FINAL

AECOM

Hydrogeological Investigation Report – Bradford Bypass – County Road 4

Highway 400 – Highway 404 Link (Bradford Bypass) County Road 4 Early Works (GWP 2008-21-00)

60636190

January 2022

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1. Introduction

The Ontario Ministry of Transportation (MTO) has retained AECOM Canada Ltd. (AECOM) to undertake the Early Works study for the grade separated bridge crossing at County Road 4 for the future Bradford Bypass (Highway 400 – Highway 404 Link) Project, in accordance with the provisions of the Ontario Regulation (O. Reg.) 697/21. The Project limits of construction work is located along County Road 4 from 8th Line to 9th Line intersections within in the Town of Bradford West Gwillimbury and Simcoe County. The Study Area map is presented in **Figure 1**. This study will advance as an early works project for the Bradford Bypass. The new bridge will be designed to include the widening of County Road 4 approved by Simcoe County.

This *Hydrogeological Investigation Report* was prepared for MTO in support of the County Road 4 Early Works Project (the Project) for the purpose of characterizing the local physical and groundwater setting, quantifying potential dewatering requirements for construction, assessing possible impacts to local water wells and groundwater dependant environmental features, and recommending appropriate monitoring and/or mitigation measures, as required. This report provides a summary, interpretation and discussion of the assessment results and recommendations on water-taking permitting requirements (i.e., Category 3 Permit to Take Water [PTTW] or Environmental Activity and Sector Registry [EASR] filing) from Ministry of the Environment, Conservation and Parks (MECP).

This report will include an assessment of the potential dewatering needs of the proposed structures and services to be installed as part of the Project. The proposed County Road 4 Study Area limits is shown in **Figure 1** of this report.

1.1 Data Review

The following background information was reviewed as part of the hydrogeological Investigation:

- Preliminary construction design drawings for structures and services (**Appendix A**);
- Golder Associates' Foundation Investigation and Design Report, December 2021;
- Ontario Geological Survey (OGS); and
- MECP Water Well Information System (WWIS) Records and PTTW/EASR database.

1.2 Study Area

The County Road 4 Early Works span a distance of approximately 1.3 km between 8th Line to 9th Line in the Town of Bradford West Gwillimbury and Simcoe County. The Study Area includes the lands within a 500 m buffer on either side of the proposed route Right-of-Way (ROW) as shown in **Figure 1**. **Section 2** of this report provides a description of the physical, geological, and hydrogeological setting within the Study Area with an emphasis on local conditions. Included in this section is a discussion on the physiography/topography and drainage, geological/hydrogeological conditions, and existing groundwater users.

2. Existing Conditions

2.1 Physiography, Topography and Drainage

The Study Area falls within the Clay Till Plains. The region is relatively drumlinized plains that were over-ridden by a glacial event following their initial deposition (Chapman and Putnam, 1984).

The ground surface within the Study Area is generally undulating with a downward gradient from the surrounding areas (east and west) to the Holland River and ultimately towards Lake Simcoe. The ground elevations within the Study Area ranged from approximately 251 m above mean sea level (mASL) (close to Holland River) to greater than 298 mASL (north end of the Study Area).

2.2 Geology

2.2.1 Quaternary and Bedrock Geology

A review of published quaternary geologic mapping (**Figures 2**) indicates that within the Study Area, the overburden material can be categorized as silt and clay which is reflective of glaciolacustrine basin and quiet water deposits.

A review of published bedrock geologic mapping (**Figures 3**) indicates that the Study Area is entirely represented by the Bass Islands Formation. The dominant rock composition is limestone, dolostone, shale, arkose, and sandstone.

2.2.2 Local Subsurface Conditions

Soil stratigraphy within the Study Area has been interpreted based on the results of a Project-specific subsurface (geotechnical) investigation program completed by Golder Associates Ltd. (Golder) that included the advancement of eighteen (18) boreholes within the Study Area. The stratigraphic logs for each borehole received by the time this report was written is included in **Appendix B** along with a map of the borehole locations.

- Pavement Structure: A surficial layer of asphalt pavement of varying thickness (100 mm to 200 mm) was encountered at HF-01 to HF-05, CR4-07, and CR4-10.
- Fill: Heterogenous fill materials were encountered below the pavement structure and/or at the ground surface at all locations, except CR4-01, CR4-06, CR4-09, and CR4-12. It contains silt, silty sand, sand, clayey sand, sandy clayey silt, clayey silt, gravelly sand, trace to some sand, trace rootlets, trace gravel to gravelly, the trace of silt pockets, and trace organics. The thickness of the fill layer ranges from 0.68 m (CR4-03) to 5.44 m (CR4-10).
- Gravelly Clayey Sand: A gravelly clayey sand layer with trace rootlets was encountered in CR4-01 and extended from the ground surface to 0.69 mBGS.
- Sand: A sand layer with trace gravel was encountered in CR4-11 and extended from 3.43 m to 3.73 mBGS.
- Silty Clay: A silty clay layer with trace sand was encountered in three (3) boreholes (CR4-01, CR4-03, and HF-01) and extended from 0.68 m to 5.94 mBGS. The thickness of the silty clay layer ranges from 1.91 m (HF-01) to 5.25 m (CR4-01). The monitoring well HF-01 was screened in this unit.

- Sandy Silt: A sandy silt layer with trace sand and trace organics was encountered in three (3) boreholes (CR4-02, CR4-05, and CR4-07) and extended from 0.91 m to 6.40 mBGS. The thickness of the sandy silt layer ranges from 0.84 m (CR4-02) to 1.50 m (CR4-07).
- Silt: A silt layer with trace to some sand, trace gravel, and trace organics was encountered in six (6) boreholes (CR4-01, CR4-10, CR-11, HF-01, HF-02, and HF-03) and extended from 2.97 m to 17.83 mBGS. The thickness of the silt layer ranges from 1.52 m (CR4-11) to 4.19 m (HF-03).
- Silty Sand: A silty sand layer with trace gravel, rootlets, and sand was encountered in ten (10) boreholes (CR4-01, CR4-02, CR4-03, CR4-04, CR4-05, CR4-06, CR4-09, CR4-11, CR4-12, and HF-01) and extended from the ground surface to 49.07 mBGS. The thickness of the silty sand layer ranges from 0.76 m (CR4-09) to 6.09 m (HF-01). The monitoring wells CR4-03 and HF-01 were screened in this unit.
- Clayey Silt to Silty Clay: A clayey silt to silty clay layer with trace sand was encountered in two (2) boreholes (CR4-04 and HF-03) and extended from 7.16 m to 49.38 mBGS. The thickness of clayey silt to silty clay layer ranges from 9.19 m (HF-03) to 31.55 m (CR4-03).
- Sandy Clayey Silt: A sandy clayey silt layer with trace gravel was encountered in CR4-09 and extended from 3.73 m to 10.21 mBGS.
- Silty Clay to Sandy Clayey Silt Till: A silty clay to sandy clayey silt till layer with trace gravel was encountered in HF-02 and extended from 6.27 m to 15.85 mBGS.
- Sandy Clayey Silt to Clayey Silt: A sandy clayey silt to clayey silt layer with trace organics was encountered in CR4-04 and extended from 4.27 m to 5.79 mBGS.
- Clayey Silt to Clayey Sand Till: A clayey silt to clayey sand till layer with trace to some gravel and trace sand was encountered in CR4-11 and extended from 3.73 m to 16.31 mBGS. The monitoring well CR4-11 was screened in this unit.
- Clayey Silt to Sandy Clayey Silt Till: A clayey silt to sandy clayey silt till layer with some sand and trace gravel was encountered in HF-05 and extended from 5.70 m to 12.40 mBGS. The monitoring well HF-05 was screened in this unit.
- Sandy Clayey Silt Till: A sandy clayey silt till layer with trace gravel to gravelly was encountered in two (2) boreholes (CR4-10 and HF-04) and extended from 5.80 m to 16.31 mBGS. The thickness of the sandy clayey silt till layer ranges from 4.58 m (CR4-10) to 8.99 m (HF-04).
- Clayey Silt Till: A clayey silt till layer with trace sand to sandy and trace gravel was encountered in seven (7) boreholes (CR4-06, CR4-07, CR4-08, CR4-10, CR4-11, CR4-12, and HF-03) and extended from 1.45 m to 50.90 mBGS. The thickness of the clayey silt till layer ranges from 1.45 m (HF-03) to 11.05 m (CR4-08). The monitoring well CR4-07 was screened in this unit.
- Clayey Silt: A clayey silt layer with trace to some sand, trace gravel, trace organics, and rootlets was encountered in eleven (11) boreholes (CR4-04, CR4-05, CR4-06, CR4-07, CR4-08, CR4-09, CR4-11, CR4-13, HF-03, HF-04, and HF-05) and extended from the ground surface to 49.38 mBGS. The thickness of the clayey silt layer ranges from 0.69 m (CR4-09) to 43.74 m (CR4-06). The monitoring wells CV1-04, CR4-07 and HF-05 were screened in this unit.
- Clayey silt-silt: A clayey silt to silt layer with trace to some sand was encountered in five (5) boreholes (CR4-02, CR4-03, CR4-05, CR4-11, and HF-04) and extended from 5.64 m to 46.02 mBGS. The thickness of this layer ranges from 1.06 m (HF-04) to 28.19 m (CR4-11). The monitoring wells CV1-01, CV1-04 and CR4-03 was screened in this unit.

2.3 Hydrogeological Conditions

The Study Area falls under the jurisdiction of the Lake Simcoe Region Conservation Authority (LSRCA) (Ainley Associates Ltd., 2012). A total of four (4) groundwater monitoring wells that were constructed by Golder within the Study Area as part of the geotechnical investigation between August and November 2021 were used for this investigation. Additional monitoring wells were installed within the active roadway and were not sampled. The four (4) monitoring wells chosen for this investigation best reflect the areas of excavation. The borehole logs for monitoring wells were provided by Golder and are found in **Appendix B**.

Water level measurements and single well response testing (SWRT) was carried out in the four (4) monitoring wells (CR4-03, CR4-11, CV1-01, and CV1-04) to provide an estimate of the saturated thickness and hydrogeological unit the wells are screened within. **Figure 1** shows the location of the monitoring wells.

2.3.1 Groundwater Levels

Groundwater level monitoring within the four (4) monitoring wells was conducted by AECOM between October 12th and November 26th. Collected groundwater level depth and elevation data is presented in **Table 1.** As shown in the **Table 1**, observed static groundwater level elevations were ranged between approximately 249.20 mASL (CV1-04) and 260.11 mASL (CR4-03). It is expected that the groundwater levels within the Study Area will be subject to seasonal fluctuations including response to the spring freshet and localized precipitation events.

Table 1: Monitoring Well Construction Details and Summary of Groundwater Level Measurements

Monitoring Well ID	Well Installation Date	Ground Surface Elevation (mASL)[2,5]	Well Bottom Depth (mBGS)[1]	Well Bottom Elevation (mASL)[2]	Screen Interval Depth (mBGS)[1]		Screen Interval Elevation (mASL)[2]		Groundwater Level Depth and Elevation		
					Top	Bottom	Top	Bottom	Date	Depth to Groundwater Level (mBGS)[1]	Groundwater Level Elevation (mASL)[2,3,4]
CR4-03	September 23, 2021	261.18	9.94	251.24	6.89	9.94	254.29	251.24	October 12, 2021	1.15	260.03
									October 13, 2021	1.16	260.02
									October 14, 2021	1.17	260.01
									November 23, 2021	1.12	260.06
									November 24, 2021	1.12	260.06
									November 26, 2021	1.07	260.11
CR4-11	August 30, 2021	253.34	9.16	244.18	6.11	9.16	247.23	244.18	October 12, 2021	0.57	252.77
									October 13, 2021	0.61	252.73
									October 14, 2021	0.60	252.74
									November 23, 2021	0.03	253.31
									November 24, 2021	0.03	253.31
									November 26, 2021	-0.20	253.54
CV1-01	October 14, 2021	252.20	10.72	241.48	7.67	10.72	244.53	241.48	November 23, 2021	0.00	252.20
									November 24, 2021	0.14	252.07
									November 25, 2021	0.60[5]	251.60
									November 26, 2021	0.01	252.19
									December 9, 2021	0.10[5]	252.10
CV1-04	August 27, 2021	250.50	9.30	241.20	6.25	9.30	244.25	241.20	October 12, 2021	0.31	250.19
									October 13, 2021	1.97	248.53
									October 14, 2021	1.45	249.05
									November 23, 2021	0.47	250.03
									November 24, 2021	0.47	250.03
									November 25, 2021	0.20[5]	250.30
									November 26, 2021	0.40	250.10
									December 9, 2021	1.3[5]	249.20

Notes: 1. mASL = metres above mean sea level
2. mbgs = metres below ground surface
3. Groundwater level data collected from CR4-03, CR4-11, and CV1-04 on October 12, 2021 and CV1-01 on November 23, 2021 was pre-development.
4. Groundwater level datasets collected on October 13 and October 14, 2021 from CV1-04 are not static as the well was recovering from following development and/or groundwater sampling.
5. Groundwater level data found in the Foundation Investigation and Design Report prepared by Golder (December 24, 2021).

2.3.2 Hydraulic Conductivity Estimate

Single Well Response Test (SWRT) was conducted at all four (4) monitoring wells within the Study Area between October 12th and November 23rd, 2021. Collected data was analyzed to provide an estimate of the hydraulic conductivity (K) of the stratum surrounding each respective monitoring well screen.

Prior to completing single well response testing (SWRT) the depth to water was measured within each monitoring well and used to determine the static water level for each well. The static water level represents the initial water levels for the single well response testing. The SWRT method involves causing a rapid change in hydraulic head within a well and measuring the water level response back to a static water level condition. The SWRT method may include one or a combination of rising head or falling head tests, depending on the position of the static groundwater level within the monitoring well being tested. Prior to start of each test, a datalogger was installed within the target well and configured to obtain readings on a regular (i.e., 0.5 to 1-second) interval. Information collected by the datalogger was confirmed through the collection of manual groundwater level measurements using an electronic water level indicator.

Falling head tests were carried out using a solid slug, which was introduced into the well to a depth completely below the static water level causing the water level to initially rise and subsequently fall back to static, and rising head tests were carried out by completely removing the solid slug from the water column causing the water level to initially drop and subsequently rise back to static. Immediately following the introduction of the slug into the well, manual groundwater levels and elapsed time were measured as the water level returned back to its original static elevation. These measurements were supplemented with data collected by the installed datalogger. Each single well response test was concluded when the water level returned to its static elevation.

Some of collected data was performed using the Kansas Geological Survey (KGS) model (Hyder et. al. 1994) in AQTESOLV Professional V4.5 to estimate the K of the aquifer material. The KGS model is highly recommended by many professionals working in the field of aquifer testing and data interpretation methods (Butler et. al., 2000).

Analysis of the most collected data is typically performed using the hydrostatic time-lag method of Hvorslev (1951) that is applicable to both unconfined or confined aquifer systems and monitoring wells with submerged screens. Hvorslev's method is described by the following general equation:

$$K = \frac{{r_c}^2}{2L_e} \ln\left[\frac{L_e}{2r_w} + \sqrt{1 + \left(\frac{L_e}{2r_w}\right)^2}\right]\left[\frac{\ln\left(\frac{h_1}{h_2}\right)}{(t_2 - t_1)}\right]$$

Where:
- K = hydraulic conductivity of the tested material (m/s)
- r_c = effective casing radius (m)
- r_w = equivalent well radius (m)
- L_e = length of screen interval (m)
- h_t = hydraulic head at time t (m)
- t = time (s)

Using the Hvorslev method, the collected data are plotted as Normalized Head versus Elapsed Time on a semi-logarithmic scale. Values are then taken from the plot and input to the equation above to estimate the hydraulic conductivity (K) of the soil and/or rock formation(s) contacted along the well screen/sand pack length.

SWRT results are summarized in **Table 2**, with the individual analysis reports contained in **Appendix C**.

Table 2: Summary of Single Well Response Testing Results

Monitoring Well ID	Test Date	Analytical Method [1, 2]	Top of Test Interval (mBGS)[3]	Bottom of Test Interval (mBGS)[3]	Type of Slug Test	Hydraulic Conductivity (m/s)[4]	Geologic Formation
CR4-03	October 14, 2021	KGS Model	6.89	9.94	Falling Head	2.08×10^{-6}	SILTY SAND (SM) and CLAYEY SILT-SILT (CL-ML) TO SILT
		KGS Model			Rising Head	1.82×10^{-6}	
CR4-11	October 14, 2021	KGS Model	6.11	9.16	Falling Head	4.25×10^{-7}	CLAYEY SILT (CL) with trace sand, trace gravel to CLAYEY SAND (SC) with some gravel (TILL)
		KGS Model			Rising Head	4.88×10^{-7}	
CV1-01	November 23, 2021	Hvorslev	7.67	10.72	Rising Head	5.91×10^{-8}	CLAYEY SILT-SILT (CL-ML), trace sand to sandy, trace gravel (TILL)
CV1-04	October 12, 2021	Hvorslev	6.25	9.30	Rising Head	8.78×10^{-9}	CLAYEY SILT (CL) to CLAYEY SILT-SILT (CL-ML), some sand to sandy, trace gravel (TILL)

Notes: *1 – KGS = Kansas Geological Survey (1994)*
2 – Hvorslev (1951)
3 – mBGS = metres Below Ground Surface
4 – m/s = metre per second

2.4 Existing Groundwater Users

2.4.1 Water Well Records Review and Groundwater Usage

The Study Area is located within the Town of Bradford West Gwillimbury and Simcoe County. Potable water in the rural areas is dependent on private well water, while potable water in urban areas is municipally serviced with water obtained from a combination of well water and surface water sources. Overall, a total of 86 records were identified within the Study Area by primary well use and are summarized in **Table 3**.

Table 3: Summary of MECP Water Well Record Information

Primary Water Use	Number of Well Records	Well Depth (m)	Primary Well Type
Domestic	68	5 - 108	Overburden
Industrial	2	16 – 133	Overburden
Livestock	1	13	Overburden
Monitoring and Test Hole	6	0 - 69	Overburden
Not Used / Unknown	9	0 - 137	Overburden

A summary of the key information obtained from the MECP well records for the existing water wells within the Study Area is provided in **Appendix D**. The locations of the existing water supply wells identified by the MECP well records, are presented on **Figure 4**.

A review of the MECP PTTW database identified no active PTTWs and a review of the EASR database found no records within the Study Area.

2.5 Groundwater Quality

Groundwater samples were collected from four (4) monitoring wells between October 13th to November 24rd, 2021.

The collected groundwater samples were submitted to AGAT Laboratories for geochemical analysis. Results of the analyses were compared to the Town of Bradford West Gwillimbury's (the "Town") Sewer Use Bylaw 2013-68 limits for both Sanitary and Storm Sewers discharges. The analysis results were also compared to Provincial Water Quality Objectives (PWQO) criteria limits. As required under the Town's Sewer Use By-Law and PWQO criteria, the samples were not filtered and are therefore representative of raw groundwater quality prior to any treatment processes.

The analytical results received from AGAT Laboratories indicate that the tested groundwater samples were generally below most of the criteria limits for the applicable standards, with the exception of those parameters summarized in **Table 4** and **Table 5**. Certificates of Analysis provided by AGAT Laboratories are included in **Appendix E**.

The concentration of Un-ionized Ammonia provided in the certificates of analysis was calculated by the laboratory for each groundwater sample based on measured pH and temperature when the samples were received, rather than the field-measured parameters of pH and temperature at the time of sample collection. As a result, the laboratory calculated and reported Un-ionized Ammonia values do not accurately reflect the actual concentration within each sampled well.

Ammonia is highly soluble in water and its speciation is affected by a wide variety of environmental parameters including pH, temperature, and ionic strength. In aqueous solutions, an equilibrium exists between Un-ionized (NH3) and Ionized (NH4+) Ammonia species (Canadian Council of Ministers of the Environment, 2010). The equilibrium constant for this reaction is a function of temperature and solution pH (Florida Department of Environmental Protection, 2001). Thus, if the equilibrium constant is known for a particular temperature and the pH of the solution is also known, the fraction of Un-ionized Ammonia can be calculated. The Un-ionized Ammonia concentration can be calculated if the Total Ammonia concentration is also known from laboratory analysis (Florida Department of Environmental Protection, 2001).

Field measurements of pH and temperature together with the laboratory-derived concentration of Total Ammonia (mg/L) were utilized to calculate the Un-ionized Ammonia concentration for selected sampled monitoring wells. The calculation process followed the procedure and equations provided in Emerson et.al.,1975 and the calculation parameters are presented in **Appendix E**. The calculated concentration of Un-ionized Ammonia for selected sampled well was compared to the PWQO criteria of 0.02 mg/L. Results indicate that none of the monitoring wells were found to contain a concentration of Un-ionized Ammonia in excess of the PWQO criteria.

Table 4: Summary of Parameters Exceeding the Town of Bradford West Gwillimbury Storm and Sanitary Sewer By-Law

Parameter →		Phenols	Total Chromium	Total Copper	Total Manganese	Total Nickel	Total Phosphorus	Total Titanium	Total Suspended Solids
Unit →		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reported Detection Limit (RDL) →		0.001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	10
Storm Sewer Limits →		0.008	0.08	0.05	0.15	0.08	0.40	-	15
Sanitary Sewer Limits →		1	2	3	5	2	10	5	350
Sampled Monitoring Wells	CV1-01	-	**0.51**	**0.31**	**7.44**	**0.37**	**9.74**	**8.34**	**62**
	CV1-04	**0.010**	<0.020	<0.015	0.055	<0.015	0.07	0.05	**62**
	CR4-04	**0.010**	-	-	-	-	-	-	**54**

Notes: mg/L = milligrams per Litre

Bolded/Shaded = indicates parameter does not meet the Town of Bradford West Gwillimbury Sanitary Sewer Discharge (Bylaw 2013-68)

Bolded = indicates parameter does not meet the Town of Bradford West Gwillimbury Storm Sewer Discharge (Bylaw 2013-68)

Table 5: Summary of Parameters Exceeding PWQO Guidelines

Parameter →		pH	Total Cobalt	Total Copper	Total Nickel	Total Vanadium	Total Iron
Unit →		pH Units	mg/L	mg/L	mg/L	mg/L	mg/L
Reported Detection Limit (RDL) →		NA	0.0005	0.0001	0.0001	0.0001	0.01
PWQO Guideline →		6.5 – 8.5	0.0009	0.005	0.025	0.006	0.3
Sampled Monitoring Wells	CR4-11	8.04	<0.0005	0.002	<0.003	<0.002	**0.411**
	CV1-01	**8.56**	**0.149**	**0.31**	**0.37**	**0.64**	**378**

Notes: mg/L = milligrams per Litre

Bolded = indicates parameter does not meet the PWQO Guidelines

As shown in **Table 4**, phenols, total chromium, total copper, total manganese, total nickel, total phosphorus, total titanium and total suspended solids exceed the Town's Storm Sewer By-Law limits.

As shown in **Table 5**, pH, total cobalt, total copper, total nickel, total vanadium and total iron exceeded the PWQO guidelines limits.

Given these exceedances, the use of water treatment prior to the discharge to the Town's storm sewer system should be included as part of the dewatering plan.

3. Water Taking Assessment

3.1 Anticipated Dewatering Requirements

According to available design details, and proposed construction elements (which are deepest below grade and affect dewatering requirements) the dewatering requirements were based on the following:

- Construction drawings for each proposed structure and services, as shown in **Appendix A**;
- An assumption that the water table at the proposed structure's construction footprint will be lowered to the target elevation;
- Dewatering target depths will extend to 1 m below the base of the excavation to ensure dry working conditions;
- An assumption that the required excavation will extend 1 m beyond the structure plan footprint in all directions;
- The highest reported water level elevation was considered in the assessment; and,
- The highest hydraulic conductivity between all four (4) monitoring wells was conservatively used.

A summary of the assumptions utilized to calculate dewatering rates are shown below in **Table 6**.

Table 6: Assumptions for Construction Dewatering Rate Estimates

Construction Type	Stations	Excavation Dimensions (m)	Ground Surface Elevation (mASL)[1]	Proposed Lowest Excavation Elevation (mASL)[2]	Aquifer Bottom Elevation (mASL)	Highest Groundwater Elevation (mASL)[3, 4]	Dewatering Target Elevation (mASL)	Hydraulic Conductivity (m/s)
BBP/CR4 Underpass Structure - Future BBP Westbound (WB)	9+950 to 10+000	50 X 17	261.1	249.0	246.8	260.1	248.0	2.08×10^{-6}
BBP/CR4 Underpass Structure - Future BBP Eastbound (EB)	10+000 to 10+050	50 X 17	259.5	249.0	246.8	253.5	248.0	4.88×10^{-7}
New Ditch Right (RT) and Left (LT)	9+900 to 9+950	50 X 3.5	261.3	260.0	256.0	260.11	259.0	2.08×10^{-6}
New Ditch RT and LT	9+950 to 10+000	50 X 3.5	258.1	257.6	253.6	***258.00***	256.6	2.08×10^{-6}
New Ditch RT and LT	10+000 to 10+050	50 X 3.5	256.0	254.7	250.7	***256.00***	253.7	2.08×10^{-6}
New Ditch RT and LT	10+050 to 10+100	50 X 3.5	253.7	252.3	248.3	253.54	251.3	4.88×10^{-7}
New Ditch RT and LT	10+100 to 10+150	50 X 3.5	251.1	250.9	246.9	250.19	249.9	8.78×10^{-9}
New Ditch RT	10+150 to 10+200	50 X 3.5	251.8	250.9	246.9	250.19	249.9	8.78×10^{-9}
New Ditch RT	10+200 to 10+250	50 X 3.5	253.2	250.5	246.5	250.19	249.5	8.78×10^{-9}
New Ditch RT	10+250 to 10+300	50 X 3.5	251.6	249.1	245.1	250.19	248.1	8.78×10^{-9}
New Ditch RT	10+300 to 10+350	50 X 3.5	250.1	249.0	245.0	250.19	248.0	8.78×10^{-9}

Notes: *1 – mASL = metres above mean sea level*
2 – Lowest Elevation of Bottom of Excavation in the Area

3 – Groundwater Level Elevation based on information from near-by well(s)

*4 - **256.0** = Estimated Groundwater Level Elevation based on Information from Near-by Well(s) and Lowest Ground Surface Elevation in the Excavation Area.*

3.2 Dewatering Rate Assessment

It is anticipated that temporary (short-term, non-recurring) construction dewatering will be required to remove water from the construction excavation(s). Excavation areas will collect water from four (4) potential sources:

- Lateral groundwater seepage through excavation sidewalls;
- Groundwater seepage through the base of excavation;
- Overburden storage; and,
- Direct precipitation.

3.2.1 Groundwater Seepage

The dewatering rate (Q), or the steady-state groundwater inflow from an unconfined aquifer to a fully penetrating long narrow excavation (in m^3/s) where the excavation can be represented as a linear source, is estimated using the following equation, which includes linear flow to the sides of the excavation and radial flow to the ends of the long narrow excavation (Powers *et al.*, 2007):

$$Q = 2\left[\frac{x*\pi*K*(H^2-h^2)}{2L}\right] + \left[\frac{\pi*K*(H^2-h^2)}{\ln(R_o/r_w)}\right] \quad \text{(for a linear source)} \qquad (1)$$

Where, K = hydraulic conductivity (m/s)
H = saturated thickness of the aquifer before dewatering (m)
h = saturated thickness of the aquifer after dewatering (m)
x = excavation length
L = distance to a line source of recharge (equivalent to Ro in the absence of a significant recharge boundary
R_o = radius of influence (m)
r_w = equivalent radius of influence (m)

The method used for estimating L and R_0 is an empirical relationship developed by Sichardt and Kyrieleis (1930) that gives L (or R_0) as a function of drawdown and hydraulic conductivity (Cashman and Preene, 2013):

$$L = r_s + 1{,}750(H-h)\sqrt{K} \quad \text{(for a long narrow excavation)} \qquad (2)$$

For a long-narrow excavation area of length x and width a where the ratio of length/width, *x/a > 1.5* (long, narrow trench), the equivalent well radius, r_s, is determined as an estimate of the distance from the centre of the trench to the dewatering system.

As the groundwater inflow equation addresses steady-state conditions, it does not account for the volume of water that is stored in the soils as pore water and would be drained during advanced dewatering or during the excavation process. The dewatering volumes estimated using the above methodology are presented in **Section 3.2.2**.

3.2.2 Total Anticipated Water Taking

The estimated groundwater inflow is summarized in **Table 7** and the detailed calculation, including the radius of influence, is included in **Appendix E.** To account for variability in aquifer thickness, storage affects, recharge

events (i.e., precipitation) and variability in hydraulic conductivity, maximum flow is equivalent to three times the calculated steady-state flow (i.e., Q3 dewatering rate).

Table 7: Dewatering Estimate for Proposed Construction

Construction Type	Stations	Steady State Dewatering Rate 'Q' (L/d)	'Q3' Dewatering Rate (L/d)	Radius of Influence (Ro) (m)
BBP/CR4 Underpass Structure - Future BBP WB	9+950 to 10+000	131,632	394,896	39.1
BBP/CR4 Underpass Structure - Future BBP EB	10+000 to 10+050	23,135	69,404	15.2
New Ditch RT and LT	9+900 to 9+950	20,242	60,726	4.6
New Ditch RT and LT	9+950 to 10+000	22,913	68,738	5.3
New Ditch RT and LT	10+000 to 10+050	30,074	90,222	7.6
New Ditch RT and LT	10+050 to 10+100	11,265	33,795	4.5
New Ditch RT and LT	10+100 to 10+150	201	602	1.8
New Ditch RT	10+150 to 10+200	201	602	1.8
New Ditch RT	10+200 to 10+250	270	809	1.9
New Ditch RT	10+250 to 10+300	532	1,595	2.1
New Ditch RT	10+300 to 10+350	552	1,655	2.1
			Total: 723,044	

3.3 Permitting Requirements

Where construction dewatering volumes between 50,000 and 400,000 L/day are expected, filing of the project on MECP's EASR system is required in accordance with Ontario Regulation 63/16 (as amended). Where expected construction dewatering volumes exceed 400,000 L/day, a PTTW (Category 3) will be required from MECP in accordance with Section 34 of the Ontario Water Resources Act (RSO, 1990). Based on the dewatering estimates provided in **Table 7**, an EASR is recommended to provide dry working conditions within in the excavations even as the total dewatering is anticipated to be a maximum for an excavation at 394,896 L per day. It is assumed that the construction will occur in stages and dewatering volumes will stay well within the limits of an EASR.

Construction dewatering activities have the potential to affect groundwater quantity, resulting in decreases in baseflow to watercourses, groundwater discharge to wetlands, yield of private water wells and alteration of groundwater flow patterns. Where dewatering occurs, local groundwater table elevations will be temporarily lowered to facilitate construction under dry conditions. These effects are typically confined to the radius of influence (R_o) from dewatering activities and are temporary in nature. A detailed assessment of potential ground settlement associated with dewatering was completed by a qualified geotechnical engineer and is presented in in Section 5.

4. Dewatering Discharge

It is recommended that dewatering effluent be directed to the local Town sanitary or storm sewer. Any discharge of water would be subject to the terms and conditions of all required permits obtained by the Contractor based on the actual conditions encountered during construction. Sewer discharge requires by-law authorization from the Town. Due to the close proximity of the construction to agricultural drains, it is suggested that the discharge be directed away from the drains to reduce overland flow and promote infiltration.

If the groundwater pumped for dewatering purposes is to be directed to the natural environment, it is recommended that water quality testing for Provincial Water Quality Objectives (PWQO) be completed prior to dewatering. Given the geological material encountered, it is suggested that the dewatering contractor be prepared to potential deal with treatment for suspended solids prior to discharge to the sanitary sewer.

The results of the baseline water quality sampling completed within the Study Area indicates that dewatering effluent may not fulfill the water quality requirements under the Town of Bradford West Gwillimbury's Sewer Use Bylaw 2013-68 for Storm Sewer Discharge without pre-treatment for the exceeded parameters, as listed in **Table 4**. It will be the responsibility of the dewatering contractor to ensure that any discharge to the local Region sewer system occurs in full compliance with the Town's Sewer Use By-Law (By-Law 2013-68). The Contractor shall ensure that all control measures implemented, and all materials collected or trapped by those measures are recovered and properly disposed of when they are no longer engaging in the activity or discharge to the sanitary sewer. Suggested treatment options for the dewatering discharge is sedimentation tanks and filtration.

The results described are representative of the condition at the sampled monitoring well at the time of sampling and do not necessarily reflect conditions that will be present at the time of construction. Confirmation of local groundwater levels and groundwater quality is recommended to be completed by the Contractor prior to the outset of project construction activities.

Prior to discharging any dewatering effluent, the Contractor will be required to ensure that all necessary discharge permits have been secured and that the water taking plan, discharge plan, a water treatment process and sampling plan has been designed and implemented in accordance with the terms and conditions of such permits and the contract documents.

5. Environmental Considerations

5.1 Groundwater Resources

A search of the MECP WWR database was conducted in the Study Area and within a surrounding 500 m buffer zone and the results identified 86 existing records, as shown in **Figure 4**, **Table 3**, and **Appendix D**.

According to the database, 68 domestic wells, one (1) livestock wells, and two (2) industrial wells were identified in the WWR search. Given that there are numerous water wells located within the Study Area or the 500 m buffer zone, a residential well monitoring program is considered to be required for this project. An initial door-to-door water well survey was completed by AECOM in 2021.

A search of the MECP PTTW and EASR databases returned zero results within the Study Area.

5.2 Wellhead Protection Areas, Highly Vulnerable and Significant Groundwater Recharge Areas

Areas that are vulnerable to contamination have been delineated for active municipal wells and are known as Wellhead Protection Areas (WHPA). A WHPA is the area or capture zone surrounding the wellhead where land use activities have the greatest potential to affect the quality of groundwater within the aquifer from which the well derives its source. According to **Figure 5**, the Study Area lies just outside Wellhead Protection Areas.

A highly vulnerable aquifer (HVA) has a relatively fast path for water to travel from the ground's surface down to the aquifer. Generally, the faster the water is able to flow through the ground to an aquifer, the more vulnerable the area is to contamination. These aquifers typically occur in areas of coarse or sandy soils with a high groundwater table. All HVAs have a vulnerability score of 6 out of 10. As shown in **Figure 5**, HVAs are mapped throughout the Study Area, consideration will have to be made during dewatering to ensure these areas are maintained.

Surface water received from precipitation will percolate or infiltrate into the ground until it reaches the water table. This occurs in surficial sediments that are permeable and allow for easy movement of water through its pore spaces. Areas such as these are known as recharge areas. Significant Groundwater Recharge Areas (SGRAs) are characterized by high permeable soils at surface, such as sand and/or gravel, which allows water to readily pass from the ground surface to an aquifer. These areas are considered significant when they aid in maintaining the water level in an aquifer that provides water for potable means or supplies groundwater to a cold-water ecosystem. The Study Area is west of mapped SGRAs.

5.3 Ground Settlement

Potential ground settlement/subsidence related to existing pavements, sidewalks, buildings, and other structures / infrastructure within the possible dewatering radius of influence should be assessed by an experienced geotechnical engineer (P.Eng.) based on dewatering Ro and magnitude of drawdown required to allow for construction of the planned construction elements within the Study Area.

It is recommended that these utilities be identified through a subsurface utility engineering survey by a qualified Professional Engineer. It is further recommended that all buried utilities, existing buildings/roads and other structures within the dewatering Ro that are planned to remain during and upon completion of construction be properly inspected / surveyed prior to the commencement of any construction activities (including construction

dewatering operation) to establish a pre-construction baseline for the completion of post-construction condition survey or assessment.

The calculation of settlement is based solely on the dewatering process during construction and only a temporary condition was considered. No other loading conditions, such as construction loads, excavation, or loss of fines, are considered in the assessment. The settlement during the drawdown of groundwater table is due to the increase in the effective stress conditions. The dewatering system should be properly designed to prevent any ground loss during construction.

5.4 Contaminant Migration

The potential sources of contamination within the Study Area include potential spills and de-icing salt usage in winter seasons along County Road 4 and local roads/streets.

Groundwater dewatering is anticipated to create a groundwater flow towards the dewatering locations within the radius of influence (ROI), but is not anticipated to cause migration of potential contaminants off-site to the surrounding areas. Given the limited extent of the ROI (approximately 20 m from the dewatering locations), and relatively short duration of dewatering (several weeks for each dewatering location), any migration of groundwater impacts related to salt application and accidental spills, if present, is expected to be minor and contained within the MTO Right-of-Way.

Given the historical nature of the area (agricultural uses), it is suggested that dewatering discharge be directed to the natural environment to promote infiltration, assuming water quality samples meet PWQO.

5.5 Water Conservation

Implementation of long-term water conservation measures is not anticipated to be required for this proposed temporary dewatering water-taking for construction purposes.

6. Proposed Monitoring and Reporting Programs

6.1 Water-Taking Strategies

Based on the groundwater volumes that potentially need to be managed during Project construction and the geological material involved, it is recommended that groundwater exclusion measures, such as the use of sheet pile walls as one example, be considered by the Contractor to minimize the groundwater inflow to the work zone and/or limiting the length of excavation trench open at any given time.

6.2 Water-Taking Volumes

A daily record of the timing, total volumes, and average rate of water-taking at each excavation location shall be maintained by the Contractor on a daily basis during completion of the Project. The flow meter(s) shall be calibrated prior to use and installed / operated in accordance with manufacturer specifications.

6.3 Groundwater Level Monitoring

Additional monitoring wells are currently being installed as part of the project, monitoring wells monitored to assess and refine dewatering calculations and assumptions as described in **Section 3.2**. Should the location of any existing monitoring wells be in conflict with the location(s) of Project construction or damaged as a result of Project construction activities, it is recommended that an MECP licenced water well contractor be retained by the Contractor to decommission those locations in accordance with Ontario Regulation 903 (Wells), as amended. It is further recommended that replacement well(s) be installed by a licenced environmental drilling contractor to replace any decommissioned monitoring wells and/or piezometers.

The monitoring wells monitored during this field program as discussed in **Section 2.3.1** can be included in the monitoring plan. The proposed frequency of groundwater level measurement within the existing monitoring well network is as noted in **Table 9**.

Table 8: Groundwater Level Monitoring Program Details

	Dewatering Period	Measurement Frequency
Pre-Construction & During Construction	1st Week	Daily
	2nd Week to End of 1st Month	Weekly
	End of 1st Month to Program Completion	Bi-Weekly
Post-Construction	Monthly monitoring will be obtained for six months after construction has completed or until baseline conditions are obtained.	

The monitoring of surface water is not included as part of the monitoring program described herein. However, the monitoring of surface water should be considered prior to, during and post construction should any dewatering discharge to a local surface water feature be required for any reason.

Where the monitoring completed above identifies a significant amount of water level drawdown (i.e., in excess of 0.3 m at a monitored location more than 92 m [R_o] away from the dewatering area), immediate action should be taken by the Contractor to assess and potentially modify their dewatering approach / methodology, and/or rate / duration of pumping, so as to limit the dewatering R_o and alleviate the observed groundwater level impact.

6.4 Confirmatory Sampling Program

It is recommended that the Contractor pursue permission for sanitary sewer discharge from the Town of Bradford West Gwillimbury. The following sections have been prepared outlining proposed requirements for the discharge of dewatering effluent that should be modified, if required, based on the discharge permit obtained.

6.4.1 Water Quality / Treatment Standards

Dewatering effluent is proposed to meet the following Water Quality Standards prior to discharging into the municipal storm and/or sanitary sewer systems:

- Town of Bradford West Gwillimbury's Sewer Use Bylaw (Bylaw 2013-68)

Adequate pre-treatment shall be provided by the Contractor at each dewatering location to achieve compliance with prior to any off-Site discharge occurring. Establishing treatment methodology (settling tank and filtration) is the responsibility of the Contractor and may be further informed by the raw (pumped) water quality and confirmatory sampling results obtained by the Contractor.

6.4.2 Proposed Confirmatory Sampling Program

Pre-assessment sampling of the water that is planned to be discharged is to be completed by the Contractor and submitted to an accredited environmental analytical laboratory for quality testing against applicable parameter concentration limits (e.g., Regional Sewer Use By-laws). The intent of this sampling is to confirm both the background (raw) and Contractor's treated water quality prior to the commencement of any dewatering discharge activities.

Regular sampling and testing of the discharge by the Contractor will be required during construction to verify that the effluent quality continues to comply with region's sewer use by-law limits and permits, as applicable. The recommended frequency of confirmatory sample collection is summarized in **Table 9**.

Table 9: Confirmatory Sampling Frequency*

Dewatering Period	Sampling Frequency
1st Week	Twice
2nd Week to End of 1st Month	Weekly
End of 1st Month to Program Completion	Monthly

Notes: ****To be modified as appropriate based on the discharge permit received.***

A visual inspection must be completed by the Contractor along with the collection of in-field turbidity and temperature measurements (both untreated and treated effluent discharge streams) on a daily basis during periods of active discharge for the duration of the dewatering system(s) operation.

In the event that a sample is determined to be 'unacceptable' based on the applicable water quality standards, field turbidity and/or temperature monitoring activities, additional effluent samples must be obtained by the Contractor immediately upon receipt of the initial laboratory results for verification purposes.

Where the verification sampling is confirmed, immediate action should be taken by the Contractor to assess and potentially modify their dewatering approach / methodology, rate / duration of pumping, and/or provide

additional / alternative pre-treatment prior resuming any further discharge. Prior to resuming any effluent discharge, a confirmatory sample should be obtained by the Contractor confirming adherence with the applicable water quality standards.

Where the verification sampling is determined to be anomalous, the confirmatory sampling program is recommended to resume at the staged sampling frequency outlined in **Table 9**.

6.4.3 Analytical Testing Suite for Confirmatory Samples

The analytical testing package for confirmatory samples is proposed to comprise a suite of metals, inorganics, volatile organic carbons (VOCs), and general water chemistry parameters (including TSS and turbidity), inclusive of the complete parameter list in the Town of Bradford West Gwillimbury's Sewer Use Bylaw 2013-68. Confirmatory Samples shall be submitted to a CALA-accredited environmental analytical laboratory for testing.

7. Closure

This hydrogeological dewatering assessment was completed for the intended purpose of characterizing the local physical and groundwater setting, quantifying potential dewatering requirements for construction, assessing possible impacts to local water wells and groundwater dependant environmental features, and to recommend appropriate discharge, mitigation and monitoring measures, as required. This report provides a summary, interpretation and discussion of the assessment results.

The results of AECOM's Hydrogeological Investigation were relied upon by AECOM in the completion of this assessment. AECOM has assumed that all information provided was factual and accurate. Judgement has been used by AECOM in the interpretation of the field information provided. However, it is recognized that subsurface physical and chemical characteristics may vary between or beyond borehole locations given the variability observed in local geological and hydrogeological conditions. If variability in geologic and/or hydrogeologic conditions, in comparison to the information presented in this report, is observed at the time of construction, AECOM should be contacted to review the conditions present and assess the potential implications.

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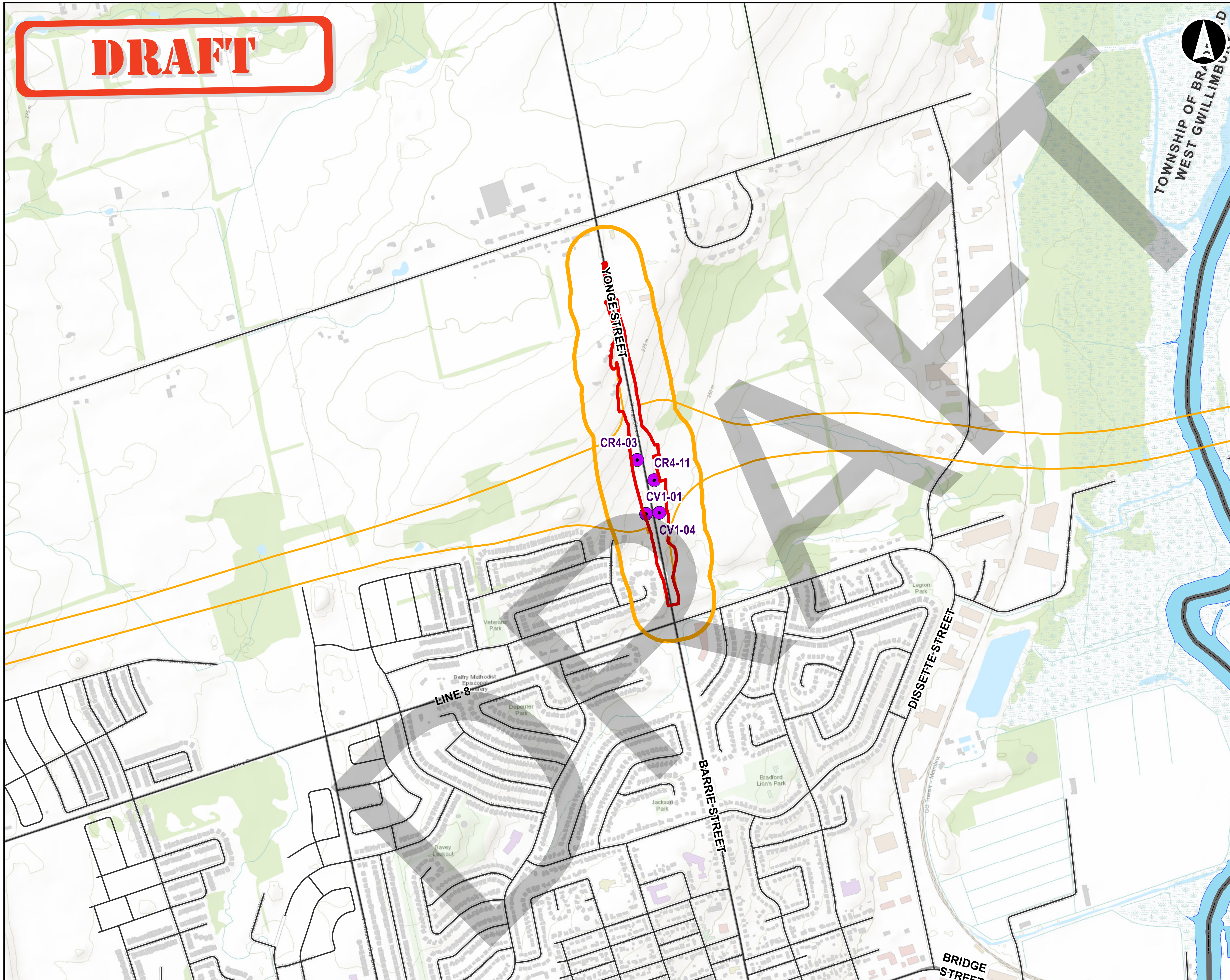
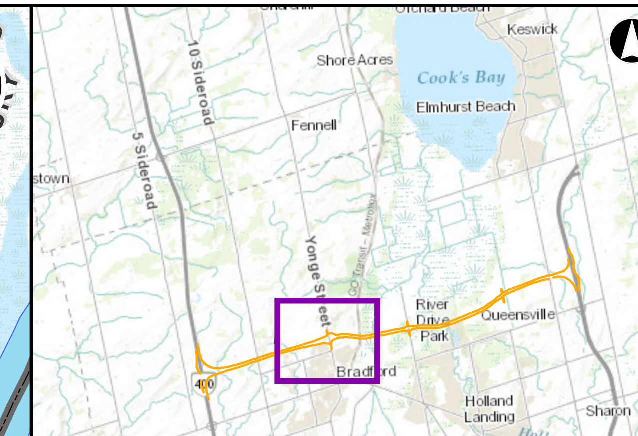
Figures





Legend

- Highway 400 - Highway 404 Link (Bradford Bypass) Right of Way
- Foundation BH Locations

Roads

- Provincial Highway
- Other
- Municipality Boundary
- Waterbody

0 145 290 580 870

Meters

Highway 400 - Highway 404 Link (Bradford Bypass)

County Road 4 Monitoring Well Locations

December 2021	1:12,500 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
	V: Study Area	Figure 1
AECOM		

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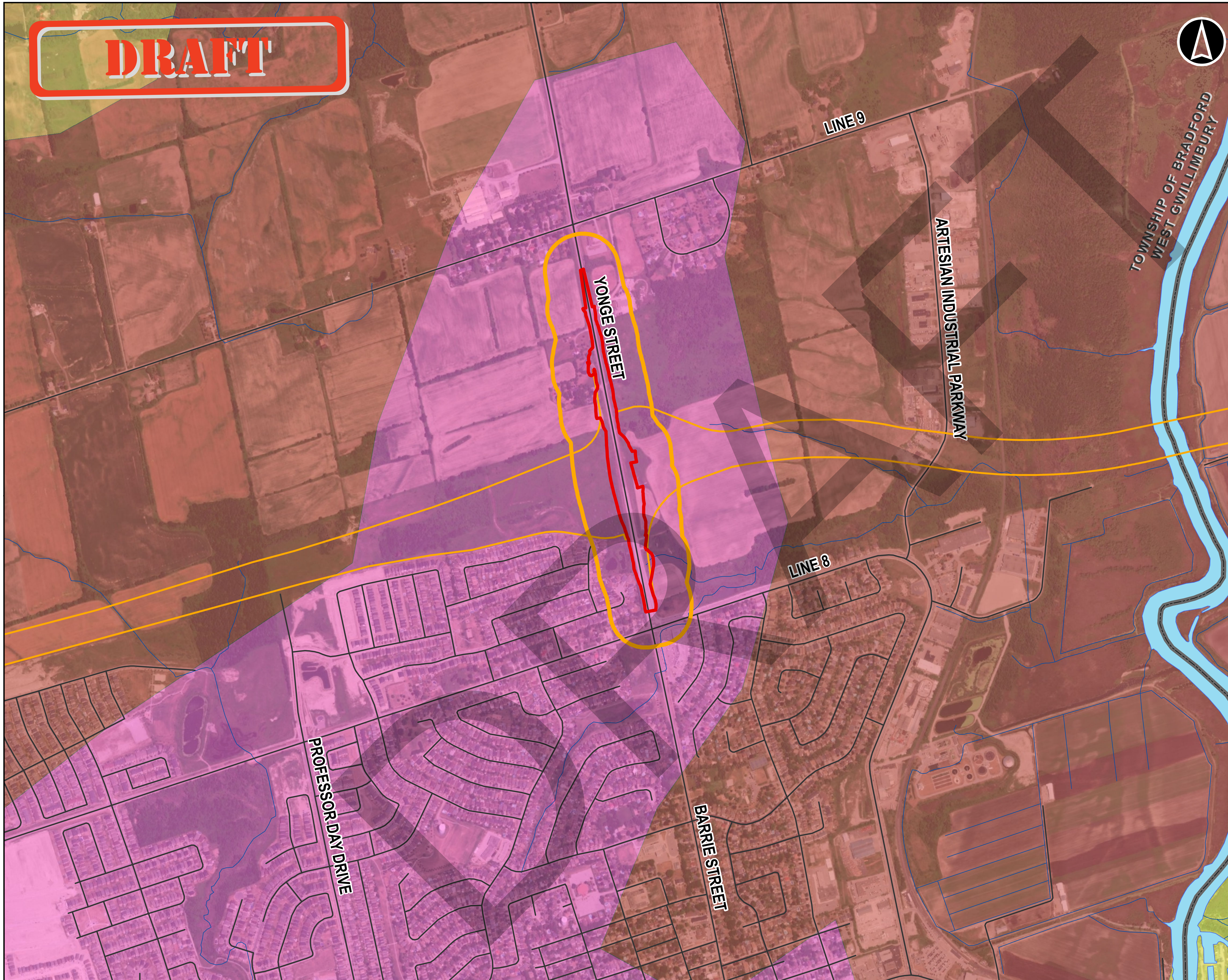
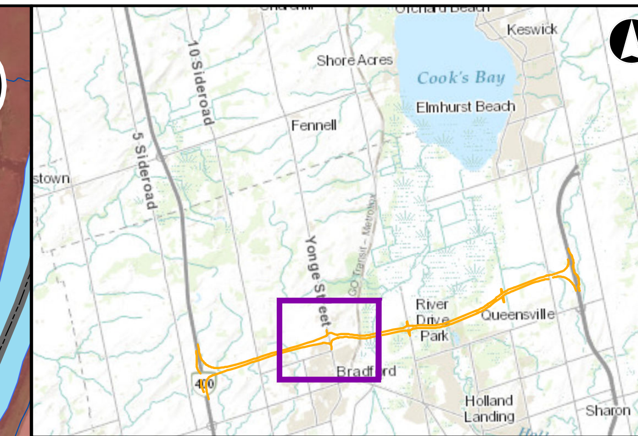




Legend

- Study Area Boundary
- County Road 4 Limits of Work
- Highway 400 - Highway 404 Link (Bradford Bypass) Right of Way

Roads

- Provincial Highway
- Other
- Municipality Boundary
- Waterbody
- Watercourses

Quaternary Geology

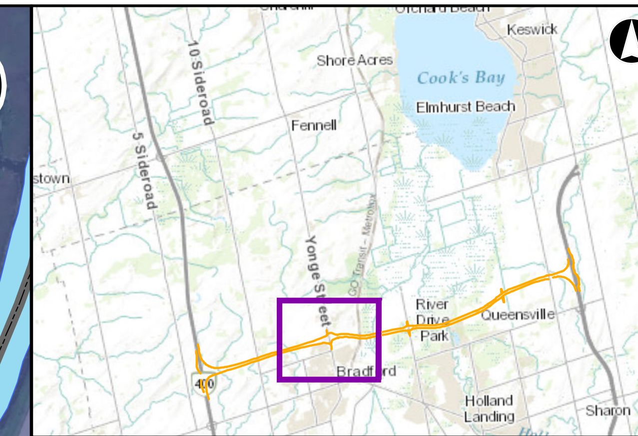
- 13: Sandy Silt to Silt (Newmarket Till)
- 22 and 23: Gravel and Sand (Ice-contact/Outwash Deposits)
- 24: Silt and Clay (Glaciolacustrine basin and quiet water deposits)
- 25: Sand and Gravel (Glaciolacustrine nearshore and beach deposits)

0 145 290 580 870
Meters

Highway 400 - Highway 404 Link (Bradford Bypass)

Quaternary Geology

December 2021	1:12,500 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS
	V: Study Area	
AECOM		**Figure 2**



Legend

- Study Area Boundary
- County Road 4 Limits of Work
- Highway 400 - Highway 404 Link (Bradford Bypass) Right of Way

Roads

- Provincial Highway
- Other
- Municipality Boundary
- Waterbody

Bedrock Geology

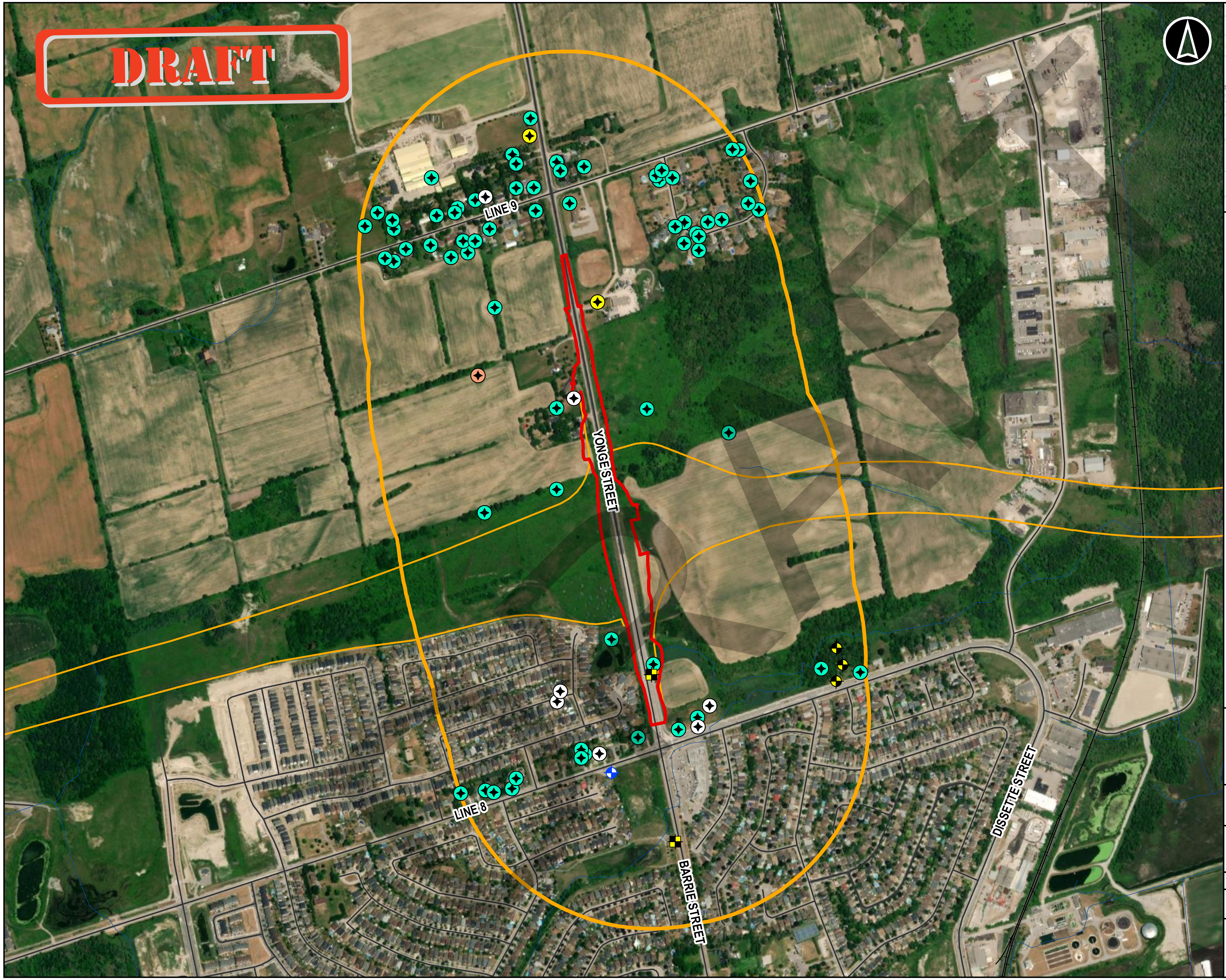
- 54a: Limestone, dolostone, shale, arkose, sandstone (Bass Islands Fm)

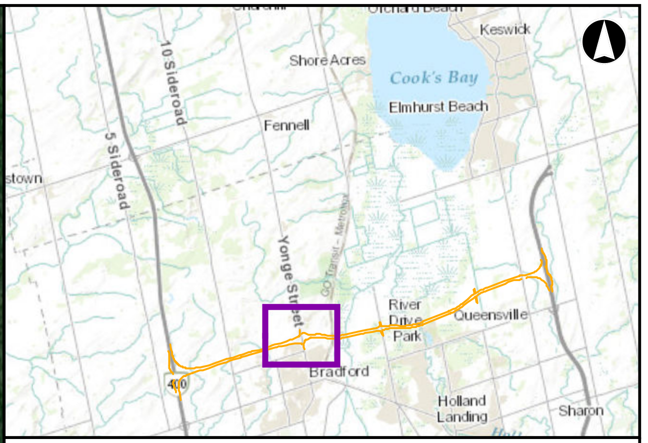
0 145 290 580 870
Meters

Highway 400 - Highway 404 Link (Bradford Bypass)

Quaternary Geology

December 2021	1:12,500 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS
	V: Study Area	
AECOM		Figure 3





Legend

- Study Area Boundary
- County Road 4 Limits of Work
- Highway 400 - Highway 404 Link (Bradford Bypass) Right of Way
- Rail
- Watercourses
- Waterbody
- Municipality Boundary

Roads

- Provincial Highway
- Other

MECP Water Wells

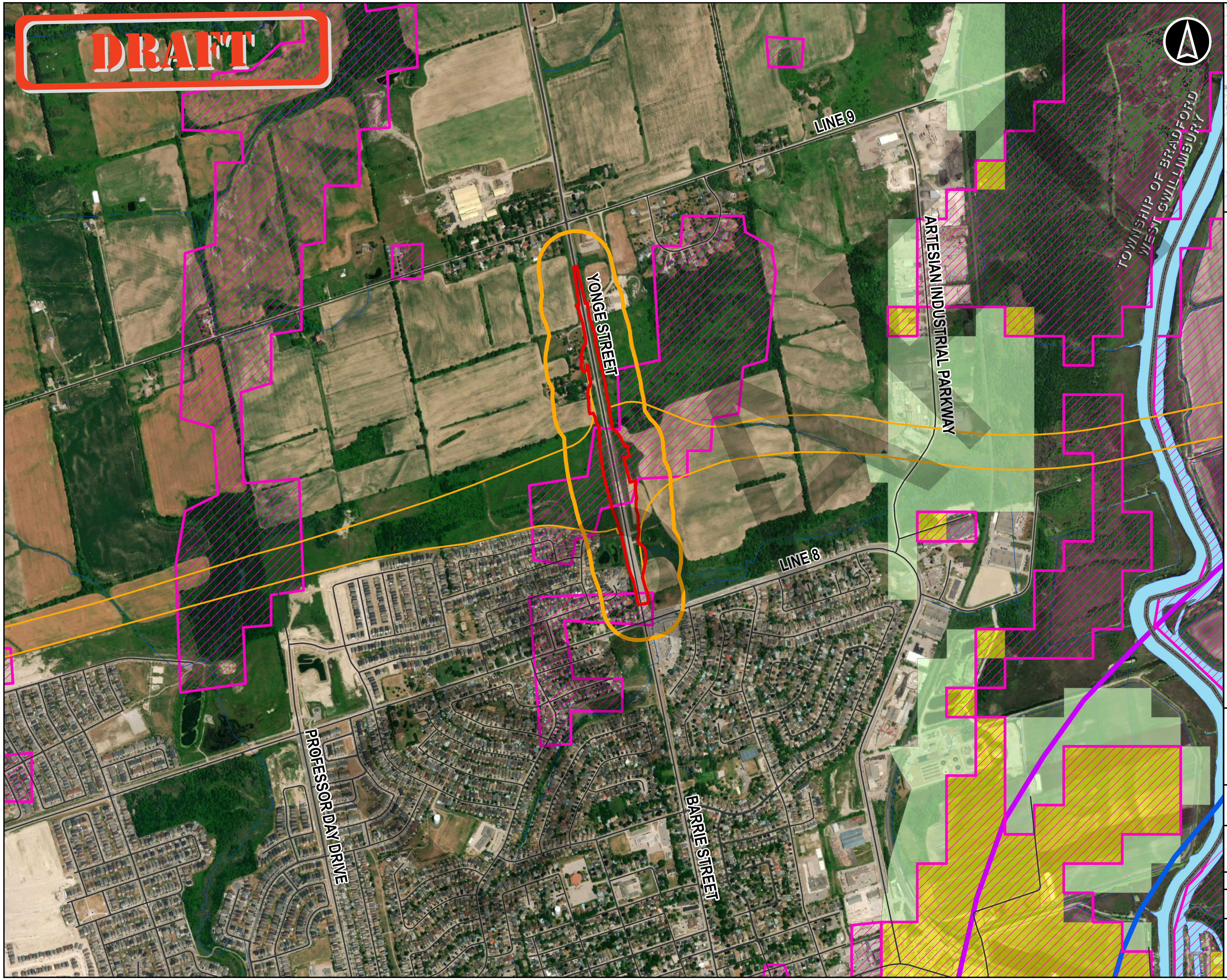
- Domestic
- Industrial
- Livestock
- Not Used
- Monitoring
- Monitoring and Test Hole
- Test Hole

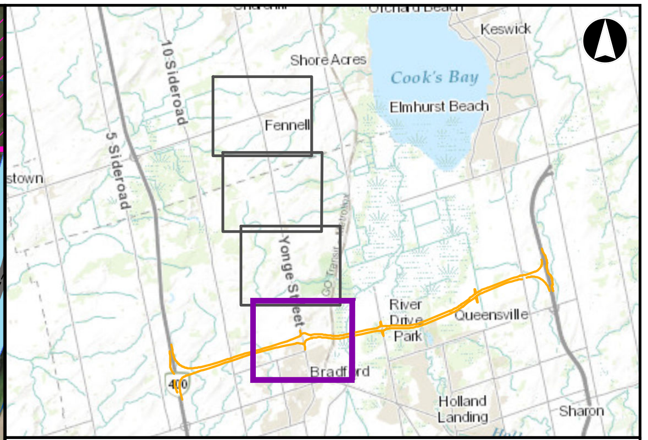
0 100 200 400 600
Meters

Highway 400 - Highway 404 Link (Bradford Bypass)

County Road 4 Hydrogeological Investigation

December 2021	1:9,000 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS
	V: 00	
AECOM		Figure 4





Legend

- Study Area Boundary
- County Road 4 Limits of Work
- Highway 400 - Highway 404 Link (Bradford Bypass) Right of Way

Roads

- Provincial Highway
- Other
- Municipality Boundary
- Waterbody
- Watercourses
- Highly Vulnerable Aquifer

Wellhead Protection Areas

- WHPA-C1
- WHPA-D

SGRA Vulnerability Level

- High
- Low

0 145 290 580 870
Meters

Highway 400 - Highway 404 Link (Bradford Bypass)

Highly Vulnerable Aquifers and Significant Groundwater Recharge Areas

December 2021	1:12,500 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS
	V: Study Area	Figure 5

AECOM

Map location: D:\AECOM-Work\60601761 Brdfd Byps\Design\01_Reports\Groundwater\M
Date Saved: 12/10/2021 10:19:44 AM User Name: carmichaelr

Appendix A

Proposed Construction Design

30% SUBMISSION
SEPTEMBER 03, 2021

CONTRACT DRAWINGS
WP NO. 2007-21-01
GWP NO. 2008-21-00
CONTRACT NO. 2021-2124
BOOK 1 OF 1

CENTRAL REGION

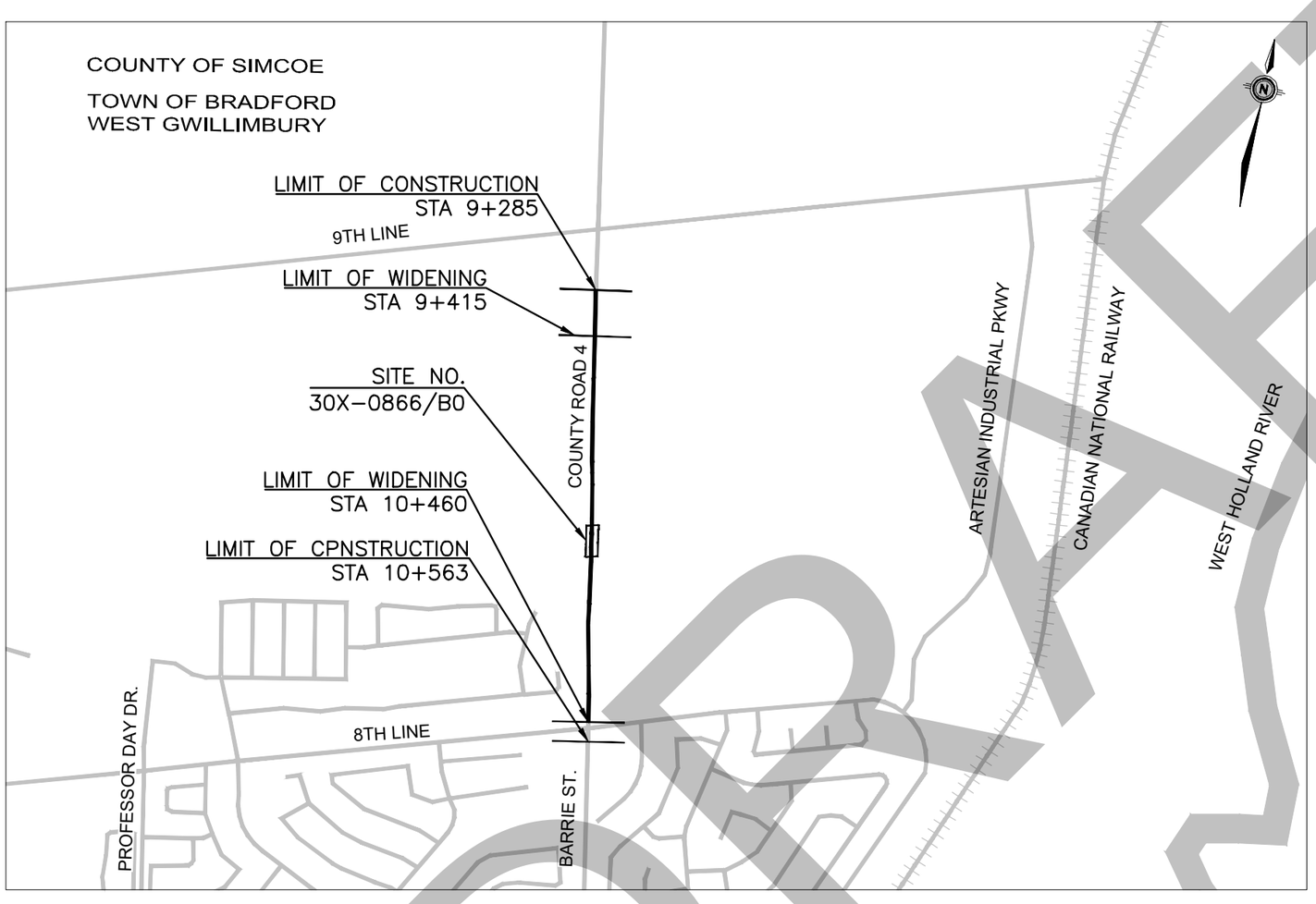
THIS DRAWING PACKAGE IS A PRELIMINARY DOCUMENT AND IS NOT TO BE USED AS THE BASIS FOR FINAL DESIGN, CONSTRUCTION OR REMEDIAL ACTION, OR AS A BASIS FOR MAJOR CAPITAL DECISIONS. PLEASE BE ADVISED THAT FINAL DETAIL DESIGN DRAWINGS WILL BE PREPARED BY OTHERS.

