Neyagawa Boulevard Between Highway 407 & Burnhamthorpe Road West, Oakville, Ontario

L6M 4L4

Hydrogeological Investigation

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1 Introduction

1.1 Project Description

EXP Services Inc. (EXP) was retained by Sky Property Group Inc. to prepare a Hydrogeological Investigation Report associated with the proposed development located at Neyagawa Boulevard Between Highway 407 & Burnhamthorpe Road West, Oakville, Ontario (hereinafter referred to as the 'Site').

The Site is an irregular parcel of vacant land located on Neyagawa Boulevard between Highway 407 and Burnhamthorpe Road West in Oakville, Ontario. It is EXP's understanding that development of the Site will include construction of five (5) high-rise condominium towers, averaging eighteen (18) stories high, with three (3) levels of common underground parking extending to the property boundary. The development will be provided with roads and services, including sewers and watermains. The Site location plan is shown in Figure 1.

EXP conducted a Preliminary Geotechnical Investigation and Environmental Site Assessment in conjunction with this investigation. The pertinent information gathered from the noted investigations is utilized for this report.

1.2 Project Objectives

The main objectives of the Hydrogeological Investigation are as follows:

- Establish the local hydrogeological settings within the Site;
- Assess construction dewatering flow rates and potential impacts;
- Provide Preliminary recommendations on construction and long-term dewatering;
- Assess groundwater quality;
- Assess potential impacts and provide preliminary guidance for mitigation;
- Conduct seasonal water level monitoring (one year) on a bi-monthly basis; and,
- Prepare a Hydrogeological Investigation Report.

1.3 Scope of Work

To achieve the investigation objectives, EXP has completed the following scope of work:

- Reviewed available geological and hydrogeological information for the Site;
- A total of eight (8) 50 mm diameter monitoring wells were advanced on the Site. Five (5) overburden monitoring wells up to 9 meters (m) deep and three (3) bedrock monitoring wells up to 18m deep were installed. Three (3) out of the five (5) locations are instrumented with nested wells including one (1) shallow (s) and one (1) deep (d) wells.
- Completed two (2) rounds of groundwater level measurements at all monitoring wells post well installations;
- Collected one (1) groundwater sample from a selected monitoring well for laboratory testing for parameters listed in Halton Region Sanitary and Storm Sewer By-Law;
- Estimated construction dewatering and long-term (sub drain) flow rates for proposed development;
- Evaluated permitting requirements for temporary water taking and dewatering effluent disposal from regulatory agencies;

- Reviewed private water supply wells on site and within 500 m of the property (MECP WWR searches);
- Evaluated the information collected during the field investigation program, including borehole geological information, Water Well Records (WWR), SWRT results, groundwater level measurements and groundwater water quality;
- Prepared site plans, cross sections, geological mapping and groundwater contour mapping for the Site;
- Provided preliminary recommendations on the requirements for construction and long-term dewatering;
- Prepared a Hydrogeological Investigation Report; and,
- Conducted seasonal groundwater level monitoring for a duration of one year on a bi-monthly basis (9 events in total).

1.4 Review of Previous Reports

The following report was reviewed as part of this Hydrogeological Investigation:

- EXP Services Inc. (December 12, 2023), Preliminary Geotechnical Investigation, Neyagawa Boulevard between Hwy 407 and Burnhamthorpe Road West, Oakville, ON, prepared for Sky Property Group Inc.
- EXP Services Inc. (November 2023), Phase One Environmental Site Assessment, Neyagawa Boulevard, Oakville, ON, prepared for Sky Property Group Inc.
- EXP Services Inc. (December 2023), Phase Two Environmental Site Assessment, Neyagawa Boulevard, Oakville, ON, prepared for Sky Property Group Inc.

Any past and/or future geotechnical, hydrogeological, environmental and risk assessments, and updated development/architectural plans should be provided to update this hydrogeological report prior to submission of permits and approvals by the municipalities and agencies.

2 Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography

The Site is within the physiographic region known as the South Slope (Figure 2B). The physiographic landform is named the Till Moraines (Figure 2C). The South Slope lies south of the Peel Plain and north of the Iroquois Plain and extends from the Niagara Escarpment in the west to the Trenton River in the east. (Chapman & Putnam, 2007).

The South Slope mostly consists of shallow shale and till plains, with minor undulations, which gently slopes in a southeasterly direction towards Lake Ontario. Typical landforms of the South Slope include low relief drumlins and moraines consisting of fine-grained soils. (Chapman & Putnam, 2007).

2.1.2 Regional Geology and Hydrogeology

The surficial geology can be described as Till consisting of clay to silt textured till (Ministry of Northern Development and Mines, 2012). The surficial geology of the Site and surrounding areas is shown on Figure 2A. Figure 2D shows the bedrock geology of the Site.

Based on the available regional geology maps, the subsurface stratigraphy of the Site from top to bottom is summarized in Table 2-1 (TRCA, 2008 and Oak Ridge Moraine Groundwater Program, 2023). The overburden thickness is approximately 16 m.

Table 2-1: Summary of Subsurface Stratigraphy

Stratigraphic Unit	General Description	Top Elevation of Stratigraphic Unit (masl)
Undifferentiated Upper Sediments	Fine textured glaciolacustrine deposits and glaciolacustrine -derived clay to silt textured till	187
Halton Till or Equivalent (Aquitard)	This lithologic unit typically consists of sandy silt to clayey silt till interbedded with silt, clay, sand and gravel.	179
Oak Ridges Moraine or Equivalent (Aquifer)	This geology unit mainly consists of interbedded fine-grained sand and silt deposits where coarse-grained sand and gravel along with clay laminae are locally reported.	172
Bedrock (Queenston Formation)	Bedrock primarily consists of red shale and siltstone, minor green shale, limestone, and sandstone, (Ministry of Northern Development and Mines, 2012).	171

Regional groundwater across the area flows south/southwest, towards Lake Ontario and Sixteen Mile Creek (Oak Ridges Moraine Groundwater Program, 2023). Local deviation from the regional groundwater flow pattern may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure.

2.1.3 Existing Water Well Survey

Water Well Records (WWRs) were compiled from the database maintained by the Ministry of the Environment, Conservation and Parks (MECP) and reviewed to determine the number of water wells documented within a 500-m radius of the Site boundaries. The locations of the MECP WWRs within 500 m of the Site are shown on Figure 3. A summary of the WWR is included in Appendix A.

The MECP WWR database indicates that thirteen (13) records within a 500 m radius from the Site centroid (Figure 3 and Appendix A).

The database indicates that the offsite wells are at an approximate distance of one hundred and eighty-six (186) m or greater from the Site centroid. All offsite wells were reportedly identified as water supply wells (8), abandoned wells (4) and/or listed with unknown use (1).

The Well Identification Number (Well ID No.) of the domestic (7) and livestock (1) water supply wells are 2802139,2802142, 2802214, 2802215, 2802219, 2802220, 2803682 and2804788 located between 186 m to 462 m from the Site centroid. It is recommended to complete a baseline residential well survey (door-to-door) to verify results of the MECP WWR searches and to confirm current conditions and use of wells in 500 m zone of the Site. The water supply wells are reportedly drilled wells with depths varying between 15.2 and 30.8 meters below ground surface (mbgs).

The found water levels reportedly ranged from depths of 14.0 m to 21.3 mbgs.

It should be noted the Site is located within Halton Region Source Protection Area (SPA) and outside of any wellhead protection areas (WHPA Q1 and Q2), Intake Protection Zone, Issue Contributing Area, Significant Groundwater Recharge Areas (SGRA), Highly Vulnerable Area (HVA) and Event Based Area.

2.2 Site Setting

2.2.1 Site Topography

The Site is in an Open field land use setting. The topography is considered higher elevation at the north and lower elevation at the south with a regional gradual southerly slope towards a tributary of Sixteen Mile Creek and Lake Ontario.

As indicated on the borehole logs included in Appendix B, the surface elevation of the Site ranges between approximately 181.06 to 190.26 meters above sea level (masl).

2.2.2 Local Surface Water Features

The Site is within the Sixteen Mile Creek watershed. No surface water features exist onsite. The nearest surface water feature is a small pond, located approximately 434 meters west of the Site boundary. East Sixteen Mile creek is approximately 300 m northwest of the Site boundary. Lake Ontario is approximately 8.7 km to the south

2.2.3 Local Geology and Hydrogeology

A summary of subsurface soil stratigraphy is provided in the following paragraphs. The soil descriptions are based on the geotechnical investigation report (EXP, 2023). They are summarized for the hydrogeological interpretations. As such, the information provided in this section shall not be used for construction design purposes.

The detailed soil profiles encountered in each borehole and the results of moisture content determinations are presented on the attached borehole logs (Appendix B). The soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the Hydrogeological Investigation and shall not be interpreted as exact planes of geological change.

The "Notes on Sample Description" preceding the borehole logs form an integral part of and should be read in conjunction with this report. The following is a brief description of the soil conditions encountered during the investigation.

Based on the results of the geotechnical investigation, the general subsurface soil stratigraphy consists of the following units from top to bottom:

Topsoil

Surficial topsoil approximately 100 to 180 mm thick was encountered in all boreholes and comprised dark brown sandy silt with rootlets and organics.

Fill

Fill was encountered below the topsoil in all boreholes, extending to depths of about 0.6 to 1.1 m below existing grade. The composition of the fill is generally sandy silt with trace amounts of gravel. Occasional rootlets were noted within the fill. Moisture contents of the moist fill ranged from 10 to 24%.

Sandy Silt Till

Sandy silt till was encountered below the fill in all boreholes and extended to depths of about 3.8 to 6.5 m below existing grade. The sandy silt till deposit was brown/red in colour, contained a trace to some clay and a trace of gravel. The till existed in a compact to dense state of compactness. Moisture contents ranged from 9 to 13%, indicating a moist condition.

Clayey Silt Till

A clayey silt deposit was encountered below the sandy silt till in all boreholes except Borehole 5. This deposit extended to depths of about 7.0 to 10.4 m below existing grade. The clayey silt till was reddish grey in colour and contained a trace of sand and gravel. It was stiff to very stiff in consistency. Moisture contents were about 12 to 15%, indicating a moist condition.

Silt Till

Below the clayey silt till in Boreholes 1D to 4 and the sandy silt till in Borehole 5, a silt till deposit was encountered. The reddish brown silt till contained trace to some clay and a trace of sand and gravel. The lower portion of the silt till became a shale/till complex in Boreholes 1D and 2D. It existed in a very dense state of compactness. Moisture contents ranged between 5 and 12%, indicating moist conditions. Boreholes 4 and 5 were terminated within the silt till while it extended to depths of about 8.8 to 15.3 m below existing grade in Boreholes 1D, 2D and 3D.

Shale Bedrock (Queenston Formation)

In Boreholes 1D, 2D and 3D, weathered shale bedrock was encountered at about 8.8 to 15.3 m below existing grade. The surface level of the shale bedrock varied from approximate Elevation 175.0 m in Borehole 1D at the northern portion of the site to about Elevation 172.8 m in Borehole 3D at the southern portion of the site. It should be noted that the upper zone of the bedrock is generally completely to highly weathered. The distinction between completely weathered shale and the overlying strata, particularly if the latter contains abundant shale fragments, is not always clear and consequently, some of the soils resting on the surface of the bedrock might be very weak or completely weathered rock. As such, the contact elevations should not be interpreted as exact planes of bedrock since the auger will frequently penetrate some distance into the weathered rock before noticeable resistance is encountered.

Coring of rock was carried out by HQ size diamond core drilling to determine the quality of the bedrock. Based on the rock core samples and knowledge of the site area, the bedrock at this site is the Queenston Formation which consists of red to maroon noncalcareous to calcareous shale with subordinate amounts of green shale, siltstone and limestone. Typically, the hard limestone layers comprise about 15 to 20 percent of the unit but may comprise as much as 70 to 90 percent of the bedrock. The hard layers are usually less than about 100 to 150 mm thick but some are much thicker. The thicker layers have been

observed to be as much as 750 to 900 mm at other sites. The layers are actually lenses and they can vary significantly in thickness over short distances.

Stress relief features such as folds and faults may be encountered in the Queenston Formation. In these features the rock is heavily fractured and sheared. It can also contain layers of shale rubble and clay. Due to the fracturing, these features may also be groundwater conduits, which could result in excessive water flow into excavation. Weathering is much deeper than the surrounding rock in sound unweathered bedrock overlying fractured and weathered bedrock. The stress relief features are usually in the order of 4 to 6 m wide, but in depth can vary from 4 to 5 m to in excess of 10 m.

The borehole and monitoring well locations are shown on Figure 4. Geological cross-section was generated based on the available borehole logs completed as part of the current investigation and shown on Figure 5A (Cross section A-A'). The cross section shows a simplified representation of soil conditions and soil deposits may be interconnected differently than represented. Borehole logs used to generate a cross-section are provided in Appendix B.

3 Results

3.1 Monitoring Well Details

The monitoring well network was installed as part of current investigations at the Site. It consists of the following:

- Five (5) shallow overburden monitoring wells (BH/MW1S, BH/MW2S, BH/MW3S, BH/MW4S and BH/MW5S) were installed to depths varying between 7.054 and 9.02 mbgs;
- Three (3) deep bedrock monitoring wells (BH/MW1D, BH/MW2D and BH/MW3D) were installed to depths varying between 15.83 and 18.32 mbgs.
- Total of three (3) nested configurations included shallow and deep wells as follows: BH/MW1S and BH/MW1D, BH/MW2S and BH/MW2D and BH/MW3S and BH/MW3D .

The diameter of all monitoring wells is 50 mm. All wells were installed with a monument (stick up) protective casing. Borehole logs and monitoring well installation details are provided in Appendix B. The monitoring well locations are shown on Figure 4.

3.2 Water Level Monitoring

As part of the Hydrogeological Investigation, static water levels in the monitoring wells were recorded in nine (9) monitoring events between November 15 of 2023 and November 19 of 2024. A summary of all static water level data as it relates to the elevation survey is given in Table 3-1 below.

The groundwater elevation recorded in the shallow wells ranged from 180.86 masl (0.73 mbgs at BH/MW3S on November 19, 2024) to 189.02 masl (1.24 mbgs at BH/MW1S on May 8, 2024). The groundwater elevation recorded in the deep wells ranged from 176.84 masl (4.75 mbgs at BH/MW3D on July 12, 2024) to 184.83 masl (5.43 mbgs on July 12, 2024). There is an artesian conditions found in BH/MW5S showing stabilized water levels reaching up to 1.18 m above ground on September 16, 2024.

Based on all three nested monitoring wells water level records, the downward vertical gradients were observed at all occasions except for at BH1S and BH1D nested location on November 15, 2023, when the upward vertical gradient was observed.

The one-year seasonal groundwater monitoring with bi-monthly events is completed on Site and the hydrographs are presented in Appendix F. The highest groundwater level conditions observed at BH/MW1S with 189.02 masl on May 8, 2024. It is interpreted that seasonal high-water levels were recorded on May 8 of 2024.

Table 3-1: Summary of Measured Groundwater Elevations

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up	Approximate Full Well Depth (mbgs)	Depth	15-Nov-23	17-Nov-23	29-Nov-23	8-Jan-24	20-Mar-24	8-May-24	12-Jul-24	16-Sep-24	19-Nov-24
BH/MW1S	190.26	1.03	9.02	mbTOP	8.80	8.54	7.34	3.36	2.96	2.27	2.72	3.03	3.99
				mbgs	7.77	7.51	6.31	2.33	1.93	1.24	1.69	2.00	2.96
				masl	182.49	182.75	183.95	187.94	188.33	189.02	188.57	188.26	187.30
BH/MW1D	190.26	1.00	18.32	mbTOP	7.48	-	7.64	7.25	6.78	6.55	6.43	6.59	7.18
				mbgs	6.48	-	6.64	6.25	5.78	5.55	5.43	5.59	6.18
				masl	183.78	-	183.62	184.01	184.48	184.71	184.83	184.67	184.08
BH/MW2S	184.30	1.00	7.54	mbTOP	1.86	1.87	2.02	1.67	1.18	1.05	0.97	1.12	1.69
				mbgs	0.86	0.87	1.02	0.67	0.18	0.05	-0.03	0.12	0.69
				masl	183.44	183.43	183.28	183.63	184.12	184.25	184.33	184.18	183.61
BH/MW2D	184.30	0.95	16.97	mbTOP	2.81	-	2.87	2.91	2.54	2.47	2.58	2.51	2.81
				mbgs	1.86	-	1.92	1.96	1.59	1.52	1.63	1.56	1.86
				masl	182.44	-	182.38	182.34	182.71	182.78	182.67	182.74	182.44
BH/MW3S	181.59	1.03	8.42	mbTOP	1.58	1.58	1.70	1.60	1.43	1.34	1.47	1.37	1.76
				mbgs	0.55	0.55	0.67	0.57	0.40	0.31	0.44	0.34	0.73
				masl	181.04	181.04	180.92	181.02	181.19	181.28	181.15	181.25	180.86
BH/MW3D	181.59	1.01	15.83	mbTOP	5.48	-	5.48	5.37	5.09	5.00	5.76	5.27	5.50
				mbgs	4.47	-	4.47	4.36	4.08	3.99	4.75	4.26	4.49
				masl	177.12	-	177.12	177.23	177.51	177.60	176.84	177.33	177.10
BH/MW4S	186.12	0.99	8.98	mbTOP	3.72	3.72	3.88	3.51	3.00	2.81	2.75	2.88	3.47
				mbgs	2.73	2.73	2.89	2.52	2.01	1.82	1.76	1.89	2.48
				masl	183.39	183.39	183.23	183.60	184.11	184.30	184.36	184.23	183.64
BH/MW5S	181.06	1.01	7.59	mbTOP	0.37	0.38	0.57	0.27	0.04	-0.03	0.11	-0.17	0.20
				mbgs	-0.64	-0.63	-0.44	-0.74	-0.97	-1.04	-0.90	-1.18	-0.81
				masl	181.70	181.69	181.50	181.80	182.03	182.10	181.96	182.24	181.87

Notes:
mbTOP – meters below top of the pipe; mbgs - meters below ground surface;
masl - meters above sea level.
XX - groundwater levels and elevations above ground surface (artesian / flowing conditions)

Two (2) maps were created for the Site to show groundwater contours of the shallow (Figure 6A) and deep water-bearing zones (Figure 6B), as measured on May 8, 2024. Accordingly, the groundwater flow directions in the shallow and deep zones are interpreted to be southeast of the Site.

Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions. This may also affect the direction and rate of flow.

3.3 Hydraulic Conductivity Testing

Eight (8) Single Well Response Tests (SWRT's) were completed on all monitoring wells (BH/MW1S, BH/MW1D, BH/MW2S, BH/MW2D, BH/MW3S, BH/MW3D, BH/MW4S, and BH/MW5S) on November 29, 2023. The tests were completed to estimate the saturated hydraulic conductivity (K) of the units at the well screen depths utilizing data loggers, preprogramed to take measurement in one second intervals.

The static water level within each monitoring well was measured prior to the start of testing. In advance of performing SWRTs, each monitoring well underwent development to remove fines introduced into the screens following construction. The development process involved purging of the monitoring wells to induce the flow of fresh formation water through the screen. Each monitoring well was permitted to fully recover prior to performing SWRTs.

Hydraulic conductivity values were calculated from the SWRT and constant rate test data as per Hvorslev's solution included in the Aqtesolv Pro. V.4.5 software package. The semi-log plots for normalized drawdown versus time are included in Appendix C.

A summary of the hydraulic conductivities (K-values) estimated from the SWRTs are provided in Table 3-2.

Table 3-2: Summary of Hydraulic Conductivity Testing

Monitoring Well	Measured Well Depth (mbgs)	Screen Interval (mbgs)		Soil Formation Screened	Estimated Hydraulic Conductivity (m/s)
		From	To		
BH/MW1S	9.02	6.02	9.02	Clayey Silt Till	1.0×10^{-7}
BH/MW1D	18.32	15.32	18.32	Shale Bedrock	3.9×10^{-6}
BH/MW2S	7.54	4.54	7.54	Clayey Silt Till and Silt Till	1.6×10^{-6}
BH/MW2D	16.97	13.97	16.97	Shale Bedrock	2.6×10^{-6}
BH/MW3S	8.42	5.42	8.42	Clayey Silt Till and Silt Till	1.2×10^{-7}
BH/MW3D	15.83	12.83	15.83	Shale Bedrock	4.7×10^{-7}
BH/MW4S	8.98	5.98	8.98	Clayey Silt Till and Silt Till	5.5×10^{-7}
BH/MW5S	7.59	4.59	7.59	Sandy Silt Till and Silt Till	4.9×10^{-6}
				Highest Estimated K Value of overburden	4.9×10^{-6}
				Geometric Mean of Estimated K Values of overburden	5.6×10^{-7}
				Arithmetic Mean of Estimated K Values of overburden	1.5×10^{-6}
				Highest Estimated K Value of Shale bedrock	3.9×10^{-6}
				Geometric Mean of Estimated K Values of Shale bedrock	1.7×10^{-6}
				Arithmetic Mean of Estimated K Values of Shale bedrock	2.3×10^{-6}

SWRTs provide K-estimates of the geological formation surrounding the well screens and may not be representative of bulk formation hydraulic conductivity. As shown in Table 3-2, the highest K-value of the tested water-bearing zone for overburden is 4.9 x 10^{-6} m/s, and the arithmetic and geometric mean of the K-values for overburden are 1.5 x 10^{-6} m/s and 5.6 x 10^{-7}m/s, respectively. The highest K-value of the tested water-bearing zone for shale bedrock is 3.9 x 10^{-6} m/s, and the arithmetic and geometric mean of the K-values for Shale bedrock are 2.3 x 10^{-6} m/s and 1.7 x 10^{-6}m/s, respectively.

3.4 Groundwater Quality

To assess the suitability for discharging pumped groundwater into the sewers owned by the Halton Region/Town of Oakville during dewatering activities, one (1) groundwater sample was collected from monitoring well BH/MW2D on November 29, 2023 using a peristaltic pump. Prior to collecting the noted water sample, approximately three (3) standing well volumes of groundwater were purged from the referred well. The samples were collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted for analysis to Bureau Veritas Laboratory, a CALA certified independent laboratory in Mississauga, Ontario. Analytical results are provided in Appendix D.

Table 3-3 summarizes exceedance(s) of the Sanitary (Table 1) and Storm Sewer Use By-Law parameters.

When comparing the chemistry of the collected groundwater samples to both the Halton Region Sanitary and Storm Sewer Discharge Criteria, there were no parameter exceedances to be reported.

Reporting detection limits (RDLs) were below the Sewer Use By-Law parameters.

For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.

For the short-term and long-term dewatering discharge to either the sanitary or storm sewer system and based on the water quality test results, the water is suitable to be discharged without a treatment system.

The water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. As such, regular water quality monitoring is recommended for the post-construction phase, as required by the Town and Region.

An agreement to discharge into the sewers owned by the Halton Region/Town of Oakville will be required prior to releasing dewatering effluent.

Based on Phase Two Environmental Site Assessment Report, the analytical results of the tested parameters in the soil and groundwater samples were either not detected or detected below the Table 2 SCS (O. Reg. 153/04) at the Site.

4 Dewatering Assessment

The dimensions of the proposed structure to support the dewatering assessment are summarized in Table 4-1 below.

Table 4-1 Building Dimensions for Dewatering Assessment

Input Parameter	Assumption	Units	Notes
Number of Subgrade Levels	3 Levels	-	P3 levels of underground parking as per drawing no. dA2.01 dated November 18, 2024 prepared by Kirkor Architects and Planners
Ground Elevations	184.94	masl	For dewatering the assumption was made based on average of all boreholes elevations
Top of Slab Elevation	174.94	masl	Assumed 10 m below the ground elevation for P3 based on the average boreholes elevations
Lowest Footing Elevation	173.44	masl	Assumed to be approximately 1.5 m below the top of slab elevation
Dewatering Target Elevation	172.44	masl	It is assumed to be approximately 1.0 m below the bottom of excavation.
Excavation Area (Length x Width)	~16,900 (260 x 65)	m^2 (m x m)	Approximate area (length x width) of Site based on drawing no. dA2.01 dated November 18, 2024 prepared by Kirkor Architects and Planners

4.1 Dewatering Flow Rate Estimate and Zone of Influence

The Dupuit-Forcheimer equation for radial flow to both sides of an excavation through an unconfined aquifer resting on a horizontal impervious surface was used to obtain a flow rate estimate. Dewatering flow rate is expressed as follows:

$$Q_w = \frac{\pi K(H^2 - h^2)}{Ln\left[\frac{R_o}{r_e}\right]}$$

$$r_e = \frac{a+b}{\pi} \qquad R_o = R_{cj} + r_e$$

Where:

Qw = Rate of pumping (m^3/s)
X = Length of excavation (m)
K = Hydraulic conductivity (m/s)
H = Hydraulic head beyond the influence of pumping (static groundwater elevation) (m)
h = Hydraulic head above the base of aquifer in an excavation (m)
R_0 = Radius of influence (m)
R_{cj} = Cooper-Jacob's radius of influence (m)

r_e = Equivalent perimeter (m)

a = Length of the excavation area (m)

b = Width of the excavation area (m)

It is expected that the initial dewatering rate will be higher to remove groundwater from within the overburden formation. The dewatering rates are expected to decrease once the target water level is achieved in the excavation footprint as groundwater will have been removed, primarily from storage, resulting in lower seepage rates into the excavation.

