



Soil Engineers Ltd.

CONSULTING ENGINEERS

GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

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May 2 2023

Reference No.: 2008-W011

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Poplar Developments 1 Inc.
5-167 Jolliffe Avenue
P O Box 760
Rockwood, Ontario
N0B 2K0

Attention: Mr. Rick McConnell

**Re: Hydrogeological Assessment Report
Summit View Subdivision Phase 3
High Street and Poplar Sideroad
Town of Collingwood**

Dear Sir:

Soil Engineers Ltd. (SEL) was retained to complete the following:

- Review all previous hydrogeological and soil investigation reports.
- Borehole drilling and installation of four monitoring wells within the Phase 3 development areas encompassing the east side of the site where it meets High Street.
- Monitoring well development and groundwater level measurements at the installed monitoring wells within Phase 3 with manual measurements performed monthly between May 2022 and March 2023.
- Performance of single well response tests the Phase 3 monitoring wells.
- Automated water level measurements at two selected monitoring wells within Phase 3
- Carry out a review of the previous groundwater level measurements performed at the Phase 2 development area.
- Providing an overview of underground servicing for Phase 2 along with applicable observations and conclusions regarding any needed groundwater control.
- Review and assess the Phase 3 development plans to make recommendations for site grading to maintain housing basement floor slabs above the seasonal high groundwater table.

SEL was retained for on-site material testing during the underground servicing for Phase 2.



Construction dewatering was not needed since the servicing trenches were mainly dry during installation. In 2021, SEL was commissioned to review the previous approved grading plan for Phase 2, in order to rationalize the lowering of the approved finished grades for Phase 2, since housing basements are above the prevailing groundwater table. The same conditions are anticipated for Phase 3, located to the east and south of Phases 1 and 2. Drawing 1 shows the location of the subject site and the Phase 3 development area.

Field Work

The fieldwork for the borehole drilling and monitoring well construction were performed, on April 27, 2022. The program consisted of the drilling of four (4) boreholes (BH) and the installation of four (4) monitoring wells (MW), one within each of the four (4) advanced boreholes. The borehole and monitoring well locations are shown on Drawing No. 2.

The borehole drilling and monitoring well construction were completed by licensed water well contractor, Ace Drilling, under the full-time supervision of a geotechnical technician from SEL, who also logged the subsoil strata encountered during borehole advancement, collected representative soil samples for textural classification and supervised the monitoring well installation. The boreholes were drilled using continuous-flight, power auger machine, equipped with solid-stem augers. Selected subsoil samples retrieved from the drilling program underwent laboratory grain size analysis to confirm the subsoil textures. Detailed descriptions of the encountered subsurface soil and groundwater conditions are presented on the borehole and monitoring well logs, Figures 1 to 4, inclusive.

The monitoring wells were constructed, using 50 mm diameter PVC riser pipes and screen sections, which were installed in the boreholes in accordance with Ontario Regulation (O. Reg.) 903. All of the monitoring wells were provided with monument-type, steel protective casings at the ground surface. The 100 series monitoring wells were used for Phase 3. The details for monitoring well construction are provided on the enclosed Borehole Logs (Figures 1 to 4, inclusive).

The ground surface elevations and horizontal coordinates at the monitoring well locations were determined at the time of the investigation, using a handheld Global Navigation Satellite System survey equipment (Trimble Geoexplorer unit TSC3) which has an accuracy of ± 0.05 m.



The recent survey plan, prepared by Tatham Engineering was used to confirm the ground elevations at the installed Phase 3 monitoring wells. The UTM coordinates and ground surface elevations at the borehole/monitoring well locations, together with the summary of the monitoring well installation details, are provided in Table 1

Table 1 - Monitoring Well Installation Details

Well ID	Installation Date	UTM Coordinates		Ground Elevation (masl)	Borehole Depth (mbgs)	Screen Interval (mbgs)	Casing Dia. (mm)
		East (m)	North (m)				
MW 101	April 27, 2022	561239.72	4925252.013	202.30	3.7	1.3-3.7	50
MW 102	April 27, 2022	561215.00	4925141.292	203.42	3.5	1.1-3.5	50
MW 103	April 27, 2022	561090.85	4925180.492	204.04	3.8	1.4-3.8	50
MW 104	April 27, 2022	561077.24	4924962.883	208.0	3.7	1.3-3.7	50

Notes: mbgs - metres below ground surface

masl -- metres above sea level

Groundwater Monitoring

The groundwater levels in the monitoring wells were measured, manually on May 25, June 23, July 25, August 23, September 23, October 31, November 25, and December 19, 2022 and again on January 27, February 27, and March 29, 2023 to record the fluctuation of the shallow groundwater table beneath the site, with the measurements provided in Table 2, with discussion that follows. An automated pressure transducer data logger was installed within two of the monitoring wells, at BH/MW 101 and BH/MW 104, to continuously track the fluctuation of the shallow water table beneath the site. Table 2 provides the summary of manual groundwater level measurements. The hydrographs illustrating the water shallow water table fluctuations at BH/MW 101 and BH/MW 104 over time are also provided in Figures 9 and 10.

As part of the field work, single well response testing (SWRT) was completed at the monitoring wells to estimate the hydraulic conductivity (K) and the monitoring well screen depths. The SWRT involves the placement of a slug of known volume into the monitoring well, below the groundwater table, to displace the groundwater level upward. The rate at which the groundwater level recovers to static conditions (falling head) is tracked using a data logger/ pressure transducer, and/or manually, using a water level tape.



After the slug is introduced, the rate at which the groundwater table recovers to static conditions is used to estimate the K value for the groundwater-bearing subsoil formation at the monitoring well screen depth interval. The SWRT test results are provided in the attachments, with a summary of the findings being provided in Table 3.

Review of Previous Reports

A review of WSP's report (for 1674715 Ontario Limited), prepared in June 2019 indicated that WSP concluded that the site is not deemed to be within an area identified as a Wellhead Protection Area (WHPA); however, the site is within an area considered a significant groundwater recharge area (SGRA), with a small portion of the central and northeast corner of the site being mapped as being highly vulnerable aquifer (HVA). Figures 10 to 12 from the said WSP report illustrated the location of the site and the WHPA, HVA and the SGRA in the surrounding area of the site. Mapping from the WSP's report is included in the Appendix.

The said hydrogeological report, prepared by WSP, also indicated the existence of an elevated groundwater table beneath the subject property.

Background

Underground servicing for Phase 1 of the development was completed during the fall of 2018 and winter of 2019. A portion of Phase 2 was serviced during the winter and spring of 2020 which included the installation of servicing, beneath Rowland Street. The remainder of Phase 2 was serviced between January and March of 2021. Drawing No.1 illustrates the phasing of the development. The 2020 Phase 2 servicing program included storm and sanitary sewer installation beneath Rowland Street from Poplar Sideroad to Plewes Drive, and from Plewes Drive to Phase 1. The 2021 servicing program included storm and sanitary sewer installation for the remainder of Phase 2. The previous hydrogeological report, prepared by WSP indicated the existence of a high groundwater table beneath the subject site, including beneath the Phase 2 area where underground services were installed, during the late winter and spring of 2020, and during January to March 2021. During the Phase 2 underground services installation, daily site visits and inspections of the servicing trenches took place, observing mainly dry servicing trenching conditions with only minor perched groundwater seepage occurring at 1 to 1.15 m



depths within isolated areas. Only minimal sporadic, pumping to address occasional seepage was needed during excavation and sewer installation within Phase 2. The deepest sewer trench depths, ranged from about 2.9 to 3.2 m, beneath Plewes Drive, over a length of about 320 m, (0+300 - 0+590), and between about 2.6 and 3.10 m depths, over a length of about 150 m beneath Rowland Street (6+000 - 6+155). The depths for the deepest sewers were estimated based on a review of Tatham Engineering drawings PP 2 and PP14.

Except for minimal sporadic pumping, no dewatering was required for the sewer installation and no groundwater issues have been encountered by the homebuilder who has been building houses within Phase 2 since servicing was completed in 2020 and 2021.

Physical Topography

A review of the topography for the subject site shows that site is relatively flat however it exhibits a decline in elevation relief towards the north and west in the direction of Black Ash Creek, elsewhere the local topography descends towards the southwest from the northeast portion on the site covering the Phase 1 area. Runoff from the site is expected to drain towards Black Ash Creek and towards the southwest.

SOIL LITHOLOGY

The Phase 3 subsurface investigation study has disclosed that beneath a layer of topsoil, the native subsoils underlying the subject site consists of fine sand, underlain by dense silt, extending to the maximum investigated depth of 3.8 m below existing grade.

The borehole logs showing the subsoil profile and borehole monitoring well installation details are provided on Figures 1 to 4.

Topsoil (All BH/MWs)

Topsoil, having a thickness, ranging from 280 to 450 mm was contacted at all of the borehole/monitoring well locations. The thickness for topsoil may vary across the site. Thicker topsoil layers may occur in the lower-lying areas and/or close to woodlot/treed areas. It is described as being dark brown, being loose to compact in relative density.



Fine Sand (All BH/MWs)

A layer of fine sand was contacted below the topsoil horizon at all of the BH/MW locations, at depths, ranging from 0.2 to 0.5 m below grade, extending to a depth of about 2.3 m suggesting a thickness of about 1.8 to 2.1 m. It generally consists of medium grained sand with occasional silt. The water contents for the retrieved subsoil samples ranged from 19 to 24% indicating very moist conditions. Grain size analysis was performed on one (1) representative subsoil sample, and the soil gradation plot is shown on Figure 6. The estimated permeability for the sand is 10^{-2} cm/sec

Silt (All BH/MW)

Silt was encountered beneath the sand unit at all of the Phase 3 monitoring well locations, extending to a maximum depth of 3.8 m below grade. It consists of mainly of dense silt with some clay and a trace of fine sand. The silt unit is described as being grey in colour and having a hard to dense in consistency. The natural water contents for the retrieved subsoil samples ranges from 13 to 20% showing that the silt unit is generally moist. Grain size analyses were performed on three (3) representative subsoil samples, and the soil gradation curves is plotted on Figures 5, 7 and 8. The estimated permeability for the silt unit ranges from 10^{-6} to 10^{-5} cm/sec.

Groundwater Level Measurements

The records for the manual groundwater level measurements beneath the Phase 3 site area provided below in Table 2, in which 11 monitoring events were conducted between May 2022 and March 2023.

**Table 2 Groundwater Level Measurements**

Well ID		May 22, 2022	June 23, 2022	July25, 2022	August 23, 2022	Sept. 23, 2022	Oct. 31, 2022	Nov 25, 2022	Dec, 19, 2022	Jan 27, 2023	Feb 27, 2023	Mar 29, 2023	Average	Fluctuation (m)
MW 101	mbgs	1.33	1.47	1.77	1.78	1.74	1.48	1.09	1.23	1.18	1.11	0.81	1.36	0.97
	masl	200.97	200.83	200.53	200.52	200.56	200.82	201.21	201.07	201.12	200.91	201.49	200.94	
MW 102	mbgs	1.11	1.24	1.36	1.41	1.49	1.25	0.99	1.11	0.96	0.84	0.65	1.13	0.84
	masl	202.31	202.18	202.06	202.01	201.93	202.17	202.44	202.31	202.46	202.58	202.77	202.29	
MW 103	mbgs	0.24	0.17	0.55	0.40	0.73	0.49	0.26	0.23	Na	Na	Na	0.38	0.50
	masl	203.80	203.87	203.49	203.64	203.31	203.55	203.78	203.81	Na	Na	Na	203.66	
MW 104	mbgs	1.26	1.38	1.79	1.89	1.94	1.74	1.63	1.48	1.27	1.09	0.76	1.48	1.18
	masl	206.74	206.62	206.21	206.11	206.06	206.26	206.37	206.52	206.73	206.91	207.24	206.52	

mbgs: metres below ground surface

masl: metres above sea level

NA – suspected frozen water column within monitoring well



The groundwater levels at the Phase 3 monitoring wells were manually recorded monthly between May, 2022 and March, 2023 to document the prevailing groundwater levels beneath the proposed Phase 3 development area. Generally, the shallow groundwater levels range from the depths of 0.23 to 1.94 m below the existing ground surface, or from the depth elevations, ranging from 200.52 to 207.24 masl, as documented over the monitoring period. The greatest fluctuation was recorded at the BH/MW 104 location where the water levels exhibited a 1.18 m fluctuation over the late spring through early winter monitoring period.