Ministry of Transportation

Ontario

COUNTY OF SIMCOE

TOWN OF BRADFORD
WEST GWILLIMBURY



Key Plan

WP No 2007-21-01 GWP No 2008-21-00 Contract No 2021-2124

Work of GRADING, DRAINAGE, GRANULAR BASE, PAVING, ELECTRICAL AND STRUCTURAL

Hwy No SIMCOE ROAD 4 Region CENTRAL

Location FROM 200m SOUTH OF BRADFORD WEST GWILLIMBURY 9th LINE INTERSECTION TO NORTH OF BRADFORD WEST GWILLIMBURY 8th LINE INTERSECTION

Length 1.1 km

Reference Plans

Date

P. Eng.
Manager, Engineering

Date

P. Eng.
Regional Director

Ministry Of Transportation

Ontario

MINISTRY OF TRANSPORTATION, ONTARIO PH-0-302 89-10

DRAWING NAME: 60543038-C-KEYPLAN-HWY410-Cont3.dwg
CREATED: 2017/05/16 MODIFIED: 2018/07/02 19:32:25

ANTICIPATED TIMING CONSTRAINTS (SUBJECT TO CHANGE)

LEGEND

- ACCESS RESTRICTED PRIOR TO XXXX 2022–FOR ARCHAEOLOGY CLEARANCE
- ACCESS RESTRICTED PRIOR TO XXXX 2022–FOR PROPERTY CLEARANCE
- ACCESS RESTRICTED PRIOR TO XXXX – TEMPORARY LIMITED INTEREST FOR CONSTRUCTION STAGING, DRAINAGE, AND CULVERT WORKS (AVAILABLE UNTIL DECEMBER 2025)
- ACCESS RESTRICTED. MTO OWNED LANDS, NOT AVAILABLE TO CONTRACTOR

Ontario Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

CONSTRUCTION CONSTRAINTS
COUNTY ROAD 4

STA TO STA
Survey Revised

AECOM

SHEET 1

GEOGRAPHIC TOWNSHIP OF WEST GWILLIMBURY
MUNICIPALITY OF SIMCOE

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

9TH LINE

8TH LINE

PROPOSED MTO ROW

℄ COUNTY ROAD 4

PROPOSED MTO ROW

NORTHING=4889097.43
EASTING=299304.22

NORTHING=4888086.73
EASTING=299206.83

NORTHING=4887494.79
EASTING=299911.12

NORTHING=4887490.30
EASTING=299390.18

NORTHING=4887481.21
EASTING=299397.82

NORTHING=4887477.53
EASTING=299385.42

NORTHING=4887433.78
EASTING=299377.99

NORTHING=4887415.11
EASTING=299381.14

NORTHING=4887707.39
EASTING=299275.30

NORTHING=4887698.99
EASTING=299232.19

NORTHING=4887618.02
EASTING=299287.75

NORTHING=4887590.35
EASTING=299305.39

NORTHING=4887586.69
EASTING=299284.59

NORTHING=4888218.31
EASTING=299187.94

NORTHING=4888211.38
EASTING=299165.52

NORTHING=4888057.02
EASTING=299168.95

LOT 15
CON 9

LOT 15
CON 8

LOT
CON

SCALE
20m 0 40m
Horizontal

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

Ontario Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

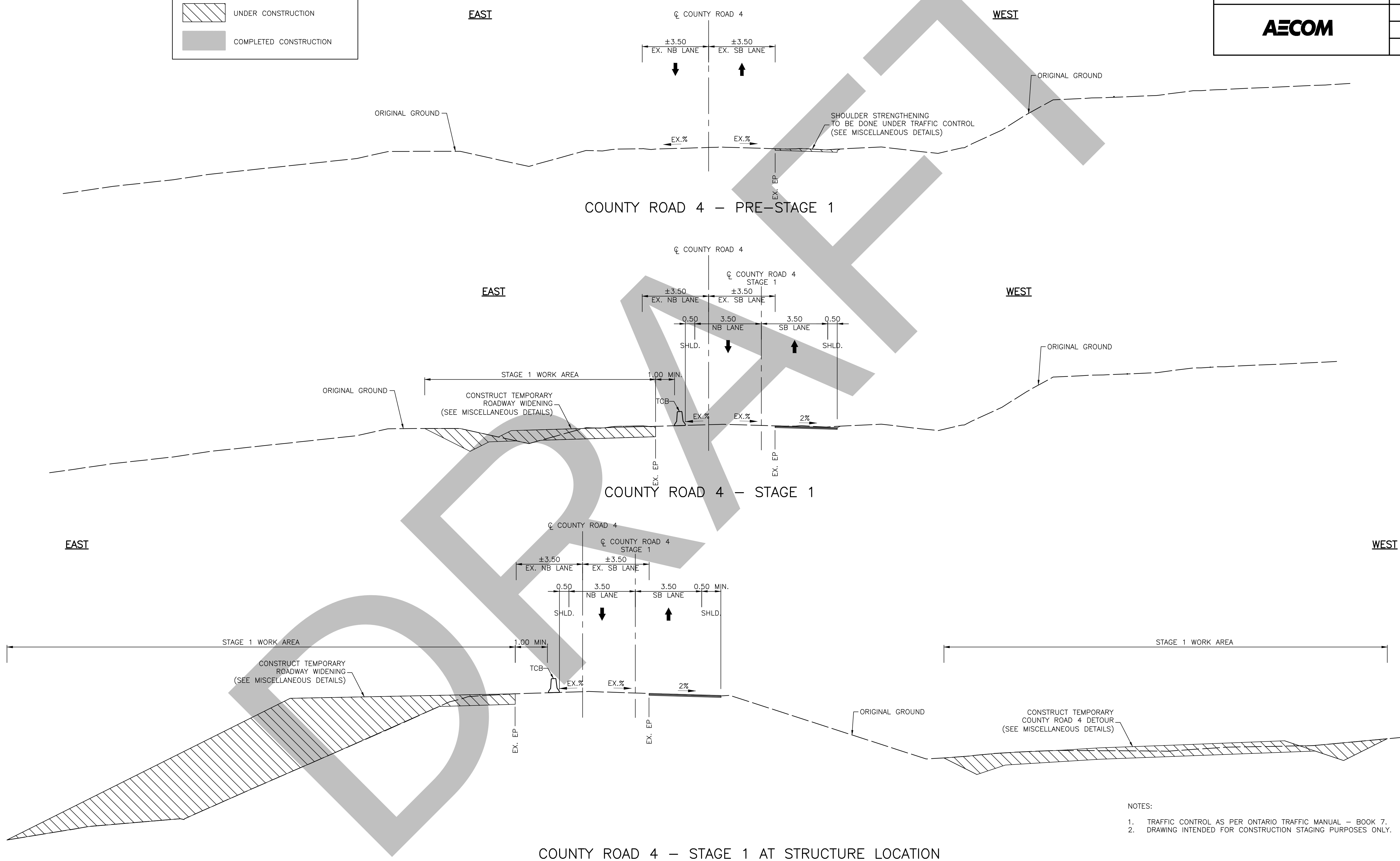
STAGING TYPICAL SECTIONS
COUNTY ROAD 4

SHEET 2

AECOM

LEGEND:

- UNDER CONSTRUCTION
- COMPLETED CONSTRUCTION



NOTES:

1. TRAFFIC CONTROL AS PER ONTARIO TRAFFIC MANUAL – BOOK 7.
2. DRAWING INTENDED FOR CONSTRUCTION STAGING PURPOSES ONLY.

N.T.S.

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

DRAFT

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

Ontario Ministry of Transportation

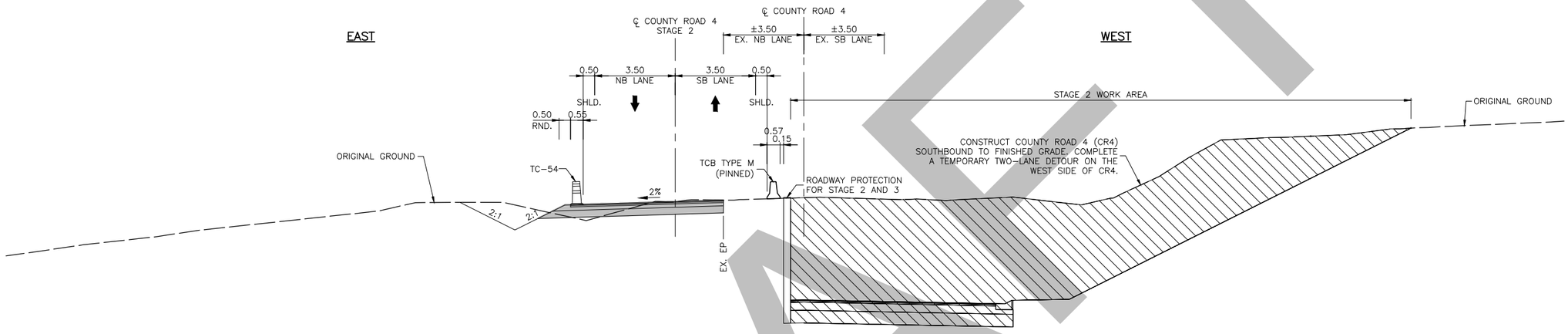
CONT 2021–2124
WP 2007–21–01

STAGING TYPICAL SECTIONS
COUNTY ROAD 4

SHEET 3

AECOM

LEGEND:
- UNDER CONSTRUCTION
- COMPLETED CONSTRUCTION



COUNTY ROAD 4 – STAGE 2

NOTES:

1. TRAFFIC CONTROL AS PER ONTARIO TRAFFIC MANUAL – BOOK 7.
2. DRAWING INTENDED FOR CONSTRUCTION STAGING PURPOSES ONLY.

N.T.S.

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

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2	SOLID DOUBLE YELLOW,10cm
3	363 BROKEN YELLOW,10cm
4	SOLID YELLOW,20cm
5	SOLID WHITE,10cm
6	333 BROKEN WHITE,10cm
7	363 BROKEN WHITE,10cm
8	393 BROKEN WHITE,10cm
9	SOLID WHITE,20cm
10	111 BROKEN WHITE,20cm
11	333 BROKEN WHITE,20cm
12	333 BROKEN WHITE,30cm
13	SOLID WHITE,30cm
14	SOLID WHITE,45cm
15	SOLID WHITE,60cm
16	111 BROKEN WHITE,10cm
18	SOLID YELLOW, 10cm & 363 BROKEN WHITE, 10cm
20	SYMBOLS
] [	LIMITS OF MARKINGS

LEGEND :

NOTES:

1. 333, 363, 393, Denotes Pavement Marking Spacing (ie., 3 m line, 3 m gap, 3 m line)
2. Use (1) to Denote PAVEMENT MARKING
3. Use [1] to Denote PAVEMENT MARKING, TEMPORARY
4. Use (triangle) to Denote PAVEMENT MARKING, TEMPORARY – REMOVABLE
5. Use (1) to Denote PAVEMENT MARKING, DURABLE
6. ALL MARKINGS AND TRAFFIC SIGNS MUST CONFORM TO ONTARIO TRAFFIC MANUAL (OTM)
7. MISSING/ADDITIONAL SIGNS AS PER OTM BOOK 7 SHALL BE INSTALLED AS REQUIRED
8. PROPOSED MARKINGS TO MATCH EXISTING AT ALL WORK AND/OR ROAD CONSTRUCTION LIMITS

TRAFFIC FLOW DIRECTION ARROW
TC-54
TEMPORARY ENERGY ATTENUATOR
TEMPORARY CONCRETE BARRIER (TCB)
UNDER CONSTRUCTION
COMPLETED CONSTRUCTION

DRAFT

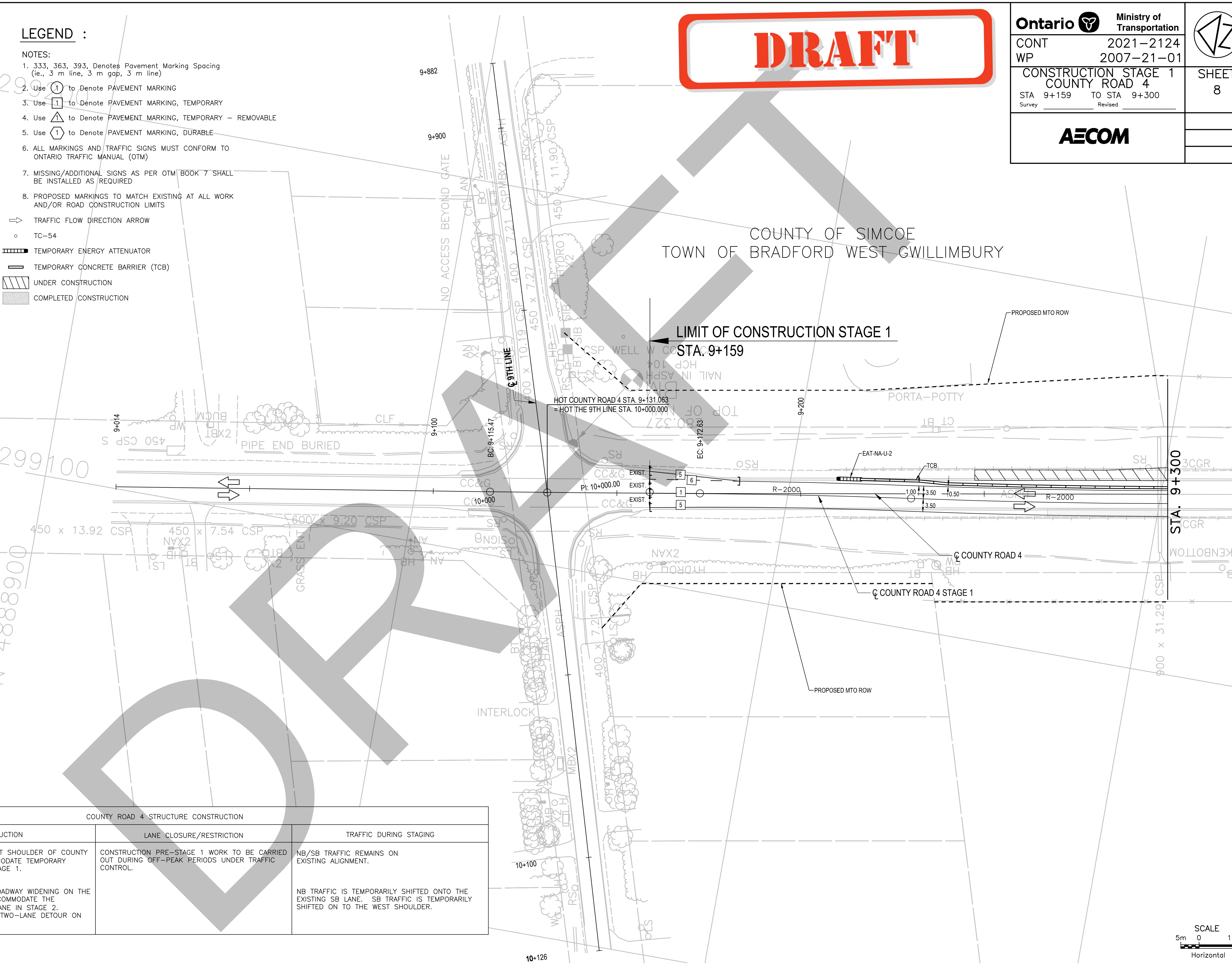
Ontario Ministry of Transportation

CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 1
COUNTY ROAD 4
STA 9+159 TO STA 9+300
Survey Revised

SHEET 8

AECOM



COUNTY ROAD 4 STRUCTURE CONSTRUCTION			
STAGE	CONSTRUCTION	LANE CLOSURE/RESTRICTION	TRAFFIC DURING STAGING
PRE–STAGE 1	STRENGTHEN EXISTING WEST SHOULDER OF COUNTY ROAD 4 (CR4) TO ACCOMMODATE TEMPORARY TRAFFIC LANE SHIFT IN STAGE 1.	CONSTRUCTION PRE–STAGE 1 WORK TO BE CARRIED OUT DURING OFF–PEAK PERIODS UNDER TRAFFIC CONTROL.	NB/SB TRAFFIC REMAINS ON EXISTING ALIGNMENT.
1	CONSTRUCT TEMPORARY ROADWAY WIDENING ON THE EAST SIDE OF CR4 TO ACCOMMODATE THE SHIFTED EB/WB TRAFFIC LANE IN STAGE 2. CONSTRUCT A TEMPORARY TWO–LANE DETOUR ON THE WEST SIDE OF CR4.		NB TRAFFIC IS TEMPORARILY SHIFTED ONTO THE EXISTING SB LANE. SB TRAFFIC IS TEMPORARILY SHIFTED ON TO THE WEST SHOULDER.

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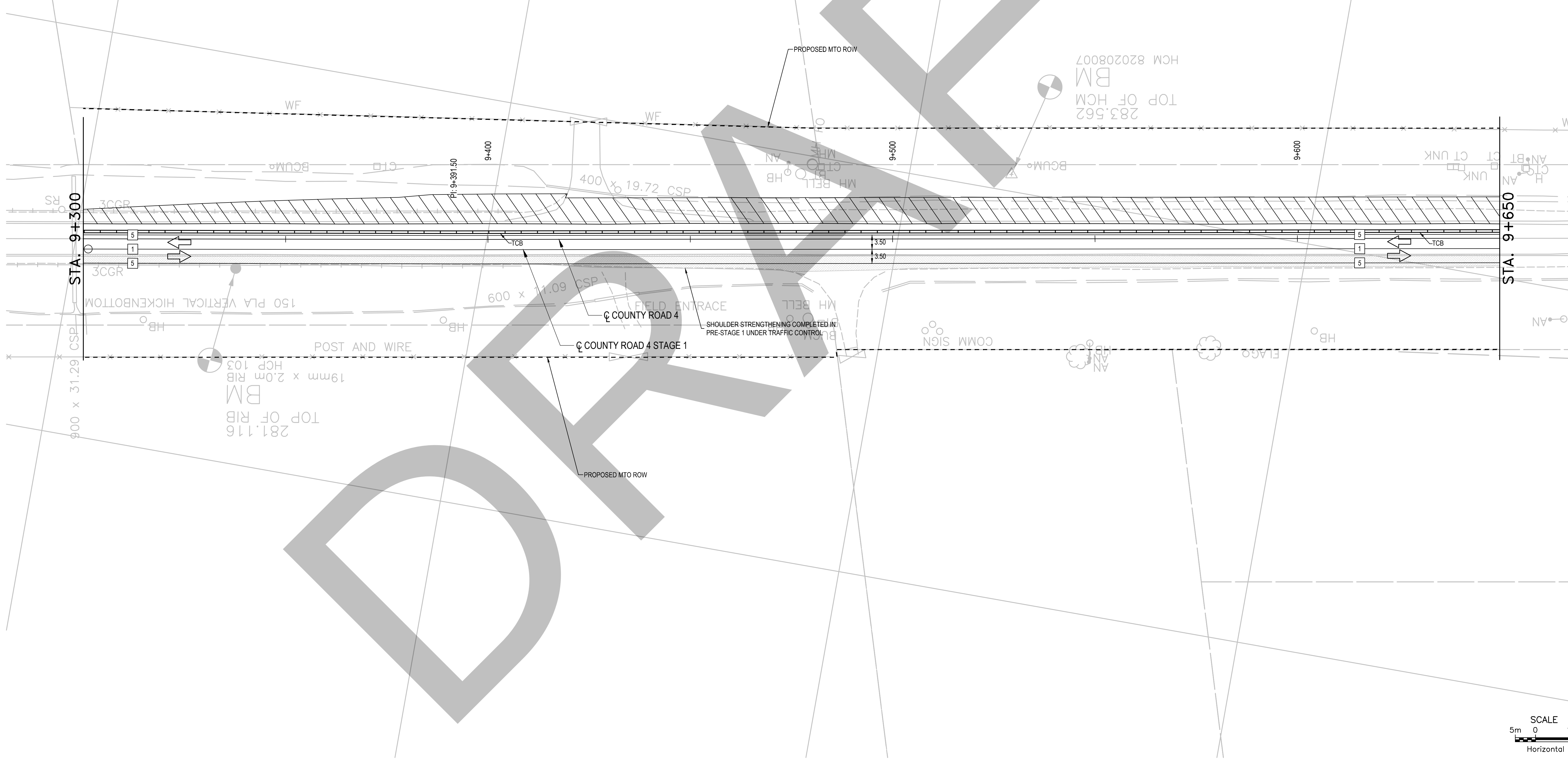
MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

NOTE:
1. DRIVEWAY AND ENTRANCE ACCESSES TO BE MAINTAINED DURING CONSTRUCTION

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

Ontario Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
CONSTRUCTION STAGE 1 COUNTY ROAD 4	SHEET 9
STA 9+300 TO STA 9+650	
AECOM	



Ontario Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

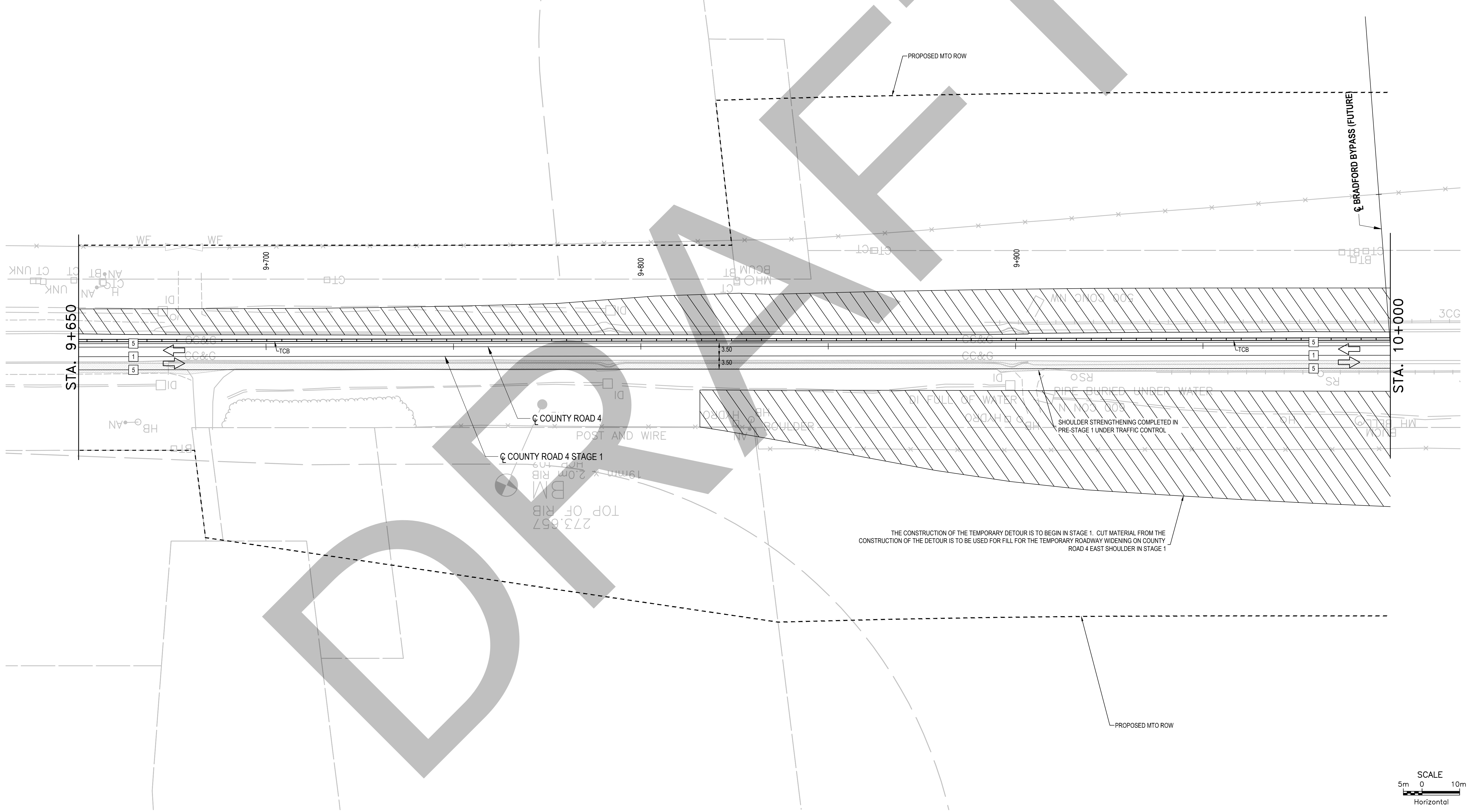
CONSTRUCTION STAGE 1
COUNTY ROAD 4
STA 9+650 TO STA 10+000
Survey Revised

SHEET 10

AECOM

DRAFT

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

Ontario — Ministry of Transportation

CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 1
COUNTY ROAD 4
STA 10+000 TO STA 10+350
Survey _____ Revised _____

SHEET 11

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

PROPOSED MTO ROW

SHOULDER STRENGTHENING TO BE CARRIED OUT DURING OFF-PEAK PERIODS UNDER TRAFFIC CONTROL

CULVERT TO BE EXTENDED AS REQUIRED

CULVERT TO BE EXTENDED AS REQUIRED

STA. 10+000

STA. 10+350

10+100

10+200

10+300

PI: 10+117.62

TCB

EAT-NA-U-2

TC-54

R-2000

R–3000

3.50

0.50

1.00

15+500

℄ COUNTY ROAD 4

℄ COUNTY ROAD 4 STAGE 1

THE CONSTRUCTION OF THE TEMPORARY DETOUR IS TO BEGIN IN STAGE 1. CUT MATERIAL FROM THE CONSTRUCTION OF THE DETOUR IS TO BE USED FOR FILL FOR THE TEMPORARY ROADWAY WIDENING ON COUNTY ROAD 4 EAST SHOULDER IN STAGE 1

℄ BRADFORD BYPASS (FUTURE)

PROPOSED MTO ROW

15+400

SCALE
5m 0 10m
Horizontal

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

DRAFT

Ontario — Ministry of Transportation

CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 1
COUNTY ROAD 4
STA 10+350 TO STA 10+488
Survey _____ Revised _____

SHEET 12

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

PROPOSED MTO ROW

LIMIT OF CONSTRUCTION STAGE 1
STA. 10+488

℄ 8TH LINE

PI: 9+968.99

HOT STA. 10+518.068 COUNTY ROAD 4
= HOT STA. 10+000.000 THE 8TH LINE

℄ COUNTY ROAD 4

STA. 10+350

R=2000
R=3000
3.50
3.50 LT-TURN
3.50 LT-TURN
3.50 THROUGH
3.50 RT-TURN
EXIST.

℄ COUNTY ROAD 4 STAGE 1

PROPOSED MTO ROW

9+867
9+900
10+000
10+100
10+111
10+400
10+500
10+600
10+630

E 299400
E 299300

SCALE
5m 0 10m
Horizontal

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2	SOLID DOUBLE YELLOW,10cm
3	363 BROKEN YELLOW,10cm
4	SOLID YELLOW,20cm
5	SOLID WHITE,10cm
6	333 BROKEN WHITE,10cm
7	363 BROKEN WHITE,10cm
8	393 BROKEN WHITE,10cm
9	SOLID WHITE,20cm
10	111 BROKEN WHITE,20cm
11	333 BROKEN WHITE,20cm
12	333 BROKEN WHITE,30cm
13	SOLID WHITE,30cm
14	SOLID WHITE,45cm
15	SOLID WHITE,60cm
16	111 BROKEN WHITE,10cm
18	SOLID YELLOW, 10cm & 363 BROKEN WHITE, 10cm
20	SYMBOLS
] [	LIMITS OF MARKINGS

LEGEND :

NOTES:

1. 333, 363, 393, Denotes Pavement Marking Spacing (ie., 3 m line, 3 m gap, 3 m line)
2. Use (1) to Denote PAVEMENT MARKING
3. Use [1] to Denote PAVEMENT MARKING, TEMPORARY
4. Use ⚠1 to Denote PAVEMENT MARKING, TEMPORARY – REMOVABLE
5. Use ⬡1 to Denote PAVEMENT MARKING, DURABLE
6. ALL MARKINGS AND TRAFFIC SIGNS MUST CONFORM TO ONTARIO TRAFFIC MANUAL (OTM)
7. MISSING/ADDITIONAL SIGNS AS PER OTM BOOK 7 SHALL BE INSTALLED AS REQUIRED
8. PROPOSED MARKINGS TO MATCH EXISTING AT ALL WORK AND/OR ROAD CONSTRUCTION LIMITS

- TRAFFIC FLOW DIRECTION ARROW
- TC-54
- TEMPORARY ENERGY ATTENUATOR
- TEMPORARY CONCRETE BARRIER (TCB)
- UNDER CONSTRUCTION
- COMPLETED CONSTRUCTION

DRAFT

Ontario Ministry of Transportation

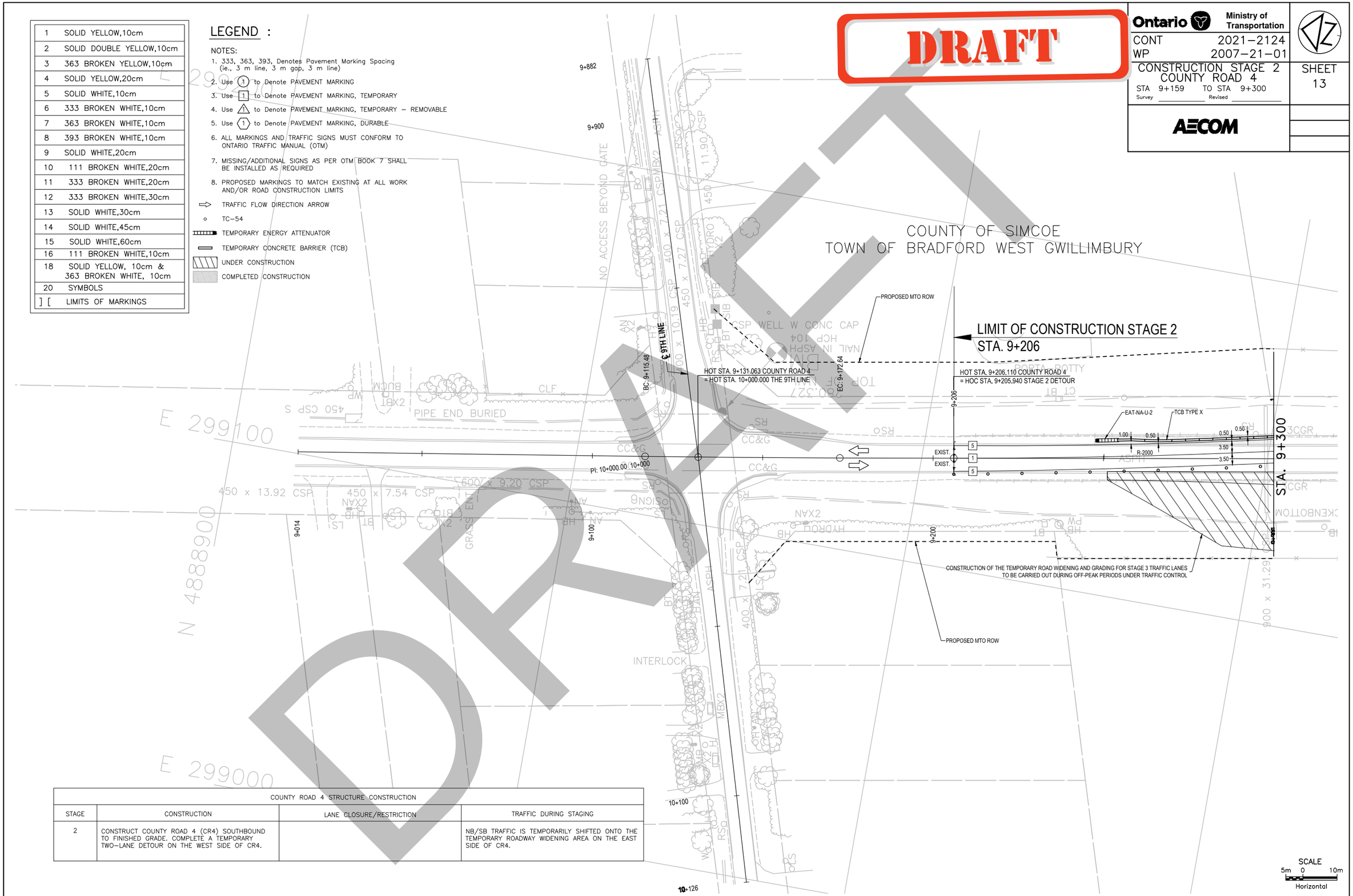
CONT 2021-2124
WP 2007-21-01

CONSTRUCTION STAGE 2
COUNTY ROAD 4
STA 9+159 TO STA 9+300
Survey _____ Revised _____

SHEET 13

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



COUNTY ROAD 4 STRUCTURE CONSTRUCTION			
STAGE	CONSTRUCTION	LANE CLOSURE/RESTRICTION	TRAFFIC DURING STAGING
2	CONSTRUCT COUNTY ROAD 4 (CR4) SOUTHBOUND TO FINISHED GRADE. COMPLETE A TEMPORARY TWO-LANE DETOUR ON THE WEST SIDE OF CR4.		NB/SB TRAFFIC IS TEMPORARILY SHIFTED ONTO THE TEMPORARY ROADWAY WIDENING AREA ON THE EAST SIDE OF CR4.

SCALE
5m 0 10m
Horizontal

NOTE:
1. DRIVEWAY AND ENTRANCE ACCESSES TO BE MAINTAINED DURING CONSTRUCTION

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

DRAFT

Ontario — Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
CONSTRUCTION STAGE 2 COUNTY ROAD 4	
STA 9+300 TO STA 9+650	
Survey _____ Revised _____	
AECOM	

SHEET 14

LIMIT OF COUNTY ROAD 4 WIDENING
STA. 9+415

PRC: 9-313.38
PI: 9+391.5
EC: 9+414.74
9+400
9+500
9+600
PROPOSED MTO ROW
℄ COUNTY ROAD 4 STAGE 2
℄ COUNTY ROAD 4 REALIGNMENT
EAT-NA-U-2
TCB TYPE X
R-2000
TCB TYPE M (PINNED)
ROADWAY PROTECTION FOR STAGE 2 & 3
CONSTRUCT TEMPORARY ROAD WIDENING TO ACCOMMODATE STAGE 3 TRAFFIC LANES
STA. 9+300
STA. 9+650
0.50
1.00
3.50
5
1

SCALE
5m 0 10m
Horizontal

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

COUNTY OF SIMCOE

TOWN OF BRADFORD WEST GWILLIMBURY

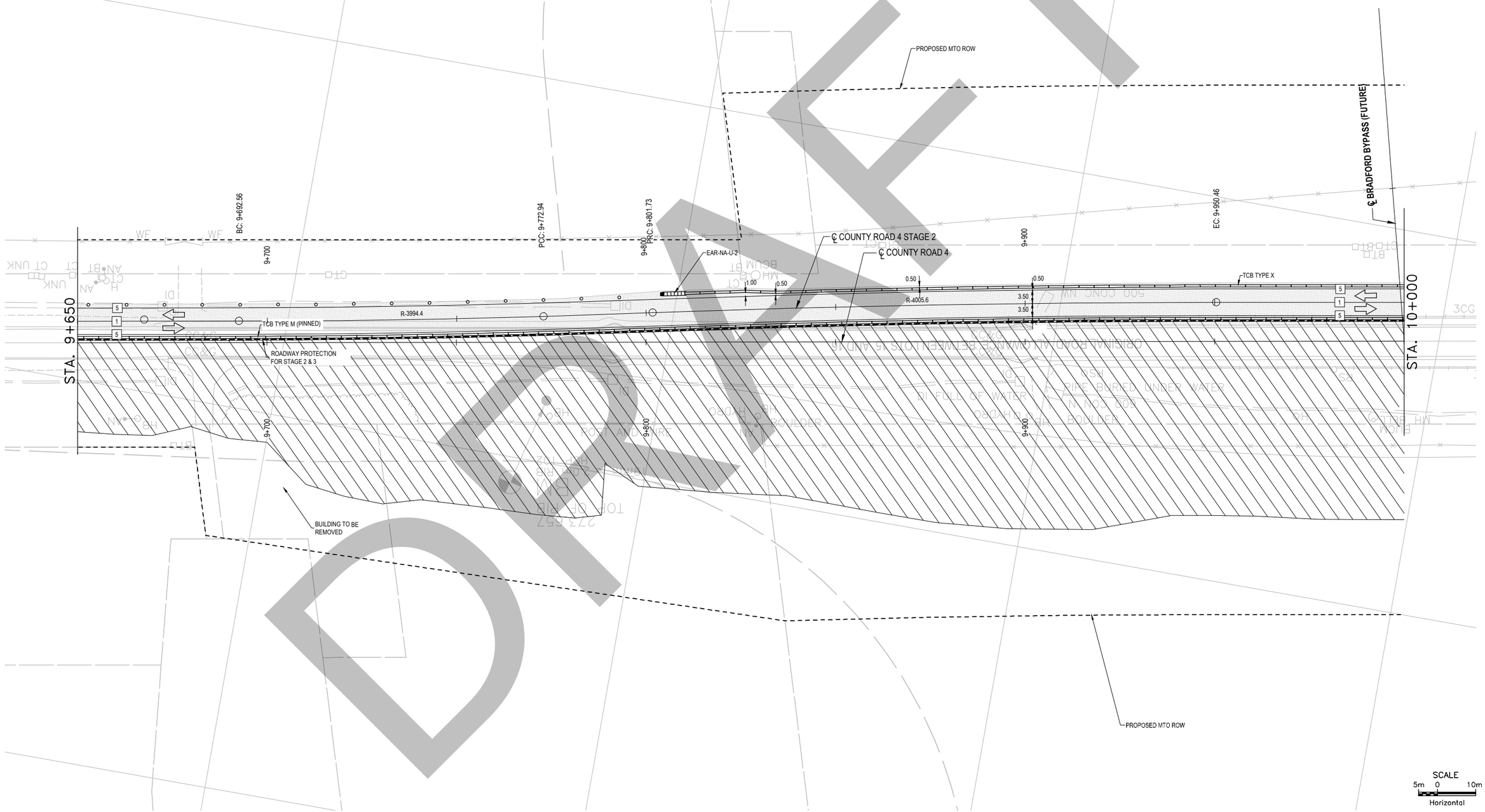
DRAFT

Ontario	Ministry of Transportation
CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 2
COUNTY ROAD 4
STA 9+650 TO STA 10+000
Survey _____ Revised _____

AECOM

SHEET 15



SCALE
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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

DRAFT

Ontario	Ministry of Transportation
CONT	2021–2124
WP	2007–21–01
CONSTRUCTION STAGE 2 COUNTY ROAD 4	
STA 10+000 TO STA 10+350	
Survey _____ Revised _____	
AECOM	

SHEET 16

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

PROPOSED MTO ROW

STA. 10+000

℄ COUNTY ROAD 4 STAGE 2

℄ COUNTY ROAD 4

BC: 10+044.76

TCB TYPE M (PINNED)

ROADWAY PROTECTION FOR STAGE 2 & 3

R-4005.6

TCB TYPE X

EAR-NA-U-2

R-2000

TCB TYPE M (PINNED)

ROADWAY PROTECTION FOR STAGE 2 & 3

STA. 10+350

10+100

PI: 10+117.63

EC: 10+173.49

10+200

10+300

15+500

℄ BRADFORD BYPASS (FUTURE)

TEMPORARY CULVERT

CULVERT EXTENSION TO BE INSTALLED

CULVERT EXTENSION TO BE INSTALLED

PROPOSED MTO ROW

15+400

SCALE
5m 0 10m
Horizontal

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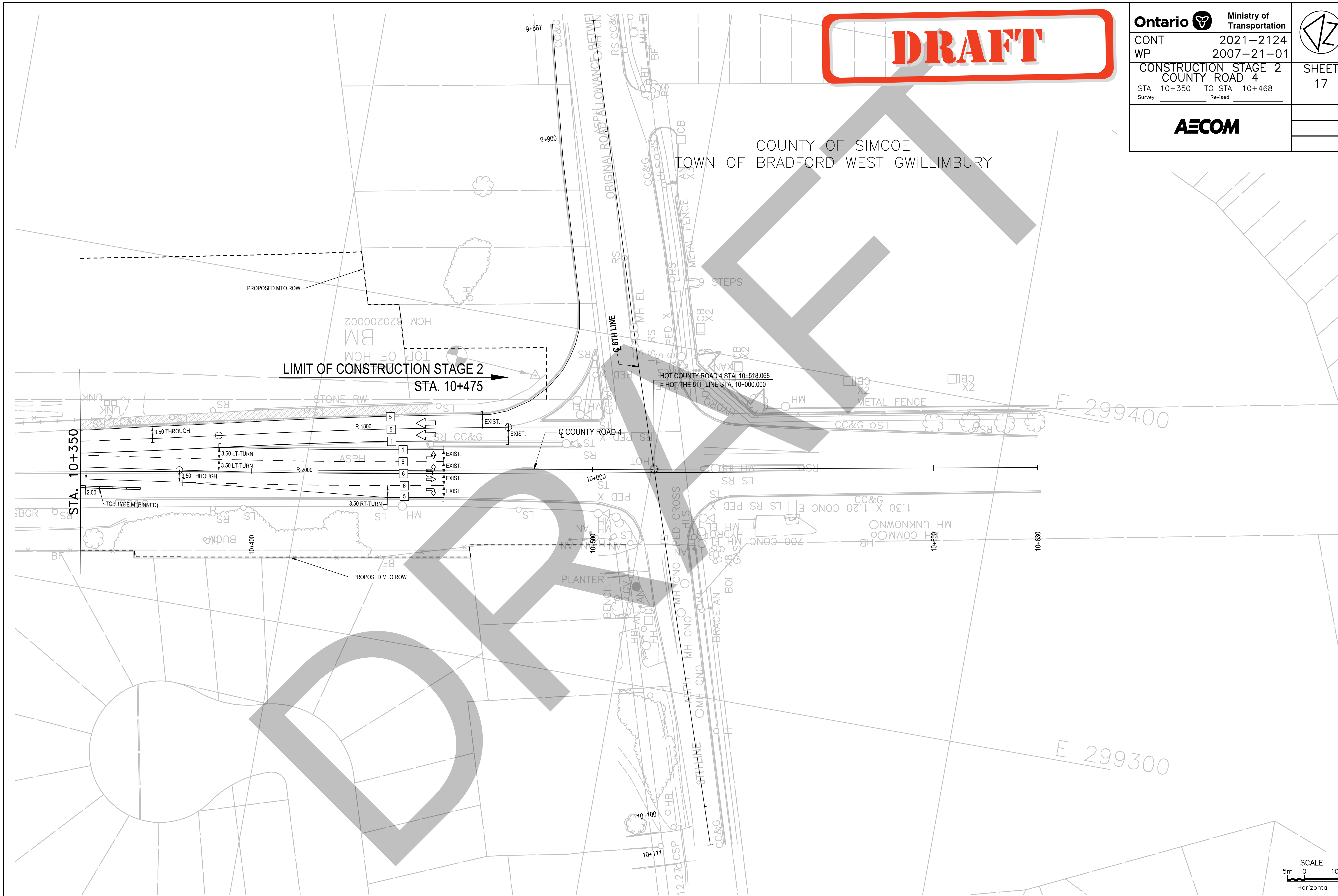

DRAFT
COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY
LIMIT OF CONSTRUCTION STAGE 2
STA. 10+475
STA. 10+350
PROPOSED MTO ROW
℄ 8TH LINE
℄ COUNTY ROAD 4
HOT COUNTY ROAD 4 STA. 10+518.068
= HOT THE 8TH LINE STA. 10+000.000
3.50 THROUGH
3.50 LT-TURN
3.50 RT-TURN
TCB TYPE M (PINNED)
R-1800
R-2000
EXIST.
ORIGINAL ROAD ALLOWANCE BETWEEN
METAL FENCE
STEPS
PLANTER
E 299400
E 299300
9+867
9+900
10+000
10+100
10+111
10+400
10+500
10+600
10+630
SCALE
5m 0 10m
Horizontal

Ontario Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

CONSTRUCTION STAGE 2
COUNTY ROAD 4
STA 10+350 TO STA 10+468

SHEET 17

AECOM

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3	363 BROKEN YELLOW,10cm
4	SOLID YELLOW,20cm
5	SOLID WHITE,10cm
6	333 BROKEN WHITE,10cm
7	363 BROKEN WHITE,10cm
8	393 BROKEN WHITE,10cm
9	SOLID WHITE,20cm
10	111 BROKEN WHITE,20cm
11	333 BROKEN WHITE,20cm
12	333 BROKEN WHITE,30cm
13	SOLID WHITE,30cm
14	SOLID WHITE,45cm
15	SOLID WHITE,60cm
16	111 BROKEN WHITE,10cm
18	SOLID YELLOW, 10cm & 363 BROKEN WHITE, 10cm
20	SYMBOLS
] [	LIMITS OF MARKINGS

LEGEND :

NOTES:

1. 333, 363, 393, Denotes Pavement Marking Spacing (ie., 3 m line, 3 m gap, 3 m line)
2. Use (1) to Denote PAVEMENT MARKING
3. Use [1] to Denote PAVEMENT MARKING, TEMPORARY
4. Use ⟨1⟩ to Denote PAVEMENT MARKING, TEMPORARY – REMOVABLE
5. Use ⟨1⟩ to Denote PAVEMENT MARKING, DURABLE
6. ALL MARKINGS AND TRAFFIC SIGNS MUST CONFORM TO ONTARIO TRAFFIC MANUAL (OTM)
7. MISSING/ADDITIONAL SIGNS AS PER OTM BOOK 7 SHALL BE INSTALLED AS REQUIRED
8. PROPOSED MARKINGS TO MATCH EXISTING AT ALL WORK AND/OR ROAD CONSTRUCTION LIMITS

TRAFFIC FLOW DIRECTION ARROW

TC-54

TEMPORARY ENERGY ATTENUATOR

TEMPORARY CONCRETE BARRIER (TCB)

UNDER CONSTRUCTION

COMPLETED CONSTRUCTION

DRAFT

Ontario Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

CONSTRUCTION STAGE 3
COUNTY ROAD 4
STA 9+220 TO STA 9+300
Survey _____ Revised _____

SHEET 18

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

LIMIT OF CONSTRUCTION STAGE 3
STA. 9+220

PROPOSED MTO ROW

HOT STA. 9+131.063 COUNTY ROAD 4
= HOT STA. 10+000.000 THE 9TH LINE

℄ 9TH LINE

℄ COUNTY ROAD 4

BC: 9+115.48

EC: 9+172.64

PI: 10+000.00

9+882 9+900 9+014 9+100 9+200 9+219 10+000 10+100 10+126

STA. 9+300

TC-54

EXIST.

EXIST.

R-2000

1.00 0.50

EAR-NA-U-2

PROPOSED MTO ROW

PORTA–POTTY

NO ACCESS BEYOND GATE

PIPE END BURIED

INTERLOCK

E 299100

E 299000

N 4888900

450 x 13.92 CSP

450 x 7.54 CSP

600 x 9.20 CSP

450 x 11.90 CSP

400 x 7.21 CSP

450 x 7.27 CSP

400 x 10.19 CSP

900 x 31.29 CSP

COUNTY ROAD 4 STRUCTURE CONSTRUCTION			
STAGE	CONSTRUCTION	LANE CLOSURE/RESTRICTION	TRAFFIC DURING STAGING
3	CONSTRUCT COUNTY ROAD 4 (CR4) STRUCTURE. CONSTRUCT CR4 NORTHBOUND TO FINISHED GRADE.		NB/SB TRAFFIC IS TEMPORARILY SHIFTED ONTO THE NEW SOUTHBOUND LANES AND TEMPORARY DETOUR ON THE WEST SIDE OF CR4.

SCALE
5m 0 10m
Horizontal

FILE NAME: \\ra.aecomnet.com\fs\AMER\Richmondhill-CARCH1\DCS\Projects_TRN\60636190_BradfordByPASS\900_CAD_GIS\910_CAD\Sheets\C\County Road 4\Staging\60636190-C-ST03-CR4_Sheet 1.dwg
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MINISTRY OF TRANSPORTATION, ONTARIO AMS-D 2018-10

NOTE:
1. DRIVEWAY AND ENTRANCE ACCESSES TO BE MAINTAINED DURING CONSTRUCTION

Ontario	Ministry of Transportation
CONT	2021–2124
WP	2007–21–01
CONSTRUCTION STAGE 3 COUNTY ROAD 4	
STA 9+300 TO STA 9+650	
Survey _____ Revised _____	
AECOM	

SHEET 19

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

LIMIT OF COUNTY ROAD 4 WIDENING
STA. 9+415

CONSTRUCTION OF THE TRANSITION FROM 2 LANE TO 4 LANE ROADWAY TO BE CARRIED OUT DURING OFF-PEAK PERIODS UNDER TRAFFIC CONTROL

PROPOSED MTO ROW

STA. 9+300

PI: 9+391.51

EAR-NA-U-2

TC-54

R-2000

3.50

2.00

0.50

1.00

℄ COUNTY ROAD 4 STAGE 3

PRC: 9+313.05

9+400

EC: 9+413.35

ROADWAY PROTECTION (INSTALLED IN STAGE 2)

TCB TYPE M (PINNED)

9+500

℄ COUNTY ROAD 4

0+000

9+600

BC: 0+012.03

EC: 0+019.27

BC: 0+078.18

EC: 0+078.18

BC: 0+068.97

BC: 0+111.98

EC: 0+128.37

0+131

0+100

EC: 0+088.66

STA. 9+650

PROPOSED MTO ROW

SCALE
5m 0 10m
Horizontal

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI–D 2016–10

DRAFT

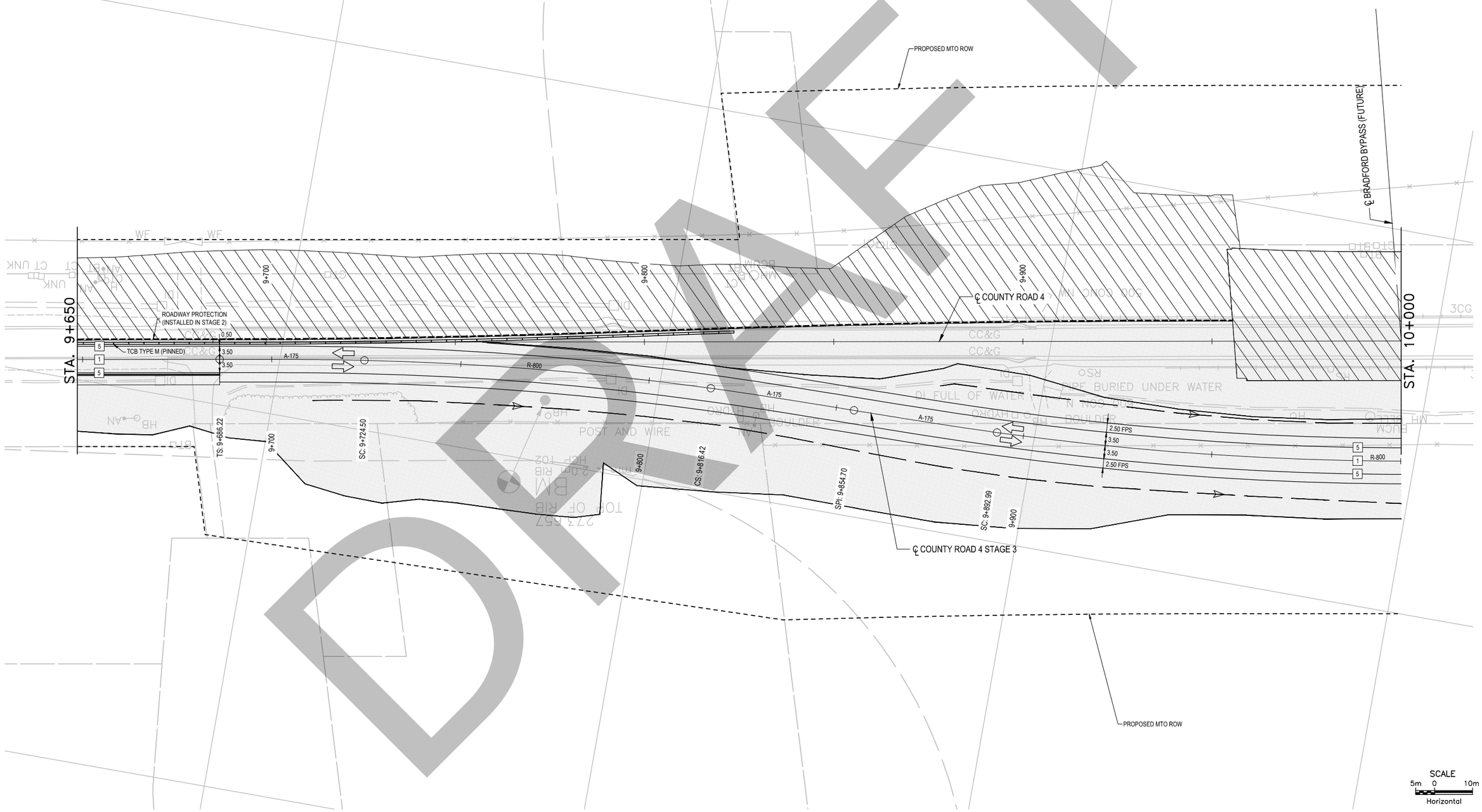
Ontario	Ministry of Transportation
CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 3
COUNTY ROAD 4
STA 9+650 TO STA 10+000
Survey _____ Revised _____

SHEET 20

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



SCALE
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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

Ontario Ministry of Transportation

CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 3
COUNTY ROAD 4
STA 10+000 TO STA 10+350
Survey _____ Revised _____

SHEET 21

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

STA. 10+000

STA. 10+350

PROPOSED MTO ROW

CULVERT EXTENSION TO BE INSTALLED

BUILDING TO BE REMOVED

℄ COUNTY ROAD 4

ROADWAY PROTECTION (INSTALLED IN STAGE 2)

EAR-NA-U-2

TCB

R-1500

R-800

A-175

2.50 FPS

3.50

1.00

℄ COUNTY ROAD 4 STAGE 3

CULVERT EXTENSION AND TEMPORARY CULVERT EXTENSION

℄ BRADFORD BYPASS (FUTURE)

PROPOSED MTO ROW

10+100

10+200

10+300

15+500

15+400

CS: 10+125.22

ST: 10+163.50
TS: 10+166.28

SC: 10+203.56

CS: 10+302.89

ST: 10+341.17

SCALE
5m 0 10m
Horizontal

DRAFT

Ontario — Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

CONSTRUCTION STAGE 3
COUNTY ROAD 4
STA 10+350 TO STA 10+470
Survey _____ Revised _____

SHEET 22

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

PROPOSED MTO ROW

LIMIT OF CONSTRUCTION STAGE 3
STA. 10+470

℄ 8TH LINE

HOT COUNTY ROAD 4 STA. 10+518.068
= HOT THE 8TH LINE STA. 10+000.000

STA. 10+350

3.50 LT-TURN
3.50 LT-TURN
3.50 THROUGH
3.50 RT-TURN

EXIST.
EXIST.
EXIST.
EXIST.
EXIST.

R-1800

℄ COUNTY ROAD 4

℄ COUNTY ROAD 4 STAGE 3

PROPOSED MTO ROW

9+867
9+900
10+000
10+100
10+111
10+400
10+500
10+564
10+600
10+630

E 299400
E 299300

SCALE
5m 0 10m
Horizontal

FILE NAME: \\na.aecomnet.com\ifs\MKER\Richmondhill-CARCH1\DCS\Projects_TRN\60636190_BradfordBypPASS\900_CAD_GIS\910_CAD\Sheets\C\County Road 4\Staging\60636190-C-ST03-CR4_Sheet 5.dwg
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MODIFIED: 2021-08-11 17:31
MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

1	SOLID YELLOW,10cm
2	SOLID DOUBLE YELLOW,10cm
3	363 BROKEN YELLOW,10cm
4	SOLID YELLOW,20cm
5	SOLID WHITE,10cm
6	333 BROKEN WHITE,10cm
7	363 BROKEN WHITE,10cm
8	393 BROKEN WHITE,10cm
9	SOLID WHITE,20cm
10	111 BROKEN WHITE,20cm
11	333 BROKEN WHITE,20cm
12	333 BROKEN WHITE,30cm
13	SOLID WHITE,30cm
14	SOLID WHITE,45cm
15	SOLID WHITE,60cm
16	111 BROKEN WHITE,10cm
18	SOLID YELLOW, 10cm & 363 BROKEN WHITE, 10cm
20	SYMBOLS
] [	LIMITS OF MARKINGS

LEGEND :

NOTES:

1. 333, 363, 393, Denotes Pavement Marking Spacing (ie., 3 m line, 3 m gap, 3 m line)
2. Use (1) to Denote PAVEMENT MARKING
3. Use [1] to Denote PAVEMENT MARKING, TEMPORARY
4. Use △ to Denote PAVEMENT MARKING, TEMPORARY – REMOVABLE
5. Use ⬡1 to Denote PAVEMENT MARKING, DURABLE
6. ALL MARKINGS AND TRAFFIC SIGNS MUST CONFORM TO ONTARIO TRAFFIC MANUAL (OTM)
7. MISSING/ADDITIONAL SIGNS AS PER OTM BOOK 7 SHALL BE INSTALLED AS REQUIRED
8. PROPOSED MARKINGS TO MATCH EXISTING AT ALL WORK AND/OR ROAD CONSTRUCTION LIMITS

⇨ TRAFFIC FLOW DIRECTION ARROW

○ TC-54

TEMPORARY ENERGY ATTENUATOR

TEMPORARY CONCRETE BARRIER (TCB)

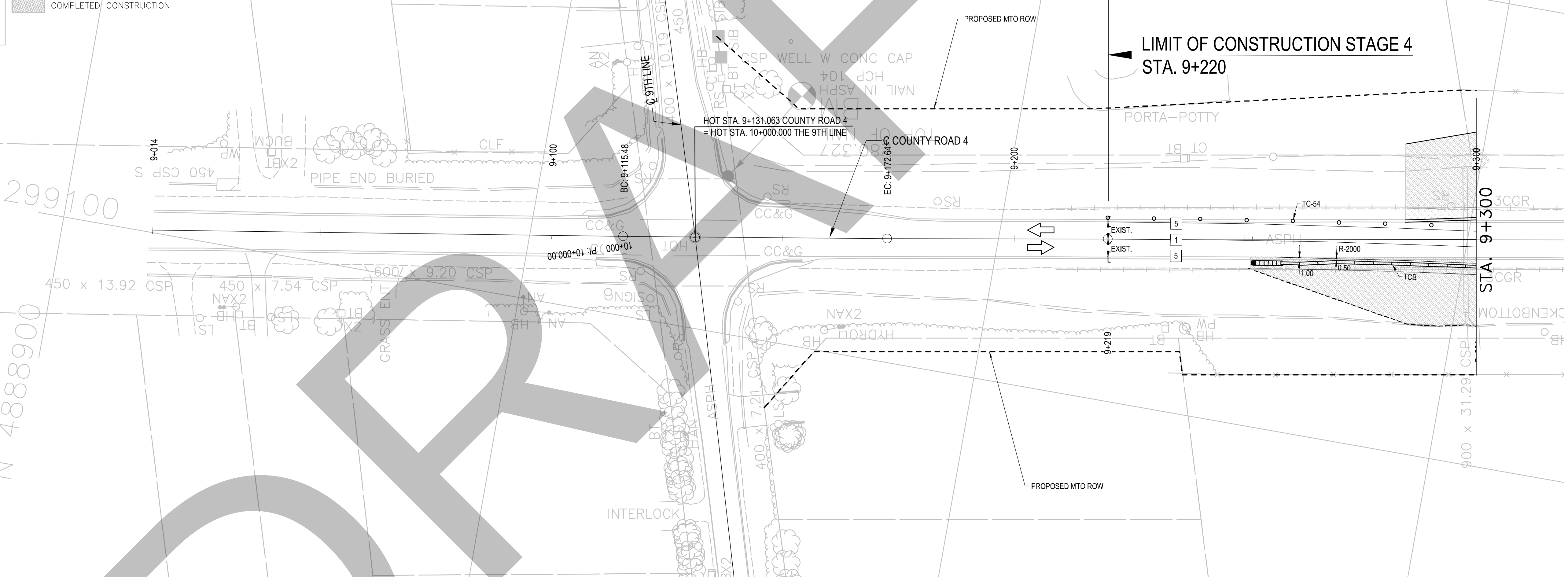
UNDER CONSTRUCTION NIGHT WORK

COMPLETED CONSTRUCTION

DRAFT

Ontario Ministry of Transportation	
CONT 2021–2124	SHEET 23
WP 2007–21–01	
CONSTRUCTION STAGE 4 COUNTY ROAD 4	
STA 9+159 TO STA 9+300	
Survey Revised	
AECOM	

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



COUNTY ROAD 4 STRUCTURE CONSTRUCTION			
STAGE	CONSTRUCTION	LANE CLOSURE/RESTRICTION	TRAFFIC DURING STAGING
4 (NIGHT WORK)	CONSTRUCT COUNTY ROAD 4 (CR4) NORTHBOUND, NORTH OF THE 8TH LINE INTERSECTION TO FINISHED GRADE.	AT THE NORTH LEG OF 8TH LINE INTERSECTION, CR4 SOUTHBOUND IS TEMPORARILY REDUCED TO ONE LEFT–TURN LANE AND ONE SHARED THROUGH AND RIGHT–TURN LANE. CONSTRUCTION STAGE 4 WORK TO BE CARRIED OUT DURING NIGHTTIME CLOSURE.	NB/SB TRAFFIC REMAINS ON THE TEMPORARY DETOUR. AT THE 8TH LINE INTERSECTION, NB TRAFFIC IS TEMPORARILY SHIFTED ONTO SB LANES. SB TRAFFIC REMAINS ON EXISTING SB ALIGNMENT WITH SB TRAFFIC LANES REDUCED TO TWO LANES.
4 (DAYTIME)	NO CONSTRUCTION	AT THE NORTH LEG OF 8TH LINE INTERSECTION, CR4 SB IS REOPENED TO TWO LEFT–TURN LANES AND ONE SHARED THROUGH AND RIGHT–TURN LANE. NO CONSTRUCTION IS ALLOWED DURING DAYTIME.	NB/SB TRAFFIC REMAINS ON THE TEMPORARY DETOUR. AT THE 8TH LINE INTERSECTION, NB TRAFFIC IS SHIFTED BACK TO EXISTING NB ALIGNMENT. SB TRAFFIC REMAINS ON EXISTING SB ALIGNMENT WITH TRAFFIC LANES REOPENED TO THREE LANES.

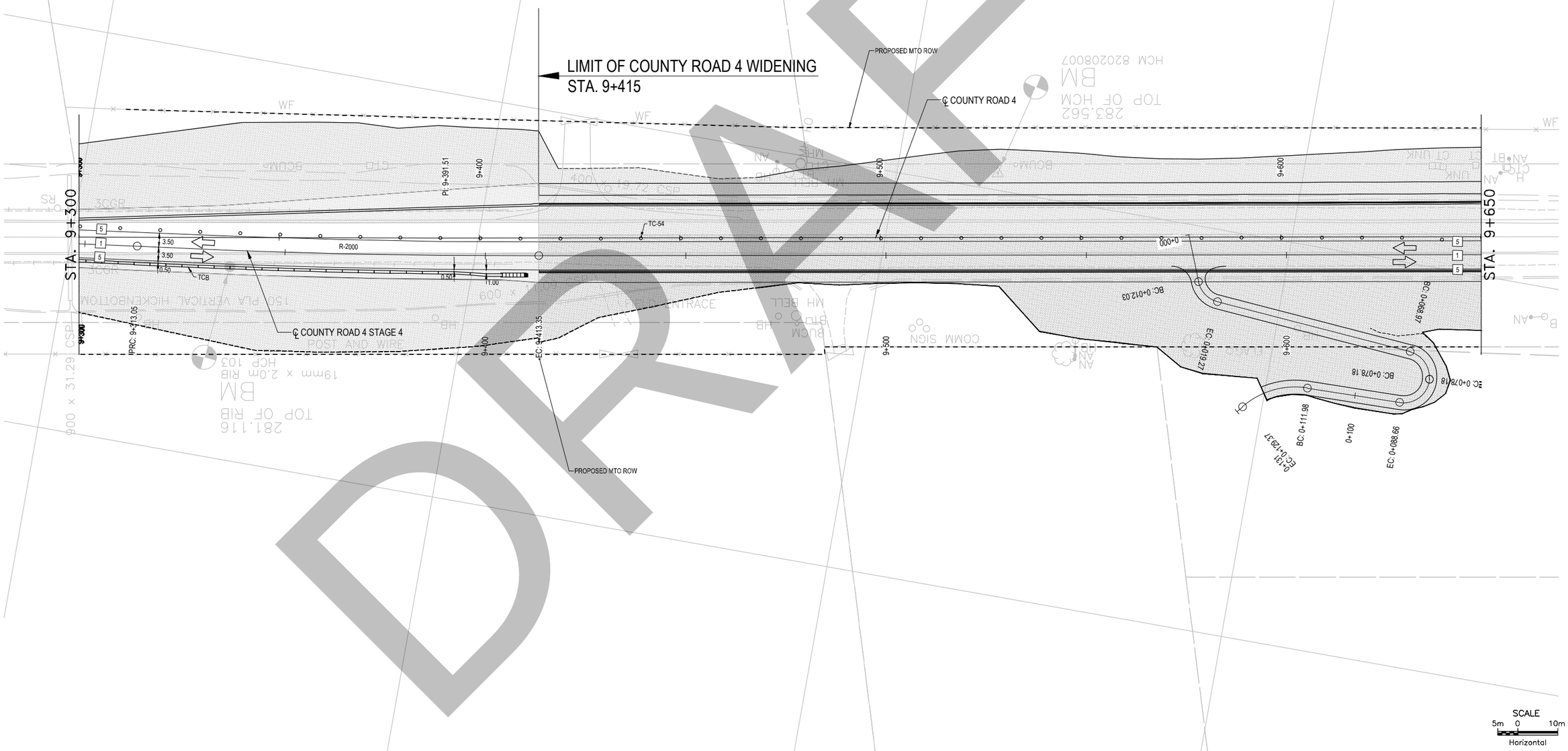
SCALE
5m 0 10m
Horizontal

NOTE:
1. DRIVEWAY AND ENTRANCE ACCESSES TO BE MAINTAINED DURING CONSTRUCTION

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

DRAFT

Ontario Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
CONSTRUCTION STAGE 4 COUNTY ROAD 4	SHEET 24
STA 9+300 TO STA 9+650 Survey _____ Revised _____	
AECOM	



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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

Ontario Ministry of Transportation

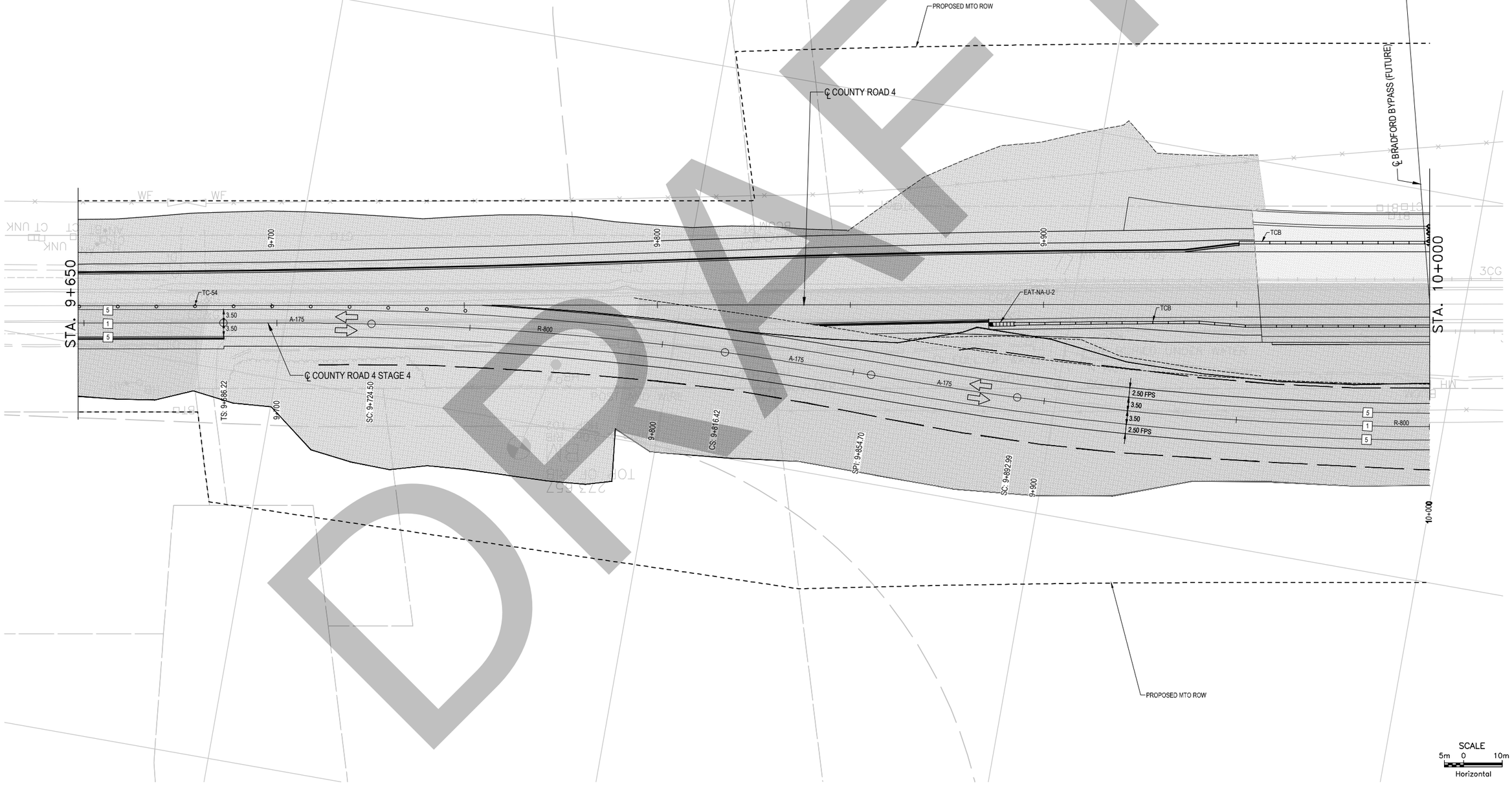
CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 4
COUNTY ROAD 4
STA 9+650 TO STA 10+000
Survey _____ Revised _____

SHEET 25

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



SCALE
5m 0 10m
Horizontal

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

DRAFT

Ontario Ministry of Transportation

CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 4
COUNTY ROAD 4
STA 10+000 TO STA 10+350
Survey _____ Revised _____

SHEET 26

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

PROPOSED MTO ROW

CONSTRUCTION WORK TO BE CARRIED OUT AT NIGHT WHERE COUNTY ROAD 4 IS TEMPORARILY REDUCED TO 4 LANES AT THE 8TH LINE INTERSECTION

℄ COUNTY ROAD 4

STA. 10+000

STA. 10+350

TCB

EAT-NA-U-2

PI: 10+17.63

10+100

10+200

10+300

15+500

R-800

2.50 FPS
3.50
3.50
2.50 FPS

A-175

℄ COUNTY ROAD 4 STAGE 4

CS: 10+125.22

ST: 10+163.50
TS: 10+184.88

SC: 10+197.55
10+200

CS: 10+268.09

ST: 10+300.75

TCB TYPE X

FAR-NA-U-2

R-600

0.50
0.40
3.50
3.50
A-160
3.50
1.00
0.50
A-160

℄ BRADFORD BYPASS (FUTURE)

PROPOSED MTO ROW

15+400

SCALE
5m 0 10m
Horizontal

FILE NAME: \\na.aecomnet.com\ifs\AMER\Richmond Hill-CARCH1\DCS\Projects_TRN\60636190_BradfordBypPASS\900_CAD_GIS\910_CAD\Sheets\C\County Road 4\Staging\60636190-C-STG4-CR4_Sheet 4.dwg
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MODIFIED: 2021-09-02 13:58

MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

Ontario — Ministry of Transportation

CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 4
COUNTY ROAD 4
STA 10+350 TO STA 10+468
Survey _____ Revised _____

SHEET 27

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

CONSTRUCTION WORK TO BE CARRIED OUT AT NIGHT WHERE COUNTY ROAD 4 IS TEMPORARILY REDUCED TO 4 LANES AT THE 8TH LINE INTERSECTION

PROPOSED MTO ROW

EXISTING RAISED ISLAND TO BE REMOVED AND PAVED PRIOR TO STAGE 4.
TRAFFIC SIGNALS TO BE REMOVED TEMPORARILY AND REPLACED WITH AERIAL TRAFFIC SIGNALS.