4.2 Cooper-Jacob's Radius of Influence

The radius of influence (Rcj) for the construction dewatering was calculated based on Cooper-Jacob's equation. This equation is used to predict the distance at which the drawdown resulting from pumping is negligible.

The estimated radius of influence due to pumping is based on Cooper-Jacob's formula as follows:

$$R_{cj} = \sqrt{2.25KDt/s}$$

Where:

Ro = Estimated radius of influence (m)

D = Aquifer thickness (original saturated thickness) (m)

K = Hydraulic conductivity (m/s)

S = Storage coefficient

t = Duration of pumping (s)

4.3 Stormwater

Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. Therefore, the dewatering rates at the Site should also include removing stormwater from the excavation.

A 25 mm precipitation event was utilized for estimating the stormwater volume. The calculation of the stormwater volume is included in Appendix E.

The estimate of the stormwater volume only accounts for direct precipitation into the excavation. The dimensions of the excavation are considered in the dewatering calculations. Runoff which originated outside of the excavation's footprint is excluded and it should be directed away from the excavation.

During precipitation events greater than 25 mm (ex: 100-year storm), measures should be taken by the contractor to retain stormwater onsite in a safe manner to not exceed the allowable water taking and discharge limits, as necessary. A two (2) and a one hundred (100) year storm event over a 24-hour period are 57.5 and 125.5 mm (refer to Appendix E).

4.4 Results of Dewatering Rate Estimates

4.4.1 Construction Dewatering Rate Estimate

For this assessment, it was assumed that the proposed construction plans include an excavation with shoring extending to the Site boundaries. EXP should be retained to review the assumptions outlined in this section, should the assumed shoring design change.

Short-term (construction) dewatering calculations are presented in Appendix E.

Pits (elevator, sump pits) are assumed to have the same excavation depth and dewatering target as the main excavation; deeper pits may require localized dewatering and revised dewatering estimates.

Based on the assumptions provided in this report, the results of the dewatering rate estimate can be summarized as follows:

Table 4-2 Summary of Construction Dewatering Rate

Peak Dewatering Flow Rate Including Rain Collection Volume	
Description	**With 3 Levels of Underground Parking (L/day)**
Total Volume (L/day) Short Term Discharge of Groundwater (Construction dewatering) with Safety Factor (including precipitation)	1,331,00

The peak dewatering flow rates does not account for flow from utility beddings and variations in hydrogeological properties beyond those encountered during this investigation.

There are artesian conditions observed in the southern portion of the site which may cause basal heave if not depressurized during excavation. As such, effective control of the groundwater utilizing a suitable positive dewatering system designed, installed and operated by an experienced dewatering contractor is required.

Local dewatering may be required for pits (elevator pits, sump pits), if these extend deeper than the dewatering target. Local dewatering is not considered to be part of this assessment. Dewatering estimates should be reviewed once the pit dimensions are available. In areas where artesian groundwater conditions are encountered, groundwater depressurization will be required to lower the groundwater levels to the dewatering target/s.

Local dewatering may be required for pits (elevator pits, sump pits, raft) and for localized areas with permeable, soft, or wet soil conditions. Local dewatering is not considered to be part of this assessment, but contractor should be ready to install additional system to manage such conditions. Dewatering estimates should be reviewed once the pit dimensions are available.

All grading around the perimeter of the excavation should be graded away from the shoring the systems and ramp/site access to redirect runoff away from excavation.

The dewatering assumptions are based on using shoring system without open cuts and sloped excavations.

The contractor is responsible for the design of the dewatering systems (depth of wells, screen length, number of wells, spacing sand pack around screens, prevent soil loss etc.) to ensure that dry conditions are always maintained within the excavation at all costs.

Dewatering should be monitored using dedicated monitoring wells within and around the perimeter of the excavation, and these wells should be monitored using manual measurements and with electronic data loggers; records should be maintained on site to track dewatering progress. Discharge rates should be monitored using calibrated flow meters and records of dewatering progress, and daily precipitation as per MECP requirements should be maintained.

4.4.2 Post-Construction Dewatering Rate Estimate

It is our understanding that the development plan includes a permanent foundation sub-drain system that will ultimately discharge to the municipal sewer system if conventional footings are installed.

The long-term dewatering was based on the same equations as construction dewatering shown in Section 4.1.

The calculation for the estimated flow to the future sub-drain system (with no cutoff walls) is provided in Appendix E. The dewatering target for the foundation drainage system is taken at 0.5 m below the lowest slab elevation.

The foundation drain analysis provides a flow rate estimate. Once the foundation drain is built, actual flow rate measurements of the sump discharge will be required to confirm the estimated flow rate.

Based on the assumptions provided in this report, the estimated sub-drain discharge volumes are summarized in Appendix E. Seasonal and daily fluctuations are expected. These estimates may be affected by hydrogeological conditions beyond those encountered at this time, fluctuations in groundwater regimes, surrounding Site alterations, and existing and future infrastructures.

Table 4-3: Summary of Long-Term Dewatering Rate

Long-Term Dewatering Flow Rate	With 3 Levels of Underground Parking (L/day)
Total Volume (L/day) Long-Term Drainage of groundwater (from foundation drainage, weeping tiles, sub slab drainage) with Safety Factor Included	237,000
Long-Term Dewatering Rate without Safety Factor	158,000

Intermittent cycling of sump pumps and seasonal fluctuation in groundwater regimes should be considered for pump specifications. A safety factor was applied to the flow rate to account for water level fluctuations due to seasonal changes.

These estimates assume that pits (elevator and/or sump pits) are made as watertight structures (without drainage), if their depths extend below the dewatering target, as previously stated. The dewatering assumptions are based on using shoring system without open cuts. Open cuts can act as preferential groundwater pathways in the long-term and cause foundation drainage volumes to increase.

The sub-drain rate estimate is based on the assumptions outlined in this report. Any variations in hydrogeological conditions beyond those encountered as part of this investigation may significantly influence the sub-drain discharge volumes.

Town of Oakville/Halton Region may not allow any long-term dewatering in which case the underground structures can be designed as watertight structures to avoid the long-term flow shown in Table 4-3 above.

4.5 MECP Water Taking Permits

4.5.1 Short-Term Discharge Rate (Construction Phase)

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering is more than 50,000 L/day but less than 400,000 L/day, then an online registration in the Environmental Activity and Sector Registry (EASR) with the

MECP will be required. If groundwater dewatering rates onsite exceed 400,000 L/day, a Category 3 Permit to Take Water (PTTW) will be required from the MECP.

As of July 1, 2021, an amendment of O. Reg. 63/16 has come into effect and replaced the former subsection 7 (5) such that the EASR water taking limit of 400,000 L/day would apply to groundwater takings of each dewatered work area only, excluding stormwater.

The dewatering estimate including a safety factor is greater than 400, 000 L/day as shown in Table 4-2. Based on the construction dewatering flow rates, a Category 3 PTTW will be required to facilitate the construction dewatering program of the Site.

A Discharge Plan (dewatering sketch, sewer discharge agreement) must be developed and applied for any discharges from the Site. Monitoring of both water quantity and water quality must be carried out for the entire duration of the construction dewatering phase. During this phase, the Discharge Plan and the daily water taking records must be available onsite.

The PTTW, Discharge Plan, hydrogeological investigation report, and geotechnical assessment of settlements must also be available at the construction Site during the entire construction dewatering. EXP should be notified immediately about any changes to the construction dewatering schedule or design. Altogether, the hydrogeological report, PTTW, Discharge Plan and geotechnical assessment constitute the Water Taking Plan which needs to be available onsite during the construction dewatering.

4.5.2 Long-Term Discharge Rate (Post Construction Phase)

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering is more than 50,000 L/day, then an application for a Category 3 Permit to Take Water (PTTW) will be required from the MECP.

Based on the dewatering estimate shown in Table 4-3 greater than 50,000 L/day, a Category 3 Permit to Take Water (PTTW) will be required to facilitate the post-development phase.

Town of Oakville/Halton Region may not allow any long-term dewatering in which case the basements structures can be designed as watertight structures. If the structures are designed watertight, PTTW will not be required for the post-development phase.

The safety factor for construction (short-term) dewatering is selected larger than for long-term to account for anticipated greater groundwater volumes during initial dewatering. The applied analytical formula is adequate for long-term (steady state) conditions as it omits specific yield and time dependency. When the formula is used for short-term conditions a larger safety factor is recommended to cover a larger initial dewatering rate, which is required to remove stored groundwater. Moreover, a large initial construction dewatering rate is favorable, as it supports reducing the time to reach the dewatering target elevation.

5 Environmental Impact

5.1 Surface Water Features

The Site is located within the Sixteen Mile Creek watershed. No surface water features exist onsite. The nearest surface water feature is a small pond, located approximately 434 meters west of the Site boundary. East Sixteen Mile creek is approximately 300 m northwest of the Site boundary. Lake Ontario is approximately 8.7 km to the south

Due to the limited extent of zone of influence and the wide distance to the nearest surface water feature, no detrimental impacts on surface water features are expected during construction activities.

5.2 Groundwater Sources

Well Records from the MECP Water Well Record (WWR) Database were reviewed to determine the presence and number of water supply wells within a 500 m radius of the Site boundaries. The MECP WWR database indicates that thirteen (13) records within a 500 m radius from the Site centroid (Figure 3 and Appendix A).

The database indicates that the offsite wells are at an approximate distance of one hundred and eighty-six (186) m or greater from the Site centroid. All offsite wells were reportedly identified as water supply wells (8), abandoned wells (4) and/or listed with unknown use (1).

The Well Identification Number (Well ID No.) of the domestic (7) and livestock (1) water supply wells are 2802139,2802142, 2802214, 2802215, 2802219, 2802220, 2803682 and 2804788 located between 186 m to 462 m from the Site centroid. It is recommended to complete a baseline residential well survey to verify results of the MECP WWR searches and to confirm current conditions and use of wells in 500 m zone of the Site.

Given the anticipated dewatering zone of influence (ZOI) and distance to a water supply wells, no short-term dewatering related impacts to well users are expected in the area.

It is recommended to complete a baseline residential well survey to verify results of the MECP WWR searches and to confirm current conditions and use of wells in 500 m zone of the Site.

5.3 Geotechnical Considerations

As per the MECP technical requirement for PTTW, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence, etc.) is required. The water taking should not have unacceptable interference on soils and underground structures (foundations, utilities, etc.).

A letter related to geotechnical issues as it pertains to the Site is required to be completed under a separate cover.

5.4 Groundwater Quality

It is our understanding that the potential effluent from the dewatering system during the construction will be released to the municipal sewer system. As such, the quality of groundwater discharge is required to conform the Halton Region/Town of Oakville Sewer Use By-Law.

Dewatering (short and long-term) may induce migration of contaminants within the zone of influence and beyond due to changing hydraulic gradients, hydrogeological conditions beyond Site boundaries and preferential pathways in utility beddings etc. The water quality sampling conducted as part of this assessment was performed under static conditions. As a result, monitoring may be required during dewatering activities (short and long-term) to monitor potential migration, and this should be performed more frequently during early dewatering stages.

For the short-term and long-term dewatering discharge to either the sanitary or storm sewer system and based on the water quality test results, the water is suitable to be discharged without a treatment system.

The water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. As such, regular water quality monitoring is recommended for the post-construction phase as required by the Town of Oakville/Halton Region.

An agreement to discharge into the sewers owned by the Halton Region/Town of Oakville will be required prior to releasing dewatering effluent.

Based on Phase Two Environmental Site Assessment Report, the analytical results of the tested parameters in the soil and groundwater samples were either not detected or detected below the Table 2 SCS (O. Reg. 153/04) at the Site.

5.5 Well Decommissioning

In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

6 Conclusions and Recommendations

Based on the findings of the Hydrogeological Investigation, the following conclusions and recommendations are provided:

- The Site is located within Sixteen Mile Creek Watershed. The Site is located in the physiographic region known as South Slope and physiographic landform known as Till Moraines.
- The main overburden soil types encountered during on-site drilling program include sandy silt till and clayey silt till.
- The nearest surface water feature is a small pond, located approximately 434 meters west of the Site boundary. East Sixteen Mile creek is approximately 300 m northwest of the Site boundary. Lake Ontario is approximately 8.7 km to the south.
- MECP WWR database indicates thirteen (13) records within a 500 m radius of the Site with eight (8) of these WWRs reportedly completed as water supply wells.
- Although given the anticipated ZOI and distance to a water supply wells no short-term dewatering related impacts to well users are predicted, it is recommended to complete a baseline residential well survey (door-to-door) prior construction to verify results of the MECP WWR searches and to confirm current conditions and use of wells in 500 m zone of the Site.
- Based on the one-year seasonal groundwater monitoring completed the shallow groundwater elevations ranged from 180.86 masl (0.73 mbgs at BH/MW3S on November 19, 2024) to 189.02 masl (1.24 mbgs at BH/MW1S on May 8, 2024). The deep groundwater elevations ranged from 176.84 masl (4.75 mbgs at BH/MW3D on July 12, 2024) to 184.83 masl (5.43 mbgs on July 12, 2024). Artesian conditions were observed at BH/MW5S with water levels reaching up to 1.18 m above ground (as measured on September 16, 2024).
- Vertical downward gradients were observed at all nested wells at all occasions except for BH1S and BH1D on November 15, 2023 where the upward vertical gradient was observed.
- The highest groundwater level conditions were observed at BH/MW1S with 189.02 masl on May 8, 2024. Seasonal high-water levels were encountered during May 8 of 2024 monitoring event.
- The direction of shallow and deep groundwater flow is interpreted to follow topographic relief and to be directed to be interpreted to be southeast of the Site.
- The highest estimated bulk hydraulic conductivity is approximately 4.9×10^{-6} m/s and the arithmetic an geometric mean of hydraulic conductivity are approximately 1.8×10^{-6} m/s and 8.4×10^{-7} m/s respectively.
- When comparing the chemistry of the collected groundwater samples to both the Halton Region Sanitary and Storm Sewer Discharge Criteria, there were no parameter exceedances to be reported.
- Based on the assumptions outlined in this report, the estimated peak dewatering rate for proposed construction activities is approximately 1,331,000 L/day. This is the rate which will be required to be discharged to the municipal sewer system. Therefore, a Category 3 PTTW will be required to facilitate the construction dewatering program for the Site.
- There are artesian conditions observed in the southern portion, thus an effective control of the groundwater utilizing a suitable positive dewatering system designed, installed and operated by an experienced dewatering contractor would be required.
- The long-term flow rate of the foundation sub-drain is estimated to be approximately 237,000 L/day. It is recommended that once the sub-drain system is in place, a flow meter be installed at the sump(s) to record daily discharge volumes during the commissioning stage of the system. Regular maintenance/cleaning of the sub-drain system is recommended to ensure its proper operation. A PTTW will be required for long-term discharge. However, Town of Oakville/Halton Region may not allow any long-term dewatering in which case the underground structures can be designed as watertight structures. If the structures are designed watertight, PTTW will not be required for the post-development phase.

- The construction dewatering and long-term estimate of sub-drain discharge volumes is based on the assumptions outlined in this report. Any variations in hydrogeological conditions beyond those encountered as part of this preliminary investigation may significantly influence the discharge volumes.
- For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.
- For the short-term and long-term dewatering discharge to either the sanitary or storm sewer system and based on the water quality test results, the water is suitable to be discharged without a treatment system.
- As per the MECP technical requirement for PTTW, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence etc.) is required. The water taking should not have unacceptable interference on soils and underground structures (foundations, utilities etc.). A letter related to geotechnical issues as it pertains to the Site is required to be completed under a separate cover.
- An agreement to discharge into the sewers owned by the Halton Region/Town of Oakville will be required prior to releasing dewatering effluent.
- A Discharge Plan (dewatering sketch, sewer discharge agreement) must be developed and applied for any discharges from the Site. The Discharge Plan and monitoring for both water quantity and water quality must be carried at the Site during the entire construction dewatering phase. The daily water taking records must be maintained onsite for the entire construction dewatering phase.
- The PTTW, Discharge Plan, hydrogeological investigation report, and geotechnical assessment of settlements must be available at the construction Site for the entire construction dewatering. EXP should be notified immediately about any changes to the construction dewatering schedule or design. The hydrogeological report, PTTW, Discharge Plan and geotechnical assessment constitutes the Water Taking Plan which needs to be available onsite for the duration of construction dewatering.
- In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

The conclusions and recommendations provided above should be reviewed in conjunction with the entirety of the report. They assume that the present design concept described throughout the report will proceed to construction. This report is solely intended for the construction and long-term dewatering assessments. Any changes to the design concept may result in a modification to the recommendations provided in this report.

7 Limitations

This report is based on a limited investigation designed to provide information to support an assessment of the current hydrogeological conditions within the study area. The conclusions and recommendations presented within this report reflect Site conditions existing at the time of the assessment. EXP must be contacted immediately, if any unforeseen Site conditions are experienced during construction activities. This will allow EXP to review the new findings and provide appropriate recommendations to allow the construction to proceed in a timely and cost-effective manner.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the geoscience/engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this report.

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We trust that this information is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact this office.

Sincerely,

EXP Services Inc.

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Environmental Services

Nataliya Tkach, P.Geo. PMP., P.Eng., FGC
Senior Hydrogeologist
Environmental Services

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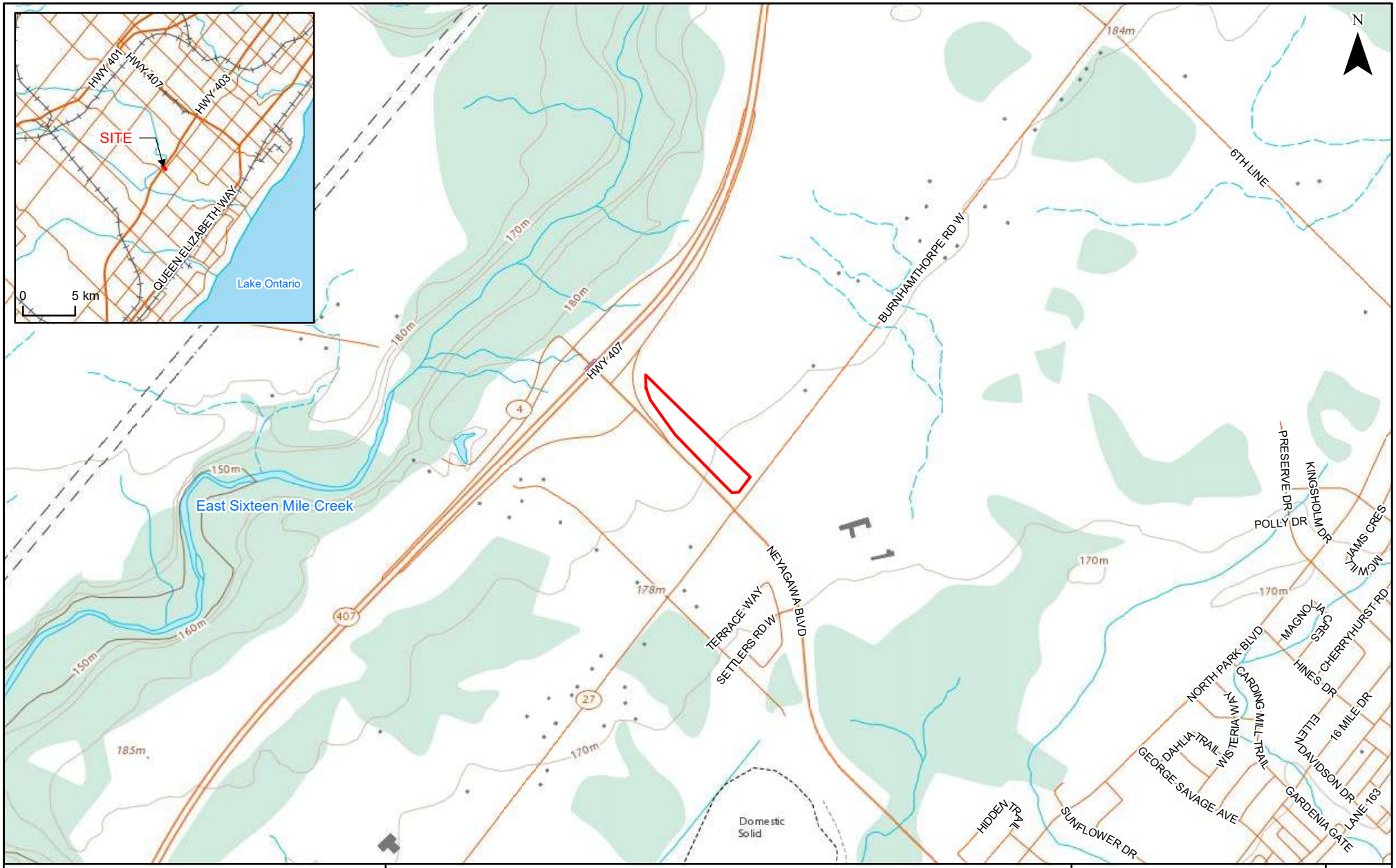
Figures



SCALE:

0 150 300 450 600 750 m

LEGEND:

APPROXIMATE SITE BOUNDARY

FIGURE: 1

SITE LOCATION PLAN

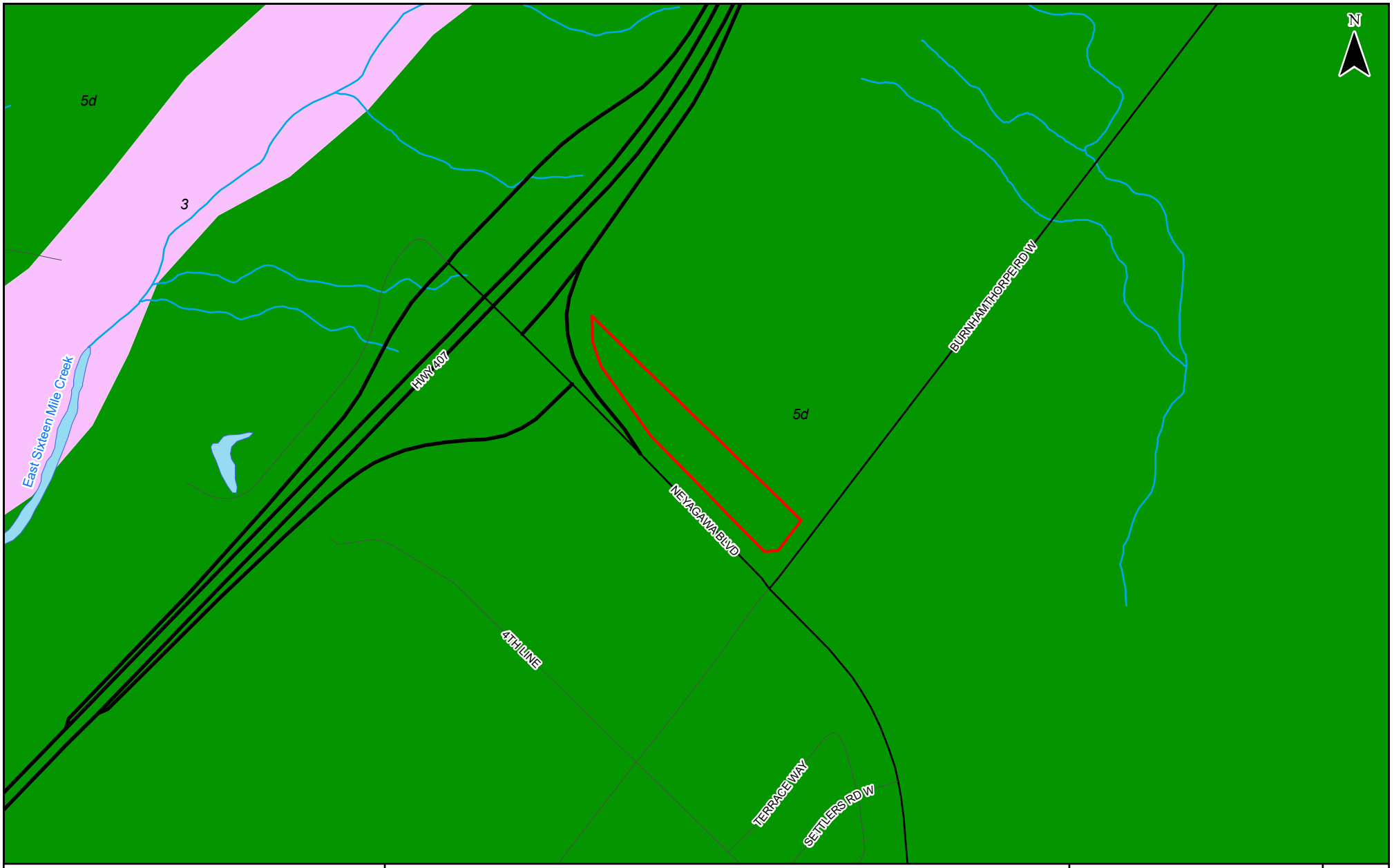
HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

exp.

