.5:8.5	7.60		5152369
Phenols-4AAP	mg/L	1	-	0.001	<0.0010	0.0010	5151978
Total Suspended Solids	mg/L	350	-	-	140	10	5148175
Dissolved Sulphate (SO4)	mg/L	1500	-	-	77	1.0	5148379
Total Cyanide (CN)	mg/L	2	-	-	<0.0050	0.0050	5146758
Petroleum Hydrocarbons							
Total Oil & Grease	mg/L	-	-	-	<0.50	0.50	5148182
Total Oil & Grease Mineral/Synthetic	mg/L	-	-	0.5	<0.50	0.50	5148184
Metals							
Mercury (Hg)	mg/L	0.05	-	0.0002	<0.0001	0.0001	5151539
Polyaromatic Hydrocarbons							
Naphthalene	ug/L	140	-	7	<0.050	0.050	5152119
Volatile Organics							
Benzene	ug/L	10	-	100	<0.10	0.10	5146466
Chloroform	ug/L	40	-	-	<0.10	0.10	5146466
1,4-Dichlorobenzene	ug/L	80	-	4	<0.20	0.20	5146466
Ethylbenzene	ug/L	160	-	8	<0.10	0.10	5146466
Methylene Chloride(Dichloromethane)	ug/L	2000	-	100	<0.50	0.50	5146466
Tetrachloroethylene	ug/L	1000	-	50	<0.10	0.10	5146466
Toluene	ug/L	16	-	0.8	<0.20	0.20	5146466
Trichloroethylene	ug/L	400	-	20	<0.10	0.10	5146466
Surrogate Recovery (%)							
D10-Anthracene	%	-	-	-	89		5152119
D14-Terphenyl (FS)	%	-	-	-	83		5152119
D8-Acenaphthylene	%	-	-	-	90		5152119
4-Bromofluorobenzene	%	-	-	-	100		5146466
D4-1,2-Dichloroethane	%	-	-	-	105		5146466
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Criteria, Criteria B: Halton Sanitary and Storm sewer by-law Criteria-2: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999							

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

HALTON SANITARY & COMBINED SEWER (2-03)

Maxxam ID					FAV311		
Sampling Date					2017/08/31 11:30		
COC Number					627156-01-01		
	UNITS	Criteria	Criteria B	Criteria-2	BH-116	RDL	QC Batch
D8-Toluene	%	-	-	-	96		5146466
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Criteria, Criteria B: Halton Sanitary and Storm sewer by-law Criteria-2: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999							

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

RESULTS OF ANALYSES OF WATER

Maxxam ID					FAV311		
Sampling Date					2017/08/31 11:30		
COC Number					627156-01-01		
	UNITS	Criteria	Criteria B	Criteria-2	BH-116	RDL	QC Batch
Calculated Parameters							
Hardness (CaCO ₃)	mg/L	-	-	-	1400	1.0	5144521
Total Un-ionized Ammonia	mg/L	-	-	-	0.0061	0.00069	5144611
Field Measurements							
Field Temperature	Celcius	-	-	-	13.5	N/A	ONSITE
Field pH	pH	6.0:10.0	6.5:8.5	6.5:8.5	7.67		ONSITE
Inorganics							
Total Ammonia-N	mg/L	-	-	-	0.45	0.050	5148228
Total BOD	mg/L	-	-	-	<2.0	2.0	5148316
Conductivity	umho/cm	-	-	-	3100	1.0	5152368
Total Organic Carbon (TOC)	mg/L	-	-	-	1.7	0.20	5147200
Orthophosphate (P)	mg/L	-	-	-	<0.010	0.010	5148380
Turbidity	NTU	-	-	-	31	0.1	5146515
Alkalinity (Total as CaCO ₃)	mg/L	-	-	-	290	1.0	5152359
Dissolved Chloride (Cl)	mg/L	-	-	-	790	10	5148376
Nitrite (N)	mg/L	-	-	-	<0.010	0.010	5146763
Nitrate (N)	mg/L	-	-	-	<0.10	0.10	5146763
Nitrate + Nitrite (N)	mg/L	-	-	-	<0.10	0.10	5146763
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Criteria, Criteria B: Halton Sanitary and Storm sewer by-law Criteria-2: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999 N/A = Not Applicable							