TC-54

℄ 8TH LINE

EAR-NA-U-2

HOT COUNTY ROAD 4 STA. 10+518.068
= HOT THE 8TH LINE STA. 10+000.000

LIMIT OF CONSTRUCTION STAGE 4
STA. 10+630

℄ COUNTY ROAD 4

STA. 10+350

TCB TYPE X

3.50 LT-TURN

3.50 THROUGH & RT-TURN

3.50 RT-TURN LANE

3.50 LT-TURN LANE

EXIST.

℄ COUNTY ROAD 4 STAGE 4

PROPOSED MTO ROW

10+400 | 10+500 | 10+000 | 10+600 | 10+630 | 10+100 | 10+111

PLANTER

E 299400

E 299300

SCALE
5m 0 10m
Horizontal

FILE NAME: \\na.aecomnet.com\ifs\AMER_Richmondhill-CARCH1\DCS\Projects_TRN\606361 90_BradfordBypPASS\900_CAD_GIS\910_CAD\Sheets\C\County Road 4\Staging\606361 90-C-STG4-CR4_Sheet 5.dwg
CREATED: 2021-09-02
MODIFIED: 2021-09-02 11:58

MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2018-10

1	SOLID YELLOW,10cm
2	SOLID DOUBLE YELLOW,10cm
3	363 BROKEN YELLOW,10cm
4	SOLID YELLOW,20cm
5	SOLID WHITE,10cm
6	333 BROKEN WHITE,10cm
7	363 BROKEN WHITE,10cm
8	393 BROKEN WHITE,10cm
9	SOLID WHITE,20cm
10	111 BROKEN WHITE,20cm
11	333 BROKEN WHITE,20cm
12	333 BROKEN WHITE,30cm
13	SOLID WHITE,30cm
14	SOLID WHITE,45cm
15	SOLID WHITE,60cm
16	111 BROKEN WHITE,10cm
18	SOLID YELLOW, 10cm & 363 BROKEN WHITE, 10cm
20	SYMBOLS
] [	LIMITS OF MARKINGS

LEGEND :

NOTES:

1. 333, 363, 393, Denotes Pavement Marking Spacing (ie., 3 m line, 3 m gap, 3 m line)
2. Use (1) to Denote PAVEMENT MARKING
3. Use [1] to Denote PAVEMENT MARKING, TEMPORARY
4. Use ⚠1 to Denote PAVEMENT MARKING, TEMPORARY – REMOVABLE
5. Use ⬡1 to Denote PAVEMENT MARKING, DURABLE
6. ALL MARKINGS AND TRAFFIC SIGNS MUST CONFORM TO ONTARIO TRAFFIC MANUAL (OTM)
7. MISSING/ADDITIONAL SIGNS AS PER OTM BOOK 7 SHALL BE INSTALLED AS REQUIRED
8. PROPOSED MARKINGS TO MATCH EXISTING AT ALL WORK AND/OR ROAD CONSTRUCTION LIMITS

- TRAFFIC FLOW DIRECTION ARROW
- TC-54
- TEMPORARY ENERGY ATTENUATOR
- TEMPORARY CONCRETE BARRIER (TCB)
- UNDER CONSTRUCTION NIGHT WORK
- COMPLETED CONSTRUCTION

Ontario Ministry of Transportation

CONT	2021–2124
WP	2007–21–01

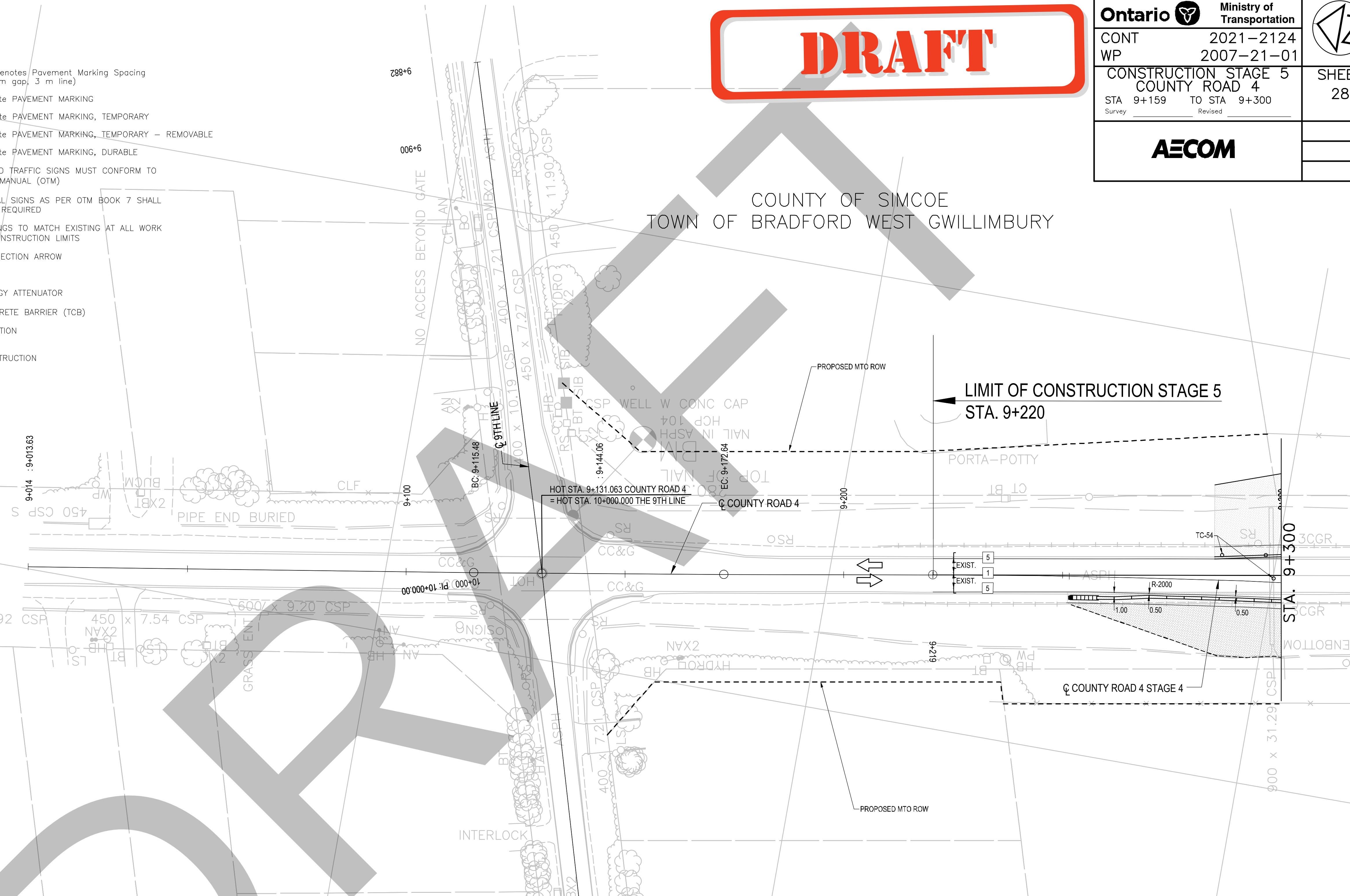
CONSTRUCTION STAGE 5
COUNTY ROAD 4
STA 9+159 TO STA 9+300
Survey Revised

SHEET 28

AECOM

DRAFT

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



COUNTY ROAD 4 STRUCTURE CONSTRUCTION			
STAGE	CONSTRUCTION	LANE CLOSURE/RESTRICTION	TRAFFIC DURING STAGING
5 (NIGHT WORK)	CONSTRUCT THE EAST PORTION OF COUNTY ROAD 4 (CR4) SOUTHBOUND, NORTH OF THE 8TH LINE INTERSECTION TO FINISHED GRADE.	AT THE NORTH LEG OF 8TH LINE INTERSECTION, CR4 SOUTHBOUND IS TEMPORARILY REDUCED TO ONE LEFT-TURN LANE AND ONE SHARED THROUGH AND RIGHT-TURN LANE. CONSTRUCTION STAGE 5 WORK TO BE CARRIED OUT DURING NIGHTTIME CLOSURE.	NB TRAFFIC IS SHIFTED ONTO THE NEWLY CONSTRUCTED CR4 NB LANE. SB TRAFFIC REMAINS ON THE TEMPORARY DETOUR. SB TRAFFIC REMAINS ON EXISTING SB ALIGNMENT AT THE 8TH LINE INTERSECTION WITH SB TRAFFIC LANES REDUCED TO TWO LANES.
5 (DAYTIME)	NO CONSTRUCTION	AT THE NORTH LEG OF 8TH LINE INTERSECTION, CR4 SB IS REOPENED TO TWO LEFT-TURN LANES AND ONE SHARED THROUGH AND RIGHT-TURN LANE. NO CONSTRUCTION IS ALLOWED DURING DAYTIME.	NB TRAFFIC REMAINS ON THE NEWLY CONSTRUCTED CR4 NB LANE. SB TRAFFIC REMAINS ON THE TEMPORARY DETOUR. AT THE 8TH LINE INTERSECTION, SB THROUGH TRAFFIC REMAINS ON EXISTING SB ALIGNMENT. LEFT-TURN TRAFFIC IS SHIFTED ONTO THE NEWLY CONSTRUCTED CR4 SB LANES.

SCALE
5m 0 10m
Horizontal

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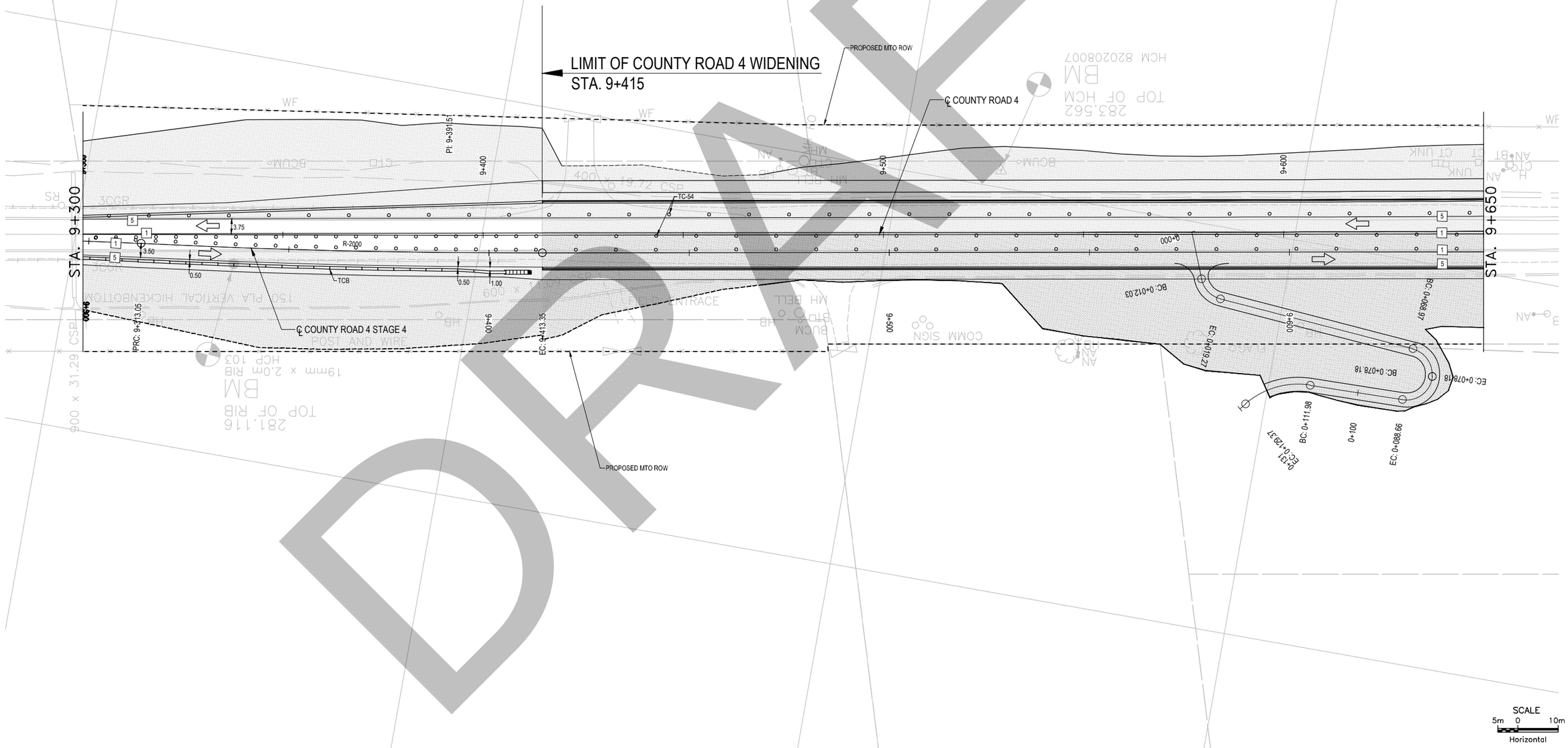
NOTE:
1. DRIVEWAY AND ENTRANCE ACCESSES TO BE MAINTAINED DURING CONSTRUCTION

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



DRAFT

Ontario — Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
CONSTRUCTION STAGE 5 COUNTY ROAD 4 STA 9+300 TO STA 9+650 Survey _____ Revised _____	SHEET 29
AECOM	

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

Ontario — Ministry of Transportation

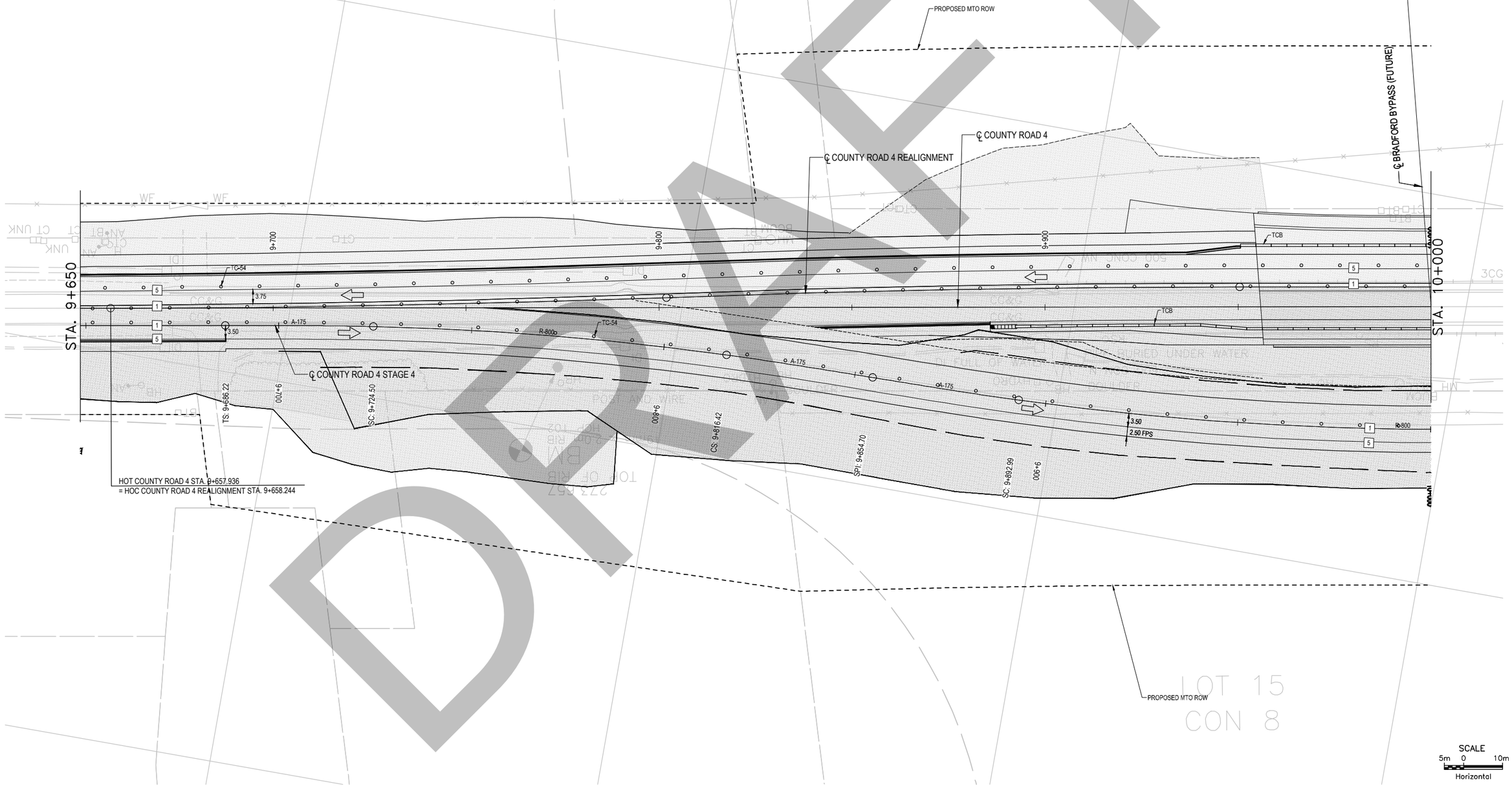
CONT	2021-2124
WP	2007-21-01

CONSTRUCTION STAGE 5
COUNTY ROAD 4
STA 9+650 TO STA 10+000
Survey _____ Revised _____

SHEET 30

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



SCALE
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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

DRAFT

Ontario Ministry of Transportation

CONT 2021-2124
WP 2007-21-01

CONSTRUCTION STAGE 5
COUNTY ROAD 4
STA 10+000 TO STA 10+350
Survey _____ Revised _____

SHEET 31

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

15+600

PROPOSED MTO ROW

CONSTRUCTION WORK TO BE CARRIED OUT AT NIGHT WHERE COUNTY ROAD 4 IS TEMPORARILY REDUCED TO 4 LANES AT THE 8TH LINE INTERSECTION

℄ COUNTY ROAD 4 REALIGNMENT

℄ COUNTY ROAD 4

STA. 10+000

STA. 10+350

10+100

PI: 10+117.63

10+200

10+300

TCB

TC-54

15+500

R-800

A-175

A-160

3.50

2.50 FPS

EAR-NA-U-2

R-600

1.00

0.50

3.50

TCB TYPE X

0.50

0.40

CS: 10+125.22

ST: 10+168.88

SC: 10+197.55

CS: 10+268.09

ST: 10+300.75

10+000

10+100

CONSTRUCTION WORK TO BE CARRIED OUT AT NIGHT WHERE COUNTY ROAD 4 IS TEMPORARILY REDUCED TO 4 LANES AT THE 8TH LINE INTERSECTION

HOT COUNTY ROAD 4 STA. 10+319.628
= HOC COUNTY ROAD 4 REALIGNMENT STA. 10+320.254

℄ COUNTY ROAD 4 STAGE 4

℄ BRADFORD BYPASS (FUTURE)

PROPOSED MTO ROW

15+400

SCALE
5m 0 10m
Horizontal

FILE NAME: \\ns.aecomnet.com\fs\AMER\RichmondHill-CARGH1\DCS\Projects_TRN\60636190_BradfordByPASS\900_CAD_GIS\910_CAD\Sheets\C\County Road 4\Staging\60636190-C-ST05-CR4_Sheet 4.dwg
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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

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Ontario — Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

CONSTRUCTION STAGE 5
COUNTY ROAD 4
STA 10+350 TO STA 10+468
Survey _____ Revised _____

SHEET 32

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

LIMIT OF CONSTRUCTION STAGE 5
STA. 10+630

HOT COUNTY ROAD 4 STA. 10+518.068
= HOT THE 8TH LINE STA. 10+000.000

℄ 8TH LINE

℄ COUNTY ROAD 4

STA. 10+350

PROPOSED MTO ROW

CONSTRUCTION WORK TO BE CARRIED OUT AT NIGHT WHERE COUNTY ROAD 4 IS TEMPORARILY REDUCED TO 4 LANES AT THE 8TH LINE INTERSECTION

EAR-NA-U-2

TCB TYPE X

TCB TYPE M (PINNED)

TC-54

3.50 LT-TURN

3.50 THROUGH & RT-TURN

3.50 RT-TURN LANE

3.50 LT-TURN LANE

EXIST.

℄ COUNTY ROAD 4 STAGE 4

PROPOSED MTO ROW

10+400 10+500 10+600 10+630.45 10+000 10+100 10+111

E 299400

E 299300

SCALE
5m 0 10m
Horizontal

1	SOLID YELLOW,10cm
2	SOLID DOUBLE YELLOW,10cm
3	363 BROKEN YELLOW,10cm
4	SOLID YELLOW,20cm
5	SOLID WHITE,10cm
6	333 BROKEN WHITE,10cm
7	363 BROKEN WHITE,10cm
8	393 BROKEN WHITE,10cm
9	SOLID WHITE,20cm
10	111 BROKEN WHITE,20cm
11	333 BROKEN WHITE,20cm
12	333 BROKEN WHITE,30cm
13	SOLID WHITE,30cm
14	SOLID WHITE,45cm
15	SOLID WHITE,60cm
16	111 BROKEN WHITE,10cm
18	SOLID YELLOW, 10cm & 363 BROKEN WHITE, 10cm
20	SYMBOLS
] [	LIMITS OF MARKINGS

LEGEND :

NOTES:

1. 333, 363, 393, Denotes Pavement Marking Spacing (ie., 3 m line, 3 m gap, 3 m line)
2. Use (1) to Denote PAVEMENT MARKING
3. Use [1] to Denote PAVEMENT MARKING, TEMPORARY
4. Use ⚠1 to Denote PAVEMENT MARKING, TEMPORARY – REMOVABLE
5. Use ⬡1 to Denote PAVEMENT MARKING, DURABLE
6. ALL MARKINGS AND TRAFFIC SIGNS MUST CONFORM TO ONTARIO TRAFFIC MANUAL (OTM)
7. MISSING/ADDITIONAL SIGNS AS PER OTM BOOK 7 SHALL BE INSTALLED AS REQUIRED
8. PROPOSED MARKINGS TO MATCH EXISTING AT ALL WORK AND/OR ROAD CONSTRUCTION LIMITS

⇨ TRAFFIC FLOW DIRECTION ARROW

○ TC–54

TEMPORARY ENERGY ATTENUATOR

TEMPORARY CONCRETE BARRIER (TCB)

UNDER CONSTRUCTION NIGHT WORK

COMPLETED CONSTRUCTION

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Ontario Ministry of Transportation

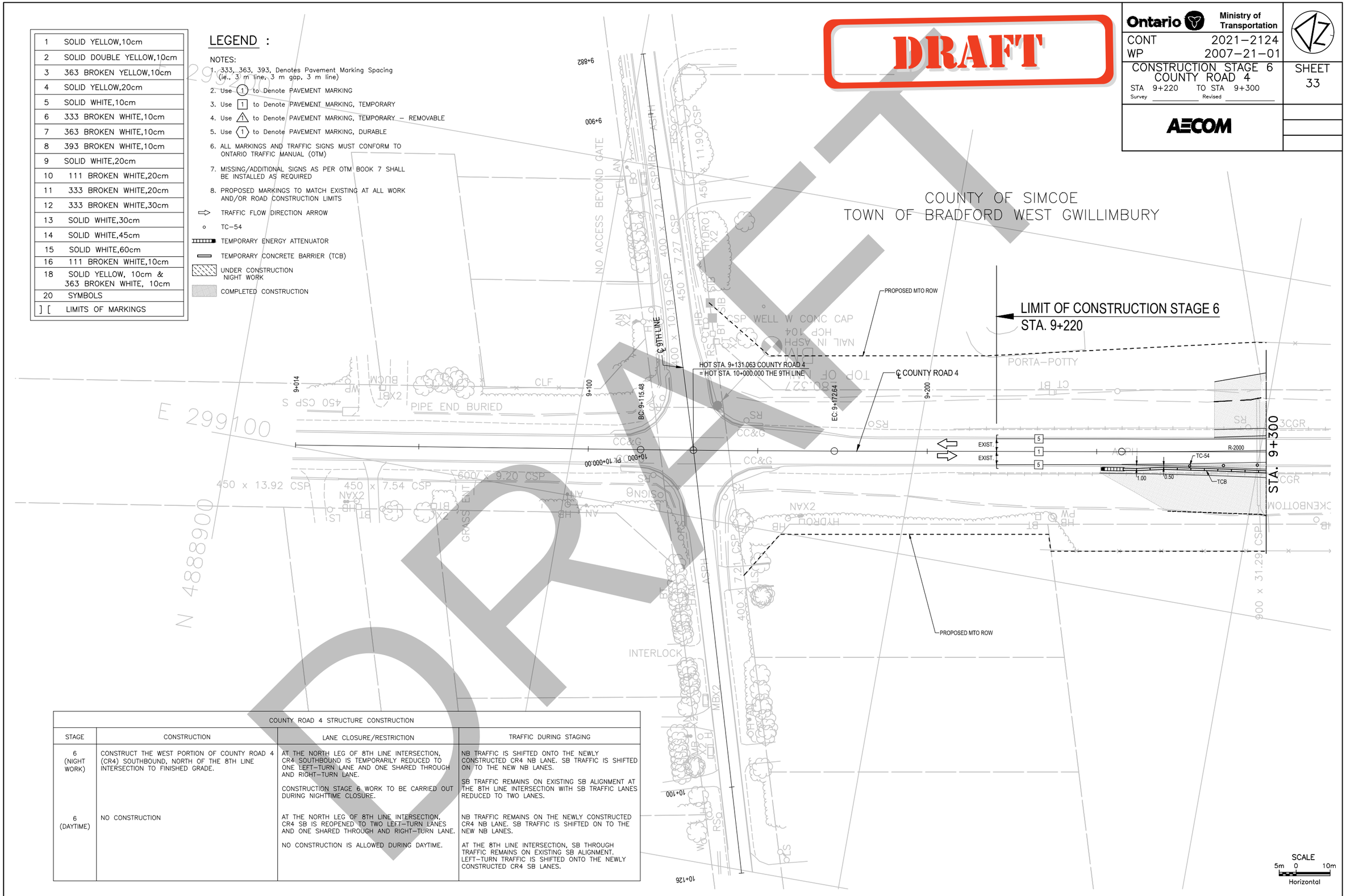
CONT 2021–2124
WP 2007–21–01

CONSTRUCTION STAGE 6
COUNTY ROAD 4
STA 9+220 TO STA 9+300
Survey _____ Revised _____

AECOM

SHEET 33

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



COUNTY ROAD 4 STRUCTURE CONSTRUCTION			
STAGE	CONSTRUCTION	LANE CLOSURE/RESTRICTION	TRAFFIC DURING STAGING
6 (NIGHT WORK)	CONSTRUCT THE WEST PORTION OF COUNTY ROAD 4 (CR4) SOUTHBOUND, NORTH OF THE 8TH LINE INTERSECTION TO FINISHED GRADE.	AT THE NORTH LEG OF 8TH LINE INTERSECTION, CR4 SOUTHBOUND IS TEMPORARILY REDUCED TO ONE LEFT–TURN LANE AND ONE SHARED THROUGH AND RIGHT–TURN LANE. CONSTRUCTION STAGE 6 WORK TO BE CARRIED OUT DURING NIGHTTIME CLOSURE.	NB TRAFFIC IS SHIFTED ONTO THE NEWLY CONSTRUCTED CR4 NB LANE. SB TRAFFIC IS SHIFTED ON TO THE NEW NB LANES. SB TRAFFIC REMAINS ON EXISTING SB ALIGNMENT AT THE 8TH LINE INTERSECTION WITH SB TRAFFIC LANES REDUCED TO TWO LANES.
6 (DAYTIME)	NO CONSTRUCTION	AT THE NORTH LEG OF 8TH LINE INTERSECTION, CR4 SB IS REOPENED TO TWO LEFT–TURN LANES AND ONE SHARED THROUGH AND RIGHT–TURN LANE. NO CONSTRUCTION IS ALLOWED DURING DAYTIME.	NB TRAFFIC REMAINS ON THE NEWLY CONSTRUCTED CR4 NB LANE. SB TRAFFIC IS SHIFTED ON TO THE NEW NB LANES. AT THE 8TH LINE INTERSECTION, SB THROUGH TRAFFIC REMAINS ON EXISTING SB ALIGNMENT. LEFT–TURN TRAFFIC IS SHIFTED ONTO THE NEWLY CONSTRUCTED CR4 SB LANES.

SCALE
5m 0 10m
Horizontal

NOTE:
1. DRIVEWAY AND ENTRANCE ACCESSES TO BE MAINTAINED DURING CONSTRUCTION

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

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Ontario — Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
CONSTRUCTION STAGE 6 COUNTY ROAD 4 STA 9+300 TO STA 9+650 Survey _____ Revised _____	SHEET 34
AECOM	

LIMIT OF COUNTY ROAD 4 WIDENING
STA. 9+415

PROPOSED MTO ROW
℄ COUNTY ROAD 4 STAGE 6
℄ COUNTY ROAD 4

STA. 9+300

STA. 9+650

PROPOSED MTO ROW

SCALE
5m 0 10m
Horizontal

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI—D 2016—10

Ontario Ministry of Transportation

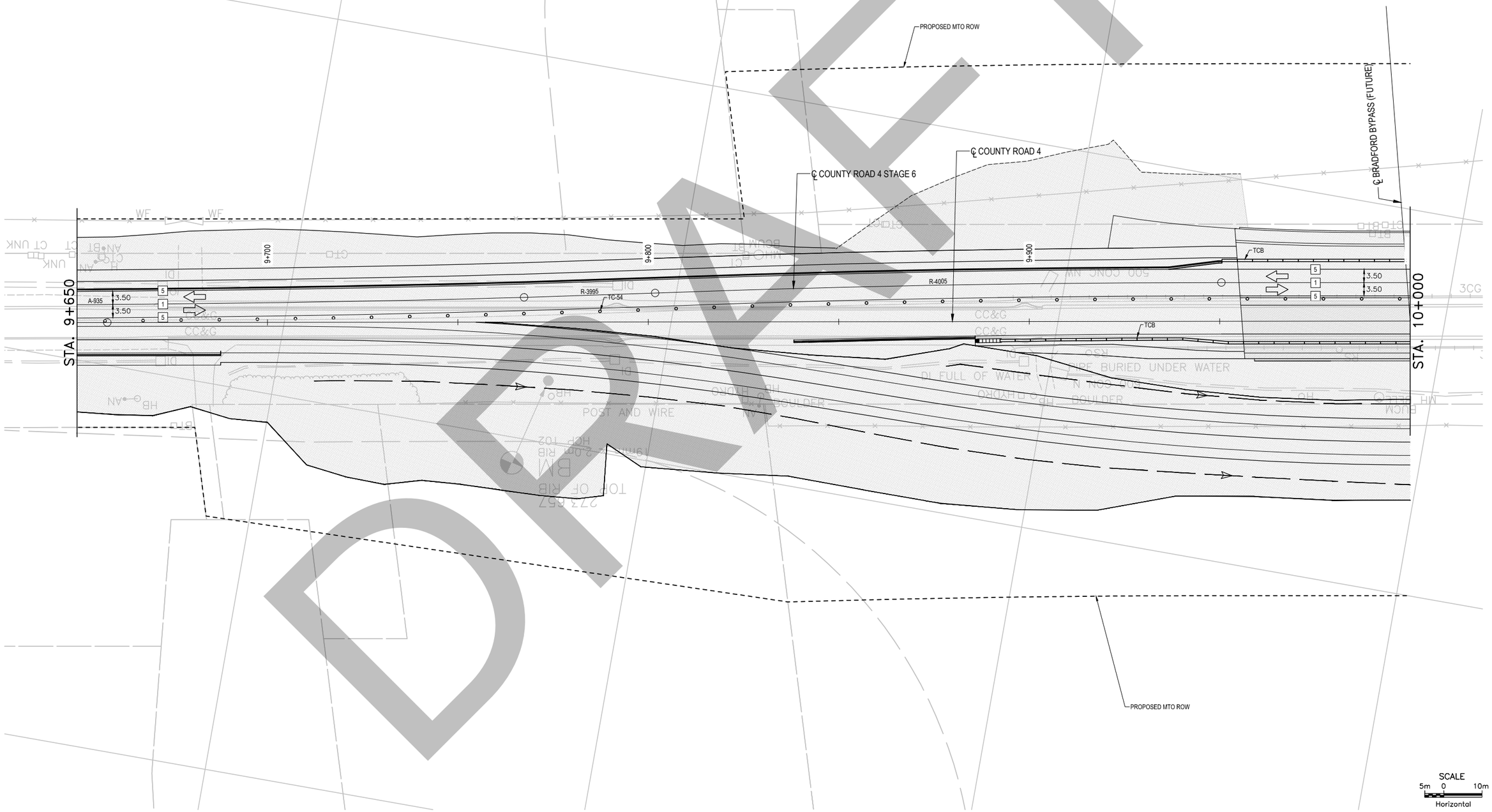
CONT 2021–2124
WP 2007–21–01

CONSTRUCTION STAGE 6
COUNTY ROAD 4
STA 9+650 TO STA 10+000
Survey _____ Revised _____

SHEET 35

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



SCALE
5m 0 10m
Horizontal

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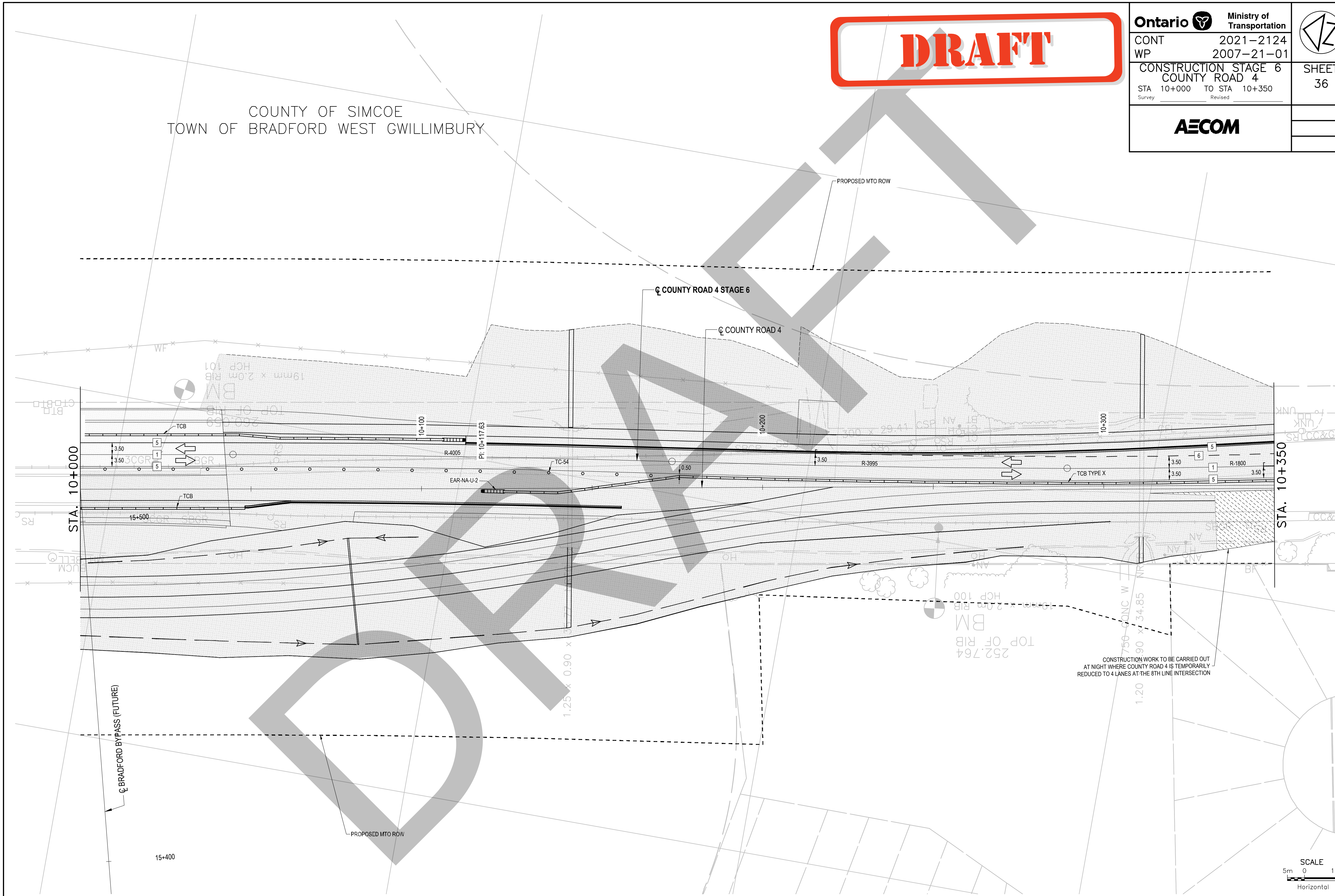
MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10


DRAFT
COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY
PROPOSED MTO ROW
℄ COUNTY ROAD 4 STAGE 6
℄ COUNTY ROAD 4
STA. 10+000
STA. 10+350
10+100
PI: 10+117.63
10+200
10+300
TCB
TCB TYPE X
TC-54
EAR-NA-U-2
R-4005
R-3995
R-1800
3.50
0.50
15+500
15+400
℄ BRADFORD BYPASS (FUTURE)
CONSTRUCTION WORK TO BE CARRIED OUT AT NIGHT WHERE COUNTY ROAD 4 IS TEMPORARILY REDUCED TO 4 LANES AT THE 8TH LINE INTERSECTION
SCALE
5m 0 10m
Horizontal

Ontario | Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

CONSTRUCTION STAGE 6
COUNTY ROAD 4
STA 10+000 TO STA 10+350

SHEET 36

AECOM

MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10
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DRAFT

Ontario	Ministry of Transportation
CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 6
COUNTY ROAD 4
STA 10+350 TO STA 10+630
Survey _____ Revised _____

SHEET 37

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

LIMIT OF CONSTRUCTION STAGE 6
STA. 10+630

PROPOSED MTO ROW

℄ COUNTY ROAD 4 STAGE 6

STA. 10+350

℄ 8TH LINE

HOT STA. 10+518.068 COUNTY ROAD 4
= HOT STA. 10+000.000 THE 8TH LINE

℄ COUNTY ROAD 4

10+400 | 10+500 | 10+600 | 10+630

R-1800 | R-1797 | R-500 | R-1000

TCB TYPE X | TCB TYPE X

3.50 LT-TURN | 3.50 THROUGH & RT-TURN | 3.50 RT-TURN LANE | 3.50 LT-TURN LANE

0.50 | 0.40 | 0.40

EXIST. | EXIST. | EXIST. | EXIST.

℄ COUNTY ROAD 4 STAGE 4

CONSTRUCTION WORK TO BE CARRIED OUT
AT NIGHT WHERE COUNTY ROAD 4 IS TEMPORARILY
REDUCED TO 4 LANES AT THE 8TH LINE INTERSECTION

PROPOSED MTO ROW

E 299400

E 299300

SCALE
5m 0 10m
Horizontal

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MODIFIED: 2021-09-02 17:27

MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2018-10

1	SOLID YELLOW,10cm
2	SOLID DOUBLE YELLOW,10cm
3	363 BROKEN YELLOW,10cm
4	SOLID YELLOW,20cm
5	SOLID WHITE,10cm
6	333 BROKEN WHITE,10cm
7	363 BROKEN WHITE,10cm
8	393 BROKEN WHITE,10cm
9	SOLID WHITE,20cm
10	111 BROKEN WHITE,20cm
11	333 BROKEN WHITE,20cm
12	333 BROKEN WHITE,30cm
13	SOLID WHITE,30cm
14	SOLID WHITE,45cm
15	SOLID WHITE,60cm
16	111 BROKEN WHITE,10cm
18	SOLID YELLOW, 10cm & 363 BROKEN WHITE, 10cm
20	SYMBOLS
] [	LIMITS OF MARKINGS

LEGEND :

NOTES:

1. 333, 363, 393, Denotes Pavement Marking Spacing (ie., 3 m line, 3 m gap, 3 m line)
2. Use (1) to Denote PAVEMENT MARKING
3. Use [1] to Denote PAVEMENT MARKING, TEMPORARY
4. Use ⚠1 to Denote PAVEMENT MARKING, TEMPORARY – REMOVABLE
5. Use ⬡1 to Denote PAVEMENT MARKING, DURABLE
6. ALL MARKINGS AND TRAFFIC SIGNS MUST CONFORM TO ONTARIO TRAFFIC MANUAL (OTM)
7. MISSING/ADDITIONAL SIGNS AS PER OTM BOOK 7 SHALL BE INSTALLED AS REQUIRED
8. PROPOSED MARKINGS TO MATCH EXISTING AT ALL WORK AND/OR ROAD CONSTRUCTION LIMITS

- TRAFFIC FLOW DIRECTION ARROW
- TC-54
- TEMPORARY ENERGY ATTENUATOR
- TEMPORARY CONCRETE BARRIER (TCB)
- UNDER CONSTRUCTION
- COMPLETED CONSTRUCTION

DRAFT

Ontario	Ministry of Transportation
CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 7
COUNTY ROAD 4
STA 9+159 TO STA 9+300
Survey _____ Revised _____

SHEET 38

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

PROPOSED MTO ROW

LIMIT OF CONSTRUCTION STAGE 6
STA. 9+220

℄ 9TH LINE

HOT STA. 9+131.063 COUNTY ROAD 4
= HOT STA. 10+000.000 THE 9TH LINE

℄ COUNTY ROAD 4

BC: 9+115.48

EC: 9+172.64

EXIST.

EXIST.

R-2000

TC-54

TCB

1.00

0.50

STA. 9+300

PROPOSED MTO ROW

COUNTY ROAD 4 STRUCTURE CONSTRUCTION			
STAGE	CONSTRUCTION	LANE CLOSURE/RESTRICTION	TRAFFIC DURING STAGING
7	REMOVE TEMPORARY DETOUR.		NB/SB TRAFFIC IS SHIFTED ONTO THE NEWLY CONSTRUCTED CR4 NB LANE.

SCALE
5m 0 10m
Horizontal

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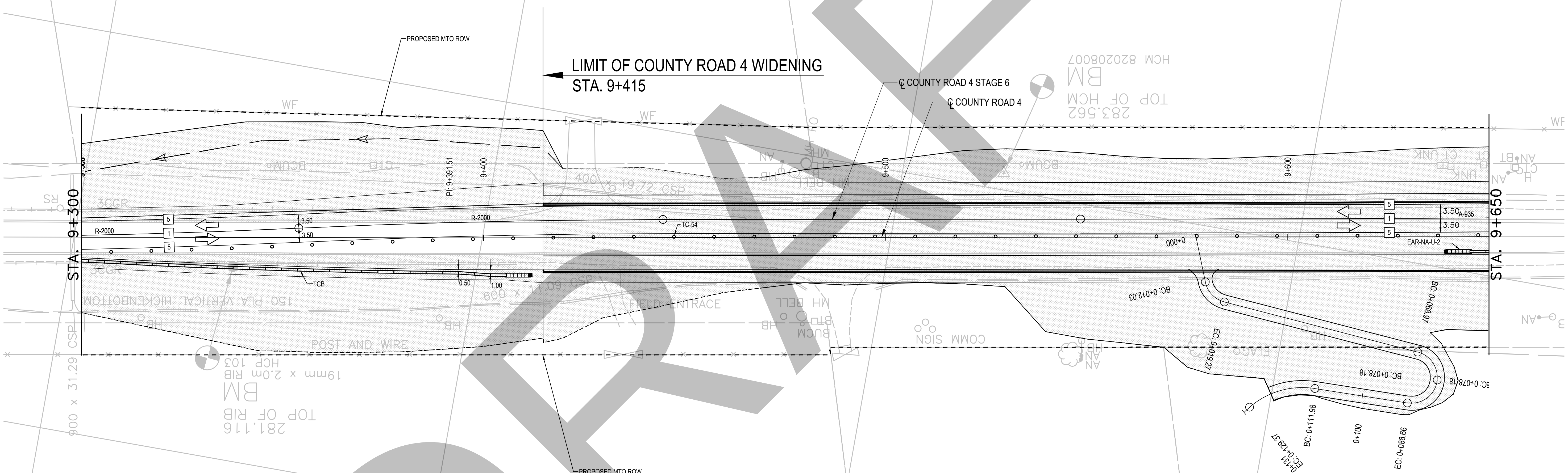
MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2018-10

NOTE:
1. DRIVEWAY AND ENTRANCE ACCESSES TO BE MAINTAINED DURING CONSTRUCTION

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

Ontario — Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
CONSTRUCTION STAGE 7 COUNTY ROAD 4	SHEET 39
STA 9+300 TO STA 9+650	
AECOM	



SCALE
5m 0 10m
Horizontal

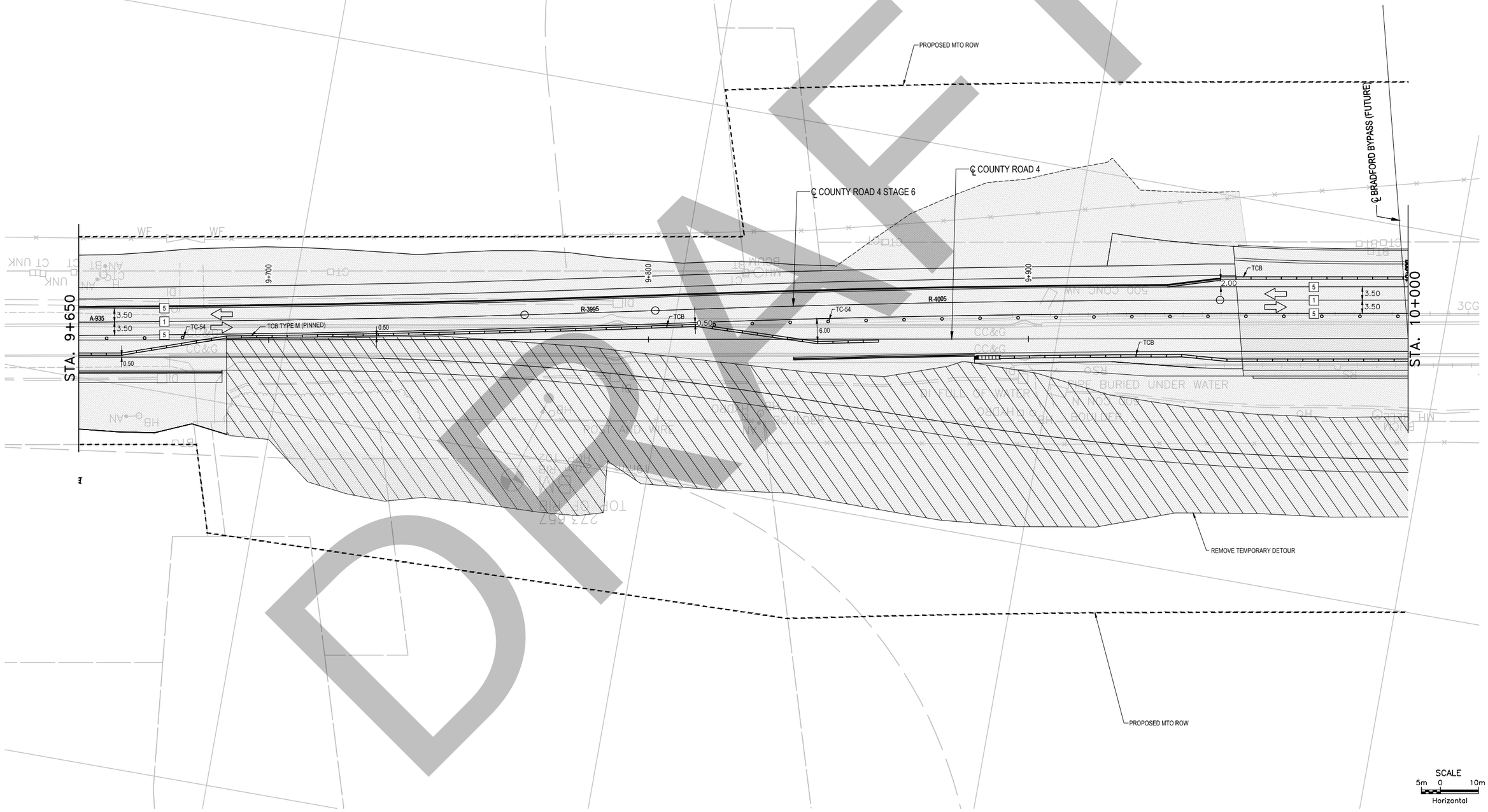
Ontario	Ministry of Transportation
CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 7
COUNTY ROAD 4
STA 9+650 TO STA 10+000
Survey _____ Revised _____

SHEET 40

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



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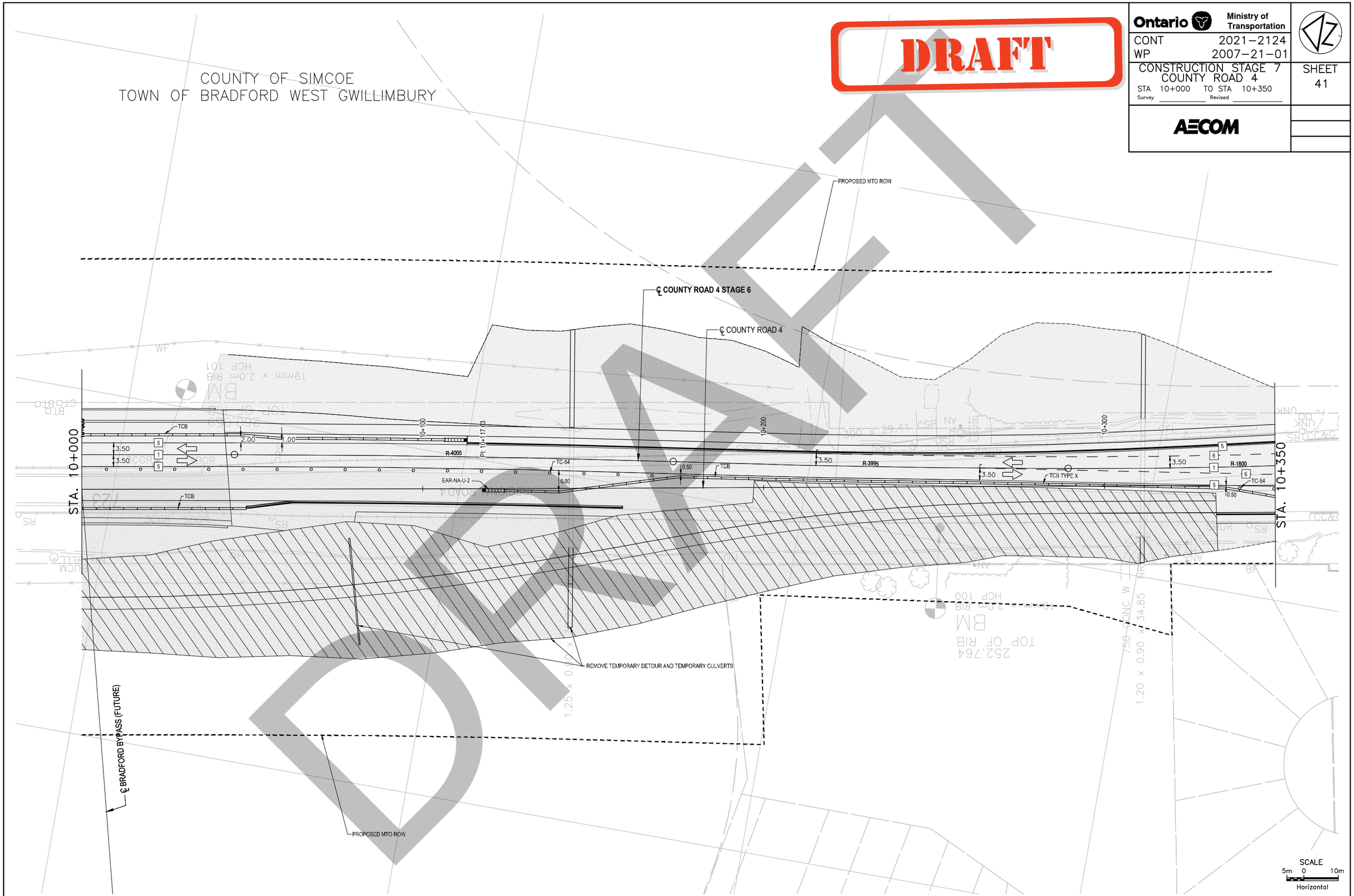
MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2018-10

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

Ontario Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
CONSTRUCTION STAGE 7 COUNTY ROAD 4	
STA 10+000 TO STA 10+350	
Survey _____ Revised _____	
AECOM	

SHEET 41



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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

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Ontario — Ministry of Transportation

CONT	2021–2124
WP	2007–21–01

CONSTRUCTION STAGE 7
COUNTY ROAD 4
STA 10+350 TO STA 10+630
Survey _____ Revised _____

SHEET 42

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

LIMIT OF CONSTRUCTION STAGE 7
STA. 10+630

PROPOSED MTO ROW

RAISED ISLAND TO BE REINSTATED AT END OF STAGE 7

℄ 8TH LINE

HOT STA. 10+518.068 COUNTY ROAD 4
= HOT STA. 10+000.000 THE 8TH LINE

℄ COUNTY ROAD 4 STAGE 6

℄ COUNTY ROAD 4

STA. 10+350

R-1800 | R-1797 | R-500 | R-1000

3.50 LT–TURN
3.50 LT–TURN
3.50 THROUGH & RT–TURN
3.50 RT-TURN LANE
3.50 LT-TURN LANE

TCB TYPE X
TC-54

10+400 | 10+500 | 10+600 | 10+630 | 10+000 | 10+100 | 10+111

EXIST.

PLANTER

SCALE
5m 0 10m
Horizontal

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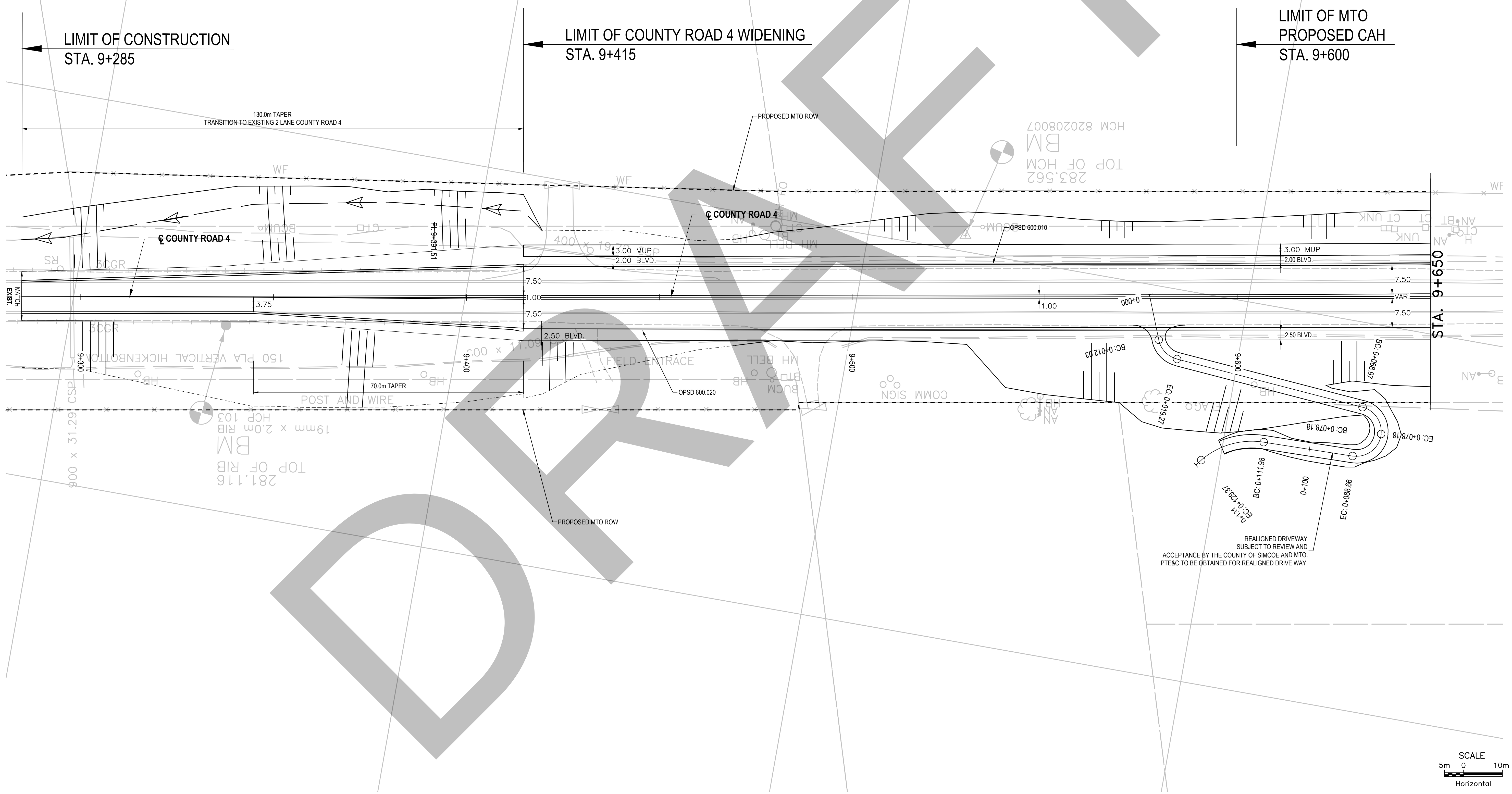
MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2018-10

NOTES:
1. EXISTING ENTRANCES WITHIN THE PROJECT LIMITS ARE TO BE RECONSTRUCTED.
2. DRAINAGE SYSTEM RECOMMENDATIONS TO BE PROVIDED.

Ontario Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
NEW CONSTRUCTION COUNTY ROAD 4	SHEET 43
STA 9+285 TO STA 9+650	
Survey / Revised	
AECOM	

DRAFT

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



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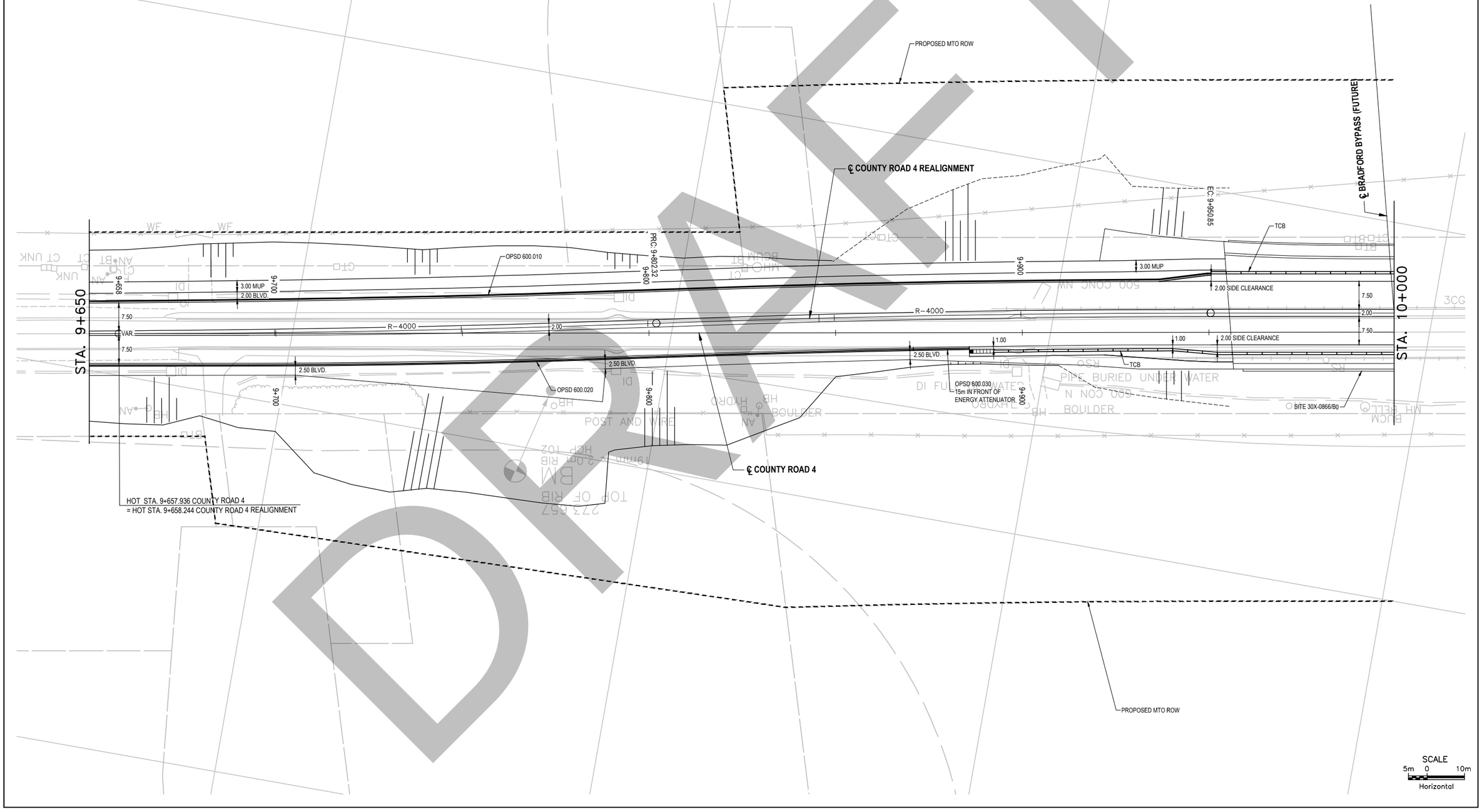
MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

NOTES:
1. GRADING PLATFORMS FOR FUTURE COUNTY ROAD 4 INTERCHANGE RAMPS TO BE PROVIDED.
2. DRAINAGE SYSTEM RECOMMENDATIONS TO BE PROVIDED.

Ontario Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
NEW CONSTRUCTION COUNTY ROAD 4	
STA 9+650 TO STA 10+000	
Survey _____ Revised _____	
AECOM	

SHEET 44

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

NOTES:
1. GRADING PLATFORMS FOR FUTURE COUNTY ROAD 4 INTERCHANGE RAMPS TO BE PROVIDED.
2. DRAINAGE SYSTEM RECOMMENDATIONS TO BE PROVIDED.
3. WORKS FOR CULVERTS AND EXTENSIONS ARE TO BE DETERMINED.

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

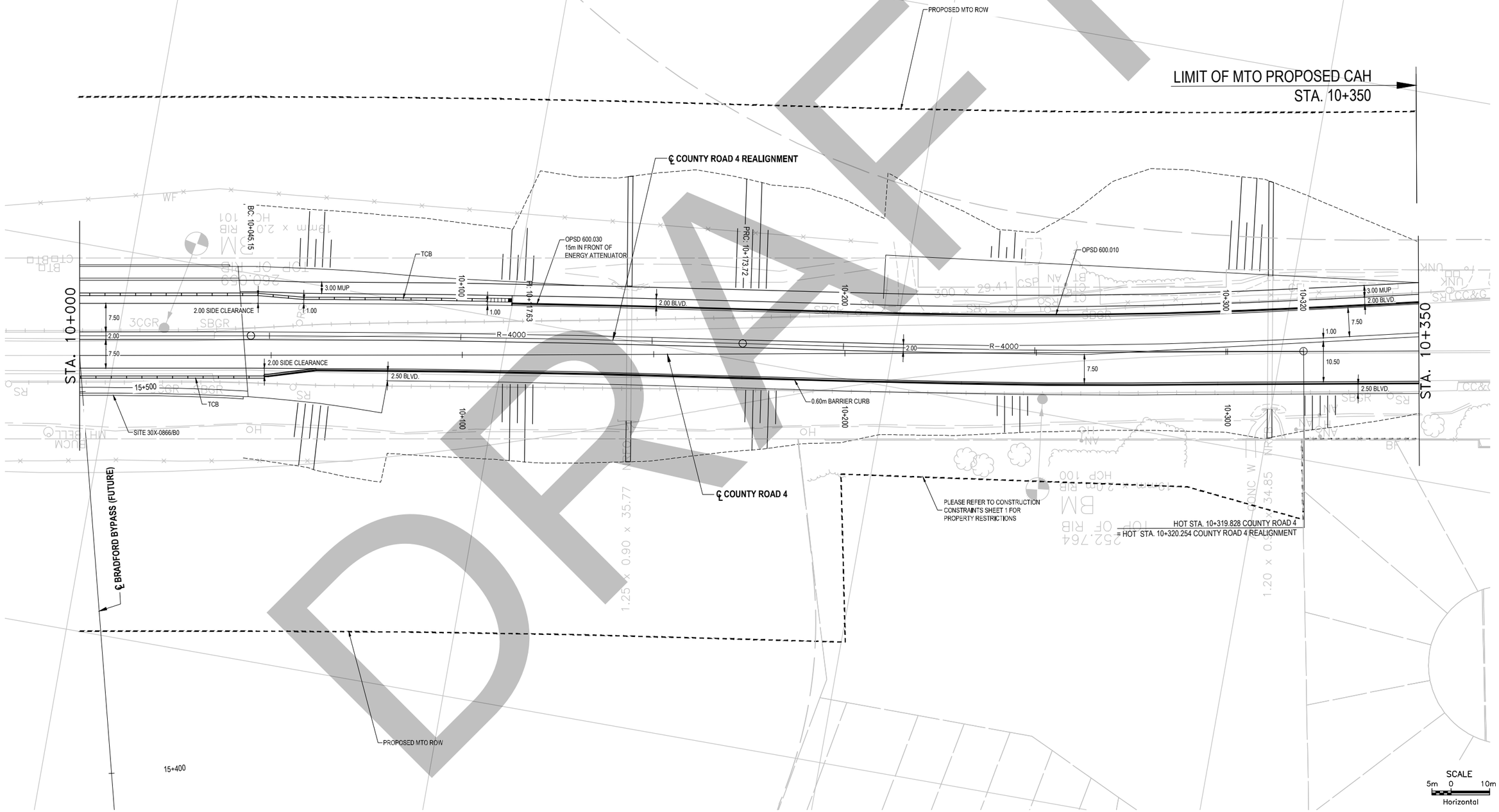
Ontario Ministry of Transportation

CONT	2021-2124
WP	2007-21-01

NEW CONSTRUCTION
COUNTY ROAD 4
STA 10+000 TO STA 10+350
Survey _____ Revised _____

AECOM

SHEET 45



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MINISTRY OF TRANSPORTATION, ONTARIO AMS-D 2016-10

NOTES:
1. DRAINAGE SYSTEM RECOMMENDATIONS TO BE PROVIDED.

Ontario — Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
NEW CONSTRUCTION COUNTY ROAD 4	
STA 10+350 TO STA 10+563	
Survey _____ Revised _____	
AECOM	

SHEET 46

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

LIMIT OF COUNTY ROAD 4 WIDENING
STA. 10+460

PROPOSED MTO ROW

LIMIT OF CONSTRUCTION
STA. 10+563

℄ 8TH LINE

HOT STA. 10+518.068 COUNTY ROAD 4
= HOT STA. 10+000.000 THE 8TH LINE

℄ COUNTY ROAD 4

MATCH EXISTING SIDEWALK

MATCH EXISTING CURB

0.60m BARRIER CURB

3.00 MUP

2.00 BLVD.

7.50

1.00

14.00

2.50 BLVD.

OPSD 600.010

MATCH EXIST.

MATCH EXIST.

