REPORT

Safarik Pit

Level One and Two Water Report

Submitted to:

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1.0 INTRODUCTION

1.1 Background

The proposed Safarik Pit property is located at 4275 7th Concession in the Township of Puslinch, Wellington County, Ontario (the Site), as shown in the Location Map, **Figure 1**. The Site is ±28 hectares (ha) in size and is located to the east/southeast of the existing CBM Neubauer and McNally Pits. The proposed limits of extraction are shown on **Figure 2**. The Site is bisected by an overhead 230 kV electrical transmission corridor with access to the eastern portion of the Site permitted below the power lines.

The proposed pit will operate above and below the natural groundwater table. Extraction below the natural water table will occur by dragline, and, therefore, dewatering will not be required. CBM is required to obtain a Class A Licence (Pit Below Water) for the Site under the Aggregate Resources Act (ARA).

WSP Canada Inc. (WSP) was retained by CBM to prepare this Level 1 and 2 Water Report to meet study requirements for the proposed pit licence application.

1.2 Evaluation Requirements

The purpose of this Level 1 and 2 Water Report is to identify potential impacts of the proposed below-water pit on local groundwater and surface water resources. This study has been undertaken to satisfy the requirements of the ARA and the County of Wellington Official Plan (OP). This study also considers the Provincial Planning Statement (2024) under Section 3 of the Planning Act, the Clean Water Act (2006) and the Drinking Water Source Protection Plan. The legislation and policies related to pit development within the context of water resources are summarized in the following sections.

1.2.1 Aggregates Resources Act

In the Aggregate Resources of Ontario Provincial Standards (Ministry of Natural Resources and Forestry (MNRF), August 2020), Part 2.5 outlines the following requirements for a Water Report to meet the study requirements for a Class A pit below groundwater:

> *Water Report Level 1:*
> *Determine the potential for impacts to ground water and surface water resources and their uses (e.g. water wells, ground water aquifers, surface water courses and bodies, springs, discharge areas) and identify if the proposed site is in a Wellhead Protection Area for Quantity (WHPA-Q) set out in an applicable source water protection plan under the Clean Water Act. If so, identify applicable source water protection policies and mitigation measures that will be implemented at the site.*
> *Water Report Level 2:*
> *Where the results of Level 1 have identified a potential for impacts from the aggregate site on ground water and/or surface water resources and their uses, an impact assessment is required. The assessment is to determine the significance of the effect and the potential for mitigation.*
>
> *The assessment must address the potential effects of the operation on any ground water and surface water features located within the zone of influence, including but not limited to:*
>
> *a) water wells (includes all types e.g. municipal, private, industrial, commercial, geothermal and agricultural)*
> *b) springs (e.g., place where ground water flows out of the ground)*
> *c) ground water aquifers;*
> *d) surface water courses and bodies (e.g., lakes, rivers, brooks)*
> *e) wetlands*

> *The assessment must include but not be limited to the following:*
>
> *f) a description of the physical setting including local geology, hydrogeology, and surface water systems;*
> *g) proposed water diversion, discharge, storage and drainage facilities;*
> *h) water budget (e.g. how water is managed on-site);*
> *i) the possible positive or negative impacts that the proposed site may have on the water regime;*
>
> *The Level 2 water report must also contain:*
>
> *j) monitoring plan(s); and*
> *k) technical support data in the form of tables, graphs and figures, usually appended to the report.*

This report addresses the Level 1 and Level 2 Water Report requirements for the proposed pit.

1.2.2 County of Wellington Official Plan

The majority of the Site is classified as Secondary Agricultural land in the County of Wellington Official Plan (1999, last amended June 2022), which permits the proposed activities at the Site. Regarding land classified as Secondary Agricultural, Policy 6.5.5 states:

> *6.5.5 Wayside Pits, Portable Asphalt Plants and Portable Concrete Plants Wayside pits and quarries, portable concrete plants and portable asphalt plants used on public authority contracts are allowed by provincial policy without the need for official plan amendment, rezoning or development permit in all areas, except those areas of existing development or particular environmental sensitivity which have been determined to be incompatible with extraction and associated activities.*

The wooded area along the eastern end of the Site is mapped as ‘Greenlands’ in the OP and four small areas of the Site are mapped as Core Greenlands. The Core Greenlands areas correspond with the mapped wetlands shown on **Figure 3**, which are not designated as Provincially Significant Wetlands. Policy 5.6.1 of the OP states:

> *5.6.1 Within the Core Greenlands designation, development and site alteration shall not be permitted within Provincially Significant Wetlands or in significant habitat of threatened or endangered species, except in accordance with provincial and federal requirements.*
>
> *In other Core Greenlands areas, and in Greenlands areas, permitted uses and activities may include:*
>
> *a) agriculture;*
> *b) existing uses;*
> *c) conservation;*
> *d) forestry;*
> *e) aggregate extraction within Mineral Aggregate Areas subject to appropriate rezoning, licensing and the policies of this Plan;*
> *f) open space; and*
> *g) passive recreation.*
>
> *Other uses permitted in the applicable adjacent or underlying designations may be permitted.*

1.2.3 Provincial Planning Statement

The Provincial Planning Statement (PPS) is issued under Section 3 of the Planning Act, effective October 20, 2024. Policies of the PPS pertaining to water resources, specifically Section 4.2, were incorporated into the scope of work outlined herein in Section 1.3. Section 4.2 of the PPS is outlined below.

4.2 Water

1 Planning authorities shall protect, improve or restore the quality and quantity of water by:

- *a) using the watershed as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for considering cumulative impacts of development;*
- *b) minimizing potential negative impacts, including cross-jurisdictional and cross-watershed impacts;*
- *c) identifying water resource systems;*
- *d) maintaining linkages and functions of water resources systems;*
- *e) implementing necessary restrictions on development and site alteration to:*
  - *1) protect all municipal drinking water supplies and designated vulnerable areas; and*
  - *2) protect, improve or restore vulnerable surface and ground water, and their hydrologic functions;*
- *f) planning for efficient and sustainable use of water resources, through practices for water conservation and sustaining water quality; and*
- *g) ensuring consideration of environmental lake capacity, where applicable.*

2. Development and site alteration shall be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions will be protected, improved or restored, which may require mitigative measures and/or alternate development approaches.

3. Municipalities are encouraged to undertake, and large and fast-growing municipalities shall undertake watershed planning to inform planning for sewage and water services and stormwater management, including low impact development, and the protection, improvement or restoration of the quality and quantity of water.

4. Despite policy 4.2.3, where planning is conducted by an upper-tier municipality that includes one or more lower-tier large and fast-growing municipalities, the upper-tier municipality shall undertake watershed planning in partnership with lower-tier municipalities, including lower-tier large and fast-growing municipalities.

5. All municipalities undertaking watershed planning are encouraged to collaborate with applicable conservation authorities.

1.2.4 Drinking Water Source Protection Plans

The Grand River Source Protection Plan (2015, amended 2025) and the Halton-Hamilton Source Protection Plan (2015, amended 2022) cover the vicinity of the Site. The Site is not situated within a wellhead protection area (WHPA-A, -B, -C, or -D) for a municipal well field based on the Grand River Source Protection Plan (2025). The Site is located within the Wellhead Water Quantity Zone (WHPA-Q) area considered as a “Significant Risk (Draft)” (GRCA, 2025a).

1.3 Objectives and Scope

The principal objectives of this Level 1 and 2 Water Report are as follows:

- Characterize the baseline groundwater and surface water conditions and uses;
- Establish a baseline water budget for the Site and local study area;
- Provide input to the proposed pit design and end use, particularly related to water management at the Site;
- Predict potential effects of the proposed pit on water resources within the study area; and

- Implement a proactive environmental monitoring program to confirm the predicted effects of the proposed pit that includes a trigger mechanism and contingency measures to ensure compliance with the Site Plan and other permits.

1.4 Statement of Qualifications

This Level 1 and 2 Water Report was completed by a project team at WSP Canada Inc. Curriculum vitae are provided in **Appendix A**.

1.5 Study Methodology

One objective of the study was to develop an understanding of the hydrogeological and hydrological conditions within the study area in order to predict the potential effects of the proposed pit on hydrogeologic features of interest. The work program included a review of published hydrogeological studies and available water monitoring data to assess the local geology, hydrogeology and hydrology and to identify gaps in the conceptual understanding of the Site. A drilling program was conducted at the Site to improve the understanding of the local geology, as well as to establish a groundwater monitoring well network. Hydraulic testing, groundwater quality sampling, groundwater level monitoring and surface water monitoring were also completed to characterize baseline water conditions.

1.5.1 Water Well Record Search

To establish an initial database of local groundwater users, a search of the MECP Water Well Record database was undertaken to identify water well records located within 500 m of the Site boundary.

The ARA Level 2 Water Report requirements include the completion of a door-to-door water well survey. The completion of the water well survey should be a condition of the ARA Licence approval.

The results of the well record database search are included in **Appendix B**, with further discussion provided in **Section 2.6**.

1.5.2 Drilling Programs

Boreholes were advanced during two separate drilling programs at the Site. The locations of boreholes completed as part of this undertaking are shown in the Site Plan, **Figure 2**. Available borehole logs and monitor construction details are included in **Appendix C**.

2020

Prior to the current study, Golder Associates Ltd. (now WSP) advanced nine (9) boreholes as part of an initial resource assessment for the Site. The boreholes were designated BH20-01 (SAF) through BH20-09 (SAF). Monitoring wells were not installed during the 2020 drilling program. Borehole logs for the 2020 boreholes are included in **Appendix C**.

2021

In December 2021, WSP advanced eight (8) additional boreholes across the Site. Four of the boreholes were sealed upon completion and were designated BH21-01 (SAF) through BH21-04 (SAF). The remaining four boreholes were completed as monitoring wells, designated MW21-01 (SAF) through MW21-04 (SAF). During drilling of MW21-03, a shallow perched groundwater condition was encountered and a second monitoring well which screened the shallow perched interval was installed. A deeper well was also installed adjacent to the shallow well. The shallow and deep wells are referred to as MW21-03-S (SAF) and MW21-03-D (SAF), respectively. Therefore, a total of five (5) monitoring wells were installed on Site. Monitoring well construction details are summarized in **Table E-1, Appendix E**. Borehole logs for the 2021 boreholes and monitoring wells are included in **Appendix C**.

1.5.3 Hydraulic Testing Program

In-situ single well response hydraulic conductivity tests were completed in August 2022 at the monitoring well locations to determine local in-situ hydraulic conductivity. The Hvorslev analytical method was used to analyze the test data at MW21-02 and MW21-03-S using *AquiferTest* software. During testing, the water levels in monitoring wells MW21-01, MW21-03-D and MW21-04 could not be lowered sufficiently to complete the analysis. The water level data and testing analyses are included in **Appendix D** and are summarized in the **Table 1**, below.

Table 1: Hydraulic Conductivity Test Results

Test Location	Figure No. (Appendix D)	Hydraulic Conductivity	Notes
MW21-01	D-1	-	Unable to lower water level sufficiently after removing ~595 L of water at a rate of ~25.5 L/min.
MW21-02	D-2	2.1×10^{-6} cm/s	Insufficient volume of water in well to complete withdrawal type test; falling head test performed by adding water to the well.
MW21-03-S	D-3a D-3b	3.3×10^{-3} cm/s 4.1×10^{-4} cm/s	Figure D-3a shows analysis based on logger readings; Figure D-3b shows analysis based on manual water level measurements. A total of ~520 L was removed from well during test.
MW21-03-D	D-4	-	Unable to lower water level sufficiently after removing ~380 L of water at a rate of ~20.1 L/min.
MW21-04	D-5	-	Unable to lower water level sufficiently after removing ~425 L of water at a rate of ~20.0 L/min.

1.5.4 Groundwater Monitoring

The baseline groundwater monitoring program completed for this study consisted of the following:

- Continuous groundwater level and temperature monitoring using dataloggers installed at the five (5) monitoring wells installed on the Site in 2021. The well locations are shown on the Site Plan, **Figure 2**. Loggers were programmed to collect data every hour. One barologger measuring barometric pressure at the Site was installed to compensate for atmospheric pressure changes over time.
- Periodic manual water level measurements at each monitoring well were made over the course of the baseline monitoring period, generally occurring on a quarterly basis. The manual measurements were used to confirm the datalogger water levels. The manual water levels were measured with an electric contact gauge. The datalogger and manual water level measurements are depicted in the hydrographs included in **Appendix E**. Thermographs presenting the automated groundwater temperature data are also included in **Appendix E**.
- A groundwater sampling event was completed in March 2022, where samples were collected from four of the five wells. A sample was unable to be collected from MW21-02 in March 2022 due to an insufficient volume of water contained in the well at the time of the sampling event. Additional attempts to collect a sample from MW21-02 were made throughout the monitoring period, however a sample was unable to be collected due to low sample volumes. Monitoring wells were purged of at least three (3) standing water volumes prior to sampling. All samples were collected into laboratory prepared bottles and submitted under standard chain-of-custody procedures to Bureau Veritas of Mississauga, Ontario, for analysis of general parameters, major ions, nutrients and organic indicators, dissolved metals and BTEX (benzene, toluene, ethylbenzene and xylenes). Where required, samples were field filtered using an in-line 0.45 µm

filter and decanted to bottles with the appropriate preservatives. Field measurement of pH, conductivity and temperature was also completed prior to sampling. The groundwater chemical results are included in **Appendix F**.

In addition to the on-Site groundwater monitoring described above, an extensive database of groundwater monitoring data collected at other local CBM owned aggregate pits was incorporated into this study.

1.5.5 Groundwater Numerical Flow Model

A steady-state numerical groundwater flow model was constructed to simulate baseline hydrogeological conditions at the Site. The model was calibrated using the available baseline groundwater and surface water elevation data for autumn conditions, as well as the results of the various hydraulic tests completed to estimate the hydrogeological properties of the local overburden and bedrock units. The calibrated baseline model was then modified to predict the effects of the proposed pit expansion on water features at both full pit development and at final rehabilitation.

MODFLOW-USG (Panday et al, 2013) was used as the numerical simulation code for the groundwater model. MODFLOW-USG (**U**n-**S**tructured **G**rid) is similar to the more traditional MODFLOW (USGS 1988-2005) code; however, it allows for more robust grid refinement in areas of increased interest. MODFLOW-USG is capable of simulating steady-state three-dimensional groundwater flow in the unconfined and confined aquifers in the local study area.

Companion programs, such as ZoneBudget (Harbaugh, 1990 and updates) and mod-PATH3DU (Muffels et al, 2018) were used during the construction and calibration process to assess mass balance and groundwater flow directions within the model. Groundwater Vistas version 8 was used as the pre- and post-processor for the model construction and calibration process. The parameter estimation software PEST (Doherty, 2016) was also used during the calibration and model prediction process.

A number of other below-water aggregate licences exist near the Site. The model predicted impacts to the hydrogeological system from these operations and the proposed extraction at the Site are presented in the numerical groundwater model report, which is included as **Appendix G**.

1.5.6 Surface Water Monitoring

To identify the surface water features present on site (i.e., watercourses, waterbodies, and/or drainage features), Ministry of Natural Resources mapping, along with information collected during site visits conducted between December 2021 to December 2024 were reviewed.

Surface water monitoring stations were established at three on-site ponds in the vicinity of the proposed pit area. A list of the monitoring stations, their locations and their installation dates are provided in the **Table 2**, below. The approximate locations of these monitoring stations are shown on **Figure 4**.

Table 2: Surface Water Monitoring Locations

Station Name	Zone	Northing	Easting	Installation Date	Measurements
SW1	17	4810046	569572	December 2, 2021	Water Level
SW2	17	4810590	570076	December 2, 2021	Water Level
SW3	17	4810420	569859	January 6, 2023	Water Level

1.6 Proposed Pit Operation

The licenced area of the proposed Safarik Pit property is ±28 ha in size and contains a proposed extraction area of ±21 ha. The proposed below water table extraction area is approximately 10 ha, as shown in **Figure 5**. The maximum depth of extraction below the water table is to an elevation of 295 metres above sea level (masl).

It is proposed that a maximum of 1,000,000 tonnes of combined above and below water table aggregate would be extracted per annum. Extraction will begin with above water table aggregate with future extraction of aggregate below the water table using a dragline method. The resource will be stockpiled on-Site and pore water allowed to drain back to the pit pond prior to shipment off-Site. Aggregate from the Site will be shipped to other nearby CBM pits for processing.

The Site operations will not require pumping or active dewatering. During extraction, there will be no direct off-site discharge of water to any watercourse or wetland. As such, all internal drainage will be directed to the resulting pond created by the excavation.

1.7 Rehabilitated Pit

The proposed Safarik Pit property will be rehabilitated with two ponds with above-water slopes contained within the property boundary. As part of the final rehabilitation design, the extraction faces will be rehabilitated to a 3:1 (horizontal:vertical) slope above the water table and a 2:1 slope that reflects the natural angle of repose below water table. The future pond water elevation is estimated to be approximately ±309 masl.

2.0 PHYSICAL SETTING

2.1 Climate

Temperature and precipitation data from the Kitchener-Waterloo Climate Station and/or Waterloo Wellington A Climate Station, both operated by Environment Canada and both located approximately 20 km west of the Site, were used in this report. Recent data recorded between 2014 and 2024 at the GRCA's Shade's Mills Climate Station, located 13 km southwest of the Site, was also used in this report. Data from the Shade's Mills Climate Station was unavailable prior to 2014. The 30-year climate normal (1981-2010) and yearly water budget data for 2011 through 2024 are included in **Appendix H**.

As shown in **Table H-1**, the 30-year climate normal (1981-2010) for total annual precipitation for the study area is 916 mm. Using the Thornthwaite Mather methodology, the estimated annual evapotranspiration is 589 mm, yielding an average water surplus of 327 mm/year available for surface water runoff and recharge to the groundwater system. As shown in **Tables H-2 through H-15,** the total annual precipitation between 2011 and 2024 ranged from 656 mm to 1,092 mm, with an average of 921 mm. Notable wet years include 2017 (1,092 mm), 2018 (1,042 mm), 2019 (1,063 mm) and 2021 (1,020 mm), while 2012 (656 mm) and 2022 (682 mm) were notably drier than normal.

2.2 Surrounding Land Use

The current land use within the Site boundary is agricultural and rural residential. The Site is bisected by a hydro corridor. Adjacent property uses are agricultural, rural residential and undeveloped. Highway 401 crosses approximately 320 m north of the Site. Several additional aggregate pits are located north and west of the Site (**Figure 3**). The proposed Highway 6 By-Pass is planned to be constructed immediately east of the Site, as shown in **Figure 3**.

2.3 Topography and Drainage

Surface topography at the Site is variable and ranges from a low of 315 masl near the mapped wetland feature located near the western corner of the Site and a high of 335 masl within the woodlot along the eastern corner of the Site (**Figure 3**).

The Site is located in the vicinity of the headwaters of three (3) individual subwatersheds, as shown in **Figure 3**. The majority of the Site is located within the Mill Creek subwatershed, located within the Grand River Conservation Authority jurisdiction. The Mill Creek subwatershed drains an area of approximately 104 square kilometres (km^2) (CH2M et al., 1996). Mill Creek is located approximately 2.3 km from the Site at its closest point. As shown in Figure 3, there are no mapped tributaries of Mill Creek located within 1 km of the Site and there are several below-water aggregate pits located between the Site and the main branch of Mill Creek.

The eastern corner of the Site is located within the Bronte Creek subwatershed, which is located within the Conservation Halton jurisdiction and drains an area of about 300 km^2 (Conservation Halton, 2002). As shown in Figure 3, Bronte Creek originates approximately 1 km east of the Site, from the Morriston Marsh, which borders as close as 700 m to the Site. A non-regulated watercourse is mapped from the wetlands located 100 m east of the Site which flows to the Morriston Marsh (**Figure 6**).

The Fletcher Creek/Spencer Creek subwatershed is present south of the Site, and its limits extends to approximately 200 m from the Site. The Fletcher Creek subwatershed is approximately 30 km^2 in area and is located within the Hamilton Conservation Authority jurisdiction (HCA, 2012). Fletcher Creek is mapped to originate approximately 2.2 km southeast of the Site, within the Fletcher Creek Swamp. The Fletcher Creek Swamp is a Provincially Significant Wetland. There are no mapped tributaries of Fletcher Creek located within 1 km of the Site.

Several mapped wetland features are present on the Site and within the study area (**Figure 3**); however, there are no Provincially Significant Wetlands (PSW) within 1 km of the Site. The wetland features on the Site and within 1 km of the Site are “off-line” from any nearby surface watercourses.

During extraction, there will be no direct off-Site discharge of water as all internal drainage will be directed to the pit excavation. Following rehabilitation, all drainage on-Site will be directed to the two permanent ponds created on-site.

2.4 Geology

Chapman and Putnam (1984) describe the Site as consisting of Till Moraines (**Figure 6**) that are part of the Horseshoe Moraines physiographic region of southern Ontario. Surficial geology mapping indicates that the Site is located south of the Aberfoyle Spillway, on the northern edge of the Galt Moraine. The Galt Moraine is formed of Wentworth Till, which is described as a stoney to sandy silt till with occasional zones of ice contact sand and gravel.

As shown in **Figure 7**, ice-contact stratified deposits are present immediately north and west of the Site. These ice contact deposits are considered of tertiary significance by the Ontario Geological Society (OGS, 1999) owing to their thin (<1.5 m) nature. The majority of the nearby aggregate pits, located west and north of the Site, are situated within a mapped sand and gravel resource of primary significance, consisting of outwash deposits associated with the Galt Moraine (OGS, 1999).

Quaternary geology mapping (**Figure 8**) indicates that glaciofluvial outwash deposits are present at the Site and the deposit extends northward toward Aberfoyle and westward within the nearby aggregate pit properties.

Site specific geology was assessed based on a total of seventeen (17) boreholes that were advanced across the Site. The borehole locations are shown on **Figure 2** and borehole logs are provided in **Appendix C**. Geologic cross-sections were prepared based on the stratigraphy encountered at the drilling locations and are provided on **Figures 10 and 11**.

In summary, a thin (0.2 to 1.5 m thick) veneer of topsoil was identified at most drilling locations. Beneath the topsoil, layers of till and outwash sand and gravel deposits exist. The cross-sections depict two continuous layers of till. The ‘Upper Till’ was described as silty sand and gravel till and was typically found to be between 5 to 10 m thick. The ‘Lower Till’ was described as a dense sandy silt, silty sand or silty clay till. The surface of the ‘Lower Till’ was encountered at an elevation ranging from 291.0 to 308.3 mASL, with an average of 299.5 mASL. The majority of the boreholes were terminated within this ‘Lower Till’ as this unit was considered to be the vertical limit of the aggregate resource. Three (3) boreholes were terminated on bedrock.

It is expected that aggregate extraction will terminate on the surface of the ‘Lower Till’ (or bedrock, when the ‘Lower Till’ was absent). As such, based on the borehole results, the extraction depth will range from approximately 20 m below existing ground surface at MW21-02 (SAF) to about 33 m below existing ground surface at BH21-03 (SAF), with an average of 25 m.

The overburden material encountered above the ‘Upper Till’ and between the ‘Upper Till’ and ‘Lower Till’ generally consisted of stratified outwash sand and gravel with varying portions of silt and/or cobble.

As shown on the cross-section figures, additional thin layers of till were observed between the ‘Upper Till’ and ‘Lower Till’ at some borehole locations. In addition, a 5.9 m thick layer of silty clayey sand was observed at a depth of 5.8 m below grade (324.2 mASL) at BH20-07 (SAF). This cohesive layer was not observed at the other borehole locations drilled closest to BH20-07 (SAF).

At MW21-03 (SAF), located in the northern corner of the proposed extraction area, saturated conditions were encountered at a shallow depth above the ‘Upper Till’ layer. A 2.6 m thick layer of saturated clayey silt was observed overlying the ‘Upper Till’. As previously noted, a shallow monitoring well was installed to screen this saturated condition (further discussed in Section 2.5).

Bedrock beneath the Site consists of tan to light brown massive dolostone of the Guelph Formation, Eramosa Member. As shown in **Figure 9,** overburden thickness mapping indicates that the depth to bedrock at the Site ranges from 20 m to more than 30 m, which is consistent with the findings of the drilling program completed at the Site. Bedrock was encountered at three (3) of the boreholes drilled at the Site: BH20-01 (SAF), MW21-01 (SAF) and MW21-03 (SAF). At these locations, bedrock was encountered at a depth of between 24.4 m and 27.7 m below grade (between 289.5 mASL and 291.6 mASL).

2.5 Hydrogeology

2.5.1 Perched Condition at MW21-03-S (SAF)

As previously noted, saturated soil was encountered above the ‘Upper Till’ at MW21-03-S (SAF). A shallow monitoring well was installed to screen this perched layer. At MW21-03-S (SAF), the groundwater elevations ranged from 318.3 to 321.3 mASL, which is from 0.1 to 3.1 m below ground surface. Based on groundwater elevations from deeper well MW21-03-D (SAF), the perched groundwater level is located at minimum 9.8 m above the local water table. Shallow saturated conditions were not observed at the other borehole locations during drilling.

As shown in **Figure E-1** (Appendix E), the perched groundwater level fluctuated with peak levels approaching the ground surface during the spring (March 2022, May 2023 and April/May 2024). Between July 10 and July 16, 2024, the water level at MW21-03-S (SAF) increased by approximately 1 m, which corresponded with a total of 145 mm of rainfall recorded at the Kitchener/Waterloo climatological station during the same period. A discernable response these significant precipitation events was not observed at the deeper wells installed within the water table (**Figure E-2**).

2.5.2 Regional Water Table

Regional groundwater modelling undertaken for the Guelph / Eramosa Tier 3 Study suggest that regional groundwater flow in the vicinity of the Site is generally to the west-southwest with groundwater elevations in the ± 300-320 mASL range (Matrix, 2017).

Based on the groundwater level data collected from the on-Site monitoring wells screened within the deeper sand and gravel deposits as part of this study, the following groundwater levels were observed:

- At MW21-01 (SAF), located in the western corner of the Site, groundwater elevations ranged from 305.9 to 307.0 mASL, or between 9.9 and 11.1 m below grade.
- At MW21-02 (SAF), located near the eastern corner of the Site, groundwater elevations ranged from 306.9 to 307.8 mASL, or between 20.2 to 21.1 m below grade.
- At MW21-03-D (SAF), located in the northern corner of the Site, groundwater elevations ranged from 307.0 to 308.5 mASL, which is between 12.9 and 14.4 m below grade.
- At MW21-04 (SAF), located in the eastern corner of the Site, groundwater elevations ranged from 306.5 to 308.1 mASL, or between 19.8 and 21.4 m below grade.

The water table elevation exhibited a seasonal fluctuation, with seasonal peak water levels observed in May 2022, June 2023 and August 2024, which is consistent with precipitation patterns during the study period. Seasonal low water levels were observed in February 2023 and January 2024. The pattern and magnitude of seasonal fluctuation was similar at MW21-01 (SAF), MW21-03-D (SAF) and MW21-04 (SAF), however the magnitude of fluctuations at MW21-02 (SAF) were slightly muted. The muted response at MW21-02 (SAF) results in the water level at MW21-02 (SAF) being higher than those at MW21-04 (SAF) during some periods, and lower than those at MW21-04 (SAF) during others. During the study period, the water level at MW21-04 (SAF) was higher than at MW21-02 (SAF) from March 2022 through August 2022, from May 2023 through October 2023 and from March 2024 through December 2024. The highest water table elevations were consistently observed at MW21-03-D (SAF) and the lowest water table elevations were consistently observed at MW21-01 (SAF).

The maximum water table elevations observed during the study occurred in August 2024. The maximum water table elevations recorded at the wells on August 9, 2024 are shown on **Figure 12**. The elevations ranged from 306.99 mASL at MW21-01 (SAF) to 308.52 mASL at MW21-03-D (SAF). Based on the groundwater elevations measured on-Site, groundwater flow across the Site is west-southwest, consistent with the Tier 3 Study noted above (Matrix, 2017).

2.6 Groundwater Use

Urban centres located near the Site are serviced by municipal well fields typically installed within the bedrock aquifer; however, there are no well-head protection areas (WHPAs) within the study area.

Outside of the serviced areas, water supply is typically obtained via private drinking water wells.

2.6.1 MECP Water Well Record Search

A search of the MECP Water Well Record database was undertaken to identify well records located within 500 m radius of the Site. The results of the search are shown on **Figure 13**, and summarized in **Table B-1**, **Appendix B**.

A total of twenty (20) water well records plot within the search area. Of these well records, fifteen (15) are reported as domestic supply, two (2) are reported as both domestic and stock supply, one (1) is reported as public supply, one (1) is report as an observation well or test hole and one (1) is reported as an abandonment record. The well record for the well reported as public supply indicates that it is for a nursing home, which is inferred to be for the Morrison Park Nursing Home located on Calfass Road.

Excluding the abandonment record and the observation well or test hole, ten (10) wells are reportedly screened within the bedrock and the remaining eight (8) wells are reported screened within the overburden. Extraction at the Site will not extend into the bedrock unit. A summary of the overburden water well records is provided in the following table.

Table 3: Off-Site MECP Well Records for Wells Completed in the Overburden

Well Record No.	Approx. Distance from Proposed Licensed Area	Well Depth (m)	Static Water Level (m)	Available Drawdown (m)
6706874	0 m (on-site)	23.8	16.2	7.6
6711908	8 m	25.0	15.5	9.5
6704038	60 m	24.4	17.7	6.7
6704389	100 m	25.6	15.8	9.8
6705877	70 m	26.5	16.8	9.7
6704042	360 m	29.0	19.8	9.2
6713014	200 m	26.5	22.3	4.2
6702534	460 m	38.1	24.4	13.7

As shown in Table 3, MECP well record no. 6706874 plots within the proposed licensed area. The well record indicates that the well is used for domestic/stock purposes and has an available drawdown of 7.6 m. Four (4) additional private overburden wells plot within 100 m of the proposed licenced area, within the properties located immediately west of the Site (4259, 4260 and 4265 Concession 7). These well records indicate the wells are used for domestic supply and contain between 6.7 and 9.8 m of available drawdown. The remaining well records pertain to overburden wells located 200 m or more from the proposed licensed area.

2.6.2 Municipal Supply Wells

There are no municipal supply wells located within 1 km of the Site and the area is not serviced with municipal water supply.

2.6.3 Permits-to-Take-Water

A search of the MECP PTTW database was undertaken as part of the current study to identify groundwater users within the study area. Potential impacts as a result of the proposed pit are discussed in **Section 4**.

A total of two (2) active issued PTTWs are mapped within 1 km of the Site, summarized as follows.

Groundwater Takings

- PTTW No. 4031-BCGP9H was issued to CBM for aggregate washing at their McNally Pit and was issued as a renewal of a previous PTTW. The Permit allows for water to be taken from the source pond at a maximum rate of 16,366 L/min for a maximum total daily taking of 23,568,000 L/day. Water taking is permitted to occur 24 hours per day, 365 days per year.
- PTTW No. 8724-9GFPQE was issued to Con-Cast Pipe Inc. for manufacturing at their facility located on Lot 27, Concession 7, Geographical Township of Puslinch. The Permit was issued in February 2014 for groundwater to be taken from two (2) drilled wells for manufacturing purposes. The Permit allows water to be taken for a maximum of 16 hours per day, 365 days per year, for a maximum daily volume of 450,000 L.

2.7 Baseline Groundwater Quality

This section summarizes the baseline water quality for the Site. Groundwater chemical results from samples collected as part of the baseline study are presented in **Table F-1** for inorganic parameters and **Table F-2** for selected VOCs. A copy of the laboratory certificate of analysis is included in **Appendix F**.

The results of the baseline groundwater quality monitoring program at the Site indicate that the groundwater within the overburden unit at the Site is typically hard with hardness concentrations ranging between 320 mg/L to 480 mg/L as calcium carbonate ($CaCO_3$). Concentrations of hardness exceeded the ODWQS at each well tested.

Chloride and sodium concentrations were elevated within the deeper overburden wells at the Site, but were notably lower at shallow perched well MW21-03-S (SAF). Concentrations of chloride exceeded the ODWQS at each deep well sampled, while only the concentration of sodium at MW21-03-D (SAF) exceeded the ODWQS. The manganese concentration at MW21-04 (SAF) also exceeded the ODWQS.

As shown in **Table F-2**, concentrations of BTEX were below the laboratory reported detection limit at the wells tested, with one exception. Toluene was reported at a concentration of 0.36 µg/L at MW21-03-S, which was below the health-related ODWQS (60 µg/L).

2.8 Hydrology

2.8.1 Surface Water Levels

Surface water stations (SW1, SW2, and SW3) were installed to assess seasonal water level fluctuation in the on-site water features. Manual staff gauges were installed at each of these monitoring locations. The elevations of the staff gauges were surveyed on December 11, 2023 (SW1 to SW3) and referenced to the Canadian Geodetic Vertical Datum of 1928 (1978 adjustment) datum. Water levels were manually recorded at the staff gauge locations during each site visit. Manual water levels during each visit are presented in the following table.

Table 4: Surface Water Levels at SW1, SW2 and SW3

Date	Monitoring Station ID		
	SW1(1)	SW2	SW3
March 11, 2022	N/A(2)	318.76	N/A
June 6, 2022	315.57	318.45	N/A
October 3, 2022	314.99(3)	317.92(3)	N/A
January 6, 2023	314.99(3)	317.94(3)	321.12
May 1, 2023	N/A(2)	318.50	321.56
October 5, 2023	315.06(3)	317.93(3)	321.37
December 11, 2023	315.06(3)	317.94(3)	321.40
March 14, 2024	N/A(2)	318.40	321.64
June 26, 2024	315.47	318.37	321.45
October 4, 2024	315.05(3)	318.31	321.07(3)
December 13, 2024	315.05(3)	317.95(3)	321.33(4)
Range of Water Levels (m)	**0.58**	**0.84**	**0.57**

Notes:

(1) Survey datum is based on Realtime Can-Net Network Observations (UTM Zone 17 CSRS 2010, Elevations are CGVD 1928, 1978 Adjustment).
(2) Fully submerged, unsafe to conduct measurement.
(3) Dry conditions.
(4) Frozen conditions.

N/A = Not available

As detailed in Table 4 above, variations in water elevation at the SW stations were observed to range from 0.57 m to 0.84 m over the period of record, with the minimum and maximum variations occurring at SW3 and SW2, respectively.

3.0 WATER BALANCE

3.1 Methodology

The Meteorological Service Data Analysis and Archive division of Environment and Climate Change Canada (ECCC) provides monthly water budget summaries for meteorological stations with greater than 53 years of meteorological data. These water budgets include monthly values for all parts of the water budget (rainfall, snowmelt, potential evaporation, etc.) for each of the years in the historic record, as well as average monthly values over the entire record.

The water balance assessment was based on meteorological data from the ECCC Thornthwaite water budgets (ECCC averaged Kitchener/Waterloo station [ID #DC20492] between 1971 and 2023), watershed boundaries, land use data, and the existing soil types. It is noted that the Site-specific water balance assessment was completed with a longer climate dataset than the published 30-year climate normal presented in **Appendix I**.

This method describes water flux in a unit area of soil on a monthly basis based on a balance of precipitation (rainfall and snowmelt), evapotranspiration (ET), soil storage, and surplus. The water budget can be summarized as follows:

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

Where: P = precipitation;

S = change in soil water storage;

ET = evapotranspiration;

R = surface runoff; and,

I = infiltration (groundwater recharge).

The various water budget components associated with catchment areas are typically presented in millimetres (mm) over their respective sub-catchments and represent the amount of water per unit of watershed area. This amount is related to specific soil properties, including field capacity and wilting point.

The water budget model combines accumulated rainfall and snowmelt to estimate total precipitation. Precipitation is assumed to be rainfall when monthly mean temperatures are greater than 0 °C. Snowmelt is initiated when snow is on the ground and monthly mean temperatures are greater than 0 °C. Hence, snowmelt is based on the depletion of snow storage (accumulated precipitation during periods of sub-zero temperatures). Precipitation data collected at the Kitchener/Waterloo monitoring station (1971 to 2023) indicated a mean annual precipitation (P) of 862 mm/year.

The potential or maximum ET is estimated, in this case, using the empirical Thornthwaite equation (using average monthly temperature and hours of daylight) and represents the amount of water that would be evaporated or transpired under saturated soil-water scenarios. The actual ET is the total evapotranspiration for the period of study based on evapotranspiration demand, available soil-water storage, and the rate at which soil water is drawn from the ground (as defined by an established drying curve specific to the soil type). The mean annual potential ET for the study Site is approximately 604 mm/year based on data provided by EC.

Annual water surplus is the difference between P and the actual ET (ignoring minor changes in storage from year to year). 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 snowpack storage is exceeded. Maximum soil storage is quantified using a water holding capacity (WHC) specific to the soil type and land use.

3.1.1 Catchment Delineation

Site catchments were delineated using topographic mapping and site boundary information, as illustrated on **Figure 14** and summarized in **Table 5** (below).

3.1.2 Water Balance Scenarios

Under existing conditions, the catchment is primarily composed of moderately rooted agricultural/pasture and wooded areas, and minor clearings with vegetated/grassed lands that contain several residential dwellings, as seen on **Figure 14**.

Under operational conditions, most of the site will be excavated to form the proposed pit leaving a narrow border of lightly vegetated area defined by the setback boundary, as seen on **Appendix J**. During operation, extraction will occur below the water table and the formation of a pond will result.

Final site conditions were also considered in this study to determine the water surplus after excavation has ceased and the pit is rehabilitated. Under rehabilitated conditions, a pond will remain where extraction has occurred below the water table and the areas where side sloping has been established to the extraction boundary above the water table are to be a combination of seeding to establish stable slopes and some wooded areas. No drainage will be directed to natural watercourses, precipitation that does not infiltrate will be directed into the excavated pond.

3.1.3 Water Balance Parameters

Soil information was taken from the 2019 Ontario Soil Survey Complex Mapping available for the area. Soils at the site are composed of sandy loam for agricultural, swamped trees and wooded areas. Sand was assumed to be the soil type for the area of the proposed pit expansion under operational conditions, based on available soil mapping in the area.

The maximum soil storage is quantified using a Water Holding Capacity (WHC) that is based on guidelines provided in Table 3.1 of the Ministry of the Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual (MECP, 2003). The WHC represents the practical maximum amount of water that can be stored in the soil void space and is defined as the difference between the water content at the field capacity and wilting point (the practical maximum and minimum soil water content), respectively.

WHCs are specific to the soil type and land use, whereby values typically range from approximately 75 mm for unsaturated sand to 300 mm for mature forest over sandy loam. For temperate region watersheds, soil storage is typically relatively stable year-round, remaining at or near field capacity with the exception of the typical mid- to late-summer dry period. As such, the change in soil storage is a minor component in the water budget, particularly at an annual scale. Surplus water is caused after actual ET has been removed (ET demand is met) and the maximum WHC is exceeded (soil-water storage demand is met).

There are three main factors that determine the percent infiltration of the total surplus: topography, soil type and ground cover. The sum of the fractions representing the three characteristics establishes the approximate annual percentage of surplus which can be infiltrated in an area with a sufficient downward groundwater gradient.

3.1.4 Water Holding Capacities and Infiltration Factors

The existing Site was divided into four land uses: mature forest, wetland, agricultural (pastures and shrubs), and impervious built-up area/ Water holding capacities and infiltration factors were identified for all four land uses. An additional water holding capacity and infiltration factor was identified for the excavation pit and pond that will be constructed in the operational and rehabilitation phases.

Table 5 below lists the water holding capacities and infiltration factors assigned to the Site for the water balance calculations.

Table 5: Summary of Catchment Areas, WHCs, Soil Types, and Infiltration Factors

Existing Conditions					
Type	**WHC**	**Type of Land Use**	**Soil Type**	**Infiltration Factor**	**Catchment Area (m^2)**
Forested Area	300 mm	Mature Forest	Sandy Loam	0.9	49,120
Treed Swamp	250 mm	Wetland	Sandy Loam	0.8	6,300
Agricultural	150 mm	Pastures & Shrubs	Sandy Loam	0.8	268,588
Impervious Built-Up Area	90% Precip	Hard Surfaces	Sandy Loam	0	402
Total					**324,410**
Operational Conditions (Proposed Excavation Pit)					
Type	**WHC**	**Type of Land Use**	**Soil Type**	**Infiltration Factor**	**Catchment Area (m^2)**
Forested Area	300 mm	Mature Forest	Sandy Loam	0.9	4,120
Treed Swamp	250 mm	Wetland	Sandy Loam	0.8	6,300
Agricultural (Setback)	150 mm	Pasture & Shrubs	Sandy Loam	0.8	53,911
Above Water Table Extraction Area (Bare)	75 mm	Sand (unsaturated)	Sandy Loam	0.5	6,100
Below Water Table Extraction Area	Precip - Lake	Pond	n/a	1.0	208,979
Total					**324,410**
Rehabilitated Conditions					
Type	**WHC**	**Type of Land Use**	**Soil Type**	**Infiltration Factor**	**Catchment Area (m^2)**
Forested Area	300 mm	Mature Forest	Sandy Loam	0.9	49,120
Treed Swamp	250 mm	Wetland	Sandy Loam	0.8	6,300
Agricultural (Setback)	150 mm	Pastures & Shrubs	Sandy Loam	0.8	53,911
Revegetated Above Water Table Extraction Area	150 mm	Pastures & Shrubs	Sandy Loam	0.8	6,100
Below Water Table Extraction Area	Precip - Lake	Pond	n/a	1.0	208,979
Total					**324,410**

Notes:

1) The infiltration factor for the extraction area is 1.0 (i.e., 100% infiltration) because the pit is a depression with no surface outlet. Therefore, all available surplus is expected to infiltrate.

3.2 Water Balance Results

Water balance results for the Site for the existing, operational, and rehabilitated conditions are summarized herein. The average annual precipitation and surplus values were averaged over the period of 1970 – 2023 for all conditions. The monthly average water balance results can be found in **Appendix I**.

3.2.1 Existing Conditions

Table 6, below, shows the results of the average annual water balance for the Site under existing conditions.

Table 6: Existing Conditions Water Balance Results

Land Use	Area	Precipitation		ET		Surplus		Infiltration		Runoff	
	Ha	mm/yr	m^3/yr	mm/yr	m^3/yr	mm/yr	m^3/yr	mm/yr	m^3/yr	mm/yr	m^3/yr
Forested Area	4.91	862	42,340	595	29,230	264	12,970	238	11,670	26	1,300
Treed Swamp	0.63	862	5,430	589	3,710	273	1,720	216	1,380	54	340
Agricultural	28.86	862	231,520	568	152,560	293	78,700	234	62,960	59	15,740
Impervious Built-Up Area	0.04	862	350	86	30	776	310	0	0	776	310
Total	**32.44**	**862**	**279,640**	**572**	**185,530**	**289**	**93,700**	**234**	**76,010**	**55**	**17,690**

The total average annual surplus for the catchment area under existing conditions was estimated to be 289 mm or 93,700 m^3 per year and the estimated infiltration is approximately 234 mm or 76,010 m^3 per year. Runoff was calculated as the difference between surplus and infiltration and was estimated to be 55 mm or 17,690 m^3 per year. Based on the assessment, approximately 81% of the annual surplus infiltrates, while the remaining 19% is surface runoff, partially flowing towards the ponds located in the Site.

3.2.2 Operational Conditions (Proposed Excavation Pit)

Table 7 shows the results of the average annual water balance for the Site under operational conditions.

Table 7: Operational Conditions - Average Annual Water Balance Results for the Period of Record 1971 -2023

Land Use	Area	Precipitation		ET		Surplus		Infiltration		Runoff	
	Ha	mm/yr	m^3/yr	mm/yr	m^3/yr	mm/yr	m^3/yr	mm/yr	m^3/yr	mm/yr	m^3/yr
Mature Forest	4.91	862	42,340	595	29,230	264	12,970	238	11,670	26	1,295
Treed Swamp	0.63	862	5,430	589	3,710	270	1,700	216	1,360	54	340
Agricultural (Setback)	5.39	862	46,470	568	30,620	293	15,795	234	12,640	59	3,160
Above Water Table Extraction Area (Bare)	0.61	862	5,260	523	3,190	339	2,070	170	1,035	170	1,035
Below Water Table Extraction Area	20.90	862	180,140	663	138,550	199	41,590	199	41,590	0	0
Total	**32.44**	**862**	**279,640**	**633**	**205,300**	**228**	**74,125**	**211**	**68,295**	**18**	**5,830**

The total average annual surplus for the catchment area was estimated to be 228 mm or 74,125 m^3 per year and the estimated infiltration is approximately 211 mm or 68,295 m^3 per year. Runoff was estimated to be 18 mm or 5,830 m^3 per year. Based on the assessment, 93% of the annual surplus infiltrates, while the remaining 7% is surface runoff in the operational conditions.

3.2.3 Rehabilitation Conditions

Table 8 shows the results of the average annual water balance for the Site under future rehabilitation conditions.

Table 8: Rehabilitation Conditions - Average Annual Water Balance Results for the Period of Record 1970 - 2023

Land Use	Area	Precipitation		ET		Surplus		Infiltration		Runoff	
	Ha	mm/yr	m^3/yr	mm/yr	m^3/yr	mm/yr	m^3/yr	mm/yr	m^3/yr	mm/yr	m^3/yr
Mature Forest	4.91	862	42,340	595	29,230	264	12,970	238	11,670	26	1,295
Treed Swamp	0.63	862	5,430	590	3,720	270	1,700	216	1,360	54	340
Agricultural (Setback)	5.93	862	46,470	568	30,620	293	15,795	234	12,635	59	3,160
Revegetated Above Water Extraction Area	0.61	862	5,260	568	3,460	293	1,785	234	1,430	59	360
Below Water Table Extraction Area	20.90	862	180,140	663	138,550	199	41,590	199	41,590	0	0
Total	**32.44**	**862**	**279,640**	**539**	**205,580**	**179**	**73,840**	**173**	**68,685**	**6**	**5,155**

The total average annual surplus for the catchment area was estimated to be 179 mm or 73,840 m^3 per year and the estimated infiltration is approximately 173 mm or 68,685 m^3 per year. Runoff was estimated to be 6 mm or 5,155 m^3 per year. Based on the assessment, 97% of the annual surplus infiltrates, while the remaining 3% is surface runoff in the rehabilitated conditions.

3.3 Water Balance Summary

A summary of the annual water balance considering surplus, infiltration, and runoff for the existing, operational, and rehabilitated conditions is provided in **Table 9**.

Table 9: Water Balance Summary

Scenario	Surplus (m^3/yr)	Infiltration (m^3/yr)	Runoff (m^3/yr)
Existing	93,700	76,010	17,690
Operational	74,125	68,295	5,830
Rehabilitated	73,840	68,700	5,155

Under operational conditions, surplus is anticipated to decrease by 21% from 93,700 to 74,125 m^3 per year – representing an increase in evaporation due to the removal of agricultural and hedgerow areas, and the creation of a pit pond. Infiltration is expected to decrease by 10% from 76,010 to 68,295 m^3 per year as the surplus from the flooded pit will be considered runoff, although it will not be discharged off-Site. This will effectively decrease the total runoff from the Site to 18 mm/yr (5,830 m^3/yr). This equates to an overall decrease in runoff of 67% or 11,860 m^3/yr.

Under rehabilitated conditions, the components of the water balance will continue to function very similarly to operational conditions, as the pit will remain ponded. The setback area will consist of vegetated lands, runoff will continue to drain to the Safarik Pit, and thus surplus is projected to only decrease by 21% to 73,840 m^3 per year (compared to existing). Site runoff is expected to be conveyed to the pond and will remain in storage or leave the Site as either evaporation or recharge to the groundwater system. The infiltration is expected to decrease by 10% to 173 mm/yr (68,685 m^3/yr) and the runoff will decrease by 71% to 6 mm/yr (5,155 m^3/yr).

4.0 IMPACT ASSESSMENT

4.1 Groundwater Impacts

4.1.1 Full Development Conditions

At full pit development (i.e., the pond surface area is at its maximum extent and the extraction is occurring at the proposed maximum annual extraction rate of 1,000,000 tonnes), two important hydrogeological changes are expected to occur:

- During the operational phase, the removal of aggregate in the proposed extraction limit will result in a one-time increase in void space in the aquifer which must be back-filled with groundwater and precipitation inputs. The groundwater flow into the pit footprint will increase to compensate for the increase in void space, which induces an apparent pumping effect.
- Once the aggregate has been extracted from the pit footprint, the pit pond will be subject to direct evaporation at a rate that is higher than the baseline evapotranspiration rate. This reduces the net groundwater flow from within the pit footprint relative to baseline conditions and will result in changes to the surrounding groundwater flow patterns to compensate for the increased loss of water from the pit.

The apparent pumping affects from the above noted changes will manifest as an additional ‘stress’ to the baseline water balance. The overburden and contact aquifers will be impacted as a result of the additional stress, and a cone of depression will expand radially from the proposed pit expansion to reach a new equilibrium. The ultimate size of the cone of depression (i.e., radius of influence) is dependent on the properties of the hydrostratigraphic layers present in the model. The cone of depression will expand such that the total groundwater inflow over the radius of influence will be equal to the increased evaporative losses from the pit pond and increase in void space. An analysis of the water balance under full development conditions is provided in **Section G.7.2**, **Appendix G**.

As discussed in **Appendix G**, a groundwater flow model was developed to simulate the impact of these changes on the groundwater system. The resulting predicted drawdown at full pit development is shown in **Figure 15**. In this scenario, a drawdown of up to 0.25 m relative to baseline water levels in the water table are predicted to impact a relatively small area adjacent to the northern end of the proposed pit expansion. The radius of influence (i.e. 0.25 m drawdown contour) in the aquifer extends to the east and northeast by approximately 600 m and 400 m, respectively.

Groundwater Quality

No adverse groundwater quality impacts are predicted as a result of the proposed pit. In general, chemicals or nutrients are not used during normal pit operations. Limited quantities of fuel and petroleum products will be used on Site as part of the resource extraction. A spill action plan for these substances is included in the mitigation plan, further discussion is provided below.

Groundwater Users

The predicted area of impact in the full development scenario (**Figure 15**) indicates that several off-site wells may be impacted by the proposed pit operation; however, the drawdown is predicted at maximum to be less than 0.4 m at the wells. Based on the groundwater level data collected from the monitoring wells, the water table elevation ranged by 1.5 m during the study period. Therefore, the predicted drawdown falls within the routine range of seasonal fluctuation observed in the aquifer. As discussed in **Section 2.6.1**, the available drawdown at the eight (8) overburden wells located within 500 m of the Site ranges from 4.2 to 13.7 m. Thus, a drawdown of up to 0.4 m is unlikely to negatively impact off-site well users.

In summary, adverse impacts to off-site well users is not predicted.

4.1.2 Rehabilitated Condition

Once the Site has been fully rehabilitated, groundwater impacts due to the infill of void space created during extraction will no longer be occurring. The pit pond will continue to be subject to direct evaporation at a rate that is higher than the baseline evapotranspiration rate, which will reduce the net groundwater flow from within the pit footprint relative to baseline conditions. The result is a change in the surrounding groundwater flow patterns to compensate for the increased loss of water from the pit. The predicted drawdown resulting from extraction at the Safarik Pit site is less than the drawdown predicted during full development (**Figure 15**). An analysis of the water balance under rehabilitated conditions is provided in **Section G.8.2**, **Appendix G**.

4.1.3 Potential Impact to Wellhead Water Quantity Zone (WHPA-Q)

The Site plots within a Wellhead Water Quantity Zone (WHPA-Q) considered a “Significant Risk (Draft)”. As discussed in Section 4.1, little impact is anticipated to groundwater levels as part of the proposed pit operation. In accordance with the 2017 Technical Rules under the Clean Water Act, the proposed site development activity would not be considered a drinking water quantity threat.

4.2 Surface Water Impacts

The impact assessment seeks to estimate potential changes to the hydrologic system as a result of Site Operations and Rehabilitation Scenarios and the effect these changes may have on surface water users and receptors.

4.2.1 Surface Water Quality

No adverse surface water quality impacts are predicted as a result of the proposed pit. The proposed pit operation will not include dewatering or direct discharge to surface water bodies.

4.2.2 Impacts to Wetlands

Several unevaluated wetlands are mapped within and in the vicinity of the Site (**Figure 3**). As shown in the cross-section figures (**Figures 10 and 11**), these wetland features are situated at least 10 m above the water table and, therefore, are not hydraulically connected to the water table. It is interpreted that the “upper till” is limiting infiltration of surface water, resulting in the creation of the perched wetland features in the area of the Site. As noted in Section 2.3, there is a mapped non-regulated watercourse draining from an unevaluated wetland feature located 100 m east of the Site to the Morriston Marsh. Similar to the local wetland features, this watercourse is interpreted to be hydraulically isolated from the regional water table. The proposed aggregate extraction at the Safarik Pit site is not expected to impact the mapped wetlands or non-regulated watercourse located outside of the extraction area.

In summary, adverse impacts to the local wetland features is not predicted.

4.2.3 Impacts to Surface Watercourses

There are no surface watercourses within the Site. According to the Ministry of Natural Resources (MNR) Ontario topographic map tool, Mill Creek is located approximately 4.5 km west of the site. Additionally, tributaries of Mill Creek are located approximately 2.9 km northwest of the site.

The water balance assessment in **Section 3** suggests that overall, there is a decrease in surplus of 21% from 93,700 to 74,125 m^3 per year for the site under operational conditions. Rehabilitated conditions are expected to have a similar change in average annual surplus (i.e., 21% decrease).

There is no expected change in runoff volume to receiving watercourses as water will continue to drain internally to pits and depressions in the area. Overall, no adverse impacts are predicted for Mill Creek and its tributaries in the surrounding area.

Long-term monitoring of Mill Creek (LRG, 2019) has shown that below water table aggregate extractions at properties located closer to Mill Creek than the Safarik Pit site have not resulted in measurable impacts on water temperatures and stream flows within Mill Creek.

5.0 MITIGATION

To mitigate the impacts of the proposed pit on the features noted in **Section 4**, the following measures are proposed:

- Conduct a long-term groundwater monitoring program to confirm predicted impacts to the local groundwater table and local wetlands;
- Prior to extraction within the groundwater resource, proactively implement a well interference and mitigation plan to ensure that local groundwater users will have adequate future groundwater supplies; and
- Develop and administer a spill action plan throughout all phases of pit operations.

5.1 Proposed Monitoring Program

The purpose of the proposed monitoring program is to:

- Proactively monitor groundwater and surface water resources during the operational and rehabilitation phases of the proposed pit until stable lake elevations are reached and compare to baseline conditions;
- Resolve potential water well interference claims with local groundwater users; and
- Provide documentation of the monitoring and assessment results and provide recommendations for operational or monitoring improvements if necessary.

The proposed monitoring program is summarized in the following table. The monitoring locations are shown on **Figure 16**. It is noted that monitoring wells located around the perimeter of the Site may need to be retrofitted with extended riser pipes as the perimeter berms are constructed. It is also noted that monitoring of any wells that are situated on privately owned lands is subject to homeowner consent.

Table 10: Proposed Monitoring Program

Monitoring Locations	Proposed Monitoring
Monitoring wells: MW21-01 (SAF), MW21-02 (SAF), MW21-03-S (SAF), MW21-03-D (SAF), MW21-04 (SAF)	Continuous (i.e. at least four times per day) water level and water temperature measurements
Up to 3 of the following private overburden wells (pending well owner permission): 6706874, 6711908, 6704038, 6705877, 6704389	Continuous (i.e. at least four times per day) water level and water temperature measurements
Formed pit pond(s)	Daily water level measurements during non-frozen period (e.g. March 15 to November 15, weather dependent).

An annual monitoring report, summarizing all monitoring activities, an interpretation of the monitoring results and any recommendations, will be produced for each calendar year during the operational phase of the pit until the license is surrendered.

5.2 Proposed Well Interference Mitigation

As discussed in **Section 2.6**, property owners located in the vicinity of the proposed area of extraction typically utilize private wells for domestic supply and agricultural uses. Based on the results of the water well record review and water well survey completed, both overburden and bedrock supply wells are in use near the Site. A well interference and mitigation plan has been formulated to ensure that the groundwater users will have adequate future groundwater supplies.

5.2.1 Water Well Interference Mitigation Plan

A number of residential wells in the close vicinity of the Site have been included in the proposed monitoring program to provide confirmation of potential effects. The proposed monitoring program is comprehensive and will be able to assess potential impact to a well and allow proactive mitigation in advance of a well being adversely impacted. In the event a well interference claim is received, the licensee will be required to implement the following mitigation plan to protect the local groundwater users.

Prior To Extraction

a) Landowners shall be provided with a copy of the water well interference plan as well as the contact information for the licensee and MECP (Wells Help Desk 1-888-396-9355 or email wellshelpdesk@ontario.ca).

Water Well Interference Mitigation Plan

a) If a water well interference claim is received by the licensee the following actions will be taken:

  - The licensee will immediately notify MNR and MECP of the complaint.
  - The licensee will contact a well contractor in the event of a well malfunction and residents will be provided a temporary water supply within 24 hours, if the issue cannot be easily determined and rectified.

b) The well contractor will contact the resident with the supply issue to rectify the problem as expediently as possible, provided landowner authorization of the work.

c) If the issue raised by the landowner is related to loss of water supply, the licensee will have a qualified hydrogeologist / well contractor determine the likely causes of the loss of water supply, which can result from a number of factors, including pump failure (owner's expense), extended overuse of the well (owner's expense), lack of well maintenance / well cleaning (owner’s expense) or lowering of the water level in the well from the pit development (licensee expense). This assessment process would be carried out at the expense of the licensee and the results provided to the homeowner.

d) If it has been determined that the pit caused the water supply interference (i.e., lowering of the water level), the pit shall continue to supply water at the licensee's expense until the problem is rectified. The following mitigation measures shall be considered, and the appropriate measure(s) implemented at the expense of the licensee:

  - adjust pump pressure;
  - lowering of the pump to take advantage of existing water storage within the well;
  - deepening of the well to increase the available drawdown, if the well deepening changes the water quality a water treatment shall be provided;
  - widening of the well to increase the available storage of water;

  - relocation of the well to another area on the property; or
  - drilling multiple wells.

e) If the issue raised by the landowner is related to water quality, the licensee will have a qualified hydrogeologist / well contractor determine the likely causes of the change in water quality, and review monitoring results at the pit and background monitoring results from the baseline well survey to determine if there is any potential correlation with the pit. If it has been determined that the pit caused a water quality issue, the pit shall continue to supply water at the licensee's expense until the problem is rectified. The licensee shall be responsible for restoring the water supply by replacing the well or providing a water treatment system. The licensee is responsible for the expense to restore the water quality.

5.3 Spill Action Plan

CBM will develop and implement a detailed spill action plan (SAP) throughout all phases of pit operations. Fuel and petroleum products are managed according to applicable Ontario regulations. No impact to surface or groundwater resources is anticipated from petroleum handling as a result of the proposed pit.

6.0 SUMMARY OF FINDINGS AND RECOMMENDATIONS

The following is a summary of the key findings of the Level 1and 2 Water Report undertaken to meet the study requirements for the Class A License (Pit Below Water) application.

Proposed Pit Operations and Existing Conditions

- CBM has proposed to licence 28 hectares of land located to the east/southeast of the existing CBM Neubauer and McNally Pits. The maximum depth of below water extraction will be to an elevation of 295 metres above sea level (masl).
- Extraction is proposed to occur below the natural water table and will result in the creation of two ponds on the site. The future pond water elevation is estimated to be approximately ±309 masl.
- Several other existing aggregate pits are located in close proximity to the Site. Detailed monitoring programs are in place for each of these existing pits and it is understood that adverse impacts to local groundwater users and surface water resources have not been observed.

Hydrogeological Conditions and Proposed Impacts

- A total of seventeen (17) boreholes have been drilled across the Site as part of the studies completed by CBM. Four (4) of the boreholes were completed with monitoring wells to monitor groundwater levels. One (1) shallow well was also installed to monitor perched groundwater conditions encountered in the northern corner of the proposed extraction area.
- As part of this study, groundwater level monitoring was completed from between December 2021 and September 2024. During this monitoring period, the maximum water table observed occurred in August 2024, when the water table ranged from 307.0 to 308.5 mASL. Groundwater flows in a west-southwest direction across the Site.
- Several unevaluated wetlands are mapped on and near the Site. The wetlands are not interpreted to be hydraulically connected to the regional water table.
- Several water wells are present near the Site, with the majority of the wells being installed into the bedrock underlying the sand and gravel resource at the Site. A total of eight (8) wells completed in the overburden aquifer were identified within 500 m of the Site. Based on the study results, there are no adverse impacts to off-site well users predicted.

- A steady-state numerical groundwater flow model was constructed to simulate baseline hydrogeological conditions at the Site, calibrated to observed baseline conditions. The calibrated baseline model was then modified to predict the effects of proposed extraction on water features at both full pit development and upon final rehabilitation.
- During full pit development, a drawdown of up to 0.25 m relative to baseline water levels in the water table are predicted to impact a relatively small area adjacent to the northern end of the proposed pit expansion property. The radius of influence (i.e. 0.25 m drawdown contour) in the aquifer extends to the east and northeast by approximately 600 m and 400 m, respectively.
- Under final rehabilitation conditions, the drawdown of up to approximately 0.25 m relative to baseline water levels in the aquifer is predicted for areas north of the proposed pit expansion property. The radius of influence (i.e., 0.25 m drawdown contour) in the aquifer covers an area of approximately 0.9 km^2.

Hydrological Conditions and Proposed Impacts

- Average annual precipitation near the Site is 862 mm/yr. Evaporation is estimated to be 572 mm/yr with a resulting surplus of 289 mm/yr. The majority of the surplus becomes infiltration (234 mm/yr) with the remainder becoming runoff (55 mm/yr).
- There are no permanent surface watercourses on-Site, and the Site is determined to be internally drained.
- The proposed changes under operational and rehabilitated conditions are anticipated to result in decreases to average annual surplus over the site footprint area of approximately 21%, for both scenarios.
- There is no expected change in runoff volume to receiving watercourses as water will continue to drain internally to pits and depressions in the area. Overall, no adverse impacts are predicted for Mill Creek and its tributaries in the surrounding area.
- No adverse impacts are predicted for the Mill Creek, Bronte Creek and/or Fletcher Creek/Spencer Creek subwatersheds.

Recommendations

To mitigate the impacts of the proposed pit, the following recommendations should be implemented upon licence approval:

- A proactive and long-term groundwater and surface water monitoring program will be completed during the pit operational and rehabilitation phases, until the license is surrendered.
- A well interference and mitigation plan will be implemented proactively prior to pit operation; and
- A spill action plan will be developed and administered throughout all phases of pit operations.

Signature Page

WSP Canada Inc.

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Water Resources Specialist

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Water Resources Engineer Lead

https://wsponline.sharepoint.com/sites/gld-148930/project files/6 deliverables/ph 2000 - hydrogeology/final october 2025/safarik pit - level 2 water report_final.docx

7.0 REFERENCES

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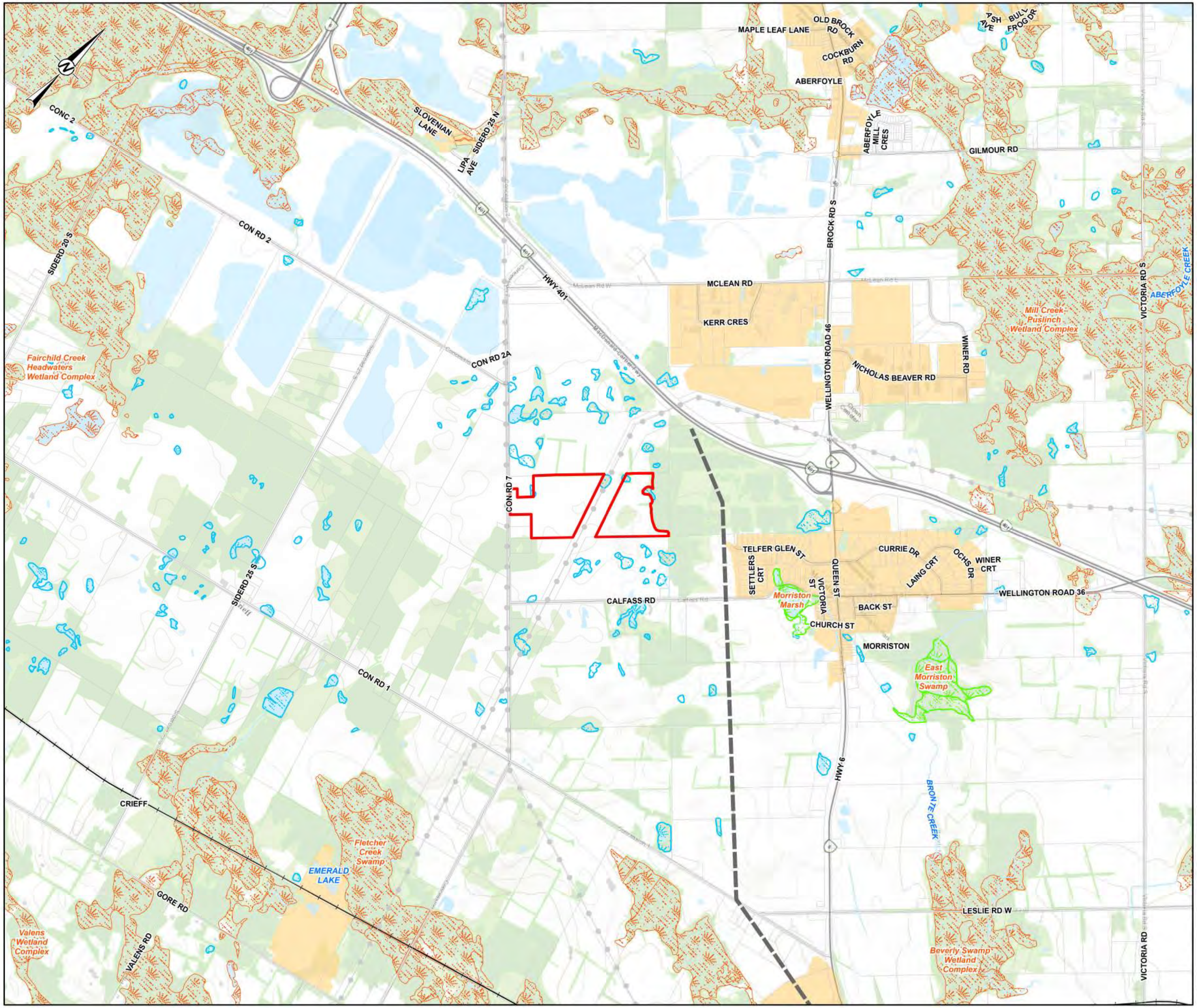
Figures



KEY MAP

SCALE 1:500,000

LEGEND

🟥	LICENCE BOUNDARY
—	ROADWAY
—	WATERCOURSE
┼	RAILWAY
●	UTILITY CORRIDOR
▬ ▬	APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
☐	PROPERTY PARCELS
▨	UNEVALUATED WETLAND
▨	EVALUATED WETLAND (NO SIGNIFICANCE)
▨	PROVINCIALLY SIGNIFICANT WETLAND (PSW)
🟦	WATERBODY
🟩	WOODED AREA
🟧	BUILT-UP

0 250 500 1,000

1:25,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

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4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT

CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT

SAFARIK PIT

TITLE

LOCATION MAP

CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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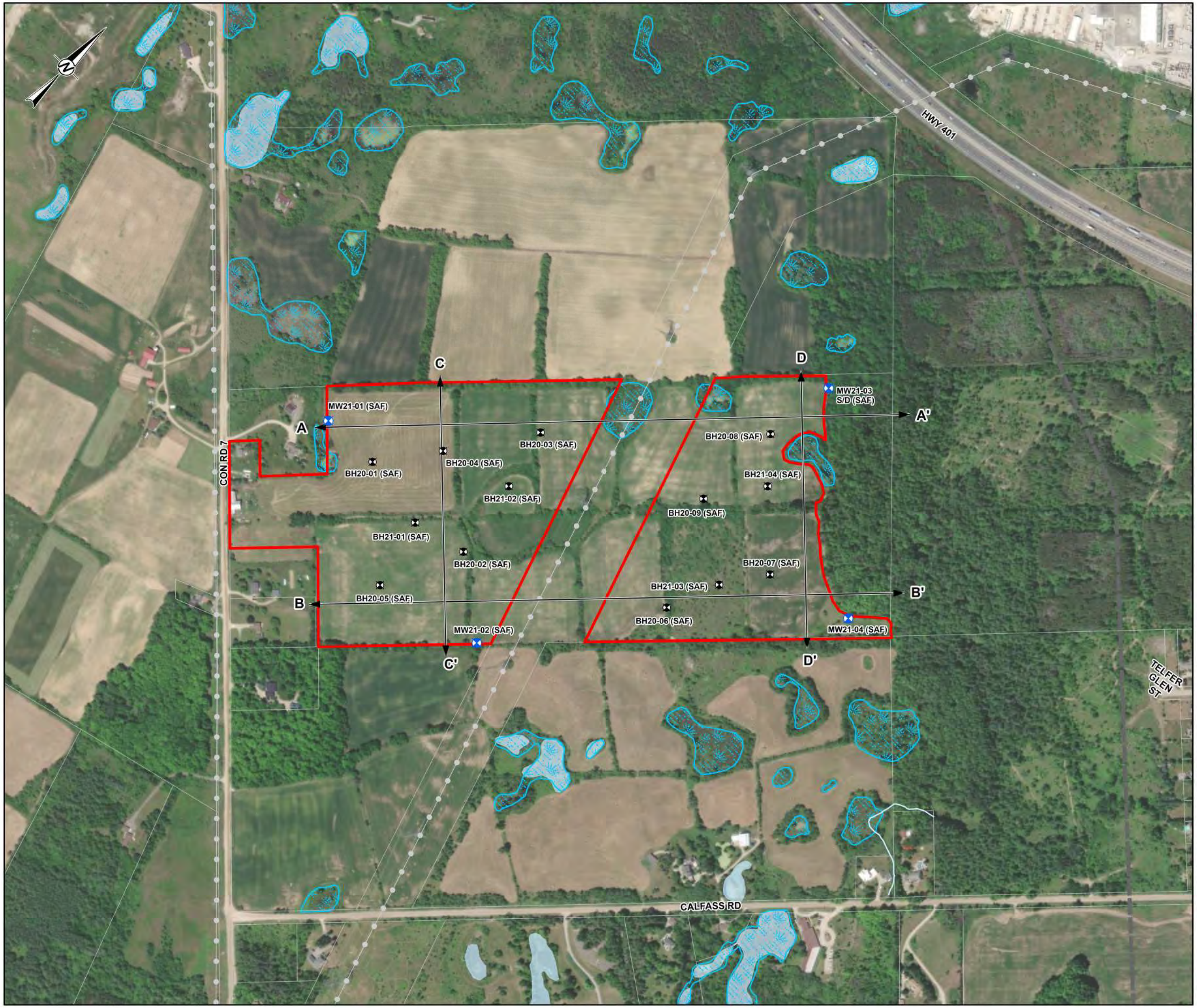

KEY MAP

SCALE 1:300,000

LEGEND

⯐	BOREHOLE LOCATION AND DESIGNATION
⯐	MONITORING WELL LOCATION AND DESIGNATION
🟥	LICENCE BOUNDARY
—	WATERCOURSE
●—	UTILITY CORRIDOR
◆	CROSS-SECTION LINES
▬ ▬	APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
☐	PROPERTY PARCELS
▨	UNEVALUATED WETLAND
■	WATERBODY

0 75 150 300

1:6,000 METRES

NOTE(S)

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REFERENCE(S)

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CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
DRILLING LOCATIONS

CONSULTANT
wsp

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APPROVED	LD

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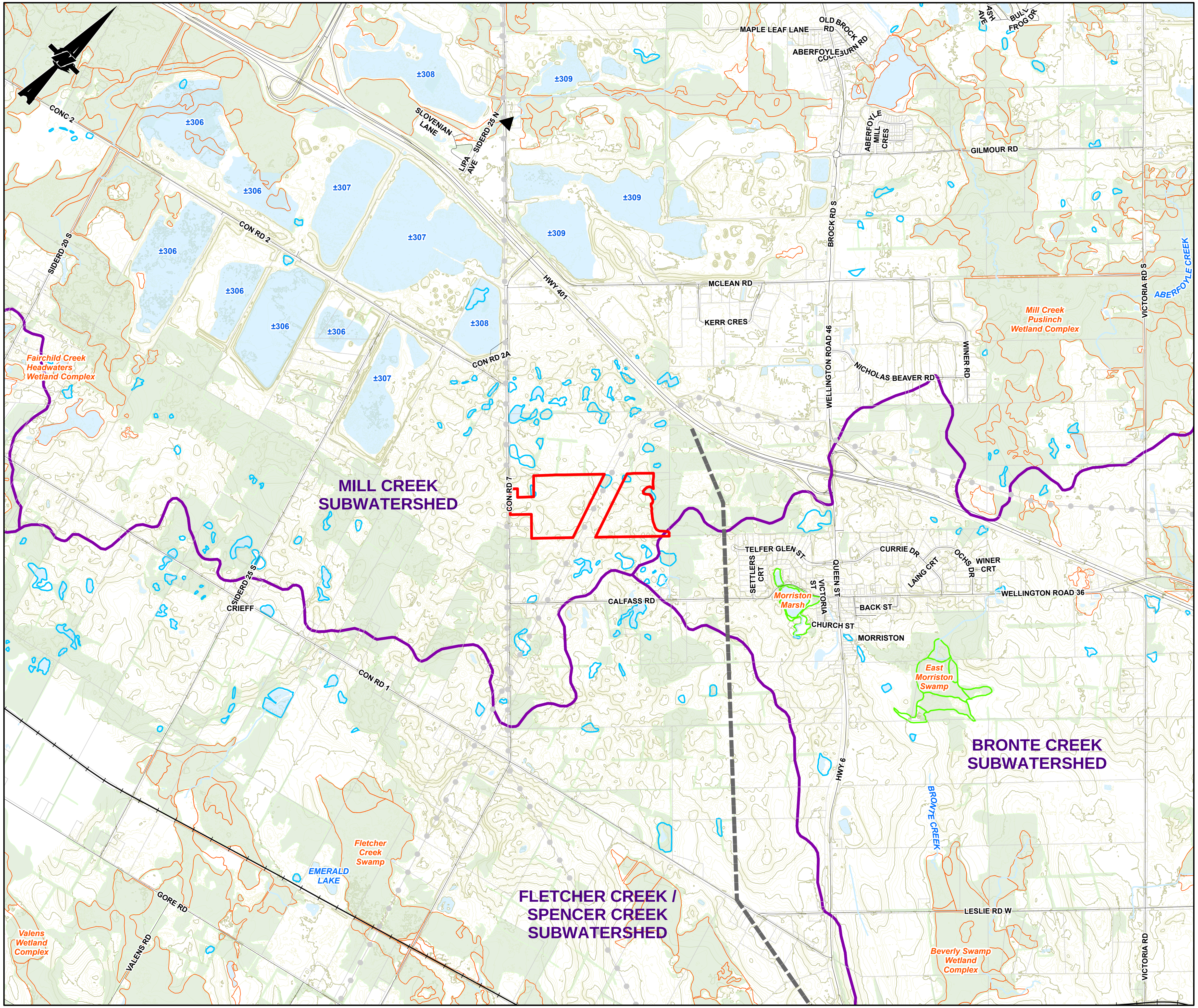

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LEGEND

- 🟥 LICENCE BOUNDARY
- ▲ GRCA FLOW GAUGE LOCATION AND NUMBER
- ROADWAY
- WATERCOURSE
- RAILWAY
- UTILITY CORRIDOR
- APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
- PROPERTY PARCELS
- APPROXIMATE WATERSHED BOUNDARY
- UNEVALUATED WETLAND
- EVALUATED WETLAND (NO SIGNIFICANCE)
- PROVINCIALLY SIGNIFICANT WETLAND (PSW)
- WATERBODY (APPROX. ELEVATION NOTED IN MASL)
- 🟩 WOODED AREA

GROUND SURFACE CONTOURS (SWOOP 2015)

- MINOR (1m INTERVALS)
- MAJOR (5m INTERVALS)

0 250 500 1,000

1:25,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

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PROJECT
SAFARIK PIT

TITLE
TOPOGRAPHY AND DRAINAGE

CONSULTANT

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APPROVED	----

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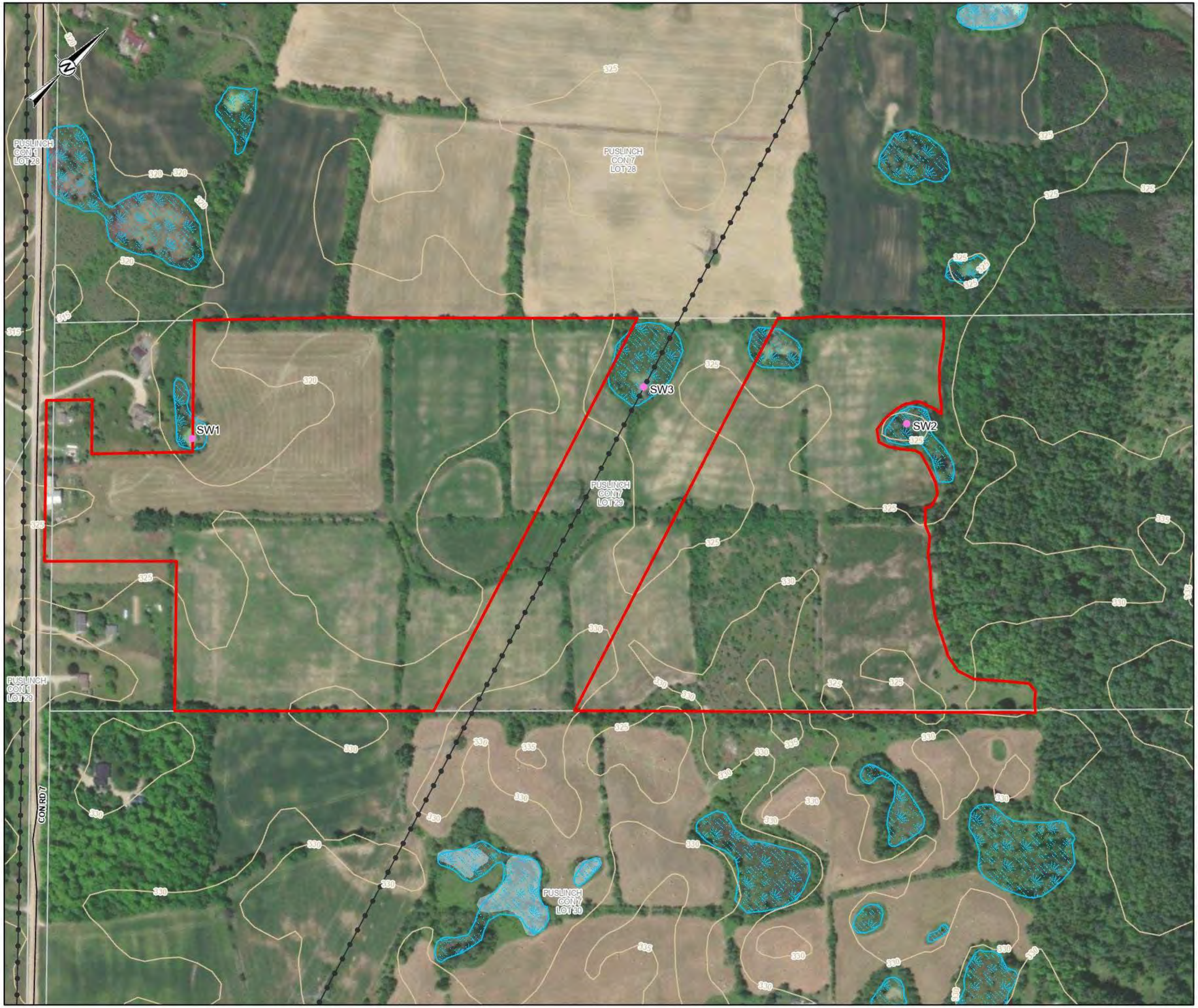

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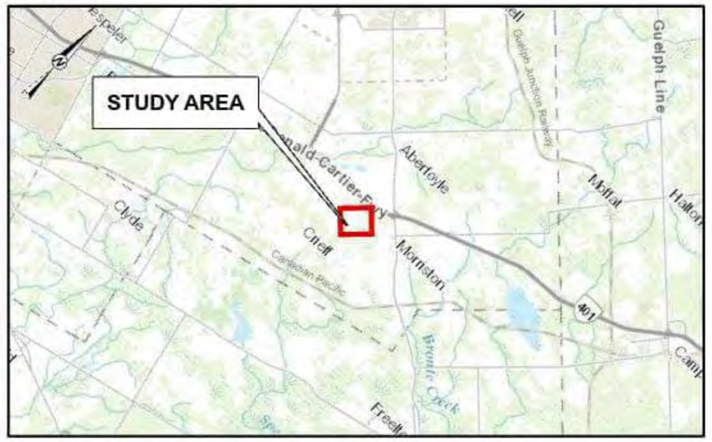

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LEGEND

▭	LICENCE BOUNDARY
●	SURFACE WATER MONITORING STATION
—	ROADWAY
●—●	HYDRO LINE
—	TOPOGRAPHIC CONTOUR, METRES

WETLAND SIGNIFICANCE

▨	UNEVALUATED WETLAND
▭	WATERBODY
▭	TOWNSHIP, CONCESSION AND LOT

0 40 80 160

1:4,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
SURFACE WATER MONITORING STATIONS

CONSULTANT

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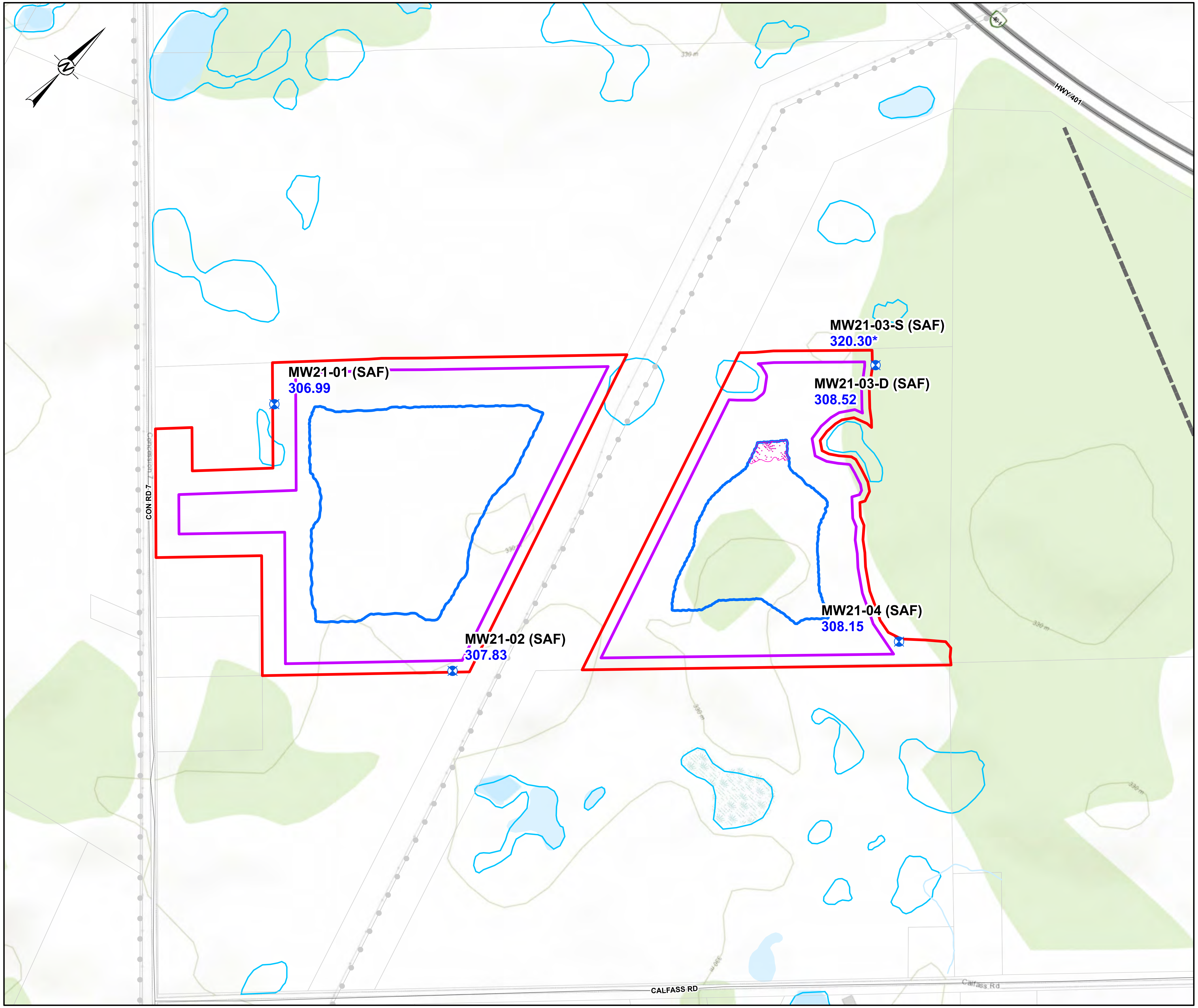

KEY MAP

SCALE 1:300,000

LEGEND

⊕ MONITORING WELL LOCATION AND DESIGNATION

🟥 LICENCE BOUNDARY

— ABOVE WATER EXTRACTION LIMIT

— BELOW WATER EXTRACTION LIMIT

— ROADWAY

— WATERCOURSE

•— UTILITY CORRIDOR

▬ ▬ APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS

☐ PROPERTY PARCELS

▨ UNEVALUATED WETLAND

▭ WATERBODY (APPROX. ELEVATION NOTED IN mASL)

▨ PROPOSED WETLAND

308.15 WATER TABLE ELEVATION (MASL), AUGUST 9, 2024

* PERCHED CONDITION INFERRED AT MW21-03-S (SAF)

0 75 150 300

1:5,000 METRES

NOTE(S)

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REFERENCE(S)

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CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
EXTRACTION LIMITS

CONSULTANT
wsp

YYYY-MM-DD	2025-10-03
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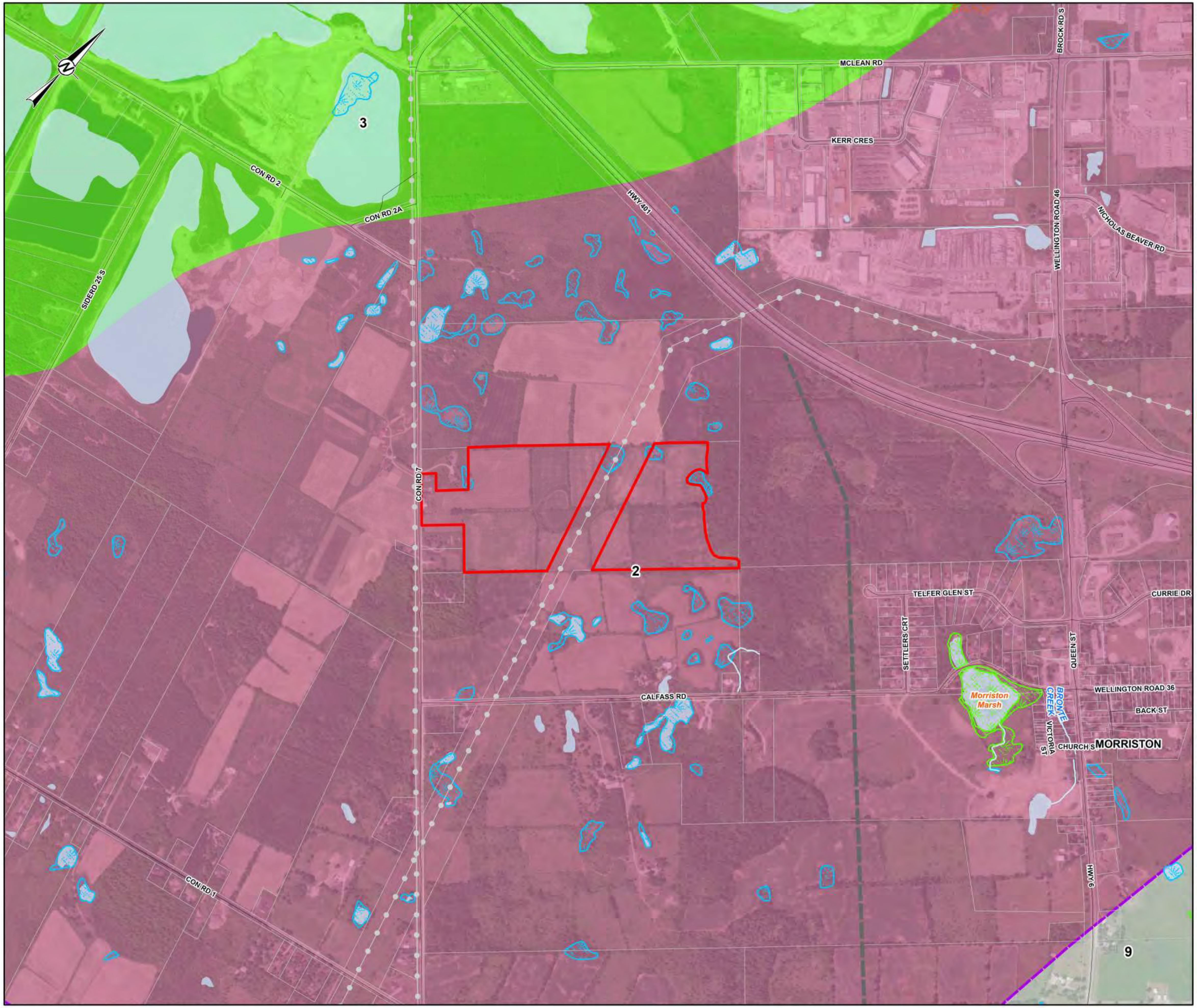