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID				FAV311		
Sampling Date				2017/08/31 11:30		
COC Number				627156-01-01		
	UNITS	Criteria	Criteria-2	BH-116	RDL	QC Batch
Metals						
Dissolved Mercury (Hg)	mg/L	0.05	0.0002	<0.0001	0.0001	5152975
Total Aluminum (Al)	mg/L	50	-	1.8	0.0050	5149536
Total Antimony (Sb)	mg/L	5	0.02	<0.00050	0.00050	5149536
Total Arsenic (As)	mg/L	1	0.1	0.0012	0.0010	5149536
Total Barium (Ba)	mg/L	-	-	0.48	0.0020	5149536
Total Beryllium (Be)	mg/L	5	0.011	<0.00050	0.00050	5149536
Total Bismuth (Bi)	mg/L	-	-	<0.0010	0.0010	5149536
Total Boron (B)	mg/L	-	0.2	0.041	0.010	5149536
Total Cadmium (Cd)	mg/L	1	0.0002	<0.00010	0.00010	5149536
Total Calcium (Ca)	mg/L	-	-	290	0.20	5149536
Total Chromium (Cr)	mg/L	3	-	<0.0050	0.0050	5149536
Total Cobalt (Co)	mg/L	5	0.0009	0.0021	0.00050	5149536
Total Copper (Cu)	mg/L	3	0.005	0.0037	0.0010	5149536
Total Iron (Fe)	mg/L	50	0.3	6.8	0.10	5149536
Total Lead (Pb)	mg/L	3	0.005	0.0019	0.00050	5149536
Total Lithium (Li)	mg/L	-	-	0.055	0.0050	5149536
Total Magnesium (Mg)	mg/L	-	-	160	0.050	5149536
Total Manganese (Mn)	mg/L	5	-	0.31	0.0020	5149536
Total Molybdenum (Mo)	mg/L	5	0.04	0.0021	0.00050	5149536
Total Nickel (Ni)	mg/L	3	0.025	0.0063	0.0010	5149536
Total Phosphorus (P)	mg/L	10	0.01	0.13	0.10	5149536
Total Potassium (K)	mg/L	-	-	5.7	0.20	5149536
Total Selenium (Se)	mg/L	5	0.1	<0.0020	0.0020	5149536
Total Silicon (Si)	mg/L	-	-	14	0.050	5149536
Total Silver (Ag)	mg/L	5	0.0001	<0.00010	0.00010	5149536
Total Sodium (Na)	mg/L	-	-	120	0.10	5149536
Total Strontium (Sr)	mg/L	-	-	1.9	0.0010	5149536
Total Tellurium (Te)	mg/L	-	-	<0.0010	0.0010	5149536
Total Thallium (Tl)	mg/L	-	0.0003	<0.000050	0.000050	5149536
Total Tin (Sn)	mg/L	5	-	<0.0010	0.0010	5149536
Total Titanium (Ti)	mg/L	5	-	0.067	0.0050	5149536
Total Tungsten (W)	mg/L	-	0.030	<0.0010	0.0010	5149536
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						
Criteria: Halton Sanitary and Storm sewer by-law						
Criteria-2: Ontario Provincial Water Quality Objectives						
Ref. to MOEE Water Management document dated Feb.1999						

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID				FAV311		
Sampling Date				2017/08/31 11:30		
COC Number				627156-01-01		
	UNITS	Criteria	Criteria-2	BH-116	RDL	QC Batch
Total Uranium (U)	mg/L	-	0.005	0.00064	0.00010	5149536
Total Vanadium (V)	mg/L	-	0.006	0.0039	0.00050	5149536
Total Zinc (Zn)	mg/L	3	0.03	0.010	0.0050	5149536
Total Zirconium (Zr)	mg/L	-	0.004	<0.0010	0.0010	5149536
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Criteria: Halton Sanitary and Storm sewer by-law Criteria-2: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999						

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

ORGANOPHOSPHORUS PESTICIDES BY GC-MS (WATER)