Overall, a general review of the subsurface information from the current borehole logs, and the associated groundwater monitoring level data suggests the groundwater conditions beneath the Phase 3 site exhibits responses to shallow unconfined water table conditions, unlike the deeper monitoring wells that were installed within Phase 2 where the groundwater levels were influenced by a deeper confined or semi- confined aquifer condition. However, all of the Phase 3 monitoring wells only extended to a maximum depth of 3.8 m below grade, in which the associated groundwater levels, which likely represent perched water within these monitoring wells only reflect the shallow perched water table conditions with no influence from the underlying confined aquifer beneath the site.

Automated pressure transducer data loggers were placed within two (2) of the monitoring wells at the locations for (BH/MW 101 and BH/MW 104) within Phase 3, during the spring season of 2022 to continuously monitor the groundwater level changes. The data loggers were downloaded and the automated information was retrieved in January 2023. The hydrographs showing the groundwater table fluctuations for both of these new monitoring wells, along with the water table response to local precipitation records are provided on Figures 9 and 10. The manual groundwater level measurements over this period which shown in green makings are included with the automated hydrographs which match the levels reported for the automated data.

Local precipitation data was obtained from the Collingwood weather station, Station ID 6111792, with the precipitation data plotted as a bar graphs on the hydrographs for Figures 9 and 10 to illustrate the precipitation received in the area over the study period. In general, the shallow groundwater levels show a response to seasonal weather patterns in the area with the levels generally decreasing over the late spring and summer seasons and rising again toward



mid and late fall. During the spring and summer seasons the shallow water levels responded to rainfall events with the shallow water table rising following significant rainfall events. By late fall, however, the shallow water table responses to precipitation are more muted as the ground shows impacts from cold and freezing conditions.

Our interpretation of the hydrographs and shallow water table response is that during spring and summer rainfall events the received rainfall infiltrates through the shallow sand profile where it pools below, the percolated water meets the dense silt unit beneath the shallow sand profile that does not allow the fast transmission of infiltrated water through the dense silt, below the surficial sand unit, resulting in higher ground water columns within the monitoring wells which were tracked by the data logger pressure transducers. As such, any temporarily pooled/perched infiltration water might be collected within housing basement drainage networks but most likely only on a sporadic basis. Any collected seepage drainage water can then be discharged to the ground where it can infiltrate or evaporate. Under these conditions there will be no continuous drainage seepage to housing basements, only that which infiltrates from the surface following heavier precipitation events or following snow melt in the early spring.

Performance of Single Well Response Tests (SWRT)

The four (4) new monitoring wells installed within Phase 3 underwent development in preparation for single well response tests (SWRT) to estimate the hydraulic conductivity (K) for saturated subsoil strata at the depths of the monitoring well screens. Well development involved the purging and removal of several casing volumes of groundwater from each monitoring well to remove remnants of clay, silt and other debris introduced into the monitoring wells during construction, and to induce the flow of formation groundwater through the well screens, thereby improving the transmissivity of the subsoil strata formation at the monitoring well screen depths.

The test results from SWRT's are used to estimate the hydraulic conductivity (K) for groundwater-bearing subsoil strata at the depths of the monitoring well screens. The K values estimated from the SWRTs provide an indication of the yield capacity for the groundwater-bearing subsoil strata, and can be used to estimate the flow of groundwater through the groundwater-bearing subsoil strata. Table 3, below summarized the K estimate determined by



Table 3 - Summary of SWRT Results

Well ID	Ground EL. (masl)	Monitoring Well Depth (mbgs)	Borehole Depth (mbgs)	Screen Interval (mbgs)	Screened Soil Strata	Hydraulic Conductivity (K) (m/sec)
BH/MW 101	202.30	3.7	3.7	1.2-3.7	Fine Sand over Silt	1.4×10^{-6}
BH/MW 102	203.42	3.5	3.5	1.1-3.5	Fine Sand over Silt	8.5×10^{-7}
BH/MW 103	204.04	3.8	3.8	1.4-3.8	Fine Sand over Silt	2.8×10^{-6}
BH/MW 104	208.00	3.7	3.7	1.2-3.7	Fine Sand over Silt	5.6×10^{-6}

As shown above, the hydraulic conductivity (K) estimates for the fine and unit ranges from to 8.5×10^{-7} to 5.6×10^{-6} m/s. The results of the SWRT suggest that the hydraulic conductivity(K) for the shallow groundwater-bearing subsoil at the depths of the monitoring well screens, ranges from low to moderate, with corresponding low to moderate groundwater seepage rates being anticipated into open excavations below the shallow groundwater table. Given that these subsoils will be present at the depths for proposed housing basements, only limited sporadic seepage may occur to housing basement foundations, likely only occasionally during spring and following heavy rain events

Assessment and Interpretation of Shallow Groundwater Table Elevation Contours

The averages for the groundwater table elevations, as recorded during the monitoring period (May 2022 through March 2023) were reviewed and considered to re-interpret the groundwater level elevation contours across the proposed Phase 3 development area as shown on Drawing 3, which can then be used for the comparison assessment against the existing site grades to provide recommendations for the preparation of the Phase 3 grading plans. Drawing 3 provides the interpreted shallow groundwater level elevation contours across the Phase 3 development area, based on the average groundwater levels recorded during May 2022 through to March 2023 or from the automated data logger plots which shows the high groundwater levels beneath the site.

A review of the Shallow Groundwater Flow Patterns (Drawing 3) indicates that shallow groundwater flows in easterly and north-easterly directions mimicking a similar pattern for the



Discussion

The current policy from the Town of Collingwood requires that the undersides of housing basements be established 0.5 m above the prevailing groundwater table.

The “Concept Servicing and Grading Plan”, prepared by Tatham Engineering, for Phase 3, Drawing No. CSG-1, dated December 22, 2022, and revised March 16, 2023 was reviewed. It comprised park and detached housing blocks along with road and sidewalk widening blocks, however, no grading elevations have yet been established. A comparison of the considered housing basements with the interpreted, shallow groundwater level elevations at individual housing lots for Phase 3 will need to be carried out to maintain a 0.5 m separation of basement under-slabs above the high, water table to established the final grading plan for Phase 3.

The shallower Phase 3 monitoring wells, that are screened within the water table sand and silt subsoil units are no deeper than 4 m below grade. The associated measured perched water levels are low during the late summer and higher during spring, late fall, and winter. Based on review of the groundwater level information from the Phase 3 monitoring wells, and from the underground servicing installation records for the earlier phases of the development, where minimal groundwater control was needed during services installation beneath Phases 1 and Phase 2, negligible groundwater control is anticipated for the construction of the Phase 3 underground services and housing basements. Phase 3 monitoring wells likely represent perched infiltration water, which should not require the proposed Phase 3 grading to be raised.

Based on this review, and from review of the basement slab clearance information assessed to date for the earlier phases of the development, we recommend that finished grade elevations be determined and provided for Phase 3 development area, based on the re-interpreted average groundwater level contours that are illustrated on Drawing 3.

Conclusions

Based on the interpreted groundwater table contours, provided in Drawing 3, it is recommended that grading plan be prepared for Phase 3 by considering a 0.5 m separation for proposed undersides of basement floor slabs above the interpreted average groundwater table,



Poplar Developments 1 Inc.
May 2, 2023
as shown in Drawing 3.

Reference No.: 2008-W011
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We trust the above satisfies your present requirements. Should you have any further queries, please feel free to contact this office.

Yours very truly,
SOIL ENGINEERS LTD.

Gavin O'Brien, M.Sc., P.Geo.
/GO



ENCLOSURES

Site Location Plan.....	Drawing No. 1
Borehole and Monitoring Well Location Plan.....	Drawing No. 2
Groundwater Level Elevation Contour Plans.....	Drawing No. 3
Borehole Logs and Monitoring Wells	Figures 1 to 4
Soil Gradation Plots	Figures 5 to 8
Hydrographs MW 101 and MW 104	Figures 9 & 10
Appendix: Well Head Protection, Vulnerable Aquifer, and Significant Groundwater Recharge Area Mapping (WSP)	

This letter/report/certification was prepared by Soil Engineers Ltd. for the account of the captioned clients and may be relied upon by regulatory agencies. The material in it reflects the writer's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this letter/report/certification, or any reliance on or decisions to be made based upon it, are the responsibility of such third parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this letter/report/certification.

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS Auger sample
CS Chunk sample
DO Drive open (split spoon)
DS Denison type sample
FS Foil sample
RC Rock core (with size and percentage recovery)
ST Slotted tube
TO Thin-walled, open
TP Thin-walled, piston
WS Wash sample

SOIL DESCRIPTION

Cohesionless Soils:

<u>'N' (blows/ft)</u>	<u>Relative Density</u>
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

PENETRATION RESISTANCE

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—●—'

Undrained Shear
Strength (ksf)

less than 0.25
0.25 to 0.50
0.50 to 1.0
1.0 to 2.0
2.0 to 4.0
over 4.0

'N' (blows/ft)

0 to 2	very soft
2 to 4	soft
4 to 8	firm
8 to 16	stiff
16 to 32	very stiff
over 32	hard

Consistency

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

Plotted as '○'

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0 Field vane test in borehole; the number denotes the sensitivity to remoulding

△ Laboratory vane test

□ Compression test in laboratory

WH Sampler advanced by static weight
PH Sampler advanced by hydraulic pressure
PM Sampler advanced by manual pressure
NP No penetration

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

METRIC CONVERSION FACTORS

1 ft = 0.3048 metres
1lb = 0.454 kg

1 inch = 25.4 mm
1ksf = 47.88 kPa



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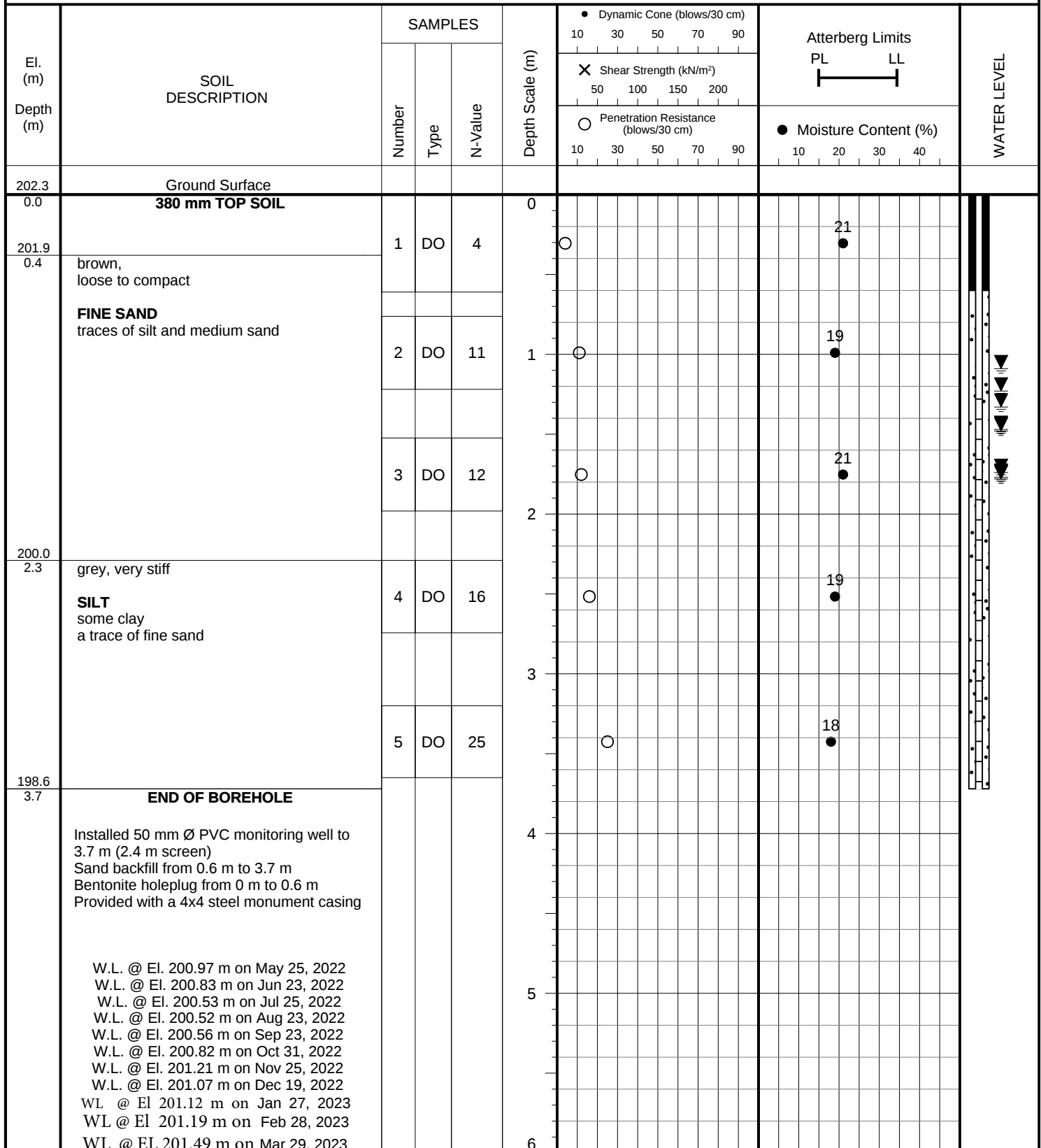
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PROJECT DESCRIPTION: High Street and Poplar Sideroad
Town of Collingwood