KEY MAP

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LEGEND

🟥 LICENCE BOUNDARY
— WATERCOURSE
— ROADWAY
—●— UTILITY CORRIDOR
▬ ▬ APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
☐ PROPERTY PARCELS
▨ UNEVALUATED WETLAND
▨ EVALUATED WETLAND (NO SIGNIFICANCE)
▨ PROVINCIALLY SIGNIFICANT WETLAND (PSW)
▭ WATERBODY (APPROX. ELEVATION NOTED IN mASL)

PHYSIOGRAPHY

☐ PHYSIOGRAPHIC REGION BOUNDARY
⬜ 9: LIMESTONE PLAINS
🟩 3: SPILLWAYS
🟪 2: TILL MORAINES

0 125 250 500
1:12,500 METRES

NOTE(S)

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CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
PHYSIOGRAPHY

CONSULTANT

wsp

YYYY-MM-DD	2025-07-15
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PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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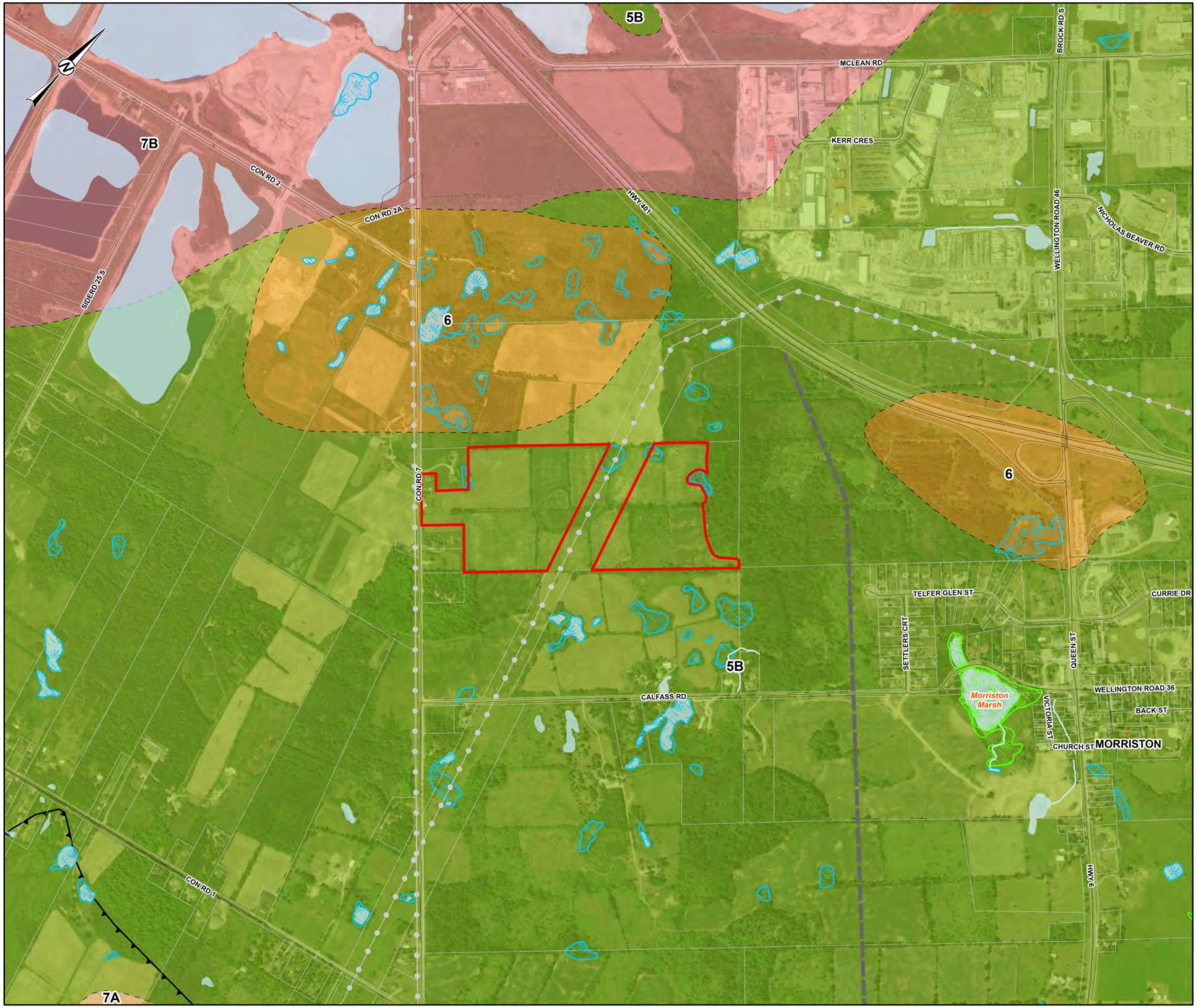

KEY MAP

SCALE 1:300,000

LEGEND

🟥 LICENCE BOUNDARY

— WATERCOURSE

— ROADWAY

○— UTILITY CORRIDOR

▬ ▬ APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS

☐ PROPERTY PARCELS

▨ UNEVALUATED WETLAND

▨ EVALUATED WETLAND (NO SIGNIFICANCE)

▨ PROVINCIALLY SIGNIFICANT WETLAND (PSW)

▭ WATERBODY (APPROX. ELEVATION NOTED IN mASL)

SURFICIAL GEOLOGY (MNDM, 2003)

▼— ICE-CONTACT SLOPE

- - APPROXIMATE/ASSUMED CONTACT

🟩 5B: STONE-POOR, CARBONATE-DERIVED SILTY TO SANDY TILL

🟧 6: ICE-CONTACT STRATIFIED DEPOSITS

🟨 7A: SANDY DEPOSITS

🟥 7B: GRAVELLY DEPOSITS

0 125 250 500

1:12,500 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS
WORLD TOPOGRAPHIC MAP: CITY OF HAMILTON, TOWN OF MILTON, ONTARIO BASE MAP, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, © OPENSTREETMAP CONTRIBUTORS, HERE, GARMIN, USGS, NGA, EPA, USDA, NPS, AAFC, NRCAN
3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
4.SURFICIAL GEOLOGY : HTTPS://SERVICES2.ARCGIS.COM/ZVN3OC2FZ0SGV7IP/ARCGIS/REST/SERVICES/SURFICIALGEOLOGYMRD128REV/FEATURESERVER

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
SURFICIAL GEOLOGY

CONSULTANT

wsp

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	0	7

PATH: S:\Clients\Votorantim_Cimentos\Neubauer_Pit\99_PROJ\21476582_Safarik_Pit_Expansion\40_PROD\0006_HydroG\CA21476582-0006-CH-0000\CA21476582-0006-CH-0000.aprx PRINTED ON: AT: 9:27:20 AM

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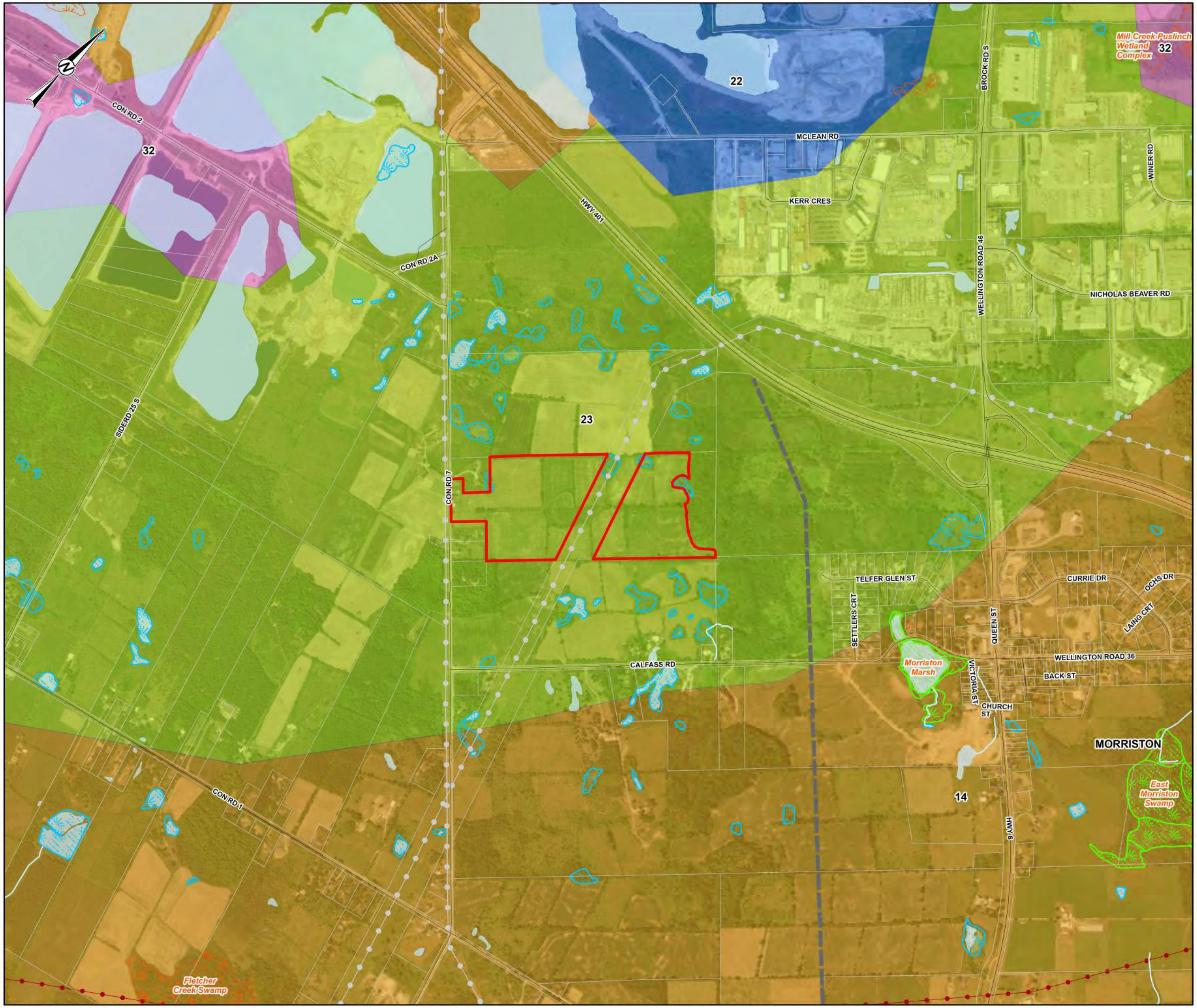
25mm



KEY MAP

SCALE 1:300,000

LEGEND

- 🟥 LICENCE BOUNDARY
- WATERCOURSE
- ROADWAY
- UTILITY CORRIDOR
- APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
- PROPERTY PARCELS
- UNEVALUATED WETLAND
- EVALUATED WETLAND (NO SIGNIFICANCE)
- PROVINCIALLY SIGNIFICANT WETLAND (PSW)
- WATERBODY (APPROX. ELEVATION NOTED IN mASL)

QUATERNARY GEOLOGY (OGS, 1997)

- TREND OF END MORAINE CREST
- 🟦 GLACIOFLUVIAL ICE-CONTACT DEPOSITS
- 🟩 GLACIOFLUVIAL OUTWASH DEPOSITS
- 🟪 ORGANIC DEPOSITS
- 🟧 WENTWORTH TILL

0 250 500 1,000

1:15,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS
WORLD TOPOGRAPHIC MAP: CITY OF HAMILTON, TOWN OF MILTON, ONTARIO BASE MAP, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, © OPENSTREETMAP CONTRIBUTORS, HERE, GARMIN, USGS, NGA, EPA, USDA, NPS, AAFC, NRCAN
3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
5. QUATERNARY GEOLOGY : Y:\ONTARIO\MNDM\EDS\EDS014-REV\EDS014-REV\GIS_DATA\QUATERNARY\GEOLOGY_LL.SHP

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

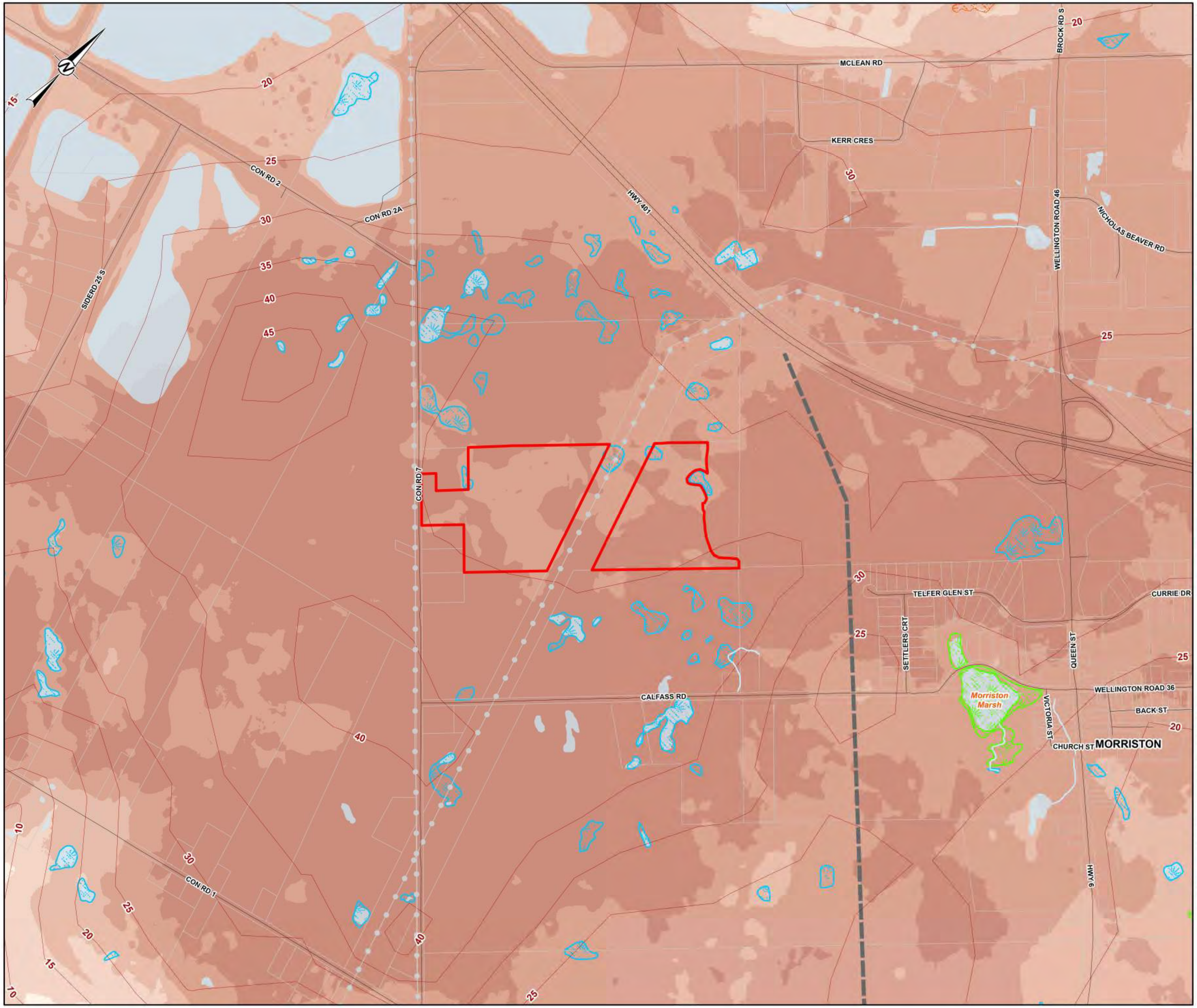
PROJECT
SAFARIK PIT

TITLE
QUATERNARY GEOLOGY

CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	0	8



KEY MAP

SCALE 1:300,000

LEGEND

- 🟥 LICENCE BOUNDARY
- WATERCOURSE
- ROADWAY
- UTILITY CORRIDOR
- DEPTH TO BEDROCK (m)
- APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
- PROPERTY PARCELS
- UNEVALUATED WETLAND
- EVALUATED WETLAND (NO SIGNIFICANCE)
- PROVINCIALLY SIGNIFICANT WETLAND (PSW)
- WATERBODY (APPROX. ELEVATION NOTED IN mASL)

INTERPOLATED OVERBURDEN THICKNESS (m)

- < 5
- 5 - 10
- 10 - 20
- 20 - 30
- > 30

0 125 250 500

1:12,500 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: CITY OF HAMILTON, TOWN OF MILTON, ONTARIO BASE MAP, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, © OPENSTREETMAP CONTRIBUTORS, HERE, GARMIN, USGS, NGA, EPA, USDA, NPS, AAFC, NRCAN
3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT

CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT

SAFARIK PIT

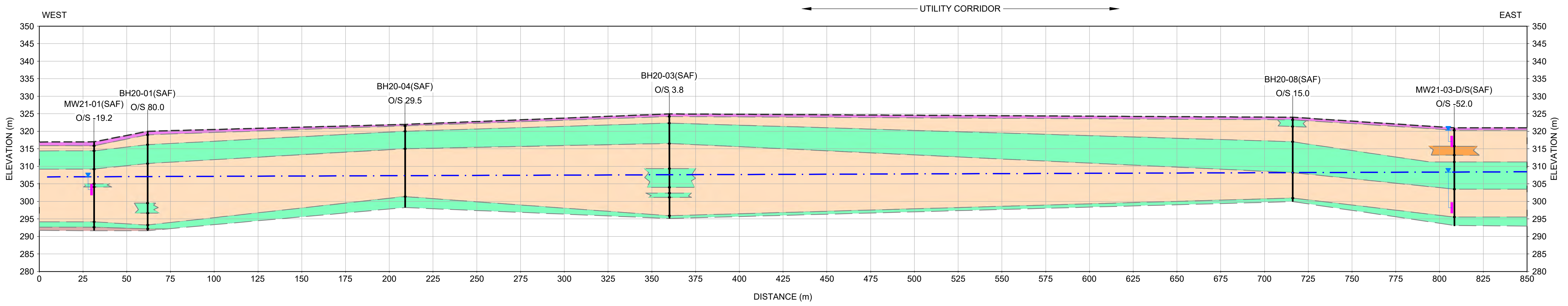
TITLE

OVERBURDEN THICKNESS

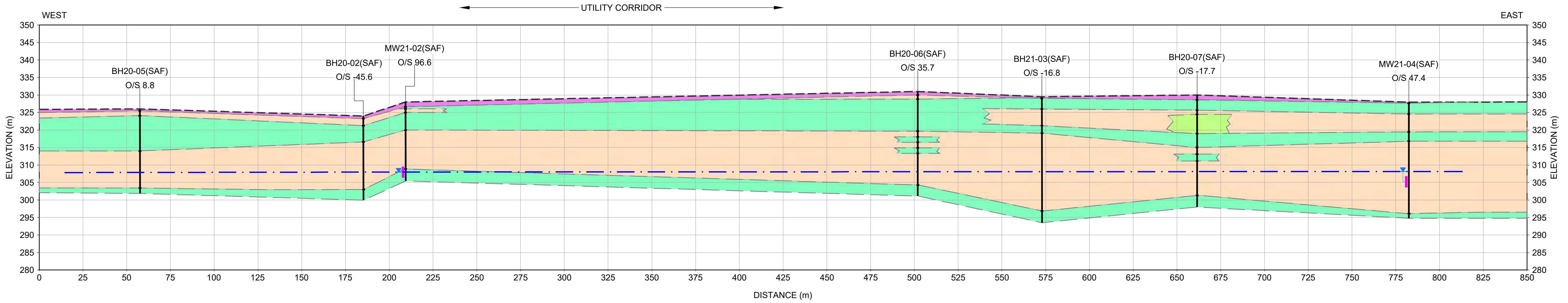
CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	0	9



HORIZ. SCALE 1:2500 A CROSS SECTION A-A'
VERT. SCALE 1:1250 2



HORIZ. SCALE 1:2500 B CROSS SECTION B-B'
VERT. SCALE 1:1250 2

REFERENCE(S)

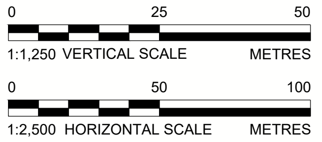
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO.

NOTE(S)

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.

LEGEND

– – – –	ASSUMED GROUND SURFACE
🟩	TILL
🟧	SAND/ GRAVEL/ COBBLE
🟪	TOPSOIL
🟫	BEDROCK
🟧	SILT, SOME CLAY TO CLAYEY
🟩	SILTY CLAYEY SAND (COHESIVE)
- —— —— ——	INTERPRETED CHANGE IN STRATIGRAPHIC UNIT
—·—·—	INTERPRETED WATER TABLE ELEVATION (AUGUST 8, 2024)
▼	WATER LEVEL (AUGUST 8, 2024)
MW21-03-D/S(SAF)	BOREHOLE NUMBER (DEEP/ SHALLOW)
O/S -21.3 ←	OFFSET FROM PROFILE LINE + NORTH OF PROFILE LINE - SOUTH OF PROFILE LINE
←	SCREEN
←	BOREHOLE



CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC.
(CANADA)

PROJECT
LEVEL ONE AND TWO WATER REPORT
SAFARIK PIT, PUSLINCH, ONTARIO

CONSULTANT

YYYY-MM-DD	2024-10-07
DESIGNED	
PREPARED	INS
REVIEWED	
APPROVED	

TITLE
GEOLOGICAL CROSS SECTIONS A-A' AND B-B'

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	A	10

Path: \\corp.pbwan.net\CA\CAMIS300\CTX_Data\SIM\Clients\Votorantim_Cimentos\Neubauer_Pit\99_PROJ\21476582_Neubauer_Pit_Expansion\40_PROD\0006_HydoG\ | File Name: 21476582-0006-CH-0008.dwg | Last Edited By: inis06739 Date: 2024-10-07 Time:10:39:11 AM | Printed By: INIS06739 Date: 2024-10-07 Time:10:40:11 AM

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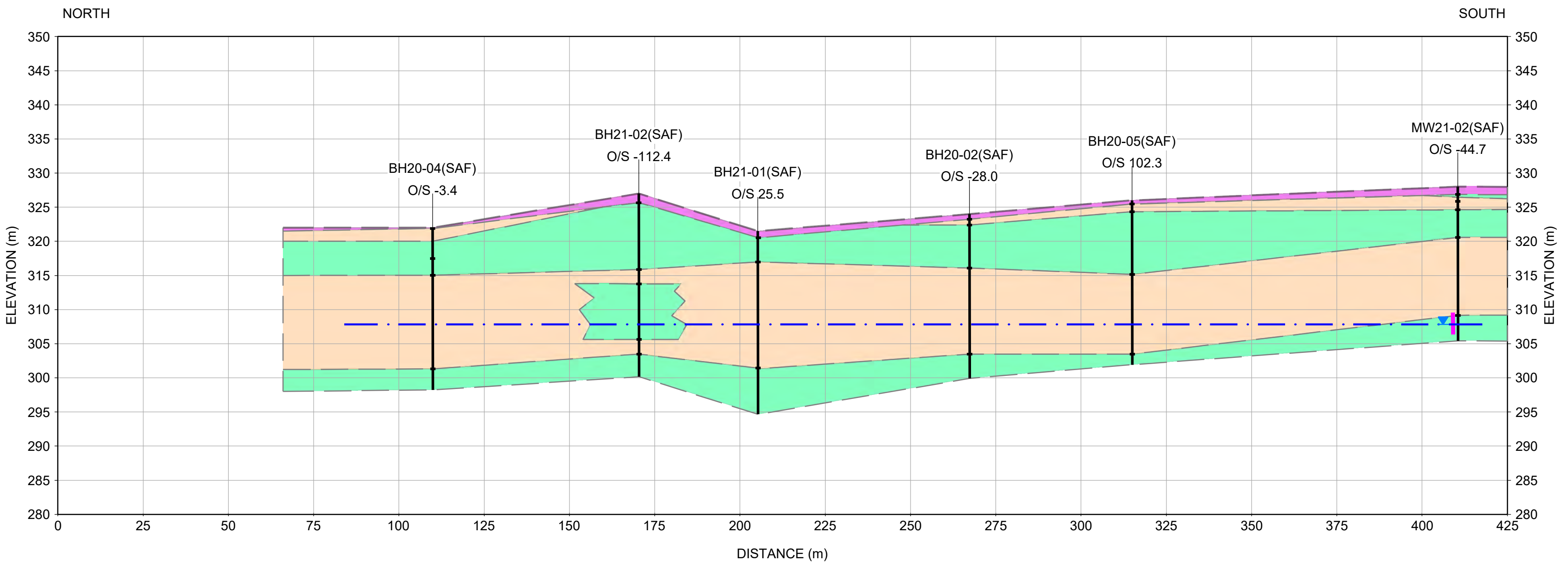
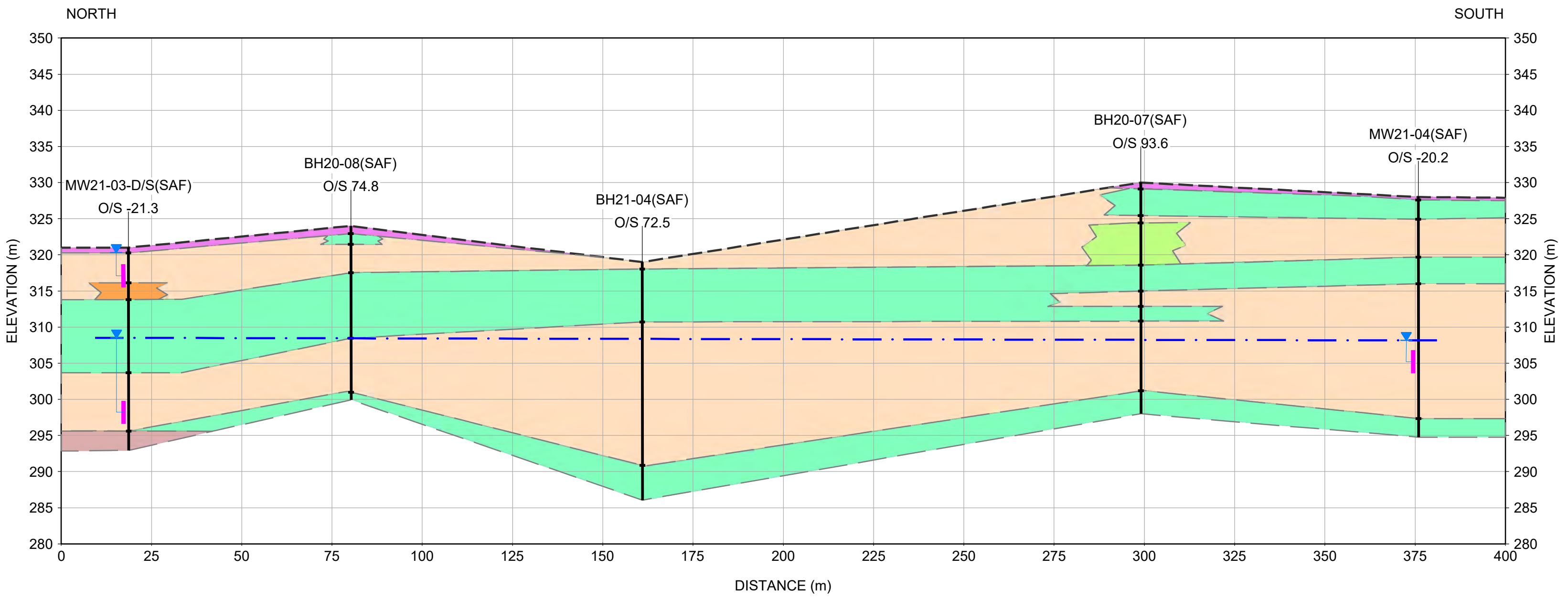


HORIZ. SCALE 1: 2000
VERT. SCALE 1:1000
C
2
CROSS SECTION C-C'



HORIZ. SCALE 1: 2000
VERT. SCALE 1:1000
D
2
CROSS SECTION D-D'

REFERENCE(S)

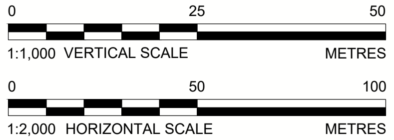
1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO.

NOTE(S)

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.

LEGEND

– – – – –	ASSUMED GROUND SURFACE
🟩	TILL
🟧	SAND/ GRAVEL/ COBBLE
🟪	TOPSOIL
🟫	BEDROCK
🟧	SILT, SOME CLAY TO CLAYEY
🟩	SILTY CLAYEY SAND (COHESIVE)
- —— —— ——	INTERPRETED CHANGE IN STRATIGRAPHIC UNIT
- · — · — · -	INTERPRETED WATER TABLE ELEVATION (AUGUST 8, 2024)
▼	WATER LEVEL (AUGUST 8, 2024)
MW21-03-D/S(SAF)	BOREHOLE NUMBER (DEEP/ SHALLOW)
O/S -21.3	OFFSET FROM PROFILE LINE + NORTH OF PROFILE LINE - SOUTH OF PROFILE LINE
	SCREEN
	BOREHOLE



CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
LEVEL ONE AND TWO WATER REPORT
SAFARIK PIT, PUSLINCH, ONTARIO

CONSULTANT

YYYY-MM-DD	2024-10-07
DESIGNED	
PREPARED	INS
REVIEWED	
APPROVED	

TITLE
GEOLOGICAL CROSS SECTIONS C-C' AND D-D'

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	A	11

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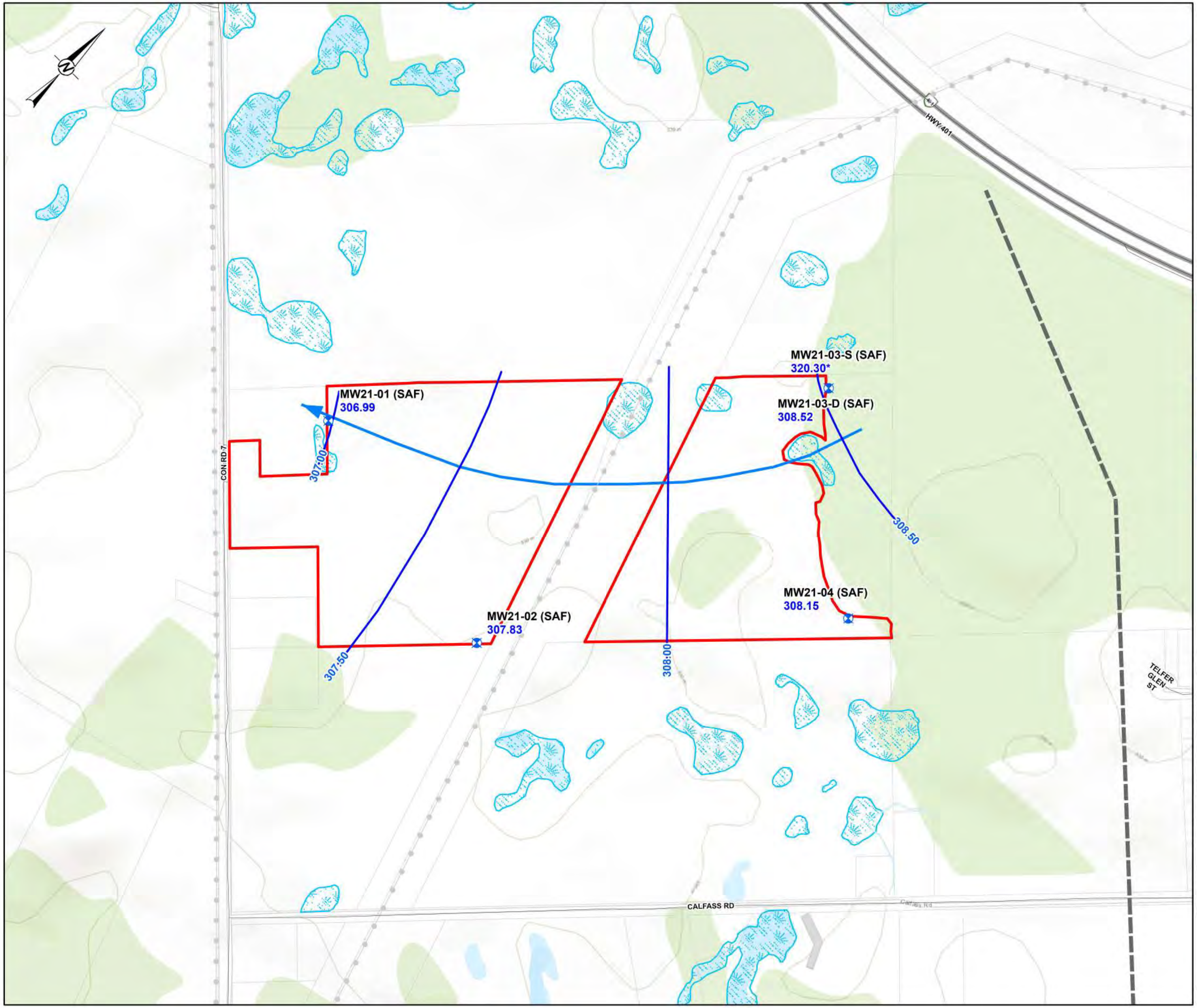
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

0



KEY MAP

SCALE 1:300,000

LEGEND

- ⊕ MONITORING WELL LOCATION AND DESIGNATION
- ▭ LICENCE BOUNDARY
- — ROADWAY
- — WATERCOURSE
- ●- UTILITY CORRIDOR
- — INTERPOLATED WATER TABLE CONTOUR (masl)
- — INFERRED DIRECTION OF GROUNDWATER FLOW
- ▬ ▬ APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
- ▭ PROPERTY PARCELS
- ▨ UNEVALUATED WETLAND
- ▭ WATERBODY (APPROX. ELEVATION NOTED IN mASL)
- 308.15 WATER TABLE ELEVATION (MASL), AUGUST 9, 2024
- * PERCHED CONDITION INFERRED AT MW21-03-S (SAF)

0 75 150 300
1:6,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: CITY OF HAMILTON, TOWN OF MILTON, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, HERE, GARMIN, INCREMENT P, USGS, EPA, USDA, AAFC, NRCAN
WORLD TOPOGRAPHIC MAP; CITY OF HAMILTON, TOWN OF MILTON, ONTARIO BASE MAP, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, © OPENSTREETMAP CONTRIBUTORS, HERE, GARMIN, USGS, NGA, EPA, USDA, NPS, AAFC, NRCAN
3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
MAXIMUM WATER TABLE ELEVATION

CONSULTANT
wsp

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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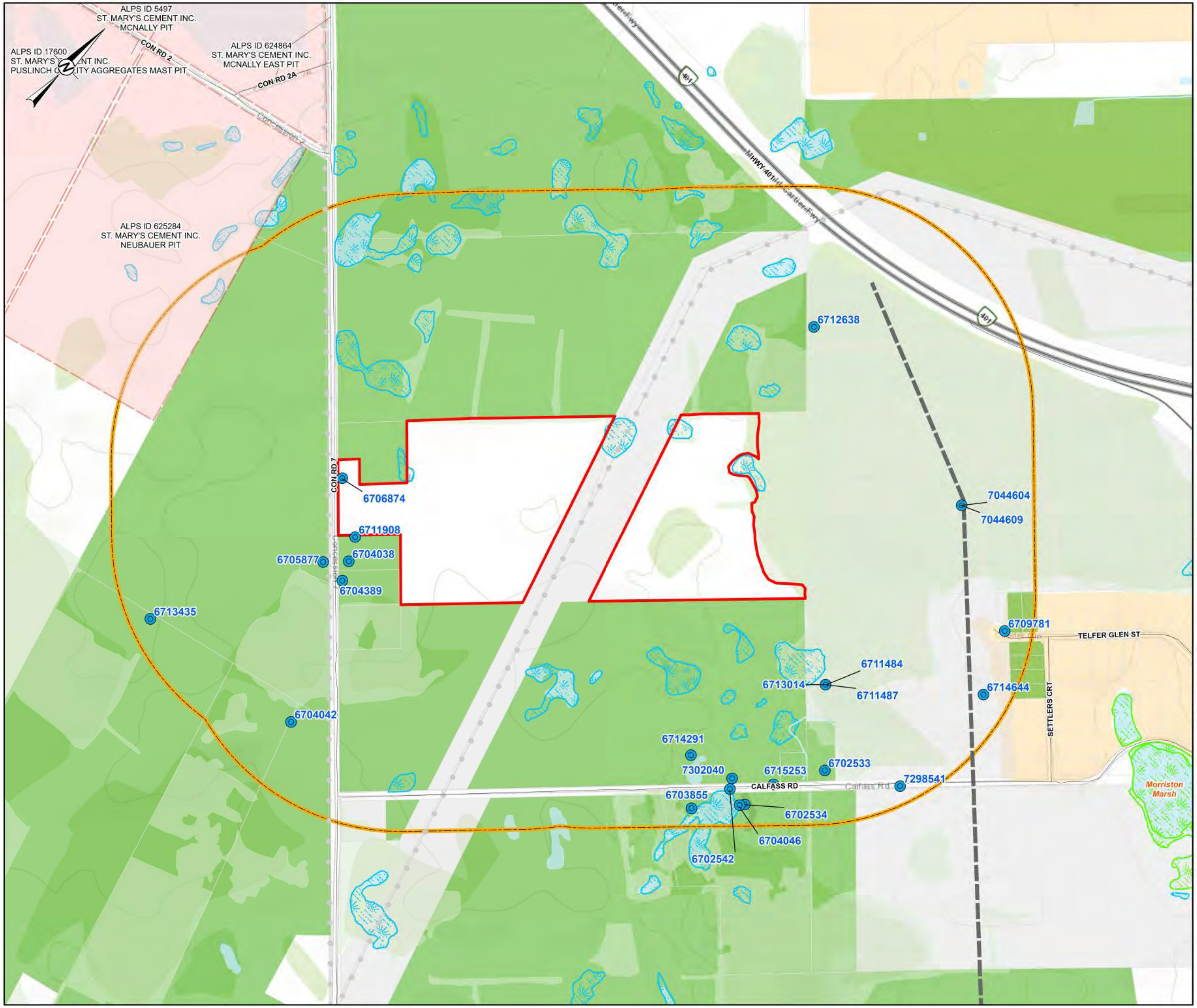

KEY MAP

SCALE 1:300,000

LEGEND

- ● MECP WATER WELL RECORD
- 🟥 LICENCE BOUNDARY
- ROADWAY
- WATERCOURSE
- UTILITY CORRIDOR
- APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
- ▨ EXISTING PIT / QUARRY LICENCE
- 🟧 500M STUDY AREA
- ▨ UNEVALUATED WETLAND
- ▨ EVALUATED WETLAND (NO SIGNIFICANCE)
- 🟦 WATERBODY
- 🟩 WOODED AREA
- ☐ PARCEL
- 🟩 PARCEL INCLUDED IN SURVEY
- ⬜ PARCEL HAS NO ADDRESS
- 🟧 BUILT UP AREA

0 75 150 300
1:8,500 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: CITY OF HAMILTON, TOWN OF MILTON, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, HERE, GARMIN, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCAN
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3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

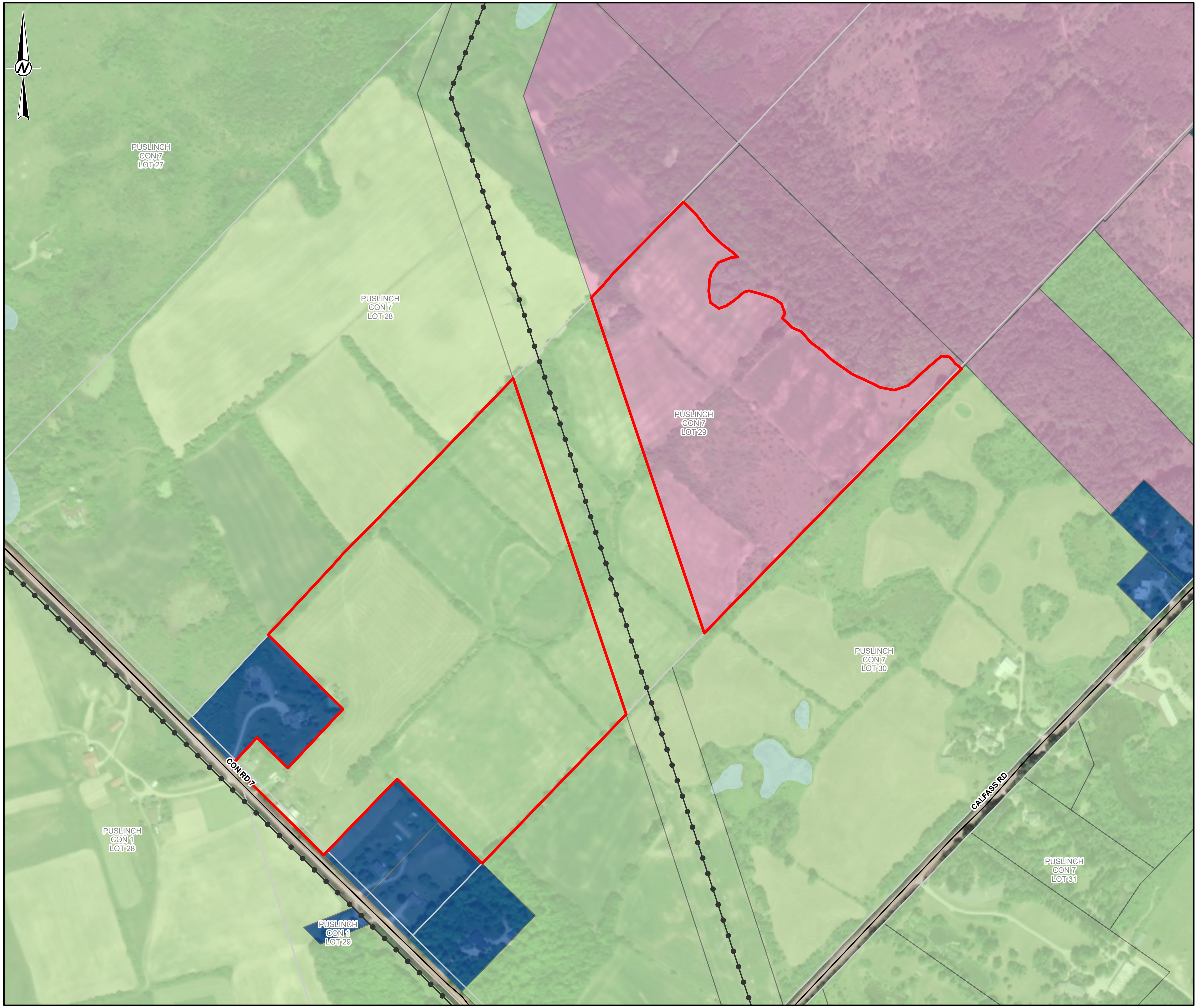
TITLE
WATER WELL RECORDS

CONSULTANT

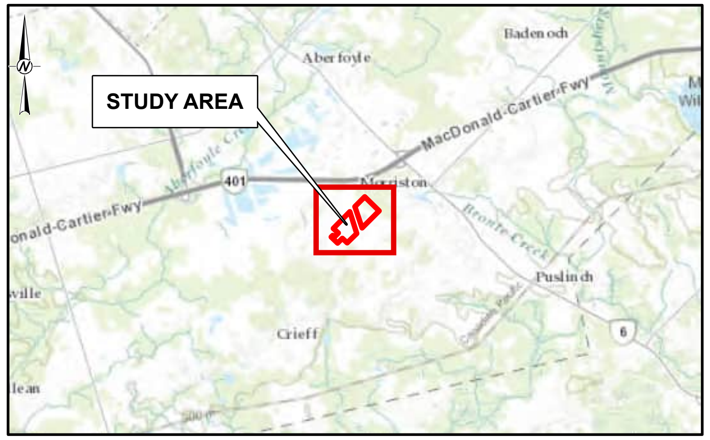
YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	0	13

25mm



KEY MAP



SCALE: 1:150,000

LEGEND

- 🟥 LICENCE BOUNDARY
- — ROADWAY
- ●—● HYDRO LINE
- ▭ WATERBODY
- ▭ TOWNSHIP, CONCESSION AND LOT

LAND USE

- 🟩 AGRICULTURE
- ▭ OPEN SPACE
- 🟦 RESIDENTIAL

0 50 100 200

1:5,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. BASE MAP: CITY OF HAMILTON, TOWN OF MILTON, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, HERE, GARMIN, USGS, NGA, EPA, USDA, NPS, AAFC, NRCAN, TOWN OF OAKVILLE, MAXAR
3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 17N

CLIENT

CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT

SAFARIK PIT

TITLE

EXISTING CONDITIONS LAND USE

CONSULTANT

wsp

YYYY-MM-DD	2025-05-09
DESIGNED	----
PREPARED	SO/LS
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0001	A	14

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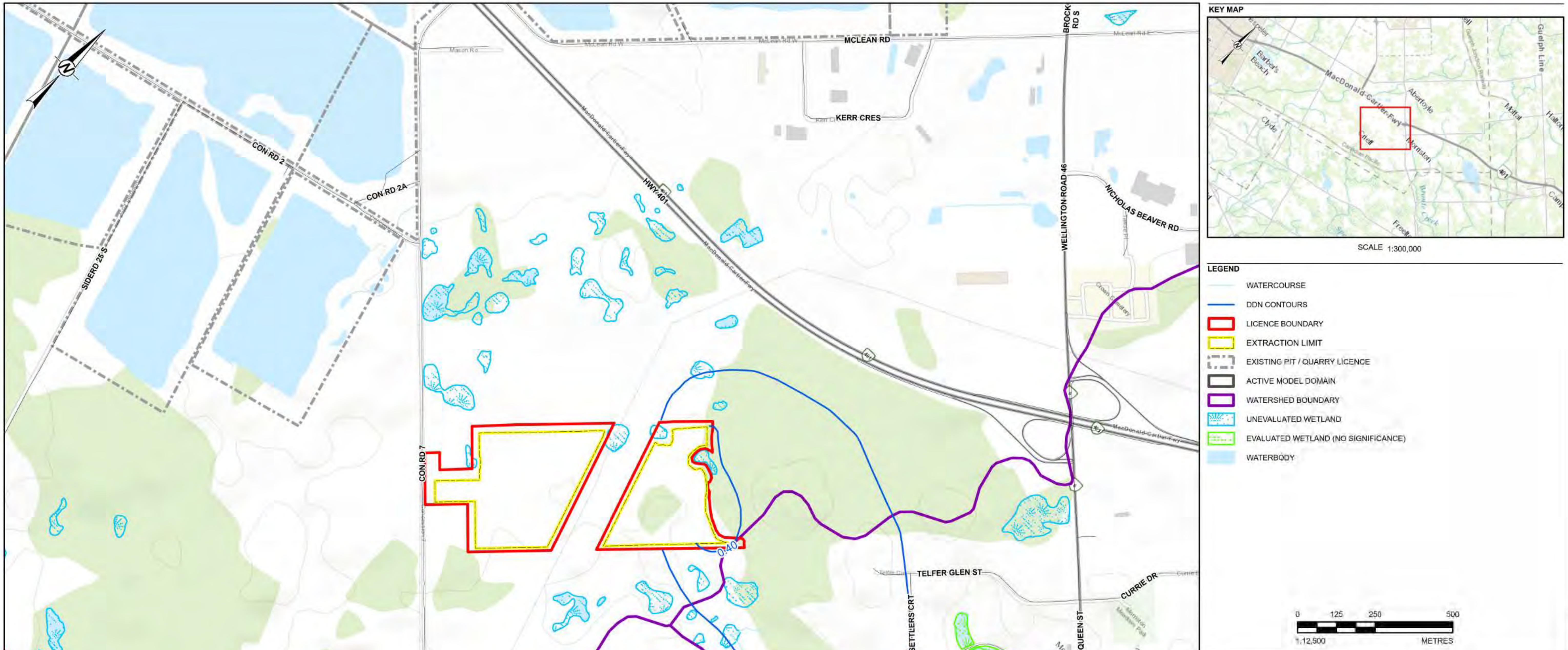

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: CITY OF HAMILTON, TOWN OF MILTON, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, HERE, GARMIN, INCREMENT P, USGS, METI/NASA, NGA, EPA, USDA, AAFC, NRCAN
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3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. EXTRACTION LIMIT PROVIDED BY MHBC JUNE 2025
5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
PREDICTED DRAWDOWN AT FULL PIT DEVELOPMENT

CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/MC
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV	FIGURE
21476582	0006	0	15

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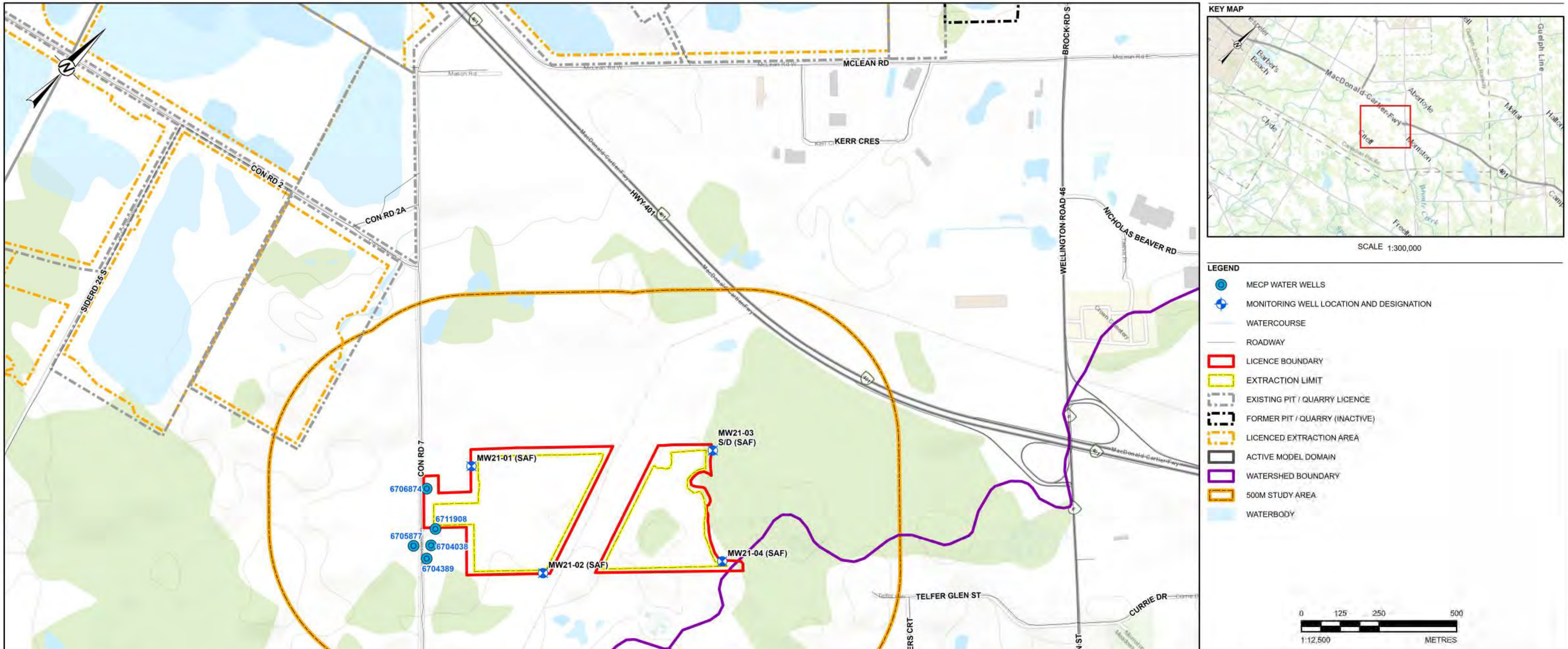

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. EXTRACTION LIMIT PROVIDED BY MHBC JUNE 2025
5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
PROPOSED MONITORING PROGRAM

CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/MC
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	0	16

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

25mm

APPENDIX A

Curriculum Vitae

CRAIG M. J. DE VITO, PEng

Water Resources Specialist

Areas of practice

Water Resources Engineering

Languages

English – Fluent

PROFILE

Responsible for conducting water quantity and water quality investigation programs that include hydraulic and hydrologic modelling, analysis of riverine and lacustrine environments, the design, execution and management of meteorological, hydrological and water quality field programs and development of water balance and water quality modelling analyses. Currently working on various surface mine and mine rehabilitation investigations of hydrology and water quality. Completes water resources projects from desktop reviews to design, construction monitoring and erosion and sediment control inspection.

EDUCATION

BSc Engineering (Co-op), University of Guelph, Guelph, Ontario	2007

CAREER

Water Resources Specialist, WSP, Mississauga, ON	2007 – Present
Co-Op , Water Resources, Golder Associates Ld. (WSP Acquisition), Mississauga, ON	May 2006 – Dec 2006
Co-Op Student, University of Guelph, Environmental Biology, Guelph, ON	May 2005 – Aug 2005
Co-Op, Water Resources, Ontario Clean Water Agency – Toronto, ON	Jan 2005 – Apr 2005
Co-Op Student, Hydromantis Inc., Consulting Engineers – Toronto, ON	Jun 2004 – Sept 2004

PROFESSIONAL EXPERIENCE

Water Supply

- City of Iqaluit, Nunavut, Canada (2012 to 2013): Developed a water balance model (using GoldSim) to quantify water deficit risks under future population growth and climate change scenarios. Analytical output and recommendations were subsequently provided in order to assist the City in water license application process for a supplementary source and provide a risk matrix of long-term probabilistic water supply deficits.
- City of Rankin Inlet, Rankin Inlet, Nunavut, Canada (2015): Water supply deficits were evaluated using a water balance model (using GoldSim) under future growth and climate change scenarios. The model evaluated water taking from the supply reservoir and an adjacent river while maintain use for aquatic live and social activities.
- Southwest Guelph Water Supply Operation Testing Program and Environmental Assessment, Guelph Ontario, Canada: The project includes completed the testing and investigation required to access the feasibility of developing a “pond Level Management” Strategy for the Dolime Quarry and municipal wells. The work includes monitoring and evaluation of the local surface water features and there response to climatic and dewatering conditions.

Channel / Crossing Design

- County of Northhumberland, Cobourg, Canada (2009 to 2015): Ongoing support regarding a channel remediation design/assessment for the County of Northhumberland on a reach of Brookside Creek located downstream of the closed Eagleson Landfill to reroute unaffected surface water flows away from a zone of leachate influenced groundwater – conducted field studies, fluvial geomorphic and hydraulic analyses, preparation of conceptual/detailed design plans, liaison with contractor and reporting.
- Region of Durham, Whitby, Canada (2014 to 2016): Completed a hydraulic analysis and fluvial geomorphic assessment at East Corbett Creek and tributary of East Corbett Creek. The analyses were conducted in support of a proposed extension of Consumers Drive that includes culvert crossings at the two watercourses – conducted field investigations, fluvial geomorphic analyses, hydraulic modelling, environmental permitting and reporting.
- Confidential Client, Timmins, Canada (2015): Ongoing support of a natural channel diversion design/assessment for a proposed pit mine. The channel design incorporates fluvial geomorphic processes to accommodate fish passage and habitat. Hydraulic modelling was conducted to limit erosion and maintain stability of the channel banks and crossings.
- Canadian National Railway, Southern Ontario, Canada (2016 to 2020): Many rail crossings were evaluated at locations of aging bridges, collapsed culverts and areas of flooding. Sites were visited and surveyed to confirm conditions and provide detailed data for desktop analysis. Hydraulic analyses were completed for each site to evaluate existing infrastructure. New crossing designs were evaluated based on MTO and CN guidelines and developed to conceptual and final designs.
- Trans Canada Pipelines Channel Rehabilitation, Dryden, Ontario, Canada (2017): Designed a stream channel rehabilitation to remediate TransCanada Line 100-1 exposure caused by erosion and beaver activity near Dryden, Ontario. The project progressed from conceptual design through to construction monitoring. The final design was focused on improving channel stability over the pipelines to reduce meander and erosion.
- Trans Canada Pipelines Channel Rehabilitation, Barrie, Ontario, Canada (2016 to 2017): Developed the design and supported construction of channel rehabilitation works at a tributary of Bear Creek that is crossed by TransCanada pipelines Line 100-1 and Line 100-2 near Barrie, Ontario. The goal of the rehabilitation is to improve long term channel stability at the watercourse crossing. The work includes the completion of field studies and hydraulic modelling, development of conceptual designs, and the preparation of environmental permitting.

Erosion and Sediment Control

- Prodigy Gold Inc., Wawa, Ontario, Canada (2021 to 2022): Completed Erosion and Sediment Control Plans for a variety of earth work projects at the Magino Mine Project. These plans for stream diversions, embankments and shorelines were completed as part of a LRIA permitting package.
- Prodigy Gold Inc., Wawa, Ontario, Canada (2021): Managed the monitoring and inspection of erosion and sediment control measures site-wide that included various earth work projects. The continuous monitoring was responsible for identifying erosion and sedimentation issues and recommend corrective actions.

Environmental Compliance Approvals, Water Discharges

- Canadian National Railway, Algonquin Park, Ontario, Canada (2015 to 2017): Completed an Environmental Compliance Approval for Industrial Sewage Works for a temporary water treatment facility which was designed to treat contaminated water and sediments from a historic train derailment. The facility discharged to a nearby lake within the Park.
- Essroc Aggregates, Cambridge, Ontario, Canada (2016 to 2017): Managed and completed an Environmental Compliance Approval for Industrial Sewage Works for an aggregate pit and wash plant in Cambridge, Ontario. The application included supporting documentation of the wash ponds which only discharged to the environment through the groundwater.
- Fish and Bird Emporium, Innisfil, Ontario, Canada (2016): Lead a team that completed an Environmental Compliance Approval for Industrial Sewage Works for a tropic fish warehouse and distribution centre. The application included multiple water filtration facilities designed to reduce the effluent contaminant concentrations without impacting the health of the fish at the site.
- Lafarge Canada Inc. – Soares, Dundas, Ontario, Canada (2007 to 2009): Carried out field investigations, water budget analysis and coordinated various project tasks related to the proposed Lafarge Soares License Application.
- Amherst Quarries Ltd., Windsor, Ontario, Canada (2008): Performed reconnaissance of the local watersheds and hydrologic features of the quarry sumps. Carrying out quarterly volumetric flow monitoring and water quality sampling. Local drainage channels were evaluated using computer models including HEC-RAS. Developed a water balance to model drainage from the site and the adjacent Canard River.
- O'Shanter Development Company – Arbour Farms Dufferin, Ontario, Canada (2007 to 2021): Conducting annual dry weather volumetric flow monitoring and groundwater well monitoring related to the Arbour Farms assessment of the proposed quarry.
- Brampton Brick – Norval, Norval, Ontario, Canada (2007 to 2008): Performed field investigations and coordinated various project tasks related to the proposed Brampton Brick Norval quarry development.
- Lafarge Canada Inc. West Paris, Ontario, Canada (2016 to 2022): Completed baseline monitoring, including flow and water level monitoring, water quality monitoring. Supported license applications for extension properties and Permit to Take Water applications and continued site plan monitoring.
- Lafarge Canada Inc. Wellington, Ontario, Canada (2015-2022): Conducted baseline investigations of site drainage, local watercourses, including the Speed River. Potential impact on the water resources as a result of below water extraction was evaluated to support Permit to Take Water Applications and Environmental Compliance Approvals.
- Lafarge Canada Inc., Woodstock, Ontario, Canada (2015-2022): Completed water quality, water level and flow monitoring at local water features. Developed potential effects assessment of quarry extraction and drain realignments in support of a Major Site Plan Amendment.
- Nelson Aggregate Company, Burlington, Ontario, Canada (2006 to 2007): Carried out volumetric flow monitoring throughout neighbouring watersheds for the

proposed Lafarge Nelson License Application. Performed wetland mapping on the proposed quarry site.

- CBM Aggregates, Various Sites in Southern Ontario (2007 to 2022): Various aggregate properties have been monitored and evaluated for aggregate license applications. This monitoring included water level monitoring, stream flow monitoring, groundwater piezometer monitoring and meteorological monitoring. Detailed site water balances as well as site and water course characterization have been evaluate and reported as part of the multidisciplinary applications.

Site Rehabilitation

- Client Confidential, Bancroft, Ontario, Canada (2010 to 2022): Completed surface water investigations at a decommissioned mine site (uranium) near Bancroft, Ontario, including meteorology, flow and water quality monitoring. Developed a detailed water balance to evaluate the site drainage and adjacent stream networks. Characterized and reported the surface water networks and their impacts.
- Client Confidential, Near Kenora, Ontario, Canada (2009 to 2018): Completed surface water investigations at a former mine (nickel) near Kenora, Ontario, including meteorology, flow monitoring, water column profiling and water quality sampling. Flow regimes were characterized and modelled to evaluate impacts of adverse water quality on downstream environments.
- Niagara Peninsula Conservation Authority, Welland, Ontario, Canada (2009 to 2010): Completed stream sediment investigations on Lyon’s Creek, downstream of the Welland Canal, including a stream survey, sediment sampling, loading, scour and re-suspension analysis. Reported investigation results as part of the Niagara River remedial options.
- Lafarge Canada Inc., Bath, Ontario, Canada (2006 to 2008): Reporting annually on volumetric flow monitoring and water quality data collected monthly on and adjacent to the Lafarge Bath cement kiln dust landfill and rehabilitation. Engineering drainage features on site was also completed.
- Canadian Gypsum Company Ltd. Haggersville, Ontario, Canada (2006 to 2015): Performing volumetric flow monitoring, water quality and continuous water level monitoring on Boston Creek adjacent to the mine site. Annual reporting was also conducted until rehabilitation completion.

Threats Assessment

- Hanson Brick Ltd. – Tremaine Bronte Creek, Burlington, Ontario, Canada (2008): Evaluated the risks of a potential drinking water intake on Bronte Creek. Risks in the watershed were evaluated and analysed using plume dispersion algorithms to estimate contaminate impacts on the potential intake. Evaluation was completed using computer models including HEC-RAS.
- Teck Resources, Elk Valley, British Columbia, Canada (2013 to 2015): Conducted water quality modelling to support mine site investigations for a mining project in British Columbia. Water quality parameters were modelled throughout the watersheds from natural sources, mining and metal processing activities as well as their reactions within the watershed. Modelling efforts were used to evaluate treatment options and water handling / management.

Urban Water Management

- Metrolinx, Toronto, Ontario, Canada (2017 to 2018): Project manager for the program which included stormwater sampling of a Metrolinx rail yard. The sample results were compared to the municipal stormwater sewer quality limits and reported at the season.
- Toronto Transit Commission, Vaughan, Ontario, Canada (2018 to 2019): Task Manager of the stormwater monitoring and reporting as part of the ECA requirements at the 407 subways station. The monitoring involved storm event water quality monitoring to evaluate Stormwater Management Pond performance, erosion and sediment control inspections, annual reporting and recommendations for performance improvements.
- Town of Oakville, Oakville, Ontario, Canada (2008 to 2012): Project manager for the program which included dry weather outfall sampling and wet weather storm sewer sampling. Results were analysed to develop water quality trends in order to estimate contaminate sources and evaluate the effectiveness of Best Management Practices and Stormwater Management Plans (Town of Oakville).
- City of Barrie, Barrie, Ontario, Canada (2008): Performing volumetric flow monitoring under flash flooding or melting conditions in areas of low permeability in the City of Barrie.
- Black and McDonald Ltd. – Castrol, Toronto, Ontario, Canada (2007): Conducted reconnaissance and water quality sampling regarding the Castrol Oil storm water discharge to the city storm sewer. Testing performance of the on-site water treatment equipment and evaluating replacements.

Mining Operations and Exploration

- Adrianna Resources, Lac Otelnuk, Quebec, Canada (2010): Conducted transducer installations and collected cross sectional geometry information at surface water points of interest influencing site drainage and watersheds adjacent to Lac Otelnuk.
- Xstrata, Copper, Las Bambas, Peru (2008): Conducted transducer installations at surface water points of interests influencing the site drainage and watersheds located on and adjacent to site Las Bambas.
- Xstrata, Copper, Antapaccay, Peru (2008): Conducted transducer installations at surface water points of interests influencing the site drainage and watersheds located on and adjacent to site Antapaccay.
- Xstrata, Nickel, Loma Miranda, Dominican Republic (2007 to 2010): Managed and carried out quarterly field campaigns for Loma Miranda and Energy Conversion Project, which involved installation and monitoring of river hydrology, water quality sampling and rain data collection. Quarterly reporting was conducted, summarizing campaigns.

Pipeline Work

- Trans Canada Pipelines, New Gas Line, Vaughan, Ontario, Canada (2017 to 2018): Managed and supported continuous instream turbidity monitoring of many watercourse crossings as part of the Vaughan Mainline pipeline construction and Gravenhurst pipe replacement. This program included site reconnaissance, equipment installation, intensive 24-hour monitoring and troubleshooting, daily and final reporting.

- Trans Canada Pipelines, New Gas Line, South Eastern, Ontario, Canada (2015 to 2016): Completed watercourse baseline investigations for Eastern Mainline Expansion in Ontario (260 km long new gas pipeline spanning central and eastern Ontario). Responsible for field data collection of baseline conditions at major watercourse crossings and evaluating the hydrotechnical characteristics of each potential crossing.
- Trans Canada Pipelines Gas Line Construction, Brampton, Ontario, Canada (2018-2020): Designed drainage improvements at a gas pipeline valve station to control flooding in the area to allow maintenance staff to work safely. The work involved conservation authority permitting and negotiation with landowners and other stakeholders.

Environmental Assessment and Permitting

- Walker Environmental Group Inc. Ingersol, Ontario, Canada (2018-2019): Completed baseline evaluation and impact assessment for the proposed landfill in the Town of Ingersol. This included the flow and water quality monitoring of the Thames River and local tributaries. Desktop analysis of the potential impacts utilized hydrologic models, climate change predictions, water quality models and stormwater design.
- Marten Falls First Nation, Marten Falls, Ontario, Canada (2019-2020): Completed existing surface water conditions report and impact assessment to support the proposed all season road from Marten Falls to Nakina Ontario. This work involved watercourse crossing surveys utilizing helicopter transportation. The field studies visited a subset of the crossings to evaluate the impacts of the road alignment.
- NextBridge, Northern Ontario, Canada (2018): Completed water quality and hydrotechnical analysis to support the NextBridge Infrastructure East-West Tie Transmission Line Project in Northern Ontario (430 km long new transmission line). Conducted baseline studies, effects evaluations, permitting support through hydrotechnical analysis and preliminary design criteria.
- Hydro One, Northern Ontario, Canada (2019-2022): Completing baseline evaluation and impact assessment for the proposed power transmission corridor from Thunder Bay to Dryden. This work involved watercourse crossing surveys in remote areas of a subset of the crossings to evaluate impacts of the proposed transmission line corridor.

KEVIN J. FITZPATRICK, P.Eng.

Senior Project Engineer, Environment

AREAS OF PRACTICE

Hydrogeology

Aggregate Resources

Geology & Geotechnical Engineering

Environmental Assessments & Remediation

Waste Management

PROFILE

Mr. Kevin Fitzpatrick, P. Eng. (Geological) is a Senior Project Engineer with more than 20 years of experience in geology, hydrogeology, geotechnical engineering, and water resources. His work experience encompasses project management, field investigations, analysis, interpretation, and peer review for numerous projects requiring his earth science expertise.

Mr. Fitzpatrick has developed his technical and project management expertise through his management of geological, hydrogeologic and geotechnical investigations related to groundwater quality and quantity compliance issues, aggregate resources, waste management, environmental remediation, dewatering, and civil construction. He has been a guest lecturer for geotechnical engineering course at Niagara College since 2012.

EDUCATION

B.A.Sc. Geological Engineering, University of Waterloo, ON	1993

PROFESSIONAL DEVELOPMENT

WHMIS	2013
Critical Thinking in Aquifer Test Interpretation, Christopher Neville, S.S. Papadopulos & Associates	2009
40-hour Health & Safety Training Course for Hazardous Waste Operations, OSHA, and update courses, Surface Miner Common Core Training	2005
Waterloo In-situ Groundwater Remediation Course, Toronto, ON	2000

PROFESSIONAL ASSOCIATIONS

Professional Engineers Ontario	1996
Ontario Stone, Sand and Gravel Association, Rehabilitation Committee	OSSGA
Aggregate Resource Prospecting and Evaluation Specialty, Ontario Ministry of Transportation, Registry Appraisal and Qualifications System	RAQS
Niagara College Programs Advisory Committee for Construction/ Civil Engineering Programs	2013

CAREER

Senior Project Engineer, Environment, WSP	2014 - Present
Senior Project Engineer, Environment, GENIVAR (now named WSP)	2009 - 2013
Project Engineer, Jagger Hims Limited (GENIVAR Acquisition)	1993 - 2009

PROFESSIONAL EXPERIENCE

Hydrogeology

- Assessments, Permit to Take Water Applications and Hydrogeologic Monitoring Reports (ongoing): Completed numerous studies as project manager in support of OWRA applications and Certificate of Approval for Discharge studies throughout Ontario, including in Lincoln, Waterford, Mosport, Thorold, Hamilton, Niagara Falls, Coboconk, Markham, Port Colborne, Port Dover, Wainfleet and Hagersville. The studies supported quarry applications, civil construction dewatering and industrial applications. Client: Various.
- Dewatering Assessment, Fort Erie, ON (2012): Hydrogeologic study for a pumping station within a productive, corrosive bedrock aquifer. Client: Region of Niagara.
- Hydrogeologic Assessment, Flamborough, ON (2011): Hydrogeologic assessment for a large food processing facility. Work included geotechnical design and wastewater compliance issues. Client: Earthfresh Foods Inc.
- Water Well Interference, Niagara-on-the-Lake, ON (2011): Completed a salt water intrusion contaminant assessment as part of a Ministry of Environment director’s order. Design of a sulphate-resistant decommissioning program to prevent future cross-contamination. Client: Aviva Canada.
- Groundwater Interference Study, Dunnville, ON (2010): Intermittent issues at residential wells located adjacent to a dolostone and limestone quarry were evaluated for quality and quantity. The hydrogeology was complicated by the high transmissivities of the aquifer and the proximity of the Grand River and Lake Erie. Client: Dunnville Rock Products.
- Lookout Point Golf Club, Pelham, ON (2008-ongoing): Conducted a multi-year groundwater and surface water investigation that led to construction of a high capacity deep well in the Fonthill Kame for golf course irrigation. Other consultants had installed deep wells at the site; however, yields were very poor. High hydrogen sulphide concentrations and a cold-water fishery were also a concern. A thorough re-evaluation of the local hydrogeology was completed and detailed long-term pump tests were performed to satisfy Niagara Escarpment Commission and MOE concerns. Monitoring of the various system components was designed to improve data quality and lower operating costs. Client: Lookout Point Golf and Country Club.
- Groundwater Salt Impact Assessment, Lincoln, ON (ongoing): Hydrogeologic monitoring at a winter sand storage facility. The facility is located above the Niagara Escarpment on fractured bedrock upgradient of several groundwater springs. A best management plan was produced for the facility. Client: Town of Lincoln.
- Hydrogeologic Study, Port Colborne, ON (2009): Hydrogeologic study to support residential development plan. A developer needed to assess a productive shallow bedrock aquifer as part of a plan of subdivision. Client: Lester Shoaltz Limited.
- Hydrogeologic Monitoring, Caledonia, ON (2009): Hydrogeologic monitoring at a golf course in support of a Permit to Take Water. Electronic groundwater monitoring was installed to provide high quality data. Client: Numbered Ontario Company.
- Niagara Tunnel Project, Niagara Falls, ON (2008): Completed detailed core logging on deep groundwater monitors. Cores represented a complete section of Niagara Escarpment bedrock from the Guelph Formation to the Queenston Formation. Client: Strabag.
- Alternative Irrigation Sources, St. Catharines, ON (2007): Conducted hydrogeologic evaluation of a groundwater irrigation source for a golf course. The site was utilizing

a municipal supply for irrigation. Multiple low-yielding wells of poor quality complicated the assessment. Client: Urban & Environmental Management.

- Hydrogeologic Assessment, Massey, ON (2006): Hydrogeologic assessment of proposed Greenfield quarry. The site is a traprock escarpment and is located at a watershed divide. Impact assessments, a monitoring program and a closure plan were completed. Client: Pioneer Construction.

Aggregate Resources

- Completed detailed resource assessments, approvals and licensing for many major aggregate producers including Ontario Ministry of Transportation, CBM Canada, Dufferin Aggregates, Lafarge Canada, Walker Industries, Capital Materials Inc., Chefero Sand, Pioneer Construction, Waterford Sand and Gravel, Nelson Aggregates, Dimension Stone Ltd. and for several private clients.
- Conducted geologic studies in unconsolidated deposits. These sites include the Oak Ridges Moraine, Paris and Galt Moraines, and sites in Ayr, Caledon, Cambridge, London, Stratford, Brantford, North Dumfries, Orangeville, Norwood, Ommemee, and more than 60 sites in Northern Ontario.
- Conducted numerous detailed bedrock resource evaluations (dolostone, limestone, shale, granite, traprock) and licenses at sites throughout Ontario, including the Niagara Escarpment, Lake Erie shoreline, Guelph, Shelburne, Hamilton, Georgian Bay, Carden, Hudson Bay lowlands, Manitoulin Island, and Northern Ontario. Northern Ontario aggregate experience has included work within the Grenville, Southern and Superior Province locations.
- Proposed Shale Quarry Assessment, Brampton, ON (2010): Completed a resource assessment of a property zoned for a shale quarry in support of redevelopment. Client: Osmington Inc.
- Proposed Dolostone Quarry, Wainfleet, ON (2009): Peer review and witness statements at a proposed quarry for an Ontario municipal board hearing. Client: Sullivan Mahoney LLP.
- Clay Borrow Pit, Thorold, ON (2007): Completed aggregate wayside pit permit for clay borrow for 400-series highway embankments. Client: Hardrock Group.

Geology and Geotechnical Engineering

- Slope Stability Studies, Excavations and Retaining Wall Inspections (ongoing): Conducted over 60 studies in support of development approval for private clients, public agencies and consultants.
- Rock Mechanics Work (ongoing): Conducted rock wall stability assessments in Lincoln, Woodstock, Orillia, Ottawa, and Quebec for various clients in support of open excavations.
- Post-construction Investigations (ongoing): Conducted forensic examinations of failed structures and roadways related to subsurface conditions in Burlington, Niagara-on-the-Lake and Lake Simcoe for various private and professional clients.
- Foundation Inspections (ongoing): Inspections of footings for bridges, buildings, marine facilities and retaining walls for public, private and institutional clients.
- Road Construction Investigations (ongoing): Geotechnical studies completed in support of road reconstruction for municipal government agencies including project management for material inspections (concrete, asphalt and compaction testing).

- Septic System Investigations and Sewage Lagoon Assessments, various locations in Niagara Region (ongoing): Conducted geotechnical investigations for new municipal sewage lagoons, and investigations for large septic systems. Client: Niagara Region.
- Dewatering Investigation, Hamilton (2019): Dewatering investigation for earth retaining structure at a proposed waste water treatment plant. Client: Canada Centre for Inland Waters.
- Pipeline Work, Geotechnical Investigations for pipeline works across CN Rail/Welland Canal/Niagara Escarpment. (2018): Client: Walker Industries.
- Retaining Pond Design, North Dumfries ON (2017): Geotechnical work for liner installation. Client: Preston Sand and Gravel; Walker Industries
- Jerseyville Road Facility, Jerseyville, ON (2017): Water supply, geotechnical investigation and wastewater servicing peer review and project management. Client: The Green Organic Dutchman.
- Boat Ramp Investigation, Fort Erie, ON (2017): Below water geotechnical investigation within the Niagara River. Client: Niagara Parks Commission.
- Binbrook Dam Safety Review, Binbrook, ON (2016): Earth dam testing and inspection. Client: Niagara Peninsula Conservation Authority.
- East Rail Maintenance Yard, Whitby, ON (2016): Construction dewatering issues for a rail siding. Client: Bird/Kiewit Joint Venture.
- Glanbrook Landfill Collector System Evaluation, Hamilton, ON (2015): Subsurface geotechnical assessment of a failed sewer. CCTV work. Client: City of Hamilton.
- Hydrogeologic Study, Flamborough, ON (2011): Proposed Earthfresh potato processing facility hydrogeologic study. Client: Earthfresh.
- Facility Relocation and reservoir installation, Dunnville, ON (2011). Client: Intercounty Concrete.
- VivaNext, Highway 7, Markham, ON (2011): Permit to take Water for three concrete box culvert stream crossings. Client: Brennan Paving and Construction.
- Hotel Dieu Hospital, St. Catharines, ON (2004, 2010): Conducted a preliminary geotechnical investigation for a proposed general hospital on an existing site; and subsequently, geotechnical considerations for site after use. Client: Niagara Health System.
- Rail Siding Hopper, Niagara Falls, ON (2012): Conducted a geotechnical investigation for an unloading facility. Client: Redpath Sugar.
- Niagara Health System
  - Hotel Dieu Hospital, St. Catharines, ON (2004, 2010): Conducted a preliminary geotechnical investigation for a proposed general hospital on an existing site; and subsequently, geotechnical considerations for site after use. Clients: Niagara Health System and Mountainview Homes.
  - Port Colborne General Hospital (2006): Geotechnical investigation at the Port Colborne Hospital Site.
  - St. Catharines General Hospital (2005): Preliminary geotechnical investigation on a proposed greenfield general hospital site.
- Commercial Construction of an Automobile Dealership, St. Catharines, ON (2008): Geotechnical studies for construction of an automobile dealership on thick fill soils. Client: Confidential.

- Hamilton Public Housing, Stone Church Road, Burlington, ON (2005): Geotechnical Drilling Program at failed former public housing building. Client: Morrison Hershfield.
- Rolling Meadows Subdivision, St. Catharines, ON (2005): Geotechnical investigation and report at a large proposed subdivision. Client: Numbered Ontario Company.
- Arcelor Mittal, East Chicago Steel Works, Gary, IN, USA (2002): Slag granulation dewatering assessment. Provided expert testimony for a construction dewatering investigation around a sheet pile wall cofferdam. This work was in support of a dispute before the American Arbitration Association. Client: Lafarge Canada Inc.
- Caisson and Pile Inspections, St. Catharines/Thorold, ON (2002, 1999): Supervised and inspected caisson installations. Geotechnical investigation of a pile-supported outbuilding at a hospital. Clients: Walker Industries Holdings Limited; Polymax Construction.

Environmental Assessment and Remediation

- Environmental Reporting (ongoing): Numerous soil, groundwater and surface water environmental reports completed for private and public clients. Reviewed and authored numerous Phase I and Phase II Environmental Site Assessments.
- Former Public Works Yard, Lincoln, ON (ongoing): Design, operation and optimization of a pump and treat groundwater remediation system in a fractured bedrock environment. The system has operated successfully for over 15 years. Client: Town of Lincoln.
- Truck Marshalling Yard, Burlington, ON (2011): Conducted a hydrogeologic investigation at a DNALP-impacted site. Client: DML Environmental.
- Former Dry Cleaning Site, Hamilton, ON (2009): Conducted a DNAPL investigation in shallow fractured bedrock, complicated by the presence of shale. This work corrected a previous consultant’s study. Client: Confidential.
- Reported PCB-impacted Automobile Dealership Property, St. Catharines, ON (2009): Groundwater assessment program at a commercial property as part of a dispute resolution. Client: Confidential.
- Pesticide-Impacted Farm Building, St. Catharines, ON (2008): Soil assessment and remediation due to pesticide and fuel oil impacts at a former farm. Client: Confidential.
- Commercial Property Assessment, Canarctic Drive, North York, ON (2005): Soil and groundwater assessment at a former manufacturing facility prior to purchase. Client: Confidential.
- Flint Road Phase II ESA, Downsview ON (2004): The absence of groundwater and soil contamination was confirmed prior to sale of a commercial property. Client: Torkin Manes Cohen Arbus LLP.
- Fuel-impacted Soil and Groundwater, Orwell Road, Mississauga, ON (2004): Conducted a soil remediation program at a leaky underground storage tank site. Work included installation of a dewatering and treatment system for soil excavation below the water table. Client: Confidential.
- Fuel Oil Tank at a Housing Complex, Dunnville, ON (2002): Underground storage tank soil and groundwater investigation. Construction activities uncovered a UST. The tank had leaked into soil and sewer utilities. Sampling was completed and remedial options presented. Client: Hydro Vac Inc.

- Vineland Quarry Asphalt Plant, Lincoln, ON (2002): Conducted an analysis of scrubber sediment for disposal options. Client: Rankin Construction.
- Former Plating Facility, Mississauga, Ontario (2001): Environmental Assessment and remediation of soil, groundwater and installation of a remedial pumping system at a chrome and copper plating facility. Client: Chambers of Canada.
- Former General Abrasives Site, Niagara Falls, ON (2001): Extensive soil and groundwater sampling and contaminant delineation program at a large (40 ha) former industrial facility. Client: R. Ste. Pierre Excavation.
- Effluent-impacted Water Course, Beamsville, ON (2000): Investigation of a complaint led to an MOE order being rescinded regarding a leaking surface water underground storage tank. Client: Desousa Wines.

Waste Management

- Involved in numerous hydrogeologic monitoring programs at private and public landfills throughout Southern Ontario, including Niagara, Hamilton, Region of Waterloo, Simcoe County, City of North Bay, Region of Halton and in Lambton County.
- Unlicensed Landfill, Grimsby, ON (2008-ongoing): Preliminary and ongoing monitoring of a 30,000 tonne unlicensed landfill within a former quarry. Work includes a hydrogeological evaluation of the site, waste delineation and impact analysis; calculations of contaminating lifespan of the waste and financial assurance. The project involves extensive liaison with the Ministry of Environment on behalf of the client. Client: Confidential.
- Park Road Landfill, Grimsby, ON (2009, 2011): Bedrock core logging for new open-hole groundwater monitors. Interpretation of downhole geophysical logs to further define bedrock stratigraphy and fractures/flow zones. Client: Niagara Region.
- Bridge Street Landfill, Fort Erie, ON (2004, 2007, 2010): Geotechnical studies in support of L.C.S. construction. Analysis of instability of waste slopes for regarding purposes. Bedrock core logging for groundwater monitors installed through the Onondaga Escarpment. Completed leachate seep analysis and review of remedial measures, and toe drain installation. Client: Niagara Region.
- Line 5 Landfill, Niagara-on-the-Lake, ON (1994, 2004): Conducted geotechnical evaluation of base of new landfill cell to support landfill operations. Hazardous material sampling and analysis of sealed drums left at landfill site. Client: Niagara Region, Town of Niagara-on-the-Lake.
- West Quarry Landfill, Leachate Management Program, Thorold, ON (1999, 2003): Field supervision of installation of large-diameter caisson wells for controlling leachate in waste. Consultations for construction of residential compost facility on waste. Client: Niagara Waste Systems Limited.
- Glanbrook Landfill Site, Artesian Conditions Assessment, Glanbrook, ON (2000): Conducted an evaluation of deep groundwater upwellings associated with a former gas well on the landfill site. Client: Regional Municipality of Hamilton Wentworth.
- Centre Street Landfill, Pelham, ON (1998): Landfill compliance monitoring reporting as part of the site’s Certificate of Approval. This landfill is located above deep unsaturated sands. Client: Town of Pelham.

PUBLICATIONS AND PRESENTATIONS

Publications

- Fitzpatrick, K and Campbell, J. 2012. Lake Erie to Lake Ontario, Spills, Mills and Landfills and GW/GS Glacial Geology; International Association of Hydrogeologists, 39th IAH Congress, September 16-21, 2012, Niagara Falls, ON, unpublished technical tour book.

J. LEIGH DAVIS, M.A.Sc., P.Eng.

Lead Professional, Environmental Engineering

Areas of practice

Groundwater Resources

Groundwater Modelling

Aggregate Resources

Waste Management

PROFILE

Mr. Leigh Davis is a licensed Project Engineer with WSP, specializing in hydrogeology. His 17 years of experience in the environmental consulting industry include peer review, project management and engineering support for hydrogeological studies and compliance reporting, numerical groundwater flow and transport model construction and calibration, coordination and analysis of in-situ testing, GIS / CAD design and analysis and field sampling (including low-flow methods).

Leigh holds a Bachelor of Applied Science in Environmental Engineering, as well as a Master of Applied Science in Civil Engineering, covering topics including hydrology, hydrogeology, contaminant transport mechanisms, groundwater modelling and landfill design. Leigh's Master's thesis was *Investigation of Seismic Excitation as a Method for Flow Enhancement in Porous Media.* He has a working knowledge of relevant software including ArcGIS, Microsoft Office (including Access), USGS MODFLOW (including various pre/post processing software), AutoCAD and HELP 3.

EDUCATION

Master of Applied Science, Honours Civil Engineering, University of Waterloo	2008
Bachelor of Applied Science, Honours Environmental Engineering (Co-op), University of Waterloo	2006

PROFESSIONAL DEVELOPMENT

Advanced Python Programming for MODFLOW Modelers, Environmental Simulations Inc. (ESI)	2024
Introduction to Python Programming for MODFLOW Modelers, Environmental Simulations Inc. (ESI)	2022
MODFLOW Solvers, Speed, Convergence and Robustness, GSI Environmental	2018
Introduction to Fortran Programming for MODFLOW Modelers, Environmental Simulations Inc. (ESI)	2018
Calibration and Uncertainty Analysis for Environmental Models, S.S. Papadopulos & Associates Inc.	2017
8-Hour Health & Safety Refresher Training Course (HAZWOPER)	2015
Surface Miner Common Core Training	2013
Estimating Rates of Groundwater Recharge, International Association of Hydrogeologists (IAH)	2012
Reactive Transport Modelling with PHT3D, International Groundwater Modeling Centre (IGWMC)	2011
The New MODFLOW Course: Theory and Hands-On Applications, National Groundwater Association (NGWA)	2009
Critical Thinking in Aquifer Test Interpretation, S.S.Papadopulos & Associates Inc.	2009

24-Hour Occupational Health & Safety Training Course (HAZWOPER)	2009

PROFESSIONAL ASSOCIATIONS

Professional Engineers Ontario	PEO
Halton Region Environmental and Ecological Advisory Committee (Volunteer, 2011 – 2014)	EEAC

CAREER

Lead Professional, Environmental Engineering, WSP	2024 – Present
Project Engineer, Earth & Environment, WSP	2014 – 2024
Project Manager, Environment, GENIVAR (now named WSP)	2009 – 2013
Project Manager, Jagger Hims Limited (GENIVAR Acquisition)	2008 – 2009
Technical Project Assistant, Jagger Hims Limited	2005 – 2006
Engineer Assistant, St. Michael's Hospital, Toronto, ON	2004

PROFESSIONAL EXPERIENCE

Groundwater Resources

- Water Resources Monitoring Review and Strategy Development, Hamilton, ON (2021-2022): Comprehensive review of field data collection techniques, data management processes, existing monitoring network configuration and continuous improvement strategies for ongoing monitoring completed by the Source Protection Planning group in relation to the municipal supply wells. Client: City of Hamilton.
- Hydrogeological Study, St. Anns, ON (2019): Development of a hydrogeological conceptual model and water supply assessment for proposed site re-development. Client: Silverdale Gun Club / IBI Group.
- Open Space Design Development, Nova Scotia (2012-2014): Analysis of step test and pumping test data to estimate private supply well capacity as part of subdivision development applications at various sites throughout Nova Scotia. Client: Confidential.
- Earthfresh Potato Processing Facility, Hydrogeological Study, Flamborough, ON (2011): Design of drilling program and analysis of in-situ testing data. Client: Earthfresh Inc. / IBI Group.
- Viva Next H3 Project, Construction Dewatering PTTW Application, Markham, ON (2011): Hydrogeological analysis and report preparation for construction dewatering Permit to Take Water application. Client: Kiewit-EllisDon / The Miller Group.
- 3091 Appleby Line, Hydrogeological Study, Burlington, ON (2011): Design of drilling program, field groundwater sampling, data analysis, figure and report preparation for a hydrogeological study of a dense non-aqueous phase liquid (DNAPL) contaminated site. Client: 1345059 Ontario Ltd.
- Greenwich Street Sewage Pumping Station, Construction Dewatering PTTW Application, Brantford, ON (2011): Hydrogeological analysis and report preparation for construction dewatering Permit to Take Water application. Client: City of Brantford.

- Dominion Road Sewage Pumping Station, Construction Dewatering PTTW Application, Fort Erie, ON (2011): In-situ testing, hydrogeological analysis and report preparation for construction dewatering Permit to Take Water application. Client: R.V. Anderson & Associates / Niagara Region.
- Microbial Contaminant Control Plan, Halton Region, Peel Region, ON (2005, 2006): Threat inventory preparation; CAD figure preparation; field reconnaissance for development of microbial contaminant control plans for groundwater supply systems. Client: Regional Municipality of Halton, Peel Region.
- Garden City Municipal Golf Club, Evaluation of Alternative Irrigation Sources, St. Catharines, ON (2006): Report preparation, CAD figure preparation to assess the ability of a local pond to supply irrigation water requirements. Client: Urban & Environmental Management Inc.

