GOLDER
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REPORT

Hydrogeological Investigation

Proposed Residential Redevelopment, 8243 and 8282 Wellington Road 19, Fergus, Ontario

Submitted to:

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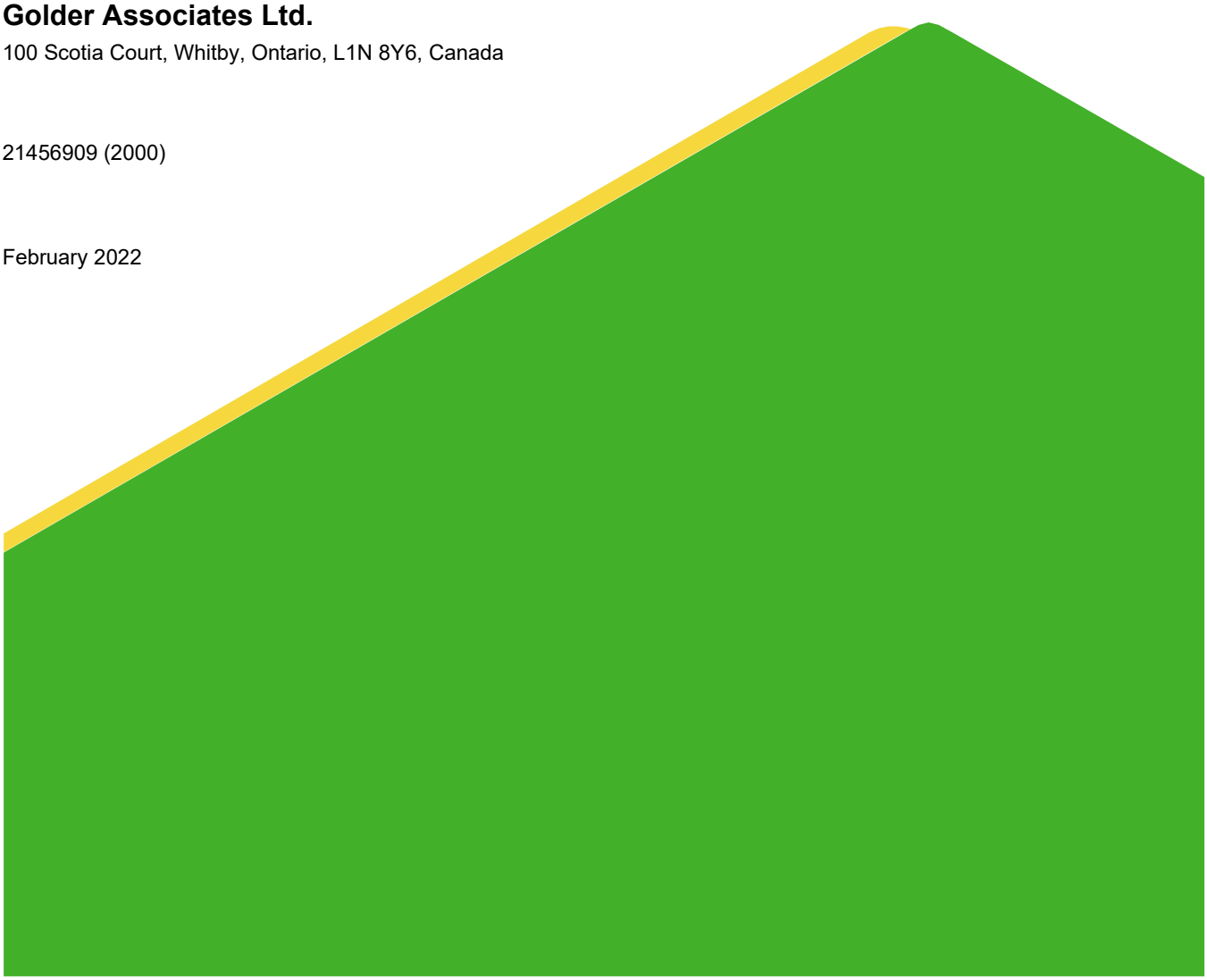

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by 883890 Ontario Limited c/o Fergus Development Inc. to conduct a hydrogeological investigation as part of the draft plan submission process for the proposed residential redevelopment to be located on the existing Fergus Golf Club property, located at 8243 and 8282 Wellington Road 19 in Fergus, Ontario (the Site), as shown on Site Location Plan (Figure 1).

The purposes of this hydrogeological investigation are to assess the existing hydrogeological conditions, to prepare a pre- and post-development water budget assessment based on current designs, to assess the potential hydrogeological impacts of development and to assess the feasibility of potential low impact development (LID) options to mitigate against any reductions in post-development infiltration rates. In addition, a preliminary assessment of the need for construction dewatering permitting is included.

The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location, elevation, or if the project is not initiated within eighteen months of the date of the report, Golder should be given an opportunity to confirm that the recommendations are still valid. In addition, this report should be read in conjunction with the attached "*Important Information and Limitations of This Report*" which are included in Appendix A. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

2.0 BACKGROUND

2.1 Site and Project Description

The Site consists of two parcels; one is located at the south side of Wellington Road 19 on the existing Fergus Golf Club property (labelled as the Southeast [SE] Site on Figure 1). The adjoining portion of the Fergus Golf Club (labelled as the Northwest [NW] Site on Figure 1) is located to the north of Wellington Road 19. The SE Site is bounded to the east by 3rd Line, to the south by agricultural land, and to the west by a rural residential property. The SE Site is currently occupied by grass fields, a residential house and a nine-hole golf course. There is a large wooded and wetland area between fairways on the east-central portion that covers approximately one third of the SE Site area, with three small ponds adjacent to its north and west limits.

The conceptual plan (GSP Group, *Fergus Golf Course Development*, December 2021) for the proposed residential development is provided in Appendix B. Based on the conceptual plan, it is understood that the overall development area of the SE Site is approximately 39.85 ha (98.5 ac) in area and is to be comprised of 118 single-family residential lots, one Storm Water Management (SWM) pond, two open space blocks the largest of which includes a wetland area, a sanitary pumping station and associated roads, walkways, trail and landscape strips. The conceptual plan is shown on Figure 2.

The golf course on the NW Site (see Figure 1) will remain operational. The proposed residential development will be provided with private communal water supply and sewage treatment. The communal water supply well will be located on the NW Site as detailed in the following hydrogeological investigation for the proposed communal water supply:

- Golder Associates Ltd., January 2022: *Water Supply Investigation, Proposed Residential Development, Fergus Golf Club, 8243 County Road 19, Fergus, Ontario* (Golder 2022a).

Water and wastewater treatment plants will be located on the NW Site, and treated effluent will be directed to ten dispersal beds also located on the NW Site (see Figure 2).

2.2 Topography and Drainage

Based on the Plan of Survey prepared by R-PE Surveying Ltd. O.L.S. (RPE, 2021; see Appendix B), the ground surface at the SE Site is gently undulating, with elevations ranging from approximately 424 metres above sea level (masl) to 437 masl (Figure 2). There is a high ground elevation of 437 masl in the southwestern part of the SE Site. The SE Site is generally trough-shaped, draining from the west, northeast and east to central low point, which in turn drains southward via Black Drain.

The SE Site is located within the Grand River watershed. The Grand River flows in a southwest direction in the area of the Lake Belwood reservoir located less than 100 m from the SE Site at its closest point. Locally the SE Site is within the Irvine Creek subwatershed. Irvine Creek and its tributaries generally flow in a southwest direction and discharge into the Grand River in Elora. At its closest point, Irvine Creek is located approximately 150 m from the SE Site. The upstream limit of Black Drain is present on the SE Site (see Figure 1), receiving run off from roadside drainage ditches on Wellington Road 19 and draining eastward to the central wetland area. Subsequently, Black Drain flows in a south direction through the low portion of the SE Site and discharges into Irvine Creek approximately 2.5 km west of the SE Site. Three off-site agricultural drains discharge westward to Black Drain at the southern end of the SE Site (see RPE 2021, Appendix B).

The SE Site is comprised primarily of anthropogenic land use as an active golf course, with a grass field located at the south portion. Three small irrigation/aesthetic ponds are located adjacent to the north limit of the central forested area. The smallest pond, approximately 40 m by 15 m, is located approximately 300 m south of 3rd Line. The other two ponds, approximately 78 m by 30 m and 53 m by 25 m, are located approximately 210 m and 440 m south of 3rd Line, respectively. The ponds will not be retained post-development and are not discussed further in this report.

Based on available on-line natural heritage mapping from the Ministry of Natural Resources and Forestry (MNRF; http://www.gisapplication.lrc.gov.on.ca), four unevaluated wetlands, ranging in size from approximately 70 m by 70 m to approximately 275 m by 25 m, are located centrally on the site from approximately 140 m to 850 m south of 3rd Line. The largest and central wetland, located on either side of Black Drain, will be retained in the central 5.31 ha open space block and is discussed in this report. The three smaller wetlands will not be retained post-development and are not discussed further.

2.3 Physiography and Surficial Geology

The physiography in the area of the site (Source: Quaternary Mapping Ontario Geological Survey, Queen's Printer 2006) is shown on Figure 3A, Physiography and Drainage, attached. In general, the areas proximal to Irvine Creek and Black Drain, including the majority of the SE Site, are located in spillways. Between the two, across the southern two-thirds of the NW Site and off-site to the east, a drumlinized till plain is mapped.

The surficial geology mapped in the area by the Ontario Geological Survey-Geological Survey of Canada (OGS-GSC, 2020) is shown on Figure 3B, Quaternary Geology Map, attached. The surficial soils at the SE Site consist mainly of relatively thin distal deposits of sand and gravel overlying glacial till deposits. The glacial till deposits are exposed at surface in the area along Wellington Road 19, being comprised of the Tavistock Till (i.e., with a fine-grained matrix) in the vicinity of 3rd Line, and the Port Stanley Till (ablation till) further to the west.

2.4 Water Well Records

Water well records were obtained from the Ministry of the Environment, Conservation and Parks (MECP). Approximately 96 water well records were reported within 500 m of the SE and NW Sites. Of the 96 well records, 90 have water supply (e.g., domestic, geothermal, stock watering) as their designated use. The remaining wells are either abandoned, or have no use listed. Of the 90 water supply wells, 69 (77%) are completed in the bedrock and 21 (23%) are completed in the overburden. The depths of the overburden wells range from 5.2 m to 65.8 m (average 16.5 m) and the depths of the bedrock wells range from 29.9 m to 108.5 m (average 55.6 m). The locations of the reported water well records are shown on Figure 4, Ministry Water Well Records. All of the overburden water wells within 500 m of the SE and NW Sites are located east of 3rd Line and are associated with the residential properties near Lake Belwood. A table summarizing the water well record data is provided in Appendix C, MECP Recorded Wells. Two hydrostratigraphic cross-sections, Figure 6, Section A-A' and Figure 7, Section B-B', based on the water well record data, are attached. It is noted that historically there was not a requirement to register dug wells with the MECP, and they can be under-represented in the water well record database.

There are four existing bedrock wells on the NW Site and SE Site that are used by Fergus Golf Club as shown on Figure 1. The North Irrigation Well (MOE#6712549) and Clubhouse Well (MOE#6714026) are located on the NW Site and completed in the bedrock to depths of 86.0 m and 74.7 m, respectively. The South Irrigation Well (MOE#6713016) and Old Clubhouse Well (possibly MOE#6706408) are located on the SE Site and completed in the bedrock to depths of 94.5 m and 108.5 m, respectively.

The water supply wells were generally reported to encounter thin surficial topsoil or various fill materials overlying clay or sandy units that sometimes-contained gravel and/or boulders (i.e. are interpreted as glacial till), which commonly contained confined sand or gravel layers/units or was underlain by confined sand or gravel units. These various confined sand or gravel layers/units are inferred to be the overburden aquifers utilized by the private wells. The bedrock consisted of shale and limestone.

Based on the MECP water well record search and our experience in the area, active private well use is expected around the SE Site.

2.5 Previous Reports

Golder conducted a concurrent preliminary geotechnical investigation at the SE and NW Sites, referenced as follows:

- Golder Associates Ltd. (February 2022). *Preliminary Geotechnical Investigation, Proposed Residential Development – Fergus Golf Club, 8243 and 8282 Wellington Road 19, Fergus, Ontario.* (Golder, 2022b).

The factual subsurface data and information obtained in the preliminary geotechnical investigation was reviewed and pertinent data was used in preparation of this report. The existing borehole and monitoring well locations from the geotechnical investigation are provided on Figure 2, and the accompanying Record of Borehole sheets are attached in Appendix D.

3.0 SITE CHARACTERIZATION

3.1 Drilling and Monitoring Well Installation

As reported in our concurrent geotechnical investigation report, the geotechnical field investigation was carried out between March 22 and March 31, 2021, during which time at total of eighteen boreholes (designated as

Boreholes BH21-1 to BH21-18) were advanced on both the SE Site and NW Site to depths between about 3 m and 10 m below existing ground surface at the approximate locations shown on the Borehole Location Plan, Figure 2. The reader is referred to the concurrent geotechnical report (Golder 2022b) for additional details.

Groundwater monitoring wells were installed in 16 of the boreholes to monitor groundwater levels and allow further testing. The wells consist of single nominal 50 mm diameter PVC pipe screens surrounded with filter sand pack, PVC riser pipes sealed with bentonite, and completed with flush-mount or stick-up monument casings. At Borehole 21-7, a bi-level installation was completed, with PVC pipe screens set at different elevations in two separate boreholes.

In addition, five shallow piezometer (P) and staff gauge (SG) pairs, PZ1/SG1, PZ2/SG2, PZ3/SG3, PZ4/SG4 and PZ5/SG5 were manually installed at the SE Site in Black Drain (PZ1/SG1) and the wetlands (PW2/SG2 to PZ5/SG5), as shown on Figure 2. The shallow piezometers (19 mm inside diameter stainless steel drive point model) were installed to an approximate depth of 0.76 to 1.16 mbgs. The pairs were installed to assess the vertical gradient in the drain and the wetlands.

The as-installed borehole, monitoring well, piezometer and staff gauge locations and the ground surface and top-of-pipe/gauge elevations were surveyed by R-PE Surveying Ltd. of Woodbridge Ontario based on UTM coordinates and Geodetic elevation (CGVD2013).

The subsurface soil and groundwater conditions encountered in the boreholes, and details of the monitoring well installations are provided on the Record of Borehole sheets (Appendix D). It should be noted that the boundaries between the strata on the borehole records have been inferred from drilling observations and non-continuous sampling. They generally represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions will vary between and beyond the boreholes.

3.2 Subsurface Soil Conditions

A detailed summary of subsurface soil conditions encountered at the borehole locations is provided in our geotechnical investigation (Golder, 2022b), to which the reader is referred. The Record of Borehole sheets, grain size distribution curves and Atterberg limits testing results for selected soil samples are provided in Appendix D.

Boreholes BH21-9, BH21-10, BH21-12, BH21-13, BH21-14 and BH21-15 were advanced on the NW Site in the general area of the proposed leaching beds. In general, the subsurface conditions encountered at these boreholes typically consist of a surficial topsoil layer underlain by a native soil deposit consisting of sandy silty clay, underlain by a silty clay to clayey silt glacial till deposit. A silty sand and gravel layer was encountered underlying or interlayered within the glacial till deposit at some borehole locations.

Boreholes BH21-1 through BH21-8, BH21-11, BH21-16, BH21-17 and BH21-18 were advanced on the SE Site in the area of the proposed residential development. In general, the subsurface conditions encountered at the boreholes advanced at the SE Site typically consist of a surficial topsoil layer underlain by native soil deposits consisting of silty sand to sand or clayey silt with sand containing varying amounts of gravel. These deposits are in turn underlain by silty clay to clayey silt and silt and sand glacial till deposits. Some granular layers of silty sand and gravel are present within and above the till deposit.

Topsoil was encountered in all boreholes on the south side of the SE Site, ranging in thickness from about 50 mm to 300 mm. An underlying organic silt layer was found in Boreholes BH21-1 and BH21-3, extending to depths of about 0.7 m and 0.9 m (Elevations 425.7 m and 434.1 m).

A deposit of sand to silty sand, trace gravel to silty sand and gravel was encountered below the topsoil and surficial organic layers in Boreholes BH21-1, BH21-2, BH21-4, BH21-5, BH21-6, BH21-11, BH21-17 and BH21-18. This deposit extended to depths between about 0.7 m to 3.5 m below ground surface (Elevations 429.0 m and 423.0 m). This deposit was layered with a glacial till deposit in Borehole BH21-8 and contained a clayey silt to silt layer in Borehole BH21-18.

A cohesive deposit of silty clay to clayey silt with sand to silt with sand was encountered below the topsoil in Boreholes BH21-3, BH21-7 and BH21-16, and below the sand to silty sand in Borehole BH21-2. This cohesive deposit extended to depths between about 2.2 m to 2.6 m below ground surface (Elevations 432.8 m and 426.4 m).

A deposit of silty clay to clayey silt till was encountered below the sand to silty sand in Boreholes BH21-1, BH21-4, BH21-5, BH21-6, BH21-11, BH21-17 and BH21-18, below the silty clay to silt with sand in Boreholes BH21-2, BH21-3, BH21-7 and BH21-16 and the topsoil in BH21-08. The till deposit was penetrated to depths between about 5.0 m to 9.6 m below ground surface (Elevations 428.3 m and 419.4 m). In Borehole BH21-8, the till deposit contained interlayers of silty sand approximately 1.3 m thick. All boreholes containing the glacial till were terminated within the till except Borehole BH21-18. Presence of cobbles and boulders in the till deposit was inferred during the field investigation due to auger grinding and difficulty advancing the boreholes.

Based on the subsurface investigation results, groundwater elevation data are presented in plan view on Figure 5, Groundwater Flow, and two shallow hydrostratigraphic sections, Figure 7, Section C-C' and Figure 8, Section D-D', are attached.

3.3 Water Level Monitoring

Groundwater levels were manually measured at the monitoring wells on April 5, April 8/9/12, and April 14, 2021. Water level depths and elevations are provided in Table E-1, Water Level Depths and Elevations (Appendix E). It should be noted that these observations reflect the groundwater conditions encountered at the time of the field investigation (selected dates in April 2021) and some seasonal and annual fluctuations should be anticipated.

The depth to groundwater at the monitoring wells ranged from -0.09 mbgs (Borehole BH21-17 on April 5, 2021) to 2.36 mbgs (Borehole BH21-01 on April 9, 2021) and from elevations of 423.97 masl (Borehole BH21-01 on April 9, 2021) to 434.56 masl (Borehole BH21-03 on April 14, 2021) on the dates monitored. The groundwater elevation data on April 14, 2021 are shown on the Record of Borehole Sheets (Appendix D), Figure 5, Groundwater Flow, Figure 7, Section C-C', and Figure 8, Section D-D'. The presence of several shallow groundwater flow divides were inferred from topographic and shallow groundwater elevation data. Shallow groundwater at most of the SE Site was inferred to flow in an easterly, southerly or westerly direction towards Black Drain, except along the eastern edge of the SE Site where shallow groundwater was inferred to flow in a northeasterly direction towards Lake Belwood (see Figure 5).

The groundwater elevations at Borehole BH21-7S (shallow) were higher than Borehole BH21-7D (deep) during the monitoring event on April 8, 2021, indicating a downward vertical gradient at that location, although stabilized groundwater conditions may not have been present at Borehole BH21-7D following well development. During the monitoring event on April 14, 2021, the groundwater elevation at Borehole BH21-7D was 0.19 m higher than Borehole 21-7S, indicating an upward vertical gradient.

Black Drain was flowing at the time of piezometer and staff gauge installation on March 29, 2021. No flowing water was observed in Black Drain during the April monitoring events. On the monitoring event when the staff

gauge was dry, stagnant water was observed. Rainfall was recorded (Fergus Shand Dam, ID 6142400[1]) on April 5 (0.2 mm), April 8 (0.4 mm), April 10 (4.4 mm), April 11 (30.9 mm), and April 12 (4 mm) 2021. The April 14, 2021 monitoring event was carried out two days after the three-day long precipitation event, at which point water was observed at all of the staff gauges except SG5, located within the central wetland, which remained dry following the precipitation events.

During the three monitoring events in April 2021, the following measurements were taken, and the vertical hydraulic gradient was inferred from the relative elevation of groundwater and stage measurements. Staff gauge SG1 at Black Drain was dry and below grade groundwater levels were measured at PZ1 during the first two monitoring events in April, and on the third event a water depth of 0.05 m was measured at SG1 an upward hydraulic gradient was present. At staff gauge SG2 (northeast wetland area), the water depth ranged from 0.02 to 0.10 m, and an upward vertical gradient was present on the first event and a downward vertical gradient was present during the last two monitoring events. At staff gauge SG3 (southwest wetland area), the water depth ranged from dry to 0.09 m, and an upward vertical gradient was present on all three events. Staff gauge SG4 (east wetland area) was dry on the first two events and a water depth of 0.07 m was measured on the third event. Above grade heads were measured at PZ and the vertical gradient was upward on the first and third events and a below grade head and downward vertical gradient was present on the second event. Staff gauge SG5 (central wetland) was dry, groundwater levels at PZ5 were below grade, and a downward vertical gradient was present on all three monitoring events.

3.4 Hydraulic Testing

Single well response testing (i.e. rising head tests) was carried out at Boreholes BH21-01, BH21-03, BH21-05, BH21-06, BH21-07S, BH21-08, BH21-10, BH21-16, BH21-17 and BH21-18 on April 8, April 9, and April 14, 2021. The rising head tests were carried out by rapidly lowering the water levels by purging with a dedicated Waterra footvalve and tubing. The resulting water level recoveries were monitored with an electronic water level tape or an automatic data logger. The recovery data were analyzed using the AQTESOLV for Windows (1996 – 2007) Version 4.5 software. The Bouwer and Rice (1976) method for unconfined conditions was applied to the rising head test data. Estimates of hydraulic conductivity (K) obtained from the rising head tests are summarized below in Table 1. Summary printouts of the rising head test data and results from AQTESOLV are included in Appendix F.

Table 1: Summary of Estimated Hydraulic Conductivity

Borehole	Unit Screened	Depth of Monitoring Well (mbgs)	Method	K (m/s)
Screened Intervals including Non-Cohesive Soil Units				
BH21-05	(SM) Silty Sand; (SM-ML) Silt and Sand (CL) Clayey Silt TILL	4.0	Bouwer and Rice (1976), unconfined	$2x10^{-6}$

[1] Daily Data Report for April 2021 - Climate - Environment and Climate Change Canada (weather.gc.ca)

Borehole	Unit Screened	Depth of Monitoring Well (mbgs)	Method	K (m/s)
BH21-06	(SM) Silty Sand; (CL) Sandy Silty Clay TILL	4.9	Bouwer and Rice (1976), unconfined	$2x10^{-7}$
BH21-08	(SM) Silty Sand; (CL) Clayey Silt TILL	4.2	Bouwer and Rice (1976), unconfined	$4x10^{-6}$
BH21-18	(ML) Sandy Silt; (SM-GM) Silty Sand and Gravel; (CL) Silty Clay TILL; (SM/ML) Silt and Sand TILL	4.2	Bouwer and Rice (1976), unconfined	$2x10^{-7}$
Screened Intervals with only Cohesive Soil Units				
BH21-01	(CL) Silty Clay TILL	5.8	Bouwer and Rice (1976), unconfined	$8x10^{-9}$
BH21-03	(CL-ML) Silty Clay-Clayey Silt; (CL) Silty Clay TILL	4.1	Bouwer and Rice (1976), unconfined	$6x10^{-6}$
BH21-07S (Shallow)	(CL-ML) Silty Clay-Clayey Silt; (CM-ML) Sandy Silty Clay-Clayey Silt (TILL)	2.7	Bouwer and Rice (1976), unconfined	$6x10^{-7}$
BH21-10	(CL) Sandy Silty Clay TILL	5.9	Bouwer and Rice (1976), unconfined	$2x10^{-8}$
BH21-16	(CL-ML) Silty Clay-Clayey Silt TILL	5.1	Bouwer and Rice (1976), unconfined	$6x10^{-8}$
BH21-17	(CL-ML) Sandy Silty Clay-Clayey Silt TILL	4.6	Bouwer and Rice (1976), unconfined	$1x10^{-8}$

Note:
mbgs – metres below ground surface. m/s –metres per second--

The hydraulic conductivity estimates from screened intervals that included non-cohesive soil units are most likely to be representative of the hydraulic conductivity of those units, and ranged from $2x10^{-7}$ m/s to $4x10^{-6}$ m/s with a geometric mean of $7x10^{-7}$ m/s (n = 4). These values are considered to be reasonable for the units tested. The hydraulic conductivity estimates from screened intervals that included mainly cohesive and non-cohesive soils and glacial till units ranged from $8x10^{-9}$ m/s to $6x10^{-6}$ m/s, with a geometric mean of $8x10^{-8}$ m/s (n=6). These values are considered to be reasonable for the units tested, with the exception of the hydraulic conductivity value estimated from Borehole BH21-03 ($6x10^{-6}$ m/s), which is higher than expected for silty clay-clayey silt and clayey silt till soils.

3.5 Summary

The SE Site is currently occupied by a nine-hole golf course including grass fields and a residential house. There is a large wooded and wetland area between fairways on the east-central portion that covers approximately one third of the SE Site area, with three small ponds adjacent to its north and west limits. The SE Site is proposed to be redeveloped with a 118-lot residential subdivision development.

Based on a review of the published information and the results of the subsurface investigations, the surficial soil conditions at the SE Site consist of relatively thin (i.e., 0.7 m to 3.5 m thick) native soil deposits consisting of silty sand to sand or clayey silt with sand containing varying amounts of gravel. These deposits are in turn underlain by silty clay to clayey silt and silt and sand glacial till deposits. Some granular layers of silty sand and gravel are present within the till deposit. The estimated geometric mean hydraulic conductivity of the surficial non-cohesive soils at the tested locations is $7x10^{-7}$ m/s (n = 4), and of the underlying cohesive soils and glacial till is $8x10^{-8}$m/s (n = 6).

Except for the northeast edge of the SE Site which grades toward Lake Belwood located off-site to the northeast, the majority of the SE Site grades toward, and is drained by, Black Drain. The upstream limit of Black Drain is present on the SE Site, receiving run off from roadside drainage ditches on Wellington Road 19 and draining eastward to a central wetland area. Subsequently, Black Drain flows in a south direction through the low portion of the SE Site and discharges into Irvine Creek approximately 2.5 km to the west.

The depth to groundwater at the monitoring wells ranged from -0.09 mbgs to 2.36 mbgs and from approximate elevations of 423.97 masl to 434.56 masl on the dates monitored in April 2021, although seasonal and annual fluctuations should be expected. Shallow groundwater at most of the SE Site was inferred to flow in an easterly, southerly or westerly direction towards Black Drain, except along the eastern edge of the SE Site where shallow groundwater was inferred to flow in a northeasterly direction towards Lake Belwood.

A bi-level monitoring well installation and five piezometer/staff gauge pairs installed near Black Drain and wetland features on the SE Site indicate variable recharging and discharging conditions during the three monitoring events carried out in April 2021. A central wetland area is present on either side of Black Drain in the topographically low central portion of the SE Site. Beacon indicates that the wetland is characterized by seasonally high groundwater conditions followed by a seasonal dry period in the summer months. It is inferred that the seasonally high groundwater levels are supported by groundwater recharge to the predominant thin non-cohesive soils during the cool, wet spring months with a groundwater flow direction toward Black Drain and the central wetland area, followed by a decline in groundwater levels in the non-cohesive soils during the warmer, drier summer months.

Water well records indicate 90 water supply wells within 500 m of the SE and NW Sites, including 4 existing irrigation wells on the NW Site and SE Site that are used by Fergus Golf Club. The water supply wells were generally reported to encounter thin surficial topsoil or various fill materials overlying clay or sandy units that sometimes-contained gravel and/or boulders (i.e., are interpreted as glacial till), which commonly contained confined sand or gravel layers/units or was underlain by confined sand or gravel units, all of which was underlain by shale or limestone bedrock. Of the 90 water supply wells, 69 (77%) are completed in the bedrock and 21 (23%) are completed in the overburden. The shale and limestone bedrock was therefore utilized by the majority of the water wells, and various confined sand or gravel layers/units were inferred to be the aquifers utilized by the overburden wells.

4.0 WATER TAKING REQUIREMENTS

This section provides a preliminary assessment of temporary groundwater taking requirements for construction purposes, and the need to obtain dewatering permitting. The engineering information and recommendations for the proposed construction activities are provided in our concurrent geotechnical investigation report (Golder, 2022b) to which the reader is referred for additional information.

4.1 Temporary Construction Dewatering Permitting

Based on the Conceptual Underground Servicing Plan prepared by Burnside (dated January 2022; Appendix B), the maximum depth of the underground services is at about 6.9 m below the existing ground surface. The proposed development will also include a 20 m long by 20 m wide sanitary pumping station between Boreholes BH21-04 and BH21-18 with sewer connection invert depth at about 7.2 mbgs (Elevation 422.21 masl) and a proposed wet well, the depth of which will be confirmed at detailed design and is assumed to be at about 14 m bgs (Elevation 415.41 masl). It should be noted that Golder has not completed a borehole to a depth of 14 m at the SE Site, and as such, should advance at least one borehole to this depth or greater at the proposed pumping station location.

A SWM pond is proposed in the vicinity of Boreholes BH21-04 and BH21-18. Based on the preliminary pond designs prepared to date, the following comments and recommendations are provided. The elevation of the base of the SWM pond is proposed to be at about Elevation 424.6 masl (or approximately 2.13 mbgs to 2.64 mbgs).

Groundwater levels across the SE Site were observed to range from -0.09 mbgs to 2.36 mbgs on the dates measured in April 2021, although seasonal and annual groundwater fluctuations should be expected. It is expected that excavations below the water table will be required for underground servicing, sanitary pump station and SWM pond, and the need for temporary groundwater control during construction is anticipated. Groundwater seepage through the glacial till deposits is anticipated to be minor and can probably be handled by pumping from properly constructed and filtered sumps located within the excavations. It is noted, however, that locally higher groundwater inflow may be experienced from saturated non-cohesive soil layers or lenses which are common in glacial till deposits and may not have been encountered in the drilling program, and from areas such as Borehole BH21-03 where higher than expected hydraulic conductivity was estimated from hydraulic testing at that monitoring well location. For deeper excavations that will extend below the groundwater table, significant groundwater inflow into the excavations may be expected from the saturated surficial non-cohesive silty sand, sand and sand and gravel deposits. Excavation sideslopes and basal stability will need to be reviewed at detailed design.

In order to control groundwater inflow and reduce the potential for instability of the sidewalls and base of the excavation in these areas, some form of positive groundwater control (e.g. well point or eductors) is recommended to sufficiently lower the groundwater level in the non-cohesive, granular deposits. The method of construction dewatering should be solely determined by the Contractor based on their own assessment of the site-specific conditions, and likely by their specialist dewatering contractor. In any case, the groundwater level should be lowered to a minimum of 1 m below the inverts in advance of the excavation reaching the invert levels. Surface water runoff must be directed away from any open excavation.

It is recommended that a licensed, specialist dewatering subcontractor supervise the installation, operation and decommissioning of any dewatering systems for this project, in accordance with applicable legislation. It is understood that a dewatering plan from a specialist subcontractor has not yet been prepared.

Water takings in excess of 50 m^3/day are regulated by the MECP. Certain takings of groundwater and storm water for construction dewatering purposes with groundwater takings less than 400 m^3/day qualify for self-registration on the MECP's Environmental Activity and Sector Registry (EASR). A Category 3 PTTW is required where the proposed groundwater taking is greater than 400 m^3/day.

The rate of groundwater inflow to excavations will vary during construction. Initially, higher inflow rates will occur as groundwater is removed from storage within the zone of influence. With time, rates will decrease toward a steady-state condition. Incident precipitation into excavations will also need to be managed with the groundwater contributions.