2.00 RAISED CONC. ISLAND

2.00 RAISED CONC. ISLAND

MATCH EXISTING CURB

PROPOSED MTO ROW

STA. 10+350

9+867
9+900
10+000
10+063
10+100
10+111
10+400
10+500
10+630

E 299400
E 299300

SCALE
5m 0 10m
Horizontal

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2018-10

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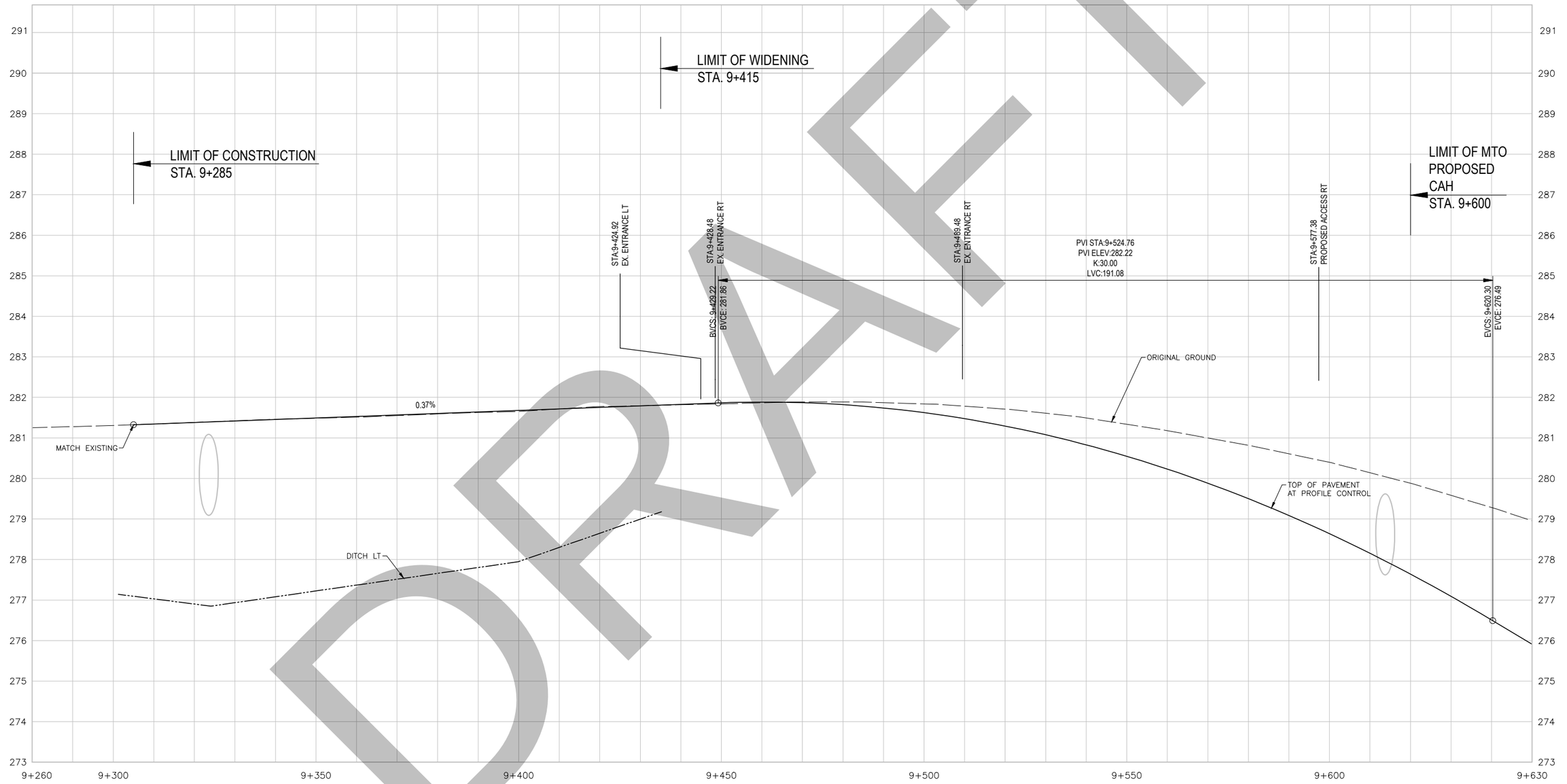
Ontario — Ministry of Transportation	
CONT	2021–2124
WP	2007–21–01
PROFILE COUNTY ROAD 4	SHEET 47
STA 9+260 TO STA 9+630	
Survey _____ Revised _____	
AECOM	

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

DRAFT

Ontario — Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

PROFILE
COUNTY ROAD 4
STA 9+630 TO STA 9+980
Survey _____ Revised _____

SHEET 48

AECOM

STA:9+683.14
EX. ENTRANCE RT

STA:9+786.96
B/N N-W RAMP

ORIGINAL GROUND

PVI STA:9+738.86
PVI ELEV:269.38
K:30.00
LVC:89.82

-6.00%

BVCS: 9+693.95
BVCE: 272.08

EVCS: 9+783.77
EVCE: 268.03

STA:9+826.95
B/N E-NS RAMP

TOP OF PAVEMENT
AT PROFILE CONTROL

STA:9+920.76
B/N S-W RAMP

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

TOP OF PAVEMENT
AT PROFILE CONTROL

ORIGINAL GROUND

PROPOSED BBP/CR4 UNDERPASS STRUCTURE

281 280 279 278 277 276 275 274 273 272 271 270 269 268 267 266 265 264 263 262 261 260 259 256

9+630 9+650 9+700 9+750 9+800 9+850 9+900 9+950 9+980

SCALE
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Horizontal
0.5m 0 1m
Vertical

FILE NAME: \\na.aecomnet.com\Vfs\AMER\Richmondhill-CARCH1\DCS\Projects_TRN\60636190_BradfordBypPASS\900_CAD_GIS\910_CAD\Sheets\C\County Road 4\Profile\60636190-C-CR4-PR-2.dwg
CREATED: 2021-09-02
MODIFIED: 2021-09-02 16:55
MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2018-10

Ontario Ministry of Transportation

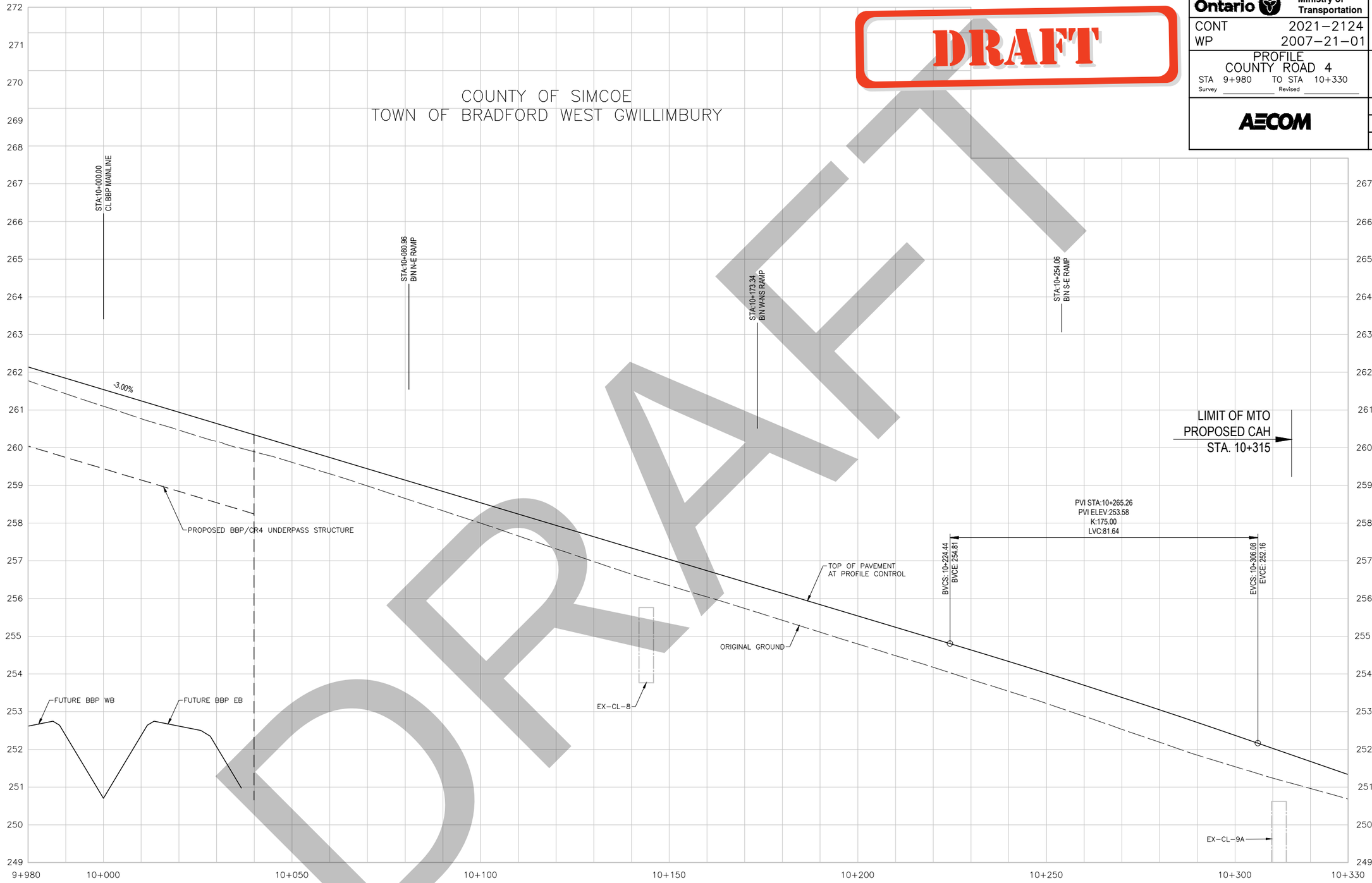
CONT	2021–2124
WP	2007–21–01

PROFILE
COUNTY ROAD 4
STA 9+980 TO STA 10+330
Survey _____ Revised _____

SHEET 49

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



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MINISTRY OF TRANSPORTATION, ONTARIO ANSI–D 2016–10

Ontario Ministry of Transportation

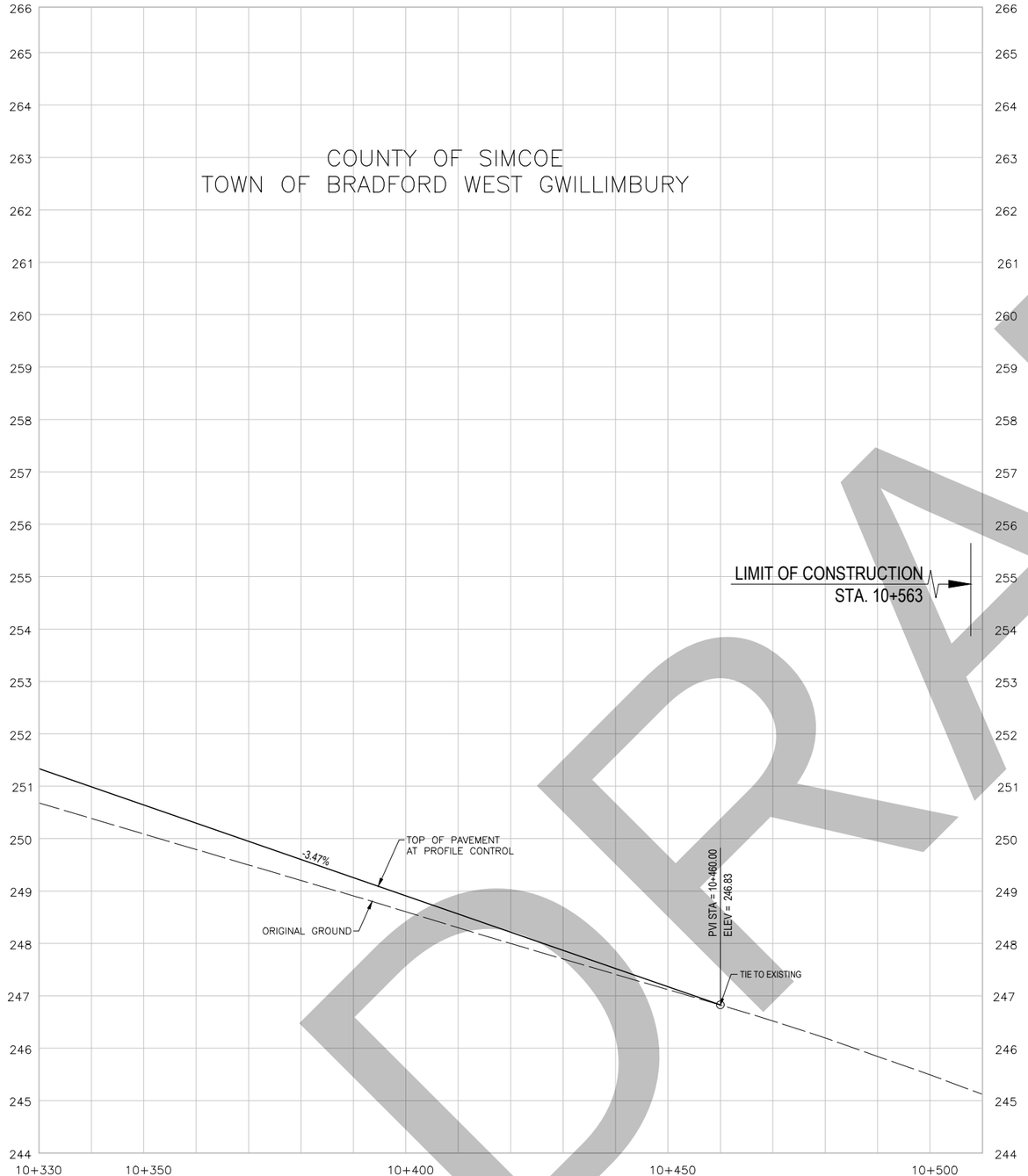
CONT	2021–2124
WP	2007–21–01

PROFILE
COUNTY ROAD 4
STA 10+330 TO STA 10+500
Survey _____ Revised _____

SHEET 50

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2018-10

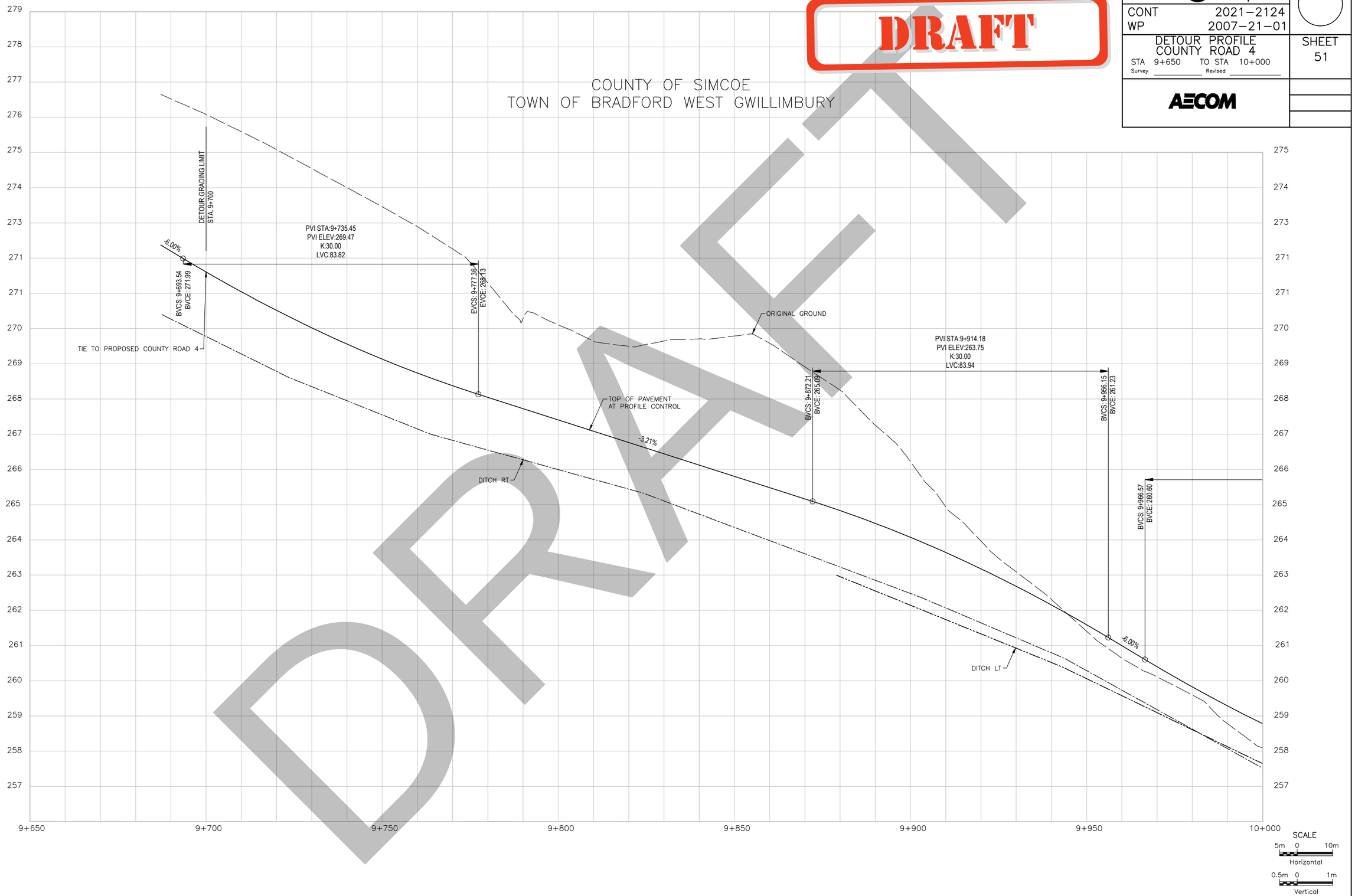
Ontario	Ministry of Transportation
CONT	2021-2124
WP	2007-21-01

DETOUR PROFILE
COUNTY ROAD 4
STA 9+650 TO STA 10+000
Survey _____ Revised _____

SHEET 51

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY



SCALE
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Horizontal
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Vertical

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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

Ontario Ministry of Transportation

CONT	2021–2124
WP	2007–21–01

DETOUR PROFILE
COUNTY ROAD 4
STA 10+000 TO STA 10+350
Survey _____ Revised _____

SHEET 52

AECOM

COUNTY OF SIMCOE
TOWN OF BRADFORD WEST GWILLIMBURY

PVI STA:10+049.15
PVI ELEV:255.64
K:30.00
LVC:165.16

EVCS: 10+131.73
EVCE: 255.23

PVI STA:10+196.25
PVI ELEV:254.91
K:31.00
LVC:81.12

BVCS: 10+155.69
BVCE: 255.11

BVCS: 10+236.81
BVCE: 253.65

TOP OF PAVEMENT AT PROFILE CONTROL

-0.50%

-3.11%

DITCH LT

DITCH RT

ORIGINAL GROUND

DETOUR GRADING LIMIT
STA. 10+340

PVI STA = 10+340.00
ELEV = 250.43

TIE TO EXISTING

268 267 266 265 264 263 262 261 260 259 258 257 256 255 254 253 252 251 250 249 248 247

10+000 10+050 10+100 10+150 10+200 10+250 10+300 10+350

SCALE
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Horizontal
0.5m 0 1m
Vertical

FILE NAME: \\ra.aecomnet.com\fs\AMER\Richmondhill-CARCH1\DCS\Projects_TRN\60636190_BradfordBypPASS\900_CAD_GIS\910_CAD\Sheets\C\County Road 4\Profile\60636190-C-CR4-DETOUR PR-2.dwg
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MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

DRAFT

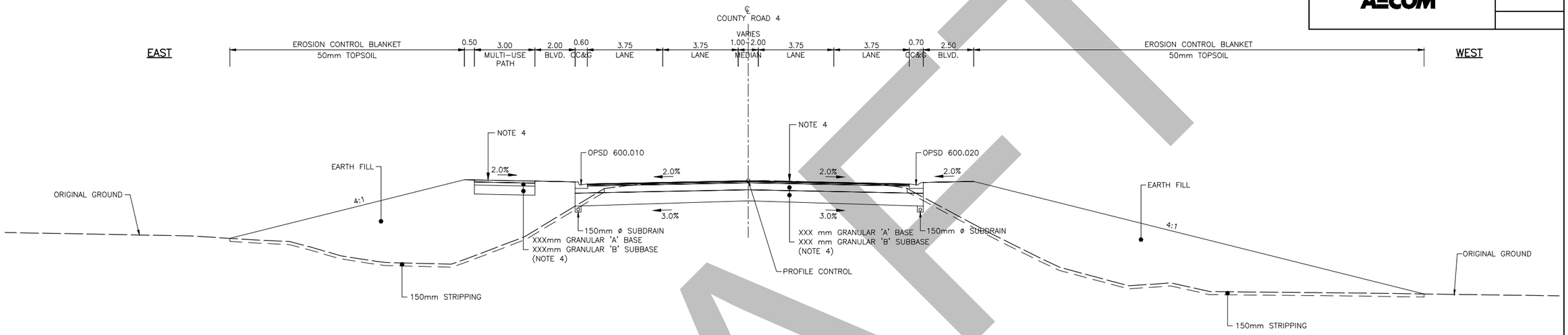
Ontario Ministry of Transportation

CONT 2021–2124
WP 2007–21–01

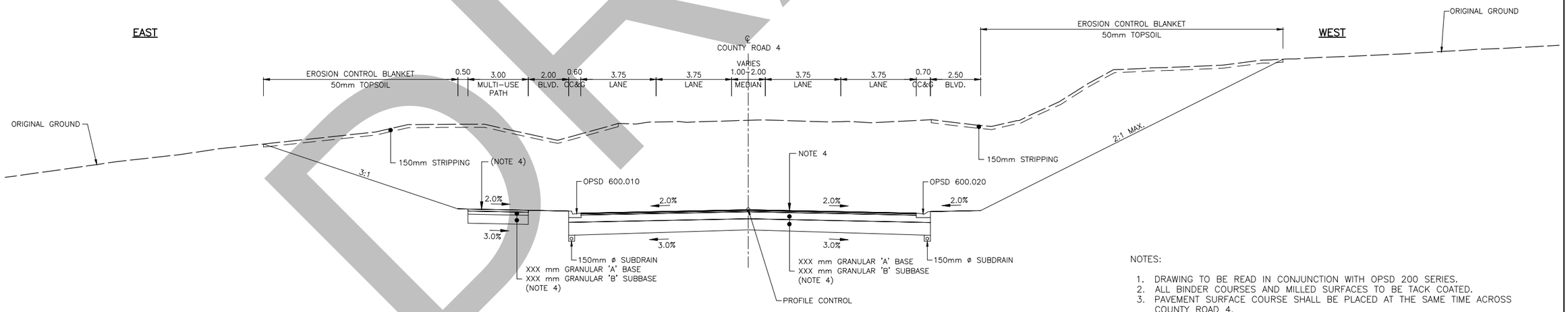
TYPICAL SECTIONS
COUNTY ROAD 4

SHEET 53

AECOM



COUNTY ROAD 4 – RECONSTRUCTION IN FILL SECTION



COUNTY ROAD 4 – RECONSTRUCTION IN CUT SECTION

NOTES:

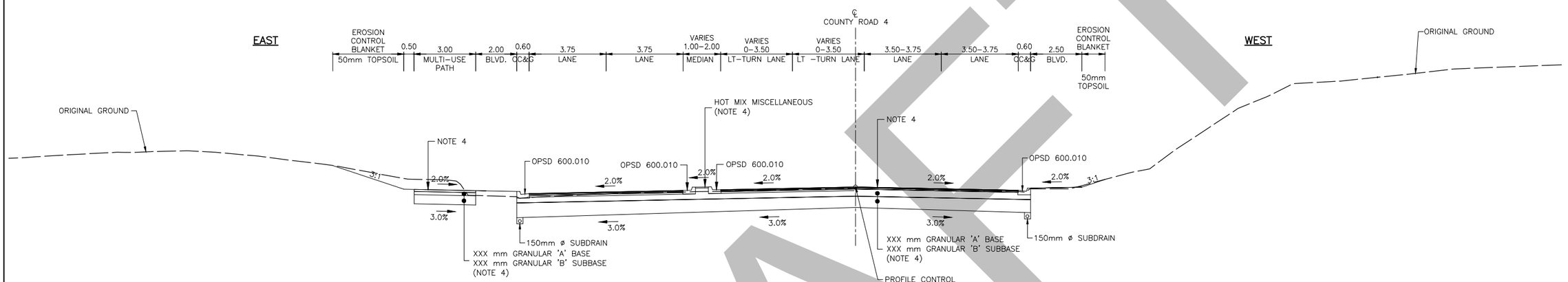
1. DRAWING TO BE READ IN CONJUNCTION WITH OPSD 200 SERIES.
2. ALL BINDER COURSES AND MILLED SURFACES TO BE TACK COATED.
3. PAVEMENT SURFACE COURSE SHALL BE PLACED AT THE SAME TIME ACROSS COUNTY ROAD 4.
4. PAVEMENT STRUCTURE SHOWN IS FOR BIDDING PURPOSES ONLY. FINAL PAVEMENT DESIGN STRUCTURE SHALL BE DETERMINED BY PAVEMENT ENGINEERING DESIGN.

N.T.S.

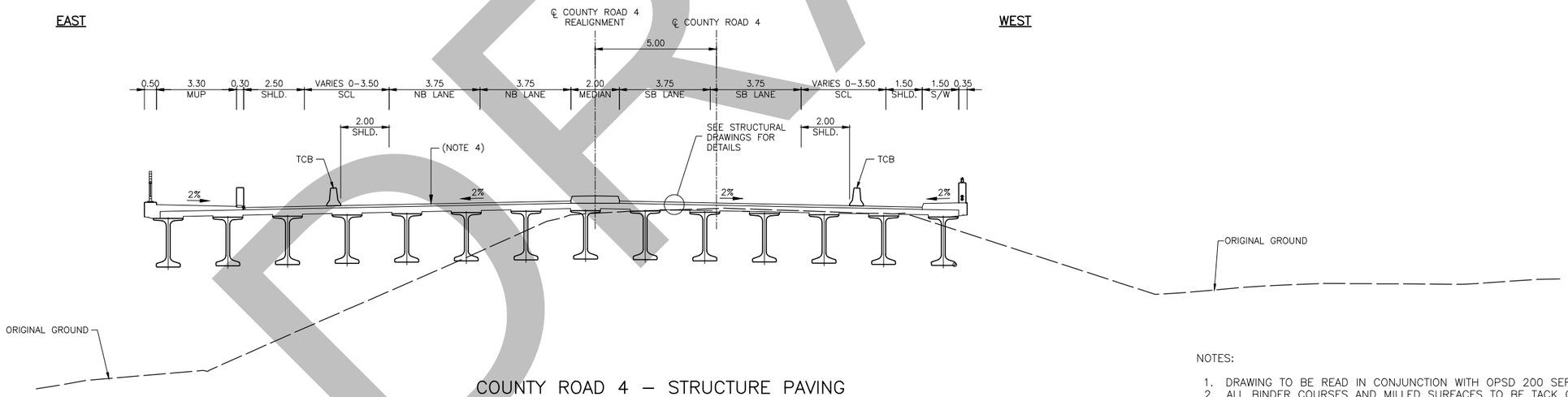
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN

DRAFT

Ontario Ministry of Transportation	
CONT 2021–2124	
WP 2007–21–01	
TYPICAL SECTIONS COUNTY ROAD 4	SHEET 54
AECOM	



COUNTY ROAD 4 – RECONSTRUCTION AT NORTH OF THE 8TH LINE INTERSECTION



COUNTY ROAD 4 – STRUCTURE PAVING

NOTES:

1. DRAWING TO BE READ IN CONJUNCTION WITH OPSD 200 SERIES.
2. ALL BINDER COURSES AND MILLED SURFACES TO BE TACK COATED.
3. PAVEMENT SURFACE COURSE SHALL BE PLACED AT THE SAME TIME ACROSS COUNTY ROAD 4.
4. PAVEMENT STRUCTURE SHOWN IS FOR BIDDING PURPOSES ONLY. FINAL PAVEMENT DESIGN STRUCTURE SHALL BE DETERMINED BY PAVEMENT ENGINEERING DESIGN.

N.T.S.

FILE NAME: \\vs.aecomnet.com\fs\AMER\Richmondhill-CARCH\1\DCS\Projects_TRN\60636190_BradfordBypPASS\900_CAD_GIS\910_CAD\Sheets\C\County Road 4\Typical Section\60636190-C-TYP-COUNTY RD 4 NC.dwg
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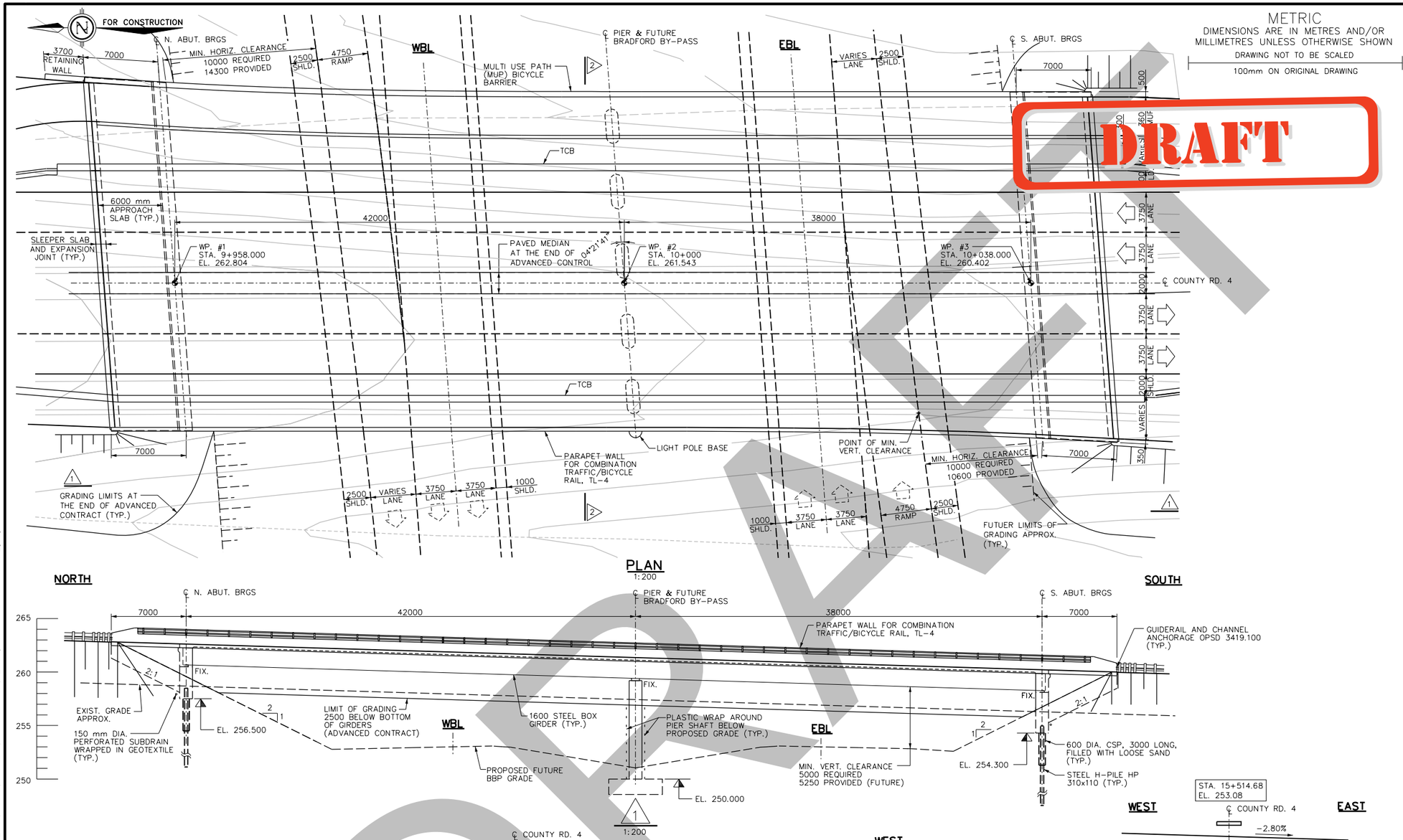
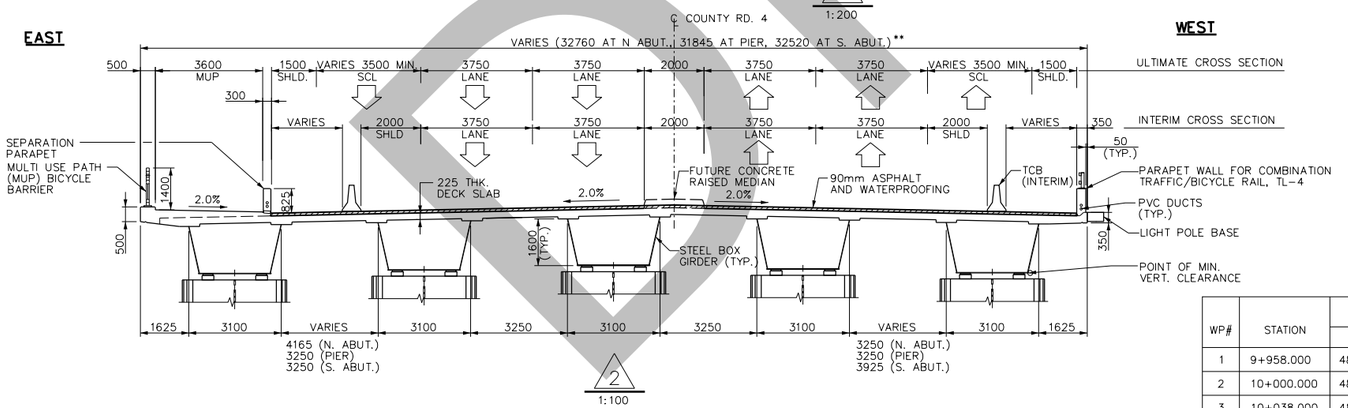
MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10



PLAN
1:200

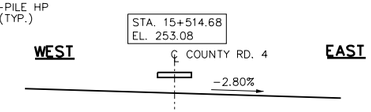
1:200



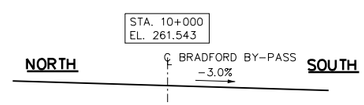
1:100

NOTE: DIMENSIONS MARKED ** ARE MEASURED ALONG ℄ OF BEARINGS, OTHER DIMENSIONS ARE PERPENDICULAR TO ℄ OF COUNTRY ROAD 4.

WP#	STATION	CO-ORDINATE	
		NORTH	EAST
1	9+958.000	4887951.642	299268.738
2	10+000.000	4887910.286	299276.065
3	10+038.000	4887872.868	299282.694



PROFILE OF FUTURE BRADFORD BY-PASS
N.T.S.



PROFILE OF COUNTY RD. 4
N.T.S.

PRELIMINARY

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

Ontario Ministry of Transportation

CONT 2021-2024
GWP 2008-21-00

BRADFORD BYPASS
COUNTY ROAD 4 UNDERPASS
GENERAL ARRANGEMENT

SHEET

AECOM

GENERAL NOTES:

1. CLASS OF CONCRETE: ..... 30 MPa
   UNLESS NOTED OTHERWISE
2. CLEAR COVER TO REINFORCING STEEL:
   FOOTINGS ..... 100±25
   DECK – TOP ..... 70±20
   BOTTOM ..... 40±10
   REMAINDER ..... 70±20
   UNLESS NOTED OTHERWISE.
3. REINFORCING STEEL:
   - REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
   - BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
   - STAINLESS REINFORCING STEEL BARS SHALL BE TYPE 316LN OR DUPLEX 2205 AND HAVE MINIMUM YIELD STRENGTH OF 500 MPa.
   - BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWING SS12-1 UNLESS INDICATED OTHERWISE.
   - UNLESS SHOWN OTHERWISE TENSION LAP SPLICES SHALL BE CLASS B.

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY THE LOCATION OF THE EXISTING BRIDGE, DIMENSIONS, PROPOSED WORK AND DETAILS AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE PROCEEDING WITH THE WORK.
2. THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESS FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT FROM THOSE GIVEN IN THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL TO SUIT.
3. BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND ABUTMENTS, KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN HEIGHTS OF THE BACKFILL BE GREATER THAN 500mm, IN ACCORDANCE WITH OPSS 902.
4. BACKFILL SHALL NOT BE PLACED BEHIND THE ABUTMENTS UNTIL CONCRETE IN DECK HAS REACHED 25 MPa.
5. SEE HIGHWAY DRAWINGS FOR DETOUR OF COUNTRY ROAD 4 DURING CONSTRUCTION.

LIST OF ABBREVIATIONS:

ABUT.	DENOTES ABUTMENT
BBP	DENOTES BRADFORD BY-PASS
BRGS.	DENOTES BEARINGS
EBL	DENOTES EAST BOUND LANE
EXP.	DENOTES EXPANSION
HORIZ.	DENOTES HORIZONTAL
MIN.	DENOTES MINIMUM
N.	DENOTES NORTH
S.	DENOTES SOUTH
SHLD.	DENOTES SHOULDER
THK.	DENOTES THICKNESS
TYP.	DENOTES TYPICAL
VERT.	DENOTES VERTICAL
WBL	DENOTES WEST BOUND LANE

LIST OF DRAWINGS

01. GENERAL ARRANGEMENT

APPLICABLE STANDARD DRAWINGS

OPSD 3101.150	WALLS ABUTMENT, BACKFILL MINIMUM GRANULAR REQUIREMENT
OPSD 3360.200	DECK LIGHT POLE BASES STRUCTURES WITH PARAPET WALLS
OPSD 3370.100	DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD
OPSD 3370.101	DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm WIDE AND CONSTRUCTION JOINTSOPSD
OPSD 3390.100	DECK DRIP CHANNEL
OPSD 3419.100	GUIDERAIL AND CHANNEL ANCHORAGE
OPSD 3941.200	FIGURES IN CONCRETE SITE NUMBER AND DATE LAYOUT
OPSD 3950.100	JOINTS-CONCRETE EXPANSION AND CONSTRUCTION ON CONCRETE

REVISIONS

DATE	BY	DESCRIPTION

DESIGN S.S.	CHK U.P.	CODE CAN/CSA S6-19	LOAD CL 625-ONT	DATE DEC. 2021
DRAWN O.Z.	CHK S.S.	SITE 30X-0866/BO		DWG 1

Appendix B

Borehole Logs

RECORD OF BOREHOLE: BH CR4-01

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 30, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling

ELEVATION: 262.80 m (CGVD28)
COORDINATES: Lat: 44.131693° Long: -79.569600°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
			Gravelly CLAYEY SAND (SC), trace rootlets Firm Brown Moist	SC		0.00	1	SS	38	2-3-6-30	9			MIS_202 110280		
						262.11										
1			SILTY CLAY (Cl) trace sand to SILTY CLAY (Cl) and sand Stiff to very stiff Brown to grey Moist			0.69	2	SS	100	6-7-5-6	12					
2							3	SS	62	4-6-9-13	15			MIS_202 110282		
							4	SS	66	8-10-16-19	26					
3				Cl			5	SS	100	8-12-16-22	28			MIS_202 110283		
			- grey below a depth of 3.7 m				6	SS	62	8-12-13-15	25					
4																
5	D 90	210 mm O.D. Hollow Stem Auger					7	SS	100	6-8-13-17	21			MIS_202 110284		
						256.86										
6			SILTY SAND (SM), trace gravel Compact to very dense Grey Moist - auger grinding between depths of 5.9 m and 6.1 m			5.94	8	SS	100	7-7-11-14	18			MIS_202 110285		▽
7				SM												
8							9	SS	100	11-25-50-73	75			MIS_202 110286		
						254.11										
9			SILT (ML) of slight plasticity, trace sand Very Dense Grey Moist			8.69										
				ML			10	SS	100	33-39-51-60	90					
10																

Continued on Next Page

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 30, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-01

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 30, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling

ELEVATION: 262.80 m (CGVD28)
COORDINATES: Lat: 44.131693° Long: -79.569600°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
11	D 90	210 mm O.D. Hollow Stem Auger	SILT (ML) of slight plasticity, trace sand Very Dense Grey Moist	ML		251.52	11	SS	100	15-25-51-95	76			MIS_202 110281		
			End of hole at 11.28 m. End of Borehole													

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 30, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-02

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 21, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 259.72 m (CGVD28)
COORDINATES: Lat: 44.131759° Long: -79.569053°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
0	D 90	210 mm O.D. Hollow Stem Auger	SILT (ML) of slight plasticity, trace gravel, trace to some sand, trace rootlets (FILL) Loose to compact Brown to grey Moist	ML		0.00	1	SS	88	2-4-3-7	7					
1							2	SS	50	4-5-8-14	13					
						258.27										
			Sandy SILT (ML) of slight plasticity Compact Grey Moist			1.45	3	SS	75	4-9-10-4	19					▼
2						257.43										
			SILTY SAND (SM), trace gravel Compact Brown to grey Moist to wet	SM		2.29	4	SS	38	5-5-6-9	11					
3							5	SS	100	6-9-12-17	21					
4							6	SS	100	7-12-17-20	29					
5							7	SS	100	4-9-14-20	23					
6							8	SS	100	8-12-18-26	30					
7						252.10										
			CLAYEY SILT-SILT (CL-ML), trace to some sand Very stiff to hard Grey Moist	CL-ML		7.62	9	SS	100	9-9-12-15	21					
8																
9							10	SS	100	15-25-22-26	47					
						249.97										
			End of hole at 9.75 m.													
10			End of Borehole													

SAMPLES: Hammer: Automatic; ASTM D1586, Blows per 0.15 m; 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 21, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-03

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 23, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 261.18 m (CGVD28)
COORDINATES: Lat: 44.131484° Long: -79.569594°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	ADDITIONAL LAB TESTING	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
	SILTY SAND (SM), trace gravel, trace rootlets (FILL) Loose Brown Moist	SM	0.00 260.50	1	SS	50	2-3-3-2	6	MIS_202 110287		
1	SILTY CLAY (CI) Firm to very stiff Brown Moist	CI	0.68	2	SS	100	2-2-3-4	5	MIS_202 1102814		
2				4	SS	100	5-6-9-11	15		24Sep21 00:00	
3				5	SS	100	5-8-8-13	16	MIS_202 1102818		0.00 - 7.01 m bgs: Bentonite
	SILTY SAND (SM) Very dense Grey Moist - clayey silt pockets between depths of 3.7 m and 4.4 m	SM	257.45 3.73	6	SS	88	9-26-38-48	64			
4				7	SS	88	13-24-33-45	57			
5											
6				8	SS	100	18-29-40-51	69	MIS_202 1102819		
7											
8				9	SS	89	28-43-60-81	103			
	CLAYEY SILT-SILT (CL-ML) to SILT (ML) of slight plasticity Hard Grey Moist	CL-ML	252.51 8.67	10	SS	100	8-12-20-24	32	MIS_202 110288		7.01 - 10.67 m bgs: Sand
9											
10											

Continued on Next Page

DRILL RIG: D 90
DRILL METHOD: 210 mm O.D. Hollow Stem Auger

SAMPLES: Hammer: Automatic ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 23, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-03

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 23, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 261.18 m (CGVD28)
COORDINATES: Lat: 44.131484° Long: -79.569594°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
11	D 90	210 mm O.D. Hollow Stem Auger	CLAYEY SILT-SILT (CL-ML) to SILT (ML) of slight plasticity Hard Grey Moist	CL-ML			11	SS		14-15-20-44	35			MIS_202 110289			
12							12	SS	100	8-16-29-65	45			MIS_202 1102810			
13																	
14							13	SS	100	23-17-25-32	42			MIS_202 1102811			
15																	
16							14	SS	100	15-23-37-47	60			MIS_202 1102812			
17							15	SS	100	17-18-24-31	42						
18			CLAYEY SILT (CL) to SILTY CLAY (CI) Hard Grey Moist to wet	CI		243.35 17.83	16	SS		21-27-55-87	82						
19																	
20																	

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 23, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-03

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 23, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 261.18 m (CGVD28)
COORDINATES: Lat: 44.131484° Long: -79.569594°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
21	D 90	210 mm O.D. Hollow Stem Auger	CLAYEY SILT (CL) to SILTY CLAY (CI) Hard Grey Moist to wet	CI			17	SS	100	19-18-21-26	39	○		MIS_202 1102813			
22																	
23																	
24																	
25							18	SS	100	16-22-37-67	59						
26																	
27																	
28							19	SS	100	10-12-18-62	30						
29																	
30																	

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 23, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-03

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 23, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 261.18 m (CGVD28)
COORDINATES: Lat: 44.131484° Long: -79.569594°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
31	D 90	210 mm O.D. Hollow Stem Auger	CLAYEY SILT (CL) to SILTY CLAY (CI) Hard Grey Moist to wet	CI			20	SS	109	21-33-56-100/108mm	89			MIS_202 1102815			
32																	
33																	
34							21	SS	100	13-17-26-42	43						
35																	
36																	
37							22	SS	100	15-17-21-29	38						
38																	
39																	
40							23	SS	100	15-26-37-57	63			MIS_202 1102816			

Continued on Next Page

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 23, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-03

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 23, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 261.18 m (CGVD28)
COORDINATES: Lat: 44.131484° Long: -79.569594°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
41	D 90	210 mm O.D. Hollow Stem Auger	CLAYEY SILT (CL) to SILTY CLAY (CI) Hard Grey Moist to wet	CI													
42																	
43							24	SS	100	12-17-20-34	37						
44																	
45																	
46							25	SS		20-49-100/133mm							
47																	
48																	
49							26	SS	104	20-68-100/135mm	88			MIS_202 1102817			
						211.80											
			End of hole at 49.38 m. End of Borehole							15							
50																	

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 23, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-04

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: July 14, 2021
INCLINATION: 90.0°
CONTRACTOR:

ELEVATION: 262.75 m (CGVD28)
COORDINATES: Lat: 44.131580° Long: -79.569143°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
	ASPHALT (180mm)		0.00					
	SAND (SP), some gravel (FILL) Dense Brown Dry	SP	262.57 0.18 261.96	1	SS	58	15-17-16-14	33
1	CLAYEY SAND (SC), trace gravel (FILL) Very stiff Grey Moist	SC	0.79 261.30	2	SS	42	7-5-12-16	17
2	SAND (SP), trace gravel, trace fines, containing silt pockets (FILL) Compact Brown Moist	SP	1.45 260.54	3	SS	50	7-12-7-9	19
	CLAYEY SAND (SC) to Sandy CLAYEY SILT (CL), trace gravel (FILL) Very stiff Brown Moist	SC	2.21	4	SS	67	4-9-10-14	19
3				5	SS	75	9-12-9-12	21
4				6A	SS	67	9-7-12-17	19
			258.48	6B				
	Sandy CLAYEY SILT (CL) to CLAYEY SILT (CL), trace organics Loose Brown Moist	CL	4.27	7	SS	67	2-2-1-2	3
5								
			256.96					
	SILTY SAND (SM), trace gravel Compact Grey Wet	SM	5.79	8	SS	0		
6								
7								
8				9	SS	83	25-8-7-8	15
9								
10				10	SS	100	8-12-16	28

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

ADDITIONAL LAB TESTING
ADDITIONAL OBSERVATIONS
GROUNDWATER OBSERVATIONS

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: DP
CHECKED: ACK

DATE: Jul 14, 2021
DATE: Jul 27, 2021

RECORD OF BOREHOLE: BH CR4-04

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: July 14, 2021
INCLINATION: 90.0°
CONTRACTOR:

ELEVATION: 262.75 m (CGVD28)
COORDINATES: Lat: 44.131580° Long: -79.569143°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
0			SILTY SAND (SM), trace gravel Compact Grey Wet	SM		252.54										
						10.21										
			CLAYEY SILT (CL), trace sand Very stiff to hard Grey Wet													
11							11	SS	75	8-12-16	28					
12							12	SS	83	10-12-14	22	26				
13																
14				CL			13	SS	88	10-18-21	23	39				
15																
16							14	SS	79	10-12-18	23	30				
17							15	SS	100	8-12-15	16	27				
18																
							16	SS	100	10-14-15	19	29				
						243.85										
19			End of hole at 18.90 m. End of Borehole													
20																

Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: DP
CHECKED: ACK

DATE: Jul 14, 2021
DATE: Jul 27, 2021

RECORD OF BOREHOLE: BH CR4-05

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 15, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 258.01 m (CGVD28)
COORDINATES: Lat: 44.131601° Long: -79.568978°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
0	D 90	Mud Rotary	CLAYEY SILT (CL), some sand, trace gravel, trace organics (FILL) Soft Brown to black Moist	CL		0.00	1	SS	50	2-2-1-1	3					
						257.10	2A									
1			Sandy Silt (ML) of slight plasticity Loose to compact Grey Wet	ML		0.91	2B	SS	89	1-3-5-8	8					▽
						255.80	3	SS	75	9-9-5-3	14					
2			CLAYEY SILT (CL). some sand, trace gravel Stiff to very stiff Grey Moist	CL		2.21	4	SS	50	2-6-5-8	11					
							5	SS	88	4-8-14-18	22					
3							6	SS	62	9-8-10-12	18					
						253.67										
4			SILTY SAND (SM), trace gravel Compact Brown Wet	SM		4.34	7	SS	62	17-12-13-13	25					
						252.37										
5			CLAYEY SILT-SILT (CL-ML), trace sand Very stiff to hard Grey Wet	CL-ML		5.64	8	SS	88	6-6-9-12	15					
6																
7							9	SS	75	9-12-19-22	31					
8																
9							10	SS	100	18-27-32-46	59					
10																

Continued on Next Page

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 15, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-05

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 15, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 258.01 m (CGVD28)
COORDINATES: Lat: 44.131601° Long: -79.568978°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
11	D 90	Mud Rotary	CLAYEY SILT-SILT (CL-ML), trace sand Very stiff to hard Grey Wet	CL-ML			11	SS		13-16-18-16	34					
12							12	SS	100	10-10-14-15	24					
13							13	SS	100	14-14-17-23	31					
14						243.23										
15			CLAYEY SILT (CL) Very stiff to hard Grey Moist	CL		14.78	14	SS	100	19-21-26-27	47					
16																
17							15	SS	100	11-12-15-22	27					
18																
19							16	SS	100	13-14-19-25	33					
20																

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 15, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-05

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 15, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 258.01 m (CGVD28)
COORDINATES: Lat: 44.131601° Long: -79.568978°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
21	D 90	Mud Rotary	CLAYEY SILT (CL) Very stiff to hard Grey Moist	CL			17	SS		10-11-17-31	28					
22																
23																
24																
25							18	SS	100	13-15-45-80	60					
26																
27																
28							19	SS	100	12-16-28-59	44					
29																
30																

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 15, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-05

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 15, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 258.01 m (CGVD28)
COORDINATES: Lat: 44.131601° Long: -79.568978°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
31	D 90	Mud Rotary	CLAYEY SILT (CL) Very stiff to hard Grey Moist	CL			20	SS	100	18-26-37-75	63					
34							21	SS	100	15-16-22-25	38					
37							22	SS	100	21-24-35-53	59					
40							23	SS	100	12-17-23-34	40					

Hammer: Automatic ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 15, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-05

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 15, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 258.01 m (CGVD28)
COORDINATES: Lat: 44.131601° Long: -79.568978°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
41	D 90	Mud Rotary	CLAYEY SILT (CL) Very stiff to hard Grey Moist	CL												
42																
43							24	SS	100	27-19-29-50	48					
44																
45																
46							25	SS	114	28-35-66-100/83mm	101					
47																
48																
49							26	SS	100	17-21-27-34	48					
						208.63										
50			End of hole at 49.38 m. End of Borehole													

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 15, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-06

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: October 01, 2021
END DATE: October 06, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 258.20 m (CGVD28)
COORDINATES: Lat: 44.131114° Long: -79.569432°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
			SILTY SAND (SM), trace sand, trace rootlets, trace gravel Loose to compact Dark brown to brown Moist to wet	SM		0.00	1	SS	88	1-2-3	5
1							2	SS	100	4-7-6-16	13
							3A	SS	100	8-7-5-6	12
2						256.22	3B				
			CLAYEY SILT (CL), trace sand to sandy, trace gravel, (TILL) Stiff to Very Stiff Brownish Grey Moist	CL		1.98	4	SS	62	5-7-10-14	17
3							5	SS	62	6-8-16-19	24
						254.47					
			SILTY SAND (SM), trace gravel Compact Grey Moist to Wet	SM		3.73	6	SS	75	6-9-11-15	20
4											
							7	SS	62	7-9-13-18	22
5	D 90	Mud Rotary									
						252.56					
			CLAYEY SILT (CL), trace sand, trace gravel Hard Grey Moist			5.64	8	SS	88	9-11-13-19	24
6											
7											
				CL			9	SS	100	23-24-25-27	49
8											
9											
							10	SS	88	17-20-22-18	42
10											

SAMPLES: Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

ADDITIONAL LAB TESTING

ADDITIONAL OBSERVATIONS

GROUNDWATER OBSERVATIONS

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Oct 01, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-06

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: October 01, 2021
END DATE: October 06, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 258.20 m (CGVD28)
COORDINATES: Lat: 44.131114° Long: -79.569432°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
11	D 90	Mud Rotary	CLAYEY SILT (CL), trace sand, trace gravel Hard Grey Moist	CL			11	SS	88	20-23-30-11	53					
12							12	SS	100	20-27-23-29	50					
13							13	SS		13-19-32-57	51					
14							14	SS	100	17-26-44-59	70					
15							15	SS	100	18-27-31-27	58					
16							16	SS	100	14-17-34-50	51					
17																
18																
19																
20																

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Oct 01, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-06

CLIENT:	AECOM	START DATE:	October 01, 2021	ELEVATION:	258.20 m (CGVD28)
PROJECT:	Bradford Bypass	END DATE:	October 06, 2021	COORDINATES:	Lat: 44.131114° Long: -79.569432°
PROJECT NO:	19136074	INCLINATION:	90.0°	COORD SYS:	Geographical Coordinates
LOCATION:	Bradford, Ontario	CONTRACTOR:	Walker	HORZ DATUM:	NAD83 VERT DATUM: CGVD28
				HOLE LOC:	Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
21	D 90	Mud Rotary	CLAYEY SILT (CL), trace sand, trace gravel Hard Grey Moist	CL			17	SS	100	11-14-33-50	47					
22																
23																
24																
25							18	SS	100	16-24-50-40	74					
26																
27																
28							19	SS	100	29-28-30-36	58					
29																
30																

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Oct 01, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-06

CLIENT:	AECOM	START DATE:	October 01, 2021	ELEVATION:	258.20 m (CGVD28)
PROJECT:	Bradford Bypass	END DATE:	October 06, 2021	COORDINATES:	Lat: 44.131114° Long: -79.569432°
PROJECT NO:	19136074	INCLINATION:	90.0°	COORD SYS:	Geographical Coordinates
LOCATION:	Bradford, Ontario	CONTRACTOR:	Walker	HORZ DATUM:	NAD83 VERT DATUM: CGVD28
				HOLE LOC:	Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
31	D 90	Mud Rotary	CLAYEY SILT (CL), trace sand, trace gravel Hard Grey Moist	CL			20	SS	100	17-19-37-100	56					
32																
33																
34							21	SS	100	10-16-18-22	34					
35																
36																
37							22	SS	100	12-15-20-31	35					
38																
39																
40							23	SS	100	12-14-18-27	32					

Hammer: Automatic ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

Continued on Next Page

DEPTH SCALE: 1:51

HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel DATE: Oct 01, 2021

CHECKED: ACK DATE:

RECORD OF BOREHOLE: BH CR4-06

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: October 01, 2021
END DATE: October 06, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 258.20 m (CGVD28)
COORDINATES: Lat: 44.131114° Long: -79.569432°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
41	D 90	Mud Rolary	CLAYEY SILT (CL), trace sand, trace gravel Hard Grey Moist	CL												
42																
43							24	SS	100	21-25-27-58	52					
44																
45																
46							25	SS	100	14-28-39-58	67					
47																
48																
49						208.82	26	SS	100	12-14-17-22	31					
50			End of hole at 49.38 m. End of Borehole													

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Oct 01, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-07

CLIENT:	AECOM	START DATE:	July 13, 2021	ELEVATION:	261.21 m (CGVD28)
PROJECT:	Bradford Bypass	END DATE:	July 15, 2021	COORDINATES:	Lat: 44.131232° Long: -79.569039°
PROJECT NO:	19136074	INCLINATION:	90.0°	COORD SYS:	Geographical Coordinates
LOCATION:	Bradford, Ontario	CONTRACTOR:	Walker Drilling Ltd.	HORZ DATUM:	NAD83 VERT DATUM: CGVD28
				HOLE LOC:	Bradford Bypass - County Road 4

DRILL RIG: Diedrich D-50 Track
DRILL METHOD: 210 mm O.D. Hollow Stem Auger - 210-mm Hole Dia.

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
0	ASPHALT (100 mm)		0.00					
	SAND (SP), trace fines, trace gravel (FILL) Compact Brown Moist	SP	261.11 0.10	1	SS	83	8-11-12-14	23
1	CLAYEY SILT (CL), some sand, trace gravel (FILL) Stiff Grey Moist	CL	260.21 1.00 259.74 1.47	2a 2b	SS	83	5-5-7-7	12
2	SILTY SAND (SM) of slight plasticity, trace gravel (FILL) Compact to Dense Brown to grey Moist	SM		3	SS	100	9-11-12-14	23
3				4	SS	50	8-19-15-16	34
4				5	SS	100	10-10-8-10	18
				6	SS	67	7-8-11-11	19
5	Sandy SILT (ML) of slight plasticity, trace sand, trace gravel, trace organics Firm to very stiff Dark brown to grey Moist	ML	256.31 4.90	7a 7b	SS	62	9-15-10-8	25
6			254.81	8a 8b	SS	100	4-3-4-7	7
7	CLAYEY SILT (CL), trace to some sand, trace gravel (TILL) Firm to Very Stiff Grey Moist	CL	6.40					
8				9	SS	100	5-9-10-12	19
9	CLAYEY SILT (CL), trace to some sand Very Stiff to Hard Grey Moist		252.51 8.70					
10				10	SS	92	11-17-23-11	40

Continued on Next Page

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

ADDITIONAL LAB TESTING

ADDITIONAL OBSERVATIONS

GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS

0.00 - 0.10 m bgs: Concrete

0.10 - 7.32 m bgs: Bentonite

7.32 - 11.28 m bgs: Sand

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Matthew Montesano DATE: Jul 13, 2021
CHECKED: ACK DATE:

RECORD OF BOREHOLE: BH CR4-07

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: July 13, 2021
END DATE: July 15, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 261.21 m (CGVD28)
COORDINATES: Lat: 44.131232° Long: -79.569039°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DRILL RIG: Diedrich D50 Track
DRILL METHOD: 210mm O.D. Hollow Stem Auger 210 mm Hole Dia.

MATERIAL PROFILE

DESCRIPTION	USCS	ELEV. / DEPTH (m)
CLAYEY SILT (CL), trace to some sand Very Stiff to Hard Grey Moist	CL	242.31
End of hole at 18.90 m. End of Borehole		

SAMPLES (Hammer: Automatic Historic & Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)

NUMBER	TYPE	REC %	BLOWS	N-VALUE
11	SS	17	10-12-10-12	22
12	SS	100	17-19-21-25	40
13	SS	100	19-24-28-32	52
14	SS	100	17-24-34-36	58
15	SS	100	18-30-41-58	71
16	SS	100	18-23-34-47	57

WATER CONTENT: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic (scale 0, 20, 40, 60, 80, 100)

SHEAR STRENGTH: × Nat Vane; ⊕ Rem Vane; ■ Pocket Pen; ● Q; O U (scale 0, 100, 200, 300, 400, 500)

ADDITIONAL LAB TESTING | ADDITIONAL OBSERVATIONS | GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS:
11.28 - 18.90 m bgs: Bentonite

DEPTH (m): 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic Historic, Automatic

REV: Pre-draft

GOLDER MEMBER OF WSP

LOGGED: Matthew Montesano
CHECKED: ACK
DATE: Jul 13, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-08

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 09, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.27 m (CGVD28)
COORDINATES: Lat: 44.131227° Long: -79.568623°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
0	D 90	Mud Rotary	CLAYEY SILT (CL), some sand, trace rootlets (FILL) Soft to firm Brown Moist	CL		0.00 252.58	1	SS	100	2-2-2-3	4					▽
1			CLAYEY SILT (CL), trace sand, trace gravel Soft to stiff Brown Moist			0.69 251.06	2	SS	75	1-1-2-3	3					
2							3	SS	50	4-4-7-9	11					
2			CLAYEY SILT (CL), trace sand, trace gravel (TILL) Stiff to Hard Grey Moist			2.21	4	SS	75	4-5-9-13	14					
3							5	SS	100	7-8-9-14	17					
4							6	SS	62	16-22-24-26	46					
5							7	SS	79	14-14-20-27	34					
6							8	SS	88	13-16-17-21	33					
7							9A									
8							9B	SS	88	10-23-50-75	73					
9																
10							10	SS	100	21-24-27-28	51					

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 09, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-08

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 09, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.27 m (CGVD28)
COORDINATES: Lat: 44.131227° Long: -79.568623°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
11	D 90	Mud Rotary	CLAYEY SILT (CL), trace sand, trace gravel (TILL) Stiff to Hard Grey Moist	CL			11	SS	100	22-28-34-41	62					
12							12	SS	100	22-28-34-27	62					
13						240.01 13.26										
14			CLAYEY SILT (CL), trace sand Hard Grey Moist				13	SS	100	16-19-22-22	41					
15							14	SS	100	13-17-21-29	38					
16																
17							15	SS	100	11-19-20-32	39					
18																
19							16	SS	100	12-16-18-21	34					
20																

SAMPLES: Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop
WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 09, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-08

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 09, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.27 m (CGVD28)
COORDINATES: Lat: 44.131227° Long: -79.568623°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
21	D 90	Mud Rotary	CLAYEY SILT (CL), trace sand Hard Grey Moist	CL			17	SS	100	24-17-21-30	38					
22																
23																
24																
25							18	SS	100	16-16-26-34	42					
26																
27																
28							19	SS	100	14-16-20-23	36					
29																
30																

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 09, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-08

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 09, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.27 m (CGVD28)
COORDINATES: Lat: 44.131227° Long: -79.568623°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
31	D 90	Mud Rotary	CLAYEY SILT (CL), trace sand Hard Grey Moist	CL			20	SS	100	14-15-25-37	40					
32																
33																
34							21	SS	100	14-19-30-38	49					
35																
36																
37							22	SS	100	15-17-21-29	38					
38																
39																
40							23	SS		25-45-100/83mm	70					

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 09, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-08

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: September 09, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.27 m (CGVD28)
COORDINATES: Lat: 44.131227° Long: -79.568623°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
41	D 90	Mud Rotary	CLAYEY SILT (CL), trace sand Hard Grey Moist	CL												
42																
43							24	SS	100	13-46-22-24	68					
44																
45																
46							25	SS	100	16-17-27-34	44					
47						206.03 47.24										
48			CLAYEY SILT (CL), trace sand, trace gravel Hard Grey Moist													
49							26	SS		29-44-53-89	97					
50						203.91										
			End of hole at 49.38 m. End of Borehole													

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Sep 09, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-09

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: October 06, 2021
END DATE: October 12, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 256.46 m (CGVD28)
COORDINATES: Lat: 44.130758° Long: -79.569369°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
0	D 90	Mud Rotary - 102-mm Hole Dia.	CLAYEY SILT (CL), some sand, trace rootlets Soft Brown Moist	CL		0.00	1	SS	38	1-1-2	3					
						255.77										
1			SILTY SAND (SM) Loose Brown Moist	SM		0.69	2	SS	50	1-1-4-5	5					
						255.01										
			CLAYEY SILT (CL), some sand, trace gravel, Very Stiff Brown Moist	CL		1.45	3	SS	62	4-6-12-17	18					
2						254.25										
			SILTY SAND (SM) Compact Grey Moist to Wet	SM		2.21	4	SS	100	5-7-7-9	14					
3							5	SS	100	6-8-11-12	19					
						252.73										
			Sandy CLAYEY SILT (CL), trace gravel Firm to very stiff Grey Moist	CL		3.73	6	SS	29	3-7-11-10	18					
4																
							7	SS	75	6-3-4-3	7					
5																
							8	SS	88	8-11-14-15	25					
6																
							9	SS	62	7-11-10-11	21					
7																
							10	SS	75	11-17-20-21	37					
8																
9																
10																

SAMPLES: Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop
WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel DATE: Oct 06, 2021
CHECKED: ACK DATE: Oct 21, 2021

RECORD OF BOREHOLE: BH CR4-09

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: October 06, 2021
END DATE: October 12, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 256.46 m (CGVD28)
COORDINATES: Lat: 44.130758° Long: -79.569369°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
11	D 90	Mud Rotary - 102-mm Hole Dia.	Sandy CLAYEY SILT (CL), trace gravel Firm to very stiff Grey Moist	CL		246.25 10.21	11	SS	75	12-14-16-19	30					
12			CLAYEY SILT (CL) Hard Grey Moist				12	SS	88	13-16-22-19	38					
13																
14							13	SS	100	24-29-31-44	60					
15							14	SS	88	24-41-36-71	77					
16																
17							15	SS	100	15-16-22-46	38					
18																
19							16	SS	100	14-15-22-35	37					
20																

SAMPLES: Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop
WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel DATE: Oct 06, 2021
CHECKED: ACK DATE: Oct 21, 2021

RECORD OF BOREHOLE: BH CR4-09

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: October 06, 2021
END DATE: October 12, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 256.46 m (CGVD28)
COORDINATES: Lat: 44.130758° Long: -79.569369°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
21	D 90	Mud Rotary - 102-mm Hole Dia.	CLAYEY SILT (CL) Hard Grey Moist	CL			17	SS	100	14-19-34-65	53					
22																
23																
24																
25							18	SS	100	35-23-27-68	50					
26																
27																
28							19	SS	100	16-23-42-100	65					
29																
30																

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel DATE: Oct 06, 2021
CHECKED: ACK DATE: Oct 21, 2021

RECORD OF BOREHOLE: BH CR4-09

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: October 06, 2021
END DATE: October 12, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 256.46 m (CGVD28)
COORDINATES: Lat: 44.130758° Long: -79.569369°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
31	D 90	Mud Rotary - 102-mm Hole Dia.	CLAYEY SILT (CL) Hard Grey Moist	CL			20	SS	100	14-20-29-36	49					
32																
33																
34							21	SS	100	15-22-29-35	51					
35																
36																
37							22	SS	100	14-21-25-24	46					
38																
39																
40							23	SS	100	14-21-25-24	46					

Hammer: Automatic ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel DATE: Oct 06, 2021
CHECKED: ACK DATE: Oct 21, 2021

RECORD OF BOREHOLE: BH CR4-09

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: October 06, 2021
END DATE: October 12, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 256.46 m (CGVD28)
COORDINATES: Lat: 44.130758° Long: -79.569369°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
41	D 90	Mud Rotary - 102-mm Hole Dia.	CLAYEY SILT (CL) Hard Grey Moist	CL												
42																
43							24	SS	114	19-28-56-100/83mm	84					
44																
45																
46							25	SS	100	14-16-24-32	40					
47																
48																
49						207.08	26	SS	100	18-24-33-37	57					
50			End of hole at 49.38 m. End of Borehole													

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel DATE: Oct 06, 2021
CHECKED: ACK DATE: Oct 21, 2021

RECORD OF BOREHOLE: BH CR4-10

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: July 13, 2021
CONTRACTOR:

ELEVATION: 259.94 m (CGVD28)
COORDINATES: Lat: 44.130808° Long: -79.568956°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
	ASPHALT (200 mm)		0.00 / 259.74					
	SAND (SP), trace gravel, trace fines (FILL) Compact Brown Dry to moist	SP	0.20	1	SS	62	10-15-16-15	31
1				2A	SS		12-10-5-5	15
			258.64	2B				
	Sandy CLAYEY SILT (CL), trace gravel (FILL) Stiff to very stiff Brown to grey Moist	CL	1.30	3	SS	103	7-8-7-9	15
2				4	SS		7-13-14-13	27
3				5	SS		5-4-5-4	9
4				6	SS		7-12-14-12	26
5				7	SS		8-10-7-8	17
			254.30					
	SILT (ML), trace sand Compact to dense Grey Wet	ML	5.64	8	SS		4-10-10-8	20
6								
7	- 7.62 to 8.23 m: no sample recovered			9	SS		14-16-15-16	31
8								
			251.25					
	CLAYEY SILT (CL), trace sand, trace gravel (TILL) Very stiff to hard Brown to brownish grey Moist	CL	8.69	10	SS		12-17-18-20	35
9								
10								

Continued on Next Page

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

ADDITIONAL LAB TESTING
ADDITIONAL OBSERVATIONS
GROUNDWATER OBSERVATIONS

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: DP
CHECKED: ACK

DATE: Jul 13, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-10

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: July 13, 2021
CONTRACTOR:

ELEVATION: 259.94 m (CGVD28)
COORDINATES: Lat: 44.130808° Long: -79.568956°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
11	CLAYEY SILT (CL), trace sand, trace gravel (TILL) Very stiff to hard Brown to brownish grey Moist	CL		11	SS		6-9-11-17	20
			248.21					
12	Sandy CLAYEY SILT (CL), trace gravel (TILL) Hard Grey Moist		11.73	12	SS		17-30-48-50	78
13								
14				13	SS		17-25-35-22	60
15				14	SS		11-100	
16			243.63					
17	SILT (ML), trace sand Dense to very dense Grey Wet	ML	16.31	15	SS		25-28-42-47	70
18								
			241.04	16	SS		12-23-26-26	49
19	End of hole at 18.90 m. End of Borehole							
20								

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500
SAMPLES: Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

ADDITIONAL LAB TESTING
ADDITIONAL OBSERVATIONS
GROUNDWATER OBSERVATIONS

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: DP
CHECKED: ACK

DATE: Jul 13, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-11

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: August 30, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.34 m (CGVD28)
COORDINATES: Lat: 44.130896° Long: -79.568730°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
0	SILTY SAND (SM), trace organics (FILL) Loose Brown Moist	SM	0.00	1	SS	58	3-3-5-6	8
			252.65					
1	CLAYEY SILT (CL), trace sand, trace gravel Firm to stiff Grey to Brown Moist	CL	0.69	2	SS	100	2-2-3-4	5
2	-Grey below a depth of 2.3m (Elev. 251.0 m)			3	SS	80	3-3-6-8	9
				4	SS	100	4-6-7-12	13
3				5A	SS	100	9-9-13-18	22
			249.91	5B				
	SAND (SP), trace gravel Compact Grey Wet	SP	3.43 249.61					
4	CLAYEY SILT (CL), trace sand, trace gravel to CLAYEY SAND (SC), some gravel (TILL) Dense Grey Moist to wet	CL	3.73	6	SS	49	100	
5	-Sandy SILT (ML) of slight plasticity interlayer			7	SS	88	12-21-22-28	43
6				8	SS	34	36-30-33-28	63
7				9A				
8				9B	SS	80	19-18-25-28	43
9				10	SS	100	32-31-35-66	66
10								

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

ADDITIONAL LAB TESTING

ADDITIONAL OBSERVATIONS

GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS

Pipe Stickup: 0.00 m

0.00 - 5.48 m bgs: Bentonite

5.48 - 9.14 m bgs: Sand

Continued on Next Page

DRILL RIG: D 90
DRILL METHOD: Mud Rotary

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Aug 30, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-11

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: August 30, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.34 m (CGVD28)
COORDINATES: Lat: 44.130896° Long: -79.568730°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
11	D 90	Mud Rotary	CLAYEY SILT (CL), trace sand, trace gravel to CLAYEY SAND (SC), some gravel (TILL) Dense Grey Moist to wet	CL			11	SS	100	21-22-31-38	53						Pipe Stickup: 0.00 m
12			-Sandy SILT (ML) of slight plasticity interlayer				12	SS	88	14-16-27-29	43						
13																	
14							13	SS	100	9-8-19-23	27						
15							14	SS		10-17-17-19	34						
16						237.03											
17			SILT (ML) of slight plasticity, trace sand Hard Grey Moist	ML		16.31	15	SS	75	22-33-43-71	76						
18						235.51											
19			CLAYEY SILT-SILT (CL-ML) to CLAYEY SILT (CL) Hard Grey Moist	CL-ML		17.83	16	SS		9-15-18-21	33						
20																	

Continued on Next Page

Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Aug 30, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-11

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: August 30, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.34 m (CGVD28)
COORDINATES: Lat: 44.130896° Long: -79.568730°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
21	D 90	Mud Rotary	CLAYEY SILT-SILT (CL-ML) to CLAYEY SILT (CL) Hard Grey Moist	CL-ML			17	SS		11-17-18-23	35						Pipe Stickup: 0.00 m
22							18	SS	100	13-15-22-40	37						
23							19	SS	100	18-30-48-100	78						
24																	
25							20	SS	100	15-18-27-39	45						
26							21	SS	100	18-25-39-63	64						
27																	
28							22	SS	100	14-17-20-26	37						
29							23	SS	100	15-17-23-36	40						
30																	

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Aug 30, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-11

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: August 30, 2021
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CONTRACTOR: Walker

ELEVATION: 253.34 m (CGVD28)
COORDINATES: Lat: 44.130896° Long: -79.568730°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
31	D 90	Mud Rotary	CLAYEY SILT-SILT (CL-ML) to CLAYEY SILT (CL) Hard Grey Moist	CL-ML			24	SS	100	14-26-34-34	60						Pipe Stickup: 0.00 m
32							25	SS	100	17-22-29-40	51						
33																	
34							26	SS	100	18-36-50-68	86						
35																	
36							27	SS	100	15-21-27-48	48						
37																	
38							28	SS	100	20-23-25-50	48						
39																	
40							29	SS	100	19-23-30-99	53						
							30	SS	114	19-40-400/83mm	59						

Continued on Next Page

SAMPLES: Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop
WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Aug 30, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-11

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: August 30, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.34 m (CGVD28)
COORDINATES: Lat: 44.130896° Long: -79.568730°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
			CLAYEY SILT-SILT (CL-ML) to CLAYEY SILT (CL) Hard Grey Moist														Pipe Stickup: 0.00 m
41							31	SS	100	16-22-28	50						
42																	
43				CL-ML			32	SS	100	16-18-25-32	43						
44																	
45	D 90	Mud Rotary					33	SS	100	15-24-28-39	52						
46						207.32											
			SILTY SAND (SM) Very dense Grey Moist			46.02											
47																	
48				SM			34	SS		28-51-92-100	143						
49						204.27											
			CLAYEY SILT (CL), trace sand, trace gravel (TILL) Hard Grey Moist			49.07											
50				CL													

Continued on Next Page

Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Aug 30, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-11

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: August 30, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 253.34 m (CGVD28)
COORDINATES: Lat: 44.130896° Long: -79.568730°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
	D 90	Mud Rotary	CLAYEY SILT (CL), trace sand, trace gravel (TILL) Hard Grey Moist	CL		202.44	35	SS	100	32-44-62-84	106						Pipe Stickup: 0.00 m
51			End of hole at 50.90 m. End of Borehole														
52																	
53																	
54																	
55																	
56																	
57																	
58																	
59																	
60																	

Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Aug 30, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-12

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: October 13, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 255.23 m (CGVD28)
COORDINATES: Lat: 44.130596° Long: -79.569281°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
0	D 90	210 mm O.D. Hollow Stem Auger	SILTY SAND (SM), trace rootlets, trace gravel, Loose, Brown, Moist	SM		0.00	1	SS	62	1-1-2-3	3					
						253.78	2	SS	62	2-2-5-7	7					
1			CLAYEY SILT (CL), trace to some sand, trace gravel, (TILL), Stiff to Hard, Grey, Moist			1.45	3	SS	100	2-4-4-9	8					
							4	SS	75	4-4-8-10	12					▽
2							5	SS	100	4-4-5-9	9					
							6	SS	100	8-13-17-23	30					
3							7	SS	100	20-35-34-45	69					
							8	SS	75	25-45-51-40	96					
4																
5																
6																
7							9	SS	100	8-14-17-23	31					
8																
						246.54	10	SS	75	17-30-38-33	68					
9			CLAYEY SILT (CL), Hard, Grey, Moist to Wet	CL		8.69										
10																

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Oct 13, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-12

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: October 13, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker

ELEVATION: 255.23 m (CGVD28)
COORDINATES: Lat: 44.130596° Long: -79.569281°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
11	D 90 210 mm O.D.	Hollow Stem Auger	CLAYEY SILT (CL) Hard Grey Moist to Wet	CL		243.95	11	SS	100	21-27-29-23	56					
			End of hole at 11.28 m. End of Borehole													

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Dipendra Paudel
CHECKED: ACK

DATE: Oct 13, 2021
DATE:

RECORD OF BOREHOLE: BH CR4-13

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario
DATE: August 27, 2021
CONTRACTOR:
ELEVATION: 252.46 m (CGVD28)
COORDINATES: Lat: 44.130667° Long: -79.568660°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
0	SILTY SAND (SM), trace organics, trace rootlets (FILL) Compact Brown Moist	SM	0.00	1	SS		3-6-11-8	17
			251.77					
1	CLAYEY SILT (CL), trace sand, trace gravel Firm Brown Moist		0.69	2	SS		1-2-2-5	4
2				3	SS		2-3-5-8	8
			250.25					
	CLAYEY SILT (CL), trace to some sand, trace gravel Very stiff to hard Brown to grey Moist		2.21	4	SS		4-6-11-13	17
3	-Grey below a depth of 3.8m below ground surface (Elev. 248.7m)			5	SS		11-17-23-28	40
4				6	SS		12-17-16-18	33
5		CL		7	SS		6-13-14-18	27
6				8	SS		10-12-18-24	30
7								
8				9	SS		14-21-26-24	47
9								
10				10	SS		14-16-17-24	33
			242.71					
	End of hole at 9.75 m.							
	End of Borehole							

Hammer: ASTM D1586, Blows per 0.15 m 623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

ADDITIONAL LAB TESTING

ADDITIONAL OBSERVATIONS

GROUNDWATER OBSERVATIONS

DEPTH SCALE: 1:51
HAMMER TYPE:

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: DP
CHECKED: ACK

DATE: Aug 27, 2021
DATE:

RECORD OF BOREHOLE: BH HF-01

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: July 19, 2021
END DATE: July 20, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 264.43 m (CGVD28)
COORDINATES: Lat: 44.131934° Long: -79.569230°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DRILL RIG: Diedrich D-50 Track
DRILL METHOD: 210 mm O.D. Hollow Stem Auger - 210-mm Hole Dia.