Groundwater Modelling

- Various contaminated and landfill sites, ON (2020-ongoing): Development and use of a 2-D Domenico-Schwartz contaminant transport model to evaluate potential off-site impacts at various sites across Ontario.
- Proposed Pit, Puslinch, ON (2022-ongoing): Level 2 Hydrogeological Study to meet the requirements for a proposed Category 1 Class ‘A’ below water pit licence application at a greenfield site. Construction and calibration of a numerical groundwater flow model to predict impacts of proposed pit on local groundwater users and sensitive features, including groundwater temperature impacts. Client: Confidential.
- Fifteen Mile Stream Gold Project, NS (2022): Construct and calibrate a numerical groundwater flow model to assess potential impacts from a proposed open pit gold mine. Client: Atlantic Mining NS Corp.
- Essex-Windsor Regional Landfill Site, Windsor, ON (2022): Predictive modeling of annual leachate production using a 2-D Visual HELP model to simulate existing and future cell construction. Client: Essex-Windsor Solid Waste Authority.
- Duntroon Quarry, Collingwood, ON (2021): Review and re-calibration of the existing numerical groundwater model as part of the quarry’s Adaptive Management Plan (AMP) 5-Year Comprehensive Review. Import and reconstruction of the model to utilize MODFLOW-USG capabilities. Client: Walker Aggregates Inc.
- Peer Review of Proposed Cumberland Quarry, County of Simcoe, ON (2018): Peer review of a Level 1 & Level 2 Hydrogeological Study report and numerical groundwater model in support of a Category 2 Class ‘A’ below water quarry application for a greenfield site. Client: Walker Aggregates Inc.
- Peer Review of Crane Mountain Landfill Groundwater Flow Model, NB (2018): Peer review of a numerical groundwater flow model used to predict landfill impacts on a drinking water aquifer in a complex bedrock setting. Client: Fundy Regional Service Commission, NB.
- Wellhead Protection Area Delineation, Pugwash, NS (2017): Construct and calibrate a numerical groundwater flow model to delineate the wellhead protection area for a municipal supply system. Client: Municipality of the County of Cumberland, NS.
- Hydrogeological Investigation / Numerical Groundwater Flow and Transport Modelling for Phosphate Mine, Kapuskasing, ON (2009-2014): Field work including drilling supervision, monitoring well installation, in-situ hydraulic conductivity tests / analysis and groundwater sampling (including low-flow sampling). Review of existing site data to construct and calibrate a groundwater flow model to be used for simulation of tailings pond leachate transport in the sub-surface in support of the

mine closure plan. Hydrogeological report and figure preparation in support of a revised mine closure plan. Client: Agrium Inc.

- Groundwater Capacity Assessment, Omemee, ON (2014): Use of an existing regional numerical groundwater model to identify potential groundwater supply well locations within the community as part of a Class EA. Client: City of Kawartha Lakes.
- Detailed Water Budget Analysis, South Lake Scugog Watershed, Durham Region, ON (2011): Use of an existing regional numerical groundwater model to calculate the groundwater components of the water budget. Client: Kawartha Lakes Conservation Authority.
- Contaminant Transport Modelling for a Thermal In-Situ Heavy Oil Processing Facility, near Cold Lake, AB (2010): Review of site data to construct and calibrate a groundwater flow model to simulate chloride transport from a process water retention pond, and evaluate remediation alternatives. Client: Canadian Natural Resources Limited.
- Numerical Groundwater Modelling, Legault Subdivision Water Supply, St. Albert, ON (2010): Construct and calibrate a numerical groundwater flow model to predict the steady-state drawdown due to proposed subdivision private water supply wells, and assess the impact on nearby existing private wells. Client: The Thomson Rosemount Group, Inc.
- Wilmot Creek Watershed Tier 2 Water Budget Analysis, Durham Region, ON (2010): Calibration of an existing regional groundwater flow model within the watershed of interest to determine the water budget components. Client: Ganaraska Region Conservation Authority.
- Hydrogeologic Study, Township of Melancthon, ON (2009-2010): Calibration of numerical groundwater flow model for existing site conditions and quarry scenario assessment. Client: The Highland Companies.
- Contaminant Transport Modelling for a Former Oil Battery Site, Calmar, AB (2009): Review of site data to construct and calibrate a groundwater flow model to simulate chloride transport and fate in the sub-surface. Client: Canadian Natural Resources Limited / Wiebe Environmental Services.
- Thermal Plume Migration Analysis, Mill Creek Aggregate Pit, Guelph, ON (2009): Use a recalibrated groundwater flow model to determine heat transfer into groundwater system from proposed final pit lake configuration, as well as assess impact on nearby cold-water fish habitat. Client: Dufferin Aggregates.
- Groundwater Vulnerability Assessment, City of Kawartha Lakes, ON (2007-2009): Regional groundwater model development; capture zone modelling; GIS figure preparation; technical memo/report preparation to develop a groundwater threat inventory database for 15 municipal well systems. Client: The City of Kawartha Lakes / Trent Conservation Coalition.

Aggregate Resources

- Norfolk Quarry, Port Dover, ON (2022-ongoing): Level 2 Hydrogeological Study in support of Category 2 Class ‘A’ below water quarry extension of existing quarry. Field support, pumping test coordination and analysis, report and figure preparation and liaison with regulatory agencies. Client: MHBC Planning.
- Haliburton, ON (2019): Level 2 Hydrogeological Study in support of Category 2 Class ‘A’ below water quarry application. Pumping test analysis and hydrogeological conceptual model development. Client: Confidential.
- Law Quarry, Wainfleet, ON (2017-ongoing): Level 2 Hydrogeological Study in support of Category 2 Class ‘A’ below water quarry extension of existing quarry.

Field support, pumping test coordination and analysis, report and figure preparation and liaison with regulatory agencies. Construction and calibration of a numerical groundwater flow model to predict impacts of quarry extension on local groundwater users and sensitive features. Client: Waterford Sand and Gravel Limited / MHBC Planning.

- Proposed Uppers Quarry, Thorold, ON (2016-ongoing): Level 2 Hydrogeological Study in support of a proposed Category 2 Class 'A' below water quarry at a greenfield site. Field support, pumping test coordination and analysis, report and figure preparation and liaison with regulatory agencies. Construction and calibration of a numerical groundwater flow model to predict impacts of quarry development on local groundwater users and sensitive features. Client: Walker Aggregates Inc. / MHBC Planning.
- Walker Aggregates Inc.
  - Walker Brothers Quarry, Niagara Falls, ON (2012-ongoing): Preparation of annual compliance monitoring report for an active quarry located adjacent to one active and two closed landfill sites. Data management and QA / QC using a custom Access database. Monitoring data from all four sites are considered when characterizing and assessing the hydrogeologic setting.
  - Duntroon Quarry Expansion, Collingwood, ON (2019-ongoing): Hydrogeological study to meet the requirements of proposed quarry deepening. Preparation of Adaptive Management Plan (AMP) annual compliance monitoring report for an active quarry located adjacent to the Niagara Escarpment. Data management and QA / QC using a custom Access database.
  - Sutherland Quarry, Owen Sound, ON (2023-ongoing): Hydrogeological investigation to mitigate quarry drawdown impacts, including design and construction of a grout curtain wall.
  - Vineland Quarry, Interference Complaint Study, Vineland, ON (2011): Evaluation of sub-watershed hydrologic data and outflow characteristics of quarry pond to determine the cause of downstream channel erosion.
- Pioneer Construction Ltd.
  - City Pit, Sault Ste. Marie, ON (2016-2020): Level 2 Hydrogeological Study in support of Category 2 Class 'A' pit / quarry licence extension for below water table extraction. Data collation, report and figure preparation and liaison with regulatory agencies.
  - Palmer Pit, Sault Ste. Marie, ON (2015-2016): Level 2 Hydrogeological Study in support of Category 2 Class 'A' pit / quarry licence extension for below water table extraction. Field support, data collation, report and figure preparation and liaison with regulatory agencies.
- Erin Pit, Erin, ON (2015-2017): Level 1 Hydrogeological Study in support of pit licence extension for above water table extraction. Field support, pumping test coordination and analysis, data collation, report and figure preparation and liaison with regulatory agencies. Client: Halton Crushed Stone Inc. / MHBC Planning.
- Identify Potential New Sand and Gravel Pit, Haldimand and Norfolk Counties, ON (2015): GIS and ARIP mapping used to assess potential new sand and gravel pit locations. Client: Confidential.
- Jigs Hollow Pit, Waterloo, ON (2014-2020): Level 2 Hydrogeological Study in support of pit licence application. Field support, pumping test coordination and analysis, data collation, report and figure preparation and liaison with regulatory agencies. Client: Preston Sand and Gravel / IBI Group.

- Vinemount Quarry, Stoney Creek, ON (2013-2018): Level 2 Hydrogeological Study in support of Category 2 Class 'A' quarry licence extension. Field support, data collation, report and figure preparation and liaison with regulatory agencies. Client: Waterford Sand and Gravel Limited / IBI Group.
- Aggregate Resource Assessment, Windsor, ON (2012): Review of borehole information and local geology to quantify remaining high-quality aggregates at two quarries near Windsor. Client: Confidential.
- Aggregate Resource Assessment, Greater Toronto Area, ON (2008): Development of aggregate resource database and GIS figure preparation to determine high quality aggregate resources in the Greater Toronto Area. Client: Confidential.

Waste Management

- Proposed South Landfill Phase 2, Niagara Falls, ON (2024-ongoing): Hydrogeological study to meet the Terms of Reference for an Environmental Assessment (EA) for a proposed landfill extension, including borehole advancement, geophysics and hydraulic testing, groundwater elevation and quality monitoring and calibration of a numerical groundwater flow model.
- Region of Halton - various closed Landfill Sites, (2021-ongoing): Peer reviewer and engineering support for annual compliance monitoring reports for several closed landfill sites within the Queenston shale plain physiographic region of Southern Ontario.
- Regional Municipality of Niagara
  - Bridge Street and Quarry Road Landfill Sites and Quarry Road Constructed Wetland, Annual Monitoring Programs (2013, 2014 and 2018-ongoing): Peer reviewer, project manager and engineering support for annual compliance monitoring programs at landfills in complex fractured bedrock settings. Responsibilities include: manage field staff; liaise with client, subcontractors and laboratories; cost / budget control, collate, QA / QC, analyze and interpret technical data for leachate, groundwater, surface water and sediment samples. Evaluate and assess the condition of the monitoring well network at the Site, develop a work / cost program and implement maintenance and repair program. Performance evaluation of containment systems and perimeter leachate collection systems. Provide routine status updates to client and prepare annual report for submission to the MECP. Additional site-specific studies include:
    - Updated Water Well Survey (2020) to identify potential downgradient groundwater users used as input for a risk-management strategy.
    - Groundwater Monitoring Network Optimization (2020) to reduce redundancy in the groundwater monitoring program using statistical analyses and an evaluation of leachate indicator parameter trends.
    - Paleo-karst Investigation (2013) to characterize paleo-karst hydrogeology and geochemistry, including the use of low-flow groundwater sampling techniques.
    - Chloride Isotope (2011) and Tritium, Oxygen and Hydrogen Isotope (2010) sampling and statistical analyses to determine the source of elevated chloride concentrations.
  - Line 5 Landfill, Niagara-on-the-Lake, ON (2013-ongoing): Project manager for annual compliance monitoring program at a closed landfill in an overburden setting. Management of field staff; liaisons with client and laboratories; cost / budget control, collation, QA / QC, analysis and interpretation of technical data for leachate, groundwater, and surface water samples; routine status updates to client; and preparation of annual compliance monitoring report. Preparation of a

revised environmental monitoring program, which included assessment of site conceptual model, potential contaminant pathways and sensitive receptors. Additional site-specific studies include:

    - Revised Groundwater Trigger Mechanism Plan (2020) including a statistical analysis of background geochemistry to develop suitable trigger levels at property boundary wells.
    - Stormwater Management Pond Trigger Mechanism Plan (2015) including a statistical analysis of historical chemical results to determine appropriate trigger parameters and levels for operation of the stormwater management pond.
    - Revised Environmental Monitoring Program (2014) to reduce redundancy in the monitoring program and revise monitor screen intervals to more effectively evaluation the leachate collection system performance.
  - Nitrate Isotope (2017) and Chloride Isotope (2014) Sampling and Assessment, Centre Street Landfill Site, Fonthill, ON (2017): Statistical analyses of isotope results to determine the source of elevated nitrate and chloride concentrations.
  - Mountain Road In-situ Hydraulic Conductivity Tests, Niagara Falls, ON (2005): In-situ hydraulic conductivity tests; slug test analysis; report preparation.
  - Landfill Monitoring Programs, Niagara Falls, Grimsby, Pelham, Niagara-on-the-Lake, Fort Erie, ON (2005-2014): Field sampling for groundwater and surface water as part of annual monitoring programs at Mountain Road, Park Road, Niagara Road 12, Line 5, Station Road, Centre Street, Quarry Road and Bridge Street Landfills.
- Region of Waterloo - Closed Woolwich Landfill Site, Woolwich, ON (2015-ongoing): Peer reviewer, project manager and engineering support for annual compliance monitoring and hydrogeological impact assessment at a small rural closed landfill situated in a thick silt, sand and gravel setting. A 1,1-dichloroethane (DCA) plume is present downgradient of the site, and an area wide study was completed to identify potential contributing sources to the 1,1-DCA plume. A hydrogeological conceptual model was developed for the site area and work program to delineate the plume was established.
- Walker Environmental Group - East, South, and West Landfill Sites, City of Niagara Falls, ON (2012-ongoing): Preparation of annual compliance monitoring reports for one operating and two closed landfill sites located within one continuous footprint. Data management and QA / QC using a custom Access database. An adjacent active quarry is also monitored and monitoring data from all four sites are considered when characterizing and assessing the hydrogeologic setting.
- Township of North Kawartha – various closed Landfill Sites (2022-2024): Peer reviewer for annual compliance monitoring reports for several closed landfill sites within the Precambrian shield bedrock setting of Central Ontario.
- County of Oxford
  - Landfill Monitoring Programs, Norwich, Salford, ON (2012-2014): Preparation of annual monitoring report data tables, figures and text at Holbrook (closed) and Oxford County (operational) landfills.
  - Well Network Assessment, Norwich, ON (2013): Completion of a well network assessment at Holbrook (closed) landfill to identify monitoring program deficiencies and recommend remedial measures.

- City of Brantford - Mohawk Street Landfill, Brantford, ON (2009-2018): Data collation, technical analysis, and reporting as part of the annual monitoring program. Field sampling for groundwater and surface water at a large operating landfill.
- Tembec Kapuskasing Operations - Private Landfill Monitoring Programs, Kapuskasing, ON (2012-2013): Preparation of annual monitoring report data tables, figures and text for two private landfill sites.
- Potential Landfill Constraint Mapping, Eastern Ontario (2006): Constraint mapping for potential landfill sites; GIS figure preparation. Client: Confidential.

Geotechnical Engineering

- OPG Pump Generating Station Dyke Monitoring Program, Niagara Falls, ON (2012-2013): Field and technical support for the abandonment of 111 pressure relief wells and piezometers and 4 additional tunnel well nests around the PGS Dyke, including 3 Waterloo System multi-level wells. Wells were located adjacent to the Niagara Escarpment and the Buried St. Davids Gorge. Additional work included rehabilitation of 48 wells; and preparation of documentation and figures. Client: Ontario Power Generation Inc.
- Sir Adam Beck Tunnel 3, Groundwater Monitoring Program, Niagara Falls, ON (2010-2013): Installation and operation of double-valve pumps (DVPs) for low-flow groundwater sampling to monitor the effect of dewatering for tunnel construction on local groundwater resources. Client: Strabag.
- Abitibi Thorold Mill, Cogeneration Plant, Geotechnical Drilling Program, Thorold, ON (2006): Drill rig supervision; borehole logging and soil sampling as part of a geotechnical investigation of soils for a planned co-generation plant. Client: Abitibi-Consolidated.
- Whirlpool Rapids Bridge Monitoring Program, Niagara Falls, ON (2005): Groundwater sampling and erosion monitoring at a contaminated site within the Niagara River Gorge. Client: Niagara Falls Bridge Commission.

Environmental Site Assessments and Site Remediation

- Designated Substance Survey, Brantford, ON (2013): Development of an Access database for survey results and automated reporting of asbestos material location and condition. Client: City of Brantford.

SAMANTHA PELAYO CAZARES, MASc., EIT

Water Resources Specialist, Earth and Environment Ontario

Areas of practice

Water Resources Management

Stormwater Design

Hydrologic Modelling

Hydraulic Modelling

Languages

English

Spanish

French (Basic)

German (Intermediate)

PROFILE

Mrs. Samantha Pelayo Cazares is a Water Resources Specialist with a MASc. in water resources management. She has 4 years of experience in the field of water resources, including stormwater design, water management, low impact development, and hydrology and hydraulic modelling.

Project experience includes design and construction inspection of low impact development assets, coordination of field programs for data collection, including meteorological, water quality and stream flow data. Water resources work has been completed for clients in the Municipalities, Land Developers, and Aggregate and Mining Sectors.

Samantha has high modeling skills. She gained a good practical and technical knowledge in software including HEC-HMS, HEC-RAS, GoldSim, and AutoCAD.

EDUCATION

Master of Applied Science, Civil Engineering, University of Toronto	2021
Bachelor of Engineering, Civil Engineering, Universidad Veracruzana	2019

PROFESSIONAL DEVELOPMENT

Confined Spaces Hazard Awareness for Construction, Infrastructure Health and Safety Association	2022
Traffic Control – Temporary Work Zones, Infrastructure Health and Safety Association	2022
Standard First Aid – CPR A – AED Blended, St. John Ambulance Ontario	2022

CAREER

Water Resources Specialist, Water Resources Group Earth & Environment Ontario, WSP	2023 – Present
Coordinator, Integrated Water Management, Credit Valley Conservation Authority, Mississauga, Ontario, Canada	2022 – 2023
Technician, Integrated Water Management, Credit Valley Conservation Authority, Mississauga, Ontario, Canada	2021 – 2022
Teaching Assistant, University of Toronto, Toronto, Ontario, Canada	2021 – 2022
Research Assistant, University of Toronto, Toronto, Ontario, Canada	2019 – 2021
Solar Panel Designer, Grupo Ertek, Veracruz, Veracruz, Mexico	2018 – 2019

AWARDS

2 years MASc. Full Scholarship from the University of Toronto	2019
Mitacs Globalink Graduate Fellowship	2019
Mitacs Globalink Research Internship at the University of Toronto	2018

PROFESSIONAL EXPERIENCE

Environmental Assessment and Permitting

- Kami Iron Ore IEA, Wabush, NL, Canada (2023 – ongoing): Water Resources Specialist. Planned and implemented a supplementary baseline characterization at the Project Site to augment the results of the previous baseline studies, as well as prepared an updated baseline report for the Project. The baseline report included field data collected on site such as: flow measurements, manual and laboratory water and sediment quality, topographic surveys, and lake water column profiles. Client: Minerai de fer Québec (MFQ). Project Value: $246,270 CAD
- Marten Falls First Nation Community Access Road Project, Ring of Fire Region of Northern Ontario. AECOM (2023): Water services support for the Marten Falls First Nation Community Access Road Project in the Ring of Fire Region of Northern Ontario. Golder-WSP's support to date to the AECOM-led project has involved the implementation of the initial baseline studies, initial hydrological assessment for key technical components (including surface water), with the understanding that the studies are being undertaken as part of a multi-disciplinary Environmental Assessment under the Canadian Environmental Assessment Act. Client: AECOM. Project Value: $ 6,466,900 CAD
- LaFarge Canada Inc.
  - Aggregate clients including Dundas Quarry, Bath, and West Paris (2023 – 2024). Water Resources Specialist: Completed monthly well and surface water gauge monitoring (water levels and downloads) in support of aggregate license and permit monitoring.
- Colgan Permit to Take Water Application, Colgan, ON, Canada (2023-2024): Water Resources Specialist. Completed quarterly well and surface water gauge monitoring (water levels and downloads) in support of permit to take water application.

Hydrology Modeling, Mining Water Resources Management, Stormwater Management

- Teck Coal Limited Company
  - Fording River Operations - Surface Water Hydrology Assessment for Fording River Operations North Saturated Rock Fill Phase 3A, Canada (2023-2024): Water resources Specialist. Goldsim flow modeler for various flow scenarios, results processing, analysis and drafting the report. WSP was retained by Teck to provide a surface water hydrology assessment for the Project. Teck is proposing to increase the capacity of the FRO-N Saturated Rock Fill (SRF) to treat 40,000 m^3/d of mine impacted water at FRO (the Project). The assessment involved the evaluation of potential effects of Project activities on flows in the Fording River and relevant tributaries.

  - Green Hills Operations - GHO Application Support Cougar Phase 5, Canada (2024): Water Resources Specialist. An existing conditions report was prepared for hydrology. The report included compilation, process, and analysis of hydrology and climate data available on the site.
  - Teck Kilmarnock Clean Water Diversion, Canada (2024). Supported data process, analysis, and results summary to compare different modeling scenarios.
- Pottersburg Creek Channel Scour Assessment, London, ON, Canada (2024): Water Resources Specialist. Supported the scour analysis using a 1-D HEC-RAS model to estimate scour potential at the crossing and provide mitigation measures necessary to protect the crossing. Client: GM Blue Plan Engineering Limited.
- 2023 Environmental Investigations and Preliminary Design for BASF Fighting Island, Detroit River, Windsor, ON, Canada (2023-2024): Water Resources Specialist. Supported the data processing of results such as surface and groundwater level monitoring, as well as borehole monitoring programs. Supported the drafting of supporting material such as maps, summary tables and hydrographs.
- Sutton Ready-Mix Concrete Plant and Distribution Center, Township of Georgina, ON, Canada (2023): Water Resources Specialist. Supported developing a stormwater management and erosion and sediment control (ESC) plan for the project as part of the site plan application for approval. Tasks included completing a precipitation event assessment, proposing an ESC plan, conducting a site water balance LID-TTT model, to evaluate the water and phosphorous loading budgets under pre- and post-development conditions, and recommending best water and sediment management practices. Client: Sunrock Canada Building Materials ULC.
- Wetland Water Balance Model, Hamlet of Claremont, Pickering, ON, Canada (2023): Water Resources Specialist. Developed a model using HEC-HMS to simulate hydrologic conditions on a continuous basis to capture the long-term average effects of the proposed development in the Site. Client: Claremont Development Inc.

APPENDIX B

MECP Water Well Records

Table B-1: Summary of Water Well Records Within 500 m of Site
Safarik Pit

									PUMP TEST			STRATIGRAPHY	
WELL	WELL DEPTH (m)	DEPTH TO BEDROCK (m)	YEAR DRILLED	CASING DIAMETER (mm)	WATER	FINAL STATUS	WELL USE	STATIC WATER LEVEL (m)	PUMP RATE (L/min)	DURATION (hours)	WATER LEVEL AFTER PUMPING (m)	MATERIAL	DEPTH TO UNIT BASE (m)
6706874	23.8	-	1978	152	Fresh	Water Supply	Domestic / Stock	16.2	38	1	21.3	Brown clay sandy Grey sand and gravel	6.1 23.8
6711908	25.0	-	1995	159	Fresh	Water Supply	Domestic	15.5	114	1	25.0	Brown clay silt stones gravel Brown gravel silt Brown gravel	21.3 22.9 25.0
6704038	24.4	-	1971	152	Fresh	Water Supply	Domestic	17.7	76	1	19.2	Brown clay sandy Grey clay gravel hardpan Grey sand gravel Grey gravel	9.1 19.8 22.9 24.4
6704389	25.6	-	1972	152	Fresh	Water Supply	Domestic	15.8	76	1	18.3	Grey clay with sand and gravel Grey sand and gravel	24.4 25.6
6705877	26.5	-	1975	152	Fresh	Water Supply	Domestic	16.8	114	1	25.9	Grey clay and gravel Grey sandy clay Grey clay some stones and gravel Grey gravel	1.2 4.6 25.0 26.5
6713435	49.4	42.1	2000	159	Fresh	Water Supply	Domestic	30.5	38	1	30.5	Brown gravel clay and stones Gravel and clay Brown clay stones Brown limestone, broken soft Dark brown limestone	9.1 33.5 42.1 43.3 49.4
6704042	29.0	-	1971	152	Fresh	Water Supply	Domestic	19.8	76	1	21.3	Brown clay some gravel Grey clay gravel hardpan Grey gravel	12.2 27.4 29.0
6712638	48.8	22.3	1998	152	Fresh	Water Supply	Domestic	1.2	45	1	-	Brown clay stones Grey clay stones Grey clay sand gravel Dark brown rock Grey rock	5.5 15.2 22.3 29.9 48.8
7044604	-	-	2007	-	-	Abandoned, poor quality	Not Used	-	-	-	-	-	
7044609	18.3	11.9	2007	152	Fresh	Water Supply	Domestic / Stock	7.0	45	1	7.9	Brown clay gravel - boulder Brown rock	11.9 18.3
6711487	30.5	14.0	1994	152	Fresh	Water Supply	Domestic	7.5	114	1	7.2	Topsoil Gravel stones Gravel sand Gravel sand Brown limestone, factured Brown limestone	0.3 6.1 12.2 14.0 15.2 30.5

Table B-1: Summary of Water Well Records Within 500 m of Site
Safarik Pit

WELL	WELL DEPTH (m)	DEPTH TO BEDROCK (m)	YEAR DRILLED	CASING DIAMETER (mm)	WATER	FINAL STATUS	WELL USE	STATIC WATER LEVEL (m)	PUMP TEST			STRATIGRAPHY	
									PUMP RATE (L/min)	DURATION (hours)	WATER LEVEL AFTER PUMPING (m)	MATERIAL	DEPTH TO UNIT BASE (m)
6713014	26.5	-	1999	152	Fresh	Water Supply	Domestic	22.3	57	1	23.8	Brown clay stones sand	4.6
												Brown clay sand gravel	9.1
												Gravel sand	25.0
												Gravel coarse	26.5
6711484	30.5	15.5	1994	152	Fresh	Recharge Well	Domestic	7.5	114	1	7.2	Topsoil	0.3
												Gravel stones	6.1
												Gravel sand	12.2
												Gravel sand	15.5
												Brown limestone	18.0
												Brown limestone	30.5
6714644	43.3	30.8	2003	159	Fresh	Water Supply	Domestic	19.2	95	1	21.3	Brown clay stones gravel	29.9
												Gravel	30.8
												Brown limestone	35.1
												Medium brown limestone	41.1
												Dark brown limestone	43.3
6714291	50.3	43.3	2002	159	Fresh	Water Supply	Domestic	30.2	61	1	29.9	Topsoil	0.6
												Brown clay stones	29.0
												Gravel clay	36.6
												Brown clay gravel soft	43.3
												Brown limestone soft/broken	44.2
												Brown limestone	50.3
6702534	38.1	-	1965	102	Fresh	Water Supply	Domestic	24.4	38	3	-	Stones clay gravel	3.0
												Stones clay	4.6
												Gravel clay	30.5
												Gravel sand fine	31.1
												Brown clay	33.5
												Blue clay	34.4
												Sand	36.6
												Gravel coarse	38.1
7302040	12.2	-	2017	51	Untested	Observation and/or Monitoring Hole	Municipal / Test Hole	-	-	-	-	Brown sand gravel cobble	1.5
												Brown sand gravel cobble/silt	6.1
												Grey silt clay gravel	9.1
												Grey sandy gravel bounders	12.2
6702533	36.3	33.5	1966	152	Fresh	Water Supply	Domestic	21.3	76	1	-	Sandy clay	10.7
												Sand and gravel in clay	33.5
												Lime rock	36.3

Table B-1: Summary of Water Well Records Within 500 m of Site
Safarik Pit

WELL	WELL DEPTH (m)	DEPTH TO BEDROCK (m)	YEAR DRILLED	CASING DIAMETER (mm)	WATER	FINAL STATUS	WELL USE	STATIC WATER LEVEL (m)	PUMP TEST			STRATIGRAPHY	
									PUMP RATE (L/min)	DURATION (hours)	WATER LEVEL AFTER PUMPING (m)	MATERIAL	DEPTH TO UNIT BASE (m)
6704046	35.1	29.6	1971	127	Fresh	Water Supply	Public Supply (Nursing Home)	18.6	76	2	18.9	Old well	24.4
												Grey gravel	25.3
												Grey hardpan	29.6
												Grey limestone	35.1
6073855	42.1	38.1	1970	152	Fresh	Water Supply	Domestic	23.5	95	1	27.4	Brown clay gravel some stones	10.7
												Grey clay gravel	13.7
												Grey gravel	19.8
												Grey clay gravel soft	33.5
												Grey clay gravel hardpan	38.1
												Grey limestone bedrock	42.1

APPENDIX C

Borehole Logs and Site Photographs

APPENDIX C-1

Borehole Logs

PROJECT: 20397048 (1000)

LOCATION: N 4810047.80; E 569619.20

RECORD OF BOREHOLE: BH20-01(SAF)

BORING DATE: November 9, 2020

SHEET 1 OF 3

DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m
		GROUND SURFACE	320.00			
0	Rotasonic Borehole size 150 mm; Core size 114 mm	TOPSOIL - SILTY CLAYEY SAND, organics; black, no odour, no staining; non-cohesive, moist	0.00 319.09	1	DO	
1		SAND and GRAVEL, some silt, some cobbles; golden brown, no odour, no staining; non-cohesive, moist	0.91 317.56	2	DO	
3		SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining	2.44 314.50	3 4	DO DO	
6		SAND and GRAVEL, some silt, some cobbles; brown, no odour, no staining; non-cohesive, moist	5.50	5 6	DO DO	
10		*CONTINUED NEXT PAGE*				

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

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

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PROJECT: 20397048 (1000)

LOCATION: N 4810047.80; E 569619.20

RECORD OF BOREHOLE: BH20-01(SAF)

BORING DATE: November 9, 2020

SHEET 2 OF 3

DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: 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
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Rotasonic Borehole size 150 mm; Core size 114 mm	SAND and GRAVEL, some silt, some cobbles; brown, no odour, no staining; non-cohesive, moist			7	DO					
					8	DO					
		Sandy Cobbley GRAVEL; brown/grey, no odour, no staining; non-cohesive, wet		305.37 14.63	9	DO					
					10	DO					
		Sandy Cobbley GRAVEL, some silt; brown/grey, no odour, no staining (TILL); non-cohesive, wet		300.80 19.20	11	DO					
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

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PROJECT: 20397048 (1000)
LOCATION: N 4810047.80; E 569619.20

RECORD OF BOREHOLE: BH20-01(SAF)

BORING DATE: November 9, 2020

SHEET 3 OF 3
DATUM: UTM Zone 17T

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
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	Rotasonic Borehole size 150 mm; Core size 114 mm	Sandy Cobbley GRAVEL, some silt; brown/grey, no odour, no staining (TILL); non-cohesive, wet			11	DO					
21		SILTY SAND; grey, no odour, no staining (TILL); cohesive, w>PL		299.27 20.73	12	DO					
22											
23					13	DO					
24		SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, wet		296.23 23.77							
25					14	DO					
26		- Silty Sand and Gravel (TILL) lense between depths of 25.91 m and 26.21 m			15	DO					
27		SILT CLAY; grey, no odour, no staining (TILL); non-cohesive		293.18 26.82	16	DO					
28		DOLOSTONE (BEDROCK)		292.26 27.74							
		END OF BOREHOLE		291.65 28.35							
29											
30											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4810099.90; E 569815.87

RECORD OF BOREHOLE: BH20-02(SAF)

BORING DATE: November 10, 2020

SHEET 1 OF 3
DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	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 ⊣ Wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	324.00							
0	Rotasonic Borehole size 150 mm; Core size 114 mm	TOPSOIL - SILTY SAND, organics; black, no odour, no staining; non-cohesive, moist	0.00							
		SILTY SAND and GRAVEL; brown, no odour, no staining; non-cohesive, moist	323.70 0.30	1	DO					
1		Sandy GRAVEL, some cobbles, some silt; brown, no odour, no staining; non-cohesive, moist	323.09 0.91	2	DO					
2										
3				3	DO					
4		SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, moist	320.04 3.96	4	DO					
5				5	DO					
6				6	DO					
7				7	DO					
8										
9				8	DO					
10										

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810099.90; E 569815.87

RECORD OF BOREHOLE: BH20-02(SAF)

BORING DATE: November 10, 2020

SHEET 2 OF 3

DATUM: UTM Zone 17T

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—⊣ Wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10 11	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY Gravelly SAND, some cobbles; brown/grey, no odour, no staining; non-cohesive, moist		313.94 10.06	9	DO					
12 13		SILTY GRAVEL, some cobbles; grey, no odour, no staining; non-cohesive, moist		312.42 11.58	10	DO					
14		SILTY SAND and GRAVEL, some cobbles; grey/brown, no odour, no staining; non-cohesive, moist		310.59 13.41	11	DO					
15 16		Gravelly SAND, some cobbles, some silt; brown, no odour, no staining; non-cohesive, moist		309.37 14.63	12	DO					
17		Cobbley SAND and GRAVEL; brown/red, no odour, no staining; non-cohesive, wet		307.54 16.46	13	DO					
18 19		SILTY SAND and GRAVEL, some cobbles; grey, no odour, no staining; non-cohesive, wet		306.02 17.98	14 15	DO DO					
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810099.90; E 569815.87

RECORD OF BOREHOLE: BH20-02(SAF)

BORING DATE: November 10, 2020

SHEET 3 OF 3

DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES 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
		--- CONTINUED FROM PREVIOUS PAGE ---								
20	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY SAND and GRAVEL, some cobbles; grey, no odour, no staining; non-cohesive, wet	303.27 20.73	15	DO					
		GRAVEL and SAND; brown, no odour, no staining (TILL); non-cohesive, wet	302.97 21.03							
21		SILT CLAY; brown, no odour, no staining (TILL); cohesive, w>PL								
22				16	DO					
23				17	DO					
24			299.92 24.08							
		END OF BOREHOLE								
25										
26										
27										
28										
29										
30										

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810316.29; E 569769.34

RECORD OF BOREHOLE: BH20-03(SAF)

BORING DATE: November 10, 2020

SHEET 1 OF 3

DATUM: UTM Zone 17T

BORING METHOD: Rotasonic
Borehole size 150 mm; Core size 114 mm

SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)
GROUND SURFACE		325.00
TOPSOIL - CLAYEY SAND, organics, some cobbles; brown, no odour, no staining (TILL); non-cohesive, moist		0.00
SAND and GRAVEL, some silt, some cobbles; brown, no odour, no staining; non-cohesive, moist		324.09 0.91
SILTY SAND and GRAVEL; brown, no odour, no staining (TILL); non-cohesive, moist		323.48 1.52
SAND and GRAVEL, some cobbles; brown, no odour, no staining (TILL); non-cohesive, moist		321.04 3.96
SILTY Gravelly SAND, some cobbles; brown, no odour, no staining (TILL); non-cohesive, moist		317.99 7.01
SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, moist then wet at at a depth of 14.9 m		316.47 8.53

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	DO	
2	DO	
3	DO	
4	DO	
5	DO	
6	DO	
7	DO	

DEPTH SCALE METRES: 0 – 10

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

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4810316.29; E 569769.34

RECORD OF BOREHOLE: BH20-03(SAF)

BORING DATE: November 10, 2020

SHEET 2 OF 3
DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	BLOWS/0.3m
		--- CONTINUED FROM PREVIOUS PAGE ---				
10	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, moist then wet at at a depth of 14.9 m		7	DO	
11				8	DO	
12				9	DO	
13						
14				10	DO	
15						
16				11	DO	
		SILTY SAND, some cobbles, some gravel; grey, no odour, no staining (TILL); cohesive, w>PL	308.80 16.20			
17				12	DO	
18				13	DO	
19				14	DO	
20		*CONTINUED NEXT PAGE*				

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20 40 60 80	10^{-6} 10^{-5} 10^{-4} 10^{-3}		
SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○	WATER CONTENT PERCENT — Wp ⊢—○W—⊣ Wl		
20 40 60 80	10 20 30 40		

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DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810316.29; E 569769.34

RECORD OF BOREHOLE: BH20-03(SAF)

BORING DATE: November 10, 2020

SHEET 3 OF 3

DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m
		--- CONTINUED FROM PREVIOUS PAGE ---				
20	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY SAND, some cobbles, some gravel; grey, no odour, no staining (TILL); cohesive, w>PL		14	DO	
21		SILTY SAND and GRAVEL; brown, no odour, no staining; non-cohesive, moist	304.00 21.00	15	DO	
22		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining (TILL); non-cohesive, moist then wet at a depth of 23.16 m	302.44 22.56	16	DO	
24		SILTY SAND and GRAVEL, some cobbles; grey, no odour, no staining; non-cohesive, wet	300.92 24.08	17	DO	
25		Gravelly SAND, some silt; brown, no odour, no staining; non-cohesive, wet	299.40 25.60	18	DO	
27		SILTY SAND; golden brown, no odour, no staining; non-cohesive, wet	297.87 27.13	19	DO	
29		SILT CLAY; grey, no odour, no staining (TILL); cohesive, w>PL	295.74 29.26			
30		END OF BOREHOLE	295.13 29.87			

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

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DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4810189.19; E 569683.94

RECORD OF BOREHOLE: BH20-04(SAF)

BORING DATE: November 11, 2020

SHEET 1 OF 3
DATUM: UTM Zone 17T

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

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	322.00					
0	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY SAND and GRAVEL, some cobbles, organics; golden brown, no odour, no staining; non-cohesive, moist	0.00					
				1	DO			
1			320.48					
		SILTY Gravelly SAND, some cobbles; golden brown, no odour, no staining; non-cohesive, moist	1.52					
2				2	DO			
			319.56					
		SILTY SAND; golden brown, no odour, no staining (TILL); non-cohesive, moist	2.44					
3				3	DO			
4			317.73					
		SAND and GRAVEL, some cobbles; dark brown, no odour, no staining (TILL); non-cohesive, moist	4.27					
5				4	DO			
6				5	DO			
			314.99					
7		SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, moist	7.01					
8				6	DO			
9				7	DO			
10								

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4810189.19; E 569683.94

RECORD OF BOREHOLE: BH20-04(SAF)

BORING DATE: November 11, 2020

SHEET 2 OF 3
DATUM: UTM Zone 17T

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

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m
		--- CONTINUED FROM PREVIOUS PAGE ---				
10	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, moist		7	DO	
11				8	DO	
12				9	DO	
13						
14				10	DO	
		SILTY GRAVEL; grey, no odour, no staining; non-cohesive, moist then wet at 15.24 m	307.37 14.63	11	DO	
15						
16		Sandy GRAVEL, some cobbles, some silt; reddish brown, no odour, no staining; non-cohesive, wet	305.85 16.15	12	DO	
17						
18				13	DO	
19						
		SAND and GRAVEL, some cobbles, some silt; brown, no odour, no staining; non-cohesive, wet	302.49 19.51	14	DO	
20		*CONTINUED NEXT PAGE*				

DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810189.19; E 569683.94

RECORD OF BOREHOLE: BH20-04(SAF)

BORING DATE: November 11, 2020

SHEET 3 OF 3

DATUM: UTM Zone 17T

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
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	Rotasonic Borehole size 150 mm; Core size 114 mm	SAND and GRAVEL, some cobbles, some silt; brown, no odour, no staining; non-cohesive, wet		301.27 20.73	14	DO					
21 22 23		Sandy SILT; brown, no odour, no staining (TILL); non-cohesive, wet		298.23 23.77	15 16	DO DO					
24 25 26 27 28 29 30		END OF BOREHOLE									

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DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4809972.05; E 569761.89

RECORD OF BOREHOLE: BH20-05(SAF)

BORING DATE: November 11, 2020

SHEET 1 OF 3

DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	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—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	326.00							
0	Rotasonic Borehole size 150 mm; Core size 114 mm	TOPSOIL - SILTY SAND, organics; brown/black, no odour, no staining (TILL); non-cohesive, moist	0.00							
		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining; non-cohesive, moist	325.39 0.61	1	DO					
1										
		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining (TILL); non-cohesive	324.48 1.52							
2				2	DO					
3				3	DO					
4										
5				4	DO					
6				5	DO					
7										
8				6	DO					
9				7	DO					
10		*CONTINUED NEXT PAGE*								

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4809972.05; E 569761.89

RECORD OF BOREHOLE: BH20-05(SAF)

BORING DATE: November 11, 2020

SHEET 2 OF 3
DATUM: UTM Zone 17T

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

--- CONTINUED FROM PREVIOUS PAGE ---

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m
10	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining (TILL); non-cohesive		7 8	DO DO	
11–12		SAND and GRAVEL, some cobbles, some silt; brown, no odour, no staining; non-cohesive, moist	314.42 11.58	9	DO	
13–14		SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, moist	312.59 13.41	10	DO	
15–16		COBBLES, some gravel, some boulders; grey, no odour, no staining; non-cohesive, moist	311.06 14.94			
16–17		SAND and GRAVEL, some cobbles, some silt; brown/grey, no odour, no staining; non-cohesive, moist	309.54 16.46	11	DO	
18–19		SILTY SAND and GRAVEL; brown/grey, no odour, no staining; non-cohesive, moist	308.02 17.98	12 13	DO DO	
20						

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DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

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PROJECT: 20397048 (1000)

LOCATION: N 4809972.05; E 569761.89

RECORD OF BOREHOLE: BH20-05(SAF)

BORING DATE: November 11, 2020

SHEET 3 OF 3

DATUM: UTM Zone 17T

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
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY SAND and GRAVEL; brown/grey, no odour, no staining; non-cohesive, moist			13	DO					
21											
22					14	DO					
		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining (TILL); non-cohesive, moist then wet at a depth of 23.16 m		303.44 22.56							
23					15	DO					
24		END OF BOREHOLE		301.92 24.08							
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810261.66; E 570099.99

RECORD OF BOREHOLE: BH20-06(SAF)

BORING DATE: November 12, 2020

SHEET 1 OF 3

DATUM: UTM Zone 17T

DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE | 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 | PIEZOMETER OR STANDPIPE INSTALLATION

BORING METHOD: Rotasonic; Borehole size 150 mm; Core size 114 mm

DESCRIPTION	ELEV. DEPTH (m)
GROUND SURFACE	331.00
TOPSOIL - SILTY SAND, some clay; brown/black, no odour, no staining; non-cohesive, moist	0.00
SILTY SAND and GRAVEL, some cobbles; light grey, no odour, no staining; non-cohesive, moist	329.78 1.22
SILTY SAND, some gravel, some boulders (between depths of 2.74 m to 4.27 m); brown, no odour, no staining (TILL); non-cohesive, moist	328.87 2.13
SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining (TILL); non-cohesive, moist	326.73 4.27

NUMBER	TYPE	BLOWS/0.3m
1	DO	
2	DO	
3	DO	
4	DO	
5	DO	
6	DO	
7	DO	

Depth scale: 0 1 2 3 4 5 6 7 8 9 10

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DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810261.66; E 570099.99

RECORD OF BOREHOLE: BH20-06(SAF)

BORING DATE: November 12, 2020

SHEET 2 OF 3

DATUM: UTM Zone 17T

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

--- CONTINUED FROM PREVIOUS PAGE ---

BORING METHOD: Rotasonic; Borehole size 150 mm; Core size 114 mm

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE
10	SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining (TILL); non-cohesive, moist		7 8	DO DO
12	SAND, some cobbles, some gravel; brown, no odour, no staining; non-cohesive, moist	318.81 12.19	9	DO
13	SILTY SAND and GRAVEL; brown, no odour, no staining (TILL); non-cohesive, moist	317.59 13.41	10	DO
15	SILTY SAND and GRAVEL; brown/grey, no odour, no staining; non-cohesive, moist then wet at 15.24 m	316.06 14.94	11	DO
16	SILTY SAND, some cobbles, some gravel; grey/brown, no odour, no staining (TILL); non-cohesive, moist	314.54 16.46	12	DO
18	SILTY SAND, some cobbles, some gravel; light brown, no odour, no staining; non-cohesive, moist	313.02 17.98	13	DO
19		311.49 19.51	14	DO
20				

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810261.66; E 570099.99

RECORD OF BOREHOLE: BH20-06(SAF)

BORING DATE: November 12, 2020

SHEET 3 OF 3

DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES 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
		--- CONTINUED FROM PREVIOUS PAGE ---								
20	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY SAND and GRAVEL some cobbles; brown, no odour, no staining; non-cohesive, wet - Sand lense between depths of 21.03 m and 21.34 m		14	DO					
21				15	DO					
22										
23				16	DO					
24		SAND and GRAVEL, some cobbles, some silt; brown, no odour, no staining; non-cohesive, wet	306.92 24.08							
25				17	DO					
		SILTY Gravelly SAND, some cobbles, some gravel; brown, no odour, no staining; cohesive, w>PL	305.40 25.60							
26				18	DO					
27		SILT CLAY; grey/brown, no odour, no staining (TILL); cohesive, w>PL	304.18 26.82							
28				19	DO					
29				20	DO					
30		END OF BOREHOLE	301.13 29.87							

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DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4810410.97; E 570177.60

RECORD OF BOREHOLE: BH20-07(SAF)

BORING DATE: November 12, 2020

SHEET 1 OF 4
DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: 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
		GROUND SURFACE	330.00							
0	Rotasonic Borehole size 150 mm; Core size 114 mm	TOPSOIL - SILTY SAND, organics; brown/black, no odour, no staining; non-cohesive, moist	0.00	1	DO					
1.52		SILTY SAND and GRAVEL, some cobbles; brown then reddish brown, no odour, no staining (TILL); non-cohesive, moist	328.48 1.52	2	DO					
				3	DO					
4.27		SILTY SAND, some cobbles, some gravel; reddish brown, no odour, no staining; non-cohesive, moist	325.73 4.27	4	DO					
5.78		SILTY CLAYEY SAND, some gravel, some cobbles; grey, no odour, no staining; cohesive, w<PL	324.22 5.78	5	DO					
				6	DO					
				7	DO					
10		*CONTINUED NEXT PAGE*								

DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810410.97; E 570177.60

RECORD OF BOREHOLE: BH20-07(SAF)

BORING DATE: November 12, 2020

SHEET 2 OF 4

DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	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
		--- CONTINUED FROM PREVIOUS PAGE ---								
10 11	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY CLAYEY SAND, some gravel, some cobbles; grey, no odour, no staining; cohesive, w<PL		7 8	DO DO					
12 13 14		SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining (TILL); cohesive, w<PL	318.42 11.58	9 10	DO DO					
15 16		SILTY SAND and GRAVEL, some cobbles; grey/brown, no odour, no staining; non-cohesive, moist	315.06 14.94	11	DO					
17		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining (TILL); non-cohesive, moist	313.54 16.46	12	DO					
18 19		SAND and GRAVEL, some cobbles, some silt; brown, no odour, no staining; non-cohesive, wet	312.02 17.98	13	DO					
20		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining; non-cohesive, moist then wet at 20.73 m	310.49 19.51	14	DO					
		CONTINUED NEXT PAGE								

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4810410.97; E 570177.60

RECORD OF BOREHOLE: BH20-07(SAF)

BORING DATE: November 12, 2020

SHEET 3 OF 4
DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: 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
		--- CONTINUED FROM PREVIOUS PAGE ---								
20	Rotasonic Borehole size 150 mm; Core size 114 mm	SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining; non-cohesive, moist then wet at 20.73 m		14	DO					
21				15	DO					
22										
		SILTY Sandy GRAVEL, some cobbles; light grey/brown, no odour, no staining; non-cohesive	307.44 22.56							
23				16	DO					
24										
25				17	DO					
		SAND and GRAVEL, some cobbles, some silt; grey, no odour, no staining; non-cohesive, wet	304.40 25.60							
26				18	DO					
27										
28				19	DO					
		SILT CLAY; grey/brown, no odour, no staining (TILL); cohesive, w>PL	301.35 28.65							
29				20	DO					
30		*CONTINUED NEXT PAGE*								

DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810410.97; E 570177.60

RECORD OF BOREHOLE: BH20-07(SAF)

BORING DATE: November 12, 2020

SHEET 4 OF 4

DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			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	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m				
		--- CONTINUED FROM PREVIOUS PAGE ---									
30	Rotasonic Borehole size 150 mm; Core size 114 mm	SILT CLAY; grey/brown, no odour, no staining (TILL); cohesive, w>PL	▨		20	DO					
31			▨		21	DO					
32		END OF BOREHOLE		298.00 32.00							
33											
34											
35											
36											
37											
38											
39											
40											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4810566.71; E 570022.80

RECORD OF BOREHOLE: BH20-08(SAF)

BORING DATE: November 13, 2020

SHEET 1 OF 3
DATUM: UTM Zone 17T

BORING METHOD: Rotasonic
Borehole size 150 mm; Core size 114 mm

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m
	GROUND SURFACE	324.00			
0	TOPSOIL - SILTY SAND, organics; black/dark brown, no odour, no staining; non-cohesive, moist	0.00	1	DO	
1	SILTY SAND, some cobbles, some gravel, some clay; golden /brown, no odour, no staining (TILL); non-cohesive, moist	323.09 0.91	2	DO	
3	SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, moist	321.26 2.74	3	DO	
			4	DO	
			5	DO	
			6	DO	
			7	DO	
10	*CONTINUED NEXT PAGE*				

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

DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

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PROJECT: 20397048 (1000)
LOCATION: N 4810566.71; E 570022.80

RECORD OF BOREHOLE: BH20-08(SAF)

BORING DATE: November 13, 2020

SHEET 2 OF 3
DATUM: UTM Zone 17T

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

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m
		--- CONTINUED FROM PREVIOUS PAGE ---				
10	Rotasonic Borehole size 150 mm; Core size 114 mm			7	DO	
		SILTY SAND, some gravel, some cobbles; brown/grey, no odour, no staining; non-cohesive, moist	313.64 10.36	8	DO	
12		SAND, some cobbles; brown, no odour, no staining; non-cohesive, moist	312.11 11.89	9	DO	
15		Sandy GRAVEL, some cobbles; grey, no odour, no staining; non-cohesive, wet	309.06 14.94	10	DO	
		SILTY Sandy GRAVEL, some cobbles; grey, no odour, no staining; non-cohesive	307.54 16.46	11	DO	
		SILT CLAY; grey, no odour, no staining (TILL); cohesive, w>PL	306.32 17.68			
18		SAND, some cobbles, some gravel; brown, no odour, no staining; non-cohesive, wet	306.02 17.98	12	DO	
20		*CONTINUED NEXT PAGE*				

DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4810566.71; E 570022.80

RECORD OF BOREHOLE: BH20-08(SAF)

BORING DATE: November 13, 2020

SHEET 3 OF 3
DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	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—⊣ Wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---								
20	Rotasonic Borehole size 150 mm; Core size 114 mm	SAND, some cobbles, some gravel; brown, no odour, no staining; non-cohesive, wet		12	DO					
21										
22				13	DO					
		Sandy GRAVEL, some cobbles, some silt; grey, no odour, no staining; non-cohesive, wet	301.44 22.56							
23		SILTY CLAYEY SAND; light grey/brown, no odour, no staining (TILL); cohesive, w<PL	300.84 23.16	14	DO					
24		END OF BOREHOLE	299.92 24.08							
25										
26										
27										
28										
29										
30										

DEPTH SCALE
1 : 50

GOLDER

LOGGED: AL
CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810422.17; E 570021.94

RECORD OF BOREHOLE: BH20-09(SAF)

BORING DATE: November 13, 2020

SHEET 1 OF 3

DATUM: UTM Zone 17T

BORING METHOD: Rotasonic; Borehole size 150 mm; Core size 114 mm

DESCRIPTION	ELEV. DEPTH (m)
GROUND SURFACE	325.00
TOPSOIL - SILTY SAND, organics; golden brown, no odour, no staining (TILL); non-cohesive, moist	0.00
SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining; non-cohesive, moist	323.48 1.52
SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining (TILL); non-cohesive, moist	322.26 2.74
SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining; non-cohesive, moist	316.47 8.53

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	DO	
2	DO	
3	DO	
4	DO	
5	DO	
6	DO	
7	DO	

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

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

CONTINUED NEXT PAGE

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DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

PROJECT: 20397048 (1000)
LOCATION: N 4810422.17; E 570021.94

RECORD OF BOREHOLE: BH20-09(SAF)

BORING DATE: November 13, 2020

SHEET 2 OF 3
DATUM: UTM Zone 17T

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	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 ⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---								
10	Rotasonic Borehole size 150 mm; Core size 114 mm			7	DO					
		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining (TILL); non-cohesive, moist	314.64 10.36							
11				8	DO					
12		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining; non-cohesive, moist	313.11 11.89	9	DO					
13										
14				10	DO					
15										
16				11	DO					
		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining (TILL); non-cohesive, moist then wet at 17.07 m	308.54 16.46							
17				12	DO					
18		Sandy SILTY GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, wet	307.02 17.98	13	DO					
19		SAND and GRAVEL, some cobbles, some silt; brown, no odour, no staining; non-cohesive, wet	306.10 18.90							
		Gravelly SAND; brown, no odour, no staining; non-cohesive, wet	305.49 19.51	14	DO					
20		*CONTINUED NEXT PAGE*								

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DEPTH SCALE	GOLDER	LOGGED: AL
1 : 50		CHECKED: GWS

PROJECT: 20397048 (1000)

LOCATION: N 4810422.17; E 570021.94

RECORD OF BOREHOLE: BH20-09(SAF)

BORING DATE: November 13, 2020

SHEET 3 OF 3

DATUM: UTM Zone 17T

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
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	Rotasonic Borehole size 150 mm; Core size 114 mm			304.88							
		SAND and GRAVEL; brown, no odour, no staining; non-cohesive, wet		20.12	14	DO					
21		SILTY SAND and GRAVEL, some cobbles; brown, no odour, no staining; non-cohesive, moist		303.97 21.03	15	DO					
22		Gravelly SAND, some cobbles; brown, no odour, no staining; non-cohesive, wet		302.44 22.56	16	DO					
23											
24		SILTY SAND and GRAVEL, some cobbles; brown/grey, no odour, no staining; non-cohesive, wet		301.23 23.77	17	DO					
25											
26		SILTY SAND; light brown, no odour, no staining; non-cohesive, moist		298.79 26.21	18	DO					
27		SILTY SAND; light brown, no odour, no staining (TILL); cohesive, w>PL		297.87 27.13	19	DO					
28											
		END OF BOREHOLE		296.35 28.65							
29											
30											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AL

CHECKED: GWS

GTA-BHS 001 S:\CLIENTS\VOTORANTIM_CIMENTOS\4275_CONCESSION_ROAD_7_PUSLINCH_ONTARIO\02_DATA\GINT\4275_CONCESSION_ROAD_7_PUSLINCH_ONTARIO.GPJ GAL-MIS.GDT 12/9/20

LOG OF BOREHOLE BH21-01 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Estimated
BH LOCATION: N 4810078 E 569731

Method: Sonic
Diameter: 152 mm
Date: Dec-09-2021 to Dec-09-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

SOIL PROFILE			SAMPLES										REMARKS AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L / WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	GR	SA	SI	CL
321.5	Ground Surface															
0.0	Dark brown sandy silt TOPSOIL, trace clay, rootlets, APL.		1A	CC			321									
320.9 0.6	Brown to dark brown CLAYEY SILT, trace rootlets, APL.		1B	CC								0	52	(48)	
320.4 1.1	Light brown SANDY SILT TILL, some gravel, trace cobble, moist.		2	CC			320					21	39	(33)	
			3	CC			319 318					35	35	(23)	
317.5 4.0	Light beige to light brown fine to medium SAND, some gravel, trace cobble, moist.		4	CC			317					42	39	(19)	
316.0 5.5	Beige-brown GRAVELLY SAND to SAND AND GRAVEL, trace silt, trace cobble, moist.		5	CC			316 315					52	29	(12)	
			6	CC			314 313								
			7	CC			312 311					56	29	(10)	
310.8 10.7	Beige SAND, some gravel, trace silt, occasional cobble, moist.		8	CC			310					32	41	(24)	
			9	CC			309					42	40	(18)	
308.7 12.8			10	CC			308 307								

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE BH21-01 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Estimated
BH LOCATION: N 4810078 E 569731

Method: Sonic
Diameter: 152 mm
Date: Dec-09-2021 to Dec-09-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

SOIL PROFILE (m) ELEV DEPTH	DESCRIPTION Continued	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Brown SAND AND GRAVEL, trace silt, trace to some cobble, moist to wet. 30 cm layer of sand at 15.2 m depth. 10 cm layer of sandy silt till at 17.6 m depth. Becomes saturated below 17.7 m depth.(Continued)	11	CC			43 40 (9)
		12	CC			
		13	CC			41 37 (15)
302.9 18.6	Light brown SILTY SAND AND GRAVEL, trace cobble, wet.	14A	CC			58 30 (7)
301.4 20.1	Grey-brown SANDY SILT TILL, some gravel, trace cobble, DTPL to APL.	14B	CC			26 33 (41)
		15	CC			
		16A	CC			34 48 (18)
		16B	CC			
		17	CC			
		18	CC			
294.7 26.8						

ELEVATION: 306, 305, 304, 303, 302, 301, 300, 299, 298, 297, 296, 295

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT W_L

WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▽ 4th ▼

GRAPH NOTES $+^3$, $\times^3$: Numbers refer to Sensitivity ○ $^{\varepsilon}$=3% Strain at Failure

LOG OF BOREHOLE BH21-02 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Estimated
BH LOCATION: N 4810230 E 569796

Method: Sonic
Diameter: 152 mm
Date: Dec-09-2021 to Dec-09-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

SOIL PROFILE		SAMPLES						REMARKS AND GRAIN SIZE DISTRIBUTION (%)		
(m) ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION		GR	SA	SI CL
327.0	Ground Surface									
0.0	Dark brown clayey silt TOPSOIL, rootlets, WTPL.	1	CC							
326.5 0.5	Brown to reddish-brown CLAYEY SILT, trace rootlets, APL.					326				
325.8 1.2	Light brown SILTY SAND to SANDY SILT TILL, some gravel, trace cobble, moist, poorly sorted, rusty orange staining observed throughout.	2	CC			325		20	40	(40)
	Orange rusty staining from 5.0 m to 5.5 m depth.	3	CC			324		36	34	(24)
						323				
		4	CC			322		32	40	(28)
		5	CC			321		33	39	(28)
		6	CC			320 319				
		7	CC			318 317				
		8	CC			316		31	40	(29)
315.4 11.6	Light brown SILTY SAND, trace gravel, moist. 25 cm layer of medium-coarse sand with trace gravel at 12.2 m depth.	9	CC			315		13	50	(37)
314.0 13.0	Light brown SANDY SILT TILL, trace gravel and cobbles, moist, poorly sorted. Minor orange rusty staining from 13.1 m to 13.7 m depth.	10	CC			314 313		40	35	(25)
312.1										

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

ONTARIO LIBRARY DATABASE.GLB WSP SOIL LOG NEUBAUER 2021 BH LOGS.GPJ 24-9-25

LOG OF BOREHOLE BH21-02 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Estimated
BH LOCATION: N 4810230 E 569796

Method: Sonic
Diameter: 152 mm
Date: Dec-09-2021 to Dec-09-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE: 20 40 60 80 100
PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT W_L; WATER CONTENT (%): 10 20 30

(m) ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	GR	SA	SI CL
	Continued										
14.9	Beige-brown to greyish-brown GRAVELLY SAND, trace cobble, moist.(Continued)	11	CC						37	36	(27)
						311					
		12	CC			310			36	40	(24)
						309					
		13	CC						40	36	(15)
						308					
		14	CC			307			59	32	(9)
306.7 20.3	Brown SAND AND GRAVEL, some cobbles, trace silt, moist to wet, minor rusty orange staining.										
						306					
		15	CC						60	32	(8)
						305					
		16	CC			304			50	33	(8)
303.2 23.8	Brownish grey SANDY SILT TO SILT TILL, some gravel, trace cobbles, DTPL to APL, poorly sorted.					303					
		17	CC								
						302					
		18	CC			301					
300.2 26.8											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
$+^3, \times^3$: Numbers refer to Sensitivity
○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE BH21-03 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Estimated
BH LOCATION: N 4810346 E 570136

Method: Sonic
Diameter: 152 mm
Date: Dec-10-2021 to Dec-10-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

(m) ELEV DEPTH	SOIL PROFILE DESCRIPTION
329.5	Ground Surface
0.0	Dark brown sandy silt TOPSOIL, rootlets, WTPL.
329.2 0.3	Light brown SILTY SAND TILL, some gravel, trace clay, trace cobble, wet, poorly sorted.
326.4 3.0	Light brown SAND, some gravel, some cobble, trace silt, moist. 15 cm thick layer of black sand, some gravel at 4.6 m depth. 16 cm thick layer of brown silty sand with orange staining at 5.3 m depth.
323.4 6.1	Brown COBBLY SAND AND GRAVEL, trace silt, moist, poorly sorted. Minor rusty orange staining from 7.3 m to 8.2 m depth.
321.0 8.5	Light brown SILTY SAND TO SANDY SILT TILL, some gravel, trace cobble, moist to wet.
319.4 10.1	Beige GRAVELLY SAND, trace cobble, trace silt, moist. Minor rusty-orange staining. 15 cm layer of brown silty sand till at 14.6 m depth. 30 cm layer of light brown sand at 17.4 m depth.

SAMPLES NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	GR	SA	SI	CL
1B	CC			55	29	(16)	
2	CC			29	35	(25)	
3	CC			34	39	(19)	
4	CC			39	48	(13)	
5	CC			52	35	(13)	
6	CC			60	29	(11)	
7	CC			42	30	(24)	
8	CC			42	38	(20)	
9	CC						
10	CC			45	33	(22)	

ELEVATION: 329, 328, 327, 326, 325, 324, 323, 322, 321, 320, 319, 318, 317, 316, 315

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L

WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE BH21-03 (SAF)

PROJECT: Safarik Pit
REF. NO.: GLD-21476582
CLIENT: CBM Aggregates
Method: Sonic
ENCL NO.:
PROJECT LOCATION: Puslinch, Ontario
Diameter: 152 mm
ORIGINATED BY BC
DATUM: Estimated
Date: Dec-10-2021 to Dec-10-2021
COMPILED BY RLW
BH LOCATION: N 4810346 E 570136
CHECKED BY KJF

SOIL PROFILE		SAMPLES					DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m^3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION Continued	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION				
	Beige GRAVELLY SAND, trace cobble, trace silt, moist. Minor rusty-orange staining. 15 cm layer of brown silty sand till at 14.6 m depth. 30 cm layer of light brown sand at 17.4 m depth.(Continued)		11	CC			314					31 48 (11)
			12	CC			313					33 43 (24)
311.8 17.7	Beige GRAVELLY SAND, trace to some cobble, trace silt, dry to moist. 10 to 13 cm thick layer of silt till at 24.1 m depth.		13	CC			312 311					40 40 (20)
			14	CC			310 309					50 37 (13)
			15	CC			308					
			16	CC			307 306					33 49 (18)
			17	CC			305					51 30 (19)
			18	CC			304 303					55 34 (11)
302.7 26.8	Beige-brown COBBLY SAND AND GRAVEL, trace silt, poorly sorted, saturated. 15 cm layer of coarse sand, trace gravel at 27.4 m depth. Silty from 30.5 m to 30.6 m depth.		19	CC			302 301					47 35 (6)
			20	CC			300					65 30 (5)

16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH21-03 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Estimated
BH LOCATION: N 4810346 E 570136

Method: Sonic
Diameter: 152 mm
Date: Dec-10-2021 to Dec-10-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

SOIL PROFILE (m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued		21	CC			299					41 38 (14)
298.4 31.1	Beige-brown medium to fine SAND, trace gravel, saturated.		22A	CC			298 297					2 69 (29)
296.9 32.6	Light brown CLAYEY SILT TO SILTY CLAY TILL, occasional fine sand lenses, WTPL to APL.		22B 23 24	CC CC CC			296 295 294					
293.5 36.0												

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ $^{\varepsilon}$=3% Strain at Failure

LOG OF BOREHOLE BH21-04 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Estimated
BH LOCATION: N 4810510 E 570080

Method: Sonic
Diameter: 152 mm
Date: Dec-10-2021 to Dec-10-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L

WATER CONTENT (%) 10 20 30

SOIL PROFILE

ELEV (m) DEPTH	DESCRIPTION
319.4	Ground Surface
0.0	Dark brown sandy silt TOPSOIL, rootlets, APL.
319.2 0.2	Light brown GRAVELLY SAND, some cobble, trace silt, wet.
318.5 0.9	Light brown SILTY SAND TO SANDY SILT TILL, some gravel, trace cobble, moist. Some orange staining from 6.4 to 7.0 m depth.
311.2 8.2	Light brown to beige SAND AND GRAVEL, trace silt, trace cobble, wet. Some orange staning from 7.9 to 8.5 m depth. 10 cm layer of silty sand at 9.1 m depth. Large cobble at 12.8 m depth. Rusty orange staining from 14.6 to 15.5 m depth.

SAMPLES / REMARKS AND GRAIN SIZE DISTRIBUTION (%)

NUMBER	TYPE	"N" BLOWS/0.3 m	GR	SA	SI	CL
1A	CC					
1B	CC		24	36	(40)	
2	CC		29	40	(31)	
3A	CC		45	30	(25)	
3B	CC		28	40	(32)	
4	CC		31	36	(33)	
5	CC		35	37	(28)	
6	CC		45	35	(20)	
7	CC					
8	CC					
9	CC		43	39	(18)	
10	CC		57	35	(8)	

GROUND WATER CONDITIONS

ELEVATION: 319 318 317 316 315 314 313 312 311 310 309 308 307 306 305

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3$, $\times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

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WSP SOIL LOG NEUBAUER 2021 BH LOGS.GPJ 24-9-25

LOG OF BOREHOLE BH21-04 (SAF)

PROJECT: Safarik Pit		REF. NO.: GLD-21476582
CLIENT: CBM Aggregates	Method: Sonic	ENCL NO.:
PROJECT LOCATION: Puslinch, Ontario	Diameter: 152 mm	ORIGINATED BY BC
DATUM: Estimated	Date: Dec-10-2021 to Dec-10-2021	COMPILED BY RLW
BH LOCATION: N 4810510 E 570080		CHECKED BY KJF

SOIL PROFILE

(m) ELEV DEPTH	DESCRIPTION Continued
303.5 15.8	Light brown SAND, trace gravel with silty fine sand lenses, graded, wet becoming saturated.
302.0 17.4	Light brown SAND AND GRAVEL, trace to some silt, trace cobble, saturated. 10 cm layer of gravel at 20.1 m depth. Some cobble from 20.3 to 20.7 m depth.
298.1 21.3	Beige-brown SANDY GRAVEL AND COBBLE, mostly sub-rounded, poorly sorted, saturated.
295.6 23.8	Beige-brown GRAVELLY SAND, trace slit, trace cobble, saturated.
293.2 26.2	Beige-brown SAND AND GRAVEL, some cobble to cobbly, saturated.
291.0 28.3	Beige SANDY SILT TO SILTY SAND TILL, gravelly, some cobble to cobbly, saturated. Angular fragments of dolostone below 29.9 m depth.

SAMPLES

NUMBER	TYPE	"N" BLOWS 0.3 m	GR	SA	SI	CL
11	CC		48	29	(23)	
12A	CC		23	55	(22)	
12B	CC		34	44	(22)	
13	CC		49	44	(7)	
14	CC		26	48	(17)	
15	CC					
16	CC					
17	CC					
18	CC		64	31	(5)	
19	CC		77	14	(5)	
20	CC					

STRATA PLOT

GROUND WATER CONDITIONS

ELEVATION: 304, 303, 302, 301, 300, 299, 298, 297, 296, 295, 294, 293, 292, 291, 290

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT W_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Depth scale: 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE BH21-04 (SAF)

PROJECT: Safarik Pit		REF. NO.: GLD-21476582
CLIENT: CBM Aggregates	Method: Sonic	ENCL NO.:
PROJECT LOCATION: Puslinch, Ontario	Diameter: 152 mm	ORIGINATED BY BC
DATUM: Estimated	Date: Dec-10-2021 to Dec-10-2021	COMPILED BY RLW
BH LOCATION: N 4810510 E 570080		CHECKED BY KJF

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED; + FIELD VANE & Sensitivity; ● QUICK TRIAXIAL; × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%): 10 20 30

SOIL PROFILE			SAMPLES										
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m^3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
	Continued												
	Beige SANDY SILT TO SILTY SAND TILL, gravelly, some cobble to cobbly, saturated. Angular fragments of dolostone below 29.9 m depth.(Continued)						289						
			21	CC									
31													
							288						
32			22	CC									
							287						
286.5 32.9													

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▽ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

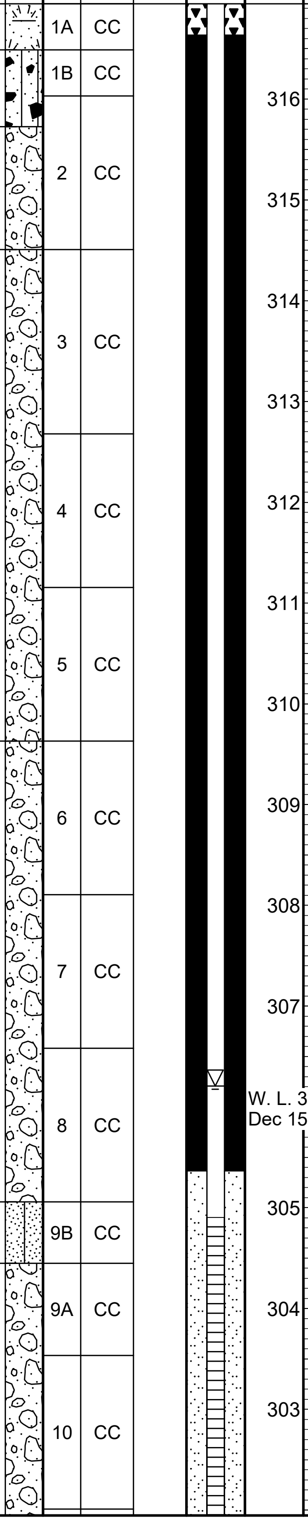
LOG OF BOREHOLE MW21-01 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Geodetic
BH LOCATION: N 4810093.943 E 569526.217

Method: Sonic
Diameter: 152 mm
Date: Dec-15-2021 to Dec-15-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

SOIL PROFILE (m) ELEV DEPTH	DESCRIPTION	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GR	SA	SI	CL
316.9	Ground Surface							
0.0	Dark brown sandy silt TOPSOIL, rootlets, APL.	1A	CC		24	41	(35)	
316.5 0.5	Light brown SANDY SILT TILL, some gravel, trace to some clay, APL.	1B	CC		12	52	(36)	
315.7 1.2	Light brown SAND AND GRAVEL, trace cobble, trace silt, moist.	2	CC					
314.5 2.4	Light brown SILTY SAND TILL, some gravel, trace cobble, wet. 10 cm layer of gravel at 3.0 m depth. Frequent orange staining below 4.0 m depth.	3	CC		39	36	(21)	
		4	CC		30	37	(21)	
		5	CC		34	45	(21)	
309.6 7.3	Beige GRAVELLY SAND, trace silt, trace cobble, moist to dry. 45 cm layer of SAND at 11.0 m depth. Becoming wet at 11.7 m depth.	6	CC		46	40	(14)	
		7	CC		52	35	(13)	
		8	CC		32	45	(18)	
305.1 11.9	Beige SILTY SAND TILL, some gravel, wet.	9B	CC		19	49	(32)	
304.4 12.5	Light brown to beige SAND AND GRAVEL, some to trace cobble, trace silt, saturated.	9A	CC		44	30	(13)	
		10	CC		62	20	(5)	



DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m^3)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity ○ $^{\varepsilon}$=3% Strain at Failure

LOG OF BOREHOLE MW21-01 (SAF)

PROJECT: Safarik Pit		REF. NO.: GLD-21476582
CLIENT: CBM Aggregates	Method: Sonic	ENCL NO.:
PROJECT LOCATION: Puslinch, Ontario	Diameter: 152 mm	ORIGINATED BY BC
DATUM: Geodetic	Date: Dec-15-2021 to Dec-15-2021	COMPILED BY RLW
BH LOCATION: N 4810093.943 E 569526.217		CHECKED BY KJF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION Continued	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m							
	Light brown to beige SAND AND GRAVEL, some to trace cobble, trace silt, saturated.(Continued)		11	CC			301					66 23 (2)
			12	CC			300					65 30 (5)
			13	CC			299 298					45 48 (3)
			14	CC			297 296					
			15	CC			295					64 23 (4)
293.9 23.0	Grey SANDY SILT TILL, some gravel, trace cobble, saturated.		16	CC			294 293					
292.6 24.4	Cream coloured LIMESTONE fragments, fine grained.		17	CC			292					

Depth scale: 16 17 18 19 20 21 22 23 24 25

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-02 (SAF)

PROJECT: Safarik Pit
REF. NO.: GLD-21476582
CLIENT: CBM Aggregates
Method: Sonic
ENCL NO.:
PROJECT LOCATION: Puslinch, Ontario
Diameter: 152 mm
ORIGINATED BY BC
DATUM: Geodetic
Date: Dec-14-2021 to Dec-14-2021
COMPILED BY RLW
BH LOCATION: N 4810014.468 E 569931.985
CHECKED BY KJF

SOIL PROFILE

(m) ELEV DEPTH	DESCRIPTION
328.0	Ground Surface
0.0	Dark brown sandy silt TOPSOIL, rootlets, DTPL.
327.1 0.9	Brown SANDY SILT TILL, some clay, trace to some gravel, trace rootlets, DTPL to APL.
326.8 1.2	Light brown to beige SAND, some gravel, trace silt, trace cobble, moist to dry.
325.5 2.4	Light brown to beige SILTY SAND TILL, some gravel, trace cobble, poorly sorted, moist to wet. Some rusty orange staining from 6.7 to 7.0 m depth.
320.5 7.5	Light brown SANDY GRAVEL TO GRAVELLY SAND, trace to some cobble, trace silt, moist to dry. Some cobble at 12.6 m depth.

Continued Next Page

SAMPLES

NUMBER	TYPE	"N" BLOWS / 0.3 m	GR	SA	SI	CL
1	CC					
2A	CC		30	42	(28)	
2B	CC		28	42	(30)	
3	CC		25	42	(33)	
4	CC		41	32	(27)	
5	CC		33	36	(28)	
6A	CC		56	27	(17)	
6B	CC		52	36	(12)	
7	CC		53	34	(13)	
8	CC		49	38	(13)	
9	CC		57	27	(7)	
10	CC		59	31	(10)	

STRATA PLOT · GROUND WATER CONDITIONS · ELEVATION: 327, 326, 325, 324, 323, 322, 321, 320, 319, 318, 317, 316, 315, 314

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P · NATURAL MOISTURE CONTENT W · LIQUID LIMIT W_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

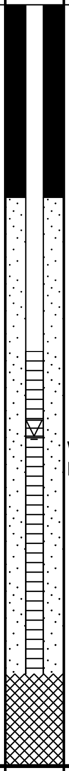
LOG OF BOREHOLE MW21-02 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Geodetic
BH LOCATION: N 4810014.468 E 569931.985

Method: Sonic
Diameter: 152 mm
Date: Dec-14-2021 to Dec-14-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

(m) ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS 0.3 m	GR	SA	SI	CL
	Continued Light brown SANDY GRAVEL TO GRAVELLY SAND, trace to some cobble, trace silt, moist to dry. Some cobble at 12.6 m depth.(Continued)	11	CC		60	28	(7)	
		12	CC		54	31	(7)	
		13	CC		60	31	(9)	
308.3 19.7	Light brown SANDY SILT TILL, trace gravel, DTPL. Becoming grey below 21.2 m depth.	14	CC					
		15	CC					
305.4 22.6								



W. L. 308.70 m
Dec 15, 2021

ONTARIO LIBRARY DATABASE.GLB
WSP SOIL LOG NEUBAUER 2021 MW LOGS.GPJ 24-9-25

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-03-D (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Geodetic
BH LOCATION: N 4810679.784 E 570037.809

Method: Sonic
Diameter: 152 mm
Date: Dec-13-2021 to Dec-13-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

ELEV (m) DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	GR SA SI CL
321.4	Ground Surface					
0.0	Dark brown sandy silt TOPSOIL, WTPL.	1	CC			
320.7 0.8	Grey-brown SANDY SILT, trace clay, DTPL, rust orange staining.					
320.3 1.1	Light brown GRAVELLY SAND, some silt, wet.	2	CC			19 53 (28)
319.0 2.4	No Recovery.	3	CC			
317.5 4.0	Light brown SAND, trace to some gravel, trace silt, saturated. 10 cm layer of sandy gravel at 5.2 m depth.	4	CC			12 75 (13)
315.9 5.5	Greyish-brown SILT, some clay to clayey, occasional fine sand lenses (saturated), laminated, WTPL.	5	CC			0 0 (100)
		6A	CC			0 7 (93)
313.3 8.1	Greyish-brown SILTY SAND TILL, some to trace gravel, some to trace cobble, moist to wet. Rusty orange staining and cohesive at 15.2 m depth.	6B	CC			18 34 (48)
		7	CC			30 32 (26)
		8	CC			42 32 (26)
		9	CC			23 48 (29)
		10A	CC			23 54 (23)
		10B	CC		W. L. 307.43 m Dec 15, 2021	24 37 (28)

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
$+^3$, $\times^3$: Numbers refer to Sensitivity
○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE MW21-03-D (SAF)

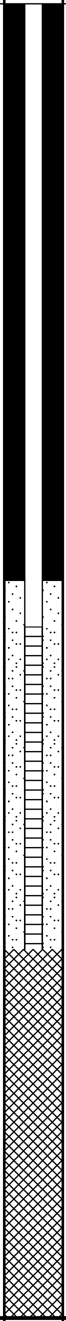
PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Geodetic
BH LOCATION: N 4810679.784 E 570037.809

Method: Sonic
Diameter: 152 mm
Date: Dec-13-2021 to Dec-13-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

ELEV (m) DEPTH	DESCRIPTION (Continued)	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	GR	SA	SI	CL
	Greyish-brown SILTY SAND TILL, some to trace gravel, some to trace cobble, moist to wet. Rusty orange staining and cohesive at 15.2 m depth.(Continued)	11	CC		36	39	(25)	
		12	CC		35	36	(29)	
303.7 17.7	Greyish-brown to light brown GRAVELLY SAND, occasional fine sand/silt lenses, saturated.	13	CC		18	66	(16)	
		14A	CC		21	62	(17)	
301.5 20.0	Light brown-beige COBBLY SAND AND GRAVEL, trace silt, saturated. 7 cm thick rusty orange silt lense at 21.6 m depth.	14B	CC		48	28	(6)	
		15	CC		52	34	(14)	
		16	CC		74	16	(4)	
		17	CC		61	19	(5)	
296.1 25.3	Brown, finely crystalline DOLOSTONE BEDROCK.	18	CC					
		19	CC					
293.4 28.0								

GROUND WATER CONDITIONS



DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L
WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

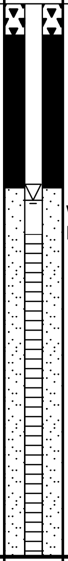
LOG OF BOREHOLE MW21-03-S (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Geodetic
BH LOCATION: N 4810677.934 E 570039.545

Method: Sonic
Diameter: 152 mm
Date: Dec-13-2021 to Dec-14-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

SOIL PROFILE (m) ELEV DEPTH	DESCRIPTION	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
321.4	Ground Surface				
0.0	Dark brown sandy silt TOPSOIL, WTPL.	1	CC		
320.6 0.8	Grey-brown SANDY SILT, trace clay, DTPL, rust orange staining.				
320.3 1.1	Light brown GRAVELLY SAND, some silt, wet.	2	CC		19 53 (28)
318.9 2.4	No Recovery.	3	CC		
317.4 4.0	Light brown SAND, trace to some gravel, trace silt, saturated. 10 cm layer of sandy gravel at 5.2 m depth.	4	CC		12 75 (13)
315.9 5.5					



W. L. 319.43 m
Dec 15, 2021

ELEVATION: 321, 320, 319, 318, 317, 316

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L
WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

GROUNDWATER ELEVATIONS
Measurement 1st ∇ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
$+^3$, $\times^3$: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-04 (SAF)

PROJECT: Safarik Pit
CLIENT: CBM Aggregates
PROJECT LOCATION: Puslinch, Ontario
DATUM: Geodetic
BH LOCATION: N 4810448.223 E 570309.851

Method: Sonic
Diameter: 152 mm
Date: Dec-13-2021 to Dec-14-2021

REF. NO.: GLD-21476582
ENCL NO.:
ORIGINATED BY BC
COMPILED BY RLW
CHECKED BY KJF

ELEV (m) DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS / 0.3 m	ELEVATION	GR	SA	SI	CL
327.9	Ground Surface								
327.6 0.0	Dark brown sandy silt TOPSOIL, rootlets, APL.								
0.3	Light brown CLAYEY SILT TILL, some gravel, some sand, DTPL to APL.	1	CC			25	25	(50)	
					327				
		2	CC		326	27	32	(41)	
		3A	CC		325	6	38	(56)	
324.7 3.2	Light brown SAND AND GRAVEL, trace to some cobble, trace silt, moist, poorly sorted.	3B	CC		324	54	28	(12)	
		4	CC		323	58	26	(7)	
					322				
		5	CC		321	51	37	(12)	
		6A	CC		320	63	27	(10)	
319.5 8.4	Light brown SILTY SAND TILL, some gravel, trace cobble, moist.	6B	CC		319	20	39	(41)	
		7	CC		318	38	35	(23)	
		8B	CC		317	41	24	(35)	
316.9 11.0	Light brown GRAVELLY SAND, some silt, trace cobble, moist.	8A	CC		316	43	32	(15)	
		9	CC		315	42	47	(11)	
					314				
		10	CC		313	48	39	(13)	
312.9									

Continued Next Page

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-04 (SAF)

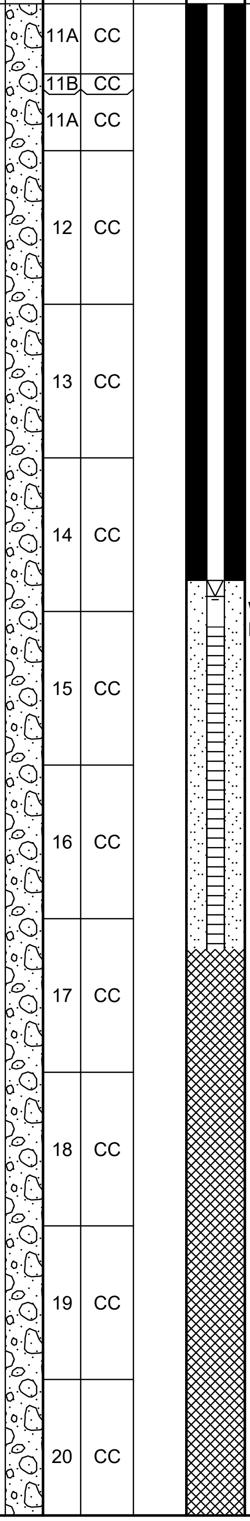
PROJECT: Safarik Pit		REF. NO.: GLD-21476582
CLIENT: CBM Aggregates	Method: Sonic	ENCL NO.:
PROJECT LOCATION: Puslinch, Ontario	Diameter: 152 mm	ORIGINATED BY BC
DATUM: Geodetic	Date: Dec-13-2021 to Dec-14-2021	COMPILED BY RLW
BH LOCATION: N 4810448.223 E 570309.851		CHECKED BY KJF

SOIL PROFILE (Continued)

(m) ELEV DEPTH	DESCRIPTION
14.9	Brown-beige SAND AND GRAVEL, trace to some cobble, trace fine sand/silt, moist. 15 cm thick layer of silt and sand at 15.7 m depth. Wet becoming saturated below 21.3 m depth.(Continued)

SAMPLES / REMARKS AND GRAIN SIZE DISTRIBUTION (%)

NUMBER	TYPE	"N" BLOWS 0.3 m	GR	SA	SI	CL
11A	CC		46	36	(13)	
11B	CC		6	49	(45)	
11A	CC		46	36	(13)	
12	CC		52	36	(12)	
13	CC		53	32	(11)	
14	CC		52	35	(13)	
15	CC		54	41	(5)	
16	CC		56	28	(7)	
17	CC		55	31	(6)	
18	CC		49	44	(7)	
19	CC		55	33	(12)	
20	CC		66	28	(6)	



W. L. 306.99 m
Dec 15, 2021

DEPTH: 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

ELEVATION: 312, 311, 310, 309, 308, 307, 306, 305, 304, 303, 302, 301, 300, 299, 298

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L

WATER CONTENT (%) 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m^3)

Continued Next Page

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3 , × 3 : Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE MW21-04 (SAF)

PROJECT: Safarik Pit		REF. NO.: GLD-21476582
CLIENT: CBM Aggregates	Method: Sonic	ENCL NO.:
PROJECT LOCATION: Puslinch, Ontario	Diameter: 152 mm	ORIGINATED BY BC
DATUM: Geodetic	Date: Dec-13-2021 to Dec-14-2021	COMPILED BY RLW
BH LOCATION: N 4810448.223 E 570309.851		CHECKED BY KJF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L / WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m^3)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION Continued	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m							GR	SA	SI	CL
31 296.0			21	CC			297					32	61	(7)	
32 31.9 33 294.6 33.2	Greyish brown SILTY SAND TILL, trace gravel, trace cobble, moist.		22	CC			296 295								