Based on the hydrogeological conditions encountered at the borehole locations, the steady state groundwater inflow rate for typical servicing excavations encountering cohesive and glacial till soils may not individually exceed 50 m^3/day. The presence of saturated non-cohesive soil units overlying or within the glacial till soils, if encountered, are expected to generate higher steady state dewatering rates. Including the initial removal of groundwater from storage and excluding contributions from incident precipitation that must be handled along with the groundwater, the total groundwater pumping rate for a typical servicing excavation, or the pumping station building, or the SWM pond, will individually exceed 50 m^3/day but not likely exceed 400 m^3/day. Accordingly, the need to register a construction dewatering taking on the EASR is anticipated to be required at a minimum. However, if multiple dewatering activities occur simultaneously, the need to obtain a Category 3 PTTW could be conservatively anticipated at this time. Additional investigation and assessment will be required to prepare the hydrogeological reporting to accompany the dewatering permitting. These findings should be re-evaluated as SE Site designs progress, construction plans are developed, and on the basis of the additional investigation and assessment activities. It is also recommended that trench plugs be installed in the servicing trenches to limit the preferential migration of groundwater in the permeable pipe bedding materials, and that watertight sewer connections be implemented.

5.0 HYDROLOGIC WATER BALANCE

A water balance assessment for the 39.85 ha SE Site was carried out to assess the potential hydrogeological impacts of the proposed site development with respect to post-development infiltration rates, including potential impacts to groundwater-dependent resources. The assessment included the pre- and post-development conditions within the SE Site boundary.

5.1 Methods

The water balance assessment was based on meteorological data obtained from Environment and Climate Change Canada (ECCC) for the Fergus Shand Dam Meteorological Station (ID 6142400), which was the nearest station to the SE Site with a substantial period of historical data (1965 to 2020), information on current and proposed land uses, and native soil types as identified through the subsurface investigation activities at the SE Site.

Water balance calculations are based on the following equation, which is described in more detail below:

$$P = S + ET + R + I$$

Where: P = precipitation;

S = change in soil water storage;

ET = evapotranspiration;

R = surface runoff; and

I = infiltration (groundwater recharge).

Precipitation data obtained from ECCC for the Fergus Shand Dam station indicate a mean annual precipitation (P) of 966 mm/yr.

Short-term or seasonal changes in soil water storage (S) are anticipated to occur on an annual basis as demonstrated by the typically dry conditions in the summer months and the wet conditions in the winter and spring. Long-term changes (e.g., year to year) in soil water storage are considered to be negligible in this assessment.

Evapotranspiration (ET) refers to water lost to the atmosphere from vegetated surfaces. The term combines evaporation (i.e., water lost from soil or water surfaces) and transpiration (i.e. water lost from plants and trees). Potential ET refers to the loss of water from a vegetated surface to the atmosphere under conditions of an unlimited water supply. The actual rate of ET is typically less than the potential rate under dry conditions (e.g. during the summer months when there is a moisture deficit). The mean annual potential ET for the areas considered in the water balance is approximately 596 mm/yr based on data provided by ECCC.

The mean annual water surplus is the difference between P and the actual ET. The water surplus represents the total amount of water available for either surface runoff (R) or groundwater infiltration (I) on an annual basis. On a monthly basis, surplus water remains after actual evapotranspiration has been removed from the sum of rainfall and snowmelt, and maximum soil or snow pack storage is exceeded. Maximum soil storage is quantified using a water holding capacity (WHC) specific to the soil type and land use. The WHC data obtained from ECCC are shown in Table G-1, Appendix G.

Infiltration rates were estimated using the method presented in the Ontario Ministry of the Environment (MOE) (now the Ministry of Environment, Conservation and Parks [MECP]) *Stormwater Management Planning and Design (SWM) Manual* (MOE, 2003). There are three main factors that determine the percent infiltration of the water surplus: topography, soil type and ground cover. The sum of the fractions representing these three factors establishes the approximate annual percentage of surplus which can be infiltrated in an area with a sufficient downward groundwater gradient. Water bodies and wetlands (e.g., the on-site wetlands and ponds) were assumed to have an upward or negligible downward gradient, resulting in all surpluses being contained in these areas, which were assumed to provide increased evaporation and no infiltration. Furthermore, irrigation was not explicitly included in the pre-development condition water balance, recognizing that the majority of withdrawals would be lost to evapotranspiration. Pertinent assumptions for pre-development and post-development conditions are described in the following subsections.

5.1.1 Pre-Development Condition

Land use at the SE Site under the existing (pre-development) condition was inferred from details shown on the Topographic Survey (R-PE Surveying Ltd., 2021; see Appendix B) and available aerial imagery. The SE Site is currently occupied by grass fields, a residential house and a nine-hole golf course, including gravel roadways. There is a large wooded and wetland area between fairways on the east-central portion of the SE Site that covers approximately one third of the site area, with three small ponds adjacent to its north and west limits.

5.1.2 Post-Development Condition

Land use at the SE Site under post-development conditions was based on the Development Concept Plan (GSP Group 2021; see Appendix B). The largest wetland in the centre of the SE Site and nearby golf course pond will

be retained, while the other three wetlands and golf course ponds will be removed. The development will include 118 single-family home dwelling lots, one SWM pond, as well as open space, wetland, trail/walkway/cart path, landscape and sanitary pumping station blocks. Infiltration rates were estimated using the method presented in the MOE *SWM Manual* (MOE, 2003). The sanitary pumping station, roads, and walkways, cart paths and trails were considered to be impervious, while the urban lawn and open space on the development were considered to be pervious. Each single-family lot was assumed to include an impervious roof area of 345 m^2 and an impervious driveway area of 85 m^2, as per the SWM Report (Burnside 2022; Appendix B).

5.2 Water Balance Parameters

Based on the results of subsurface investigation activities at the SE Site (see Section 3), the existing surficial soils were divided into three categories and considered for the purposes of this report to be sand loam, silt loam or clay loam given the results of grain size distribution curves obtained from selected soil samples. For the purpose of this report, the post-development surficial soil types were also considered to be sand loam, silt loam and clay loam noting that this assumption will need to be confirmed during detailed design on the basis of any soil movement or importation requirements. Sand loam soil was assumed to be present on the northeast end of the SE Site, approximately 17 ha in area. Silt loam was assumed to be present in the centre of the SE Site, approximately 20 ha in area, and the southwest end of the site was assumed to be clay loam, approximately 2 ha in area. Water holding capacities were assigned to the soil types using the values listed in Table 3.1: Hydrologic Cycle Component Values, from the MOE *SWM Manual* (MOE, 2003), as summarized in Table G-2, Appendix G.

The surplus data obtained from ECCC for the respective water holding capacities were split into infiltration and runoff components by applying infiltration factors based on Table 3.1 from the MOE *SWM Manual* (MOE, 2003). The infiltration factors were based on a sum of site-specific topography, surficial soil type and vegetative cover factors as presented in Table G-2 of Appendix G. Based on the Topographic Survey (R-PE Surveying Ltd., 2021; see Appendix B), topography factors of 0.1, representing hilly land (with an average slope of 28 m/km to 47 m/km), and 0.15 representing rolling to hilly land (with an average slope between 3.8 m/km to 28 m/km), were applied to the pre-development and post-development conditions at the SE Site, where applicable. Based on the Grading Plan (Burnside 2022; Appendix B), the post-development grading will be similar to pre-development conditions. The sand loam soil was considered to be open sandy loam, having an infiltration factor of 0.4. The silt loam soil was considered to be between clay loam and open sandy loam and was assigned an infiltration factor of 0.3. The clay loam soil was considered to be medium combinations of clay and loam, having an infiltration factor of 0.2. Grass-covered areas, meadows and shrubs were assigned a cover factor of 0.1, representing cultivated land. Forested areas were assigned a cover factor of 0.2, representing woodland. For impervious surfaces (buildings, gravel paths, and paved areas), no infiltration factor was applied.

The water balance analysis was developed under the following assumptions:

- WHCs were chosen based on Table 3.1 in the MOE *SWM Manual* (2003) corresponding to the soil types, existing land uses and proposed post-development conditions.
  - Forested Area (Mature Forest):
    - Sand Loam: 300 mm WHC and 0.75 infiltration factor.
    - Silt Loam: 400 mm WHC and 0.60 infiltration factor.
    - Clay Loam: 400 mm WHC and 0.50 infiltration factor.
  - Undeveloped Area (Pasture and Shrubs):

  - Sand Loam: 150 mm WHC and 0.65 infiltration factor.
  - Silt Loam: 250 mm WHC and 0.50 infiltration factor.
  - Clay Loam: 250 mm WHC and 0.40 infiltration factor.
- Golf Course Lawns, Residential Lawns and Landscaping (Urban Lawn):
  - Sand Loam: 75 mm WHC and 0.65 infiltration factor.
  - Silt Loam: 125 mm WHC and 0.50 infiltration factor.
  - Clay Loam: 100 mm WHC and 0.40 infiltration factor.
- Wetlands, Existing Ponds, and SWM Pond: Surplus assumed to equal precipitation minus potential evapotranspiration, with a null (i.e., 0%) infiltration factor.
- Impervious Areas (i.e., roads, pathways, and rooftops): Surplus assumed as 90% of precipitation and null (i.e., 0%) infiltration factor (Conservation Authorities Geoscience Group, 2013).

- Net surplus was estimated by multiplying the estimated monthly surplus (mm/month) for the assumed WHC by the associated drainage area. Annual evapotranspiration and surplus values were obtained from the meteorological data from the Fergus Shand Dam ECCC Meteorological Station based on the WHC assigned to each land use area.
- Runoff was calculated as the difference between surplus and infiltration.

5.3 Water Balance Results

Average annual water balance assessments were carried out on a site-wide basis for the SE Site, as described in Sections 5.1 and 5.2. The results for the pre-development, post-development, and mitigated post-development scenarios are presented in this section.

5.3.1 Pre-Development Condition

Based on the results of the assessment, the average annual pre-development water balance was estimated as summarized in Table 2, and as detailed in Table G-3, Appendix G.

Table 2: Pre-Development Average Annual Water Balance Results

Component	Average Annual Volume m^3/yr
	Site-Wide
Precipitation (P)	384,950
Evapotranspiration (ET)	226,610
Surplus (S)	157,530
Infiltration (I)	87,150
Runoff (R)	70,380

For the pre-development condition, the estimated average annual runoff from the SE Site is approximately 70,380 m^3 and the average annual infiltration on the SE Site is approximately 87,150 m^3.

5.3.2 Post-Development Condition

Based on the results of the assessment, the average annual post-development water balance was estimated as summarized in Table 3, and as detailed in Table G-4, Appendix G.

Table 3: Post-Development Average Annual Water Balance Results

Component	Average Annual Volume m^3/yr
	Site-Wide
Precipitation (P)	384,950
Evapotranspiration (ET)	176,800
Surplus (S)	207,630
Infiltration (I)	61,730
Runoff (R)	145,900

For the post-development condition, the estimated average annual runoff from the SE Site is approximately 145,900 m^3 and the estimated average annual infiltration on the SE Site is approximately 61,730 m^3. As a result of land use changes, runoff is expected to increase by 107% (i.e., 70,380 m^3 to 145,900 m^3) and infiltration is expected to decrease by 29% (i.e., 87,150 m^3 to 61,730 m^3) on an average annual basis.

5.3.3 Post-Development Condition Including Mitigation

Average annual infiltration volumes at the SE Site are expected to decrease relative to pre-development conditions and runoff volumes are expected to increase as a result of development. Groundwater recharge at the site assists to maintain seasonally high groundwater levels that are understood to support the central wetland area which requires seasonally high groundwater levels followed by a drier period in the summer months. In addition, potable groundwater use is present in the SE Site area, although the predominant aquifer hydraulically downgradient of the majority of the SE Site is the bedrock which receives recharge from an extensive geographical area and not just from the site. Therefore, it is considered prudent to incorporate LID measures into the development design to mitigate against reductions to post-development infiltration rates to the extent practical. Further, the use of LID measures for stormwater runoff from the development assists to support the natural hydrologic cycle by helping to maintain groundwater recharge, provide additional water quality treatment and reduce the volume of runoff from a site.

Given the seasonally high groundwater levels (e.g., average of 0.5 mbgs on April 14, 2021), the predominant use of surface-based LID measures has been recommended for the SE Site. It is understood that a foundation drain collector (FDC) is proposed for a number of residential homes in the southern portion of the SE Site. The FDC is a third pipe system that will segregate groundwater inputs to the residential foundation drains from the stormwater management system, in order to maintain its thermal properties. As a LID measure, the FDC will discharge to Black Drain on the downstream side of the central wetland area. This location was selected so that the

seasonally dry conditions in the wetland would be maintained while directing groundwater from the FDC to Black Drain to off-set the reduction in average annual post-development infiltration rates.

Downspout disconnection was incorporated as an LID mitigation in the water balance assessment. Downspout disconnection is proposed to occur for the entire roof area of each house to promote infiltration and reduce stormwater runoff. Based on this mitigation, the average annual mitigated post-development water balance was estimated as summarized in Table 4, and as detailed in Table G-5, Appendix G.

Table 4: Mitigated Post-Development Average Annual Water Balance Results

Component	Annual Volume m^3/yr
	Site-Wide
Precipitation (P)	384,950
Evapotranspiration (ET)	176,800
Surplus (S)	207,630
Infiltration (I)	75,000
Runoff (R)	132,630

The proposed LID mitigation scheme, relying on downspout disconnection, is estimated to increase average annual infiltration by approximately 13,270 m^3 and reduce average annual runoff similarly, compared to the un-mitigated post-development condition. As a result, on a site-wide basis, average annual infiltration is estimated to decrease by 14% (i.e., 87,150 m^3 to 75,000 m^3) and average annual runoff is expected to increase by 88% (i.e., 70,380 m^3 to 132,630 m^3 to) as a result of development with mitigation compared to pre-development conditions.

It is understood that additional LID measures will be investigated at the time of detailed design with the goal of maintaining (e.g., within +/- 10%) post-development infiltration rates.

6.0 DISCUSSION

The 39.85 ha SE Site, currently developed as a nine-hole golf course, is proposed to be redeveloped as a residential subdivision comprised of 118 single-family home dwelling lots, one SWM pond, as well as open space, park, wetland, trail/walkway/cart path, landscape and sanitary pumping station blocks.

The surficial soil conditions at the SE Site consist of relatively thin (i.e., 0.7 m to 3.5 m thick) native soil deposits consisting of silty sand to sand or clayey silt with sand, underlain by silty clay to clayey silt and silt and sand glacial till deposits. Some granular layers of silty sand and gravel are present within the till deposit. The estimated geometric mean hydraulic conductivity of the surficial non-cohesive soils at the tested locations is $7x10^{-7}$ m/s, and of the underlying cohesive soils and glacial till is $8x10^{-8}$m/s.

Except for the northeast edge of the SE Site which grades toward Lake Belwood located off-site to the northeast, the majority of the SE Site grades toward, and is drained by, Black Drain. The upstream limit of Black Drain is present on the SE Site, receiving run off from roadside drainage ditches on Wellington Road 19 and draining eastward to a central wetland area. Subsequently, Black Drain flows in a south direction through the low portion of the SE Site and discharges into Irvine Creek approximately 2.5 km to the west.

The depth to groundwater at the monitoring wells ranged from -0.09 mbgs to 2.36 mbgs and from approximate elevations of 423.97 masl to 434.56 masl on the dates monitored in April 2021, although seasonal and annual fluctuations should be expected. Shallow groundwater at most of the SE Site was inferred to flow in an easterly, southerly or westerly direction towards Black Drain, except along the eastern edge of the SE Site where shallow groundwater was inferred to flow in a northeasterly direction towards Lake Belwood.

A bi-level monitoring well installation and five piezometer/staff gauge pairs installed near Black Drain and wetland features on the SE Site indicate variable recharging and discharging conditions during the three monitoring events carried out in April 2021. The central wetland area is present on either side of Black Drain in the topographically low central portion of the SE Site. Beacon indicates that the wetland is characterized by seasonally high groundwater conditions followed by a seasonal dry period in the summer months. It is inferred that the seasonally high groundwater levels are supported by groundwater recharge to the predominant thin non-cohesive soils during the cool, wet spring months with a groundwater flow direction toward Black Drain and the central wetland area, followed by a decline in groundwater levels in the non-cohesive soils during the warmer, drier summer months.

Water well records indicate 90 water supply wells within 500 m of the SE and NW Sites, including 4 existing irrigation wells on the NW Site and SE Site that are used by Fergus Golf Club. The water supply wells were generally reported to encounter thick glacial till, which commonly contained confined sand or gravel layers/units or was underlain by confined sand or gravel units, all of which was underlain by shale and limestone bedrock. Of the 90 water supply wells, 69 (77%) are completed in the bedrock and 21 (23%) are completed in the overburden. The shale and limestone bedrock was therefore utilized by the majority of the water wells, and various confined sand or gravel layers/units were inferred to be the aquifers utilized by the overburden wells.

A site-wide water balance estimate was carried out for the SE Site to assess the potential hydrogeological impacts of the proposed development with respect to average annual post-development infiltration rates. The development of the 39.85 ha SE Site, without the implementation of mitigation measures, is expected to result in a 29% reduction in average annual infiltration.

Average annual infiltration volumes at the SE Site are expected to decrease relative to pre-development conditions and runoff volumes are expected to increase as a result of development. Groundwater recharge at the SE Site assists to maintain seasonally high groundwater levels that are understood to support the central wetland area. In addition, potable groundwater use is present in the SE Site area, although the predominant aquifer hydraulically downgradient of the majority of the SE Site is the bedrock which receives recharge from an extensive geographical area and not just from the SE Site. Therefore, it is considered prudent to incorporate LID measures into the development design to mitigate against reductions to post-development infiltration rates to the extent practical. Further, the use of LID measures for stormwater runoff from the development assists to support the natural hydrologic cycle by helping to maintain groundwater recharge, provide additional water quality treatment and reduce the volume of runoff from a site.

Given the seasonally high groundwater levels, the predominant use of surface-based LID measures has been recommended for the SE Site. It is understood that a foundation drain collector (FDC) is proposed for a number of residential homes in the southern portion of the SE Site. The FDC will segregate groundwater from the residential foundation drains from the stormwater management system, in order to maintain its thermal properties. As a LID measure, the FDC will discharge to Black Drain on the downstream side of the central wetland area. This location was selected so that the seasonally dry conditions in the wetland would be maintained while

directing groundwater from the FDC to Black Drain to off-set the reduction in average annual post-development infiltration rates.

Downspout disconnection, comprised of disconnection for the entire roof area of each house, is proposed as an LID measure to promote infiltration and reduce stormwater runoff. With the implementation of downspout disconnection, the development is expected to result in a 14% reduction in average annual infiltration. It is understood that additional LID measures will be investigated at the time of detailed design with the goal of maintaining (e.g., within +/- 10%) post-development infiltration rates. It is noted that although a reduction in post-development infiltration rates is predicted, the effects of less infiltration will be least noticeable in the topographically lowest and hydraulically downgradient portion of the flow system where the central wetland is located.

The designs for the SE Site are at a conceptual or preliminary stage, and therefore a preliminary assessment of short-term (construction) dewatering needs and permitting requirements is provided at this time. The steady state groundwater inflow rate for typical servicing excavations encountering cohesive and glacial till soils may not individually exceed 50 m^3/day. The presence of saturated non-cohesive soil units overlying or within the glacial till soils, if encountered, are expected to generate higher steady state dewatering rates. Including the initial removal of groundwater from storage and excluding contributions from incident precipitation that must be handled along with the groundwater, the total groundwater pumping rate for a typical servicing excavation, or the pumping station building, or the SWM pond, will individually exceed 50 m^3/day but not likely exceed 400 m^3/day. Accordingly, the need to register a construction dewatering taking on the EASR is anticipated to be required at a minimum. However, if multiple dewatering activities occur simultaneously, the need to obtain a Category 3 PTTW could be conservatively anticipated at this time. This assessment will need to be confirmed at the time of detailed design once additional details are available.

Private water well use is present in the SE Site area and on the SE Site for golf course uses. The use of the deep, confined bedrock aquifer is predominant, although some overburden water well use, including shallow dug wells, is present at residences between the SE Site and Lake Belwood to the northeast. The bedrock aquifer receives recharge from a large geographical area well beyond the site limits. Therefore, the 14% reduction in average annual post-development infiltration rates at the SE Site is not expected to result in a noticeable reduction in groundwater quantity downgradient of the SE Site. Given the small portion of the SE Site with an inferred groundwater flow direction toward the northeast to Lake Belwood, only negligible impacts, if any, to groundwater quantity in shallow water wells in this area are anticipated.

Roof runoff from all houses is proposed to be directed to pervious areas within lawns to promote additional infiltration of clean water. Some precipitation from paved areas (e.g., driveways) may also infiltrate in grassed areas. This infiltration is not expected to significantly degrade the groundwater quality at the SE Site, although stormwater from driveways and roads may have increased concentrations of one or more of reduced metals, oil and grease, and road salt. With the exception of road salt, these materials quickly become immobile in the shallow subsurface.

7.0 RECOMMENDATIONS

Based on the findings of this hydrogeological investigation, the following are recommended:

- The monitoring well network can be maintained and used for further monitoring. Continued monitoring of water levels in the monitoring wells, piezometers and staff gauges can be carried out to assess seasonal

conditions, such as groundwater conditions in the summer/fall months. Once the monitoring wells are no longer required, decommissioning should occur in accordance with applicable legislation.

- The implementation of additional LID measures should be investigated at the time of detailed design with the goal of maintaining (e.g., within +/- 10%) post-development infiltration rates to the extent practical. Additional LIDs should focus on surface-based techniques given the limitations associated with high seasonal groundwater levels.
- A detailed assessment of construction dewatering needs and potential impacts to receptors should be carried out at the time of detailed design and in conjunction with obtaining dewatering permitting from the MECP, and on the basis of the additional investigation activities.
- Trench plugs should be installed in the servicing trenches to limit the preferential migration of groundwater in the permeable pipe bedding materials, and watertight sewer connections should be utilized.
- All unused private water wells (i.e., golf irrigation wells) at the SE Site should be decommissioned in accordance with applicable legislation as part of site development activities.

8.0 CLOSURE

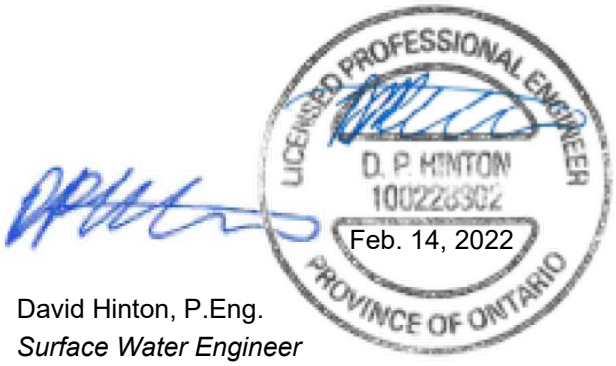
We trust that this submission meets your current requirements. If you have any questions regarding the contents of this report, please contact the undersigned.

Signature Page

Yours truly,

Golder Associates Ltd.

Syed Ali, Ph.D.
Project Scientist



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Associate, Senior Hydrogeologist

DH/MK/SAA/CMK/sv

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FIGURES

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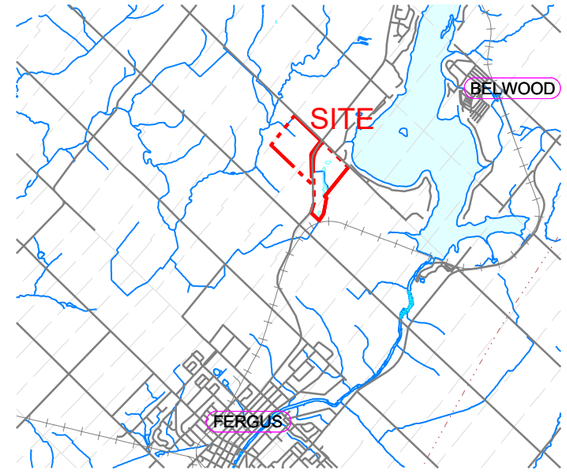

PLAN LEGEND

PROPERTY BOUNDARY

EXISTING PRODUCTION WELL

REFERENCES & DISCLAIMERS

BASE IMAGERY - SOURCE: ESRI, MAXAR, GEOEYE; GIS USER COMMUNITY.

ALIGNMENT OF ORTHOGRAPHIC IMAGERY IS APPROXIMATED TO SELECT FEATURES ON DATUM. AWAY FROM POINTS OF ALIGNMENT THE ORTHOGRAPHIC IMAGE MAY BE DIMENSIONALLY SKEWED OR PROJECTED OFF THE MAP DATUM PLANE.

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PLOTTED 11X17" TABLOID

PROJECTION IS UTM NAD 83 ZONE 17

CLIENT

883890 ONTARIO LIMITED
c/o FERGUS DEVELOPMENT INC.

PROJECT

FERGUS GOLF CLUB
HYDROGEOLOGICAL INVESTIGATION

TITLE

AREA LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

PROJECT NO.	CONTROL	REV.	FIGURE
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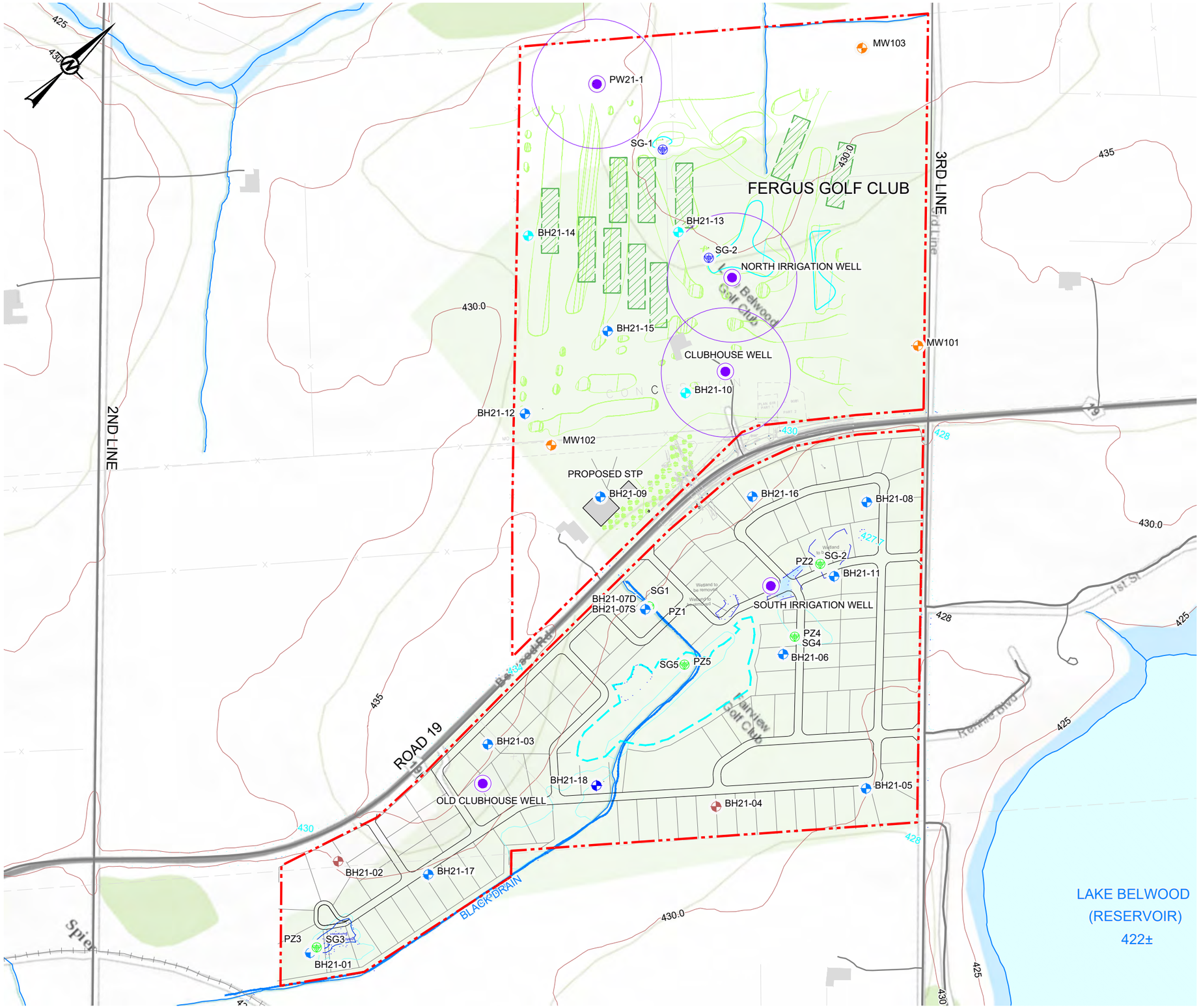

PLAN LEGEND

- PROPERTY BOUNDARY
- MAPPED WETLAND FEATURE
- CONCEPT PLAN WETLAND PROTECTED AREA

SITE EXISTING & PROPOSED WELLS

- BOREHOLE
- OVERBURDEN MONITORING WELL
- BEDROCK MONITORING WELL
- STAFF GAUGE
- PIEZOMETER
- EXISTING PRODUCTION WELL

- PROPOSED LEACHING BEDS (BY OTHERS)

REFERENCES & DISCLAIMERS

BASE IMAGERY - SOURCE: ESRI, MAXAR, GEOEYE; GIS USER COMMUNITY.

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*IRRIGATION POND GAUGE STATION(S) MAY REPRESENT MOUNDED POTENTIAL OVER UNSATURATED SOILS TO GROUNDWATER TABLE.

0 120 240 360 m

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PLOTTED 11X17" TABLOID PROJECTION IS UTM NAD 83 ZONE 17

CLIENT
883890 ONTARIO LIMITED
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HYDROGEOLOGICAL INVESTIGATION

TITLE
SITE LOCATION MAP

CONSULTANT
GOLDER

YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

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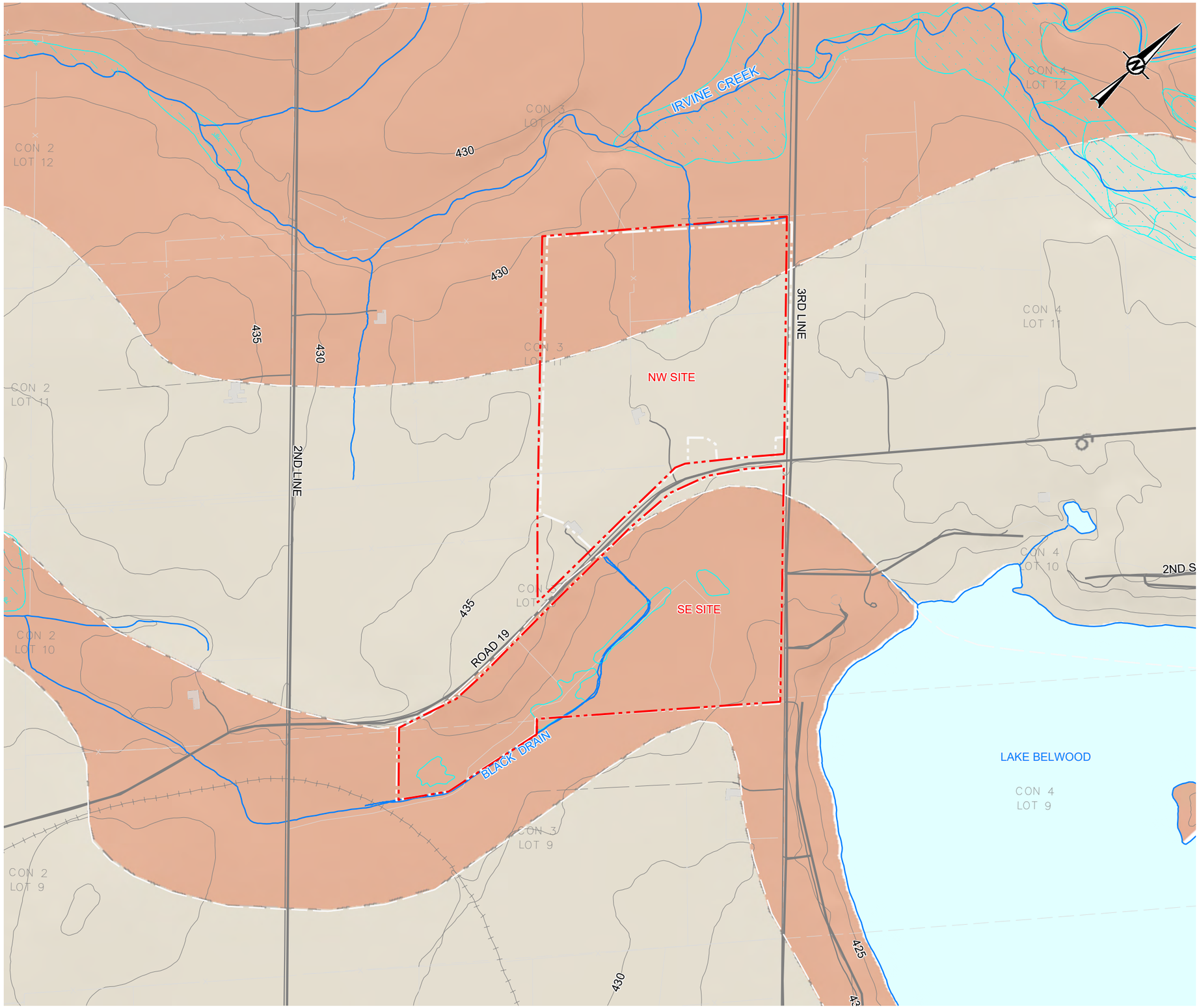


SPILLWAY

DRUMLINIZED TILL PLAIN

MAPPED WETLAND

MNR MAPPED WETLAND

PLAN LEGEND

PROPERTY BOUNDARY

REFERENCES & DISCLAIMERS

PHYSIOGRAPHY OF SOUTHERN ONTARIO, DIGITAL COMPILATION, QUEEN'S PRINTER 2006

ALIGNMENT OF ORTHOGRAPHIC IMAGERY IS APPROXIMATED TO SELECT FEATURES ON DATUM. AWAY FROM POINTS OF ALIGNMENT THE ORTHOGRAPHIC IMAGE MAY BE DIMENSIONALLY SKEWED OR PROJECTED OFF THE MAP DATUM PLANE.