Maxxam ID			FAV311		
Sampling Date			2017/08/31 11:30		
COC Number			627156-01-01		
	UNITS	Criteria	BH-116	RDL	QC Batch
Pesticides & Herbicides					
Demeton-S	ug/L	-	<2.0	2.0	5154960
Dichlorvos	ug/L	-	<2.0	2.0	5154960
Dimethoate	ug/L	-	<2.0	2.0	5154960
Fenclorophos (Ronnell)	ug/L	-	<2.0	2.0	5154960
Fonofos	ug/L	-	<2.0	2.0	5154960
Metolachlor	ug/L	3	<5.0 (1)	5.0	5154960
Mevinphos	ug/L	-	<2.0	2.0	5154960
Phosmet	ug/L	-	<2.0	2.0	5154960
Triallate	ug/L	-	<5.0	5.0	5154960
Trifluralin	ug/L	-	<5.0	5.0	5154960
Atrazine	ug/L	-	<1.0	1.0	5154960
Diazinon	ug/L	0.08	<2.0 (1)	2.0	5154960
Malathion	ug/L	0.1	<2.0 (1)	2.0	5154960
Parathion Ethyl	ug/L	-	<2.0	2.0	5154960
Parathion Methyl	ug/L	-	<2.0	2.0	5154960
Simazine	ug/L	10	<2.0	2.0	5154960
Aldicarb	ug/L	-	<5.0	5.0	5154960
Bendiocarb	ug/L	-	<2.0	2.0	5154960
Carbaryl	ug/L	0.2	<5.0 (1)	5.0	5154960
Carbofuran	ug/L	-	<5.0	5.0	5154960
Cyanazine (Bladex)	ug/L	-	<5.0	5.0	5154960
Prometryne	ug/L	-	<1.0	1.0	5154960
Chlorpyrifos (Dursban)	ug/L	0.001	<2.0 (1)	2.0	5154960
Terbufos	ug/L	-	<1.0	1.0	5154960
Phorate	ug/L	-	<1.0	1.0	5154960
Guthion (Azinphos-methyl)	ug/L	0.005	<1.0 (1)	1.0	5154960
Ethion	ug/L	-	<1.0	1.0	5154960
Fenthion	ug/L	-	<1.0	1.0	5154960
Surrogate Recovery (%)					
2-Fluorobiphenyl	%	-	49		5154960
D14-Terphenyl (FS)	%	-	92		5154960
D5-Nitrobenzene	%	-	50		5154960
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Criteria: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999 (1) RDL exceeds criteria					

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

MICROBIOLOGY (WATER)

Maxxam ID				FAV311		
Sampling Date				2017/08/31 11:30		
COC Number				627156-01-01		
	UNITS	Criteria B	Criteria	BH-116	RDL	QC Batch
Microbiological						
Escherichia coli	CFU/100mL	200	100	<10	10	5145573
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Criteria B: Halton Sanitary and Storm sewer by-law Criteria: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999						

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

O.REG 153 OC PESTICIDES (WATER)

Maxxam ID			FAV311		
Sampling Date			2017/08/31 11:30		
COC Number			627156-01-01		
	UNITS	Criteria	BH-116	RDL	QC Batch
Calculated Parameters					
Chlordane (Total)	ug/L	0.06	<0.005	0.005	5144775
o,p-DDD + p,p-DDD	ug/L	-	<0.005	0.005	5144775
o,p-DDE + p,p-DDE	ug/L	-	<0.005	0.005	5144775
o,p-DDT + p,p-DDT	ug/L	-	<0.005	0.005	5144775
Total Endosulfan	ug/L	-	<0.005	0.005	5144775
Total PCB	ug/L	0.001	<0.05 (1)	0.05	5144775
Pesticides & Herbicides					
Aldrin	ug/L	0.001	<0.005 (1)	0.005	5146176
Dieldrin	ug/L	0.001	<0.005 (1)	0.005	5146176
a-Chlordane	ug/L	0.06	<0.005	0.005	5146176
g-Chlordane	ug/L	0.06	<0.005	0.005	5146176
o,p-DDD	ug/L	0.003	<0.005 (1)	0.005	5146176
p,p-DDD	ug/L	0.003	<0.005 (1)	0.005	5146176
o,p-DDE	ug/L	0.003	<0.005 (1)	0.005	5146176
p,p-DDE	ug/L	0.003	<0.005 (1)	0.005	5146176
o,p-DDT	ug/L	0.003	<0.005 (1)	0.005	5146176
p,p-DDT	ug/L	0.003	<0.005 (1)	0.005	5146176
Lindane	ug/L	0.01	<0.003	0.003	5146176
Endosulfan I (alpha)	ug/L	-	<0.005	0.005	5146176
Endosulfan II (beta)	ug/L	-	<0.005	0.005	5146176
Endrin	ug/L	0.002	<0.005 (1)	0.005	5146176
Heptachlor	ug/L	0.001	<0.005 (1)	0.005	5146176
Heptachlor epoxide	ug/L	0.001	<0.005 (1)	0.005	5146176
Hexachlorobenzene	ug/L	0.0065	<0.005	0.005	5146176
Hexachlorobutadiene	ug/L	0.009	<0.009	0.009	5146176
Hexachloroethane	ug/L	1	<0.01	0.01	5146176
Methoxychlor	ug/L	0.04	<0.01	0.01	5146176
Aroclor 1242	ug/L	0.001	<0.05 (1)	0.05	5146176
Aroclor 1248	ug/L	0.001	<0.05 (1)	0.05	5146176
Aroclor 1254	ug/L	0.001	<0.05 (1)	0.05	5146176
Aroclor 1260	ug/L	0.001	<0.05 (1)	0.05	5146176
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Criteria: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999 (1) RDL exceeds criteria					