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity

○ ε=3% Strain at Failure

APPENDIX C-2

Borehole Photographs

Appendix C-2: 2021 Borehole Photographs

BH21-01: Photo 1 of 19

BH21-01: Photo 2 of 19

BH21-01: Photo 3 of 19

Appendix C-2: 2021 Borehole Photographs

BH21-01: Photo 4 of 19

BH21-01: Photo 5 of 19

BH21-01: Photo 6 of 19

Appendix C-2: 2021 Borehole Photographs

BH21-01: Photo 7 of 19

BH21-01: Photo 8 of 19

BH21-01: Photo 9 of 19

BH21-01: Photo 10 of 19

BH21-01: Photo 11 of 19

BH21-01: Photo 12 of 19

Appendix C-2: 2021 Borehole Photographs

BH21-01: Photo 13 of 19

BH21-01: Photo 14 of 19

BH21-01: Photo 15 of 19

BH21-01: Photo 16 of 19

BH21-01: Photo 17 of 19

BH21-01: Photo 18 of 19

Appendix C-2: 2021 Borehole Photographs

BH21-01: Photo 19 of 19

BH21-02: Photo 1 of 23

BH21-02: Photo 2 of 23

BH21-02: Photo 3 of 23

BH21-02: Photo 4 of 23

BH21-02: Photo 5 of 23

Appendix C-2: 2021 Borehole Photographs

BH21-02: Photo 6 of 23

BH21-02: Photo 7 of 23

BH21-02: Photo 8 of 23

Appendix C-2: 2021 Borehole Photographs

BH21-02: Photo 9 of 23

BH21-02: Photo 10 of 23

BH21-02: Photo 11 of 23

Appendix C-2: 2021 Borehole Photographs

BH21-02: Photo 12 of 23

BH21-02: Photo 13 of 23

BH21-02: Photo 14 of 23

Appendix C-2: 2021 Borehole Photographs

BH21-02: Photo 15 of 23

BH21-02: Photo 16 of 23

BH21-02: Photo 17 of 23

Appendix C-2: 2021 Borehole Photographs

BH21-02: Photo 18 of 23

BH21-02: Photo 19 of 23

Appendix C-2: 2021 Borehole Photographs

BH21-02: Photo 20 of 23

BH21-02: Photo 21 of 23

BH21-02: Photo 22 of 23

Appendix C-2: 2021 Borehole Photographs

BH21-02: Photo 23 of 23

BH21-03: Photo 1 of 24

BH21-03: Photo 2 of 24

BH21-03: Photo 3 of 24

BH21-03: Photo 4 of 24

BH21-03: Photo 5 of 24

Appendix C-2: 2021 Borehole Photographs

BH21-03: Photo 6 of 24

BH21-03: Photo 7 of 24

BH21-03: Photo 8 of 24

BH21-03: Photo 9 of 24

BH21-03: Photo 10 of 24

BH21-03: Photo 11 of 24

Appendix C-2: 2021 Borehole Photographs

BH21-03: Photo 12 of 24

BH21-03: Photo 13 of 24

BH21-03: Photo 14 of 24

Appendix C-2: 2021 Borehole Photographs

BH21-03: Photo 15 of 24

BH21-03: Photo 16 of 24

BH21-03: Photo 17 of 24

Appendix C-2: 2021 Borehole Photographs

BH21-03: Photo 18 of 24

BH21-03: Photo 19 of 24

BH21-03: Photo 20 of 24

Appendix C-2: 2021 Borehole Photographs

BH21-03: Photo 21 of 24

BH21-03: Photo 22 of 24

BH21-03: Photo 23 of 24

Appendix C-2: 2021 Borehole Photographs

BH21-03: Photo 24 of 24

BH21-04: Photo 1 of 30

BH21-04: Photo 2 of 30

Appendix C-2: 2021 Borehole Photographs

BH21-04: Photo 3 of 30

BH21-04: Photo 4 of 30

BH21-04: Photo 5 of 30

Appendix C-2: 2021 Borehole Photographs

BH21-04: Photo 6 of 30

BH21-04: Photo 7 of 30

BH21-04: Photo 8 of 30

BH21-04: Photo 9 of 30

BH21-04: Photo 10 of 30

BH21-04: Photo 11 of 30

BH21-04: Photo 12 of 30

BH21-04: Photo 13 of 30

BH21-04: Photo 14 of 30

BH21-04: Photo 15 of 30

BH21-04: Photo 16 of 30

BH21-04: Photo 17 of 30

BH21-04: Photo 18 of 30

BH21-04: Photo 19 of 30

BH21-04: Photo 20 of 30

Appendix C-2: 2021 Borehole Photographs

BH21-04: Photo 21 of 30

BH21-04: Photo 22 of 30

BH21-04: Photo 23 of 30

Appendix C-2: 2021 Borehole Photographs

BH21-04: Photo 24 of 30

BH21-04: Photo 25 of 30

BH21-04: Photo 26 of 30

BH21-04: Photo 27 of 30

BH21-04: Photo 28 of 30

BH21-04: Photo 29 of 30

Appendix C-2: 2021 Borehole Photographs

BH21-04: Photo 30 of 30

MW21-01: Photo 1 of 15

MW21-01: Photo 2 of 15

Appendix C-2: 2021 Borehole Photographs

MW21-01: Photo 3 of 15

MW21-01: Photo 4 of 15

MW21-01: Photo 5 of 15

Appendix C-2: 2021 Borehole Photographs

MW21-01: Photo 6 of 15

MW21-01: Photo 7 of 15

MW21-01: Photo 8 of 15

Appendix C-2: 2021 Borehole Photographs

MW21-01: Photo 9 of 15

MW21-01: Photo 10 of 15

MW21-01: Photo 11 of 15

Appendix C-2: 2021 Borehole Photographs

MW21-01: Photo 12 of 15

MW21-01: Photo 13 of 15

MW21-01: Photo 14 of 15

Appendix C-2: 2021 Borehole Photographs

MW21-01: Photo 15 of 15

MW21-02: Photo 1 of 16

MW21-02: Photo 2 of 16

Appendix C-2: 2021 Borehole Photographs

MW21-02: Photo 3 of 16

MW21-02: Photo 4 of 16

MW21-02: Photo 5 of 16

Appendix C-2: 2021 Borehole Photographs

MW21-02: Photo 6 of 16

MW21-02: Photo 7 of 16

MW21-02: Photo 8 of 16

Appendix C-2: 2021 Borehole Photographs

MW21-02: Photo 9 of 16

MW21-02: Photo 10 of 16

MW21-02: Photo 11 of 16

Appendix C-2: 2021 Borehole Photographs

MW21-02: Photo 12 of 16

MW21-02: Photo 13 of 16

MW21-02: Photo 14 of 16

Appendix C-2: 2021 Borehole Photographs

MW21-02: Photo 15 of 16

MW21-02: Photo 16 of 16

Appendix C-2: 2021 Borehole Photographs

MW21-03: Photo 1 of 22

MW21-03: Photo 2 of 22

MW21-03: Photo 3 of 22

MW21-03: Photo 4 of 22

MW21-03: Photo 5 of 22

Appendix C-2: 2021 Borehole Photographs

MW21-03: Photo 6 of 22

MW21-03: Photo 7 of 22

MW21-03: Photo 8 of 22

Appendix C-2: 2021 Borehole Photographs

MW21-03: Photo 9 of 22

MW21-03: Photo 10 of 22

MW21-03: Photo 11 of 22

Appendix C-2: 2021 Borehole Photographs

MW21-03: Photo 12 of 22

MW21-03: Photo 13 of 22

MW21-03: Photo 14 of 22

Appendix C-2: 2021 Borehole Photographs

MW21-03: Photo 15 of 22

MW21-03: Photo 16 of 22

MW21-03: Photo 17 of 22

Appendix C-2: 2021 Borehole Photographs

MW21-03: Photo 18 of 22

MW21-03: Photo 19 of 22

MW21-03: Photo 20 of 22

Appendix C-2: 2021 Borehole Photographs

MW21-03: Photo 21 of 22

MW21-03: Photo 22 of 22

Appendix C-2: 2021 Borehole Photographs

MW21-04: Photo 1 of 21

MW21-04: Photo 2 of 21

MW21-04: Photo 3 of 21

MW21-04: Photo 4 of 21

MW21-04: Photo 5 of 21

MW21-04: Photo 6 of 21

Appendix C-2: 2021 Borehole Photographs

MW21-04: Photo 7 of 21

MW21-04: Photo 8 of 21

MW21-04: Photo 9 of 21

MW21-04: Photo 10 of 21

MW21-04: Photo 11 of 21

MW21-04: Photo 12 of 21

Appendix C-2: 2021 Borehole Photographs

MW21-04: Photo 13 of 21

MW21-04: Photo 14 of 21

MW21-04: Photo 15 of 21

MW21-04: Photo 16 of 21

MW21-04: Photo 17 of 21

MW21-04: Photo 18 of 21

Appendix C-2: 2021 Borehole Photographs

MW21-04: Photo 19 of 21

MW21-04: Photo 20 of 21

MW21-04: Photo 21 of 21

APPENDIX C-3

Soil Gradation Test Results

BH 21-01

Run Depth (ft)				Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushable Stone (%)	Stone to Sand Ratio		
Top		Bottom										
(ft)	(m)	(ft)	(m)							Ratio	Stone	Sand
2		3		1B		0.69	0.69	42.3	0	0:100	0	100
3		8		2		3.45	2.29	47.1	90	28:72	28	72
8		13		3		5.20	2.87	38.1	23	42:58	42	58
13		18		4		5.02	3.20	32.2	16	41:59	41	59
18		23		5		7.05	3.82	27.4	32	58:42	58	42
23		28		6								
28		33		7		7.09	3.91	25.4	30	61:39	61	39
33		38		8		4.36	2.96	36.4	11	35:65	35	65
38.0		43		9		4.83	3.30	28.9	10	42:58	42	58
43.0		48		10								
48.0		53		11		6.03	3.59	17.0	28	50:50	50	50
53.0		58		12								
58.0		63		13		5.72	3.34	28.0	23	47:53	47	53
64.0		69		14A		7.02	3.97	19.5	27	62:38	62	38
66.0		68		14B		6.27	3.50	35.3	29	52:48	52	48
66.0		68		14C		3.00	1.93	54.2	10	26:74	26	74
68.0		73		15								
73		76		16A		3.97	2.89	22.3	5	34:66	34	66

BH 21-02

Run Depth (ft)				Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushable Stone (%)	Stone to Sand Ratio		
Top		Bottom										
(ft)	(m)	(ft)	(m)							Ratio	Stone	Sand
1.5		3		1B								
3		8		2		2.52	1.83	48.3	5	20:80	20	80
8		13		3		5.17	2.95	40.5	23	42:58	42	58
13		18		4		4.20	2.58	40.2	15	32:68	32	68
18		23		5		4.11	2.61	36.5	15	33:67	33	67
23		28		6								
28		33		7								
33		38		8		3.82	2.46	41.5	13	31:69	31	69
38.0		43		9		2.22	1.74	41.7	4	12:88	12	88
43.0		48		10		4.84	2.79	40.4	21	40:60	40	60
48.0		53		11		4.53	2.75	41.4	17	37:63	37	63
53.0		58		12		4.39	2.94	36.1	13	36:64	36	64
58.0		63		13		5.81	3.47	29.9	22	49:51	49	51
63.0		68		14		6.91	3.95	21.8	32	58:42	58	42
68.0		73		15		6.56	3.95	18.9	23	59:41	59	41
73		78		16		6.78	4.01	18.3	27	59:41	59	41

BH 21-03

Run Depth (ft)				Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushable Stone (%)	Stone to Sand Ratio		
Top		Bottom										
(ft)	(m)	(ft)	(m)							Ratio	Stone	Sand
0.5		3		1B		6.58	2.12	28.9	36	55:45	55	45
3		8		2		5.02	2.84	41.4	23	40:60	40	60
8		13		3		5.47	3.16	32.0	22	42:58	42	58
13.0		18		4		4.88	3.27	21.4	14	39:61	39	61
18		23		5		6.13	3.62	26.9	23	53:47	53	47
23		28		6		6.65	3.81	27.5	28	60:40	60	40
28		33		7		5.52	3.02	43.7	24	45:55	45	55
33		38		8		4.85	3.11	34.8	15	42:58	42	58
38.0		43		9								
43.0		48		10		5.11	3.14	40.0	20	45:55	45	55
48.0		53		11		5.50	3.35	18.1	22	40:60	40	60
53.0		58		12		3.87	2.81	35.5	7	33:67	33	67
58.0		63		13		4.75	3.15	32.7	14	40:60	40	60
63.0		68		14		5.82	3.57	24.8	20	49:51	49	51
68.0		73		15								
73.0		78		16		4.05	3.00	26.7	7	33:67	33	67
78.0		83		17		5.58	3.41	37.2	21	50:50	50	50
83		88		18		6.29	3.80	24.1	23	55:45	55	45
88.0		93		19		7.46	3.89	13.7	35	59:41	59	41
93.0		98		20		7.34	4.18	12.6	28	65:35	65	35
98.0		103		21		5.60	3.30	26.3	21	49:51	49	51
103		107		22A		0.38	0.32	24.8	0	2:98	2	98

Project: 21476582

BH 21-04

Run Depth (ft)				Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushable Stone (%)	Stone to Sand Ratio		
Top		Bottom										
(ft)	(m)	(ft)	(m)							Ratio	Stone	Sand
0.8		3		1B		2.85	1.83	51.5	8	6:19	24	76
3		8		2		3.47	2.39	42.7	9	29:71	29	71
8		9		3A		5.06	2.99	44.3	22	11:14	44	56
8		13		3B		3.52	2.42	44.7	8	7:18	28	72
13		18		4		3.74	2.00	46.4	11	31:69	31	69
18		23		5		4.69	2.74	43.0	17	7:13	35	65
23		28		6		5.58	3.19	58.0	25	9:11	45	55
28		33		7								
33		38		8								
38		43		9		5.46	3.33	29.8	22	43:57	43	57
43		48		10		6.62	3.87	16.9	28	57:43	57	43
48		53		11		5.36	3.14	45.0	21	47:53	47	53
53		57		12A		3.06	2.38	26.5	2	24:76	24	76
57		58		12B		4.23	2.72	33.0	16	17:33	34	66
58		63		13		5.79	3.89	11.3	25	49:51	49	51
63		68		14								
68		73		15								
73		78		16								
78		83		17								
83		88		18		7.57	4.07	13.2	37	16:9	64	36
88		93		19		8.68	4.48	24.1	40	81:19	81	19

MW 21-01

Run Depth (ft)				Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushable Stone (%)	Stone to Sand Ratio		
Top		Bottom										
(ft)	(m)	(ft)	(m)							Ratio	Stone	Sand
0.0		1.5		1A		2.59	1.81	46.1	8	24:76	24	76
1.5		3		1B		1.74	1.31	38.5	4	11:89	11	89
3		8		2		5.11	3.04	35.4	20	43:57	43	57
8		14		3		4.61	2.66	36.2	20	35:65	35	65
14.0		19		4		4.23	2.84	31.4	12	35:65	35	65
19		24		5		5.34	3.34	23.7	17	46:54	46	54
24		29		6		6.06	3.82	26.8	22	51:49	51	49
29.0		34		7		4.66	3.01	27.8	16	36:64	36	64
34		39		8		6.86	3.71	28.8	33	56:44	56	44
39.0		44		9		2.52	2.13	38.8	0	19:81	19	81
44.0		49		10		9.07	4.39	15.0	50	75:25	75	25
49.0		54		11		8.93	4.55	6.7	49	75:25	75	25
54.0		59		12		7.10	4.30	13.1	26	65:35	65	35
59.0		64		13		5.79	3.92	4.6	14	48:52	48	52
64.0		69		14								
69.0		74		15		8.51	4.40	15.8	40	73:27	73	27

Project: 21476582

MW 21-02

Run Depth (ft)				Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushable Stone (%)	Stone to Sand Ratio		
Top		Bottom										
(ft)	(m)	(ft)	(m)							Ratio	Stone	Sand
3		4		2A		3.54	2.28	36.6	8	29:71	29	71
3		8		2B		3.44	2.47	41.9	8	28:72	28	72
8		13		3		3.21	2.28	43.7	8	25:75	25	75
13		18		4		4.59	2.83	43.2	17	40:60	40	60
18		23		5		4.22	2.61	42.7	16	35:65	35	65
23		24.5		6A		6.32	3.65	34.6	27	56:44	56	44
23		28		6B		5.91	3.66	22.6	19	52:48	52	48
28		33		7		6.01	3.75	24.6	20	53:47	53	47
33		38		8		5.61	3.58	24.7	18	48:52	48	52
38		43		9		7.95	4.15	19.6	39	66:34	66	34
43		48		10		6.73	3.86	23.3	30	59:41	59	41
48		53		11		7.55	4.07	19.0	34	65:35	65	35
53		58		12		7.23	4.09	19.0	30	62:38	62	38
58		63		13		6.69	3.99	20.6	25	59:41	59	41

Project: 21476582

MW 21-03

Run Depth (ft)				Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushable Stone (%)	Stone to Sand Ratio		
Top		Bottom										
(ft)	(m)	(ft)	(m)							Ratio	Stone	Sand
3		8		2		2.22	1.45	34.0	1	19:81	19	81
8		13		3								
13		18		4		2.40	2.20	14.4	0	12:88	12	88
18		23		5		0.00	0.00	99.3	0	0:100	0	100
23		28		6A		0.08	0.08	93.9	0	0:100	0	100
27		28		6B		2.26	1.67	59.8	4	19:81	19	81
28		33		7		5.39	2.85	44.5	28	42:58	42	58
33		38		8		5.18	2.81	44.3	25	43:57	43	57
38		43		9		3.07	2.50	37.1	4	22:78	22	78
43		46		10A		3.12	2.68	29.3	1	22:78	22	78
43		48		10B		4.37	2.63	42.9	17	35:65	35	65
48		53		11		4.59	2.83	39.5	17	36:64	36	64
53		58		12		4.15	2.55	44.7	17	34:66	34	66
58		63		13		3.31	2.70	18.1	3	19:81	19	81
63		65.5		14A		3.59	3.03	20.6	3	20:80	20	80
63		68		14B		8.17	4.27	15.6	41	65:35	65	35
68		73		15		6.35	3.54	28.1	29	51:49	51	49
73		78		16		9.35	4.49	20.0	50	80:20	80	20
78		83		17		8.94	4.29	21.8	51	76:24	76	24

Project: 21476582

MW 21-04

Run Depth (ft)				Sample ID	Field Description (optional)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushable Stone (%)	Stone to Sand Ratio		
Top		Bottom										
(ft)	(m)	(ft)	(m)							Ratio	Stone	Sand
0		4		1B		3.06	1.76	65.8	14	24:76	24	76
4		9		2		3.53	2.12	55.8	15	28:72	28	72
9		10		3A		1.25	1.14	58.7	0	6:94	6	94
9		14		3B		7.46	3.83	27.1	37	60:40	60	40
14		19		4		8.13	4.15	28.4	42	68:32	68	32
19		24		5		5.69	3.68	20.2	17	50:50	50	50
24		27.5		6A		7.73	3.92	25.5	39	62:38	62	38
28		29		6B		2.55	1.80	50.3	7	19:81	19	81
29		34		7		5.10	2.90	40.0	23	42:58	42	58
34		38.5		8A		6.22	3.59	30.8	25	53:47	53	47
34		39		8B		4.85	2.70	58.6	23	40:60	40	60
39		44		9		4.99	3.42	18.0	12	42:58	42	58
44		49		10		12.38	3.50	24.3	17	49:51	49	51
49		54		11A		5.92	3.58	26.2	20	51:49	51	49
51.5		52		11B		1.45	1.34	46.9	0	6:94	6	94
54		59		12		5.91	3.76	20.4	17	53:47	53	47
59		64		13		6.73	3.80	24.5	28	56:44	56	44
64		69		14		5.99	3.71	25.6	19	52:48	52	48
69		74		15		6.36	3.99	10.8	22	54:46	54	46
74		79		16		7.67	4.13	18.8	44	65:35	65	35
79		84		17		7.42	4.24	16.1	31	63:37	63	37
84		89		18		6.13	3.94	12.8	22	49:51	49	51
89		94		19		6.25	3.80	27.4	25	55:45	55	45
94		99		20		7.79	4.24	16.6	34	67:33	67	33
99		104		21		4.80	3.47	13.2	12	31:69	31	69

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 2533.6(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
13.2mm	0.00	0.00	13.20	100.0
9.5mm	0.00	0.00	9.50	100.0
4.75mm	0.00	0.00	4.75	100.0
PAN	2533.60	100.00	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	1.80	0.62	2.36	99.4
1.18mm	5.70	1.35	1.18	98.0
600µm	21.60	5.50	0.60	92.5
300µm	59.90	13.26	0.30	79.3
150µm	110.20	17.41	0.15	61.9
75µm	148.50	13.26	0.08	48.6

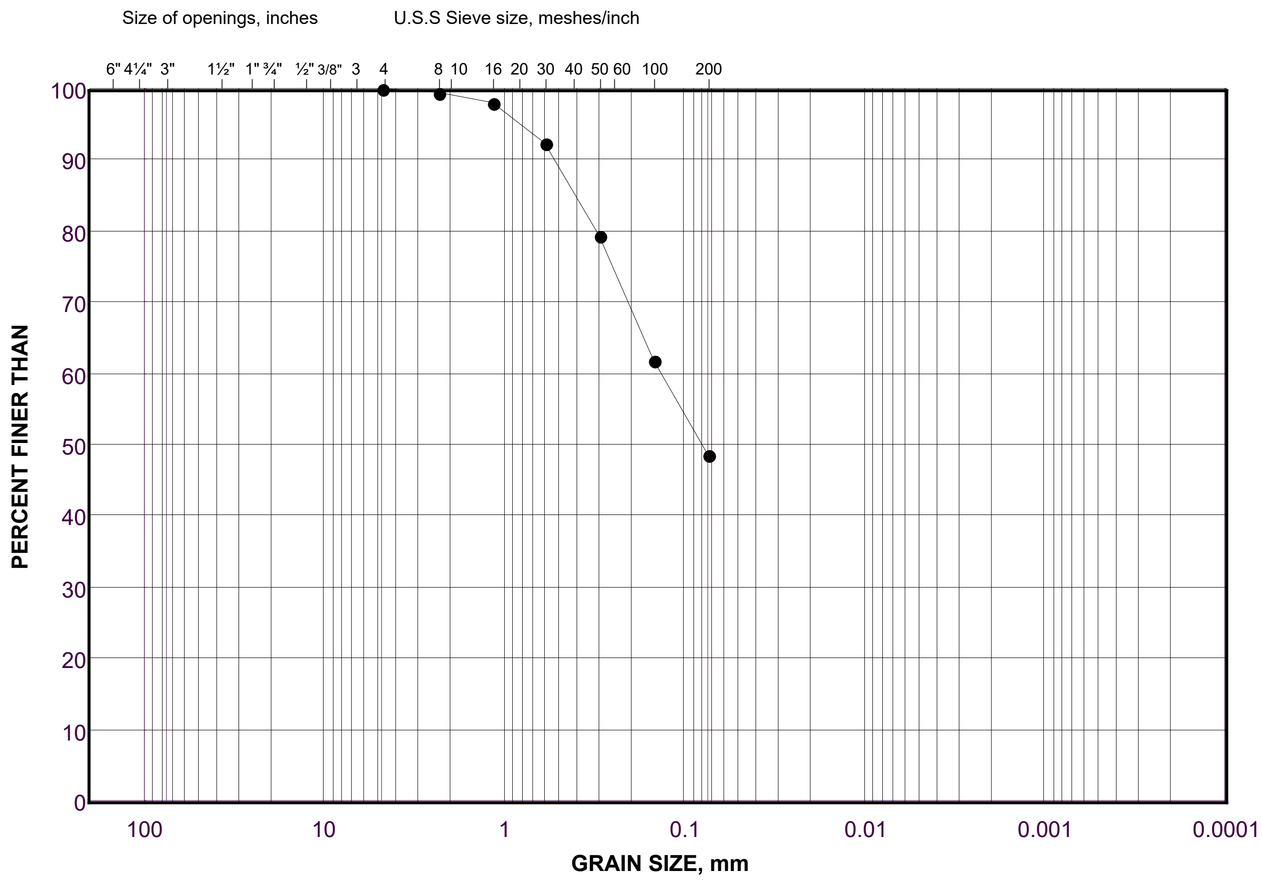
Project Number	21476582	Depth	3
Project Task	1000	Units	Metric
Borehole Number	BH 21-01	Testing Date	3/24/22 10:25:02 AM
Sample Number	1B	Tested By	Sieve - LB
Checked By	____________________	LabID	22-555

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	1B	2.0 - 3.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14049.3(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	935.70	6.66	75.00	93.3
63mm	935.70	0.00	63.00	93.3
53mm	935.70	0.00	53.00	93.3
37.5mm	1191.40	1.82	37.50	91.5
26.5mm	1341.80	1.07	26.50	90.5
19.0mm	1963.20	4.42	19.00	86.0
16mm	1994.10	0.22	16.00	85.8
13.2mm	2174.80	1.29	13.20	84.5
9.5mm	2749.50	4.09	9.50	80.4
4.75mm	3909.70	8.26	4.75	72.2
PAN	10093.00	72.17	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	22.40	5.62	2.36	66.6
1.18mm	46.60	6.08	1.18	60.5
600µm	71.00	6.13	0.60	54.3
300µm	96.10	6.30	0.30	48.0
150µm	123.10	6.78	0.15	41.3
75µm	151.10	7.03	0.08	34.2

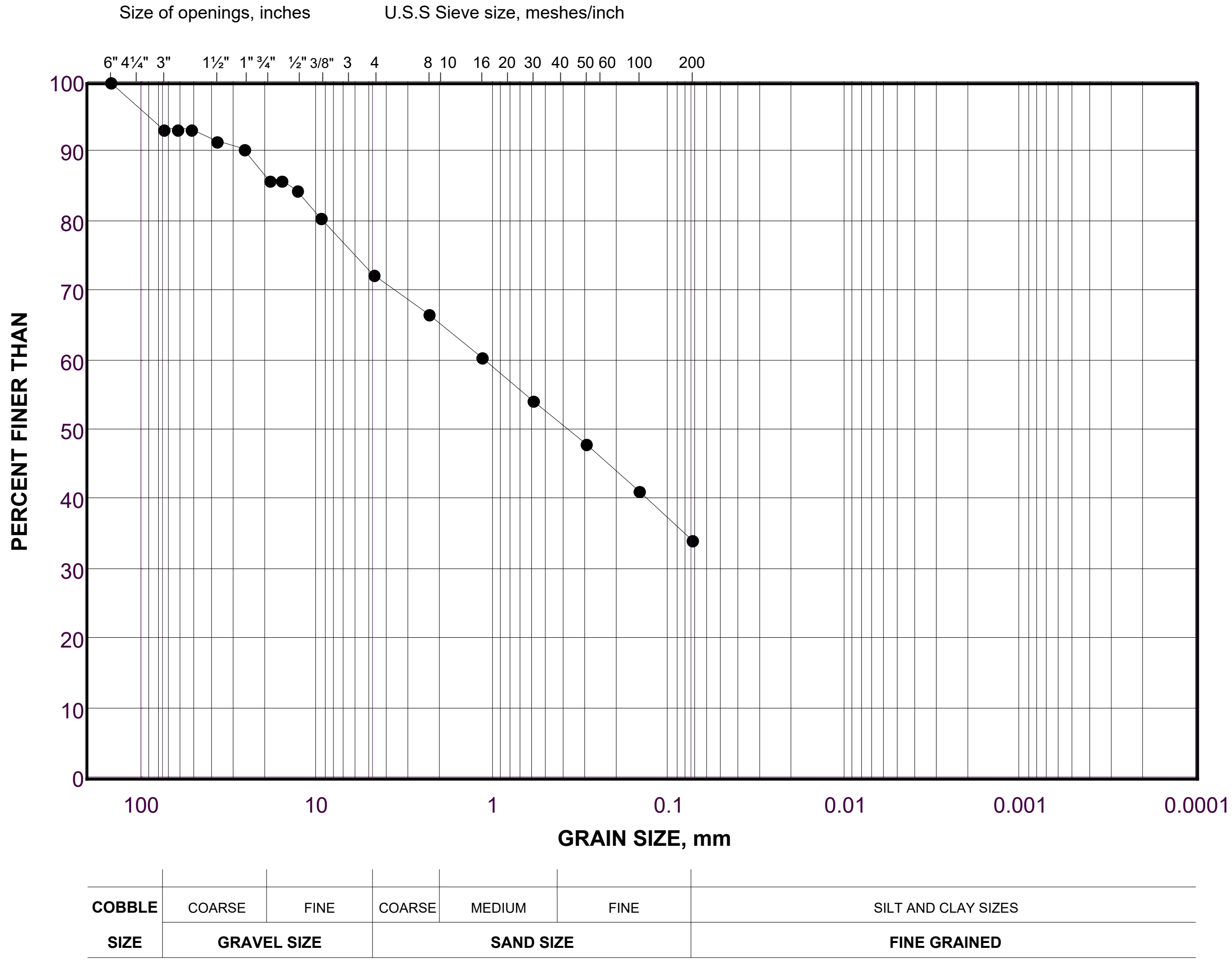
Project Number	21476582	Depth	8
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/24/22 10:29:15 AM
Sample Number	2	Tested By	Sieve - AM
Checked By	______________________	LabID	22-211

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	2	3.0 - 8.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 21871(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1648.00	7.54	75.00	92.5
63mm	2070.00	1.93	63.00	90.5
53mm	2290.00	1.01	53.00	89.5
37.5mm	4314.00	9.25	37.50	80.3
26.5mm	4976.00	3.03	26.50	77.2
19.0mm	5758.00	3.58	19.00	73.7
16mm	6282.00	2.40	16.00	71.3
13.2mm	6752.00	2.15	13.20	69.1
9.5mm	7640.00	4.06	9.50	65.1
4.75mm	9116.00	6.75	4.75	58.3
PAN	12755.00	58.30	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	24.21	4.16	2.36	54.1
1.18mm	54.35	5.18	1.18	49.0
600µm	88.37	5.85	0.60	43.1
300µm	125.80	6.43	0.30	36.7
150µm	164.32	6.62	0.15	30.1
75µm	201.34	6.36	0.08	23.7

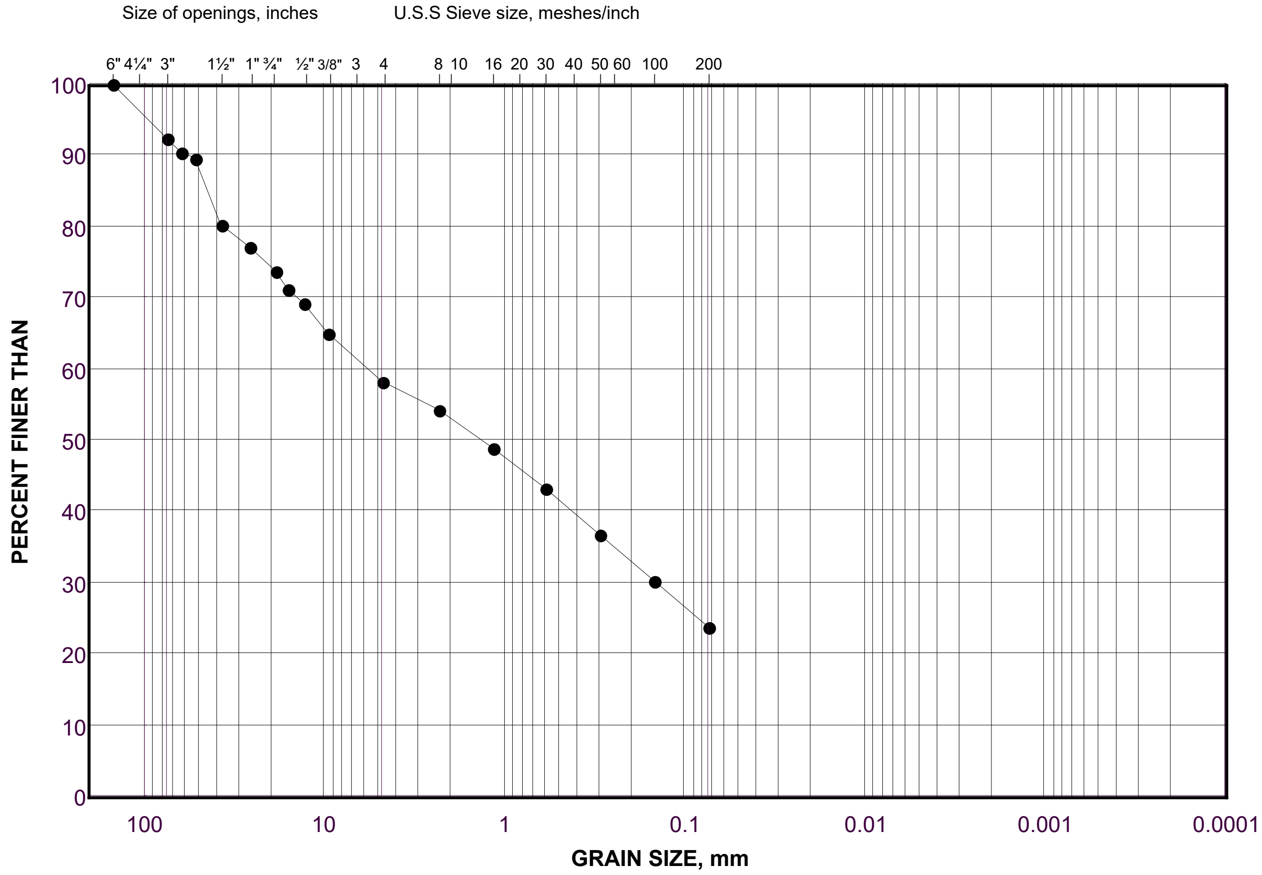
Project Number	21476582	Depth	13
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/24/22 10:37:51 AM
Sample Number	3	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-598

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	3	8.0 - 13.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15726.8(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	1106.60	7.04	53.00	93.0
37.5mm	1883.40	4.94	37.50	88.0
26.5mm	2580.70	4.43	26.50	83.6
19.0mm	3324.00	4.73	19.00	78.9
16mm	3803.60	3.05	16.00	75.8
13.2mm	4236.50	2.75	13.20	73.1
9.5mm	5151.00	5.81	9.50	67.3
4.75mm	6524.80	8.74	4.75	58.5
PAN	9161.70	58.51	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	39.20	8.22	2.36	50.3
1.18mm	81.20	8.80	1.18	41.5
600µm	114.30	6.94	0.60	34.6
300µm	140.80	5.56	0.30	29.0
150µm	162.70	4.59	0.15	24.4
75µm	186.00	4.88	0.08	19.5

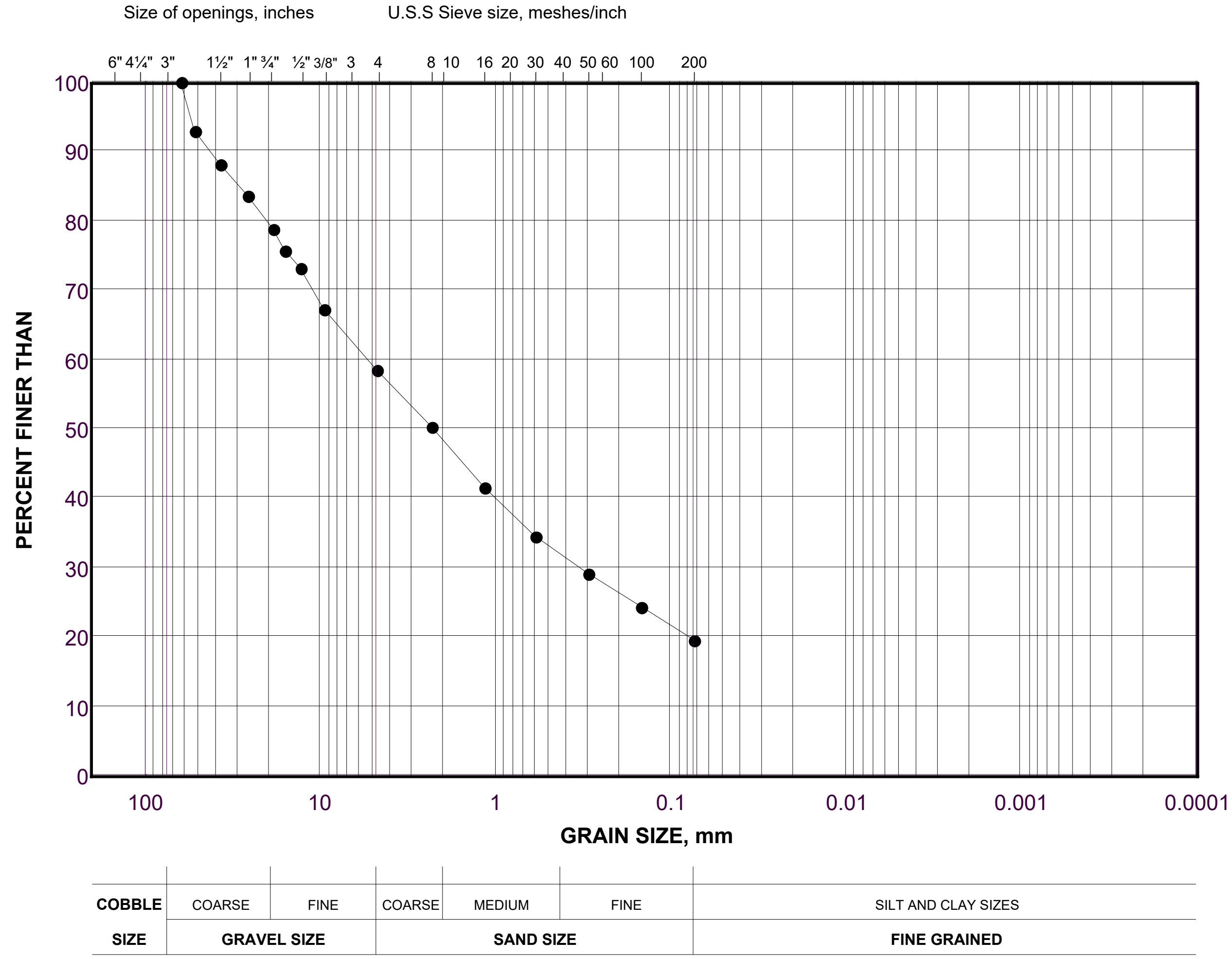
Project Number	21476582	Depth	18
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/07/22 3:26:32 PM
Sample Number	4	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-419

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	21-01	4	13.0 - 18.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 8659.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	604.60	6.98	75.00	93.0
63mm	1094.40	5.66	63.00	87.4
53mm	1332.40	2.75	53.00	84.6
37.5mm	2042.70	8.20	37.50	76.4
26.5mm	2796.90	8.71	26.50	67.7
19.0mm	3324.50	6.09	19.00	61.6
16mm	3590.00	3.07	16.00	58.5
13.2mm	3831.90	2.79	13.20	55.8
9.5mm	4272.10	5.08	9.50	50.7
4.75mm	5032.30	8.78	4.75	41.9
PAN	3618.50	41.89	0.00	0.0

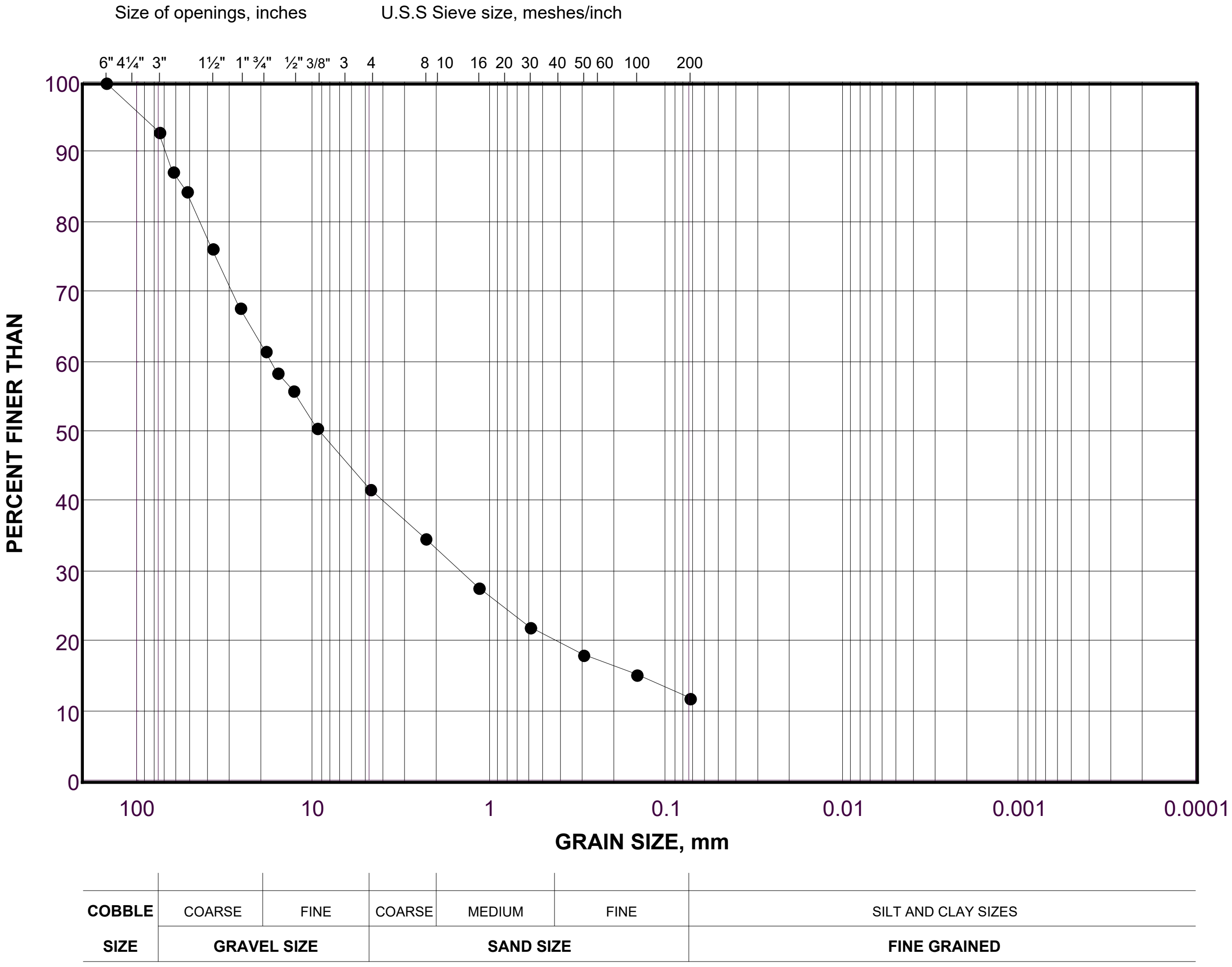
HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	45.20	7.12	2.36	34.8
1.18mm	90.50	7.14	1.18	27.6
600µm	126.60	5.69	0.60	21.9
300µm	150.10	3.70	0.30	18.2
150µm	169.30	3.02	0.15	15.2
75µm	189.80	3.23	0.08	12.0

Project Number	21476582	Depth	23
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/24/22 10:58:40 AM
Sample Number	5	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-609

Golder Associates

# GRAIN SIZE DISTRIBUTION MTO LS-602	FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	5	18.0 - 23.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 20326(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1152.00	5.67	75.00	94.3
63mm	2152.00	4.92	63.00	89.4
53mm	3270.00	5.50	53.00	83.9
37.5mm	5114.00	9.07	37.50	74.8
26.5mm	6210.00	5.39	26.50	69.5
19.0mm	7374.00	5.73	19.00	63.7
16mm	8078.00	3.46	16.00	60.3
13.2mm	8754.00	3.33	13.20	56.9
9.5mm	10046.00	6.36	9.50	50.6
4.75mm	12332.00	11.25	4.75	39.3
PAN	7994.00	39.32	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	58.65	6.97	2.36	32.4
1.18mm	112.10	6.35	1.18	26.0
600µm	156.28	5.25	0.60	20.8
300µm	193.87	4.46	0.30	16.3
150µm	220.99	3.22	0.15	13.1
75µm	244.31	2.77	0.08	10.3

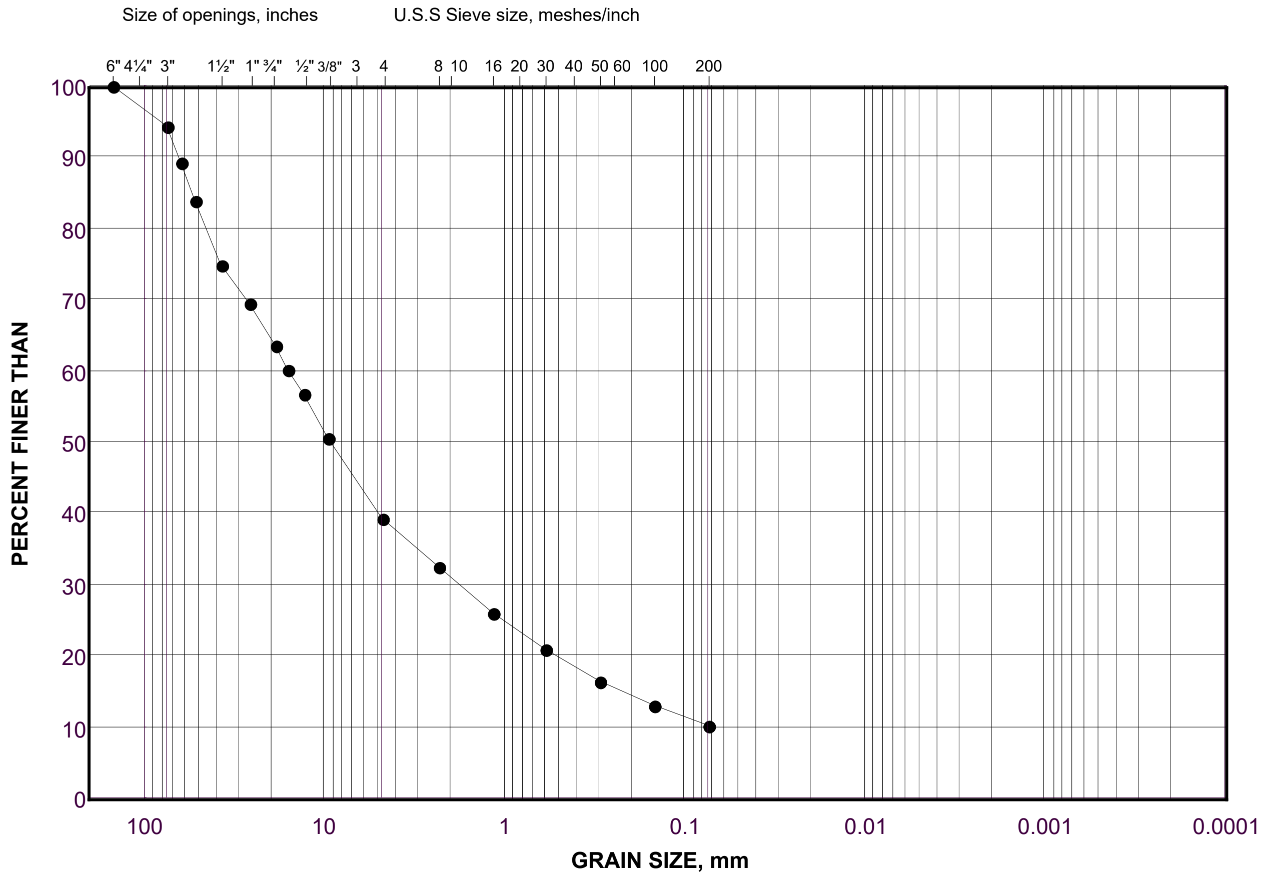
Project Number	21476582	Depth	33
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/24/22 11:05:31 AM
Sample Number	7	Tested By	Sieve -
Checked By	______________________	LabID	22-599

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	7	28.0 - 33.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 22587.3(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	810.80	3.59	75.00	96.4
63mm	1124.20	1.39	63.00	95.0
53mm	1124.20	0.00	53.00	95.0
37.5mm	1890.40	3.39	37.50	91.6
26.5mm	2553.50	2.94	26.50	88.7
19.0mm	3393.00	3.72	19.00	85.0
16mm	3898.30	2.24	16.00	82.7
13.2mm	4381.20	2.14	13.20	80.6
9.5mm	5543.00	5.14	9.50	75.5
4.75mm	7891.80	10.40	4.75	65.1
PAN	14656.50	65.05	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	47.00	9.80	2.36	55.3
1.18mm	88.60	8.68	1.18	46.6
600µm	124.50	7.49	0.60	39.1
300µm	150.80	5.49	0.30	33.6
150µm	171.90	4.40	0.15	29.2
75µm	196.90	5.21	0.08	24.0

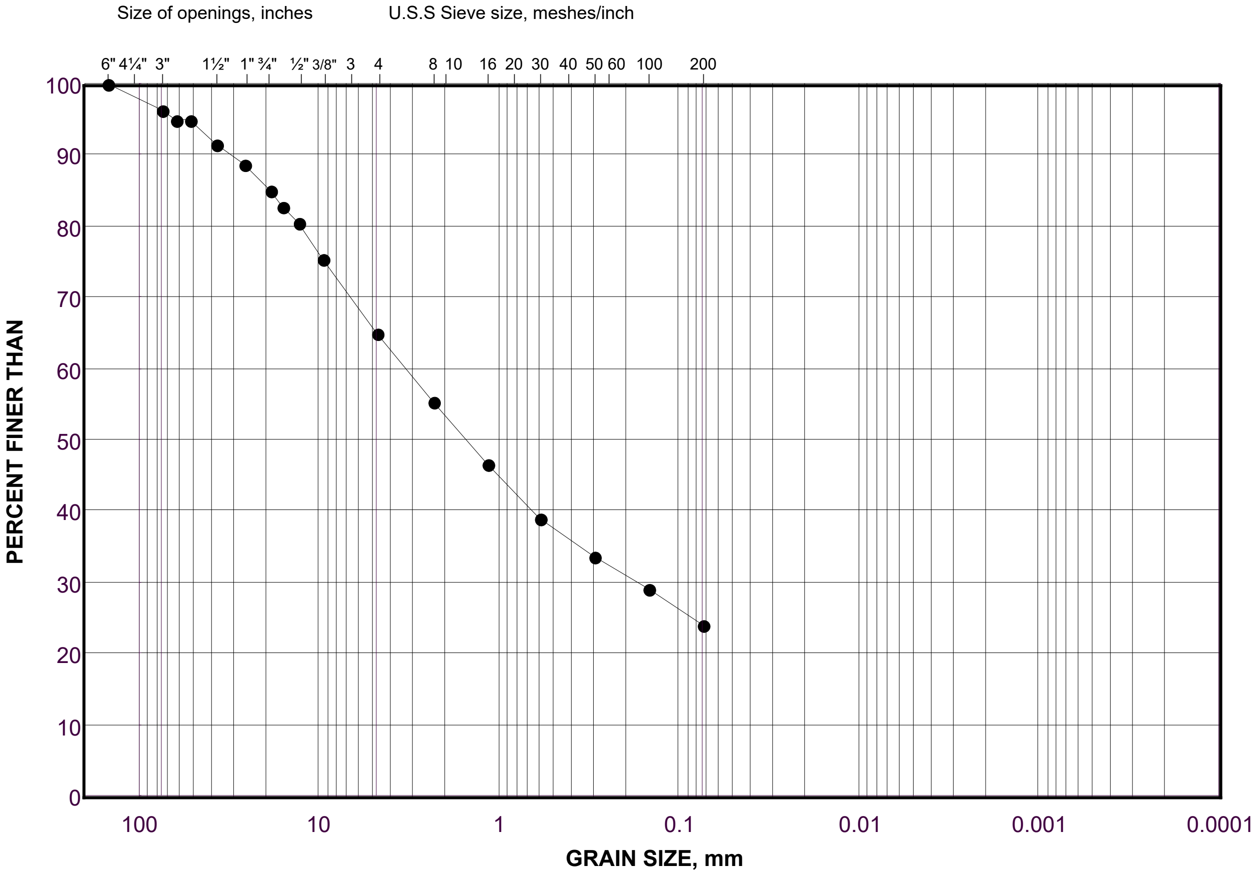
Project Number	21476582	Depth	33
Project Task	1000	Units	Imperial
Test Pit Number	BH 21-01	Testing Date	3/24/22 11:13:18 AM
Sample Number	8	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-192

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	TEST PIT	SAMPLE	DEPTH(ft)
●	BH 21-01	8	38.0 - 33.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 19326.6(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	562.20	2.91	53.00	97.1
37.5mm	910.90	1.80	37.50	95.3
26.5mm	1965.90	5.46	26.50	89.8
19.0mm	3315.20	6.98	19.00	82.9
16mm	4015.10	3.62	16.00	79.2
13.2mm	4638.20	3.22	13.20	76.0
9.5mm	5942.50	6.75	9.50	69.3
4.75mm	8117.10	11.25	4.75	58.0
PAN	11180.40	58.01	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	40.10	8.99	2.36	49.0
1.18mm	79.60	8.85	1.18	40.2
600µm	115.10	7.96	0.60	32.2
300µm	141.70	5.96	0.30	26.3
150µm	160.90	4.30	0.15	22.0
75µm	181.00	4.51	0.08	17.4

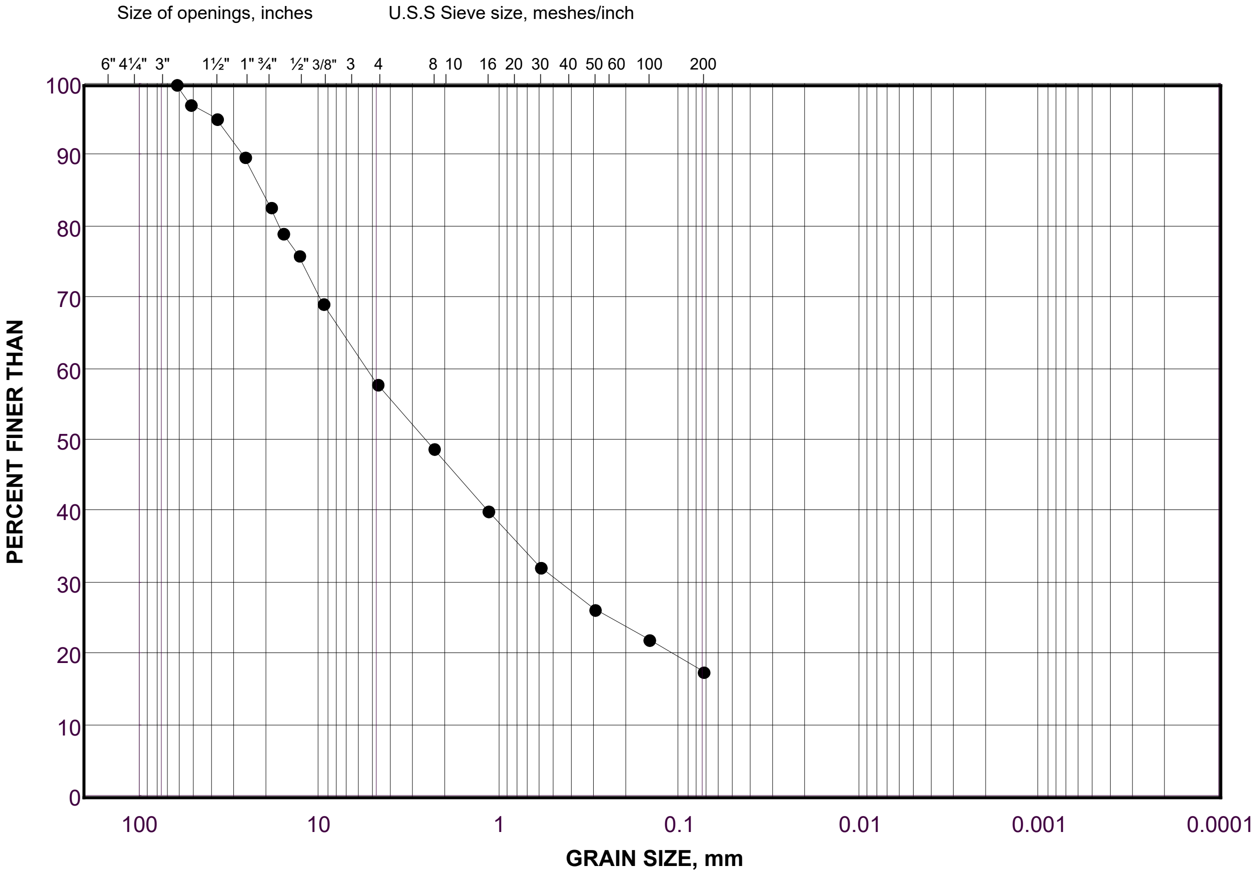
Project Number	21476582	Depth	
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/07/22 3:31:26 PM
Sample Number	9	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-420

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	9	38.0 - 43.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17134.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1377.50	8.04	75.00	92.0
63mm	1377.50	0.00	63.00	92.0
53mm	2067.80	4.03	53.00	87.9
37.5mm	2740.80	3.93	37.50	84.0
26.5mm	3802.70	6.20	26.50	77.8
19.0mm	4863.40	6.19	19.00	71.6
16mm	5365.30	2.93	16.00	68.7
13.2mm	5891.80	3.07	13.20	65.6
9.5mm	7063.90	6.84	9.50	58.8
4.75mm	8651.80	9.27	4.75	49.5
PAN	8470.10	49.50	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	37.00	6.97	2.36	42.5
1.18mm	67.10	5.67	1.18	36.9
600µm	106.90	7.49	0.60	29.4
300µm	159.70	9.94	0.30	19.4
150µm	196.10	6.85	0.15	12.6
75µm	216.90	3.92	0.08	8.7

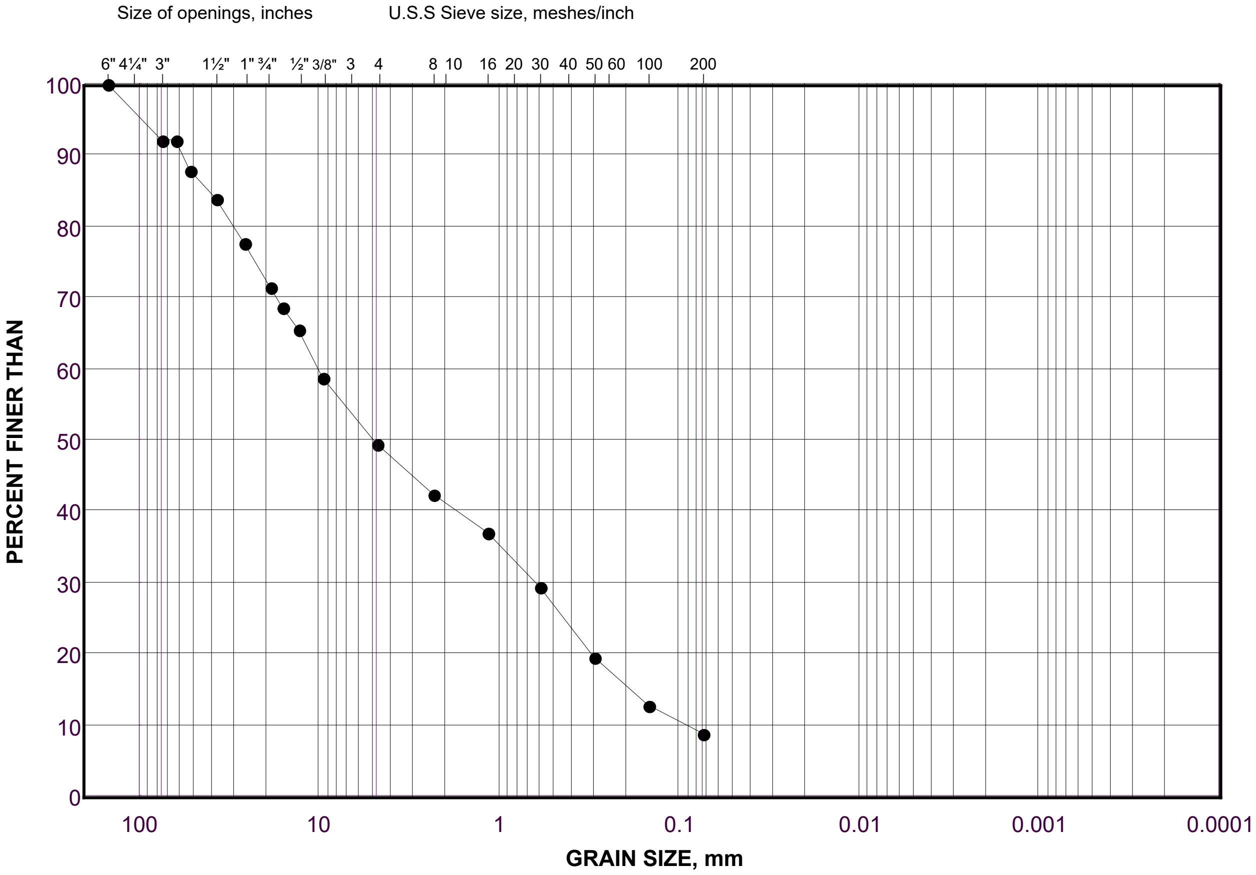
Project Number	21476582	Depth	53
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/24/22 11:29:27 AM
Sample Number	11	Tested By	Sieve - JT
Checked By	______________________________	LabID	22-220

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	11	48.0 - 53.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 20385.8(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1644.90	8.07	75.00	91.9
63mm	1644.90	0.00	63.00	91.9
53mm	2221.70	2.83	53.00	89.1
37.5mm	3042.50	4.03	37.50	85.1
26.5mm	4729.70	8.28	26.50	76.8
19.0mm	5808.30	5.29	19.00	71.5
16mm	6338.40	2.60	16.00	68.9
13.2mm	6938.20	2.94	13.20	66.0
9.5mm	8016.30	5.29	9.50	60.7
4.75mm	9667.20	8.10	4.75	52.6
PAN	10651.80	52.57	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	30.90	6.06	2.36	46.5
1.18mm	66.80	7.04	1.18	39.5
600µm	102.00	6.90	0.60	32.6
300µm	133.40	6.16	0.30	26.4
150µm	162.30	5.67	0.15	20.7
75µm	190.40	5.51	0.08	15.2

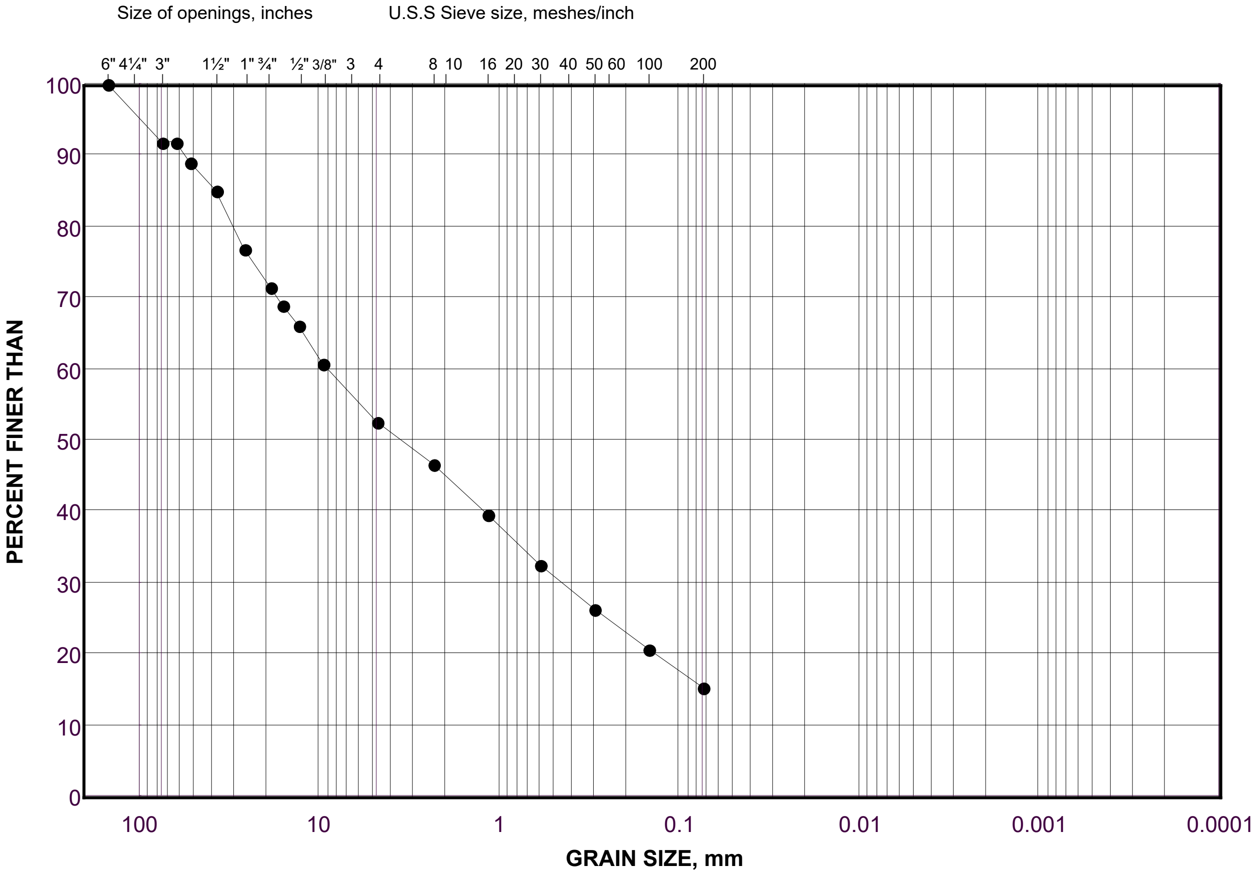
Project Number	21476582	Depth	58
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/24/22 11:37:55 AM
Sample Number	13	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-610

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	13	58.0 - 63.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18660.3(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	861.90	4.62	75.00	95.4
63mm	2087.00	6.57	63.00	88.8
53mm	2645.30	2.99	53.00	85.8
37.5mm	5031.20	12.79	37.50	73.0
26.5mm	5031.20	0.00	26.50	73.0
19.0mm	7444.60	12.93	19.00	60.1
16mm	8298.60	4.58	16.00	55.5
13.2mm	8831.40	2.86	13.20	52.7
9.5mm	9983.70	6.18	9.50	46.5
4.75mm	11647.50	8.92	4.75	37.6
PAN	7003.20	37.56	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	42.30	5.46	2.36	32.1
1.18mm	89.30	6.07	1.18	26.0
600µm	140.00	6.55	0.60	19.5
300µm	178.40	4.96	0.30	14.5
150µm	208.00	3.82	0.15	10.7
75µm	231.40	3.02	0.08	7.7

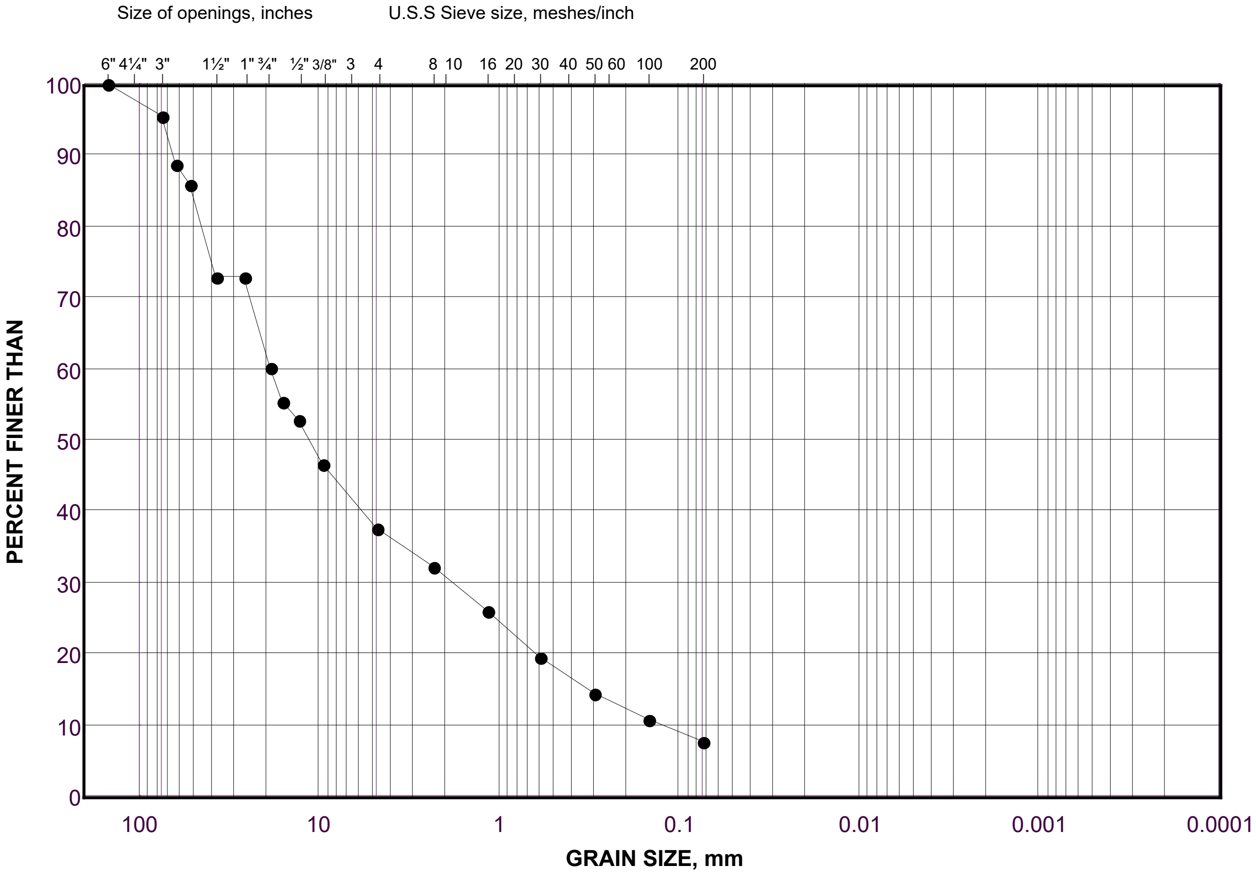
Project Number	21476582	Depth	69
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/24/22 11:44:58 AM
Sample Number	14A	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-611

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	14A	63.0 - 68.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 7932.6(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	358.10	4.51	37.50	95.5
26.5mm	770.50	5.20	26.50	90.3
19.0mm	1102.40	4.18	19.00	86.1
16mm	1235.10	1.67	16.00	84.4
13.2mm	1390.40	1.96	13.20	82.5
9.5mm	1644.20	3.20	9.50	79.3
4.75mm	2044.60	5.05	4.75	74.2
PAN	5874.70	74.23	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	13.30	3.62	2.36	70.6
1.18mm	27.70	3.92	1.18	66.7
600µm	43.90	4.41	0.60	62.3
300µm	62.50	5.06	0.30	57.2
150µm	88.30	7.02	0.15	50.2
75µm	121.80	9.12	0.08	41.1

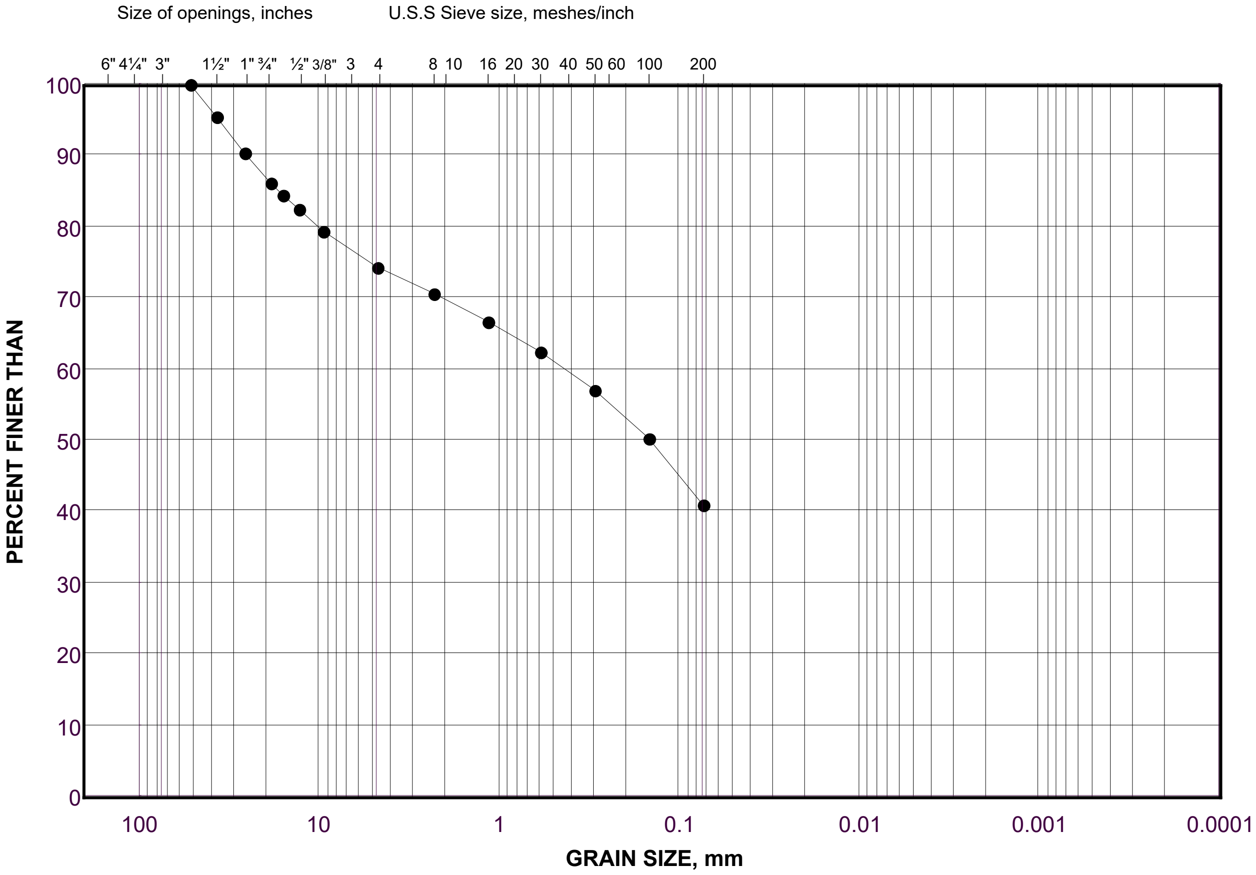
Project Number	21476582	Depth	68
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/24/22 11:57:55 AM
Sample Number	14B	Tested By	Sieve - LB
Checked By	______________________	LabID	22-613

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	14B	66.0 - 68.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 10139.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	237.20	2.34	53.00	97.7
37.5mm	361.10	1.22	37.50	96.4
26.5mm	545.30	1.82	26.50	94.6
19.0mm	868.30	3.19	19.00	91.4
16mm	1351.50	4.77	16.00	86.7
13.2mm	1726.60	3.70	13.20	83.0
9.5mm	2344.50	6.09	9.50	76.9
4.75mm	3484.90	11.25	4.75	65.6
PAN	6655.00	65.62	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	31.70	7.41	2.36	58.2
1.18mm	64.80	7.74	1.18	50.5
600µm	97.70	7.69	0.60	42.8
300µm	135.30	8.79	0.30	34.0
150µm	173.10	8.84	0.15	25.2
75µm	204.80	7.41	0.08	17.7

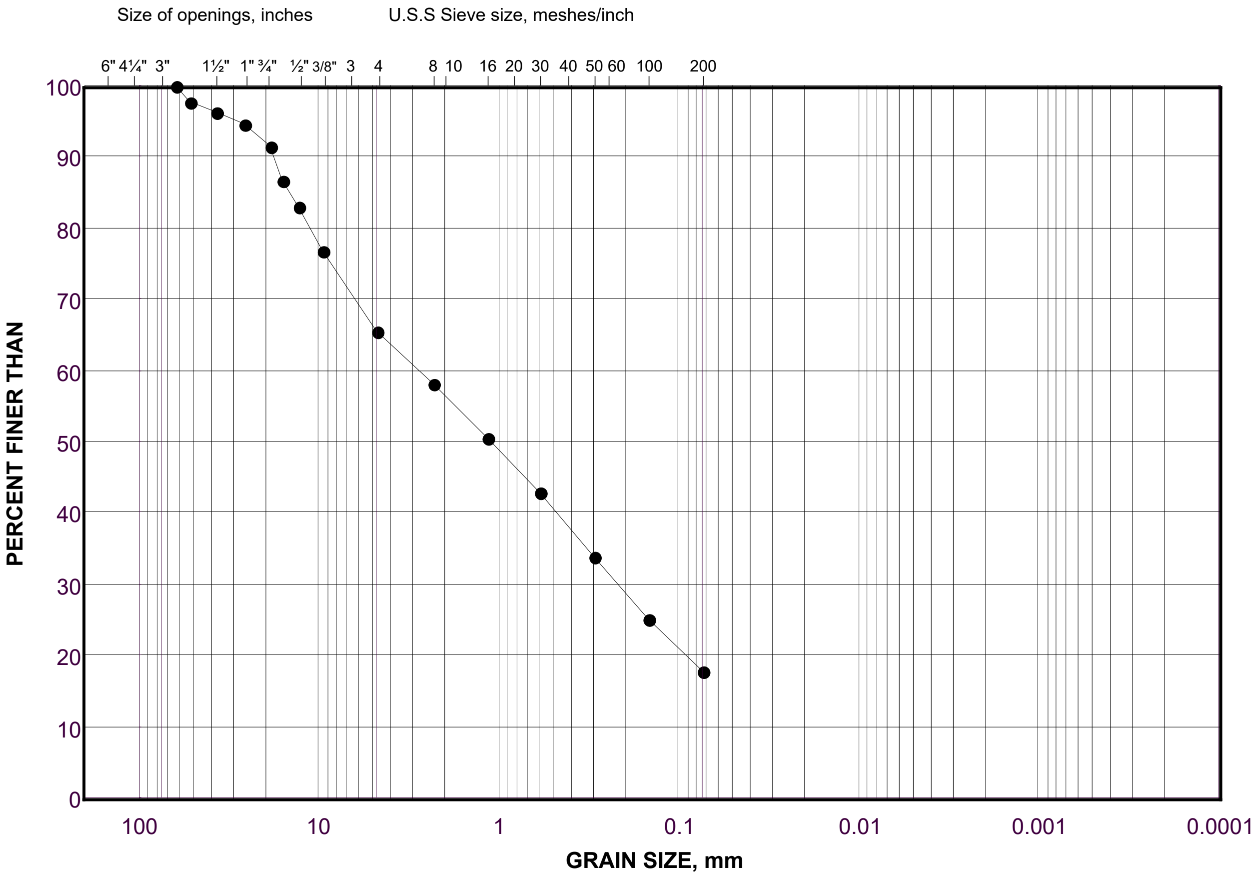
Project Number	21476582	Depth	76
Project Task	1000	Units	Imperial
Borehole Number	BH 21-01	Testing Date	3/24/22 12:05:37 PM
Sample Number	16A	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-557

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-01	16A	73.0 - 76.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 12803.6(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	324.50	2.53	37.50	97.5
26.5mm	635.10	2.43	26.50	95.0
19.0mm	1025.80	3.05	19.00	92.0
16mm	1248.50	1.74	16.00	90.3
13.2mm	1379.40	1.02	13.20	89.2
9.5mm	1797.90	3.27	9.50	86.0
4.75mm	2539.20	5.79	4.75	80.2
PAN	10238.40	80.17	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	16.90	4.92	2.36	75.3
1.18mm	36.00	5.56	1.18	69.7
600µm	55.50	5.67	0.60	64.0
300µm	76.50	6.11	0.30	57.9
150µm	101.80	7.36	0.15	50.6
75µm	136.20	10.01	0.08	40.5

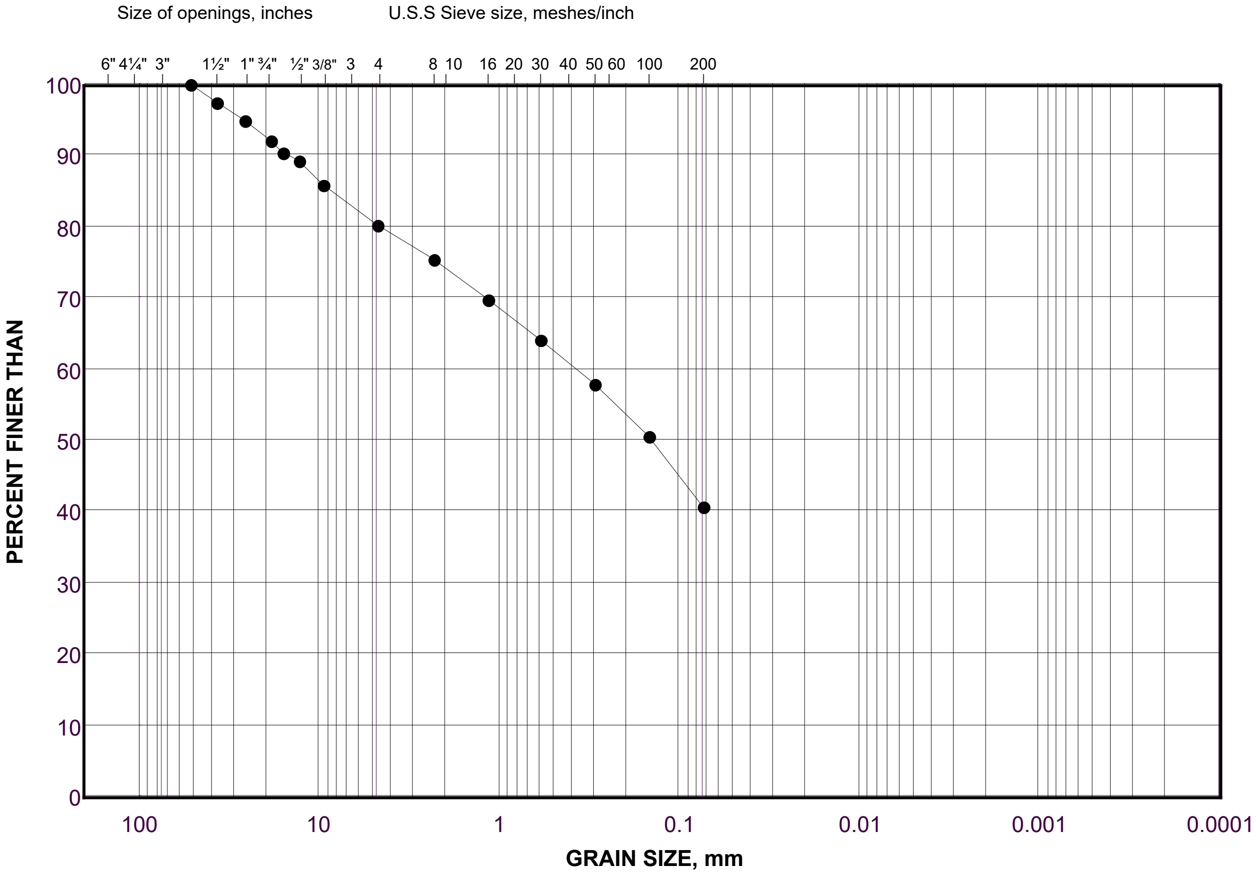
Project Number	21476582	Depth	8
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/25/22 2:27:58 PM
Sample Number	2	Tested By	Sieve -
Checked By	______________________________	LabID	22-223

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	2	3.0 - 8.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14971(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	952.60	6.36	75.00	93.6
63mm	1523.20	3.81	63.00	89.8
53mm	1523.20	0.00	53.00	89.8
37.5mm	2561.40	6.93	37.50	82.9
26.5mm	3501.50	6.28	26.50	76.6
19.0mm	4147.00	4.31	19.00	72.3
16mm	4301.60	1.03	16.00	71.3
13.2mm	4656.10	2.37	13.20	68.9
9.5mm	5248.00	3.95	9.50	65.0
4.75mm	6332.30	7.24	4.75	57.7
PAN	8617.00	57.72	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	26.40	5.56	2.36	52.2
1.18mm	52.50	5.50	1.18	46.7
600µm	78.60	5.50	0.60	41.2
300µm	106.00	5.77	0.30	35.4
150µm	133.00	5.69	0.15	29.7
75µm	159.30	5.54	0.08	24.2

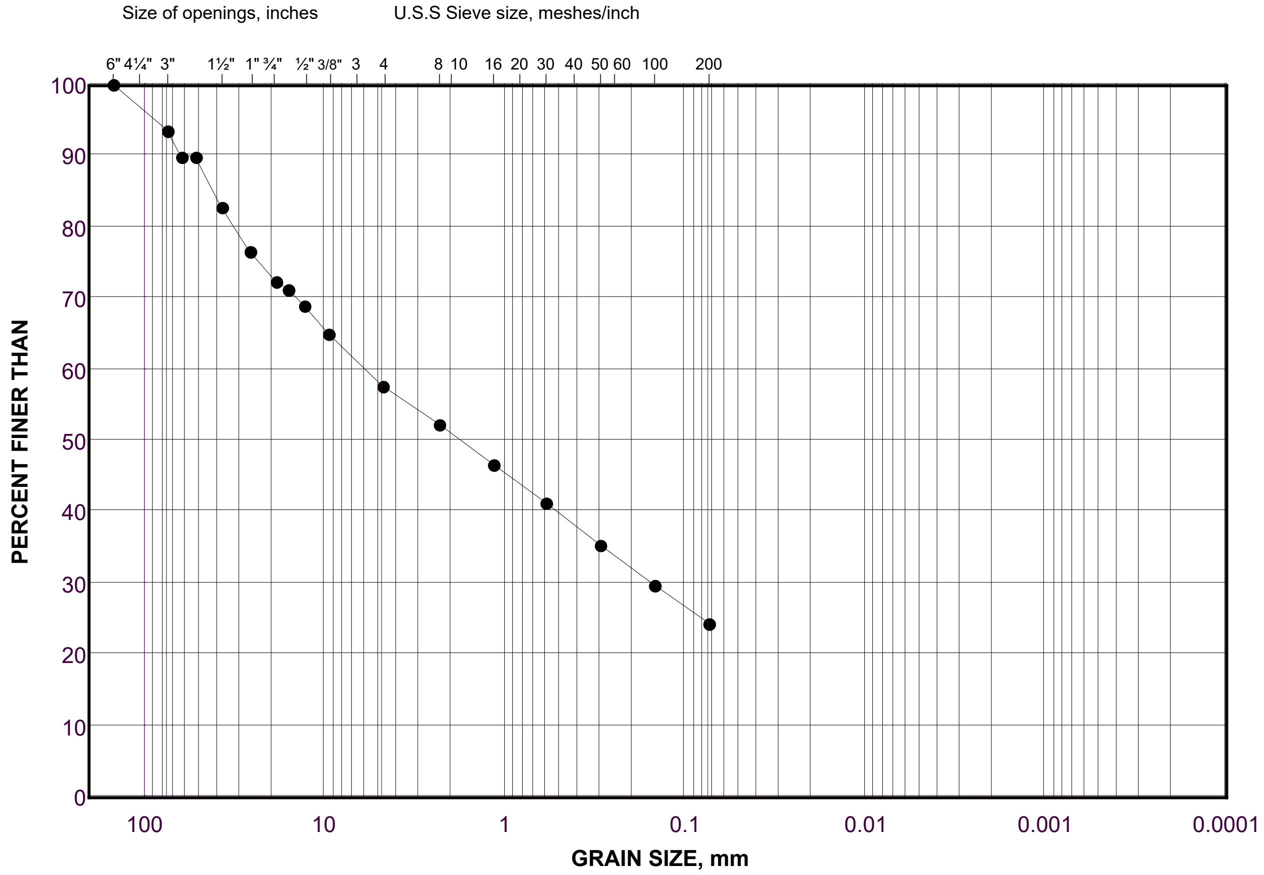
Project Number	21476582	Depth	13
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/25/22 2:36:49 PM
Sample Number	3	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-616

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	3	8.0 - 13.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16264.4(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	1077.40	6.62	63.00	93.4
53mm	1424.40	2.13	53.00	91.3
37.5mm	2062.10	3.92	37.50	87.3
26.5mm	2496.10	2.67	26.50	84.7
19.0mm	2933.80	2.69	19.00	82.0
16mm	3274.20	2.09	16.00	79.9
13.2mm	3553.90	1.72	13.20	78.2
9.5mm	4226.20	4.13	9.50	74.0
4.75mm	5287.20	6.52	4.75	67.5
PAN	10944.60	67.51	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	22.40	5.62	2.36	61.9
1.18mm	48.00	6.42	1.18	55.5
600µm	74.60	6.67	0.60	48.8
300µm	103.30	7.19	0.30	41.6
150µm	132.10	7.22	0.15	34.4
75µm	159.20	6.79	0.08	27.6

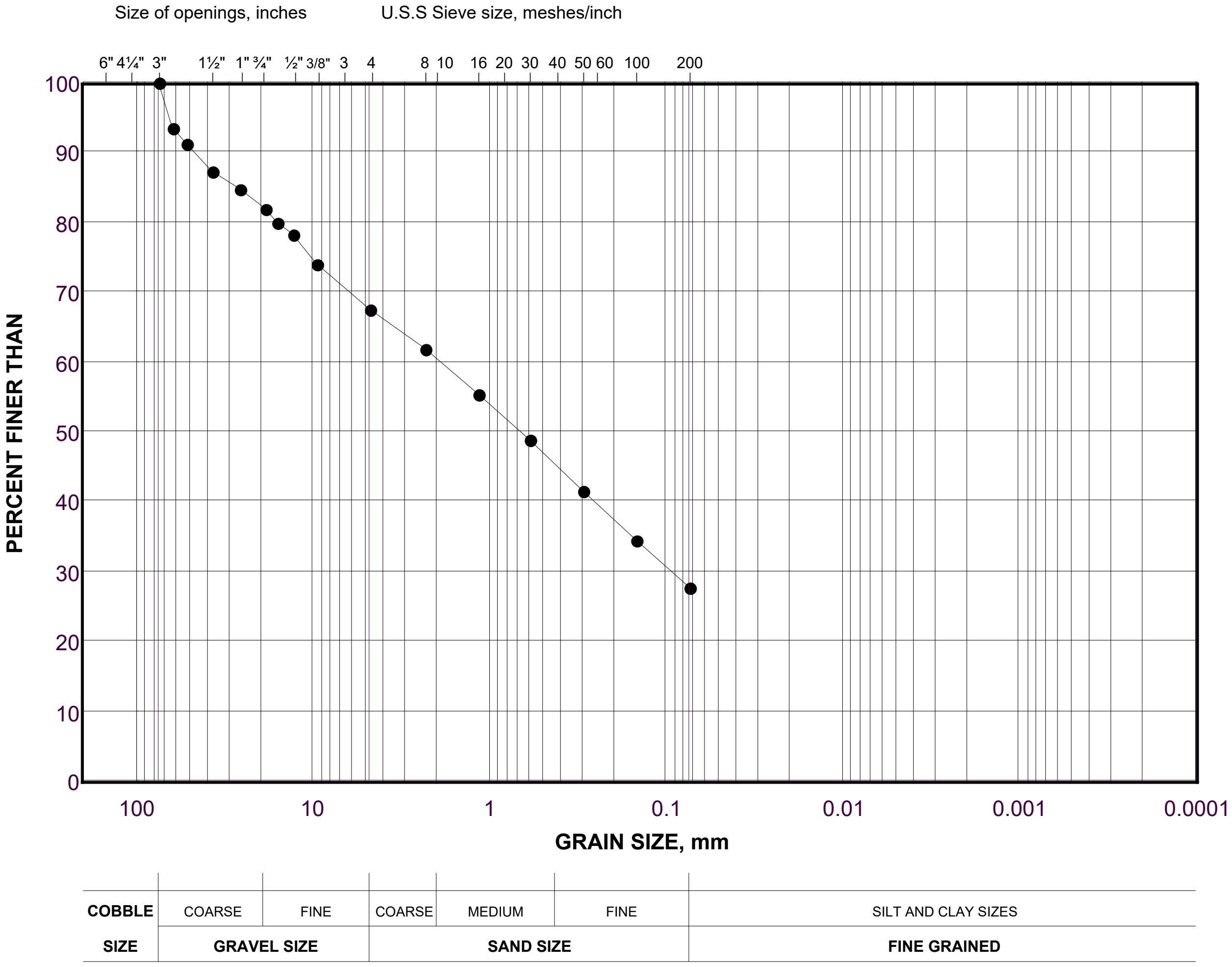
Project Number	21476582	Depth	18
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/07/22 3:19:50 PM
Sample Number	4	Tested By	Sieve - LB
Checked By	____________________________	LabID	22-421

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	4	13.0 - 18.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18514.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	270.10	1.46	53.00	98.5
37.5mm	1766.30	8.08	37.50	90.5
26.5mm	2709.00	5.09	26.50	85.4
19.0mm	3611.80	4.88	19.00	80.5
16mm	3991.30	2.05	16.00	78.4
13.2mm	4244.70	1.37	13.20	77.1
9.5mm	5028.30	4.23	9.50	72.8
4.75mm	6165.00	6.14	4.75	66.7
PAN	12349.90	66.70	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	22.70	5.79	2.36	60.9
1.18mm	47.40	6.30	1.18	54.6
600µm	73.10	6.55	0.60	48.1
300µm	101.10	7.14	0.30	40.9
150µm	128.40	6.96	0.15	34.0
75µm	155.10	6.81	0.08	27.2