0 200 400 600 m

1:10000

PLOTTED 11X17" TABLOID PROJECTION IS UTM NAD 83 ZONE 17

CLIENT

883890 ONTARIO LIMITED
c/o FERGUS DEVELOPMENT INC.

PROJECT

FERGUS GOLF CLUB
HYDROGEOLOGICAL INVESTIGATION

TITLE

PHYSIOGRAPHY AND DRAINAGE

CONSULTANT

GOLDER

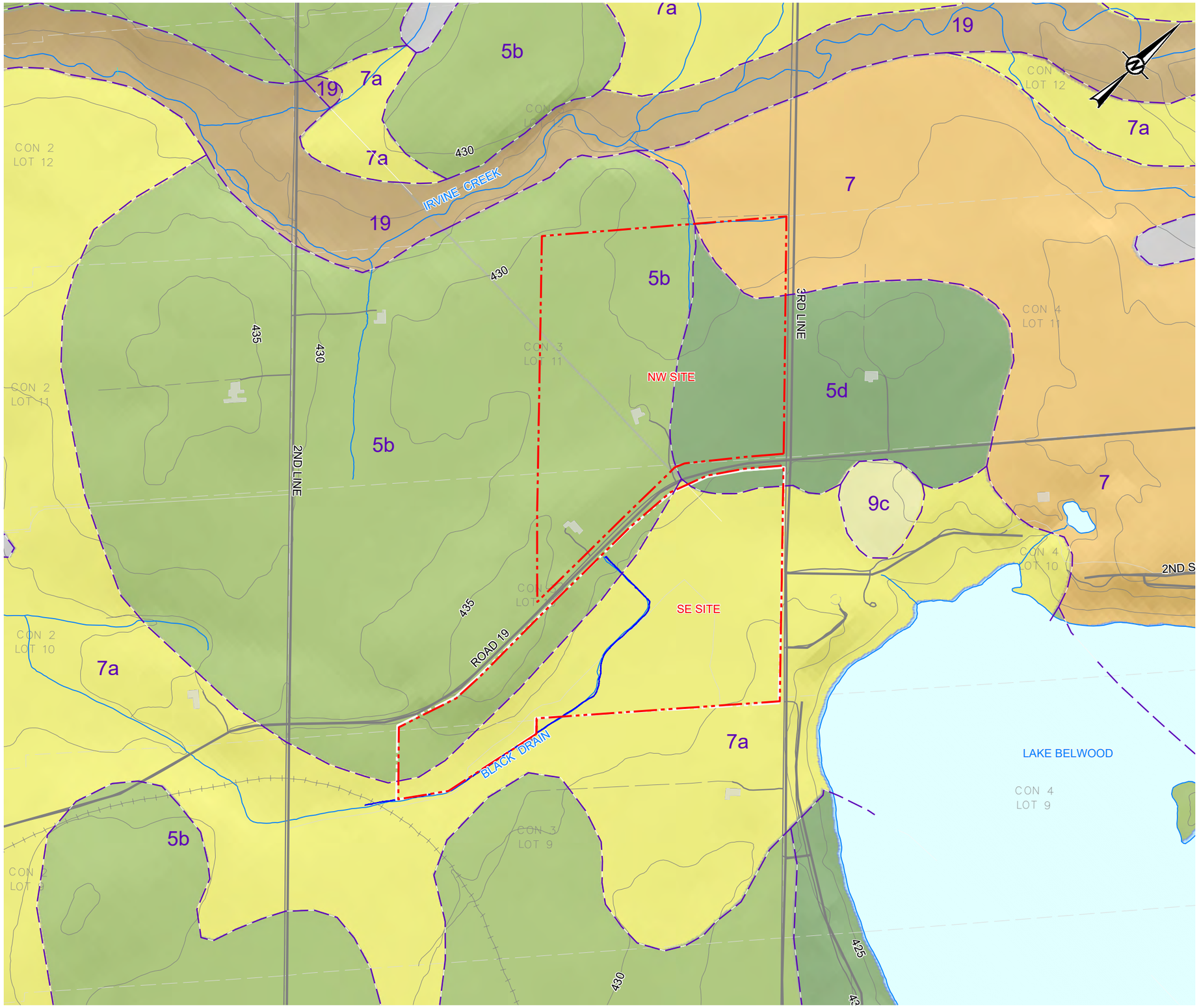
YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

PROJECT NO.	CONTROL	REV.	FIGURE
21456909	0011	----	3A

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

25 mm

0



20	ORGANIC DEPOSITS
19	FLUVIAL SILT, SAND, GRAVEL
9c	GLACIOLACUSTRINE SILT & SAND DEPOSITS
7	GLACIOFLUVIAL OUTWASH SAND & GRAVEL
7a	DISTAL SAND & GRAVEL
5d	FINE GRAINED TILL
5b	ABLATION TILL

PLAN LEGEND

PROPERTY BOUNDARY

REFERENCES & DISCLAIMERS

QUATERNARY MAPPING ONTARIO GEOLOGICAL SURVEY, QUEEN'S PRINTER 2016

ALIGNMENT OF ORTHOGRAPHIC IMAGERY IS APPROXIMATED TO SELECT FEATURES ON DATUM. AWAY FROM POINTS OF ALIGNMENT THE ORTHOGRAPHIC IMAGE MAY BE DIMENSIONALLY SKEWED OR PROJECTED OFF THE MAP DATUM PLANE.

0 200 400 600 m

1:10000

PLOTTED 11X17" TABLOID PROJECTION IS UTM NAD 83 ZONE 17

CLIENT
883890 ONTARIO LIMITED
c/o FERGUS DEVELOPMENT INC.

PROJECT
FERGUS GOLF CLUB
HYDROGEOLOGICAL INVESTIGATION

TITLE
QUATERNARY GEOLOGY MAP

CONSULTANT

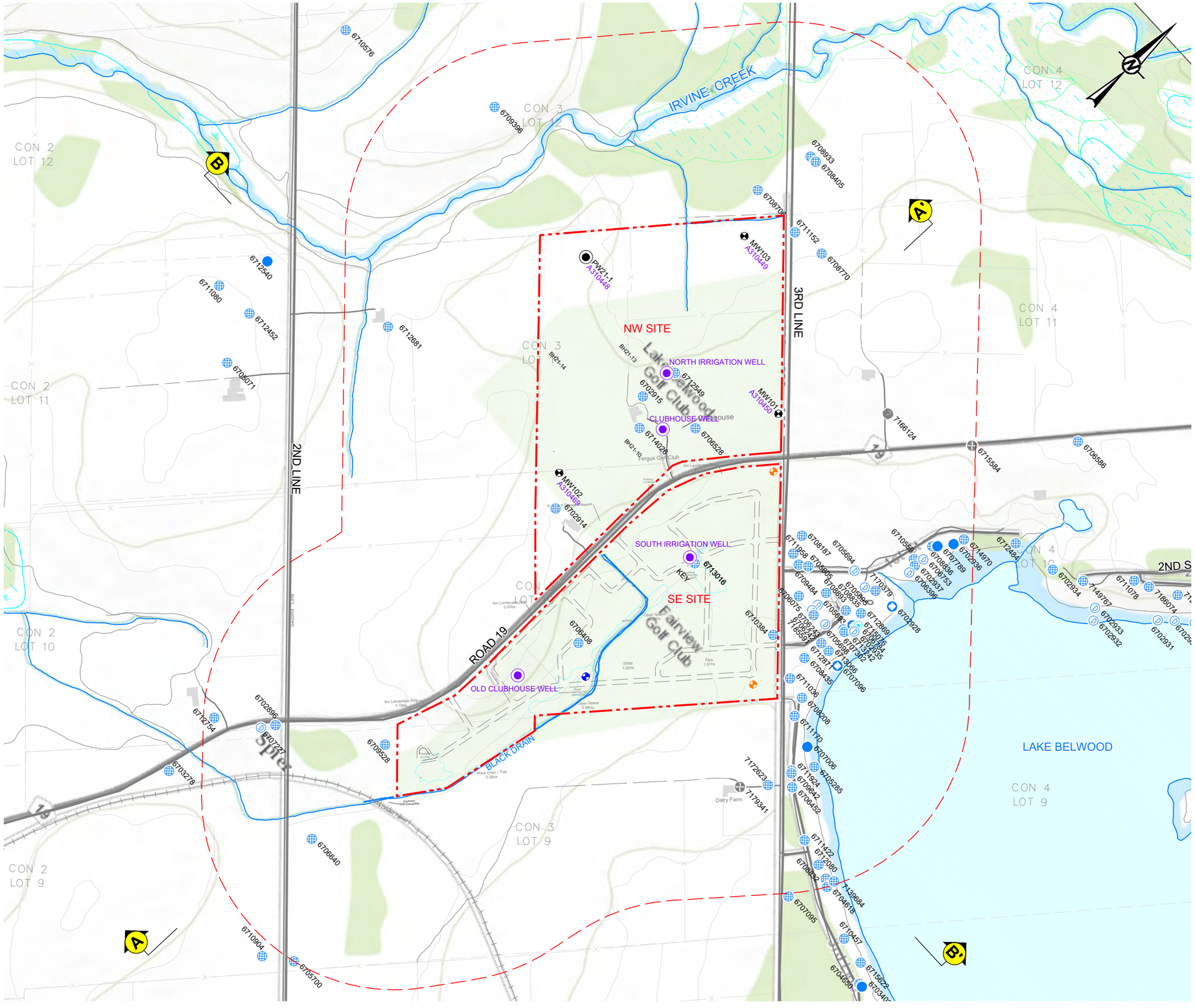
GOLDER

YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

PROJECT NO.	CONTROL	REV.	FIGURE
21456909	0011	----	3B

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

0 25 mm



PLAN LEGEND

- PROPERTY BOUNDARY WITH 500 m OFFSET
- EXISTING PRODUCTION WELL
- LINE OF SECTION

RECORDED MINISTRY WATER WELL

- SHALLOW DUG OR BORED <10 M
- DEEP BORED WELL >10 M
- DRILLED OVERBURDEN WELL
- TEST OR OBSERVATION WELL
- DRILLED BEDROCK WELL
- RECORD OF ABANDONMENT
- INFORMATION UNRECORDED
- TEMPORARY DEWATERING WELL

REFERENCES & DISCLAIMERS

MINISTRY OF ENVIRONMENT WATER WELL INFORMATION SYSTEM, QUEEN'S PRINTER. LOCATION AND ELEVATIONS OF MAPPED WELLS ARE SUBJECT TO REVISION BASED ON DRILL RECORD OR FIELD VERIFICATION.

ALIGNMENT OF ORTHOGRAPHIC IMAGERY IS APPROXIMATED TO SELECT FEATURES ON DATUM. AWAY FROM POINTS OF ALIGNMENT THE ORTHOGRAPHIC IMAGE MAY BE DIMENSIONALLY SKEWED OR PROJECTED OFF THE MAP DATUM PLANE.

0 200 400 600 m

1:10000

PLOTTED 11X17" TABLOID PROJECTION IS UTM NAD 83 ZONE 17

CLIENT
883890 ONTARIO LIMITED
c/o FERGUS DEVELOPMENT INC.

PROJECT
FERGUS GOLF CLUB
HYDROGEOLOGICAL INVESTIGATION

TITLE
MINISTRY RECORDED WELLS

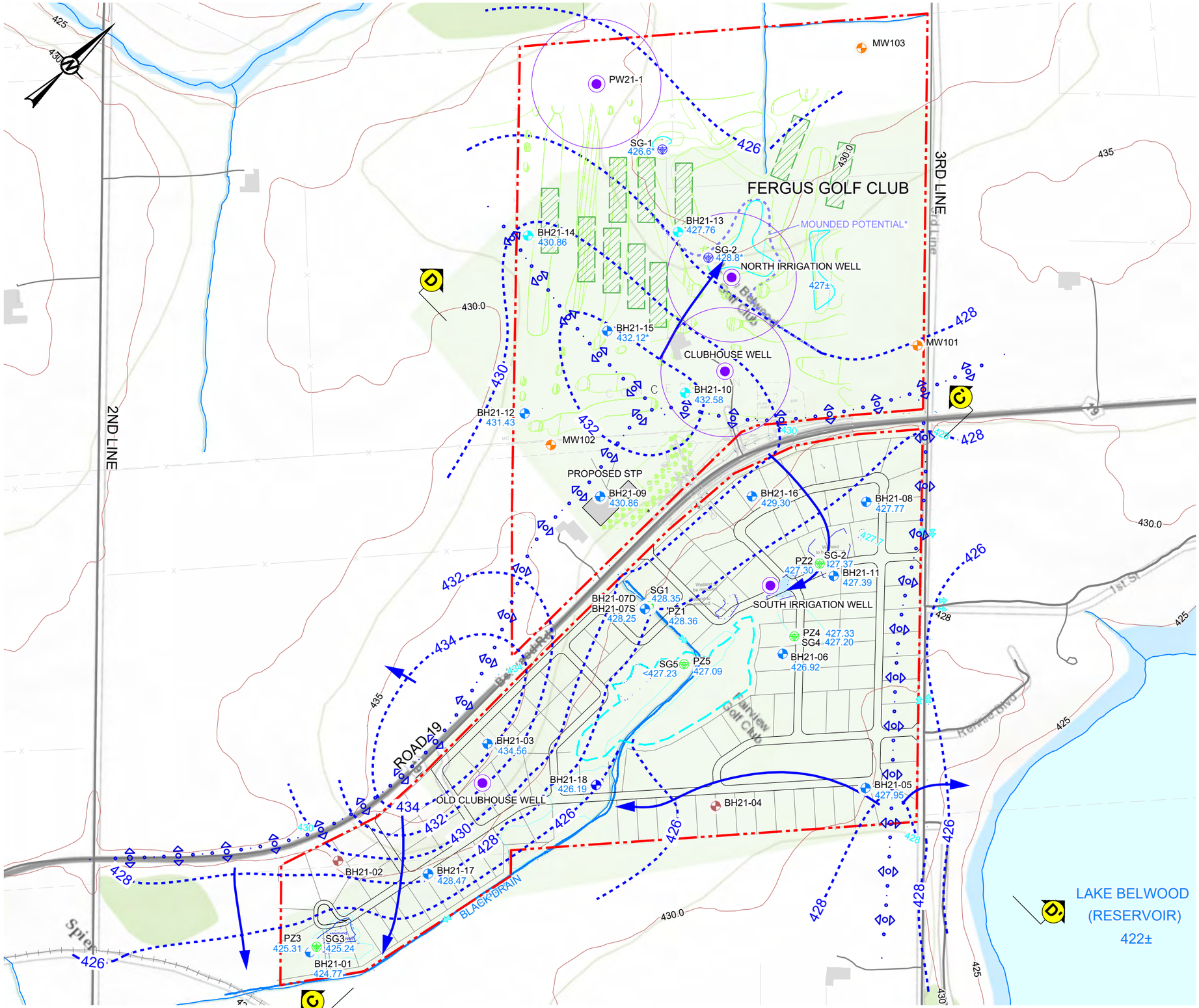
CONSULTANT
GOLDER

YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

PROJECT NO.	CONTROL	REV.	FIGURE
21456909	0011	----	4

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

0 25 mm



PLAN LEGEND

- PROPERTY BOUNDARY
- SITE EXISTING & PROPOSED WELLS
  - BOREHOLE
  - OVERBURDEN MONITORING WELL
  - BEDROCK MONITORING WELL
  - STAFF GAUGE
  - PIEZOMETER
  - SURFACE WATER SAMPLE LOCATION
  - EXISTING PRODUCTION WELL
- PROPOSED LEACHING BEDS (BY OTHERS)
- 427.30 STATIC WATER LEVEL (masl, APRIL 14 2021)
- SHALLOW GROUNDWATER CONTOUR* (masl)
- INFERRED GROUNDWATER FLOW DIRECTION
- LINE OF SITE SECTION

REFERENCES & DISCLAIMERS

BASE IMAGERY - SOURCE: ESRI, MAXAR, GEOEYE; GIS USER COMMUNITY.

ALIGNMENT OF ORTHOGRAPHIC IMAGERY IS APPROXIMATED TO SELECT FEATURES ON DATUM. AWAY FROM POINTS OF ALIGNMENT THE ORTHOGRAPHIC IMAGE MAY BE DIMENSIONALLY SKEWED OR PROJECTED OFF THE MAP DATUM PLANE.

*IRRIGATION POND GAUGE STATION(S) MAY REPRESENT MOUNDED POTENTIAL OVER UNSATURATED SOILS TO GROUNDWATER TABLE.

0 120 240 360 m

1:6000

PLOTTED 11X17" TABLOID PROJECTION IS UTM NAD 83 ZONE 17

CLIENT
883890 ONTARIO LIMITED
c/o FERGUS DEVELOPMENT INC.

PROJECT
FERGUS GOLF CLUB
HYDROGEOLOGICAL INVESTIGATION

TITLE
SHALLOW GROUNDWATER FLOW

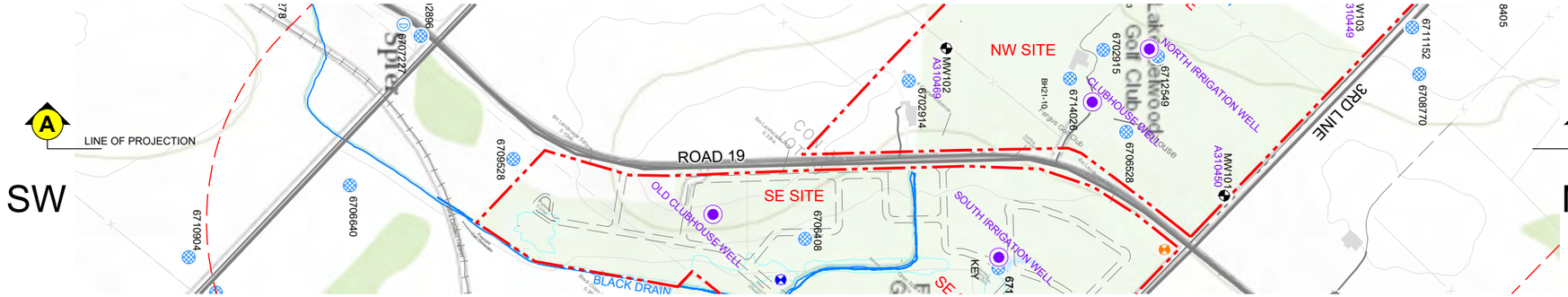
CONSULTANT
GOLDER

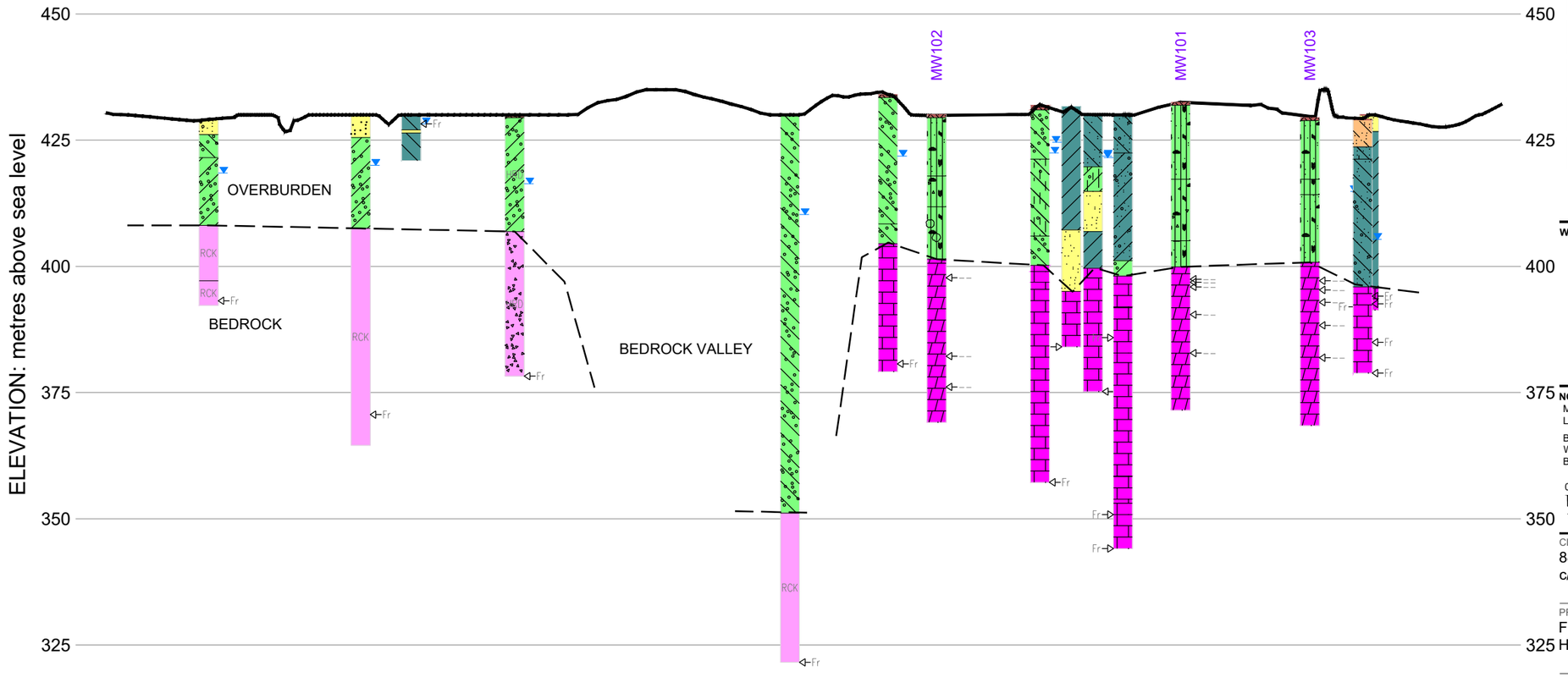
YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

PROJECT NO.	CONTROL	REV.	FIGURE
21456909	0011	----	5

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

0 25mm





PLAN LEGEND

- SHALLOW DUG OR BORED <10 M
- DEEP BORED WELL >10 M
- DRILLED OVERBURDEN WELL
- TEST OR OBSERVATION WELL
- DRILLED BEDROCK WELL
- BEDROCK TEST WELL
- EXISTING PRODUCTION WELL
- BEDROCK MONITORING WELL

SOIL PATTERN LEGEND AND GENERIC SHADING

- UNOXIDIZED CLAY BLUE, GREY WHITE, OR UNDEFINED
- OXIDIZED CLAY BROWN, RED, YELLOW
- SILT
- SAND
- GRAVEL
- STONES, PEBBLES
- BOULDER
- TILL
- LIMESTONE
- SHALE
- UNKNOWN
- PEAT/LOAM
- SANDS & GRAVELS
- GRANULAR TILL
- SILT
- SILT CLAYEY
- CLAY
- TILL
- LIMESTONES
- SHALES
- UNDIFFERENTIATED

WELL SYMBOLS

- 23453 MOE RECORDED PRIVATE WELL
- RECORDED STATIC WATER LEVEL
- WATER PRODUCING ZONE
- SCREEN

NOTES

MINISTRY OF ENVIRONMENT WATER WELL INFORMATION SYSTEM, QUEEN'S PRINTER. LOCATION AND ELEVATIONS OF FIELD VERIFIED WELLS ARE SUBJECT TO REVISION.

BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DETERMINED ONLY AT WELL AND TEST WELL LOCATIONS. BETWEEN THE WELLS AND TEST WELLS, BOUNDARIES ARE NOT PROVEN BUT ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

0 200 400 600 m
1:10000

CLIENT
883890 ONTARIO LIMITED
c/o FERGUS DEVELOPMENT INC.

PROJECT
FERGUS GOLF CLUB
HYDROGEOLOGICAL INVESTIGATION

TITLE
SECTION A - A'

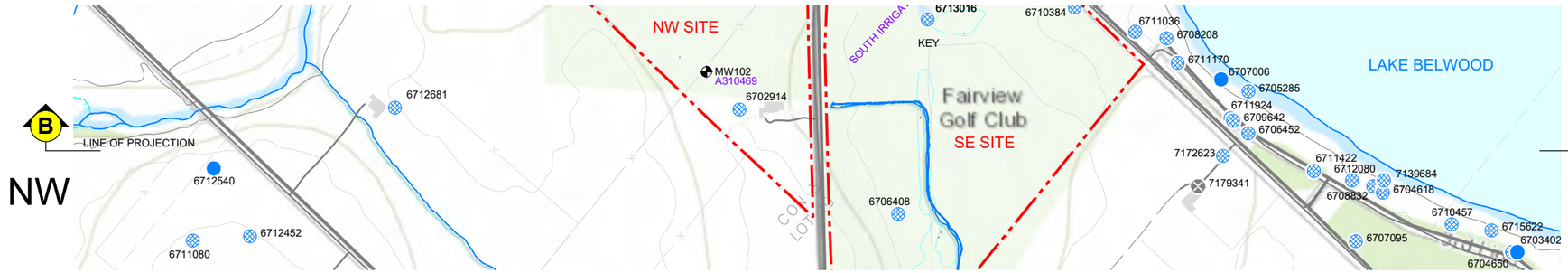
CONSULTANT
GOLDER

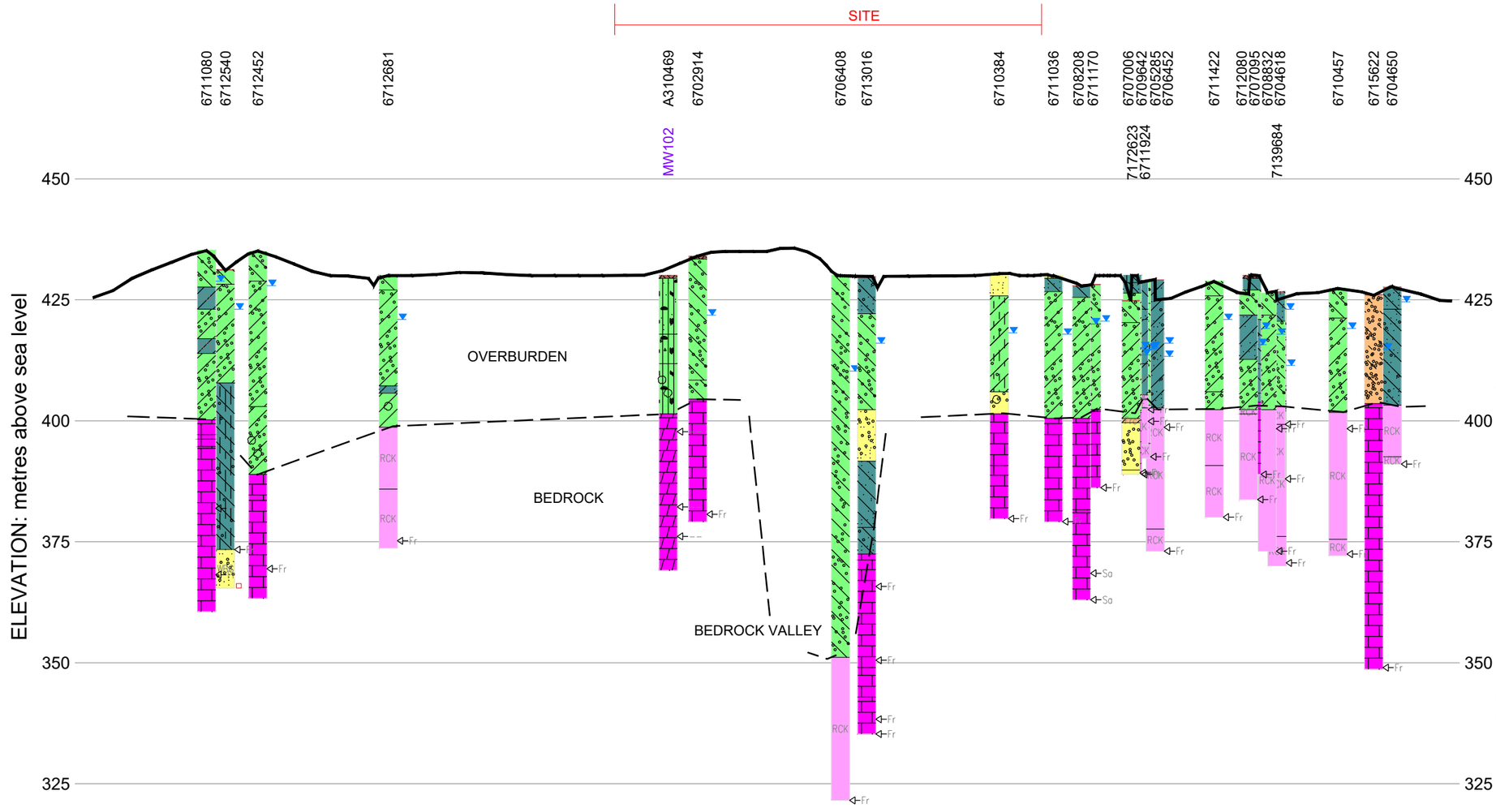
YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

PROJECT NO.	CONTROL	REV.	FIGURE
21456909	0011	----	6

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

25 mm





PLAN LEGEND

- SHALLOW DUG OR BORED <10 M
- DEEP BORED WELL >10 M
- DRILLED OVERBURDEN WELL
- TEST OR OBSERVATION WELL
- DRILLED BEDROCK WELL
- BEDROCK TEST WELL
- EXISTING PRODUCTION WELL
- BEDROCK MONITORING WELL

SOIL PATTERN LEGEND AND GENERIC SHADING

- UNOXIDIZED CLAY BLUE, GREY WHITE, OR UNDEFINED
- OXIDIZED CLAY BROWN, RED, YELLOW
- SILT
- SAND
- GRAVEL
- STONES, PEBBLES
- BOULDER
- TILL
- LIMESTONE
- SHALE
- UNKNOWN
- PEAT/LOAM
- SANDS & GRAVELS
- GRANULAR TILL
- SILT
- SILT CLAYEY
- CLAY
- TILL
- LIMESTONES
- SHALES
- UNDIFFERENTIATED

WELL SYMBOLS

- 23453 MOE RECORDED PRIVATE WELL
- RECORDED STATIC WATER LEVEL
- WATER PRODUCING ZONE
- SCREEN

NOTES

MINISTRY OF ENVIRONMENT WATER WELL INFORMATION SYSTEM, QUEEN'S PRINTER. LOCATION AND ELEVATIONS OF FIELD VERIFIED WELLS ARE SUBJECT TO REVISION.

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0 200 400 600 m

1:10000

CLIENT
883890 ONTARIO LIMITED
c/o FERGUS DEVELOPMENT INC.