DRAWN BY:	CHECKED BY:
AC	NT

PROJECT NUMBER: GTR-23012833-B0

DATE: NOVEMBER 2023



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SOURCE:
BASED ON ONTARIO GEOLOGICAL SURVEY DATA PUBLISHED IN 2010

exp.

DRAWN BY:	CHECKED BY:
AC	NT

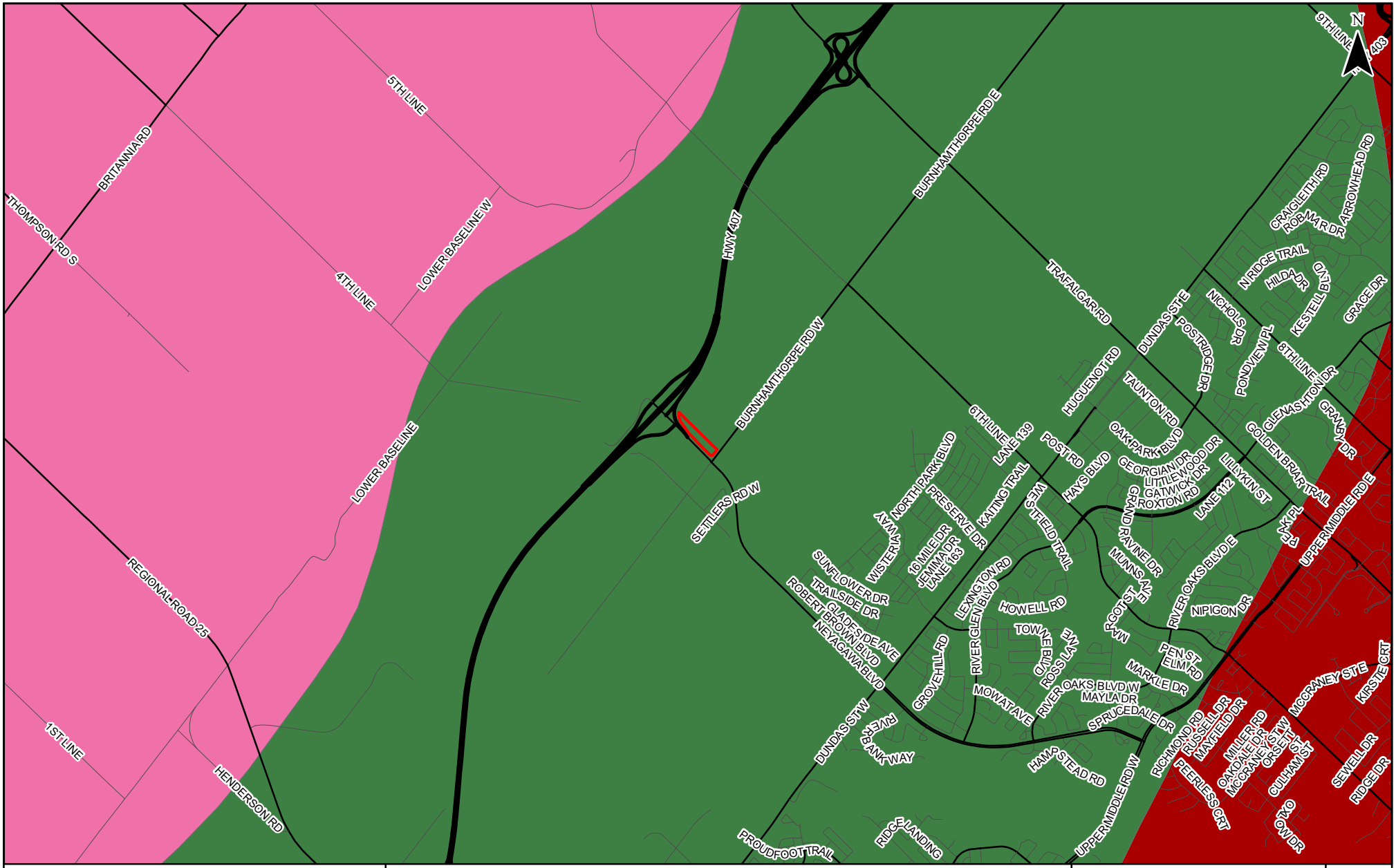
LEGEND:
- APPROXIMATE SITE BOUNDARY
- 5D: GLACIOLACUSTRINE-DERIVED SILTY TO CLAYEY TILL
- 3: PALEOZOIC BEDROCK

SURFICIAL GEOLOGY

FIGURE: 2A

HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

PROJECT NUMBER: GTR-23012833-B0 | DATE: NOVEMBER 2023



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SOURCE:

BASED ON ONTARIO GEOLOGICAL SURVEY DATA PUBLISHED IN 2007

exp.

DRAWN BY:	CHECKED BY:
AC	NT

LEGEND:

- APPROXIMATE SITE BOUNDARY
- IROQUOIS PLAIN
- PEEL PLAIN
- SOUTH SLOPE

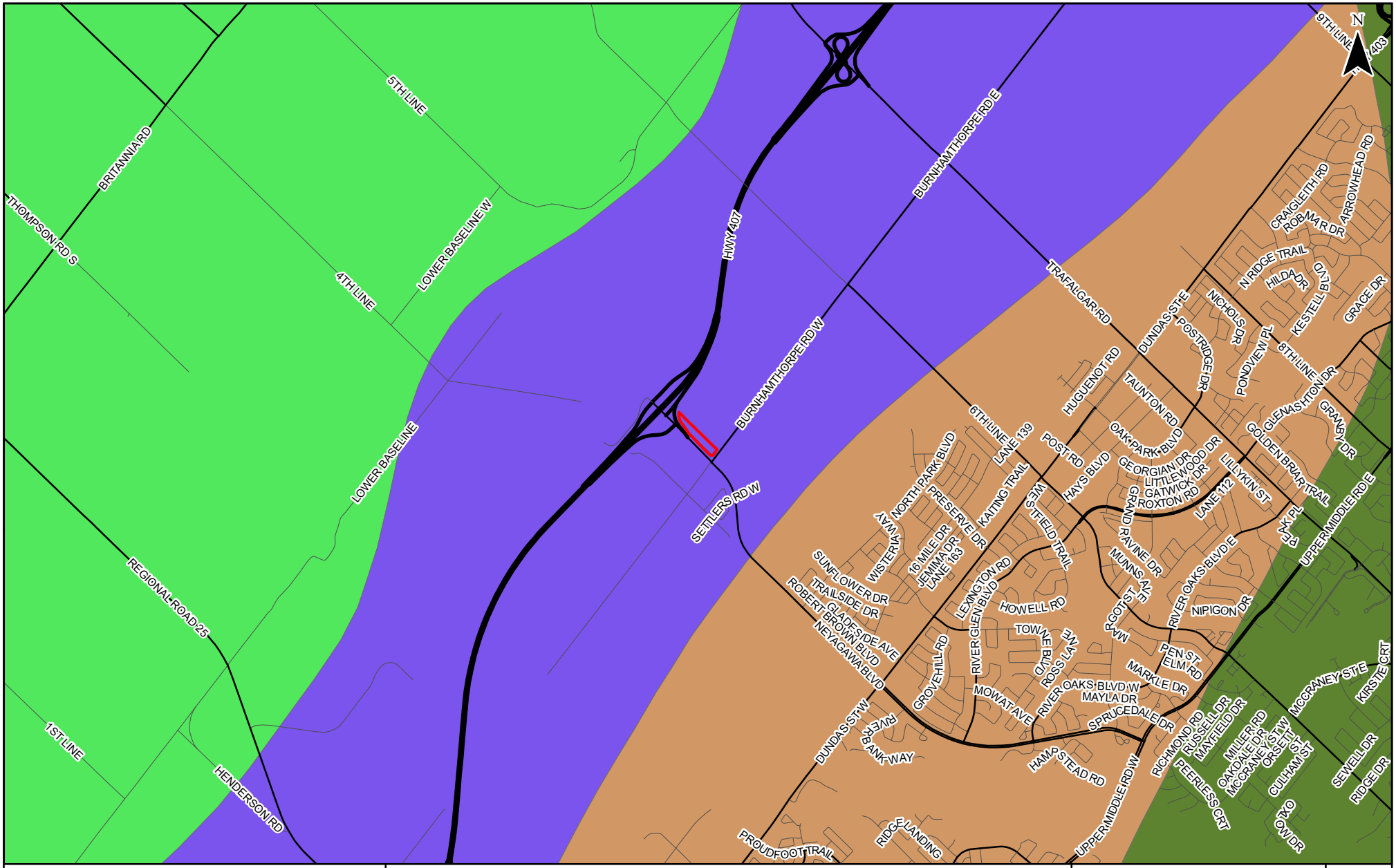
PHYSIOGRAPHIC REGIONS

FIGURE: 2B

HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

PROJECT NUMBER: GTR-23012833-B0

DATE: NOVEMBER 2023



SCALE:
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SOURCE:
BASED ON ONTARIO GEOLOGICAL SURVEY DATA PUBLISHED IN 2007

exp.

DRAWN BY:	CHECKED BY:
AC	NT

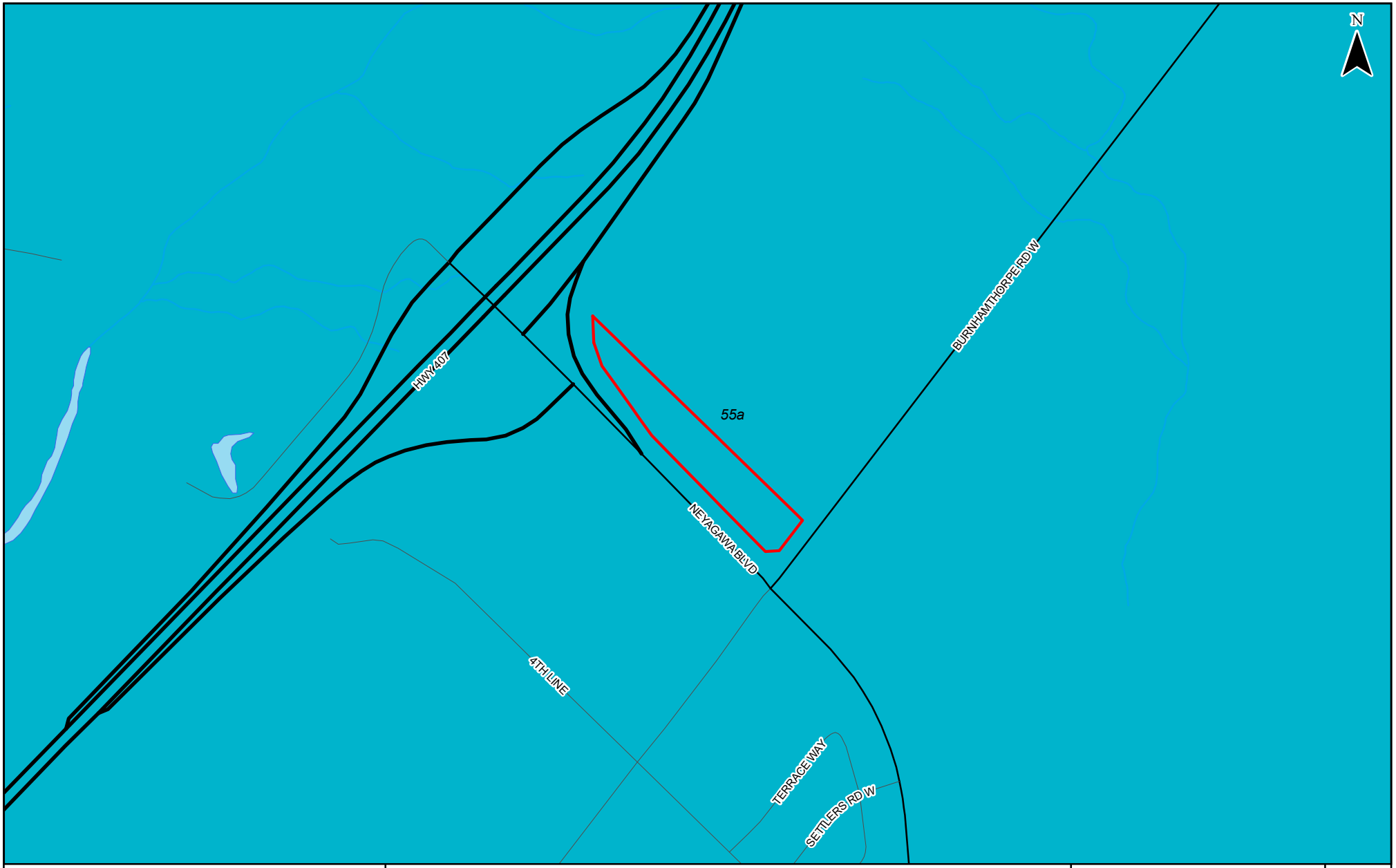
LEGEND:
- APPROXIMATE SITE BOUNDARY
- BEVELLED TILL PLAINS
- SHALE PLAINS
- TILL MORAINES
- TILL PLAINS (DRUMLINIZED)

PHYSIOGRAPHIC LANDFORMS

FIGURE: 2C

HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

PROJECT NUMBER: GTR-23012833-B0 | DATE: NOVEMBER 2023



SCALE:
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SOURCE:
BASED ON ONTARIO GEOLOGICAL SURVEY DATA PUBLISHED IN 2011

exp.

DRAWN BY:	CHECKED BY:
AC	NT

LEGEND:
- APPROXIMATE SITE BOUNDARY
- 55a: QUEENSTON FORMATION (SHALE, LIMESTONE, DOLOSTONE, SILTSTONE)

BEDROCK GEOLOGY

FIGURE: 2D

HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

PROJECT NUMBER: GTR-23012833-B0 | DATE: NOVEMBER 2023

SCALE:
0 100 200 300 400 500 m

SOURCE:
BASED ON GOOGLE EARTH IMAGERY DATED 2022
AVAILABLE WELL RECORD INFORMATION AS OF JUNE 2022

exp.

DRAWN BY:	CHECKED BY:
AC	NT

LEGEND:
- WATER SUPPLY WELL
- ABANDONED WELL
- UNCLASSIFIED / UNFINISHED WELL
- APPROXIMATE SITE BOUNDARY
- 500 m ZONE

MECP WATER WELL RECORDS MAP

FIGURE: 3

HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

PROJECT NUMBER: GTR-23012833-B0
DATE: NOVEMBER 2023

SCALE:

0 20 40 60 80 100 m

LEGEND:

- BOREHOLE / MONITORING WELL (EXP, 2023)
- CROSS SECTION AXIS
- APPROXIMATE SITE BOUNDARY

exp.

DRAWN BY:	CHECKED BY:
AC	NT

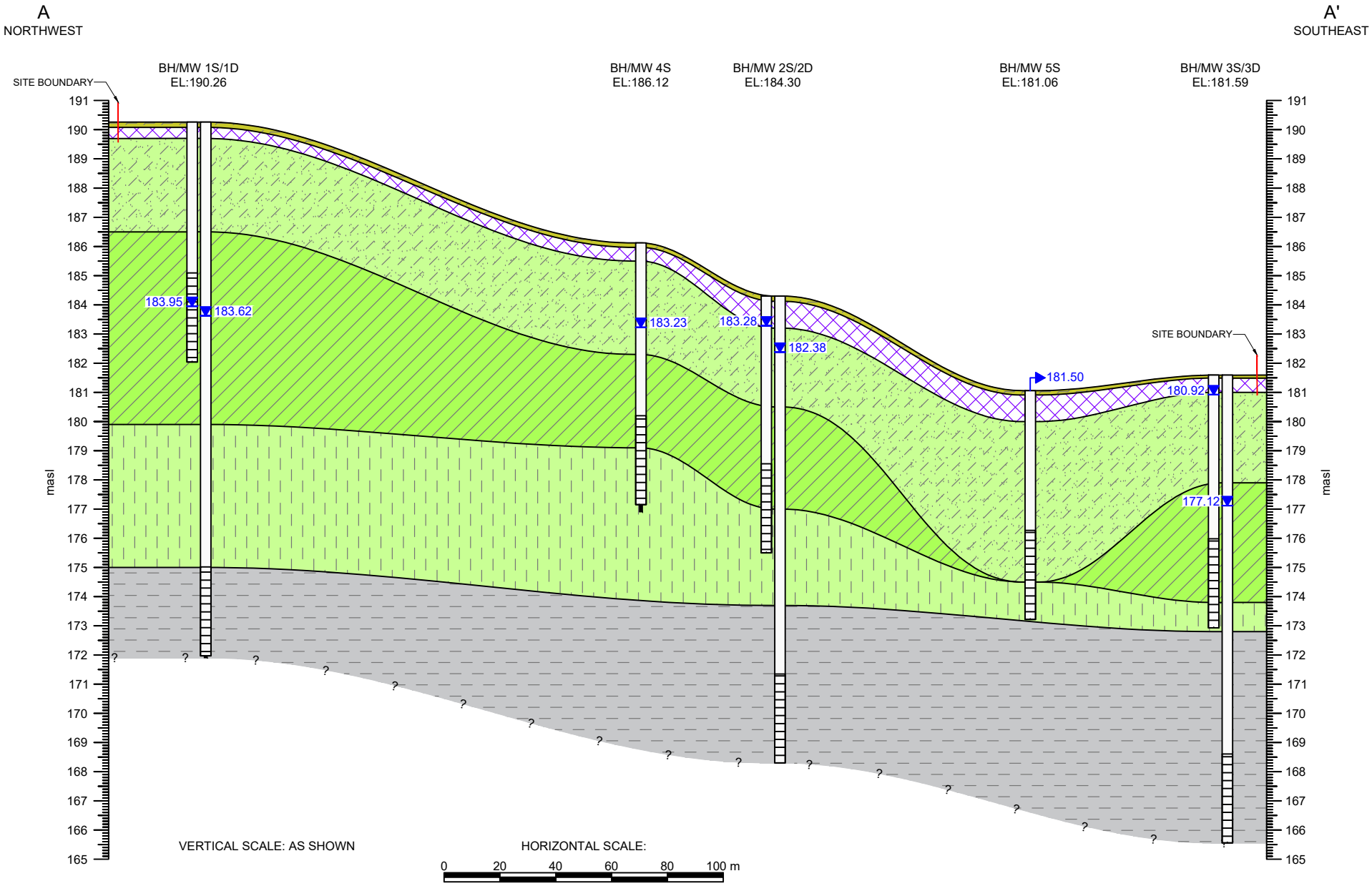
BOREHOLE / MONITORING WELL LOCATION PLAN

FIGURE: 4

HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

PROJECT NUMBER: GTR-23012833-B0

DATE: NOVEMBER 2023



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LEGEND:

- TOPSOIL
- FILL
- SANDY SILT TILL
- CLAYEY SILT TILL
- SILT TILL
- SHALE BEDROCK

GROUNDWATER ELEVATION (masl) AS MEASURED ON NOVEMBER 29, 2023

TITLE AND LOCATION:

CROSS SECTION A-A'

HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

PROJECT NO.:	DWN.:
GTR-23012833-B0	JA
SCALE:	CK:
AS NOTED	NT
DATE:	FIG. NO.:
DECEMBER 2023	5

E:\BRM\GTR-23012833-B0\60 Execution\65 Drawings_HydroG\Cross Sections\GTR-23012833-B0.dwg

SCALE:

0 20 40 60 80 100 m

LEGEND:

- BOREHOLE / MONITORING WELL (EXP, 2023)
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- XX.XX GROUNDWATER ELEVATION (m asl) AS MEASURED ON MAY 8, 2024
- APPROXIMATE SITE BOUNDARY

exp.

DRAWN BY:	CHECKED BY:
AC	NT

SHALLOW GROUNDWATER CONTOUR PLAN

FIGURE: 6A

HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

PROJECT NUMBER: GTR-23012833-B0 | DATE: MARCH 2025

SCALE:

0 20 40 60 80 100 m

LEGEND:

- BOREHOLE / MONITORING WELL (EXP, 2023)
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- XX.XX GROUNDWATER ELEVATION (m asl) AS MEASURED ON MAY 8, 2024
- APPROXIMATE SITE BOUNDARY

exp.

DRAWN BY:	CHECKED BY:
AC	NT

DEEP GROUNDWATER CONTOUR PLAN

FIGURE: 6B

HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
NEYAGAWA BOULEVARD BETWEEN
HIGHWAY 407 AND BURNHAMTHORPE ROAD WEST
OAKVILLE, ONTARIO

PROJECT NUMBER: GTR-23012833-B0 | DATE: MARCH 2025

Appendix A – MECP WWR Summary Table

Off-Site															
BORE_HOLE_ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m ASL)	LOCATION ACCURACY	STREET	CITY	DISTANCE FROM SITE CENTROID (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
10148693	2802139	5/15/1959	600065	4814686	177.4	margin of error : 100 m - 300 m			320	Cable Tool	15.2	14.0	15.2	Domestic		Water Supply
10148696	2802142	9/21/1967	599972	4814572	177.2	margin of error : 100 m - 300 m			462	Cable Tool	15.2	14.3	12.7	Domestic		Water Supply
10148768	2802214	10/22/1956	600076	4814831	180.5	UTM very unreliable			186	Cable Tool	16.8	16.2	15.2	Domestic		Water Supply
10148769	2802215	9/26/1961	599681	4815037	189.3	margin of error : 100 m - 300 m			342	Cable Tool	30.8	20.1	15.2	Domestic		Water Supply
10148773	2802219	3/2/1966	599703	4814863	186.1	margin of error : 100 m - 300 m			427	Cable Tool	25.3	21.3	15.2	Domestic		Water Supply
10148774	2802220	9/23/1966	599809	4814802	182.8	margin of error : 100 m - 300 m			395	Cable Tool	22.6	18.6	15.2	Domestic		Water Supply
10150215	2803682	12/22/1971	599775	4814803	182.8	margin of error : 30 m - 100 m			420	Cable Tool	18.6	17.7	15.2	Livestock		Water Supply
10151299	2804788	8/20/1975	599971	4814693	178.5	margin of error : 30 m - 100 m			360	Cable Tool	21.3	18.9	15.2	Domestic		Water Supply
1002876554	7135912	11/19/2009	600397	4815275	183.1	margin of error : 30 m - 100 m	HALTON REGION	OAKVILLE	294	Digging	8.4			Not Used		Abandoned-Other
1005288750	7235873	8/12/2014	600236	4814586	174.6	margin of error : 30 m - 100 m	CORNER OF NEYAGAWA & BURNAMTHORPE	Oakville	401					Not Used		Abandoned-Other
1006343488	7279653	12/2/2016	600393	4815145	181.4	margin of error : 30 m - 100 m	374 BURNHAMTHORPE	Oakville	196							Abandoned-Other
1000065362	7100722	11/9/2007	600282	4814637	175.0	margin of error : 10 - 30 m	DUNDAS W NEYOGAWA RD	Oakville	358					Monitoring		Abandoned-Other
1005880075	7257332	5/1/2015	600473	4815088	177.5	margin of error : 30 m - 100 m			246							

	COUNT
Monitoring Well / Test Hole	0
Dewatering Well	0
Water Supply Well	8
Abandoned Well	4
Unclassified / Unfinished Well	1
TOTAL	13

Appendix B – Borehole Logs

Log of Borehole 1D

Project No. BRM-23012833-D0 Drawing No. 2

Project: Preliminary Geotechnical Investigation - Proposed Development Sheet No. 1 of 1

Location: Neyagawa Boulevard between Hwy 407 & Burnhamthorpe Road West, Oakville, Ontario

Date Drilled: November 7-8, 2023

Drill Type: CME75 Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
			190.26	0
		TOPSOIL - approximately 180 mm thick	190.1	
		FILL - sandy silt, trace gravel, trace rootlets; brown/red, moist	189.7	1
		SANDY SILT TILL - trace to some clay, trace gravel; brown/red, moist, compact to dense		2
				3
			186.5	
		CLAYEY SILT TILL - trace sand, trace gravel; reddish-grey, moist, stiff to very stiff		4
				5
				6
				7
				8
				9
			179.9	10
		SILT TILL - trace to some clay, trace sand, trace gravel; reddish grey, moist, very dense		11
				12
				13
				14
			175.0	15
		- becoming shale/till complex		
		WEATHERED SHALE - reddish brown, moist		16
			173.5	
		ROCK CORING COMMENCED. REFER TO ROCK CORE LOG FOR DETAILS.		17
			171.9	18
		END OF BOREHOLE		

NOTES:
1. Groundwater monitoring well installed to 18.29 m depth.