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
0	ASPHALT (100 mm)		0.00					
	SAND (SP) some gravel to gravelly, trace fines (FILL) Compact Brown Moist	SP	264.33 0.10	1a	SS	75	9-10-15-9	25
			263.70	1b				
1	SILT (ML) of slight plasticity, some sand to SILTY SAND (ML), of slight plasticity, trace gravel (FILL) Loose to compact Brown to Grey Moist	CL	0.73	2	SS	54	6-17-12-5	29
2				3	SS	83	9-9-8-15	17
				4	SS	100	4-2-3-2	5
3				5a	SS	75	2-4-6-16	10
				5b				
			260.70					
4	SILTY CLAY (Cl), trace sand Firm to very stiff Brown Moist	Cl	3.73	6	SS	100	2-2-3-5	5
5	- 4.60 m: Wet sands noted at approximately 4.6 m, difficult advancement with augers. Borehole moved 1.0 m south, obstruction encountered at a depth of 0.3 m. Borehole moved approximately 2.7 m south of original location, sampling resumed at a depth of 10.7 m.			7	SS	67	5-9-15-19	24
			258.79					
6	SILTY SAND (SM) Loose to very dense Brown to Grey Wet	SM	5.64	8	SS	100	13-18-24-29	42
7								
				9	SS	100	19-48-52/81mm	
8								
9								
10				10	SS	100	2-4-4-7	8

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

ADDITIONAL LAB TESTING: MIS_202 109103; MIS_202 109105; MIS_202 109101; MIS_202 109131; MIS_202 109104; MIS_202 109106

CONSTRUCTION AND INSTALLATION DETAILS:
- 0.00 - 0.10 m bgs:
- 0.10 - 4.27 m bgs: Bentonite
- 4.27 - 7.62 m bgs: Sand
- 7.62 - 10.67 m bgs:

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

GOLDER
MEMBER OF WSP

REV: Pre-draft

LOGGED: Matthew Montesano DATE: Jul 19, 2021
CHECKED: ACK DATE:

RECORD OF BOREHOLE: BH HF-01

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: July 19, 2021
END DATE: July 20, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 264.43 m (CGVD28)
COORDINATES: Lat: 44.131934° Long: -79.569230°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
	SILTY SAND (SM) Loose to very dense Brown to Grey Wet - 10.21 m: - grey below a depth of 10.2 m	SM	252.70	11	SS	100	9-18-31-46	49
	SILT (ML) of slight plasticity, trace sand Hard Grey Wet	ML	11.73	12	SS	100	17-23-30-62	53
				13	SS	100	26-42-58/133mm	
			248.58	14	SS	100	20-23-26-53	49
	End of hole at 15.85 m. End of Borehole Note: 1. Borehole moved 1 m south due to flowing sands in hollow stem augers at a depth of 4.6 m.							

DRILL RIG: Diedrich D-50 Track
DRILL METHOD: 210 mm O.D. Hollow Stem Auger - 210-mm Hole Dia.

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

ADDITIONAL LAB TESTING: MIS_202 109102

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Matthew Montesano
CHECKED: ACK

DATE: Jul 19, 2021
DATE:

RECORD OF BOREHOLE: BH HF-02

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: July 06, 2021
END DATE: July 09, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 258.07 m (CGVD28)
COORDINATES: Lat: 44.130378° Long: -79.568995°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DRILL RIG: Diedrich D-50 Track
DRILL METHOD: 210 mm O.D. Hollow Stem Auger - 210-mm Hole Dia.

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
0	ASPHALT (200 mm)		257.87 / 0.00					
	Gravelly SAND (SP-SW), trace fines (FILL) Loose to compact Brown Moist	SP-SM	0.20	1	SS	75	11-12-11-9	23
1			257.03	2a	SS	83	4-3-2-3	5
	SILTY SAND (SM) of slight plasticity, some gravel (FILL) Loose to dense Brown Moist - trace organics, trace rootlets between a depth of 1.0 m and 2.2 m	SP	1.04	2b				
2				3	SS	58	2-2-2-3	4
				4	SS	33	3-2-2-3	4
3				5	SS	67	39-17-12-16	29
4			4.50	6a	SS	83	12-18-13-11	31
				6b				
				6c				
	SILT (ML) of slight plasticity and sand trace gravel, trace organics Compact Brown Moist	ML	253.57	7	SS	83	2-12-11-8	23
5								
6			251.80	8a				
	SILTY CLAY (CI) to sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Stiff to hard Brown to grey Moist	CL	6.27	8b	SS	100	3-4-11-15	15
7								
				9	SS	96	9-10-13-12	23
8	- grey below a depth of 8.7 m							
9				10	SS	100	2-4-4-7	8
10								

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 100 200 300 400 500

ADDITIONAL LAB TESTING: MIS_2021072713 1; MIS_2021072713 4; MIS_2021072713 5; MIS_2021072713 6; MIS_2021072713 7

ADDITIONAL OBSERVATIONS: 0.00 - 15.85 m: 25 bags of hole plug, 1 bag of silica sand

GROUNDWATER OBSERVATIONS

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Matthew Montesano DATE: Jul 06, 2021
CHECKED: ACK DATE:

RECORD OF BOREHOLE: BH HF-02

CLIENT:	AECOM	START DATE:	July 06, 2021	ELEVATION:	258.07 m (CGVD28)
PROJECT:	Bradford Bypass	END DATE:	July 09, 2021	COORDINATES:	Lat: 44.130378° Long: -79.568995°
PROJECT NO:	19136074	INCLINATION:	90.0°	COORD SYS:	Geographical Coordinates
LOCATION:	Bradford, Ontario	CONTRACTOR:	Walker Drilling Ltd.	HORZ DATUM:	NAD83 VERT DATUM: CGVD28
				HOLE LOC:	Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS (Hammer: Automatic, ASTM D1586, Blows per 0.15 m, 623-N hammer, 0.76-m drop)	N-VALUE	WATER CONTENT (Plastic & Liquid Limits (%), Water Content (%), NP Nonplastic)	SHEAR STRENGTH (Nat Vane, Rem Vane, Pocket Pen, Q, U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
11	Diedrich D-50 Track	210 mm O.D. Hollow Stem Auger - 210-mm Hole Dia.	SILTY CLAY (CI) to sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Stiff to hard Brown to grey Moist	CL			11	SS	92	7-6-9-17	15					
12							12	SS	75	22-20-38-50	58			MIS_2021072132		
13							13	SS	100	31-49-51/133mm						
14																
15							14	SS	100	21-23-17-27	40			MIS_2021072133		
						242.22										
16			End of hole at 15.85 m. End of Borehole													
17																
18																
19																
20																

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

GOLDER
MEMBER OF WSP

REV: Pre-draft

LOGGED: Matthew Montesano DATE: Jul 06, 2021
CHECKED: ACK DATE:

RECORD OF BOREHOLE: BH HF-03

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: July 12, 2021
END DATE: July 13, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 258.04 m (CGVD28)
COORDINATES: Lat: 44.130388° Long: -79.568829°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DRILL RIG: Diedrich D-50 Track
DRILL METHOD: 210 mm O.D. Hollow Stem Auger - 210-mm Hole Dia.

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	ADDITIONAL LAB TESTING
0	ASPHALT (200 mm)		257.84 0.00						
0	SAND (SP), some gravel, trace fines (FILL) Compact to dense Brown Moist	SP	0.20	1	SS	75	19-18-16-15	34	
1				2	SS	83	8-9-8-6	17	MIS_2021072141
1			256.57						
1	Sandy CLAYEY SILT-SILT (CL-ML), trace to some gravel (FILL) Firm to stiff Grey Moist	CL-ML	1.47	3	SS	92	6-4-4-9	8	
2				4	SS	100	10-6-8-14	14	MIS_2021072142
2			255.07						
2	SILT (ML) of slight plasticity, some sand, trace gravel Firm to very stiff Brown Moist	ML	2.97	5	SS	100	8-8-12-16	20	
3				6	SS	100	9-12-13-15	25	MIS_2021072143
4				7	SS	62	9-15-10-8	25	MIS_2021072144
5				8	SS	100	2-3-6-9	9	MIS_2021072145
5			250.88						
5	CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI), trace sand Hard Moist Grey	CI	7.16	9	SS	92	9-10-14-16	24	
6				10	SS	100	8-9-14-11	23	MIS_2021071338

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

ADDITIONAL OBSERVATIONS: 0.00 - 18.69 m: 11 bags of hole plug mixed with cuttings

GROUNDWATER OBSERVATIONS:

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Matthew Montesano DATE: Jul 12, 2021
CHECKED: ACK DATE:

RECORD OF BOREHOLE: BH HF-03

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

START DATE: July 12, 2021
END DATE: July 13, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 258.04 m (CGVD28)
COORDINATES: Lat: 44.130388° Long: -79.568829°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
11	Diedrich D-50 Track	210 mm O.D. Hollow Stem Auger - 210-mm Hole Dia.	CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI), trace sand Hard Moist Grey	CI			11	SS	100	6-7-9-9	16					
12							12	SS		30-38-43-47	81					
13																
14							13	SS	100	15-15-22-40	37	PL MC		MIS_2021072139		
15																
16							14	SS	100	19-31-38-38	69					
17			CLAYEY SILT (CL) trace sand, trace gravel (TILL) Hard Grey Moist	CL		241.69 16.35	15	SS	100	16-21-16-19	37			MIS_2021072140		
18			CLAYEY SILT (CL) Hard Grey Moist			240.24 17.80	16	SS	100	15-58-42/105mm						
19			End of hole at 18.69 m. End of Borehole			239.35										
20																

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Matthew Montesano DATE: Jul 12, 2021
CHECKED: ACK DATE:

RECORD OF BOREHOLE: BH HF-04

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: June 29, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 255.52 m (CGVD28)
COORDINATES: Lat: 44.129614° Long: -79.568812°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS
	ASPHALT (180 mm)		0.00							
	SILTY SAND (SM), some gravel (FILL) Compact Brown Moist	SM	255.34 0.18	1	SS	50	10-11-11-13	22		
1				2	SS	38	11-8-6-8	14	MIS_202 1091014	
			254.06							
	SILT (ML), some sand to SILTY SAND (SM) some gravel (FILL) Compact to Dense Brown Moist	ML	1.46	3	SS	21	7-6-6-6	12		
2				4	SS	100	2-11-18-25	29		
3				5a 5b	SS	67	18-29-13-10	42	MIS_202 1091132	
			251.78							
	CLAYEY SILT (CL), trace sand, trace gravel, trace organics Firm Dark brown Moist	CL	3.74	6	SS	100	4-4-4-3	8	MIS_202 1091011	
4										
5										
			249.72							
	Sandy CLAYEY SILT (CL), trace gravel to gravelly (TILL) Stiff to hard Brown to grey Moist		5.80	7	SS	100	9-8-12-12	20	MIS_202 1091010	
6										
7										
8				8	SS	100	12-19-24-28	43		
9				9	SS	83	14-17-17-18	34	MIS_202 1091012	
10										

Continued on Next Page

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Matthew Montesano DATE: Jun 29, 2021
CHECKED: ACK DATE:

RECORD OF BOREHOLE: BH HF-04

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: June 29, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 255.52 m (CGVD28)
COORDINATES: Lat: 44.129614° Long: -79.568812°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS
11	Diedrich D-90 Track	210 mm O.D. Hollow Stem Auger - 210-mm Hole Dia.	Sandy CLAYEY SILT (CL), trace gravel to gravelly (TILL) Stiff to hard Brown to grey Moist	CL			10	SS	100	8-10-11-14	21					
12							11	SS	83	8-10-12-18	22					
13																
14							12	SS	46	9-15-20-25	35			MIS_202 1091013		
15			CLAYEY SILT-SILT (CL-ML) Hard grey Moist	CL-ML		240.73 14.79 239.67	13	SS	100	22-21-34-41	55			MIS_202 109109		
16			End of hole at 15.85 m. End of Borehole													
17																
18																
19																
20																

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Matthew Montesano DATE: Jun 29, 2021
CHECKED: ACK DATE:

RECORD OF BOREHOLE: BH HF-05

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: June 24, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 254.70 m (CGVD28)
COORDINATES: Lat: 44.129434° Long: -79.568551°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DESCRIPTION	USCS	ELEV. DEPTH (m)	NUMBER	TYPE	REC %	BLOWS	N-VALUE	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
	ASPHALT (100 mm)		254.70 0.00								0.00 - 0.10 m bgs:
	SAND (SP) and Gravel, trace fines (FILL) Dense Brown Moist	SP	254.60 0.10	1	SS	50	19-17-15-16	32	MIS_2021072146		
1	SILTY SAND (SM) of slight plasticity, some gravel (FILL) Loose to dense Brown Moist	SM	253.70 1.00	2a 2b	SS	58	6-13-26-27	39			
2				3	SS	50	8-7-9-11	16	MIS_2021072149		0.10 - 3.96 m bgs: Bentonite
				4	SS	100	6-10-11-9	21			
3				5	SS	67	8-4-5-7	9	MIS_2021072150		
4	CLAYEY SILT (CL), trace sand, trace organics Firm Dark brown Moist		250.65 4.05	6a 6b	SS	100	8-4-6-6	10	MIS_2021072151		
5				7	SS	83	3-5-5-4	10	MIS_2021072152		
			249.00								
6	CLAYEY SILT (CL), some sand, trace gravel to Sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Very stiff to hard Brown to grey Moist	CL	5.70	8	SS	100	5-7-13-18	20	MIS_2021072153		3.96 - 7.62 m bgs: Sand
7	Grey below a depth of 9.1m										
8				9	SS	100	27-40-45-58/135mm	85			
9										9.10 - 9.10 m: Grey below a depth of 9.1 m	
10				10	SS	100	20-27-38-42	65	MIS_2021072147		

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

Continued on Next Page

DRILL RIG: Diedrich D-50 Track
DRILL METHOD: 210 mm O.D. Hollow Stem Auger - 203-mm Hole Dia.

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

GOLDER
MEMBER OF WSP

LOGGED: Matthew Montesano
CHECKED: ACK

DATE: Jun 24, 2021
DATE:

RECORD OF BOREHOLE: BH HF-05

CLIENT: AECOM
PROJECT: Bradford Bypass
PROJECT NO: 19136074
LOCATION: Bradford, Ontario

DATE: June 24, 2021
INCLINATION: 90.0°
CONTRACTOR: Walker Drilling Ltd.

ELEVATION: 254.70 m (CGVD28)
COORDINATES: Lat: 44.129434° Long: -79.568551°
COORD SYS: Geographical Coordinates
HORZ DATUM: NAD83 VERT DATUM: CGVD28
HOLE LOC: Bradford Bypass - County Road 4

DEPTH (m)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
11	Diedrich D-50 Track	210 mm O.D. Hollow Stem Auger - 203-mm Hole Dia.	CLAYEY SILT (CL), some sand, trace gravel to Sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Very stiff to hard Brown to grey Moist Grey below a depth of 9.1m				11	SS		21-25-33-41	58						
12							12a	SS	100	20-48-60	108						
						242.30	12b										
			CLAYEY SILT (CL) Hard Grey Moist	CL		12.40											
13																	
14							13	SS	100	34-43-57	100			MIS_2021072148			
15																	
							14	SS	100	28-52-48/105mm							
						239.05											
			End of hole at 15.65 m. End of Borehole														
16																	
17																	
18																	
19																	
20																	

Hammer: Automatic
ASTM D1586, Blows per 0.15 m
623-N hammer, 0.76-m drop

WATER CONTENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U

DEPTH SCALE: 1:51
HAMMER TYPE: Automatic

REV: Pre-draft

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LOGGED: Matthew Montesano DATE: Jun 24, 2021
CHECKED: ACK DATE:

Ontario

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PROJECT 19136074

RECORD OF BOREHOLE No. CV1-01 Sheet 1 of 2 METRIC

G.W.P. 2008-21-00 LOCATION N 4887764.9; E 299268.2 NAD83 / MTM zone 10 (LAT. 44.129859; LONG. -79.569128) ORIGINATED BY DP

DIST Central HWY Bradford Bypass - ~~County Road 4~~ BOREHOLE TYPE 210 mm O.D. Hollow Stem Auger COMPILED BY ACK/BL

DATUM CGVD28 Surface Elevation:252.19 m DATE Oct 14, 2021 - CHECKED BY KJB

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUNDWATER CONDITIONS	ELEVTION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) (Field Vane, Remoulded, Pocket Pen, Quick Triaxial, Unconfined) 20 40 60 80 100	WATER CONTENT (%) PL W_p NMC W LL W_l NP Nonplastic 20 40 60 80	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL	REMARKS
0.0	CLAYEY SILT (CL), trace sand to sandy, trace gravel, trace to some organics, containing organic pockets and rootlets/vegetation Very soft to soft Dark brown Moist		1	SS	0		252								
			2	SS	4		251								
1.4															
250.7	CLAYEY SILT (CL), trace sand to sandy, trace gravel Stiff to hard Brown to grey Moist		3	SS	10						4	21	45	30	
			4	SS	22		250								
			5	SS	28		249								
	- 3.8 m: becoming grey (Elev. 248.4 m)		6	SS	41		248				1	2	56	42	
247.7															
4.5	CLAYEY SILT-SILT (CL-ML), trace sand to sandy, trace gravel (TILL) Hard Grey Moist		7	SS	131		247								
	- 5.8 to 6.0 m: grinding of augers noted		8	SS	49		246								
			9	SS	54		245				2	28	52	19	
							244								
			10	SS	46		243								

Continued on Next Page

+³, x³ : Numbers refer to Sensitivity o³% STRAIN AT FAILURE

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PROJECT 19136074

RECORD OF BOREHOLE No. CV1-01 Sheet 2 of 2 METRIC

G.W.P. 2008-21-00 LOCATION N 4887764.9; E 299268.2 NAD83 / MTM zone 10 (LAT. 44.129859; LONG. -79.569128) ORIGINATED BY DP

DIST Central HWY Bradford Bypass - ~~County Road 4~~ BOREHOLE TYPE 210 mm O.D. Hollow Stem Auger COMPILED BY ACK/BL

DATUM CGVD28 Surface Elevation:252.19 m DATE Oct 14, 2021 - CHECKED BY KJB

SOIL PROFILE			SAMPLES												
ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES	GROUNDWATER CONDITIONS	ELEVTION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT SHEAR STRENGTH (kPa) Field Vane Remoulded Pocket Pen Quick Triaxial Unconfined 20 40 60 80 100	WATER CONTENT (%) PL W_p NMC W LL W_l NP Nonplastic 20 40 60 80	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL	REMARKS
242.0 10.2	CLAYEY SILT-SILT (CL-ML), trace sand to sandy, trace gravel (TILL) Hard Grey Moist						242								
240.9	CLAYEY SILT-SILT (CL-ML), trace sand Hard Grey Moist		11	SS	69		241		⊕			2	79	19	
11.28	End of Borehole						240								
							239								
							238								
							237								
							236								
							235								
							234								
							233								

+³, x³ : Numbers refer to Sensitivity o³% STRAIN AT FAILURE

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PROJECT 19136074

RECORD OF BOREHOLE No. CV1-02 Sheet 1 of 2 METRIC

G.W.P. 2008-21-00 LOCATION N 4887762.6; E 299289.6 NAD83 / MTM zone 10 (LAT. 44.129838; LONG. -79.568861) ORIGINATED BY MM

DIST Central HWY Bradford Bypass - County Road 4 BOREHOLE TYPE 210 mm O.D. Hollow Stem Auger COMPILED BY ACK/BL

DATUM CGVD28 Surface Elevation:256.28 m DATE Jul 05, 2021 - Jul 06, 2021 CHECKED BY KJB

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUNDWATER CONDITIONS	ELEVTION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) (Field Vane, Remoulded, Pocket Pen, Quick Triaxial, Unconfined) 20 40 60 80 100	WATER CONTENT (%) PL W_p NMC W LL W_l NP Nonplastic 20 40 60 80	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL	REMARKS
0.0	ASPHALT (200 mm)														
256.1 / 0.2	SILTY SAND (SM) of slight plasticity, some gravel to gravelly SILTY SAND (SM) (FILL) Compact to very dense Brown Moist - 0.8 to 1.0 m: pocket of clayey silt (CL) (between Elev. 255.5 m and Elev. 255.3 m)		1	SS	16		256				27	60	10	2	
			2a / 2b	SS	14		255								
			3	SS	17						16	54	24	6	
	- 2.5 to 2.9 m: layer of sandy silt (ML) (between Elev. 253.8 m and Elev. 253.4 m)		4a / 4b	SS	20		254								
	- 3.0 to 3.2 m: layer of sandy silt (ML) (between Elev. 253.2 m and Elev. 253.1 m)		5a / 5b	SS	60		253								
4.5			6	SS	14		252								
251.8	CLAYEY SILT-SILT (CL-ML), trace sand, trace gravel, trace organics, trace rootlets Soft to firm Brown Moist		7	SS	3										OC= 2.4%
250.6							251								
5.6	SILT (ML), trace sand Compact Grey Wet		8	SS	10	▽	250								
249.5															
6.8	CLAYEY SILT (CL) to CLAYEY SILT-SILT (CL-ML), trace sand to sandy, trace gravel (TILL) Stiff to hard Brown to grey Moist		9	SS	9		249				1	9	46	44	
			10	SS	30		248								
	- 9.1 m: becoming grey (Elev. 247.2 m)		11	SS	47		247								

Continued on Next Page

+³, x³ : Numbers refer to Sensitivity o³% STRAIN AT FAILURE

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PROJECT 19136074

RECORD OF BOREHOLE No. CV1-02 Sheet 2 of 2 METRIC

G.W.P. 2008-21-00 LOCATION N 4887762.6; E 299289.6 NAD83 / MTM zone 10 (LAT. 44.129838; LONG. -79.568861) ORIGINATED BY MM

DIST Central HWY Bradford Bypass - ~~County Road 4~~ BOREHOLE TYPE 210 mm O.D. Hollow Stem Auger COMPILED BY ACK/BL

DATUM CGVD28 Surface Elevation:256.28 m DATE Jul 05, 2021 - Jul 06, 2021 CHECKED BY KJB

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUNDWATER CONDITIONS	ELEVTION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) (Field Vane, Remoulded, Pocket Pen, Quick Triaxial, Unconfined) 20 40 60 80 100	WATER CONTENT (%) PL W_p NMC W LL W_l NP Nonplastic 20 40 60 80	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL	REMARKS
	CLAYEY SILT (CL) to CLAYEY SILT-SILT (CL-ML), trace sand to sandy, trace gravel (TILL) Stiff to hard Brown to grey Moist						246								
			12	SS	100		245								
							244								
			13	SS	79				OH		8	33	46	13	
							243								
			14	SS	58		242								
							241								
			15	SS	79										
240.0															
16.3	CLAYEY SILT (CL) Hard Grey Moist						240								
			16	SS	64/130mm				~~OH~~		0	0	74	25	
239.2															
17.04	End of Borehole NOTE: 1) Water encountered at a depth of 6.1 m during drilling.						239								
							238								
							237								

+³, x³ : Numbers refer to Sensitivity o³% STRAIN AT FAILURE

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PROJECT 19136074

RECORD OF BOREHOLE No. CV1-03

Sheet 1 of 2

METRIC

G.W.P. 2008-21-00 LOCATION N 4887772.3; E 299303.4 NAD83 / MTM zone 10 (LAT. 44.129926; LONG. -79.568688) ORIGINATED BY MM

DIST Central HWY Bradford Bypass - County Road 4 BOREHOLE TYPE 210 mm O.D. Hollow Stem Auger COMPILED BY ACK/BL

DATUM CGVD28 Surface Elevation:256.50 m DATE Jun 25, 2021 - Jun 28, 2021 CHECKED BY KJB

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUNDWATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) (Field Vane, Remoulded, Pocket Pen, Quick Triaxial, Unconfined) 20 40 60 80 100	WATER CONTENT (%) PL W_p NMC W LL W_l NP Nonplastic 20 40 60 80	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL	REMARKS
0.0	ASPHALT (200 mm)														
256.3 / 0.2	Gravelly SAND (SP) to SAND (SP), some gravel (FILL) Compact Brown Moist		1	SS	24		256		○						
	- 1.1 to 1.4 m: layer of clayey sand (SC) (between Elev. 255.4 m and Elev. 255.1 m)		2a 2b	SS	21										
255.0 / 1.4	CLAYEY SILT (CL), trace sand to sandy, some to trace gravel (FILL) Stiff to very stiff Brown to dark brown Moist		3a 3b	SS	11		255								
	- 2.1 to 2.3 m: containing trace organics and dark brown (between Elev. 254.4 m and Elev. 254.2 m)		4a 4b	SS	27		254		○						
			5	SS	31		253								
	- 3.8 to 4.1 m: layer of silty sand (SM), some gravel (between Elev. 252.7 m and Elev. 252.4 m)		6a 6b	SS	15				○H			11	49	31	9
	- 4.1 to 4.4 m: cotaining rootlets and asphalt pieces (between Elev. 252.4 m and Elev. 252.1 m)						252								
252.0 / 4.5	CLAYEY SILT-SILT (CL-ML), some sand, trace gravel Firm to stiff Brown Moist		7	SS	14										
			8	SS	8		251		⊕H						
	- 6.1 to 6.7 m: no sample recovery		9	SS	15		250	⊕ ×							
249.7 / 6.8	CLAYEY SILT (CL) to CLAYEY SILT-SILT (CL-ML), trace sand to sandy, trace to some gravel (TILL) Very stiff to hard Grey Moist		10	SS	15				H○H			1	8	41	50
			11	SS	23		249								
							248								
			12	SS	38		247								

Continued on Next Page

+³, x³ : Numbers refer to Sensitivity o³% STRAIN AT FAILURE

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PROJECT 19136074

RECORD OF BOREHOLE No. CV1-03 Sheet 2 of 2 METRIC

G.W.P. 2008-21-00 LOCATION N 4887772.3; E 299303.4 NAD83 / MTM zone 10 (LAT. 44.129926; LONG. -79.568688) ORIGINATED BY MM

DIST Central HWY Bradford Bypass - County Road 4 BOREHOLE TYPE 210 mm O.D. Hollow Stem Auger COMPILED BY ACK/BL

DATUM CGVD28 Surface Elevation:256.50 m DATE Jun 25, 2021 - Jun 28, 2021 CHECKED BY KJB

SOIL PROFILE			SAMPLES			GROUNDWATER CONDITIONS	ELEVTION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) (Field Vane, Remoulded, Pocket Pen, Quick Triaxial, Unconfined) 20 40 60 80 100	WATER CONTENT (%) PL W_p NMC W LL W_l NP Nonplastic 20 40 60 80	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES										
	CLAYEY SILT (CL) to CLAYEY SILT-SILT (CL-ML), trace sand to sandy, trace to some gravel (TILL) Very stiff to hard Grey Moist						246								
			13	SS	53		245		○						
			14	SS	90		244								
							243								
			15	SS	68				○H		10	34	44	12	
241.1							242								
15.4	CLAYEY SILT-SILT (CL-ML) Hard Grey Moist		16a 16b	SS	101		241								
							240								
239.5			17	SS	60/130mm				○H		1	81	18		
17.04	End of Borehole						239								
							238								
							237								

+³, x³ : Numbers refer to Sensitivity o³% STRAIN AT FAILURE

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PROJECT 19136074

RECORD OF BOREHOLE No. CV1-04 Sheet 1 of 1 METRIC

G.W.P. 2008-21-00 LOCATION N 4887770.4; E 299328.7 NAD83 / MTM zone 10 (LAT. 44.129909; LONG. -79.568372) ORIGINATED BY DP

DIST Central HWY Bradford Bypass - County Road 4 BOREHOLE TYPE 210 mm O.D. Hollow Stem Auger COMPILED BY ACK/BL

DATUM CGVD28 Surface Elevation:250.48 m DATE Aug 26, 2021 - Aug 27, 2021 CHECKED BY KJB

ELEV. / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUNDWATER CONDITIONS	ELEVTION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL	REMARKS
0.0	Sandy SILT (ML), trace clay, trace organics (FILL) Brown Moist Loose		1	SS	6		250				0	32	65	3	
249.8															
0.7	Sandy SILTY CLAY (CI), trace organics Brown Moist Soft to firm		2	SS	4							17	37	46	
249.0							249								
1.4	CLAYEY SILT (CL) to CLAYEY SILT-SILT (CL-ML), some sand to sandy, trace gravel (TILL) Brown to grey Moist Stiff to hard		3	SS	11										
			4	SS	21		248				8	17	39	35	
			5	SS	32										
	- 3.8 m: becoming grey (Elev. 246.7m)						247								
			6	SS	31										
	- 4.6 to 5.2 m: layer of sandy silt (ML) of slight plasticity TILL (between Elevation 245.9 m and Elevation 245.3 m)						246								
			7	SS	30				CH		5	34	47	14	
							245								
			8	SS	64		244								
			9	SS	44		243								
							242								
			10	SS	64										
240.7							241								
9.75	End of Borehole														

DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa): Field Vane, Remoulded, Pocket Pen, Quick Triaxial, Unconfined; 20 40 60 80 100

WATER CONTENT (%): PL W_p NMC W LL W_l; NP Nonplastic; 20 40 60 80

+³, x³ : Numbers refer to Sensitivity o³% STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. 2021-2124
WP No. 2008-21-00

SHEET

BRADFORD BYPASS
COUNTY ROAD 4

BOREHOLE LOCATION PLAN

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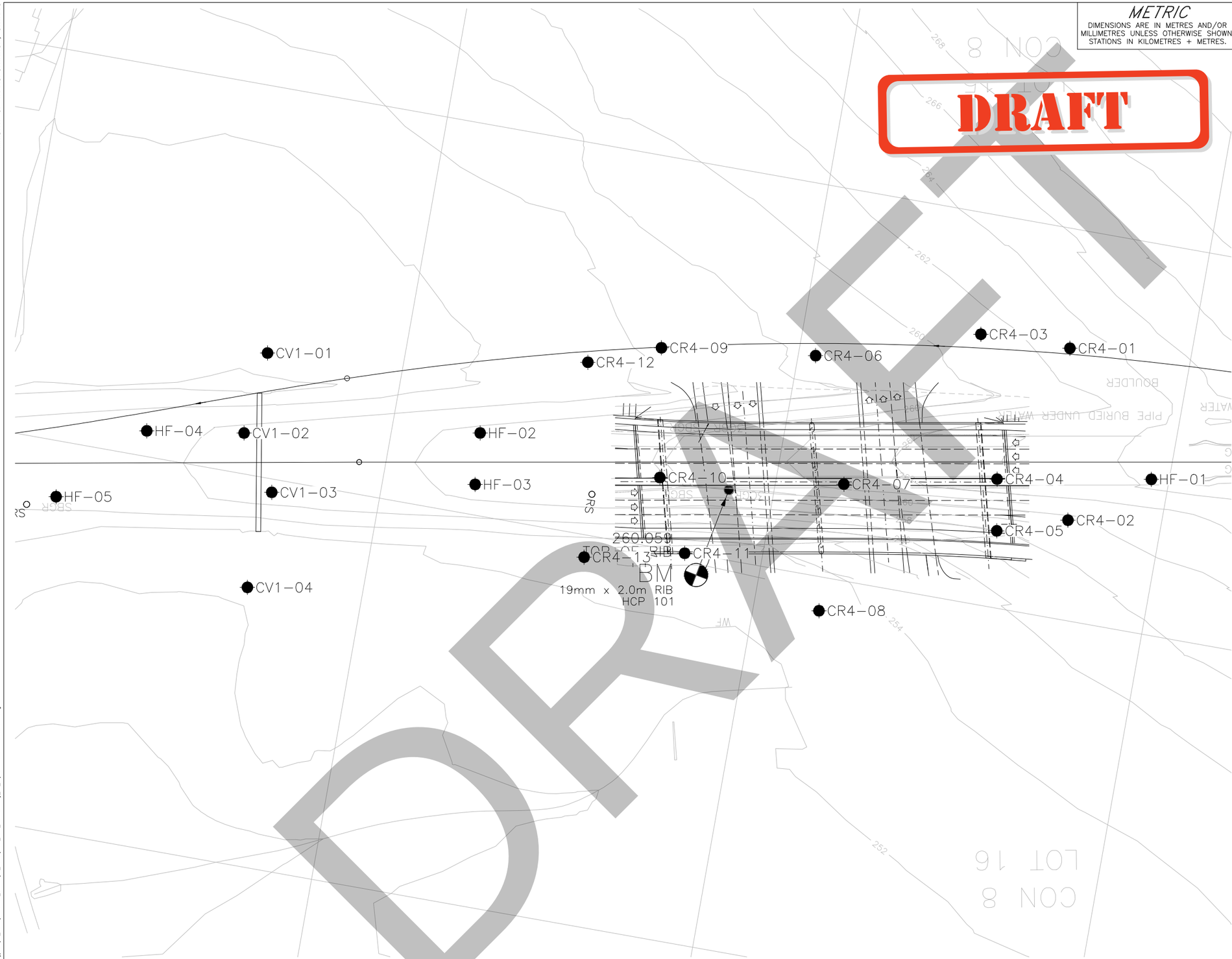
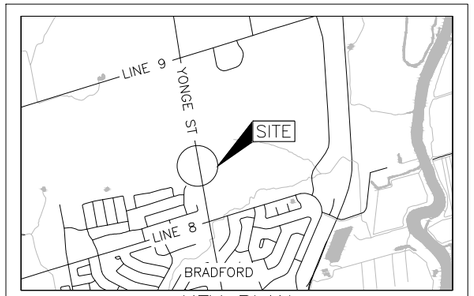


PLAN
SCALE
10 0 10 20 m



KEY PLAN
SCALE
500 0 500 1000 m

LEGEND

● Borehole – Current Investigation

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
CR4-01	262.8	4887968.8	299230.6
CR4-02	259.7	4887976.1	299274.4
CR4-03	261.2	4887945.5	299231.0
CR4-04	262.7	4887956.2	299267.1
CR4-05	258.0	4887958.5	299280.3
CR4-06	258.2	4887904.5	299244.0
CR4-07	261.3	4887917.5	299275.4
CR4-08	253.3	4887916.9	299308.7
CR4-09	256.5	4887864.9	299249.0
CR4-10	259.9	4887870.4	299282.0
CR4-11	253.3	4887880.1	299300.2
CR4-12	255.2	4887846.8	299256.0
CR4-13	252.8	4887854.7	299305.7
CV1-01	252.2	4887764.9	299268.2
CV1-02	256.3	4887762.6	299289.6
CV1-03	256.5	4887772.3	299303.4
CV1-04	250.5	4887770.4	299328.7
HF-01	264.2	4887995.4	299260.2
HF-02	258.3	4887822.6	299278.8
HF-03	258.4	4887823.7	299292.2
HF-04	255.5	4887737.7	299293.4
HF-05	254.7	4887717.7	299314.3

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

REFERENCE

Base plans provided in digital format by Aecom, drawing file no. 20-23507 Bradford Bypass.dwg, received November 3, 2021.
General arrangement provided in digital format by Aecom, file no. 01_County RD. UP OVER BBP_ga.dwg, received June 6, 2021.

NO.	DATE	BY	REVISION
.	.	.	.

Geocres No. .

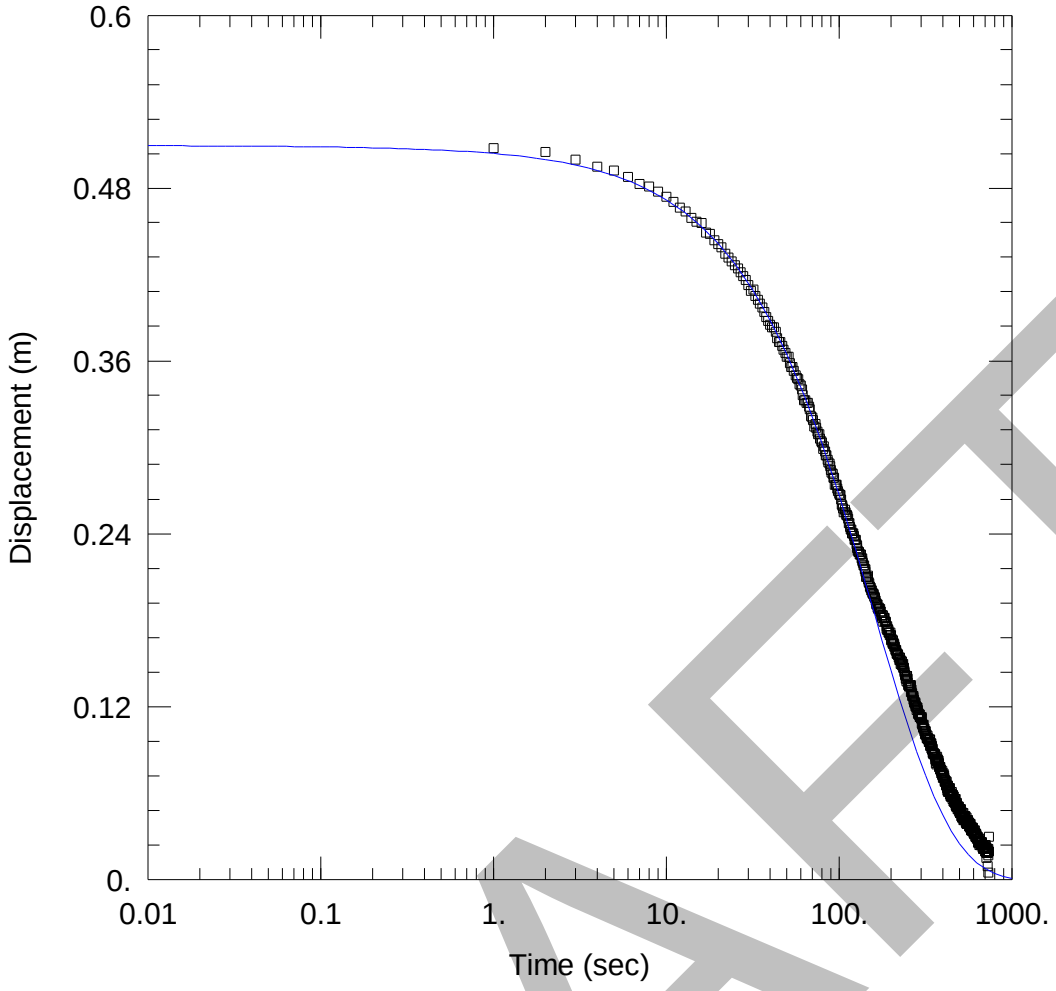
HWY. BRADFORD BYPASS	PROJECT NO. 19136074		DIST. CENTRAL
SUBM'D. ACK	CHKD. ACK	DATE: 11/19/2021	SITE: .
DRAWN: DD	CHKD. .	APPD. KJB	DWG. 1

DRAFT

PLOT DATE: November 19, 2021
FILENAME: S:\Clients\MTO\Bradford_Bypass\VA_PROJ\19136074_Aecom\60_PROD\0001_Tech_Memo-County_Rd_4\19136074-0001-BD-0001.dwg

Appendix C

Hydraulic Conductivity Results



BRADFORD BYPASS (BBP) - CR4-03 - FALLING HEAD TEST

Data Set: C:\...\CR4-03 FHT.aqt
Date: 11/05/21 Time: 16:14:01

PROJECT INFORMATION

Company: AECOM Canada Ltd.
Project: 60636190
Test Well: CR4-03
Test Date: 2021-10-14

AQUIFER DATA

Saturated Thickness: 8.77 m

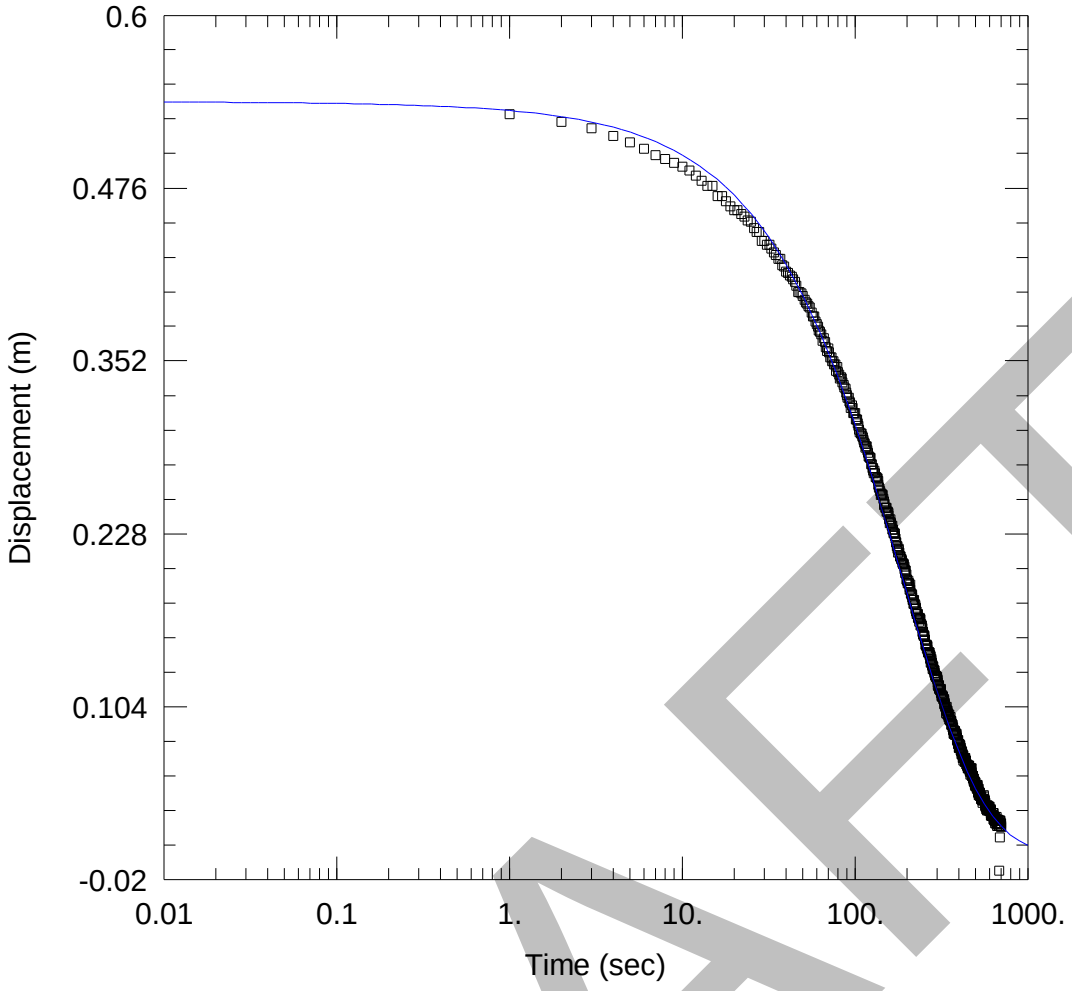
WELL DATA (CR4-03)

Initial Displacement: 0.5097 m
Total Well Penetration Depth: 10.65 m
Casing Radius: 0.025 m
Static Water Column Height: 8.77 m
Screen Length: 3.05 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 3.614E-6 m/sec
Kz/Kr = 1.
Ss = 9.221E-6 m^{-1}



BRADFORD BYPASS (BBP) - CR4-03 - RISING HEAD TEST

Data Set: C:\...\CR4-03 RHT.aqt
Date: 11/05/21 Time: 16:19:01

PROJECT INFORMATION

Company: AECOM Canada Ltd.
Project: 60636190
Test Well: CR4-03
Test Date: 2021-10-14

AQUIFER DATA

Saturated Thickness: 8.77 m

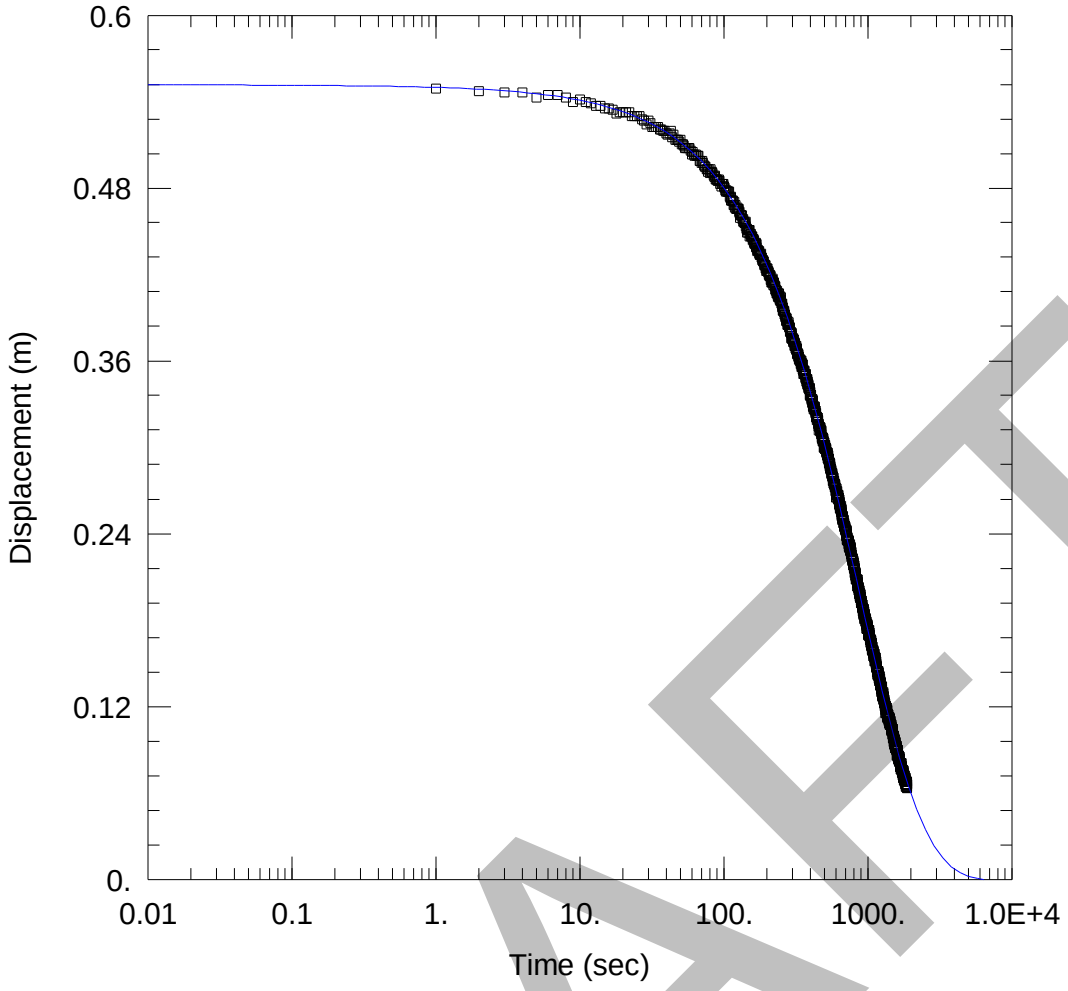
WELL DATA (CR4-03)

Initial Displacement: 0.5381 m
Total Well Penetration Depth: 10.65 m
Casing Radius: 0.025 m
Static Water Column Height: 8.77 m
Screen Length: 3.05 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 2.984E-6 m/sec
Kz/Kr = 1.
Ss = 2.343E-5 m^{-1}



BRADFORD BYPASS (BBP) - CR4-11 - FALLING HEAD TEST

Data Set: C:\...\CR4-11 FHT.aqt
Date: 11/05/21 Time: 16:33:10

PROJECT INFORMATION

Company: AECOM Canada Ltd.
Project: 60636190
Test Well: CR4-11
Test Date: 2021-10-14

AQUIFER DATA

Saturated Thickness: 8.56 m

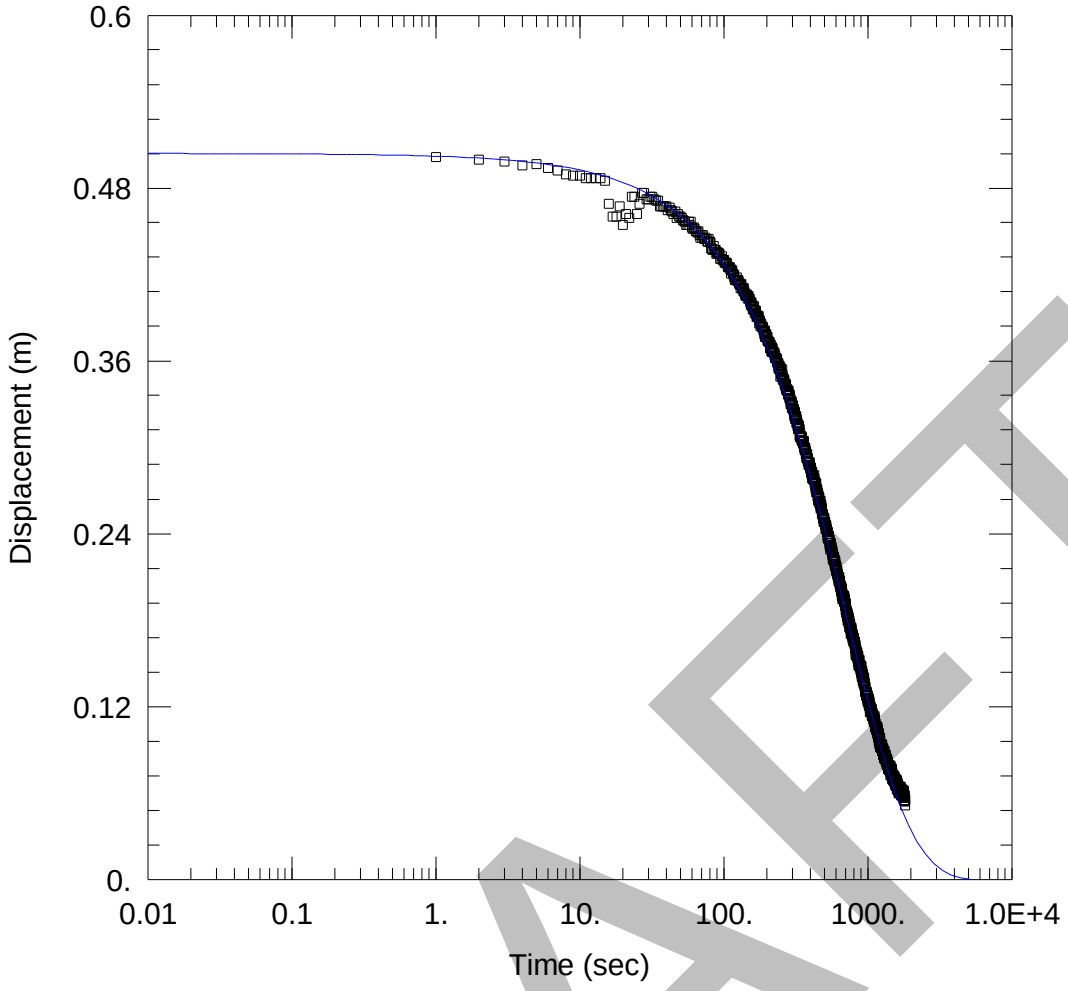
WELL DATA (CR4-11)

Initial Displacement: 0.5518 m
Total Well Penetration Depth: 9.15 m
Casing Radius: 0.025 m
Static Water Column Height: 8.56 m
Screen Length: 3.05 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 5.379E-7 m/sec
Kz/Kr = 1.
Ss = 9.221E-6 m^{-1}



BRADFORD BYPASS (BBP) - CR4-11 - RISING HEAD TEST

Data Set: C:\...\CR4-11 RHT.aqt
Date: 11/05/21 Time: 17:30:39

PROJECT INFORMATION

Company: AECOM Canada Ltd.
Project: 60636190
Test Well: CR4-11
Test Date: 2021-10-14

AQUIFER DATA

Saturated Thickness: 8.56 m

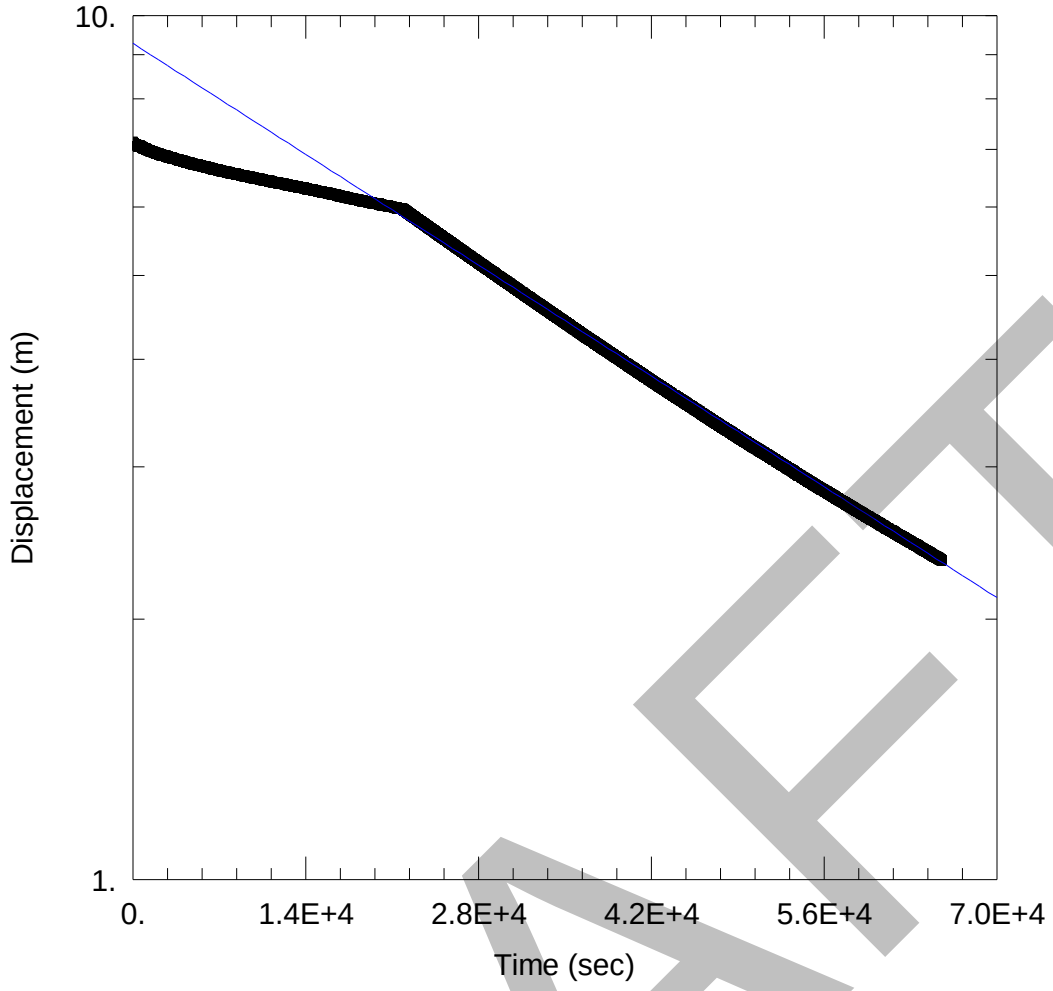
WELL DATA (CR4-11)

Initial Displacement: 0.5042 m
Total Well Penetration Depth: 9.15 m
Casing Radius: 0.025 m
Static Water Column Height: 8.56 m
Screen Length: 3.05 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 6.583E-7 m/sec
Kz/Kr = 1.
Ss = 9.221E-6 m^{-1}



BRADFORD BYPASS (BBP) - CV1-04 - RISING HEAD TEST

Data Set: C:\...\Cv1-04 RHT.aqt
Date: 11/05/21 Time: 17:44:07

PROJECT INFORMATION

Company: AECOM Canada Ltd.
Project: 60636190
Test Well: CV1-04
Test Date: 2021-10-12

AQUIFER DATA

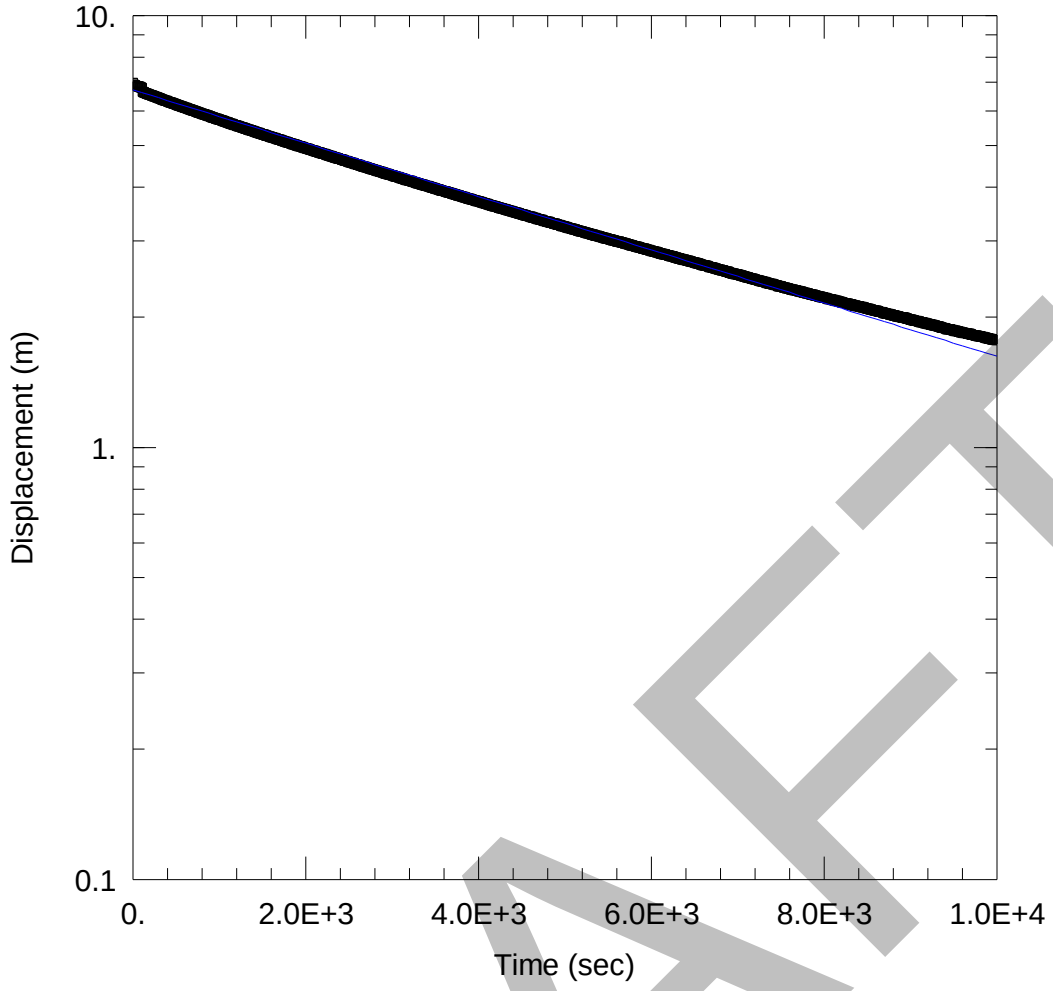
Saturated Thickness: 8.99 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CV1-04)

Initial Displacement: 7.136 m
Total Well Penetration Depth: 9.15 m
Casing Radius: 0.025 m
Static Water Column Height: 8.99 m
Screen Length: 3.05 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 8.78E-9 m/sec
y0 = 9.277 m



BRADFORD BYPASS (BBP) - CV1-01 - RISING HEAD TEST

Data Set: C:\...\Cv1-01 RHT.aqt
Date: 11/29/21 Time: 12:40:15

PROJECT INFORMATION

Company: AECOM Canada Ltd.
Project: 60636190
Test Well: CV1-01
Test Date: 2021-11-23

AQUIFER DATA

Saturated Thickness: 10.58 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (CV1-01)

Initial Displacement: 6.969 m
Total Well Penetration Depth: 10.58 m
Casing Radius: 0.025 m
Static Water Column Height: 10.58 m
Screen Length: 3.05 m
Well Radius: 0.105 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 5.913E-8 m/sec
y0 = 6.721 m

Appendix D

MECP Water Well Records

Borehole ID	Well ID	Date Completed	Depth (m)	Static Level (m)	Water Kind	Easting	Northing	Well Type	Primary Water Use	Elevation (masl)
10378191	5700298	1946-09-25	69.80	0.00		614605.4	4886697	Overburden	Test Hole	244.952178
10383173	5705288	1961-05-03	17.10	6.10	FRESH	614514.4	4886953	Overburden	Domestic	249.987533
10383175	5705290	1962-08-03	5.50	1.80	FRESH	614079.4	4886816	Overburden	Domestic	263.168914
10383176	5705291	1963-10-01	7.60	2.40	FRESH	614384.4	4886912	Overburden	Domestic	253.783081
10383177	5705292	1964-10-28	12.80	2.40	FRESH	614121.4	4887843	Overburden	Livestock	278.39923
10383178	5705293	1966-06-07	8.50	1.80	Not stated	614204.4	4886827	Overburden	Domestic	257.866851
10383179	5705294	1967-04-20	10.70	4.90	FRESH	614096.4	4888144	Overburden	Domestic	274.560485
10383180	5705295	1966-02-10	10.70	0.00	FRESH	614660.4	4887003	Overburden	Domestic	243.286636
10383191	5705306	1961-11-26	14.00	6.10	FRESH	614070.4	4888254	Overburden	Domestic	276.080352
10383192	5705307	1966-06-03	14.60	12.20	FRESH	614205.4	4888385	Overburden	Domestic	277.993103
10383193	5705308	1963-08-23	14.60	11.30	FRESH	614250.4	4888475	Overburden	Domestic	276.566284
10383298	5705413	1968-07-29	9.40	4.30	FRESH	614084.4	4888173	Overburden	Domestic	274.96997
10383299	5705414	1968-07-08	9.40	4.30	FRESH	614054.4	4888133	Overburden	Domestic	274.258697
10383642	5705763	1968-10-04	13.10	6.10	FRESH	614214.4	4888303	Overburden	Domestic	278.428771
10383991	5706117	1968-11-25	8.80	3.40	FRESH	614314.4	4887563	Overburden	Domestic	277.73941
10383999	5706125	1968-10-23	8.50	3.70	FRESH	614004.4	4888163	Overburden	Domestic	274.669158
10383860	5705984	1968-08-01	8.50	5.50	FRESH	613914.4	4888203	Overburden	Domestic	274.592071
10384860	5707014	1969-10-25	15.20	4.60	FRESH	614374.4	4886923	Overburden	Domestic	255.273818
10384861	5707015	1969-10-31	15.20	4.30	FRESH	614374.4	4886903	Overburden	Domestic	253.379943
10384888	5707042	1969-12-11	17.40	10.40	FRESH	614214.4	4886853	Overburden	Domestic	257.740844
10385609	5707770	1970-07-31	11.00	7.30	FRESH	613914.4	4888123	Overburden	Domestic	273.208801
10385870	5708033	1971-05-07	11.90	9.40	FRESH	614064.4	4888243	Overburden	Domestic	275.899444
10386977	5709152	1972-05-04	8.20	4.30	FRESH	613944.4	4888153	Overburden	Domestic	273.983642
10386490	5708661	1971-11-15	13.40	8.50	FRESH	614214.4	4888363	Overburden	Domestic	278.184875
10386578	5708749	1971-12-23	10.70	3.70	FRESH	614139.4	4886823	Overburden	Domestic	259.871276
10386984	5709159	1972-06-09	13.40	8.50	FRESH	614114.4	4888173	Overburden	Domestic	274.980712
10387005	5709180	1972-07-07	11.60	8.50	FRESH	614114.4	4888273	Overburden	Domestic	276.700897
10387006	5709181	1972-07-08	10.70	5.50	FRESH	613874.4	4888243	Overburden	Domestic	275.076782
10387268	5709446	1972-08-10	15.80	12.80	FRESH	614314.4	4887763	Overburden	Domestic	286.523162
10389529	5711738	1974-08-13	12.80	6.70	FRESH	613843.4	4888209	Overburden	Domestic	274.273498
10389530	5711739	1974-03-19	15.20	11.00	FRESH	613910.4	4888224	Overburden	Domestic	274.939178
10392847	5715129	1978-04-12	50.90	15.80	FRESH	614964.4	4887123	Overburden	Domestic	236.41629
10393920	5716219	1979-06-05	16.80	9.10	FRESH	614414.4	4888023	Overburden	Industrial	278.885192
10394694	5717000	1980-06-16	13.70	4.60	FRESH	614614.4	4886973	Overburden	Domestic	243.404129
10398291	5720665	1985-06-20	15.20	4.60	Not stated	614737.4	4887702	Overburden	Domestic	247.345336
10398767	5721141	1986-04-14	108.50	56.70	FRESH	614737.4	4887702	Overburden	Domestic	247.345336
10399002	5721377	1986-04-30	22.30	6.10	Not stated	614737.4	4887702	Overburden	Domestic	247.345336
10399201	5721577	1986-09-06	15.50	6.10	Not stated	614263	4888247	Overburden	Domestic	279.049255
10400640	5723028	1987-08-13	133.20	113.10	FRESH	614247.6	4888431	Overburden	Industrial	277.38739
10401635	5724025	1988-09-29	41.80	18.30	FRESH	615060.6	4887113	Overburden	Domestic	240.69104
10401832	5724233	1988-09-20	17.10	3.00	Not stated	614762	4888397	Overburden	Domestic	265.235351
10402085	5724486	1988-10-24	19.20	9.10	Not stated	614566.6	4888323	Overburden	Domestic	272.518707
10402528	5724930	1989-04-01	17.10	9.10	Not stated	614162.6	4888010	Overburden	Domestic	274.107177
10402813	5725216	1989-03-10	11.90	3.00	Not stated	613892.6	4888131	Overburden	Domestic	273.204589
10402929	5725332	1989-07-19	70.40	36.00	FRESH	614811.6	4888250	Overburden	Domestic	255.297363
10403929	5726341	1990-02-22	74.40	28.70	FRESH	614657.6	4888192	Overburden	Domestic	268.192138
10403291	5725701	1989-10-03	86.30	53.30	FRESH	614598.6	4888328	Overburden	Domestic	271.997344
10403383	5725793	1989-07-20	17.10	6.10	Not stated	614664	4888150	Overburden	Domestic	265.445953
10403386	5725796	1989-07-20	17.10	6.10	Not stated	614785	4888265	Overburden	Domestic	258.593078
10403662	5726072	1989-12-01	82.60	43.00	FRESH	614685.6	4888220	Overburden	Domestic	265.879272
10403705	5726116	1989-12-08	76.80	39.00	FRESH	614719.6	4888225	Overburden	Domestic	262.062774
10403747	5726158	1989-03-01	19.50	9.10	Not stated	614628.6	4888219	Overburden	Domestic	272.316925
10403748	5726159	1989-12-10	22.60	6.10	Not stated	614559	4888334	Overburden	Domestic	272.099731
10403994	5726406	1990-03-30	93.00	54.90	FRESH	614605.6	4888208	Bedrock	Domestic	273.796783
10404647	5727068	1990-08-13	79.20	55.80	FRESH	614791	4888320	Overburden	Domestic	261.561462
10404681	5727102	1990-04-02	24.40	6.10	Not stated	614314	4888367	Overburden	Domestic	278.211944