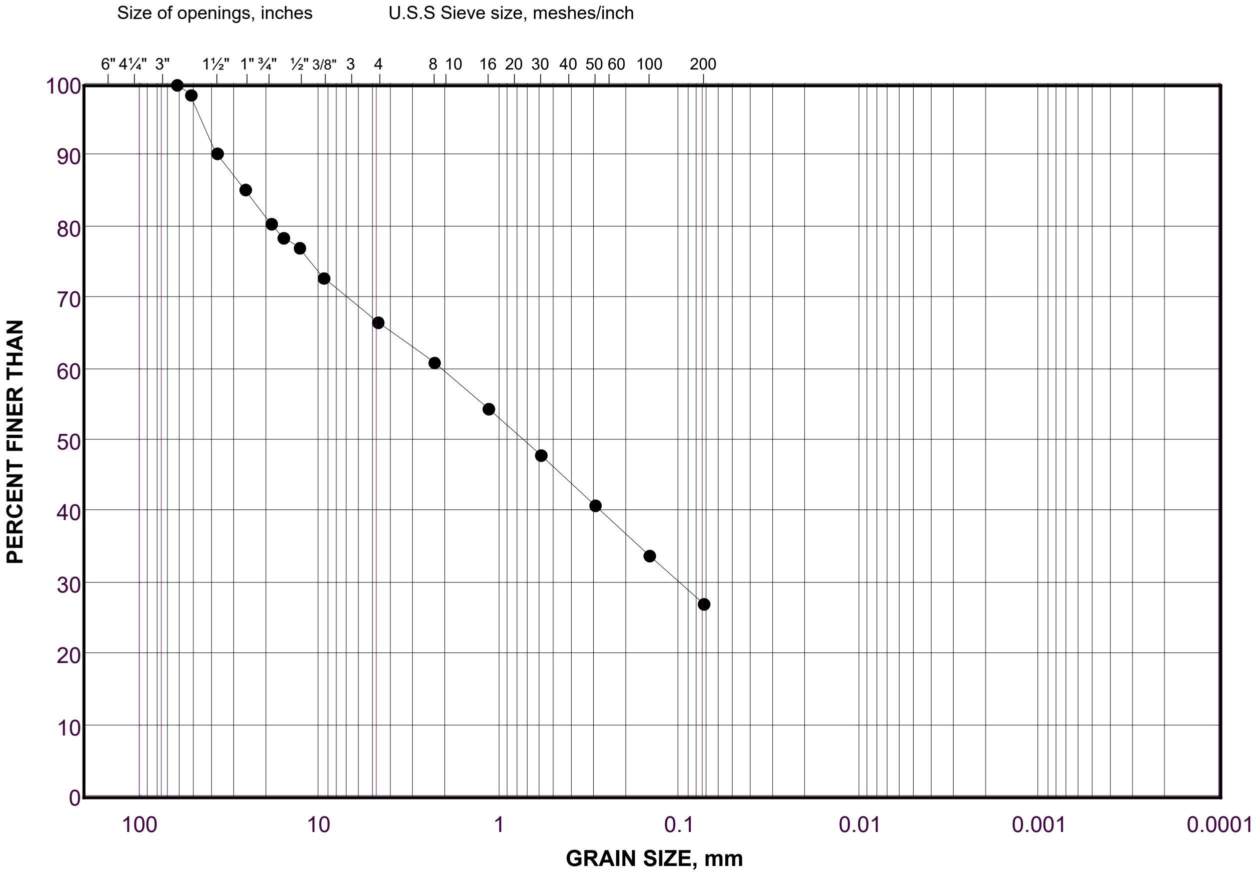
Project Number	21476582	Depth	23
Project Task	1000	Units	Metric
Borehole Number	BH 21-02	Testing Date	3/25/22 2:23:35 PM
Sample Number	5	Tested By	Sieve -
Checked By	______________________________	LabID	22-558

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 21-02	5	18.0 - 23.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18148(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	240.00	1.32	53.00	98.7
37.5mm	1548.00	7.21	37.50	91.5
26.5mm	2414.00	4.77	26.50	86.7
19.0mm	3140.00	4.00	19.00	82.7
16mm	3444.00	1.68	16.00	81.0
13.2mm	3776.00	1.83	13.20	79.2
9.5mm	4504.00	4.01	9.50	75.2
4.75mm	5624.00	6.17	4.75	69.0
PAN	12524.00	69.01	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	26.92	5.34	2.36	63.7
1.18mm	56.26	5.81	1.18	57.9
600µm	88.67	6.42	0.60	51.4
300µm	125.25	7.25	0.30	44.2
150µm	163.39	7.56	0.15	36.6
75µm	200.91	7.44	0.08	29.2

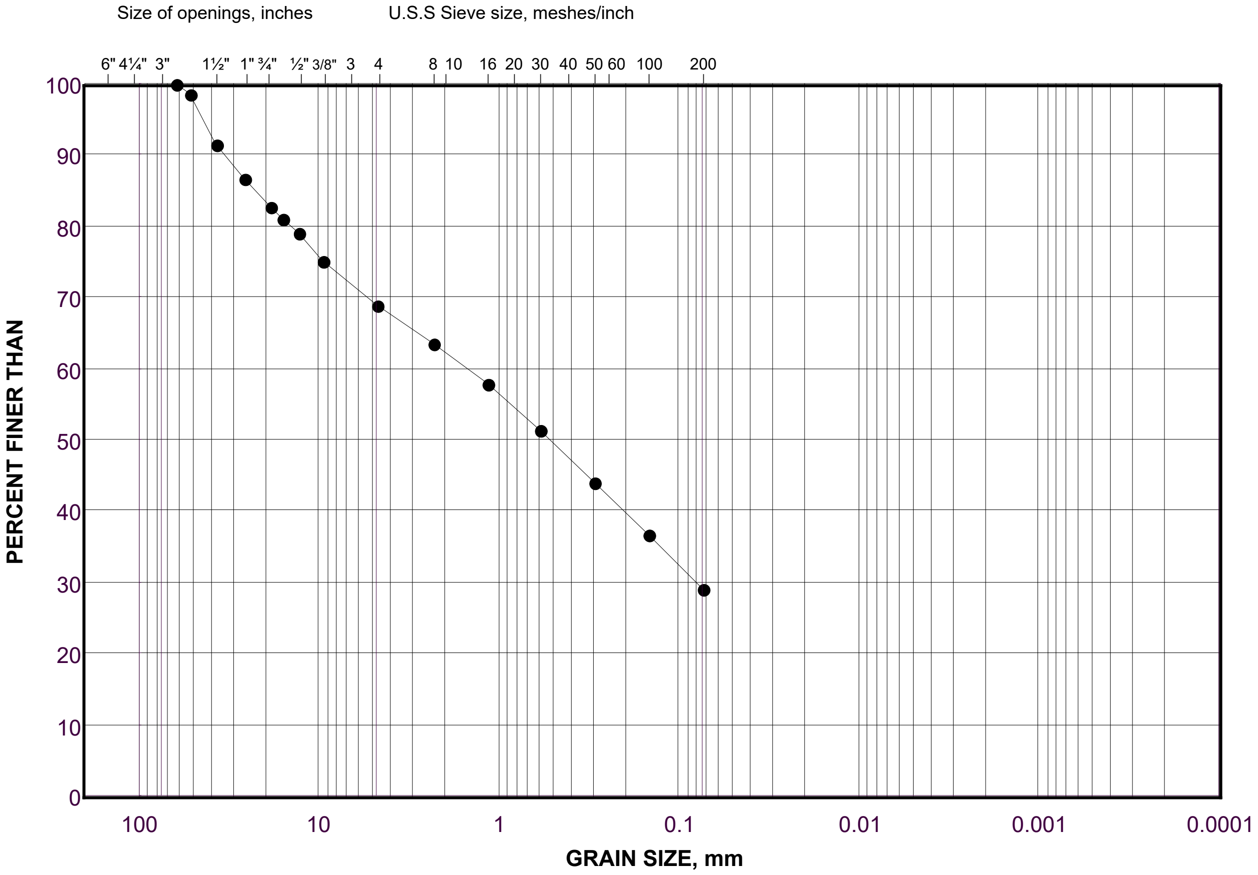
Project Number	21476582	Depth	38
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/25/22 2:39:12 PM
Sample Number	8	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-600

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	8	33.0 - 38.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14184.7(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	456.00	3.21	53.00	96.8
37.5mm	530.00	0.52	37.50	96.3
26.5mm	606.10	0.54	26.50	95.7
19.0mm	662.00	0.39	19.00	95.3
16mm	802.20	0.99	16.00	94.4
13.2mm	896.10	0.66	13.20	93.7
9.5mm	1124.10	1.61	9.50	92.1
4.75mm	1757.90	4.47	4.75	87.6
PAN	12415.10	87.61	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	14.00	4.59	2.36	83.0
1.18mm	33.40	6.36	1.18	76.7
600µm	64.10	10.06	0.60	66.6
300µm	100.70	11.99	0.30	54.6
150µm	128.20	9.01	0.15	45.6
75µm	153.60	8.32	0.08	37.3

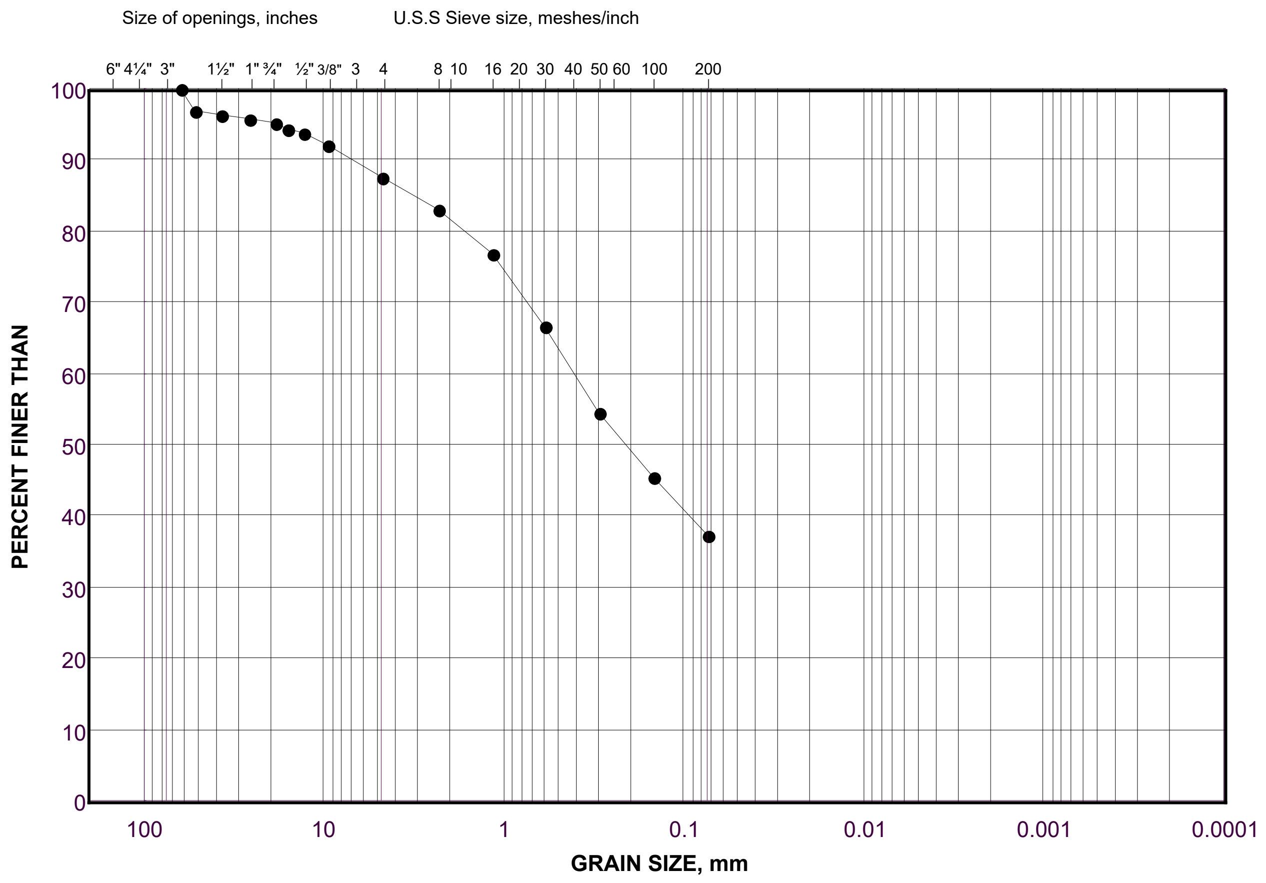
Project Number	21476582	Depth	43
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/25/22 2:42:03 PM
Sample Number	9	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-617

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	9	38.0 - 43.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18176.8(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	646.10	3.55	63.00	96.5
53mm	1374.40	4.01	53.00	92.4
37.5mm	2964.70	8.75	37.50	83.7
26.5mm	3880.50	5.04	26.50	78.7
19.0mm	4659.80	4.29	19.00	74.4
16mm	4981.60	1.77	16.00	72.6
13.2mm	5400.30	2.30	13.20	70.3
9.5mm	6078.00	3.73	9.50	66.6
4.75mm	7232.80	6.35	4.75	60.2
PAN	10917.00	60.21	0.00	0.0

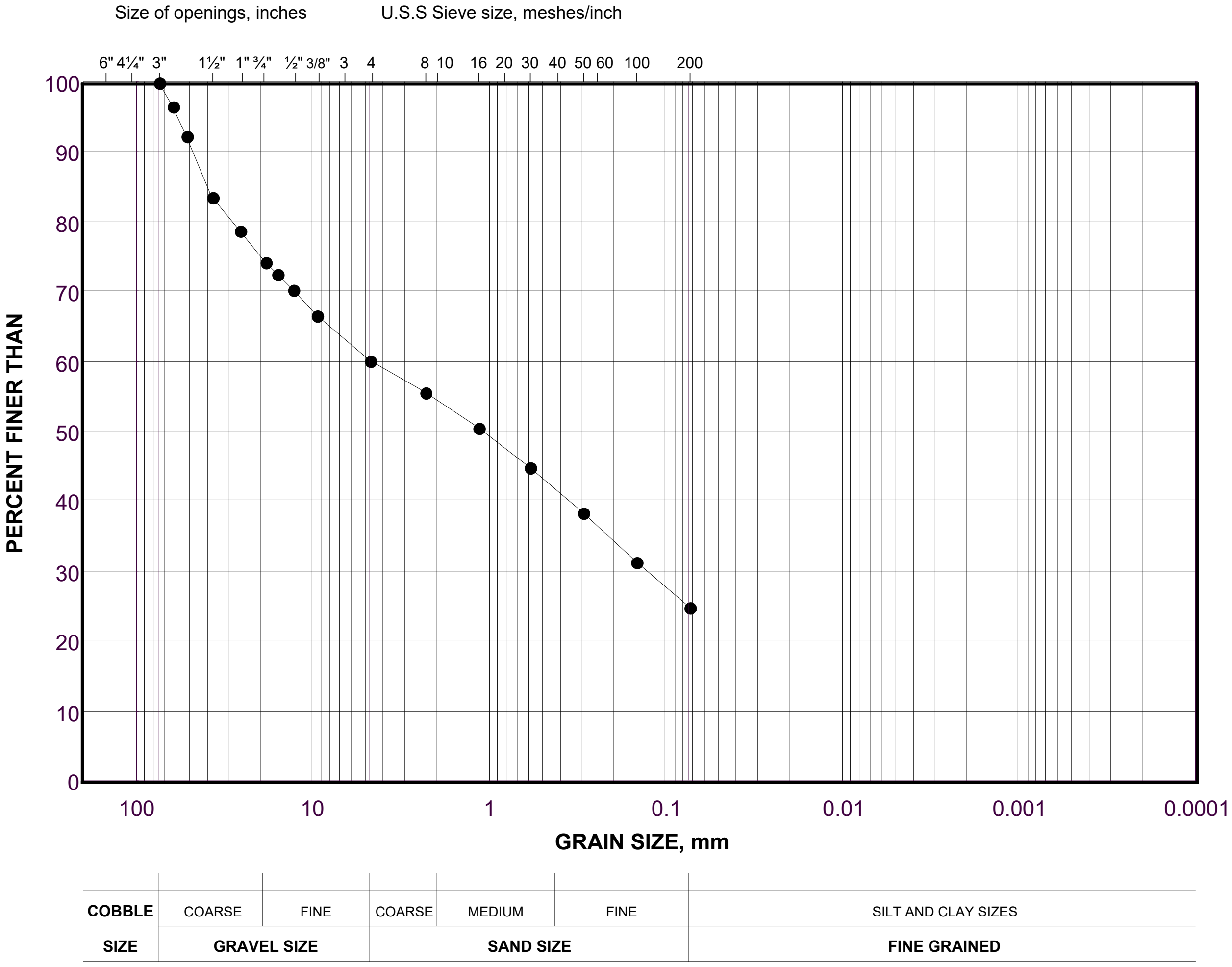
HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	22.10	4.47	2.36	55.7
1.18mm	48.20	5.28	1.18	50.5
600µm	75.70	5.57	0.60	44.9
300µm	107.90	6.52	0.30	38.4
150µm	142.50	7.00	0.15	31.4
75µm	174.20	6.42	0.08	25.0

Project Number	21476582	Depth	48
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/25/22 3:10:51 PM
Sample Number	10	Tested By	Sieve - TP
Checked By	______________________	LabID	22-618

Golder Associates

GRAIN SIZE DISTRIBUTION MTO LS-602	FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	10	43.0 - 48.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15598(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	1312.00	8.41	63.00	91.6
53mm	1312.00	0.00	53.00	91.6
37.5mm	2072.00	4.87	37.50	86.7
26.5mm	2586.00	3.30	26.50	83.4
19.0mm	3472.00	5.68	19.00	77.7
16mm	3756.00	1.82	16.00	75.9
13.2mm	4018.00	1.68	13.20	74.2
9.5mm	4642.00	4.00	9.50	70.2
4.75mm	5756.00	7.14	4.75	63.1
PAN	9842.00	63.10	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	33.65	6.12	2.36	57.0
1.18mm	65.78	5.85	1.18	51.1
600µm	98.70	5.99	0.60	45.1
300µm	132.99	6.24	0.30	38.9
150µm	168.40	6.44	0.15	32.5
75µm	200.51	5.84	0.08	26.6

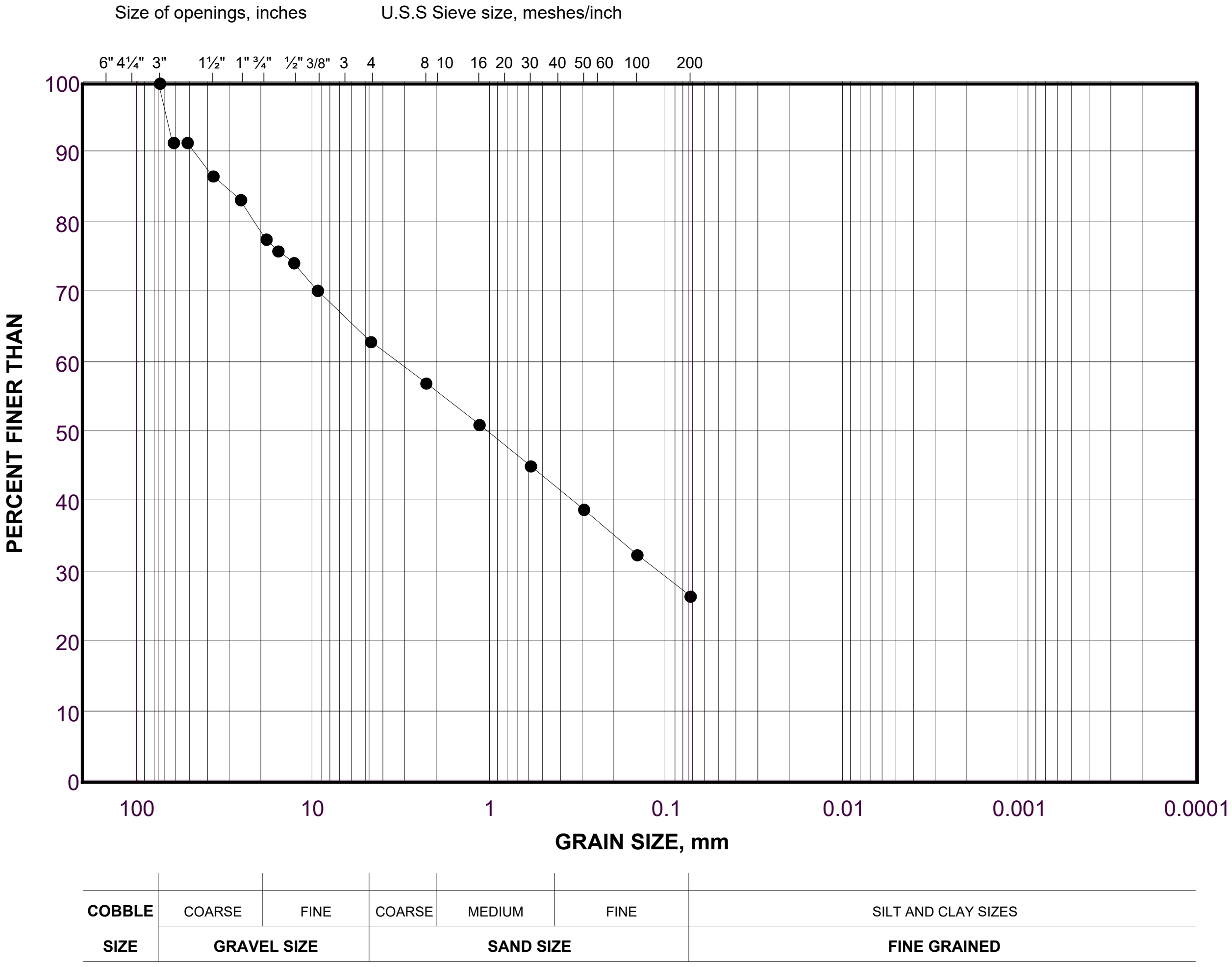
Project Number	21476582	Depth	53
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/25/22 3:13:20 PM
Sample Number	11	Tested By	Sieve -
Checked By	______________________________	LabID	22-601

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	11	48.0 - 53.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17591.3(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	838.20	4.76	53.00	95.2
37.5mm	1303.10	2.64	37.50	92.6
26.5mm	2261.40	5.45	26.50	87.2
19.0mm	2995.20	4.17	19.00	83.0
16mm	3446.80	2.57	16.00	80.4
13.2mm	3780.20	1.90	13.20	78.5
9.5mm	4662.40	5.01	9.50	73.5
4.75mm	6296.10	9.29	4.75	64.2
PAN	11248.70	64.21	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	33.80	8.42	2.36	55.8
1.18mm	68.70	8.69	1.18	47.1
600µm	97.70	7.22	0.60	39.9
300µm	121.50	5.93	0.30	34.0
150µm	140.70	4.78	0.15	29.2
75µm	161.90	5.28	0.08	23.9

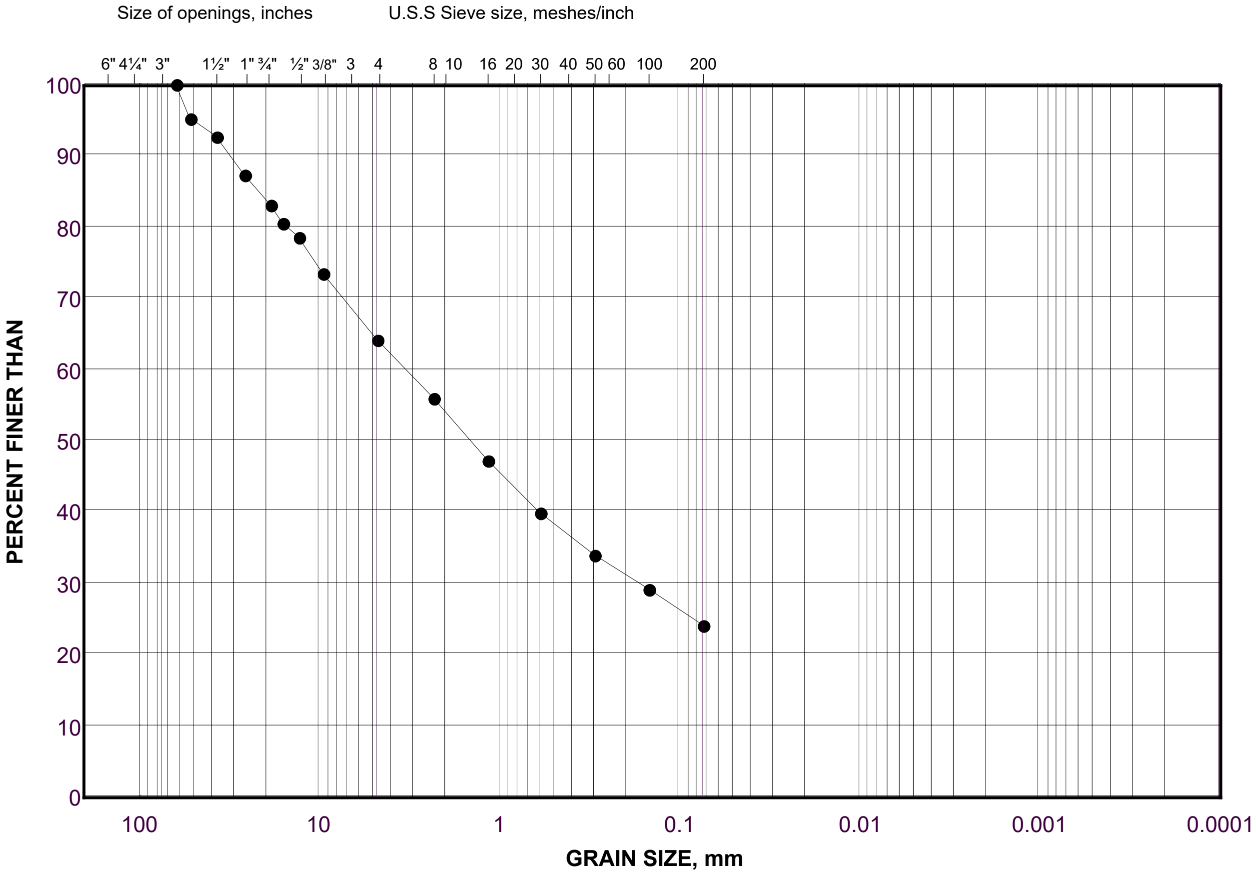
Project Number	21476582	Depth	58
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/29/22 9:42:00 AM
Sample Number	12	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-649

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	12	53.0 - 58.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15836(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1362.00	8.60	75.00	91.4
63mm	1362.00	0.00	63.00	91.4
53mm	1714.00	2.22	53.00	89.2
37.5mm	2678.00	6.09	37.50	83.1
26.5mm	3526.00	5.35	26.50	77.7
19.0mm	4212.00	4.33	19.00	73.4
16mm	4578.00	2.31	16.00	71.1
13.2mm	5112.00	3.37	13.20	67.7
9.5mm	6084.00	6.14	9.50	61.6
4.75mm	7724.00	10.36	4.75	51.2
PAN	8112.00	51.23	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	48.79	7.24	2.36	44.0
1.18mm	103.24	8.08	1.18	35.9
600µm	151.20	7.12	0.60	28.8
300µm	183.67	4.82	0.30	24.0
150µm	208.59	3.70	0.15	20.3
75µm	237.99	4.36	0.08	15.9

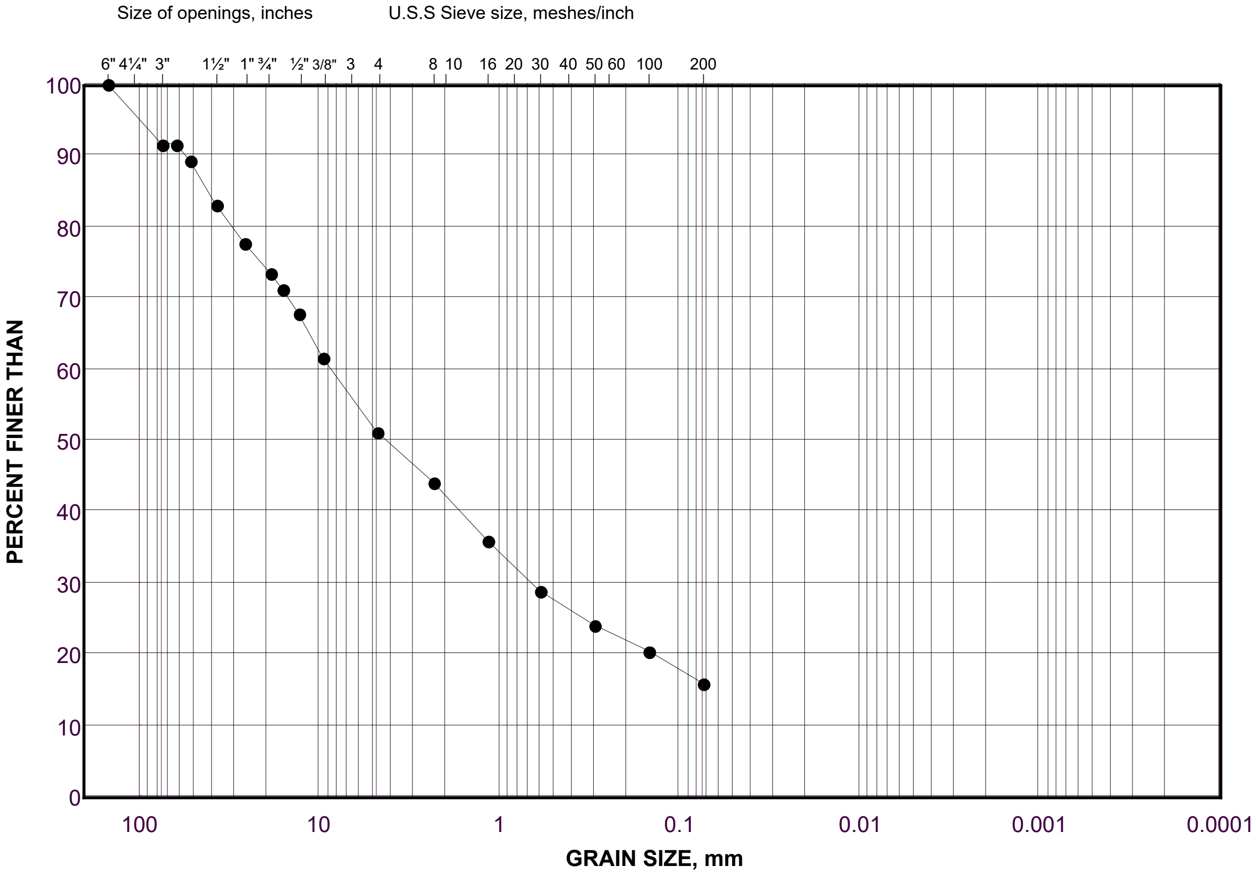
Project Number	21476582	Depth	63
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/25/22 3:18:12 PM
Sample Number	13	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-602

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	13	58.0 - 63.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17165(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	1505.60	8.77	63.00	91.2
53mm	2384.90	5.12	53.00	86.1
37.5mm	3733.80	7.86	37.50	78.3
26.5mm	5458.30	10.05	26.50	68.2
19.0mm	6432.10	5.67	19.00	62.5
16mm	6940.40	2.96	16.00	59.6
13.2mm	7445.40	2.94	13.20	56.6
9.5mm	8440.60	5.80	9.50	50.8
4.75mm	10037.60	9.30	4.75	41.5
PAN	7086.80	41.53	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	54.10	7.88	2.36	33.7
1.18mm	109.80	8.11	1.18	25.5
600µm	152.60	6.23	0.60	19.3
300µm	183.20	4.46	0.30	14.9
150µm	202.80	2.85	0.15	12.0
75µm	220.40	2.56	0.08	9.4

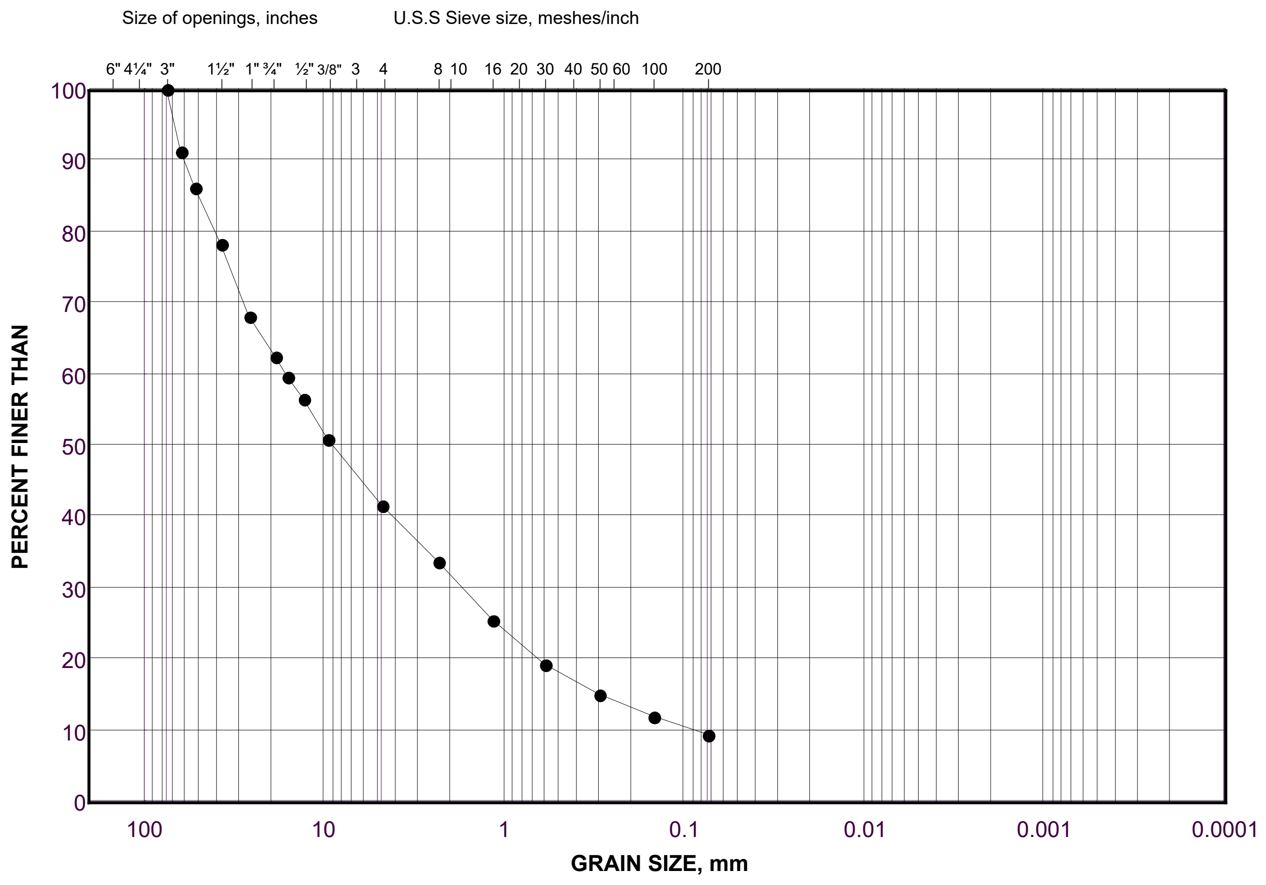
Project Number	21476582	Depth	68
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/25/22 3:23:23 PM
Sample Number	14	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-619

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	14	63.0 - 68.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18688.2(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	477.30	2.55	63.00	97.5
53mm	477.30	0.00	53.00	97.5
37.5mm	3129.60	14.19	37.50	83.3
26.5mm	4380.10	6.69	26.50	76.6
19.0mm	6008.50	8.71	19.00	67.9
16mm	7064.80	5.65	16.00	62.2
13.2mm	7370.10	1.63	13.20	60.6
9.5mm	9206.70	9.83	9.50	50.8
4.75mm	11117.30	10.22	4.75	40.5
PAN	7552.30	40.53	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	49.00	7.25	2.36	33.3
1.18mm	98.90	7.38	1.18	25.9
600µm	141.70	6.33	0.60	19.6
300µm	173.80	4.75	0.30	14.8
150µm	200.00	3.87	0.15	11.0
75µm	220.30	3.00	0.08	8.0

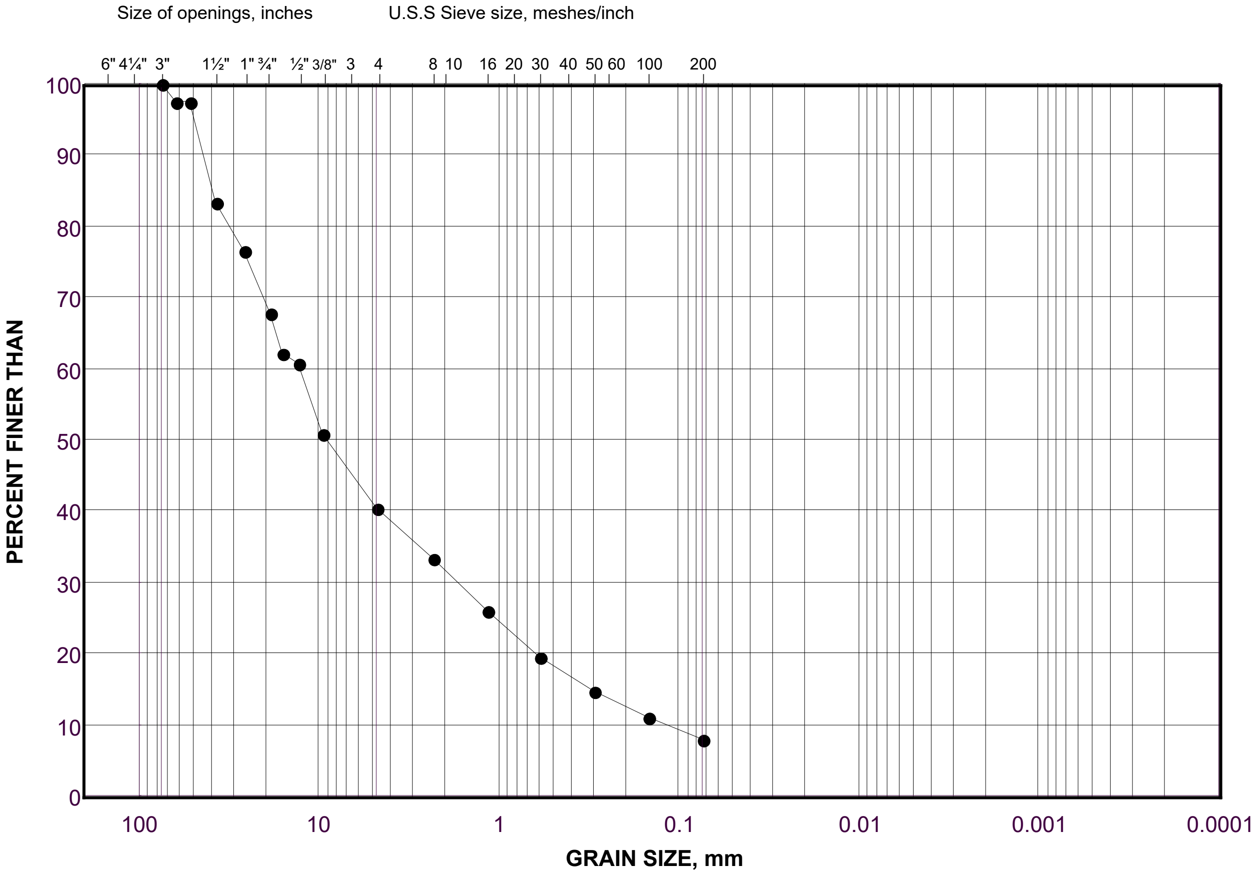
Project Number	21476582	Depth	73
Project Task	1000	Units	Imperial
Borehole Number	BH 21-02	Testing Date	3/25/22 3:28:07 PM
Sample Number	15	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-204

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-02	15	68.0 - 73.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 20182.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1991.20	9.87	75.00	90.1
63mm	1991.20	0.00	63.00	90.1
53mm	1991.20	0.00	53.00	90.1
37.5mm	3990.30	9.90	37.50	80.2
26.5mm	5535.00	7.65	26.50	72.6
19.0mm	6935.00	6.94	19.00	65.6
16mm	7729.40	3.94	16.00	61.7
13.2mm	8311.20	2.88	13.20	58.8
9.5mm	9673.20	6.75	9.50	52.1
4.75mm	11830.90	10.69	4.75	41.4
PAN	8329.80	41.38	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	59.00	8.59	2.36	32.8
1.18mm	117.70	8.55	1.18	24.2
600µm	160.90	6.29	0.60	18.0
300µm	190.60	4.33	0.30	13.6
150µm	212.20	3.15	0.15	10.5
75µm	230.20	2.62	0.08	7.9

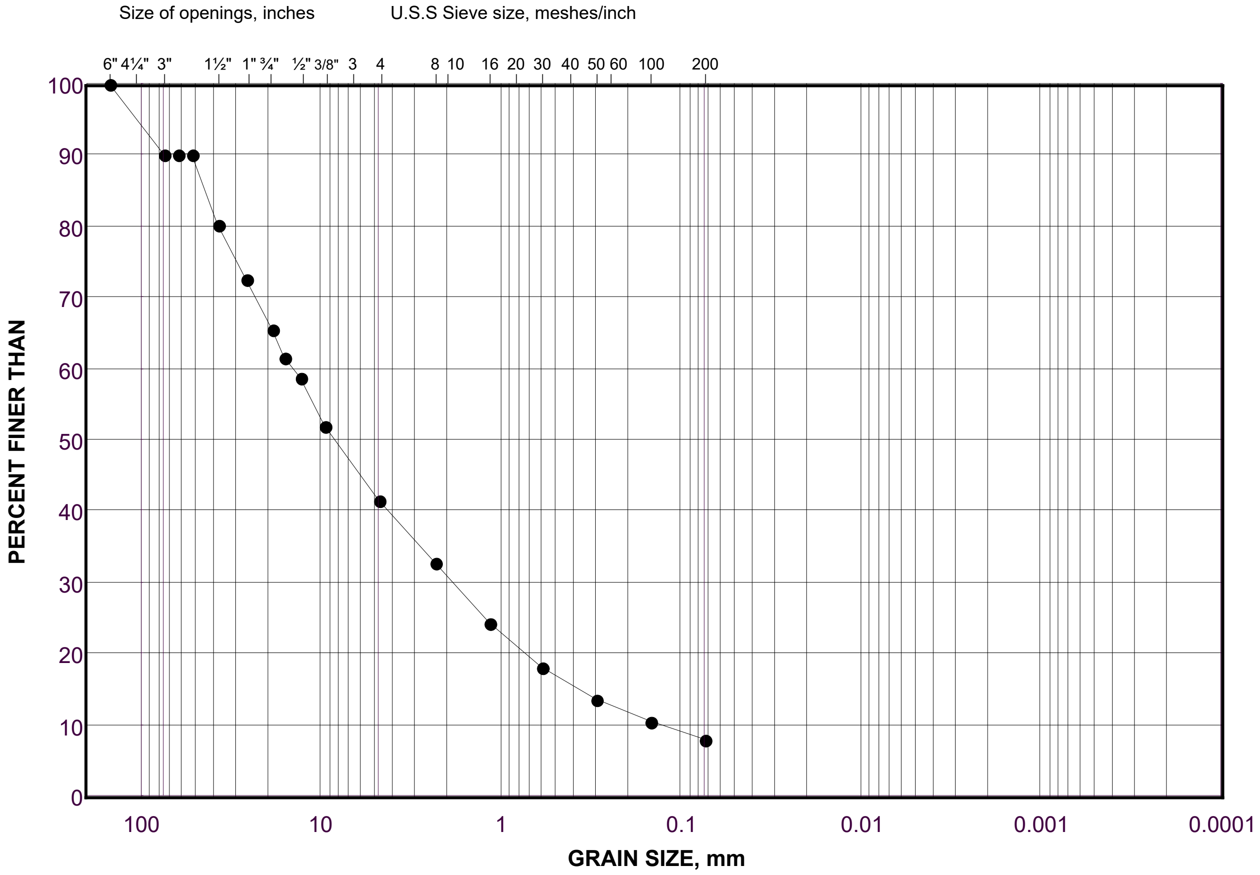
Project Number	21476582	Depth	78
Project Task	1000	Units	Metric
Borehole Number	BH 21-02	Testing Date	3/25/22 3:43:55 PM
Sample Number	16	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-199

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 21-02	16	73.0 - 78.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 8457.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	870.50	10.29	63.00	89.7
53mm	1129.10	3.06	53.00	86.7
37.5mm	2226.80	12.98	37.50	73.7
26.5mm	3008.50	9.24	26.50	64.4
19.0mm	3474.30	5.51	19.00	58.9
16mm	3672.20	2.34	16.00	56.6
13.2mm	3829.00	1.85	13.20	54.7
9.5mm	4132.60	3.59	9.50	51.1
4.75mm	4632.40	5.91	4.75	45.2
PAN	3825.50	45.23	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	26.20	4.13	2.36	41.1
1.18mm	55.40	4.60	1.18	36.5
600µm	82.20	4.23	0.60	32.3
300µm	109.50	4.30	0.30	28.0
150µm	143.20	5.31	0.15	22.7
75µm	185.00	6.59	0.08	16.1

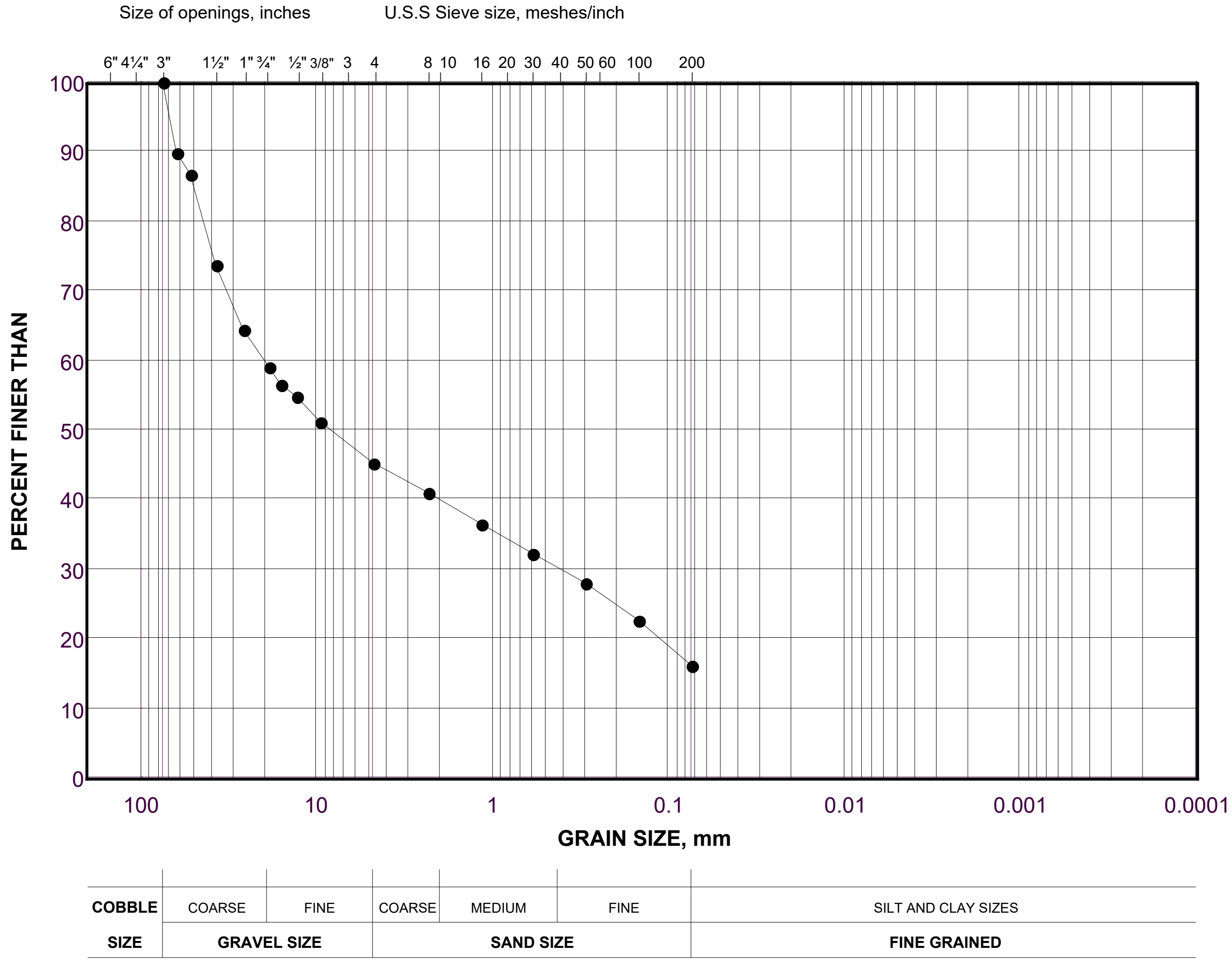
Project Number	21476582	Depth	3
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 3:48:43 PM
Sample Number	1B	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-561

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	1B	0.50 - 3.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16584.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1774.60	10.70	75.00	89.3
63mm	1774.60	0.00	63.00	89.3
53mm	2008.80	1.41	53.00	87.9
37.5mm	2753.40	4.49	37.50	83.4
26.5mm	3748.60	6.00	26.50	77.4
19.0mm	4217.80	2.83	19.00	74.6
16mm	4565.30	2.10	16.00	72.5
13.2mm	4894.20	1.98	13.20	70.5
9.5mm	5536.10	3.87	9.50	66.6
4.75mm	6651.00	6.72	4.75	59.9
PAN	9933.50	59.90	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	22.60	5.19	2.36	54.7
1.18mm	49.10	6.09	1.18	48.6
600µm	72.80	5.44	0.60	43.2
300µm	96.80	5.51	0.30	37.7
150µm	122.90	5.99	0.15	31.7
75µm	151.60	6.59	0.08	25.1

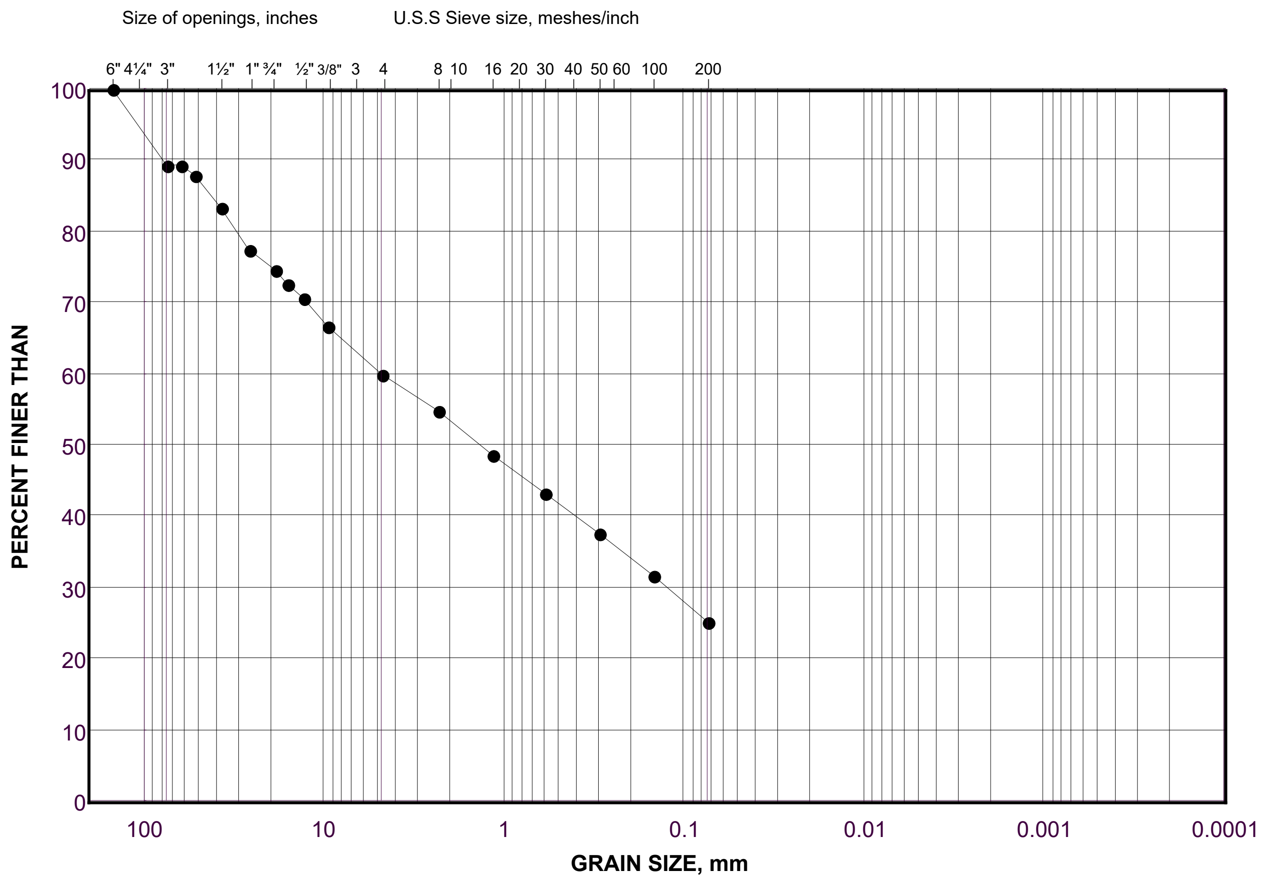
Project Number	21476582	Depth	8
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 3:50:41 PM
Sample Number	2	Tested By	Sieve - TP
Checked By	______________________	LabID	22-216

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	2	3.0 - 8.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15025(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1082.00	7.20	75.00	92.8
63mm	1922.00	5.59	63.00	87.2
53mm	2174.00	1.68	53.00	85.5
37.5mm	2556.00	2.54	37.50	83.0
26.5mm	3330.00	5.15	26.50	77.8
19.0mm	3466.00	0.91	19.00	76.9
16mm	4214.00	4.98	16.00	72.0
13.2mm	4470.00	1.70	13.20	70.3
9.5mm	5168.00	4.65	9.50	65.6
4.75mm	6340.00	7.80	4.75	57.8
PAN	8685.00	57.80	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	48.13	8.03	2.36	49.8
1.18mm	89.63	6.93	1.18	42.8
600µm	127.33	6.29	0.60	36.6
300µm	163.51	6.04	0.30	30.5
150µm	199.88	6.07	0.15	24.4
75µm	232.90	5.51	0.08	18.9

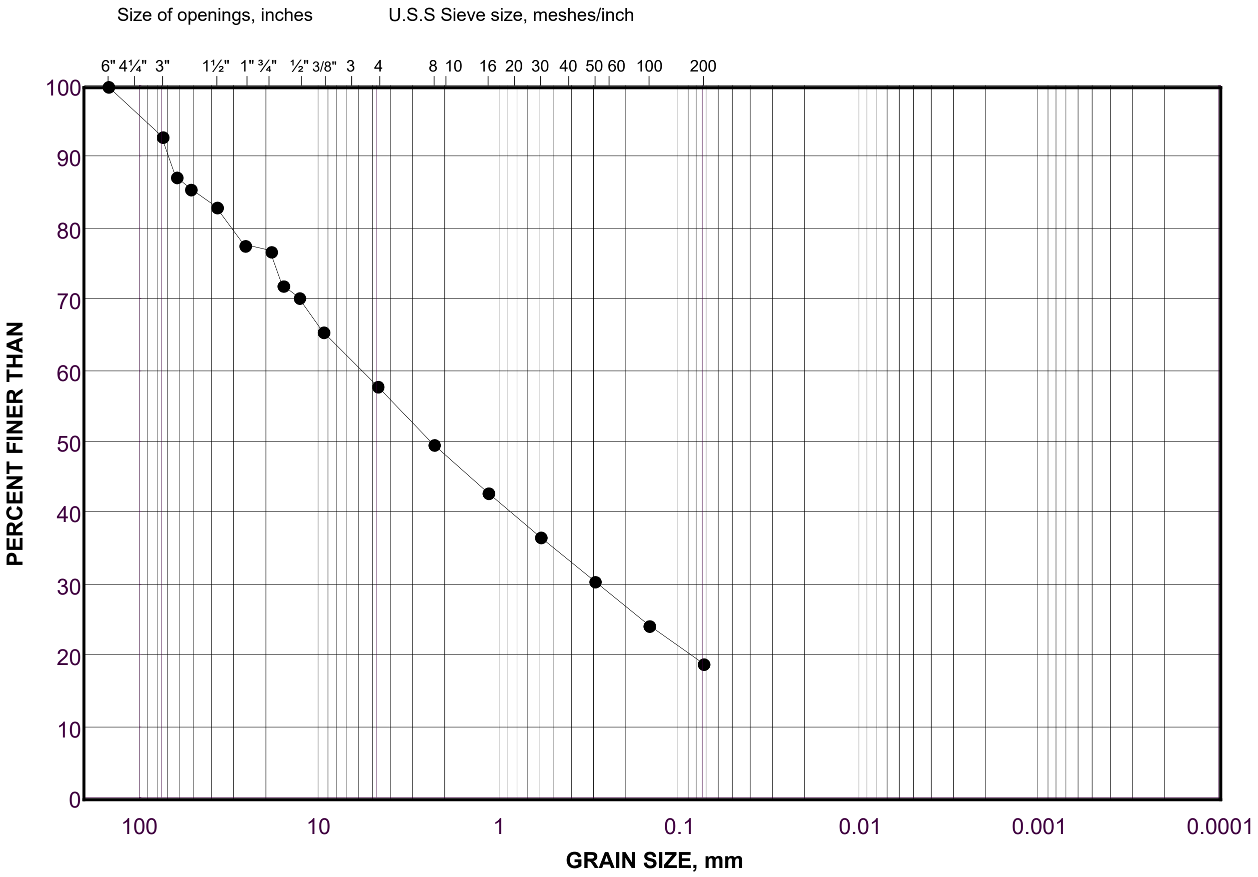
Project Number	21476582	Depth	13
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 3:54:53 PM
Sample Number	3	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-603

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	3	8.0 - 13.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15792.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	1074.20	6.80	53.00	93.2
37.5mm	1167.80	0.59	37.50	92.6
26.5mm	2194.50	6.50	26.50	86.1
19.0mm	3005.60	5.14	19.00	81.0
16mm	3415.80	2.60	16.00	78.4
13.2mm	3766.50	2.22	13.20	76.2
9.5mm	4661.80	5.67	9.50	70.5
4.75mm	6134.80	9.33	4.75	61.2
PAN	9633.40	61.15	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	35.40	8.22	2.36	52.9
1.18mm	76.60	9.57	1.18	43.4
600µm	118.00	9.62	0.60	33.7
300µm	155.90	8.81	0.30	24.9
150µm	186.00	6.99	0.15	17.9
75µm	205.30	4.48	0.08	13.5

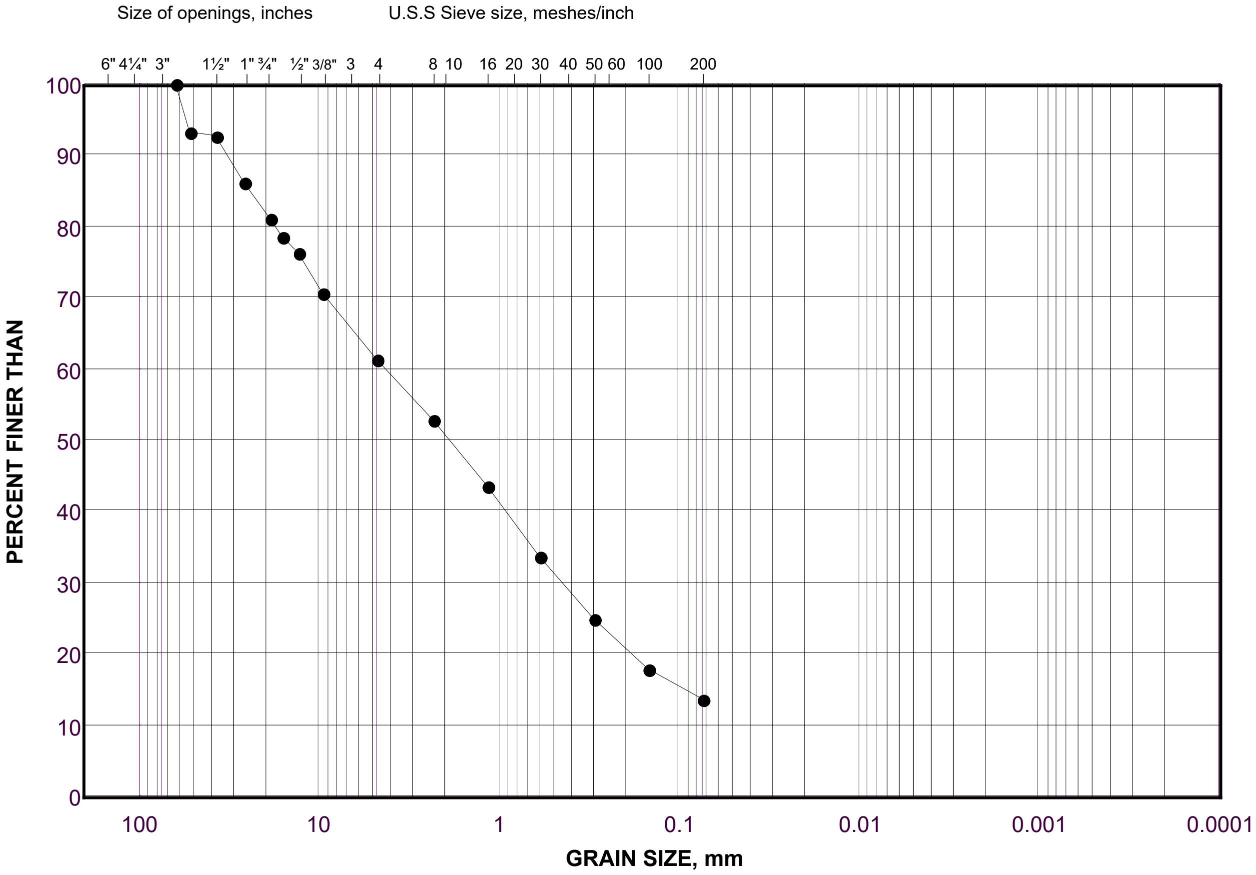
Project Number	21476582	Depth	18
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 4:03:38 PM
Sample Number	4	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-620

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	4	13.0 - 18.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15305(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	590.40	3.86	63.00	96.1
53mm	1160.30	3.72	53.00	92.4
37.5mm	2622.80	9.56	37.50	82.9
26.5mm	3595.60	6.36	26.50	76.5
19.0mm	4770.60	7.68	19.00	68.8
16mm	5198.20	2.79	16.00	66.0
13.2mm	5659.20	3.01	13.20	63.0
9.5mm	6635.40	6.38	9.50	56.6
4.75mm	8078.10	9.43	4.75	47.2
PAN	7226.90	47.21	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	42.20	7.65	2.36	39.6
1.18mm	81.90	7.19	1.18	32.4
600µm	113.90	5.80	0.60	26.6
300µm	140.70	4.86	0.30	21.7
150µm	164.80	4.37	0.15	17.3
75µm	186.40	3.91	0.08	13.4

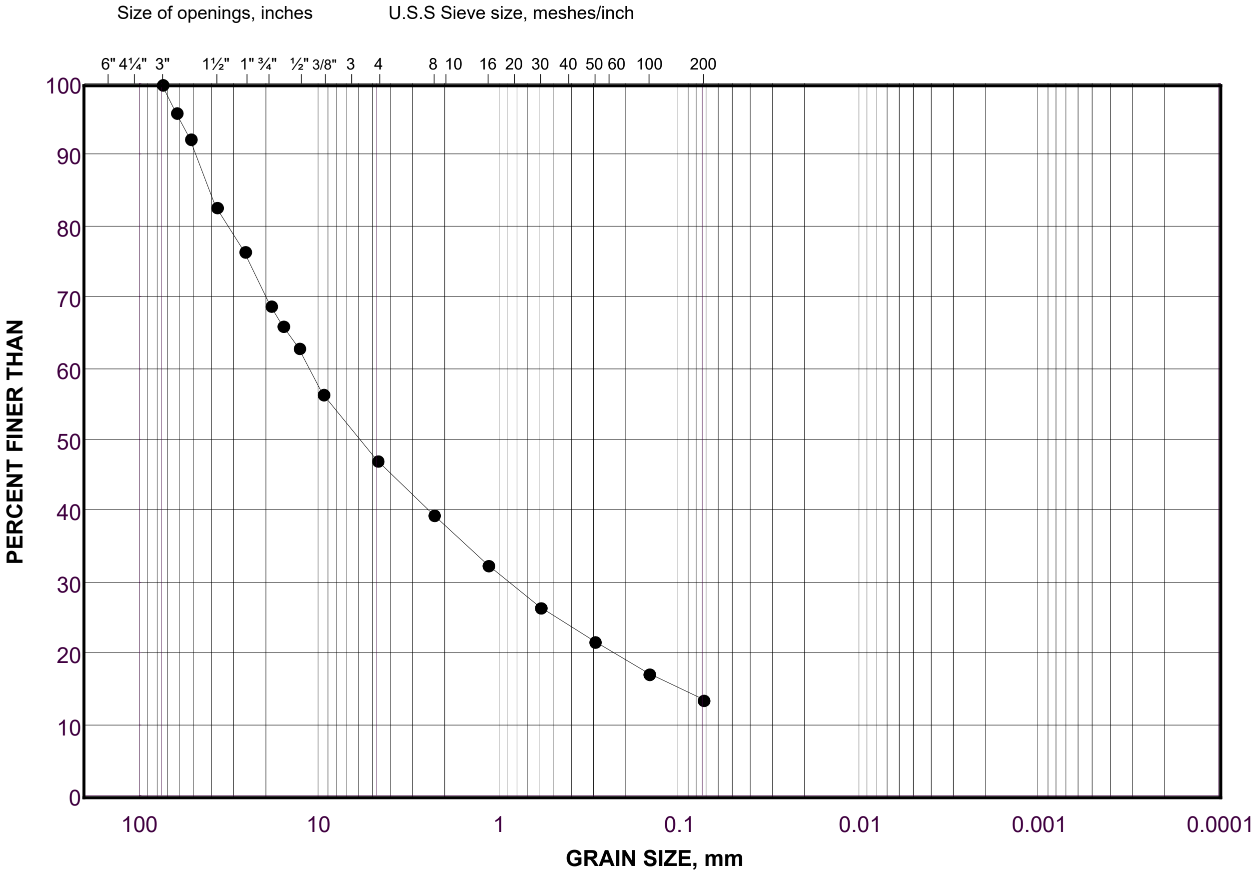
Project Number	21476582	Depth	23
Project Task	1000	Units	Metric
Borehole Number	BH 21-03	Testing Date	3/25/22 4:05:32 PM
Sample Number	5	Tested By	Sieve - IC
Checked By	______________________________	LabID	22-553

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 21-03	5	18.0 - 23.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15374.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	354.90	2.31	63.00	97.7
53mm	914.70	3.64	53.00	94.1
37.5mm	2610.50	11.03	37.50	83.0
26.5mm	4300.60	10.99	26.50	72.0
19.0mm	5584.30	8.35	19.00	63.7
16mm	6253.40	4.35	16.00	59.3
13.2mm	6755.00	3.26	13.20	56.1
9.5mm	7750.20	6.47	9.50	49.6
4.75mm	9162.00	9.18	4.75	40.4
PAN	6180.80	40.42	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	45.50	6.81	2.36	33.6
1.18mm	83.10	5.63	1.18	28.0
600µm	114.50	4.70	0.60	23.3
300µm	142.50	4.19	0.30	19.1
150µm	169.30	4.01	0.15	15.1
75µm	193.80	3.67	0.08	11.4

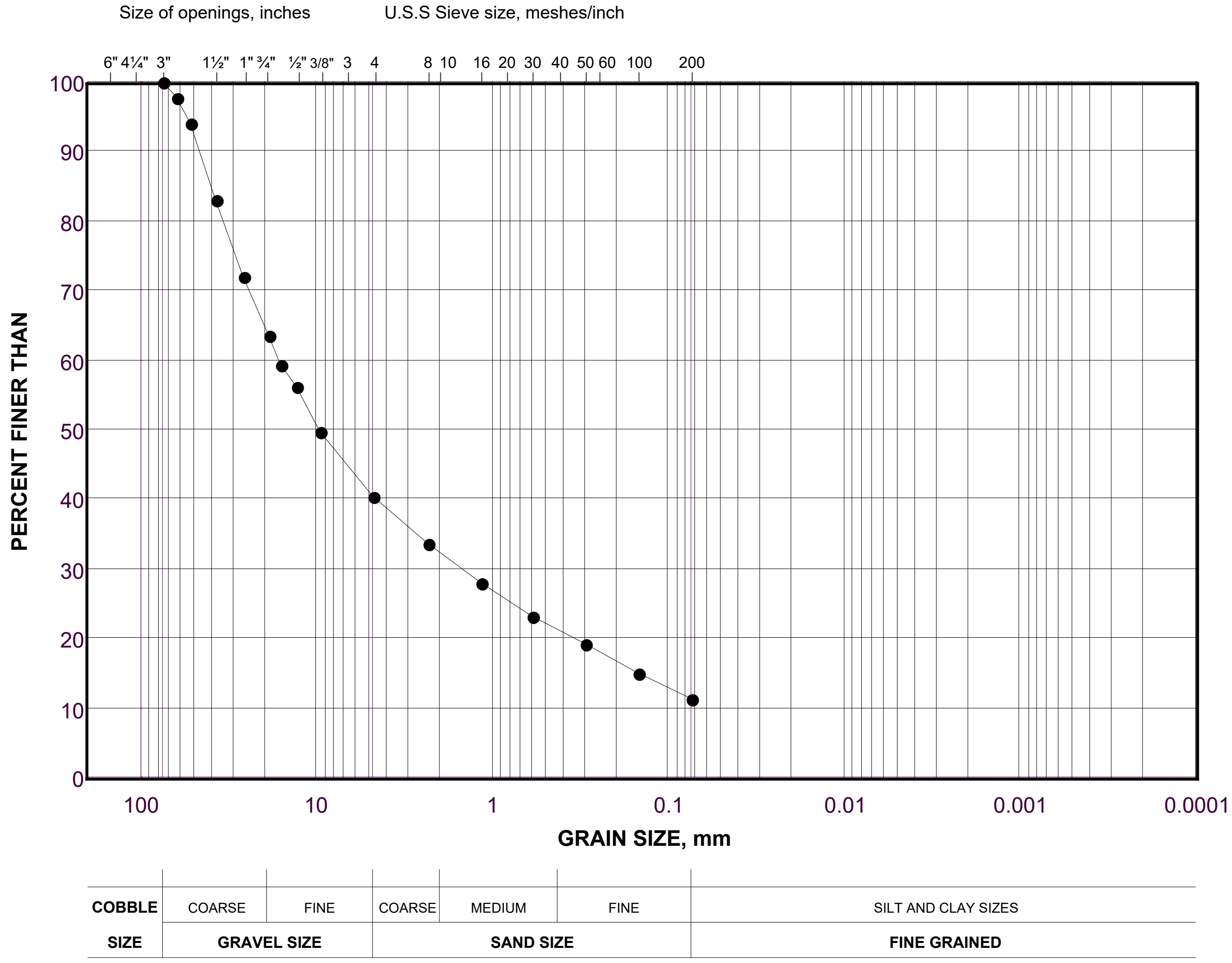
Project Number	21476582	Depth	28
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 4:07:54 PM
Sample Number	6	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-621

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	6	23.0 - 28.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15531.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	622.90	4.01	75.00	96.0
63mm	1615.20	6.39	63.00	89.6
53mm	1897.10	1.82	53.00	87.8
37.5mm	3342.00	9.30	37.50	78.5
26.5mm	3812.90	3.03	26.50	75.5
19.0mm	4573.10	4.89	19.00	70.6
16mm	4941.90	2.37	16.00	68.2
13.2mm	5215.70	1.76	13.20	66.4
9.5mm	5822.40	3.91	9.50	62.5
4.75mm	7035.70	7.81	4.75	54.7
PAN	8481.50	54.71	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	26.60	5.31	2.36	49.4
1.18mm	52.70	5.21	1.18	44.2
600µm	75.80	4.61	0.60	39.6
300µm	99.10	4.65	0.30	34.9
150µm	125.10	5.19	0.15	29.7
75µm	152.20	5.41	0.08	24.3

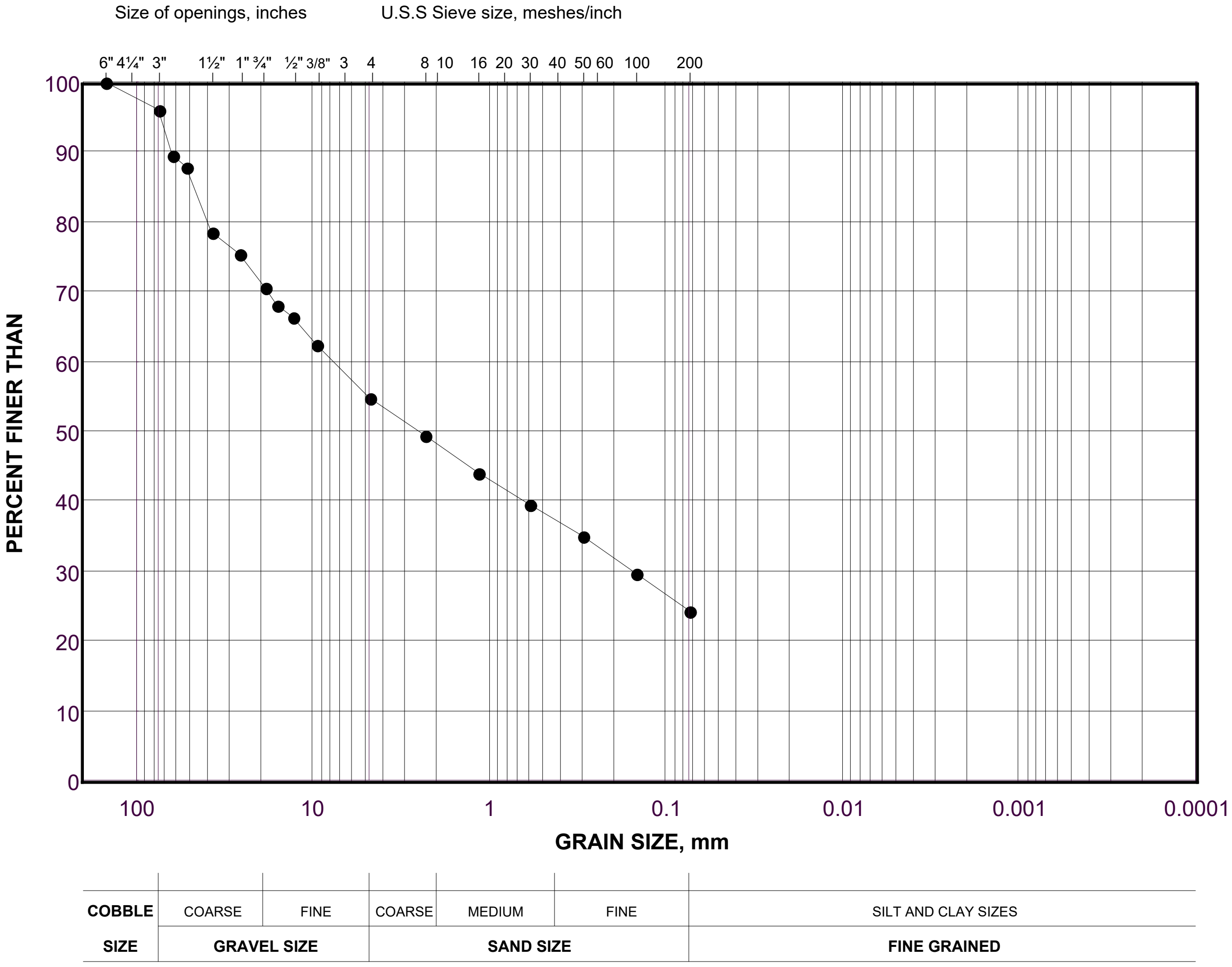
Project Number	21476582	Depth	33
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 4:12:32 PM
Sample Number	7	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-622

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	7	28.0 - 33.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13204(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	652.00	4.94	53.00	95.1
37.5mm	1120.00	3.54	37.50	91.5
26.5mm	1992.00	6.60	26.50	84.9
19.0mm	2794.00	6.07	19.00	78.9
16mm	3162.00	2.79	16.00	76.1
13.2mm	3516.00	2.68	13.20	73.4
9.5mm	4258.00	5.62	9.50	67.8
4.75mm	5498.00	9.39	4.75	58.4
PAN	7706.00	58.37	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	39.14	6.74	2.36	51.6
1.18mm	84.40	7.80	1.18	43.8
600µm	124.52	6.91	0.60	36.9
300µm	158.45	5.84	0.30	31.1
150µm	189.09	5.28	0.15	25.8
75µm	218.88	5.13	0.08	20.7

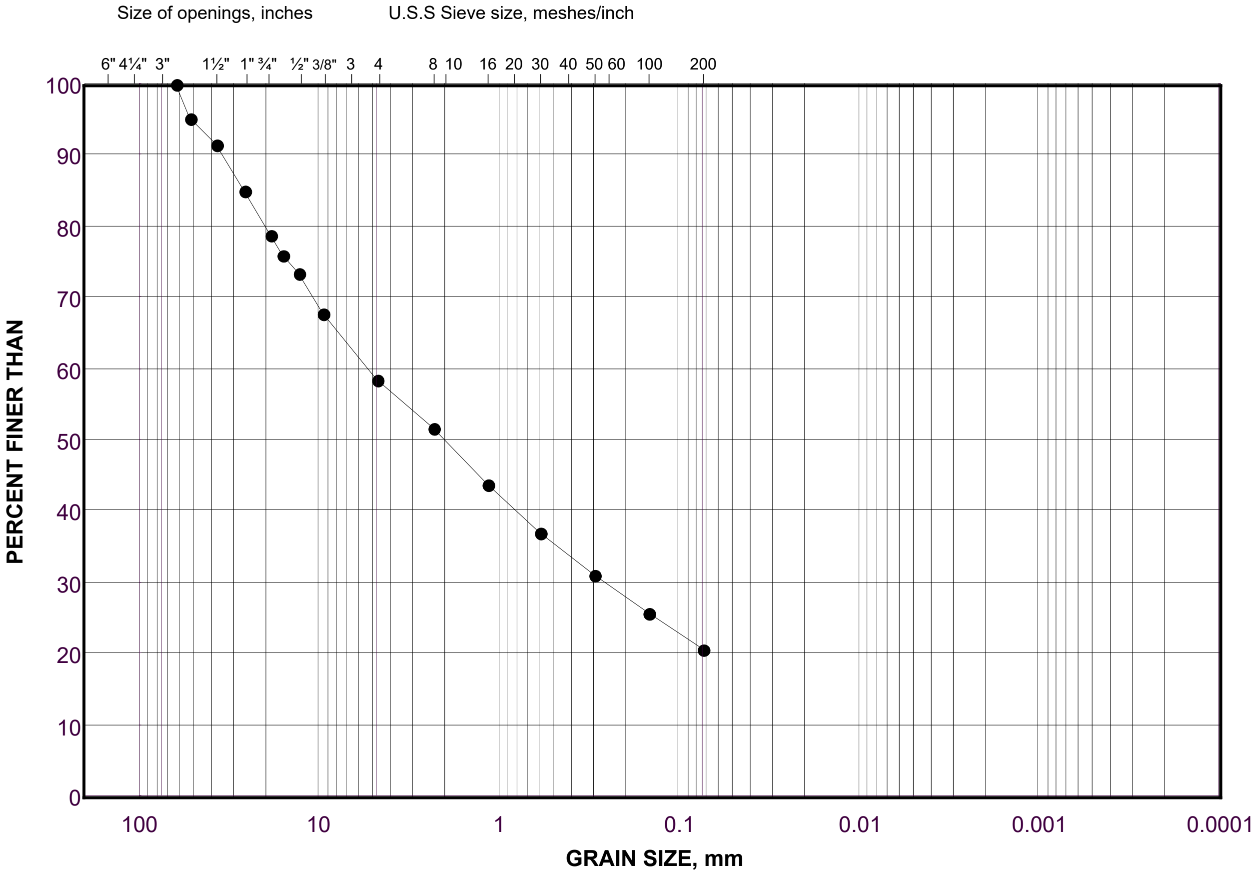
Project Number	21476582	Depth	38
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 4:15:12 PM
Sample Number	8	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-604

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	8	33.0 - 38.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14163(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	720.00	5.08	53.00	94.9
37.5mm	1654.00	6.59	37.50	88.3
26.5mm	2808.00	8.15	26.50	80.2
19.0mm	3560.00	5.31	19.00	74.9
16mm	3834.00	1.93	16.00	72.9
13.2mm	4186.00	2.49	13.20	70.5
9.5mm	4906.00	5.08	9.50	65.4
4.75mm	6312.00	9.93	4.75	55.4
PAN	7851.00	55.44	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	43.99	7.38	2.36	48.1
1.18mm	79.46	5.95	1.18	42.1
600µm	110.74	5.25	0.60	36.9
300µm	138.81	4.71	0.30	32.1
150µm	167.92	4.88	0.15	27.3
75µm	196.05	4.72	0.08	22.6

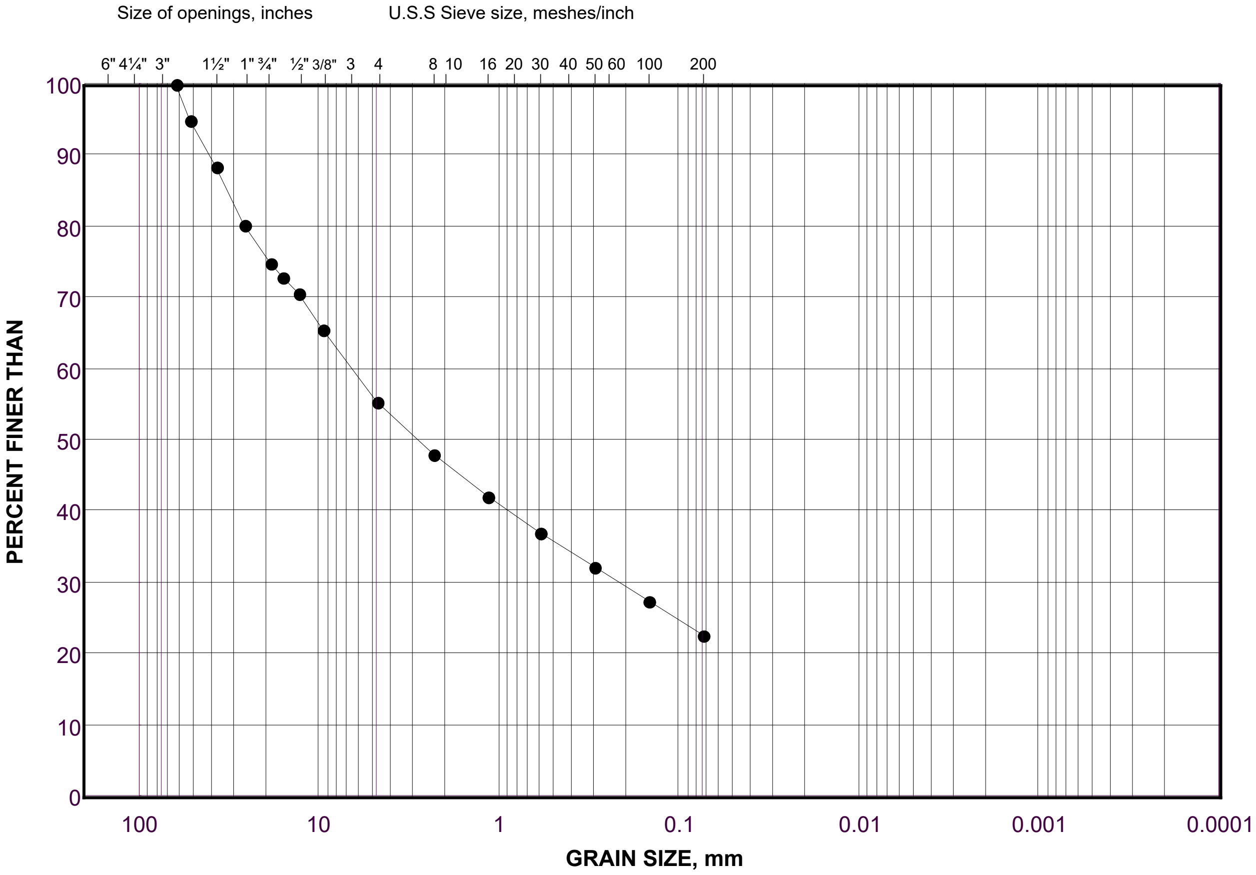
Project Number	21476582	Depth	48
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 4:17:17 PM
Sample Number	10	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-605

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	10	43.0 - 48.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14110.8(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1361.30	9.65	75.00	90.4
63mm	1361.30	0.00	63.00	90.4
53mm	1606.80	1.74	53.00	88.6
37.5mm	2653.50	7.42	37.50	81.2
26.5mm	3040.20	2.74	26.50	78.5
19.0mm	3449.60	2.90	19.00	75.6
16mm	3763.90	2.23	16.00	73.3
13.2mm	4089.80	2.31	13.20	71.0
9.5mm	4693.70	4.28	9.50	66.7
4.75mm	5692.00	7.07	4.75	59.7
PAN	8406.00	59.66	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	39.70	9.19	2.36	50.5
1.18mm	83.30	10.09	1.18	40.4
600µm	119.20	8.31	0.60	32.1
300µm	149.10	6.92	0.30	25.2
150µm	183.60	7.99	0.15	17.2
75µm	209.20	5.93	0.08	11.2

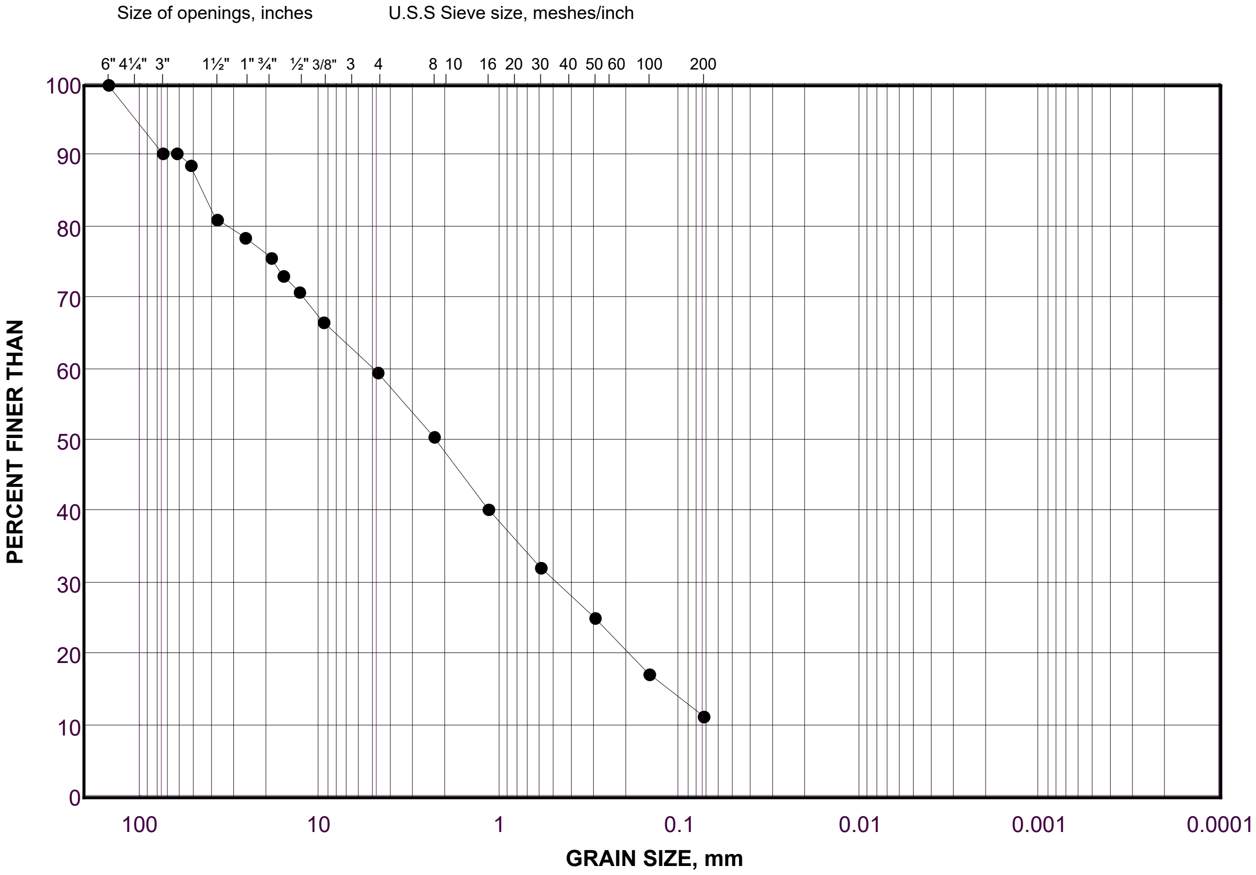
Project Number	21476582	Depth	53
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/07/22 2:15:44 PM
Sample Number	11	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-423

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	11	48.0 - 53.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15045.3(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	427.80	2.84	37.50	97.2
26.5mm	1049.50	4.13	26.50	93.0
19.0mm	1644.40	3.95	19.00	89.1
16mm	2082.00	2.91	16.00	86.2
13.2mm	2482.40	2.66	13.20	83.5
9.5mm	3261.00	5.18	9.50	78.3
4.75mm	4957.90	11.28	4.75	67.1
PAN	10087.40	67.05	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	32.90	8.80	2.36	58.3
1.18mm	62.90	8.02	1.18	50.2
600µm	89.00	6.98	0.60	43.3
300µm	113.70	6.60	0.30	36.7
150µm	136.80	6.18	0.15	30.5
75µm	158.70	5.85	0.08	24.6