N Value: 20 40 60 80
Shear Strength: 0.1 0.2 MPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SAMPLES

Natural Unit Weight kN/m³

17 31 37 40 30 14 12 11 17 18 50/125mm 50/125mm 50/140mm 50/140mm

LAGWGL02 BRM-23012833-D0 - NEYAGAWA.GPJ NEW.GDT 12/6/23

Time	Water Level (m)	Depth to Cave (m)
On completion	N/A	Well
November 15, 2023	6.48	Well
November 29, 2023	6.64	Well

ROCK CORE LOG

BH/MW 1D

PROJECT	ORIENTATION	ELEVATION (m)	DATUM	PROJECT NUMBER
Preliminary Geotechnical Investigation	Vertical	190.3	Geodetic	BRM-23012833-D0
LOCATION	**DATE STARTED**	**COMPLETED**	**LOGGED BY**	**DRAWING NUMBER**
Neyagawa Bvld (Hwy 407 & Burhamthorpe Rd W) Oakville,ON	11/08/23	11/08/23	RY	
CLIENT	**DRILLER**	**DRILL TYPE**	**CORE BARREL**	**SHEET**
Sky Property Group Inc.	3D Drilling	CME 75 Truck	HQ	1 of 1

ELEVATION (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	ELEVATION (m)	JOINT CHARACTERISTICS: JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERTURE (mm)	WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN NUMBER	RECOVERY (%)	RQD	WATER RECOVERY (%)	WATER COLOUR
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
173.4				173.4														
			QUEENSTON FORMATION Brick red to maroon noncalcareous to calcareous shale with subordinate amounts of green shale, siltstone and limestone															
	17		**RUN 1 :** Moderately weathered (W3) to unweathered (W1), weak (R2) to medium strong (R3), reddish brown, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)		B C B	F V F		SP RU RP	T T T									
			Highly Weathered Zone (W1): 17.01 - 17.08 m (70mm)		B	F		RU	S	1								
			Fracture Zones: 16.81 - 17.08 m (270mm) 17.48 - 17.53 m (50mm)											1	100	65		
			Vertical Fracture: 17.08 - 17.18 m (100mm)		B	F		SP	S	1								
			Solid Core Recovery: 72%															
	18				B	F		SP	S	1								
					B	F		SP	Si	10								
171.9				171.9														
			End of Borehole at 18.3 m															
	19																	
	20																	

EXP_ROCKCOREAM ROCK CORE LOGS.GPJ CORE_LOG.GDT 11/20/23

exp.

Log of Borehole 1S

Project No. BRM-23012833-D0 Drawing No. 2A

Project: Preliminary Geotechnical Investigation - Proposed Development Sheet No. 1 of 1

Location: Neyagawa Boulevard between Hwy 407 & Burnhamthorpe Road West, Oakville, Ontario

Date Drilled: November 8, 2023

Drill Type: CME75 Track Mount

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○⊣
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		NO SAMPLING. BOREHOLE DRILLED FOR THE PURPOSE OF GROUNDWATER MONITORING WELL INSTALLATION.	190.26	0
				1
				2
				3
				4
				5
				6
				7
			182.0	8
		END OF BOREHOLE		
		NOTES: 1. Groundwater monitoring well installed to 8.22 m depth.		

N Value: 20 40 60 80
Shear Strength: 0.1 MPa 0.2
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30
SAMPLES
Natural Unit Weight kN/m³

LAGWGL02 BRM-23012833-D0 - NEYAGAWA.GPJ NEW.GDT 12/6/23

Time	Water Level (m)	Depth to Cave (m)
On completion	N/A	Well
November 15, 2023	7.77	Well
November 17, 2023	7.71	Well
November 29, 2023	6.31	Well

Log of Borehole 2D

Project No. BRM-23012833-D0 Drawing No. 3

Project: Preliminary Geotechnical Investigation - Proposed Development Sheet No. 1 of 1

Location: Neyagawa Boulevard between Hwy 407 & Burnhamthorpe Road West, Oakville, Ontario

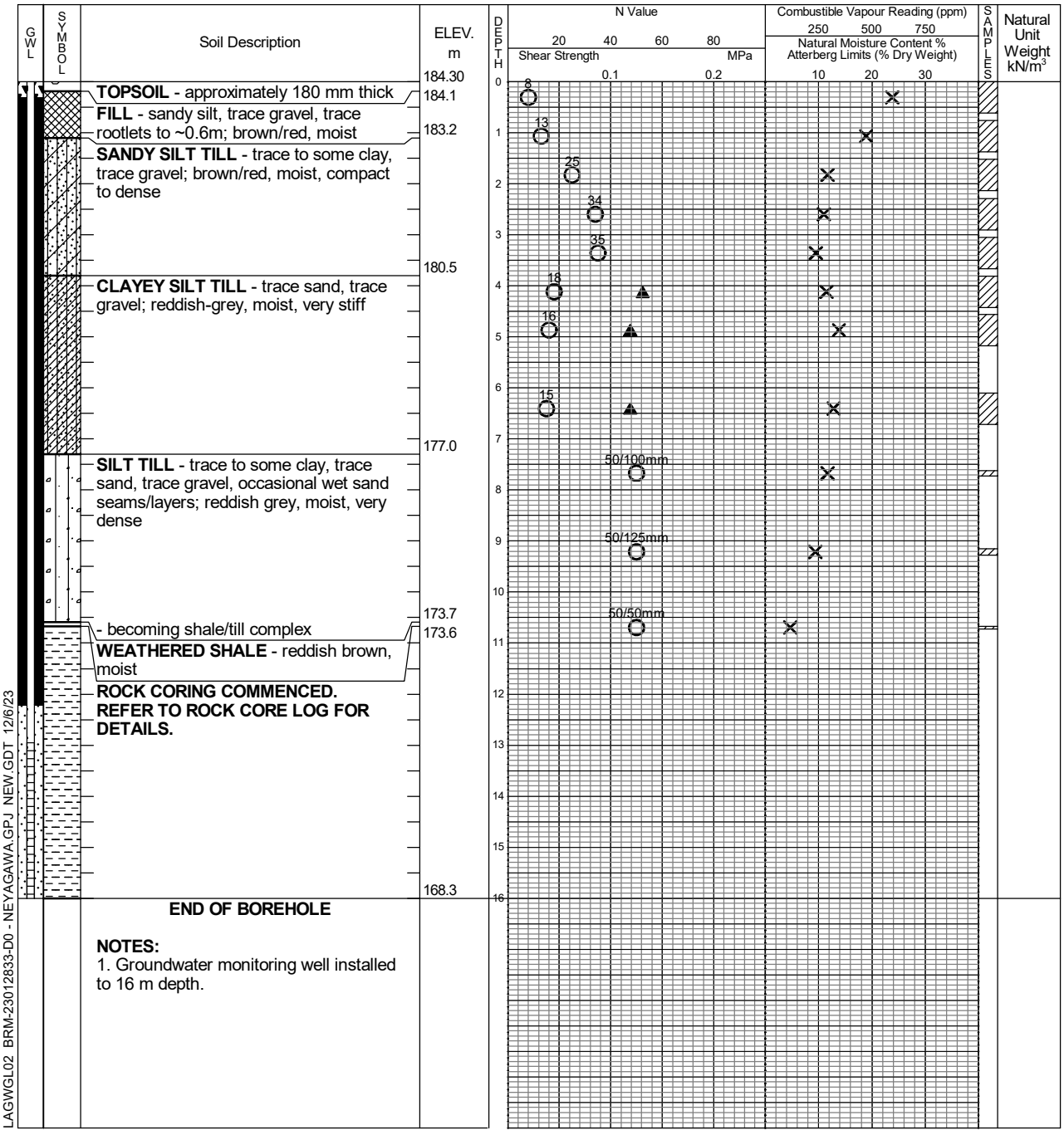
Date Drilled: November 8-9, 2023

Drill Type: CME75 Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



NOTES:
1. Groundwater monitoring well installed to 16 m depth.

Time	Water Level (m)	Depth to Cave (m)
On completion	N/A	Well
November 15, 2023	1.86	Well
November 29, 2023	1.92	Well

LAGWGL02 BRM-23012833-D0 - NEYAGAWA.GPJ NEW.GDT 12/6/23

ROCK CORE LOG

BH2

PROJECT	ORIENTATION	ELEVATION (m)	DATUM	PROJECT NUMBER
Preliminary Geotechnical Investigation	Vertical	184.3	Geodetic	BRM-23012833-D0
LOCATION	**DATE STARTED**	**COMPLETED**	**LOGGED BY**	**DRAWING NUMBER**
Neyagawa Bvld (Hwy 407 & Burhamthorpe Rd W) Oakville,ON	11/09/23	11/09/23	RY	
CLIENT	**DRILLER**	**DRILL TYPE**	**CORE BARREL**	**SHEET**
Sky Property Group Inc.	3D Drilling	CME 75 Truck	HQ	1 of 2

ELEVATION (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	ELEVATION (m)	JOINT CHARACTERISTICS: JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERTURE (mm)	WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN NUMBER	RECOVERY (%)	RQD	WATER RECOVERY (%)	WATER COLOUR
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
173.8			**GRAVEL**	173.8														
173.7			**QUEENSTON FORMATION** Brick red to maroon noncalcareous to calcareous shale with subordinate amounts of green shale, siltstone and limestone	173.7	B	F		SP	T									
			RUN 1 : Moderately weathered (W3) to slightly weathered (W2), weak (R2) to medium strong (R3), reddish brown to greenish grey, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)		B	F		SP	T					1	100	18		
	11		Fracture Zones: 10.59 - 10.79 m (200mm) 10.99 - 11.31 m (320mm)															
			Solid Core Recovery: 31% **RUN 2 :** Slightly Weathered (W2) to unweathered (W1), medium strong (R3), reddish brown to greenish grey, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)		B	F		RP	T									
					B	F		SP	T									
			Fracture Zones: 11.54 - 11.62 m (80mm)															
			Solid Core Recovery: 96%		B	F		SP	T									
	12																	
					B	F		RU	T					2	100	94		
					B	F		SP	T									
					B	F		RP	T									
	13		**RUN 3 :** Slightly Weathered (W2) to unweathered (W1), medium strong (R3), reddish brown to greenish grey, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)		B	F		SP	T									
					B	F		RP	T									
			Highly Weathered Zone (W4): 13.21 - 13.34 m (130mm)		B	F		RU	T									
			Fracture Zones: 13.07 - 13.13 m (60mm)															
			Solid Core Recovery: 96%											3	100	96		

EXP_ROCKCOREAM ROCK CORE LOGS.GPJ CORE_LOG.GDT 11/20/23

exp.

ROCK CORE LOG

BH2

PROJECT	ORIENTATION	ELEVATION (m)	DATUM	PROJECT NUMBER
Preliminary Geotechnical Investigation	Vertical	184.3	Geodetic	BRM-23012833-D0
LOCATION	**DATE STARTED**	**COMPLETED**	**LOGGED BY**	**DRAWING NUMBER**
Neyagawa Bvld (Hwy 407 & Burhamthorpe Rd W) Oakville,ON	11/09/23	11/09/23	RY	
CLIENT	**DRILLER**	**DRILL TYPE**	**CORE BARREL**	**SHEET**
Sky Property Group Inc.	3D Drilling	CME 75 Truck	HQ	2 of 2

ELEVATION (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	ELEVATION (m)	JOINT CHARACTERISTICS: JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERTURE (mm)	WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN NUMBER	RECOVERY (%)	RQD	WATER RECOVERY (%)	WATER COLOUR
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	14																	
			RUN 4 : Slightly Weathered (W2) to unweathered (W1), medium strong (R3), reddish brown to greenish grey, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)															
			dissolution features: 15.18 - 15.31 m (130mm)		B	F		RP	S	1								
					B	F		RP	T									
			Solid Core Recovery: 96%		B	F		SP	T									
	15																	
					B	F		SP	T					4	100	86		
					B	F		SP	T									
					B	F		SP	T									
					B	F		RP	T									
					B	F		SP	T									
168.3	16		End of Borehole at 16.0 m	168.3														
	17																	

Log of Borehole 2S

Project No. BRM-23012833-D0 | Drawing No. 3A

Project: Preliminary Geotechnical Investigation - Proposed Development | Sheet No. 1 of 1

Location: Neyagawa Boulevard between Hwy 407 & Burnhamthorpe Road West, Oakville, Ontario

Date Drilled: November 9, 2023

Drill Type: CME75 Track Mount

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		NO SAMPLING. BOREHOLE DRILLED FOR THE PURPOSE OF GROUNDWATER MONITORING WELL INSTALLATION.	184.30	0
				1
				2
				3
				4
				5
				6
				7
				8
			175.5	
		END OF BOREHOLE		

N Value: 20 40 60 80
Shear Strength: 0.1 0.2 MPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SAMPLES

Natural Unit Weight kN/m³

NOTES:
1. Groundwater monitoring well installed to 8.8 m depth.

LAGWGL02 BRM-23012833-D0 - NEYAGAWA.GPJ NEW.GDT 12/6/23

exp.

Time	Water Level (m)	Depth to Cave (m)
On completion	N/A	Well
November 15, 2023	0.86	Well
November 17, 2023	1.10	Well
November 29, 2023	1.02	Well

Log of Borehole 3D

Project No. BRM-23012833-D0 Drawing No. 4

Project: Preliminary Geotechnical Investigation - Proposed Development Sheet No. 1 of 1

Location: Neyagawa Boulevard between Hwy 407 & Burnhamthorpe Road West, Oakville, Ontario

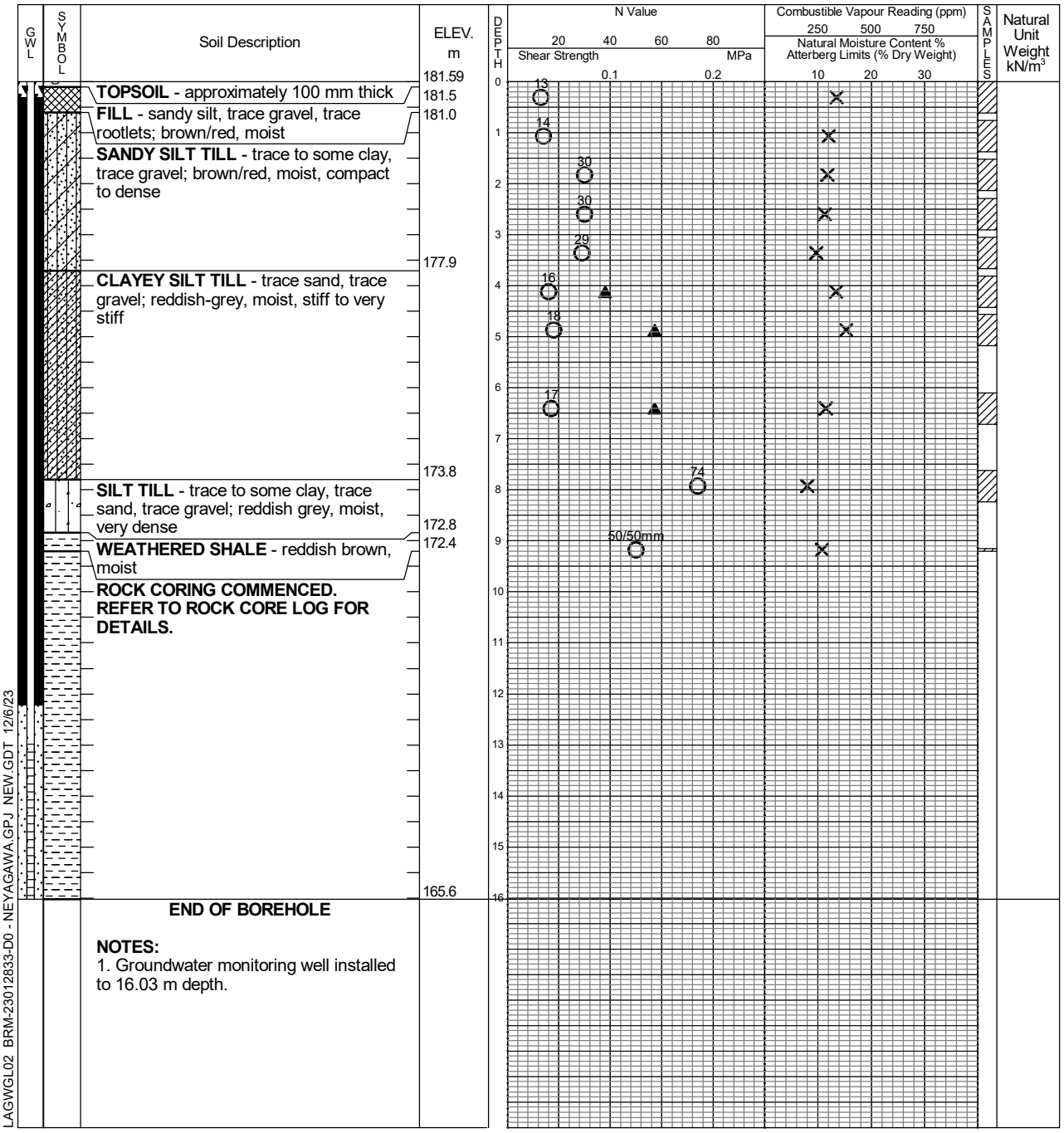
Date Drilled: November 6 and 10, 2023

Drill Type: CME75 Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test S

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



TOPSOIL - approximately 100 mm thick

FILL - sandy silt, trace gravel, trace rootlets; brown/red, moist

SANDY SILT TILL - trace to some clay, trace gravel; brown/red, moist, compact to dense

CLAYEY SILT TILL - trace sand, trace gravel; reddish-grey, moist, stiff to very stiff

SILT TILL - trace to some clay, trace sand, trace gravel; reddish grey, moist, very dense

WEATHERED SHALE - reddish brown, moist

ROCK CORING COMMENCED. REFER TO ROCK CORE LOG FOR DETAILS.

END OF BOREHOLE

NOTES:
1. Groundwater monitoring well installed to 16.03 m depth.

Time	Water Level (m)	Depth to Cave (m)
On completion	N/A	Well
November 15, 2023	4.47	Well
November 29, 2023	4.47	Well

LAGWGL02 BRM-23012833-D0 - NEYAGAWA.GPJ NEW.GDT 12/6/23

ROCK CORE LOG

BH/MW 3D

PROJECT	ORIENTATION	ELEVATION (m)	DATUM	PROJECT NUMBER
Preliminary Geotechnical Investigation	Vertical	181.6	Geodetic	BRM-23012833-D0
LOCATION	**DATE STARTED**	**COMPLETED**	**LOGGED BY**	**DRAWING NUMBER**
Neyagawa Bvld (Hwy 407 & Burhamthorpe Rd W) Oakville,ON	11/10/23	11/10/23	RY	
CLIENT	**DRILLER**	**DRILL TYPE**	**CORE BARREL**	**SHEET**
Sky Property Group Inc.	3D Drilling	CME 75 Truck	HQ	1 of 2

ELEVATION (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	ELEVATION (m)	JOINT CHARACTERISTICS: JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERTURE (mm)	WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN NUMBER	RECOVERY (%)	RQD	WATER RECOVERY (%)	WATER COLOUR
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
172.5			**QUEENSTON FORMATION** Brick red to maroon noncalcareous to calcareous shale with subordinate amounts of green shale, siltstone and limestone	172.5														
			RUN 1 : Moderately weathered (W3) to slightly weathered (W2), very weak (R1) to weak (R2), reddish brown to greenish grey, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)											1	100	28		
			Fracture Zones: 9.12 - 9.67 m (550mm)															
			Solid Core Recovery: 36%		B	F		RP	T									
					B	F		SP	T									
	10		**RUN 2 :** Moderately weathered (W3) to unweathered (W1), weak (R2) to medium strong (R3), reddish brown to greenish grey, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)		B	F		SP	T									
			Highly Weathered Zone (W4): 11.29 - 11.46 m (170mm)															
			Fracture Zones: 9.94 - 10.06 m (120mm) 10.15 - 10.2 m (50mm) 10.65 - 10.68 m (30mm) 10.93 - 10.99 m (50mm)		B	F		SP	T									
					B	F		RP	T									
			Solid Core Recovery: 81%											2	100	70		
					B	F		SP	O									
					B	F		SP	S	4								
	11				B	F		RU	S	4								
					B	F		RP	T									
			RUN 3 : Moderately weathered (W3) to slightly weathered (W2), weak (R2) to medium strong (R3), reddish brown to greenish grey, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)		B	F		RU	S	1								
			Solid Core Recovery: 96%															
					B	F		RU	S	1								
	12													3	100	92		

EXP_ROCKCOREAM ROCK CORE LOGS.GPJ CORE_LOG.GDT 11/20/23

exp.

ROCK CORE LOG

BH/MW 3D

PROJECT	ORIENTATION	ELEVATION (m)	DATUM	PROJECT NUMBER
Preliminary Geotechnical Investigation	Vertical	181.6	Geodetic	BRM-23012833-D0
LOCATION	**DATE STARTED**	**COMPLETED**	**LOGGED BY**	**DRAWING NUMBER**
Neyagawa Bvld (Hwy 407 & Burhamthorpe Rd W) Oakville,ON	11/10/23	11/10/23	RY	
CLIENT	**DRILLER**	**DRILL TYPE**	**CORE BARREL**	**SHEET**
Sky Property Group Inc.	3D Drilling	CME 75 Truck	HQ	2 of 2

ELEVATION (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	ELEVATION (m)	JOINT CHARACTERISTICS: JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERTURE (mm)	WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN NUMBER	RECOVERY (%)	RQD	WATER RECOVERY (%)	WATER COLOUR
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
					B	F		SP	T									
					B	F		RU	T									
					B	F		SP	T									
	13		**RUN 4 :**		B	F		SP	T									
			Unweathered (W1), medium strong (R3), reddish brown to greenish grey, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)		B	F		SU	S	1								
			Fracture Zones:															
			13.59 - 13.61 m (20mm)		B	F		SP	T									
					B	F		SP	T									
			Solid Core Recovery: 98%		B	F		SU	S	1								
					B	F		SP	T									
					B	F		RP	T									
					B	F		RP	T									
														4	100	93		
					B	F		SP	T									
	14																	
					B	F		SP	T									
			RUN 5 :		B	F		SU	T									
			Unweathered (W1), weak (R2) to medium strong (R3), reddish brown to greenish grey, hematitic, sandy, bedded / laminated, calcareous SHALE and SILTSTONE (100%)		B	F		RP	T									
					B	F		RP	T									
					B	F		RP	T									
			Solid Core Recovery: 99%		B	F		SP	Si	3								
					B	F		RP	T									
	15																	
					B	F		SP	Si	2				5	100	85		
					B	F		SP	T									
					B	F		SP	T									
165.6	16		End of Borehole at 16.0 m	165.6														

exp.

Log of Borehole 3S

Project No. BRM-23012833-D0 Drawing No. 4A

Project: Preliminary Geotechnical Investigation - Proposed Development Sheet No. 1 of 1

Location: Neyagawa Boulevard between Hwy 407 & Burnhamthorpe Road West, Oakville, Ontario

Date Drilled: November 6, 2023

Drill Type: CME75 Track Mount

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		NO SAMPLING. BOREHOLE DRILLED FOR THE PURPOSE OF GROUNDWATER MONITORING WELL INSTALLATION.	181.59	0
				1
				2
				3
				4
				5
				6
				7
			172.9	8
		END OF BOREHOLE		
		NOTES: 1. Groundwater monitoring well installed to 8.66 m depth.		

N Value: 20 40 60 80
Shear Strength: 0.1 MPa 0.2
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30
SAMPLES
Natural Unit Weight kN/m³

LAGWGL02 BRM-23012833-D0 - NEYAGAWA.GPJ NEW.GDT 12/6/23

Time	Water Level (m)	Depth to Cave (m)
On completion	N/A	Well
November 15, 2023	0.55	Well
November 17, 2023	0.66	Well
November 29, 2023	0.67	Well

Log of Borehole 4

Project No. BRM-23012833-D0 Drawing No. 5

Project: Preliminary Geotechnical Investigation - Proposed Development Sheet No. 1 of 1

Location: Neyagawa Boulevard between Hwy 407 & Burnhamthorpe Road West, Oakville, Ontario

Date Drilled: November 7, 2023

Drill Type: CME75 Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test S

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		TOPSOIL - approximately 150 mm thick	186.12 186.0	0
		FILL - sandy silt, trace gravel, trace rootlets; brown/red, moist	185.5	
		SANDY SILT TILL - trace to some clay, trace gravel; brown/red, moist, compact to dense		1 2 3
			182.3	
		CLAYEY SILT TILL - trace sand, trace gravel; reddish-grey, moist, stiff		4 5 6
			179.1	7
		SILT TILL - trace to some clay, trace sand, trace gravel; reddish grey, moist, very dense		8
			176.9	9
		END OF BOREHOLE		

N Value: 20 40 60 80
Shear Strength: 0.1 0.2 MPa

17
31
35
27
16
13
10
12
50/125mm
50/50mm

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SAMPLES

Natural Unit Weight kN/m³

NOTES:
1. Groundwater monitoring well installed to 8.97 m depth.