METHOD OF BORING: Hollow Stem

PROJECT LOCATION: Proposed Residential Subdivision

DRILLING DATE: April 27, 2022

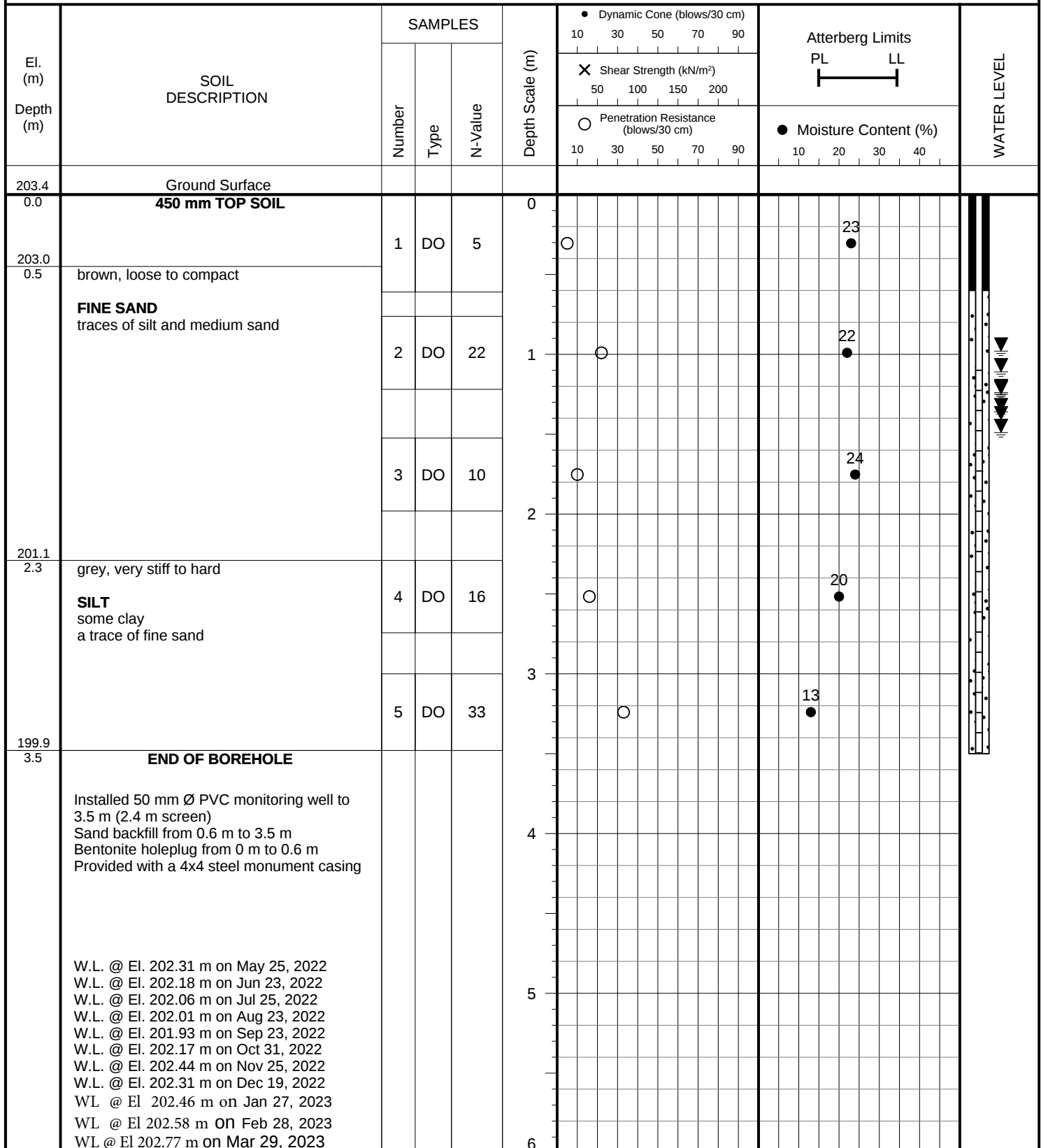


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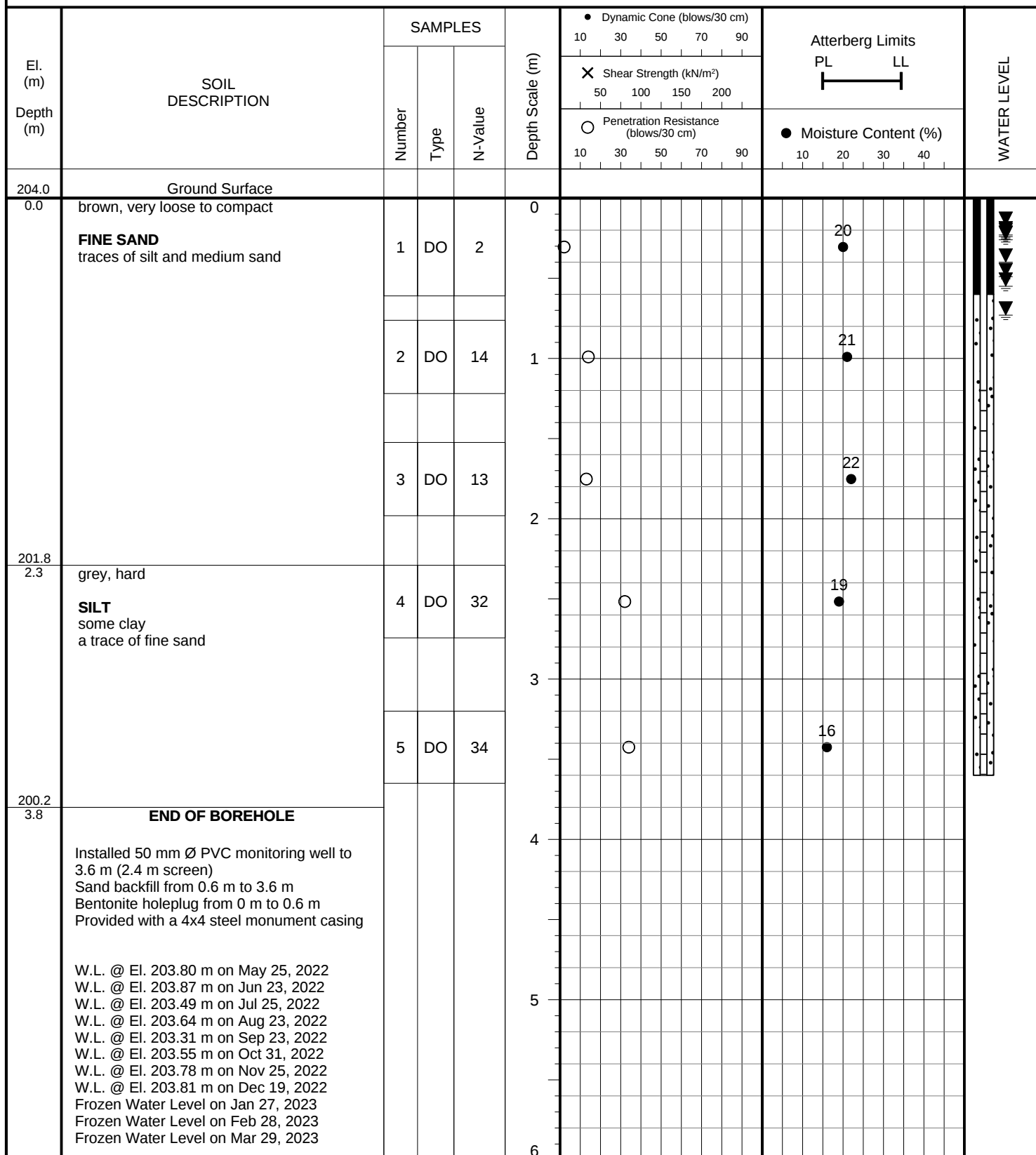
DRILLING DATE: April 27, 2022



JOB NO.: 2008-W011

LOG OF BOREHOLE NO.: BH/MW 103

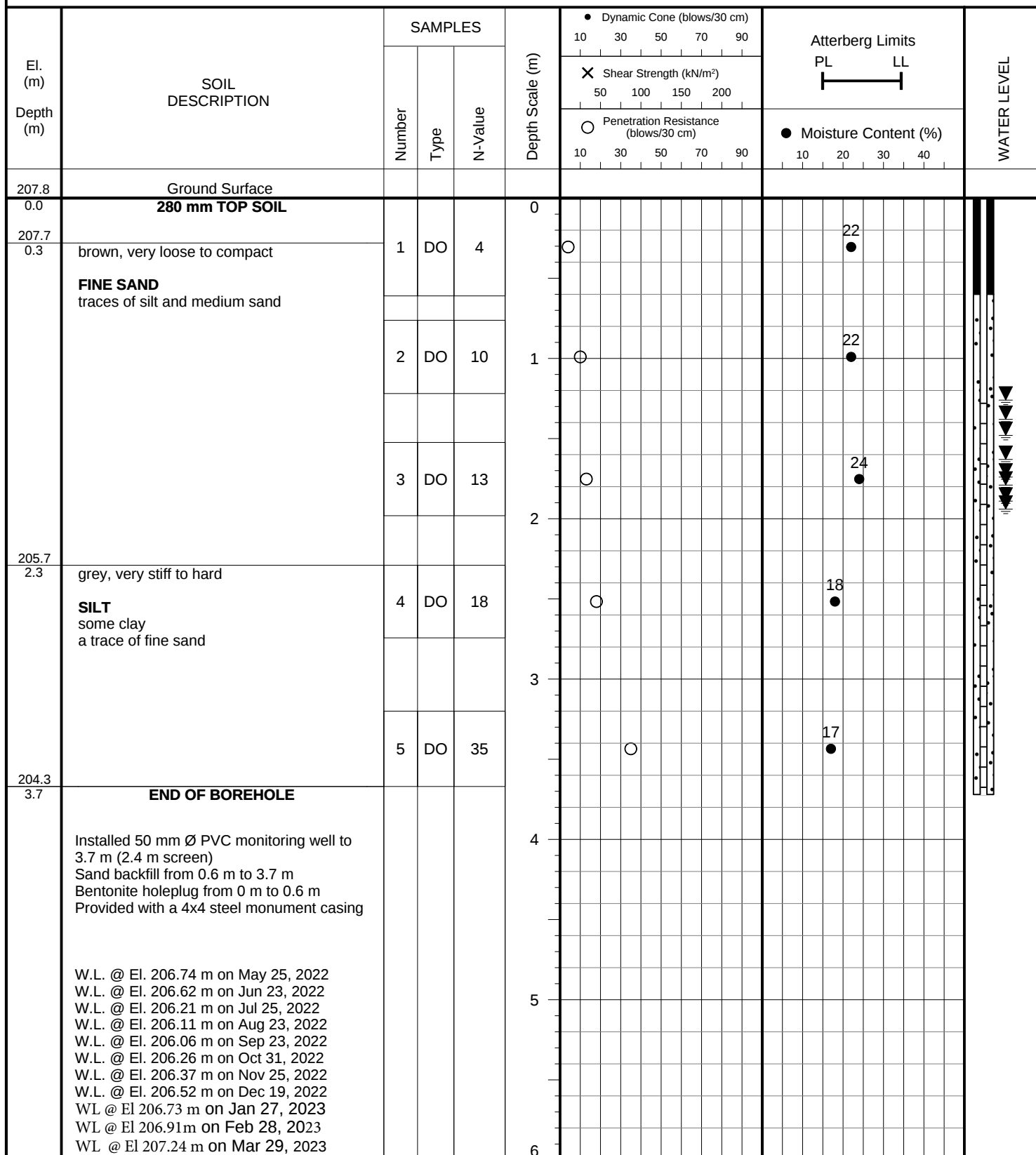
FIGURE NO.: 3

PROJECT DESCRIPTION: High Street and Poplar Sideroad
Town of Collingwood**METHOD OF BORING:** Hollow Stem**PROJECT LOCATION:** Proposed Residential Subdivision**DRILLING DATE:** April 27, 2022**Soil Engineers Ltd.**