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

O.REG 153 OC PESTICIDES (WATER)

Maxxam ID			FAV311		
Sampling Date			2017/08/31 11:30		
COC Number			627156-01-01		
	UNITS	Criteria	BH-116	RDL	QC Batch
Surrogate Recovery (%)					
2,4,5,6-Tetrachloro-m-xylene	%	-	77		5146176
Decachlorobiphenyl	%	-	98		5146176
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Criteria: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999					

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

TEST SUMMARY

Maxxam ID: FAV311
Sample ID: BH-116
Matrix: Water

Collected: 2017/08/31
Shipped:
Received: 2017/08/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5152359	N/A	2017/09/07	Surinder Rai
Biochemical Oxygen Demand (BOD)	DO	5148316	2017/09/02	2017/09/07	Prakash Piya
Carbonaceous BOD	DO	5148322	2017/09/02	2017/09/07	Prakash Piya
Chloride by Automated Colourimetry	KONE	5148376	N/A	2017/09/05	Alina Dobreanu
Conductivity	AT	5152368	N/A	2017/09/07	Surinder Rai
Total Cyanide	SKAL/CN	5146758	2017/09/01	2017/09/01	Xuanhong Qiu
Fluoride	ISE	5152347	2017/09/06	2017/09/07	Surinder Rai
Hardness (calculated as CaCO ₃)		5144521	N/A	2017/09/06	Automated Statchk
Dissolved Mercury in Water by CVAA	CV/AA	5152975	2017/09/07	2017/09/07	Ron Morrison
Mercury	CV/AA	5151539	2017/09/06	2017/09/07	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5149536	N/A	2017/09/06	Arefa Dabhad
E.coli, (CFU/100mL)	PL	5145573	N/A	2017/08/31	Sonja Elavinamannil
Total Ammonia-N	LACH/NH ₄	5148228	N/A	2017/09/06	Charles Opoku-Ware
Nitrate (NO ₃) and Nitrite (NO ₂) in Water	LACH	5146763	N/A	2017/09/01	Chandra Nandlal
Animal and Vegetable Oil & Grease	BAL	5144525	N/A	2017/09/02	Automated Statchk
Total Oil and Grease	BAL	5148182	2017/09/02	2017/09/02	Mansoor Ahmed
OC Pesticides (Selected) & PCB	GC/ECD	5146176	2017/09/01	2017/09/02	Joy Zhang
OC Pesticides Summed Parameters	CALC	5144775	N/A	2017/09/01	Automated Statchk
GC/MS Analysis of OP Pesticides.	GC/MS	5154960	2017/09/08	2017/09/08	May Yin Mak
PAH Compounds in Water by GC/MS (SIM)	GC/MS	5152119	2017/09/06	2017/09/07	Mitesh Raj
pH	AT	5152369	N/A	2017/09/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5151978	N/A	2017/09/06	Zahid Soikot
Field pH	PH	ONSITE	N/A	2017/08/31	Amanda Sica
Orthophosphate	KONE	5148380	N/A	2017/09/05	Alina Dobreanu
Sulphate by Automated Colourimetry	KONE	5148379	N/A	2017/09/05	Alina Dobreanu
Field pH	PH	ONSITE	N/A	2017/08/31	Amanda Sica
Total Kjeldahl Nitrogen in Water	SKAL	5148627	2017/09/02	2017/09/05	Bramdeo Motiram
Total Organic Carbon (TOC)	TOCV/NDIR	5147200	N/A	2017/09/02	Anastasia Hamanov
TPH (Heavy Oil)	BAL	5148184	2017/09/02	2017/09/02	Mansoor Ahmed
Total Suspended Solids	BAL	5148175	2017/09/02	2017/09/02	Xue Zheng Li(Scott)
Turbidity	AT	5146515	N/A	2017/09/02	Neil Dassanayake
Un-ionized Ammonia	CALC/NH ₃	5144611	2017/09/07	2017/09/07	Automated Statchk
Volatile Organic Compounds in Water	P&T/MS	5146466	N/A	2017/09/05	Juan Pangilinan

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	15.3°C
-----------	--------

Revised report (2017/09/18): Criteria has been updated as requested.

Results relate only to the items tested.