LAGWGL02 BRM-23012833-D0 - NEYAGAWA.GPJ NEW.GDT 12/6/23

Time	Water Level (m)	Depth to Cave (m)
On completion	N/A	Well
November 15, 2023	2.73	Well
November 17, 2023	2.84	Well
November 29, 2023	2.89	Well

Log of Borehole 5

Project No. BRM-23012833-D0 Drawing No. 6

Project: Preliminary Geotechnical Investigation - Proposed Development Sheet No. 1 of 1

Location: Neyagawa Boulevard between Hwy 407 & Burnhamthorpe Road West, Oakville, Ontario

Date Drilled: November 6, 2023

Drill Type: CME75 Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
			181.06	0
		TOPSOIL - approximately 150 mm thick	180.9	
		FILL - sandy silt, trace gravel, trace rootlets to ~0.6m; brown/red, moist	180.0	1
		SANDY SILT TILL - trace to some clay, trace gravel; brown/red, moist, compact to dense		2
				3
				4
				5
			174.5	6
		SILT TILL - trace to some clay, trace sand, trace gravel; reddish grey, moist, very dense		7
			173.2	
		END OF BOREHOLE		

NOTES:
1. Groundwater monitoring well installed to 7.84 m depth.

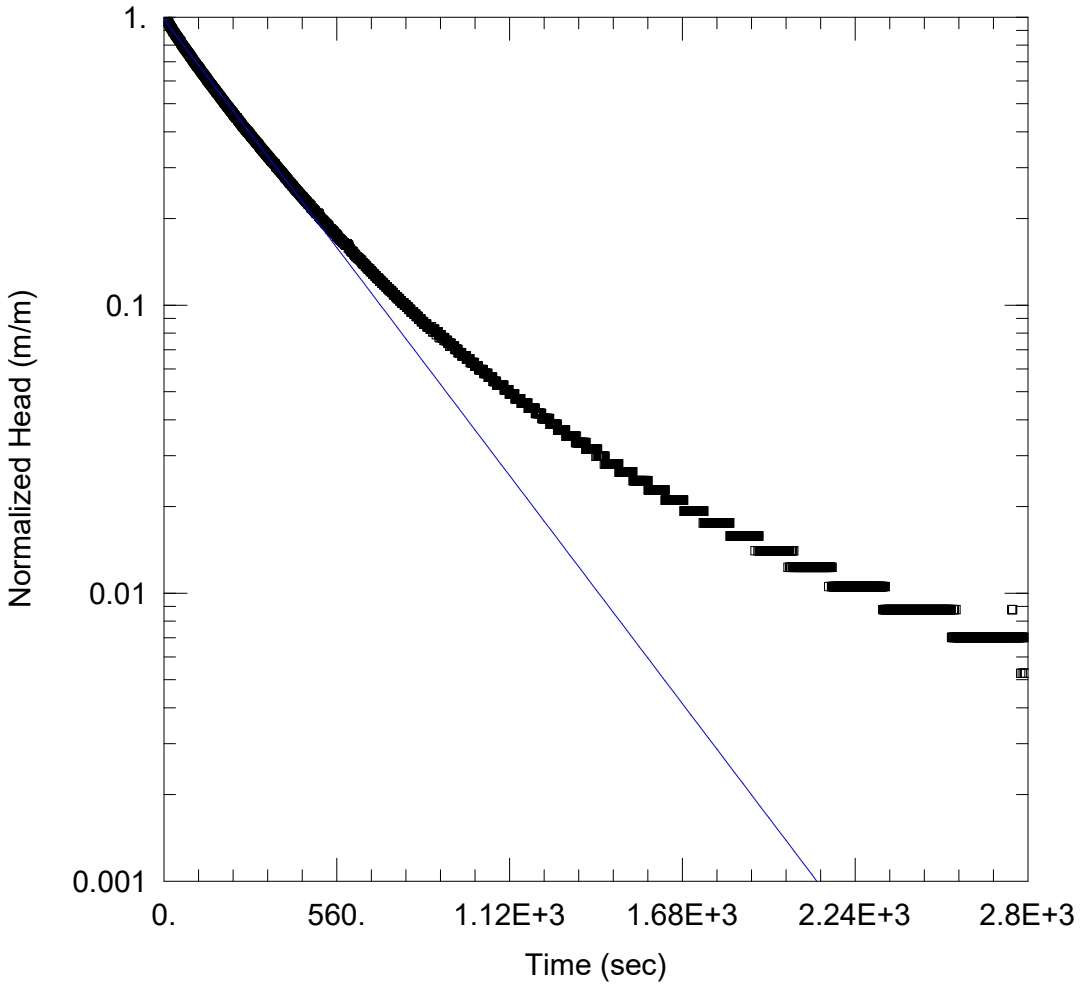
N Value: 20 40 60 80
Shear Strength: 0.1 0.2 MPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30
SAMPLES
Natural Unit Weight kN/m³

12
15
34
51
45
24
28
29
50/70mm

Time	Water Level (m)	Depth to Cave (m)
On completion	N/A	Well
November 15, 2023	-0.64	Well
November 17, 2023	-0.49	Well
November 29, 2023	-0.44	Well

LAGWGL02 BRM-23012833-D0 - NEYAGAWA.GPJ NEW.GDT 12/6/23

Appendix C – SWRT Procedures and Results



BH/MW 1D

Data Set: C:\Users\holmesm\OneDrive - EXP\Desktop\BH1D.aqt
Date: 12/05/23 Time: 09:24:40

PROJECT INFORMATION

Company: EXP
Client: Sky Property Group Inc.
Project: GTR-23012833-B0
Location: Neyagawa Blvd & Hwy 407
Test Well: BH/MW 1D
Test Date: November 29, 2023

AQUIFER DATA

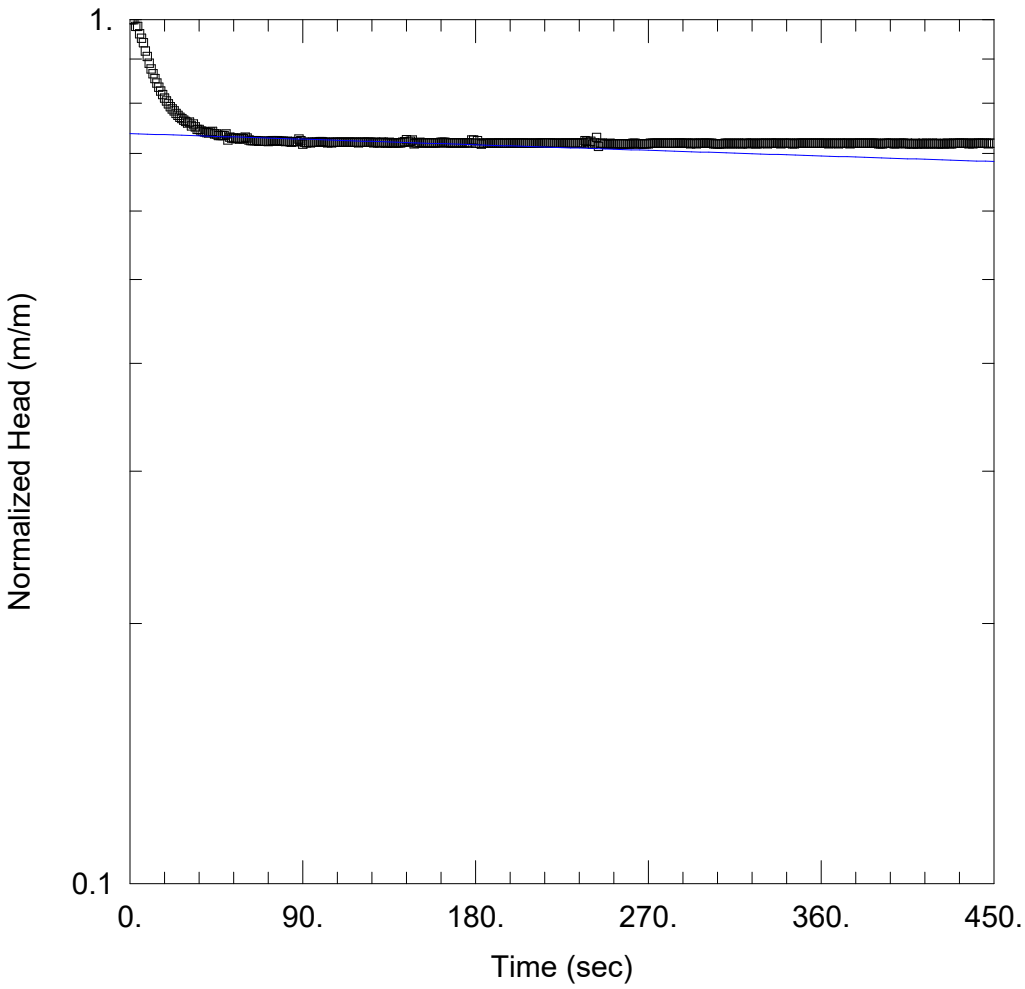
Saturated Thickness: 11.68 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 1D)

Initial Displacement: 1.71 m
Total Well Penetration Depth: 9.68 m
Casing Radius: 0.0254 m
Static Water Column Height: 11.68 m
Screen Length: 1. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.858E-6 m/sec
y0 = 1.678 m



BH/MW 1S - FALLING HEAD TEST

Data Set: E:\...\BH1S Rev.aqt
Date: 12/06/23 Time: 15:05:51

PROJECT INFORMATION

Company: EXP
Client: Sky Property Group Inc.
Project: GTR-23012833-B0
Location: Neyagawa Blvd & Hwy 407
Test Well: BH/MW 1S
Test Date: November 29, 2023

AQUIFER DATA

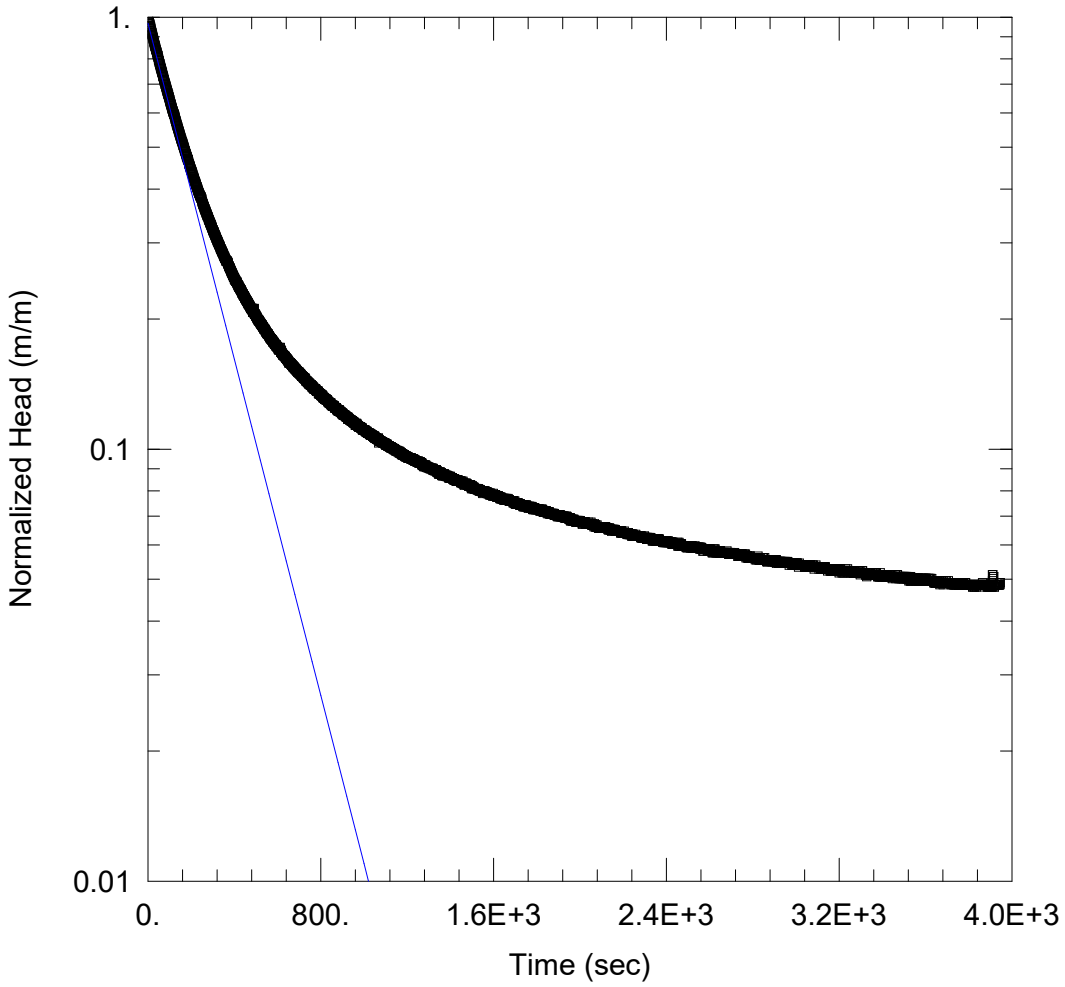
Saturated Thickness: 2.71 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 1S)

Initial Displacement: 1.004 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 2.71 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.043E-7 m/sec
y0 = 0.7408 m



BH/MW 2D - FALLING HEAD TEST

Data Set: C:\Users\holmesm\OneDrive - EXP\Desktop\BH2D.aqt
Date: 12/05/23 Time: 09:33:49

PROJECT INFORMATION

Company: EXP
Client: Sky Property Group Inc.
Project: GTR-23012833-B0
Location: Neyagawa Blvd & Hwy 407
Test Well: BH/MW 2D
Test Date: November 29, 2023

AQUIFER DATA

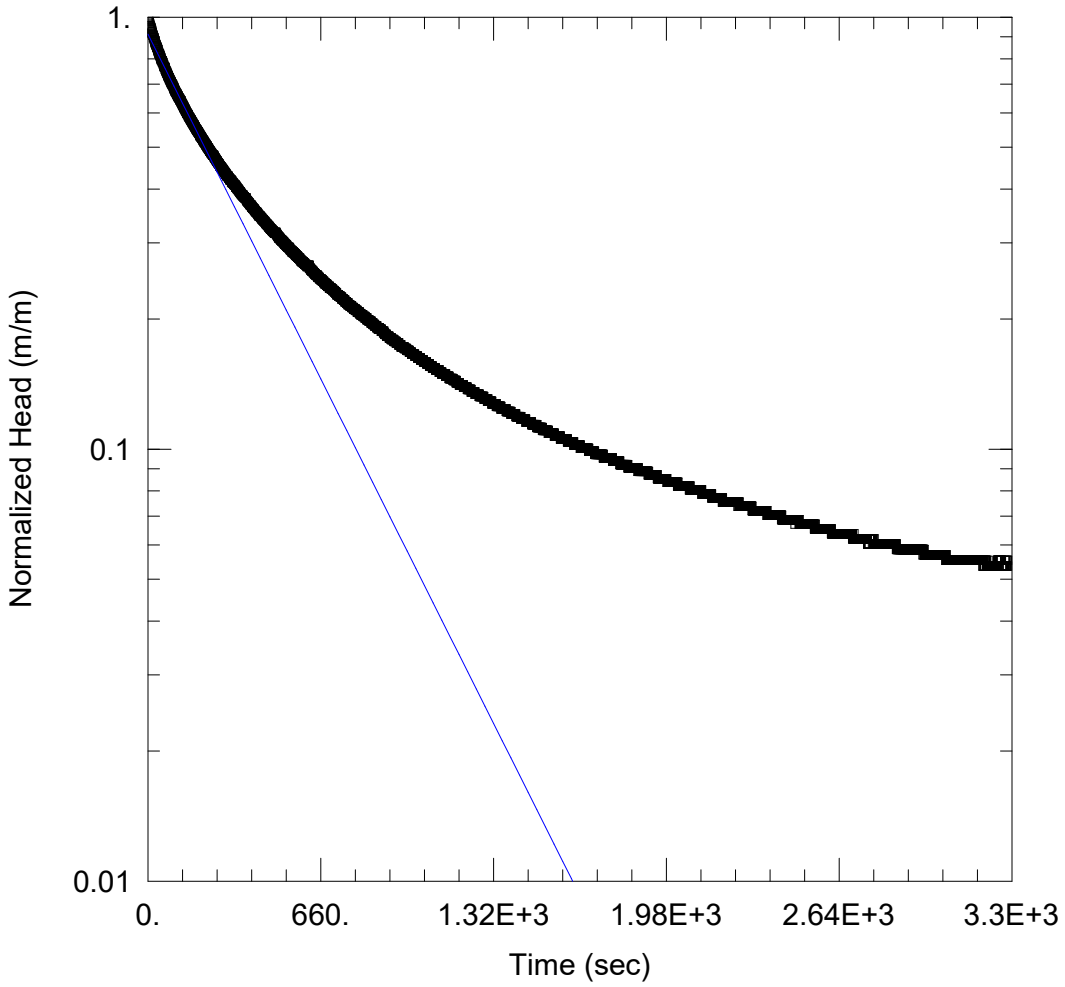
Saturated Thickness: 15.05 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 2D)

Initial Displacement: 1.875 m
Total Well Penetration Depth: 15.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 15.05 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 2.631E-6 m/sec
y0 = 1.814 m



BH/MW 2S - FALLING HEAD TEST

Data Set: C:\Users\holmesm\OneDrive - EXP\Desktop\BH2S.aqt
Date: 12/05/23 Time: 09:29:42

PROJECT INFORMATION

Company: EXP
Client: Sky Property Group Inc.
Project: GTR-23012833-B0
Location: Neyagawa Blvd & Hwy 407
Test Well: BH/MW 2S
Test Date: November 29, 2023

AQUIFER DATA

Saturated Thickness: 6.52 m Anisotropy Ratio (Kz/Kr): 1.

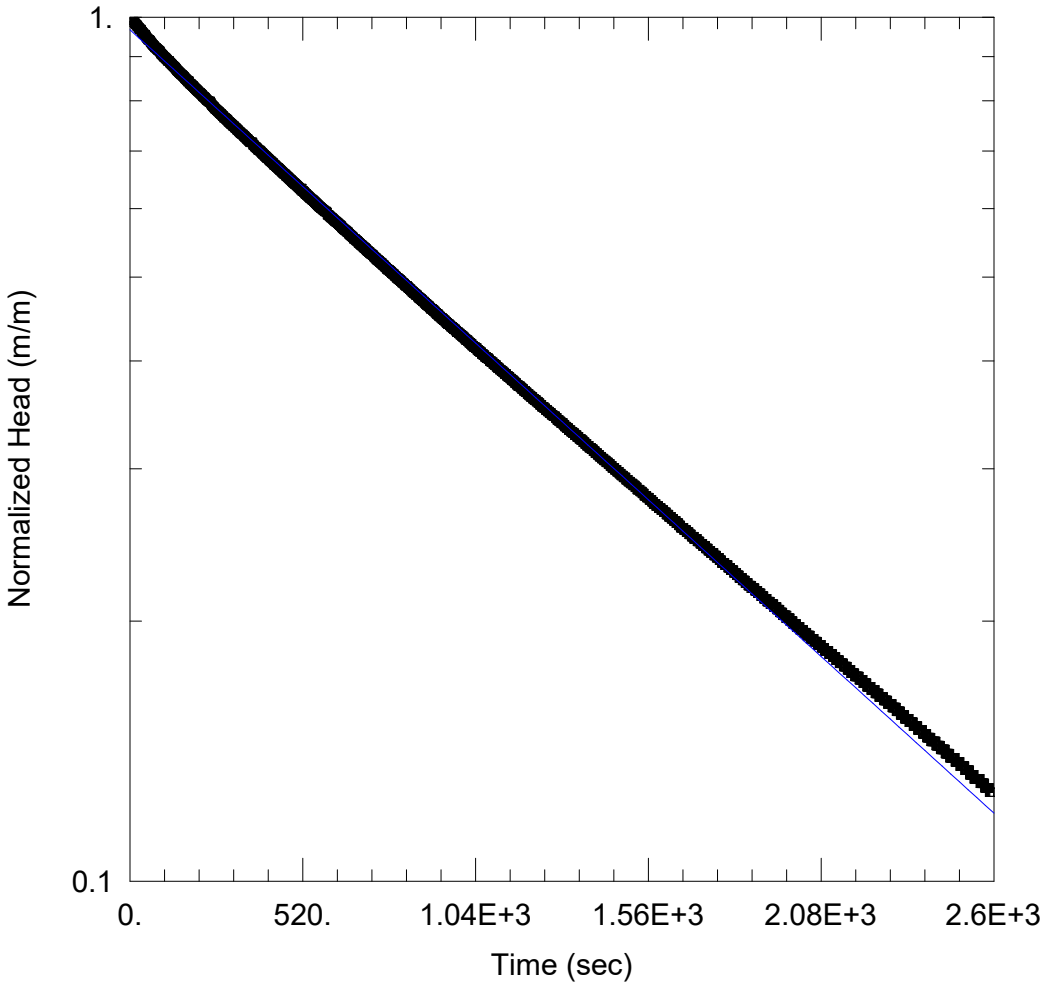
WELL DATA (BH/MW 2S)

Initial Displacement: 1.791 m
Total Well Penetration Depth: 6.52 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.52 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.635E-6 m/sec y0 = 1.634 m



BH/MW 3D - FALLING HEAD TEST

Data Set: C:\Users\holmesm\OneDrive - EXP\Desktop\BH3D.aqt
Date: 12/05/23 Time: 09:22:21

PROJECT INFORMATION

Company: EXP
Client: Sky Property Group Inc.
Project: GTR-23012833-B0
Location: Neyagawa Blvd & Hwy 407
Test Well: BH/MW 3D
Test Date: November 29, 2023

AQUIFER DATA

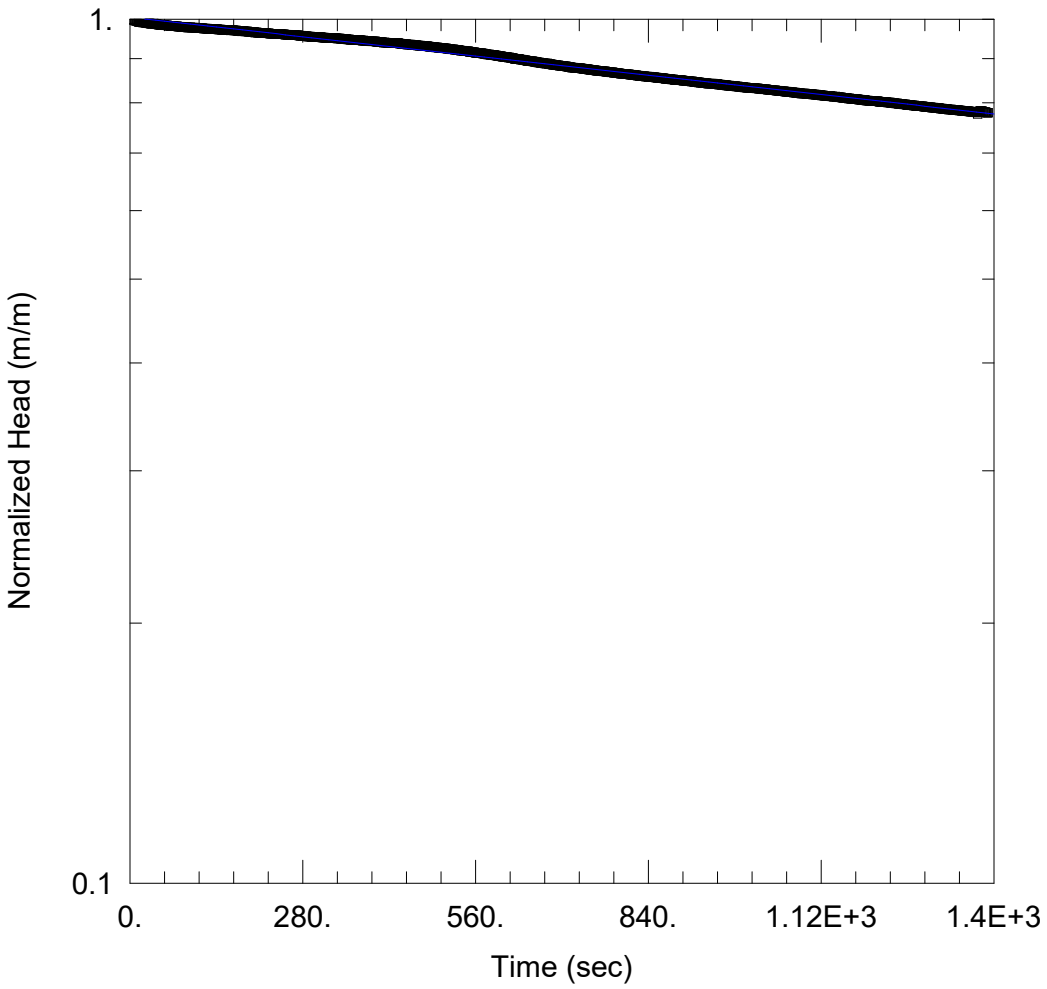
Saturated Thickness: 11.36 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 3D)