Borehole ID	Well ID	Date Completed	Depth (m)	Static Level (m)	Water Kind	Easting	Northing	Well Type	Primary Water Use	Elevation (masl)
10404684	5727105	1990-03-15	24.40	10.70	Not stated	617370.4	4890193	Overburden	Domestic	219.093841
10404752	5727173	1990-08-17	79.20	48.80	FRESH	614746	4888398	Overburden	Domestic	265.721771
10405654	5728079	1991-05-20	23.80	7.00	Not stated	614572.6	4888347	Overburden	Domestic	271.142883
10406614	5729040	1992-03-13	76.20	42.70	FRESH	614551.6	4887133	Overburden	Domestic	249.116653
10407594	5730035	1993-04-08	97.50	58.80	FRESH	614006.6	4888328	Overburden	Domestic	276.952239
10408275	5730719	1994-05-05	96.00	59.40	FRESH	614324	4888346	Overburden	Domestic	278.438415
10408862	5731308	1994-12-21	86.90	59.40	FRESH	614381.6	4888356	Overburden	Domestic	277.603393
10409630	5732097	1995-12-15	61.60	33.50	FRESH	614449	4887195	Overburden	Domestic	251.98973
10411546	5734015	1999-01-05	91.40	38.10	FRESH	614160	4886818	Overburden	Domestic	259.341186
10411995	5734465	1999-08-23	23.20	11.00	FRESH	614020	4888236	Overburden	Domestic	275.405853
10412402	5734872	1999-10-05	92.00	61.30	FRESH	614137	4887505	Overburden	Domestic	282.420318
10412403	5734873	1999-09-23	137.80	0.00		614357	4887786	Overburden	Not Used	283.443847
10412499	5734969	1999-12-17	92.00	64.60	FRESH	614258	4888304	Overburden	Domestic	279.030578
10521883	5736334	2001-08-16	0.00	0.00		614315	4887041		Not Used	256.30429
10521884	5736335	2001-07-16	0.00	0.00		614323	4887066		Not Used	256.215148
11325489	5739993	2005-06-24	0.00	0.00		614419	4886913		Not Used	250.718215
1003174350	7148502	2010-04-29	0.00	0.00		614690	4887031		Not Used	244.543136
1003354618	7153416	2010-10-01	4.60	0.00		614547	4887108		Test Hole	249.310165
1003543217	7166452	2011-03-31	0.00	0.60	Untested	614662	4886980		Not Used	240.113296
1003704553	7178301	2011-12-16	83.80	45.80	FRESH	614664	4888184		Domestic	266.888061
1004892735	7220941	2013-05-09	85.30	48.50	FRESH	614627	4888167		Domestic	270.591094
1005916653	7260179	2015-11-26	0.00	0.00		614500	4888050		Unkown	275.893829
1006865389	7300962	2017-11-07	0.00	0.00					Monitoring	
1006916000	7301874	2017-11-09	0.00	0.00					Not Used	
1006943715	7302531	2017-10-27	28.70	9.10					Domestic	
1007155131	7314497	2018-04-06	0.00	0.00					Unkown	
1007798252	7349701	2019-11-04	12.20	0.00					Monitoring and Test Hole	
1007798465	7349766	2019-11-05	3.70	0.00					Monitoring and Test Hole	
1007798468	7349767	2019-11-05	6.10	0.00					Monitoring and Test Hole	

AECOM

Appendix E

Groundwater Quality

					AGAT Work Order ID#	21T834435	21T815206	21T815212	21T815210
					Sampling Date	Nov. 24, 2021	Oct 13, 2021	Oct 13, 2021	Oct 13, 2021
					Well Location ID	CV1-01	**CV1-04**	**CR4-03**	**CR4-11**
Parameters	Units	RDL	Town of Bradford West Gwillumbrury Sanitary Sewer Bylaw	Town of Bradford West Gwillumbrury Storm Sewer Bylaw	PWQO				
O. Reg. 153(511) - PHCs F1 - F4 (with PAHs and VOC) (Water)									
F1 (C6-C10)	µg/L	25	-	-	-	<25	-	-	<25
F1 (C6 to C10) minus BTEX	µg/L	25	-	-	-	<25	-	-	<25
Toluene-d8	% Recover	1.00	-	-	-	<100	-	-	102
F2 (C10 to C16)	µg/L	100	-	-	-	<100	-	-	<100
F2 (C10 to C16) minus Naphthalene	µg/L	100	-	-	-	<100	-	-	<100
F3 (C16 to C34)	µg/L	100	-	-	-	<100	-	-	<100
F3 (C16 to C34) minus PAHs	µg/L	100	-	-	-	<100	-	-	<100
F4 (C34 to C50)	µg/L	100	-	-	-	<100	-	-	<100
Gravimetric Heavy Hydrocarbons	µg/L	500	-	-	-	NA	-	-	NA
O. Reg. 153(511) - PAHs (Water)									
Naphthalene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Acenaphthylene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Acenaphthene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Fluorene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Phenanthrene	µg/L	0.10	-	-	-	<0.10	-	-	<0.10
Anthracene	µg/L	0.10	-	-	-	<0.10	-	-	<0.10
Fluoranthene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Pyrene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Benzo(a)anthracene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Chrysene	µg/L	0.10	-	-	-	<0.10	-	-	<0.10
Benzo(b)fluoranthene	µg/L	0.10	-	-	-	<0.10	-	-	<0.10
Benzo(k)fluoranthene	µg/L	0.10	-	-	-	<0.10	-	-	<0.10
Benzo(a)pyrene	µg/L	0.01	-	-	-	<0.01	-	-	<0.01
Indeno(1,2,3-cd)pyrene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Dibenz(a,h)anthracene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Benzo(g,h,i)perylene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
2-and 1-methyl Naphthalene	µg/L	0.20	-	-	-	<0.20	-	-	<0.20
Naphthalene-d8	%	1	-	-	-	78	-	-	119
Acridine-d9	%	1	-	-	-	84	-	-	114
Terphenyl-d14	%	1	-	-	-	88	-	-	91
Sediment			-	-	-	No	-	-	No
O. Reg. 153(511) - VOCs (Water)									
Dichlorodifluoromethane	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20

					AGAT Work Order ID#	21T834435	21T815206	21T815212	21T815210
					Sampling Date	Nov. 24, 2021	Oct 13, 2021	Oct 13, 2021	Oct 13, 2021
					Well Location ID	CV1-01	**CV1-04**	**CR4-03**	**CR4-11**
Parameters	Units	RDL	Town of Bradford West Gwillumbrury Sanitary Sewer Bylaw	Town of Bradford West Gwillumbrury Storm Sewer Bylaw	PWQO				
Vinyl Chloride	µg/L	0.17	-	-	-	<0.17	<0.17	<0.17	<0.17
Bromomethane	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Trichlorofluoromethane	µg/L	0.40	-	-	-	<0.40	<0.40	<0.40	<0.40
Acetone	µg/L	1.0	-	-	-	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethylene	µg/L	0.30	-	-	-	<0.30	<0.30	<0.30	<0.30
Methylene Chloride	µg/L	0.30	-	-	-	<0.30	<0.30	<0.30	<0.30
trans- 1,2-Dichloroethylene	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Methyl tert-butyl ether	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
1,1-Dichloroethane	µg/L	0.30	-	-	-	<0.30	<0.30	<0.30	<0.30
Methyl Ethyl Ketone	µg/L	1.0	-	-	-	<1.0	<1.0	<1.0	<1.0
cis- 1,2-Dichloroethylene	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Chloroform	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
1,2-Dichloroethane	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.30	-	-	-	<0.30	<0.30	<0.30	<0.30
Carbon Tetrachloride	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Benzene	µg/L	0.20	-	-	-	0.40	<0.20	<0.20	<0.20
1,2-Dichloropropane	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Trichloroethylene	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Bromodichloromethane	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Methyl Isobutyl Ketone	µg/L	1.0	-	-	-	<1.	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Toluene	µg/L	0.20	-	-	-	0.49	0.3	<0.20	<0.20
Dibromochloromethane	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
Ethylene Dibromide	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
Tetrachloroethylene	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
1,1,1,2-Tetrachloroethane	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
Chlorobenzene	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
Ethylbenzene	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
m & p-Xylene	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Bromoform	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
Styrene	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
1,1,2,2-Tetrachloroethane	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
o-Xylene	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
1,3-Dichlorobenzene	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10

						AGAT Work Order ID#	21T815206	21T815212	21T815210
						Sampling Date	Oct 13, 2021	Oct 13, 2021	Oct 13, 2021
						Well Location ID	**CV1-04**	**CR4-03**	**CR4-11**
Parameters	Units	RDL	Town of Bradford West Gwillumbrury Sanitary Sewer Bylaw	Town of Bradford West Gwillumbrury Storm Sewer Bylaw	PWQO				
1,4-Dichlorobenzene	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
1,2-Dichlorobenzene	µg/L	0.10	-	-	-	<0.10	<0.10	<0.10	<0.10
1,3-Dichloropropene	µg/L	0.30	-	-	-	<0.30	<0.30	<0.30	<0.30
Xylenes (Total)	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
n-Hexane	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Toluene-d8	% Recover	1	-	-	-	96	102	104	91
4-Bromofluorobenzene	% Recover	1	-	-	-	97	91	98	96
Organics									
Oil and Grease (animal/vegetable	mg/L	0.5	100	-	-	-	0.64	<0.5	-
Oil and Grease (mineral) in water	mg/L	0.5	15	5.2	-	-	<0.5	<0.5	-
Methylene Chloride	µg/L	0.3	2000	-	-	<0.30	<0.3	<0.3	-
trans-1,3-Dichloropropene	µg/L	0.30	140	5.6	-	-	<0.30	<0.30	-
Methyl Ethyl Ketone	µg/L	0.9	-	-	-	<1.0	<0.9	<0.9	-
cis- 1,2-Dichloroethylene	µg/L	0.2	4000	5.6	-	<0.20	<0.2	<0.2	-
Chloroform	µg/L	0.2	40	2	-	<0.20	<0.2	<0.2	-
Benzene	µg/L	0.2	10	2	-	0.4	<0.2	<0.2	-
Trichloroethylene	µg/L	0.2	400	8	-	<0.20	<0.2	<0.2	-
Toluene	µg/L	0.2	270	2	-	0.49	0.3	<0.2	-
Tetrachloroethene	µg/L	0.1	1000	4.4	-	<0.10	<0.1	<0.1	-
Ethylbenzene	µg/L	0.1	160	2	-	<0.10	<0.1	<0.1	-
1,1,2,2-Tetrachloroethane	µg/L	0.1	1400	17	-	<0.10	<0.1	<0.1	-
Styrene	µg/L	0.1	-	-	-	<0.10	<0.1	<0.1	-
1,2-Dichlorobenzene	µg/L	0.1	50	5.6	-	<0.10	<0.1	<0.1	-
1,4-Dichlorobenzene	µg/L	0.1	80	6.8	-	<0.10	<0.1	<0.1	-
m & p-Xylene	µg/L	0.2		-	-	<0.20	<0.2	<0.2	-
o-Xylene	µg/L	0.1		-	-	<0.10	<0.1	<0.1	-
Xylenes (Total)	µg/L	0.2	1400	4	-	<0.20	<0.2	<0.2	-
Toluene-d8	% Recover	1		-	-	-	102	102	-
4-Bromofluorobenzene	% Recover	1		-	-	-	89	89	-
PCBs	µg/L	0.2	1	0.4	-	-	<0.2	<0.2	-
Decachlorobiphenyl	%	1		-	-	-	91	87	-
Di-n-butyl phthalate	µg/L	0.5	80	15	-	-	<0.5	<0.5	-
Bis(2-Ethylhexyl)phthalate	µg/L	0.5	12	8.8	-	-	<0.5	<0.5	-
2,4,6-Tribromophenol	%	1		-	-	-	78	75	-

						AGAT Work Order ID#	21T815206	21T815212	21T815210
						Sampling Date	Oct 13, 2021	Oct 13, 2021	Oct 13, 2021
						Well Location ID	**CV1-04**	**CR4-03**	**CR4-11**
Parameters	Units	RDL	Town of Bradford West Gwillumbrury Sanitary Sewer Bylaw	Town of Bradford West Gwillumbrury Storm Sewer Bylaw	PWQO				
2-Fluorophenol	%	1		-	-	-	85	69	-
Chrysene-d12	%	1		-	-	-	99	93	-
phenol-d6 surrogate	%	1		-	-	-	98	91	-
O. Reg. 153(511) - Metals & Inorganics (Water)									
Dissolved Antimony	µg/L	1.0	-	-	-	<1.0	<1.0	<1.0	<1.0
Dissolved Arsenic	µg/L	1.0	-	-	-	4.4	3.2	2.2	2.3
Dissolved Barium	µg/L	2.0	-	-	-	344	48.8	216	162
Dissolved Beryllium	µg/L	0.50	-	-	-	1.28	<0.50	<0.50	<0.50
Dissolved Boron	µg/L	10.0	-	-	-	146	193	28.8	60.4
Dissolved Cadmium	µg/L	0.20	-	-	-	0.49	<0.20	<0.20	<0.20
Dissolved Chromium	µg/L	2.0	-	-	-	14.9	<2.0	<2.0	<2.0
Dissolved Cobalt	µg/L	0.50	-	-	-	13.2	<0.50	<0.50	<0.50
Dissolved Copper	µg/L	1.0	-	-	-	24.2	<1.0	<1.0	<1.0
Dissolved Lead	µg/L	0.50	-	-	-	18.5	<0.50	<0.50	0.62
Dissolved Molybdenum	µg/L	0.50	-	-	-	9.28	46	4.55	3.60
Dissolved Nickel	µg/L	3.0	-	-	-	15.9	<3.0	<3.0	<3.0
Dissolved Selenium	µg/L	1.0	-	-	-	2	<1.0	<1.0	<1.0
Dissolved Silver	µg/L	0.20	-	-	-	<0.20	<0.20	<0.20	<0.20
Dissolved Thallium	µg/L	0.30	-	-	-	<0.30	<0.30	<0.30	<0.30
Dissolved Uranium	µg/L	0.50	-	-	-	12	8.66	0.57	1.60
Dissolved Vanadium	µg/L	0.40	-	-	-	37	2.99	<0.40	3.74
Dissolved Zinc	µg/L	5.0	-	-	-	64.1	<5.0	<5.0	<5.0
Mercury	µg/L	0.02	-	-	-	<0.02	<0.02	<0.02	<0.02
Chromium VI	µg/L	2.000	-	-	-	<2.000	<2.000	<2.000	<2.000
Cyanide, Free	µg/L	2	2	0.02	-	<2	<2	<2	<2
Dissolved Sodium	µg/L	50	-	-	-	142000	126000	8640	204000
Chloride	µg/L	100	-	-	-	10600	113000	36500	257000
Electrical Conductivity	uS/cm	2	-	-	-	634	790	610	1340
pH	pH Units	NA	-	-	-	8.56	8.15	8.03	8.03
York Region Sanitary Sewer Use By-Law - Inorganics									
Biochemical Oxygen Demand, Carb	mg/L	2.00	300	15	-	-	<2.00	<2.00	-
pH	pH Units	NA	-	-	-	8.56	8.16	8.01	-
Total Suspended Solids	mg/L	10	350	15	-		62	54	-
Fluoride	mg/L	0.05	10	-	-	<0.05	0.21	<0.05	-

					AGAT Work Order ID#	21T834435	21T815206	21T815212	21T815210
					Sampling Date	Nov. 24, 2021	Oct 13, 2021	Oct 13, 2021	Oct 13, 2021
					Well Location ID	CV1-01	**CV1-04**	**CR4-03**	**CR4-11**
Parameters	Units	RDL	Town of Bradford West Gwillumbrury Sanitary Sewer Bylaw	Town of Bradford West Gwillumbrury Storm Sewer Bylaw	PWQO				
Sulphate	mg/L	0.10	1500	-	-	<0.05	12.8	33.9	-
Total Cyanide	mg/L	0.002	-	-	-	-	<0.002	<0.002	-
Phenols	mg/L	0.001	-	-	-		0.01	0.01	-
Total Kjeldahl Nitrogen	mg/L	0.10	100	1	-		0.24	0.22	-
Total Aluminum	mg/L	0.010	50	-	-	-	1.05	0.282	-
Total Antimony	mg/L	0.020	5	-	-	0.05	<0.020	<0.020	-
Total Arsenic	mg/L	0.015	1	0.02	-	<0.15	<0.015	<0.015	-
Total Cadmium	mg/L	0.005	0.7	0.008	-	<0.005	<0.005	<0.005	-
Total Chromium	mg/L	0.020	2	0.08	-	0.51	<0.020	<0.020	-
Total Cobalt	mg/L	0.020	5	-	-	0.149	<0.020	<0.020	-
Total Copper	mg/L	0.015	3	0.05	-	0.31	<0.015	<0.015	-
Total Lead	mg/L	0.020	1	0.12	-	0.12	<0.020	<0.020	-
Total Manganese	mg/L	0.020	5	0.15	-	7.44	0.055	0.052	-
Total Mercury	mg/L	0.0002	10	0.4	-	-	<0.0002	<0.0002	-
Total Molybdenum	mg/L	0.020	5	-	-	<0.10	0.032	<0.020	-
Total Nickel	mg/L	0.015	2	0.08	-	0.37	<0.015	<0.015	-
Total Phosphorus	mg/L	0.02	10	0.4	-	9.74	0.07	0.05	-
Total Selenium	mg/L	0.002	1	0.02	-	<0.10	0.002	<0.002	-
Total Silver	mg/L	0.020	5	0.12	-	<0.0005	<0.020	<0.020	-
Total Tin	mg/L	0.025	5	-	-	<0.10	<0.025	<0.025	-
Total Titanium	mg/L	0.010	5	-	-	8.34	0.05	0.019	-
Total Zinc	mg/L	0.020	2	0.04	-	<1.00	<0.020	<0.020	-
Nonylphenol and Nonylphenol Ethoxylates (Ontario, mg/L)									
Total Nonylphenol	mg/L	0.001	20	-	-	-	<0.001	<0.001	-
NP1EO	mg/L	0.001	-	-	-	-	<0.001	<0.001	-
NP2EO	mg/L	0.0003	-	-	-	-	<0.0003	<0.0003	-
Total Nonylphenol Ethoxylates	mg/L	0.001	200	-	-	-	<0.001	<0.001	-
O. Reg. 153(511) - OC Pesticides + PCBs (Water)									
Gamma-Hexachlorocyclohexane	ug/L	0.01	-	-	-	<0.01	-	-	<0.01
Heptachlor	ug/L	0.01	-	-	-	<0.01	-	-	<0.01
Aldrin	ug/L	0.01	-	-	-	<0.01	-	-	<0.01
Heptachlor Epoxide	ug/L	0.01	-	-	-	<0.01	-	-	<0.01
Endosulfan I	µg/L	0.05	-	-	-	<0.05	-	-	<0.05
Endosulfan II	µg/L	0.05	-	-	-	<0.05	-	-	<0.05

					AGAT Work Order ID#	21T834435	21T815206	21T815212	21T815210
					Sampling Date	Nov. 24, 2021	Oct 13, 2021	Oct 13, 2021	Oct 13, 2021
					Well Location ID	CV1-01	**CV1-04**	**CR4-03**	**CR4-11**
Parameters	Units	RDL	Town of Bradford West Gwillumbrury Sanitary Sewer Bylaw	Town of Bradford West Gwillumbrury Storm Sewer Bylaw	PWQO				
Endosulfan	ug/L	0.05	-	-	-	<0.05	-	-	<0.05
alpha - chlordane	µg/L	0.1	-	-	-	<0.1	-	-	<0.1
gamma-Chlordane	µg/L	0.2	-	-	-	<0.2	-	-	<0.2
Chlordane	ug/L	0.04	-	-	-	<0.04	-	-	<0.04
op'-DDE	µg/L	0.01	-	-	-	<0.01	-	-	<0.01
pp'-DDE	µg/L	0.01	-	-	-	<0.01	-	-	<0.01
DDE	ug/L	0.01	-	-	-	<0.01	-	-	<0.01
op'-DDD	µg/L	0.05	-	-	-	<0.05	-	-	<0.05
pp'-DDD	µg/L	0.05	-	-	-	<0.05	-	-	<0.05
DDD	ug/L	0.05	-	-	-	<0.05	-	-	<0.05
op'-DDT	µg/L	0.04	-	-	-	<0.04	-	-	<0.04
pp'-DDT	µg/L	0.05	-	-	-	<0.05	-	-	<0.05
DDT	ug/L	0.04	-	-	-	<0.04	-	-	<0.04
Dieldrin	ug/L	0.02	-	-	-	<0.02	-	-	<0.02
Endrin	ug/L	0.05	-	-	-	<0.05	-	-	<0.05
Methoxychlor	ug/L	0.04	-	-	-	<0.04	-	-	<0.04
Hexachlorobenzene	ug/L	0.01	-	-	-	<0.01	-	-	<0.01
Hexachlorobutadiene	ug/L	0.01	-	-	-	<0.01	-	-	<0.01
Hexachloroethane	ug/L	0.01	-	-	-	<0.01	-	-	<0.01
Aroclor 1242	ug/L	0.1	-	-	-	<0.1	-	-	<0.1
Aroclor 1248	ug/L	0.1	-	-	-	<0.1	-	-	<0.1
Aroclor 1254	ug/L	0.1	-	-	-	<0.1	-	-	<0.1
Aroclor 1260	ug/L	0.1	-	-	-	<0.1	-	-	<0.1
Polychlorinated Biphenyls	ug/L	0.1	-	-	-	-	-	-	<0.1
TCMX	%	1	-	-	-	83	-	-	72
Decachlorobiphenyl	%		-	-	-	99	-	-	91
OP Pesticides (Water)									
Phorate	µg/L	0.5	-	-	-	<0.5	-	-	<0.5
Dimethoate	µg/L	2.5	-	-	-	<2.5	-	-	<2.5
Terbufos	µg/L	0.5	-	-	-	<0.5	-	-	<0.5
Diazinon	µg/L	1	-	-	-	<1	-	-	<1
Malathion	µg/L	5	-	-	-	<5	-	-	<5
Chlorpyrifos	µg/L	1	-	-	-	<1	-	-	<1
Parathion	µg/L	1	-	-	-	<1	-	-	<1

					AGAT Work Order ID#	21T834435	21T815206	21T815212	21T815210
					Sampling Date	Nov. 24, 2021	Oct 13, 2021	Oct 13, 2021	Oct 13, 2021
					Well Location ID	CV1-01	**CV1-04**	**CR4-03**	**CR4-11**
Parameters	Units	RDL	Town of Bradford West Gwillumbrury Sanitary Sewer Bylaw	Town of Bradford West Gwillumbrury Storm Sewer Bylaw	PWQO				
Azinphos-methyl	µg/L	2	-	-	-	<2	-	-	<2
Triphenyl phosphate (surr)	%	1	-	-	-	78	-	-	108
Water Quality Assessment - PWQO (mg/L)									
Electrical Conductivity	µS/cm	2	-	-		641	-	-	1180
pH	pH Units	NA	-	-	6.5-8.5	8.56	-	-	8.04
Saturation pH (Calculated)			-	-		5.14	-	-	7.16
Langelier Index (Calculated)			-	-		3.42	-	-	0.88
Hardness (as CaCO3) (Calculated)	mg/L	0.5	-	-		3230	-	-	203
Total Dissolved Solids	mg/L	10	-	-		724	-	-	596
Alkalinity (as CaCO3)	mg/L	5	-	-		1730	-	-	265
Bicarbonate (as CaCO3)	mg/L	5	-	-		1700	-	-	265
Carbonate (as CaCO3)	mg/L	5	-	-		31	-	-	<5
Hydroxide (as CaCO3)	mg/L	5	-	-		<5	-	-	<5
Fluoride	mg/L	0.05	-	-		<0.05	-	-	<0.05
Chloride	mg/L	0.12	-	-		10.8	-	-	219
Nitrate as N	mg/L	0.05	-	-		<0.05	-	-	<0.05
Nitrite as N	mg/L	0.05	-	-		<0.05	-	-	<0.05
Bromide	mg/L	0.05	-	-		<0.05	-	-	<0.05
Sulphate	mg/L	0.10	-	-		28.5	-	-	8.2
Ortho Phosphate as P	mg/L	0.10	-	-		<0.10	-	-	<0.10
Ammonia as N	mg/L	0.02	-	-		0.11	-	-	0.36
Ammonia-Un-ionized (Calculated)	mg/L	0.000002	-	-	0.02	0.0172	-	-	**0.0231**
Total Phosphorus	mg/L	0.02	-	-	*	9.74	-	-	0.07
Total Organic Carbon	mg/L	0.5	-	-		64.1	-	-	38.6
True Colour	TCU	5	-	-		221	-	-	<5
Turbidity	NTU	0.5	-	-		20300	-	-	13.3
Total Calcium	mg/L	0.16	-	-		1080	-	-	42
Total Magnesium	mg/L	0.17	-	-		130	-	-	23.8
Total Potassium	mg/L	0.58	-	-		47.3	-	-	2.33
Total Sodium	mg/L	0.22	-	-		182	-	-	153
Aluminum-dissolved	mg/L	0.004	-	-	*	1.45	-	-	0.004
Total Antimony	mg/L	0.001	-	-	0.020	<0.05	-	-	<0.001
Total Arsenic	mg/L	0.003	-	-	0.1	<0.15	-	-	0.003
Total Barium	mg/L	0.002	-	-		2.29	-	-	0.128

					AGAT Work Order ID#	21T834435	21T815206	21T815212	21T815210
					Sampling Date	Nov. 24, 2021	Oct 13, 2021	Oct 13, 2021	Oct 13, 2021
					Well Location ID	CV1-01	**CV1-04**	**CR4-03**	**CR4-11**
Parameters	Units	RDL	Town of Bradford West Gwillumbrury Sanitary Sewer Bylaw	Town of Bradford West Gwillumbrury Storm Sewer Bylaw	PWQO				
Total Beryllium	mg/L	0.001	-	-	*	<0.05	-	-	<0.001
Total Boron	mg/L	0.010	-	-	0.2	<0.50	-	-	0.048
Total Cadmium	mg/L	0.0001	-	-	0.0002	<0.005	-	-	<0.0001
Total Chromium	mg/L	0.003	-	-		0.51	-	-	<0.003
Total Cobalt	mg/L	0.0005	-	-	0.0009	0.149	-	-	<0.0005
Total Copper	mg/L	0.001	-	-	0.005	0.31	-	-	0.002
Total Iron	mg/L	0.010	-	-	0.3	378	-	-	**0.411**
Total Lead	mg/L	0.001	-	-	*	0.12	-	-	<0.001
Total Manganese	mg/L	0.002	-	-		7.44	-	-	0.031
Dissolved Mercury	mg/L	0.0001	-	-	0.0002	<0.0001	-	-	<0.0001
Total Molybdenum	mg/L	0.002	-	-	0.040	<0.10	-	-	0.004
Total Nickel	mg/L	0.003	-	-	0.025	0.37	-	-	<0.003
Total Selenium	mg/L	0.002	-	-	0.1	<0.10	-	-	0.003
Total Silver	mg/L	0.0001	-	-	0.0001	<0.005	-	-	<0.0001
Total Strontium	mg/L	0.005	-	-		2.29	-	-	0.647
Total Thallium	mg/L	0.0003	-	-	0.0003	<0.015	-	-	<0.0003
Total Tin	mg/L	0.002	-	-		<0.10	-	-	0.003
Total Titanium	mg/L	0.010	-	-		8.34	-	-	0.019
Total Tungsten	mg/L	0.010	-	-	0.030	<0.50	-	-	<0.010
Total Uranium	mg/L	0.002	-	-	0.005	<0.10	-	-	<0.002
Total Vanadium	mg/L	0.002	-	-	0.006	0.64	-	-	<0.002
Total Zinc	mg/L	0.020	-	-	0.030	<1.00	-	-	<0.020
Total Zirconium	mg/L	0.004	-	-	0.004	<0.20	-	-	<0.004

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

AECOM

Calculated Un-Ionized Ammonia Concentration in Sampled Monitoring Wells

Well ID	Sampling Date	Water Temperature °C (Field)*[1]	pH (Field)*[1]	Total Ammonia From Laboratory Certificate of Analysis (mg/L)	Ambient Water Temperature in Kelvin (T)	pKa	*f*	Ammonia Un-ionized (Calculated) (mg/L)
				0.02*[2]				0.02*[3]
CR4-11	October 13, 2021	15.80	7.73	0.36	288.96	9.54	0.015336	0.0055
CV1-01	November 24, 2021	8.86	8.13		282.02	9.77	0.022393	0.0000

Notes:

*[1] Water Temperature and pH values were obtained at the time of sample collection.

*[2] Laboratory Reporting Detection Limit (RDL) for Total Ammonia = 0.02 mg/L.

*[3] PWQO Threshold for Un-Ionized Ammonia = 0.02 mg/L.

AGAT Laboratories

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CLIENT NAME: AECOM CANADA LTD
105 Commerce Valley Drive West 7th Floor
MARKHAM, ON L3T7W3
(905) 886-7022
ATTENTION TO: Dhwanish Parikh
PROJECT: 60636190
AGAT WORK ORDER: 21T815206
TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist
ULTRA TRACE REVIEWED BY: Marc Paquet, Chimiste, AGAT Québec
WATER ANALYSIS REVIEWED BY: Jacky Zhu, Spectroscopy Technician
DATE REPORTED: Oct 21, 2021
PAGES (INCLUDING COVER): 21
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
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Certificate of Analysis

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - VOCs (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

		SAMPLE DESCRIPTION:		CV1-04
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 12:15
Parameter	Unit	G / S	RDL	3086571
Dichlorodifluoromethane	µg/L	590	0.20	<0.20
Vinyl Chloride	µg/L	0.5	0.17	<0.17
Bromomethane	µg/L	0.89	0.20	<0.20
Trichlorofluoromethane	µg/L	150	0.40	<0.40
Acetone	µg/L	2700	1.0	<1.0
1,1-Dichloroethylene	µg/L	0.5	0.30	<0.30
Methylene Chloride	µg/L	5	0.30	<0.30
trans- 1,2-Dichloroethylene	µg/L	1.6	0.20	<0.20
Methyl tert-butyl ether	µg/L	15	0.20	<0.20
1,1-Dichloroethane	µg/L	0.5	0.30	<0.30
Methyl Ethyl Ketone	µg/L	400	1.0	<1.0
cis- 1,2-Dichloroethylene	µg/L	1.6	0.20	<0.20
Chloroform	µg/L	2	0.20	<0.20
1,2-Dichloroethane	µg/L	0.5	0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.5	0.30	<0.30
Carbon Tetrachloride	µg/L	0.2	0.20	<0.20
Benzene	µg/L	0.5	0.20	<0.20
1,2-Dichloropropane	µg/L	0.5	0.20	<0.20
Trichloroethylene	µg/L	0.5	0.20	<0.20
Bromodichloromethane	µg/L	2	0.20	<0.20
Methyl Isobutyl Ketone	µg/L	640	1.0	<1.0
1,1,2-Trichloroethane	µg/L	0.5	0.20	<0.20
Toluene	µg/L	0.8	0.20	0.30
Dibromochloromethane	µg/L	2	0.10	<0.10
Ethylene Dibromide	µg/L	0.2	0.10	<0.10
Tetrachloroethylene	µg/L	0.5	0.20	<0.20
1,1,1,2-Tetrachloroethane	µg/L	1.1	0.10	<0.10
Chlorobenzene	µg/L	0.5	0.10	<0.10
Ethylbenzene	µg/L	0.5	0.10	<0.10

Certified By: N Popnikolof

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Certificate of Analysis

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - VOCs (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

				SAMPLE DESCRIPTION:	CV1-04
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2021-10-13 12:15
Parameter	**Unit**	**G / S**	**RDL**		**3086571**
m & p-Xylene	µg/L		0.20		<0.20
Bromoform	µg/L	5	0.10		<0.10
Styrene	µg/L	0.5	0.10		<0.10
1,1,2,2-Tetrachloroethane	µg/L	0.5	0.10		<0.10
o-Xylene	µg/L		0.10		<0.10
1,3-Dichlorobenzene	µg/L	0.5	0.10		<0.10
1,4-Dichlorobenzene	µg/L	0.5	0.10		<0.10
1,2-Dichlorobenzene	µg/L	0.5	0.10		<0.10
1,3-Dichloropropene	µg/L	0.5	0.30		<0.30
Xylenes (Total)	µg/L	72	0.20		<0.20
n-Hexane	µg/L	5	0.20		<0.20
Surrogate	**Unit**	**Acceptable Limits**			
Toluene-d8	% Recovery	50-140			102
4-Bromofluorobenzene	% Recovery	50-140			91

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086571 Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
1,3-Dichloropropene total is a calculated parameter. The calculated value is the sum of Cis-1,3-Dichloropropene and Trans-1,3-Dichloropropene.
The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

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AGAT WORK ORDER: 21T815206

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

York Region Sanitary - Organics

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

					SAMPLE DESCRIPTION:	CV1-04
					SAMPLE TYPE:	Water
					DATE SAMPLED:	2021-10-13 11:45
Parameter	**Unit**	**G / S: A**	**G / S: B**	**RDL**		**3086564**
Oil and Grease (animal/vegetable) in water	mg/L	150		0.5		0.64[<A]
Oil and Grease (mineral) in water	mg/L	15		0.5		<0.5[<A]
Methylene Chloride	µg/L	2000	5.2	0.3		<0.3[<B]
trans-1,3-Dichloropropene	µg/L	140	5.6	0.30		<0.30[<B]
Methyl Ethyl Ketone	µg/L	8000		0.9		<0.9[<A]
cis- 1,2-Dichloroethylene	µg/L	4000	5.6	0.2		<0.2[<B]
Chloroform	µg/L	40	2.0	0.2		<0.2[<B]
Benzene	µg/L	10	2.0	0.2		<0.2[<B]
Trichloroethylene	µg/L	400	8.0	0.2		<0.2[<B]
Toluene	µg/L	270	2.0	0.2		0.3[<B]
Tetrachloroethene	µg/L	1000	4.4	0.1		<0.1[<B]
Ethylbenzene	µg/L	160	2.0	0.1		<0.1[<B]
1,1,2,2-Tetrachloroethane	µg/L	1400	17.0	0.1		<0.1[<B]
Styrene	µg/L	200		0.1		<0.1[<A]
1,2-Dichlorobenzene	µg/L	50	5.6	0.1		<0.1[<B]
1,4-Dichlorobenzene	µg/L	80	6.8	0.1		<0.1[<B]
m & p-Xylene	µg/L			0.2		<0.2
o-Xylene	µg/L			0.1		<0.1
Xylenes (Total)	µg/L	1400	4.4	0.2		<0.2[<B]
PCBs	µg/L	1	0.4	0.2		<0.2[<B]
Di-n-butyl phthalate	µg/L	80	15.0	0.5		<0.5[<B]
Bis(2-Ethylhexyl)phthalate	µg/L	12	8.8	0.5		<0.5[<B]

Certified By: NPopnikolof

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Certificate of Analysis

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

York Region Sanitary - Organics

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

			SAMPLE DESCRIPTION:	CV1-04
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2021-10-13 11:45
Surrogate	**Unit**	**Acceptable Limits**		**3086564**
Toluene-d8	% Recovery	50-140		102
4-Bromofluorobenzene	% Recovery	50-140		89
Decachlorobiphenyl	%	50-140		91
2,4,6-Tribromophenol	%	50-140		78
2-Fluorophenol	%	50-140		85
Chrysene-d12	%	50-140		99
phenol-d6 surrogate	%	50-140		98

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to The Regional Municipality of York - Limits for Sanitary Sewer Discharge [BY-LAW NO.2011-56], B Refers to The Regional Municipality of York - Limits for Storm Sewer Discharge [BY-LAW NO.2011-56]
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086564 Oil and Grease animal/vegetable is a calculated parameter. The calculated value is the difference between Total O&G and Mineral O&G.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

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AGAT WORK ORDER: 21T815206

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Nonylphenol and Nonylphenol Ethoxylates (Ontario, mg/L)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

				SAMPLE DESCRIPTION:	CV1-04
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2021-10-13 11:45
Parameter	**Unit**	**G / S**	**RDL**		**3086564**
Total Nonylphenol	mg/L	0.020	0.001		<0.001
NP1EO	mg/L		0.001		<0.001
NP2EO	mg/L		0.0003		<0.0003
Total Nonylphenol Ethoxylates	mg/L	0.200	0.001		<0.001

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to The Regional Municipality of York - Limits for Sanitary Sewer Discharge [BY-LAW NO.2011-56]
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Montréal (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

CBOD5

DATE RECEIVED: 2021-10-13

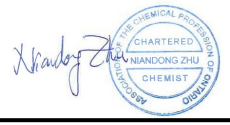
DATE REPORTED: 2021-10-21

					SAMPLE DESCRIPTION:	CV1-04
					SAMPLE TYPE:	Water
					DATE SAMPLED:	2021-10-13 11:45
Parameter	**Unit**	**G / S: A**	**G / S: B**	**RDL**	**3086564**	
Biochemical Oxygen Demand, Carbonaceous	mg/L	300	15	2.00	<2.00[<B]	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to The Regional Municipality of York - Limits for Sanitary Sewer Discharge [BY-LAW NO.2011-56], B Refers to The Regional Municipality of York - Limits for Storm Sewer Discharge [BY-LAW NO.2011-56]
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - Metals & Inorganics (Water)

DATE RECEIVED: 2021-10-13 **DATE REPORTED: 2021-10-21**

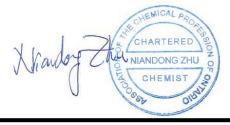
		SAMPLE DESCRIPTION:		CV1-04
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 12:15
Parameter	**Unit**	**G / S**	**RDL**	**3086571**
Dissolved Antimony	µg/L	1.5	1.0	<1.0
Dissolved Arsenic	µg/L	13	1.0	3.2
Dissolved Barium	µg/L	610	2.0	48.8
Dissolved Beryllium	µg/L	0.5	0.50	<0.50
Dissolved Boron	µg/L	1700	10.0	193
Dissolved Cadmium	µg/L	0.5	0.20	<0.20
Dissolved Chromium	µg/L	11	2.0	<2.0
Dissolved Cobalt	µg/L	3.8	0.50	<0.50
Dissolved Copper	µg/L	5	1.0	<1.0
Dissolved Lead	µg/L	1.9	0.50	<0.50
Dissolved Molybdenum	µg/L	23	0.50	**46.0**
Dissolved Nickel	µg/L	14	3.0	<3.0
Dissolved Selenium	µg/L	5	1.0	<1.0
Dissolved Silver	µg/L	0.3	0.20	<0.20
Dissolved Thallium	µg/L	0.5	0.30	<0.30
Dissolved Uranium	µg/L	8.9	0.50	8.66
Dissolved Vanadium	µg/L	3.9	0.40	2.99
Dissolved Zinc	µg/L	160	5.0	<5.0
Mercury	µg/L	0.1	0.02	<0.02
Chromium VI	µg/L	25	2.000	<2.000
Cyanide, Free	µg/L	5	2	<2
Dissolved Sodium	µg/L	490000	50	126000
Chloride	µg/L	790000	100	113000
Electrical Conductivity	uS/cm	NA	2	790
pH	pH Units		NA	8.15

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086571 Metals analysis completed on a filtered sample.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

York Region Sanitary Sewer Use By-Law - Inorganics

DATE RECEIVED: 2021-10-13

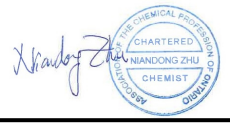
DATE REPORTED: 2021-10-21

					SAMPLE DESCRIPTION:	CV1-04
					SAMPLE TYPE:	Water
					DATE SAMPLED:	2021-10-13 11:45
Parameter	**Unit**	**G / S: A**	**G / S: B**	**RDL**	**3086564**	
pH	pH Units	6.0-10.5	6.0-9.0	NA	8.16	
Total Suspended Solids	mg/L	350	15	10	62[B-A]	
Fluoride	mg/L	10		0.05	0.21[<A]	
Sulphate	mg/L	1500		0.10	12.8[<A]	
Total Cyanide	mg/L	2	0.02	0.002	<0.002[<B]	
Phenols	mg/L	1	0.008	0.001	0.010[B-A]	
Total Kjeldahl Nitrogen	mg/L	100	1	0.10	0.24[<B]	
Total Aluminum	mg/L	50		0.010	1.05[<A]	
Total Antimony	mg/L	5		0.020	<0.020[<A]	
Total Arsenic	mg/L	1	0.020	0.015	<0.015[<B]	
Total Cadmium	mg/L	0.7	0.008	0.005	<0.005[<B]	
Total Chromium	mg/L	2	0.080	0.020	<0.020[<B]	
Total Cobalt	mg/L	5		0.020	<0.020[<A]	
Total Copper	mg/L	3	0.050	0.015	<0.015[<B]	
Total Lead	mg/L	1	0.120	0.020	<0.020[<B]	
Total Manganese	mg/L	5	0.150	0.020	0.055[<B]	
Total Mercury	mg/L	0.01	0.0004	0.0002	<0.0002[<B]	
Total Molybdenum	mg/L	5		0.020	0.032[<A]	
Total Nickel	mg/L	2	0.080	0.015	<0.015[<B]	
Total Phosphorus	mg/L	10	0.400	0.02	0.07[<B]	
Total Selenium	mg/L	1	0.020	0.002	0.002[<B]	
Total Silver	mg/L	5	0.120	0.020	<0.020[<B]	
Total Tin	mg/L	5		0.025	<0.025[<A]	
Total Titanium	mg/L	5		0.010	0.050[<A]	
Total Zinc	mg/L	2	0.040	0.020	<0.020[<B]	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to The Regional Municipality of York - Limits for Sanitary Sewer Discharge [BY-LAW NO.2011-56], B Refers to The Regional Municipality of York - Limits for Storm Sewer Discharge [BY-LAW NO.2011-56]
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Exceedance Summary

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
3086564	CV1-04	ON York SM	York Region Sanitary Sewer Use By-Law - Inorganics	Phenols	mg/L	0.008	0.010
3086564	CV1-04	ON York SM	York Region Sanitary Sewer Use By-Law - Inorganics	Total Suspended Solids	mg/L	15	62
3086571	CV1-04	ON T1 GW	O. Reg. 153(511) - Metals & Inorganics (Water)	Dissolved Molybdenum	µg/L	23	46.0

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD
AGAT WORK ORDER: 21T815206
PROJECT: 60636190
ATTENTION TO: Dhwanish Parikh
SAMPLING SITE:Bradford Bypass (BBP)
SAMPLED BY:Dhwanish Parikh

Trace Organics Analysis

RPT Date: Oct 21, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
York Region Sanitary - Organics															
Oil and Grease (animal/vegetable) in water	3080465		< 0.5	< 0.5	NA	< 0.5	81%	70%	130%	104%	70%	130%	113%	70%	130%
Oil and Grease (mineral) in water	3080465		< 0.5	< 0.5	NA	< 0.5	93%	70%	130%	81%	70%	130%	77%	70%	130%
Methylene Chloride	3092058		<0.3	<0.3	NA	< 0.3	114%	50%	140%	107%	60%	130%	112%	50%	140%
trans-1,3-Dichloropropene	3092058		<0.30	<0.30	NA	< 0.30	110%	50%	140%	114%	60%	130%	98%	50%	140%
Methyl Ethyl Ketone	3092058		<0.9	<0.9	NA	< 0.9	95%	50%	140%	102%	50%	140%	104%	50%	140%
cis- 1,2-Dichloroethylene	3092058		<0.2	<0.2	NA	< 0.2	86%	50%	140%	92%	60%	130%	89%	50%	140%
Chloroform	3092058		<0.2	<0.2	NA	< 0.2	89%	50%	140%	93%	60%	130%	104%	50%	140%
Benzene	3092058		<0.2	<0.2	NA	< 0.2	78%	50%	140%	89%	60%	130%	100%	50%	140%
Trichloroethylene	3092058		<0.2	<0.2	NA	< 0.2	90%	50%	140%	99%	60%	130%	108%	50%	140%
Toluene	3092058		<0.2	<0.2	NA	< 0.2	101%	50%	140%	102%	60%	130%	111%	50%	140%
Tetrachloroethene	3092058		<0.1	<0.1	NA	< 0.1	103%	50%	140%	108%	60%	130%	115%	50%	140%
Ethylbenzene	3092058		<0.1	<0.1	NA	< 0.1	115%	50%	140%	104%	60%	130%	113%	50%	140%
1,1,2,2-Tetrachloroethane	3092058		<0.1	<0.1	NA	< 0.1	107%	50%	140%	93%	60%	130%	113%	50%	140%
Styrene	3092058		<0.1	<0.1	NA	< 0.1	103%	50%	140%	97%	60%	130%	109%	50%	140%
1,2-Dichlorobenzene	3092058		<0.1	<0.1	NA	< 0.1	117%	50%	140%	99%	60%	130%	119%	50%	140%
1,4-Dichlorobenzene	3092058		<0.1	<0.1	NA	< 0.1	92%	50%	140%	100%	60%	130%	94%	50%	140%
m & p-Xylene	3092058		<0.2	<0.2	NA	< 0.2	111%	50%	140%	107%	60%	130%	111%	50%	140%
o-Xylene	3092058		<0.1	<0.1	NA	< 0.1	119%	50%	140%	107%	60%	130%	117%	50%	140%
PCBs	3086334		< 0.2	< 0.2	NA	< 0.2	104%	50%	140%	101%	50%	140%	80%	50%	140%
Di-n-butyl phthalate	3026196		< 0.5	< 0.5	NA	< 0.5	78%	50%	140%	99%	50%	140%	85%	50%	140%
Bis(2-Ethylhexyl)phthalate	3026196		< 0.5	< 0.5	NA	< 0.5	85%	50%	140%	90%	50%	140%	98%	50%	140%
O. Reg. 153(511) - VOCs (Water)															
Dichlorodifluoromethane	3092058		<0.20	<0.20	NA	< 0.20	99%	50%	140%	108%	50%	140%	103%	50%	140%
Vinyl Chloride	3092058		<0.17	<0.17	NA	< 0.17	98%	50%	140%	109%	50%	140%	104%	50%	140%
Bromomethane	3092058		<0.20	<0.20	NA	< 0.20	98%	50%	140%	95%	50%	140%	101%	50%	140%
Trichlorofluoromethane	3092058		<0.40	<0.40	NA	< 0.40	106%	50%	140%	104%	50%	140%	98%	50%	140%
Acetone	3092058		<1.0	<1.0	NA	< 1.0	98%	50%	140%	104%	50%	140%	102%	50%	140%
1,1-Dichloroethylene	3092058		<0.30	<0.30	NA	< 0.30	88%	50%	140%	103%	60%	130%	93%	50%	140%
Methylene Chloride	3092058		<0.30	<0.30	NA	< 0.30	114%	50%	140%	107%	60%	130%	112%	50%	140%
trans- 1,2-Dichloroethylene	3092058		<0.20	<0.20	NA	< 0.20	111%	50%	140%	110%	60%	130%	105%	50%	140%
Methyl tert-butyl ether	3092058		<0.20	<0.20	NA	< 0.20	110%	50%	140%	108%	60%	130%	110%	50%	140%
1,1-Dichloroethane	3092058		<0.30	<0.30	NA	< 0.30	98%	50%	140%	101%	60%	130%	102%	50%	140%
Methyl Ethyl Ketone	3092058		<1.0	<1.0	NA	< 1.0	95%	50%	140%	102%	50%	140%	104%	50%	140%
cis- 1,2-Dichloroethylene	3092058		<0.20	<0.20	NA	< 0.20	86%	50%	140%	92%	60%	130%	89%	50%	140%
Chloroform	3092058		<0.20	<0.20	NA	< 0.20	89%	50%	140%	93%	60%	130%	104%	50%	140%
1,2-Dichloroethane	3092058		<0.20	<0.20	NA	< 0.20	73%	50%	140%	70%	60%	130%	94%	50%	140%
1,1,1-Trichloroethane	3092058		<0.30	<0.30	NA	< 0.30	87%	50%	140%	101%	60%	130%	94%	50%	140%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Trace Organics Analysis (Continued)

RPT Date: Oct 21, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Carbon Tetrachloride	3092058		<0.20	<0.20	NA	< 0.20	111%	50%	140%	116%	60%	130%	111%	50%	140%
Benzene	3092058		<0.20	<0.20	NA	< 0.20	78%	50%	140%	89%	60%	130%	100%	50%	140%
1,2-Dichloropropane	3092058		<0.20	<0.20	NA	< 0.20	91%	50%	140%	88%	60%	130%	102%	50%	140%
Trichloroethylene	3092058		<0.20	<0.20	NA	< 0.20	90%	50%	140%	99%	60%	130%	108%	50%	140%
Bromodichloromethane	3092058		<0.20	<0.20	NA	< 0.20	112%	50%	140%	107%	60%	130%	113%	50%	140%
Methyl Isobutyl Ketone	3092058		<1.0	<1.0	NA	< 1.0	90%	50%	140%	100%	50%	140%	105%	50%	140%
1,1,2-Trichloroethane	3092058		<0.20	<0.20	NA	< 0.20	118%	50%	140%	96%	60%	130%	114%	50%	140%
Toluene	3092058		<0.20	<0.20	NA	< 0.20	101%	50%	140%	102%	60%	130%	111%	50%	140%
Dibromochloromethane	3092058		<0.10	<0.10	NA	< 0.10	111%	50%	140%	118%	60%	130%	98%	50%	140%
Ethylene Dibromide	3092058		<0.10	<0.10	NA	< 0.10	115%	50%	140%	99%	60%	130%	119%	50%	140%
Tetrachloroethylene	3092058		<0.20	<0.20	NA	< 0.20	103%	50%	140%	108%	60%	130%	115%	50%	140%
1,1,1,2-Tetrachloroethane	3092058		<0.10	<0.10	NA	< 0.10	93%	50%	140%	114%	60%	130%	106%	50%	140%
Chlorobenzene	3092058		<0.10	<0.10	NA	< 0.10	116%	50%	140%	99%	60%	130%	114%	50%	140%
Ethylbenzene	3092058		<0.10	<0.10	NA	< 0.10	115%	50%	140%	104%	60%	130%	113%	50%	140%
m & p-Xylene	3092058		<0.20	<0.20	NA	< 0.20	111%	50%	140%	107%	60%	130%	111%	50%	140%
Bromoform	3092058		<0.10	<0.10	NA	< 0.10	95%	50%	140%	104%	60%	130%	106%	50%	140%
Styrene	3092058		<0.10	<0.10	NA	< 0.10	103%	50%	140%	97%	60%	130%	109%	50%	140%
1,1,2,2-Tetrachloroethane	3092058		<0.10	<0.10	NA	< 0.10	107%	50%	140%	93%	60%	130%	113%	50%	140%
o-Xylene	3092058		<0.10	<0.10	NA	< 0.10	119%	50%	140%	107%	60%	130%	117%	50%	140%
1,3-Dichlorobenzene	3092058		<0.10	<0.10	NA	< 0.10	107%	50%	140%	99%	60%	130%	116%	50%	140%
1,4-Dichlorobenzene	3092058		<0.10	<0.10	NA	< 0.10	92%	50%	140%	100%	60%	130%	94%	50%	140%
1,2-Dichlorobenzene	3092058		<0.10	<0.10	NA	< 0.10	117%	50%	140%	99%	60%	130%	119%	50%	140%
n-Hexane	3092058		<0.20	<0.20	NA	< 0.20	100%	50%	140%	81%	60%	130%	103%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Ultra Trace Analysis

RPT Date: Oct 21, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Nonylphenol and Nonylphenol Ethoxylates (Ontario, mg/L)															
Total Nonylphenol	1	NA	NA	NA	0.0%	< 0.001	NA	60%	140%	89%	60%	140%	NA	60%	140%
NP1EO	1	NA	NA	NA	0.0%	< 0.001	NA	60%	140%	108%	60%	140%	NA	60%	140%
NP2EO	1	NA	NA	NA	0.0%	< 0.0003	NA	60%	140%	120%	60%	140%	NA	60%	140%

Certified By:

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Water Analysis

RPT Date: Oct 21, 2021

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
York Region Sanitary Sewer Use By-Law - Inorganics															
pH	3086235		7.42	7.44	0.3%	NA	103%	90%	110%						
Total Suspended Solids	3095290		1560	1560	0.0%	< 10	100%	80%	120%						
Fluoride	3090703		<0.05	<0.05	NA	< 0.05	101%	70%	130%	96%	80%	120%	108%	70%	130%
Sulphate	3090703		19.5	19.5	0.0%	< 0.10	100%	70%	130%	100%	80%	120%	108%	70%	130%
Total Cyanide	3083722		<0.002	<0.002	NA	< 0.002	94%	70%	130%	92%	80%	120%	92%	70%	130%
Phenols	3071594		0.016	0.016	0.0%	< 0.001	99%	90%	110%	96%	90%	110%	115%	80%	120%
Total Kjeldahl Nitrogen	3084132		2.71	2.72	0.4%	< 0.10	104%	70%	130%	102%	80%	120%	100%	70%	130%
Total Aluminum	3086564	3086564	1.09	0.983	10.3%	< 0.010	103%	70%	130%	99%	80%	120%	110%	70%	130%
Total Antimony	3086564	3086564	<0.020	<0.020	NA	< 0.020	101%	70%	130%	104%	80%	120%	110%	70%	130%
Total Arsenic	3086564	3086564	<0.015	<0.015	NA	< 0.015	98%	70%	130%	104%	80%	120%	122%	70%	130%
Total Cadmium	3086564	3086564	<0.005	<0.005	NA	< 0.005	103%	70%	130%	103%	80%	120%	112%	70%	130%
Total Chromium	3086564	3086564	<0.020	<0.020	NA	< 0.020	102%	70%	130%	101%	80%	120%	101%	70%	130%
Total Cobalt	3086564	3086564	<0.020	<0.020	NA	< 0.020	100%	70%	130%	103%	80%	120%	100%	70%	130%
Total Copper	3086564	3086564	<0.015	<0.015	NA	< 0.015	100%	70%	130%	101%	80%	120%	101%	70%	130%
Total Lead	3086564	3086564	<0.020	<0.020	NA	< 0.020	99%	70%	130%	99%	80%	120%	99%	70%	130%
Total Manganese	3086564	3086564	0.055	0.052	NA	< 0.020	98%	70%	130%	102%	80%	120%	99%	70%	130%
Total Mercury	3086529		<0.0002	<0.0002	NA	< 0.0002	99%	70%	130%	104%	80%	120%	92%	70%	130%
Total Molybdenum	3086564	3086564	0.032	0.029	NA	< 0.020	100%	70%	130%	98%	80%	120%	99%	70%	130%
Total Nickel	3086564	3086564	<0.015	<0.015	NA	< 0.015	95%	70%	130%	109%	80%	120%	103%	70%	130%
Total Phosphorus	3083887		2.76	2.68	2.9%	< 0.02	96%	70%	130%	96%	80%	120%	NA	70%	130%
Total Selenium	3086564	3086564	0.006	0.007	NA	< 0.002	102%	70%	130%	100%	80%	120%	117%	70%	130%
Total Silver	3086564	3086564	<0.020	<0.020	NA	< 0.020	99%	70%	130%	102%	80%	120%	98%	70%	130%
Total Tin	3086564	3086564	<0.025	<0.025	NA	< 0.025	99%	70%	130%	100%	80%	120%	107%	70%	130%
Total Titanium	3086564	3086564	0.055	0.061	10.3%	< 0.010	105%	70%	130%	99%	80%	120%	104%	70%	130%
Total Zinc	3086564	3086564	<0.020	<0.020	NA	< 0.020	104%	70%	130%	100%	80%	120%	113%	70%	130%
O. Reg. 153(511) - Metals & Inorganics (Water)															
Dissolved Antimony	3084132		<1.0	<1.0	NA	< 1.0	102%	70%	130%	108%	80%	120%	110%	70%	130%
Dissolved Arsenic	3084132		<1.0	<1.0	NA	< 1.0	95%	70%	130%	111%	80%	120%	112%	70%	130%
Dissolved Barium	3084132		32.6	32.2	1.2%	< 2.0	100%	70%	130%	101%	80%	120%	99%	70%	130%
Dissolved Beryllium	3084132		<0.50	<0.50	NA	< 0.50	101%	70%	130%	118%	80%	120%	119%	70%	130%
Dissolved Boron	3084132		309	308	0.3%	< 10.0	101%	70%	130%	113%	80%	120%	125%	70%	130%
Dissolved Cadmium	3084132		<0.20	<0.20	NA	< 0.20	100%	70%	130%	107%	80%	120%	103%	70%	130%
Dissolved Chromium	3084132		<2.0	<2.0	NA	< 2.0	100%	70%	130%	105%	80%	120%	117%	70%	130%
Dissolved Cobalt	3084132		<0.50	<0.50	NA	< 0.50	101%	70%	130%	109%	80%	120%	115%	70%	130%
Dissolved Copper	3084132		1.5	2.1	NA	< 1.0	98%	70%	130%	105%	80%	120%	108%	70%	130%
Dissolved Lead	3084132		<0.50	<0.50	NA	< 0.50	98%	70%	130%	105%	80%	120%	103%	70%	130%
Dissolved Molybdenum	3084132		95.2	112	16.2%	< 0.50	98%	70%	130%	105%	80%	120%	117%	70%	130%
Dissolved Nickel	3084132		<3.0	<3.0	NA	< 3.0	99%	70%	130%	103%	80%	120%	111%	70%	130%
Dissolved Selenium	3084132		2.2	3.0	NA	< 1.0	99%	70%	130%	111%	80%	120%	97%	70%	130%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

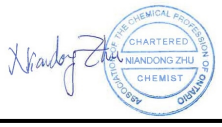
SAMPLED BY:Dhwanish Parikh

Water Analysis (Continued)

RPT Date: Oct 21, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Dissolved Silver	3084132		<0.20	<0.20	NA	< 0.20	101%	70%	130%	106%	80%	120%	102%	70%	130%
Dissolved Thallium	3084132		<0.30	<0.30	NA	< 0.30	98%	70%	130%	107%	80%	120%	107%	70%	130%
Dissolved Uranium	3084132		<0.50	<0.50	NA	< 0.50	92%	70%	130%	105%	80%	120%	110%	70%	130%
Dissolved Vanadium	3084132		<0.40	<0.40	NA	< 0.40	100%	70%	130%	104%	80%	120%	119%	70%	130%
Dissolved Zinc	3084132		<5.0	<5.0	NA	< 5.0	99%	70%	130%	111%	80%	120%	122%	70%	130%
Mercury	3073029		<0.02	<0.02	NA	< 0.02	98%	70%	130%	97%	80%	120%	97%	70%	130%
Chromium VI	3071878		<2.000	<2.000	NA	< 2	98%	70%	130%	104%	80%	120%	105%	70%	130%
Cyanide, Free	3071887		<2	<2	NA	< 2	99%	70%	130%	95%	80%	120%	92%	70%	130%
Dissolved Sodium	3094556		115000	115000	0.0%	< 50	96%	70%	130%	97%	80%	120%	107%	70%	130%
Chloride	3090703		108000	109000	0.9%	< 100	96%	70%	130%	103%	80%	120%	107%	70%	130%
Electrical Conductivity	3086235		6120	6130	0.2%	< 2	104%	90%	110%						
pH	3086235		7.42	7.44	0.3%	NA	103%	90%	110%						
CBOD5															
Biochemical Oxygen Demand, Carbonaceous	3083995		180	187	3.8%	< 2	97%	70%	130%						

Comments: NA Signifies Not Applicable.
Duplicate NA: results are less than 5X the RDL and RPD will not be calculated.
Matrix spike: Spike level < native concentration. Matrix spike acceptance limits do not apply.

Certified By:



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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Dichlorodifluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromomethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Acetone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl tert-butyl ether	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromodichloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Dibromochloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Chlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromoform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Styrene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
n-Hexane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Oil and Grease (animal/vegetable) in water	VOL-91-5011	EPA SW-846 3510C & SM 5520	GRAVIMETRIC
Oil and Grease (mineral) in water	VOL-91-5011	EPA SW-846 3510C & SM 5520	GRAVIMETRIC
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
trans-1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Methyl Ethyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
cis- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Tetrachloroethene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Styrene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Xylenes (Total)	VOL-91-5001	EPA SW-846 5230B & 8260	CALCULATION
Toluene-d8	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
PCBs	ORG-91-5112	modified from EPA SW-846 3510 & 8082A	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW846 3510C & 8082A	GC/ECD
Di-n-butyl phthalate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Bis(2-Ethylhexyl)phthalate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
2,4,6-Tribromophenol	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
2-Fluorophenol	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Chrysene-d12	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
phenol-d6 surrogate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Ultra Trace Analysis			
Total Nonylphenol	TOX-151-19003F	ASTM D7065-6	LCMSMS
NP1EO	TOX-151-19003F	ASTM D7065-6	LCMSMS
NP2EO	TOX-151-19003F	ASTM D7065-6	LCMSMS
Total Nonylphenol Ethoxylates	TOX-19003F	ASTM D7065-6	LCMSMS

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Biochemical Oxygen Demand, Carbonaceous	INOR-121-6023	SM 5210 B	INCUBATOR
Dissolved Antimony	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Arsenic	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Barium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Beryllium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Boron	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cadmium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Chromium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cobalt	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Copper	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Lead	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Molybdenum	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Nickel	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Selenium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Silver	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Thallium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Uranium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Vanadium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Zinc	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Chromium VI	INOR-93-6034	modified from SM 3500-CR B	LACHAT FIA
Cyanide, Free	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	TECHNICON AUTO ANALYZER
Dissolved Sodium	MET-93-6105	modified from EPA 6010D	ICP/OES
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Electrical Conductivity	INOR-93-6000	SM 2510 B	PC TITRATE
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Total Suspended Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Total Cyanide	INOR-93-6051	modified from MOECC E3015; SM 4500-CN- A, B, & C	TECHNICON AUTO ANALYZER
Phenols	INOR-93-6072	modified from SM 5530 D	LACHAT FIA

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815206

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Kjeldahl Nitrogen	INOR-93-6048	modified from EPA 351.2 and SM 4500-NORG D	LACHAT FIA
Total Aluminum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tin	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Titanium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

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Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: AECOM Canada Ltd.
Contact: Dhwanish Parikh / Brian Holden
Address: 105 Commerce Valley Dr, W, 7th Floor
Markham, ON
Phone: 416 476 3490 Fax:
Reports to be sent to:
1. Email: dhwanish.parikh@aecom.com
2. Email: Brian.holden@aecom.com

Project Information:

Project: 60630190
Site Location: Bradford Bypass (BBP)
Sampled By: Dhwanish Parikh
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

(Please check all applicable boxes)

☑ Regulation 153/04
Table 1 (Indicate One)
☑ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture (Check One)
☑ Coarse
☐ Fine

☐ Excess Soils R406
Table ____ (Indicate One)

☐ Regulation 558

☐ CCME

☑ Sewer Use
☐ Sanitary ☑ Storm
York (Region)

☐ Prov. Water Quality Objectives (PWQO)

☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Laboratory Use Only

Work Order #: 21T815206 + ice packs
Cooler Quantity: 1 (Blue Ice)
Arrival Temperatures: 16.8 | 16.3 | 16.4
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered (Metals, Hg, CrVI, DOC)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs	O. Reg 153: Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	York Region Sewer Use	O. Reg 153/04 (MBTEX)	VOC				Potentially Hazardous or High Concentration (Y/N)
CVI-04	Oct 13, 2021	11:45 AM PM	5	GW	21													✓						
CVI-04		12:15 AM PM		GW	9	✓													✓					
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Dhwanish Parikh	Oct 13, 2021	3:45	Neil Ramnarain		
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

21 OCT 13 4:29 PM

Page ____ of ____

Nº: T 126012

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CLIENT NAME: AECOM CANADA LTD
105 Commerce Valley Drive West 7th Floor
MARKHAM, ON L3T7W3
(905) 886-7022
ATTENTION TO: Dhwanish Parikh
PROJECT: 60636190
AGAT WORK ORDER: 21T815210
TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor
WATER ANALYSIS REVIEWED BY: Jacky Zhu, Spectroscopy Technician
DATE REPORTED: Oct 20, 2021
PAGES (INCLUDING COVER): 28
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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Certificate of Analysis

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - OC Pesticides + PCBs (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-20

		SAMPLE DESCRIPTION:		CR4-11
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 10:45
Parameter	Unit	G / S	RDL	3086589
Gamma-Hexachlorocyclohexane	ug/L	0.01	0.01	<0.01
Heptachlor	ug/L	0.01	0.01	<0.01
Aldrin	ug/L	0.01	0.01	<0.01
Heptachlor Epoxide	ug/L	0.01	0.01	<0.01
Endosulfan I	µg/L		0.05	<0.05
Endosulfan II	µg/L		0.05	<0.05
Endosulfan	ug/L	0.05	0.05	<0.05
alpha - chlordane	µg/L		0.1	<0.1
gamma-Chlordane	µg/L		0.2	<0.2
Chlordane	ug/L	0.06	0.04	<0.04
op'-DDE	µg/L		0.01	<0.01
pp'-DDE	µg/L		0.01	<0.01
DDE	ug/L		0.01	<0.01
op'-DDD	µg/L		0.05	<0.05
pp'-DDD	µg/L		0.05	<0.05
DDD	ug/L	1.8	0.05	<0.05
op'-DDT	µg/L		0.04	<0.04
pp'-DDT	µg/L		0.05	<0.05
DDT	ug/L		0.04	<0.04
Dieldrin	ug/L	0.05	0.02	<0.02
Endrin	ug/L	0.05	0.05	<0.05
Methoxychlor	ug/L	0.05	0.04	<0.04
Hexachlorobenzene	ug/L	0.01	0.01	<0.01
Hexachlorobutadiene	ug/L	0.01	0.01	<0.01
Hexachloroethane	ug/L	0.01	0.01	<0.01
Aroclor 1242	ug/L		0.1	<0.1
Aroclor 1248	ug/L		0.1	<0.1
Aroclor 1254	ug/L		0.1	<0.1
Aroclor 1260	ug/L		0.1	<0.1

Certified By:

AGAT Laboratories
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Certificate of Analysis

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - OC Pesticides + PCBs (Water)

DATE RECEIVED: 2021-10-13 **DATE REPORTED: 2021-10-20**

				SAMPLE DESCRIPTION:	CR4-11
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2021-10-13 10:45
Parameter	**Unit**	**G / S**	**RDL**	**3086589**	
Polychlorinated Biphenyls	ug/L	0.2	0.1	<0.1	
Surrogate	**Unit**	**Acceptable Limits**			
TCMX	%	50-140		72	
Decachlorobiphenyl	%	50-140		91	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086589 DDT total is a calculated parameter. The calculated value is the sum of op'DDT and pp'DDT.
DDD total is a calculated parameter. The calculated value is the sum of op'DDD and pp'DDD.
DDE total is a calculated parameter. The calculated value is the sum of op'DDE and pp'DDE.
Endosulfan total is a calculated parameter. The calculated value is the sum of Endosulfan I and Endosulfan II.
Chlordane total is a calculated parameter. The calculated value is the sum of Alpha-Chlordane and Gamma-Chlordane.
PCB total is a calculated parameter. The calculated value is the sum of Aroclor 1242, Aroclor 1248, Aroclor 1254 and Aroclor 1260.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - PAHs (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-20

		SAMPLE DESCRIPTION:		CR4-11
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 10:45
Parameter	**Unit**	**G / S**	**RDL**	**3086589**
Naphthalene	µg/L	7	0.20	<0.20
Acenaphthylene	µg/L	1	0.20	<0.20
Acenaphthene	µg/L	4.1	0.20	<0.20
Fluorene	µg/L	120	0.20	<0.20
Phenanthrene	µg/L	0.1	0.10	<0.10
Anthracene	µg/L	0.1	0.10	<0.10
Fluoranthene	µg/L	0.4	0.20	<0.20
Pyrene	µg/L	0.2	0.20	<0.20
Benzo(a)anthracene	µg/L	0.2	0.20	<0.20
Chrysene	µg/L	0.1	0.10	<0.10
Benzo(b)fluoranthene	µg/L	0.1	0.10	<0.10
Benzo(k)fluoranthene	µg/L	0.1	0.10	<0.10
Benzo(a)pyrene	µg/L	0.01	0.01	<0.01
Indeno(1,2,3-cd)pyrene	µg/L	0.2	0.20	<0.20
Dibenz(a,h)anthracene	µg/L	0.2	0.20	<0.20
Benzo(g,h,i)perylene	µg/L	0.2	0.20	<0.20
2-and 1-methyl Naphthalene	µg/L	2	0.20	<0.20
Sediment				No
Surrogate	**Unit**	**Acceptable Limits**		
Naphthalene-d8	%	50-140		119
Acridine-d9	%	50-140		114
Terphenyl-d14	%	50-140		91

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086589 Note: The result for Benzo(b)Fluoranthene is the total of the Benzo(b)&(j)Fluoranthene isomers because the isomers co-elute on the GC column.
2- and 1-Methyl Naphthalene is a calculated parameter. The calculated value is the sum of 2-Methyl Naphthalene and 1-Methyl Naphthalene. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.
Sediment parameter is comment only based on visual inspection of the sample prior to extraction and is not an accredited test.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs and VOC) (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-20

				SAMPLE DESCRIPTION:	CR4-11
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2021-10-13 10:45
Parameter	**Unit**	**G / S**	**RDL**	**3086589**	
F1 (C6-C10)	µg/L	420	25	<25	
F1 (C6 to C10) minus BTEX	µg/L	420	25	<25	
F2 (C10 to C16)	µg/L	150	100	<100	
F2 (C10 to C16) minus Naphthalene	µg/L		100	<100	
F3 (C16 to C34)	µg/L	500	100	<100	
F3 (C16 to C34) minus PAHs	µg/L		100	<100	
F4 (C34 to C50)	µg/L	500	100	<100	
Gravimetric Heavy Hydrocarbons	µg/L		500	NA	
Sediment				No	
Surrogate	**Unit**	**Acceptable Limits**			
Toluene-d8	% Recovery	50-140		102	
Terphenyl	% Recovery	60-140		98	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086589 The C6-C10 fraction is calculated using toluene response factor.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX and PAH contributions.
C>10 – C16 (F2- Naphthalene) is a calculated parameter. The calculated value is F2 - Naphthalene.
C>16 - C34 (F3-PAH) is a calculated parameter. The calculated value is F3-PAH (PAH: sum of Phenanthrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-c,d)pyrene and Pyrene).
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Sediment parameter is comment only based on visual inspection of the sample prior to extraction and is not an accredited test.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - VOCs (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-20

		SAMPLE DESCRIPTION:		CR4-11
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 10:45
Parameter	Unit	G / S	RDL	3086589
Dichlorodifluoromethane	µg/L	590	0.20	<0.20
Vinyl Chloride	µg/L	0.5	0.17	<0.17
Bromomethane	µg/L	0.89	0.20	<0.20
Trichlorofluoromethane	µg/L	150	0.40	<0.40
Acetone	µg/L	2700	1.0	<1.0
1,1-Dichloroethylene	µg/L	0.5	0.30	<0.30
Methylene Chloride	µg/L	5	0.30	<0.30
trans- 1,2-Dichloroethylene	µg/L	1.6	0.20	<0.20
Methyl tert-butyl ether	µg/L	15	0.20	<0.20
1,1-Dichloroethane	µg/L	0.5	0.30	<0.30
Methyl Ethyl Ketone	µg/L	400	1.0	<1.0
cis- 1,2-Dichloroethylene	µg/L	1.6	0.20	<0.20
Chloroform	µg/L	2	0.20	<0.20
1,2-Dichloroethane	µg/L	0.5	0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.5	0.30	<0.30
Carbon Tetrachloride	µg/L	0.2	0.20	<0.20
Benzene	µg/L	0.5	0.20	<0.20
1,2-Dichloropropane	µg/L	0.5	0.20	<0.20
Trichloroethylene	µg/L	0.5	0.20	<0.20
Bromodichloromethane	µg/L	2	0.20	<0.20
Methyl Isobutyl Ketone	µg/L	640	1.0	<1.0
1,1,2-Trichloroethane	µg/L	0.5	0.20	<0.20
Toluene	µg/L	0.8	0.20	<0.20
Dibromochloromethane	µg/L	2	0.10	<0.10
Ethylene Dibromide	µg/L	0.2	0.10	<0.10
Tetrachloroethylene	µg/L	0.5	0.20	<0.20
1,1,1,2-Tetrachloroethane	µg/L	1.1	0.10	<0.10
Chlorobenzene	µg/L	0.5	0.10	<0.10
Ethylbenzene	µg/L	0.5	0.10	<0.10

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Certificate of Analysis

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - VOCs (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-20

				SAMPLE DESCRIPTION:	CR4-11
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2021-10-13 10:45
Parameter	**Unit**	**G / S**	**RDL**		**3086589**
m & p-Xylene	µg/L		0.20		<0.20
Bromoform	µg/L	5	0.10		<0.10
Styrene	µg/L	0.5	0.10		<0.10
1,1,2,2-Tetrachloroethane	µg/L	0.5	0.10		<0.10
o-Xylene	µg/L		0.10		<0.10
1,3-Dichlorobenzene	µg/L	0.5	0.10		<0.10
1,4-Dichlorobenzene	µg/L	0.5	0.10		<0.10
1,2-Dichlorobenzene	µg/L	0.5	0.10		<0.10
1,3-Dichloropropene	µg/L	0.5	0.30		<0.30
Xylenes (Total)	µg/L	72	0.20		<0.20
n-Hexane	µg/L	5	0.20		<0.20
Surrogate	**Unit**	**Acceptable Limits**			
Toluene-d8	% Recovery	50-140			91
4-Bromofluorobenzene	% Recovery	50-140			96

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086589 Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
1,3-Dichloropropene total is a calculated parameter. The calculated value is the sum of Cis-1,3-Dichloropropene and Trans-1,3-Dichloropropene.
The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

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AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

OP Pesticides (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-20

			SAMPLE DESCRIPTION:	CR4-11
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2021-10-13 10:45
Parameter	**Unit**	**G / S**	**RDL**	**3086589**
Phorate	µg/L		0.5	<0.5
Dimethoate	µg/L		2.5	<2.5
Terbufos	µg/L		0.5	<0.5
Diazinon	µg/L		1	<1
Malathion	µg/L		5	<5
Chlorpyrifos	µg/L		1	<1
Parathion	µg/L		1	<1
Azinphos-methyl	µg/L		2	<2
Surrogate	**Unit**	**Acceptable Limits**		
Triphenyl phosphate (surr)	%	50-140		108

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3086589 Results relate only to the items tested.