Maxxam Job #: B719404
Report Date: 2017/09/18

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5146176	2,4,5,6-Tetrachloro-m-xylene	2017/09/02	55	50 - 130	59	50 - 130	64	%				
5146176	Decachlorobiphenyl	2017/09/02	98	50 - 130	113	50 - 130	113	%				
5146466	4-Bromofluorobenzene	2017/09/05	99	70 - 130	102	70 - 130	98	%				
5146466	D4-1,2-Dichloroethane	2017/09/05	97	70 - 130	102	70 - 130	102	%				
5146466	D8-Toluene	2017/09/05	99	70 - 130	99	70 - 130	99	%				
5152119	D10-Anthracene	2017/09/06	97	50 - 130	99	50 - 130	95	%				
5152119	D14-Terphenyl (FS)	2017/09/06	84	50 - 130	85	50 - 130	83	%				
5152119	D8-Acenaphthylene	2017/09/06	96	50 - 130	98	50 - 130	94	%				
5154960	2-Fluorobiphenyl	2017/09/08			70	30 - 130	67	%				
5154960	D14-Terphenyl (FS)	2017/09/08			88	30 - 130	91	%				
5154960	D5-Nitrobenzene	2017/09/08			78	30 - 130	73	%				
5146176	a-Chlordane	2017/09/02	83	50 - 130	85	50 - 130	<0.005	ug/L	0.13	30		
5146176	Aldrin	2017/09/02	77	50 - 130	79	50 - 130	<0.005	ug/L	1.0	30		
5146176	Aroclor 1242	2017/09/02					<0.05	ug/L				
5146176	Aroclor 1248	2017/09/02					<0.05	ug/L				
5146176	Aroclor 1254	2017/09/02					<0.05	ug/L				
5146176	Aroclor 1260	2017/09/02					<0.05	ug/L				
5146176	Dieldrin	2017/09/02	96	50 - 130	102	50 - 130	<0.005	ug/L	1.9	30		
5146176	Endosulfan I (alpha)	2017/09/02	77	50 - 130	85	50 - 130	<0.005	ug/L	4.3	30		
5146176	Endosulfan II (beta)	2017/09/02	84	50 - 130	90	50 - 130	<0.005	ug/L	0.54	30		
5146176	Endrin	2017/09/02	90	50 - 130	93	50 - 130	<0.005	ug/L	0.37	30		
5146176	g-Chlordane	2017/09/02	98	50 - 130	84	50 - 130	<0.005	ug/L	0.79	30		
5146176	Heptachlor epoxide	2017/09/02	81	50 - 130	87	50 - 130	<0.005	ug/L	1.4	30		
5146176	Heptachlor	2017/09/02	76	50 - 130	79	50 - 130	<0.005	ug/L	0.86	30		
5146176	Hexachlorobenzene	2017/09/02	76	50 - 130	84	50 - 130	<0.005	ug/L	3.0	30		
5146176	Hexachlorobutadiene	2017/09/02	73	50 - 130	76	50 - 130	<0.009	ug/L	3.0	30		
5146176	Hexachloroethane	2017/09/02	64	50 - 130	67	50 - 130	<0.01	ug/L	3.0	30		
5146176	Lindane	2017/09/02	76	50 - 130	81	50 - 130	<0.003	ug/L	2.6	30		
5146176	Methoxychlor	2017/09/02	95	50 - 130	92	50 - 130	<0.01	ug/L	0.81	30		
5146176	o,p-DDD	2017/09/02	90	50 - 130	92	50 - 130	<0.005	ug/L	2.3	30		
5146176	o,p-DDE	2017/09/02	76	50 - 130	81	50 - 130	<0.005	ug/L	0.99	30		