Initial Displacement: 1.965 m
Total Well Penetration Depth: 11.36 m
Casing Radius: 0.0254 m
Static Water Column Height: 11.36 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 4.719E-7 m/sec
y0 = 1.9 m



BH/MW 3S - FALLING HEAD TEST

Data Set: C:\Users\holmesm\OneDrive - EXP\Desktop\BH3S.aqt
Date: 12/05/23 Time: 09:36:04

PROJECT INFORMATION

Company: EXP
Client: Sky Property Group Inc.
Project: GTR-23012833-B0
Location: Neyagawa Blvd & Hwy 407
Test Well: BH/MW 3S
Test Date: November 29, 2023

AQUIFER DATA

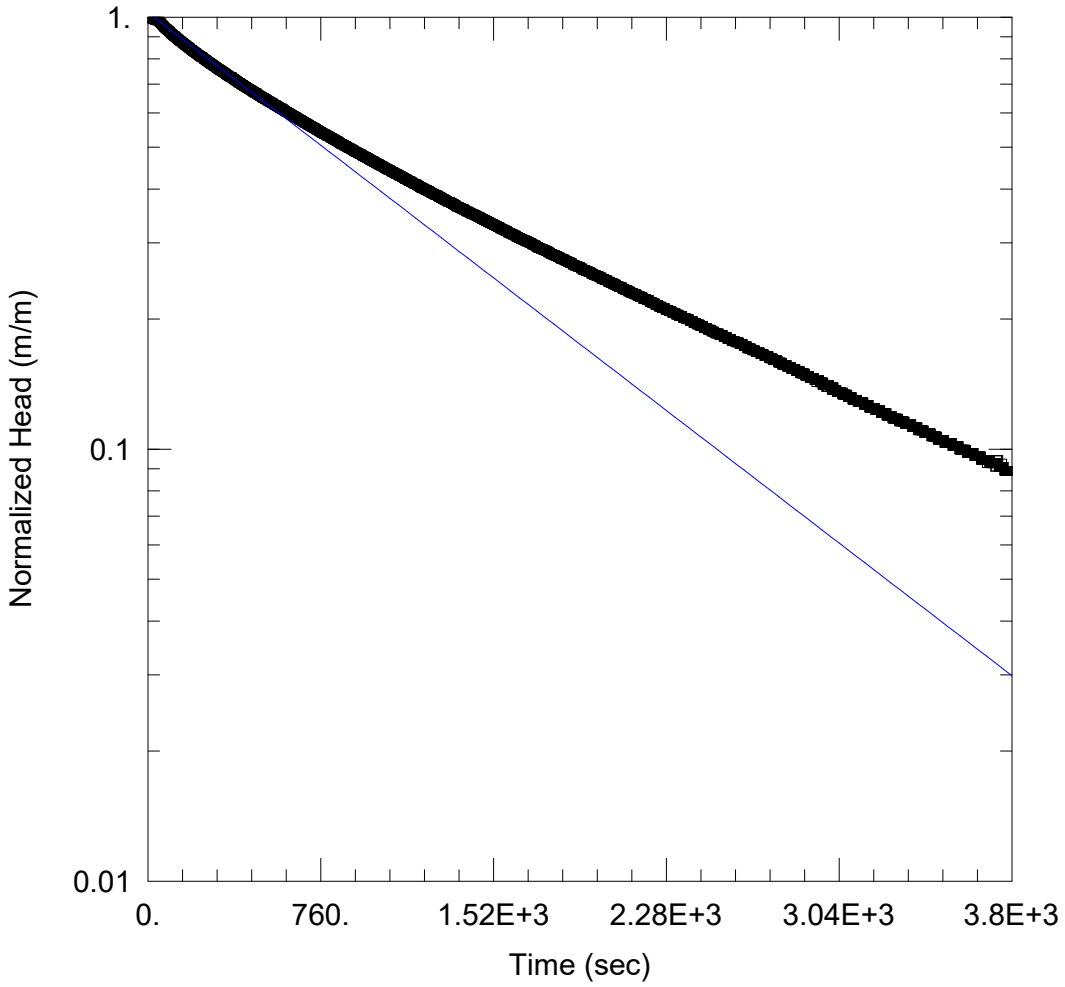
Saturated Thickness: 2.68 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 3S)

Initial Displacement: 1.504 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 2.68 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.171E-7 m/sec
y0 = 1.511 m



BH/MW 4S - FALLING HEAD TEST

Data Set:
Date: 12/05/23 Time: 09:26:49

PROJECT INFORMATION

Company: EXP
Client: Sky Property Group Inc.
Project: GTR-23012833-B0
Location: Neyagawa Blvd & Hwy 407
Test Well: BH/MW 4S
Test Date: November 29, 2023

AQUIFER DATA

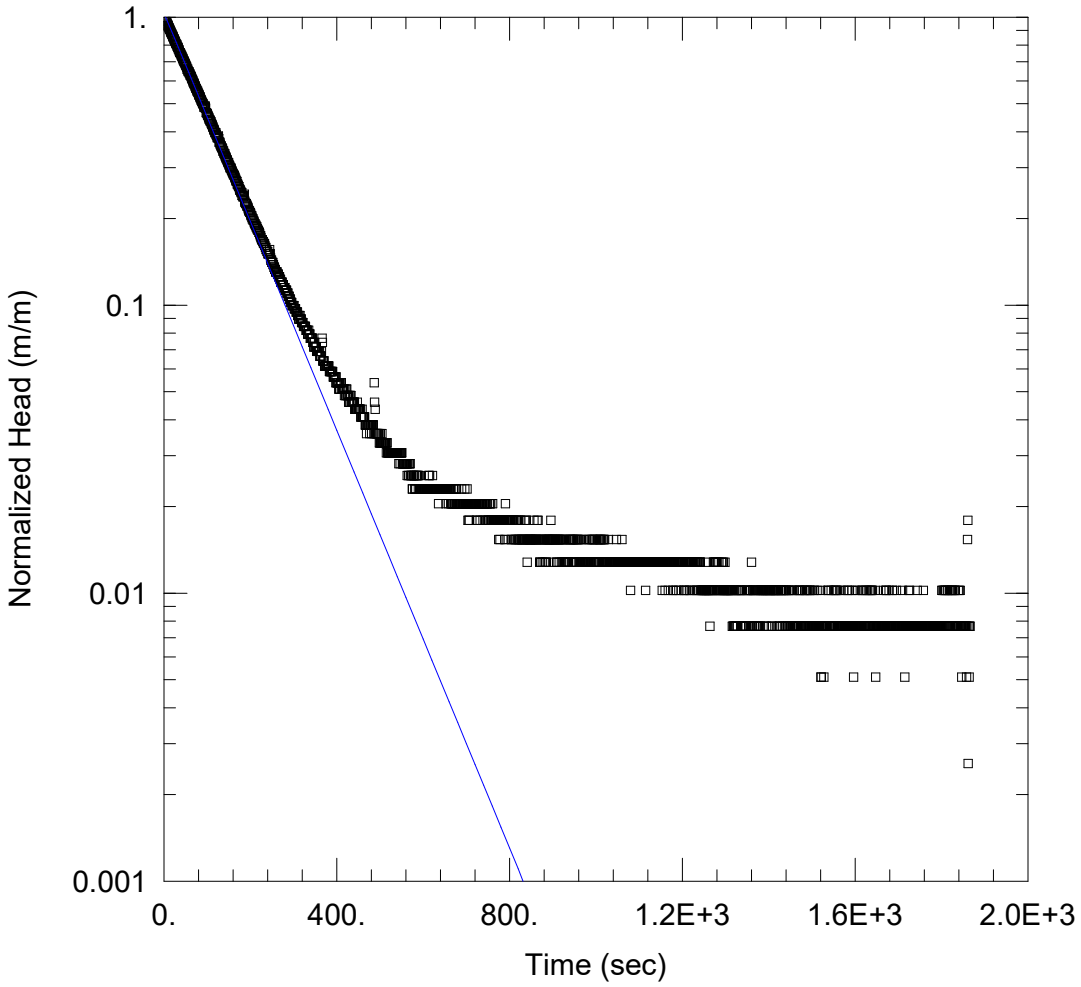
Saturated Thickness: 6.09 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 4S)

Initial Displacement: 1.683 m
Total Well Penetration Depth: 8.09 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.09 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 5.465E-7 m/sec
y0 = 1.724 m



BH/MW 5S - FALLING HEAD TEST

Data Set: C:\Users\holmesm\OneDrive - EXP\Desktop\BH5S.aqt
Date: 12/05/23 Time: 09:31:47

PROJECT INFORMATION

Company: EXP
Client: Sky Property Group Inc.
Project: GTR-23012833-B0
Location: Neyagawa Blvd & Hwy 407
Test Well: BH/MW 5S
Test Date: November 29, 2023

AQUIFER DATA

Saturated Thickness: 8.19 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 5S)

Initial Displacement: 0.391 m
Total Well Penetration Depth: 8.19 m
Casing Radius: 0.0254 m
Static Water Column Height: 8.19 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

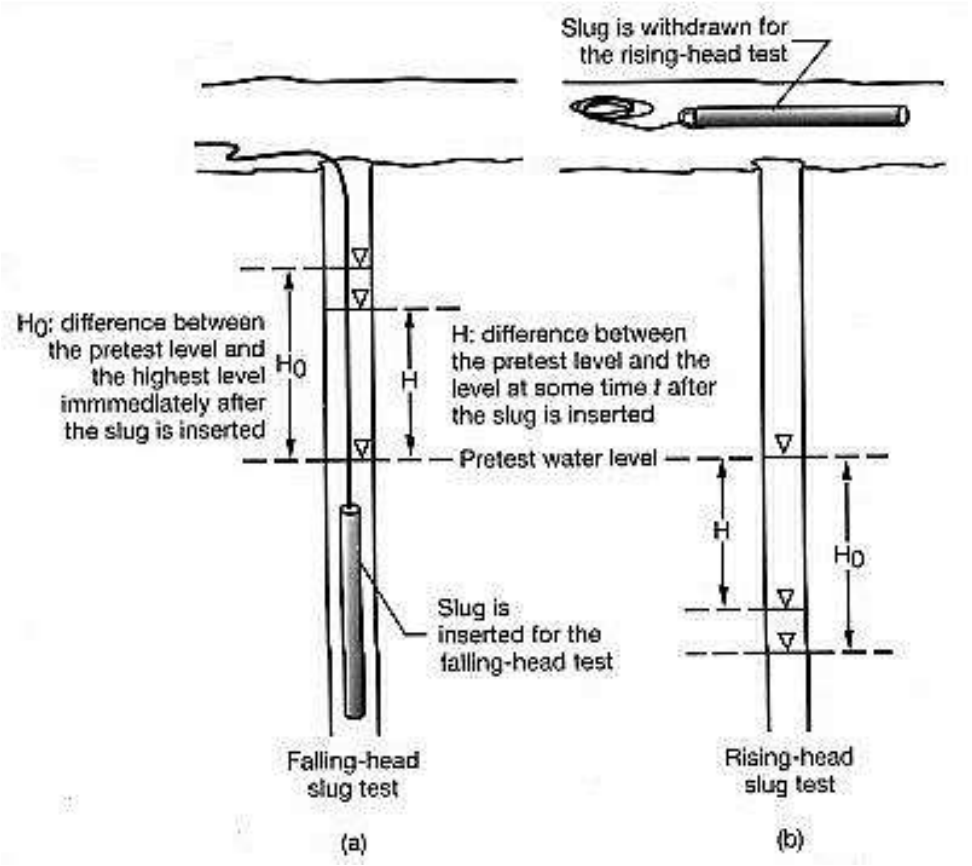
Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 4.906E-6 m/sec
y0 = 0.4053 m

Single Well Response Test Procedure

A Single Well Response Test (SWRT), also known as a bail test or a slug test, is conducted in order to determine the saturated hydraulic conductivity (K) of an aquifer. The method of the SWRT is to characterize the change of groundwater level in a well or borehole over time.

In order to ensure consistency and repeatability, all **exp** employees are to follow the procedure outlined in this document when conducting SWRTs.

The figure below depicts a schematic of a slug and bail test and the respective water level changes.



Initials ___

Slug Test Procedure

Equipment Required

- Copy of a signed health and safety plan
- Copy of the work program
- PPE as required by Site-Specific HASP
- Copy of the monitoring well location plan/site plan
- Waterproof pen and bound field note book
- SWRT field data Entry form
- Disposable gloves
- Duct tape
- Deionized water
- Alconox (phosphate free detergent)
- Spray bottles
- Electronic water level meter and spare batteries
- Solid PVC or stainless steel slug of known volume or clean water
- String (nylon)
- Water pressure transducer (data logger) and baro-logger
- Watch or stop watch with second hand
- Plastic sheeting

Testing Procedure

1. Remove cap from well and collect static water level
2. Remove waterra tubing/bailer and place in garbage bag. Record static water level measurement again.
3. Lower the slug into the well and record the dynamic water level.
4. Record the drawdown (for the slug test) at set five (5) second intervals for the first five (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown until 95% recovery is reached. To calculate this value: Find the difference between the dynamic water level and the static water level, then multiply by 95% (.95). Add the resulting value to the dynamic water level.

   (Static Water Level – Dynamic Water Level).95 + Static Water Level = 95% Recovery Value
6. Once complete, replace the waterra tubing/bailer and re-secure the well cap.

Note: If the well is deep, more than one slug may be inserted by attaching the slugs to a series.

Slugs must be washed with methanol, then lab grade soap, and then rinsed with de-ionized water after each use.

Based on the recorded observations, the hydraulic conductivity (in m/s) of the aquifer will be determined. In order to determine the hydraulic conductivity; the well diameter, radius of the borehole and length of the screen will also be required.

Bail Test Procedure

Equipment Required

- 20 L (5 gal) Graduated pail
- Stop watch or watch with seconds
- Garbage bags
- Water level meter
- Field sheets/log book
- Latex Gloves
- Bailer and Rope

Procedure

1. Remove cap from well and collect static water level.
2. If using a **bailer**:
    a. Affix the rope to the bailer.
    b. Remove the waterra tubing and place in garbage bag
    c. Record static water level measurement again.
    d. Record how much water was removed by either counting the number of full bailers or emptying removed water into a container.
    e. Quickly lower the bailer into the well and remove.
    f. Continue this process until the water level will reduce no further.
    g. Record the dynamic water level.
3. If using **waterra** to bail the water:
    a. Pump the water into graduated bucket until the water level will reduce no further.
    b. Record how much water has been removed.
    c. Record the dynamic water level.
4. Record the recovery at set five (5) second intervals for the first (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown/recovery until 95% recovery is reached.
6. Once complete, replace any waterra tubing that may have been removed from the well and re-secure the well cap.

Appendix D – Laboratory's Certificates of Analysis

Your Project #: GTR-23012833-B0
Site#: Neyagawa Blvd and Hwy 407, Oak
Site Location: Neyagawa Blvd and Hwy 407, Oakville, ON
Your C.O.C. #: 962377-01-01

Attention: Nataliya Tkach

exp Services Inc
1595 Clark Blvd
Brampton, ON
CANADA L6T 4V1

Report Date: 2023/12/07
Report #: R7944926
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3AP336
Received: 2023/11/29, 16:21

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbonaceous BOD	1	2023/12/01	2023/12/06	CAM SOP-00427	SM 24 5210B m
Total Cyanide	1	2023/12/01	2023/12/01	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2023/12/01	2023/12/02	CAM SOP-00449	SM 24 4500-F C m
Mercury in Water by CVAA	1	2023/12/05	2023/12/06	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2023/12/04	2023/12/05	CAM SOP-00408	EPA 6010D m
E.coli, (CFU/100mL)	1	N/A	2023/11/30	CAM SOP-00552	MECP E3371
Animal and Vegetable Oil and Grease	1	N/A	2023/12/07	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2023/12/07	2023/12/07	CAM SOP-00326	EPA1664B m,SM5520B m
PAH Compounds in Water by GC/MS (SIM)	1	2023/12/01	2023/12/02	CAM SOP-00318	EPA 8270E
pH	1	2023/12/01	2023/12/02	CAM SOP-00413	SM 24th - 4500H+ B
Phenols (4AAP)	1	N/A	2023/12/05	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	1	N/A	2023/12/05	CAM SOP-00464	SM 24 4500-SO42- E m
Total Kjeldahl Nitrogen in Water	1	2023/12/01	2023/12/04	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (1)	1	2023/12/07	2023/12/07	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2023/12/02	2023/12/04	CAM SOP-00428	SM 24 2540D m
Volatile Organic Compounds in Water	1	N/A	2023/12/04	CAM SOP-00228	EPA 8260D

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Your Project #: GTR-23012833-B0
Site#: Neyagawa Blvd and Hwy 407, Oak
Site Location: Neyagawa Blvd and Hwy 407, Oakville, ON
Your C.O.C. #: 962377-01-01

Attention: Nataliya Tkach

exp Services Inc
1595 Clark Blvd
Brampton, ON
CANADA L6T 4V1

Report Date: 2023/12/07
Report #: R7944926
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3AP336

Received: 2023/11/29, 16:21

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

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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

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

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

Encryption Key

Patricia Legette
Project Manager
07 Dec 2023 17:46:43

Please direct all questions regarding this Certificate of Analysis to:
Patricia Legette, Project Manager
Email: Patricia.Legette@bureauveritas.com
Phone# (905)817-5799

==========

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

HALTON SANITARY & COMBINED BYLAW (2-03)

Bureau Veritas ID			XTA766			XTA766		
Sampling Date			2023/11/29 11:30			2023/11/29 11:30		
COC Number			962377-01-01			962377-01-01		
	UNITS	Criteria	BH/MW2D	RDL	QC Batch	BH/MW2D Lab-Dup	RDL	QC Batch
Calculated Parameters								
Total Animal/Vegetable Oil and Grease	mg/L	150	ND	0.50	9082125			
Inorganics								
Total Carbonaceous BOD	mg/L	300	ND	2	9084262			
Fluoride (F-)	mg/L	10	0.47	0.10	9086484	0.44	0.10	9086484
Total Kjeldahl Nitrogen (TKN)	mg/L	100	1.7	0.10	9083303			
Phenols-4AAP	mg/L	1	ND	0.0010	9091339			
Total Suspended Solids	mg/L	350	ND	10	9085380	ND	10	9085380
Dissolved Sulphate (SO4)	mg/L	1500	440	5.0	9086636	440	5.0	9086636
Total Cyanide (CN)	mg/L	2	ND	0.0050	9085168			
Petroleum Hydrocarbons								
Total Oil & Grease	mg/L	-	ND	0.50	9096282			
Total Oil & Grease Mineral/Synthetic	mg/L	-	ND	0.50	9096284			
Metals								
Total Aluminum (Al)	mg/L	50	ND	0.1	9089230			
Total Antimony (Sb)	mg/L	5	ND	0.02	9089230			
Total Arsenic (As)	mg/L	1	ND	0.01	9089230			
Total Beryllium (Be)	mg/L	5	ND	0.0005	9089230			
Total Cadmium (Cd)	mg/L	1	ND	0.002	9089230			
Total Chromium (Cr)	mg/L	3	ND	0.01	9089230			
Total Cobalt (Co)	mg/L	5	ND	0.002	9089230			
Total Copper (Cu)	mg/L	3	ND	0.01	9089230			
Total Iron (Fe)	mg/L	50	0.22	0.02	9089230			
Total Lead (Pb)	mg/L	3	ND	0.01	9089230			
Total Manganese (Mn)	mg/L	5	0.066	0.001	9089230			
Mercury (Hg)	mg/L	0.05	ND	0.00010	9090576			
Total Molybdenum (Mo)	mg/L	5	0.009	0.005	9089230			
Total Nickel (Ni)	mg/L	3	ND	0.005	9089230			
Total Phosphorus (P)	mg/L	10	ND	0.05	9089230			
Total Selenium (Se)	mg/L	5	ND	0.02	9089230			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Halton Sanitary & Combined Sewer Bylaw (2-03)
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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HALTON SANITARY & COMBINED BYLAW (2-03)

Bureau Veritas ID			XTA766			XTA766		
Sampling Date			2023/11/29 11:30			2023/11/29 11:30		
COC Number			962377-01-01			962377-01-01		
	UNITS	Criteria	BH/MW2D	RDL	QC Batch	BH/MW2D Lab-Dup	RDL	QC Batch
Total Silver (Ag)	mg/L	5	ND	0.01	9089230			
Total Tin (Sn)	mg/L	5	ND	0.02	9089230			
Total Titanium (Ti)	mg/L	5	ND	0.005	9089230			
Total Zinc (Zn)	mg/L	3	ND	0.005	9089230			
Polyaromatic Hydrocarbons								
Naphthalene	ug/L	140	ND	0.050	9085388			
Volatile Organics								
Benzene	ug/L	10	ND	0.20	9087533	ND	0.20	9087533
Chloroform	ug/L	40	ND	0.20	9087533	ND	0.20	9087533
1,4-Dichlorobenzene	ug/L	80	ND	0.40	9087533	ND	0.40	9087533
Ethylbenzene	ug/L	160	ND	0.20	9087533	ND	0.20	9087533
Methylene Chloride(Dichloromethane)	ug/L	2000	ND	2.0	9087533	ND	2.0	9087533
Tetrachloroethylene	ug/L	1000	ND	0.20	9087533	ND	0.20	9087533
Toluene	ug/L	16	ND	0.20	9087533	ND	0.20	9087533
Trichloroethylene	ug/L	400	ND	0.20	9087533	ND	0.20	9087533
Surrogate Recovery (%)								
D10-Anthracene	%	-	96		9085388			
D14-Terphenyl (FS)	%	-	96		9085388			
D8-Acenaphthylene	%	-	83		9085388			
4-Bromofluorobenzene	%	-	102		9087533	102		9087533
D4-1,2-Dichloroethane	%	-	96		9087533	93		9087533
D8-Toluene	%	-	96		9087533	97		9087533

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Halton Sanitary & Combined Sewer Bylaw (2-03)
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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HALTON STORM SEWER BYLAW (2-03)

Bureau Veritas ID				XTA766			XTA766	
Sampling Date				2023/11/29 11:30			2023/11/29 11:30	
COC Number				962377-01-01			962377-01-01	
	UNITS	**Criteria**	**Criteria-2**	**BH/MW2D**	**RDL**	**QC Batch**	**BH/MW2D Lab-Dup**	**QC Batch**
Inorganics								
pH	pH	6.5:8.5	6.0:10.0	7.77		9086486	7.89	9086486
Microbiological								
Escherichia coli	CFU/100mL	200	-	<10	10	9083936		

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Halton Storm Sewer ByLaw
Criteria-2: Halton Sanitary & Combined Sewer Bylaw (2-03)

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TEST SUMMARY

Bureau Veritas ID: XTA766
Sample ID: BH/MW2D
Matrix: Water

Collected: 2023/11/29
Shipped:
Received: 2023/11/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	9084262	2023/12/01	2023/12/06	Nusrat Naz
Total Cyanide	SKAL/CN	9085168	2023/12/01	2023/12/01	Prgya Panchal
Fluoride	ISE	9086484	2023/12/01	2023/12/02	Nachiketa Gohil
Mercury in Water by CVAA	CV/AA	9090576	2023/12/05	2023/12/06	Gagandeep Rai
Total Metals Analysis by Axial ICP	ICPX	9089230	2023/12/04	2023/12/05	Medhat Nasr
E.coli, (CFU/100mL)	PL	9083936	N/A	2023/11/30	Soham Patel
Animal and Vegetable Oil and Grease	BAL	9082125	N/A	2023/12/07	Automated Statchk
Total Oil and Grease	BAL	9096282	2023/12/07	2023/12/07	Navneet Singh
PAH Compounds in Water by GC/MS (SIM)	GC/MS	9085388	2023/12/01	2023/12/02	Jonghan Yoon
pH	AT	9086486	2023/12/01	2023/12/02	Nachiketa Gohil
Phenols (4AAP)	TECH/PHEN	9091339	N/A	2023/12/05	Chloe Pollock
Sulphate by Automated Turbidimetry	SKAL	9086636	N/A	2023/12/05	Alina Dobreanu
Total Kjeldahl Nitrogen in Water	SKAL	9083303	2023/12/01	2023/12/04	Kruti Jitesh Patel
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	9096284	2023/12/07	2023/12/07	Navneet Singh
Total Suspended Solids	BAL	9085380	2023/12/02	2023/12/04	Razieh Tabesh
Volatile Organic Compounds in Water	GC/MS	9087533	N/A	2023/12/04	Narayan Ghimire