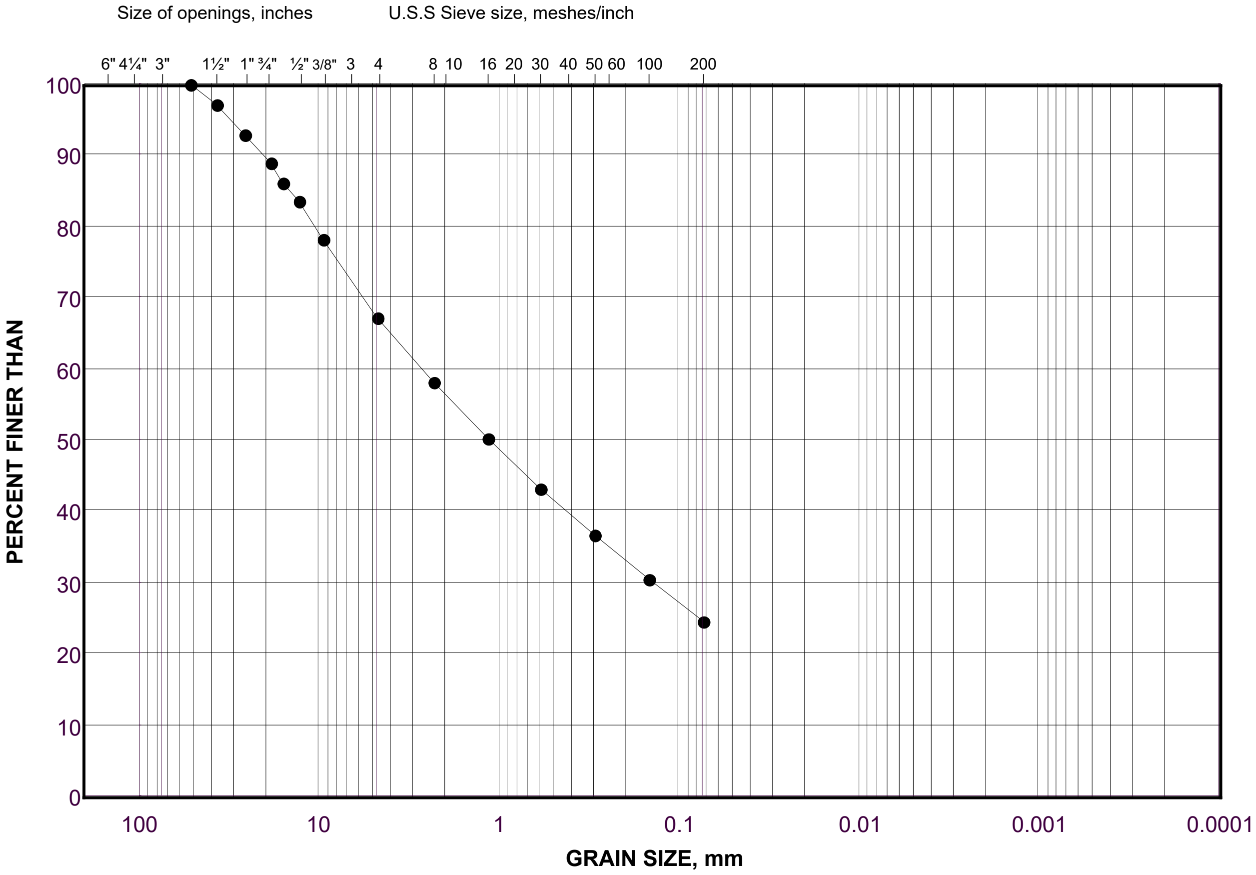
Project Number	21476582	Depth	58
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/07/22 2:42:57 PM
Sample Number	12	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-424

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	12	53.0 - 58.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17415(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	283.50	1.63	53.00	98.4
37.5mm	1659.90	7.90	37.50	90.5
26.5mm	2440.10	4.48	26.50	86.0
19.0mm	3357.10	5.27	19.00	80.7
16mm	3819.60	2.66	16.00	78.1
13.2mm	4268.30	2.58	13.20	75.5
9.5mm	5198.60	5.34	9.50	70.1
4.75mm	6926.40	9.92	4.75	60.2
PAN	10469.50	60.22	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	40.60	8.26	2.36	52.0
1.18mm	83.20	8.66	1.18	43.3
600µm	120.10	7.50	0.60	35.8
300µm	150.60	6.20	0.30	29.6
150µm	174.80	4.92	0.15	24.7
75µm	197.10	4.54	0.08	20.1

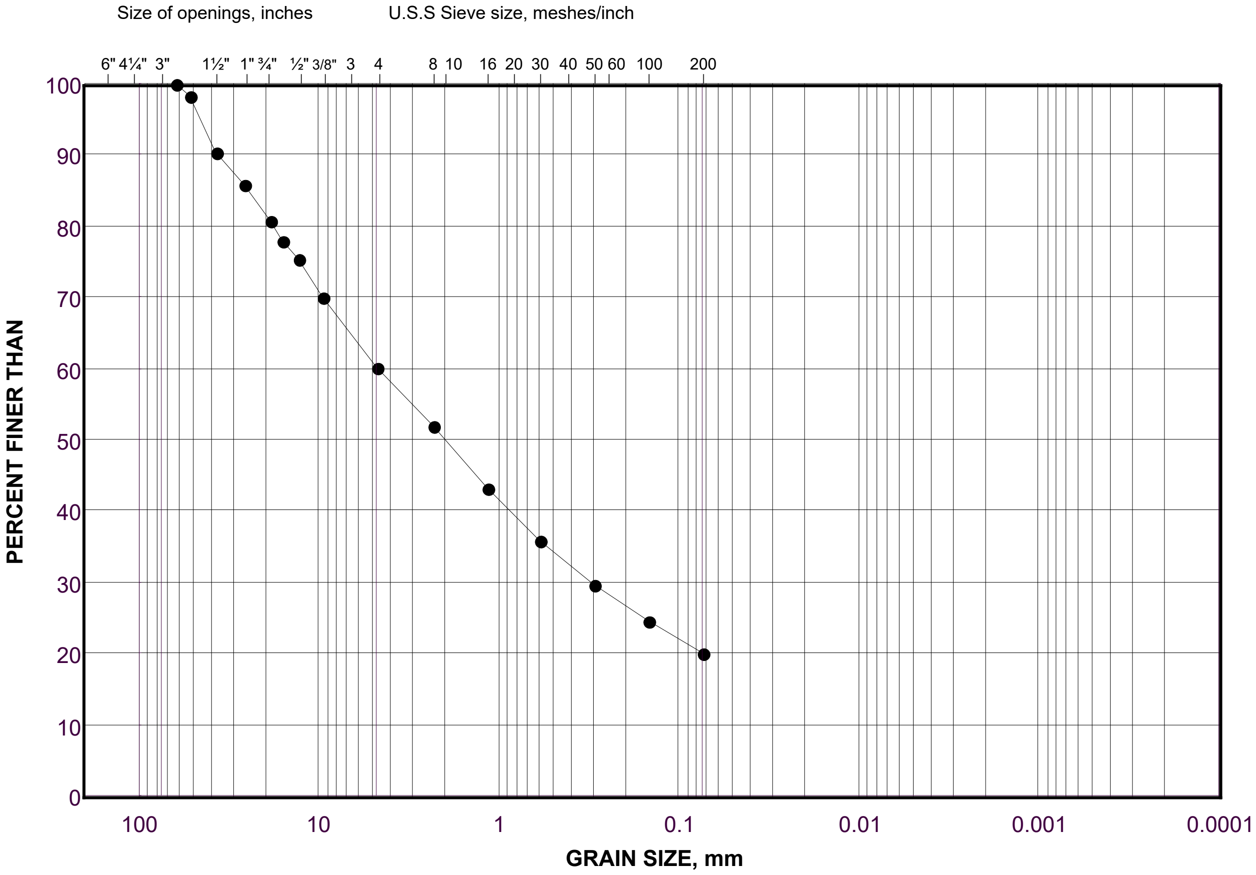
Project Number	21476582	Depth	63
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/07/22 2:49:31 PM
Sample Number	13	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-425

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	13	58.0 - 63.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16895.7(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	705.70	4.18	63.00	95.8
53mm	1527.00	4.86	53.00	91.0
37.5mm	2491.60	5.71	37.50	85.3
26.5mm	3306.10	4.82	26.50	80.4
19.0mm	4438.00	6.70	19.00	73.7
16mm	4850.70	2.44	16.00	71.3
13.2mm	5448.30	3.54	13.20	67.8
9.5mm	6551.10	6.53	9.50	61.2
4.75mm	8328.80	10.52	4.75	50.7
PAN	8542.60	50.70	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	40.00	7.44	2.36	43.3
1.18mm	86.90	8.72	1.18	34.5
600µm	129.60	7.94	0.60	26.6
300µm	162.90	6.19	0.30	20.4
150µm	185.50	4.20	0.15	16.2
75µm	202.50	3.16	0.08	13.1

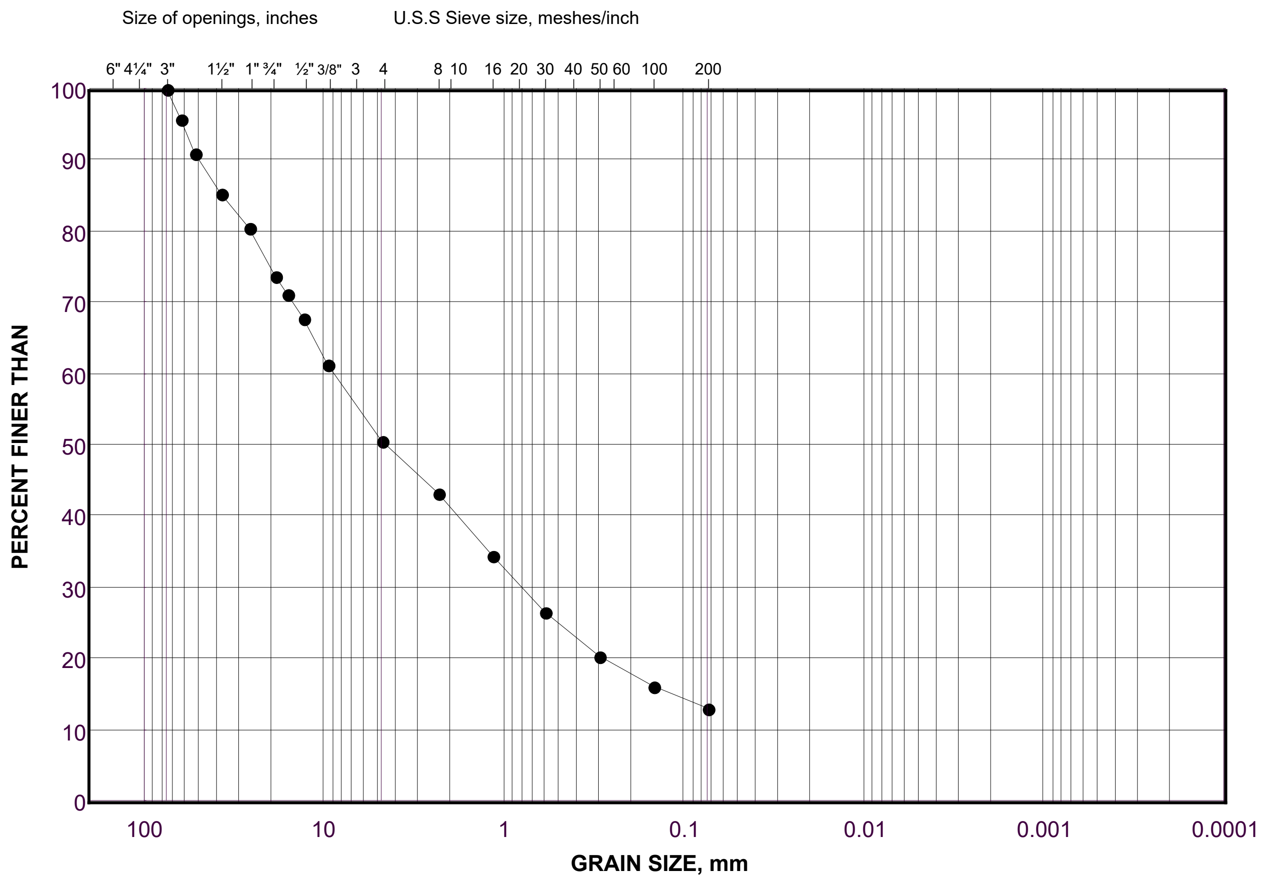
Project Number	21476582	Depth	68
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/07/22 2:59:36 PM
Sample Number	14	Tested By	Sieve -
Checked By	______________________________	LabID	22-426

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	14	63.0 - 68.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17898(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	268.80	1.50	37.50	98.5
26.5mm	1295.10	5.73	26.50	92.8
19.0mm	2030.00	4.11	19.00	88.7
16mm	2466.40	2.44	16.00	86.2
13.2mm	2923.70	2.56	13.20	83.7
9.5mm	4006.40	6.05	9.50	77.6
4.75mm	5886.90	10.51	4.75	67.1
PAN	11965.50	67.10	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	36.60	9.22	2.36	57.9
1.18mm	74.50	9.55	1.18	48.3
600µm	111.60	9.34	0.60	39.0
300µm	144.40	8.26	0.30	30.7
150µm	169.90	6.42	0.15	24.3
75µm	192.30	5.64	0.08	18.7

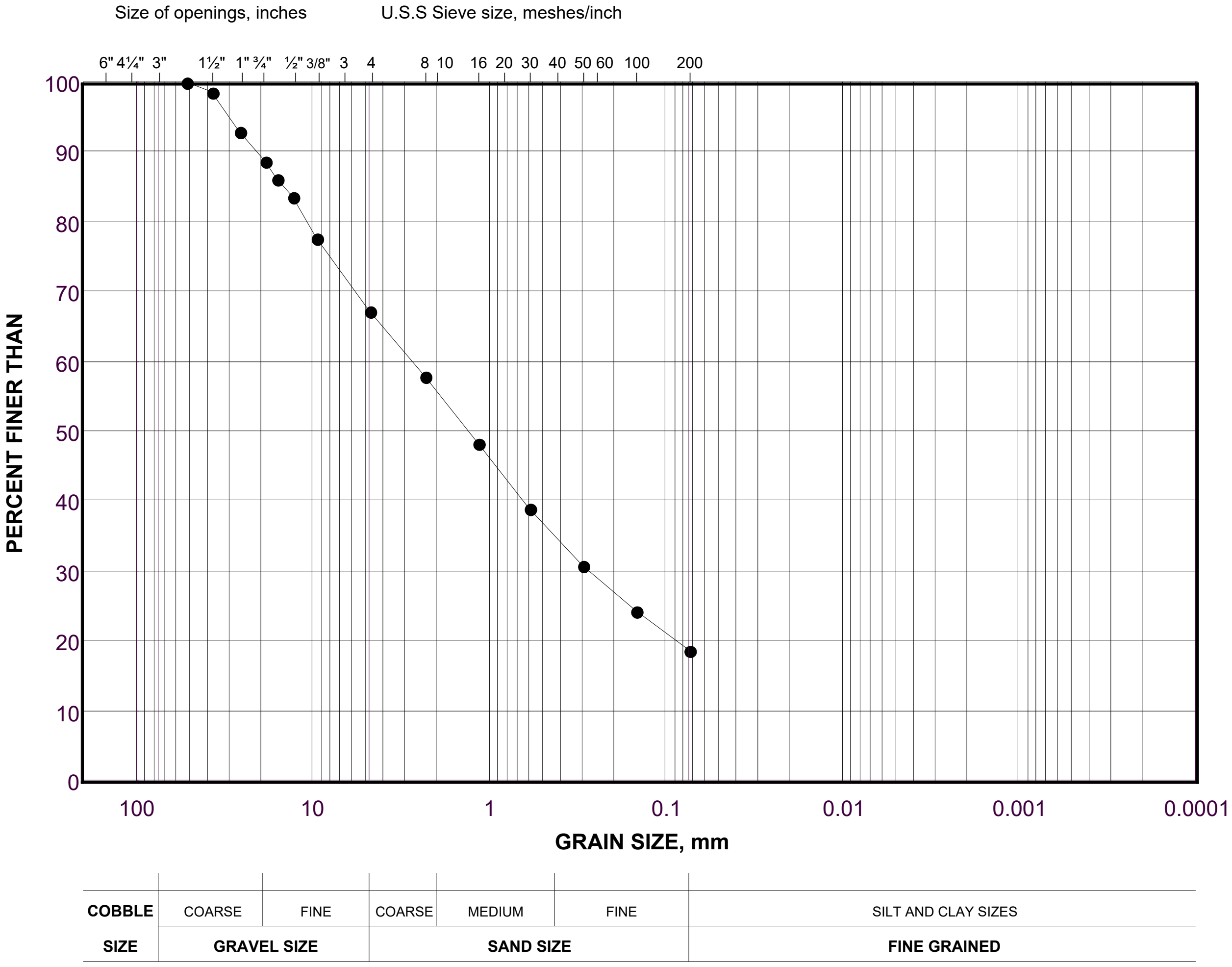
Project Number	21476582	Depth	78
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/07/22 3:15:53 PM
Sample Number	16	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-427

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	16	73.0 - 78.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 12826(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	1203.20	9.38	37.50	90.6
26.5mm	2696.60	11.64	26.50	79.0
19.0mm	3512.10	6.36	19.00	72.6
16mm	4115.30	4.70	16.00	67.9
13.2mm	4516.60	3.13	13.20	64.8
9.5mm	5246.30	5.69	9.50	59.1
4.75mm	6462.70	9.48	4.75	49.6
PAN	6360.40	49.62	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	38.70	7.02	2.36	42.6
1.18mm	74.80	6.55	1.18	36.1
600µm	104.70	5.42	0.60	30.6
300µm	127.20	4.08	0.30	26.6
150µm	147.50	3.68	0.15	22.9
75µm	169.70	4.03	0.08	18.8

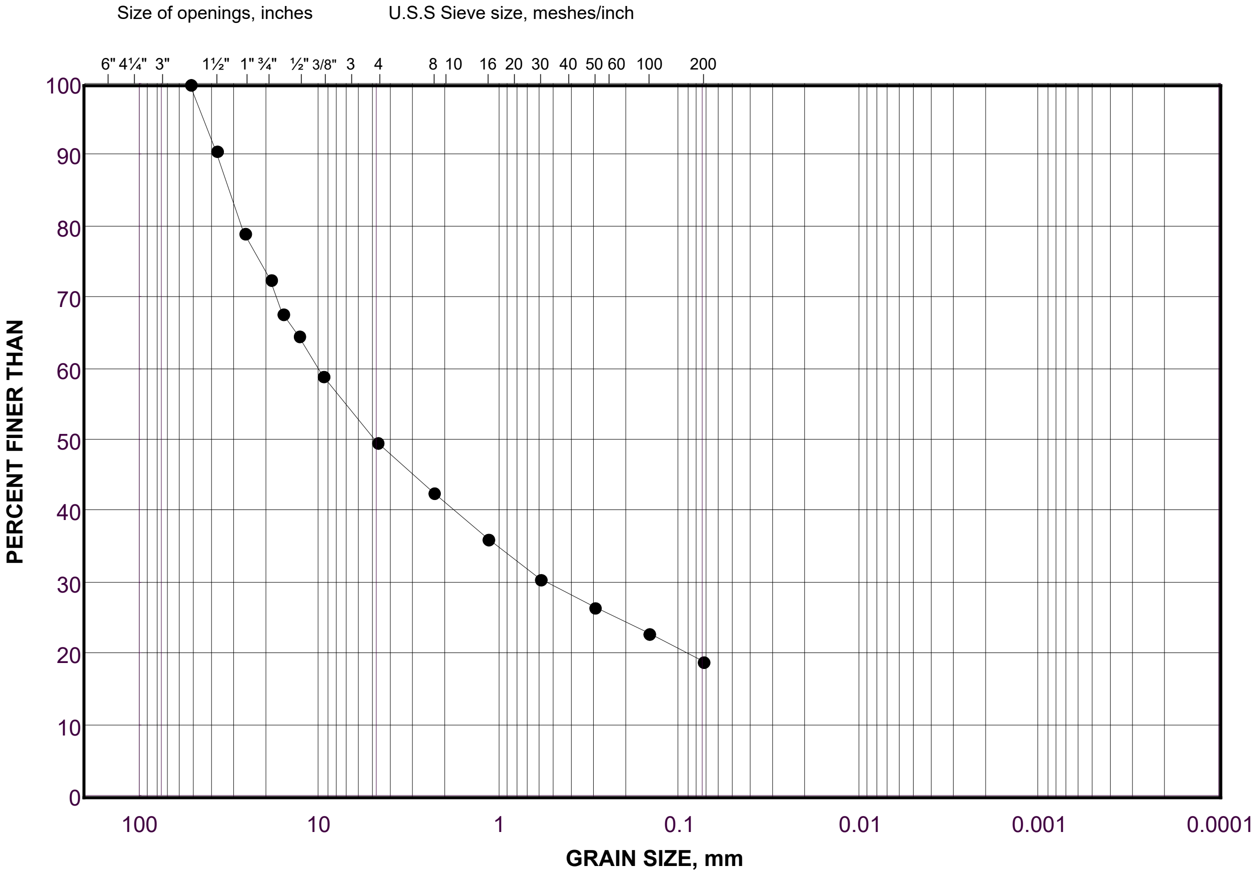
Project Number	21476582	Depth	83
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 4:20:06 PM
Sample Number	17	Tested By	Sieve - JT
Checked By	______________________________	LabID	22-219

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	17	78.0 - 83.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18560.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	769.80	4.15	63.00	95.9
53mm	1566.10	4.29	53.00	91.6
37.5mm	2697.30	6.09	37.50	85.5
26.5mm	4343.10	8.87	26.50	76.6
19.0mm	5347.10	5.41	19.00	71.2
16mm	6232.00	4.77	16.00	66.4
13.2mm	6900.50	3.60	13.20	62.8
9.5mm	8188.20	6.94	9.50	55.9
4.75mm	10207.40	10.88	4.75	45.0
PAN	8340.00	45.00	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	46.40	7.26	2.36	37.7
1.18mm	101.60	8.63	1.18	29.1
600µm	145.40	6.85	0.60	22.3
300µm	177.10	4.96	0.30	17.3
150µm	198.50	3.35	0.15	14.0
75µm	216.90	2.88	0.08	11.1

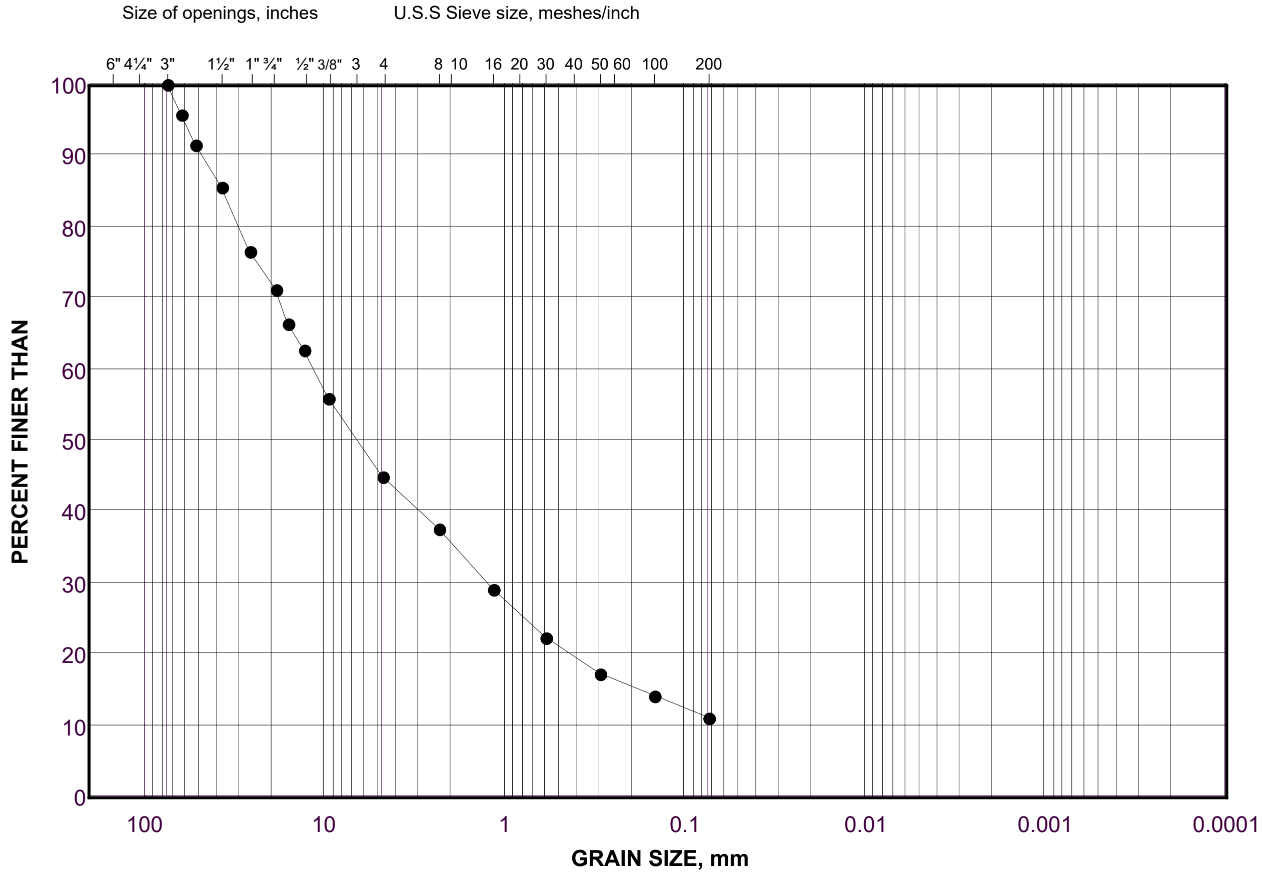
Project Number	21476582	Depth	88
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 4:22:15 PM
Sample Number	18	Tested By	Sieve - AM
Checked By	______________________	LabID	22-623

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	18	83.0 - 88.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18694.6(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	2171.60	11.62	75.00	88.4
63mm	3184.20	5.42	63.00	83.0
53mm	4364.00	6.31	53.00	76.7
37.5mm	5407.50	5.58	37.50	71.1
26.5mm	6593.10	6.34	26.50	64.7
19.0mm	7577.50	5.27	19.00	59.5
16mm	8146.30	3.04	16.00	56.4
13.2mm	8688.20	2.90	13.20	53.5
9.5mm	9620.30	4.99	9.50	48.5
4.75mm	10945.20	7.09	4.75	41.4
PAN	7726.30	41.44	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	31.70	5.03	2.36	36.4
1.18mm	68.20	5.79	1.18	30.6
600µm	119.20	8.09	0.60	22.5
300µm	178.50	9.41	0.30	13.1
150µm	208.20	4.71	0.15	8.4
75µm	223.80	2.48	0.08	5.9

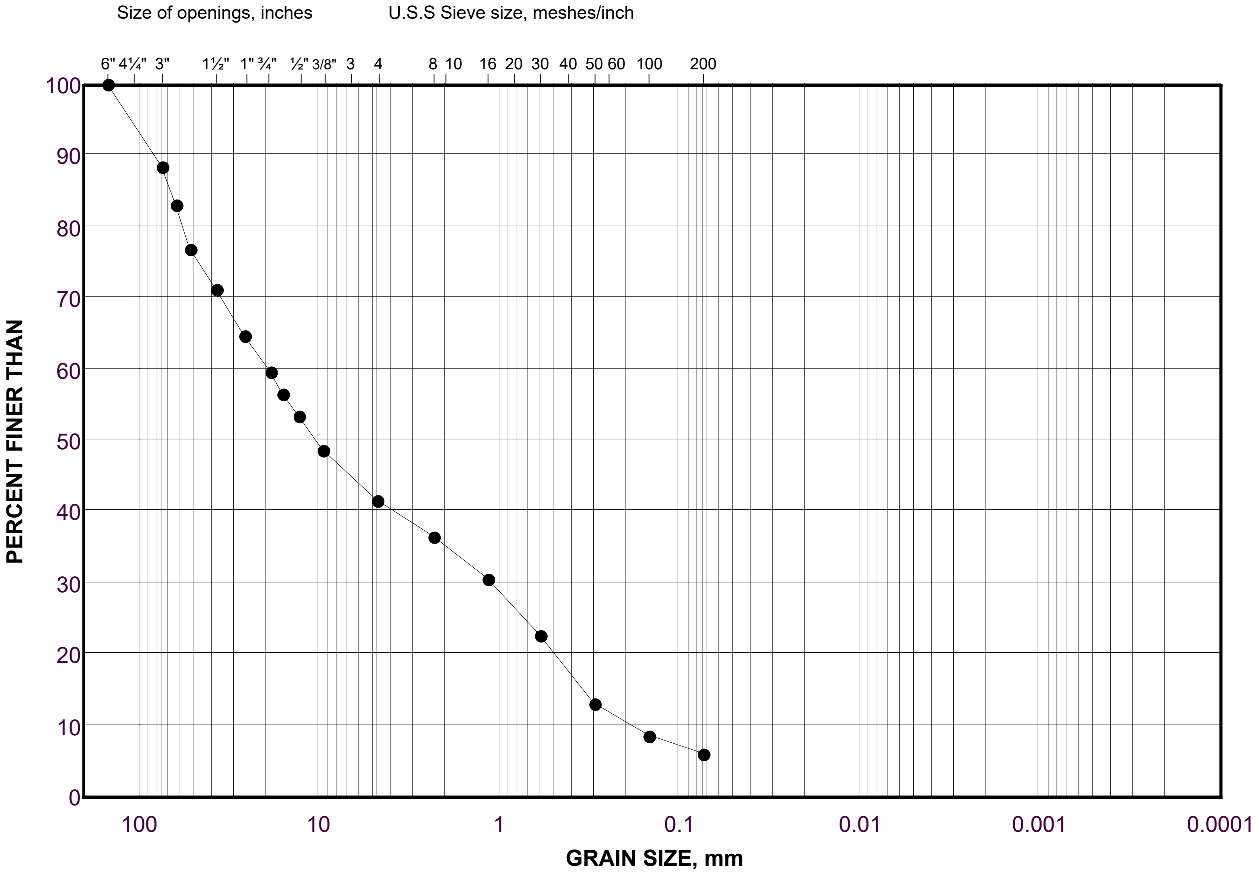
Project Number	21476582	Depth	93
Project Task	1000	Units	Metric
Borehole Number	BH 21-03	Testing Date	3/25/22 4:25:31 PM
Sample Number	19	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-194

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 21-03	19	88.0 - 93.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 19612.3(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	1848.20	9.42	63.00	90.6
53mm	2507.60	3.36	53.00	87.2
37.5mm	4030.70	7.77	37.50	79.5
26.5mm	5418.20	7.07	26.50	72.4
19.0mm	7439.20	10.30	19.00	62.1
16mm	8232.20	4.04	16.00	58.0
13.2mm	9173.70	4.80	13.20	53.2
9.5mm	10636.20	7.46	9.50	45.8
4.75mm	12727.70	10.66	4.75	35.1
PAN	6884.60	35.12	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	50.70	6.96	2.36	28.2
1.18mm	97.50	6.42	1.18	21.7
600µm	142.70	6.20	0.60	15.5
300µm	181.20	5.28	0.30	10.3
150µm	208.70	3.77	0.15	6.5
75µm	222.70	1.92	0.08	4.6

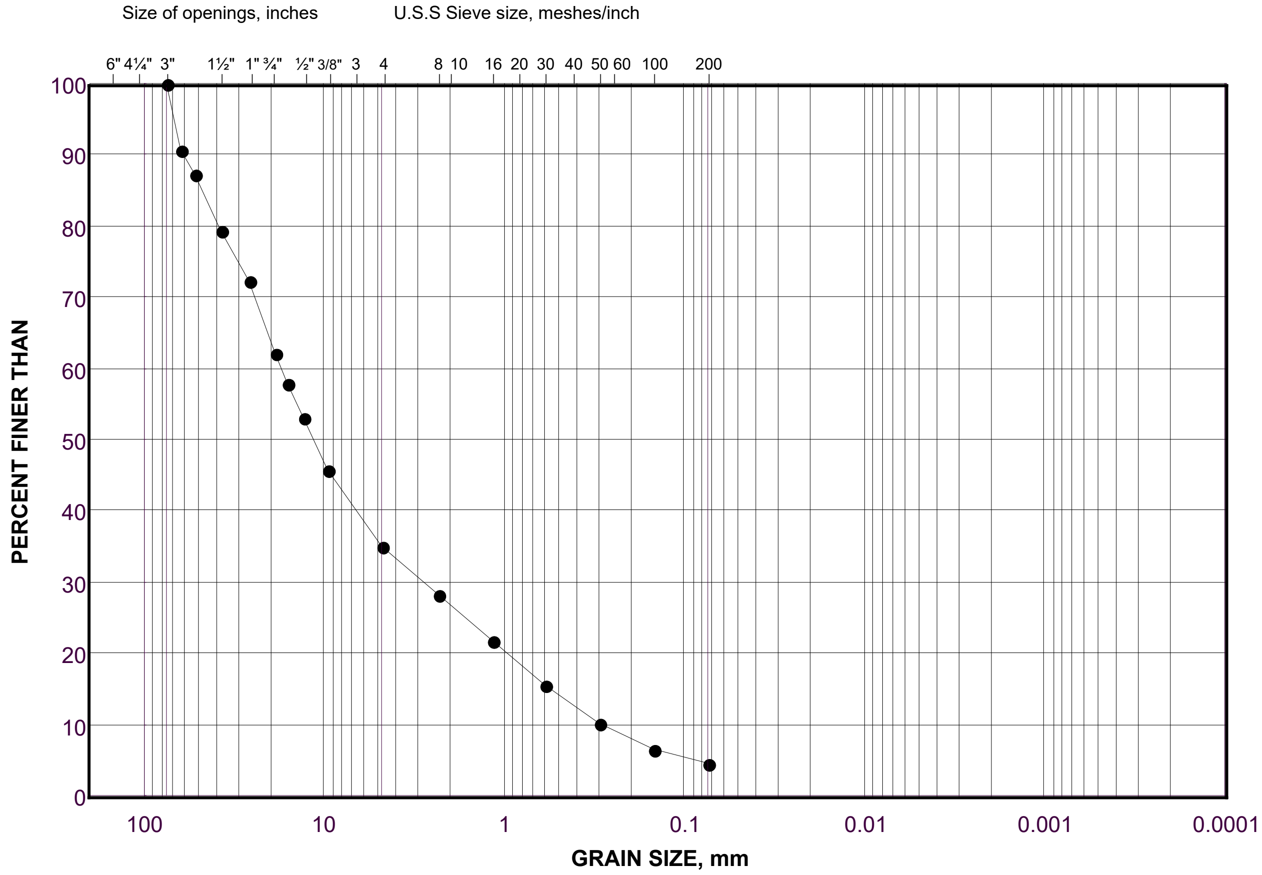
Project Number	21476582	Depth	93
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 4:27:15 PM
Sample Number	20	Tested By	Sieve - JT
Checked By	______________________________	LabID	22-218

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	20	98.0 - 93.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 19968.4(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1232.40	6.17	75.00	93.8
63mm	1232.40	0.00	63.00	93.8
53mm	1593.10	1.81	53.00	92.0
37.5mm	2436.50	4.22	37.50	87.8
26.5mm	4252.40	9.09	26.50	78.7
19.0mm	5650.60	7.00	19.00	71.7
16mm	6252.40	3.01	16.00	68.7
13.2mm	6806.30	2.77	13.20	65.9
9.5mm	7907.90	5.52	9.50	60.4
4.75mm	9719.90	9.07	4.75	51.3
PAN	10212.70	51.34	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	36.20	6.02	2.36	45.3
1.18mm	72.00	5.96	1.18	39.4
600µm	109.00	6.16	0.60	33.2
300µm	136.80	4.62	0.30	28.6
150µm	167.30	5.07	0.15	23.5
75µm	222.80	9.23	0.08	14.3

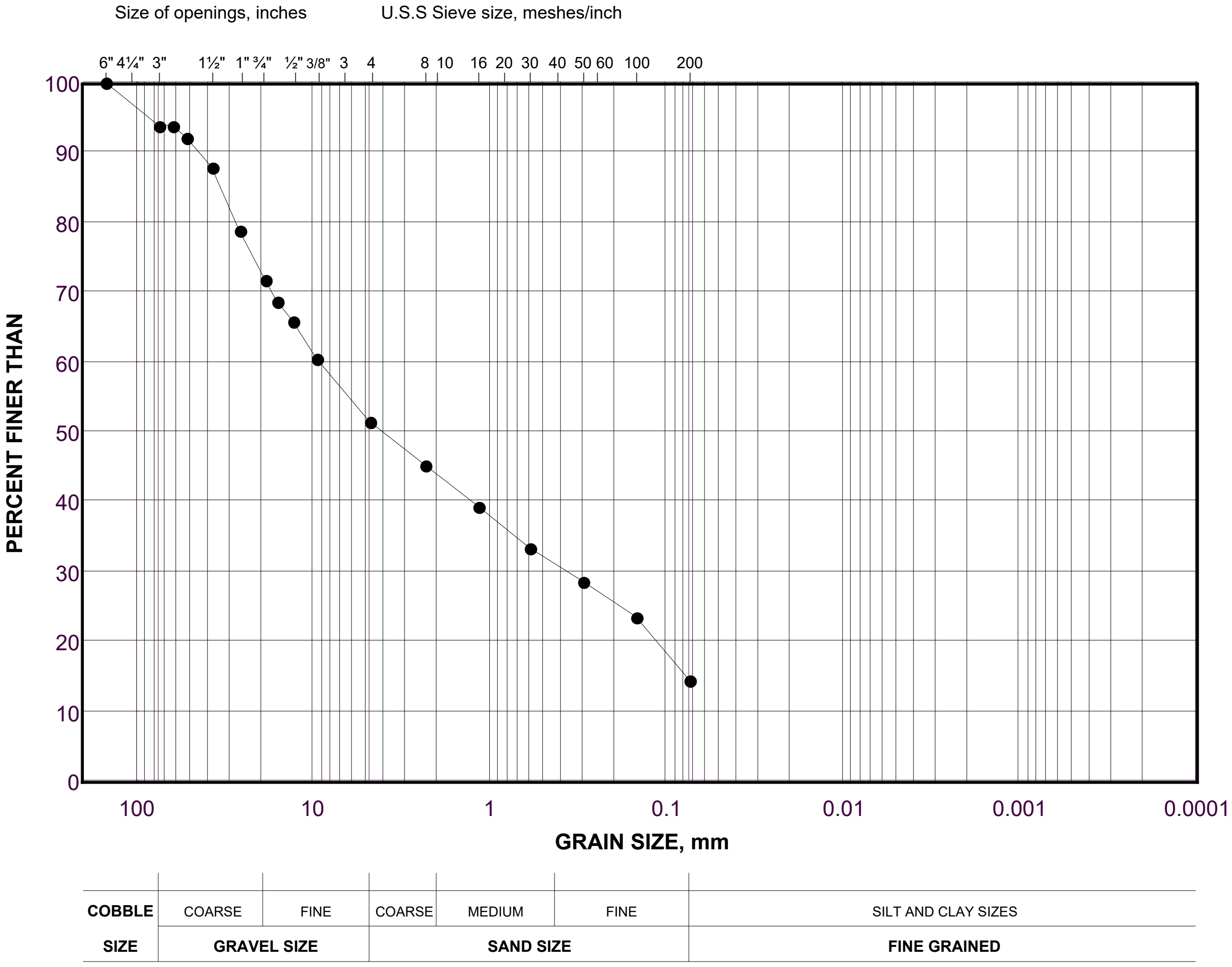
Project Number	21476582	Depth	103
Project Task	1000	Units	Imperial
Borehole Number	BH 21-03	Testing Date	3/25/22 4:29:55 PM
Sample Number	21	Tested By	Sieve - AM
Checked By	______________________	LabID	22-209

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-03	21	98.0 - 103.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 12246.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	0.00	0.00	37.50	100.0
26.5mm	0.00	0.00	26.50	100.0
19.0mm	66.30	0.54	19.00	99.5
16mm	98.00	0.26	16.00	99.2
13.2mm	119.80	0.18	13.20	99.0
9.5mm	201.00	0.66	9.50	98.4
4.75mm	274.00	0.60	4.75	97.8
PAN	11972.50	97.76	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	0.90	0.34	2.36	97.4
1.18mm	2.10	0.45	1.18	97.0
600µm	3.70	0.60	0.60	96.4
300µm	5.00	0.48	0.30	95.9
150µm	42.90	14.12	0.15	81.8
75µm	182.40	51.97	0.08	29.8

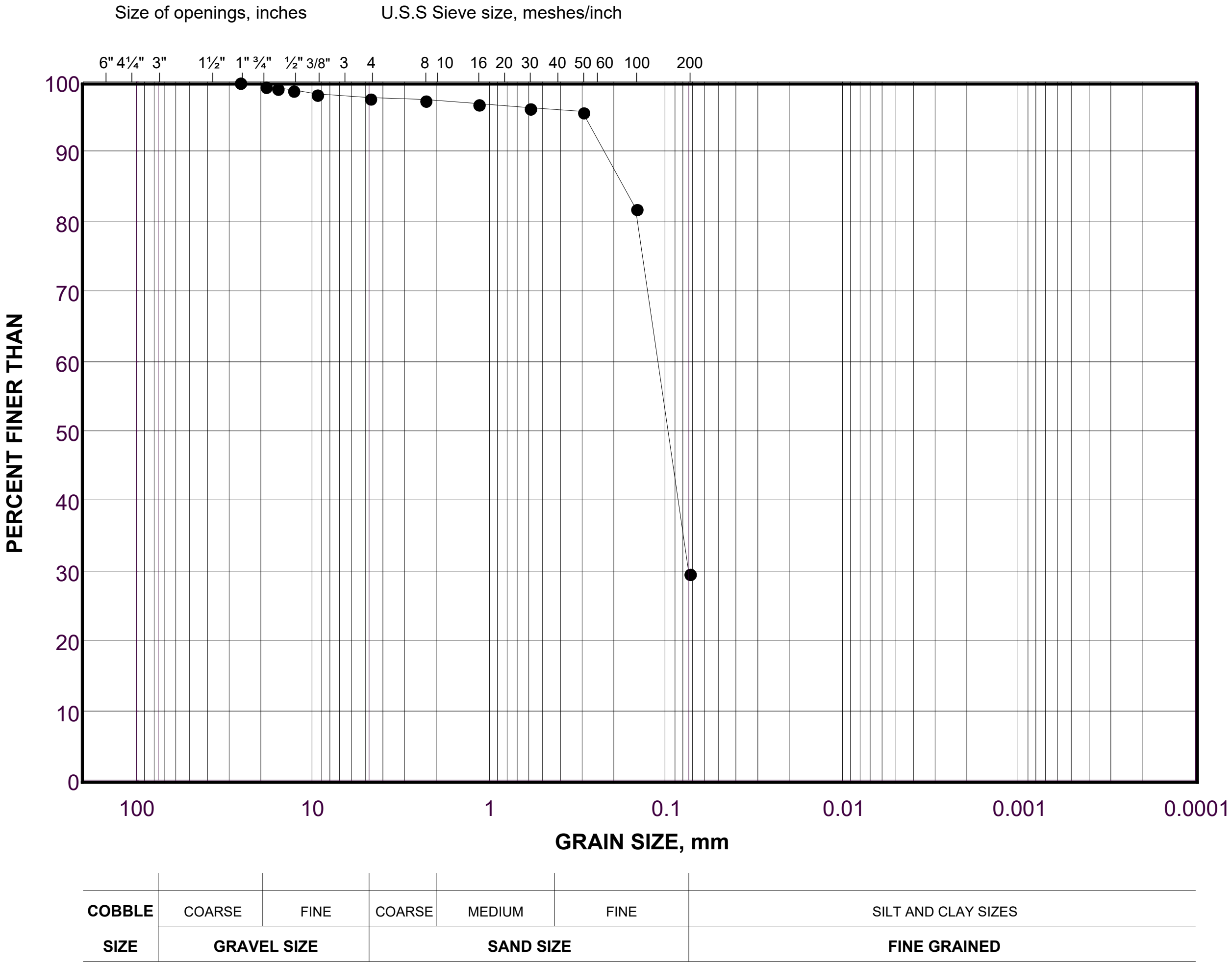
Project Number	21476582	Depth	107
Project Task	1000	Units	Metric
Borehole Number	BH 21-03	Testing Date	3/25/22 4:38:02 PM
Sample Number	22A	Tested By	Sieve - IC
Checked By	______________________	LabID	22-552

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 21-03	22A	103.0 - 107.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 10807.7(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1034.80	9.57	75.00	90.4
63mm	1034.80	0.00	63.00	90.4
53mm	1345.40	2.87	53.00	87.6
37.5mm	2509.80	10.77	37.50	76.8
26.5mm	3186.50	6.26	26.50	70.5
19.0mm	3577.40	3.62	19.00	66.9
16mm	3850.40	2.53	16.00	64.4
13.2mm	4169.90	2.96	13.20	61.4
9.5mm	4689.40	4.81	9.50	56.6
4.75mm	5609.10	8.51	4.75	48.1
PAN	5177.90	48.10	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	33.90	6.01	2.36	42.1
1.18mm	73.70	7.06	1.18	35.0
600µm	110.30	6.49	0.60	28.5
300µm	135.90	4.54	0.30	24.0
150µm	154.30	3.26	0.15	20.7
75µm	173.30	3.37	0.08	17.4

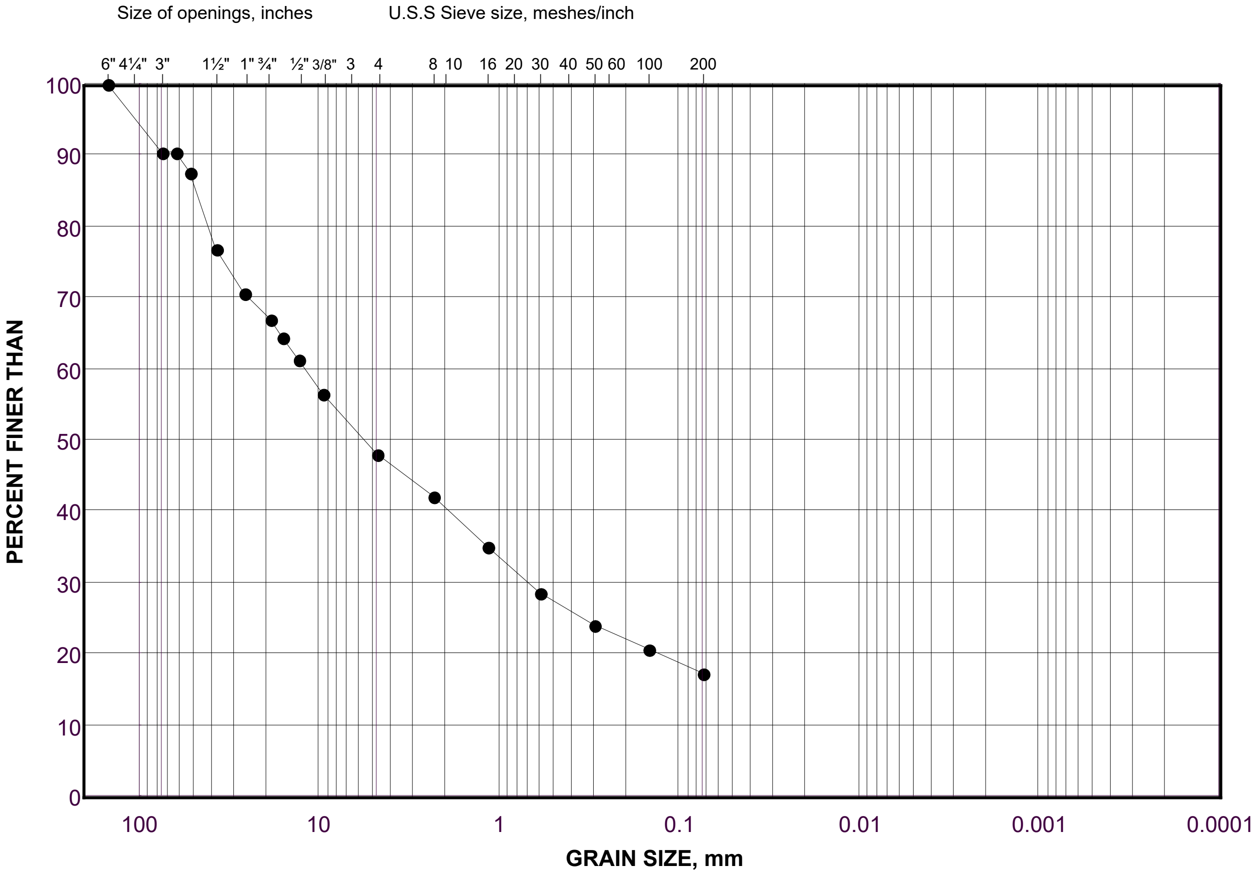
Project Number	21476582	Depth	68
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/24/22 11:51:13
Sample Number	14	Tested By	AM Sieve - LB
Checked By	______________________________	LabID	22-612

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	14	63.0 - 68.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 04-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 2292(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	0.00	0.00	37.50	100.0
26.5mm	186.00	8.12	26.50	91.9
19.0mm	360.00	7.59	19.00	84.3
16mm	398.00	1.66	16.00	82.6
13.2mm	410.00	0.52	13.20	82.1
9.5mm	450.00	1.75	9.50	80.4
4.75mm	542.00	4.01	4.75	76.4
PAN	1750.00	76.35	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	14.16	3.22	2.36	73.1
1.18mm	31.10	3.85	1.18	69.3
600µm	51.25	4.58	0.60	64.7
300µm	76.60	5.76	0.30	58.9
150µm	111.94	8.03	0.15	50.9
75µm	157.76	10.41	0.08	40.5

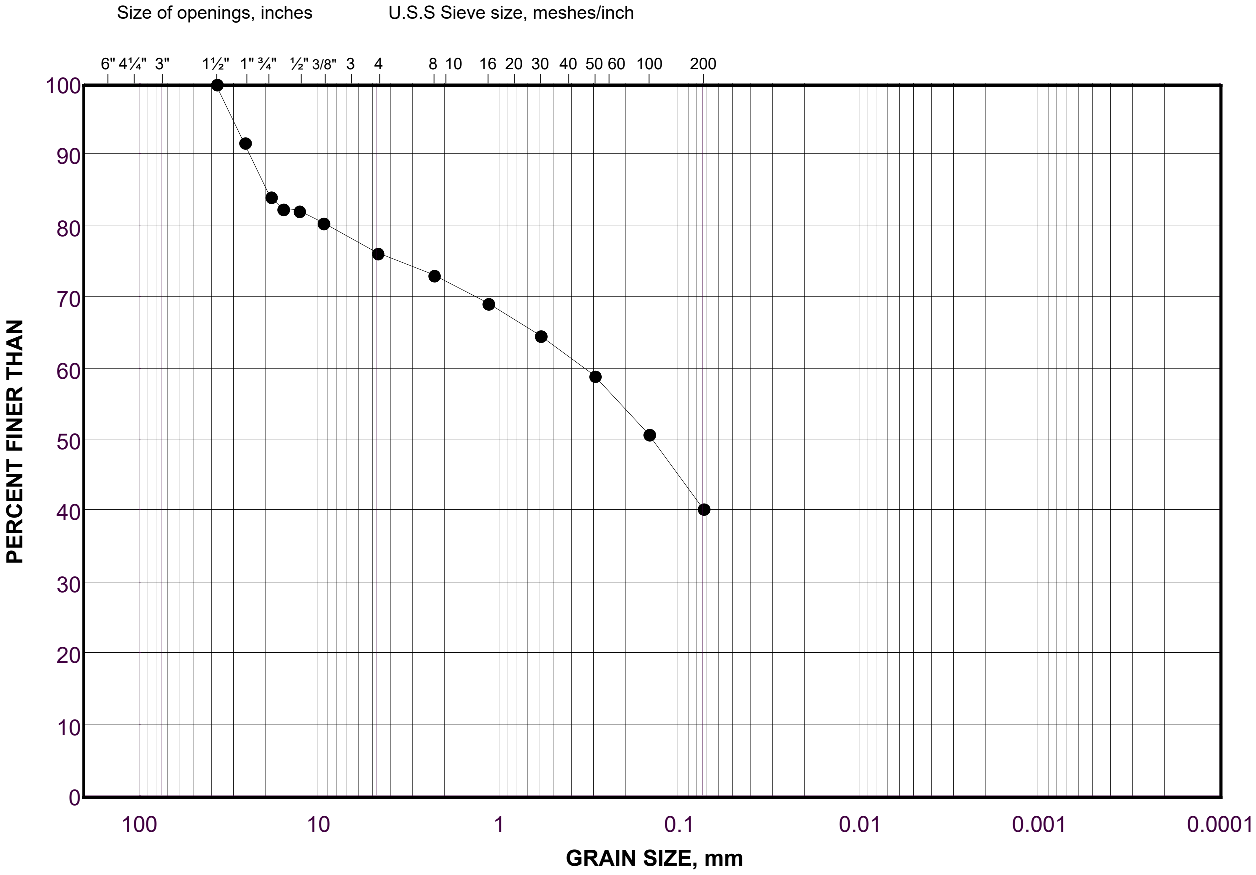
Project Number	21476582	Depth	3
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 12:47:22 PM
Sample Number	1B	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-606

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	1B	0.66 - 3.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13362(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	546.00	4.09	37.50	95.9
26.5mm	1192.00	4.83	26.50	91.1
19.0mm	1866.00	5.04	19.00	86.0
16mm	2110.00	1.83	16.00	84.2
13.2mm	2392.00	2.11	13.20	82.1
9.5mm	2454.00	0.46	9.50	81.6
4.75mm	3908.00	10.88	4.75	70.8
PAN	9454.00	70.76	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	27.11	5.45	2.36	65.3
1.18mm	58.10	6.23	1.18	59.1
600µm	91.21	6.66	0.60	52.4
300µm	124.87	6.77	0.30	45.7
150µm	160.40	7.15	0.15	38.5
75µm	198.66	7.69	0.08	30.8

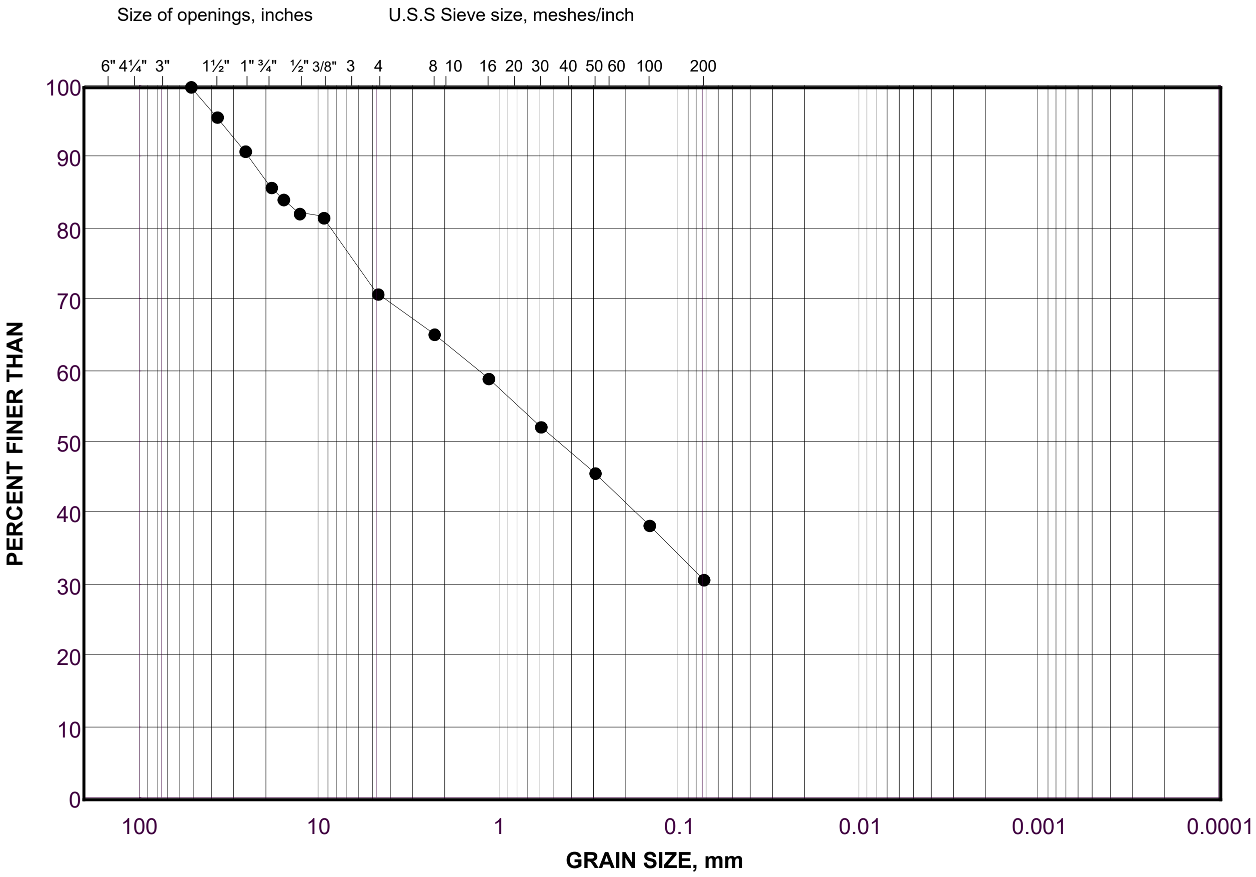
Project Number	21476582	Depth	8
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 12:52:44 PM
Sample Number	2	Tested By	Sieve - JB
Checked By	____________________	LabID	22-607

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	2	3.0 - 8.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 4202.8(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	698.50	16.62	37.50	83.4
26.5mm	917.30	5.21	26.50	78.2
19.0mm	1131.10	5.09	19.00	73.1
16mm	1259.40	3.05	16.00	70.0
13.2mm	1331.80	1.72	13.20	68.3
9.5mm	1505.30	4.13	9.50	64.2
4.75mm	1867.00	8.61	4.75	55.6
PAN	2327.00	55.57	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	27.70	4.89	2.36	50.7
1.18mm	58.40	5.42	1.18	45.3
600µm	89.20	5.43	0.60	39.8
300µm	117.70	5.03	0.30	34.8
150µm	143.90	4.62	0.15	30.2
75µm	175.10	5.50	0.08	24.7

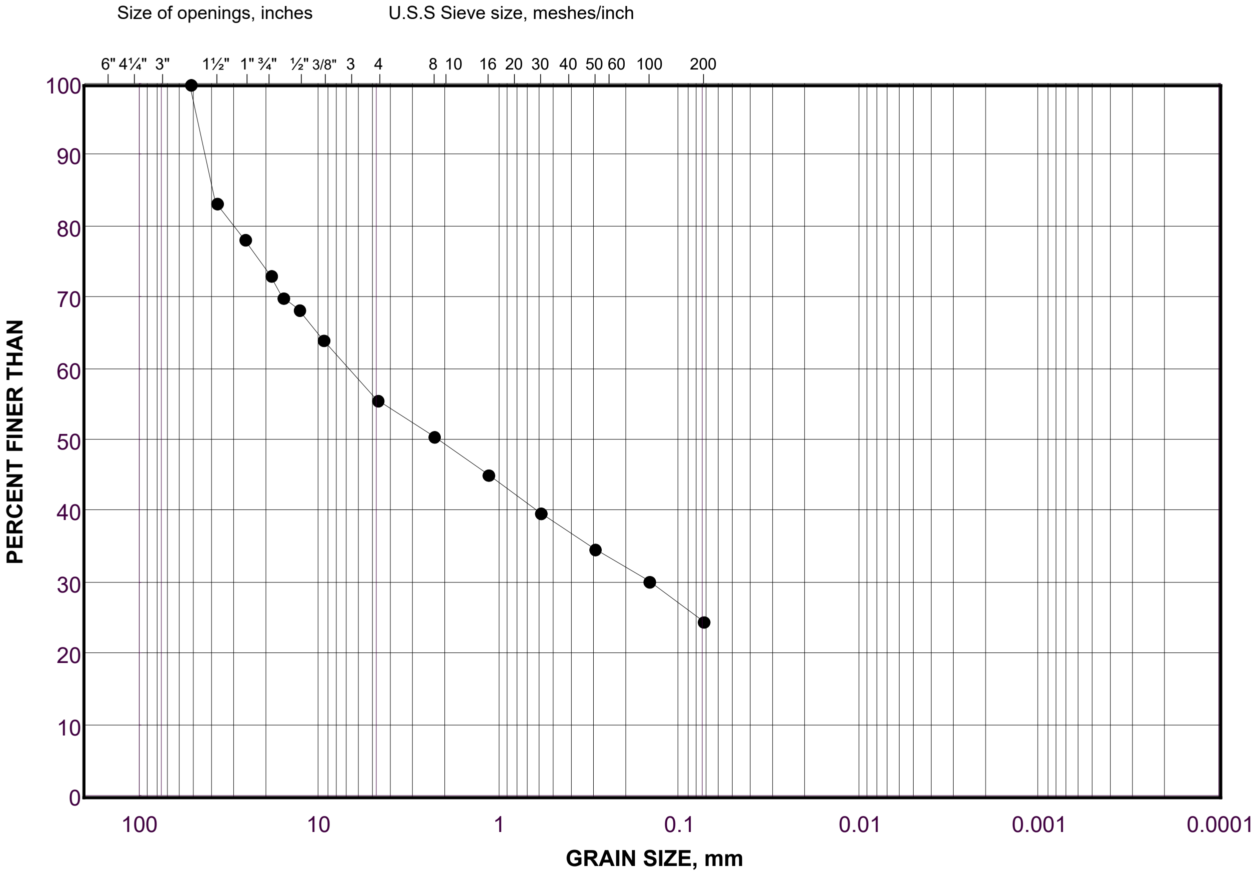
Project Number	21476582	Depth	8
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 1:22:32 PM
Sample Number	3A	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-636

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	3A	8.0 - 9.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 10615(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	274.20	2.58	53.00	97.4
37.5mm	574.70	2.83	37.50	94.6
26.5mm	902.40	3.09	26.50	91.5
19.0mm	1381.30	4.51	19.00	87.0
16mm	1603.70	2.10	16.00	84.9
13.2mm	1776.60	1.63	13.20	83.3
9.5mm	2152.20	3.54	9.50	79.7
4.75mm	2985.00	7.85	4.75	71.9
PAN	7607.90	71.87	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	23.90	6.62	2.36	65.3
1.18mm	49.60	7.12	1.18	58.1
600µm	75.20	7.09	0.60	51.0
300µm	98.10	6.34	0.30	44.7
150µm	119.30	5.87	0.15	38.8
75µm	141.80	6.23	0.08	32.6

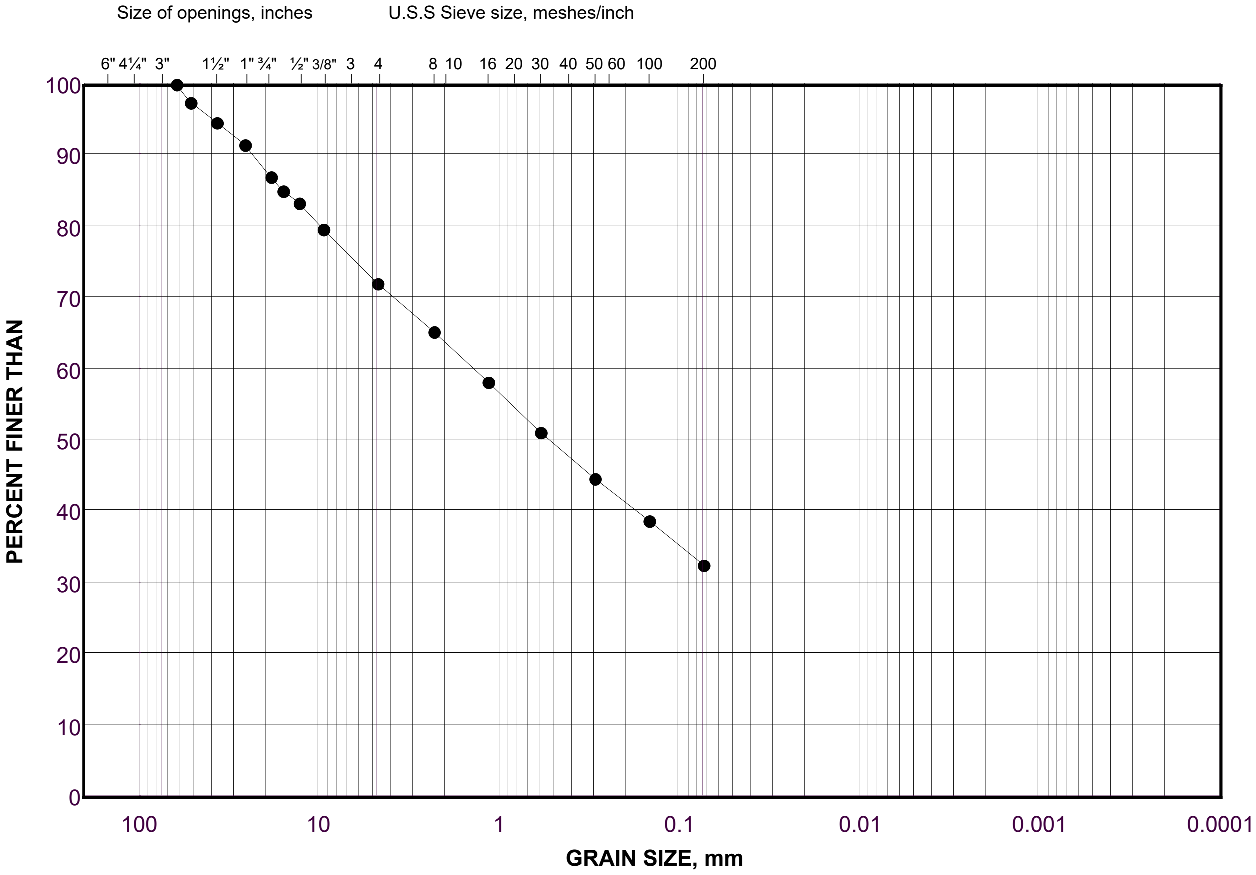
Project Number	21476582	Depth	13
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 1:25:47 PM
Sample Number	3B	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-637

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	3B	9.0 - 13.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14039.4(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	283.00	2.02	53.00	98.0
37.5mm	508.20	1.60	37.50	96.4
26.5mm	1574.70	7.60	26.50	88.8
19.0mm	2252.40	4.83	19.00	84.0
16mm	2583.40	2.36	16.00	81.6
13.2mm	2778.20	1.39	13.20	80.2
9.5mm	3185.20	2.90	9.50	77.3
4.75mm	4316.80	8.06	4.75	69.2
PAN	9722.60	69.24	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	31.60	7.46	2.36	61.8
1.18mm	60.10	6.73	1.18	55.1
600µm	81.70	5.10	0.60	50.0
300µm	104.40	5.36	0.30	44.6
150µm	128.90	5.79	0.15	38.8
75µm	151.70	5.39	0.08	33.4

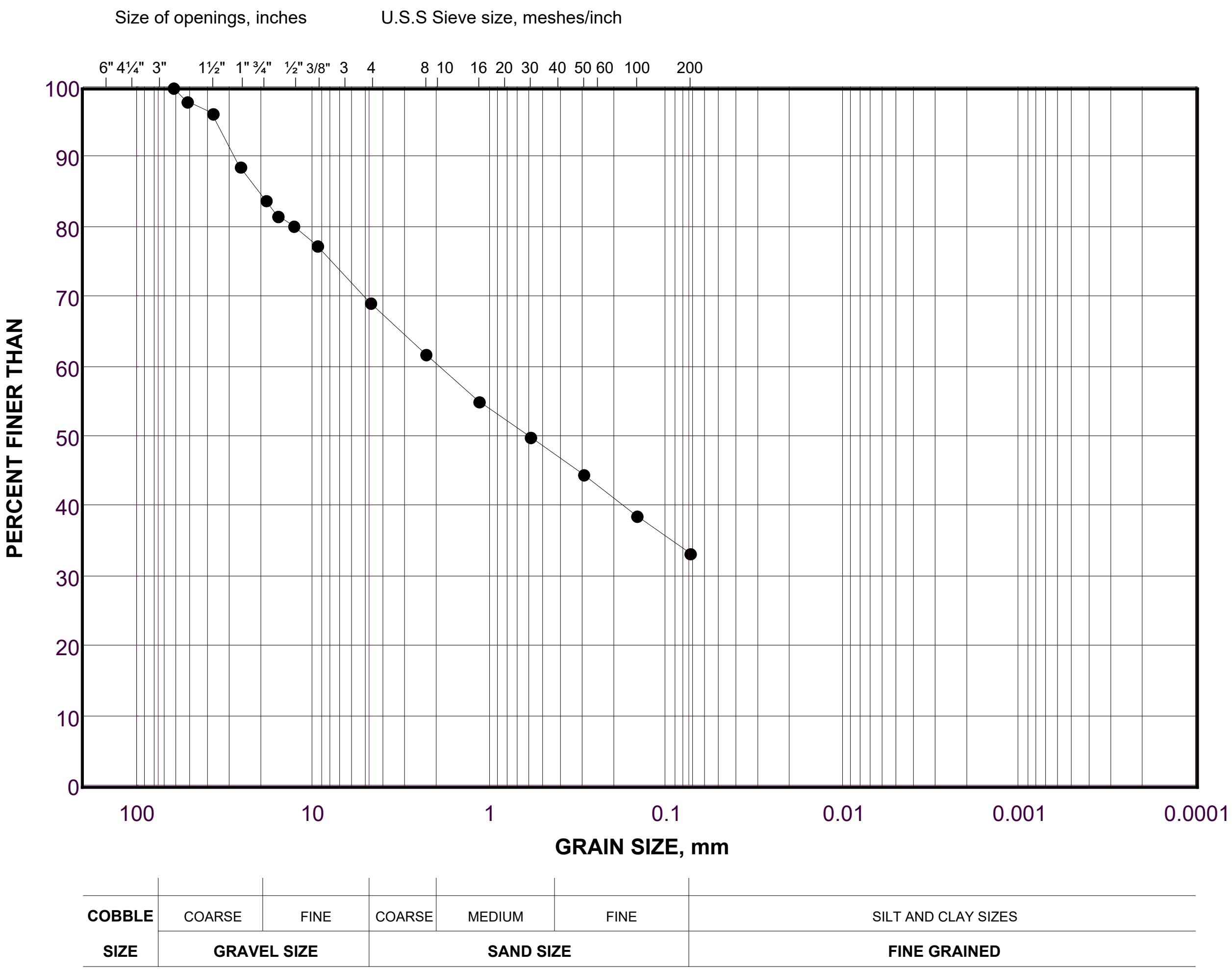
Project Number	21476582	Depth	
Project Task	1000	Units	Metric
Borehole Number	BH 21-04	Testing Date	3/28/22 1:31:00 PM
Sample Number	4	Tested By	Sieve - IC
Checked By	______________________________	LabID	22-563

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 21-04	4	13.0 - 18.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18908.4(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1592.30	8.42	75.00	91.6
63mm	2205.20	3.24	63.00	88.3
53mm	2472.40	1.41	53.00	86.9
37.5mm	2809.80	1.78	37.50	85.2
26.5mm	3221.90	2.18	26.50	83.0
19.0mm	3892.40	3.55	19.00	79.4
16mm	4304.90	2.18	16.00	77.2
13.2mm	4640.60	1.78	13.20	75.5
9.5mm	5304.00	3.51	9.50	72.0
4.75mm	6578.40	6.74	4.75	65.2
PAN	12326.30	65.21	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	30.70	7.54	2.36	57.7
1.18mm	58.10	6.73	1.18	50.9
600µm	82.60	6.02	0.60	44.9
300µm	105.60	5.65	0.30	39.3
150µm	128.20	5.55	0.15	33.7
75µm	149.20	5.16	0.08	28.6

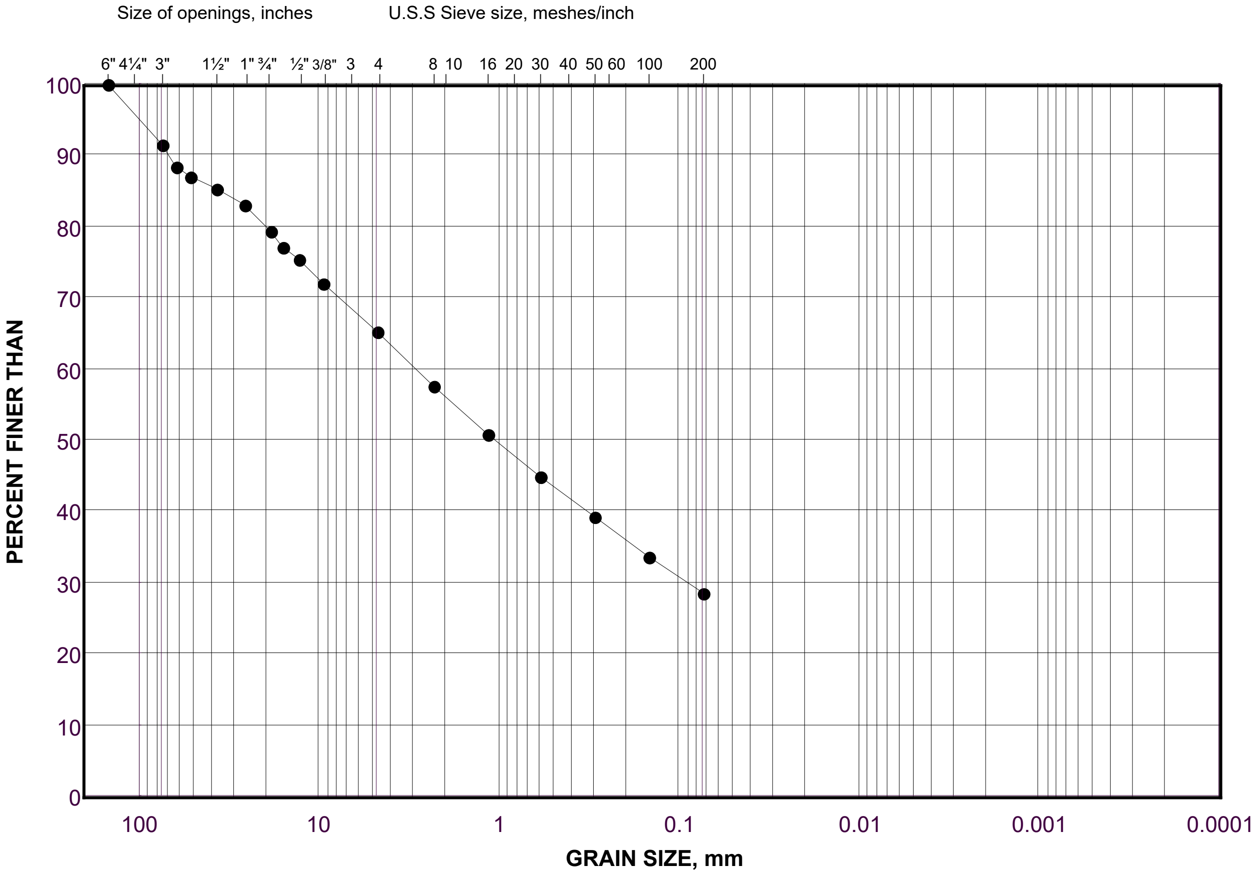
Project Number	21476582	Depth	23
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 1:34:21 PM
Sample Number	5	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-638

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	5	18.0 - 23.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14971(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1064.00	7.11	75.00	92.9
63mm	1542.00	3.19	63.00	89.7
53mm	1542.00	0.00	53.00	89.7
37.5mm	2516.00	6.51	37.50	83.2
26.5mm	3786.00	8.48	26.50	74.7
19.0mm	4434.00	4.33	19.00	70.4
16mm	4736.00	2.02	16.00	68.4
13.2mm	5120.00	2.56	13.20	65.8
9.5mm	5770.00	4.34	9.50	61.5
4.75mm	6806.00	6.92	4.75	54.5
PAN	8165.00	54.54	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	39.11	6.37	2.36	48.2
1.18mm	77.17	6.20	1.18	42.0
600µm	114.45	6.08	0.60	35.9
300µm	149.15	5.66	0.30	30.2
150µm	181.27	5.24	0.15	25.0
75µm	209.98	4.68	0.08	20.3

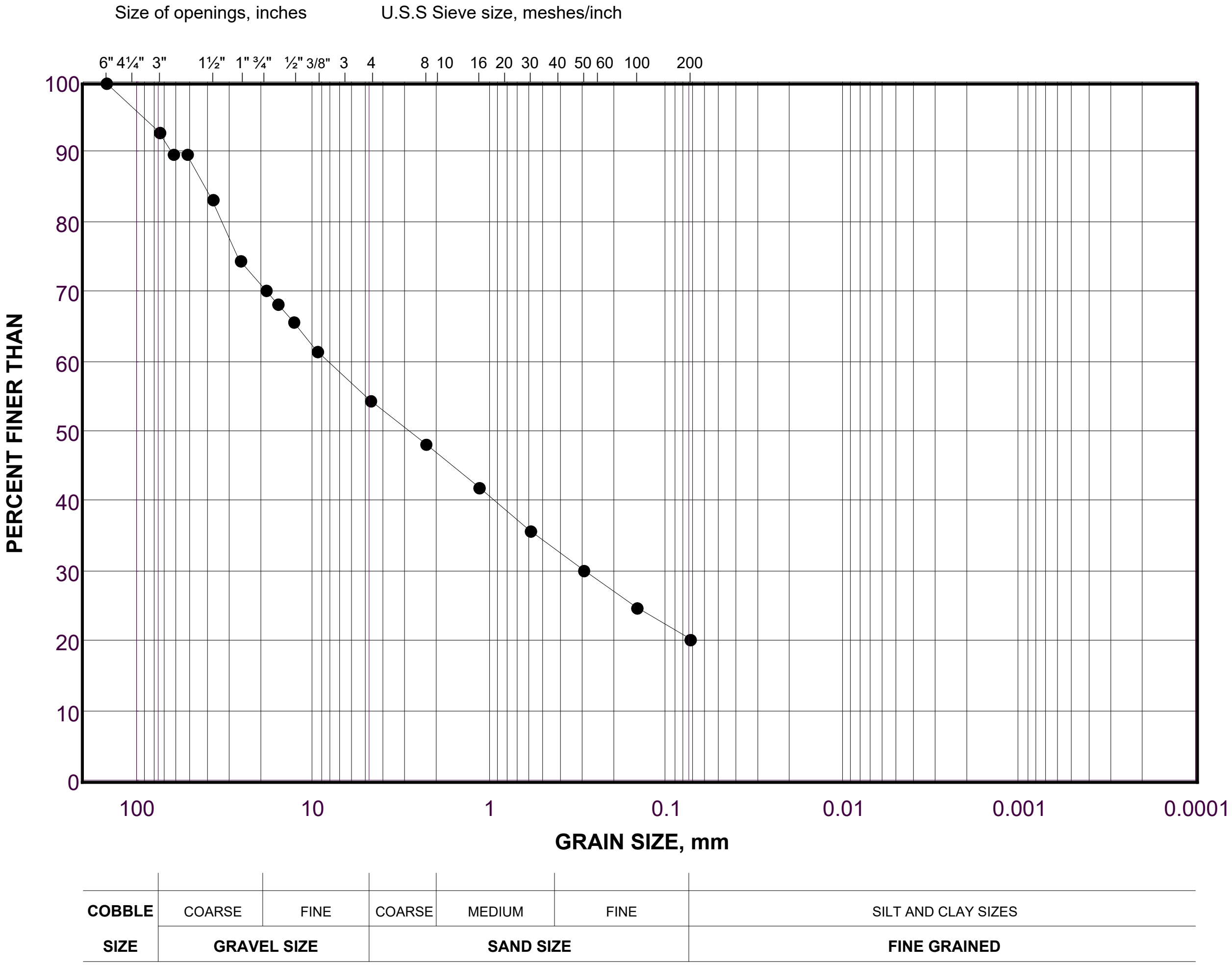
Project Number	21476582	Depth	28
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 1:38:28 PM
Sample Number	6	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-608

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	6	23.0 - 28.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13603.1(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1678.00	12.34	75.00	87.7
63mm	1678.00	0.00	63.00	87.7
53mm	1678.00	0.00	53.00	87.7
37.5mm	2448.80	5.67	37.50	82.0
26.5mm	3025.80	4.24	26.50	77.8
19.0mm	3428.60	2.96	19.00	74.8
16mm	3770.00	2.51	16.00	72.3
13.2mm	4055.60	2.10	13.20	70.2
9.5mm	4708.70	4.80	9.50	65.4
4.75mm	5860.90	8.47	4.75	56.9
PAN	7702.30	56.91	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	43.40	9.25	2.36	47.7
1.18mm	83.80	8.61	1.18	39.1
600µm	118.10	7.31	0.60	31.7
300µm	144.80	5.69	0.30	26.1
150µm	163.80	4.05	0.15	22.0
75µm	182.70	4.03	0.08	18.0

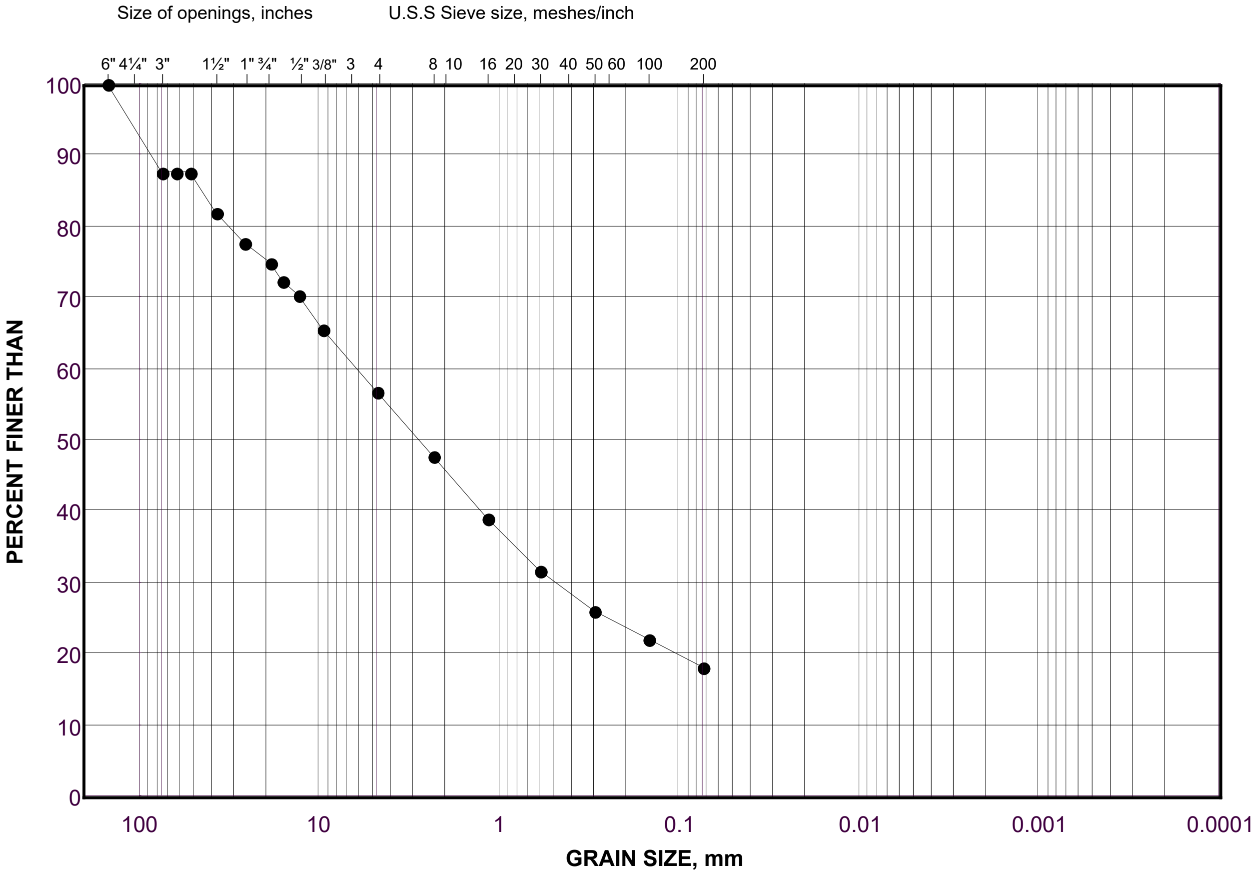
Project Number	21476582	Depth	43
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/07/22 1:06:47 PM
Sample Number	9	Tested By	Sieve - lb
Checked By	______________________________	LabID	22-428

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	9	38.0 - 43.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13996.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	1599.70	11.43	63.00	88.6
53mm	1599.70	0.00	53.00	88.6
37.5mm	2382.90	5.60	37.50	83.0
26.5mm	3947.10	11.18	26.50	71.8
19.0mm	4960.00	7.24	19.00	64.6
16mm	386.70	-32.67	16.00	97.2
13.2mm	5792.50	38.62	13.20	58.6
9.5mm	6534.40	5.30	9.50	53.3
4.75mm	7938.60	10.03	4.75	43.3
PAN	6031.60	43.27	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	56.90	8.63	2.36	34.6
1.18mm	101.00	6.69	1.18	28.0
600µm	140.30	5.96	0.60	22.0
300µm	174.40	5.17	0.30	16.8
150µm	207.70	5.05	0.15	11.8
75µm	232.90	3.82	0.08	8.0

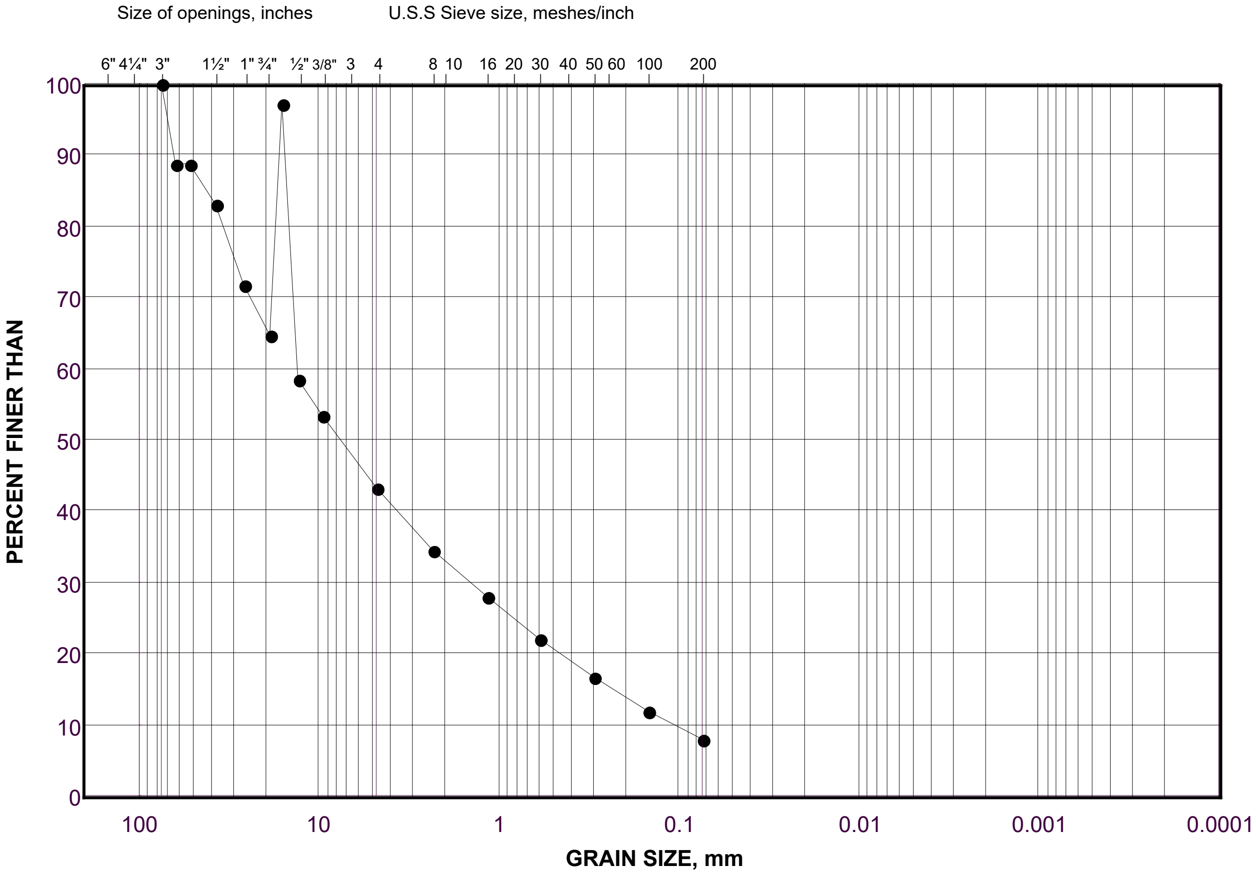
Project Number	21476582	Depth	48
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 1:55:49 PM
Sample Number	10	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-571