PROJECT
FERGUS GOLF CLUB
HYDROGEOLOGICAL INVESTIGATION

TITLE
SECTION B - B'

CONSULTANT
GOLDER

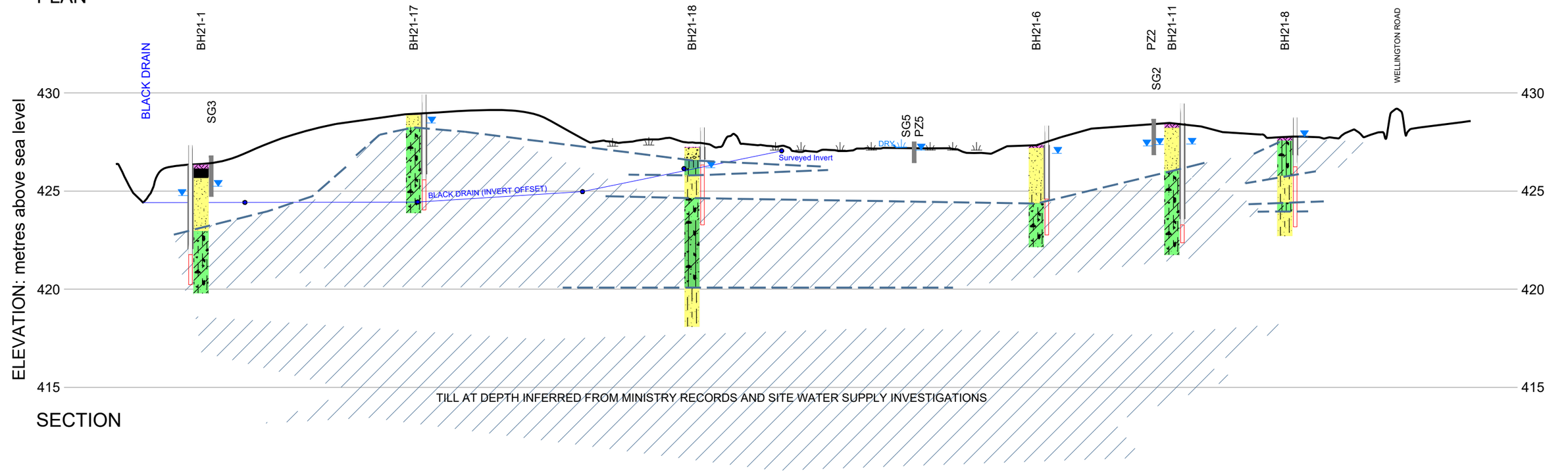
YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

PROJECT NO.	CONTROL	REV.	FIGURE
21456909	0011	----	7

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

0 25 mm

PLAN



SECTION

SOIL PATTERN LEGEND AND GENERIC SHADING

- ORGANICS / TOPSOIL
- FILL
- SAND & GRAVEL
- SAND
- SAND TRACE SILT
- SILTY SAND
- SILT
- SANDY SILT
- SANDY SILT WITH TO SOME CLAY
- CLAYEY SILT
- SILTY CLAY
- SILT TILL
- SILTY CLAY TILL
- SILTY SAND / SANDY SILT TILL

PLAN LEGEND

- PROPERTY BOUNDARY

SITE EXISTING & PROPOSED WELLS

- TEST BOREHOLE
- PROPOSED MONITORING WELL / TO BE SURVEYED
- MONITORING WELL (SURVEYED)
- ENVIRONMENTAL SAMPLING LOCATION
- STAFF GAUGE
- PIEZOMETER
- EXISTING PRODUCTION WELL

WELL SYMBOLS

- BH21-4 BOREHOLE REFERENCE
- RECORDED STATIC WATER LEVEL (APRIL 14 2021)
- SCREEN

NOTES

SURVEY BY RPE, APRIL 2021.

BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DETERMINED ONLY AT WELL AND TEST WELL LOCATIONS. BETWEEN THE WELLS AND TEST WELLS, BOUNDARIES ARE NOT PROVEN BUT ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

0 200 400 600 m

1:10000

CLIENT
883890 ONTARIO LIMITED
c/o FERGUS DEVELOPMENT INC.

PROJECT
FERGUS GOLF CLUB
HYDROGEOLOGICAL INVESTIGATION

TITLE
SITE SECTION C - C'

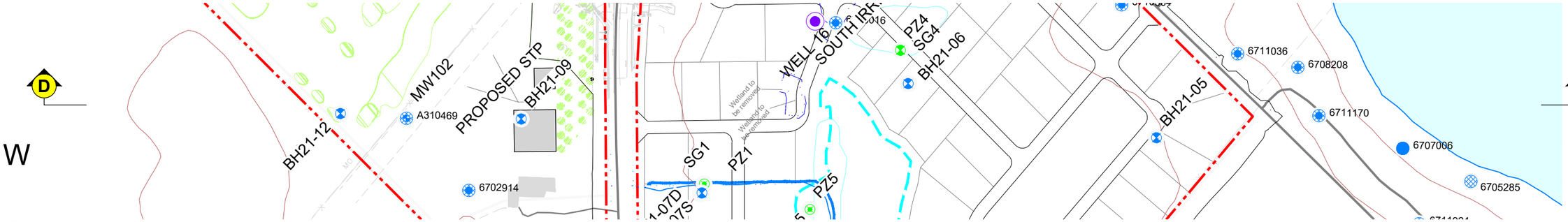
CONSULTANT
GOLDER

YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

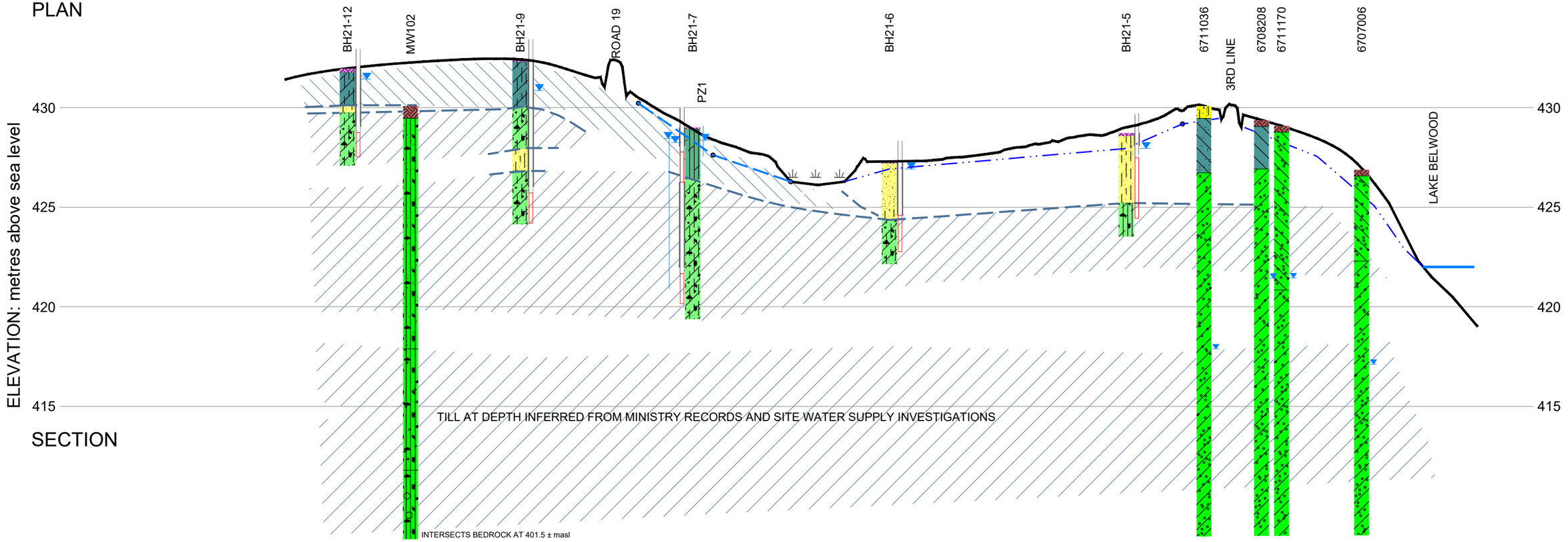
PROJECT NO.	CONTROL	REV.	FIGURE
21456909	0011	----	8

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

0 25 mm



PLAN



SECTION

SOIL PATTERN LEGEND AND GENERIC SHADING

- ORGANICS / TOPSOIL
- FILL
- SAND & GRAVEL
- SAND
- SAND TRACE SILT
- SILTY SAND
- SILT
- SANDY SILT
- SANDY SILT WITH TO SOME CLAY
- CLAYEY SILT
- SILTY CLAY
- SILT TILL
- SILTY CLAY TILL
- SILTY SAND / SANDY SILT TILL

PLAN LEGEND

- PROPERTY BOUNDARY

SITE EXISTING & PROPOSED WELLS

- TEST BOREHOLE
- PROPOSED MONITORING WELL / TO BE SURVEYED
- MONITORING WELL (SURVEYED)
- ENVIRONMENTAL SAMPLING LOCATION
- STAFF GAUGE
- PIEZOMETER
- EXISTING PRODUCTION WELL

WELL SYMBOLS

- BH21-4 — BOREHOLE REFERENCE
- RECORDED STATIC WATER LEVEL APRIL 14 2021
- SCREEN

NOTES

SURVEY BY RPE, APRIL 2021.

BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DETERMINED ONLY AT WELL AND TEST WELL LOCATIONS. BETWEEN THE WELLS AND TEST WELLS, BOUNDARIES ARE NOT PROVEN BUT ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

0 200 400 600 m

1:10000

CLIENT
883890 ONTARIO LIMITED
c/o FERGUS DEVELOPMENT INC.

PROJECT
FERGUS GOLF CLUB
HYDROGEOLOGICAL INVESTIGATION

TITLE
SITE SECTION D - D'

CONSULTANT
GOLDER

YYYY-MM-DD	2022-02-10
DESIGNED	
PREPARED	JPR
REVIEWED	SAA
APPROVED	CMK

PROJECT NO.	CONTROL	REV.	FIGURE
21456909	0011	----	9

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

25 mm

APPENDIX A

Important Information and Limitations of this Report

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

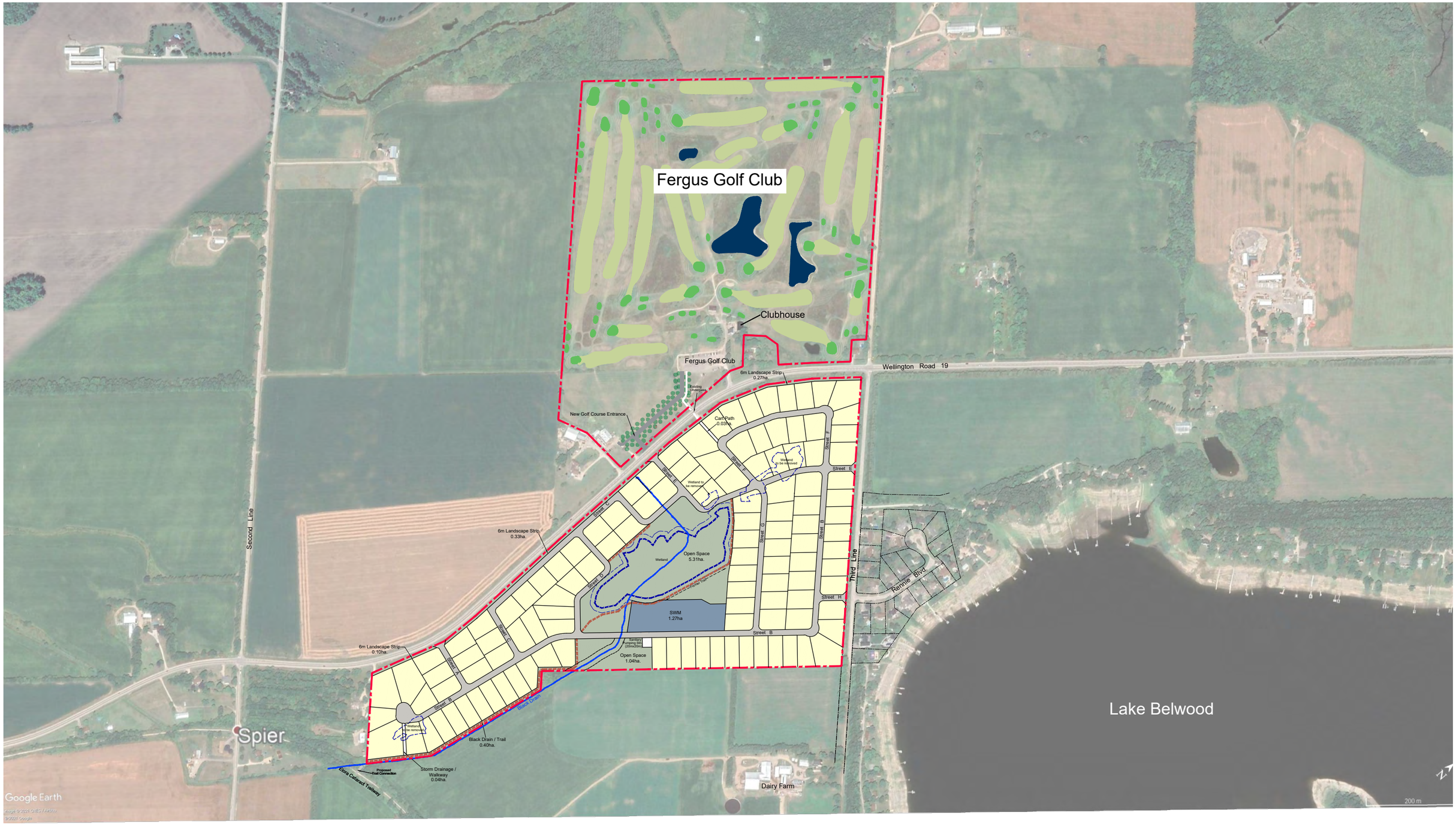
Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

APPENDIX B

Supporting Documentation

FERGUS GOLF COURSE DEVELOPMENT



1/2 Acre Residential Lots

GRCA Wetland / OP Core Greenlands

10m Wetland Buffer

Potential Trails

Site Area: 39.85ha. (98.5ac.)
No. of Lots: 118
Area of wetlands to be removed: 7,076sq.m.

0 50 100 200 300 400 500
Metres

NOTE: This concept should be considered as a preliminary demonstration model that illustrates an 'order of magnitude' development scenario for the site. The number of lots are approximate and subject to more detailed design as well as municipal planning approvals.

Scale 1:7,500 | December 10, 2021 | Project No.: 21021 | Drawn By: SL

GSP group

SKETCH SHOWING ELEVATIONS FOR ENGINEER'S USE

SCALE 1:1000

10m 0 10m 20m 30m 40m 50m 60m 70m 80m 90m 100 metres

R-PE SURVEYING LTD., O.L.S.

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NOTES

BK	DENOTES BELL BOX
CB	DENOTES CATCH BASIN
CONC.	DENOTES CONCRETE
FH	DENOTES FIRE HYDRANT
GS	DENOTES GARAGE SILL ELEVATION
P.I.N.	DENOTES PROPERTY IDENTIFIER NUMBER
LS	DENOTES LAMP STANDARD
MH	DENOTES MANHOLE
MHSAN	DENOTES MANHOLE SANITARY
MHSTM	DENOTES MANHOLE STORM
MHW	DENOTES MANHOLE WATER
SSIE	DENOTES SANITARY SEWER INVERT ELEVATION
CIEV	DENOTES CULVERT OBVERT ELEVATION
TS	DENOTES TRAFFIC SIGN
UP	DENOTES UTILITY POLE
WV	DENOTES WATER VALVE
—W—	DENOTES OVERHEAD WIRE
Ø	DENOTES DIAMETER
0.15ø	DENOTES DECIDUOUS TREE
0.50ø	DENOTES CONIFEROUS TREE
x—x—x	DENOTES FENCE LINE
HYDRANT	DENOTES HYDRANT
	DENOTES ANCHOR

CAUTION

A) THIS IS NOT A PLAN OF SURVEY AND SHALL NOT BE USED EXCEPT FOR THE PURPOSE IN THE TITLE BLOCK.
B) THIS SKETCH IS PROTECTED BY COPYRIGHT ©.

NOTES

THIS IS NOT A PLAN OF SURVEY.
BOUNDARIES ARE NOT CERTIFIED BY THIS PLAN, AND ARE SUBJECT TO CLARIFICATION UPON THE INCORPORATION OF ADDITIONAL DOCUMENTARY AND FIELD SURVEY EVIDENCE.

ALL BOUNDARY INFORMATION HAS BEEN COMPILED USING VARIOUS PLANS AND HAS NOT BEEN CONFIRMED.

BENCHMARK NOTE

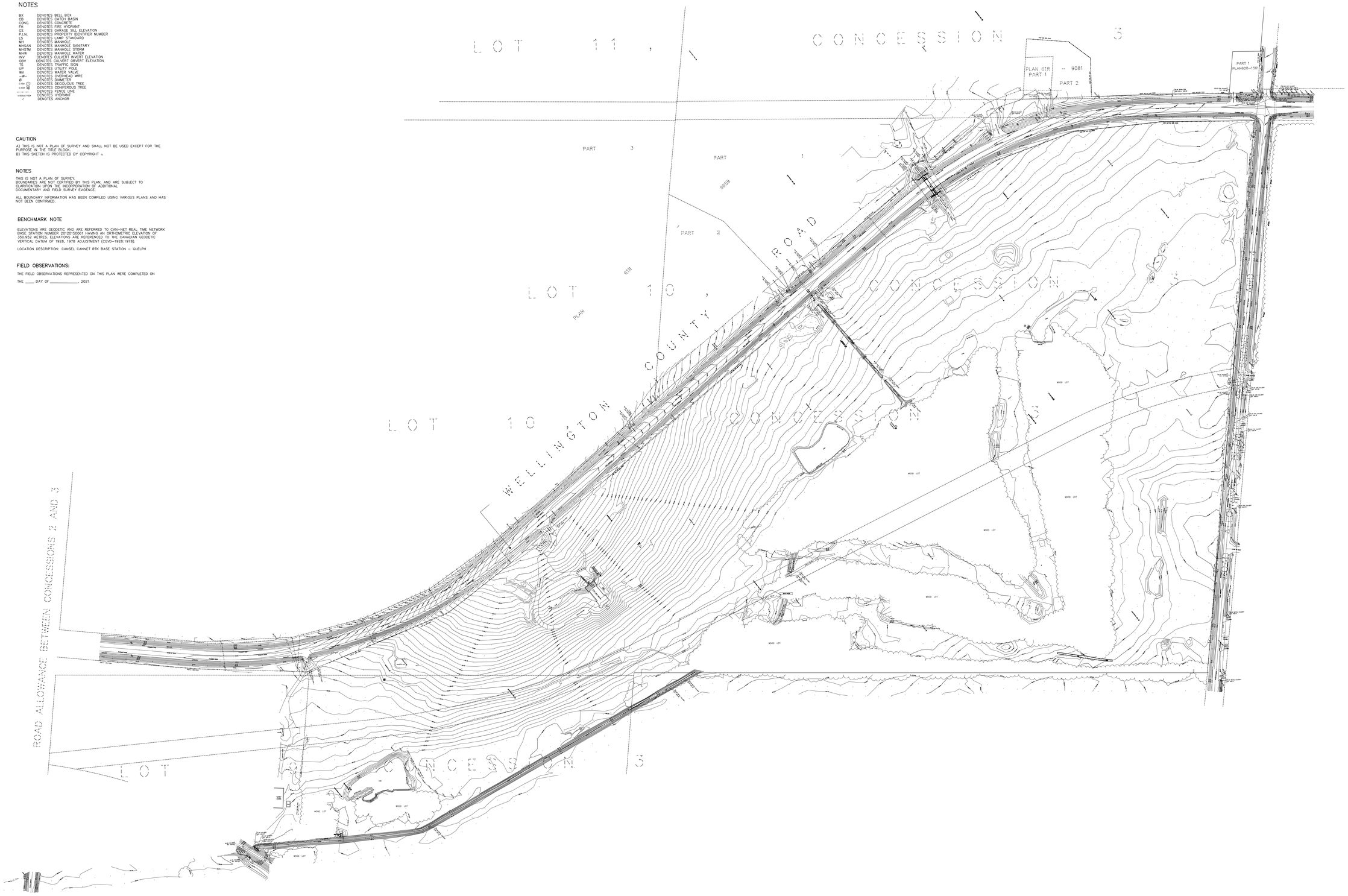
ELEVATIONS ARE GEODETIC AND ARE REFERRED TO CAN-NET REAL TIME NETWORK BASE STATION NUMBER 2012015006I HAVING AN ORTHOMETRIC ELEVATION OF 350.952 METRES. ELEVATIONS ARE REFERENCED TO THE CANADIAN GEODETIC VERTICAL DATUM OF 1928, 1978 ADJUSTMENT (CGVD-1928:1978).

LOCATION DESCRIPTION: CANSEL CANNET RTK BASE STATION - GUELPH

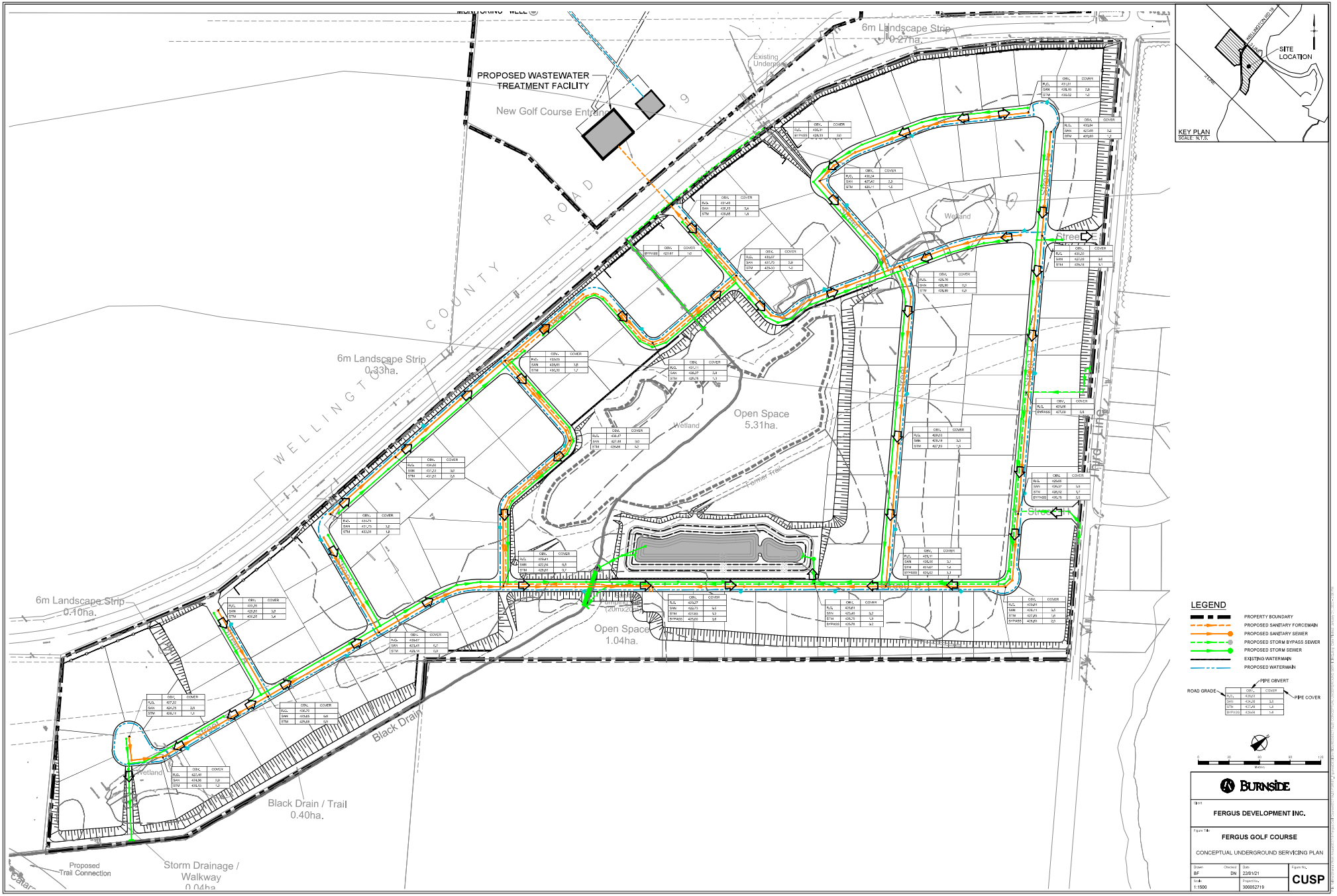
FIELD OBSERVATIONS:

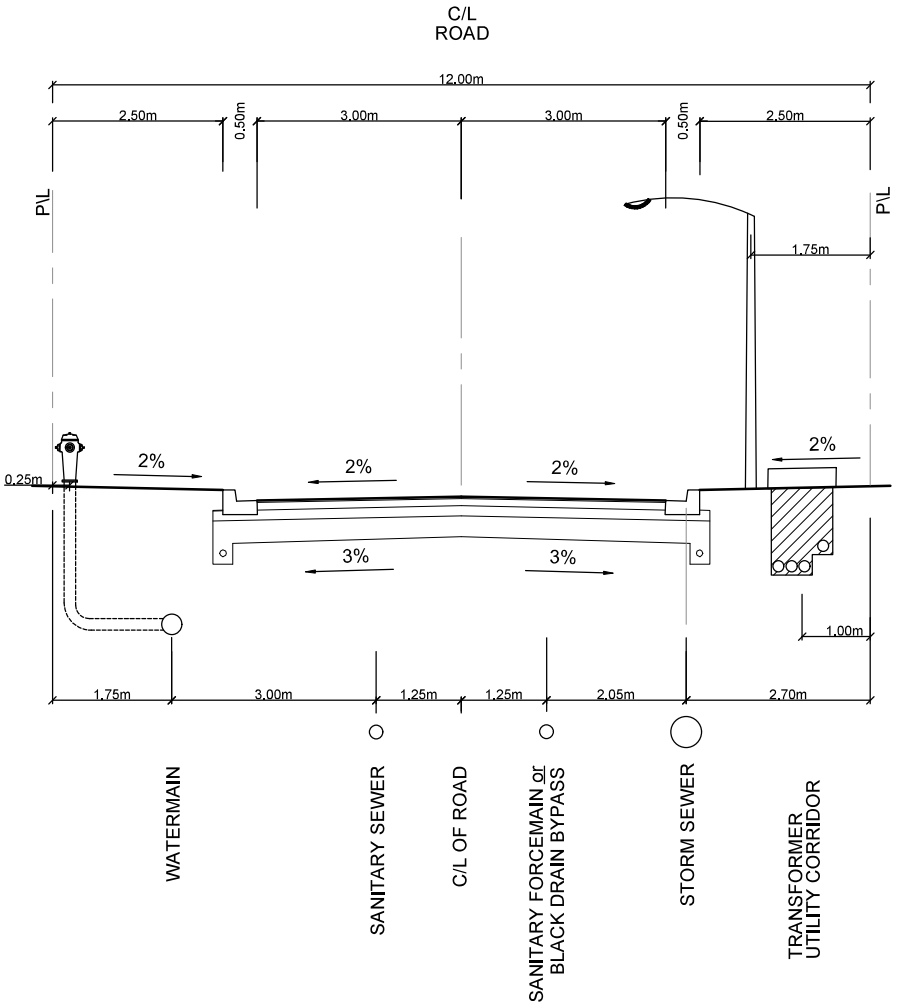
THE FIELD OBSERVATIONS REPRESENTED ON THIS PLAN WERE COMPLETED ON

THE ____ DAY OF _____, 2021



R-PE SURVEYING LTD.
ONTARIO LAND SURVEYORS
643 Chrislea Road, Suite 7
Woodbridge, Ontario L4L 8A3
Tel:(416)635-5000 Fax (416)635-5001
Tel:(905)264-0881 Fax (905)264-2099
Website:www.r-pe.ca
DRAWN: S.L. CHECKED:
JOB No. 21-016 CAD FILE No.21016TP1d


PROPOSED WASTEWATER TREATMENT FACILITY
New Golf Course Entrance
6m Landscape Strip 0.27ha.
Existing Underpass
WELLINGTON COUNTY ROAD 19
6m Landscape Strip 0.33ha.
Open Space 5.31ha.
Wetland
Trail
Third Line
6m Landscape Strip 0.10ha.
Open Space 1.04ha.
Black Drain
Black Drain / Trail 0.40ha.
Proposed Trail Connection
Storm Drainage / Walkway 0.04ha
SITE LOCATION
KEY PLAN
SCALE: N.T.S.
LEGEND
PROPERTY BOUNDARY
PROPOSED SANITARY FORCEMAIN
PROPOSED SANITARY SEWER
PROPOSED STORM BYPASS SEWER
PROPOSED STORM SEWER
EXISTING WATERMAIN
PROPOSED WATERMAIN
PIPE OBVERT
ROAD GRADE
PIPE COVER
BURNSIDE
FERGUS DEVELOPMENT INC.
FERGUS GOLF COURSE
CONCEPTUAL UNDERGROUND SERVICING PLAN
Drawn BF
Checked DN
Date 22/01/21
Scale 1:1500
Project No. 300052719
Figure No. CUSP



PROPOSED 12.0m RIGHT OF WAY

N.T.S.

BURNSIDE

Client

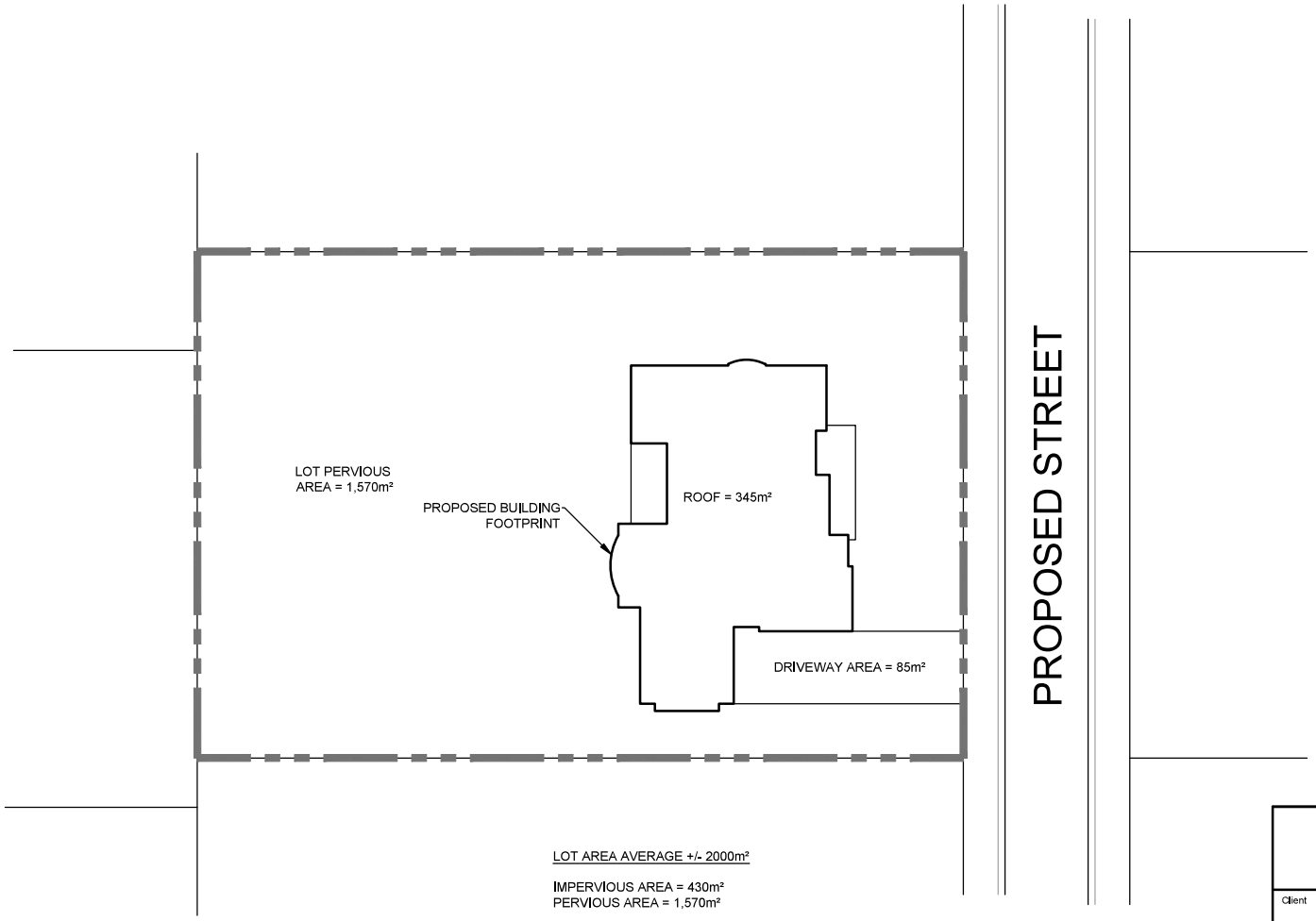
FERGUS DEVELOPMENT INC.