JOB NO.: 2008-W011

LOG OF BOREHOLE NO.: BH/MW 104

FIGURE NO.: 4

PROJECT DESCRIPTION: High Street and Poplar Sideroad
Town of Collingwood**METHOD OF BORING:** Hollow Stem**PROJECT LOCATION:** Proposed Residential Subdivision**DRILLING DATE:** April 27, 2022**Soil Engineers Ltd.**

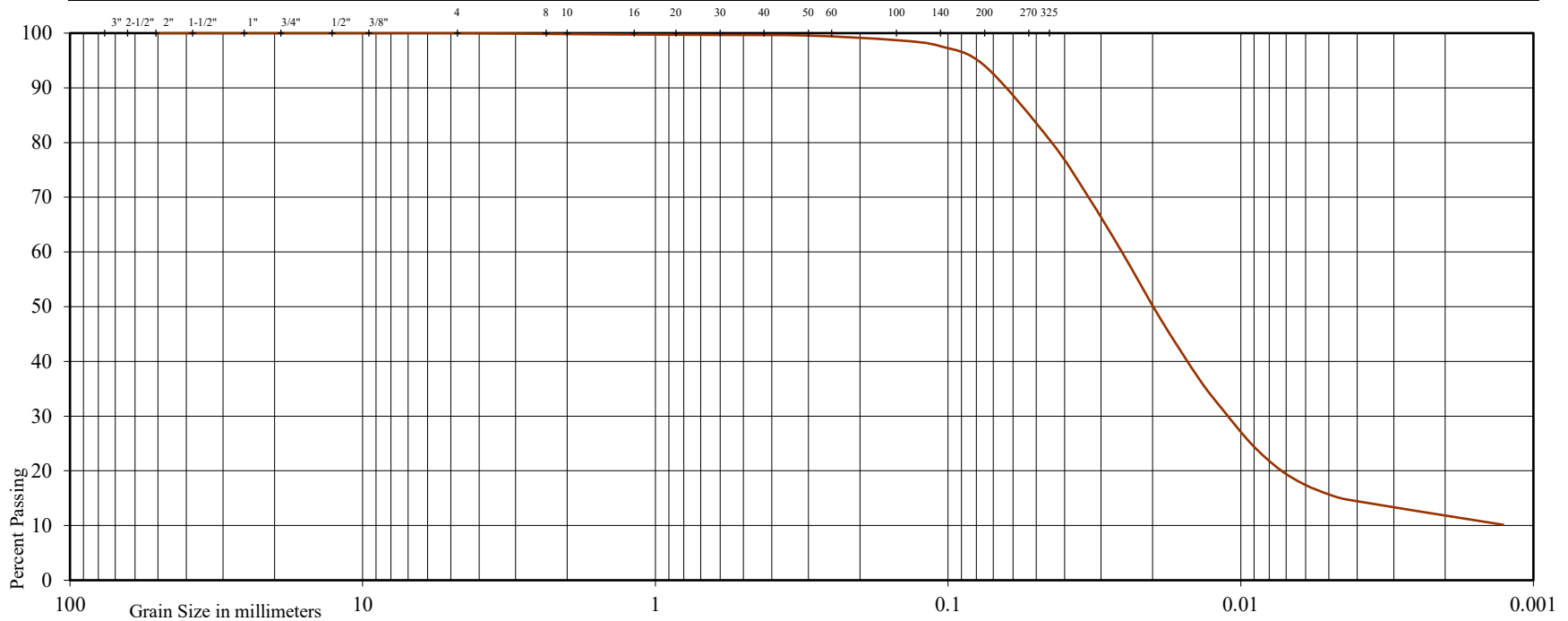


U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL			SAND				SILT	CLAY
COARSE		FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Summit View Subdivision Phase 3

Location: High Street and Poplar Sideroad, Town of Collingwood

Borehole No: 101

Sample No: 4

Depth (m):

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability

(cm./sec.) = 10^{-6}

Classification of Sample [& Group Symbol]: SILT
some clay, a trace of fine sand

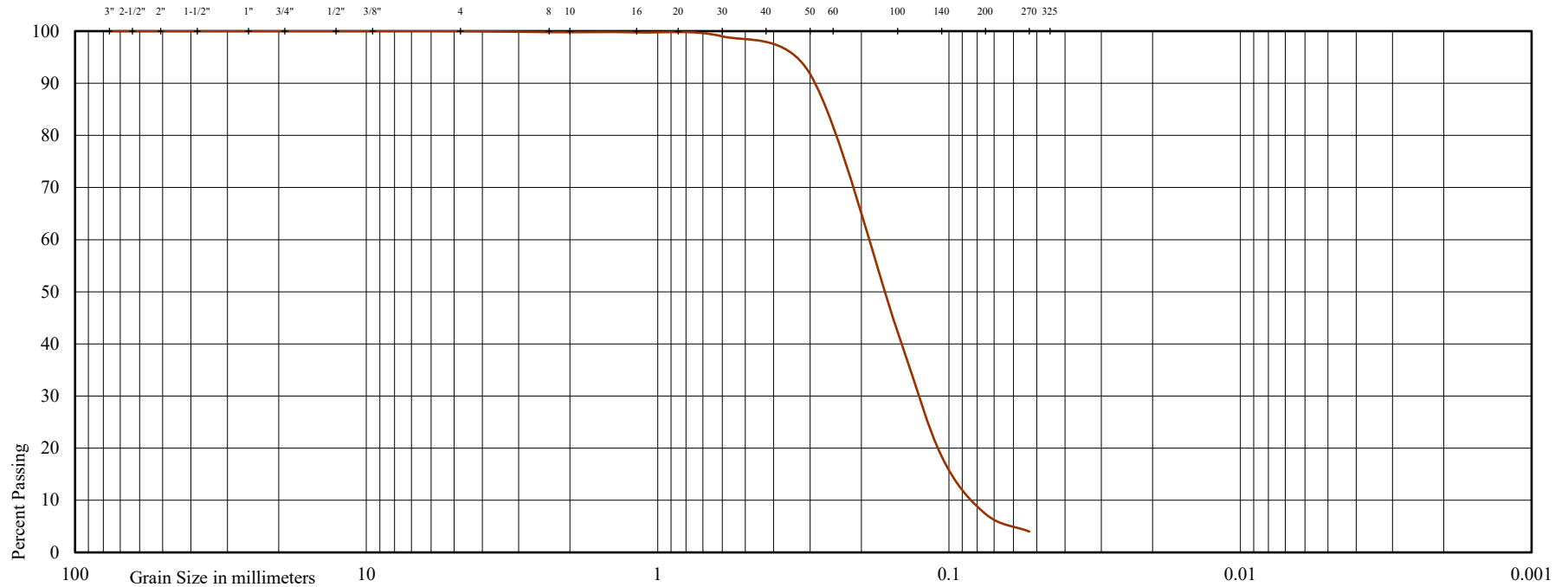


U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL			SAND				SILT	CLAY
COARSE		FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Summit View Subdivision Phase 3

Location: High Street and Poplar Sideroad, Town of Collingwood

Borehole No: 104

Sample No: 2

Depth (m):

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability

(cm./sec.) = 10^{-2}

Classification of Sample [& Group Symbol]: FINE SAND
traces of silt and medium sand

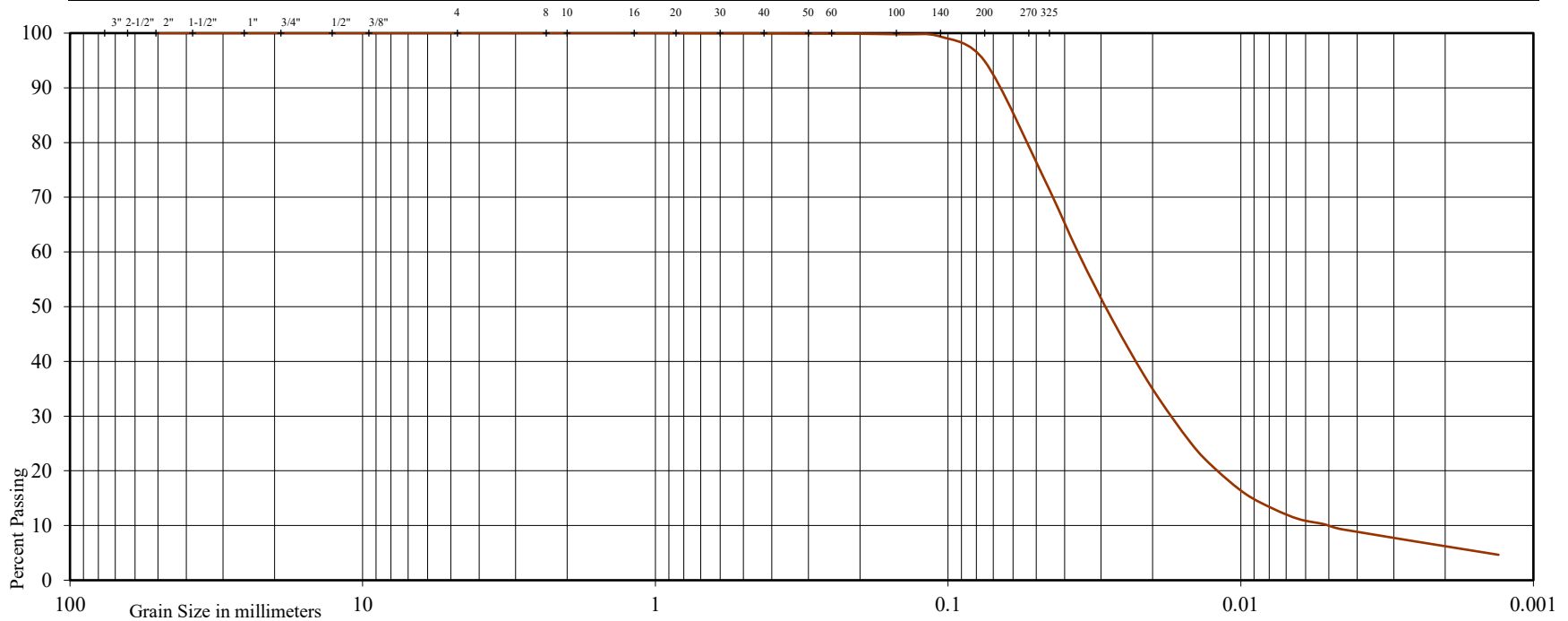


U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL			SAND				SILT	CLAY
COARSE		FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Summit View Subdivision Phase 3

Location: High Street and Poplar Sideroad

Borehole No: 102

Sample No: 4

Depth (m):