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	10	43.0 - 48.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14993.3(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	638.50	4.26	63.00	95.7
53mm	1023.10	2.57	53.00	93.2
37.5mm	2382.80	9.07	37.50	84.1
26.5mm	3130.00	4.98	26.50	79.1
19.0mm	3958.10	5.52	19.00	73.6
16mm	4470.10	3.41	16.00	70.2
13.2mm	4836.60	2.44	13.20	67.8
9.5mm	5708.10	5.81	9.50	61.9
4.75mm	7124.60	9.45	4.75	52.5
PAN	7847.20	52.49	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	24.80	4.96	2.36	47.5
1.18mm	53.00	5.64	1.18	41.9
600µm	78.50	5.10	0.60	36.8
300µm	101.60	4.62	0.30	32.2
150µm	122.90	4.26	0.15	27.9
75µm	143.10	4.04	0.08	23.9

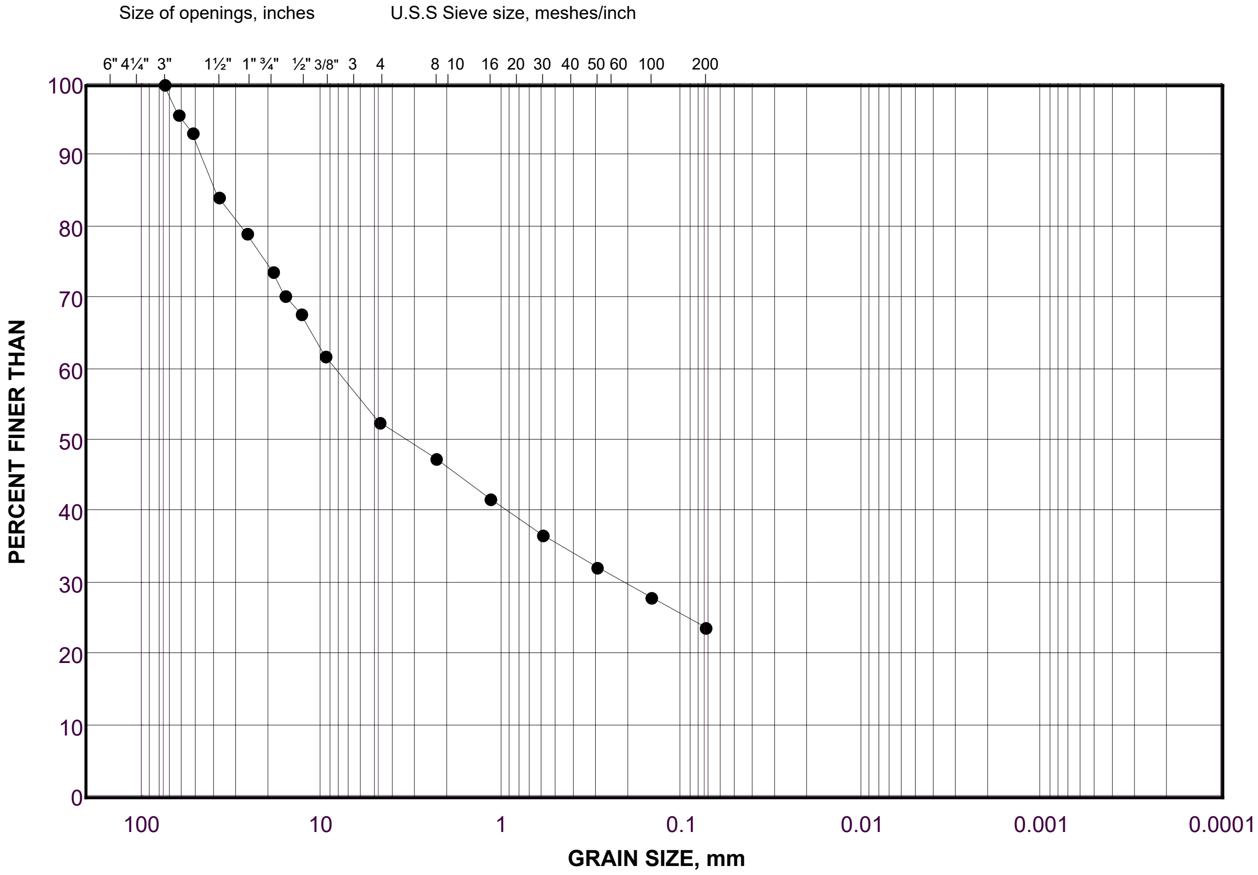
Project Number	21476582	Depth	53
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 1:58:55 PM
Sample Number	11	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-639

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	11	48.0 - 53.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13664.4(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	0.00	0.00	37.50	100.0
26.5mm	314.30	2.30	26.50	97.7
19.0mm	946.90	4.63	19.00	93.1
16mm	1178.30	1.69	16.00	91.4
13.2mm	1445.10	1.95	13.20	89.4
9.5mm	2114.40	4.90	9.50	84.5
4.75mm	3263.80	8.41	4.75	76.1
PAN	10390.70	76.12	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	27.90	7.06	2.36	69.1
1.18mm	57.40	7.46	1.18	61.6
600µm	87.10	7.51	0.60	54.1
300µm	125.30	9.66	0.30	44.4
150µm	171.00	11.56	0.15	32.9
75µm	213.90	10.85	0.08	22.0

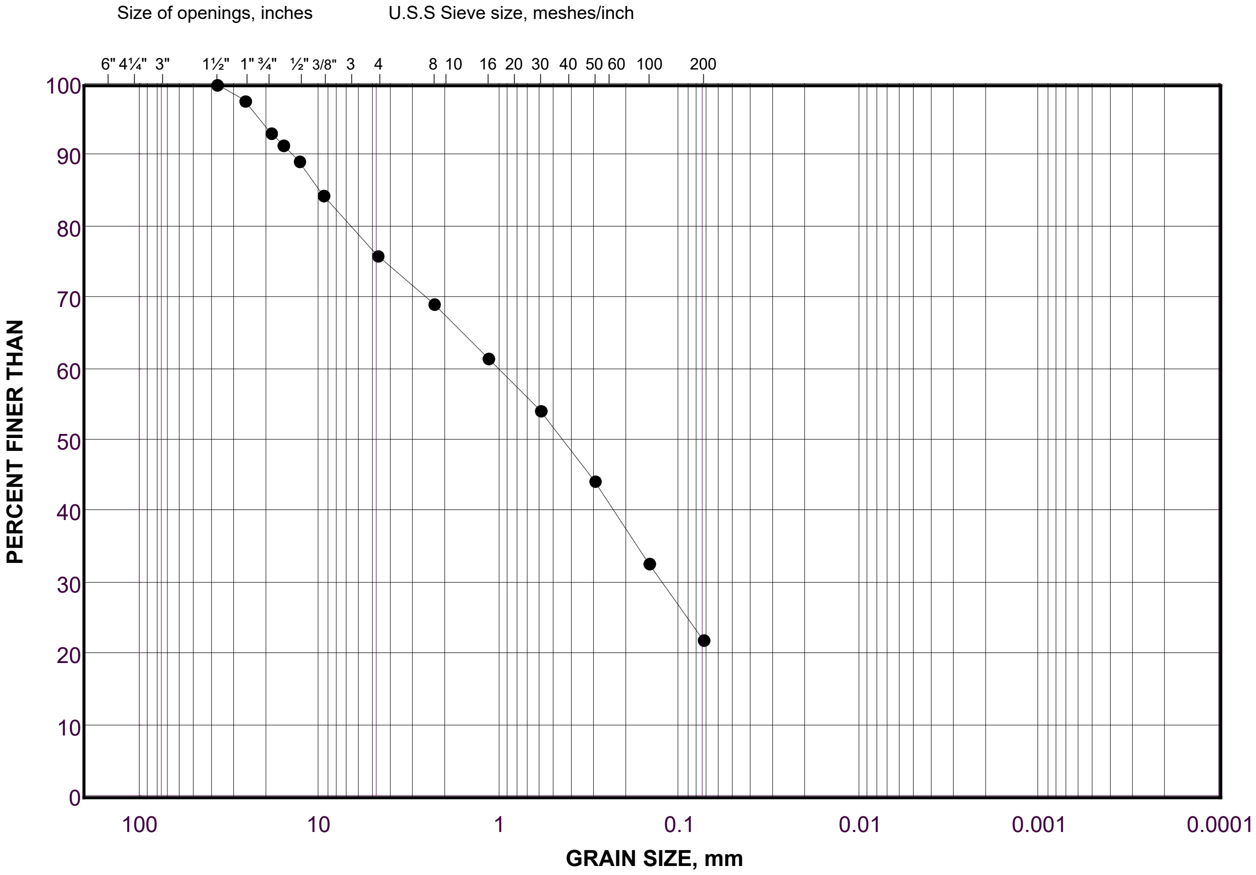
Project Number	21476582	Depth	57
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 2:01:59 PM
Sample Number	12A	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-640

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	12A	53.0 - 57.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 4285.7(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	475.60	11.10	37.50	88.9
26.5mm	692.50	5.06	26.50	83.8
19.0mm	881.90	4.42	19.00	79.4
16mm	905.00	0.54	16.00	78.9
13.2mm	926.20	0.49	13.20	78.4
9.5mm	1123.70	4.61	9.50	73.8
4.75mm	1448.30	7.57	4.75	66.2
PAN	2837.40	66.21	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	28.40	7.06	2.36	59.2
1.18mm	56.40	6.96	1.18	52.2
600µm	80.10	5.89	0.60	46.3
300µm	109.90	7.41	0.30	38.9
150µm	141.70	7.90	0.15	31.0
75µm	176.30	8.60	0.08	22.4

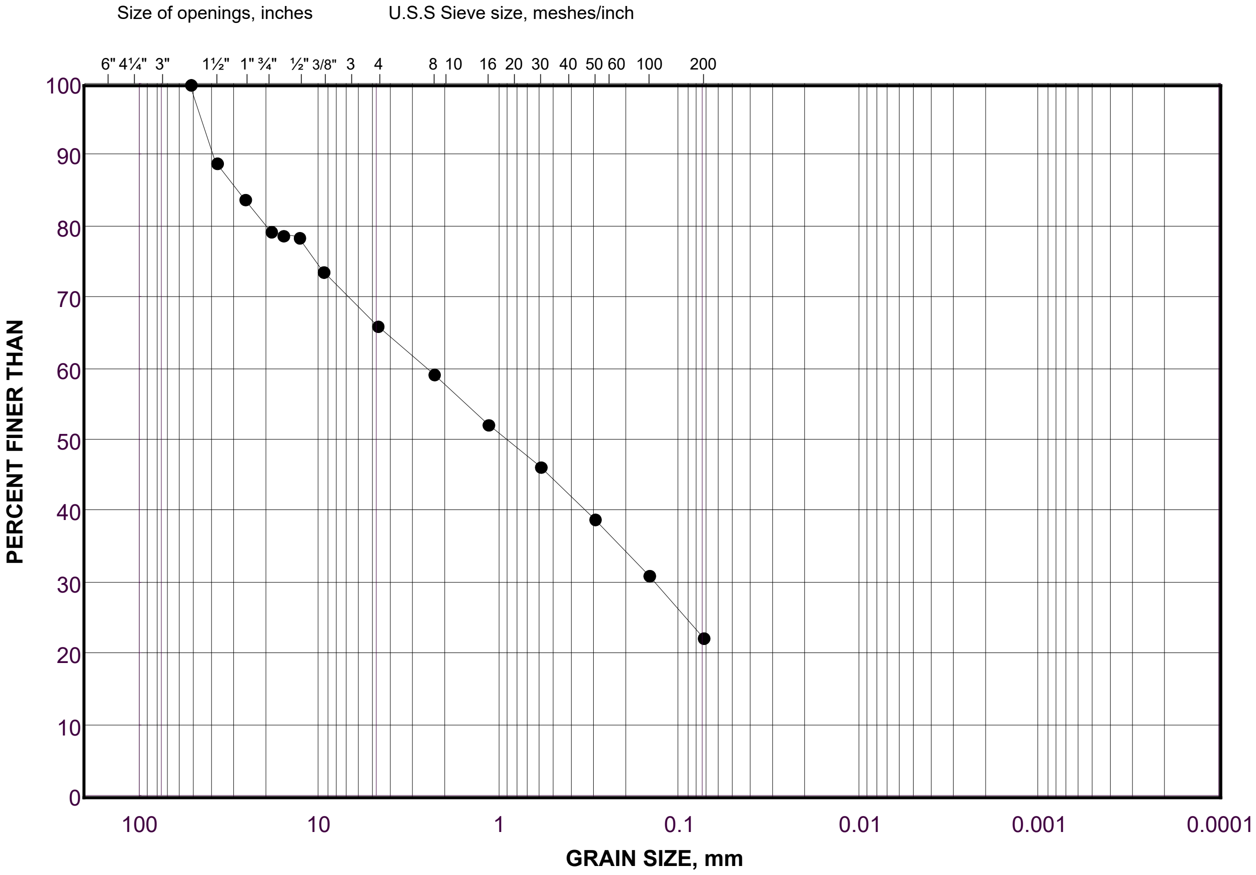
Project Number	21476582	Depth	58
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 2:05:20 PM
Sample Number	12B	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-641

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	12B	57.0 - 58.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 12919.8(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	527.50	4.08	53.00	95.9
37.5mm	1493.00	7.47	37.50	88.5
26.5mm	2040.00	4.23	26.50	84.2
19.0mm	2700.60	5.11	19.00	79.1
16mm	3218.70	4.01	16.00	75.1
13.2mm	3637.70	3.24	13.20	71.9
9.5mm	4632.40	7.70	9.50	64.2
4.75mm	6279.30	12.75	4.75	51.4
PAN	6616.20	51.41	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	69.30	12.14	2.36	39.3
1.18mm	128.00	10.29	1.18	29.0
600µm	177.70	8.71	0.60	20.3
300µm	217.20	6.92	0.30	13.4
150µm	241.50	4.26	0.15	9.1
75µm	256.30	2.59	0.08	6.5

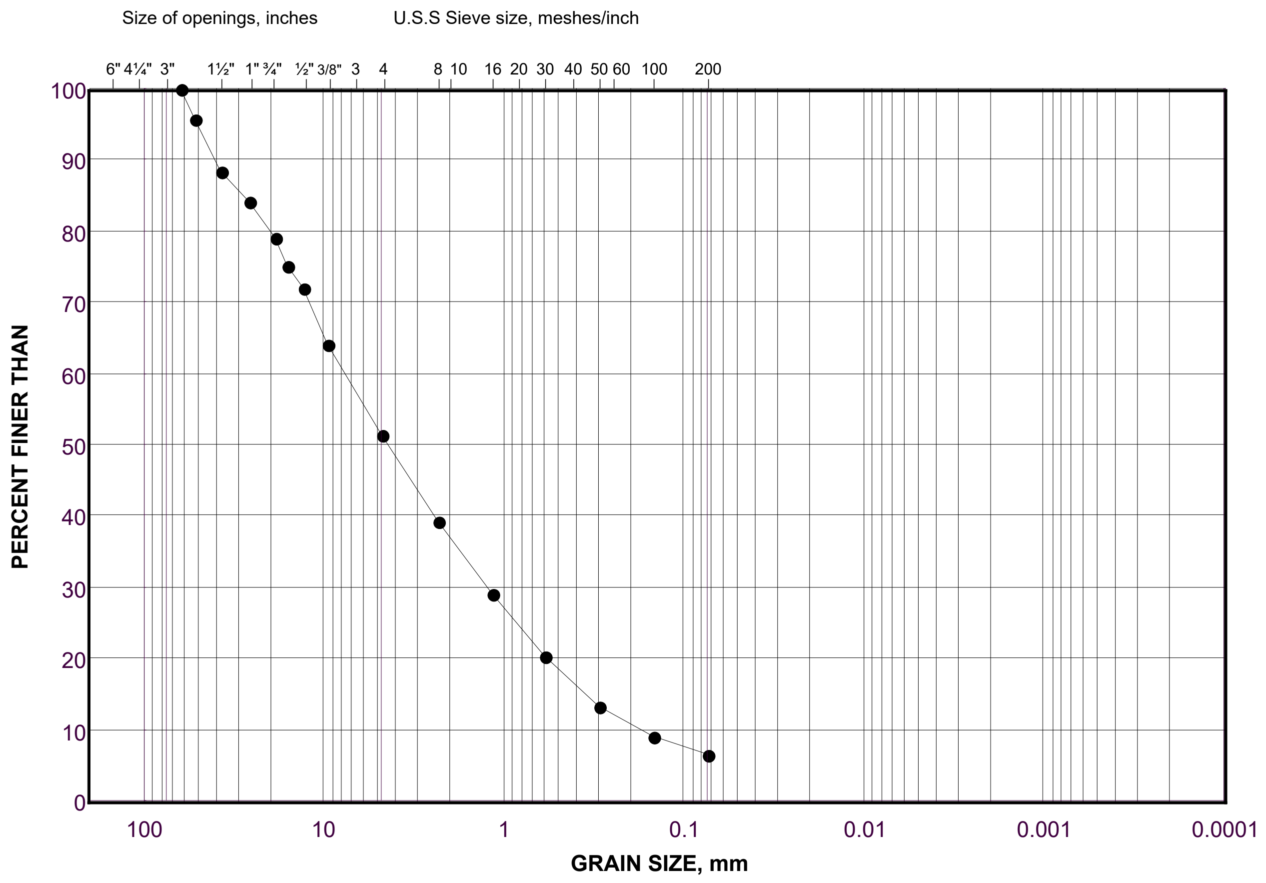
Project Number	21476582	Depth	63
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/07/22 1:10:06 PM
Sample Number	13	Tested By	Sieve -
Checked By	______________________________	LabID	22-429

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	13	58.0 - 63.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15336.7(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	544.40	3.55	63.00	96.5
53mm	2822.40	14.85	53.00	81.6
37.5mm	4383.40	10.18	37.50	71.4
26.5mm	5663.90	8.35	26.50	63.1
19.0mm	6776.20	7.25	19.00	55.8
16mm	7318.60	3.54	16.00	52.3
13.2mm	7750.60	2.82	13.20	49.5
9.5mm	8785.90	6.75	9.50	42.7
4.75mm	9757.30	6.33	4.75	36.4
PAN	5559.70	36.38	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	45.30	5.44	2.36	30.9
1.18mm	91.10	5.50	1.18	25.4
600µm	150.50	7.13	0.60	18.3
300µm	208.90	7.01	0.30	11.3
150µm	241.60	3.92	0.15	7.4
75µm	261.20	2.35	0.08	5.0

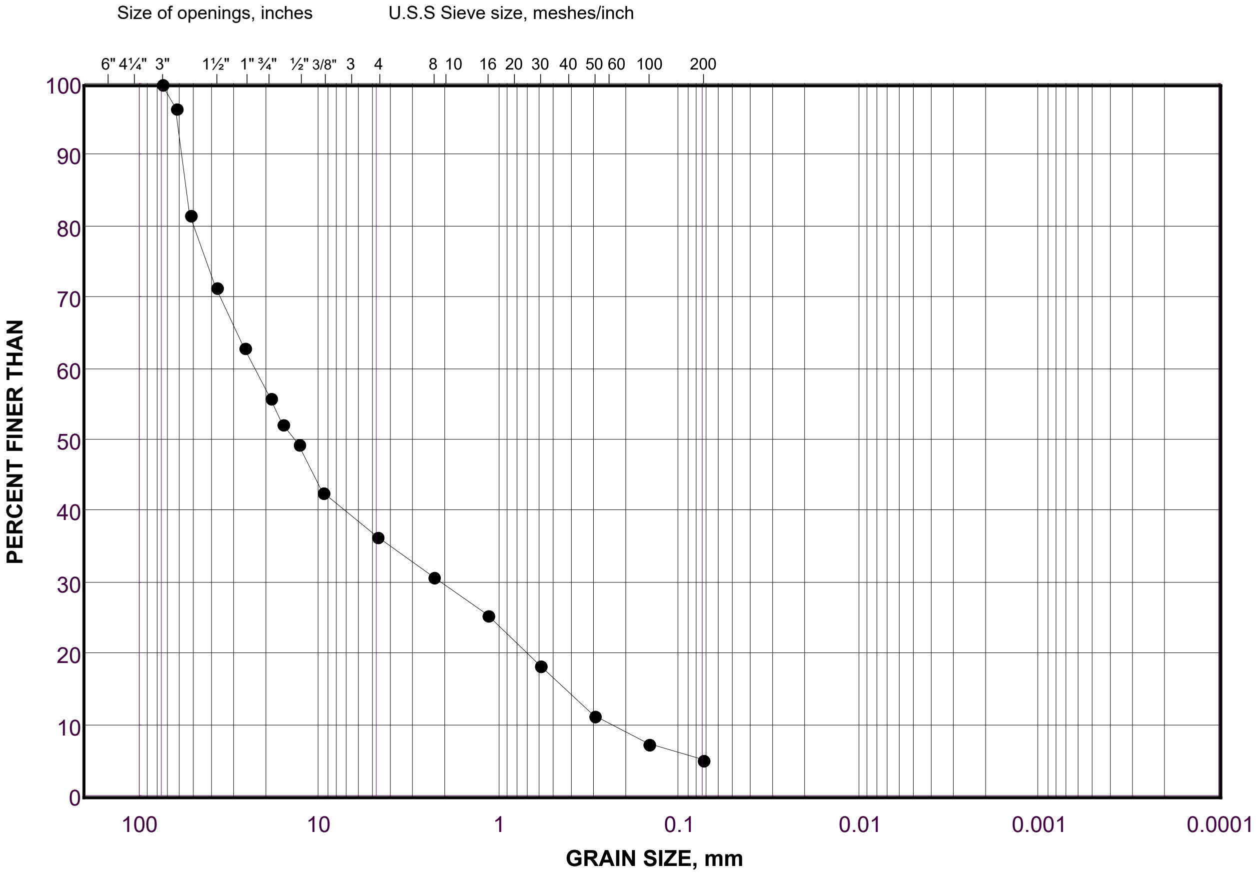
Project Number	21476582	Depth	88
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/28/22 2:15:10 PM
Sample Number	18	Tested By	Sieve - AM
Checked By	____________________	LabID	22-642

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	18	83.0 - 88.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16706(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	614.50	3.68	75.00	96.3
63mm	2614.50	11.97	63.00	84.4
53mm	2876.50	1.57	53.00	82.8
37.5mm	5622.90	16.44	37.50	66.3
26.5mm	6722.00	6.58	26.50	59.8
19.0mm	8533.60	10.84	19.00	48.9
16mm	9140.10	3.63	16.00	45.3
13.2mm	9750.40	3.65	13.20	41.6
9.5mm	10933.20	7.08	9.50	34.6
4.75mm	13486.70	15.28	4.75	19.3
PAN	3219.80	19.28	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	48.50	3.71	2.36	15.6
1.18mm	90.80	3.24	1.18	12.3
600µm	122.00	2.39	0.60	9.9
300µm	144.40	1.72	0.30	8.2
150µm	170.10	1.97	0.15	6.3
75µm	189.70	1.50	0.08	4.8

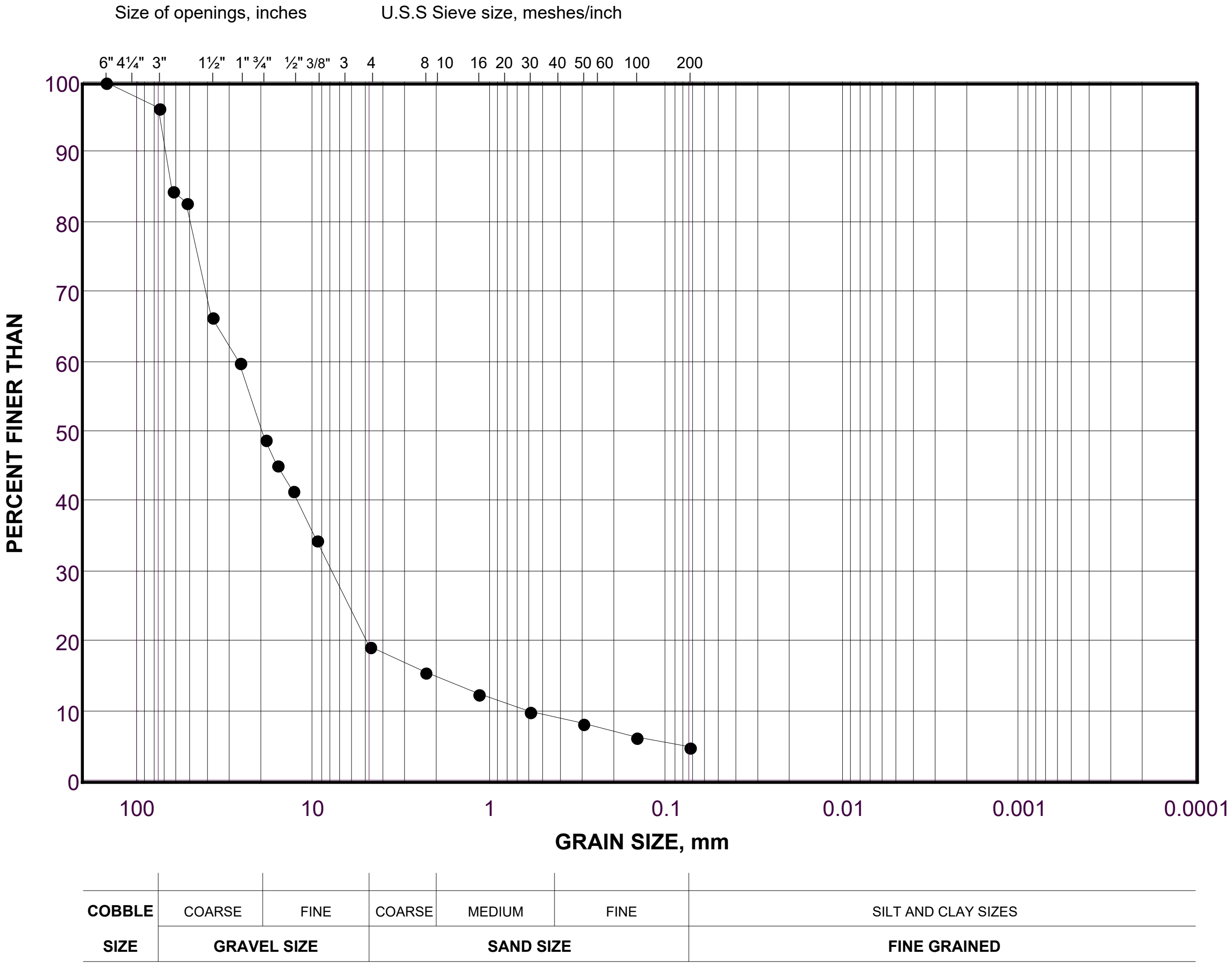
Project Number	21476582	Depth	93
Project Task	1000	Units	Imperial
Borehole Number	BH 21-04	Testing Date	3/07/22 1:55:50 PM
Sample Number	19	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-430

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	BH 21-04	19	88.0 - 93.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 3077.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	0.00	0.00	37.50	100.0
26.5mm	240.20	7.80	26.50	92.2
19.0mm	370.90	4.25	19.00	88.0
16mm	470.30	3.23	16.00	84.7
13.2mm	571.30	3.28	13.20	81.4
9.5mm	571.30	0.00	9.50	81.4
4.75mm	731.20	5.20	4.75	76.2
PAN	2341.80	76.24	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	9.70	2.67	2.36	73.6
1.18mm	20.60	3.01	1.18	70.6
600µm	35.40	4.08	0.60	66.5
300µm	60.20	6.84	0.30	59.6
150µm	100.80	11.19	0.15	48.5
75µm	146.40	12.57	0.08	35.9

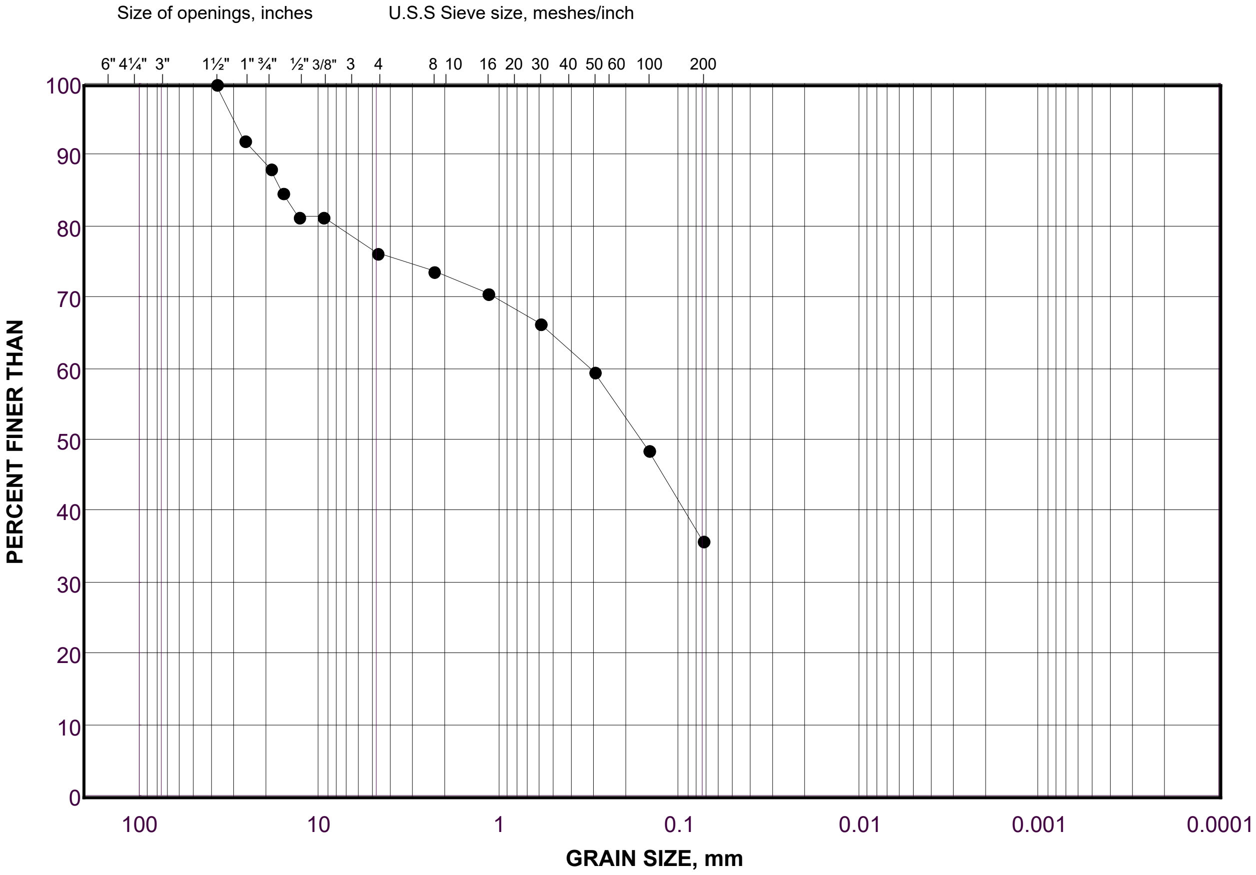
Project Number	21476582	Depth	1.5
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 2:45:39 PM
Sample Number	1A	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-643

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	1A	0.0 - 1.50

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 3698.2(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
37.5mm	0.00	0.00	37.50	100.0
26.5mm	138.40	3.74	26.50	96.3
19.0mm	184.40	1.24	19.00	95.0
16mm	254.50	1.90	16.00	93.1
13.2mm	261.10	0.18	13.20	92.9
9.5mm	320.90	1.62	9.50	91.3
4.75mm	404.70	2.27	4.75	89.1
PAN	3286.40	89.05	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	10.10	2.92	2.36	86.1
1.18mm	20.80	3.10	1.18	83.0
600µm	36.40	4.51	0.60	78.5
300µm	70.20	9.78	0.30	68.7
150µm	126.80	16.38	0.15	52.4
75µm	181.70	15.89	0.08	36.5

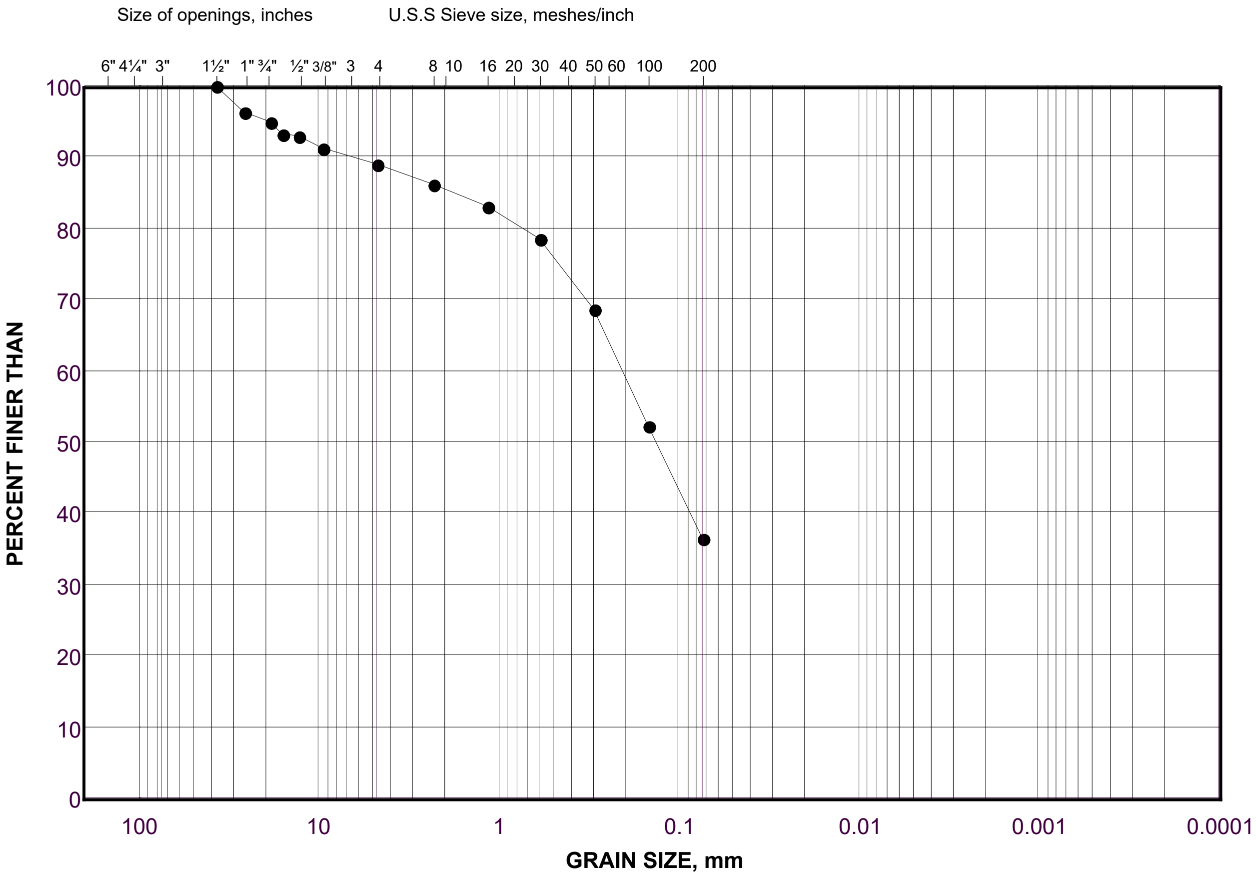
Project Number	21476582	Depth	3
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 2:47:45 PM
Sample Number	1B	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-644

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	1B	1.50 - 3.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17676.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	631.00	3.57	75.00	96.4
63mm	631.00	0.00	63.00	96.4
53mm	1213.20	3.29	53.00	93.1
37.5mm	2374.10	6.57	37.50	86.6
26.5mm	3549.80	6.65	26.50	79.9
19.0mm	4540.30	5.60	19.00	74.3
16mm	5041.30	2.83	16.00	71.5
13.2mm	5495.20	2.57	13.20	68.9
9.5mm	6320.10	4.67	9.50	64.3
4.75mm	7570.60	7.07	4.75	57.2
PAN	10106.30	57.18	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	29.70	5.75	2.36	51.4
1.18mm	60.30	5.92	1.18	45.5
600µm	90.40	5.83	0.60	39.7
300µm	124.10	6.52	0.30	33.2
150µm	158.10	6.58	0.15	26.6
75µm	188.90	5.96	0.08	20.6

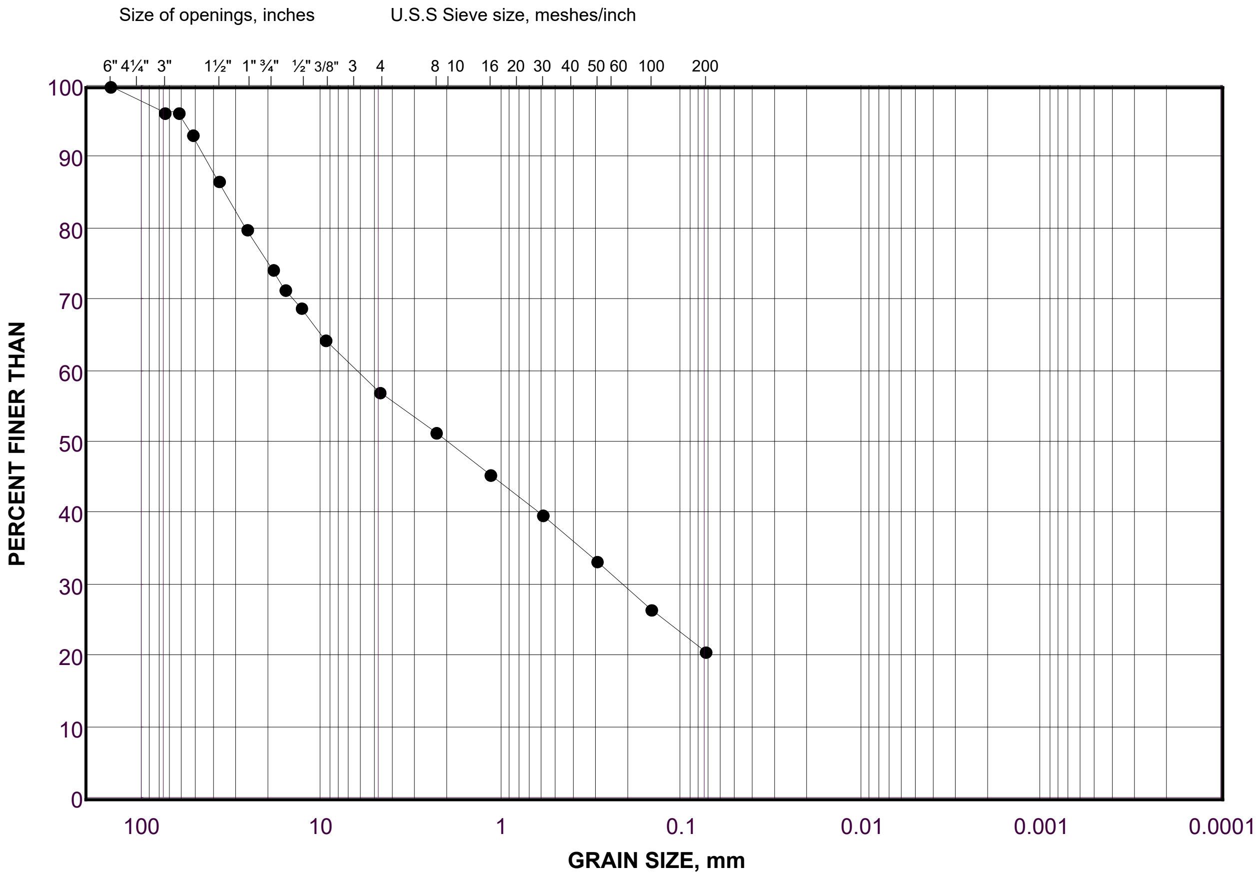
Project Number	21476582	Depth	14
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 2:56:35 PM
Sample Number	3	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-203

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	3	8.0 - 14.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15210(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1972.00	12.97	75.00	87.0
63mm	2622.00	4.27	63.00	82.8
53mm	2622.00	0.00	53.00	82.8
37.5mm	3034.00	2.71	37.50	80.1
26.5mm	3592.00	3.67	26.50	76.4
19.0mm	4136.00	3.58	19.00	72.8
16mm	4386.00	1.64	16.00	71.2
13.2mm	4680.00	1.93	13.20	69.2
9.5mm	5264.00	3.84	9.50	65.4
4.75mm	6362.00	7.22	4.75	58.2
PAN	8848.00	58.17	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	27.81	4.98	2.36	53.2
1.18mm	59.81	5.73	1.18	47.5
600µm	95.11	6.32	0.60	41.1
300µm	134.29	7.02	0.30	34.1
150µm	171.66	6.69	0.15	27.4
75µm	205.34	6.03	0.08	21.4

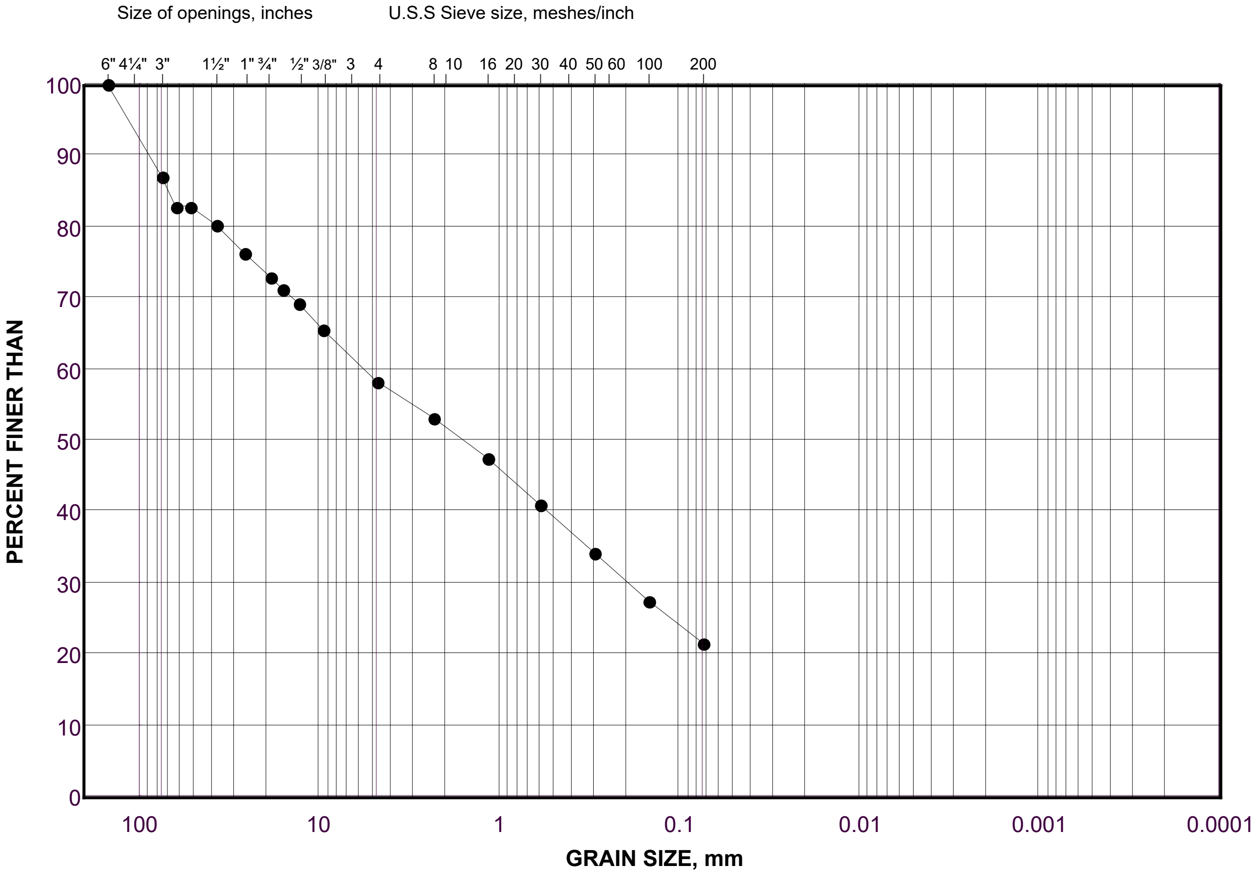
Project Number	21476582	Depth	19
Project Task	1000	Units	Imperial
Borehole Number	MW21-01	Testing Date	3/28/22 3:00:15 PM
Sample Number	4	Tested By	Sieve - JB
Checked By	____________________________	LabID	22-592

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW21-01	4	14.0 - 19.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 8426(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	452.00	5.36	53.00	94.6
37.5mm	452.00	0.00	37.50	94.6
26.5mm	1010.00	6.62	26.50	88.0
19.0mm	1488.00	5.67	19.00	82.4
16mm	1704.00	2.56	16.00	79.8
13.2mm	1878.00	2.07	13.20	77.7
9.5mm	2316.00	5.20	9.50	72.5
4.75mm	2920.00	7.17	4.75	65.4
PAN	5506.00	65.35	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	30.20	5.85	2.36	59.5
1.18mm	69.58	7.63	1.18	51.9
600µm	112.00	8.22	0.60	43.7
300µm	158.24	8.96	0.30	34.7
150µm	199.52	8.00	0.15	26.7
75µm	228.53	5.62	0.08	21.1

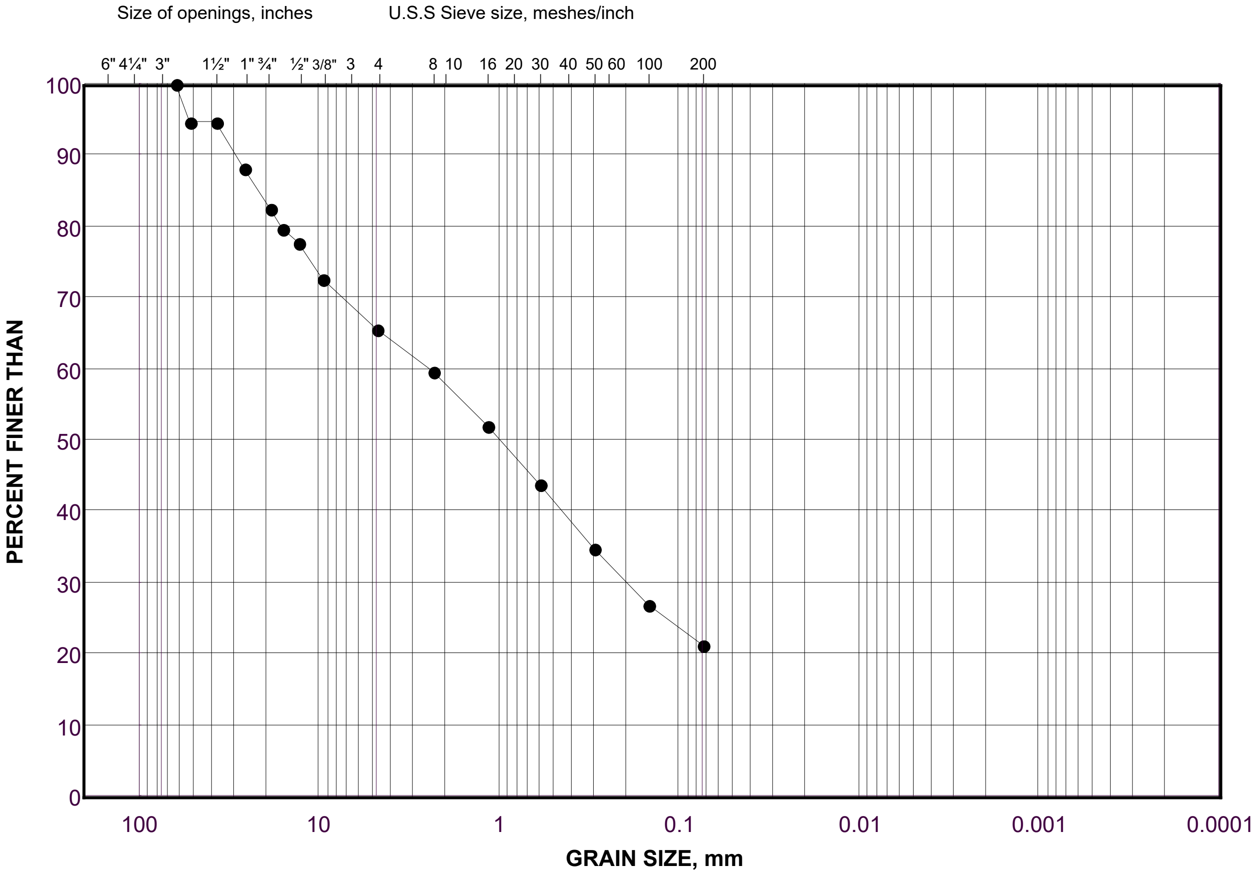
Project Number	21476582	Depth	24
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 3:02:18 PM
Sample Number	5	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-593

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	5	19.0 - 24.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16108.6(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	597.00	3.71	63.00	96.3
53mm	1337.90	4.60	53.00	91.7
37.5mm	1522.20	1.14	37.50	90.6
26.5mm	2781.90	7.82	26.50	82.7
19.0mm	3713.70	5.78	19.00	77.0
16mm	4276.40	3.49	16.00	73.5
13.2mm	4771.10	3.07	13.20	70.4
9.5mm	5776.90	6.24	9.50	64.1
4.75mm	7402.60	10.09	4.75	54.1
PAN	8669.20	54.06	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	38.80	7.96	2.36	46.1
1.18mm	75.70	7.57	1.18	38.5
600µm	104.10	5.83	0.60	32.7
300µm	130.70	5.46	0.30	27.2
150µm	160.50	6.11	0.15	21.1
75µm	194.60	7.00	0.08	14.1

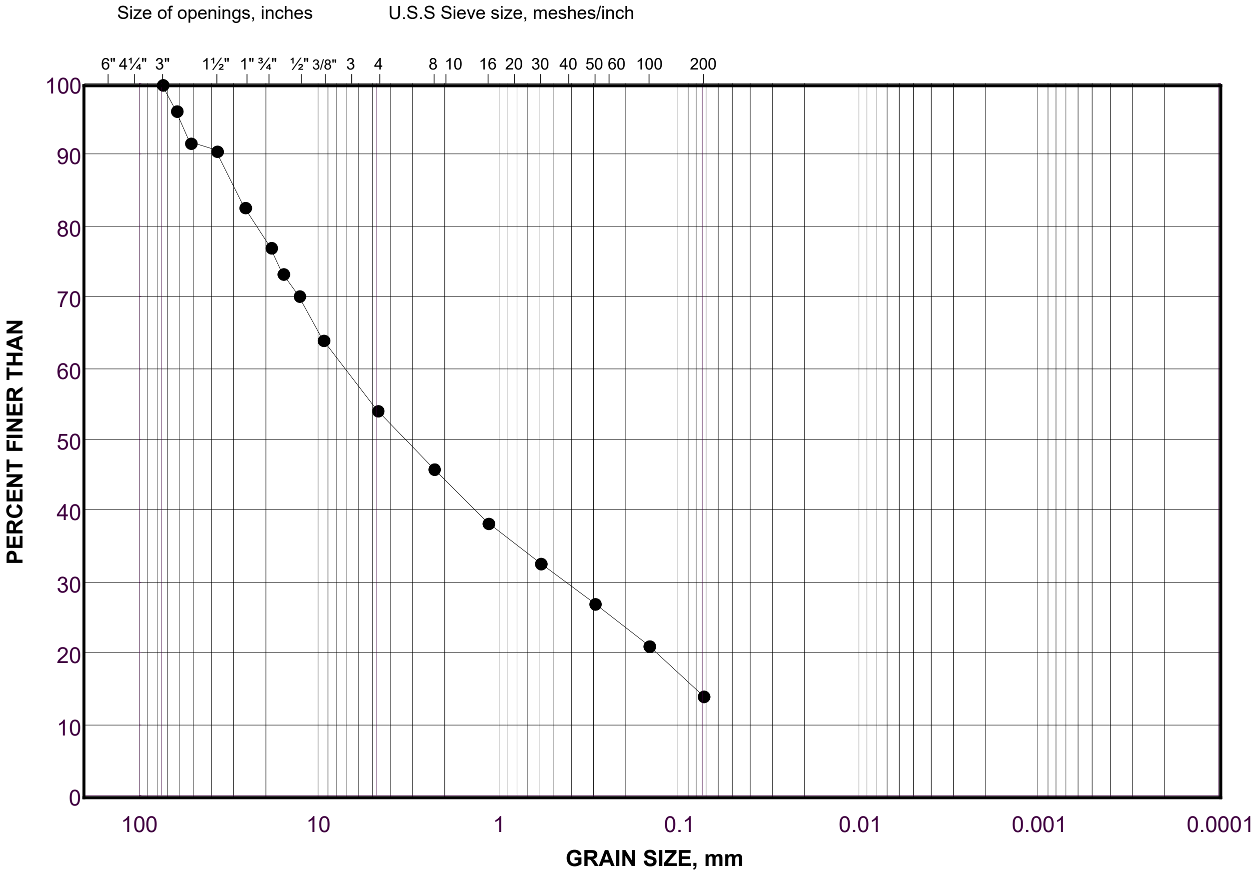
Project Number	21476582	Depth	29
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 3:04:17 PM
Sample Number	6	Tested By	Sieve -
Checked By	______________________________	LabID	22-568

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	6	24.0 - 29.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18388(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	538.00	2.93	63.00	97.1
53mm	538.00	0.00	53.00	97.1
37.5mm	2186.00	8.96	37.50	88.1
26.5mm	3986.00	9.79	26.50	78.3
19.0mm	5282.00	7.05	19.00	71.3
16mm	5876.00	3.23	16.00	68.0
13.2mm	6414.00	2.93	13.20	65.1
9.5mm	7546.00	6.16	9.50	59.0
4.75mm	9436.00	10.28	4.75	48.7
PAN	8952.00	48.67	0.00	0.0

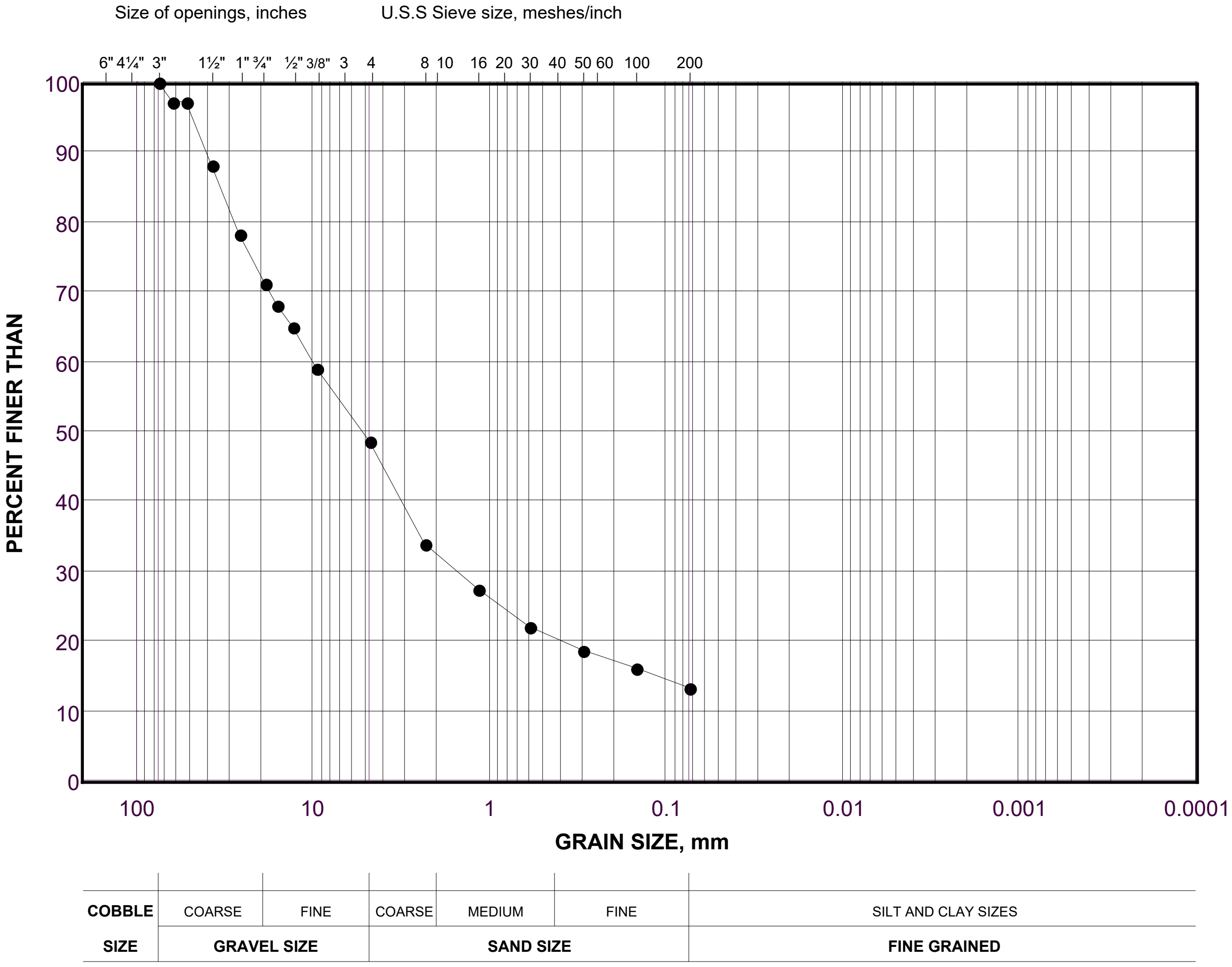
HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	102.99	14.77	2.36	33.9
1.18mm	149.24	6.63	1.18	27.3
600µm	185.31	5.17	0.60	22.1
300µm	209.39	3.45	0.30	18.7
150µm	226.95	2.52	0.15	16.1
75µm	246.10	2.75	0.08	13.4

Project Number	21476582	Depth	34
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 3:08:14 PM
Sample Number	7	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-594

Golder Associates

GRAIN SIZE DISTRIBUTION MTO LS-602	FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	7	29.0 - 34.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16218(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	972.00	5.99	75.00	94.0
63mm	972.00	0.00	63.00	94.0
53mm	972.00	0.00	53.00	94.0
37.5mm	1762.00	4.87	37.50	89.1
26.5mm	2660.00	5.54	26.50	83.6
19.0mm	3336.00	4.17	19.00	79.4
16mm	3606.00	1.66	16.00	77.8
13.2mm	3980.00	2.31	13.20	75.5
9.5mm	4606.00	3.86	9.50	71.6
4.75mm	5860.00	7.73	4.75	63.9
PAN	10358.00	63.87	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	30.46	5.90	2.36	58.0
1.18mm	71.88	8.02	1.18	50.0
600µm	130.02	11.26	0.60	38.7
300µm	180.99	9.87	0.30	28.8
150µm	209.18	5.46	0.15	23.4
75µm	236.65	5.32	0.08	18.0

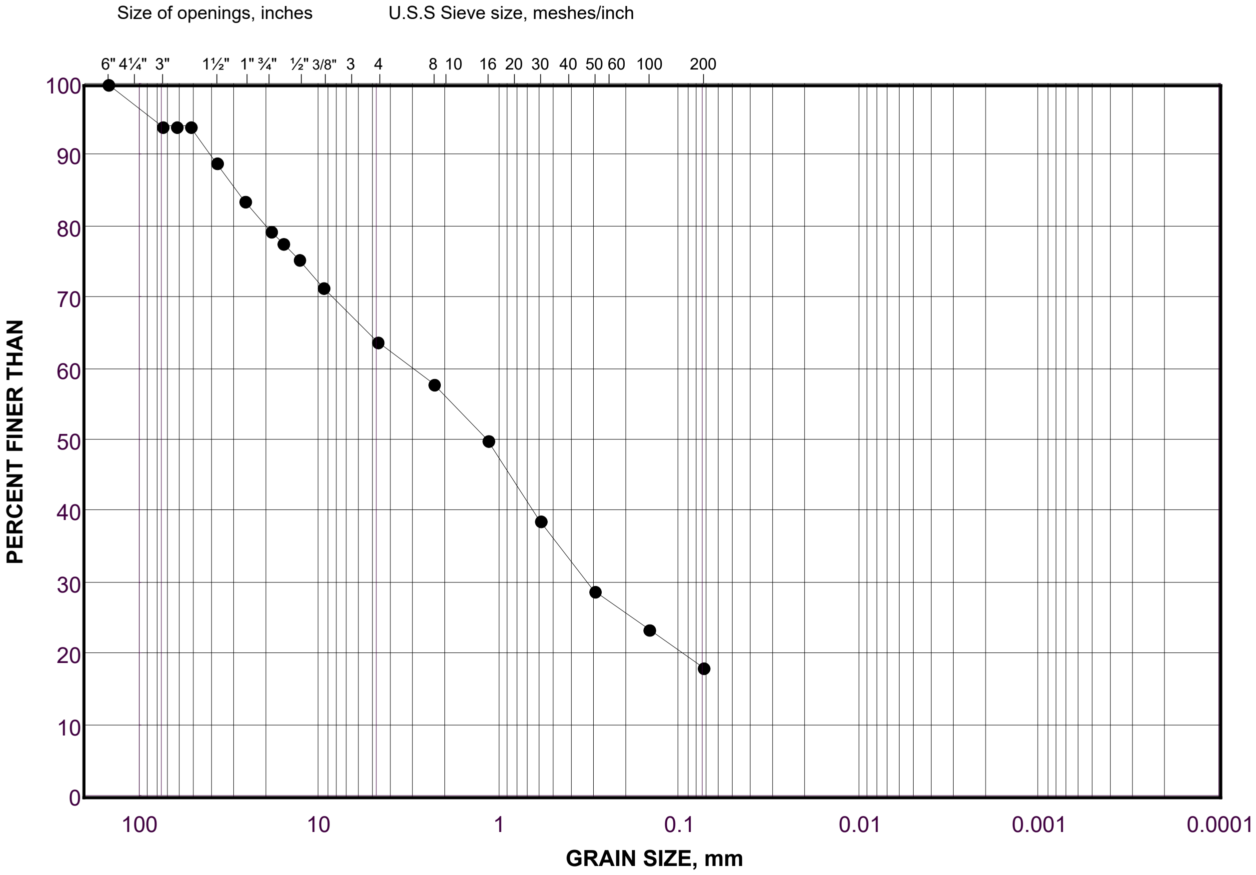
Project Number	21476582	Depth	39
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 3:30:22 PM
Sample Number	8	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-595

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	8	34.0 - 39.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13353(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1833.60	13.73	75.00	86.3
63mm	2274.60	3.30	63.00	83.0
53mm	2274.60	0.00	53.00	83.0
37.5mm	3290.80	7.61	37.50	75.4
26.5mm	4369.70	8.08	26.50	67.3
19.0mm	5140.50	5.77	19.00	61.5
16mm	5473.80	2.50	16.00	59.0
13.2mm	5780.70	2.30	13.20	56.7
9.5mm	6418.90	4.78	9.50	51.9
4.75mm	7523.40	8.27	4.75	43.7
PAN	5814.10	43.66	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	35.50	5.69	2.36	38.0
1.18mm	77.50	6.73	1.18	31.2
600µm	120.90	6.96	0.60	24.3
300µm	151.70	4.94	0.30	19.3
150µm	171.10	3.11	0.15	16.2
75µm	191.50	3.27	0.08	13.0

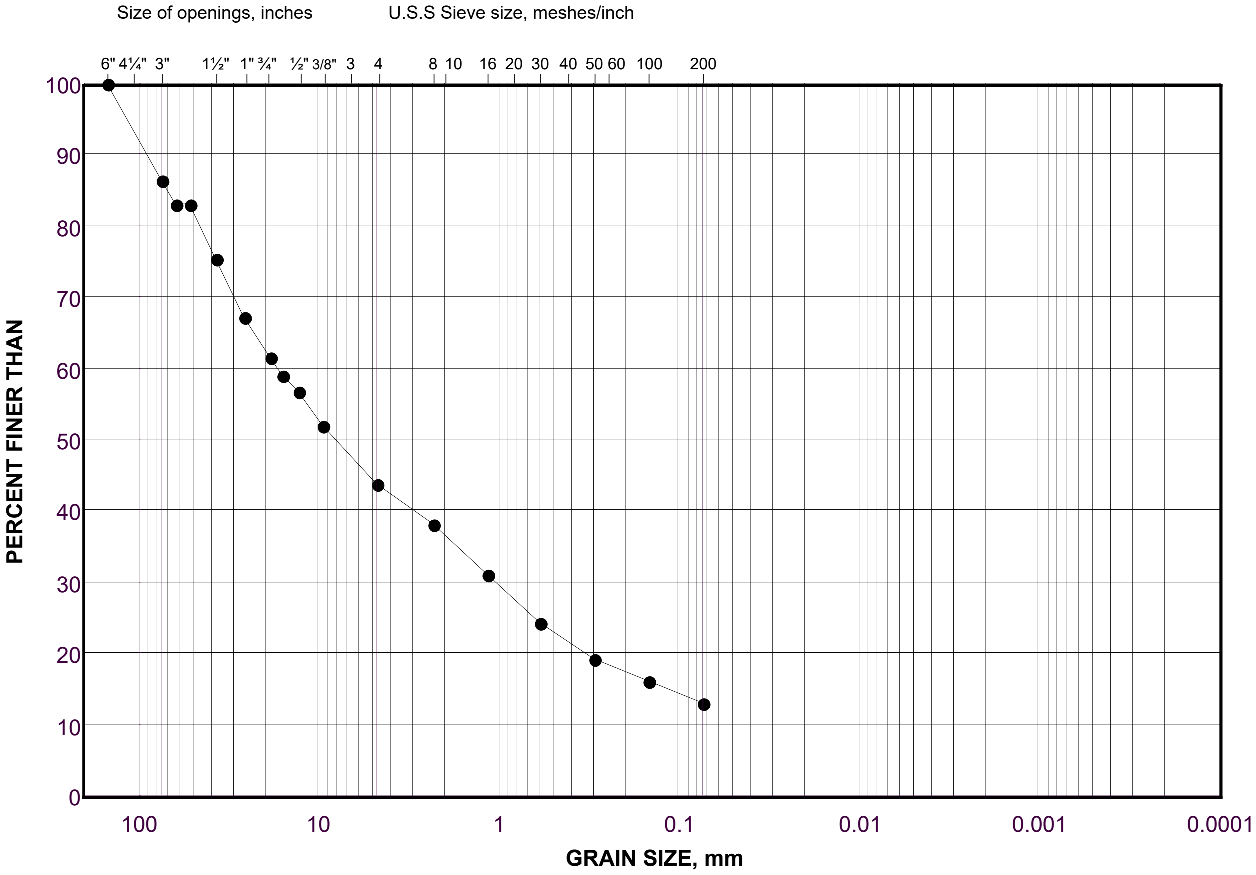
Project Number	21476582	Depth	44
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 3:35:37 PM
Sample Number	9A	Tested By	Sieve - AM
Checked By	______________________	LabID	22-217

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	9A	41.0 - 44.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 6873.2(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
37.5mm	0.00	0.00	37.50	100.0
26.5mm	0.00	0.00	26.50	100.0
19.0mm	131.30	1.91	19.00	98.1
16mm	269.60	2.01	16.00	96.1
13.2mm	360.20	1.32	13.20	94.8
9.5mm	636.00	4.01	9.50	90.8
4.75mm	1297.30	9.62	4.75	81.1
PAN	5565.90	81.13	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	26.60	7.24	2.36	73.9
1.18mm	54.60	7.62	1.18	66.3
600µm	86.10	8.58	0.60	57.7
300µm	118.60	8.85	0.30	48.8
150µm	150.20	8.60	0.15	40.2
75µm	180.00	8.11	0.08	32.1

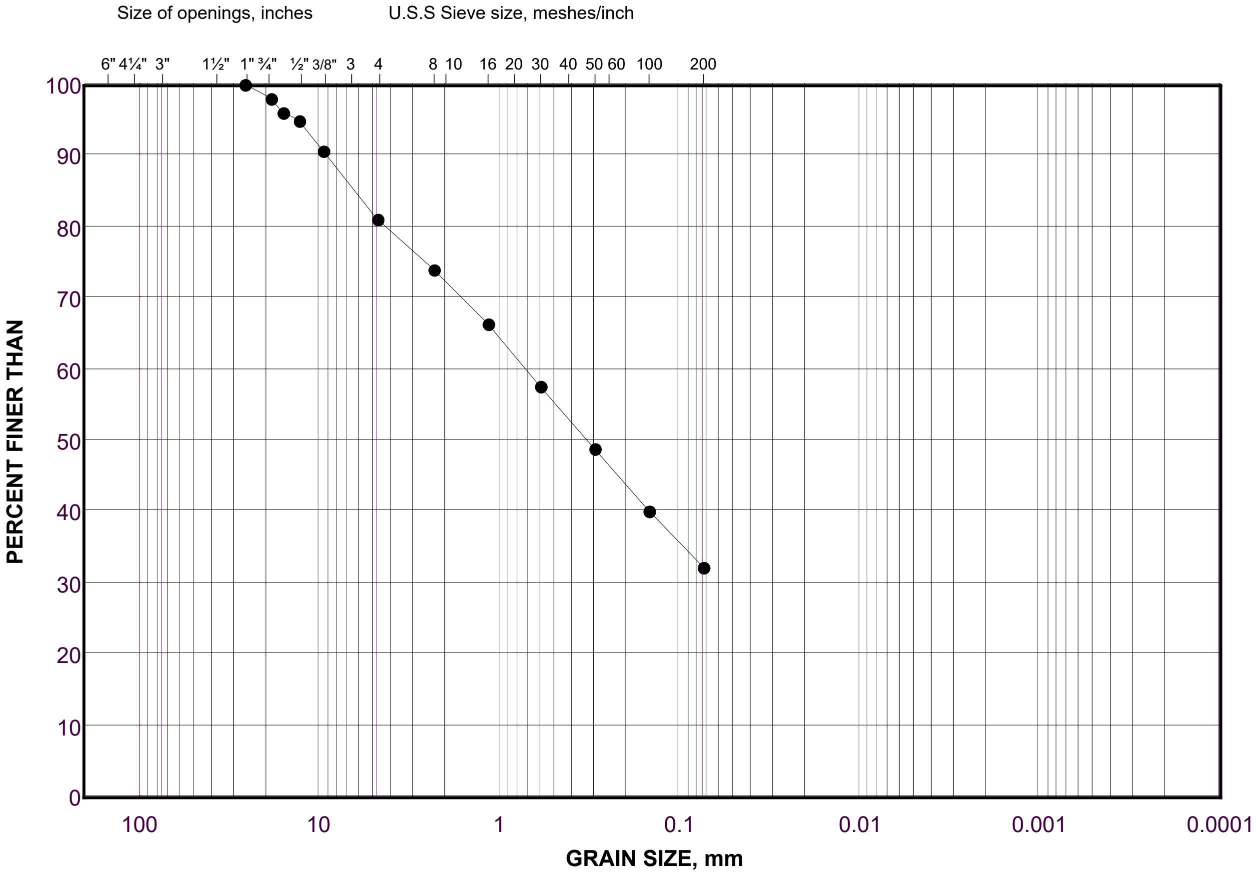
Project Number	21476582	Depth	41
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 3:33:56 PM
Sample Number	9B	Tested By	Sieve - AM
Checked By	______________________	LabID	22-206

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	9B	39.0 - 41.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 11077.6(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	2660.50	24.02	75.00	76.0
63mm	2660.50	0.00	63.00	76.0
53mm	3220.80	5.06	53.00	70.9
37.5mm	4784.90	14.12	37.50	56.8
26.5mm	5587.30	7.24	26.50	49.6
19.0mm	6347.80	6.87	19.00	42.7
16mm	6646.90	2.70	16.00	40.0
13.2mm	6928.80	2.54	13.20	37.5
9.5mm	7483.60	5.01	9.50	32.4
4.75mm	8288.80	7.27	4.75	25.2
PAN	2788.80	25.17	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	54.40	4.94	2.36	20.2
1.18mm	104.00	4.51	1.18	15.7
600µm	150.00	4.18	0.60	11.5
300µm	188.30	3.48	0.30	8.1
150µm	211.40	2.10	0.15	6.0
75µm	228.50	1.55	0.08	4.4

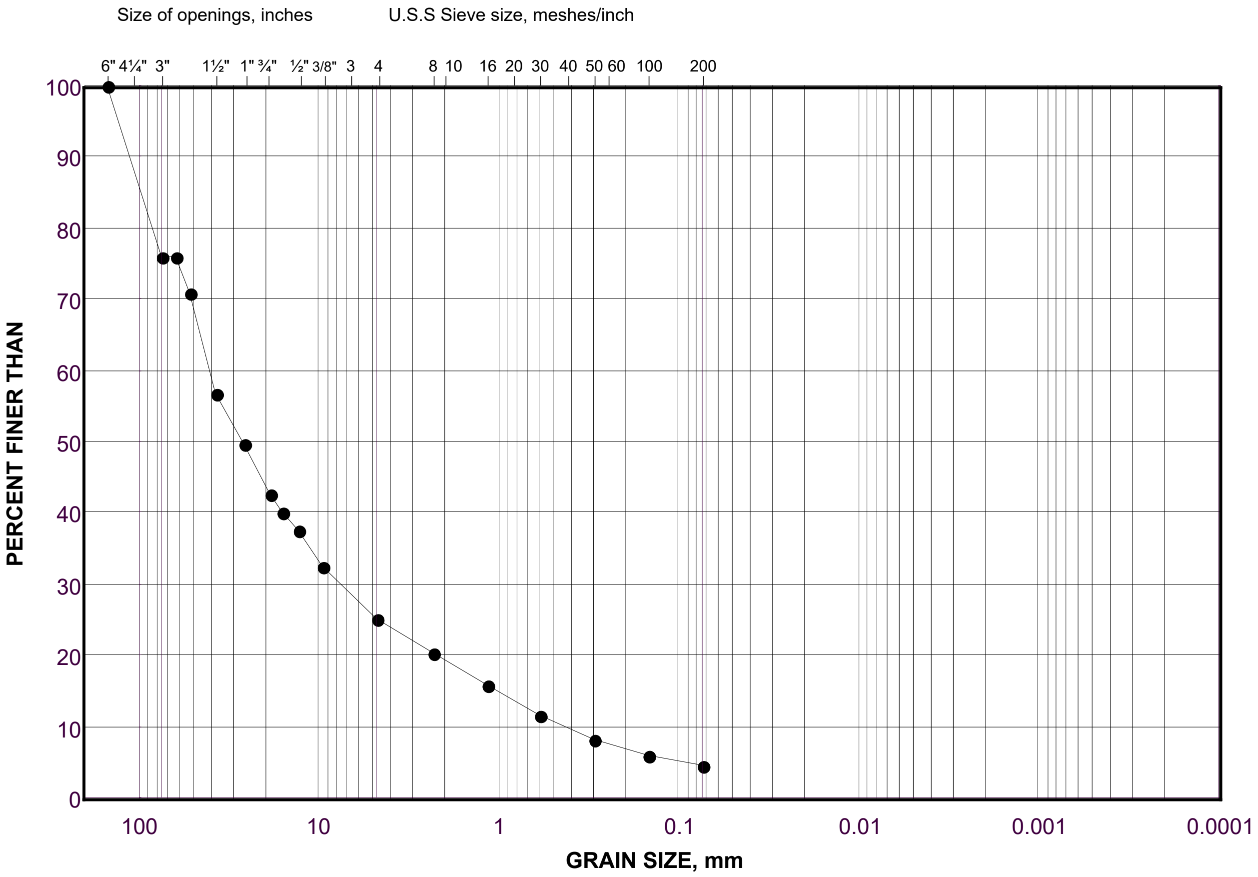
Project Number	21476582	Depth	49
Project Task	1000	Units	Metric
Borehole Number	MW 21-01	Testing Date	3/28/22 3:38:54 PM
Sample Number	10	Tested By	Sieve - LB
Checked By	______________________	LabID	22-556

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	MW 21-01	10	44.0 - 49.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 20108.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1957.60	9.74	75.00	90.3
63mm	1957.60	0.00	63.00	90.3
53mm	4052.80	10.42	53.00	79.8
37.5mm	7126.90	15.29	37.50	64.6
26.5mm	9877.10	13.68	26.50	50.9
19.0mm	11419.60	7.67	19.00	43.2
16mm	12087.30	3.32	16.00	39.9
13.2mm	12634.60	2.72	13.20	37.2
9.5mm	13696.80	5.28	9.50	31.9
4.75mm	15159.80	7.28	4.75	24.6
PAN	4936.50	24.60	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	80.30	6.39	2.36	18.2
1.18mm	138.90	4.67	1.18	13.5
600µm	223.80	6.76	0.60	6.8
300µm	260.90	2.95	0.30	3.8
150µm	276.80	1.27	0.15	2.6
75µm	285.50	0.69	0.08	1.9

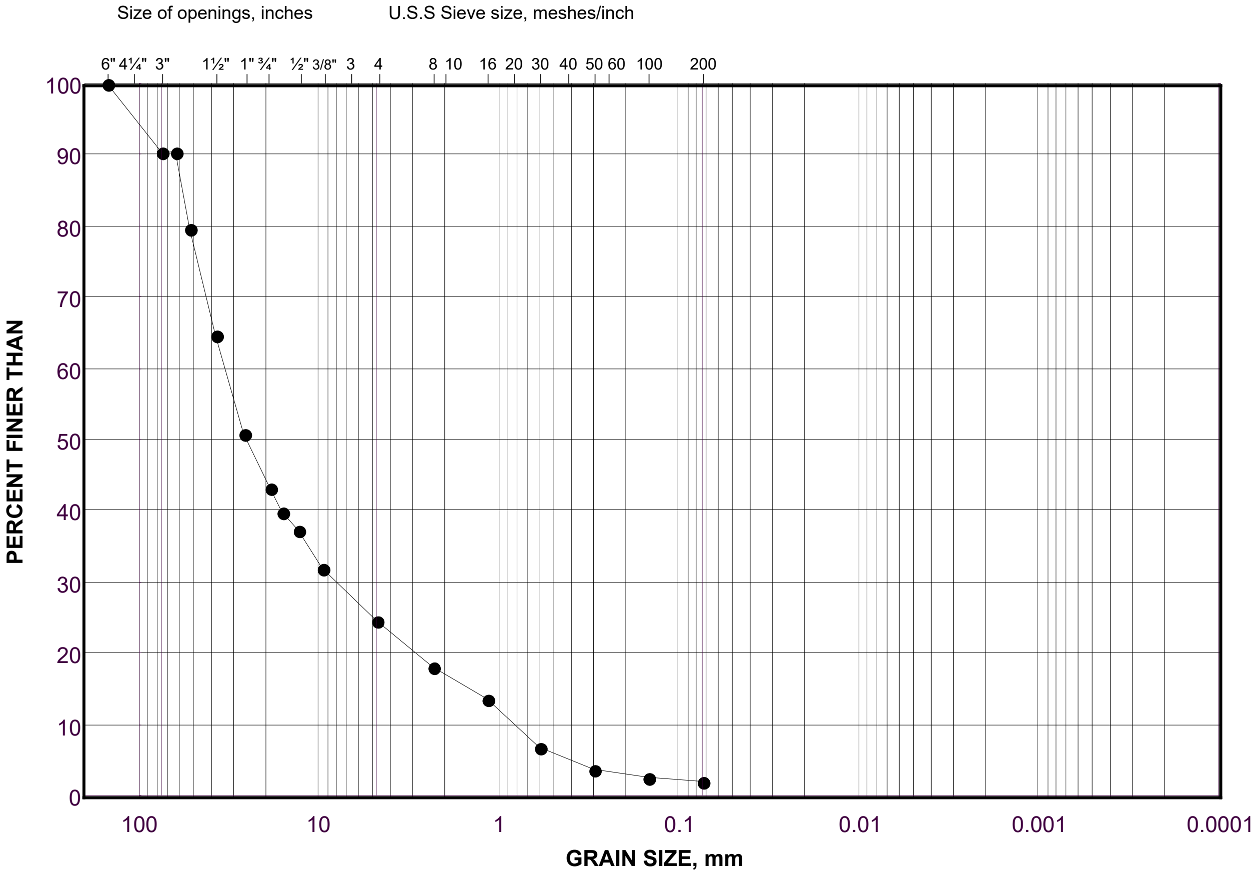
Project Number	21476582	Depth	54
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 3:50:27 PM
Sample Number	11	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-201

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	11	49.0 - 54.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13932.1(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	337.70	2.42	53.00	97.6
37.5mm	2017.70	12.06	37.50	85.5
26.5mm	3682.30	11.95	26.50	73.6
19.0mm	4831.40	8.25	19.00	65.3
16mm	5509.50	4.87	16.00	60.5
13.2mm	6093.30	4.19	13.20	56.3
9.5mm	7444.20	9.70	9.50	46.6
4.75mm	9062.90	11.62	4.75	34.9
PAN	4860.80	34.94	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	64.80	8.78	2.36	26.2
1.18mm	125.00	8.16	1.18	18.0
600µm	172.80	6.48	0.60	11.5
300µm	198.10	3.43	0.30	8.1
150µm	211.80	1.86	0.15	6.2
75µm	223.70	1.61	0.08	4.6

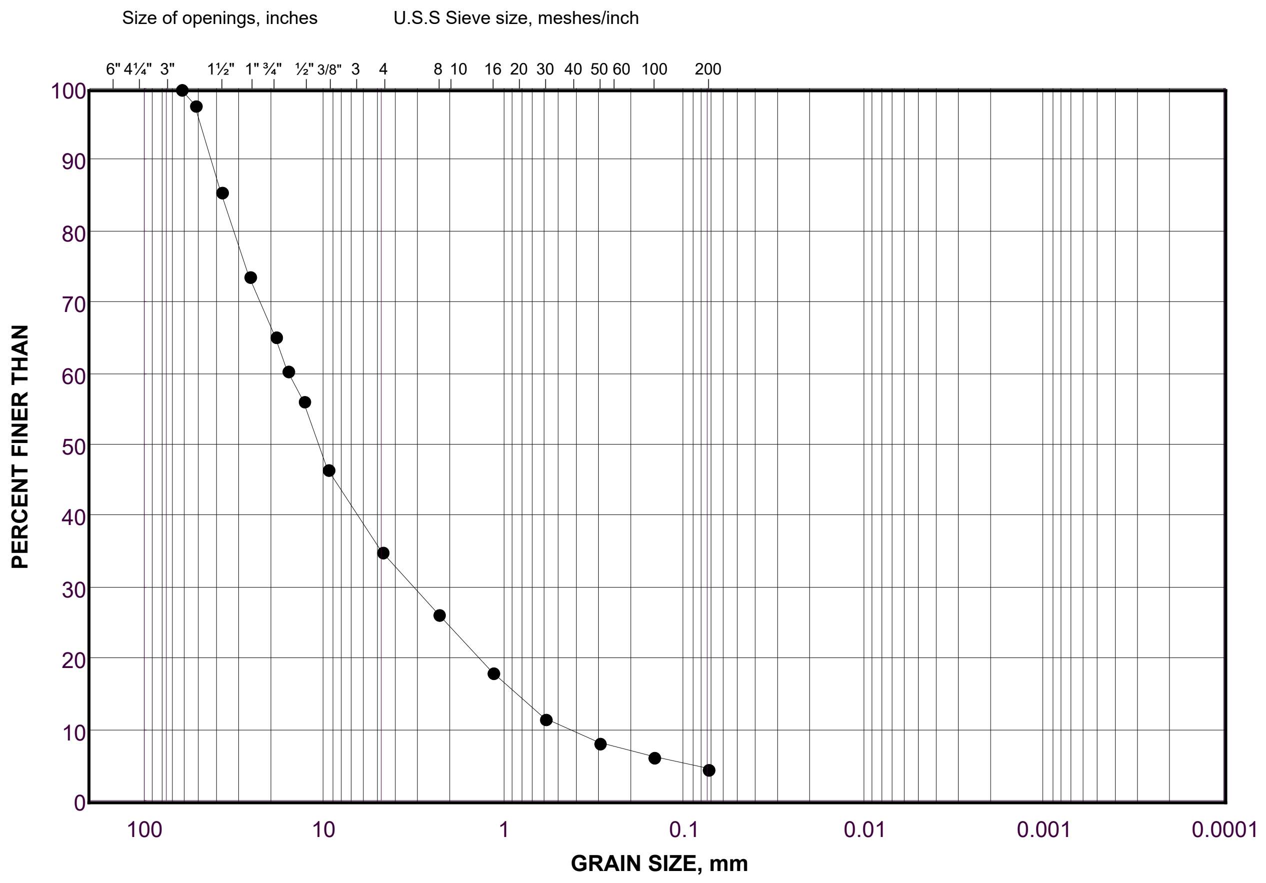
Project Number	21476582	Depth	59
Project Task	1000	Units	Metric
Borehole Number	MW 21-01	Testing Date	3/28/22 3:55:18 PM
Sample Number	12	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-198

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	MW 21-01	12	54.0 - 59.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15414(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	618.00	4.01	75.00	96.0
63mm	618.00	0.00	63.00	96.0
53mm	618.00	0.00	53.00	96.0
37.5mm	1432.00	5.28	37.50	90.7
26.5mm	2188.00	4.90	26.50	85.8
19.0mm	3416.00	7.97	19.00	77.8
16mm	3830.00	2.69	16.00	75.2
13.2mm	4400.00	3.70	13.20	71.5
9.5mm	5594.00	7.75	9.50	63.7
4.75mm	7472.00	12.18	4.75	51.5
PAN	7942.00	51.52	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	70.23	10.43	2.36	41.1
1.18mm	134.83	9.60	1.18	31.5
600µm	199.06	9.54	0.60	22.0
300µm	283.35	12.52	0.30	9.4
150µm	317.09	5.01	0.15	4.4
75µm	329.20	1.80	0.08	2.6

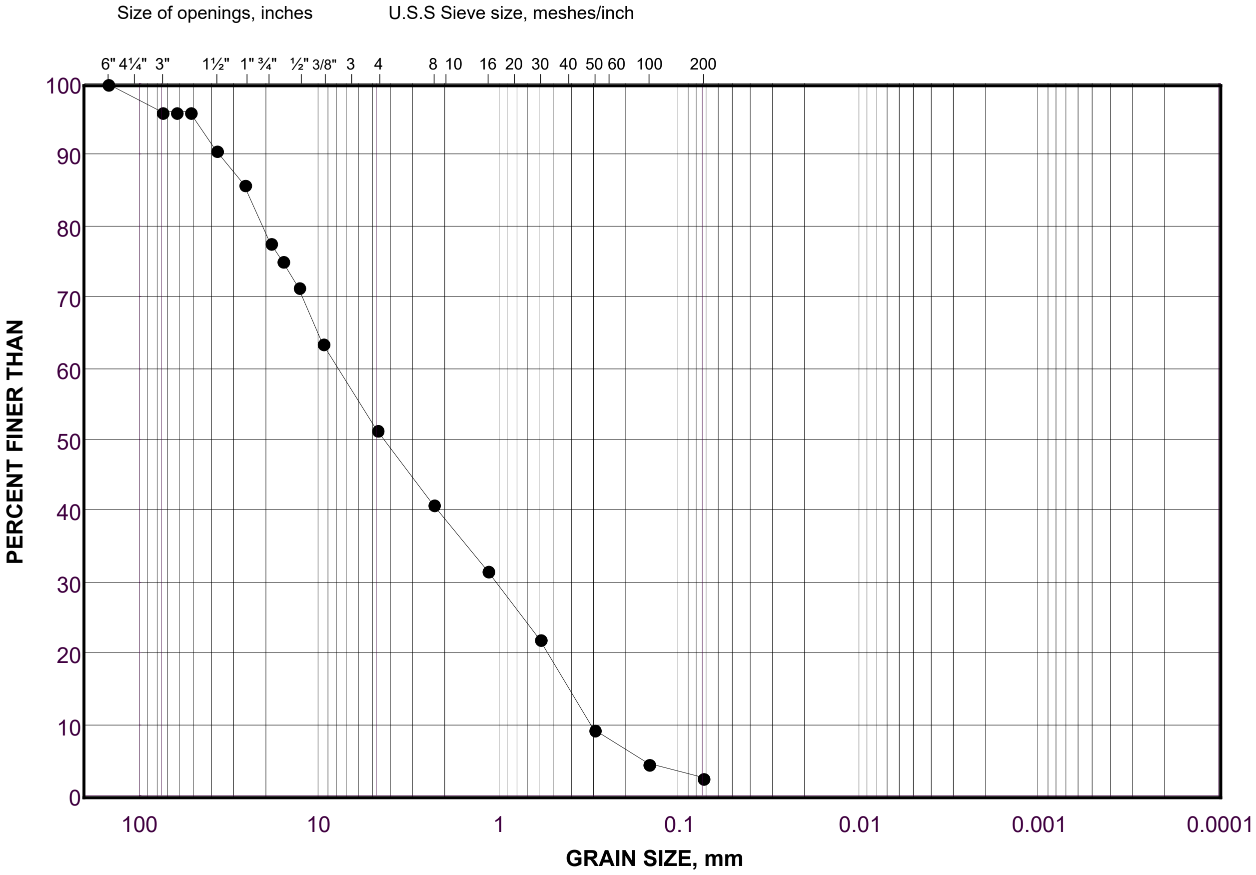
Project Number	21476582	Depth	64
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 4:00:22 PM
Sample Number	13	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-596