Figure Title

FERGUS GOLF COURSE

TYPICAL CROSS SECTION OF PROPOSED STREET - 12.0m ROW

Drawn	Checked	Date	Figure No.
BF	DN	22/01/21	**8**
Scale		Project No.	
N.T.S.		300052719	



LOT AREA AVERAGE +/- 2000m²

IMPERVIOUS AREA = 430m²
PERVIOUS AREA = 1,570m²

LOT % IMPERVIOUS = 21.5%

% IMPERVIOUS USED IN SWM
MODELLING = 25%

BURNSIDE

Client

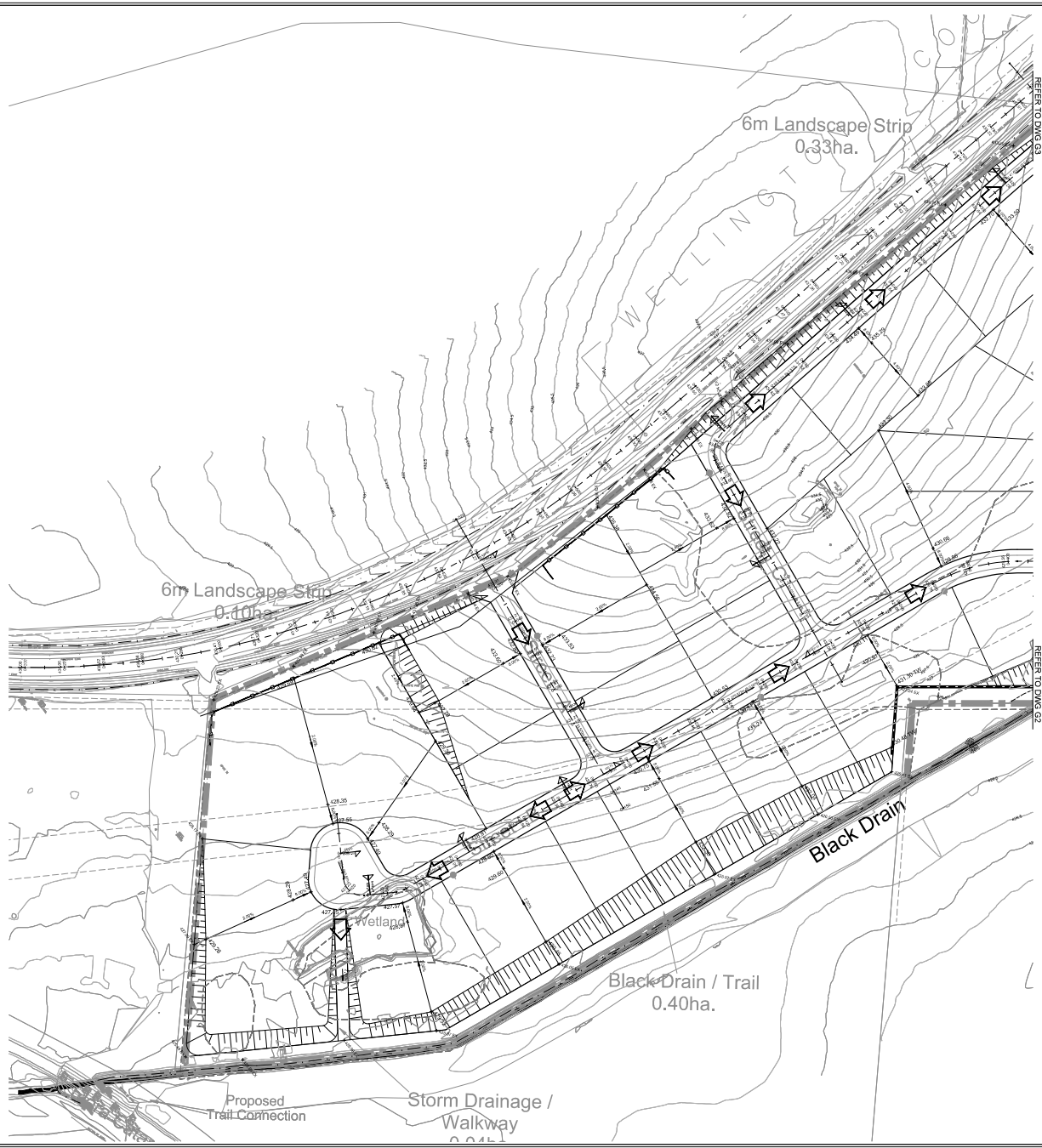
FERGUS DEVELOPMENT INC.

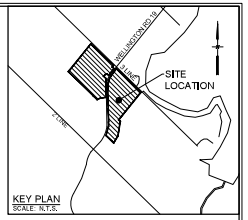
Figure Title

FERGUS GOLF COURSE

SAMPLE LOT IMPERVIOUS BREAKDOWN

Drawn	Checked	Date	Figure No.
LG	BF	22/01/21	6
Scale		Project No.	
N.T.S.		300052719	





LEGEND

- PROPERTY BOUNDARY
- EASEMENT
- EXISTING CONTOUR
- EXISTING ELEVATION
- PROPOSED ELEVATION
- PROPOSED SLOPE
- PROPOSED OVERLAND FLOW DIRECTION
- MAX. 3:1 SIDE SLOPES
- PROPOSED RETAINING WALL
- PROPOSED NOISE WALL (BY OTHERS)
- PROPOSED SWALE

LOT TYPES:

- F — FRONT DRAINAGE
- S — SPLIT DRAINAGE
- WO — WALK OUT LOT
- LO — LOOK OUT LOT

0 40 80 120 160
Metres

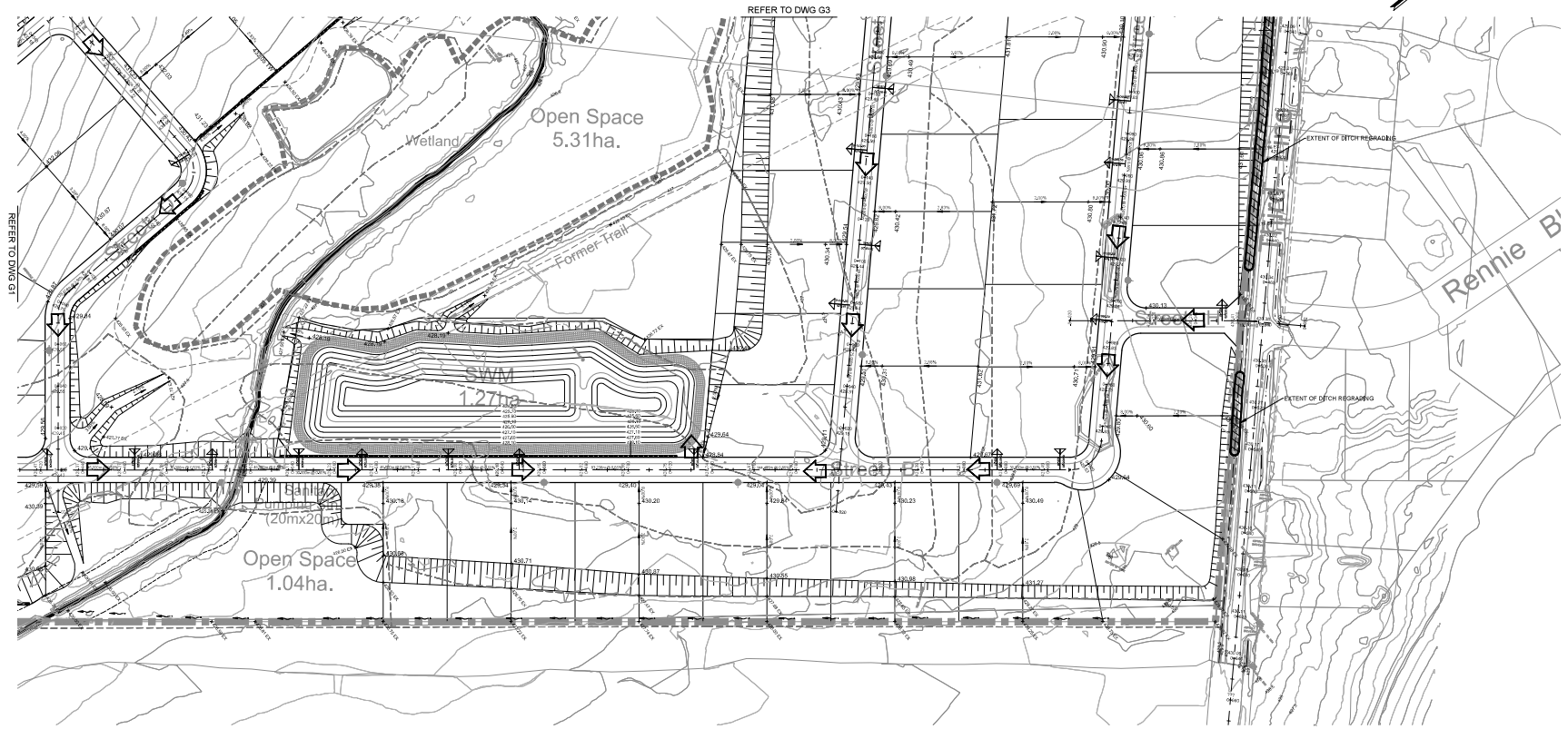
BURNSIDE

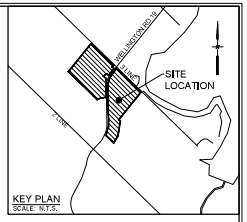
Client: FERGUS DEVELOPMENT INC.

Figure Title: FERGUS GOLF COURSE

GRADING PLAN

Drawn	Checked	Date	Figure No.
BF	DN	22/01/21	G1
Scale: 1:1000		Project No.: 300052219	





LEGEND

- PROPERTY BOUNDARY
- EASEMENT
- EXISTING CONTOUR
- EXISTING ELEVATION
- PROPOSED ELEVATION
- PROPOSED SLOPE
- PROPOSED OVERLAND FLOW DIRECTION
- MAX. 3:1 SIDE SLOPES
- PROPOSED RETAINING WALL
- PROPOSED NOISE WALL (BY OTHERS)
- PROPOSED SWALE

LOT TYPES:

- F — FRONT DRAINAGE
- S — SPLIT DRAINAGE
- WO — WALK OUT LOT
- LO — LOOK OUT LOT

0 40 80 120 160
Metres

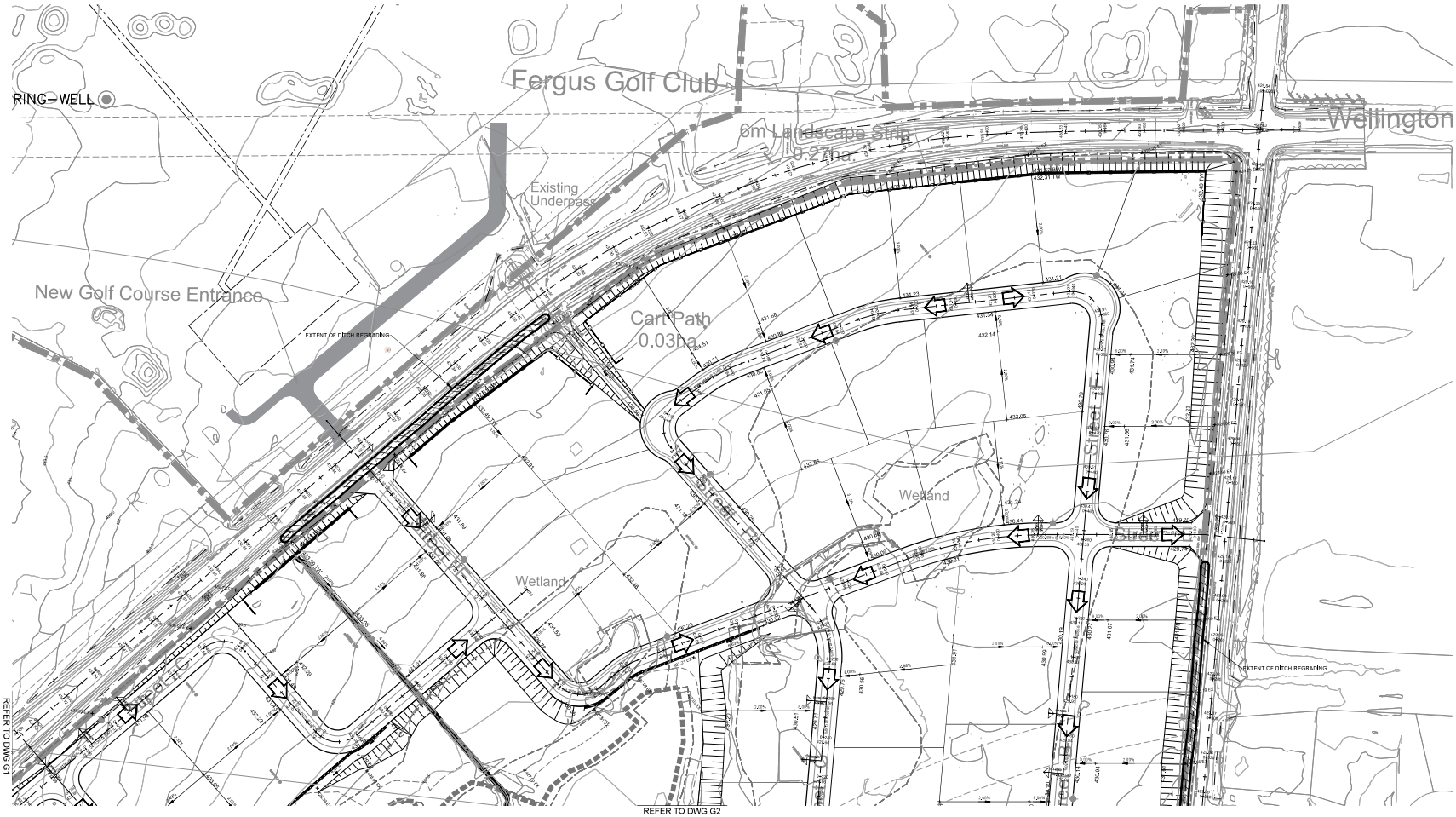
BURNSIDE

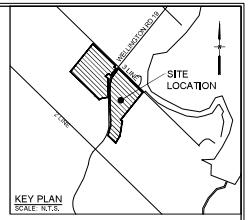
Client: FERGUS DEVELOPMENT INC.

Figure Title: FERGUS GOLF COURSE

GRADING PLAN

Drawn	Checked	Date	Figure No.
BF	DN	22/01/21	G2
Scale: 1:1000		Project No.: 300052219	





LEGEND

- PROPERTY BOUNDARY
- EASEMENT
- EXISTING CONTOUR
- EXISTING ELEVATION
- PROPOSED ELEVATION
- PROPOSED SLOPE
- PROPOSED OVERLAND FLOW DIRECTION
- MAX. 3:1 SIDE SLOPES
- PROPOSED RETAINING WALL
- PROPOSED NOISE WALL (BY OTHERS)
- PROPOSED SWALE

LOT TYPES:

- F — FRONT DRAINAGE
- S — SPLIT DRAINAGE
- WO — WALK OUT LOT
- LO — LOOK OUT LOT

0 40 80 120 160
Metres

BURNSIDE

Client
FERGUS DEVELOPMENT INC.

Figure Title
FERGUS GOLF COURSE
GRADING PLAN

Drawn	Checked	Date	Figure No.
BF	DN	22/01/21	G3
Scale		Project No.	
1:1000		300052219	

APPENDIX C

MECP Water Well Records

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
6702896	2 9	Oct-59	551133 4843103	427.3	53.9	Fr			10.7	41	270	18.3	1659 CT	WS DO	**MOE# 6702896** 0.0 CLAY MSND 4.6 CLAY STNS 12.2 BLUE CLAY 23.5 GREY LMSN 53.9
6702914	3 10	Dec-67	551217 4844015	433.7	53.3	Fr			12.2	45	90	18.3	2406 CT	WS ST	**MOE# 6702914** 0.0 TPSL 0.6 BRWN CLAY STNS 25.6 BRWN CLAY GRVL 29.6 BRWN LMSN 54.9
6702915	3 11	Dec-51	551159 4844378	429.8	47.5	Fr			7.0	45	30	9.1	2521 CT	WS ST	**MOE# 6702915** 0.0 CLAY 24.4 MSND 36.6 LMSN 47.5
6702928	4 10	Nov-65	551996 4844479	426.7	7.6	Fr			7.6				5001 BR	WS DO	**MOE# 6702928** 0.0 TPSL 0.6 TPSL MSND 3.0 CLAY STNS 10.1 CLAY GRVL 10.7
6702930	4 10	Jul-65	552536 4844973	425.2	6.1	Fr			4.6			6.1	2519 BR	WS DO	**MOE# 6702930** 0.0 CLAY 4.6 BLDR 6.7
6702931	4 10	Jul-65	552491 4844957	425.2	6.7	Fr			6.1				2519 BR	WS DO	**MOE# 6702931** 0.0 BLDR CLAY 6.7 MSND 7.0 BRWN CLAY 8.5
6702932	4 10	Jul-65	552378 4844835	425.2	4.3	Fr			4.6				2519 CT	WS ST	**MOE# 6702932** 0.0 MSND 5.2
6702933	4 10	Jul-65	552357 4844860	425.2	3.0	Fr			3.0				2519 BR	WS DO	**MOE# 6702933** 0.0 BRWN CLAY 3.0 CLAY BLDR 5.2
6702934	4 10	Oct-66	552158 4844767	425.2	38.1 33.5	Fr Fr			6.7	45	240	12.2	1906 CT	WS DO	**MOE# 6702934** 0.0 CLAY MSND STNS 3.0 BLUE CLAY STNS 24.4 CLAY MSND 28.7 GREY LMSN 32.0 LMSN 38.4
6702935	4 10	Nov-66	551977 4844363	426.7	5.2	Fr			1.5	9		8.8	2519 BR	WS DO	**MOE# 6702935** 0.0 TPSL 0.3 BRWN CLAY 0.9 MSND 1.5 BLUE HPAN 5.2 MSND 6.1 HPAN STNS 9.1
6702936	4 10	Apr-67	552123 4844697	425.2	33.5 32.6	Fr Fr			2.4	68	300	6.1	1906 CT	WS DO	**MOE# 6702936** 0.0 CLAY STNS 7.6 CLAY 21.3 CLAY STNS 27.1 BLUE LMSN 33.2 GRVL 33.5
6702937	4 10	Jul-67	551959 4844594	426.7	26.8	Fr			5.5	14	960	8.5	1905 CT	WS DO	**MOE# 6702937** 0.0 TPSL 0.3 GREY CLAY STNS 26.5 SHLE 29.9
6703278	2 9	Apr-68	551032 4842821	426.7	61.0	Fr			8.8	55	30	18.3	2406 CT	WS DO	**MOE# 6703278** 0.0 TPSL 0.3 BRWN CLAY STNS 3.0 GREY CLAY STNS 23.2 GREY LMSN 33.5 BRWN LMSN 61.0
6703402	4 8	Jun-69	552662 4843751	426.7	26.2	Fr			7.6	45		12.2	2414 CT	WS DO	**MOE# 6703402** 0.0 TPSL 0.3 BRWN CLAY STNS 10.7 BRWN CLAY MSND STNS 13.7 BRWN CLAY GRVL 22.9 BRWN MSND GRVL 26.2
6704618	4 8	May-73	552412 4843861	426.7	38.7 27.4	Fr Fr			3.7	45	60	13.7	2406 CT	WS DO	**MOE# 6704618** 0.0 TPSL 0.3 BRWN CLAY SAND STNS 6.1 BRWN CLAY GRVL 23.8 BRWN ROCK 27.4 GREY ROCK 38.7
6704650	4 8	Jun-73	552652 4843751	426.7	36.6	Fr			3.0	45	60	18.3	2406 CT	WS DO	**MOE# 6704650** 0.0 TPSL 0.3 BRWN CLAY SAND STNS 4.6 BRWN CLAY SAND GRVL 24.4 GREY ROCK 35.1 BRWN ROCK 36.6
6705071	2 11	Oct-74	550362 4843651	434.3	65.5	Fr			9.1	91	60	18.3	2336 RC	WS DO	**MOE# 6705071** 0.0 TPSL 0.3 BRWN CLAY STNS 3.0 GREY CLAY STNS 36.3 GREY ROCK 45.1 BRWN ROCK 65.5
6705285	4 9	Sep-74	552214 4844060	423.1	51.8	Fr			8.8	45	60	15.2	2336 RC	WS DO	**MOE# 6705285** 0.0 TPSL 0.3 BRWN CLAY STNS 7.0 GREY CLAY 21.3 BRWN ROCK FCRD 25.0 GREY ROCK 47.2 BRWN ROCK 51.8

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
6705605	4 10	Jul-75	551772 4844391	428.2	79.2	Fr			11.9	45	60	19.8	2336 RC	WS DO	**MOE# 6705605** 0.0 TPSL 0.3 BRWN CLAY SAND 4.6 GREY CLAY STNS 44.2 GREY SAND 46.3 GREY CLAY 63.4 BRWN SAND 73.5 BRWN ROCK 79.2
6705693	4 10	Sep-75	551862 4844341	428.2	1.8	Fr			1.8	14	60	7.6	2519 BR	WS DO	**MOE# 6705693** 0.0 BRWN SAND 1.8 GREY SAND 3.0 GREY CLAY 7.6
6705694	4 10	Apr-75	551862 4844471	428.2	1.8	Fr			1.8	14	60	7.6	2519 BR	WS DO	**MOE# 6705694** 0.0 BRWN SAND 1.8 GREY SAND 3.0 GREY CLAY 7.6
6705695	4 10	Apr-75	551912 4844461	427.3	1.8	Fr			1.8	14	60	7.6	2519 BR	WS DO	**MOE# 6705695** 0.0 BRWN SAND 1.8 GREY SAND 3.0 GREY CLAY 7.6
6705698	4 10	Aug-75	551912 4844321	430.4	4.0	Fr			3.0	14	60	7.6	2519 BR	WS DO	**MOE# 6705698** 0.0 BRWN SAND 4.6 GREY CLAY 7.6
6705700	3 8	Oct-75	551612 4842721	429.8	63.1	Fr			10.4	55	60		4320 RC	WS DO	**MOE# 6705700** 0.0 BRWN CLAY BLDR 11.0 GREY CLAY BLDR 21.9 LMSN CLAY 31.7 GREY LMSN HARD 47.2 BRWN DLMT 63.1
6706075	4 10	Jun-76	551812 4844321	428.2	57.9	Fr			10.7	45	60	22.9	2336 RC	WS DO	**MOE# 6706075** 0.0 BRWN SAND 3.7 GREY CLAY GRVL 29.6 GREY ROCK 38.7 BRWN ROCK 61.3
6706242	4 10	Oct-76	551862 4844321	429.8	1.8	Fr			1.8		120		2519 BR	WS DO	**MOE# 6706242** 0.0 BRWN SAND 4.3 GREY CLAY 7.3
6706243	4 10	Oct-76	551862 4844321	429.8	1.2	Fr			1.2		180		2519 BR	WS DO	**MOE# 6706243** 0.0 BRWN SAND 4.3 GREY CLAY 6.4
6706396	4 10	May-77	551962 4844571	425.2	3.7	Fr			3.4				2519 BR	WS DO	**MOE# 6706396** 0.0 BLCK TPSL 0.3 BRWN CLAY BLDR 3.7 BRWN SAND 4.0 BRWN CLAY BLDR 6.7
6706408	3 10	May-77	551512 4843821	429.8	108.5	Fr			19.8	68	300	25.9	1906 RC	WS DO	**MOE# 6706408** 0.0 BRWN CLAY STNS 78.9 GREY STNS 108.5
6706452	4 9	Jul-77	552162 4843971	426.7	30.5	Fr			15.8	45	60	23.8	2336 RC	WS DO	**MOE# 6706452** 0.0 BRWN TPSL 0.3 GREY CLAY SAND STNS 26.5 BRWN ROCK 36.6
6706528	3 11	Jan-77	551312 4844421	429.8	54.9	Fr			8.2	41	60	22.9	3740 RA	WS DO	**MOE# 6706528** 0.0 BRWN CLAY SAND 10.4 GREY HPAN STNS 15.2 BRWN SAND 23.2 GREY CLAY 30.5 GREY LMSN 54.9
6706586	4 10	Feb-77	552012 4845121	435.9	93.0	Fr			10.7	50	180	25.3	3317 RC	WS PU	**MOE# 6706586** 0.0 SAND 8.5 GREY CLAY STNS 36.9 GREY LMSN 50.3 BRWN LMSN 91.4 BRWN ROCK 97.5
6706640	3 9	Sep-77	551412 4842971	428.2	59.4	Fr			10.1	32	180	14.3	2332 RC	WS DO	**MOE# 6706640** 0.0 BRWN CSND 4.6 GREY CLAY STNS 22.6 GREY ROCK 65.5
6706753	4 10	Jan-78	551962 4844621	426.7	2.1	Fr			3.0	23	60	9.1	5469 BR	WS DO	**MOE# 6706753** 0.0 BRWN SAND 3.0 GREY CLAY 9.1
6706784	4 10	Aug-78	551962 4844371	426.7	7.9 Fr 2.7	Fr			2.7				5469 BR	WS DO	**MOE# 6706784** 0.0 TPSL 0.3 BRWN CLAY SNDY 2.7 GREY CLAY STNS 7.9 BRWN SAND 8.5 GREY CLAY STNS 12.2

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
6707006	4 9	Jun-79	552112 4844071	426.7	35.7	Fr			9.8	91	60	16.8	2336 RC	WS DO	**MOE# 6707006** 0.0 BRWN TPSL 0.3 BRWN CLAY STNS 4.6 GREY CLAY STNS GRVL 24.4 GREY STNS CLAY FCRD 25.3 GREY STNS 35.1 BRWN STNS 36.0
6707095	3 9	Apr-79	552362 4843771	431.0	41.1	Fr			11.0	23	180	18.3	1669 CT	WS DO	**MOE# 6707095** 0.0 BLCK TPSL 0.6 YLLW CLAY 3.0 YLLW CLAY STNS 9.1 BRWN HPAN 18.3 BRWN HPAN SAND 24.4 BRWN CLAY 26.2 BRWN LMSN 41.1
6707096	4 10	Sep-79	552012 4844271	426.7	10.1 4.9 3.0 3.0	Fr Fr Fr Fr			1.2	18		12.2	5477 BR	WS DO	**MOE# 6707096** 0.0 BRWN SAND GRVL 1.2 GREY CLAY 3.0 GREY MARL SAND 3.7 GREY CLAY 4.9 GRVL 5.2 GREY CLAY 9.1 GREY MARL SAND 10.1 GREY CLAY 12.2
6707132	4 8	Jun-79	552812 4843721	426.7	29.3	Fr			6.1	91	180	12.2	2564 CT	WS DO	**MOE# 6707132** 0.0 CLAY 7.6 GRVL 9.1 CLAY GRVL LYRD 28.3 GREY STNS 29.3
6707227	2 10	Jan-80	551112 4843071	429.8	1.8	Fr			1.8	14		1.8	5477 RC	WS DO	**MOE# 6707227** 0.0 BRWN TPSL 0.3 BRWN CLAY 3.0 BRWN SAND 3.7 BRWN CLAY 9.1
6707302	4 10	Jul-80	551960 4844344	428.9	34.7	Fr			13.1	68	60	19.8	2336 RC	WS DO	**MOE# 6707302** 0.0 BRWN FSND 3.7 GREY CLAY GRVL 27.1 GREY ROCK 36.0
6707789	4 10	Jun-82	551962 4844671	426.7	53.6	Fr			4.9	50	720	7.3	3317 RC	WS DO	**MOE# 6707789** 0.0 CLAY GRVL 1.8 CLAY STNS 16.8 GREY CLAY 21.3 CLAY STNS 32.0 CLAY SOFT SNDY 52.4 STNS 53.6 53.9
6708187	4 10	Jun-84	551703 4844433	426.1	38.1	Fr			7.0	36	120	19.8	5317 RC	WS DO	**MOE# 6708187** 0.0 CLAY STNS 28.7 LMSN 42.7
6708208	4 9	Aug-85	552010 4844147	427.0	64.9 59.4	Sa Sa			7.9	41	90	25.9	3740 RC	WS DO	**MOE# 6708208** 0.0 BLCK TPSL 0.3 BRWN CLAY 2.4 GREY CLAY STNS 27.4 GREY LMSN 46.3 BRWN LMSN 64.9
6708405	4 12	Mar-86	551020 4845119	427.9	50.3 47.9	Fr Fr			12.8	45	60	17.7	3740 RC	WS DO	**MOE# 6708405** 0.0 BLCK TPSL 0.3 BRWN CLAY SAND 3.7 GREY CLAY STNS 29.0 GREY LMSN SHLE 51.5
6708435	4 10	Jun-86	551939 4844222	429.8	56.4	Fr			7.3	32	60	18.3	3740 RC	WS DO	**MOE# 6708435** 0.0 BRWN CLAY SAND 3.4 GREY CLAY STNS 27.4 GREY LMSN 61.0
6708706	3 12	May-86	550971 4844959	427.0	50.3 45.7	Fr Fr			2.1	91		6.1	2564 CT	WS DO	**MOE# 6708706** 0.0 GRVL 3.0 CLAY 30.5 SAND 33.5 LMSN 50.3
6708770	4 11	May-87	551204 4844968	428.9	38.1	Fr			15.2	23	60	30.5	4643 RC	WS DO	**MOE# 6708770** 0.0 BLCK TPSL 0.3 BRWN SAND 3.4 BLUE CLAY 34.4 GREY LMSN 38.7
6708832	4 8	Jun-87	552394 4843873	425.8	53.3 28.0	Fr Fr			8.5	45	60	15.2	2336 RC	WS DO	**MOE# 6708832** 0.0 BRWN CLAY STNS 4.6 GREY CLAY STNS 24.1 GREY ROCK 53.3
6708835	4 10	Jun-87	551922 4844384	428.9	48.8 42.7	Fr Fr			11.6	41	90	21.3	3317 RC	WS DO	**MOE# 6708835** 0.0 BRWN CLAY STNS 1.5 SAND 2.4 GREY CLAY STNS 22.3 GREY CLAY STKY 23.8 GREY CLAY STNS 29.3 GREY CLAY STKY 29.9 ROCK 30.5 GREY LMSN 39.0 BRWN LMSN 53.0