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability

(cm./sec.) = 10^{-5}

Classification of Sample [& Group Symbol]: SILT
traces of clay and fine sand

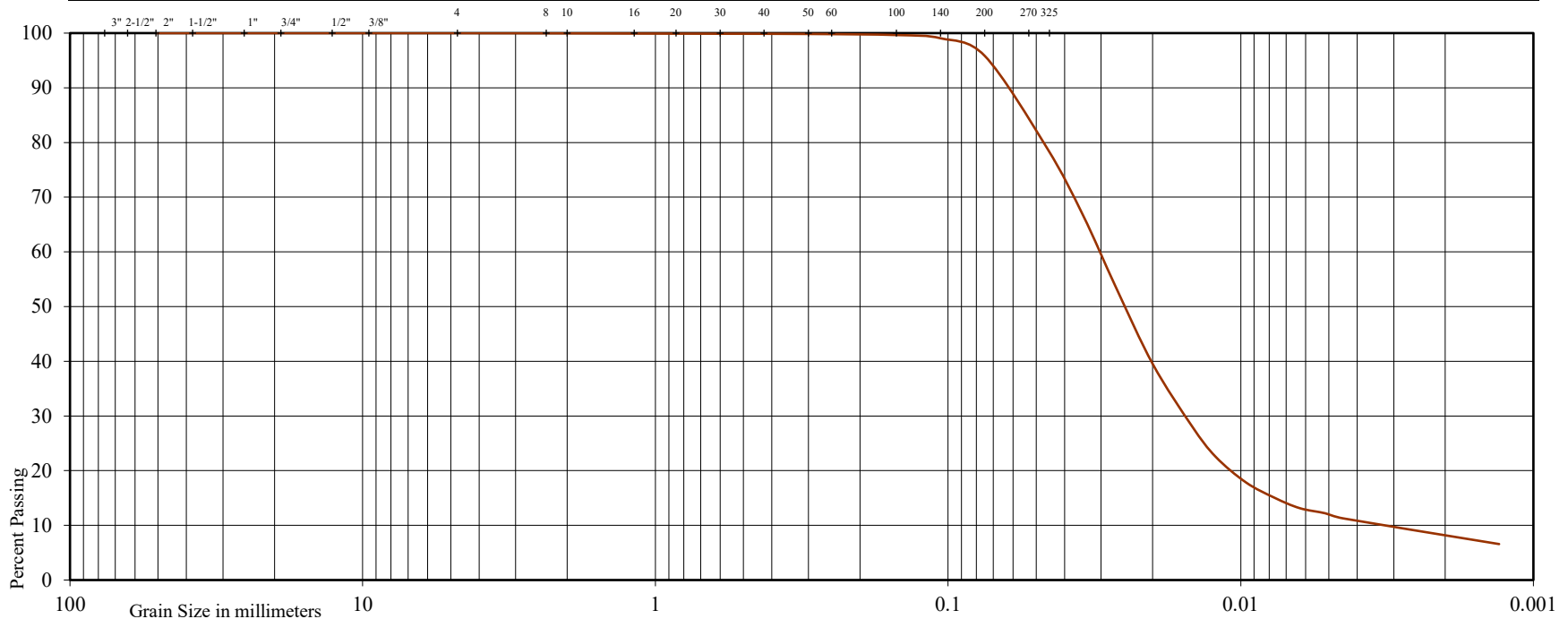


U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL			SAND				SILT	CLAY
COARSE		FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Summit View Subdivision Phase 3

Location: High Street and Poplar Sideroad

Borehole No: 103

Sample No: 4

Depth (m):

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability

(cm./sec.) = 10^{-5}

Classification of Sample [& Group Symbol]: SILT
traces of clay and fine sand



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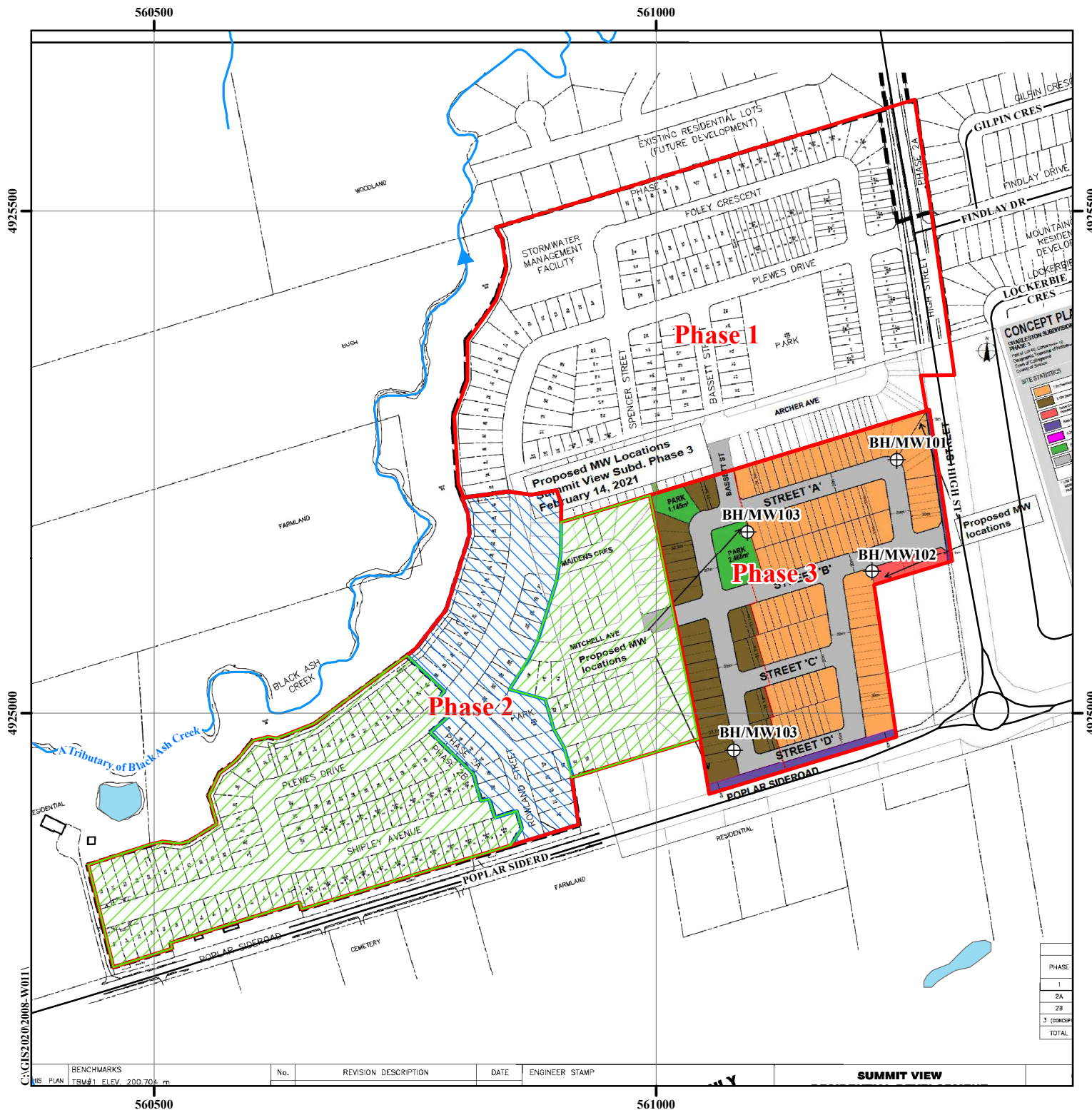
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90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL (416) 754-8515 · FAX (905) 881-8335

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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 725-1315	FAX: (905) 542-2769

DRAWINGS

REFERENCE NO. 2008-W011



N

Approximate Boundary of Subject Site

Area Served Winter/ Spring 2020

Area Served Winter/ Spring 2021

Borehole with Monitoring Well by SEL

Waterbody

Watercourse

Local Road

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Title: Site Location Plan

Project:

Hydrogeological Assessment
Proposed Residential Subdivision
Summit View Subdivision (Phase 3)
Town of Collingwood

Reference No. 2008-W011

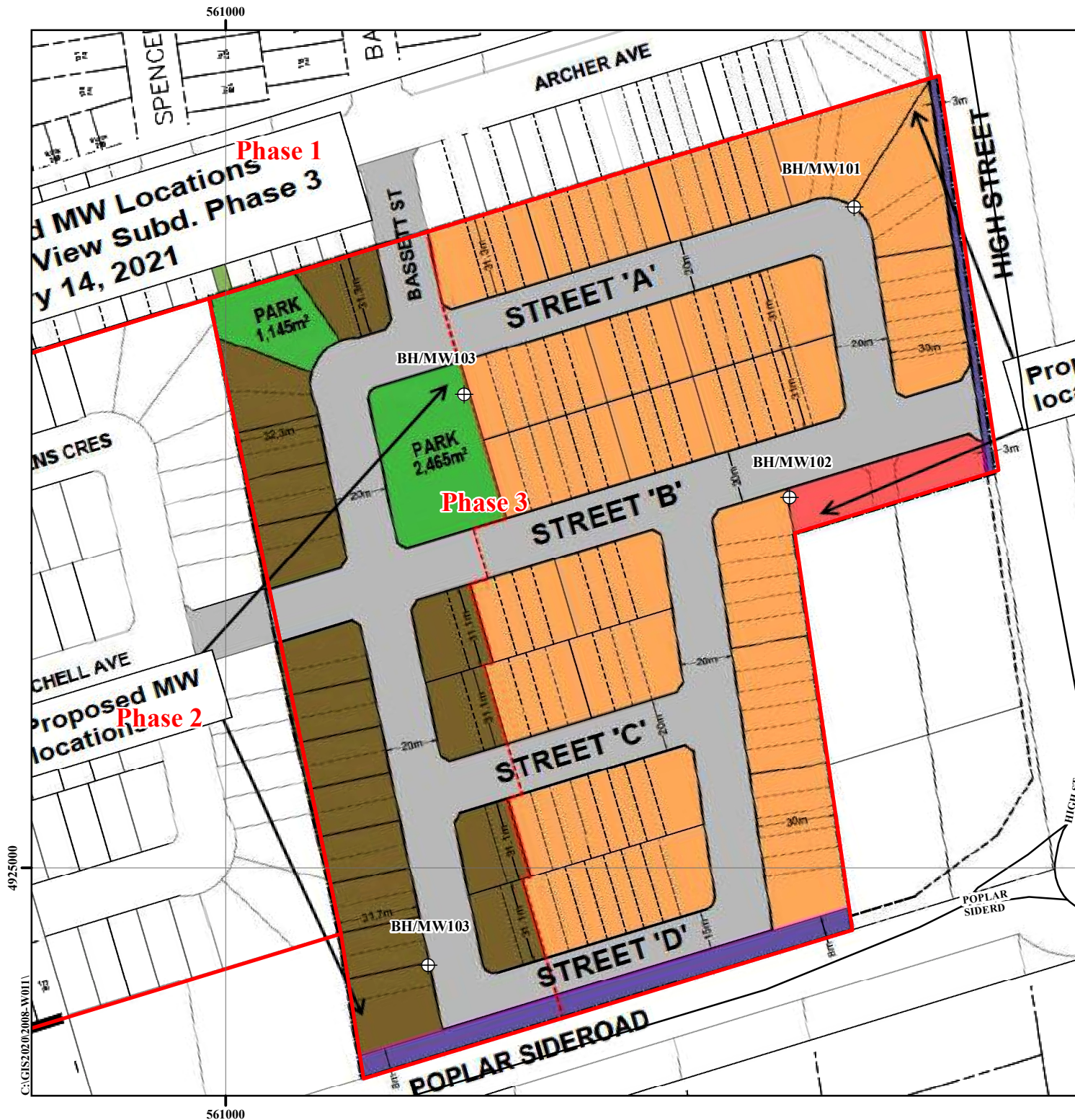
Date: April 11, 2023

Scale:

0 25 50 100 150 200 250

Metres

Drawing No. 1



- Approximate Boundary of Subject Site
- Borehole with Monitoring Well by SEL
- Local Road



Title: Site Location Plan

Project:
Hydrogeological Assessment
Proposed Residential Subdivision
Summit View Subdivision (Phase 3)
Town of Collingwood