Analysis performed at AGAT Toronto (unless marked by *)

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AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - Metals & Inorganics (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-20

		SAMPLE DESCRIPTION:		CR4-11
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 10:45
Parameter	Unit	G / S	RDL	3086589
Dissolved Antimony	µg/L	1.5	1.0	<1.0
Dissolved Arsenic	µg/L	13	1.0	2.3
Dissolved Barium	µg/L	610	2.0	162
Dissolved Beryllium	µg/L	0.5	0.50	<0.50
Dissolved Boron	µg/L	1700	10.0	60.4
Dissolved Cadmium	µg/L	0.5	0.20	<0.20
Dissolved Chromium	µg/L	11	2.0	<2.0
Dissolved Cobalt	µg/L	3.8	0.50	<0.50
Dissolved Copper	µg/L	5	1.0	<1.0
Dissolved Lead	µg/L	1.9	0.50	0.62
Dissolved Molybdenum	µg/L	23	0.50	3.60
Dissolved Nickel	µg/L	14	3.0	<3.0
Dissolved Selenium	µg/L	5	1.0	<1.0
Dissolved Silver	µg/L	0.3	0.20	<0.20
Dissolved Thallium	µg/L	0.5	0.30	<0.30
Dissolved Uranium	µg/L	8.9	0.50	1.60
Dissolved Vanadium	µg/L	3.9	0.40	3.74
Dissolved Zinc	µg/L	160	5.0	<5.0
Mercury	µg/L	0.1	0.02	<0.02
Chromium VI	µg/L	25	2.000	<2.000
Cyanide, Free	µg/L	5	2	<2
Dissolved Sodium	µg/L	490000	250	204000
Chloride	µg/L	790000	100	257000
Electrical Conductivity	uS/cm	NA	2	1340
pH	pH Units		NA	8.03

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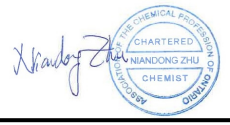

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Certificate of Analysis

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - Metals & Inorganics (Water)

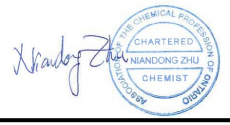
DATE RECEIVED: 2021-10-13 **DATE REPORTED: 2021-10-20**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086589 Metals analysis completed on a filtered sample.
Dilution required, RDL has been increased accordingly

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-20

		SAMPLE DESCRIPTION:		CR4-11
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 10:15
Parameter	Unit	G / S	RDL	3086587
Electrical Conductivity	µS/cm		2	1180
pH	pH Units	6.5-8.5	NA	8.04
Saturation pH (Calculated)				7.16
Langelier Index (Calculated)				0.880
Hardness (as CaCO3) (Calculated)	mg/L		0.5	203
Total Dissolved Solids	mg/L		10	596
Alkalinity (as CaCO3)	mg/L		5	265
Bicarbonate (as CaCO3)	mg/L		5	265
Carbonate (as CaCO3)	mg/L		5	<5
Hydroxide (as CaCO3)	mg/L		5	<5
Fluoride	mg/L		0.05	<0.05
Chloride	mg/L		0.12	219
Nitrate as N	mg/L		0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05
Bromide	mg/L		0.05	<0.05
Sulphate	mg/L		0.10	8.20
Ortho Phosphate as P	mg/L		0.10	<0.10
Ammonia as N	mg/L		0.02	0.36
Ammonia-Un-ionized (Calculated)	mg/L	0.02	0.000002	**0.0231**
Total Phosphorus	mg/L	*	0.02	0.07
Total Organic Carbon	mg/L		0.5	38.6
True Colour	TCU		5	<5
Turbidity	NTU		0.5	13.3
Total Calcium	mg/L		0.16	42.0
Total Magnesium	mg/L		0.17	23.8
Total Potassium	mg/L		0.58	2.33
Total Sodium	mg/L		0.22	153
Aluminum-dissolved	mg/L	*	0.004	0.004
Total Antimony	mg/L	0.020	0.001	<0.001

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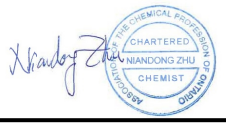

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Certificate of Analysis

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-20

		SAMPLE DESCRIPTION:		CR4-11
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 10:15
Parameter	**Unit**	**G / S**	**RDL**	**3086587**
Total Arsenic	mg/L	0.1	0.003	0.003
Total Barium	mg/L		0.002	0.128
Total Beryllium	mg/L	*	0.001	<0.001
Total Boron	mg/L	0.2	0.010	0.048
Total Cadmium	mg/L	0.0002	0.0001	<0.0001
Total Chromium	mg/L		0.003	<0.003
Total Cobalt	mg/L	0.0009	0.0005	<0.0005
Total Copper	mg/L	0.005	0.001	0.002
Total Iron	mg/L	0.3	0.010	**0.411**
Total Lead	mg/L	*	0.001	<0.001
Total Manganese	mg/L		0.002	0.031
Dissolved Mercury	mg/L	0.0002	0.0001	<0.0001
Total Molybdenum	mg/L	0.040	0.002	0.004
Total Nickel	mg/L	0.025	0.003	<0.003
Total Selenium	mg/L	0.1	0.002	0.003
Total Silver	mg/L	0.0001	0.0001	<0.0001
Total Strontium	mg/L		0.005	0.647
Total Thallium	mg/L	0.0003	0.0003	<0.0003
Total Tin	mg/L		0.002	0.003
Total Titanium	mg/L		0.010	0.019
Total Tungsten	mg/L	0.030	0.010	<0.010
Total Uranium	mg/L	0.005	0.002	<0.002
Total Vanadium	mg/L	0.006	0.002	<0.002
Total Zinc	mg/L	0.030	0.020	<0.020
Total Zirconium	mg/L	0.004	0.004	<0.004
Lab Filtration Aluminum Dissolved				2021/10/14
Lab Filtration mercury				2021/10/14

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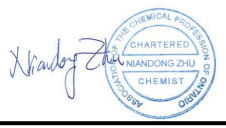

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Certificate of Analysis

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Water Quality Assessment - PWQO (mg/L)

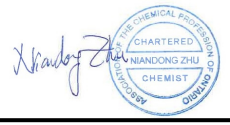
DATE RECEIVED: 2021-10-13 **DATE REPORTED: 2021-10-20**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086587 Dilution required, RDL has been increased accordingly

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Exceedance Summary

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
3086587	CR4-11	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Ammonia-Un-ionized (Calculated)	mg/L	0.02	0.0231
3086587	CR4-11	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Iron	mg/L	0.3	0.411

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD
AGAT WORK ORDER: 21T815210
PROJECT: 60636190
ATTENTION TO: Dhwanish Parikh
SAMPLING SITE:Bradford Bypass (BBP)
SAMPLED BY:Dhwanish Parikh

Trace Organics Analysis

RPT Date: Oct 20, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (with PAHs and VOC) (Water)															
F1 (C6-C10)	3086589	3086589	<25	<25	NA	< 25	109%	60%	140%	114%	60%	140%	110%	60%	140%
F2 (C10 to C16)	3086741		< 100	< 100	NA	< 100	107%	60%	140%	70%	60%	140%	88%	60%	140%
F3 (C16 to C34)	3086741		< 100	< 100	NA	< 100	100%	60%	140%	77%	60%	140%	98%	60%	140%
F4 (C34 to C50)	3086741		< 100	< 100	NA	< 100	96%	60%	140%	97%	60%	140%	96%	60%	140%
O. Reg. 153(511) - PAHs (Water)															
Naphthalene	3044248		28.2	31.5	11.1%	< 0.20	78%	50%	140%	78%	50%	140%	108%	50%	140%
Acenaphthylene	3044248		2.32	2.22	4.4%	< 0.20	85%	50%	140%	85%	50%	140%	98%	50%	140%
Acenaphthene	3044248		89.9	100	10.6%	< 0.20	70%	50%	140%	96%	50%	140%	78%	50%	140%
Fluorene	3044248		10.6	11.7	9.9%	< 0.20	107%	50%	140%	94%	50%	140%	86%	50%	140%
Phenanthrene	3044248		1.10	1.44	26.8%	< 0.10	98%	50%	140%	105%	50%	140%	96%	50%	140%
Anthracene	3044248		1.97	2.59	27.2%	< 0.10	86%	50%	140%	98%	50%	140%	93%	50%	140%
Fluoranthene	3044248		8.53	9.36	9.3%	< 0.20	96%	50%	140%	78%	50%	140%	95%	50%	140%
Pyrene	3044248		10.3	11.3	9.3%	< 0.20	93%	50%	140%	86%	50%	140%	105%	50%	140%
Benzo(a)anthracene	3044248		0.35	0.58	NA	< 0.20	95%	50%	140%	96%	50%	140%	78%	50%	140%
Chrysene	3044248		0.38	0.39	NA	< 0.10	97%	50%	140%	95%	50%	140%	85%	50%	140%
Benzo(b)fluoranthene	3044248		0.11	0.14	NA	< 0.10	98%	50%	140%	97%	50%	140%	96%	50%	140%
Benzo(k)fluoranthene	3044248		< 0.10	<0.10	NA	< 0.10	86%	50%	140%	98%	50%	140%	93%	50%	140%
Benzo(a)pyrene	3044248		0.10	0.08	22.2%	< 0.01	88%	50%	140%	86%	50%	140%	95%	50%	140%
Indeno(1,2,3-cd)pyrene	3044248		< 0.20	<0.20	NA	< 0.20	85%	50%	140%	96%	50%	140%	97%	50%	140%
Dibenz(a,h)anthracene	3044248		< 0.20	< 0.20	NA	< 0.20	96%	50%	140%	96%	50%	140%	78%	50%	140%
Benzo(g,h,i)perylene	3044248		< 0.20	<0.20	NA	< 0.20	94%	50%	140%	99%	50%	140%	86%	50%	140%
O. Reg. 153(511) - VOCs (Water)															
Dichlorodifluoromethane	3086254		<0.20	<0.20	NA	< 0.20	99%	50%	140%	108%	50%	140%	93%	50%	140%
Vinyl Chloride	3086254		<0.17	<0.17	NA	< 0.17	98%	50%	140%	109%	50%	140%	100%	50%	140%
Bromomethane	3086254		<0.20	<0.20	NA	< 0.20	98%	50%	140%	95%	50%	140%	98%	50%	140%
Trichlorofluoromethane	3086254		<0.40	<0.40	NA	< 0.40	106%	50%	140%	104%	50%	140%	101%	50%	140%
Acetone	3086254		<1.0	<1.0	NA	< 1.0	98%	50%	140%	104%	50%	140%	97%	50%	140%
1,1-Dichloroethylene	3086254		<0.30	<0.30	NA	< 0.30	88%	50%	140%	103%	60%	130%	91%	50%	140%
Methylene Chloride	3086254		<0.30	<0.30	NA	< 0.30	114%	50%	140%	107%	60%	130%	110%	50%	140%
trans- 1,2-Dichloroethylene	3086254		<0.20	<0.20	NA	< 0.20	111%	50%	140%	110%	60%	130%	104%	50%	140%
Methyl tert-butyl ether	3086254		<0.20	<0.20	NA	< 0.20	110%	50%	140%	108%	60%	130%	84%	50%	140%
1,1-Dichloroethane	3086254		<0.30	<0.30	NA	< 0.30	98%	50%	140%	101%	60%	130%	83%	50%	140%
Methyl Ethyl Ketone	3086254		<1.0	<1.0	NA	< 1.0	95%	50%	140%	102%	50%	140%	102%	50%	140%
cis- 1,2-Dichloroethylene	3086254		<0.20	<0.20	NA	< 0.20	86%	50%	140%	92%	60%	130%	117%	50%	140%
Chloroform	3086254		0.51	0.68	NA	< 0.20	89%	50%	140%	93%	60%	130%	86%	50%	140%
1,2-Dichloroethane	3086254		<0.20	<0.20	NA	< 0.20	73%	50%	140%	70%	60%	130%	118%	50%	140%
1,1,1-Trichloroethane	3086254		<0.30	<0.30	NA	< 0.30	87%	50%	140%	101%	60%	130%	120%	50%	140%
Carbon Tetrachloride	3086254		<0.20	<0.20	NA	< 0.20	111%	50%	140%	116%	60%	130%	119%	50%	140%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD
AGAT WORK ORDER: 21T815210
PROJECT: 60636190
ATTENTION TO: Dhwanish Parikh
SAMPLING SITE:Bradford Bypass (BBP)
SAMPLED BY:Dhwanish Parikh

Trace Organics Analysis (Continued)

RPT Date: Oct 20, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Benzene	3086254		<0.20	<0.20	NA	< 0.20	78%	50%	140%	89%	60%	130%	101%	50%	140%
1,2-Dichloropropane	3086254		<0.20	<0.20	NA	< 0.20	91%	50%	140%	88%	60%	130%	105%	50%	140%
Trichloroethylene	3086254		<0.20	<0.20	NA	< 0.20	90%	50%	140%	99%	60%	130%	109%	50%	140%
Bromodichloromethane	3086254		0.65	0.65	NA	< 0.20	112%	50%	140%	107%	60%	130%	99%	50%	140%
Methyl Isobutyl Ketone	3086254		<1.0	<1.0	NA	< 1.0	90%	50%	140%	100%	50%	140%	100%	50%	140%
1,1,2-Trichloroethane	3086254		<0.20	<0.20	NA	< 0.20	118%	50%	140%	96%	60%	130%	106%	50%	140%
Toluene	3086254		<0.20	<0.20	NA	< 0.20	101%	50%	140%	102%	60%	130%	109%	50%	140%
Dibromochloromethane	3086254		0.63	0.64	1.6%	< 0.10	111%	50%	140%	118%	60%	130%	101%	50%	140%
Ethylene Dibromide	3086254		<0.10	<0.10	NA	< 0.10	115%	50%	140%	99%	60%	130%	115%	50%	140%
Tetrachloroethylene	3086254		<0.20	<0.20	NA	< 0.20	103%	50%	140%	108%	60%	130%	112%	50%	140%
1,1,1,2-Tetrachloroethane	3086254		<0.10	<0.10	NA	< 0.10	93%	50%	140%	114%	60%	130%	113%	50%	140%
Chlorobenzene	3086254		<0.10	<0.10	NA	< 0.10	116%	50%	140%	99%	60%	130%	111%	50%	140%
Ethylbenzene	3086254		<0.10	<0.10	NA	< 0.10	115%	50%	140%	104%	60%	130%	108%	50%	140%
m & p-Xylene	3086254		<0.20	<0.20	NA	< 0.20	111%	50%	140%	107%	60%	130%	111%	50%	140%
Bromoform	3086254		<0.10	<0.10	NA	< 0.10	95%	50%	140%	104%	60%	130%	118%	50%	140%
Styrene	3086254		<0.10	<0.10	NA	< 0.10	103%	50%	140%	97%	60%	130%	107%	50%	140%
1,1,2,2-Tetrachloroethane	3086254		<0.10	<0.10	NA	< 0.10	107%	50%	140%	93%	60%	130%	110%	50%	140%
o-Xylene	3086254		<0.10	<0.10	NA	< 0.10	119%	50%	140%	107%	60%	130%	113%	50%	140%
1,3-Dichlorobenzene	3086254		<0.10	<0.10	NA	< 0.10	107%	50%	140%	99%	60%	130%	111%	50%	140%
1,4-Dichlorobenzene	3086254		<0.10	<0.10	NA	< 0.10	92%	50%	140%	100%	60%	130%	108%	50%	140%
1,2-Dichlorobenzene	3086254		<0.10	<0.10	NA	< 0.10	117%	50%	140%	99%	60%	130%	118%	50%	140%
n-Hexane	3086254		<0.20	<0.20	NA	< 0.20	100%	50%	140%	81%	60%	130%	116%	50%	140%
O. Reg. 153(511) - OC Pesticides + PCBs (Water)															
Gamma-Hexachlorocyclohexane	3094790		< 0.01	< 0.01	NA	< 0.01	92%	50%	140%	81%	50%	140%	75%	50%	140%
Heptachlor	3094790		< 0.01	< 0.01	NA	< 0.01	83%	50%	140%	108%	50%	140%	109%	50%	140%
Aldrin	3094790		< 0.01	< 0.01	NA	< 0.01	93%	50%	140%	104%	50%	140%	92%	50%	140%
Heptachlor Epoxide	3094790		< 0.01	< 0.01	NA	< 0.01	94%	50%	140%	107%	50%	140%	96%	50%	140%
Endosulfan I	3094790		< 0.05	< 0.05	NA	< 0.05	92%	50%	140%	96%	50%	140%	91%	50%	140%
Endosulfan II	3094790		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	102%	50%	140%	93%	50%	140%
alpha - chlordane	3094790		< 0.1	< 0.1	NA	< 0.1	90%	50%	140%	102%	50%	140%	97%	50%	140%
gamma-Chlordane	3094790		< 0.2	< 0.2	NA	< 0.2	91%	50%	140%	99%	50%	140%	94%	50%	140%
op'-DDE	3094790		< 0.01	< 0.01	NA	< 0.01	87%	50%	140%	100%	50%	140%	95%	50%	140%
pp'-DDE	3094790		< 0.01	< 0.01	NA	< 0.01	91%	50%	140%	108%	50%	140%	104%	50%	140%
op'-DDD	3094790		< 0.05	< 0.05	NA	< 0.05	101%	50%	140%	107%	50%	140%	109%	50%	140%
pp'-DDD	3094790		< 0.05	< 0.05	NA	< 0.05	109%	50%	140%	105%	50%	140%	112%	50%	140%
op'-DDT	3094790		< 0.04	< 0.04	NA	< 0.04	85%	50%	140%	101%	50%	140%	105%	50%	140%
pp'-DDT	3094790		< 0.05	< 0.05	NA	< 0.05	86%	50%	140%	104%	50%	140%	99%	50%	140%
Dieldrin	3094790		< 0.02	< 0.02	NA	< 0.02	91%	50%	140%	106%	50%	140%	97%	50%	140%
Endrin	3094790		< 0.05	< 0.05	NA	< 0.05	85%	50%	140%	106%	50%	140%	101%	50%	140%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD
AGAT WORK ORDER: 21T815210
PROJECT: 60636190
ATTENTION TO: Dhwanish Parikh
SAMPLING SITE:Bradford Bypass (BBP)
SAMPLED BY:Dhwanish Parikh

Trace Organics Analysis (Continued)

RPT Date: Oct 20, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Methoxychlor	3094790		< 0.04	< 0.04	NA	< 0.04	82%	50%	140%	109%	50%	140%	105%	50%	140%
Hexachlorobenzene	3094790		< 0.01	< 0.01	NA	< 0.01	99%	50%	140%	96%	50%	140%	89%	50%	140%
Hexachlorobutadiene	3094790		< 0.01	< 0.01	NA	< 0.01	96%	50%	140%	108%	50%	140%	103%	50%	140%
Hexachloroethane	3094790		< 0.01	< 0.01	NA	< 0.01	82%	50%	140%	93%	50%	140%	83%	50%	140%
Aroclor 1242	3094790		< 0.1	< 0.1	NA	< 0.1	98%	60%	140%	NA	60%	140%	NA	60%	140%
Aroclor 1248	3094790		< 0.1	< 0.1	NA	< 0.1	88%	60%	140%	NA	60%	140%	NA	60%	140%
Aroclor 1254	3094790		< 0.1	< 0.1	NA	< 0.1	80%	60%	140%	NA	60%	140%	NA	60%	140%
Aroclor 1260	3094790		< 0.1	< 0.1	NA	< 0.1	102%	60%	140%	NA	60%	140%	NA	60%	140%
Polychlorinated Biphenyls	3094790		< 0.1	< 0.1	NA	< 0.1	104%	60%	140%	101%	60%	140%	80%	60%	140%
OP Pesticides (Water)															
Phorate	2767079		< 0.5	< 0.5	NA	< 0.5	97%	50%	140%	74%	50%	140%	72%	50%	140%
Dimethoate	2767079		< 2.5	< 2.5	NA	< 2.5	105%	50%	140%	85%	50%	140%	94%	50%	140%
Terbufos	2767079		< 0.5	< 0.5	NA	< 0.5	98%	50%	140%	93%	50%	140%	98%	50%	140%
Diazinon	2767079		< 1	< 1	NA	< 1	86%	50%	140%	95%	50%	140%	98%	50%	140%
Malathion	2767079		< 5	< 5	NA	< 5	98%	50%	140%	105%	50%	140%	93%	50%	140%
Chlorpyrifos	2767079		< 1	< 1	NA	< 1	88%	50%	140%	98%	50%	140%	95%	50%	140%
Parathion	2767079		< 1	< 1	NA	< 1	86%	50%	140%	86%	50%	140%	105%	50%	140%
Azinphos-methyl	2767079		< 2	< 2	NA	< 2	95%	50%	140%	95%	50%	140%	98%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD
AGAT WORK ORDER: 21T815210
PROJECT: 60636190
ATTENTION TO: Dhwanish Parikh
SAMPLING SITE:Bradford Bypass (BBP)
SAMPLED BY:Dhwanish Parikh

Water Analysis

RPT Date: Oct 20, 2021

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Water Quality Assessment - PWQO (mg/L)															
Electrical Conductivity	3086235		6120	6130	0.2%	< 2	104%	90%	110%						
pH	3086235		7.42	7.44	0.3%	NA	103%	90%	110%						
Total Dissolved Solids	3086147		540	558	3.3%	< 10	102%	80%	120%						
Alkalinity (as CaCO3)	3086235		689	702	1.9%	< 5	85%	80%	120%						
Bicarbonate (as CaCO3)	3086235		689	702	1.9%	< 5									
Carbonate (as CaCO3)	3086235		<5	<5	NA	< 5									
Hydroxide (as CaCO3)	3086235		<5	<5	NA	< 5									
Fluoride	3090703		<0.05	<0.05	NA	< 0.05	101%	70%	130%	96%	80%	120%	108%	70%	130%
Chloride	3090703		108	109	0.9%	< 0.10	96%	70%	130%	103%	80%	120%	107%	70%	130%
Nitrate as N	3090703		0.49	0.48	2.1%	< 0.05	99%	70%	130%	107%	80%	120%	105%	70%	130%
Nitrite as N	3090703		<0.05	<0.05	NA	< 0.05	99%	70%	130%	96%	80%	120%	109%	70%	130%
Bromide	3090703		<0.05	<0.05	NA	< 0.05	105%	70%	130%	103%	80%	120%	101%	70%	130%
Sulphate	3090703		19.5	19.5	0.0%	< 0.10	100%	70%	130%	100%	80%	120%	108%	70%	130%
Ortho Phosphate as P	3090703		<0.10	<0.10	NA	< 0.10	98%	70%	130%	95%	80%	120%	100%	70%	130%
Ammonia as N	3084096		0.03	0.03	NA	< 0.02	103%	70%	130%	106%	80%	120%	89%	70%	130%
Total Phosphorus	3083887		2.76	2.68	2.9%	< 0.02	96%	70%	130%	96%	80%	120%	NA	70%	130%
Total Organic Carbon	3080535		11.2	11.2	0.0%	< 0.5	95%	90%	110%	100%	90%	110%	NA	80%	120%
True Colour	3095546		46	46	0.0%	< 5	100%	90%	110%						
Turbidity	3089426		14.4	15.2	5.4%	< 0.5	99%	80%	120%						
Total Calcium	3086587	3086587	42.0	47.7	12.7%	< 0.10	94%	70%	130%	95%	80%	120%	97%	70%	130%
Total Magnesium	3086587	3086587	23.8	25.8	8.1%	< 0.10	98%	70%	130%	98%	80%	120%	99%	70%	130%
Total Potassium	3086587	3086587	2.33	2.53	NA	< 0.50	97%	70%	130%	97%	80%	120%	99%	70%	130%
Total Sodium	3086587	3086587	153	168	9.3%	< 0.10	95%	70%	130%	95%	80%	120%	99%	70%	130%
Aluminum-dissolved	3073029		0.062	0.064	3.2%	< 0.004	105%	70%	130%	115%	80%	120%	110%	70%	130%
Total Antimony	3086587	3086587	<0.001	<0.001	NA	< 0.001	101%	70%	130%	102%	80%	120%	105%	70%	130%
Total Arsenic	3086587	3086587	0.003	0.003	NA	< 0.003	97%	70%	130%	107%	80%	120%	117%	70%	130%
Total Barium	3086587	3086587	0.128	0.136	6.1%	< 0.002	99%	70%	130%	102%	80%	120%	99%	70%	130%
Total Beryllium	3086587	3086587	<0.001	<0.001	NA	< 0.001	96%	70%	130%	103%	80%	120%	115%	70%	130%
Total Boron	3086587	3086587	0.048	0.050	NA	< 0.010	99%	70%	130%	102%	80%	120%	110%	70%	130%
Total Cadmium	3086587	3086587	<0.0001	<0.0001	NA	< 0.0001	102%	70%	130%	107%	80%	120%	107%	70%	130%
Total Chromium	3086587	3086587	<0.003	<0.003	NA	< 0.003	102%	70%	130%	101%	80%	120%	99%	70%	130%
Total Cobalt	3086587	3086587	<0.0005	<0.0005	NA	< 0.0005	96%	70%	130%	109%	80%	120%	100%	70%	130%
Total Copper	3086587	3086587	0.002	<0.001	NA	< 0.001	99%	70%	130%	102%	80%	120%	99%	70%	130%
Total Iron	3086587	3086587	0.411	0.377	8.6%	< 0.010	92%	70%	130%	104%	80%	120%	98%	70%	130%
Total Lead	3086587	3086587	<0.001	<0.001	NA	< 0.001	94%	70%	130%	102%	80%	120%	99%	70%	130%
Total Manganese	3086587	3086587	0.031	0.035	12.1%	< 0.002	97%	70%	130%	108%	80%	120%	101%	70%	130%
Dissolved Mercury	3086788		<0.0001	<0.0001	NA	< 0.0001	99%	70%	130%	104%	80%	120%	95%	70%	130%
Total Molybdenum	3086587	3086587	0.004	0.003	NA	< 0.002	99%	70%	130%	105%	80%	120%	101%	70%	130%
Total Nickel	3086587	3086587	<0.003	<0.003	NA	< 0.003	95%	70%	130%	109%	80%	120%	98%	70%	130%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD
AGAT WORK ORDER: 21T815210
PROJECT: 60636190
ATTENTION TO: Dhwanish Parikh
SAMPLING SITE:Bradford Bypass (BBP)
SAMPLED BY:Dhwanish Parikh

Water Analysis (Continued)

RPT Date: Oct 20, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Selenium	3086587	3086587	0.003	<0.002	NA	< 0.002	107%	70%	130%	112%	80%	120%	119%	70%	130%
Total Silver	3086587	3086587	<0.0001	<0.0001	NA	0.0001	97%	70%	130%	110%	80%	120%	98%	70%	130%
Total Strontium	3086587	3086587	0.647	0.711	9.4%	< 0.005	97%	70%	130%	103%	80%	120%	99%	70%	130%
Total Thallium	3086587	3086587	<0.0003	<0.0003	NA	< 0.0003	95%	70%	130%	105%	80%	120%	102%	70%	130%
Total Tin	3086587	3086587	0.003	0.003	NA	< 0.002	98%	70%	130%	103%	80%	120%	103%	70%	130%
Total Titanium	3086587	3086587	0.019	0.017	NA	< 0.010	96%	70%	130%	108%	80%	120%	106%	70%	130%
Total Tungsten	3086587	3086587	<0.010	<0.010	NA	< 0.010	97%	70%	130%	101%	80%	120%	100%	70%	130%
Total Uranium	3086587	3086587	<0.002	<0.002	NA	< 0.002	93%	70%	130%	102%	80%	120%	102%	70%	130%
Total Vanadium	3086587	3086587	<0.002	<0.002	NA	< 0.002	94%	70%	130%	105%	80%	120%	98%	70%	130%
Total Zinc	3086587	3086587	<0.020	<0.020	NA	< 0.020	99%	70%	130%	104%	80%	120%	108%	70%	130%
Total Zirconium	3086587	3086587	<0.004	<0.004	NA	< 0.004	103%	70%	130%	107%	80%	120%	104%	70%	130%
O. Reg. 153(511) - Metals & Inorganics (Water)															
Dissolved Antimony	3084132		<1.0	<1.0	NA	< 1.0	102%	70%	130%	108%	80%	120%	110%	70%	130%
Dissolved Arsenic	3084132		<1.0	<1.0	NA	< 1.0	95%	70%	130%	111%	80%	120%	112%	70%	130%
Dissolved Barium	3084132		32.6	32.2	1.2%	< 2.0	100%	70%	130%	101%	80%	120%	99%	70%	130%
Dissolved Beryllium	3084132		<0.50	<0.50	NA	< 0.50	101%	70%	130%	118%	80%	120%	119%	70%	130%
Dissolved Boron	3084132		309	308	0.3%	< 10.0	101%	70%	130%	113%	80%	120%	125%	70%	130%
Dissolved Cadmium	3084132		<0.20	<0.20	NA	< 0.20	100%	70%	130%	107%	80%	120%	103%	70%	130%
Dissolved Chromium	3084132		<2.0	<2.0	NA	< 2.0	100%	70%	130%	105%	80%	120%	117%	70%	130%
Dissolved Cobalt	3084132		<0.50	<0.50	NA	< 0.50	101%	70%	130%	109%	80%	120%	115%	70%	130%
Dissolved Copper	3084132		1.5	2.1	NA	< 1.0	98%	70%	130%	105%	80%	120%	108%	70%	130%
Dissolved Lead	3084132		<0.50	<0.50	NA	< 0.50	98%	70%	130%	105%	80%	120%	103%	70%	130%
Dissolved Molybdenum	3084132		95.2	112	16.2%	< 0.50	98%	70%	130%	105%	80%	120%	117%	70%	130%
Dissolved Nickel	3084132		<3.0	<3.0	NA	< 3.0	99%	70%	130%	103%	80%	120%	111%	70%	130%
Dissolved Selenium	3084132		2.2	3.0	NA	< 1.0	99%	70%	130%	111%	80%	120%	97%	70%	130%
Dissolved Silver	3084132		<0.20	<0.20	NA	< 0.20	101%	70%	130%	106%	80%	120%	102%	70%	130%
Dissolved Thallium	3084132		<0.30	<0.30	NA	< 0.30	98%	70%	130%	107%	80%	120%	107%	70%	130%
Dissolved Uranium	3084132		<0.50	<0.50	NA	< 0.50	92%	70%	130%	105%	80%	120%	110%	70%	130%
Dissolved Vanadium	3084132		<0.40	<0.40	NA	< 0.40	100%	70%	130%	104%	80%	120%	119%	70%	130%
Dissolved Zinc	3084132		<5.0	<5.0	NA	< 5.0	99%	70%	130%	111%	80%	120%	122%	70%	130%
Mercury	3086788		<0.02	<0.02	NA	< 0.02	99%	70%	130%	104%	80%	120%	95%	70%	130%
Chromium VI	3071878		<2.000	<2.000	NA	< 2	98%	70%	130%	104%	80%	120%	105%	70%	130%
Cyanide, Free	3071887		<2	<2	NA	< 2	99%	70%	130%	95%	80%	120%	92%	70%	130%
Dissolved Sodium	3086543		8640	8570	0.8%	< 50	96%	70%	130%	96%	80%	120%	102%	70%	130%
Chloride	3090703		108000	109000	0.9%	< 100	96%	70%	130%	103%	80%	120%	107%	70%	130%
Electrical Conductivity	3086235		6120	6130	0.2%	< 2	104%	90%	110%						
pH	3086235		7.42	7.44	0.3%	NA	103%	90%	110%						

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

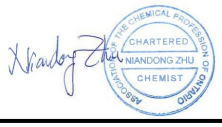
SAMPLED BY:Dhwanish Parikh

Water Analysis (Continued)

RPT Date: Oct 20, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: NA Signifies Not Applicable.
Duplicate NA: results are less than 5X the RDL and RPD will not be calculated.
Matrix spike: Spike level < native concentration. Matrix spike acceptance limits do not apply.

Certified By:



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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Gamma-Hexachlorocyclohexane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Heptachlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Aldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Heptachlor Epoxide	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan I	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan II	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
alpha - chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
gamma-Chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
Dieldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Methoxychlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachlorobenzene	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachlorobutadiene	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachloroethane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Aroclor 1242	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Aroclor 1248	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD

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Method Summary

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AGAT WORK ORDER: 21T815210

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Aroclor 1254	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Aroclor 1260	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Polychlorinated Biphenyls	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
TCMX	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Naphthalene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Acenaphthylene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Acenaphthene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Fluorene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Phenanthrene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Anthracene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Fluoranthene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Pyrene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(a)anthracene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Chrysene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(b)fluoranthene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(k)fluoranthene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(a)pyrene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Dibenz(a,h)anthracene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(g,h,i)perylene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
2-and 1-methyl Naphthalene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Naphthalene-d8	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Acridine-d9	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Terphenyl-d14	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Sediment			
F1 (C6-C10)	VOL-91-5010	modified from MOE PHC-E3421	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5010	modified from MOE PHC-E3421	P&T GC/FID
Toluene-d8	VOL-91-5010	modified from MOE PHC-E3421	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
F2 (C10 to C16) minus Naphthalene	VOL-91-5010	modified from MOE PHC-E3421	GC/FID

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F3 (C16 to C34)	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
F3 (C16 to C34) minus PAHs	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
F4 (C34 to C50)	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5010	modified from MOE PHC-E3421	BALANCE
Terphenyl	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
Dichlorodifluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromomethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Acetone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl tert-butyl ether	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromodichloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Dibromochloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Tetrachloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromoform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Styrene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
n-Hexane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Phorate	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Dimethoate	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Terbufos	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Diazinon	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Malathion	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Chlorpyrifos	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Parathion	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Azinphos-methyl	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Triphenyl phosphate (surr)	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Dissolved Antimony	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Arsenic	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Barium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Beryllium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Boron	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cadmium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Chromium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cobalt	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Copper	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Lead	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Molybdenum	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Nickel	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Selenium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Silver	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Thallium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Uranium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Vanadium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Zinc	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Chromium VI	INOR-93-6034	modified from SM 3500-CR B	LACHAT FIA
Cyanide, Free	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	TECHNICON AUTO ANALYZER
Dissolved Sodium	MET-93-6105	modified from EPA 6010D	ICP/OES
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Electrical Conductivity	INOR-93-6000	SM 2510 B	PC TITRATE
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Electrical Conductivity	INOR-93-6000	modified from SM 2510 B	PC TITRATE
Saturation pH (Calculated)		SM 2320 B	CALCULATION
Langelier Index (Calculated)		SM 2330B	CALCULATION
Hardness (as CaCO3) (Calculated)	MET-93-6105	modified from EPA SW-846 6010C & 200.7 & SM 2340 B	CALCULATION
Total Dissolved Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Alkalinity (as CaCO3)	INOR-93-6000	Modified from SM 2320 B	PC TITRATE
Bicarbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE

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Method Summary

CLIENT NAME: AECOM CANADA LTD

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PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Carbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Hydroxide (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ortho Phosphate as P	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	modified from SM 4500-NH3 H	LACHAT FIA
Ammonia-Un-ionized (Calculated)		MOE REFERENCE, PWQOs Tab 2	CALCULATION
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Total Organic Carbon	INOR-93-6049	modified from SM 5310 B	SHIMADZU CARBON ANALYZER
True Colour	INOR-93-6074	modified from SM 2120 B	LACHAT FIA
Turbidity	INOR-93-6044	modified from SM 2130 B	NEPHELOMETER
Total Calcium	MET-93-6105	modified from EPA 6010D	ICP/OES
Total Magnesium	MET-93-6105	modified from EPA 6010D	ICP/OES
Total Potassium	MET-93-6105	modified from EPA 6010D	ICP/OES
Total Sodium	MET-93-6105	modified from EPA 6010D	ICP/OES
Aluminum-dissolved	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Barium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Beryllium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Boron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Iron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Dissolved Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815210

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Strontium	INOR-93-6003	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Thallium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tin	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Titanium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tungsten	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Uranium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Vanadium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zirconium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Lab Filtration Aluminum Dissolved	SR-78-9001		FILTRATION
Lab Filtration mercury	SR-78-9001		FILTRATION

AGAT Laboratories

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Mississauga, Ontario L4Z 1Y2
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Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 21T815210
Cooler Quantity: 1 Blk (free ice)
Arrival Temperatures: 4.8 | 6.1 | 5.2
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes:

Report Information:

Company: AECOM Canada Ltd.
Contact: Dhwanish Parikh / Brian Holden
Address: 105 Commerce Valley Dr W, 7th floor
Markham, ON
Phone: 416 420 5590 Fax:
Reports to be sent to:
1. Email: dhwanish.parikh@aecom.com
2. Email: Brian.holden@aecom.com

Regulatory Requirements:

(Please check all applicable boxes)

- ☑ Regulation 153/04 — Table 1 (Indicate One): ☑ Ind/Com ☐ Res/Park ☐ Agriculture
- Soil Texture (Check One): ☑ Coarse ☐ Fine
- ☐ Excess Soils R406 — Table (Indicate One)
- ☐ Regulation 558
- ☐ CCME
- ☐ Sewer Use: ☐ Sanitary ☐ Storm — Region
- ☑ Prov. Water Quality Objectives (PWQO)
- ☐ Other (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 60636190
Site Location: Bradford Bypass (BBP)
Sampled By: Dhwanish Parikh
AGAT Quote #: PO:

Please note: If quotation number is not provided, client will be billed full price for analysis

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Analysis columns: Field Filtered - Metals, Hg, CrVI, DOC (Y/N); O. Reg 153: Metals & Inorganics; Metals - ☐ CrVI, ☐ Hg, ☐ HWSB; BTEX, F1-F4 PHCs; Analyze F4G if required ☐ Yes ☐ No; PAHs; PCBs; VOC; O. Reg 558: Landfill Disposal Characterization TCLP: TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs; O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs; Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4; Salt - EC/SAR; PWQO (8 Bottles) (10:15 am); O. Reg 153/04 (20 bottles) (10:45 am); [ME, F, VOC, BTEX, PHC, PAHs, PCB, DCP(OP)]; Potentially Hazardous or High Concentration (Y/N)

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered (Y/N)	PWQO (8 Bottles)	O. Reg 153/04 (20 bottles)
CR4-11	Oct 13, 2021	10:15 AM	8	GW			✓	
CR4-11	Oct 13, 2021	10:45 AM	20	GW		✓		✓
		AM PM						
		AM PM						
		AM PM						
		AM PM						
		AM PM						
		AM PM						
		AM PM						
		AM PM						
		AM PM						

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Dhwanish Parikh [signature]	Oct 13, 2021	3:30	Neil Ramnaraign [signature]		

21OCT13 4:10PM

Page ____ of ____

Nº: T 126011

DRAFT

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CLIENT NAME: AECOM CANADA LTD
105 COMMERCE VALLEY DR.W 7TH FLOOR
MARKHAM, ON L3T7W3
(905) 886-7022
ATTENTION TO: Dhwanish Parikh
PROJECT: 60636190
AGAT WORK ORDER: 21T815212
TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist
ULTRA TRACE REVIEWED BY: Marc Paquet, Chimiste, AGAT Québec
WATER ANALYSIS REVIEWED BY: Jacky Zhu, Spectroscopy Technician
DATE REPORTED: Oct 21, 2021
PAGES (INCLUDING COVER): 21
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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Certificate of Analysis

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - VOCs (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

		SAMPLE DESCRIPTION:		CR4-03
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 13:15
Parameter	Unit	G / S	RDL	3086543
Dichlorodifluoromethane	µg/L	590	0.20	<0.20
Vinyl Chloride	µg/L	0.5	0.17	<0.17
Bromomethane	µg/L	0.89	0.20	<0.20
Trichlorofluoromethane	µg/L	150	0.40	<0.40
Acetone	µg/L	2700	1.0	<1.0
1,1-Dichloroethylene	µg/L	0.5	0.30	<0.30
Methylene Chloride	µg/L	5	0.30	<0.30
trans- 1,2-Dichloroethylene	µg/L	1.6	0.20	<0.20
Methyl tert-butyl ether	µg/L	15	0.20	<0.20
1,1-Dichloroethane	µg/L	0.5	0.30	<0.30
Methyl Ethyl Ketone	µg/L	400	1.0	<1.0
cis- 1,2-Dichloroethylene	µg/L	1.6	0.20	<0.20
Chloroform	µg/L	2	0.20	<0.20
1,2-Dichloroethane	µg/L	0.5	0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.5	0.30	<0.30
Carbon Tetrachloride	µg/L	0.2	0.20	<0.20
Benzene	µg/L	0.5	0.20	<0.20
1,2-Dichloropropane	µg/L	0.5	0.20	<0.20
Trichloroethylene	µg/L	0.5	0.20	<0.20
Bromodichloromethane	µg/L	2	0.20	<0.20
Methyl Isobutyl Ketone	µg/L	640	1.0	<1.0
1,1,2-Trichloroethane	µg/L	0.5	0.20	<0.20
Toluene	µg/L	0.8	0.20	<0.20
Dibromochloromethane	µg/L	2	0.10	<0.10
Ethylene Dibromide	µg/L	0.2	0.10	<0.10
Tetrachloroethylene	µg/L	0.5	0.20	<0.20
1,1,1,2-Tetrachloroethane	µg/L	1.1	0.10	<0.10
Chlorobenzene	µg/L	0.5	0.10	<0.10
Ethylbenzene	µg/L	0.5	0.10	<0.10

Certified By: N Popnikolof

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Certificate of Analysis

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - VOCs (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

				SAMPLE DESCRIPTION:	CR4-03
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2021-10-13 13:15
Parameter	**Unit**	**G / S**	**RDL**	**3086543**	
m & p-Xylene	µg/L		0.20	<0.20	
Bromoform	µg/L	5	0.10	<0.10	
Styrene	µg/L	0.5	0.10	<0.10	
1,1,2,2-Tetrachloroethane	µg/L	0.5	0.10	<0.10	
o-Xylene	µg/L		0.10	<0.10	
1,3-Dichlorobenzene	µg/L	0.5	0.10	<0.10	
1,4-Dichlorobenzene	µg/L	0.5	0.10	<0.10	
1,2-Dichlorobenzene	µg/L	0.5	0.10	<0.10	
1,3-Dichloropropene	µg/L	0.5	0.30	<0.30	
Xylenes (Total)	µg/L	72	0.20	<0.20	
n-Hexane	µg/L	5	0.20	<0.20	
Surrogate	**Unit**	**Acceptable Limits**			
Toluene-d8	% Recovery	50-140		104	
4-Bromofluorobenzene	% Recovery	50-140		98	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086543 Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
1,3-Dichloropropene total is a calculated parameter. The calculated value is the sum of Cis-1,3-Dichloropropene and Trans-1,3-Dichloropropene.
The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

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Certificate of Analysis

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

York Region Sanitary - Organics

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

				SAMPLE DESCRIPTION:	CR4-03
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2021-10-13 13:30
Parameter	Unit	G / S: A	G / S: B	RDL	3086529
Oil and Grease (animal/vegetable) in water	mg/L	150		0.5	<0.5[<A]
Oil and Grease (mineral) in water	mg/L	15		0.5	<0.5[<A]
Methylene Chloride	µg/L	2000	5.2	0.3	<0.3[<B]
trans-1,3-Dichloropropene	µg/L	140	5.6	0.30	<0.30[<B]
Methyl Ethyl Ketone	µg/L	8000		0.9	<0.9[<A]
cis- 1,2-Dichloroethylene	µg/L	4000	5.6	0.2	<0.2[<B]
Chloroform	µg/L	40	2.0	0.2	<0.2[<B]
Benzene	µg/L	10	2.0	0.2	<0.2[<B]
Trichloroethylene	µg/L	400	8.0	0.2	<0.2[<B]
Toluene	µg/L	270	2.0	0.2	<0.2[<B]
Tetrachloroethene	µg/L	1000	4.4	0.1	<0.1[<B]
Ethylbenzene	µg/L	160	2.0	0.1	<0.1[<B]
1,1,2,2-Tetrachloroethane	µg/L	1400	17.0	0.1	<0.1[<B]
Styrene	µg/L	200		0.1	<0.1[<A]
1,2-Dichlorobenzene	µg/L	50	5.6	0.1	<0.1[<B]
1,4-Dichlorobenzene	µg/L	80	6.8	0.1	<0.1[<B]
m & p-Xylene	µg/L			0.2	<0.2
o-Xylene	µg/L			0.1	<0.1
Xylenes (Total)	µg/L	1400	4.4	0.2	<0.2[<B]
PCBs	µg/L	1	0.4	0.2	<0.2[<B]
Di-n-butyl phthalate	µg/L	80	15.0	0.5	<0.5[<B]
Bis(2-Ethylhexyl)phthalate	µg/L	12	8.8	0.5	<0.5[<B]

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Certificate of Analysis

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

York Region Sanitary - Organics

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

			SAMPLE DESCRIPTION:	CR4-03
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2021-10-13 13:30
Surrogate	**Unit**	**Acceptable Limits**		**3086529**
Toluene-d8	% Recovery	50-140		102
4-Bromofluorobenzene	% Recovery	50-140		89
Decachlorobiphenyl	%	50-140		87
2,4,6-Tribromophenol	%	50-140		75
2-Fluorophenol	%	50-140		69
Chrysene-d12	%	50-140		93
phenol-d6 surrogate	%	50-140		91

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to The Regional Municipality of York - Limits for Sanitary Sewer Discharge [BY-LAW NO.2011-56], B Refers to The Regional Municipality of York - Limits for Storm Sewer Discharge [BY-LAW NO.2011-56]
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086529 Oil and Grease animal/vegetable is a calculated parameter. The calculated value is the difference between Total O&G and Mineral O&G.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

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Certificate of Analysis

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Nonylphenol and Nonylphenol Ethoxylates (Ontario, mg/L)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

				SAMPLE DESCRIPTION:	CR4-03
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2021-10-13 13:30
Parameter	**Unit**	**G / S**	**RDL**		**3086529**
Total Nonylphenol	mg/L	0.020	0.001		<0.001
NP1EO	mg/L		0.001		<0.001
NP2EO	mg/L		0.0003		<0.0003
Total Nonylphenol Ethoxylates	mg/L	0.200	0.001		<0.001

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to The Regional Municipality of York - Limits for Sanitary Sewer Discharge [BY-LAW NO.2011-56]
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Montréal (unless marked by *)

Certified By:

AGAT Laboratories

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CANADA L4Z 1Y2
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Certificate of Analysis

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

CBOD5

DATE RECEIVED: 2021-10-13

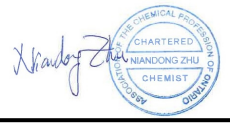
DATE REPORTED: 2021-10-21

					SAMPLE DESCRIPTION:	CR4-03
					SAMPLE TYPE:	Water
					DATE SAMPLED:	2021-10-13 13:30
Parameter	**Unit**	**G / S: A**	**G / S: B**	**RDL**	**3086529**	
Biochemical Oxygen Demand, Carbonaceous	mg/L	300	15	2.00	<2.00[<B]	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to The Regional Municipality of York - Limits for Sanitary Sewer Discharge [BY-LAW NO.2011-56], B Refers to The Regional Municipality of York - Limits for Storm Sewer Discharge [BY-LAW NO.2011-56]
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

O. Reg. 153(511) - Metals & Inorganics (Water)

DATE RECEIVED: 2021-10-13

DATE REPORTED: 2021-10-21

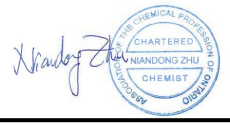
		SAMPLE DESCRIPTION:		CR4-03
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-10-13 13:15
Parameter	**Unit**	**G / S**	**RDL**	**3086543**
Dissolved Antimony	µg/L	1.5	1.0	<1.0
Dissolved Arsenic	µg/L	13	1.0	2.2
Dissolved Barium	µg/L	610	2.0	216
Dissolved Beryllium	µg/L	0.5	0.50	<0.50
Dissolved Boron	µg/L	1700	10.0	28.8
Dissolved Cadmium	µg/L	0.5	0.20	<0.20
Dissolved Chromium	µg/L	11	2.0	<2.0
Dissolved Cobalt	µg/L	3.8	0.50	<0.50
Dissolved Copper	µg/L	5	1.0	<1.0
Dissolved Lead	µg/L	1.9	0.50	<0.50
Dissolved Molybdenum	µg/L	23	0.50	4.55
Dissolved Nickel	µg/L	14	3.0	<3.0
Dissolved Selenium	µg/L	5	1.0	<1.0
Dissolved Silver	µg/L	0.3	0.20	<0.20
Dissolved Thallium	µg/L	0.5	0.30	<0.30
Dissolved Uranium	µg/L	8.9	0.50	0.57
Dissolved Vanadium	µg/L	3.9	0.40	<0.40
Dissolved Zinc	µg/L	160	5.0	<5.0
Mercury	µg/L	0.1	0.02	<0.02
Chromium VI	µg/L	25	2.000	<2.000
Cyanide, Free	µg/L	5	2	<2
Dissolved Sodium	µg/L	490000	50	8640
Chloride	µg/L	790000	100	36500
Electrical Conductivity	uS/cm	NA	2	610
pH	pH Units		NA	8.03

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3086543 Metals analysis completed on a filtered sample.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

York Region Sanitary Sewer Use By-Law - Inorganics

DATE RECEIVED: 2021-10-13

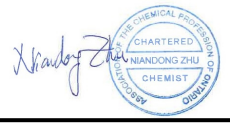
DATE REPORTED: 2021-10-21

					SAMPLE DESCRIPTION:	CR4-03
					SAMPLE TYPE:	Water
					DATE SAMPLED:	2021-10-13 13:30
Parameter	**Unit**	**G / S: A**	**G / S: B**	**RDL**		**3086529**
pH	pH Units	6.0-10.5	6.0-9.0	NA		8.01
Total Suspended Solids	mg/L	350	15	10		54[B-A]
Fluoride	mg/L	10		0.05		<0.05[<A]
Sulphate	mg/L	1500		0.10		33.9[<A]
Total Cyanide	mg/L	2	0.02	0.002		<0.002[<B]
Phenols	mg/L	1	0.008	0.001		0.010[B-A]
Total Kjeldahl Nitrogen	mg/L	100	1	0.10		0.22[<B]
Total Aluminum	mg/L	50		0.010		0.282[<A]
Total Antimony	mg/L	5		0.020		<0.020[<A]
Total Arsenic	mg/L	1	0.020	0.015		<0.015[<B]
Total Cadmium	mg/L	0.7	0.008	0.005		<0.005[<B]
Total Chromium	mg/L	2	0.080	0.020		<0.020[<B]
Total Cobalt	mg/L	5		0.020		<0.020[<A]
Total Copper	mg/L	3	0.050	0.015		<0.015[<B]
Total Lead	mg/L	1	0.120	0.020		<0.020[<B]
Total Manganese	mg/L	5	0.150	0.020		0.052[<B]
Total Mercury	mg/L	0.01	0.0004	0.0002		<0.0002[<B]
Total Molybdenum	mg/L	5		0.020		<0.020[<A]
Total Nickel	mg/L	2	0.080	0.015		<0.015[<B]
Total Phosphorus	mg/L	10	0.400	0.02		0.05[<B]
Total Selenium	mg/L	1	0.020	0.002		<0.002[<B]
Total Silver	mg/L	5	0.120	0.020		<0.020[<B]
Total Tin	mg/L	5		0.025		<0.025[<A]
Total Titanium	mg/L	5		0.010		0.019[<A]
Total Zinc	mg/L	2	0.040	0.020		<0.020[<B]

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to The Regional Municipality of York - Limits for Sanitary Sewer Discharge [BY-LAW NO.2011-56], B Refers to The Regional Municipality of York - Limits for Storm Sewer Discharge [BY-LAW NO.2011-56]
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Exceedance Summary

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
3086529	CR4-03	ON York SM	York Region Sanitary Sewer Use By-Law - Inorganics	Phenols	mg/L	0.008	0.010
3086529	CR4-03	ON York SM	York Region Sanitary Sewer Use By-Law - Inorganics	Total Suspended Solids	mg/L	15	54

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD
AGAT WORK ORDER: 21T815212
PROJECT: 60636190
ATTENTION TO: Dhwanish Parikh
SAMPLING SITE:Bradford Bypass (BBP)
SAMPLED BY:Dhwanish Parikh

Trace Organics Analysis

RPT Date: Oct 21, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
York Region Sanitary - Organics															
Oil and Grease (animal/vegetable) in water	3080465		< 0.5	< 0.5	NA	< 0.5	81%	70%	130%	104%	70%	130%	113%	70%	130%
Oil and Grease (mineral) in water	3080465		< 0.5	< 0.5	NA	< 0.5	93%	70%	130%	81%	70%	130%	77%	70%	130%
Methylene Chloride	3092058		<0.3	<0.3	NA	< 0.3	114%	50%	140%	107%	60%	130%	112%	50%	140%
trans-1,3-Dichloropropene	3092058		<0.30	<0.30	NA	< 0.30	110%	50%	140%	114%	60%	130%	98%	50%	140%
Methyl Ethyl Ketone	3092058		<0.9	<0.9	NA	< 0.9	95%	50%	140%	102%	50%	140%	104%	50%	140%
cis- 1,2-Dichloroethylene	3092058		<0.2	<0.2	NA	< 0.2	86%	50%	140%	92%	60%	130%	89%	50%	140%
Chloroform	3092058		<0.2	<0.2	NA	< 0.2	89%	50%	140%	93%	60%	130%	104%	50%	140%
Benzene	3092058		<0.2	<0.2	NA	< 0.2	78%	50%	140%	89%	60%	130%	100%	50%	140%
Trichloroethylene	3092058		<0.2	<0.2	NA	< 0.2	90%	50%	140%	99%	60%	130%	108%	50%	140%
Toluene	3092058		<0.2	<0.2	NA	< 0.2	101%	50%	140%	102%	60%	130%	111%	50%	140%
Tetrachloroethene	3092058		<0.1	<0.1	NA	< 0.1	103%	50%	140%	108%	60%	130%	115%	50%	140%
Ethylbenzene	3092058		<0.1	<0.1	NA	< 0.1	115%	50%	140%	104%	60%	130%	113%	50%	140%
1,1,2,2-Tetrachloroethane	3092058		<0.1	<0.1	NA	< 0.1	107%	50%	140%	93%	60%	130%	113%	50%	140%
Styrene	3092058		<0.1	<0.1	NA	< 0.1	103%	50%	140%	97%	60%	130%	109%	50%	140%
1,2-Dichlorobenzene	3092058		<0.1	<0.1	NA	< 0.1	117%	50%	140%	99%	60%	130%	119%	50%	140%
1,4-Dichlorobenzene	3092058		<0.1	<0.1	NA	< 0.1	92%	50%	140%	100%	60%	130%	94%	50%	140%
m & p-Xylene	3092058		<0.2	<0.2	NA	< 0.2	111%	50%	140%	107%	60%	130%	111%	50%	140%
o-Xylene	3092058		<0.1	<0.1	NA	< 0.1	119%	50%	140%	107%	60%	130%	117%	50%	140%
PCBs	3086334		< 0.2	< 0.2	NA	< 0.2	104%	50%	140%	101%	50%	140%	80%	50%	140%
Di-n-butyl phthalate	3026196		< 0.5	< 0.5	0.0%	< 0.5	78%	50%	140%	99%	50%	140%	85%	50%	140%
Bis(2-Ethylhexyl)phthalate	3026196		< 0.5	< 0.5	NA	< 0.5	78%	50%	140%	90%	50%	140%	98%	50%	140%
O. Reg. 153(511) - VOCs (Water)															
Dichlorodifluoromethane	3092058		<0.20	<0.20	NA	< 0.20	99%	50%	140%	108%	50%	140%	103%	50%	140%
Vinyl Chloride	3092058		<0.17	<0.17	NA	< 0.17	98%	50%	140%	109%	50%	140%	104%	50%	140%
Bromomethane	3092058		<0.20	<0.20	NA	< 0.20	98%	50%	140%	95%	50%	140%	101%	50%	140%
Trichlorofluoromethane	3092058		<0.40	<0.40	NA	< 0.40	106%	50%	140%	104%	50%	140%	98%	50%	140%
Acetone	3092058		<1.0	<1.0	NA	< 1.0	98%	50%	140%	104%	50%	140%	102%	50%	140%
1,1-Dichloroethylene	3092058		<0.30	<0.30	NA	< 0.30	88%	50%	140%	103%	60%	130%	93%	50%	140%
Methylene Chloride	3092058		<0.30	<0.30	NA	< 0.30	114%	50%	140%	107%	60%	130%	112%	50%	140%
trans- 1,2-Dichloroethylene	3092058		<0.20	<0.20	NA	< 0.20	111%	50%	140%	110%	60%	130%	105%	50%	140%
Methyl tert-butyl ether	3092058		<0.20	<0.20	NA	< 0.20	110%	50%	140%	108%	60%	130%	110%	50%	140%
1,1-Dichloroethane	3092058		<0.30	<0.30	NA	< 0.30	98%	50%	140%	101%	60%	130%	102%	50%	140%
Methyl Ethyl Ketone	3092058		<1.0	<1.0	NA	< 1.0	95%	50%	140%	102%	50%	140%	104%	50%	140%
cis- 1,2-Dichloroethylene	3092058		<0.20	<0.20	NA	< 0.20	86%	50%	140%	92%	60%	130%	89%	50%	140%
Chloroform	3092058		<0.20	<0.20	NA	< 0.20	89%	50%	140%	93%	60%	130%	104%	50%	140%
1,2-Dichloroethane	3092058		<0.20	<0.20	NA	< 0.20	73%	50%	140%	70%	60%	130%	94%	50%	140%
1,1,1-Trichloroethane	3092058		<0.30	<0.30	NA	< 0.30	87%	50%	140%	101%	60%	130%	94%	50%	140%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Trace Organics Analysis (Continued)

RPT Date: Oct 21, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Carbon Tetrachloride	3092058		<0.20	<0.20	NA	< 0.20	111%	50%	140%	116%	60%	130%	111%	50%	140%
Benzene	3092058		<0.20	<0.20	NA	< 0.20	78%	50%	140%	89%	60%	130%	100%	50%	140%
1,2-Dichloropropane	3092058		<0.20	<0.20	NA	< 0.20	91%	50%	140%	88%	60%	130%	102%	50%	140%
Trichloroethylene	3092058		<0.20	<0.20	NA	< 0.20	90%	50%	140%	99%	60%	130%	108%	50%	140%
Bromodichloromethane	3092058		<0.20	<0.20	NA	< 0.20	112%	50%	140%	107%	60%	130%	113%	50%	140%
Methyl Isobutyl Ketone	3092058		<1.0	<1.0	NA	< 1.0	90%	50%	140%	100%	50%	140%	105%	50%	140%
1,1,2-Trichloroethane	3092058		<0.20	<0.20	NA	< 0.20	118%	50%	140%	96%	60%	130%	114%	50%	140%
Toluene	3092058		<0.20	<0.20	NA	< 0.20	101%	50%	140%	102%	60%	130%	111%	50%	140%
Dibromochloromethane	3092058		<0.10	<0.10	NA	< 0.10	111%	50%	140%	118%	60%	130%	98%	50%	140%
Ethylene Dibromide	3092058		<0.10	<0.10	NA	< 0.10	115%	50%	140%	99%	60%	130%	119%	50%	140%
Tetrachloroethylene	3092058		<0.20	<0.20	NA	< 0.20	103%	50%	140%	108%	60%	130%	115%	50%	140%
1,1,1,2-Tetrachloroethane	3092058		<0.10	<0.10	NA	< 0.10	93%	50%	140%	114%	60%	130%	106%	50%	140%
Chlorobenzene	3092058		<0.10	<0.10	NA	< 0.10	116%	50%	140%	99%	60%	130%	114%	50%	140%
Ethylbenzene	3092058		<0.10	<0.10	NA	< 0.10	115%	50%	140%	104%	60%	130%	113%	50%	140%
m & p-Xylene	3092058		<0.20	<0.20	NA	< 0.20	111%	50%	140%	107%	60%	130%	111%	50%	140%
Bromoform	3092058		<0.10	<0.10	NA	< 0.10	95%	50%	140%	104%	60%	130%	106%	50%	140%
Styrene	3092058		<0.10	<0.10	NA	< 0.10	103%	50%	140%	97%	60%	130%	109%	50%	140%
1,1,2,2-Tetrachloroethane	3092058		<0.10	<0.10	NA	< 0.10	107%	50%	140%	93%	60%	130%	113%	50%	140%
o-Xylene	3092058		<0.10	<0.10	NA	< 0.10	119%	50%	140%	107%	60%	130%	117%	50%	140%
1,3-Dichlorobenzene	3092058		<0.10	<0.10	NA	< 0.10	107%	50%	140%	99%	60%	130%	116%	50%	140%
1,4-Dichlorobenzene	3092058		<0.10	<0.10	NA	< 0.10	92%	50%	140%	100%	60%	130%	94%	50%	140%
1,2-Dichlorobenzene	3092058		<0.10	<0.10	NA	< 0.10	117%	50%	140%	99%	60%	130%	119%	50%	140%
n-Hexane	3092058		<0.20	<0.20	NA	< 0.20	100%	50%	140%	81%	60%	130%	103%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Ultra Trace Analysis

RPT Date: Oct 21, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Nonylphenol and Nonylphenol Ethoxylates (Ontario, mg/L)															
Total Nonylphenol	1	NA	NA	NA	0.0%	< 0.001	NA	60%	140%	89%	60%	140%	NA	60%	140%
NP1EO	1	NA	NA	NA	0.0%	< 0.001	NA	60%	140%	108%	60%	140%	NA	60%	140%
NP2EO	1	NA	NA	NA	0.0%	< 0.0003	NA	60%	140%	120%	60%	140%	NA	60%	140%

Certified By:

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

Water Analysis

RPT Date: Oct 21, 2021

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
York Region Sanitary Sewer Use By-Law - Inorganics															
pH	3086235		7.42	7.44	0.3%	NA	103%	90%	110%						
Total Suspended Solids	3095290		1560	1560	0.0%	< 10	100%	80%	120%						
Fluoride	3090703		<0.05	<0.05	NA	< 0.05	101%	70%	130%	96%	80%	120%	108%	70%	130%
Sulphate	3090703		19.5	19.5	0.0%	< 0.10	100%	70%	130%	100%	80%	120%	108%	70%	130%
Total Cyanide	3083722		<0.002	<0.002	NA	< 0.002	94%	70%	130%	92%	80%	120%	92%	70%	130%
Phenols	3071594		0.016	0.016	0.0%	< 0.001	99%	90%	110%	96%	90%	110%	115%	80%	120%
Total Kjeldahl Nitrogen	3084132		2.71	2.72	0.4%	< 0.10	104%	70%	130%	102%	80%	120%	100%	70%	130%
Total Aluminum	3086587		0.297	0.311	4.6%	< 0.010	92%	70%	130%	102%	80%	120%	102%	70%	130%
Total Antimony	3086587		<0.020	<0.020	NA	< 0.020	101%	70%	130%	102%	80%	120%	105%	70%	130%
Total Arsenic	3086587		<0.015	<0.015	NA	< 0.015	97%	70%	130%	107%	80%	120%	117%	70%	130%
Total Cadmium	3086587		<0.005	<0.005	NA	< 0.005	102%	70%	130%	107%	80%	120%	107%	70%	130%
Total Chromium	3086587		<0.020	<0.020	NA	< 0.020	102%	70%	130%	101%	80%	120%	99%	70%	130%
Total Cobalt	3086587		<0.020	<0.020	NA	< 0.020	96%	70%	130%	109%	80%	120%	100%	70%	130%
Total Copper	3086587		<0.015	<0.015	NA	< 0.015	99%	70%	130%	102%	80%	120%	99%	70%	130%
Total Lead	3086587		<0.020	<0.020	NA	< 0.020	94%	70%	130%	102%	80%	120%	99%	70%	130%
Total Manganese	3086587		0.031	0.035	NA	< 0.020	97%	70%	130%	108%	80%	120%	101%	70%	130%
Total Mercury	3086529	3086529	<0.0002	<0.0002	NA	< 0.0002	99%	70%	130%	104%	80%	120%	92%	70%	130%
Total Molybdenum	3086587		<0.020	<0.020	NA	< 0.020	99%	70%	130%	105%	80%	120%	101%	70%	130%
Total Nickel	3086587		<0.015	<0.015	NA	< 0.015	95%	70%	130%	109%	80%	120%	98%	70%	130%
Total Phosphorus	3083887		2.76	2.68	2.9%	< 0.02	96%	70%	130%	96%	80%	120%	NA	70%	130%
Total Selenium	3086587		0.003	<0.002	NA	< 0.002	107%	70%	130%	112%	80%	120%	119%	70%	130%
Total Silver	3086587		<0.020	<0.020	NA	0.0001	97%	70%	130%	110%	80%	120%	98%	70%	130%
Total Tin	3086587		<0.025	<0.025	NA	< 0.025	98%	70%	130%	103%	80%	120%	103%	70%	130%
Total Titanium	3086587		0.019	0.017	NA	< 0.010	96%	70%	130%	108%	80%	120%	106%	70%	130%
Total Zinc	3086587		<0.020	<0.020	NA	< 0.020	99%	70%	130%	104%	80%	120%	108%	70%	130%
O. Reg. 153(511) - Metals & Inorganics (Water)															
Dissolved Antimony	3084132		<1.0	<1.0	NA	< 1.0	102%	70%	130%	108%	80%	120%	110%	70%	130%
Dissolved Arsenic	3084132		<1.0	<1.0	NA	< 1.0	95%	70%	130%	111%	80%	120%	112%	70%	130%
Dissolved Barium	3084132		32.6	32.2	1.2%	< 2.0	100%	70%	130%	101%	80%	120%	99%	70%	130%
Dissolved Beryllium	3084132		<0.50	<0.50	NA	< 0.50	101%	70%	130%	118%	80%	120%	119%	70%	130%
Dissolved Boron	3084132		310	306	1.3%	< 10.0	101%	70%	130%	110%	80%	120%	119%	70%	130%
Dissolved Cadmium	3084132		<0.20	<0.20	NA	< 0.20	100%	70%	130%	107%	80%	120%	103%	70%	130%
Dissolved Chromium	3084132		<2.0	<2.0	NA	< 2.0	100%	70%	130%	105%	80%	120%	117%	70%	130%
Dissolved Cobalt	3084132		<0.50	<0.50	NA	< 0.50	101%	70%	130%	109%	80%	120%	115%	70%	130%
Dissolved Copper	3084132		1.5	2.1	NA	< 1.0	98%	70%	130%	105%	80%	120%	108%	70%	130%
Dissolved Lead	3084132		<0.50	<0.50	NA	< 0.50	98%	70%	130%	105%	80%	120%	103%	70%	130%
Dissolved Molybdenum	3084132		95.2	112	16.2%	< 0.50	98%	70%	130%	105%	80%	120%	117%	70%	130%
Dissolved Nickel	3084132		<3.0	<3.0	NA	< 3.0	99%	70%	130%	103%	80%	120%	111%	70%	130%
Dissolved Selenium	3084132		2.2	3.0	NA	< 1.0	99%	70%	130%	111%	80%	120%	97%	70%	130%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

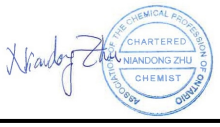
SAMPLED BY:Dhwanish Parikh

Water Analysis (Continued)

RPT Date: Oct 21, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Dissolved Silver	3084132		<0.20	<0.20	NA	< 0.20	101%	70%	130%	106%	80%	120%	102%	70%	130%
Dissolved Thallium	3084132		<0.30	<0.30	NA	< 0.30	98%	70%	130%	107%	80%	120%	107%	70%	130%
Dissolved Uranium	3084132		<0.50	<0.50	NA	< 0.50	92%	70%	130%	105%	80%	120%	110%	70%	130%
Dissolved Vanadium	3084132		<0.40	<0.40	NA	< 0.40	100%	70%	130%	104%	80%	120%	119%	70%	130%
Dissolved Zinc	3084132		<5.0	<5.0	NA	< 5.0	99%	70%	130%	111%	80%	120%	122%	70%	130%
Mercury	3086788		<0.02	<0.02	NA	< 0.02	99%	70%	130%	104%	80%	120%	95%	70%	130%
Chromium VI	3071878		<2.000	<2.000	NA	< 2	98%	70%	130%	104%	80%	120%	105%	70%	130%
Cyanide, Free	3071887		<2	<2	NA	< 2	99%	70%	130%	95%	80%	120%	92%	70%	130%
Dissolved Sodium	3086543	3086543	8640	8570	0.8%	< 50	96%	70%	130%	96%	80%	120%	102%	70%	130%
Chloride	3090703		108000	109000	0.9%	< 100	96%	70%	130%	103%	80%	120%	107%	70%	130%
Electrical Conductivity	3086235		6120	6130	0.2%	< 2	104%	90%	110%						
pH	3086235		7.42	7.44	0.3%	NA	103%	90%	110%						
CBOD5															
Biochemical Oxygen Demand, Carbonaceous	3083995		180	187	3.8%	< 2	97%	70%	130%						

Comments: NA Signifies Not Applicable.
Duplicate NA: results are less than 5X the RDL and RPD will not be calculated.
Matrix spike: Spike level < native concentration. Matrix spike acceptance limits do not apply.