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
6708836	4 10	Jun-87	551953 4844661	427.0	42.1	Fr			9.1	41	75	13.7	3317 RC	WS DO	**MOE# 6708836** 0.0 BRWN CLAY STNS 3.0 GREY CLAY STNS 18.9 GREY CLAY STKY 25.9 GREY CLAY STNS 40.2 GREY LMSN 44.2
6708893	4 10	Jun-87	551854 4844378	428.9	79.2	Fr			12.8	41	60	20.7	3740 RC	WS DO	**MOE# 6708893** 0.0 BRWN FILL 0.9 BRWN CLAY 3.7 GREY CLAY STNS 50.3 GREY SAND 59.4 GREY CLAY STNS 61.3 BRWN SNDS SHLE 63.1 BRWN LMSN 79.2
6708933	4 12	Jan-87	551001 4845118	427.0	41.1	Fr			4.6	91	60	24.4	2336 RC	WS DO	**MOE# 6708933** 0.0 BRWN CLAY GRVL STNS 5.5 GREY CLAY 36.9 GREY ROCK 41.1
6709396	3 12	Jul-88	550350 4844608	431.9	56.1	Fr			5.2	45	180	29.0	1906 RC	WS DO	**MOE# 6709396** 0.0 BRWN CLAY STNS 36.0 BLUE ROCK 37.5 GREY ROCK 42.7 LMSN 56.4
6709484	4 10	Sep-88	551752 4844376	427.9	39.3	Fr			15.8	32	60	21.3	3740 RC	WS DO	**MOE# 6709484** 0.0 BLCK TPSL 0.3 BRWN SAND CLAY 3.7 BRWN CLAY STNS 10.4 GREY CLAY STNS 30.5 GREY LMSN 39.3
6709528	3 9	Aug-88	551363 4843276	428.9	51.8	Fr			13.7	45	60	39.6	3518 RA	WS DO	**MOE# 6709528** 0.0 BLCK TPSL SOFT 0.6 GREY CLAY STNS HARD 23.2 BRWN ROCK LMSN HARD 51.8
6709642	4 9	Jan-89	552134 4843994	427.9	36.3	Fr			13.7	68	60	19.8	2336 RA	WS DO	**MOE# 6709642** 0.0 BRWN CLAY STNS 4.6 BRWN CLAY GRVL 25.6 GREY ROCK 33.5 BRWN ROCK 36.6
6710384	3 10	Jun-90	551840 4844204	431.0	50.6	Fr			12.2	68	60		2663 RA	WS DO	**MOE# 6710384** 0.0 TPSL 0.3 SAND 4.6 CLAY HPAN 24.4 BLDR GRVL 29.0 GREY LMSN 39.6 BRWN LMSN 50.6
6710457	4 8	Aug-90	552540 4843802	427.0	54.9 29.0	Fr Fr			8.2	36	60	25.9	2336 RA	WS DO	**MOE# 6710457** 0.0 BRWN CLAY STNS 6.1 GREY CLAY STNS GRVL 25.6 GREY ROCK 51.8 BRWN ROCK 55.2
6710559	4 10	Nov-90	551945 4844603	427.0	41.1	Fr			4.9	45	90	8.2	3317 RC	WS DO	**MOE# 6710559** 0.0 BRWN CLAY STNS 3.0 GREY CLAY STNS 29.0 GREY LMSN 43.9
6710904	2 9	Feb-92	551546 4842670	427.9	36.0	Fr			10.7	55	60	18.3	2336 RA	WS DO	**MOE# 6710904** 0.0 BRWN SAND STNS 3.0 BRWN CLAY GRVL 7.6 GREY CLAY GRVL 21.0 GREY ROCK 32.0 BRWN ROCK 36.9
6711036	4 10	Sep-92	551952 4844159	429.8	50.9	Fr			12.2	45	60		3740 RC	WS DO	**MOE# 6711036** 0.0 BRWN SAND FILL 0.6 BRWN CLAY SAND 3.4 GREY CLAY STNS 29.6 GREY LMSN 50.9
6711078	4 10	Aug-92	552374 4844982	434.9	38.1	Fr			12.2	45	90	15.2	3317 RC	WS DO	**MOE# 6711078** 0.0 SAND GRVL CLAY 4.6 GREY CLAY 30.5 GREY CLAY STNS 34.7 GREY LMSN 41.1
6711152	4 11	Dec-93	551117 4844955	428.9	50.3 44.2 36.6 36.6	Fr Fr Fr Fr			23.8	41	60	27.4	2663 RA	WS DO	**MOE# 6711152** 0.0 TPSL 0.3 BRWN SAND CLAY 5.5 BRWN CLAY SAND HPAN 7.9 BRWN CLAY SAND GRVL 33.2 GREY LMSN 50.3
6711170	4 9	May-93	552031 4844101	427.0	42.1	Fr			7.6	45	60	9.8	3740 RC	WS DO	**MOE# 6711170** 0.0 BLCK TPSL 0.3 BRWN CLAY STNS 8.2 GREY CLAY STNS 25.9 GREY LMSN 42.1

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
6711422	4 9	May-94	552284 4843901	427.9	48.8	Fr			7.9	18	480	16.8	2336 RA	WS DO	**MOE# 6711422** 0.0 BRWN CLAY STNS 3.0 GREY CLAY STNS 22.9 GREY CLAY GRVL 26.5 GREY ROCK 38.1 BRWN ROCK 48.8
6711924	4 9	Jan-96	552129 4843999	428.2	28.7 26.2	Fr Fr			13.7	36	120	14.6	2336 CT	WS DO	**MOE# 6711924** 0.0 BRWN CLAY 5.5 GREY CLAY SAND 7.6 GREY CLAY SOFT 16.8 GREY CLAY HARD 23.2 GREY ROCK 24.1 GREY ROCK LOOS 25.9 GREY ROCK 33.5
6711958	4 10	Sep-96	551722 4844385	427.9	65.5	Fr			12.5	91	60	15.2	6865 RC	WS DO	**MOE# 6711958** 0.0 TPSL 0.3 BRWN SAND 3.4 BRWN GRVL SAND 4.9 GREY CLAY STNS 25.3 GREY CLAY GRVL 35.7 GREY CLAY SILT STNS 51.2 GREY LMSN 70.1
6712080	4 9	Sep-96	552355 4843884	426.4	42.7	Fr			10.7	27	120	32.0	2336 RR	WS DO	**MOE# 6712080** 0.0 BRWN CLAY STNS 4.6 GREY CLAY SAND 13.7 GREY CLAY GRVL 24.1 BRWN ROCK 25.0 GREY ROCK 42.7
6712452	2 12	Aug-97	550308 4843780	434.9	65.5	Fr			7.0	91	90	22.9	3317 RC	WS DO	**MOE# 6712452** 0.0 BRWN CLAY STNS 6.1 GREY CLAY STNS 32.0 GREY CLAY STNS BLDR 46.0 GREY LMSN 50.3 GREY LMSN 71.6
6712484	4 10	Mar-98	552095 4844824	424.9	49.7 44.2	Fr Fr			12.8	68	60	27.4	2663 RA	WS DO	**MOE# 6712484** 0.0 BRWN CLAY SAND GRVL 12.2 GREY CLAY SAND STNS 28.3 GREY LMSN 28.7 BRWN LMSN LTCL 49.7
6712540	2 13	Jun-98	550241 4843906	431.3	57.9	Fr	64.9	-0.9	8.2	91	90		2576 RA	WS DO	**MOE# 6712540** 0.0 TPSL 0.3 BRWN CLAY GRVL 3.0 GREY CLAY GRVL 23.5 BRWN CLAY SLTY GRVL 57.9 GREY SAND GRVL WBRG 65.8
6712549	3 11	Jun-98	551171 4844480	430.1	86.0 79.2 44.2 44.2 44.2 44.2	Fr Fr Fr Fr Fr Fr			8.5	136	60	26.8	2663 RA	WS DO	**MOE# 6712549** 0.0 BRWN CLAY SAND GRVL 7.6 GREY CLAY SAND GRVL 29.0 GREY CLAY GRVL LMSN 32.0 BRWN LMSN LTCL 38.1 BRWN LMSN 47.2 BRWN LMSN LTCL 71.6 GREY LMSN LTCL 76.2 GREY LMSN 79.2 GREY LMSN LTCL 86.0
6712681	3 11	Sep-98	550577 4844018	430.1	54.9	Fr			9.1	136	60	16.8	2336 RA	WS DO	**MOE# 6712681** 0.0 BRWN CLAY STNS 3.0 GREY CLAY STNS 22.9 GREY CLAY SAND GRVL 24.4 GREY CLAY BLDR 31.4 GREY ROCK 44.2 BRWN ROCK 56.4
6712754	2 10	Nov-98	551011 4843000	428.5	35.1	Fr			18.3	55	60	25.9	2336 RA	WS DO	**MOE# 6712754** 0.0 BRWN CLAY SAND 7.6 GREY CLAY STNS 23.8 BRWN ROCK 33.5 GREY ROCK 36.6
6712755	4 8	Nov-98	552763 4843724	428.2	37.8	Fr			17.4	55	60	21.9	2336 RA	WS DO	**MOE# 6712755** 0.0 BRWN CLAY STNS 7.6 GREY CLAY STNS 26.8 GREY ROCK 37.8
6712869	4 10	Jul-98	551954 4844408	427.9	53.3	Fr			11.3	45	90	24.4	3317 RC	WS DO	**MOE# 6712869** 0.0 TPSL 0.3 BRWN CLAY STNS 4.9 GREY CLAY STNS 27.4 SAND CLAY 29.3 BRWN LMSN 56.1
6712871	4 9	Aug-98	551941 4844280	423.1	86.3	Fr			14.0	45	90	21.3	3317 RC	WS DO	**MOE# 6712871 TAG#ASSMNT** 0.0 TPSL 0.9 BRWN CLAY SAND 1.8 BRWN CLAY STNS 5.5 GREY CLAY STNS 51.8 SAND CLAY 72.5 GREY LMSN 86.3

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
6712964	4 42	May-99	552755 4843735	427.0	36.6	Fr			6.7	45	60	15.2	2336 RA	WS DO	**MOE# 6712964** 0.0 BRWN CLAY STNS 9.1 GREY CLAY STNS 24.4 BRWN GRVL SAND 25.6 GREY ROCK 36.6
6713016	3 11	Jun-99	551566 4844182	430.1	94.5 91.4 79.2 79.2 79.2 79.2	Fr Fr Fr Fr Fr Fr			13.7	136	60	33.5	2663 RA	WS DO	**MOE# 6713016** 0.0 TPSL 0.3 BRWN CLAY SAND STNS 7.6 BRWN CLAY GRVL 27.4 GREY SAND GRVL 38.1 BRWN CLAY SAND 51.8 BRWN CLAY SAND GRVL 57.3 BRWN LMSN FCRD 58.5 BRWN LMSN 80.8 GREY LMSN 86.9 GREY LMSN 94.5
6713066	4 10	May-99	551968 4844280	428.9	76.2 75.0	Fr Fr			9.1	45	60	32.3	6865 RC	WS DO	**MOE# 6713066** 0.0 TPSL 0.3 BRWN SAND GRVL CLAY 1.2 BRWN CLAY STNS 2.7 GREY CLAY GRVL 8.2 GREY CLAY STNS 47.9 GREY CLAY GRVL 52.1 GREY GRVL SAND SILT 70.1 GREY LMSN 76.2
6713242	4 10	Aug-99	551953 4844346	429.5	60.4 52.4	Fr Fr			13.7	45	90	16.8	3317 RC	WS DO	**MOE# 6713242** 0.0 BRWN TPSL 0.3 BRWN CLAY STNS SNDY 3.7 GRN CLAY STNS 30.2 GRN LMSN 61.6
6713880	4 8	Sep-01	552742 4843408	430.7	42.7	Fr			12.5	45	60	21.3	2336 RA	WS DO	**MOE# 6713880** 0.0 BRWN CLAY STNS 8.5 GREY CLAY STNS 24.4 BRWN GRVL SAND 26.5 GREY ROCK 42.7
6714026	3 11	Mar-02	551213 4844316	430.1	74.7	Fr			9.4	68	60	36.3	2663 RA	WS DO	**MOE# 6714026** 0.0 BLCK TPSL 0.9 BRWN CLAY STNS 10.7 BRWN CLAY HPAN 25.9 BRWN CLAY GRVL 31.7 GREY LMSN FCRD 32.9 GREY LMSN 35.1 BLUE LMSN 74.7
6714970	4 6	Dec-03	551996 4844733	425.8	37.5	Un			8.5	55	60	11.3	2663 RA	WS DO	**MOE# 6714970 TAG#A001865** 0.0 BRWN TPSL 0.6 BRWN CLAY SAND GRVL 28.3 GREY LMSN 37.5
6715076	4 10	Aug-04	551973 4844381	427.6	61.9	Un			12.8	59	60	14.6	6865 RC	RC DO	**MOE# 6715076 TAG#A005682** 0.0 BRWN SAND CLAY 3.7 GREY CLAY STNS 21.0 GREY CLAY 29.3 BRWN LMSN 32.0 GREY LMSN 44.2 BRWN LMSN 62.8
6715584	11	Nov-05	551833 4844914	433.1					NR				2663 -	AS -	**MOE# 6715584** 0.0
6715622	4 8	Oct-05	552614 4843791	426.1	77.1	Fr			11.3	32	60	32.9	6865 RC	WS DO	**MOE# 6715622 TAG#A026051** 0.0 BRWN TPSL 0.3 BRWN GRVL STNS CLAY 22.6 BRWN LMSN LYRD 77.4
7139684	4 9	Jan-10	552414 4843884	424.9	54.3	Fr			13.4	55	60	17.1	7385 RA	WS DO	**MOE# 7139684 TAG#A079614** 0.0 BRWN CLAY STNS 7.6 GREY CLAY STNS 21.3 GREY CLAY SAND GRVL 22.9 BRWN ROCK FCRD 27.1 GREY ROCK 48.8 BRWN ROCK 54.9
7149767	5 10	Jul-10	552285 4844885	430.7	54.9	Fr			7.9	23	360	26.2	7385 RA	WS DO	**MOE# 7149767 TAG#A079617** 0.0 BRWN SAND STNS 3.7 GREY CLAY STNS 29.0 GREY CLAY SAND GRVL 31.4 GREY ROCK 41.1 BRWN ROCK 54.9
7166124	4 11	NR	551624 4844811	432.5					NR				6475 -	- -	**MOE# 7166124 TAG#A103263** 0.0
7170379	4 10	Oct-11	551937 4844475	425.8	62.5	Fr			12.8	68	60	19.8	7154 RC	WS DO	**MOE# 7170379 TAG#A115054** 0.0 BRWN CLAY 11.3 GREY CLAY 34.1 GREY CLAY STNS 43.6 GREY CLAY SLTY 59.7 GREY LMSN 63.4

LABEL	CON LOT	DATE mmm-yr	EASTING NORTHING	ELEV masl	WTR mbgl	FND Qu	SCR TOP mbgl	LEN m	SWL mbgl	RATE L/min	TIME min	PL mbgl	DRILLER METHOD	TYPE STAT	WELL NAME DESCRIPTION OF MATERIALS
7172623	3 9	Oct-11	552115 4843929	431.3	41.1	Fr			16.5	45	60	28.3	7221 RC	WS DO	**MOE# 7172623 TAG#A104425** 0.0 BRWN CLAY SLTY 1.5 BRWN CLAY SAND 3.7 GREY CLAY STNS 28.3 GREY LMSN 41.1
7179341	3 9	Mar-12	552069 4843873	431.3					NR				7221 -	AS DO	**MOE# 7179341** 0.0
7185591	4 9	Jul-12	551874 4844315	430.1	75.6	Fr			15.2	55	720	15.8	7154 RC	WS DO	**MOE# 7185591 TAG#A125533** 0.0 BRWN SAND 4.9 BRWN CLAY STNS 31.1 GREY CLAY 57.6 GREY CLAY STNS 74.7 GREY LMSN 75.6
7186074	4 10	Jul-12	552412 4844999	432.2	33.5	Fr			12.2	45	60		2576 OTH	WS DO	**MOE# 7186074 TAG#A123030** 0.0 BRWN CLAY GRVL SNDY 3.7 GREY CLAY STNS 27.4 BRWN CLAY STNS 31.1 GREY LMSN 35.4

QUALITY:

Fr	Fresh
Mn	Mineral
Sa	Salty
Su	Sulphur
--	Unrecorded

TYPE:

WS	Water Supply
AQ	Abandoned Quality
AS	Abandoned Supply
AB	Abandonment Record
TH	Test Hole or Observation

USE:

CO	Comercial
DO	Domestic
MU	Municipal
PU	Public
ST	Stock
NU	Not Used
IR	Irrigation
AL	Alteration
MO	Monitoring
-	Not Recorded

METHOD :

CT	Cable Tool
JT	Jetting
RC	Rotary Conventional
RA	Rotary Air
BR	Boring

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

APPENDIX D

Method of Soil Clasification

Abbreviations and Terms Used on Records of Boreholes and Test Pits

List of Symbols

Record of Borehole Sheets (BH20-1 to BH20-18)

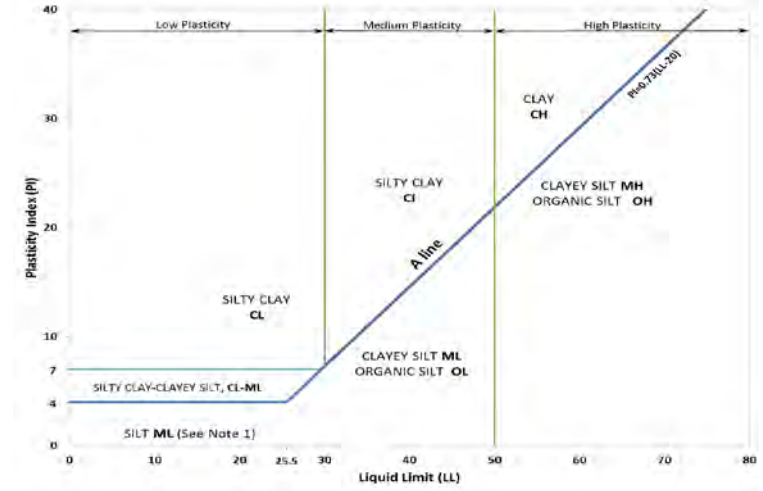
Plasticity Chart and Grain Size Analysis

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% **(see Note 2)**	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

PROJECT: 21456909

RECORD OF BOREHOLE: BH21-1

SHEET 1 OF 1

LOCATION: N 4843275.90; E 551475.50

BORING DATE: March 25, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		426.33							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (200 mm)		0.00 / 426.13	1A	SS	5				
		(OH) ORGANIC SILT; brown; non-cohesive, moist, loose		0.20 / 425.65	1B						
		(SP) SAND, some gravel to gravelly; black to brown; non-cohesive wet, compact to very dense		0.68	2	SS	16				
1											
					3	SS	12		○	MH	▽ April 14, 2021
2											Bentonite
					4	SS	12				
3					5A				○		
		(CL) SILTY CLAY, some gravel with silty sand seams; grey (TILL); cohesive, w<PL, hard - Auger grinding at 3.7 m		422.95 / 3.38	5B	SS	43		○		
4					6	SS	57				
					7	SS	50/ 0.10		○		Sand
5											Screen
6					8	SS	81/ 0.28				
				419.80							
		END OF BOREHOLE		6.53							
7		NOTES: 1. Groundwater measured at 1.5 m below ground surface upon completion of drilling. 2. Groundwater measured at 1.56 m below ground surface on April 14, 2021.									
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-2

SHEET 1 OF 1

LOCATION: N 4843404.00; E 551401.70

BORING DATE: March 25, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		429.80							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (50 mm)		429.71 0.09	1A						
		(SM) SILTY SAND, some clay, some gravel, trace organics; brown; non-cohesive, moist, loose		0.09	1B	SS	9		○		
				428.97	2A	SS	8				
1		(CL) SILTY CLAY, some sand, some gravel; brown; cohesive, w<PL, firm		0.83	2B				○		
					3	SS	8		○		
2				427.59							
		(CL) Sandy SILTY CLAY, some gravel, sand seams; brown (TILL); cohesive, w<PL, very stiff to hard		2.21	4	SS	22				
3					5	SS	54		○ ⊢	MH	▽ March 25, 2021
4					6	SS	50/ 0.23				
					7	SS	69		○		
5											
6					8	SS	50/ 0.13				
				423.42							
		END OF BOREHOLE		6.38							
7		NOTE: 1. Groundwater measured at 3.4 m below ground surface upon completion of drilling.									
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-3

SHEET 1 OF 1

LOCATION: N 4843696.30; E 551427.00

BORING DATE: March 29, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
0		GROUND SURFACE		434.96			
	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (250 mm)		0.00 / 434.71	1A		
		(OH) Sandy ORGANIC SILT, some gravel; non-cohesive, moist, loose		0.25	1B	SS	1
				434.05	2A	SS	7
1		(CL-ML) SILTY CLAY-CLAYEY SILT, trace sand to sandy, some gravel; brown; cohesive, w<PL, firm		0.91	2B		
					3	SS	5
2		- Auger grinding between 2.1 m and 3.4 m		432.75			
		(CL) SILTY CLAY, trace sand to sandy, some gravel; brown to grey (TILL); cohesive, w~PL to w<PL, very stiff to hard		2.21	4	SS	29
3					5	SS	50/ 0.03
4					6	SS	50/ 0.13
5					7	SS	50/ 0.15
6					8	SS	30
				428.25			
7		END OF BOREHOLE		6.71			
8		NOTES: 1. Groundwater measured at 2.13 m below ground surface upon completion of drilling. 2. Groundwater measured at 0.4 m below ground surface on April 14, 2021.					
9							
10							

SAMPLES

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○: 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl: 10 20 30 40

ADDITIONAL LAB. TESTING: MH

PIEZOMETER OR STANDPIPE INSTALLATION

GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

April 14, 2021

Bentonite

Sand

Screen

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-4

SHEET 1 OF 1

LOCATION: N 4843888.70; E 551737.90

BORING DATE: March 30, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		426.73							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (300 mm)		0.00	1A						
				426.43		SS	4				
		(SM/ML) SILT and SAND, trace gravel; brown; non-cohesive, moist to wet, loose		0.30	1B						▽ March 30, 2021
1					2	SS	8		○	MH	
					3	SS	6				
2				424.62							
		(CL) SILTY CLAY, trace sand to Sandy, trace to some gravel; grey (TILL); cohesive, w~PL to w<PL, stiff to very stiff		2.11	4	SS	8		○		
3					5	SS	20				
4					6	SS	29				
					7	SS	20		○	MH	
5				421.55							
		END OF BOREHOLE		5.18							
6		NOTE: 1. Groundwater measured at 0.6 m below ground surface upon completion of drilling.									
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: EN

CHECKED: MWK

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-5

SHEET 1 OF 1

LOCATION: N 4844077.10; E 551875.60

BORING DATE: March 30, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		428.71							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (150 mm)		0.00	1A	SS	2				Bentonite
		(SM) SILTY SAND, trace gravel, trace organics; brown; non-cohesive, moist, very loose to loose		0.15	1B				○		
				427.80	2A	SS	7				April 14, 2021 Sand
1		(SM/ML) SILT and SAND, trace gravel; brown; non-cohesive, wet, loose to compact		0.91	2B						
					3	SS	7		○	MH	
2					4	SS	10				Screen
3		- gravel seam at 3.45 m			5A				○		
				425.21	5B	SS	10				
		(CL) CLAYEY SILT, trace sand, trace gravel; brown to grey (TILL); cohesive, w~PL to w<PL, stiff to very stiff		3.50	6	SS	20				Sand
4					7	SS	16		○		
5				423.53							
		END OF BOREHOLE		5.18							
6		NOTES:									
		1. Groundwater measured at 0.6 m below ground surface upon completion of drilling.									
		2. Groundwater measured at 0.76 m below ground surface on April 14, 2021.									
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: EN

CHECKED: MWK

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-6

SHEET 1 OF 1

LOCATION: N 4844124.90; E 551636.50

BORING DATE: March 30, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		427.33							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (150 mm)		0.00	1A						
		(SP) SAND, some silt; brown; non-cohesive, moist to wet, loose to compact		0.15	1B	SS	4		W		April 14, 2021
1					2	SS	13				Bentonite
2					3	SS	15		W	MH	
				424.89	4A	SS	20				
		(SM) SILTY SAND; brown; non-cohesive, wet, compact		2.44	4B						
3				424.36							Screen
		(CL) Sandy SILTY CLAY, some gravel with sand seams; grey (TILL); cohesive, w<PL, firm to stiff		2.97	5A	SS	9				
					5B				W		
4					6A						
					6B	SS	7		W	MH	
5				422.15	7	SS	7				
		END OF BOREHOLE		5.18							
6		NOTES:									
		1. Groundwater measured at 0.9 m below ground surface upon completion of drilling.									
		2. Groundwater measured at 0.41 m below ground surface on April 14, 2021.									
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: MWK

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PROJECT: 21456909

LOCATION: N 4844015.70; E 551439.30

RECORD OF BOREHOLE: BH21-7

SHEET 1 OF 2

BORING DATE: March 30, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		428.99							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (75 mm)		0.00	1A						
		(CL-ML) SILTY CLAY-CLAYEY SILT with SAND, some gravel; brown; cohesive, w<PL, firm to stiff		0.07	1B	SS	4				Bentonite; April 14, 2021 (D); April 14, 2021 (S)
1					2	SS	6		W	MH	Sand
					3	SS	9				
2					4A	SS					Screen
				426.39		SS	37				
		(CL-ML) Sandy SILTY CLAY-CLAYEY SILT, some gravel; brown to grey (TILL); cohesive, w<PL, hard		2.60	4B						
3					5	SS	64		W	MH	
4					6	SS	67				
					7	SS	100/ 0.25				Bentonite
5											
6					8	SS	78				
7											Sand
					9	SS	80/ 0.18				
8											Screen
9					10	SS	67				Sand
				419.39							
		END OF BOREHOLE		9.60							
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-7

SHEET 2 OF 2

LOCATION: N 4844015.70; E 551439.30

BORING DATE: March 30, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		--- CONTINUED FROM PREVIOUS PAGE ---									GR SA SI CL
10		NOTES: 1. Groundwater measured at 3.0 m below ground surface upon completion of drilling. 2. Groundwater measured at 0.74 m below ground surface in shallow well and at 0.53 m below ground surface in deep well on April 14, 2021.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

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PROJECT: 21456909

LOCATION: N 4844379.70; E 551552.80

RECORD OF BOREHOLE: BH21-8

SHEET 1 OF 1

BORING DATE: March 30, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		427.75							GR SA SI CL ▽
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (200 mm)		0.00 / 427.55	1	SS	WH				April 14, 2021
		(CL) CLAYEY SILT, trace sand, trace gravel; brown (TILL); cohesive, w<PL, stiff to very stiff		0.20							Bentonite
1					2	SS	14		W		Sand
					3A						
2		(SM) SILTY SAND, trace gravel; brown; non-cohesive, wet, compact to dense		425.77 / 1.98	3B	SS	19				
					4	SS	30				
3					5A						Screen
		(CL) CLAYEY SILT, trace sand, trace gravel; grey (TILL); cohesive, w<PL, very stiff		424.40 / 3.35	5B	SS	15				
		(SM) SILTY SAND, some gravel; grey; non-cohesive, wet, compact		423.94 / 3.81	6	SS	29			MH	
4					7	SS	22				
5				422.72							
		END OF BOREHOLE		5.03							
6		NOTES:									
		1. Groundwater measured at 0.2 m below ground surface upon completion of drilling.									
		2. Groundwater measured at -0.02 m below ground surface on April 14, 2021.									
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: EN

CHECKED: MWK

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-9

SHEET 1 OF 1

LOCATION: N 4844084.50; E 551266.00

BORING DATE: March 22, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		432.43							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (150 mm)- (SM) SILTY SAND		0.00	1A						
		(CL) Sandy SILTY CLAY, some gravel, occasional cobbles; brown; cohesive, w<PL, firm		0.15	1B	SS	6				
1					2	SS	9				
					3	SS	7				April 14, 2021
2				429.99							
		- Auger grinding between 2.4 m and 4.5 m		2.44	4	SS	46			MH	
		(CL-ML) Sandy SILTY CLAY-CLAYEY SILT, some gravel; brown (TILL); cohesive, w<PL, hard									
3					5	SS	50/ 0.05				Bentonite
4					6	SS	50/ 0.07				
				427.93							
		(SM-GM) SILTY SAND and GRAVEL; brown; non-cohesive, dry, very dense - Auger grinding between 4.5 m and 5.6 m		4.50	7	SS	50/ 0.07				
5											
				426.83							
		(CL) Sandy SILTY CLAY, some gravel; grey (TILL); cohesive, w<PL, hard - Auger grinding between 5.6 m and 6.1 m		5.60							
6					8	SS	50/ 0.07				Sand
7											Screen
					9	SS	50/ 0.07				
8				424.15	10	SS	50/ 0.05				
		END OF BOREHOLE		8.28							
9		NOTES: 1. Groundwater measured at 7.3 m below ground surface upon completion of drilling. 2. Groundwater measured at 1.57 m below ground surface on April 14, 2021.									
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: MWK

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-10

SHEET 1 OF 1

LOCATION: N 4844290.00; E 551238.50

BORING DATE: March 24, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		433.20							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (300 mm) - Sandy ORGANIC SILT		0.00	1A	SS	3				
				432.90							
		(CL) Sandy SILTY CLAY, some gravel with occasional cobbles; brown to grey at 4.57 m (TILL); cohesive, w<PL, soft to hard		0.30	1B						
1					2	SS	12				Bentonite
2					3	SS	11				
					4	SS	35				
3											Sand
					5	SS	28				
4											
											Screen
5					6	SS	10				
6											
					7	SS	40			MH	
7											Bentonite
				425.35	8	SS	50/ 0.07				
8		END OF BOREHOLE		7.85							
		NOTES:									
9		1. Groundwater in monitoring well measured at 3.0 m below ground level on March 26, 2021.									
		2. Groundwater measured at 0.62 m below ground surface on April 14, 2021.									
10											

April 14, 2021

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-11

SHEET 1 OF 1

LOCATION: N 4844264.70; E 551602.20

BORING DATE: March 31, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		428.46							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (250 mm)		0.00 / 428.21	1	SS	3				
		(SP) SAND, some silt; brown; non-cohesive, moist, loose to compact		0.25							
1					2	SS	7				April 14, 2021
2					3	SS	11				
				426.02	4A	SS	8				Hole Plug
		(CL) SILTY CLAY, some sand to SANDY, some gravel; grey (TILL); cohesive, w<PL, firm		2.44	4B						
3					5	SS	14				
4					6	SS	12				
5					7	SS	11			MH	Sand
6											Screen
					8	SS	11				
				421.75							
7		END OF BOREHOLE		6.71							
8		NOTES: 1. Groundwater in open borehole at 1.5 m below ground surface upon completion of drilling. 2. Groundwater measured at 1.07 m below ground surface on April 14, 2021.									
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-12

SHEET 1 OF 1

LOCATION: N 4844086.60; E 551092.60

BORING DATE: March 23, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		431.95							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (200 mm)-SILTY SAND		0.00 / 431.75	1A						
		(CL) SILTY CLAY, some sand, some gravel; brown; cohesive, w<PL, soft to stiff		0.20	1B	SS	8		○		April 14, 2021 ▽
1					2	SS	7				Hole Plug
				430.12	3	SS	9				
2		(SM-GM) SILTY SAND and GRAVEL; brown; non-cohesive, moist, compact		1.83 / 429.74							
		(CL-ML) Gravelly SILTY CLAY-CLAYEY SILT with SAND; brown (TILL); cohesive, w<PL, very stiff to hard		2.21	4	SS	28		○		Sand
3					5	SS	28				
4											Screen
					6	SS	50/ 0.13		○ ⊢	MH	
				427.10							
5		END OF BOREHOLE		4.85							
		NOTES:									
		1. Groundwater measured at 3.7 m below ground surface upon completion of drilling.									
6		2. Groundwater measured at 0.52 m below ground surface on April 14, 2021.									
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: MWK

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-13

SHEET 1 OF 1

LOCATION: N 4844451.50; E 551049.00

BORING DATE: March 23, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		429.07							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (300 mm)- (OH) CLAYEY ORGANIC SILT		0.00 / 428.77	1A	SS	5				
		(CL) SILTY CLAY, some sand, some gravel, some organics to 0.61 m; brown; non-cohesive, w<PL, firm		0.30	1B	SS	5				
1					2	SS	5				
				427.62							April 14, 2021 ▽
		(CL) SILTY CLAY, some sand, some gravel, occasional cobbles; brown to grey (TILL); cohesive, w<PL, stiff to hard		1.45	3	SS	10		○	MH	
2					4	SS	30				
											Hole Plug
3					5	SS	50/ 0.13		○		
4		- Auger grinding between 4.6 m and 6.9 m			6	SS	91				
5											Sand
6					7	SS	93/ 0.25		○		Screen
				422.14							
7		(SM-GM) SILTY SAND and GRAVEL; grey; non-cohesive, wet, very dense		6.93 / 421.70	8	SS	50/ 0.05		○		
		END OF BOREHOLE		7.37							
		NOTE:									
8		1. Groundwater measured at 1.31 m below ground surface on April 14, 2021.									
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: MWK

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-14

SHEET 1 OF 1

LOCATION: N 4844278.70; E 550895.00

BORING DATE: March 23, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		431.06							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (300 mm)		0.00	1A	SS	1				April 14, 2021
				430.76	1B						Hole Plug
		(CL) Sandy SILTY CLAY, some gravel, cobbles present; brown; cohesive, w<PL, very soft to very stiff		0.30							
1					2	SS	6				Sand
					3	SS	17			MH	
2		- Auger grinding between 2.1 m and 6.9 m			4	SS	50/ 0.15				Screen
3				427.94	5	SS	50/ 0.08				
		END OF BOREHOLE		3.12							
4		NOTES: 1. Groundwater measured at 1.7 m below ground surface upon completion of drilling. 2. Groundwater measured at 0.2 m below ground surface on April 14, 2021.									
5											
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: MWK