Reference No. 2008-W011

Date: April 11, 2023

Scale:
0 10 20 40 60 80 100
Metres

Drawing No. 2

Source: Ministry of Natural Resources and Forestry
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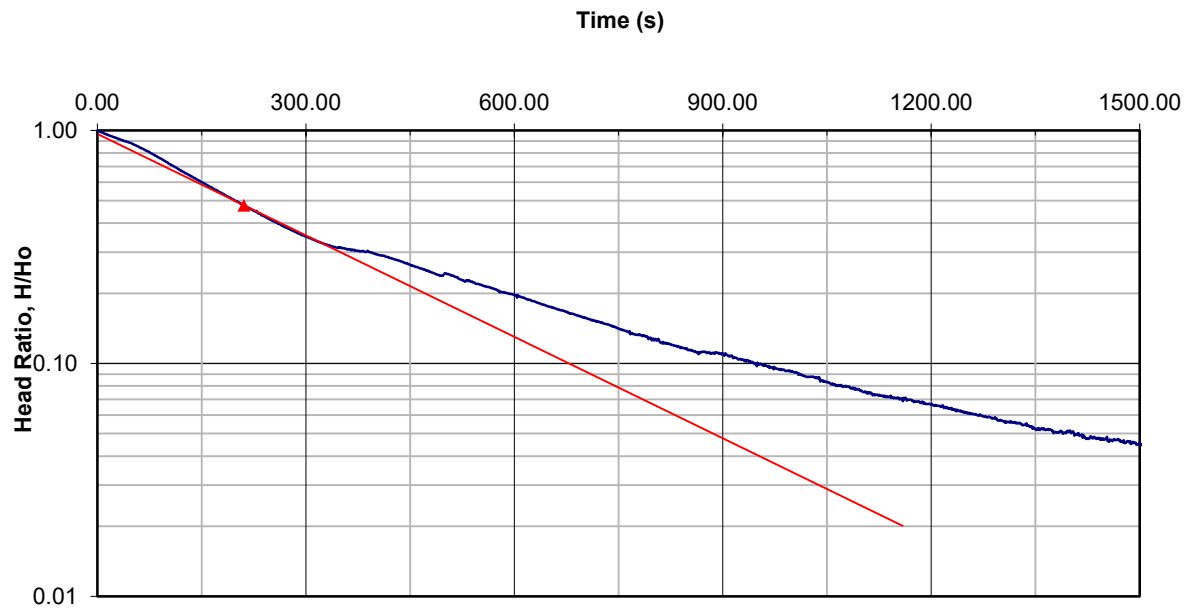
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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 725-1315	FAX: (905) 542-2769

SINGLE WELL RESPONSE TEST RESULTS

REFERENCE NO. 2008-W011

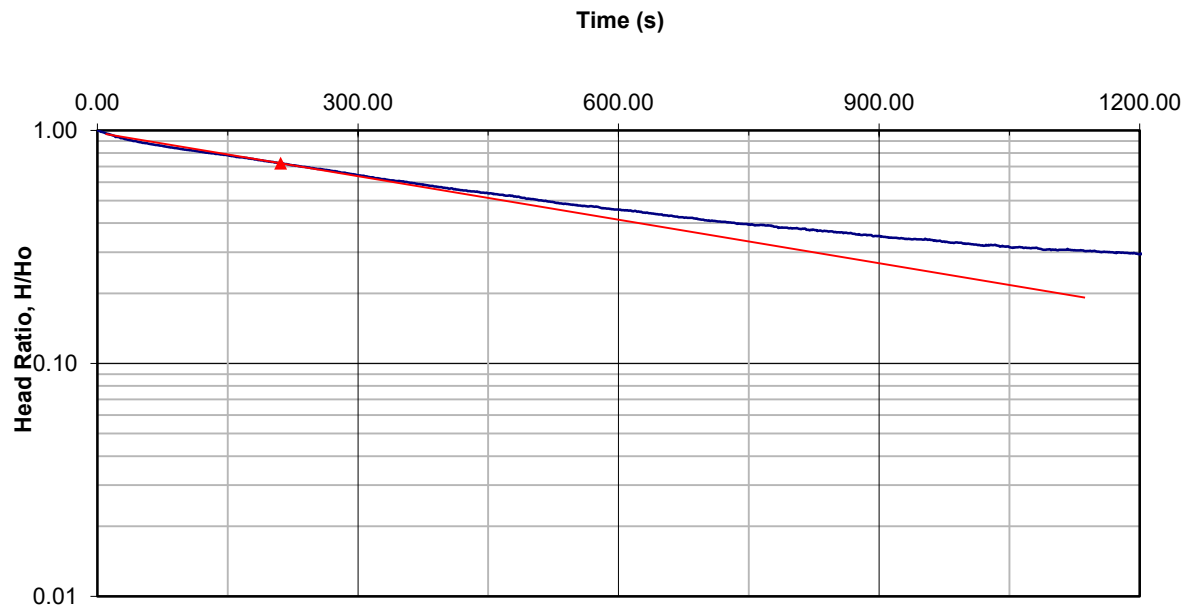
Falling Head Test (Slug Test)

Test Date: 25-Jul-22
 Piezometer/Well No.: BH/MW 101
 Ground level: 202.30 m
 Screen top level: 201.60 m
 Screen bottom level: 198.60 m
 Test El. (at midpoint of screen): 200.10 m
 Test depth (at midpoint of screen): 2.2 m
 Screen length L= 2.4 m
 Diameter of undisturbed portion $c 2R=$ 0.22 m
 Standpipe diameter $2r=$ 0.05 m
 Initial unbalanced head $H_o=$ -0.3167 m
 Initial water depth 1.77 m
 Aquifer material: Fine Sand and Silt
 $2 \times 3.14 \times L$
 Shape factor $F= \frac{3.14 \times r^2}{\ln(L/R)} = 4.891631 \text{ m}$
 Permeability $K= \frac{3.14 \times r^2}{F \times (t_2 - t_1)} \times \ln(H_1/H_2)$ (Bouwer and Rice Method)
 $\frac{\ln(H_1/H_2)}{(t_2 - t_1)} = 0.00338413$
 $K= 1.4E-04 \text{ cm/s}$
 $1.4E-06 \text{ m/s}$



Falling Head Test (Slug Test)

Test Date: 25-Jul-22
 Piezometer/Well No.: BH/MW 102
 Ground level: 203.42 m
 Screen top level: 202.92 m
 Screen bottom level: 199.92 m
 Test El. (at midpoint of screen): 201.42 m
 Test depth (at midpoint of screen): 2 m
 Screen length L= 2.4 m
 Diameter of undisturbed portion $c \ 2R=$ 0.22 m
 Standpipe diameter $2r=$ 0.05 m
 Initial unbalanced head $H_o=$ -0.1976 m
 Initial water depth 1.36 m
 Aquifer material: Fine Sand and Silt
 $2 \times 3.14 \times L$
 Shape factor $F= \frac{2 \times 3.14 \times L}{\ln(L/R)} = 4.891631 \text{ m}$
 Permeability $K= \frac{3.14 \times r^2}{F \times (t_2 - t_1)} \times \ln(H_1/H_2)$ (Bouwer and Rice Method)
 $\frac{\ln(H_1/H_2)}{(t_2 - t_1)} = 0.002109$
 $K= 8.5E-05 \text{ cm/s}$
 $8.5E-07 \text{ m/s}$

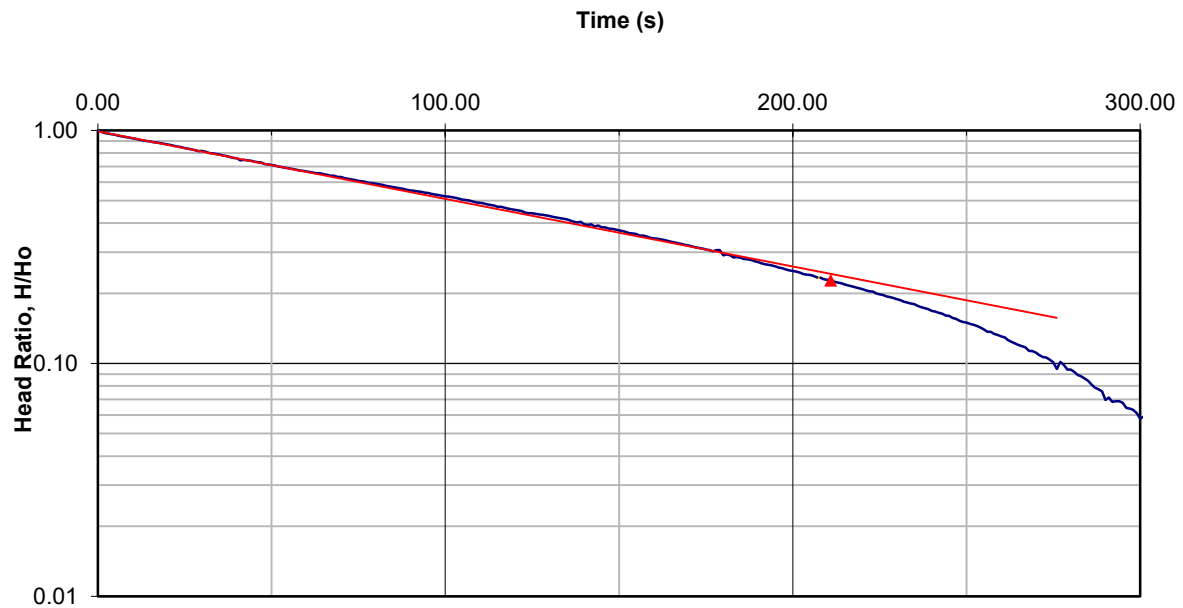


Falling Head Test (Slug Test)

Test Date: 25-Jul-22
 Piezometer/Well No.: BH/MW 103
 Ground level: 204.04 m
 Screen top level: 203.44 m
 Screen bottom level: 200.44 m
 Test El. (at midpoint of screen): 201.94 m
 Test depth (at midpoint of screen): 2.1 m
 Screen length L= 2.4 m
 Diameter of undisturbed portion c 2R= 0.22 m
 Standpipe diameter 2r= 0.05 m
 Initial unbalanced head Ho= -0.2453 m
 Initial water depth 0.55 m
 Aquifer material: Fine Sand and Silt
 2 x 3.14 x L
 Shape factor F= $\frac{2 \times 3.14 \times L}{\ln(L/R)}$ = 4.891631 m
 Permeability K= $\frac{3.14 \times r^2}{F \times (t_2 - t_1)} \times \ln(H_1/H_2)$ (Bouwer and Rice Method)

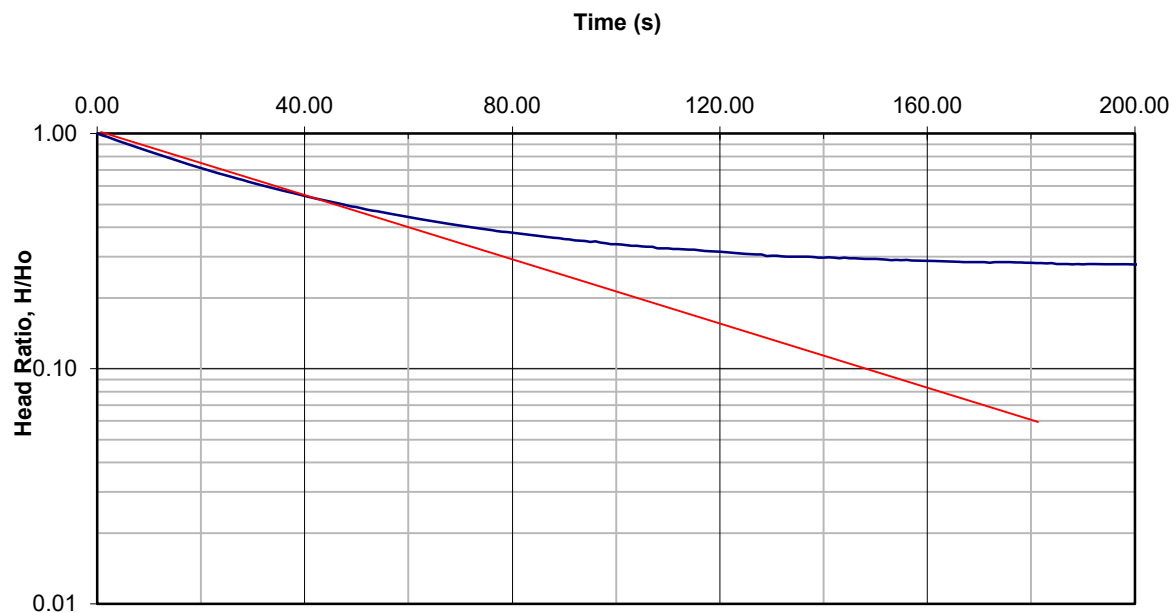
$$\frac{\ln(H_1/H_2)}{(t_2 - t_1)} = 0.00693088$$