Maxxam Job #: B719404
Report Date: 2017/09/18

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5146176	o,p-DDT	2017/09/02	82	50 - 130	83	50 - 130	<0.005	ug/L	0.59	30		
5146176	p,p-DDD	2017/09/02	89	50 - 130	93	50 - 130	<0.005	ug/L	0.13	30		
5146176	p,p-DDE	2017/09/02	84	50 - 130	89	50 - 130	<0.005	ug/L	0.60	30		
5146176	p,p-DDT	2017/09/02	96	50 - 130	89	50 - 130	<0.005	ug/L	2.1	30		
5146466	1,4-Dichlorobenzene	2017/09/05	104	70 - 130	107	70 - 130	<0.20	ug/L	NC	30		
5146466	Benzene	2017/09/05	103	70 - 130	107	70 - 130	<0.10	ug/L	NC	30		
5146466	Chloroform	2017/09/05	96	70 - 130	102	70 - 130	<0.10	ug/L				
5146466	Ethylbenzene	2017/09/05	102	70 - 130	106	70 - 130	<0.10	ug/L	NC	30		
5146466	Methylene Chloride(Dichloromethane)	2017/09/05	89	70 - 130	96	70 - 130	<0.50	ug/L	NC	30		
5146466	Tetrachloroethylene	2017/09/05	95	70 - 130	100	70 - 130	<0.10	ug/L	NC	30		
5146466	Toluene	2017/09/05	98	70 - 130	102	70 - 130	<0.20	ug/L	NC	30		
5146466	Trichloroethylene	2017/09/05	98	70 - 130	101	70 - 130	<0.10	ug/L	NC	30		
5146515	Turbidity	2017/09/02			99	85 - 115	<0.1	NTU	1.9	20		
5146758	Total Cyanide (CN)	2017/09/01	99	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20		
5146763	Nitrate (N)	2017/09/01	97	80 - 120	99	80 - 120	<0.10	mg/L	4.0	20		
5146763	Nitrite (N)	2017/09/01	103	80 - 120	104	80 - 120	<0.010	mg/L	14	20		
5147200	Total Organic Carbon (TOC)	2017/09/01	96	80 - 120	99	80 - 120	0.21, RDL=0.20	mg/L	3.8	20		
5148175	Total Suspended Solids	2017/09/02					<10	mg/L	NC	25	96	85 - 115
5148182	Total Oil & Grease	2017/09/02			93	85 - 115	<0.50	mg/L	4.0	25		
5148184	Total Oil & Grease Mineral/Synthetic	2017/09/02			92	85 - 115	<0.50	mg/L	3.0	25		
5148228	Total Ammonia-N	2017/09/06	102	80 - 120	97	85 - 115	<0.050	mg/L	NC	20		
5148316	Total BOD	2017/09/07					<2.0	mg/L	NC	25	103	80 - 120
5148322	Total Carbonaceous BOD	2017/09/07					<2	mg/L	NC	25	93	85 - 115
5148376	Dissolved Chloride (Cl)	2017/09/05	110	80 - 120	101	80 - 120	<1.0	mg/L	4.3	20		
5148379	Dissolved Sulphate (SO4)	2017/09/05	104	75 - 125	103	80 - 120	<1.0	mg/L	0.29	20		
5148380	Orthophosphate (P)	2017/09/05	101	75 - 125	99	80 - 120	<0.010	mg/L	12	25		
5148627	Total Kjeldahl Nitrogen (TKN)	2017/09/05	117	80 - 120	108	80 - 120	<0.10	mg/L	NC	20	107	80 - 120
5149536	Total Aluminum (Al)	2017/09/06	129 (1)	80 - 120	100	80 - 120	<0.0050	mg/L	0.52	20		
5149536	Total Antimony (Sb)	2017/09/06	103	80 - 120	103	80 - 120	<0.00050	mg/L	2.0	20		
5149536	Total Arsenic (As)	2017/09/06	102	80 - 120	101	80 - 120	<0.0010	mg/L	0.19	20		

Maxxam Job #: B719404
Report Date: 2017/09/18

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5149536	Total Barium (Ba)	2017/09/06	94	80 - 120	95	80 - 120	<0.0020	mg/L				
5149536	Total Beryllium (Be)	2017/09/06	99	80 - 120	102	80 - 120	<0.00050	mg/L				
5149536	Total Bismuth (Bi)	2017/09/06	94	80 - 120	95	80 - 120	<0.0010	mg/L				
5149536	Total Boron (B)	2017/09/06	NC	80 - 120	98	80 - 120	<0.010	mg/L				
5149536	Total Cadmium (Cd)	2017/09/06	99	80 - 120	101	80 - 120	<0.00010	mg/L	NC	20		
5149536	Total Calcium (Ca)	2017/09/06	NC	80 - 120	99	80 - 120	<0.20	mg/L				
5149536	Total Chromium (Cr)	2017/09/06	100	80 - 120	100	80 - 120	<0.0050	mg/L	NC	20		
5149536	Total Cobalt (Co)	2017/09/06	99	80 - 120	100	80 - 120	<0.00050	mg/L	0.59	20		
5149536	Total Copper (Cu)	2017/09/06	99	80 - 120	103	80 - 120	<0.0010	mg/L	NC	20		
5149536	Total Iron (Fe)	2017/09/06	100	80 - 120	100	80 - 120	<0.10	mg/L	0.86	20		
5149536	Total Lead (Pb)	2017/09/06	98	80 - 120	99	80 - 120	<0.00050	mg/L	NC	20		
5149536	Total Lithium (Li)	2017/09/06	101	80 - 120	104	80 - 120	<0.0050	mg/L				
5149536	Total Magnesium (Mg)	2017/09/06	NC	80 - 120	99	80 - 120	<0.050	mg/L				
5149536	Total Manganese (Mn)	2017/09/06	99	80 - 120	100	80 - 120	<0.0020	mg/L	1.2	20		
5149536	Total Molybdenum (Mo)	2017/09/06	106	80 - 120	106	80 - 120	<0.00050	mg/L	0.088	20		
5149536	Total Nickel (Ni)	2017/09/06	97	80 - 120	101	80 - 120	<0.0010	mg/L	13	20		
5149536	Total Phosphorus (P)	2017/09/06	110	80 - 120	117	80 - 120	<0.10	mg/L	NC	20		
5149536	Total Potassium (K)	2017/09/06	NC	80 - 120	102	80 - 120	<0.20	mg/L				
5149536	Total Selenium (Se)	2017/09/06	106	80 - 120	105	80 - 120	<0.0020	mg/L	NC	20		
5149536	Total Silicon (Si)	2017/09/06	102	80 - 120	98	80 - 120	<0.050	mg/L				
5149536	Total Silver (Ag)	2017/09/06	96	80 - 120	100	80 - 120	<0.00010	mg/L	NC	20		
5149536	Total Sodium (Na)	2017/09/06	NC	80 - 120	103	80 - 120	<0.10	mg/L				
5149536	Total Strontium (Sr)	2017/09/06	NC	80 - 120	98	80 - 120	<0.0010	mg/L				
5149536	Total Tellurium (Te)	2017/09/06	102	80 - 120	107	80 - 120	<0.0010	mg/L				
5149536	Total Thallium (Tl)	2017/09/06	95	80 - 120	95	80 - 120	<0.000050	mg/L				
5149536	Total Tin (Sn)	2017/09/06	98	80 - 120	98	80 - 120	<0.0010	mg/L	NC	20		
5149536	Total Titanium (Ti)	2017/09/06	100	80 - 120	96	80 - 120	<0.0050	mg/L	NC	20		
5149536	Total Tungsten (W)	2017/09/06	103	80 - 120	101	80 - 120	<0.0010	mg/L				
5149536	Total Uranium (U)	2017/09/06	100	80 - 120	99	80 - 120	<0.00010	mg/L				
5149536	Total Vanadium (V)	2017/09/06	101	80 - 120	100	80 - 120	<0.00050	mg/L				
5149536	Total Zinc (Zn)	2017/09/06	100	80 - 120	102	80 - 120	<0.0050	mg/L	NC	20		