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-15

SHEET 1 OF 1

LOCATION: N 4844267.20; E 551086.40

BORING DATE: March 24, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		432.46							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (300 mm) - ORGANIC SILT and SAND		0.00	1A	SS	1				April 14, 2021
				432.16							
		(SM) SILTY SAND, some gravel		0.30	1B						
				431.85							
		(CL) SILTY CLAY, some gravel with occasional cobbles; brown; cohesive, w<PL, firm to stiff		0.61							
1					2	SS	4				Hole Plug
2					3	SS	11		○		
				430.25							
		(CL) Sandy SILTY CLAY, some gravel; brown to grey (TILL); cohesive, w<PL, hard - Auger grinding at 2.3 m		2.21	4	SS	30				Sand
3											
					5	SS	33		○⊢	MH	
											Screen
4											
					6	SS	50				
5				427.30							
		END OF BOREHOLE		5.16							
6		NOTES: 1. Groundwater measured at 3.8 m below ground surface upon completion of drilling. 2. Groundwater measured at 0.34 m below ground surface on April 14, 2021.									
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

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PROJECT: 21456909

LOCATION: N 4844256.07; E 551424.87

RECORD OF BOREHOLE: BH21-16

SHEET 1 OF 1

BORING DATE: March 31, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		429.46							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (50 mm)		0.05							April 14, 2021
		(SM/ML) Gravelly SILT with slight plasticity and SAND, cobbles; brown; cohesive, w<PL, firm to very stiff			1	SS	4				
1					2	SS	17				
					3	SS	13			MH	Hole Plug
2				427.25							
		(CL-ML) SILTY CLAY-CLAYEY SILT, some sand, some gravel, some cobbles; brown to grey (TILL); cohesive, w<PL, hard		2.21	4	SS	61				
3					5	SS	64				Sand
4					6	SS	66				Screen
					7	SS	88				
5											
6					8	SS	50/ 0.13				
				423.08							
		END OF BOREHOLE		6.38							
7		NOTES:									
		1. Groundwater at 0.6 m below ground surface upon completion of drilling.									
8		2. Groundwater measured at 0.13 m below ground surface on April 14, 2021.									
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-17

SHEET 1 OF 1

LOCATION: N 4843491.90; E 551511.50

BORING DATE: March 26, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		428.92									GR SA SI CL
0		TOPSOIL (50 mm)		0.00									
		(SP) SAND, some gravel, trace organics; brown; non-cohesive, wet		0.05	1	SS	2						April 14, 2021
				428.24									
1		(CL-ML) Sandy SILTY CLAY-CLAYEY SILT, some gravel; brown to grey (TILL); cohesive, w>PL to w<PL, soft to hard at 3.05 m		0.68	2	SS	3						
					3	SS	10						Hole Plug
2	Power Auger 102 mm O.D. Solid Stem	- Auger grinding at 2.3 m			4	SS	31					MH	
					5	SS	41						Sand
3													
4					6	SS	58						Screen
					7	SS	50/ 0.13						
5				423.89									
		END OF BOREHOLE		5.03									
6		NOTES:											
		1. Groundwater measured at 2.13 m below ground surface on completion of drilling.											
		2. Groundwater measured at 0.46 m below ground surface on April 14, 2021.											
7													
8													
9													
10													

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DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: SM

CHECKED: EN

PROJECT: 21456909

RECORD OF BOREHOLE: BH21-18

SHEET 1 OF 2

LOCATION: N 4843775.60; E 551588.20

BORING DATE: March 29, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		GROUND SURFACE		427.24							GR SA SI CL
0	Power Auger 102 mm O.D. Solid Stem	TOPSOIL (50 mm)		0.00							
		(SP-GP) SAND and GRAVEL, some silt; brown; non-cohesive, moist, compact		0.05	1	SS	10				Bentonite
				426.56							
		(CL) CLAYEY SILT, some gravel, some sand, trace organics; cohesive, w<PL, very stiff		0.68	2A						Sand
1				426.17		SS	5				
		(ML) Sandy SILT, some gravel; brown (TILL); non-cohesive, moist, loose		1.07	2B						April 14, 2021
				425.79							
		(SM-GM) SILTY SAND and GRAVEL; brown; non-cohesive, moist, compact		1.45	3		16				
2											
					4A						Screen
				424.64							
		(CL) SILTY CLAY, some gravel, trace sand; brown (TILL); cohesive, w~PL, stiff		2.60	4B		11				
3					5		33				
				423.51							
		(SM/ML) SILT with slight plasticity and SAND, some gravel, trace clay; grey (TILL); cohesive, w<PL, hard		3.73	6		68				
4											
					7		66			MH	
5											
6					8		85/ 0.28				
				420.08							
		(SM) SILTY SAND, some gravel; grey; non-cohesive, wet, dense		7.16							
7											
					9		32				
8											
9				418.10							
		END OF BOREHOLE		9.14							
		NOTES:									
		1. Groundwater measured at 1.2 m below ground surface upon completion of drilling.									
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: EN

CHECKED: MWK

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PROJECT: 21456909

RECORD OF BOREHOLE: BH21-18

SHEET 2 OF 2

LOCATION: N 4843775.60; E 551588.20

BORING DATE: March 29, 2021

DATUM:

DRILL RIG: Geoprobe

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%)
		--- CONTINUED FROM PREVIOUS PAGE ---									GR SA SI CL
10		2. Groundwater measured at 1.05 m below ground surface on April 14, 2021.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: EN

CHECKED: MWK

GTA-BHS 005 S:\CLIENTS\GERANIUM\FERGUS_GOLFNORTH_PROPERTIES\02_DATA\GINT\FERGUS_GOLFNORTH_PROPERTIES.GPJ GAL-MIS.GDT 11/29/21

APPENDIX E

Water Level Measurements

Table E-1: Water Depth and Elevation Data, Proposed Residential Development, Fergus, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Top of Pipe Elevation (masl)	Stick-Up (surveyed)	Screen Interval (masl)		On Completion of Drilling		05-Apr-21		08, 09, 12-Apr-21		14-Apr-21	
						Depth to Groundwater (mbgs)	Groundwater Elevation (masl)	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)	Depth to Groundwater (mbgs)	Groundwater Elevation (masl)
BH21-01	426.33	427.42	1.09	421.76	420.23	1.5	425.92	0.81	425.52	2.36	423.97	1.56	424.77
BH21-02	429.80	-				3.4		-	-	-	-	-	-
BH21-03	434.96	434.91	-0.05	433.13	430.08	2.1	432.78	0.59	434.37	0.73	434.23	0.40	434.56
BH21-04	426.73	-				0.6		-	-	-	-	-	-
BH21-05	428.71	429.99	1.28	427.49	424.44	0.6	429.39	0.91	427.80	1.01	427.71	0.76	427.95
BH21-06	427.33	428.35	1.02	424.63	422.73	0.9	427.45	0.45	426.88	0.57	426.76	0.41	426.92
BH21-07S	428.99	428.90	-0.09	427.47	426.25	3.0	425.90	-	-	0.43	428.57	0.74	428.25
BH21-07D	428.99	428.91	-0.08	421.67	420.15	3.0	425.91	-	-	1.30	427.69	0.53	428.46
BH21-08	427.75	428.86	1.11	426.25	423.15	0.2	428.66	0.06	427.69	0.14	427.61	-0.02	427.77
BH21-09	432.43	433.60	1.17	425.72	424.20	7.3	426.30	1.71	430.72	1.85	430.58	1.57	430.86
BH21-10	433.20	433.03	-0.17	430.15	427.10	3.0	430.03	1.41	431.79	1.05	432.15	0.62	432.58
BH21-11	428.46	429.54	1.08	423.26	422.36	1.5	428.04	1.25	427.21	1.30	427.16	1.07	427.39
BH21-12	431.95	433.11	1.16	428.72	427.55	3.7	429.41	0.42	431.53	0.11	431.84	0.52	431.43
BH21-13	429.07	429.00	-0.07	423.28	421.75	7.4	421.60	1.38	427.69	1.30	427.77	1.31	427.76
BH21-14	431.06	430.96	-0.10	429.54	428.01	1.7	429.26	0.31	430.75	0.29	430.77	0.20	430.86
BH21-15	432.46	432.30	-0.16	429.46	427.86	3.8	428.50	1.35	431.11	0.34	432.12	-	-
BH21-16	429.43	429.35	-0.08	426.13	424.53	0.6	428.75	-	-	0.65	428.78	0.13	429.30
BH21-17	428.92	430.09	1.17	425.62	424.02	2.1	427.96	-0.09	429.02	0.74	428.18	0.46	428.47
BH21-18	427.24	428.41	1.17	426.34	423.24	1.2	427.21	1.29	425.95	1.29	425.95	1.05	426.19
Piezometer ID													
PZ1	428.70	429.69	0.99	-	-	-	-	0.46	428.24	0.43	428.27	0.34	428.36
PZ2	427.34	428.43	1.09	-	-	-	-	0.00	427.34	0.07	427.27	0.04	427.30
PZ3	425.54	426.96	1.42	-	-	-	-	0.21	425.34	0.32	425.22	0.23	425.31
PZ4	427.14	428.38	1.24	-	-	-	-	-0.12	427.26	0.05	427.09	-0.19	427.33
PZ5	427.21	428.32	1.11	-	-	-	-	0.35	426.86	0.43	426.78	0.13	427.09
Staff Gauge ID		**Top of Gauge (masl)**						**Water Depth (m)**	**Stage Elev. (masl)**	**Water Depth (m)**	**Stage Elev. (masl)**	**Water Depth (m)**	**Stage Elev. (masl)**
SG1	428.29	429.30	1.01	-	-	-	-	dry	dry @428.29	Dry	dry @428.29	0.05	428.35
SG2	427.24	428.27	1.03	-	-	-	-	0.04	427.31	0.02	427.29	0.10	427.37
SG3	425.18	426.17	0.99	-	-	-	-	0.09	425.26	Dry	dry @425.18	0.07	425.24
SG4	427.10	428.13	1.03	-	-	-	-	dry	dry @427.10	Dry	dry @427.10	0.07	427.20
SG5	427.23	428.23	1.00	-	-	-	-	dry	dry @427.23	Dry	dry @427.23	dry	dry @427.23

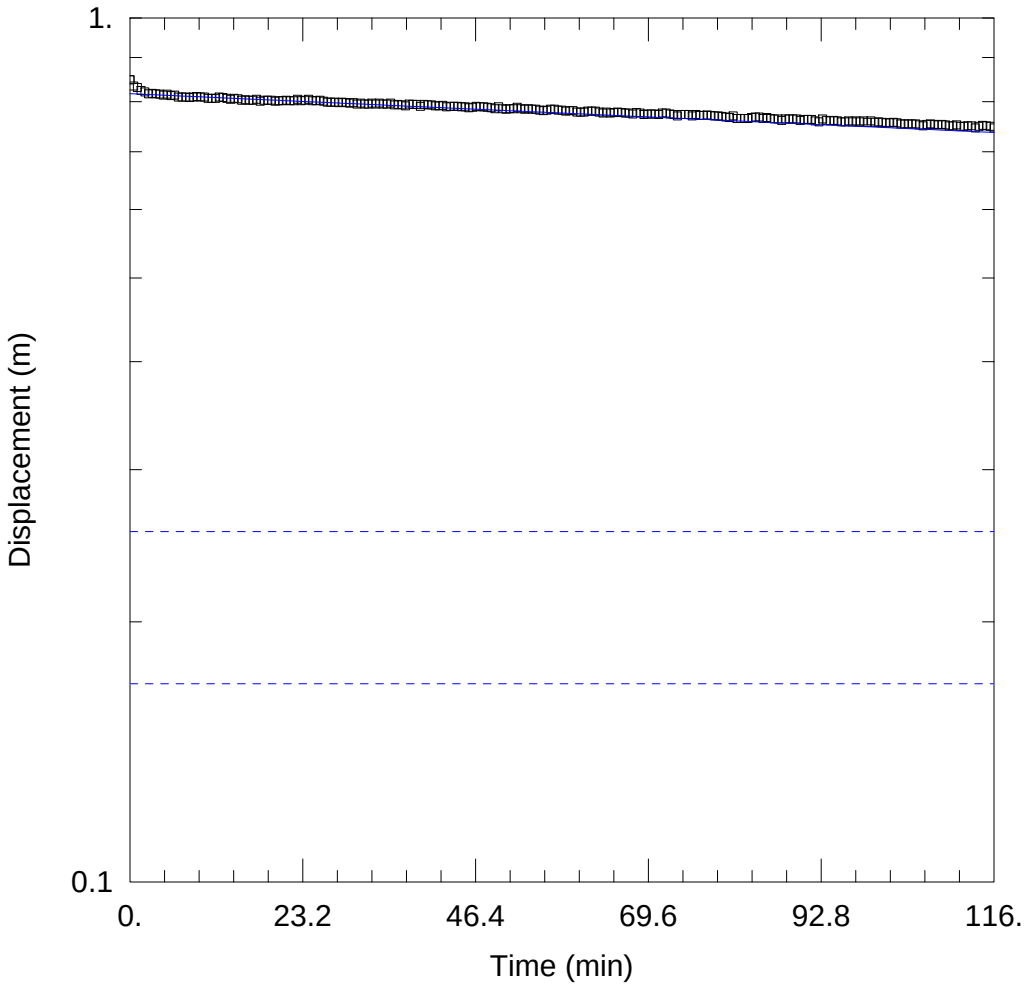
Notes:

-	no data, not installed
mbgs	metres below ground surface
masl	metres above sea level
	borehole only

Survey data provided by Rady-Pentak & Edward, relative to a geodetic datum

APPENDIX F

Hydraulic Conductivity Testing



WELL TEST ANALYSIS

Data Set: C:\...\BH21-01.aqt
Date: 01/18/22 Time: 15:28:01

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-01
Test Date: 9Apr2021

AQUIFER DATA

Saturated Thickness: 3.74 m Anisotropy Ratio (Kz/Kr): 1.

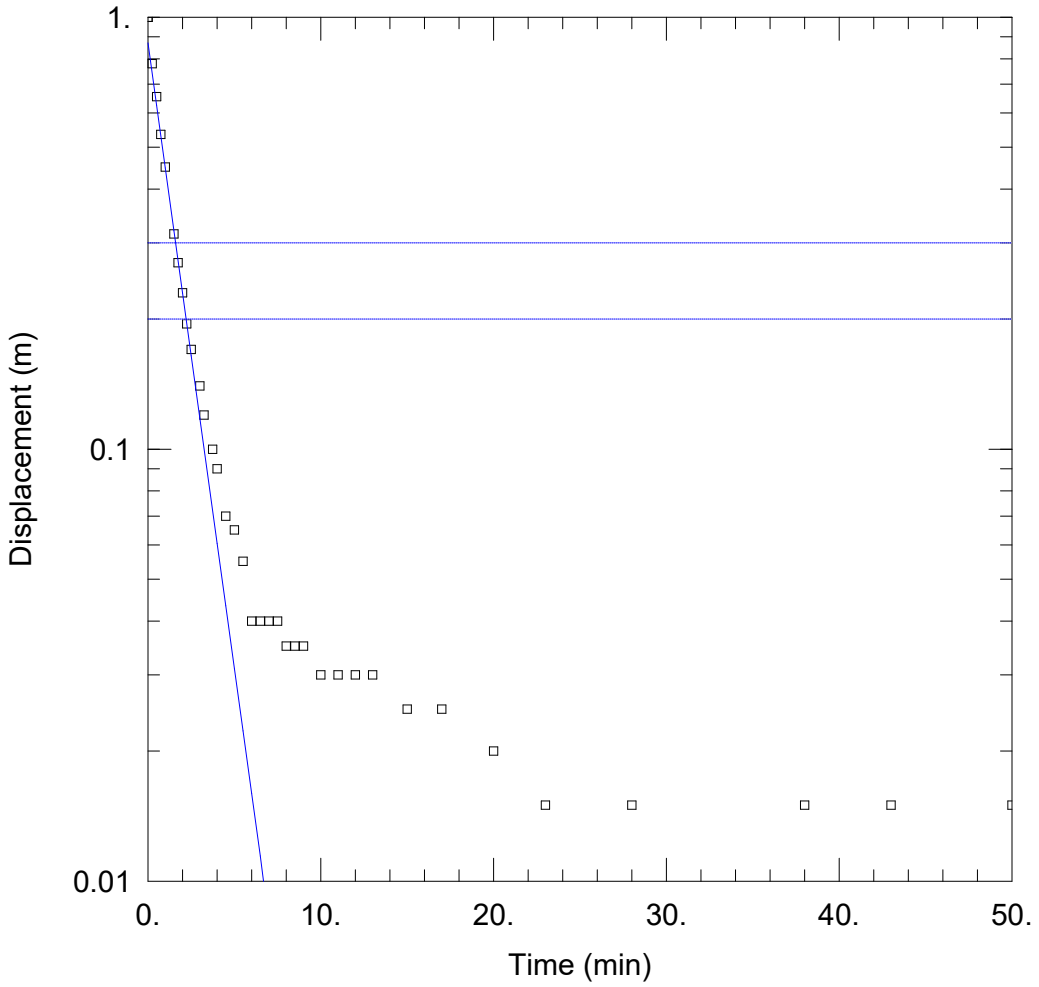
WELL DATA (BH21-01)

Initial Displacement: 0.848 m
Total Well Penetration Depth: 3.74 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.74 m
Screen Length: 1.83 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 8.395E-9 m/sec y0 = 0.8172 m



WELL TEST ANALYSIS

Data Set:
Date: 04/26/21 Time: 15:54:58

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-03
Test Date: 8Apr2021

AQUIFER DATA

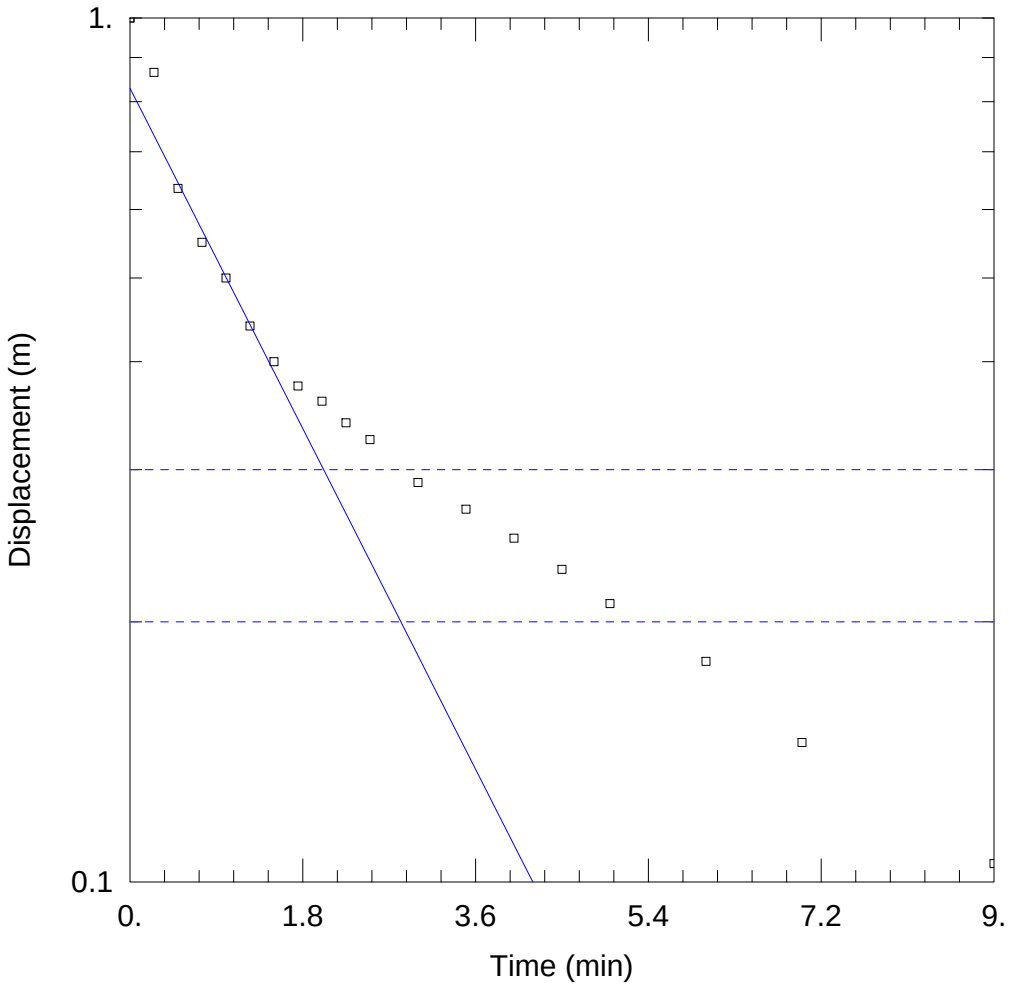
Saturated Thickness: 4.08 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH21-03)

Initial Displacement: 1. m
Total Well Penetration Depth: 4.08 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.08 m
Screen Length: 3.66 m
Well Radius: 0.051 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.269E-6 m/sec
y0 = 0.8716 m



WELL TEST ANALYSIS

Data Set: C:\...\BH21-05.aqt
Date: 01/18/22 Time: 15:36:33

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-05
Test Date: 8Apr2021

AQUIFER DATA

Saturated Thickness: 3.57 m Anisotropy Ratio (Kz/Kr): 1.

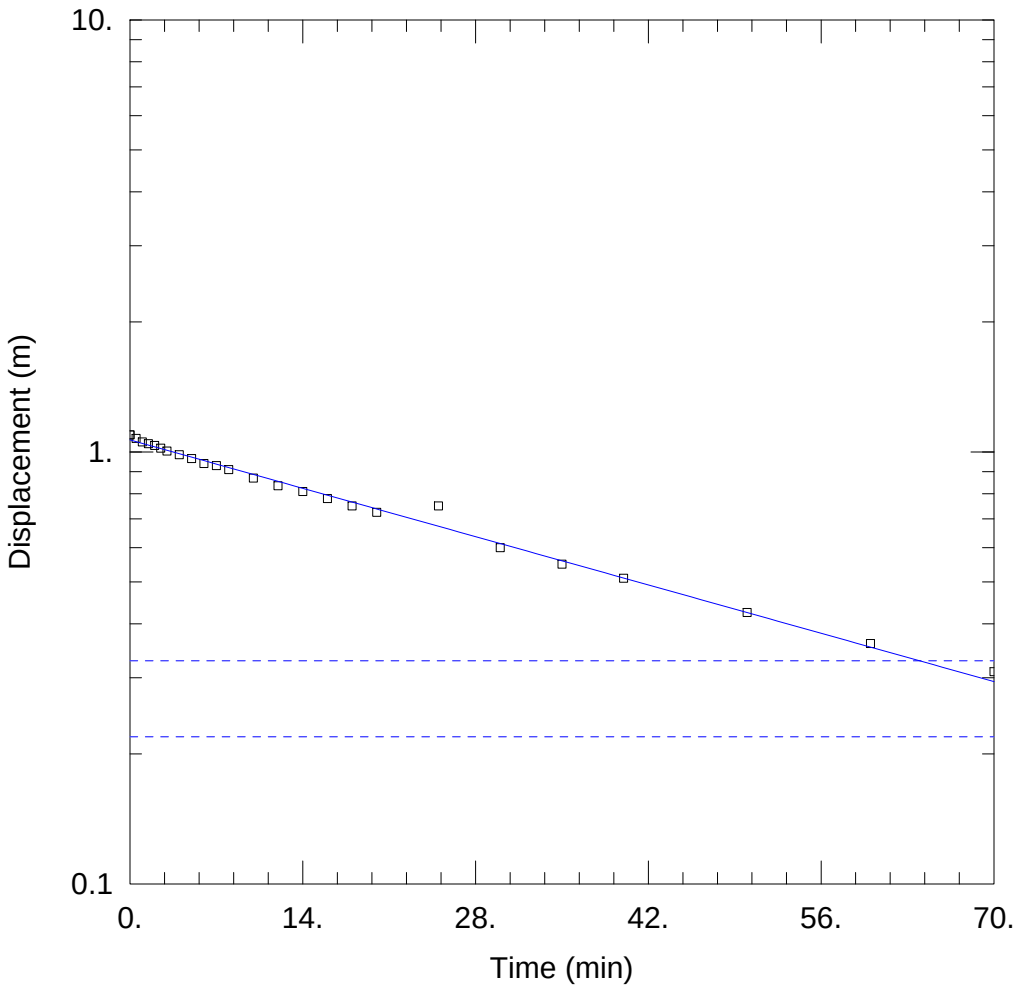
WELL DATA (BH21-05)

Initial Displacement: 1. m
Total Well Penetration Depth: 3.57 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.57 m
Screen Length: 3.57 m
Well Radius: 0.035 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 3.431E-6 m/sec y0 = 0.8293 m



WELL TEST ANALYSIS

Data Set: C:\...\BH21-06.aqt
Date: 01/13/22 Time: 22:26:36

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-06
Test Date: 8Apr2021

AQUIFER DATA

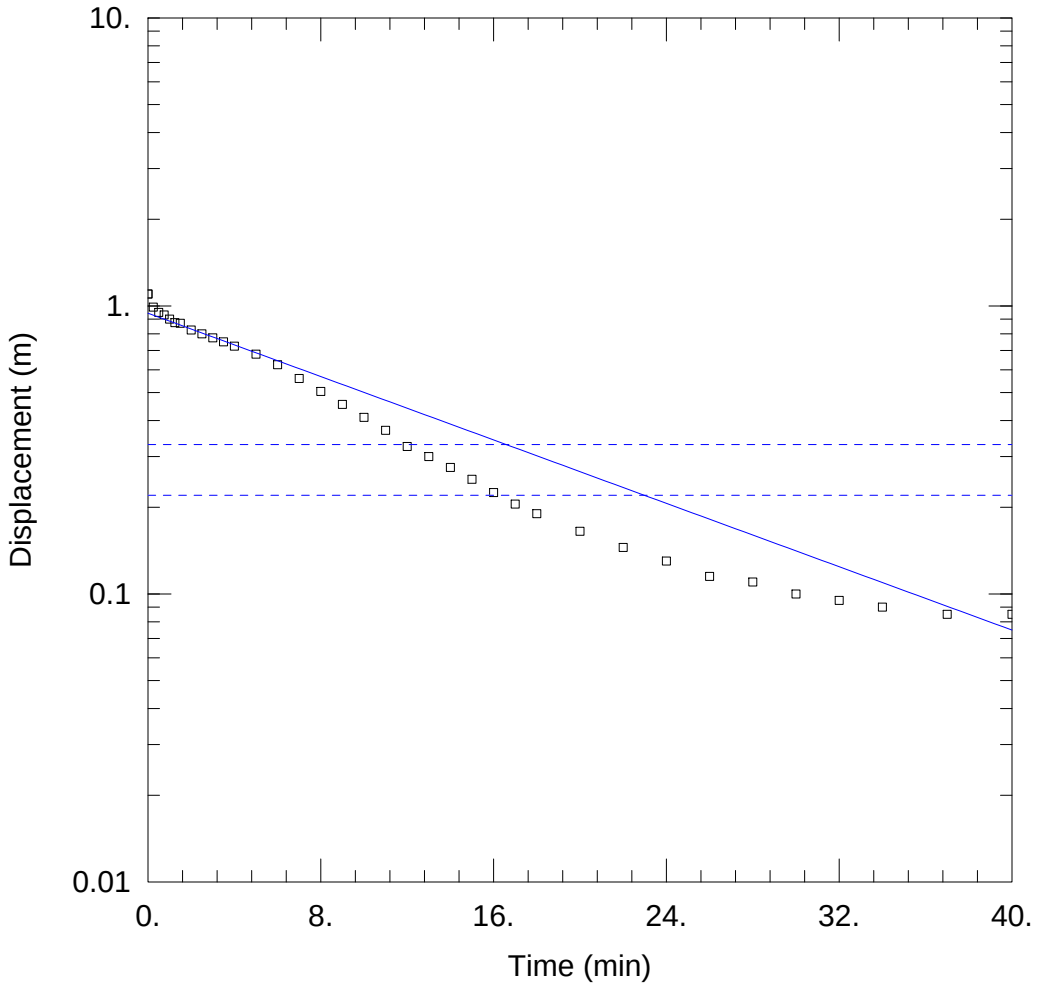
Saturated Thickness: 4.025 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH21-06)

Initial Displacement: 1.095 m
Total Well Penetration Depth: 4.025 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.025 m
Screen Length: 1.9 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.675E-7 m/sec
y0 = 1.066 m



WELL TEST ANALYSIS

Data Set: C:\...\BH21-07.aqt
Date: 01/18/22 Time: 15:35:10

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-07
Test Date: 8Apr2021

AQUIFER DATA

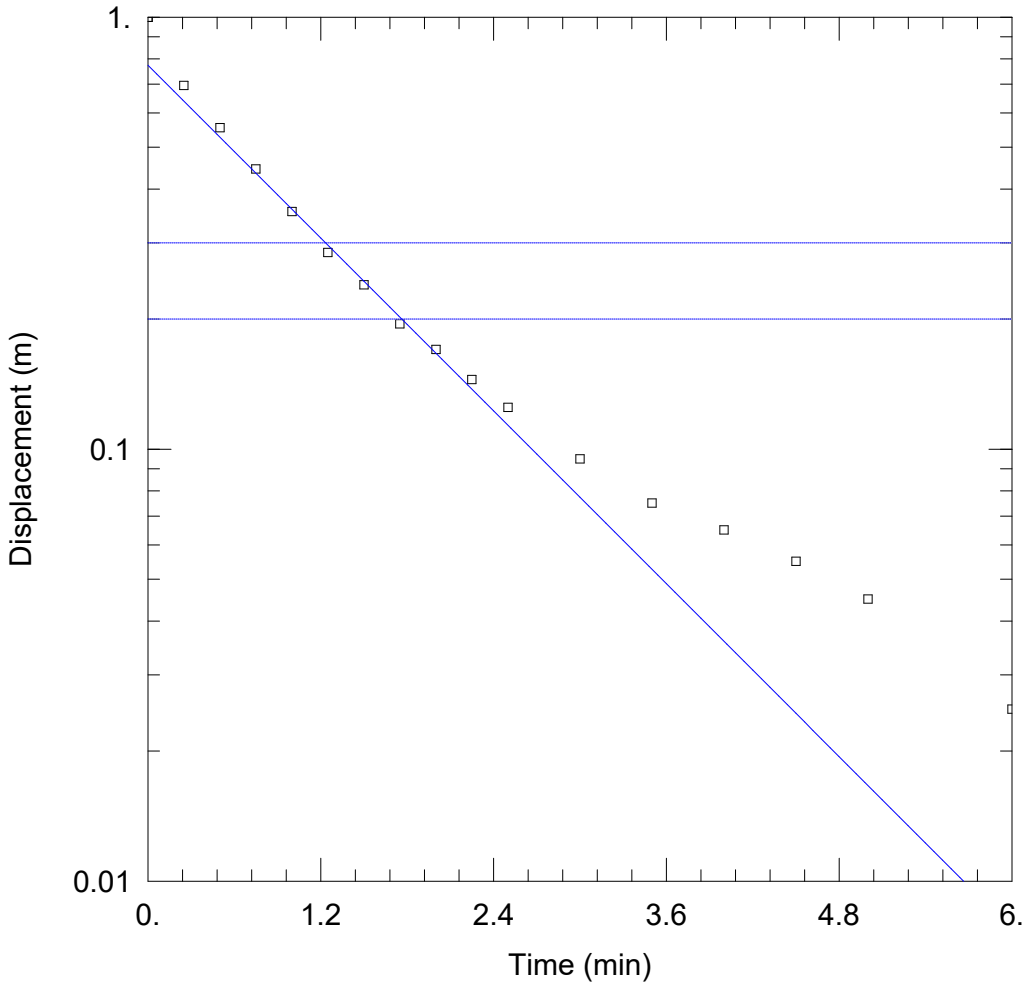
Saturated Thickness: 2.315 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH21-07S)

Initial Displacement: 1.1 m
Total Well Penetration Depth: 2.315 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.315 m
Screen Length: 1.83 m
Well Radius: 0.0351 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 5.913E-7 m/sec
y0 = 0.9436 m



WELL TEST ANALYSIS

Data Set: C:\Users\CElliott\OneDrive - Golder Associates\Desktop\BH21-08.aqt
Date: 04/26/21 Time: 17:07:00

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-08
Test Date: 8Apr2021

AQUIFER DATA

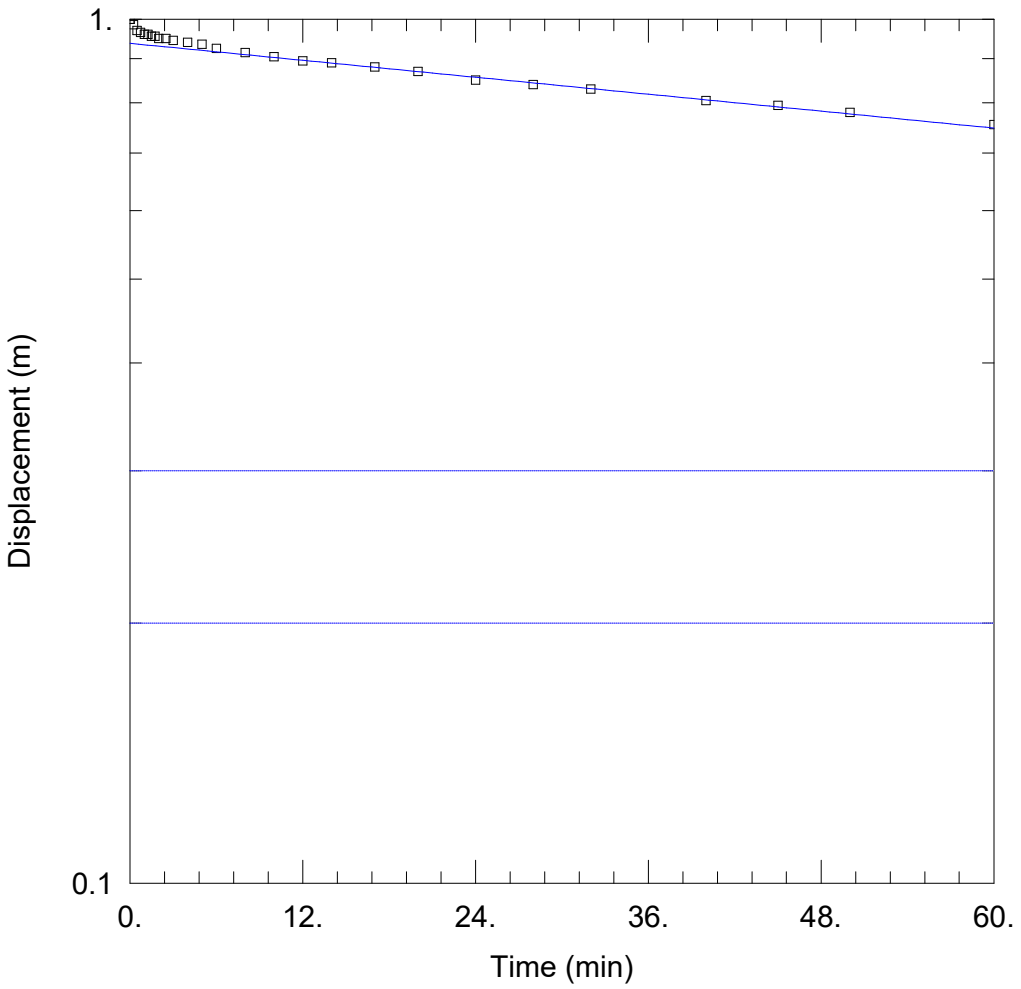
Saturated Thickness: 4.455 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH21-08)

Initial Displacement: 1. m
Total Well Penetration Depth: 4.455 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.455 m
Screen Length: 3.7 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 3.803E-6 m/sec
y0 = 0.7743 m



WELL TEST ANALYSIS

Data Set: C:\...\BH21-10.aqt
Date: 04/28/21 Time: 16:49:14

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-10
Test Date: 09Apr2021

AQUIFER DATA

Saturated Thickness: 5.05 m Anisotropy Ratio (Kz/Kr): 1.