 K= **2.8E-04 cm/s**
2.8E-06 m/s



Falling Head Test (Slug Test)

Test Date: 25-Jul-22
 Piezometer/Well No.: BH/MW 104
 Ground level: 208.00 m
 Screen top level: 207.30 m
 Screen bottom level: 204.30 m
 Test El. (at midpoint of screen): 205.80 m
 Test depth (at midpoint of screen): 2.2 m
 Screen length L= 3.0 m
 Diameter of undisturbed portion (2R= 0.22 m
 Standpipe diameter 2r= 0.05 m
 Initial unbalanced head Ho= -0.2664 m
 Initial water depth 1.79 m
 Aquifer material: Fine Sand and Silt
 $2 \times 3.14 \times L$
 Shape factor $F = \frac{2 \times 3.14 \times L}{\ln(L/R)} = 5.701815 \text{ m}$
 Permeability $K = \frac{3.14 \times r^2}{F \times (t_2 - t_1)} \times \ln(H_1/H_2)$ (Bouwer and Rice Method)
 $\frac{\ln(H_1/H_2)}{(t_2 - t_1)} = 0.01619024$
 $K = 5.6E-04 \text{ cm/s}$
 $5.6E-06 \text{ m/s}$





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FAX: (905) 725-1315

NEWMARKET
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FAX: (905) 881-8335

GRAVENHURST
TEL: (705) 684-4242
FAX: (705) 684-8522

PETERBOROUGH
TEL: (905) 440-2040
FAX: (905) 725-1315

HAMILTON
TEL: (905) 777-7956
FAX: (905) 542-2769

HYDROGRAPHS **Figures 9 & 10**

REFERENCE NO. 2008-W011

Hydrograph : BH/MW 101

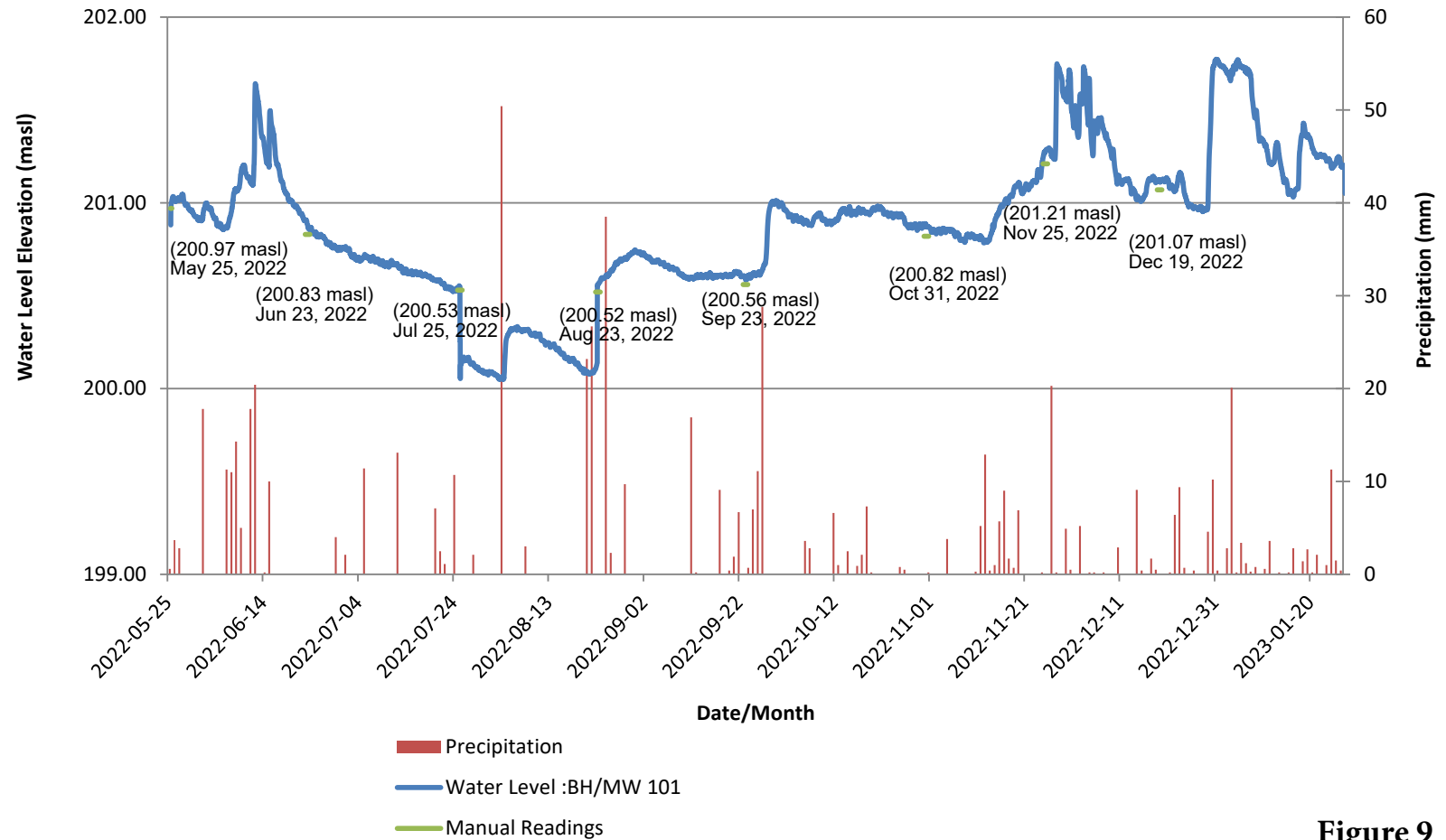


Figure 9

Hydrograph : BH/MW 104

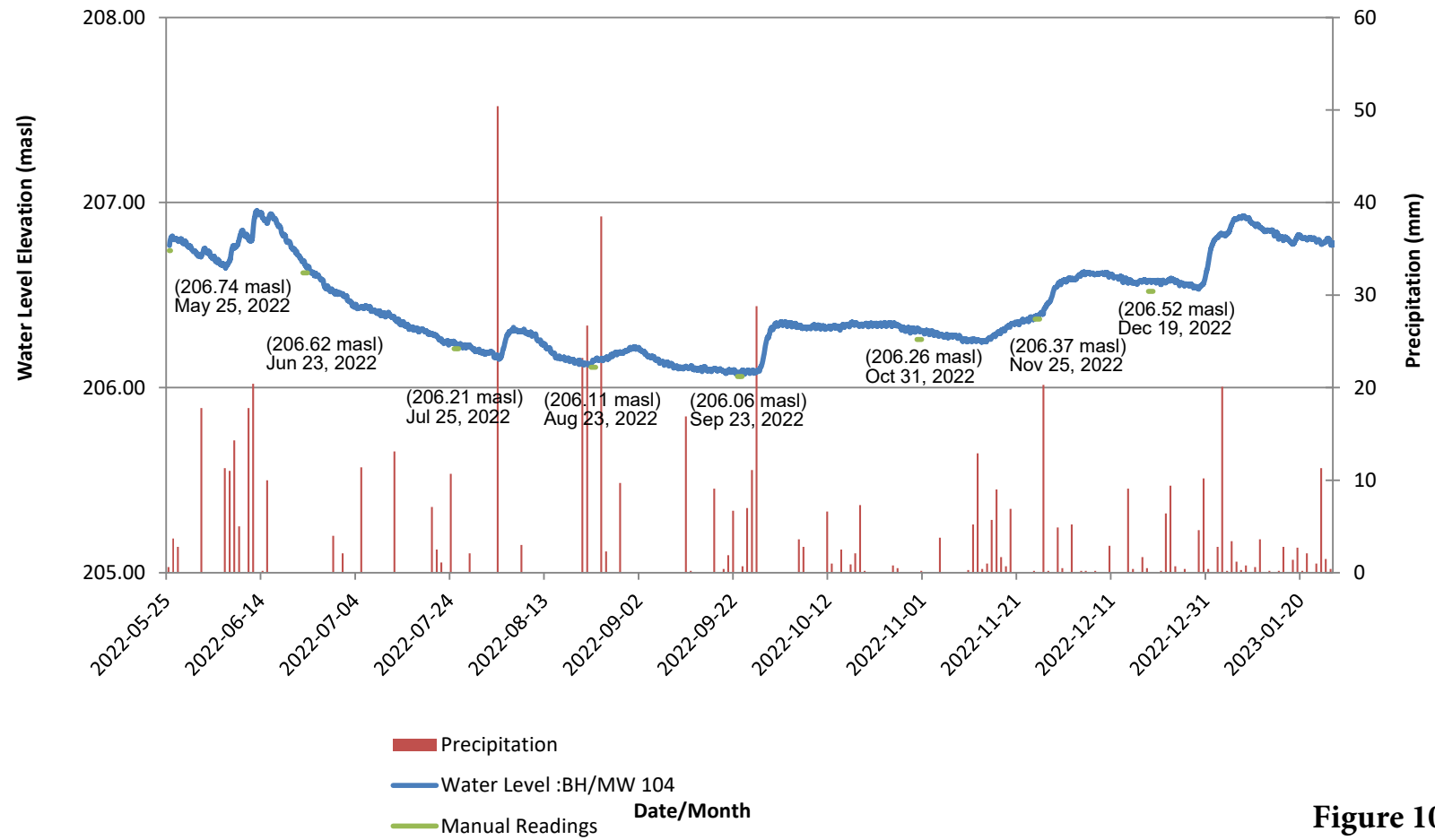


Figure 10



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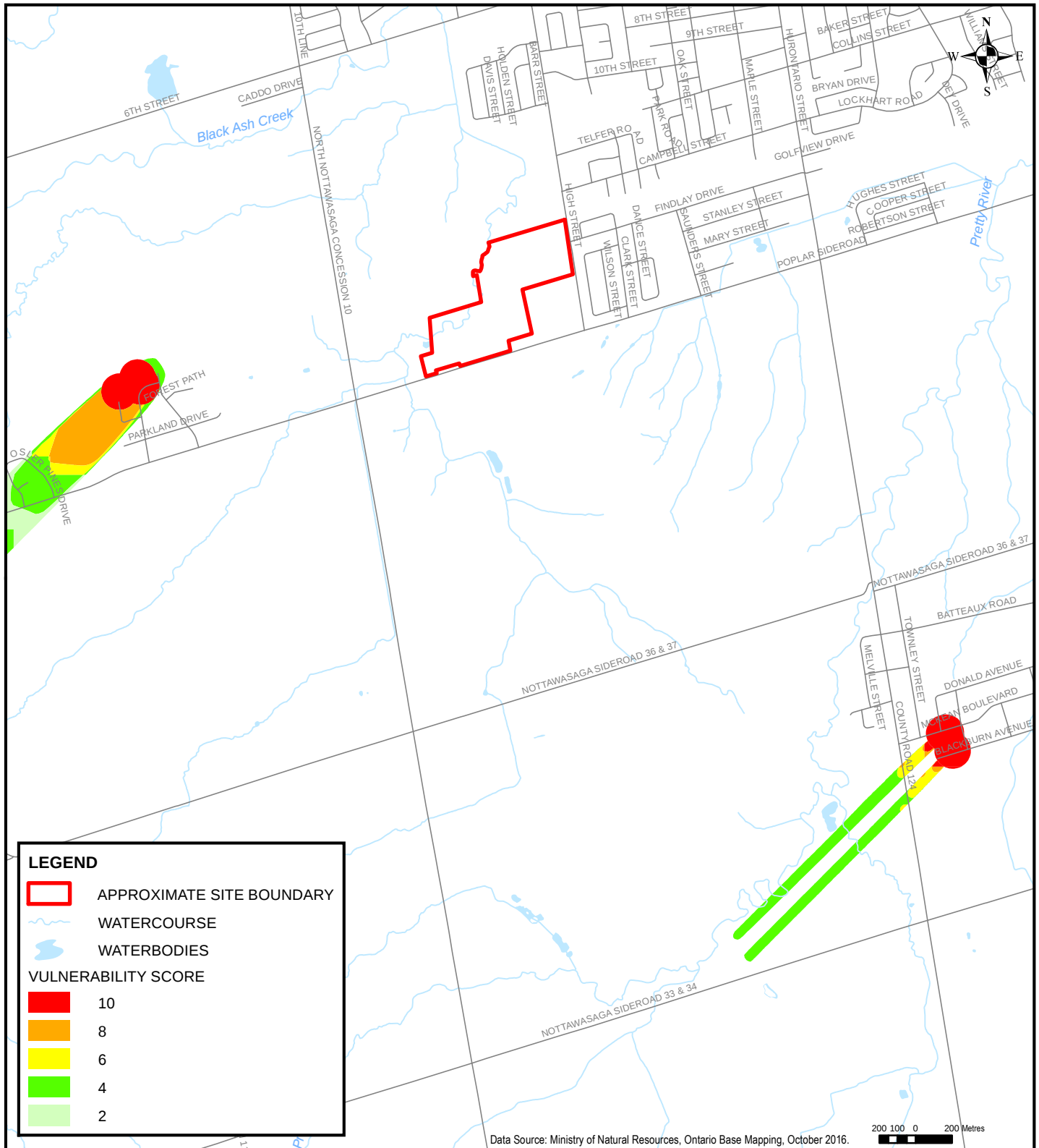
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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 725-1315	FAX: (905) 542-2769