Maxxam Job #: B719404
Report Date: 2017/09/18

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5149536	Total Zirconium (Zr)	2017/09/06	105	80 - 120	105	80 - 120	<0.0010	mg/L				
5151539	Mercury (Hg)	2017/09/07	95	75 - 125	104	80 - 120	<0.0001	mg/L	NC	20		
5151978	Phenols-4AAP	2017/09/06	101	80 - 120	98	85 - 115	<0.0010	mg/L	NC	20		
5152119	Naphthalene	2017/09/07	98	50 - 130	95	50 - 130	<0.050	ug/L	NC	30		
5152347	Fluoride (F-)	2017/09/07	102	80 - 120	105	80 - 120	<0.10	mg/L	NC	20		
5152359	Alkalinity (Total as CaCO3)	2017/09/07			96	85 - 115	<1.0	mg/L	1.6	20		
5152368	Conductivity	2017/09/07			100	85 - 115	<1.0	umho/cm	0	25		
5152369	pH	2017/09/07			101	98 - 103			0.94	N/A		
5152975	Dissolved Mercury (Hg)	2017/09/07	108	75 - 125	101	80 - 120	<0.0001	mg/L	NC	20		
5154960	Aldicarb	2017/09/08			94	30 - 130	<5.0	ug/L	3.0	40		
5154960	Atrazine	2017/09/08			93	30 - 130	<1.0	ug/L	1.2	40		
5154960	Bendiocarb	2017/09/08			97	30 - 130	<2.0	ug/L	0.39	40		
5154960	Carbaryl	2017/09/08			99	30 - 130	<5.0	ug/L	2.7	40		
5154960	Carbofuran	2017/09/08			101	30 - 130	<5.0	ug/L	0.64	40		
5154960	Chlorpyrifos (Dursban)	2017/09/08			91	30 - 130	<2.0	ug/L	2.1	40		
5154960	Cyanazine (Bladex)	2017/09/08			94	30 - 130	<5.0	ug/L	1.5	40		
5154960	Demeton-S	2017/09/08			82	30 - 130	<2.0	ug/L	4.8	40		
5154960	Diazinon	2017/09/08			91	30 - 130	<2.0	ug/L	0.78	40		
5154960	Dichlorvos	2017/09/08			90	30 - 130	<2.0	ug/L	5.7	40		
5154960	Dimethoate	2017/09/08			84	30 - 130	<2.0	ug/L	2.7	40		
5154960	Ethion	2017/09/08			89	30 - 130	<1.0	ug/L	2.0	40		
5154960	Fenchlorphos (Ronnel)	2017/09/08			89	30 - 130	<2.0	ug/L	1.6	40		
5154960	Fenthion	2017/09/08			81	30 - 130	<1.0	ug/L	1.5	40		
5154960	Fonofos	2017/09/08			93	30 - 130	<2.0	ug/L	3.0	40		
5154960	Guthion (Azinphos-methyl)	2017/09/08			87	30 - 130	<1.0	ug/L	5.7	40		
5154960	Malathion	2017/09/08			90	30 - 130	<2.0	ug/L	0.60	40		
5154960	Metolachlor	2017/09/08			96	30 - 130	<5.0	ug/L	1.1	40		
5154960	Mevinphos	2017/09/08			93	30 - 130	<2.0	ug/L	1.8	40		
5154960	Parathion Ethyl	2017/09/08			88	30 - 130	<2.0	ug/L	2.5	40		
5154960	Parathion Methyl	2017/09/08			87	30 - 130	<2.0	ug/L	1.6	40		