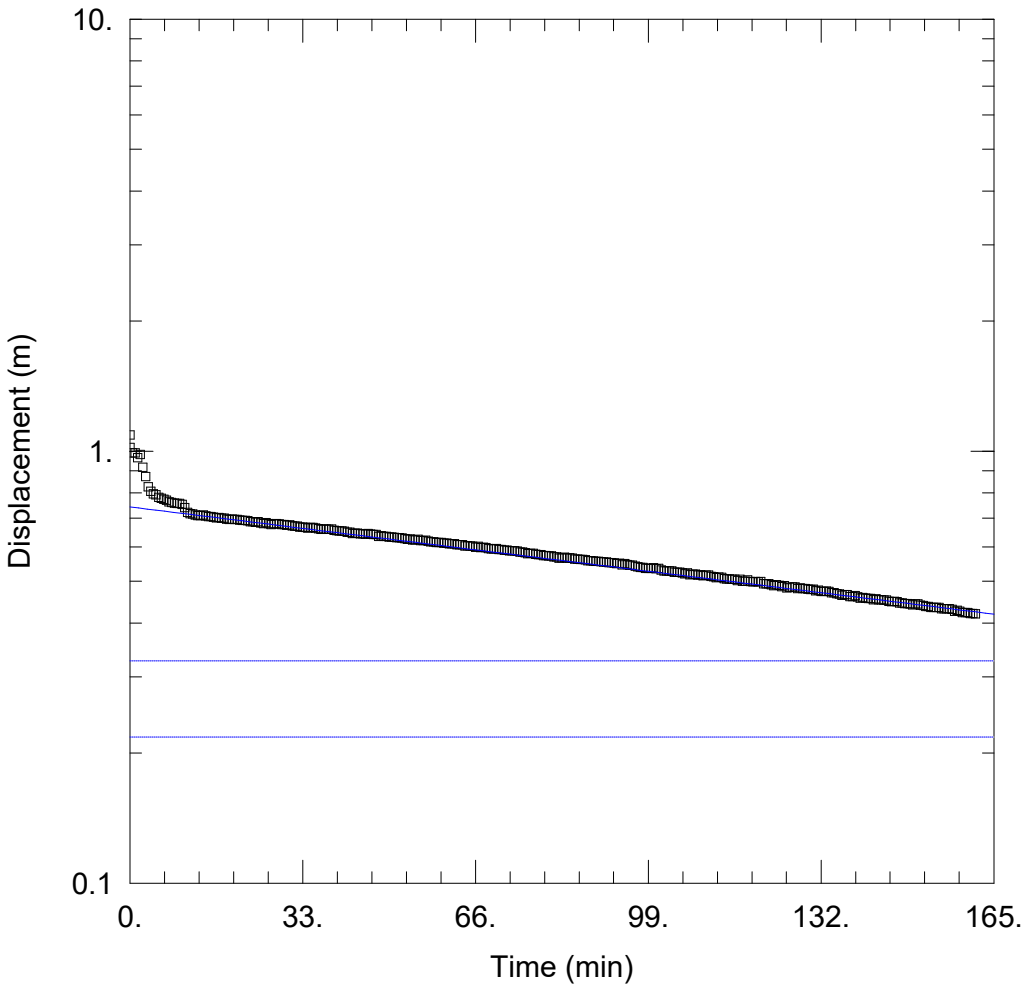
WELL DATA (BH21-10)

Initial Displacement: 1. m
Total Well Penetration Depth: 5.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.05 m
Screen Length: 3.4 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 2.069E-8 m/sec
y0 = 0.9375 m



WELL TEST ANALYSIS

Data Set: C:\Users\CElliott\OneDrive - Golder Associates\Desktop\BH21-16.aqt
Date: 04/27/21 Time: 08:18:33

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-16
Test Date: 9Apr2021

AQUIFER DATA

Saturated Thickness: 2.12 m Anisotropy Ratio (Kz/Kr): 1.

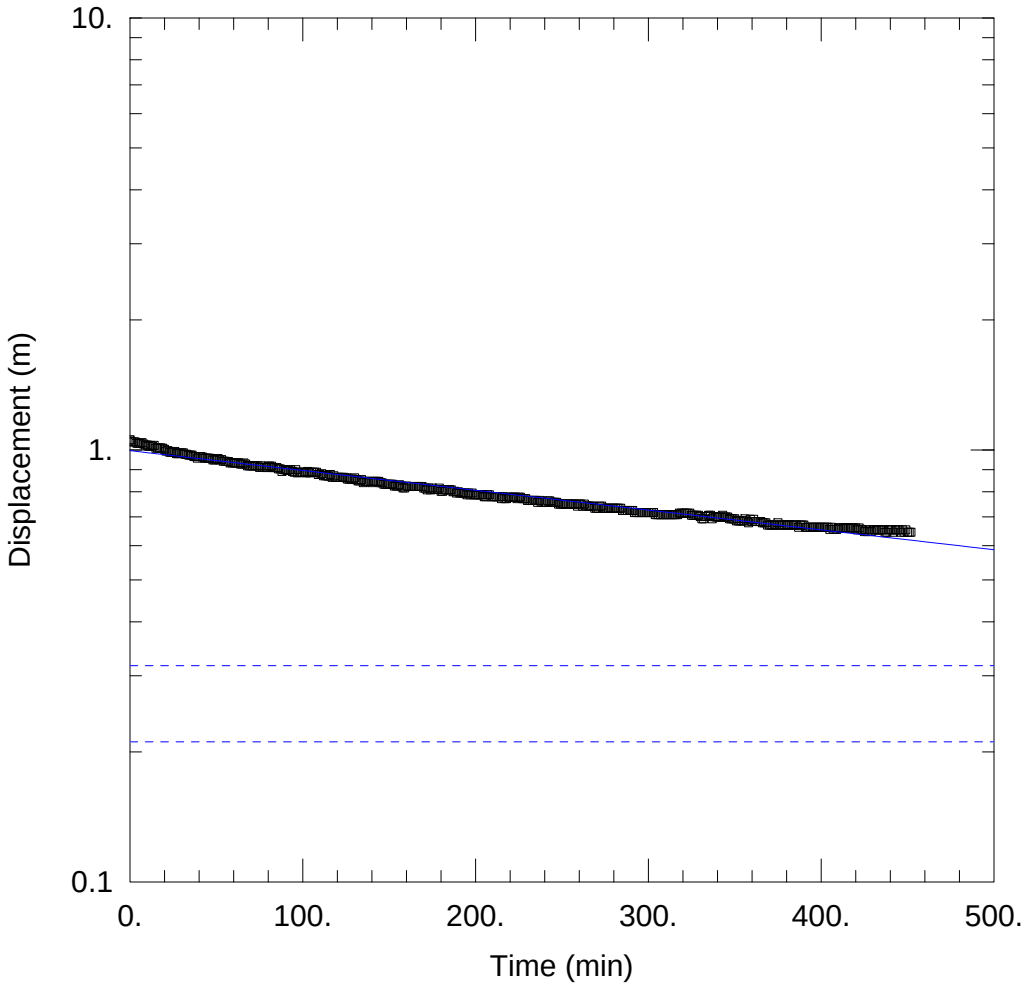
WELL DATA (BH21-16)

Initial Displacement: 1.09 m
Total Well Penetration Depth: 1.87 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.12 m
Screen Length: 1.6 m
Well Radius: 0.051 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 5.485E-8 m/sec y0 = 0.7427 m



WELL TEST ANALYSIS

Data Set: C:\...\BH21-17.aqt
Date: 01/13/22 Time: 22:49:57

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-17
Test Date: 14Apr2021

AQUIFER DATA

Saturated Thickness: 4.445 m Anisotropy Ratio (Kz/Kr): 1.

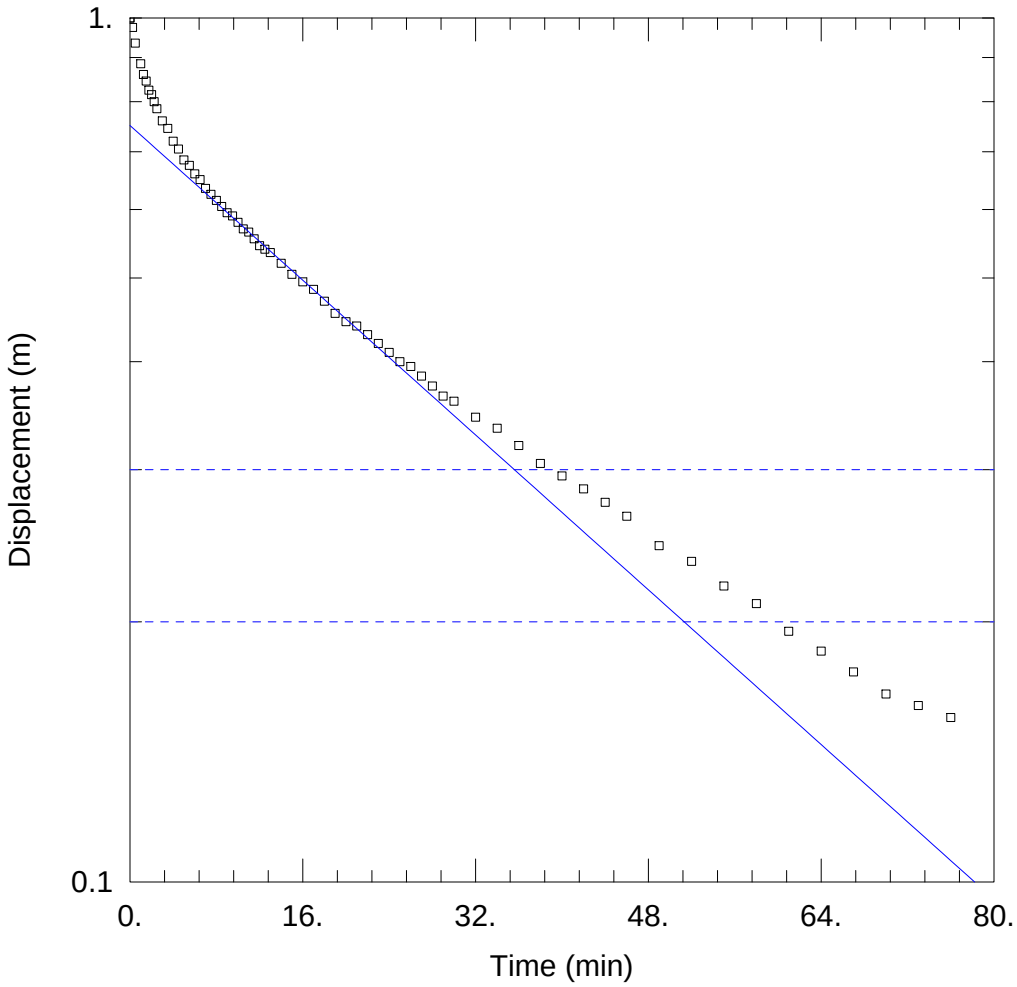
WELL DATA (BH21-17)

Initial Displacement: 1.055 m
Total Well Penetration Depth: 4.445 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.445 m
Screen Length: 1.85 m
Well Radius: 0.051 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.002E-8 m/sec y0 = 0.996 m



WELL TEST ANALYSIS

Data Set: C:\...\BH21-18.aqt
Date: 01/18/22 Time: 15:30:59

PROJECT INFORMATION

Company: Golder Associates
Client: Fergus Golf Course
Project: 21456909
Test Well: BH21-18
Test Date: 8Apr2021

AQUIFER DATA

Saturated Thickness: 2.705 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH21-18)

Initial Displacement: 1. m
Total Well Penetration Depth: 2.705 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.705 m
Screen Length: 2.705 m
Well Radius: 0.035 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.172E-7 m/sec y0 = 0.7508 m

APPENDIX G

Water Balance Results

Table G-1: Environment Canada Precipitation, Surplus Data Fergus Shand Dam, Ontario

Fergus Shand Dam Water Budget Means for the period 1965-2020 6142400

Water Holding Capacity	75	mm
Heat Index	34.84	
Lower Zone	45	mm
A	1.052	
Date Range	1965	2020

Date	Temperature	Precipitation	Rain	Melt	Potential Evaporation	Actual Evapotranspiration	Deficit	Surplus	Snow	Soil	Accumulated Precipiation
	(oC)	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
January	-7.6	75	21	19	1	1	0	39	69	75	325
February	-7.1	60	18	25	1	1	0	42	85	75	384
March	-2.2	66	38	71	7	7	0	102	43	75	450
April	5.2	80	73	50	30	30	0	92	0	75	531
May	12.2	82	82	0	76	76	0	19	0	62	613
June	17.4	93	93	0	110	103	-7	11	0	41	707
July	19.9	82	82	0	128	104	-24	2	0	18	789
August	19	89	89	0	114	88	-26	4	0	15	879
September	15	88	88	0	77	67	-10	7	0	28	966
October	8.3	85	85	0	38	37	-1	20	0	56	84
November	2	87	75	8	12	12	0	54	4	72	170
December	-4.2	79	32	16	2	2	0	44	34	75	248
AVE	6.4										
TTL		966	776	189	596	528	-68	436			

Table G-1: Environment Canada Precipitation, Surplus Data Fergus Shand Dam, Ontario

Fergus Shand Dam Water Budget Means for the period 1965-2020 6142400

Water Holding Capacity	100	mm
Heat Index	34.84	
Lower Zone	60	mm
A	1.052	
Date Range	1965	2020

Date	Temperature	Precipitation	Rain	Melt	Potential Evaporation	Actual Evapotranspiration	Deficit	Surplus	Snow	Soil	Accumulated Precipiation
	(oC)	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
January	-7.6	75	21	19	1	1	0	38	69	100	325
February	-7.1	60	18	25	1	1	0	42	85	100	384
March	-2.2	66	38	71	7	7	0	101	43	100	450
April	5.2	80	73	50	30	30	0	92	0	100	531
May	12.2	82	82	0	76	76	0	19	0	87	613
June	17.4	93	93	0	110	107	-3	11	0	63	707
July	19.9	82	82	0	128	113	-15	2	0	30	789
August	19	89	89	0	114	91	-22	4	0	24	879
September	15	88	88	0	77	68	-9	7	0	37	966
October	8.3	85	85	0	38	37	-1	16	0	69	84
November	2	87	75	8	12	12	0	46	4	94	170
December	-4.2	79	32	16	2	2	0	41	34	99	248
AVE	6.4										
TTL		966	776	189	596	545	-50	419			

Table G-1: Environment Canada Precipitation, Surplus Data Fergus Shand Dam, Ontario

Fergus Shand Dam Water Budget Means for the period 1965-2020 6142400

Water Holding Capacity	125	mm
Heat Index	34.84	
Lower Zone	75	mm
A	1.052	
Date Range	1965	2020

Date	Temperature	Precipitation	Rain	Melt	Potential Evaporation	Actual Evapotranspiration	Deficit	Surplus	Snow	Soil	Accumulated Precipiation
	(oC)	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
January	-7.6	75	21	19	1	1	0	36	69	124	325
February	-7.1	60	18	25	1	1	0	42	85	125	384
March	-2.2	66	38	71	7	7	0	101	43	125	450
April	5.2	80	73	50	30	30	0	92	0	125	531
May	12.2	82	82	0	76	76	0	19	0	112	613
June	17.4	93	93	0	110	109	-1	11	0	85	707
July	19.9	82	82	0	128	119	-10	2	0	47	789
August	19	89	89	0	114	96	-18	4	0	36	879
September	15	88	88	0	77	69	-8	7	0	49	966
October	8.3	85	85	0	38	37	-1	13	0	83	84
November	2	87	75	8	12	12	0	38	4	116	170
December	-4.2	79	32	16	2	2	0	40	34	122	248
AVE	6.4										
TTL		966	776	189	596	559	-38	405			

Table G-1: Environment Canada Precipitation, Surplus Data Fergus Shand Dam, Ontario

Fergus Shand Dam Water Budget Means for the period 1965-2020 6142400

Water Holding Capacity	150	mm
Heat Index	34.84	
Lower Zone	90	mm
A	1.052	
Date Range	1965	2020

Date	Temperature	Precipitation	Rain	Melt	Potential Evaporation	Actual Evapotranspiration	Deficit	Surplus	Snow	Soil	Accumulated Precipiation
	(oC)	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
January	-7.6	75	21	19	1	1	0	35	69	148	325
February	-7.1	60	18	25	1	1	0	42	85	149	384
March	-2.2	66	38	71	7	7	0	101	43	150	450
April	5.2	80	73	50	30	30	0	92	0	150	531
May	12.2	82	82	0	76	76	0	19	0	137	613
June	17.4	93	93	0	110	110	0	11	0	109	707
July	19.9	82	82	0	128	122	-6	2	0	67	789
August	19	89	89	0	114	100	-13	4	0	53	879
September	15	88	88	0	77	70	-7	7	0	64	966
October	8.3	85	85	0	38	37	-1	12	0	99	84
November	2	87	75	8	12	12	0	34	4	136	170
December	-4.2	79	32	16	2	2	0	37	34	145	248
AVE	6.4										
TTL		966	776	189	596	568	-27	396			

Table G-1: Environment Canada Precipitation, Surplus Data Fergus Shand Dam, Ontario

Fergus Shand Dam Water Budget Means for the period 1965-2020 6142400

Water Holding Capacity	250	mm
Heat Index	34.84	
Lower Zone	150	mm
A	1.052	
Date Range	1965	2020

Date	Temperature	Precipitation	Rain	Melt	Potential Evaporation	Actual Evapotranspiration	Deficit	Surplus	Snow	Soil	Accumulated Precipiation
	(oC)	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
January	-7.6	75	21	19	1	1	0	29	69	243	325
February	-7.1	60	18	25	1	1	0	40	85	246	384
March	-2.2	66	38	71	7	7	0	99	43	248	450
April	5.2	80	73	50	30	30	0	90	0	250	531
May	12.2	82	82	0	76	76	0	19	0	237	613
June	17.4	93	93	0	110	110	0	11	0	209	707
July	19.9	82	82	0	128	127	-1	2	0	162	789
August	19	89	89	0	114	110	-4	4	0	138	879
September	15	88	88	0	77	73	-4	7	0	146	966
October	8.3	85	85	0	38	38	0	11	0	182	84
November	2	87	75	8	12	12	0	31	4	222	170
December	-4.2	79	32	16	2	2	0	33	34	235	248
AVE	6.4										
TTL		966	776	189	596	587	-9	376			

Table G-1: Environment Canada Precipitation, Surplus Data Fergus Shand Dam, Ontario

Fergus Shand Dam Water Budget Means for the period 1965-2020 6142400

Water Holding Capacity	300	mm
Heat Index	34.84	
Lower Zone	180	mm
A	1.052	
Date Range	1965	2020

Date	Temperature	Precipitation	Rain	Melt	Potential Evaporation	Actual Evapotranspiration	Deficit	Surplus	Snow	Soil	Accumulated Precipiation
	(oC)	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
January	-7.6	75	21	19	1	1	0	28	69	292	325
February	-7.1	60	18	25	1	1	0	40	85	295	384
March	-2.2	66	38	71	7	7	0	99	43	297	450
April	5.2	80	73	50	30	30	0	90	0	300	531
May	12.2	82	82	0	76	76	0	19	0	287	613
June	17.4	93	93	0	110	110	0	11	0	259	707
July	19.9	82	82	0	128	128	0	2	0	212	789
August	19	89	89	0	114	111	-2	4	0	186	879
September	15	88	88	0	77	74	-3	7	0	192	966
October	8.3	85	85	0	38	38	0	11	0	228	84
November	2	87	75	8	12	12	0	31	4	269	170
December	-4.2	79	32	16	2	2	0	33	34	282	248
AVE	6.4										
TTL		966	776	189	596	590	-5	375			

Table G-1: Environment Canada Precipitation, Surplus Data Fergus Shand Dam, Ontario

Fergus Shand Dam Water Budget Means for the period 1965-2020 6142400

Water Holding Capacity	400	mm
Heat Index	34.84	
Lower Zone	240	mm
A	1.052	
Date Range	1965	2020

Date	Temperature	Precipitation	Rain	Melt	Potential Evaporation	Actual Evapotranspiration	Deficit	Surplus	Snow	Soil	Accumulated Precipiation
	(oC)	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
January	-7.6	75	21	19	1	1	0	27	69	390	325
February	-7.1	60	18	25	1	1	0	39	85	393	384
March	-2.2	66	38	71	7	7	0	98	43	396	450
April	5.2	80	73	50	30	30	0	89	0	400	531
May	12.2	82	82	0	76	76	0	19	0	387	613
June	17.4	93	93	0	110	110	0	11	0	359	707
July	19.9	82	82	0	128	128	0	2	0	311	789
August	19	89	89	0	114	113	-1	4	0	284	879
September	15	88	88	0	77	76	-1	7	0	289	966
October	8.3	85	85	0	38	38	0	11	0	325	84
November	2	87	75	8	12	12	0	30	4	365	170
December	-4.2	79	32	16	2	2	0	32	34	380	248
AVE	6.4										
TTL		966	776	189	596	594	-2	369			

Table G-2: Estimated Infiltration Factors and Annual Infiltration Rates

Land Use		Water Holding Capacity (mm)	Infiltration Factor	Precipitation (mm)	Evapotranpiration (mm)	Surplus (mm)	Runoff (mm)	Infiltration (mm)
Forested Area	Sand Loam	300	0.75	966	590	375	94	281
	Silt Loam	400	0.60	966	594	369	148	221
	Clay Loam	400	0.50	966	594	369	185	185
Undeveloped Area (Pasture and Shrubs)	Sand Loam	150	0.65	966	568	396	139	257
	Silt Loam	250	0.50	966	587	376	188	188
	Clay Loam	250	0.40	966	587	376	226	150
Golf Lawns, Residential Lawns and Landscaping (Urban Lawn)	Sand Loam	75	0.65	966	528	436	153	283
	Silt Loam	125	0.50	966	559	405	203	203
	Clay Loam	100	0.40	966	545	419	251	168
Wetland, Ponds, and SWM Ponds		Precip - PET	0.00	966	596	370	370	0
Impervious Areas		90% Precip	0.00	966	97	869	869	0

Table G-3: Pre-development Scenario Water Balance Results

Catchment	Area (m^2)	Precipitation (mm/yr) (m^3/yr)	Evapo-transpiration (mm/yr) (m^3/yr)	Surplus (mm/yr) (m^3/yr)	Infiltration (mm/yr) (m^3/yr)	Runoff (mm/yr) (m^3/yr)
Forested Area - Sand Loam	40,509	(966)	(590)	(375)	(281)	(94)
		39,130	23,900	15,190	11,390	3,800
Forested Area - Silt Loam	69,151	(966)	(594)	(369)	(221)	(148)
		66,800	41,080	25,520	15,310	10,210
Forested Area - Clay Loam	632	(966)	(594)	(369)	(185)	(185)
		610	380	240	120	120
Undeveloped Area - Sand Loam	56,551	(966)	(568)	(396)	(257)	(139)
		54,630	32,120	22,400	14,560	7,840
Undeveloped Area - Silt Loam	42,566	(966)	(587)	(376)	(188)	(188)
		41,120	24,990	16,010	8,000	8,000
Undeveloped Area - Clay Loam	18,518	(966)	(587)	(376)	(150)	(226)
		17,890	10,870	6,960	2,780	4,180
Lawn - Sand Loam	70,345	(966)	(528)	(436)	(283)	(153)
		67,950	37,140	30,670	19,940	10,730
Lawn - Silt Loam	74,306	(966)	(559)	(405)	(203)	(203)
		71,780	41,540	30,090	15,050	15,050
Ponds	1,847	(966)	(596)	(370)	(0)	(370)
		1,790	1,100	680	0	680
Wetland	22,342	(966)	(596)	(370)	(0)	(370)
		21,580	13,320	8,270	0	8,270
Fairview Golf & Country Club Clubhouse / Golf Sheds / Storage	508	(966)	(97)	(869)	(0)	(869)
		490	50	440	0	440
Entrance Roadways	1,224	(966)	(97)	(869)	(0)	(869)
		1,180	120	1,060	0	1,060
Total	**398,500**	**384,950**	**226,610**	**157,530**	**87,150**	**70,380**

Table G-4: Proposed Development Scenario Water Balance Results - Without Mitigation

Catchment	Area (m^2)	Precipitation (mm/yr) (m^3/yr)	Evapo-transpiration (mm/yr) (m^3/yr)	Surplus (mm/yr) (m^3/yr)	Infiltration (mm/yr) (m^3/yr)	Runoff (mm/yr) (m^3/yr)
Residential Lawns - Sand Loam	123,533	(966)	(528)	(436)	(283)	(153)
		119,330	65,230	53,860	35,010	18,850
Residential Lawns - Clay Loam	14,462	(966)	(545)	(419)	(168)	(251)
		13,970	7,880	6,060	2,420	3,630
Residential Lawns - Silt Loam	83,065	(966)	(559)	(405)	(203)	(203)
		80,240	46,430	33,640	16,820	16,820
Open Space / Landscaping - Silt Loam	28,932	(966)	(559)	(405)	(203)	(203)
		27,950	16,170	11,720	5,860	5,860
Landscape Strip - Clay Loam	800	(966)	(545)	(419)	(168)	(251)
		770	440	330	140	200
Landscape Strip - Silt Loam	3,400	(966)	(559)	(405)	(203)	(203)
		3,280	1,900	1,380	690	690
Landscape Strip - Sand Loam	2,800	(966)	(528)	(436)	(283)	(153)
		2,710	1,480	1,220	790	430
Wetland	34,568	(966)	(596)	(370)	(0)	(370)
		33,390	20,600	12,790	0	12,790
SWM Pond	12,700	(966)	(596)	(370)	(0)	(370)
		12,270	7,570	4,700	0	4,700
House - Roof	40,710	(966)	(97)	(869)	(0)	(869)
		39,330	3,930	35,390	0	35,390
House - Driveway	10,030	(966)	(97)	(869)	(0)	(869)
		9,690	970	8,720	0	8,720
Roads, Sidewalks & Paths	43,100	(966)	(97)	(869)	(0)	(869)
		41,630	4,160	37,470	0	37,470
Sanitary Pumping Station	400	(966)	(97)	(869)	(0)	(869)
		390	40	350	0	350
Total	**398,500**	**384,950**	**176,800**	**207,630**	**61,730**	**145,900**

Table G-5: Proposed Development Scenario Water Balance Results - With Mitigation

Catchment	Area (m^2)	Precipitation (mm/yr) (m^3/yr)	Evapo-transpiration (mm/yr) (m^3/yr)	Surplus (mm/yr) (m^3/yr)	Infiltration (mm/yr) (m^3/yr)	Runoff (mm/yr) (m^3/yr)
Residential Lawns - Sand Loam	123,533	(966)	(528)	(436)	(283)	(153)
		119,330	65,230	53,860	35,010	18,850
Residential Lawns - Clay Loam	14,462	(966)	(545)	(419)	(168)	(251)
		13,970	7,880	6,060	2,420	3,630
Residential Lawns - Silt Loam	83,065	(966)	(559)	(405)	(203)	(203)
		80,240	46,430	33,640	16,820	16,820
Open Space / Landscaping - Silt Loam	28,932	(966)	(559)	(405)	(203)	(203)
		27,950	16,170	11,720	5,860	5,860
Landscape Strip - Clay Loam	800	(966)	(545)	(419)	(168)	(251)
		770	440	330	140	200
Landscape Strip - Silt Loam	3,400	(966)	(559)	(405)	(203)	(203)
		3,280	1,900	1,380	690	690
Landscape Strip - Sand Loam	2,800	(966)	(528)	(436)	(283)	(153)
		2,710	1,480	1,220	790	430
Wetland	34,568	(966)	(596)	(370)	(0)	(370)
		33,390	20,600	12,790	0	12,790
SWM Pond	12,700	(966)	(596)	(370)	(0)	(370)
		12,270	7,570	4,700	0	4,700
House - Roof (to Downspout Disconnect) - Sand Loam	20,355	(966)	(97)	(869)	(435)	(435)
		19,660	1,960	17,690	8,850	8,850
House - Roof (to Downspout Disconnect) - Silt Loam	18,285	(966)	(97)	(869)	(217)	(652)
		17,670	1,770	15,900	3,970	11,920
House - Roof (to Downspout Disconnect) - Clay Loam	2,070	(966)	(97)	(869)	(217)	(652)
		2,000	200	1,800	450	1,350
House - Driveway	10,030	(966)	(97)	(869)	(0)	(869)
		9,690	970	8,720	0	8,720
Roads, Sidewalks & Paths	43,100	(966)	(97)	(869)	(0)	(869)
		41,630	4,160	37,470	0	37,470
Sanitary Pumping Station	400	(966)	(97)	(869)	(0)	(869)
		390	40	350	0	350
Total	**398,500**	**384,950**	**176,800**	**207,630**	**75,000**	**132,630**

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