APPENDIX

Well Head Protection, Highly Vulnerable Aquifers And Significant Groundwater Recharge Areas Mapping (WSP Report)

REFERENCE NO. 2008-W011



51 CONSTELLATION COURT
TORONTO, ONTARIO CANADA M9W 1K4
TEL.: 416-798-0065 | FAX: 416-798-0518 | WWW.WSP.COM

PROJECT: HYDROGEOLOGICAL ASSESSMENT
SUMMIT VIEW PROPOSED RESIDENTIAL DEVELOPMENT
HIGH STREET & POPLAR SIDEROAD, COLLINGWOOD

TITLE: WELLHEAD PROTECTION AREAS

CLIENT: 1674715 ONTARIO LIMITED
c/o MATSON PLANNING DEVELOPMENT INC.

SCALE:

1:30,000

DRAWN BY:

TP

CHECKED BY:

GJ

PROJECT NO:

181-02851-00

DATE:

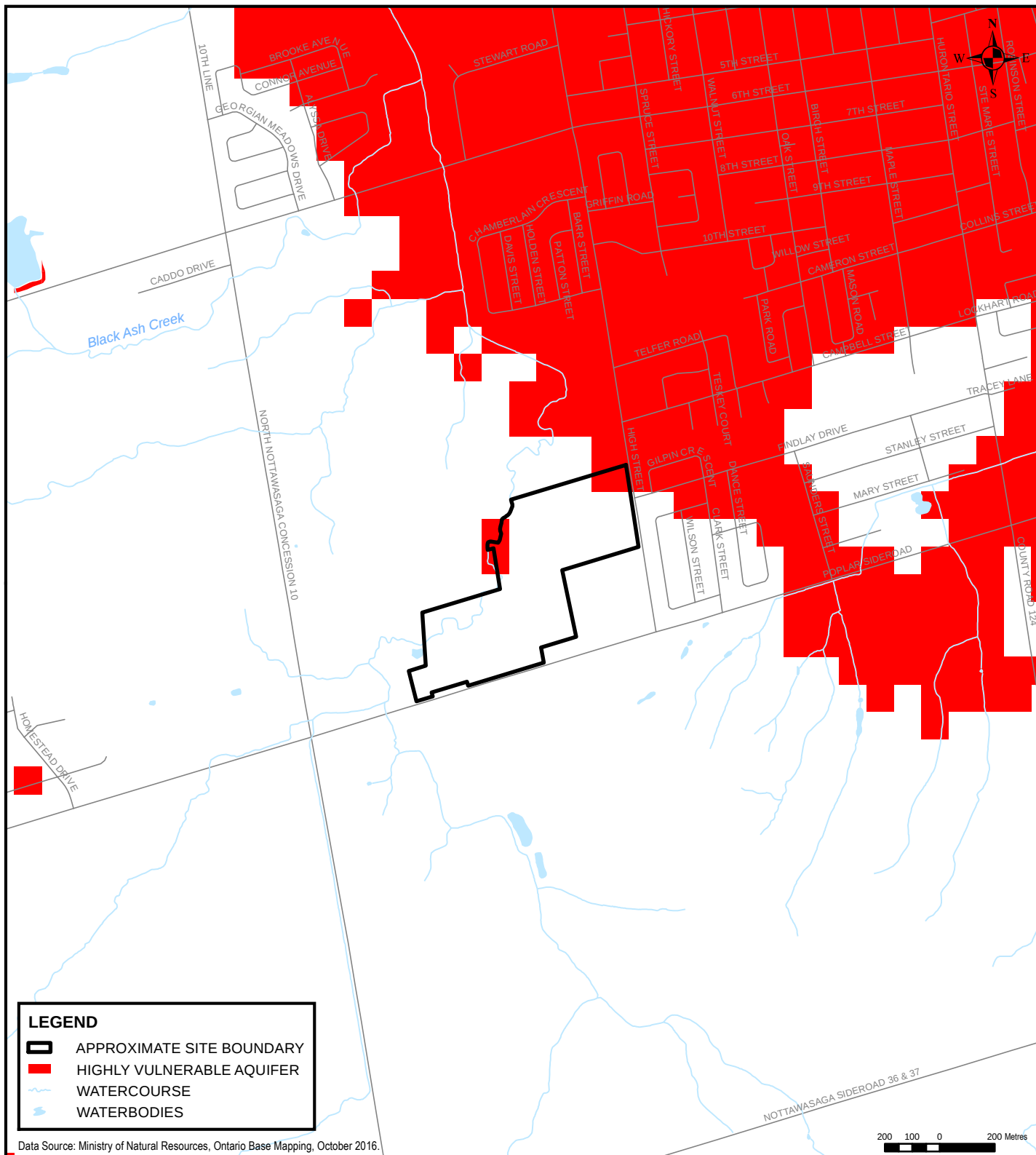
JUNE 2019

FIGURE NO:

10

REV.:

-



Data Source: Ministry of Natural Resources, Ontario Base Mapping, October 2016.

LEGEND

- APPROXIMATE SITE BOUNDARY
- HIGHLY VULNERABLE AQUIFER
- WATERCOURSE
- WATERBODIES



51 CONSTELLATION COURT
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PROJECT: HYDROGEOLOGICAL ASSESSMENT
SUMMIT VIEW PROPOSED RESIDENTIAL DEVELOPMENT
HIGH STREET & POPLAR SIDEROAD, COLLINGWOOD

TITLE: HIGHLY VULNERABLE AQUIFERS

CLIENT: 1674715 ONTARIO LIMITED
c/o MATSON PLANNING DEVELOPMENT INC.

SCALE:

1:20,000

DRAWN BY:

TP

CHECKED BY:

GJ

PROJECT NO:

181-02851-00

DATE:

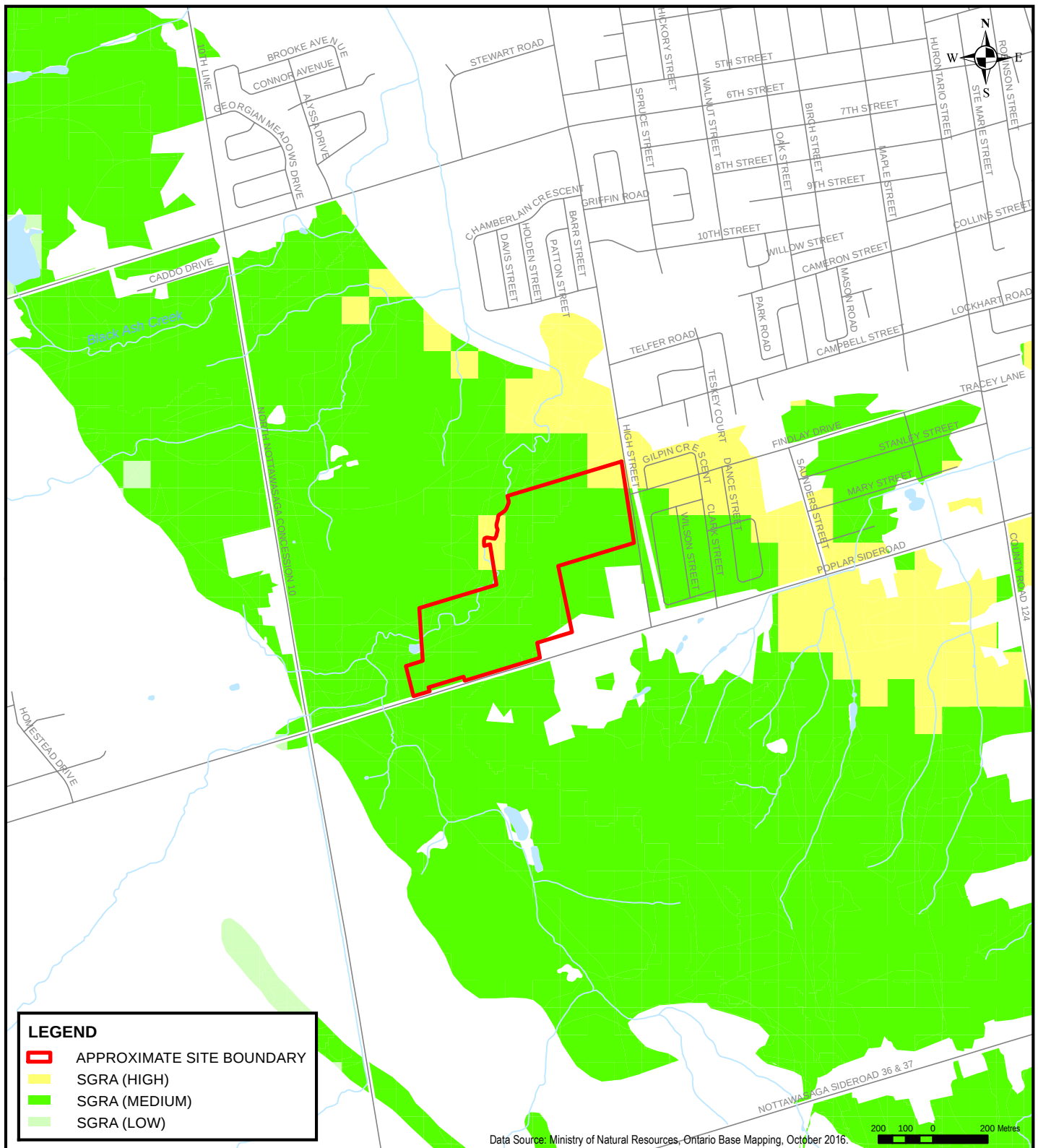
JUNE 2019

FIGURE NO:

11

REV.:

-



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PROJECT: HYDROGEOLOGICAL ASSESSMENT AND
PRELIMINARY DEWATERING INVESTIGATION
SUMMIT VIEW PROPOSED RESIDENTIAL DEVELOPMENT
HIGH STREET & POPLAR SIDEROAD, COLLINGWOOD

TITLE: SIGNIFICANT GROUNDWATER RECHARGE AREAS

CLIENT: 1674715 ONTARIO LIMITED
c/o MATSON PLANNING DEVELOPMENT INC.

SCALE:
1:20,000

DRAWN BY:
TP

CHECKED BY:
GJ

PROJECT NO:
181-02851-00

DATE:
JUNE 2019

FIGURE NO:
12

REV.:
-