Maxxam Job #: B719404
Report Date: 2017/09/18

QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5154960	Phorate	2017/09/08			86	30 - 130	<1.0	ug/L	3.6	40		
5154960	Phosmet	2017/09/08			77	30 - 130	<2.0	ug/L	6.7	40		
5154960	Prometryne	2017/09/08			95	30 - 130	<1.0	ug/L	0.29	40		
5154960	Simazine	2017/09/08			84	30 - 130	<2.0	ug/L	1.5	40		
5154960	Terbufos	2017/09/08			85	30 - 130	<1.0	ug/L	2.5	40		
5154960	Triallate	2017/09/08			89	30 - 130	<5.0	ug/L	1.0	40		
5154960	Trifluralin	2017/09/08			87	30 - 130	<5.0	ug/L	2.5	40		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Maxxam Job #: B7I9404
Report Date: 2017/09/18

Golder Associates Ltd
Client Project #: 1648031
Sampler Initials: AF

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Cristina Carriere, Scientific Service Specialist



Sonja Elavinamannil, Analyst I

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Maxxam Analytics International Corporation o/a Maxxam Analytics
 6240 Campbell Road, Mississauga, Ontario Canada L5N 2L8 Tel: (905) 817-6700 Toll-free 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

INVOICE TO: 1326 Golder Associates Ltd
 Accounts Payable
 6925 Century Ave Suite 100
 Mississauga ON L5N 7K2
 Tel: (905) 567-4444 x Fax: (905) 567-6561 x
 Email: AP_CustomerService@golder.com

REPORT TO: Sharon Wood
 Attention: Sharon Wood
 Address: (905) 567-6100 x1117 Fax: Sharon_Wood@golder.com

PROJECT INFORMATION:
 Quotation #: B70916
 P.O. #: 1648031
 Project: 1648031
 Project Name: Fomento
 Site #: KES ENV-1079
 Sampled By: Fomento

31-Aug-17 13:30
 Ema Gitej
 B7I9404
 627156
 C#627156-01-01

Page 1 of 1
 nly: Bottle Order #: 627156
 Project Manager: Ema Gitej

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)		Other Regulations		Special Instructions	
☐ Table 1	☐ Res/Park ☐ Medium/Fine	☐ CCME	☒ Sanitary Sewer Bylaw		
☐ Table 2	☐ Ind/Comm ☐ Coarse	☐ Reg 558	☒ Storm Sewer Bylaw		
☐ Table 3	☐ Agri/Other ☐ For RSC	☐ MISA	Municipality <u>Halton</u>		
☐ Table		☒ PWQO			
		☐ Other			

Include Criteria on Certificate of Analysis (Y/N)? Y

Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (Please circle): Metals / Hg / Cr VI	Halton Sanitary & Storm Sewer Bylaw and Additional Metals	O Reg 153 DC Pesticides	OP Pesticides by GC/MS	Additional PWQO Parameters	Field pH	Field Temperature	Turnaround Time (TAT) Required: Please provide advance notice for rush projects
1 BH-116	BH-116	7/08/31	1130	GW	Hg	X	X	X	X	X	X	Regular (Standard) TAT: (will be applied if Rush TAT is not specified): Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details. Job Specific Rush TAT (if applies to entire submission): Date Required: Time Required: Rush Confirmation Number: (call lab for #)
2												19
3												
4												
5												
6												
7												
8												
9												
10												

RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only
A. Fomenko	17/08/31	1230	[Signature]	21/08/31	1330		Temperature (°C) on Receipt: 16.1/17 Custody Seal: Present Intact: Yes White: Maxxa Yellow: Client

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WWP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

For more information, visit golder.com

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
6925 Century Avenue, Suite #100
Mississauga, Ontario, L5N 7K2
Canada
T: +1 (905) 567 4444