Bureau Veritas ID: XTA766 Dup
Sample ID: BH/MW2D
Matrix: Water

Collected: 2023/11/29
Shipped:
Received: 2023/11/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Fluoride	ISE	9086484	2023/12/01	2023/12/02	Nachiketa Gohil
pH	AT	9086486	2023/12/01	2023/12/02	Nachiketa Gohil
Sulphate by Automated Turbidimetry	SKAL	9086636	N/A	2023/12/05	Alina Dobreanu
Total Suspended Solids	BAL	9085380	2023/12/02	2023/12/04	Razieh Tabesh
Volatile Organic Compounds in Water	GC/MS	9087533	N/A	2023/12/04	Narayan Ghimire

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GENERAL COMMENTS

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

Package 1	4.0°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9085388	D10-Anthracene	2023/12/01			95	50 - 130	91	%				
9085388	D14-Terphenyl (FS)	2023/12/01			105	50 - 130	98	%				
9085388	D8-Acenaphthylene	2023/12/01			74	50 - 130	73	%				
9087533	4-Bromofluorobenzene	2023/12/04	103	70 - 130	101	70 - 130	102	%				
9087533	D4-1,2-Dichloroethane	2023/12/04	98	70 - 130	95	70 - 130	94	%				
9087533	D8-Toluene	2023/12/04	99	70 - 130	99	70 - 130	96	%				
9083303	Total Kjeldahl Nitrogen (TKN)	2023/12/04	115	80 - 120	97	80 - 120	ND, RDL=0.10	mg/L	4.6	20	92	80 - 120
9084262	Total Carbonaceous BOD	2023/12/06					ND,RDL=2	mg/L	4.2	30	92	80 - 120
9085168	Total Cyanide (CN)	2023/12/01	98	80 - 120	102	80 - 120	ND, RDL=0.0050	mg/L	NC	20		
9085380	Total Suspended Solids	2023/12/04			95	80 - 120	ND, RDL=10	mg/L	NC	20		
9085388	Naphthalene	2023/12/01			92	50 - 130	ND, RDL=0.050	ug/L	6.1	30		
9086484	Fluoride (F-)	2023/12/02	96	80 - 120	99	80 - 120	ND, RDL=0.10	mg/L	7.1	20		
9086486	pH	2023/12/02			102	98 - 103			1.5	N/A		
9086636	Dissolved Sulphate (SO4)	2023/12/05	NC	75 - 125	94	80 - 120	ND, RDL=1.0	mg/L	1.1	20		
9087533	1,4-Dichlorobenzene	2023/12/04	104	70 - 130	104	70 - 130	ND, RDL=0.40	ug/L	NC	30		
9087533	Benzene	2023/12/04	94	70 - 130	92	70 - 130	ND, RDL=0.20	ug/L	NC	30		
9087533	Chloroform	2023/12/04	106	70 - 130	102	70 - 130	ND, RDL=0.20	ug/L	NC	30		
9087533	Ethylbenzene	2023/12/04	94	70 - 130	92	70 - 130	ND, RDL=0.20	ug/L	NC	30		
9087533	Methylene Chloride(Dichloromethane)	2023/12/04	101	70 - 130	96	70 - 130	ND, RDL=2.0	ug/L	NC	30		
9087533	Tetrachloroethylene	2023/12/04	96	70 - 130	95	70 - 130	ND, RDL=0.20	ug/L	NC	30		
9087533	Toluene	2023/12/04	94	70 - 130	92	70 - 130	ND, RDL=0.20	ug/L	NC	30		
9087533	Trichloroethylene	2023/12/04	102	70 - 130	101	70 - 130	ND, RDL=0.20	ug/L	NC	30		
9089230	Total Aluminum (Al)	2023/12/05	99	80 - 120	88	80 - 120	ND, RDL=0.1	mg/L	NC	20		
9089230	Total Antimony (Sb)	2023/12/05	102	80 - 120	101	80 - 120	ND, RDL=0.02	mg/L	NC	20		
9089230	Total Arsenic (As)	2023/12/05	105	80 - 120	103	80 - 120	ND, RDL=0.01	mg/L	NC	20		
9089230	Total Beryllium (Be)	2023/12/05	100	80 - 120	98	80 - 120	ND, RDL=0.0005	mg/L				
9089230	Total Cadmium (Cd)	2023/12/05	100	80 - 120	99	80 - 120	ND, RDL=0.002	mg/L	NC	20		
9089230	Total Chromium (Cr)	2023/12/05	103	80 - 120	101	80 - 120	ND, RDL=0.01	mg/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9089230	Total Cobalt (Co)	2023/12/05	97	80 - 120	98	80 - 120	ND, RDL=0.002	mg/L	NC	20		
9089230	Total Copper (Cu)	2023/12/05	99	80 - 120	99	80 - 120	ND, RDL=0.01	mg/L	0.84	20		
9089230	Total Iron (Fe)	2023/12/05	97	80 - 120	98	80 - 120	ND, RDL=0.02	mg/L				
9089230	Total Lead (Pb)	2023/12/05	95	80 - 120	98	80 - 120	ND, RDL=0.01	mg/L	NC	20		
9089230	Total Manganese (Mn)	2023/12/05	99	80 - 120	99	80 - 120	ND, RDL=0.001	mg/L	NC	20		
9089230	Total Molybdenum (Mo)	2023/12/05	100	80 - 120	100	80 - 120	ND, RDL=0.005	mg/L	NC	20		
9089230	Total Nickel (Ni)	2023/12/05	97	80 - 120	99	80 - 120	ND, RDL=0.005	mg/L	NC	20		
9089230	Total Phosphorus (P)	2023/12/05	98	80 - 120	95	80 - 120	ND, RDL=0.05	mg/L	NC	20		
9089230	Total Selenium (Se)	2023/12/05	100	80 - 120	97	80 - 120	ND, RDL=0.02	mg/L	NC	20		
9089230	Total Silver (Ag)	2023/12/05	93	80 - 120	94	80 - 120	ND, RDL=0.01	mg/L	NC	20		
9089230	Total Tin (Sn)	2023/12/05	98	80 - 120	99	80 - 120	ND, RDL=0.02	mg/L	NC	20		
9089230	Total Titanium (Ti)	2023/12/05	97	80 - 120	97	80 - 120	ND, RDL=0.005	mg/L	NC	20		
9089230	Total Zinc (Zn)	2023/12/05	98	80 - 120	97	80 - 120	ND, RDL=0.005	mg/L	1.3	20		
9090576	Mercury (Hg)	2023/12/06	104	75 - 125	106	80 - 120	ND, RDL=0.00010	mg/L	NC	20		
9091339	Phenols-4AAP	2023/12/05	103	80 - 120	100	80 - 120	ND, RDL=0.0010	mg/L	NC	20		
9096282	Total Oil & Grease	2023/12/07			98	80 - 110	ND, RDL=0.50	mg/L	0.76	25		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9096284	Total Oil & Grease Mineral/Synthetic	2023/12/07			96	65 - 130	ND, RDL=0.50	mg/L	1.0	25		

N/A = Not Applicable

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

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

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

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

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

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

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

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

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere

Cristina Carriere, Senior Scientific Specialist

Soham N Patel

Soham Patel, Senior Analyst

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

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29-Nov-23 16:21
Patricia Legette
C3AP336
JDK ENV-1731

Page of

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		
Company Name:	#30554 exp Services Inc	Company Name:		Quotation #:	C31675 (STREAM 2)	Bottle Order #: 962377
Attention:	Accounts Payable	Attention:	Nataliya Tkach	P.O. #:		
Address:	1595 Clark Blvd Brampton ON L6T 4V1	Address:		Project:	GTR-23012833-B0	
Tel:	(905) 793-9800 Fax: (905) 793-0641	Tel:	(905) 793-9800 Ext: 3621 Fax:	Project Name:		COC #: C#962377-01-01 / Project Manager: Patricia Legette
Email:	AP@exp.com; Karen.Burke@exp.com	Email:	Nataliya.Tkach@exp.com, MICHAEL.HOLMES@EXP.COM	Site #:	Neyagawa Blvd and Hwy 407, Oak	
				Sampled By:	MH	

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

Regulation 153 (2011)
- ☐ Table 1 ☐ Res/Park ☐ Medium/Fine
- ☐ Table 2 ☐ Ind/Comm ☐ Coarse
- ☐ Table 3 ☐ Agri/Other ☐ For RSC
- ☐ Table ___

Other Regulations
- ☐ CCME ☑ Sanitary Sewer Bylaw
- ☐ Reg 558 ☐ Storm Sewer Bylaw
- ☐ MISA Municipality OAKVILLE/HALTON
- ☐ PWQO ☐ Reg 406 Table ___
- ☐ Other ___

Special Instructions

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

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☑
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Hamilton Sanitary & Storm Bylaw (22-103)	OAKVILLE STORM & SANITARY SEWER USE BY-LAW	# of Bottles	Comments
1		BH/MW 2D	2023/11/29	11:30	GW	N	~~✓~~	✓	17	5 DAY MIN TAT
2										*PLEASE PROVIDE LOC ON
3										REPORT
4										
5										
6										
7										
8										
9										
10										

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
MICHAEL HOLMES	23/11/29	15:30		23/11/29	1621	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	4 4 6	Present		
		Intact	✓	

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-TERMS-AND-CONDITIONS.

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

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS.

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

White: Bureau Veritas Yellow: Client

Bureau Veritas Canada (2019) Inc.

Exceedance Summary Table – Halton Storm Sewer

Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						
The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.						

Exceedance Summary Table – Halton Sanitary Sewer

Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						
The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.						

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Appendix E – Construction and Post-Construction Flow Rate Calculations

APPENDIX E: Dewatering Flow Rates

Neyagawa Boulevard Between Highway 407 & Burnhamthorpe Road West, Oakville, Ontario
GTR-23012833-B0

Table E-1: Construction and Post Construction Dewatering Assessments

Parameters	Symbols	Unit	Construction	Post Construction
Geological Formation	-	-	Glacial Deposit	Glacial Deposit
INPUTS				
Ground Elevation	-	mASL	**184.94**	**184.94**
Highest Groundwater Elevation	-	mASL	**189.02**	**189.02**
Lowest Top Slab Elevation	-	mASL	**174.94**	**174.94**
Lowest Foundation Invert Elevation	-	mASL	**173.44**	-
Height of Static Water Table Above the Base of the Water-Bearing Zone	**H**	m	26.02	26.02
Dewatering Target Elevation	-	mASL	172.44	174.44
Height of Target Water Level Above the Base of Water-Bearing Zone	**h_w**	m	9.44	11.44
Drawdown	**s**	m	16.58	14.58
Dupuit Check (> 45%)		m	36%	44%
Base of Aquifer / Water Bearing Zone	-	mASL	**163.00**	**163.00**
Hydraulic Conductivity	**K**	m/s	**1.8E-06**	**8.4E-07**
Length of Excavation	-	m	260.00	260.00
Width of Excavation	-	m	65.00	65.00
Equivalent Radius (equivalent perimeter)	**r_e**	m	103.45	103.13
Method to Calculate Radius of Influence	-	-	**Cooper-Jacob**	**Cooper-Jacob**
Time (days)			**90.00**	**365.00**
Time (seconds)	**t**	s	7776000	31536000
Specific Yield	**Sy**		**0.10**	**0.10**
OUTPUTS				
Cooper-Jacob's Radius of Influence from Sides of Excavation	**Rcj**	m	90.11	124.80
Radius of Influence	**Ro**	m	193.56	227.93
Dewatering Flow Rate (unconfined radial flow component)	**Q**	m^3/day	**454.35**	**157.70**
Factor of Safety	**fs**	-	2.00	1.50
Dewatering Flow Rate (multiplied by factor of safety)	**Q.fs**	m^3/day	**909**	**237**
Precipitation Event	-	mm/day	25	-
Volume from Precipitation	-	m^3/day	423	-
Total Volume (L/day) Discharge of Groundwater (Construction dewatering) **without Safety Factor** (including precipitation	-	m^3/day	**877**	**-**
Total Volume (L/day) Discharge of Groundwater (Construction dewatering) **with Safety Factor** (including precipitation)	-	m^3/day	**1331**	**-**

Precipitation Event 2 year storm	-	mm/day	57.5
Volume from Precipitation	-	m^3/event	972
Precipitation Event 100 year storm	-	mm/day	125.5
Volume from Precipitation	-	m^3/event	2121

Notes:
mASL - meters above sea level

Analytical Solution for Estimating Radial Flow from an Unconfined Aquifer to a Fully-Penetrating Excavation

$$Q_w = \frac{\pi K(H^2 - h^2)}{Ln\,[\frac{R_o}{r_e}]}$$

(Based on the Dupuit-Forcheimer Equation)

$$r_e = \frac{a+b}{\pi} \qquad R_o = R_{cj} + r_e \qquad R_{cj} = \sqrt{2.25KDt/S}$$

Where:

Q_w = Flow rate per unit length of excavation (m^3/s)

K = Hydraulic conductivity (m/s)

H = Height of static water table above base of water-bearing zone (m)

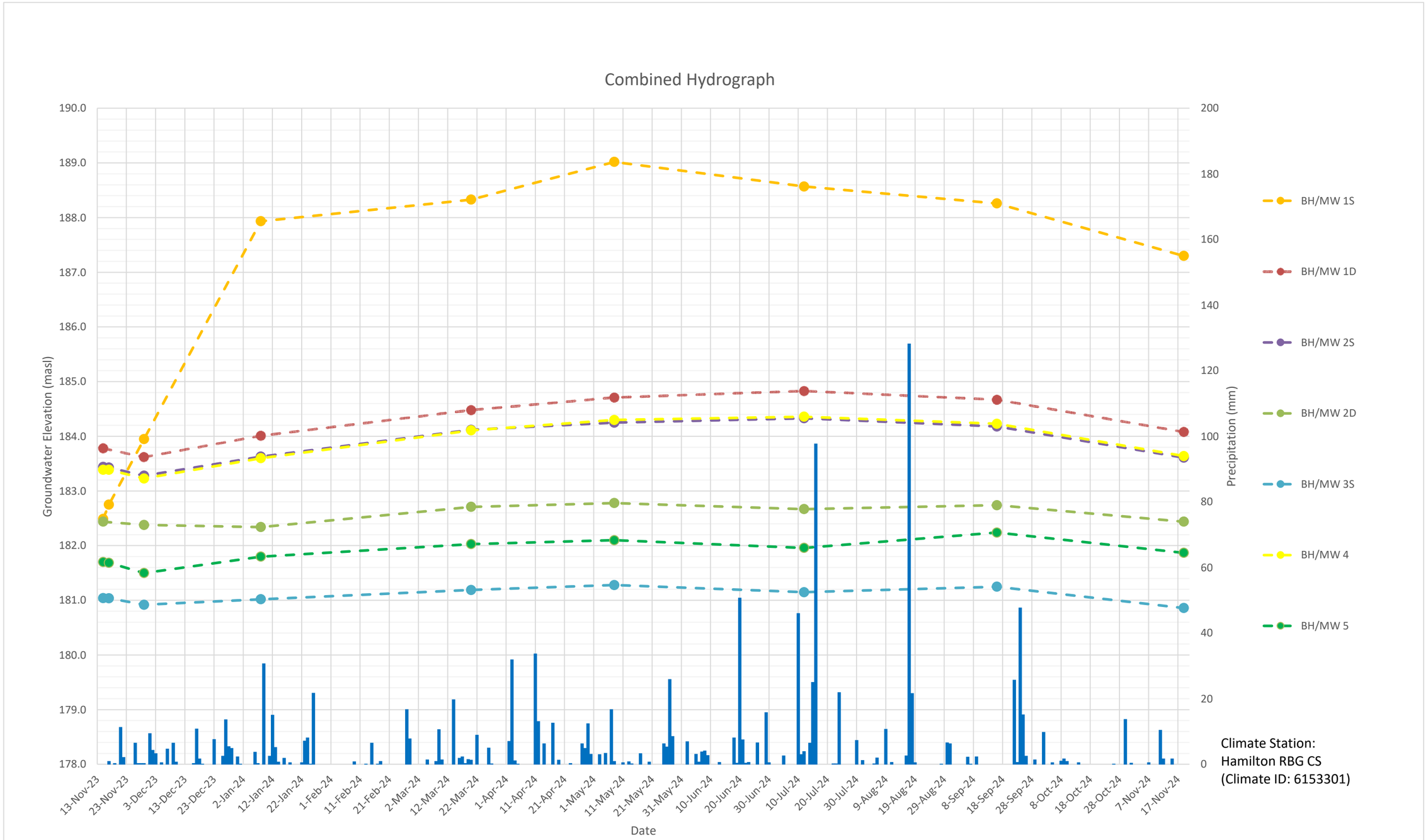
h_w = Height of target water level above the base of water-bearing zone (m)

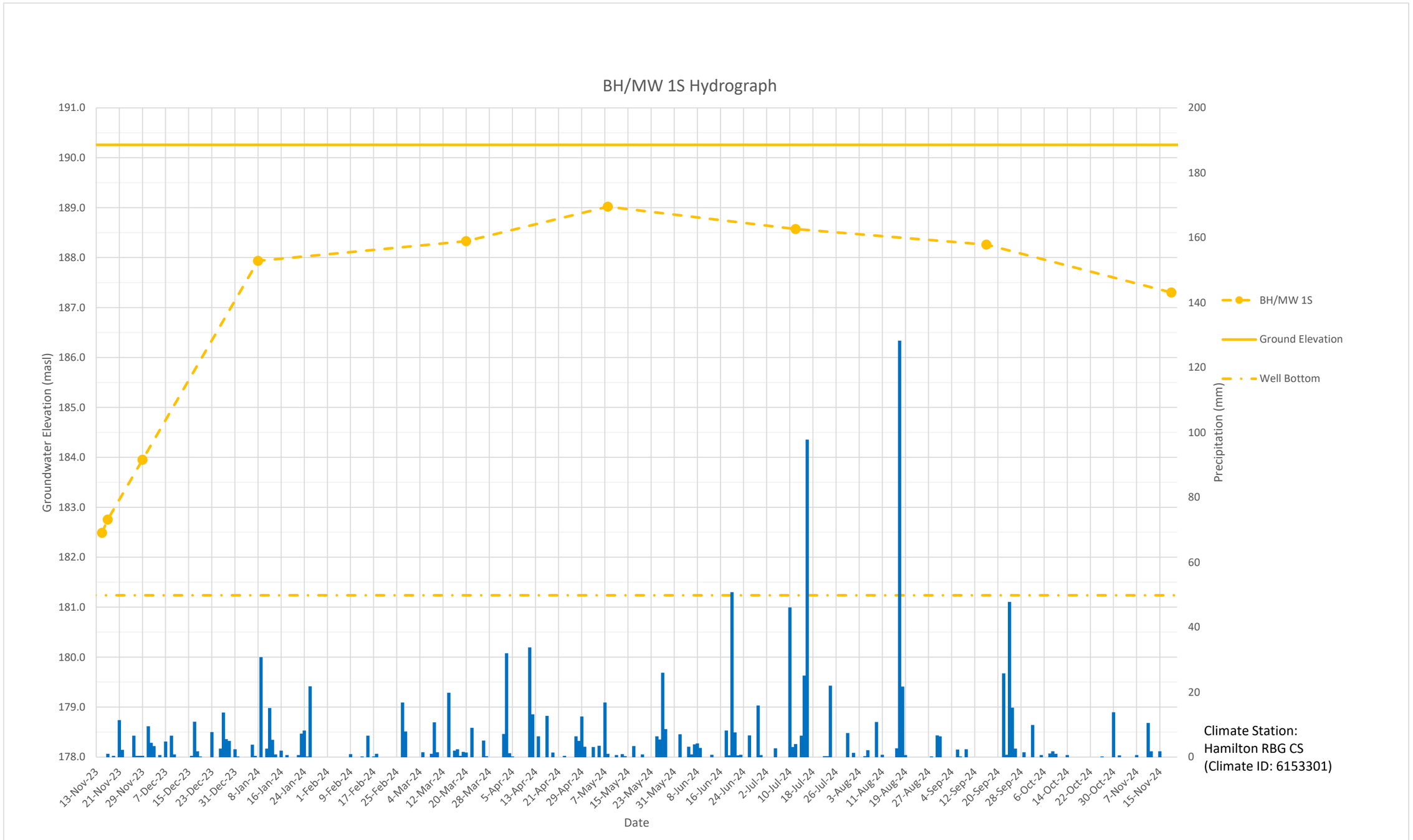
Rcj=Cooper Jacob Radius of Influence (m)

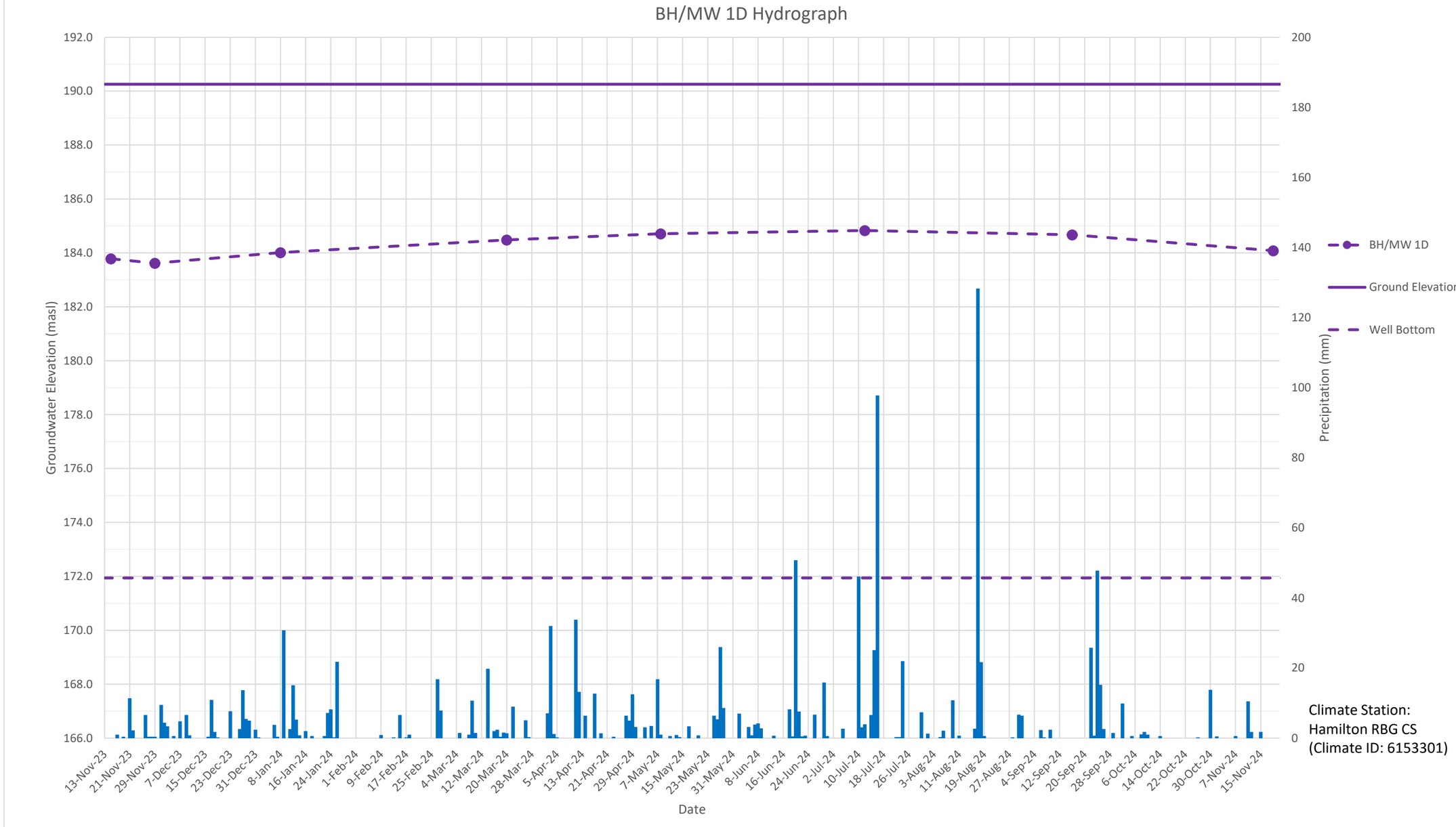
R_o=Radius of influence (m)