Certified By:



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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Dichlorodifluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromomethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Acetone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl tert-butyl ether	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromodichloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Dibromochloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Chlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromoform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Styrene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
n-Hexane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Oil and Grease (animal/vegetable) in water	VOL-91-5011	EPA SW-846 3510C & SM 5520	GRAVIMETRIC
Oil and Grease (mineral) in water	VOL-91-5011	EPA SW-846 3510C & SM 5520	GRAVIMETRIC
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
trans-1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Methyl Ethyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
cis- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Tetrachloroethene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Styrene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P & T) GC/MS
Xylenes (Total)	VOL-91-5001	EPA SW-846 5230B & 8260	CALCULATION
Toluene-d8	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
PCBs	ORG-91-5112	modified from EPA SW-846 3510 & 8082A	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW846 3510C & 8082A	GC/ECD
Di-n-butyl phthalate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Bis(2-Ethylhexyl)phthalate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
2,4,6-Tribromophenol	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
2-Fluorophenol	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Chrysene-d12	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
phenol-d6 surrogate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Ultra Trace Analysis			
Total Nonylphenol	TOX-151-19003F	ASTM D7065-6	LCMSMS
NP1EO	TOX-151-19003F	ASTM D7065-6	LCMSMS
NP2EO	TOX-151-19003F	ASTM D7065-6	LCMSMS
Total Nonylphenol Ethoxylates	TOX-19003F	ASTM D7065-6	LCMSMS

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Biochemical Oxygen Demand, Carbonaceous	INOR-121-6023	SM 5210 B	INCUBATOR
Dissolved Antimony	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Arsenic	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Barium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Beryllium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Boron	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cadmium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Chromium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cobalt	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Copper	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Lead	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Molybdenum	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Nickel	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Selenium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Silver	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Thallium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Uranium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Vanadium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Zinc	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Chromium VI	INOR-93-6034	modified from SM 3500-CR B	LACHAT FIA
Cyanide, Free	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	TECHNICON AUTO ANALYZER
Dissolved Sodium	MET-93-6105	modified from EPA 6010D	ICP/OES
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Electrical Conductivity	INOR-93-6000	SM 2510 B	PC TITRATE
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Total Suspended Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Total Cyanide	INOR-93-6051	modified from MOECC E3015; SM 4500-CN- A, B, & C	TECHNICON AUTO ANALYZER
Phenols	INOR-93-6072	modified from SM 5530 D	LACHAT FIA

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T815212

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh

SAMPLING SITE:Bradford Bypass (BBP)

SAMPLED BY:Dhwanish Parikh

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Kjeldahl Nitrogen	INOR-93-6048	modified from EPA 351.2 and SM 4500-NORG D	LACHAT FIA
Total Aluminum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tin	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Titanium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

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Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 21T815212

Cooler Quantity: 1 Blk (Free ice)

Arrival Temperatures: 18.0 | 17.4 | 16.9

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: AECOM Canada Ltd.

Contact: Dhanesh Parian / Brian Holden

Address: 105 Commerce Valley Dr W, 7th Floor Markham, ON

Phone: 416 420 5590 Fax:

Reports to be sent to:

1. Email: dhanesh.parian@aecom.com
2. Email: brian.holden@aecom.com

Regulatory Requirements:

(Please check all applicable boxes)

☑ Regulation 153/04 — Table 1 (Indicate One): ☑ Ind/Com ☐ Res/Park ☐ Agriculture

Soil Texture (Check One): ☑ Coarse ☐ Fine

☐ Excess Soils R406 — Table (Indicate One)

☐ Regulation 558

☐ CCME

☑ Sewer Use ☑ Sanitary ☐ Storm — York Region (Region)

☐ Prov. Water Quality Objectives (PWQO)

☐ Other (Indicate One)

Is this submission for a Record of Site Condition? ☐ Yes ☑ No

Report Guideline on Certificate of Analysis: ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply) ☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT

*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 60636190

Site Location: Bradford Bypass (BBP)

Sampled By: Dhanesh Parian

AGAT Quote #: PO:

Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:

Contact:

Address:

Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Analysis columns: Field Filtered - Metals, Hg, CrVI, DOC (Y/N); O. Reg 153: Metals & Inorganics; Metals - ☐ CrVI, ☐ Hg, ☐ HWSB; BTEX, F1-F4 PHCs; Analyze F4G if required ☐ Yes ☐ No; PAHs; PCBs; VOC; O. Reg 558: Landfill Disposal Characterization TCLP: TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs; O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs; Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4; Salt - EC/SAR; York Region Sewer Use; O.Reg 153/04 (M&I, VOC); Potentially Hazardous or High Concentration (Y/N)

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered	York Region Sewer Use	O.Reg 153/04 (M&I, VOC)
CR4-03	Oct 13, 2021	1:20 PM	21	GW			✓	
CR4-03	SAME	1:15 PM	9	GW		✓		✓

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Dhanesh Parian	Oct 13, 2021	3:55	Neil Mamnoor [signature]		

21 OCT 13 4:13PM

Page ____ of ____

Nº: T 125911

DRAFT

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CLIENT NAME: AECOM CANADA LTD
105 Commerce Valley Drive West 7th Floor
MARKHAM, ON L3T7W3
(905) 886-7022
ATTENTION TO: Dhwanish Parikh, Brian Holden
PROJECT: 60636190
AGAT WORK ORDER: 21T834435
TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor
WATER ANALYSIS REVIEWED BY: Yris Verastegui, Report Reviewer
DATE REPORTED: Dec 02, 2021
PAGES (INCLUDING COVER): 28
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
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- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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Certificate of Analysis

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

SAMPLING SITE:

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLED BY:

O. Reg. 153(511) - OC Pesticides + PCBs (Water)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		CV1-01
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-11-24 10:30
Parameter	Unit	G / S	RDL	3246760
Gamma-Hexachlorocyclohexane	ug/L	0.01	0.01	<0.01
Heptachlor	ug/L	0.01	0.01	<0.01
Aldrin	ug/L	0.01	0.01	<0.01
Heptachlor Epoxide	ug/L	0.01	0.01	<0.01
Endosulfan I	µg/L		0.05	<0.05
Endosulfan II	µg/L		0.05	<0.05
Endosulfan	ug/L	0.05	0.05	<0.05
alpha - chlordane	µg/L		0.1	<0.1
gamma-Chlordane	µg/L		0.2	<0.2
Chlordane	ug/L	0.06	0.04	<0.04
op'-DDE	µg/L		0.01	<0.01
pp'-DDE	µg/L		0.01	<0.01
DDE	ug/L		0.01	<0.01
op'-DDD	µg/L		0.05	<0.05
pp'-DDD	µg/L		0.05	<0.05
DDD	ug/L	1.8	0.05	<0.05
op'-DDT	µg/L		0.04	<0.04
pp'-DDT	µg/L		0.05	<0.05
DDT	ug/L		0.04	<0.04
Dieldrin	ug/L	0.05	0.02	<0.02
Endrin	ug/L	0.05	0.05	<0.05
Methoxychlor	ug/L	0.05	0.04	<0.04
Hexachlorobenzene	ug/L	0.01	0.01	<0.01
Hexachlorobutadiene	ug/L	0.01	0.01	<0.01
Hexachloroethane	ug/L	0.01	0.01	<0.01
Aroclor 1242	ug/L		0.1	<0.1
Aroclor 1248	ug/L		0.1	<0.1
Aroclor 1254	ug/L		0.1	<0.1
Aroclor 1260	ug/L		0.1	<0.1

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AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - OC Pesticides + PCBs (Water)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		CV1-01
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-11-24 10:30
Parameter	**Unit**	**G / S**	**RDL**	**3246760**
Polychlorinated Biphenyls	ug/L	0.2	0.1	<0.1
Surrogate	**Unit**	**Acceptable Limits**		
TCMX	%	50-140		83
Decachlorobiphenyl	%	50-140		99

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3246760 DDT total is a calculated parameter. The calculated value is the sum of op'DDT and pp'DDT.
DDD total is a calculated parameter. The calculated value is the sum of op'DDD and pp'DDD.
DDE total is a calculated parameter. The calculated value is the sum of op'DDE and pp'DDE.
Endosulfan total is a calculated parameter. The calculated value is the sum of Endosulfan I and Endosulfan II.
Chlordane total is a calculated parameter. The calculated value is the sum of Alpha-Chlordane and Gamma-Chlordane.
PCB total is a calculated parameter. The calculated value is the sum of Aroclor 1242, Aroclor 1248, Aroclor 1254 and Aroclor 1260.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.

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AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PAHs (Water)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		CV1-01
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-11-24 10:30
Parameter	**Unit**	**G / S**	**RDL**	**3246760**
Naphthalene	µg/L	7	0.20	<0.20
Acenaphthylene	µg/L	1	0.20	<0.20
Acenaphthene	µg/L	4.1	0.20	<0.20
Fluorene	µg/L	120	0.20	<0.20
Phenanthrene	µg/L	0.1	0.10	<0.10
Anthracene	µg/L	0.1	0.10	<0.10
Fluoranthene	µg/L	0.4	0.20	<0.20
Pyrene	µg/L	0.2	0.20	<0.20
Benzo(a)anthracene	µg/L	0.2	0.20	<0.20
Chrysene	µg/L	0.1	0.10	<0.10
Benzo(b)fluoranthene	µg/L	0.1	0.10	<0.10
Benzo(k)fluoranthene	µg/L	0.1	0.10	<0.10
Benzo(a)pyrene	µg/L	0.01	0.01	<0.01
Indeno(1,2,3-cd)pyrene	µg/L	0.2	0.20	<0.20
Dibenz(a,h)anthracene	µg/L	0.2	0.20	<0.20
Benzo(g,h,i)perylene	µg/L	0.2	0.20	<0.20
2-and 1-methyl Naphthalene	µg/L	2	0.20	<0.20
Sediment				No
Surrogate	**Unit**	**Acceptable Limits**		
Naphthalene-d8	%	50-140		78
Acridine-d9	%	50-140		84
Terphenyl-d14	%	50-140		88

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3246760 Note: The result for Benzo(b)Fluoranthene is the total of the Benzo(b)&(j)Fluoranthene isomers because the isomers co-elute on the GC column.
2- and 1-Methyl Naphthalene is a calculated parameter. The calculated value is the sum of 2-Methyl Naphthalene and 1-Methyl Naphthalene. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.
Sediment parameter is comment only based on visual inspection of the sample prior to extraction and is not an accredited test.

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AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs and VOC) (Water)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

				SAMPLE DESCRIPTION:	CV1-01
				SAMPLE TYPE:	Water
				DATE SAMPLED:	2021-11-24 10:30
Parameter	**Unit**	**G / S**	**RDL**	**3246760**	
F1 (C6-C10)	µg/L	420	25	<25	
F1 (C6 to C10) minus BTEX	µg/L	420	25	<25	
F2 (C10 to C16)	µg/L	150	100	<100	
F2 (C10 to C16) minus Naphthalene	µg/L		100	<100	
F3 (C16 to C34)	µg/L	500	100	<100	
F3 (C16 to C34) minus PAHs	µg/L		100	<100	
F4 (C34 to C50)	µg/L	500	100	<100	
Gravimetric Heavy Hydrocarbons	µg/L		500	NA	
Sediment				No	
Surrogate	**Unit**	**Acceptable Limits**			
Toluene-d8	% Recovery	50-140		80.8	
Terphenyl	% Recovery	60-140		84	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3246760 The C6-C10 fraction is calculated using toluene response factor.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX and PAH contributions.
C>10 – C16 (F2- Naphthalene) is a calculated parameter. The calculated value is F2 - Naphthalene.
C>16 - C34 (F3-PAH) is a calculated parameter. The calculated value is F3-PAH (PAH: sum of Phenanthrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-c,d)pyrene and Pyrene).
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Sediment parameter is comment only based on visual inspection of the sample prior to extraction and is not an accredited test.

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AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - VOCs (Water)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		CV1-01
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-11-24 10:30
Parameter	Unit	G / S	RDL	3246760
Dichlorodifluoromethane	µg/L	590	0.20	<0.20
Vinyl Chloride	µg/L	0.5	0.17	<0.17
Bromomethane	µg/L	0.89	0.20	<0.20
Trichlorofluoromethane	µg/L	150	0.40	<0.40
Acetone	µg/L	2700	1.0	<1.0
1,1-Dichloroethylene	µg/L	0.5	0.30	<0.30
Methylene Chloride	µg/L	5	0.30	<0.30
trans- 1,2-Dichloroethylene	µg/L	1.6	0.20	<0.20
Methyl tert-butyl ether	µg/L	15	0.20	<0.20
1,1-Dichloroethane	µg/L	0.5	0.30	<0.30
Methyl Ethyl Ketone	µg/L	400	1.0	<1.0
cis- 1,2-Dichloroethylene	µg/L	1.6	0.20	<0.20
Chloroform	µg/L	2	0.20	<0.20
1,2-Dichloroethane	µg/L	0.5	0.20	<0.20
1,1,1-Trichloroethane	µg/L	0.5	0.30	<0.30
Carbon Tetrachloride	µg/L	0.2	0.20	<0.20
Benzene	µg/L	0.5	0.20	0.40
1,2-Dichloropropane	µg/L	0.5	0.20	<0.20
Trichloroethylene	µg/L	0.5	0.20	<0.20
Bromodichloromethane	µg/L	2	0.20	<0.20
Methyl Isobutyl Ketone	µg/L	640	1.0	<1.0
1,1,2-Trichloroethane	µg/L	0.5	0.20	<0.20
Toluene	µg/L	0.8	0.20	0.49
Dibromochloromethane	µg/L	2	0.10	<0.10
Ethylene Dibromide	µg/L	0.2	0.10	<0.10
Tetrachloroethylene	µg/L	0.5	0.20	<0.20
1,1,1,2-Tetrachloroethane	µg/L	1.1	0.10	<0.10
Chlorobenzene	µg/L	0.5	0.10	<0.10
Ethylbenzene	µg/L	0.5	0.10	<0.10

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Certificate of Analysis

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - VOCs (Water)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		CV1-01
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-11-24 10:30
Parameter	**Unit**	**G / S**	**RDL**	**3246760**
m & p-Xylene	µg/L		0.20	<0.20
Bromoform	µg/L	5	0.10	<0.10
Styrene	µg/L	0.5	0.10	<0.10
1,1,2,2-Tetrachloroethane	µg/L	0.5	0.10	<0.10
o-Xylene	µg/L		0.10	<0.10
1,3-Dichlorobenzene	µg/L	0.5	0.10	<0.10
1,4-Dichlorobenzene	µg/L	0.5	0.10	<0.10
1,2-Dichlorobenzene	µg/L	0.5	0.10	<0.10
1,3-Dichloropropene	µg/L	0.5	0.30	<0.30
Xylenes (Total)	µg/L	72	0.20	<0.20
n-Hexane	µg/L	5	0.20	<0.20
Surrogate	**Unit**	**Acceptable Limits**		
Toluene-d8	% Recovery	50-140		96
4-Bromofluorobenzene	% Recovery	50-140		97

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Ground Water - All Types of Property Uses
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3246760 Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
1,3-Dichloropropene total is a calculated parameter. The calculated value is the sum of Cis-1,3-Dichloropropene and Trans-1,3-Dichloropropene.
The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

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PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

OP Pesticides (Water)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

			SAMPLE DESCRIPTION:	CV1-01
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2021-11-24 10:30
Parameter	**Unit**	**G / S**	**RDL**	**3246760**
Phorate	µg/L		0.5	<0.5
Dimethoate	µg/L		2.5	<2.5
Terbufos	µg/L		0.5	<0.5
Diazinon	µg/L		1	<1
Malathion	µg/L		5	<5
Chlorpyrifos	µg/L		1	<1
Parathion	µg/L		1	<1
Azinphos-methyl	µg/L		2	<2
Surrogate	**Unit**	**Acceptable Limits**		
Triphenyl phosphate (surr)	%	50-140		78

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ODWS - Table D
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3246760 Results relate only to the items tested.

Analysis performed at AGAT Toronto (unless marked by *)

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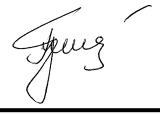

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AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Water)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

					SAMPLE DESCRIPTION:	CV1-01
					SAMPLE TYPE:	Water
					DATE SAMPLED:	2021-11-24 10:30
Parameter	Unit	G / S: A	G / S: B	RDL	3246760	
Dissolved Antimony	µg/L		20	1.0	<1.0	
Dissolved Arsenic	µg/L		100	1.0	4.4[<B]	
Dissolved Barium	µg/L			2.0	344	
Dissolved Beryllium	µg/L		*	0.50	1.28	
Dissolved Boron	µg/L		200	10.0	146[<B]	
Dissolved Cadmium	µg/L		0.2	0.20	0.49[>B]	
Dissolved Chromium	µg/L			2.0	14.9	
Dissolved Cobalt	µg/L		0.9	0.50	13.2[>B]	
Dissolved Copper	µg/L		5	1.0	24.2[>B]	
Dissolved Lead	µg/L		*	0.50	18.5	
Dissolved Molybdenum	µg/L		40	0.50	9.28[<B]	
Dissolved Nickel	µg/L		25	1.0	15.9[<B]	
Dissolved Selenium	µg/L		100	1.0	2.0[<B]	
Dissolved Silver	µg/L		0.1	0.20	<0.20	
Dissolved Thallium	µg/L		0.3	0.30	<0.30	
Dissolved Uranium	µg/L		5	0.50	12.0[>B]	
Dissolved Vanadium	µg/L		6	0.40	37.0[>B]	
Dissolved Zinc	µg/L		30	5.0	64.1[>B]	
Mercury	µg/L		0.2	0.02	<0.02	
Chromium VI	µg/L		1	2.000	<2.000	
Cyanide, Free	µg/L		5	2	<2	
Dissolved Sodium	µg/L			500	142000	
Chloride	µg/L			100	10600	
Electrical Conductivity	uS/cm			2	634	
pH	pH Units		6.5-8.5	NA	8.56	
Lab Filtration mercury					2021/11/26	

Certified By: Iris Verástegui

AGAT Laboratories

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AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Water)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Agricultural or Other Property Use, B Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3246760 Metals analysis completed on a filtered sample.
Dilution required, RDL has been increased accordingly.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verástegui

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AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		CV1-01
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-11-24 10:00
Parameter	**Unit**	**G / S**	**RDL**	**3246757**
Electrical Conductivity	µS/cm		2	641
pH	pH Units	6.5-8.5	NA	**8.56**
Saturation pH (Calculated)				5.14
Langelier Index (Calculated)				3.42
Hardness (as CaCO3) (Calculated)	mg/L		0.5	3230
Total Dissolved Solids	mg/L		10	724
Alkalinity (as CaCO3)	mg/L		5	1730
Bicarbonate (as CaCO3)	mg/L		5	1700
Carbonate (as CaCO3)	mg/L		5	31
Hydroxide (as CaCO3)	mg/L		5	<5
Fluoride	mg/L		0.05	<0.05
Chloride	mg/L		0.10	10.8
Nitrate as N	mg/L		0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05
Bromide	mg/L		0.05	<0.05
Sulphate	mg/L		0.10	28.5
Ortho Phosphate as P	mg/L		0.10	<0.10
Ammonia as N	mg/L		0.02	0.11
Ammonia-Un-ionized (Calculated)	mg/L	0.02	0.000002	0.0172
Total Phosphorus	mg/L	*	1.20	9.74
Total Organic Carbon	mg/L		0.5	64.1
True Colour	TCU		5	221
Turbidity	NTU		0.5	20300
Total Calcium	mg/L		3.2	1080
Total Magnesium	mg/L		3.4	130
Total Potassium	mg/L		11.5	47.3
Total Sodium	mg/L		4.5	182
Aluminum-dissolved	mg/L	*	0.004	1.45
Total Antimony	mg/L	0.020	**0.05**	<0.05

Certified By: Iris Verástegui

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Certificate of Analysis

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		CV1-01
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2021-11-24 10:00
Parameter	**Unit**	**G / S**	**RDL**	**3246757**
Total Arsenic	mg/L	0.1	**0.15**	<0.15
Total Barium	mg/L		0.10	2.29
Total Beryllium	mg/L	*	0.05	<0.05
Total Boron	mg/L	0.2	**0.50**	<0.50
Total Cadmium	mg/L	0.0002	**0.005**	<0.005
Total Chromium	mg/L		0.15	0.51
Total Cobalt	mg/L	0.0009	**0.025**	**0.149**
Total Copper	mg/L	0.005	**0.05**	**0.31**
Total Iron	mg/L	0.3	**0.50**	**378**
Total Lead	mg/L	*	0.05	0.12
Total Manganese	mg/L		0.10	7.44
Dissolved Mercury	mg/L	0.0002	0.0001	<0.0001
Total Molybdenum	mg/L	0.040	**0.10**	<0.10
Total Nickel	mg/L	0.025	**0.15**	**0.37**
Total Selenium	mg/L	0.1	0.10	<0.10
Total Silver	mg/L	0.0001	**0.005**	<0.005
Total Strontium	mg/L		0.25	2.29
Total Thallium	mg/L	0.0003	**0.015**	<0.015
Total Tin	mg/L		0.10	<0.10
Total Titanium	mg/L		0.50	8.34
Total Tungsten	mg/L	0.030	**0.50**	<0.50
Total Uranium	mg/L	0.005	**0.10**	<0.10
Total Vanadium	mg/L	0.006	**0.10**	**0.64**
Total Zinc	mg/L	0.030	**1.00**	<1.00
Total Zirconium	mg/L	0.004	**0.20**	<0.20
Lab Filtration Aluminum Dissolved				Y
Lab Filtration mercury				Y

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AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2021-11-24 **DATE REPORTED: 2021-12-02**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3246757 Dissolved Aluminum and Dissolved Mercury analysis completed on a lab filtered sample.
Dilution required, RDL has been increased accordingly.
Un-ionized Ammonia detection limit is a calculated RDL. The calculation of Un-ionized Ammonia is based on lab measured parameters (ammonia as N, pH and temperature).Values are reported as calculated.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verástegui

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Exceedance Summary

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
3246757	CV1-01	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Cobalt	mg/L	0.0009	0.149
3246757	CV1-01	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Copper	mg/L	0.005	0.31
3246757	CV1-01	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Iron	mg/L	0.3	378
3246757	CV1-01	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Nickel	mg/L	0.025	0.37
3246757	CV1-01	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Vanadium	mg/L	0.006	0.64
3246757	CV1-01	ON PWQO	Water Quality Assessment - PWQO (mg/L)	pH	pH Units	6.5-8.5	8.56
3246760	CV1-01	ON PWQO	O. Reg. 153(511) - Metals & Inorganics (Water)	Dissolved Cadmium	µg/L	0.2	0.49
3246760	CV1-01	ON PWQO	O. Reg. 153(511) - Metals & Inorganics (Water)	Dissolved Cobalt	µg/L	0.9	13.2
3246760	CV1-01	ON PWQO	O. Reg. 153(511) - Metals & Inorganics (Water)	Dissolved Copper	µg/L	5	24.2
3246760	CV1-01	ON PWQO	O. Reg. 153(511) - Metals & Inorganics (Water)	Dissolved Uranium	µg/L	5	12.0
3246760	CV1-01	ON PWQO	O. Reg. 153(511) - Metals & Inorganics (Water)	Dissolved Vanadium	µg/L	6	37.0
3246760	CV1-01	ON PWQO	O. Reg. 153(511) - Metals & Inorganics (Water)	Dissolved Zinc	µg/L	30	64.1
3246760	CV1-01	ON PWQO	O. Reg. 153(511) - Metals & Inorganics (Water)	pH	pH Units	6.5-8.5	8.56

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Dec 02, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - VOCs (Water)															
Dichlorodifluoromethane	3251511		<0.20	<0.20	NA	< 0.20	101%	50%	140%	84%	50%	140%	96%	50%	140%
Vinyl Chloride	3251511		<0.17	<0.17	NA	< 0.17	84%	50%	140%	82%	50%	140%	99%	50%	140%
Bromomethane	3251511		<0.20	<0.20	NA	< 0.20	103%	50%	140%	80%	50%	140%	81%	50%	140%
Trichlorofluoromethane	3251511		<0.40	<0.40	NA	< 0.40	78%	50%	140%	85%	50%	140%	88%	50%	140%
Acetone	3251511		<1.0	<1.0	NA	< 1.0	102%	50%	140%	98%	50%	140%	99%	50%	140%
1,1-Dichloroethylene	3251511		<0.30	<0.30	NA	< 0.30	80%	50%	140%	117%	60%	130%	110%	50%	140%
Methylene Chloride	3251511		<0.30	<0.30	NA	< 0.30	95%	50%	140%	98%	60%	130%	110%	50%	140%
trans- 1,2-Dichloroethylene	3251511		<0.20	<0.20	NA	< 0.20	88%	50%	140%	83%	60%	130%	106%	50%	140%
Methyl tert-butyl ether	3251511		<0.20	<0.20	NA	< 0.20	102%	50%	140%	119%	60%	130%	94%	50%	140%
1,1-Dichloroethane	3251511		<0.30	<0.30	NA	< 0.30	96%	50%	140%	87%	60%	130%	90%	50%	140%
Methyl Ethyl Ketone	3251511		<1.0	<1.0	NA	< 1.0	99%	50%	140%	103%	50%	140%	103%	50%	140%
cis- 1,2-Dichloroethylene	3251511		<0.20	<0.20	NA	< 0.20	114%	50%	140%	95%	60%	130%	81%	50%	140%
Chloroform	3251511		<0.20	<0.20	NA	< 0.20	115%	50%	140%	113%	60%	130%	86%	50%	140%
1,2-Dichloroethane	3251511		<0.20	<0.20	NA	< 0.20	120%	50%	140%	113%	60%	130%	71%	50%	140%
1,1,1-Trichloroethane	3251511		<0.30	<0.30	NA	< 0.30	103%	50%	140%	108%	60%	130%	88%	50%	140%
Carbon Tetrachloride	3251511		<0.20	<0.20	NA	< 0.20	97%	50%	140%	75%	60%	130%	95%	50%	140%
Benzene	3251511		<0.20	<0.20	NA	< 0.20	83%	50%	140%	82%	60%	130%	87%	50%	140%
1,2-Dichloropropane	3251511		<0.20	<0.20	NA	< 0.20	112%	50%	140%	112%	60%	130%	113%	50%	140%
Trichloroethylene	3251511		<0.20	<0.20	NA	< 0.20	117%	50%	140%	104%	60%	130%	84%	50%	140%
Bromodichloromethane	3251511		<0.20	<0.20	NA	< 0.20	110%	50%	140%	87%	60%	130%	115%	50%	140%
Methyl Isobutyl Ketone	3251511		<1.0	<1.0	NA	< 1.0	103%	50%	140%	101%	50%	140%	99%	50%	140%
1,1,2-Trichloroethane	3251511		<0.20	<0.20	NA	< 0.20	118%	50%	140%	118%	60%	130%	98%	50%	140%
Toluene	3251511		0.46	0.46	NA	< 0.20	116%	50%	140%	96%	60%	130%	50%	50%	140%
Dibromochloromethane	3251511		<0.10	<0.10	NA	< 0.10	111%	50%	140%	77%	60%	130%	120%	50%	140%
Ethylene Dibromide	3251511		<0.10	<0.10	NA	< 0.10	114%	50%	140%	110%	60%	130%	116%	50%	140%
Tetrachloroethylene	3251511		<0.20	<0.20	NA	< 0.20	83%	50%	140%	105%	60%	130%	109%	50%	140%
1,1,1,2-Tetrachloroethane	3251511		<0.10	<0.10	NA	< 0.10	109%	50%	140%	106%	60%	130%	109%	50%	140%
Chlorobenzene	3251511		<0.10	<0.10	NA	< 0.10	88%	50%	140%	107%	60%	130%	98%	50%	140%
Ethylbenzene	3251511		<0.10	<0.10	NA	< 0.10	73%	50%	140%	102%	60%	130%	83%	50%	140%
m & p-Xylene	3251511		<0.20	<0.20	NA	< 0.20	100%	50%	140%	105%	60%	130%	88%	50%	140%
Bromoform	3251511		<0.10	<0.10	NA	< 0.10	88%	50%	140%	88%	60%	130%	97%	50%	140%
Styrene	3251511		<0.10	<0.10	NA	< 0.10	81%	50%	140%	86%	60%	130%	76%	50%	140%
1,1,2,2-Tetrachloroethane	3251511		<0.10	<0.10	NA	< 0.10	113%	50%	140%	116%	60%	130%	114%	50%	140%
o-Xylene	3251511		<0.10	<0.10	NA	< 0.10	75%	50%	140%	102%	60%	130%	87%	50%	140%
1,3-Dichlorobenzene	3251511		<0.10	<0.10	NA	< 0.10	72%	50%	140%	92%	60%	130%	80%	50%	140%
1,4-Dichlorobenzene	3251511		<0.10	<0.10	NA	< 0.10	86%	50%	140%	95%	60%	130%	90%	50%	140%
1,2-Dichlorobenzene	3251511		<0.10	<0.10	NA	< 0.10	83%	50%	140%	97%	60%	130%	85%	50%	140%
n-Hexane	3251511		<0.20	<0.20	NA	< 0.20	115%	50%	140%	99%	60%	130%	83%	50%	140%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis (Continued)

RPT Date: Dec 02, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (with PAHs and VOC) (Water)															
F1 (C6-C10)	3245309		<25	<25	NA	< 25	88%	60%	140%	86%	60%	140%	86%	60%	140%
F2 (C10 to C16)	3260916		< 100	< 100	NA	< 100	109%	60%	140%	63%	60%	140%	80%	60%	140%
F3 (C16 to C34)	3260916		< 100	< 100	NA	< 100	106%	60%	140%	61%	60%	140%	69%	60%	140%
F4 (C34 to C50)	3260916		< 100	< 100	NA	< 100	99%	60%	140%	107%	60%	140%	87%	60%	140%
O. Reg. 153(511) - PAHs (Water)															
Naphthalene	3227991		< 0.20	< 0.20	NA	< 0.20	105%	50%	140%	78%	50%	140%	77%	50%	140%
Acenaphthylene	3227991		< 0.20	< 0.20	NA	< 0.20	98%	50%	140%	82%	50%	140%	107%	50%	140%
Acenaphthene	3227991		< 0.20	< 0.20	NA	< 0.20	105%	50%	140%	71%	50%	140%	81%	50%	140%
Fluorene	3227991		< 0.20	< 0.20	NA	< 0.20	86%	50%	140%	92%	50%	140%	92%	50%	140%
Phenanthrene	3227991		< 0.10	< 0.10	NA	< 0.10	98%	50%	140%	88%	50%	140%	85%	50%	140%
Anthracene	3227991		< 0.10	< 0.10	NA	< 0.10	85%	50%	140%	93%	50%	140%	78%	50%	140%
Fluoranthene	3227991		< 0.20	< 0.20	NA	< 0.20	99%	50%	140%	96%	50%	140%	93%	50%	140%
Pyrene	3227991		< 0.20	< 0.20	NA	< 0.20	78%	50%	140%	96%	50%	140%	99%	50%	140%
Benzo(a)anthracene	3227991		< 0.20	< 0.20	NA	< 0.20	96%	50%	140%	94%	50%	140%	96%	50%	140%
Chrysene	3227991		< 0.10	< 0.10	NA	< 0.10	86%	50%	140%	114%	50%	140%	84%	50%	140%
Benzo(b)fluoranthene	3227991		< 0.10	< 0.10	NA	< 0.10	92%	50%	140%	76%	50%	140%	92%	50%	140%
Benzo(k)fluoranthene	3227991		< 0.10	< 0.10	NA	< 0.10	98%	50%	140%	92%	50%	140%	78%	50%	140%
Benzo(a)pyrene	3227991		< 0.01	< 0.01	NA	< 0.01	78%	50%	140%	105%	50%	140%	101%	50%	140%
Indeno(1,2,3-cd)pyrene	3227991		< 0.20	< 0.20	NA	< 0.20	92%	50%	140%	108%	50%	140%	105%	50%	140%
Dibenz(a,h)anthracene	3227991		< 0.20	< 0.20	NA	< 0.20	95%	50%	140%	75%	50%	140%	72%	50%	140%
Benzo(g,h,i)perylene	3227991		< 0.20	< 0.20	NA	< 0.20	91%	50%	140%	85%	50%	140%	105%	50%	140%
O. Reg. 153(511) - OC Pesticides + PCBs (Water)															
Gamma-Hexachlorocyclohexane	3246774		< 0.01	< 0.01	NA	< 0.01	102%	50%	140%	103%	50%	140%	78%	50%	140%
Heptachlor	3246774		< 0.01	< 0.01	NA	< 0.01	109%	50%	140%	107%	50%	140%	88%	50%	140%
Aldrin	3246774		< 0.01	< 0.01	NA	< 0.01	103%	50%	140%	93%	50%	140%	91%	50%	140%
Heptachlor Epoxide	3246774		< 0.01	< 0.01	NA	< 0.01	104%	50%	140%	102%	50%	140%	81%	50%	140%
Endosulfan I	3246774		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	103%	50%	140%	75%	50%	140%
Endosulfan II	3246774		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	100%	50%	140%	79%	50%	140%
alpha - chlordane	3246774		< 0.1	< 0.1	NA	< 0.1	90%	50%	140%	97%	50%	140%	89%	50%	140%
gamma-Chlordane	3246774		< 0.2	< 0.2	NA	< 0.2	96%	50%	140%	89%	50%	140%	105%	50%	140%
op'-DDE	3246774		< 0.01	< 0.01	NA	< 0.01	106%	50%	140%	91%	50%	140%	83%	50%	140%
pp'-DDE	3246774		< 0.01	< 0.01	NA	< 0.01	109%	50%	140%	93%	50%	140%	87%	50%	140%
op'-DDD	3246774		< 0.05	< 0.05	NA	< 0.05	112%	50%	140%	104%	50%	140%	102%	50%	140%
pp'-DDD	3246774		< 0.05	< 0.05	NA	< 0.05	114%	50%	140%	108%	50%	140%	94%	50%	140%
op'-DDT	3246774		< 0.04	< 0.04	NA	< 0.04	102%	50%	140%	88%	50%	140%	87%	50%	140%
pp'-DDT	3246774		< 0.05	< 0.05	NA	< 0.05	104%	50%	140%	85%	50%	140%	84%	50%	140%
Dieldrin	3246774		< 0.02	< 0.02	NA	< 0.02	112%	50%	140%	104%	50%	140%	80%	50%	140%
Endrin	3246774		< 0.05	< 0.05	NA	< 0.05	108%	50%	140%	101%	50%	140%	79%	50%	140%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis (Continued)

RPT Date: Dec 02, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Methoxychlor	3246774		< 0.04	< 0.04	NA	< 0.04	106%	50%	140%		50%	140%	102%	50%	140%
Hexachlorobenzene	3246774		< 0.01	< 0.01	NA	< 0.01	104%	50%	140%	94%	50%	140%	93%	50%	140%
Hexachlorobutadiene	3246774		< 0.01	< 0.01	NA	< 0.01	94%	50%	140%	102%	50%	140%	82%	50%	140%
Hexachloroethane	3246774		< 0.01	< 0.01	NA	< 0.01	83%	50%	140%	99%	50%	140%	79%	50%	140%
Aroclor 1242	3246774		< 0.1	< 0.1	NA	< 0.1	104%	60%	140%	NA	60%	140%	NA	60%	140%
Aroclor 1248	3246774		< 0.1	< 0.1	NA	< 0.1	106%	60%	140%	NA	60%	140%	NA	60%	140%
Aroclor 1254	3246774		< 0.1	< 0.1	NA	< 0.1	102%	60%	140%	NA	60%	140%	NA	60%	140%
Aroclor 1260	3246774		< 0.1	< 0.1	NA	< 0.1	98%	60%	140%	NA	60%	140%	NA	60%	140%
Polychlorinated Biphenyls	3246774		< 0.1	< 0.1	NA	< 0.1	96%	60%	140%	98%	60%	140%	80%	60%	140%
OP Pesticides (Water)															
Phorate	3223838		< 0.5	< 0.5	NA	< 0.5	108%	50%	140%	87%	50%	140%	104%	50%	140%
Dimethoate	3223838		< 2.5	< 2.5	NA	< 2.5	98%	50%	140%	85%	50%	140%	82%	50%	140%
Terbufos	3223838		< 0.5	< 0.5	NA	< 0.5	86%	50%	140%	93%	50%	140%	93%	50%	140%
Diazinon	3223838		< 1	< 1	NA	< 1	99%	50%	140%	91%	50%	140%	94%	50%	140%
Malathion	3223838		< 5	< 5	NA	< 5	83%	50%	140%	75%	50%	140%	98%	50%	140%
Chlorpyrifos	3223838		< 1	< 1	NA	< 1	92%	50%	140%	98%	50%	140%	78%	50%	140%
Parathion	3223838		< 1	< 1	NA	< 1	105%	50%	140%	82%	50%	140%	85%	50%	140%
Azinphos-methyl	3223838		< 2	< 2	NA	< 2	98%	50%	140%	99%	50%	140%	93%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Dec 02, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Water)															
Dissolved Antimony	3245213		<1.0	<1.0	NA	< 1.0	97%	70%	130%	99%	80%	120%	98%	70%	130%
Dissolved Arsenic	3245213		<1.0	<1.0	NA	< 1.0	95%	70%	130%	96%	80%	120%	115%	70%	130%
Dissolved Barium	3245213		94.6	93.1	1.6%	< 2.0	101%	70%	130%	105%	80%	120%	102%	70%	130%
Dissolved Beryllium	3245213		<0.50	<0.50	NA	< 0.50	103%	70%	130%	110%	80%	120%	111%	70%	130%
Dissolved Boron	3245213		208	219	5.2%	< 10.0	103%	70%	130%	104%	80%	120%	112%	70%	130%
Dissolved Cadmium	3245213		<0.20	<0.20	NA	< 0.20	98%	70%	130%	103%	80%	120%	105%	70%	130%
Dissolved Chromium	3245213		<2.0	<2.0	NA	< 2.0	100%	70%	130%	103%	80%	120%	104%	70%	130%
Dissolved Cobalt	3245213		0.77	0.67	NA	< 0.50	102%	70%	130%	111%	80%	120%	104%	70%	130%
Dissolved Copper	3245213		1.4	1.2	NA	< 1.0	104%	70%	130%	110%	80%	120%	105%	70%	130%
Dissolved Lead	3245213		<0.50	<0.50	NA	< 0.50	97%	70%	130%	103%	80%	120%	101%	70%	130%
Dissolved Molybdenum	3245213		4.62	4.89	5.7%	< 0.50	99%	70%	130%	101%	80%	120%	113%	70%	130%
Dissolved Nickel	3245213		1.8	1.7	NA	< 1.0	105%	70%	130%	111%	80%	120%	104%	70%	130%
Dissolved Selenium	3245213		1.0	<1.0	NA	< 1.0	102%	70%	130%	107%	80%	120%	127%	70%	130%
Dissolved Silver	3245213		<0.20	<0.20	NA	< 0.20	100%	70%	130%	105%	80%	120%	103%	70%	130%
Dissolved Thallium	3245213		<0.30	<0.30	NA	< 0.30	103%	70%	130%	108%	80%	120%	106%	70%	130%
Dissolved Uranium	3245213		1.84	1.76	NA	< 0.50	99%	70%	130%	102%	80%	120%	105%	70%	130%
Dissolved Vanadium	3245213		1.13	1.09	NA	< 0.40	97%	70%	130%	101%	80%	120%	102%	70%	130%
Dissolved Zinc	3245213		<5.0	<5.0	NA	< 5.0	99%	70%	130%	104%	80%	120%	107%	70%	130%
Mercury	3259145		<0.02	<0.02	NA	< 0.02	104%	70%	130%	101%	80%	120%	97%	70%	130%
Chromium VI	3241136		<2.000	<2.000	NA	< 2	100%	70%	130%	98%	80%	120%	107%	70%	130%
Cyanide, Free	3229156		<2	<2	NA	< 2	96%	70%	130%	92%	80%	120%	98%	70%	130%
Dissolved Sodium	3232930		1480	1500	1.3%	< 50	102%	70%	130%	100%	80%	120%	105%	70%	130%
Chloride	3246768		7770	7680	1.2%	< 100	95%	70%	130%	102%	80%	120%	100%	70%	130%
Electrical Conductivity	3245263		1700	1710	0.6%	< 2	103%	90%	110%						
pH	3245263		7.61	7.73	1.6%	NA	103%	90%	110%						
Water Quality Assessment - PWQO (mg/L)															
Electrical Conductivity	3245263		1700	1710	0.6%	< 2	103%	90%	110%						
pH	3245263		7.61	7.73	1.6%	NA	103%	90%	110%						
Total Dissolved Solids	3245104		532	538	1.1%	< 10	100%	80%	120%						
Alkalinity (as CaCO3)	3245263		337	347	2.9%	< 5	88%	80%	120%						
Bicarbonate (as CaCO3)	3245263		337	347	2.9%	< 5	NA								
Carbonate (as CaCO3)	3245263		<5	<5	NA	< 5	NA								
Hydroxide (as CaCO3)	3245263		<5	<5	NA	< 5	NA								
Fluoride	3246768		<0.05	<0.05	NA	< 0.05	113%	70%	130%	104%	80%	120%	95%	70%	130%
Chloride	3246768		7.77	7.68	1.2%	< 0.10	95%	70%	130%	102%	80%	120%	100%	70%	130%
Nitrate as N	3246768		<0.05	<0.05	NA	< 0.05	92%	70%	130%	101%	80%	120%	102%	70%	130%
Nitrite as N	3246768		<0.05	<0.05	NA	< 0.05	100%	70%	130%	100%	80%	120%	100%	70%	130%
Bromide	3246768		<0.05	<0.05	NA	< 0.05	101%	70%	130%	101%	80%	120%	95%	70%	130%
Sulphate	3246768		148	146	1.4%	< 0.10	94%	70%	130%	101%	80%	120%	NA	70%	130%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Dec 02, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Ortho Phosphate as P	3246768		<0.10	<0.10	NA	< 0.10	104%	70%	130%	92%	80%	120%	91%	70%	130%
Ammonia as N	3247832		<0.02	<0.02	NA	< 0.02	105%	70%	130%	101%	80%	120%	86%	70%	130%
Total Phosphorus	3268646		<0.02	<0.02	NA	< 0.02	96%	70%	130%	94%	80%	120%	97%	70%	130%
Total Organic Carbon	3229156		12.3	12.5	1.6%	< 0.5	98%	90%	110%	104%	90%	110%	98%	80%	120%
True Colour	3249207		<5	<5	NA	< 5	102%	90%	110%						
Turbidity	3245073		1.0	1.0	NA	< 0.5	101%	80%	120%						
Total Calcium	3262134		14.0	13.7	2.2%	< 0.10	96%	70%	130%	99%	80%	120%	99%	70%	130%
Total Magnesium	3262134		13.6	13.4	1.5%	< 0.10	98%	70%	130%	103%	80%	120%	100%	70%	130%
Total Potassium	3262134		8.44	8.45	0.1%	< 0.50	98%	70%	130%	103%	80%	120%	98%	70%	130%
Total Sodium	3262134		89.5	88.7	0.9%	< 0.10	99%	70%	130%	104%	80%	120%	103%	70%	130%
Aluminum-dissolved	3254779		<0.004	<0.004	NA	< 0.004	103%	70%	130%	109%	80%	120%	107%	70%	130%
Total Antimony	3269822		<0.001	<0.001	NA	< 0.001	102%	70%	130%	99%	80%	120%	104%	70%	130%
Total Arsenic	3269822		<0.003	<0.003	NA	< 0.003	98%	70%	130%	106%	80%	120%	106%	70%	130%
Total Barium	3269822		0.010	0.011	9.5%	< 0.002	102%	70%	130%	99%	80%	120%	103%	70%	130%
Total Beryllium	3269822		<0.001	<0.001	NA	< 0.001	99%	70%	130%	102%	80%	120%	106%	70%	130%
Total Boron	3269822		<0.010	0.010	NA	< 0.010	98%	70%	130%	102%	80%	120%	102%	70%	130%
Total Cadmium	3269822		<0.0001	<0.0001	NA	< 0.0001	100%	70%	130%	101%	80%	120%	106%	70%	130%
Total Chromium	3269822		<0.003	<0.003	NA	< 0.003	101%	70%	130%	102%	80%	120%	99%	70%	130%
Total Cobalt	3269822		<0.0005	<0.0005	NA	< 0.0005	104%	70%	130%	102%	80%	120%	100%	70%	130%
Total Copper	3269822		0.031	0.036	14.9%	< 0.001	99%	70%	130%	100%	80%	120%	105%	70%	130%
Total Iron	3269822		0.012	0.010	NA	< 0.010	104%	70%	130%	99%	80%	120%	97%	70%	130%
Total Lead	3269822		<0.001	<0.001	NA	< 0.001	99%	70%	130%	100%	80%	120%	102%	70%	130%
Total Manganese	3269822		<0.002	<0.002	NA	< 0.002	104%	70%	130%	100%	80%	120%	104%	70%	130%
Dissolved Mercury	3253322		<0.0001	<0.0001	NA	< 0.0001	99%	70%	130%	102%	80%	120%	96%	70%	130%
Total Molybdenum	3269822		<0.002	<0.002	NA	< 0.002	101%	70%	130%	104%	80%	120%	110%	70%	130%
Total Nickel	3269822		<0.003	<0.003	NA	< 0.003	104%	70%	130%	103%	80%	120%	102%	70%	130%
Total Selenium	3269822		<0.002	<0.002	NA	< 0.002	99%	70%	130%	106%	80%	120%	108%	70%	130%
Total Silver	3269822		<0.0001	<0.0001	NA	< 0.0001	101%	70%	130%	103%	80%	120%	104%	70%	130%
Total Strontium	3269822		0.021	0.028	NA	< 0.005	99%	70%	130%	97%	80%	120%	106%	70%	130%
Total Thallium	3269822		<0.0003	<0.0003	NA	< 0.0003	96%	70%	130%	101%	80%	120%	104%	70%	130%
Total Tin	3269822		<0.002	<0.002	NA	< 0.002	103%	70%	130%	100%	80%	120%	104%	70%	130%
Total Titanium	3269822		<0.010	<0.010	NA	< 0.010	101%	70%	130%	90%	80%	120%	93%	70%	130%
Total Tungsten	3269822		<0.010	<0.010	NA	< 0.010	102%	70%	130%	98%	80%	120%	105%	70%	130%
Total Uranium	3269822		<0.002	<0.002	NA	< 0.002	100%	70%	130%	104%	80%	120%	105%	70%	130%
Total Vanadium	3269822		<0.002	<0.002	NA	< 0.002	105%	70%	130%	102%	80%	120%	104%	70%	130%
Total Zinc	3269822		<0.020	<0.020	NA	< 0.020	102%	70%	130%	107%	80%	120%	115%	70%	130%
Total Zirconium	3269822		<0.004	<0.004	NA	< 0.004	101%	70%	130%	104%	80%	120%	105%	70%	130%

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Dec 02, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: NA signifies Not Applicable.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.
Matrix spike: Spike level < native concentration. Matrix spike acceptance limits do not apply.

Certified By: Iris Verástegui

AGAT Laboratories

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Method Summary

CLIENT NAME: AECOM CANADA LTD

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SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Gamma-Hexachlorocyclohexane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Heptachlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Aldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Heptachlor Epoxide	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan I	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan II	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
alpha - chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
gamma-Chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
Dieldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Methoxychlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachlorobenzene	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachlorobutadiene	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachloroethane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Aroclor 1242	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Aroclor 1248	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD

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Method Summary

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SAMPLING SITE:

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Aroclor 1254	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Aroclor 1260	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Polychlorinated Biphenyls	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
TCMX	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Naphthalene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Acenaphthylene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Acenaphthene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Fluorene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Phenanthrene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Anthracene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Fluoranthene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Pyrene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(a)anthracene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Chrysene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(b)fluoranthene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(k)fluoranthene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(a)pyrene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Dibenz(a,h)anthracene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(g,h,i)perylene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
2-and 1-methyl Naphthalene	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Naphthalene-d8	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Acridine-d9	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Terphenyl-d14	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Sediment			
F1 (C6-C10)	VOL-91-5010	modified from MOE PHC-E3421	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5010	modified from MOE PHC-E3421	P&T GC/FID
Toluene-d8	VOL-91-5010	modified from MOE PHC-E3421	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
F2 (C10 to C16) minus Naphthalene	VOL-91-5010	modified from MOE PHC-E3421	GC/FID

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
F3 (C16 to C34)	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
F3 (C16 to C34) minus PAHs	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
F4 (C34 to C50)	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5010	modified from MOE PHC-E3421	BALANCE
Terphenyl	VOL-91-5010	modified from MOE PHC-E3421	GC/FID
Dichlorodifluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromomethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Acetone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl tert-butyl ether	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromodichloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Dibromochloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

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http://www.agatlabs.com

Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Tetrachloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromoform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Styrene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
n-Hexane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Phorate	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Dimethoate	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Terbufos	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Diazinon	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Malathion	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Chlorpyrifos	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Parathion	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Azinphos-methyl	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS
Triphenyl phosphate (surr)	ORG-91-5103	modified from EPA SW-846 3510C, 8141B & 8270E	GC/MS

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Dissolved Antimony	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Arsenic	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Barium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Beryllium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Boron	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cadmium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Chromium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cobalt	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Copper	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Lead	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Molybdenum	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Nickel	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Selenium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Silver	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Thallium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Uranium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Vanadium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Zinc	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Chromium VI	INOR-93-6034	modified from SM 3500-CR B	LACHAT FIA
Cyanide, Free	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	TECHNICON AUTO ANALYZER
Dissolved Sodium	MET-93-6105	modified from EPA 6010D	ICP/OES
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Electrical Conductivity	INOR-93-6000	SM 2510 B	PC TITRATE
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Lab Filtration mercury	SR-78-9001		FILTRATION
Electrical Conductivity	INOR-93-6000	modified from SM 2510 B	PC TITRATE
Saturation pH (Calculated)		SM 2320 B	CALCULATION
Langelier Index (Calculated)		SM 2330B	CALCULATION
Hardness (as CaCO3) (Calculated)	MET-93-6105	modified from EPA SW-846 6010C & 200.7 & SM 2340 B	CALCULATION
Total Dissolved Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Alkalinity (as CaCO3)	INOR-93-6000	Modified from SM 2320 B	PC TITRATE

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FAX (905)712-5122
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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Bicarbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Carbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Hydroxide (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ortho Phosphate as P	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	modified from SM 4500-NH3 H	LACHAT FIA
Ammonia-Un-ionized (Calculated)		MOE REFERENCE, PWQOs Tab 2	CALCULATION
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Total Organic Carbon	INOR-93-6049	modified from SM 5310 B	SHIMADZU CARBON ANALYZER
True Colour	INOR-93-6074	modified from SM 2120 B	LACHAT FIA
Turbidity	INOR-93-6044	modified from SM 2130 B	NEPHELOMETER
Total Calcium	MET-93-6105	modified from EPA 6010D	ICP/OES
Total Magnesium	MET-93-6105	modified from EPA 6010D	ICP/OES
Total Potassium	MET-93-6105	modified from EPA 6010D	ICP/OES
Total Sodium	MET-93-6105	modified from EPA 6010D	ICP/OES
Aluminum-dissolved	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Barium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Beryllium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Boron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Iron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Dissolved Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

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Method Summary

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 21T834435

PROJECT: 60636190

ATTENTION TO: Dhwanish Parikh, Brian Holden

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Strontium	INOR-93-6003	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Thallium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tin	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Titanium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tungsten	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Uranium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Vanadium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zirconium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Lab Filtration Aluminum Dissolved	SR-78-9001		FILTRATION

AGAT Laboratories

Twb

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
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webearth.agatlabs.com

Laboratory Use Only

Work Order #: 21T834435

Cooler Quantity: 1 large

Arrival Temperatures: 2.6 | 3.4 | 3.2

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes: Rec Ref

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: AECOM Canada Ltd.
Contact: Dhwanish Parikh / Brian Holden
Address: 105 Commerce Valley Dr W, 7th floor Markham, ON
Phone: 416 420 5590 Fax:
Reports to be sent to:
1. Email: dhwanish.parikh@aecom.com
2. Email: Brian.Holden@aecom.com

Regulatory Requirements:

(Please check all applicable boxes)

☑ Regulation 153/04 — Table 1 (Indicate One) ☑ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One): ☑ Coarse ☐ Fine
☐ Excess Soils R406 — Table ___ (Indicate One)
☐ Regulation 558
☐ CCME
☐ Sewer Use ☐ Sanitary ☐ Storm — Region ___
☑ Prov. Water Quality Objectives (PWQO)
☐ Other ___ (Indicate One)

Is this submission for a Record of Site Condition? ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 60636190
Site Location: Bradford Bypass (BBP)
Sampled By: Dhwanish Parikh
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	BTEX, F1-F4 PHCs / Analyze F4G if required ☐ Yes ☐ No	PAHs	PCBs	VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	+ PWQO (WDM)	O. Reg. 153/04 → MBI, VOCs, BTEX PHC, PAH's, PCB, OCP/OPP	Potentially Hazardous or High Concentration (Y/N)
CVI-01	Nov 24, 2021	10:00 AM	8	GW													+		
CVI-01	Nov 24, 2021	10:30 AM	20	GW		Y												X	

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Dhwanish Parikh	12:00 pm	Nov 24, 2021	HEAC 9 28		

21 NOV 24 1:45PM

Page ___ of ___

Nº: T 125908

Appendix F

Dewatering Calculations

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *9+900 to 9+950 New Ditch RT and LT*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	4.6	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		260.11	m	<< *From BH Information* >>
Target Water Level:		259.00	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		256.00	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	4.1	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	1.8	m	
Hydraulic Conductivity:	K =	2.1E-06	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	14.3	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	1.8	m	
Width of Trench:	a =	3.50	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	4.6	m	
Equivalent Well Radius:	r_s =	1.8	m	
Saturated Thickness before Dewatering:	H =	4.1	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	2.1E-06	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	4.6	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	2.3E-04	m^3/s	
	Q =	20,242	L/day	
	Q_3 =	60,726	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	24,291	L/day
80% Effectiveness	Q_3 =	12,145	L/day

REFERENCES:

1. Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.

2. Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

3. Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *9+900 to 9+950 New Ditch RT and LT*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		<< *Determine from Table 2.4 Below* >>
Saturated Excavation Length:	x =	50	m	<< *Import From Dewatering Calc's* >>
Saturated Excavation Width:	y =	3.5	m	<< *Import From Dewatering Calc's* >>
Radius of Influence:	R_o =	4.6		<< *Import From Dewatering Calc's* >>
Depth of Dewatering:	H-h =	1.1	m	<< *Import From Dewatering Calc's* >>
Pi:	π =	3.1416		
Overburden Storage:	V_s =	235	m^3	
		235,470	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *9+950 to 10+000 New Ditch RT and LT*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	5.3	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		258.00	m	<< *From BH Information* >>
Target Water Level:		256.60	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		253.60	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	4.4	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	1.8	m	
Hydraulic Conductivity:	K =	2.1E-06	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	14.3	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	1.8	m	
Width of Trench:	a =	3.50	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	5.3	m	
Equivalent Well Radius:	r_s =	1.8	m	
Saturated Thickness before Dewatering:	H =	4.4	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	2.1E-06	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	5.3	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	2.7E-04	m^3/s	
	Q =	22,913	L/day	
	Q_3 =	68,738	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	27,495	L/day
80% Effectiveness	Q_3 =	13,748	L/day

REFERENCES:

1. *Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.*
2. *Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.*
3. *Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.*

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *9+950 to 10+000 New Ditch RT and LT*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		<< *Determine from Table 2.4 Below* >>
Saturated Excavation Length:	x =	50	m	<< *Import From Dewatering Calc's* >>
Saturated Excavation Width:	y =	3.5	m	<< *Import From Dewatering Calc's* >>
Radius of Influence:	R_o =	5.3		<< *Import From Dewatering Calc's* >>
Depth of Dewatering:	H-h =	1.4	m	<< *Import From Dewatering Calc's* >>
Pi:	π =	3.1416		
Overburden Storage:	V_s =	328	m^3	
		327,883	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *10+000 to 10+050 New Ditch RT and LT*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	7.6	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		256.00	m	<< *From BH Information* >>
Target Water Level:		253.70	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		250.70	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	5.3	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	1.8	m	
Hydraulic Conductivity:	K =	2.1E-06	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	14.3	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	1.8	m	
Width of Trench:	a =	3.50	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	7.6	m	
Equivalent Well Radius:	r_s =	1.8	m	
Saturated Thickness before Dewatering:	H =	5.3	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	2.1E-06	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	7.6	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	3.5E-04	m^3/s	
	Q =	30,074	L/day	
	Q_3 =	90,222	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	36,089	L/day
80% Effectiveness	Q_3 =	18,044	L/day

REFERENCES:

1. Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.

2. Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

3. Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *10+000 to 10+050 New Ditch RT and LT*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3)) * (H-h) * n$				
Effective Porosity:	n =	0.5		<< *Determine from Table 2.4 Below* >>
Saturated Excavation Length:	x =	50	m	<< *Import From Dewatering Calc's* >>
Saturated Excavation Width:	y =	3.5	m	<< *Import From Dewatering Calc's* >>
Radius of Influence:	R_o =	7.6		<< *Import From Dewatering Calc's* >>
Depth of Dewatering:	H-h =	2.3	m	<< *Import From Dewatering Calc's* >>
Pi:	π =	3.1416		
Overburden Storage:	V_s =	704	m^3	
		704,396	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *10+050 to 10+100 New Ditch RT and LT*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	4.5	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		253.54	m	<< *From BH Information* >>
Target Water Level:		251.30	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		248.30	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	5.2	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	1.8	m	
Hydraulic Conductivity:	K =	4.9E-07	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	14.3	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	1.8	m	
Width of Trench:	a =	3.50	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	4.5	m	
Equivalent Well Radius:	r_s =	1.8	m	
Saturated Thickness before Dewatering:	H =	5.2	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	4.9E-07	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	4.5	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	1.3E-04	m^3/s	
	Q =	11,265	L/day	
	Q_3 =	33,795	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	13,518	L/day
80% Effectiveness	Q_3 =	6,759	L/day

REFERENCES:

1. *Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.*
2. *Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.*
3. *Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.*

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *10+050 to 10+100 New Ditch RT and LT*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		<< *Determine from Table 2.4 Below* >>
Saturated Excavation Length:	x =	50	m	<< *Import From Dewatering Calc's* >>
Saturated Excavation Width:	y =	3.5	m	<< *Import From Dewatering Calc's* >>
Radius of Influence:	R_o =	4.5		<< *Import From Dewatering Calc's* >>
Depth of Dewatering:	H-h =	2.2	m	<< *Import From Dewatering Calc's* >>
Pi:	π =	3.1416		
Overburden Storage:	V_s =	471	m^3	
		470,978	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *10+100 to 10+150 New Ditch RT and LT*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	1.8	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		250.19	m	<< *From BH Information* >>
Target Water Level:		249.90	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		246.90	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	3.3	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	1.8	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	14.3	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	1.8	m	
Width of Trench:	a =	3.50	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	1.8	m	
Equivalent Well Radius:	r_s =	1.8	m	
Saturated Thickness before Dewatering:	H =	3.3	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	1.8	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	2.3E-06	m^3/s	
	Q =	201	L/day	
	Q_3 =	602	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	241	L/day
80% Effectiveness	Q_3 =	120	L/day

REFERENCES:

1. *Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.*
2. *Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.*
3. *Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.*

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *10+100 to 10+150 New Ditch RT and LT*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		<< *Determine from Table 2.4 Below* >>
Saturated Excavation Length:	x =	50	m	<< *Import From Dewatering Calc's* >>
Saturated Excavation Width:	y =	3.5	m	<< *Import From Dewatering Calc's* >>
Radius of Influence:	R_o =	1.8		<< *Import From Dewatering Calc's* >>
Depth of Dewatering:	H-h =	0.3	m	<< *Import From Dewatering Calc's* >>
Pi:	π =	3.1416		
Overburden Storage:	V_s =	39	m^3	
		38,898	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *10+150 to 10+200 New Ditch RT*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	1.8	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		250.19	m	<< *From BH Information* >>
Target Water Level:		249.90	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		246.90	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	3.3	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	1.8	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	14.3	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	1.8	m	
Width of Trench:	a =	3.50	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	1.8	m	
Equivalent Well Radius:	r_s =	1.8	m	
Saturated Thickness before Dewatering:	H =	3.3	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	1.8	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	2.3E-06	m^3/s	
	Q =	201	L/day	
	Q_3 =	602	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	241	L/day
80% Effectiveness	Q_3 =	120	L/day

REFERENCES:

1. Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.

2. Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

3. Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *10+150 to 10+200 New Ditch RT*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		<< *Determine from Table 2.4 Below* >>
Saturated Excavation Length:	x =	50	m	<< *Import From Dewatering Calc's* >>
Saturated Excavation Width:	y =	3.5	m	<< *Import From Dewatering Calc's* >>
Radius of Influence:	R_o =	1.8		<< *Import From Dewatering Calc's* >>
Depth of Dewatering:	H-h =	0.3	m	<< *Import From Dewatering Calc's* >>
Pi:	π =	3.1416		
Overburden Storage:	V_s =	39	m^3	
		38,898	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *10+200 to 10+250 New Ditch RT*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	1.9	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		250.19	m	<< *From BH Information* >>
Target Water Level:		249.50	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		246.50	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	3.7	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	1.8	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	14.3	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	1.8	m	
Width of Trench:	a =	3.50	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	1.9	m	
Equivalent Well Radius:	r_s =	1.8	m	
Saturated Thickness before Dewatering:	H =	3.7	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	1.9	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	3.1E-06	m^3/s	
	Q =	270	L/day	
	Q_3 =	809	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	323	L/day
80% Effectiveness	Q_3 =	162	L/day

REFERENCES:

1. Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.

2. Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

3. Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *10+200 to 10+250 New Ditch RT*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		<< *Determine from Table 2.4 Below* >>
Saturated Excavation Length:	x =	50	m	<< *Import From Dewatering Calc's* >>
Saturated Excavation Width:	y =	3.5	m	<< *Import From Dewatering Calc's* >>
Radius of Influence:	R_o =	1.9		<< *Import From Dewatering Calc's* >>
Depth of Dewatering:	H-h =	0.7	m	<< *Import From Dewatering Calc's* >>
Pi:	π =	3.1416		
Overburden Storage:	V_s =	94	m^3	
		93,768	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *10+250 to 10+300 New Ditch RT*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	2.1	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		250.19	m	<< From BH Information >>
Target Water Level:		248.10	m	<< From BH Information >>
Approximate Aquifer Bottom:		245.10	m	<< Assumed as 3m Below Target >>
Saturated Thickness before Dewatering:	H =	5.1	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	1.8	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	<< From SWRT Data >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	14.3	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	1.8	m	
Width of Trench:	a =	3.50	m	<< From Project Dwgs >>
Length of Trench:	x =	50.00	m	<< From Project Dwgs >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	2.1	m	
Equivalent Well Radius:	r_s =	1.8	m	
Saturated Thickness before Dewatering:	H =	5.1	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	2.1	m	<< Measured Distance or R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	6.2E-06	m^3/s	
	Q =	532	L/day	
	Q_3 =	1,595	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	638	L/day
80% Effectiveness	Q_3 =	319	L/day

REFERENCES:

1. *Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.*
2. *Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.*
3. *Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.*

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *10+250 to 10+300 New Ditch RT*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		<< *Determine from Table 2.4 Below* >>
Saturated Excavation Length:	x =	50	m	<< *Import From Dewatering Calc's* >>
Saturated Excavation Width:	y =	3.5	m	<< *Import From Dewatering Calc's* >>
Radius of Influence:	R_o =	2.1		<< *Import From Dewatering Calc's* >>
Depth of Dewatering:	H-h =	2.1	m	<< *Import From Dewatering Calc's* >>
Pi:	π =	3.1416		
Overburden Storage:	V_s =	297	m^3	
		297,012	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *10+300 to 10+350 New Ditch RT*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	2.1	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		250.19	m	<< *From BH Information* >>
Target Water Level:		248.00	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		245.00	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	5.2	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	1.8	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	14.3	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	1.8	m	
Width of Trench:	a =	3.50	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	2.1	m	
Equivalent Well Radius:	r_s =	1.8	m	
Saturated Thickness before Dewatering:	H =	5.2	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	8.8E-09	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	2.1	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	6.4E-06	m^3/s	
	Q =	552	L/day	
	Q_3 =	1,655	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	662	L/day
80% Effectiveness	Q_3 =	331	L/day

REFERENCES:

1. *Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.*
2. *Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.*
3. *Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.*

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *10+300 to 10+350 New Ditch RT*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		*<< Determine from Table 2.4 Below >>*
Saturated Excavation Length:	x =	50	m	*<< Import From Dewatering Calc's >>*
Saturated Excavation Width:	y =	3.5	m	*<< Import From Dewatering Calc's >>*
Radius of Influence:	R_o =	2.1		*<< Import From Dewatering Calc's >>*
Depth of Dewatering:	H-h =	2.2	m	*<< Import From Dewatering Calc's >>*
Pi:	π =	3.1416		
Overburden Storage:	V_s =	312	m^3	
		312,200	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *CR4 Underpass Structure - Future BBP EB*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	15.2	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		253.50	m	<< *From BH Information* >>
Target Water Level:		248.00	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		245.00	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	8.5	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	8.5	m	
Hydraulic Conductivity:	K =	4.9E-07	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	2.9	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	8.5	m	
Width of Trench:	a =	17.00	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	15.2	m	
Equivalent Well Radius:	r_s =	8.5	m	
Saturated Thickness before Dewatering:	H =	8.5	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	4.9E-07	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	15.2	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	2.7E-04	m^3/s	
	Q =	23,135	L/day	
	Q_3 =	69,404	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	27,761	L/day
80% Effectiveness	Q_3 =	13,881	L/day

REFERENCES:

1. Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.

2. Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

3. Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *CR4 Underpass Structure - Future BBP EB*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		*<< Determine from Table 2.4 Below >>*
Saturated Excavation Length:	x =	50	m	*<< Import From Dewatering Calc's >>*
Saturated Excavation Width:	y =	17.0	m	*<< Import From Dewatering Calc's >>*
Radius of Influence:	R_o =	15.2		*<< Import From Dewatering Calc's >>*
Depth of Dewatering:	H-h =	5.5	m	*<< Import From Dewatering Calc's >>*
Pi:	π =	3.1416		
Overburden Storage:	V_s =	5,098	m^3	
		5,098,191	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation
(Unconfined Aquifer - Long Narrow Excavation)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Construction Type: *CR4 Underpass Structure - Future BBP WB*

.1 RADIUS OF INFLUENCE (R_o)				
Sichardt's Empirical Relationship:	$R_o = r_s+C(H-h)(K^{0.5})$			
Radial Flow to Pumped Wells:	C = 3,000			
Line Flow to Trenches or Line of Wellpoints:	C = 1,500 to 2,000			
Radius of Influence (line source)	R_o =	39.1	m	
Coefficient:	C =	1,750	unitless	
Highest Water Level:		260.11	m	<< *From BH Information* >>
Target Water Level:		248.00	m	<< *From BH Information* >>
Approximate Aquifer Bottom:		245.00	m	<< *Assumed as 3m Below Target* >>
Saturated Thickness before Dewatering:	H =	15.1	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Equivalent Well Radius:	r_s =	8.5	m	
Hydraulic Conductivity:	K =	2.1E-06	m/s	<< *From SWRT Data* >>

.2 EXCAVATION LENGTH TO WIDTH RATIO (x/a)			
Equation:	x/a =	2.9	

.3 EQUVALENT WELL RADIUS FOR LONG NARROW EXCAVATIONS (r_s)				
Validity:	For long narrow excavations (i.e., x/a >1.5), r_s is approximated as the distance wellpoints are from the centreline of the excavation.			
Equivalent Well Radius:	r_s =	8.5	m	
Width of Trench:	a =	17.00	m	<< *From Project Dwgs* >>
Length of Trench:	x =	50.00	m	<< *From Project Dwgs* >>

.4 GROUNDWATER SEEPAGE RATE (Q)				
Equation:	$Q = [(\pi K(H^2-h^2))/\ln(R_o/r_s)]+ 2[(xK(H^2-h^2))/2L]$			
	* Based on Jacob's modified non-equilibrium equation for long, narrow systems in an unconfined aquifer.			
Radius of Influence:	R_o =	39.1	m	
Equivalent Well Radius:	r_s =	8.5	m	
Saturated Thickness before Dewatering:	H =	15.1	m	
Saturated Thickness after Dewatering:	h =	3.0	m	
Hydraulic Conductivity:	K =	2.1E-06	m/s	
Length of Trench:	x =	50.0	m	
Line Source Distance:	L =	39.1	m	<< *Measured Distance or* R_o >>
Pi:	π =	3.1416		
Groundwater Inflow Rate:	Q =	1.5E-03	m^3/s	
	Q =	131,632	L/day	
	Q_3 =	394,896	L/day	(with 3x Fs)

.5 SHORING EFFECTIVENESS (IF APPLICABLE)			
60% Effectiveness	Q_3 =	157,958	L/day
80% Effectiveness	Q_3 =	78,979	L/day

REFERENCES:

1. Cashman, P, and Preene, M., 2012. Groundwater Lowering in Construction, A Practical Guide to Dewatering, 2nd Ed. CRC Press.

2. Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

3. Sichart, W. and Kyrieleis, W., 1930. Grundwasser Absekungen bei Fundierungsarbeiten. Berlin, Germany.

Overburden Storage Volume Calculation
(Ineffective Cut-Off Measures)

Project Name: *County Road 4 Improvements*
Client: *Ontario Ministry of Transportation*
AECOM Project No.: *60636190*
Station: *CR4 Underpass Structure - Future BBP WB*

.1 OVERBURDEN STORAGE VOLUME				
Equation: $V_s = (xy + R_o x + (\pi R_o^2/3))*(H-h)*n$				
Effective Porosity:	n =	0.5		*<< Determine from Table 2.4 Below >>*
Saturated Excavation Length:	x =	50	m	*<< Import From Dewatering Calc's >>*
Saturated Excavation Width:	y =	17.0	m	*<< Import From Dewatering Calc's >>*
Radius of Influence:	R_o =	39.1		*<< Import From Dewatering Calc's >>*
Depth of Dewatering:	H-h =	12.1	m	*<< Import From Dewatering Calc's >>*
Pi:	π =	3.1416		
Overburden Storage:	V_s =	26,650	m^3	
		26,649,589	L	

POROSITY VALUES

Source: Freeze & Cherry (1979), Table 2.4	
Value:	n (%)
Unconsolidated deposits	
Gravel	25–40
Sand	25–50
Silt	35–50
Clay	40–70
Rocks	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

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