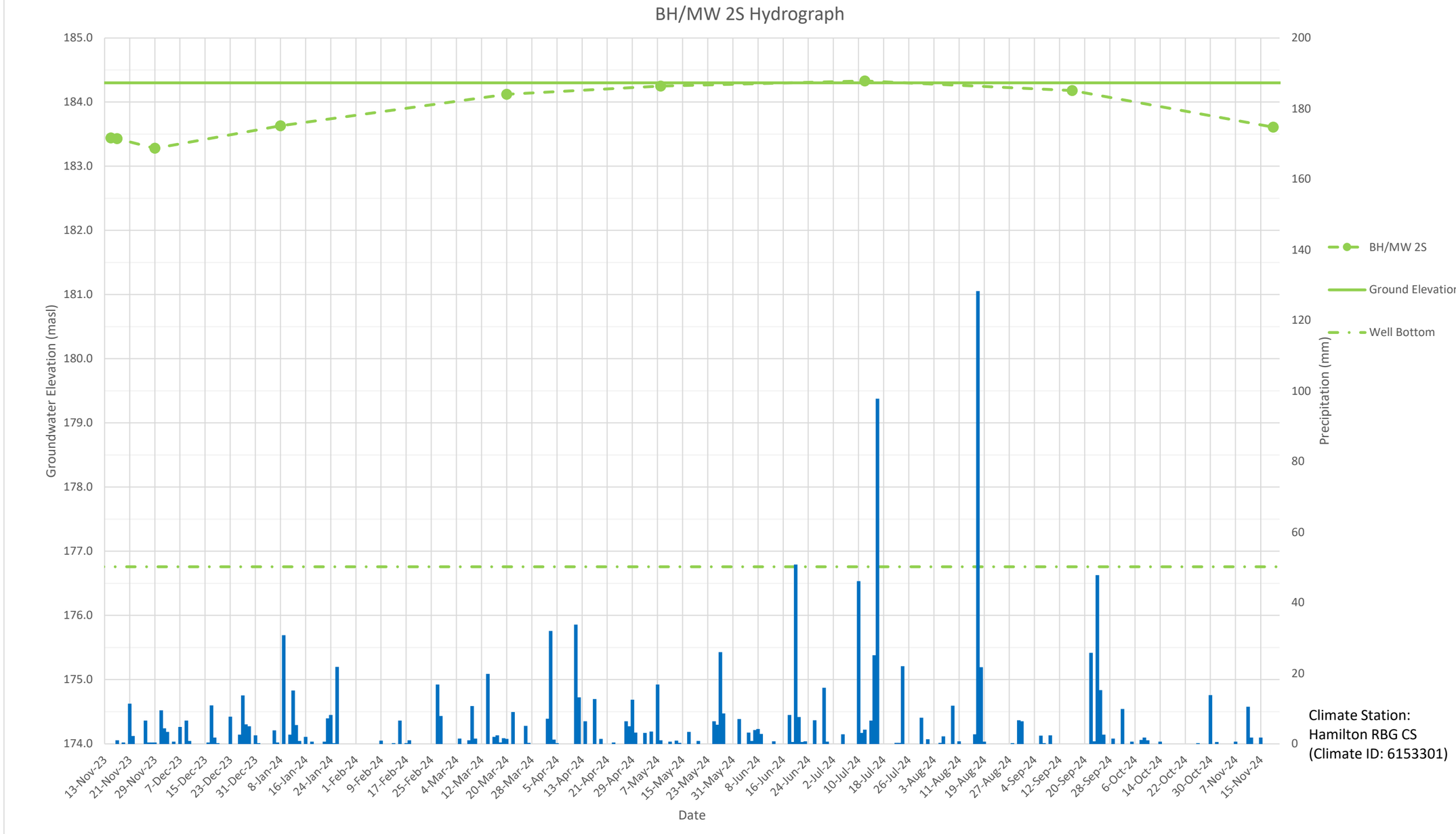
re=Equivalent perimeter (m)

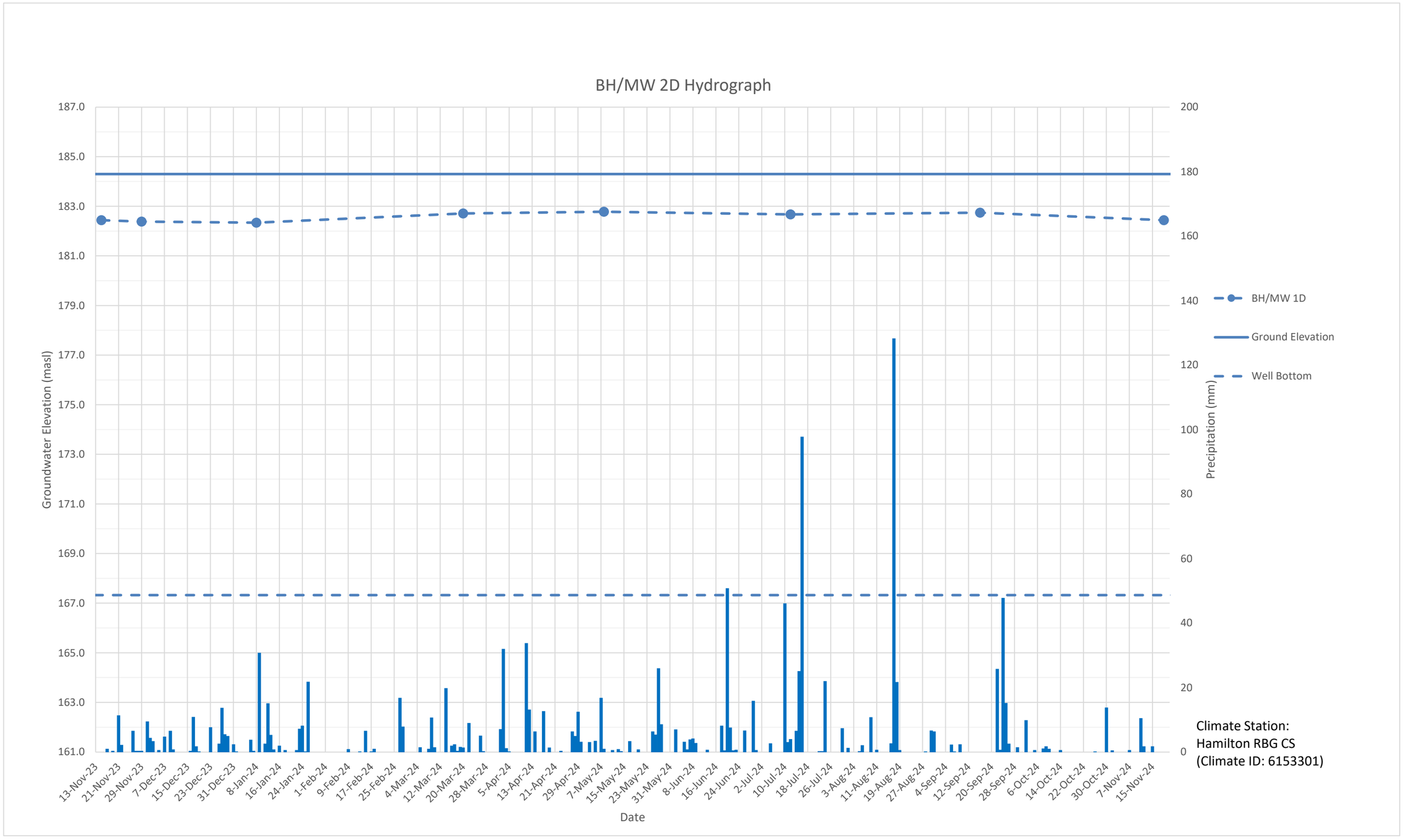
Appendix F - Hydrographs

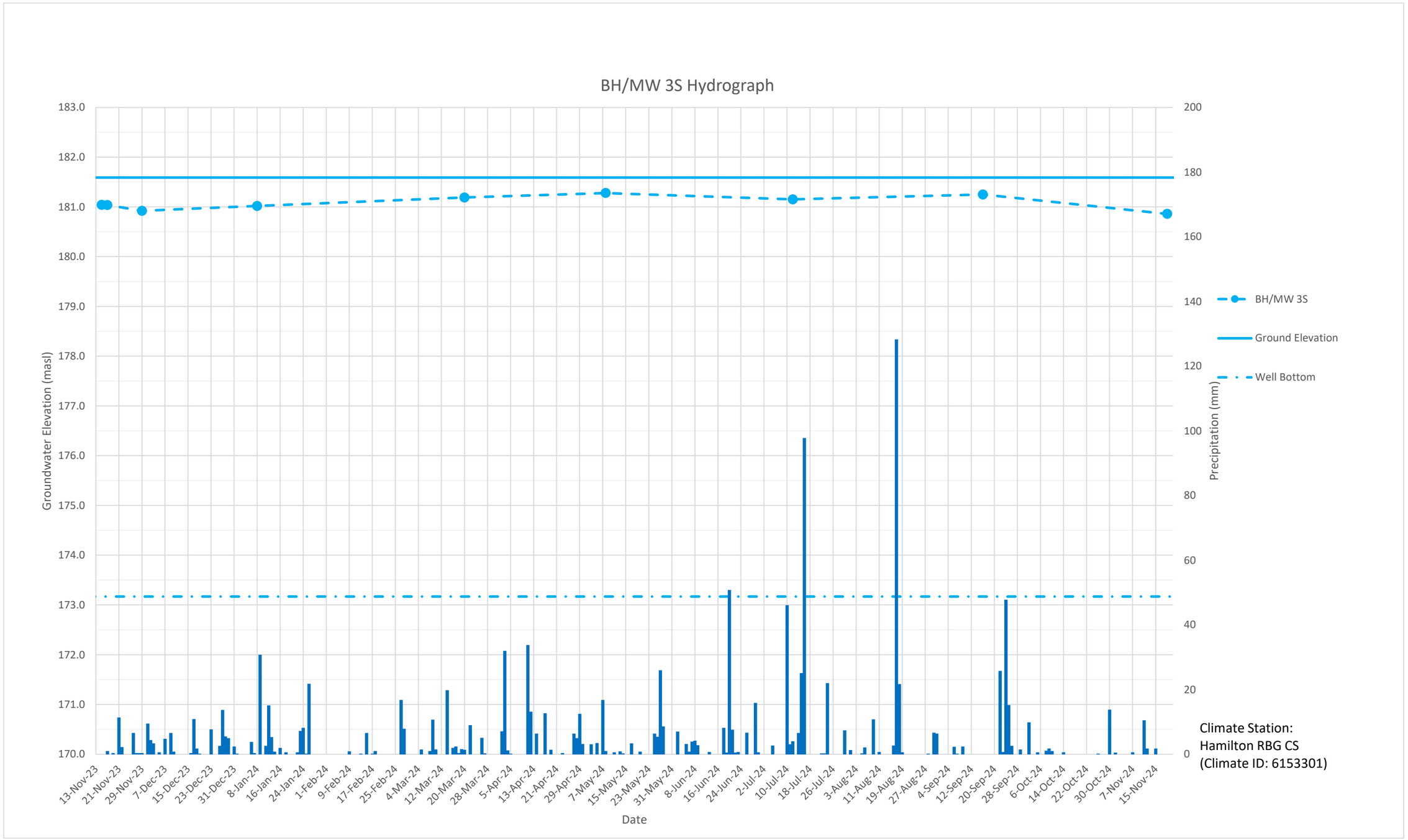

Combined Hydrograph
Groundwater Elevation (masl)
Precipitation (mm)
Date
190.0
189.0
188.0
187.0
186.0
185.0
184.0
183.0
182.0
181.0
180.0
179.0
178.0
200
180
160
140
120
100
80
60
40
20
0
13-Nov-23
23-Nov-23
3-Dec-23
13-Dec-23
23-Dec-23
2-Jan-24
12-Jan-24
22-Jan-24
1-Feb-24
11-Feb-24
21-Feb-24
2-Mar-24
12-Mar-24
22-Mar-24
1-Apr-24
11-Apr-24
21-Apr-24
1-May-24
11-May-24
21-May-24
31-May-24
10-Jun-24
20-Jun-24
30-Jun-24
10-Jul-24
20-Jul-24
30-Jul-24
9-Aug-24
19-Aug-24
29-Aug-24
8-Sep-24
18-Sep-24
28-Sep-24
8-Oct-24
18-Oct-24
28-Oct-24
7-Nov-24
17-Nov-24
BH/MW 1S
BH/MW 1D
BH/MW 2S
BH/MW 2D
BH/MW 3S
BH/MW 4
BH/MW 5
Climate Station:
Hamilton RBG CS
(Climate ID: 6153301)

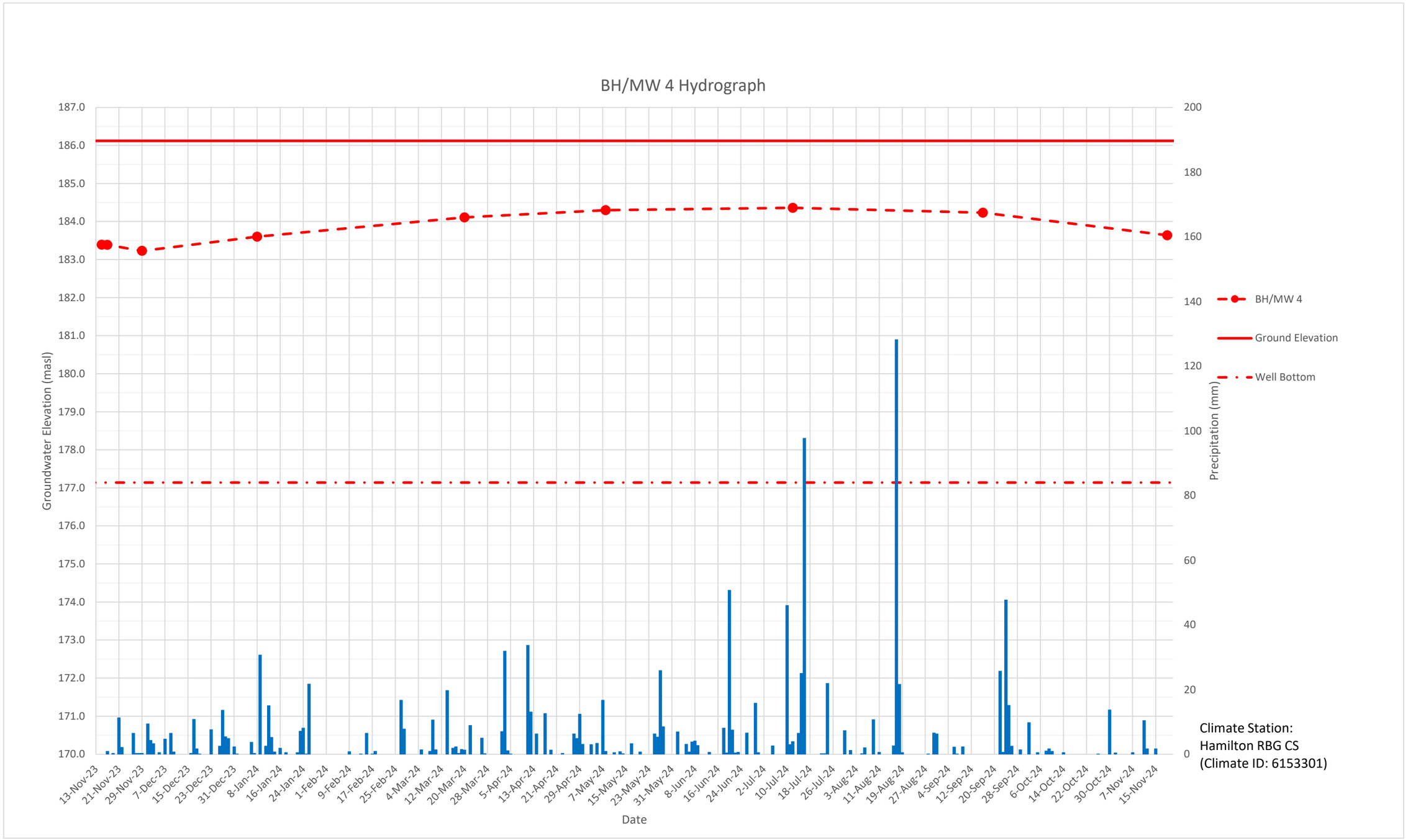

BH/MW 1S Hydrograph
Groundwater Elevation (masl)
Precipitation (mm)
Date
BH/MW 1S
Ground Elevation
Well Bottom
Climate Station:
Hamilton RBG CS
(Climate ID: 6153301)

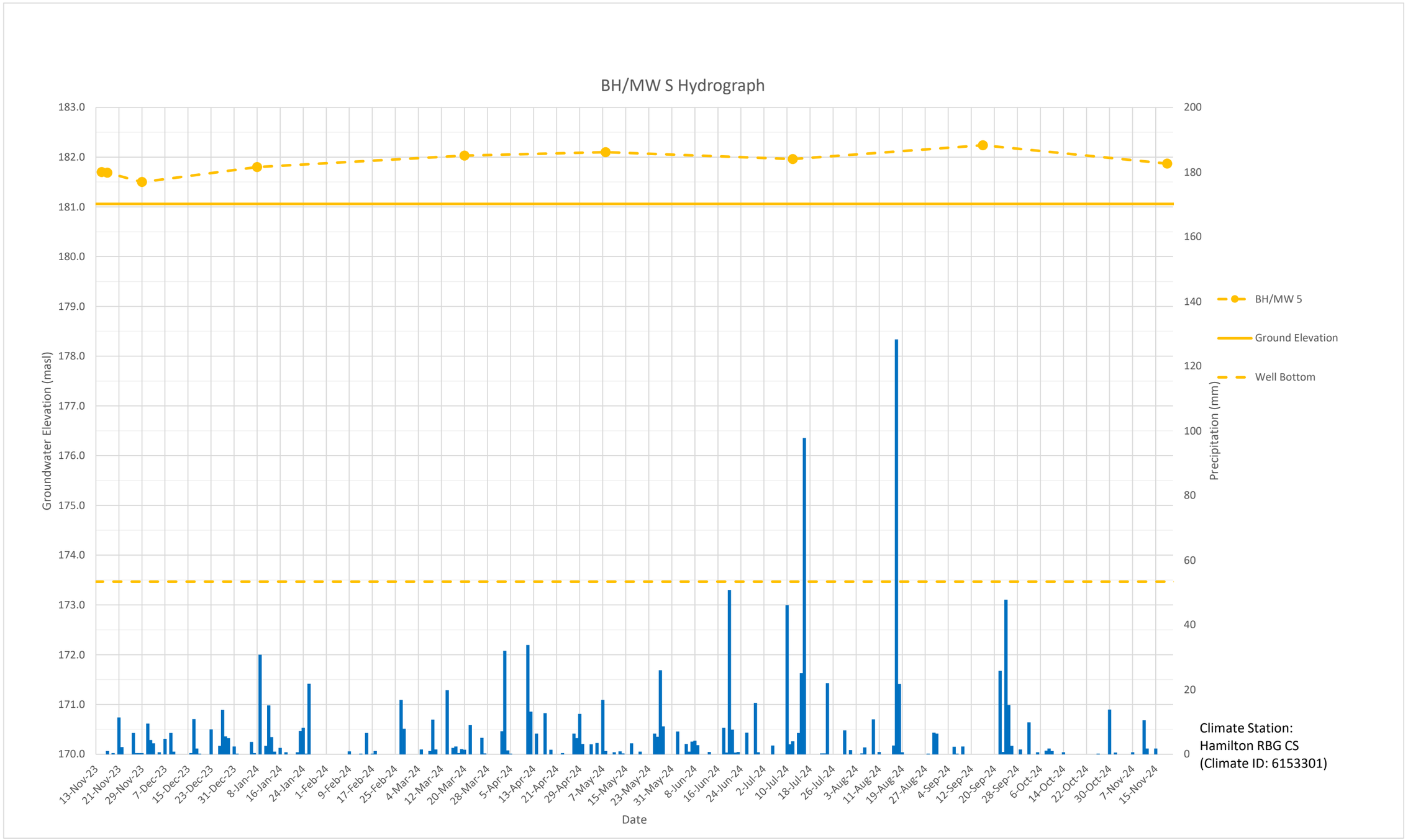

BH/MW 1D Hydrograph
Groundwater Elevation (masl)
Precipitation (mm)
Date
BH/MW 1D
Ground Elevation
Well Bottom
Climate Station:
Hamilton RBG CS
(Climate ID: 6153301)


BH/MW 2S Hydrograph
Groundwater Elevation (masl)
Precipitation (mm)
185.0
184.0
183.0
182.0
181.0
180.0
179.0
178.0
177.0
176.0
175.0
174.0
200
180
160
140
120
100
80
60
40
20
0
BH/MW 2S
Ground Elevation
Well Bottom
13-Nov-23
21-Nov-23
29-Nov-23
7-Dec-23
15-Dec-23
23-Dec-23
31-Dec-23
8-Jan-24
16-Jan-24
24-Jan-24
1-Feb-24
9-Feb-24
17-Feb-24
25-Feb-24
4-Mar-24
12-Mar-24
20-Mar-24
28-Mar-24
5-Apr-24
13-Apr-24
21-Apr-24
29-Apr-24
7-May-24
15-May-24
23-May-24
31-May-24
8-Jun-24
16-Jun-24
24-Jun-24
2-Jul-24
10-Jul-24
18-Jul-24
26-Jul-24
3-Aug-24
11-Aug-24
19-Aug-24
27-Aug-24
4-Sep-24
12-Sep-24
20-Sep-24
28-Sep-24
6-Oct-24
14-Oct-24
22-Oct-24
30-Oct-24
7-Nov-24
15-Nov-24
Date
Climate Station:
Hamilton RBG CS
(Climate ID: 6153301)


BH/MW 2D Hydrograph
Groundwater Elevation (masl)
187.0
185.0
183.0
181.0
179.0
177.0
175.0
173.0
171.0
169.0
167.0
165.0
163.0
161.0
Precipitation (mm)
200
180
160
140
120
100
80
60
40
20
0
BH/MW 1D
Ground Elevation
Well Bottom
Climate Station:
Hamilton RBG CS
(Climate ID: 6153301)
13-Nov-23
21-Nov-23
29-Nov-23
7-Dec-23
15-Dec-23
23-Dec-23
31-Dec-23
8-Jan-24
16-Jan-24
24-Jan-24
1-Feb-24
9-Feb-24
17-Feb-24
25-Feb-24
4-Mar-24
12-Mar-24
20-Mar-24
28-Mar-24
5-Apr-24
13-Apr-24
21-Apr-24
29-Apr-24
7-May-24
15-May-24
23-May-24
31-May-24
8-Jun-24
16-Jun-24
24-Jun-24
2-Jul-24
10-Jul-24
18-Jul-24
26-Jul-24
3-Aug-24
11-Aug-24
19-Aug-24
27-Aug-24
4-Sep-24
12-Sep-24
20-Sep-24
28-Sep-24
6-Oct-24
14-Oct-24
22-Oct-24
30-Oct-24
7-Nov-24
15-Nov-24
Date


BH/MW 3S Hydrograph
Groundwater Elevation (masl)
Precipitation (mm)
Date
BH/MW 3S
Ground Elevation
Well Bottom
Climate Station:
Hamilton RBG CS
(Climate ID: 6153301)


BH/MW 4 Hydrograph
Groundwater Elevation (masl)
Precipitation (mm)
Date
BH/MW 4
Ground Elevation
Well Bottom
Climate Station:
Hamilton RBG CS
(Climate ID: 6153301)


BH/MW S Hydrograph
Groundwater Elevation (masl)
183.0
182.0
181.0
180.0
179.0
178.0
177.0
176.0
175.0
174.0
173.0
172.0
171.0
170.0
Precipitation (mm)
200
180
160
140
120
100
80
60
40
20
0
13-Nov-23
21-Nov-23
29-Nov-23
7-Dec-23
15-Dec-23
23-Dec-23
31-Dec-23
8-Jan-24
16-Jan-24
24-Jan-24
1-Feb-24
9-Feb-24
17-Feb-24
25-Feb-24
4-Mar-24
12-Mar-24
20-Mar-24
28-Mar-24
5-Apr-24
13-Apr-24
21-Apr-24
29-Apr-24
7-May-24
15-May-24
23-May-24
31-May-24
8-Jun-24
16-Jun-24
24-Jun-24
2-Jul-24
10-Jul-24
18-Jul-24
26-Jul-24
3-Aug-24
11-Aug-24
19-Aug-24
27-Aug-24
4-Sep-24
12-Sep-24
20-Sep-24
28-Sep-24
6-Oct-24
14-Oct-24
22-Oct-24
30-Oct-24
7-Nov-24
15-Nov-24
Date
BH/MW 5
Ground Elevation
Well Bottom
Climate Station:
Hamilton RBG CS
(Climate ID: 6153301)