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	13	59.0 - 64.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 22322(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	2156.00	9.66	75.00	90.3
63mm	3214.00	4.74	63.00	85.6
53mm	4778.00	7.01	53.00	78.6
37.5mm	7004.00	9.97	37.50	68.6
26.5mm	8976.00	8.83	26.50	59.8
19.0mm	10866.00	8.47	19.00	51.3
16mm	11714.00	3.80	16.00	47.5
13.2mm	12472.00	3.40	13.20	44.1
9.5mm	14144.00	7.49	9.50	36.6
4.75mm	16322.00	9.76	4.75	26.9
PAN	6000.00	26.87	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	81.18	6.73	2.36	20.1
1.18mm	140.63	4.93	1.18	15.2
600µm	192.94	4.34	0.60	10.9
300µm	230.92	3.15	0.30	7.7
150µm	255.00	2.00	0.15	5.7
75µm	271.28	1.35	0.08	4.4

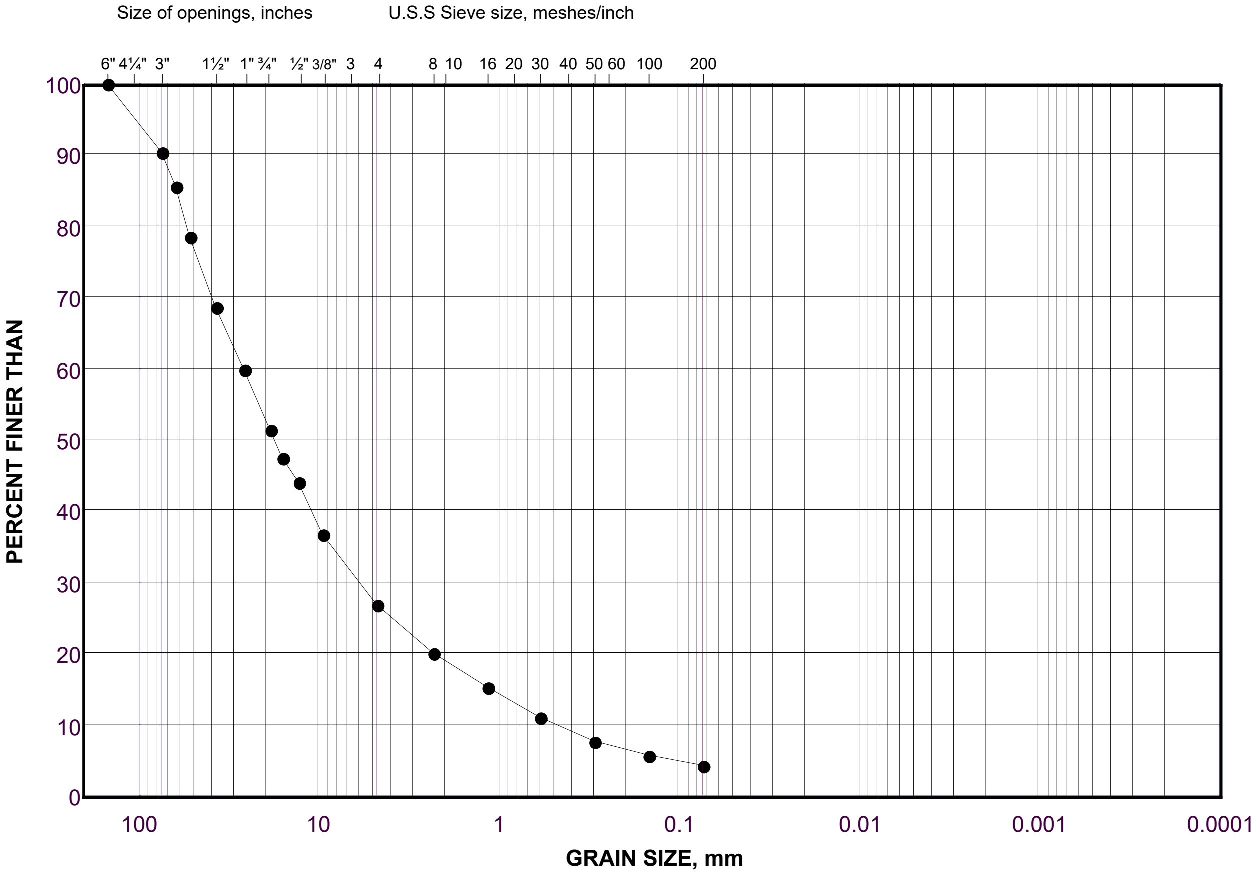
Project Number	21476582	Depth	74
Project Task	1000	Units	Imperial
Borehole Number	MW 21-01	Testing Date	3/28/22 4:05:38 PM
Sample Number	15	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-597

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-01	15	69.0 - 74.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 2473.4(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	94.40	3.82	37.50	96.2
26.5mm	200.40	4.29	26.50	91.9
19.0mm	430.60	9.31	19.00	82.6
16mm	499.60	2.79	16.00	79.8
13.2mm	558.80	2.39	13.20	77.4
9.5mm	624.10	2.64	9.50	74.8
4.75mm	724.20	4.05	4.75	70.7
PAN	1749.20	70.71	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	21.10	5.11	2.36	65.6
1.18mm	38.10	4.12	1.18	61.5
600µm	57.50	4.70	0.60	56.8
300µm	87.30	7.22	0.30	49.6
150µm	131.70	10.76	0.15	38.8
75µm	178.00	11.22	0.08	27.6

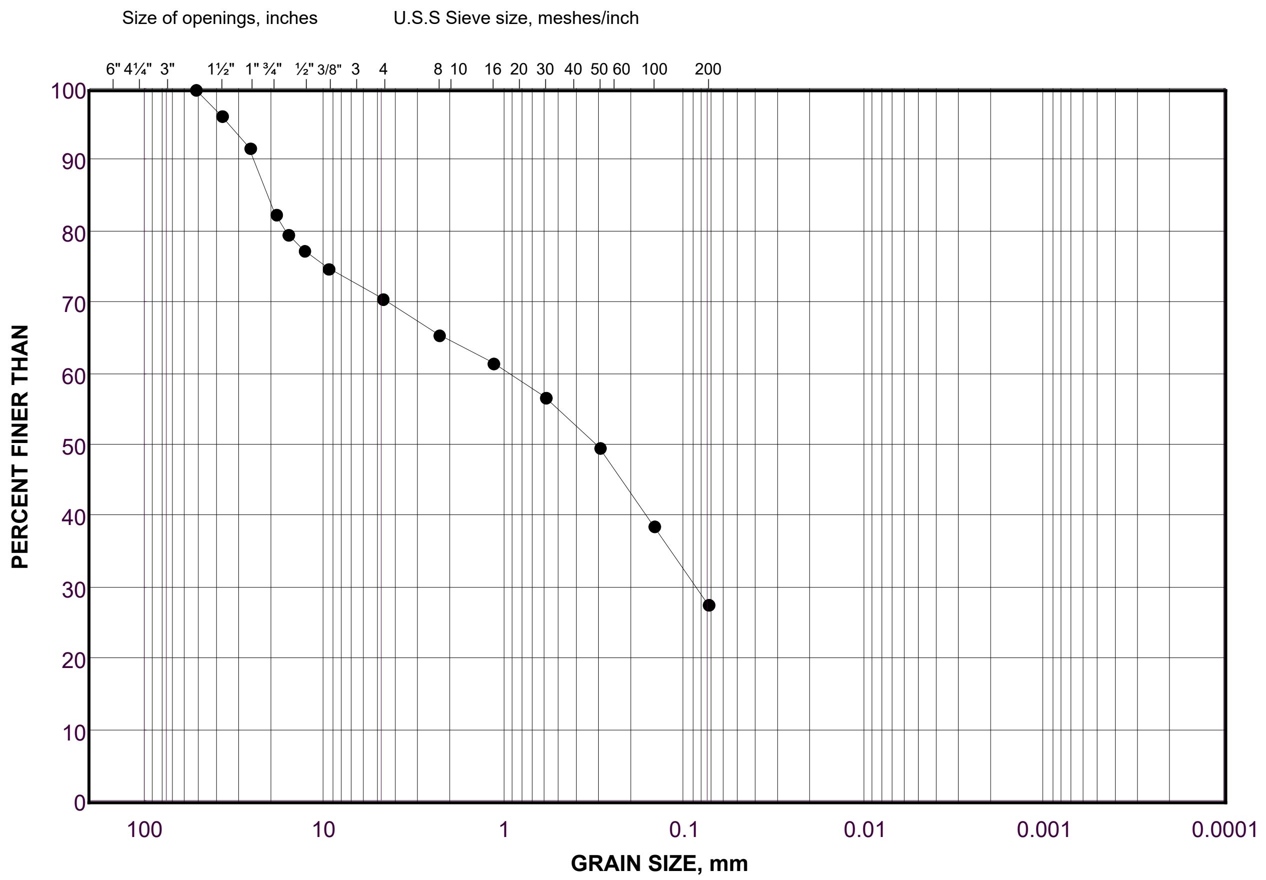
Project Number	21476582	Depth	4
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:12:18 PM
Sample Number	2A	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-645

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	2A	3.0 - 4.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 8437.2(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	357.20	4.23	53.00	95.8
37.5mm	357.20	0.00	37.50	95.8
26.5mm	631.30	3.25	26.50	92.5
19.0mm	836.20	2.43	19.00	90.1
16mm	997.60	1.91	16.00	88.2
13.2mm	1283.50	3.39	13.20	84.8
9.5mm	1693.40	4.86	9.50	79.9
4.75mm	2405.90	8.44	4.75	71.5
PAN	6014.50	71.49	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	30.90	7.17	2.36	64.3
1.18mm	62.50	7.33	1.18	57.0
600µm	90.80	6.57	0.60	50.4
300µm	119.00	6.55	0.30	43.9
150µm	147.00	6.50	0.15	37.4
75µm	176.20	6.78	0.08	30.6

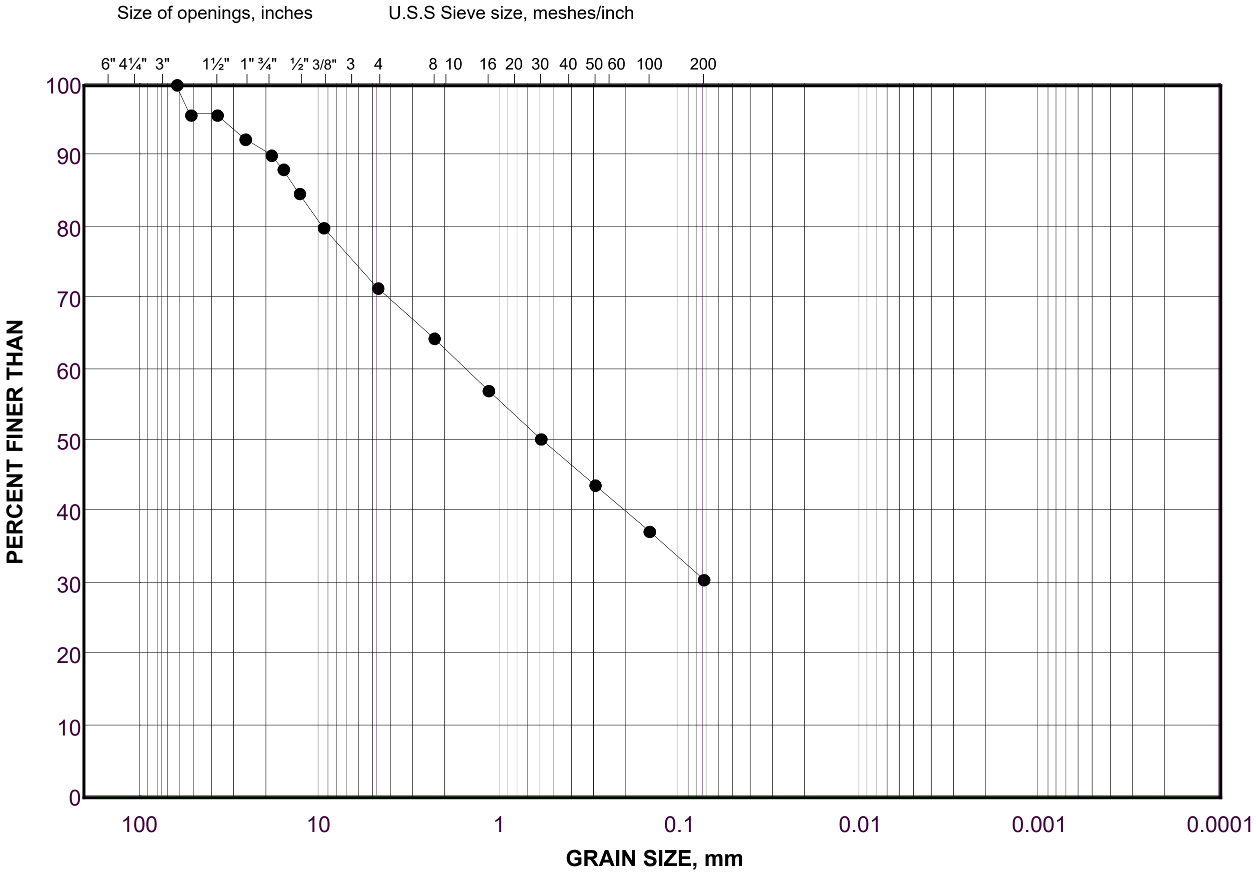
Project Number	21476582	Depth	8
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:15:14 PM
Sample Number	2B	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-646

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	2B	4.0 - 8.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13008.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	395.00	3.04	37.50	97.0
26.5mm	1051.60	5.05	26.50	91.9
19.0mm	1446.10	3.03	19.00	88.9
16mm	1638.00	1.48	16.00	87.4
13.2mm	1902.20	2.03	13.20	85.4
9.5mm	2326.60	3.26	9.50	82.1
4.75mm	3320.90	7.64	4.75	74.5
PAN	9657.70	74.47	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	22.50	6.13	2.36	68.3
1.18mm	46.60	6.56	1.18	61.8
600µm	71.20	6.70	0.60	55.1
300µm	102.70	8.58	0.30	46.5
150µm	124.80	6.02	0.15	40.5
75µm	152.90	7.65	0.08	32.8

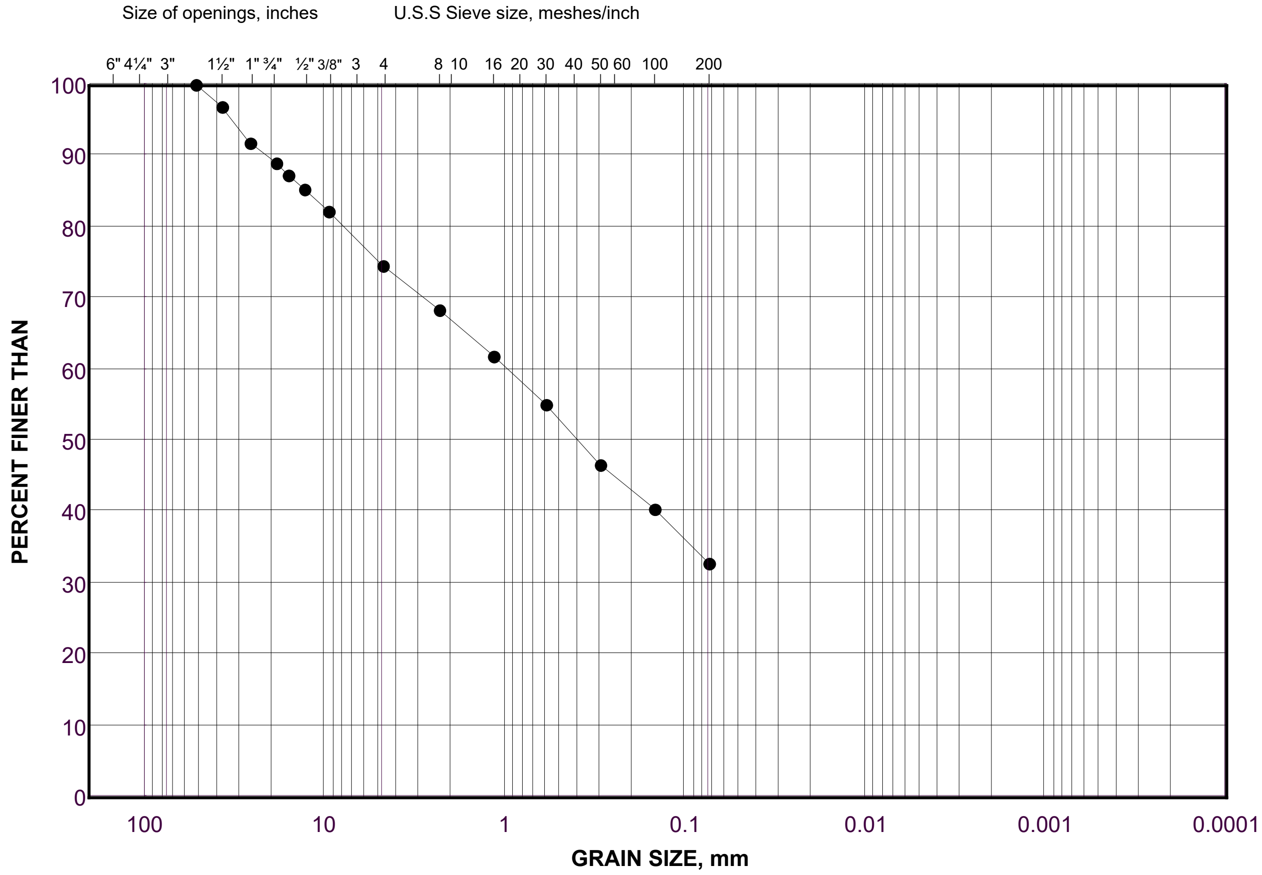
Project Number	21476582	Depth	13
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:16:59 PM
Sample Number	3	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-213

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	3	8.0 - 13.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 12407(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	860.70	6.94	63.00	93.1
53mm	860.70	0.00	53.00	93.1
37.5mm	1352.40	3.96	37.50	89.1
26.5mm	2158.50	6.50	26.50	82.6
19.0mm	2650.10	3.96	19.00	78.6
16mm	2920.20	2.18	16.00	76.5
13.2mm	3166.00	1.98	13.20	74.5
9.5mm	3773.90	4.90	9.50	69.6
4.75mm	5015.80	10.01	4.75	59.6
PAN	7391.20	59.57	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	20.50	4.63	2.36	54.9
1.18mm	46.70	5.91	1.18	49.0
600µm	72.60	5.84	0.60	43.2
300µm	96.70	5.44	0.30	37.8
150µm	121.80	5.66	0.15	32.1
75µm	147.60	5.82	0.08	26.3

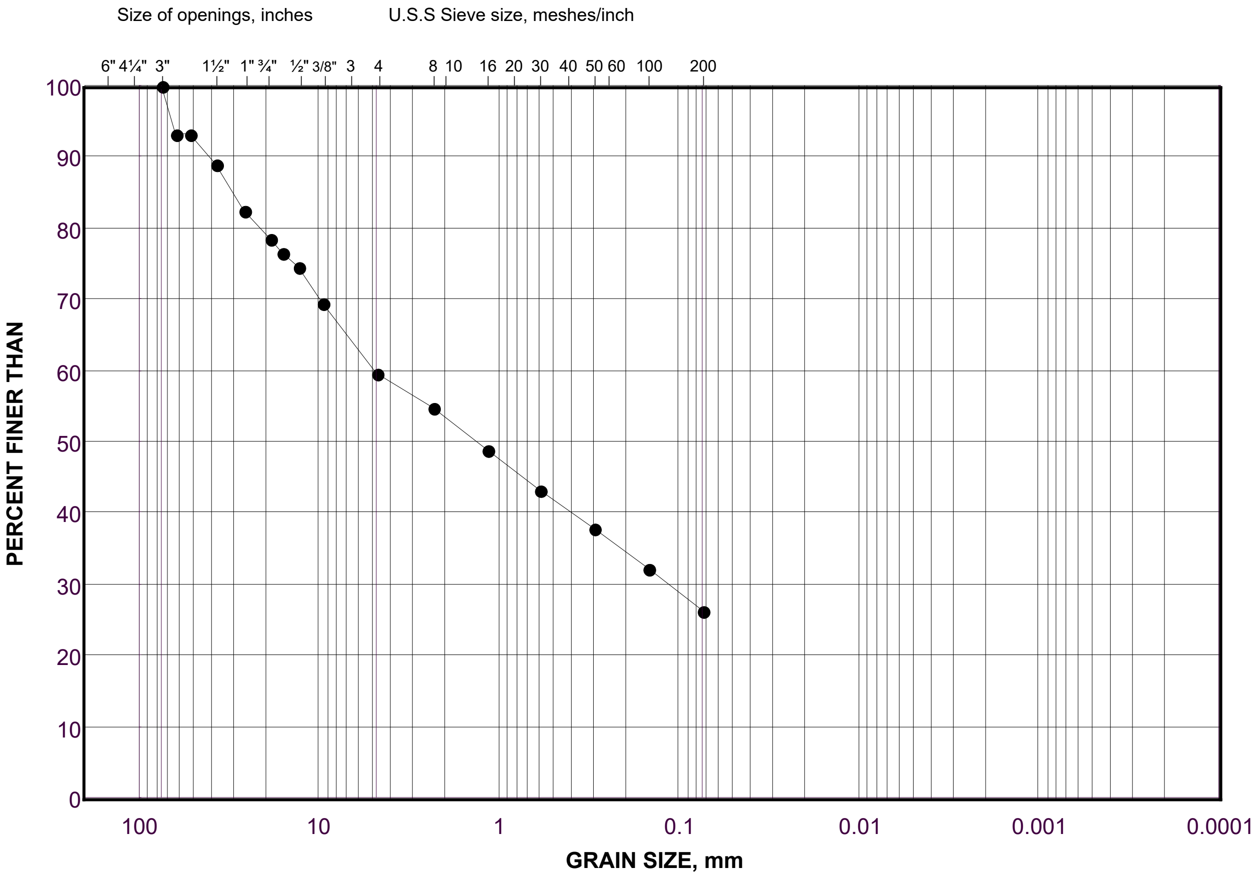
Project Number	21476582	Depth	18
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:18:57 PM
Sample Number	4	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-647

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	4	13.0 - 18.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17920.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	590.80	3.30	75.00	96.7
63mm	590.80	0.00	63.00	96.7
53mm	590.80	0.00	53.00	96.7
37.5mm	1849.80	7.03	37.50	89.7
26.5mm	2853.80	5.60	26.50	84.1
19.0mm	3600.30	4.17	19.00	79.9
16mm	4060.00	2.57	16.00	77.3
13.2mm	4396.60	1.88	13.20	75.5
9.5mm	5165.90	4.29	9.50	71.2
4.75mm	6367.30	6.70	4.75	64.5
PAN	11493.80	64.46	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	23.50	5.26	2.36	59.2
1.18mm	48.30	5.55	1.18	53.7
600µm	72.00	5.30	0.60	48.4
300µm	98.50	5.93	0.30	42.4
150µm	129.90	7.02	0.15	35.4
75µm	163.40	7.49	0.08	27.9

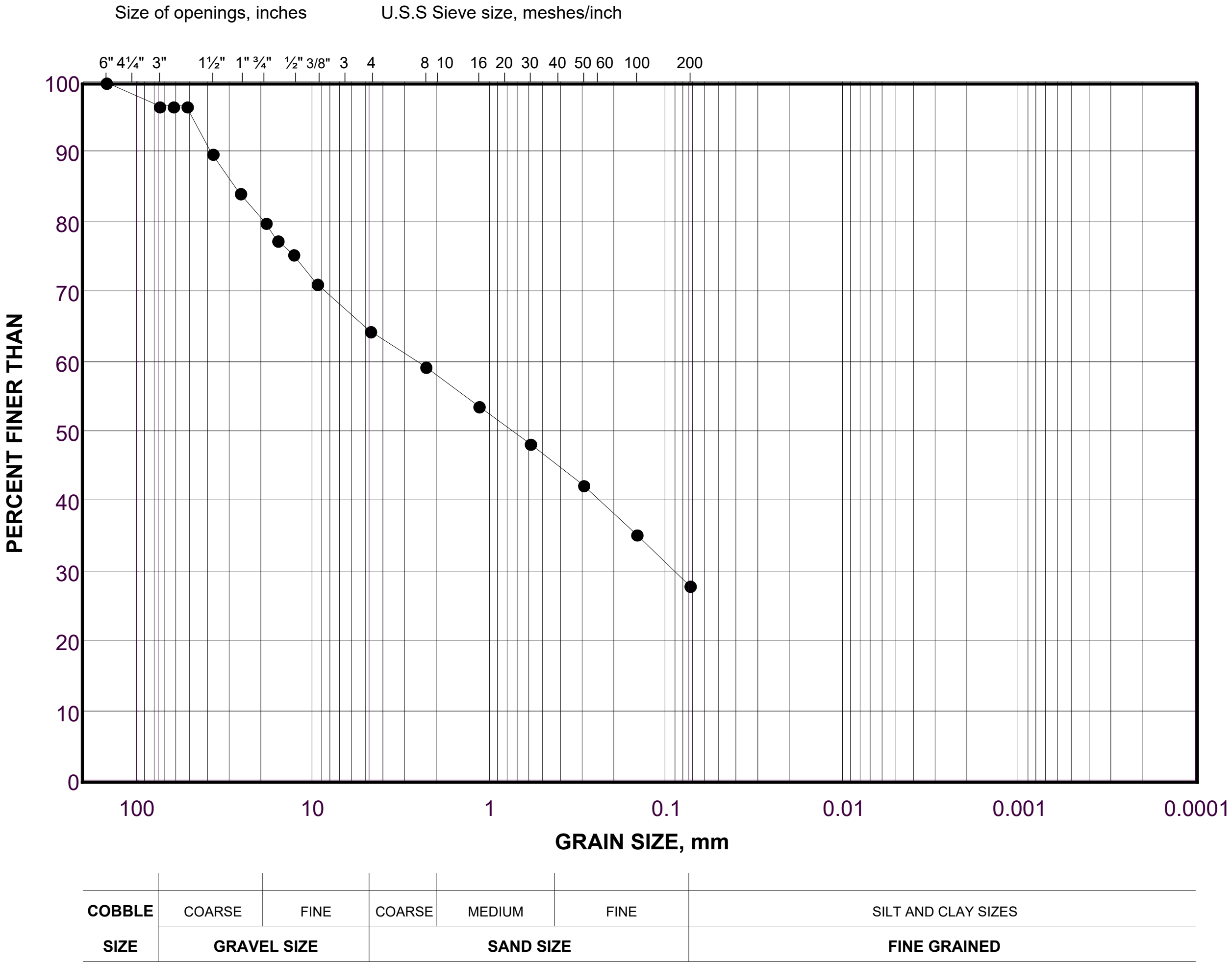
Project Number	21476582	Depth	23
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:24:38 PM
Sample Number	5	Tested By	Sieve - TP
Checked By	______________________	LabID	22-208

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	5	18.0 - 23.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 5489(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	247.40	4.51	53.00	95.5
37.5mm	930.40	12.44	37.50	83.1
26.5mm	1506.40	10.49	26.50	72.6
19.0mm	1929.80	7.71	19.00	64.9
16mm	2088.60	2.89	16.00	62.0
13.2mm	2274.00	3.38	13.20	58.6
9.5mm	2587.80	5.72	9.50	52.9
4.75mm	3076.20	8.90	4.75	44.0
PAN	2402.10	43.96	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	48.50	7.45	2.36	36.5
1.18mm	87.00	5.92	1.18	30.6
600µm	117.00	4.61	0.60	26.0
300µm	140.60	3.63	0.30	22.4
150µm	160.50	3.06	0.15	19.3
75µm	179.10	2.86	0.08	16.4

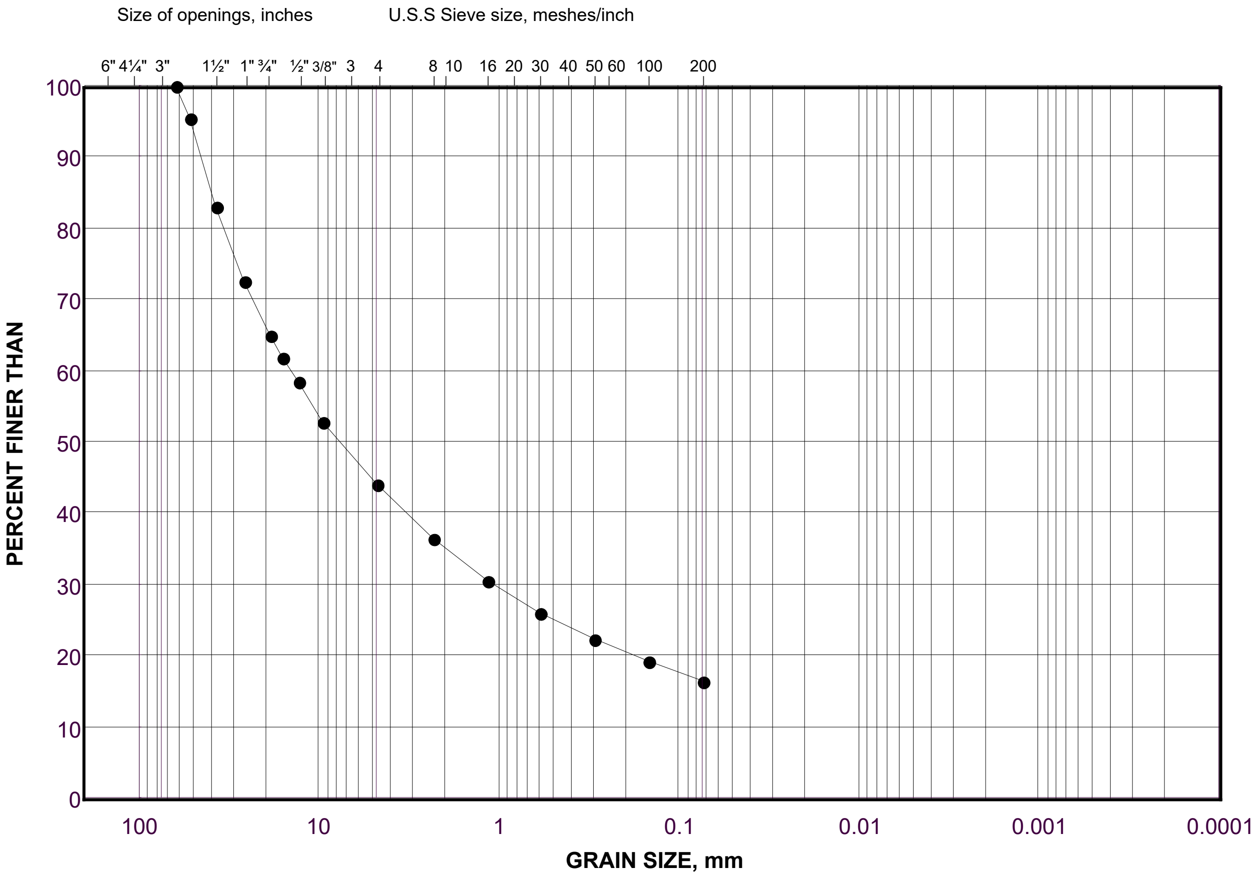
Project Number	21476582	Depth	24.5
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:28:31 PM
Sample Number	6A	Tested By	Sieve - JT
Checked By	______________________________	LabID	22-559

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	6A	23.0 - 24.50

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 10122.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	1011.30	9.99	63.00	90.0
53mm	1011.30	0.00	53.00	90.0
37.5mm	1382.60	3.67	37.50	86.3
26.5mm	1907.40	5.18	26.50	81.2
19.0mm	2627.90	7.12	19.00	74.0
16mm	3072.40	4.39	16.00	69.7
13.2mm	3394.40	3.18	13.20	66.5
9.5mm	4080.90	6.78	9.50	59.7
4.75mm	5261.80	11.67	4.75	48.0
PAN	4860.70	48.02	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	45.00	7.63	2.36	40.4
1.18mm	89.10	7.48	1.18	32.9
600µm	127.80	6.56	0.60	26.4
300µm	167.20	6.68	0.30	19.7
150µm	197.40	5.12	0.15	14.6
75µm	216.60	3.25	0.08	11.3

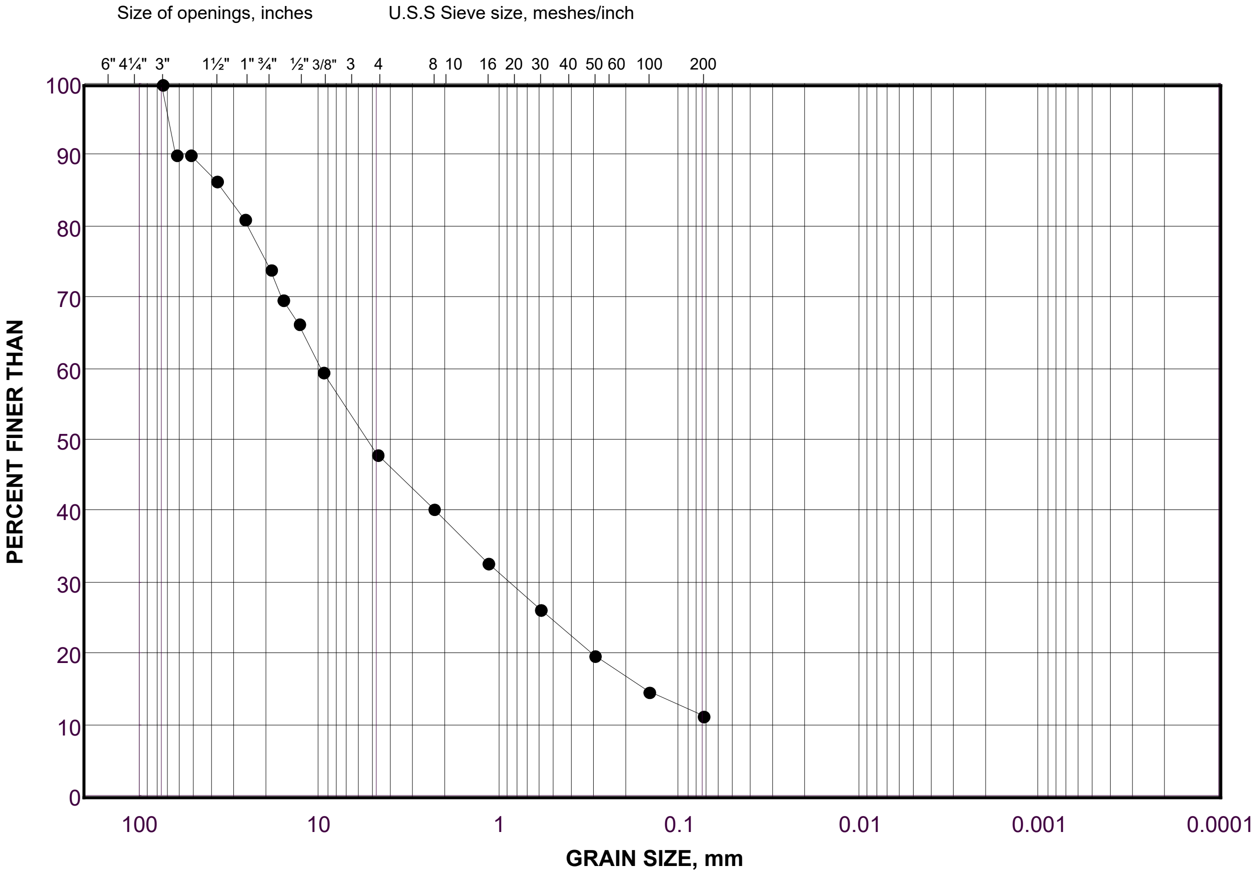
Project Number	21476582	Depth	28
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:30:49 PM
Sample Number	6B	Tested By	Sieve - IC
Checked By	______________________________	LabID	22-569

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	6B	24.5 - 28.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 11283(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	340.90	3.02	53.00	97.0
37.5mm	1121.00	6.91	37.50	90.1
26.5mm	2198.70	9.55	26.50	80.5
19.0mm	3308.30	9.83	19.00	70.7
16mm	3703.20	3.50	16.00	67.2
13.2mm	4022.70	2.83	13.20	64.4
9.5mm	4793.90	6.84	9.50	57.5
4.75mm	5943.50	10.19	4.75	47.3
PAN	5329.80	47.33	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	50.40	9.04	2.36	38.3
1.18mm	95.50	8.09	1.18	30.2
600µm	132.80	6.69	0.60	23.5
300µm	163.10	5.43	0.30	18.1
150µm	182.50	3.48	0.15	14.6
75µm	196.40	2.49	0.08	12.1

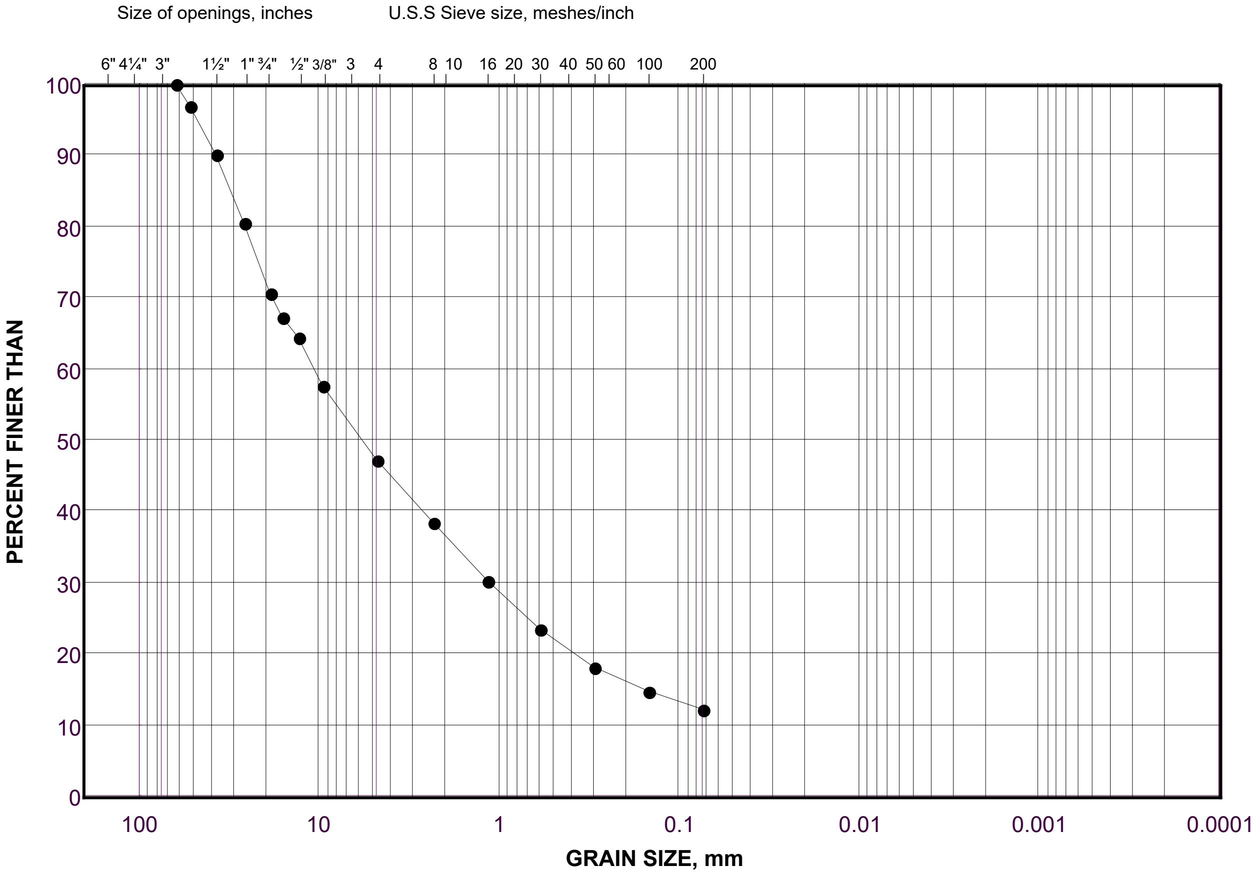
Project Number	21476582	Depth	33
Project Task	1000	Units	Imperial
Station Number	MW 21-02	Testing Date	3/07/22 4:03:15 PM
Sample Number	7	Tested By	Sieve -
Checked By	______________________________	LabID	22-422

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	STATION	SAMPLE	DEPTH(ft)
●	MW 21-02	7	28.0 - 33.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13334(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	303.80	2.28	53.00	97.7
37.5mm	1616.50	9.84	37.50	87.9
26.5mm	2446.70	6.23	26.50	81.7
19.0mm	3341.10	6.71	19.00	74.9
16mm	3803.80	3.47	16.00	71.5
13.2mm	4164.50	2.71	13.20	68.8
9.5mm	5028.90	6.48	9.50	62.3
4.75mm	6456.60	10.71	4.75	51.6
PAN	6865.00	51.57	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	46.90	8.67	2.36	42.9
1.18mm	95.30	8.95	1.18	34.0
600µm	133.00	6.97	0.60	27.0
300µm	164.40	5.81	0.30	21.2
150µm	186.50	4.09	0.15	17.1
75µm	204.80	3.38	0.08	13.7

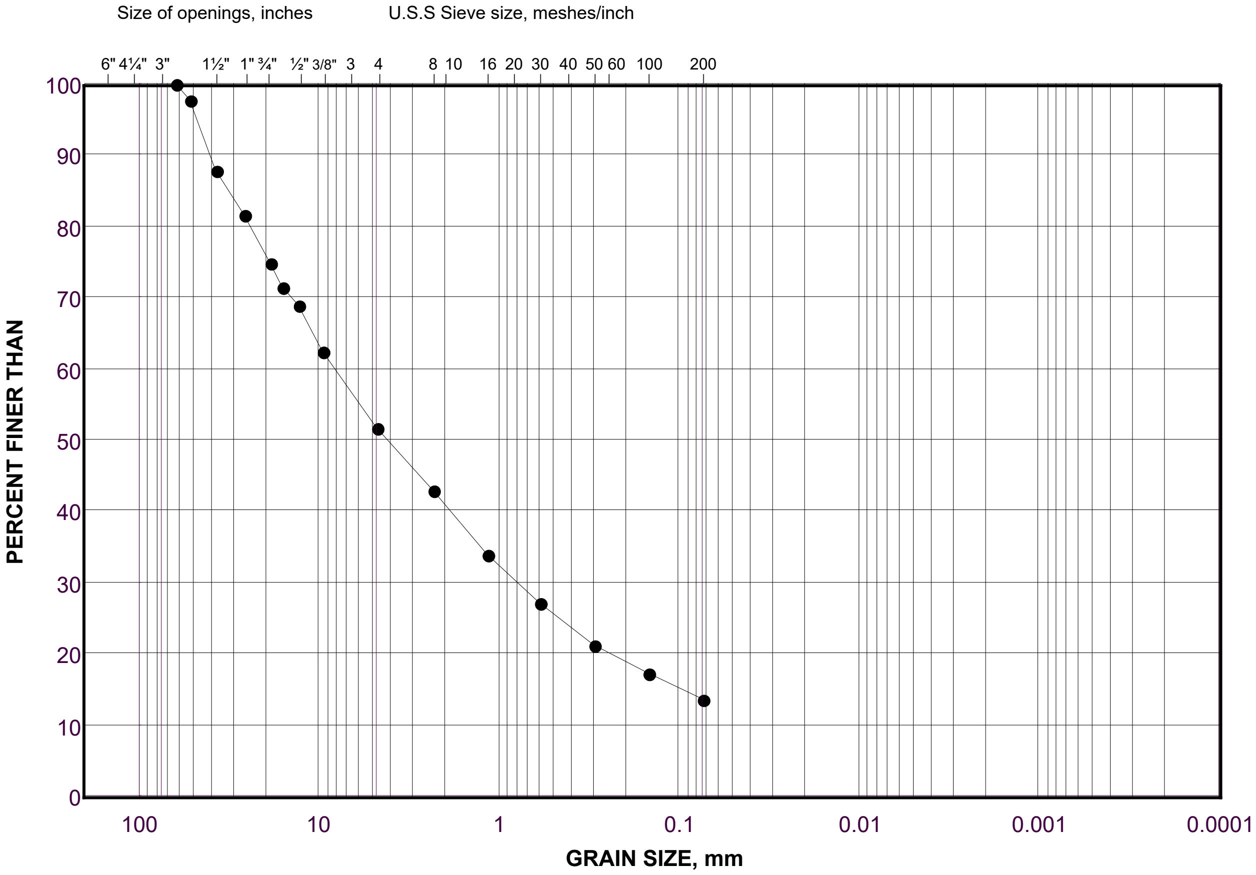
Project Number	21476582	Depth	38
Project Task	1000	Units	Metric
Borehole Number	MW 21-02	Testing Date	3/28/22 4:33:20 PM
Sample Number	8	Tested By	Sieve - IC
Checked By	______________________________	LabID	22-560

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	MW 21-02	8	33.0 - 38.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 20084(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1855.80	9.24	75.00	90.8
63mm	2812.10	4.76	63.00	86.0
53mm	4218.20	7.00	53.00	79.0
37.5mm	5782.10	7.79	37.50	71.2
26.5mm	7820.10	10.15	26.50	61.1
19.0mm	9227.20	7.01	19.00	54.1
16mm	9804.20	2.87	16.00	51.2
13.2mm	10326.80	2.60	13.20	48.6
9.5mm	11405.80	5.37	9.50	43.2
4.75mm	13270.90	9.29	4.75	33.9
PAN	6813.10	33.92	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	61.20	7.37	2.36	26.6
1.18mm	108.70	5.72	1.18	20.8
600µm	143.10	4.14	0.60	16.7
300µm	181.30	4.60	0.30	12.1
150µm	204.40	2.78	0.15	9.3
75µm	222.50	2.18	0.08	7.1

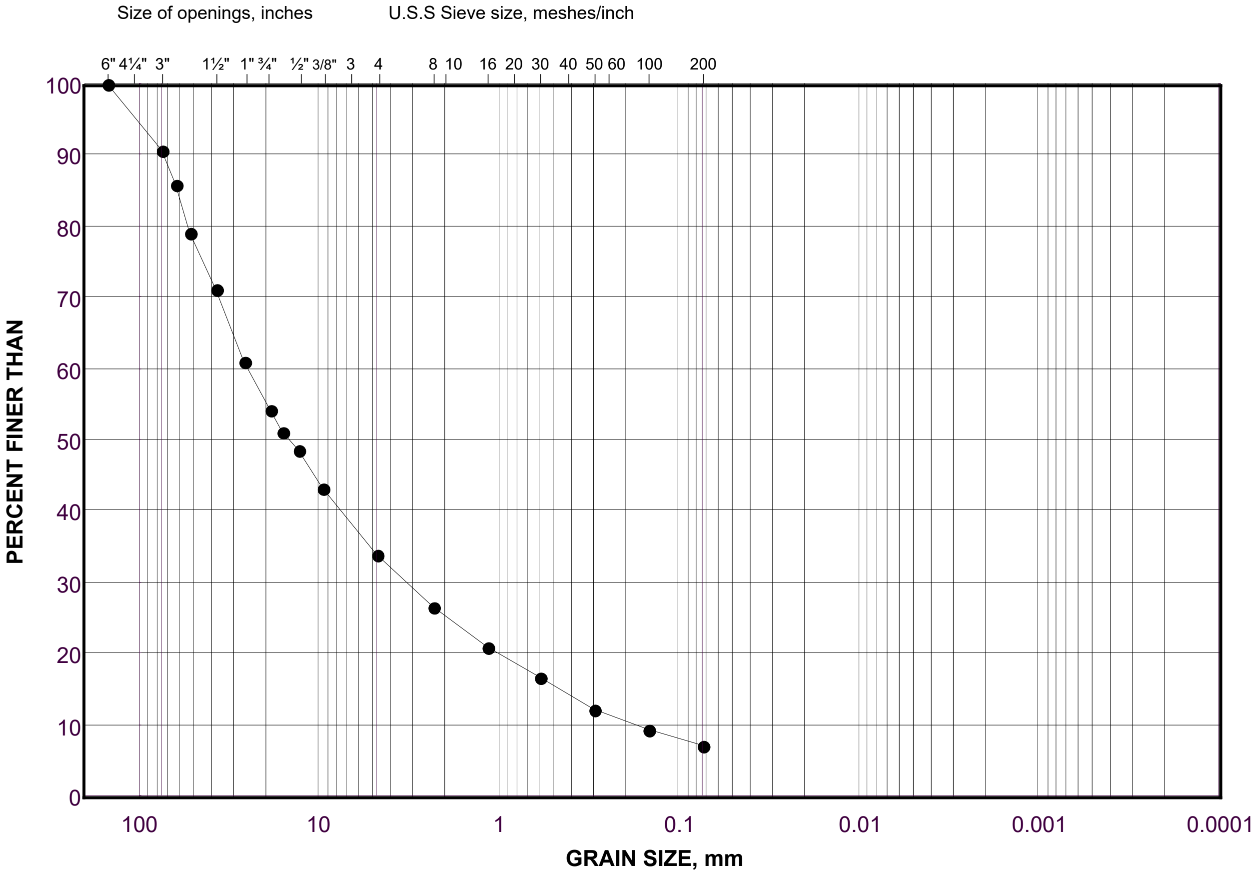
Project Number	21476582	Depth	43
Project Task	1000	Units	Metric
Borehole Number	MW 21-02	Testing Date	3/28/22 4:35:29 PM
Sample Number	9	Tested By	Sieve - IC
Checked By	______________________________	LabID	22-554

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	MW 21-02	9	38.0 - 43.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 19312(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	1232.00	6.38	63.00	93.6
53mm	1232.00	0.00	53.00	93.6
37.5mm	4222.00	15.48	37.50	78.1
26.5mm	5728.00	7.80	26.50	70.3
19.0mm	7090.00	7.05	19.00	63.3
16mm	7790.00	3.62	16.00	59.7
13.2mm	8464.00	3.49	13.20	56.2
9.5mm	9590.00	5.83	9.50	50.4
4.75mm	11422.00	9.49	4.75	40.9
PAN	7890.00	40.86	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	62.55	7.50	2.36	33.4
1.18mm	111.00	5.81	1.18	27.6
600µm	155.98	5.39	0.60	22.2
300µm	193.92	4.55	0.30	17.6
150µm	226.59	3.92	0.15	13.7
75µm	258.28	3.80	0.08	9.9

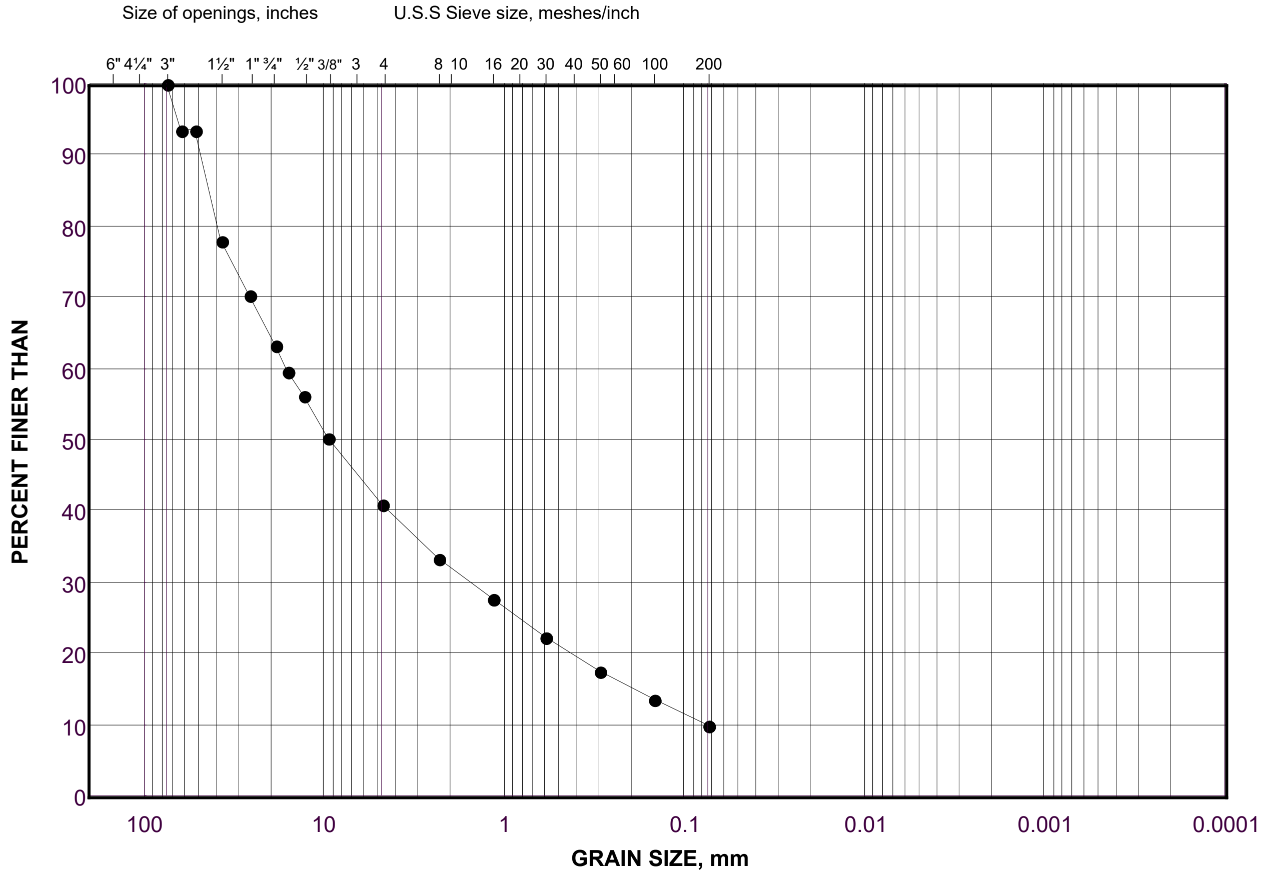
Project Number	21476582	Depth	
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:37:51 PM
Sample Number	10	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-573

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	10	43.0 - 48.0

Project Number: 21476582

Checked By: ________________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15556.3(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	754.60	4.85	75.00	95.2
63mm	1808.80	6.78	63.00	88.4
53mm	2554.30	4.79	53.00	83.6
37.5mm	3910.80	8.72	37.50	74.9
26.5mm	5222.80	8.43	26.50	66.4
19.0mm	6290.20	6.86	19.00	59.6
16mm	7131.80	5.41	16.00	54.2
13.2mm	7678.30	3.51	13.20	50.7
9.5mm	8695.20	6.54	9.50	44.1
4.75mm	10090.90	8.97	4.75	35.1
PAN	5465.40	35.14	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	42.70	5.57	2.36	29.6
1.18mm	86.80	5.75	1.18	23.8
600µm	134.70	6.24	0.60	17.6
300µm	173.70	5.08	0.30	12.5
150µm	197.00	3.04	0.15	9.5
75µm	215.70	2.44	0.08	7.0

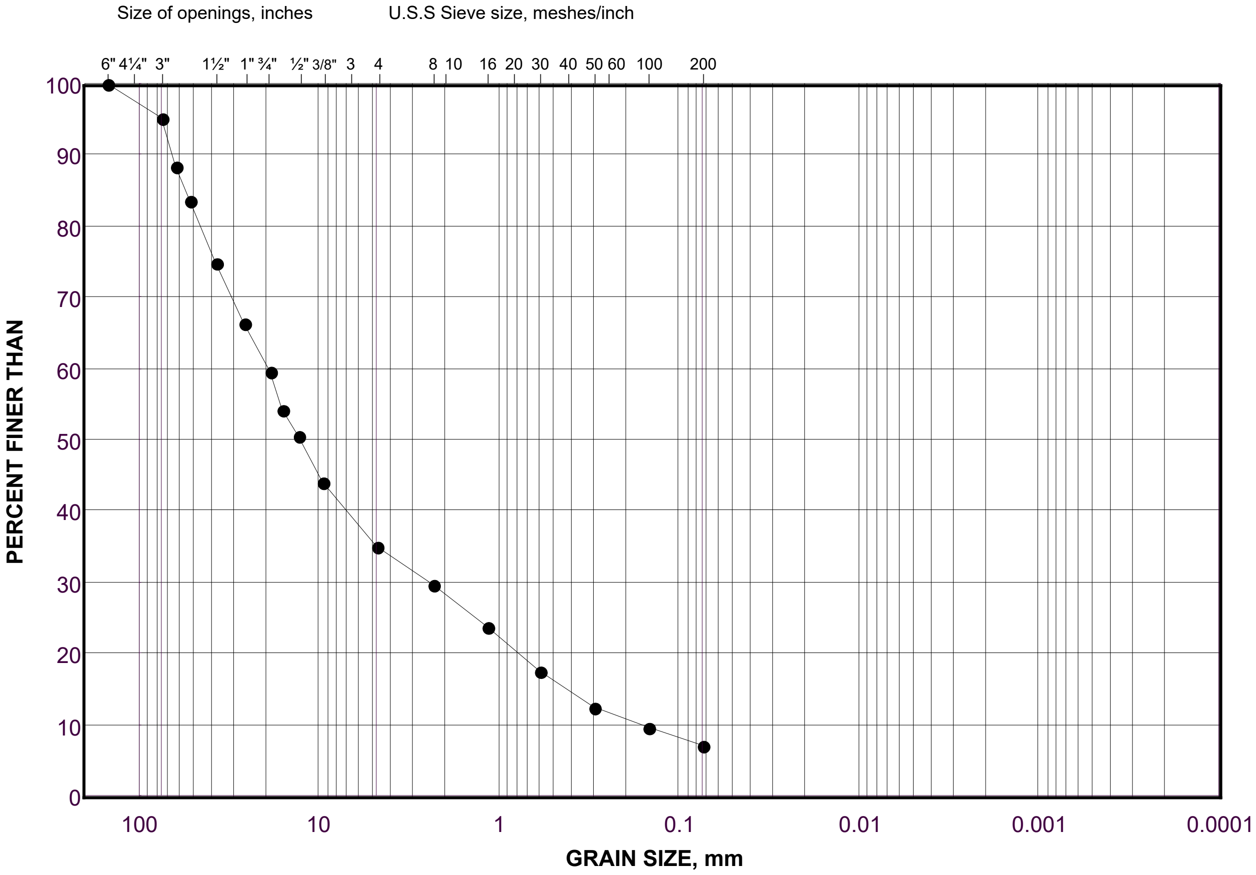
Project Number	21476582	Depth	53
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:40:32 PM
Sample Number	11	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-648

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	11	48.0 - 53.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 10430(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	780.00	7.48	75.00	92.5
63mm	1146.00	3.51	63.00	89.0
53mm	1630.00	4.64	53.00	84.4
37.5mm	2018.00	3.72	37.50	80.7
26.5mm	3168.00	11.03	26.50	69.6
19.0mm	3464.00	2.84	19.00	66.8
16mm	4240.00	7.44	16.00	59.3
13.2mm	4610.00	3.55	13.20	55.8
9.5mm	5220.00	5.85	9.50	49.9
4.75mm	6428.00	11.58	4.75	38.4
PAN	4002.00	38.36	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	77.65	8.92	2.36	29.4
1.18mm	134.42	6.52	1.18	22.9
600µm	193.00	6.73	0.60	16.2
300µm	226.66	3.87	0.30	12.3
150µm	244.56	2.06	0.15	10.3
75µm	268.30	2.73	0.08	7.5

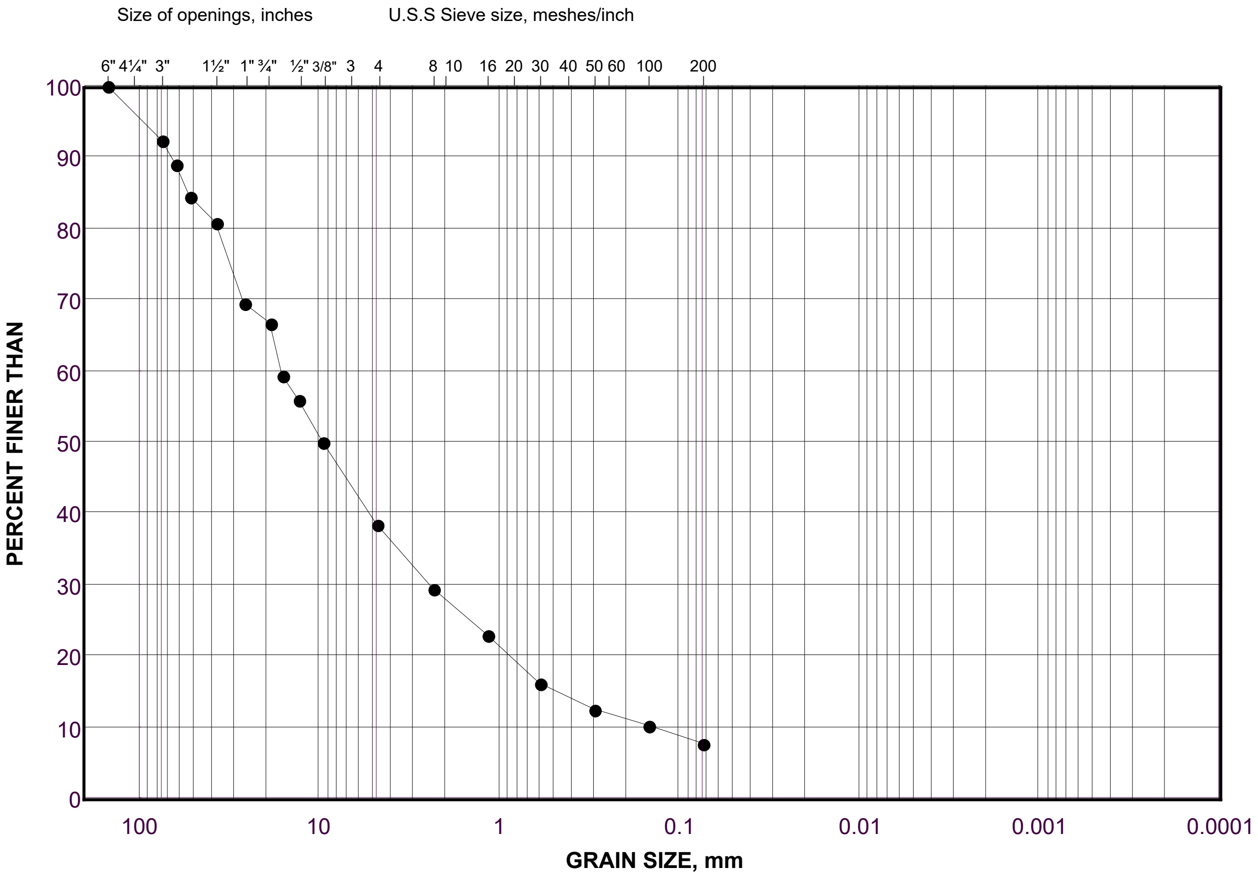
Project Number	21476582	Depth	58
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 4:43:46 PM
Sample Number	12	Tested By	Sieve - JB
Checked By	______________________	LabID	22-574

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	12	53.0 - 58.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 12339.1(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	411.90	3.34	63.00	96.7
53mm	980.40	4.61	53.00	92.1
37.5mm	2299.00	10.69	37.50	81.4
26.5mm	3048.40	6.07	26.50	75.3
19.0mm	3935.70	7.19	19.00	68.1
16mm	4417.60	3.91	16.00	64.2
13.2mm	4930.40	4.16	13.20	60.0
9.5mm	5909.10	7.93	9.50	52.1
4.75mm	7331.20	11.53	4.75	40.6
PAN	4965.80	40.57	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	60.60	7.79	2.36	32.8
1.18mm	120.80	7.74	1.18	25.0
600µm	173.40	6.77	0.60	18.3
300µm	207.50	4.39	0.30	13.9
150µm	230.30	2.93	0.15	11.0
75µm	248.30	2.32	0.08	8.6

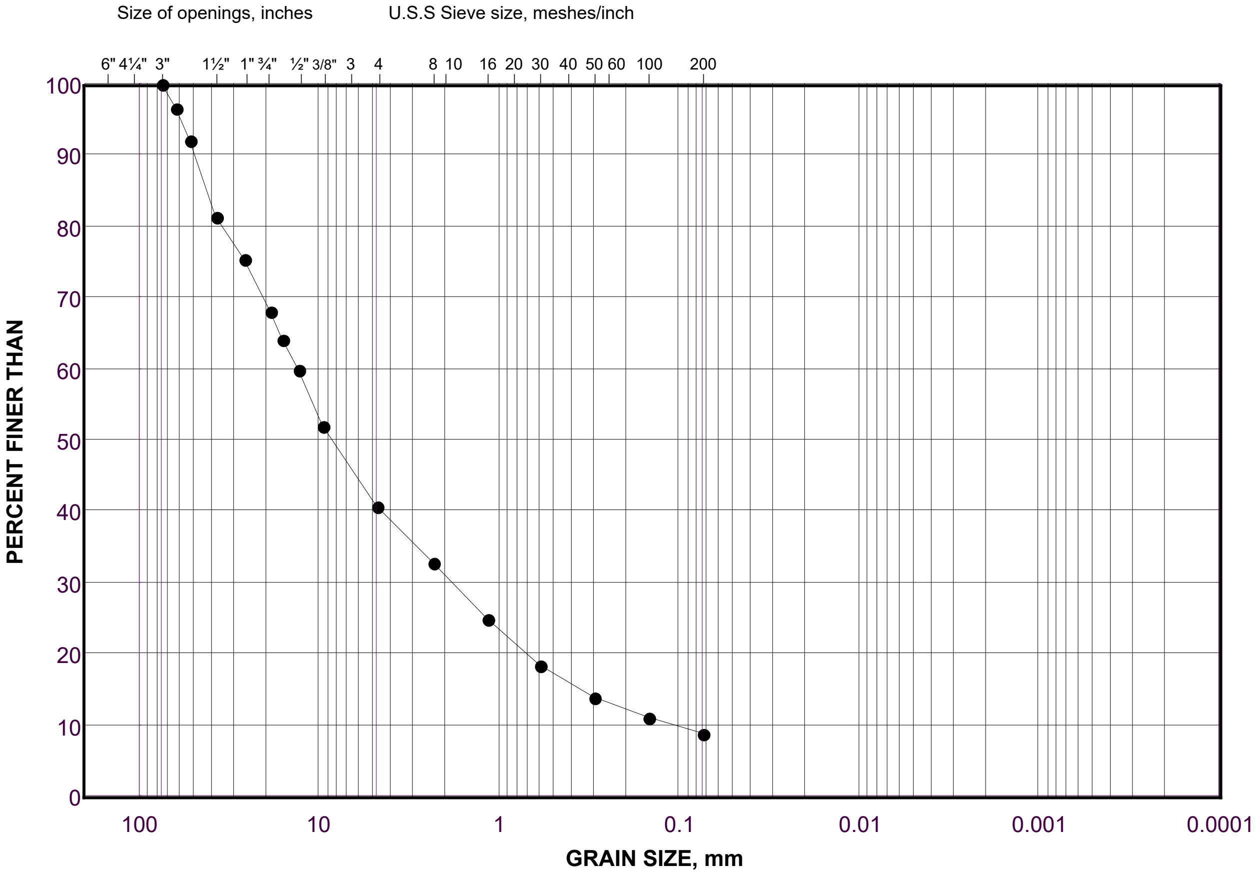
Project Number	21476582	Depth	63
Project Task	1000	Units	Imperial
Borehole Number	MW 21-02	Testing Date	3/28/22 5:06:06 PM
Sample Number	13	Tested By	Sieve - TP
Checked By	____________________	LabID	22-200

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-02	13	58.0 - 63.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 5455(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	0.00	0.00	37.50	100.0
26.5mm	48.00	0.88	26.50	99.1
19.0mm	262.00	3.92	19.00	95.2
16mm	354.00	1.69	16.00	93.5
13.2mm	448.00	1.72	13.20	91.8
9.5mm	654.00	3.78	9.50	88.0
4.75mm	1054.00	7.33	4.75	80.7
PAN	4401.00	80.68	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	24.13	5.70	2.36	75.0
1.18mm	52.78	6.76	1.18	68.2
600µm	82.72	7.07	0.60	61.2
300µm	126.45	10.32	0.30	50.8
150µm	180.61	12.79	0.15	38.0
75µm	222.24	9.83	0.08	28.2

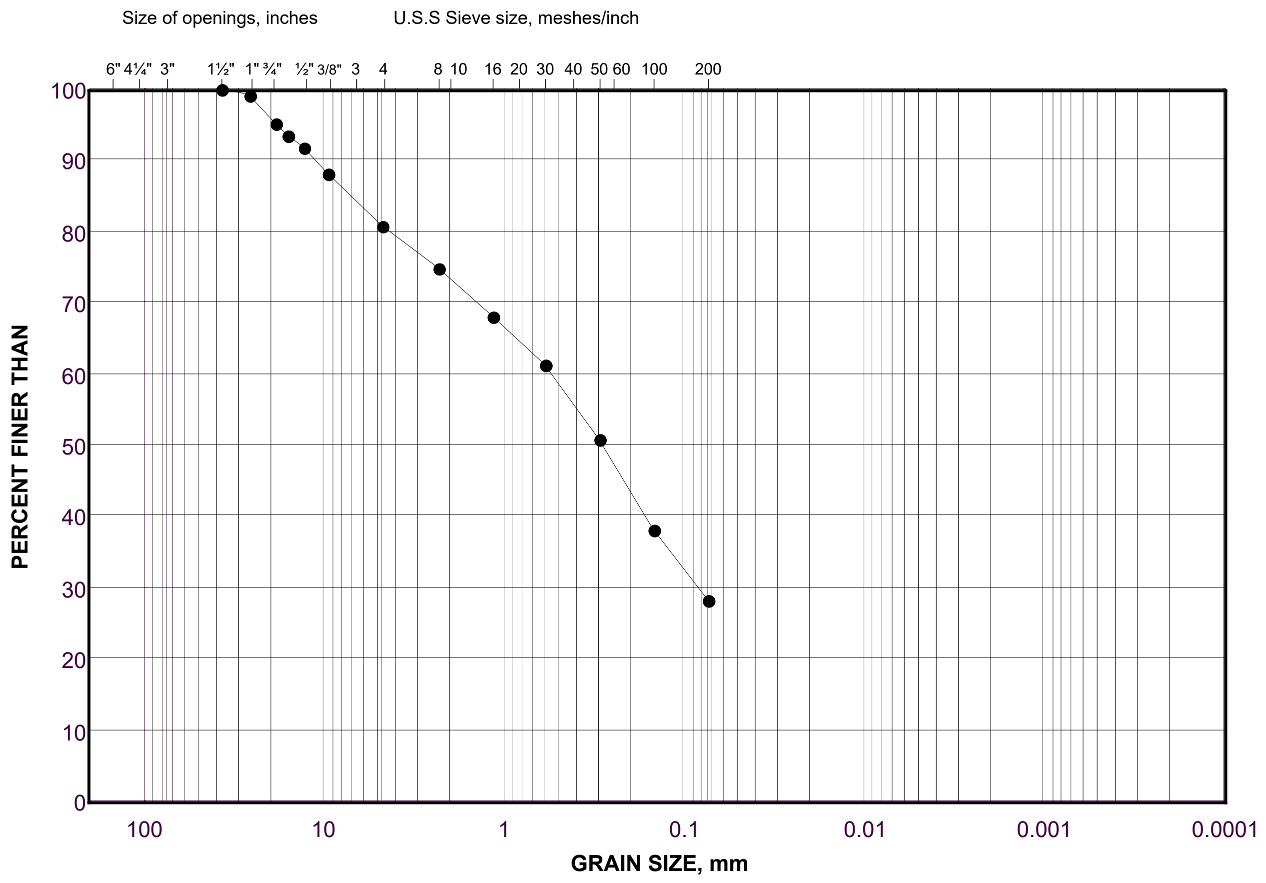
Project Number	21476582	Depth	8
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:30:01 AM
Sample Number	2	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-583

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	2	3.0 - 8.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15090(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	0.00	0.00	37.50	100.0
26.5mm	40.00	0.27	26.50	99.7
19.0mm	88.00	0.32	19.00	99.4
16mm	158.00	0.46	16.00	99.0
13.2mm	250.00	0.61	13.20	98.3
9.5mm	578.00	2.17	9.50	96.2
4.75mm	1820.00	8.23	4.75	87.9
PAN	13270.00	87.94	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	33.00	8.67	2.36	79.3
1.18mm	65.50	8.54	1.18	70.7
600µm	95.20	7.80	0.60	62.9
300µm	158.57	16.64	0.30	46.3
150µm	257.29	25.93	0.15	20.4
75µm	285.00	7.28	0.08	13.1

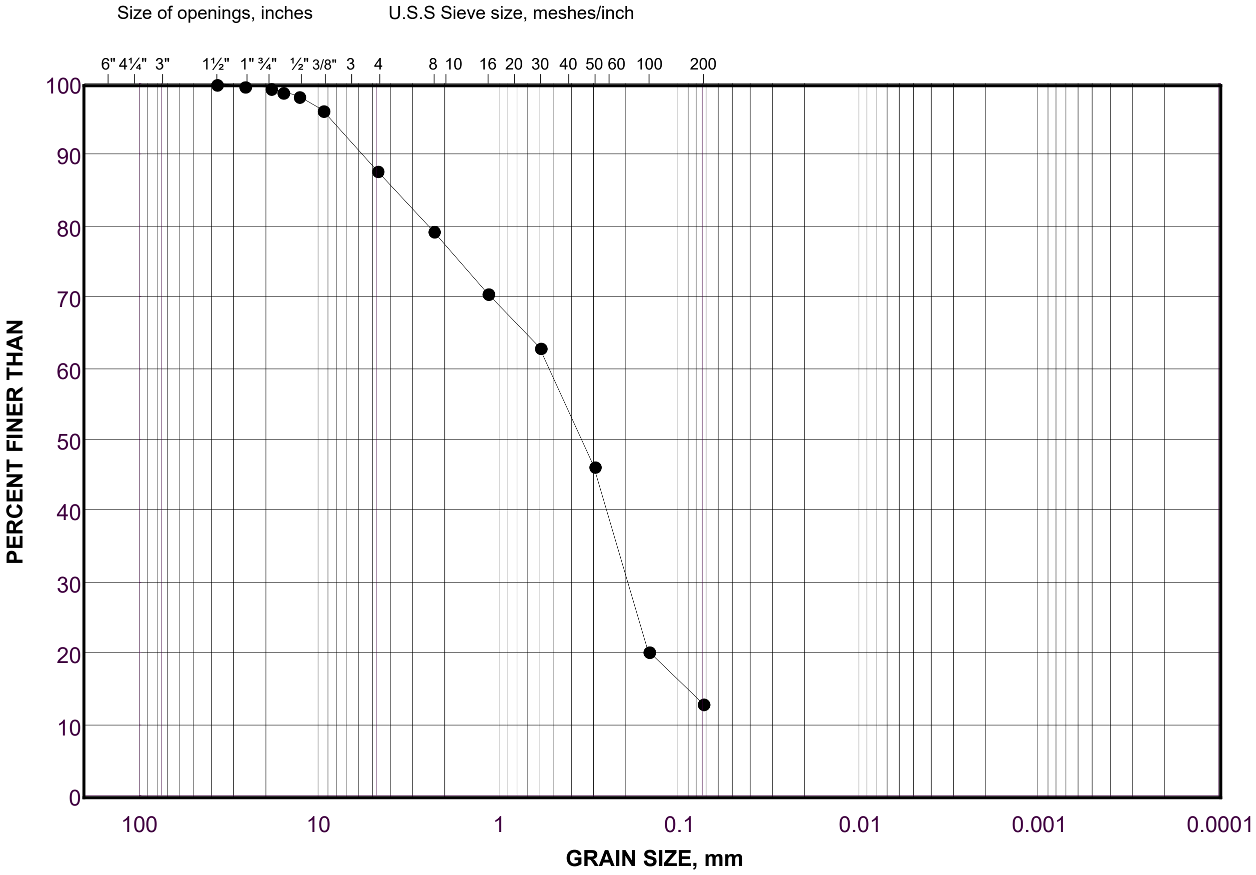
Project Number	21476582	Depth	18
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:33:29 AM
Sample Number	4	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-584

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	4	13.0 - 18.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 1027.7(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
13.2mm	0.00	0.00	13.20	100.0
9.5mm	0.00	0.00	9.50	100.0
4.75mm	0.00	0.00	4.75	100.0
PAN	1027.70	100.00	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	0.01	0.00	2.36	100.0
1.18mm	0.03	0.01	1.18	100.0
600µm	0.10	0.03	0.60	100.0
300µm	0.19	0.04	0.30	99.9
150µm	0.39	0.08	0.15	99.8
75µm	1.64	0.50	0.08	99.3

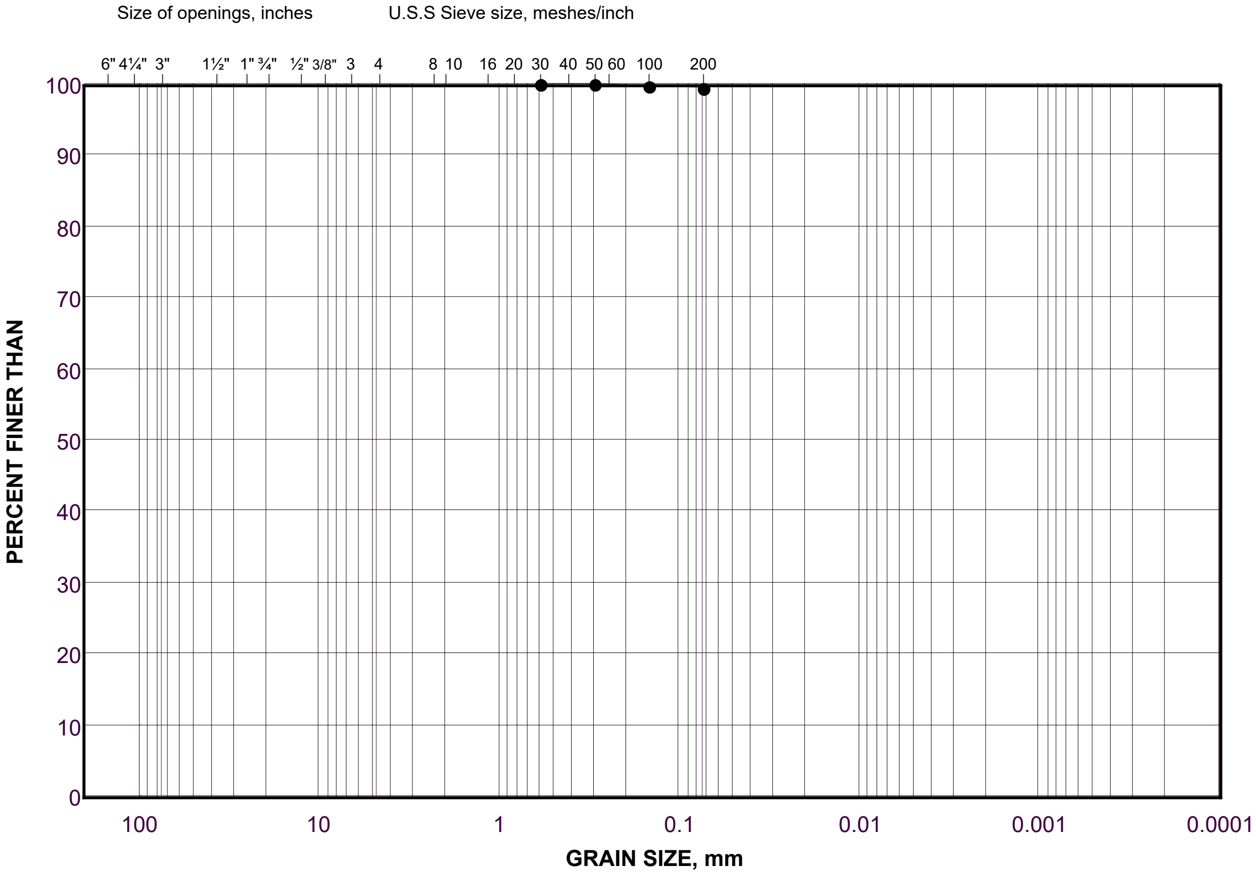
Project Number	21476582	Depth	23
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:36:34 AM
Sample Number	5	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-585

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	5	18.0 - 23.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 10195.1(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
13.2mm	0.00	0.00	13.20	100.0
9.5mm	5.60	0.05	9.50	100.0
4.75mm	29.30	0.23	4.75	99.7
PAN	10160.80	99.72	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	0.90	0.31	2.36	99.4
1.18mm	2.00	0.38	1.18	99.0
600µm	3.30	0.45	0.60	98.6
300µm	4.70	0.48	0.30	98.1
150µm	6.80	0.72	0.15	97.4
75µm	17.20	3.58	0.08	93.8

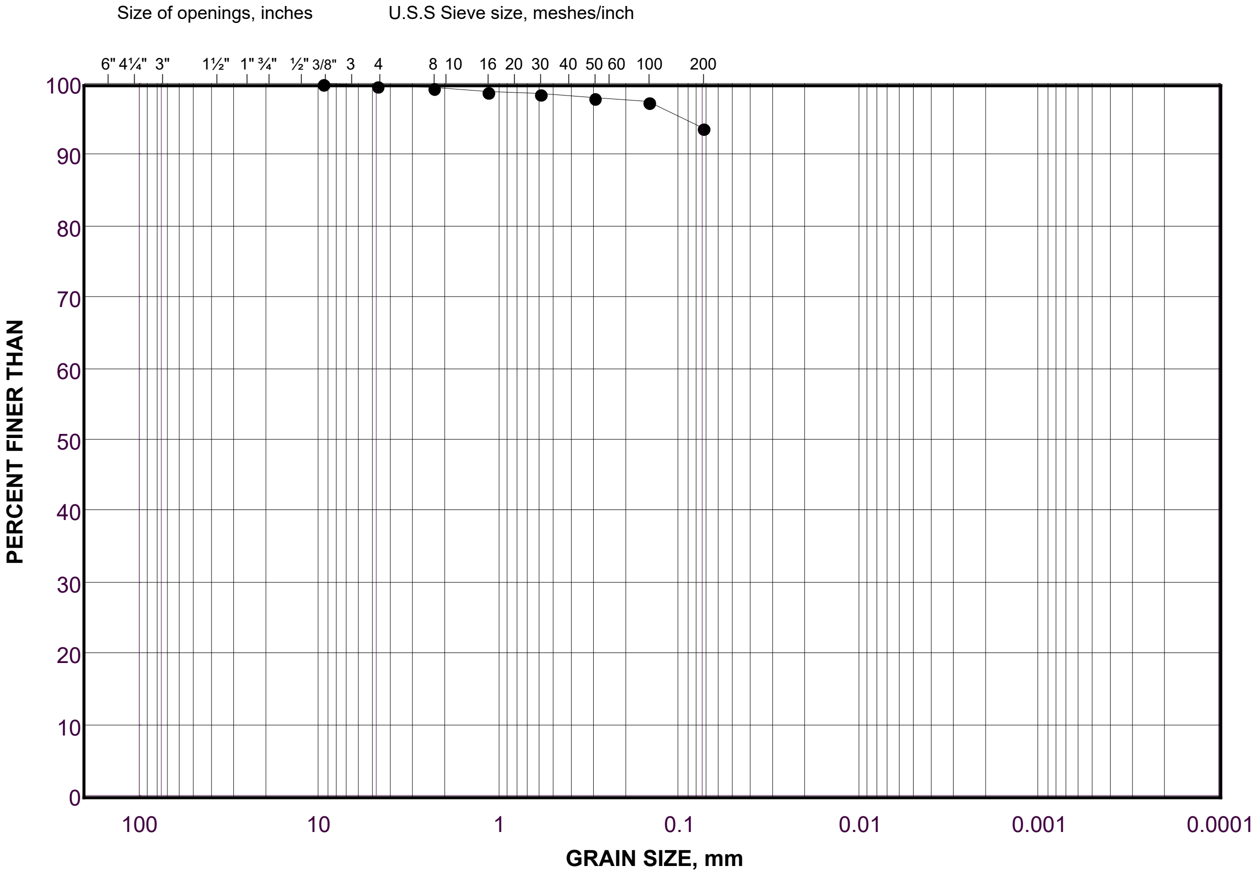
Project Number	21476582	Depth	28
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/08/22 3:31:46 PM
Sample Number	6A	Tested By	Sieve - TP
Checked By	______________________	LabID	22-214

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	6A	23.0 - 26.5

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 7378.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	92.30	1.25	37.50	98.8
26.5mm	287.80	2.65	26.50	96.1
19.0mm	504.40	2.94	19.00	93.2
16mm	565.70	0.83	16.00	92.3
13.2mm	652.80	1.18	13.20	91.2
9.5mm	847.80	2.64	9.50	88.5
4.75mm	1375.60	7.15	4.75	81.4
PAN	5969.70	81.36	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	15.10	4.50	2.36	76.9
1.18mm	32.20	5.10	1.18	71.8
600μm	48.80	4.95	0.60	66.8
300μm	66.20	5.19	0.30	61.6
150μm	86.10	5.93	0.15	55.7
75μm	108.50	6.68	0.08	49.0

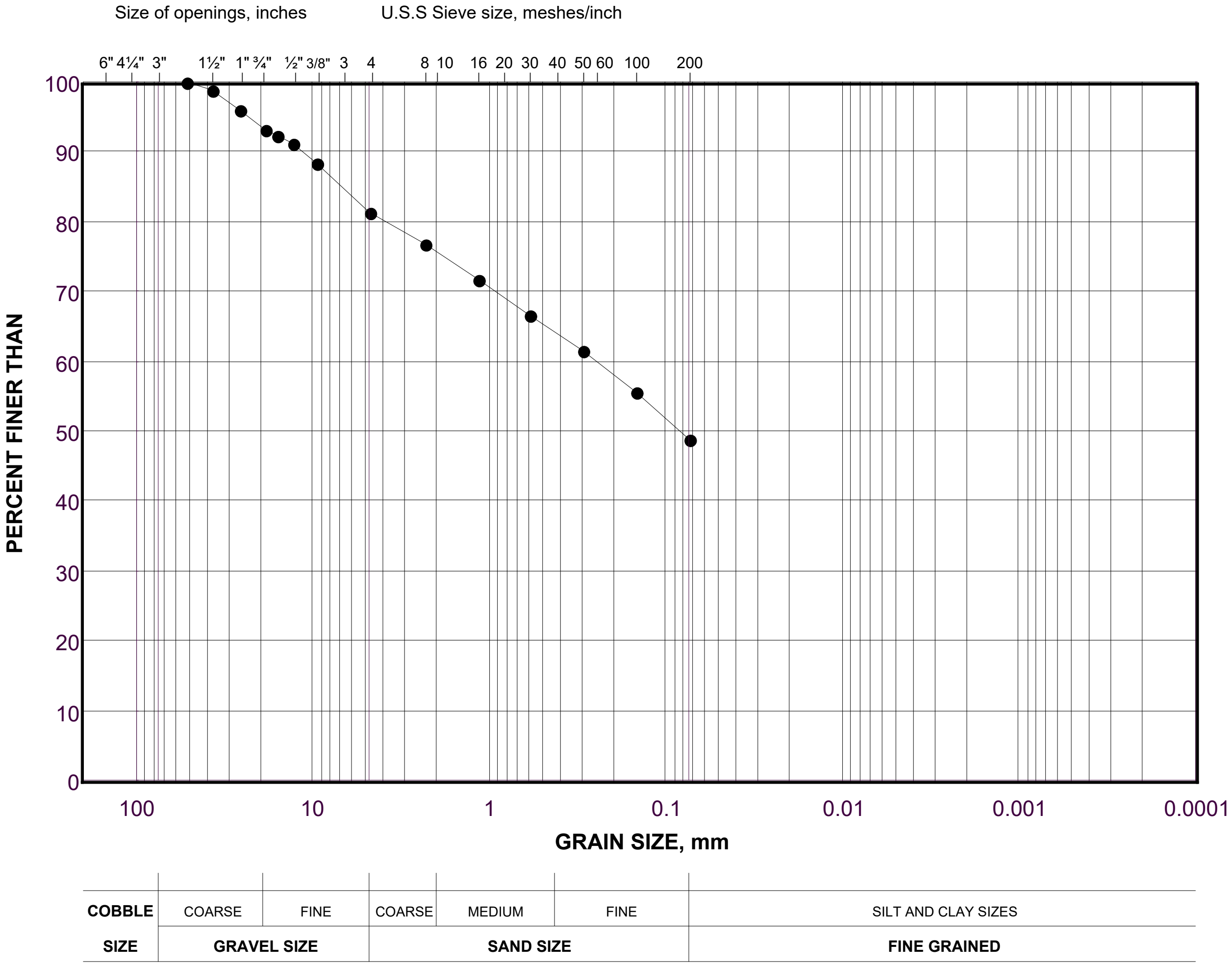
Project Number	21476582	Depth	28
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/08/22 3:39:06 PM
Sample Number	6B	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-205

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	6B	26.50 - 28.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16380(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1983.10	12.11	75.00	87.9
63mm	2728.70	4.55	63.00	83.3
53mm	2728.70	0.00	53.00	83.3
37.5mm	3482.30	4.60	37.50	78.7
26.5mm	4536.40	6.44	26.50	72.3
19.0mm	5048.70	3.13	19.00	69.2
16mm	5268.20	1.34	16.00	67.8
13.2mm	5510.40	1.48	13.20	66.4
9.5mm	6029.50	3.17	9.50	63.2
4.75mm	6924.50	5.46	4.75	57.7
PAN	9455.50	57.72	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	22.40	4.61	2.36	53.1
1.18mm	46.10	4.88	1.18	48.2
600µm	71.50	5.23	0.60	43.0
300µm	96.20	5.09	0.30	37.9
150µm	123.20	5.56	0.15	32.4
75µm	153.50	6.24	0.08	26.1

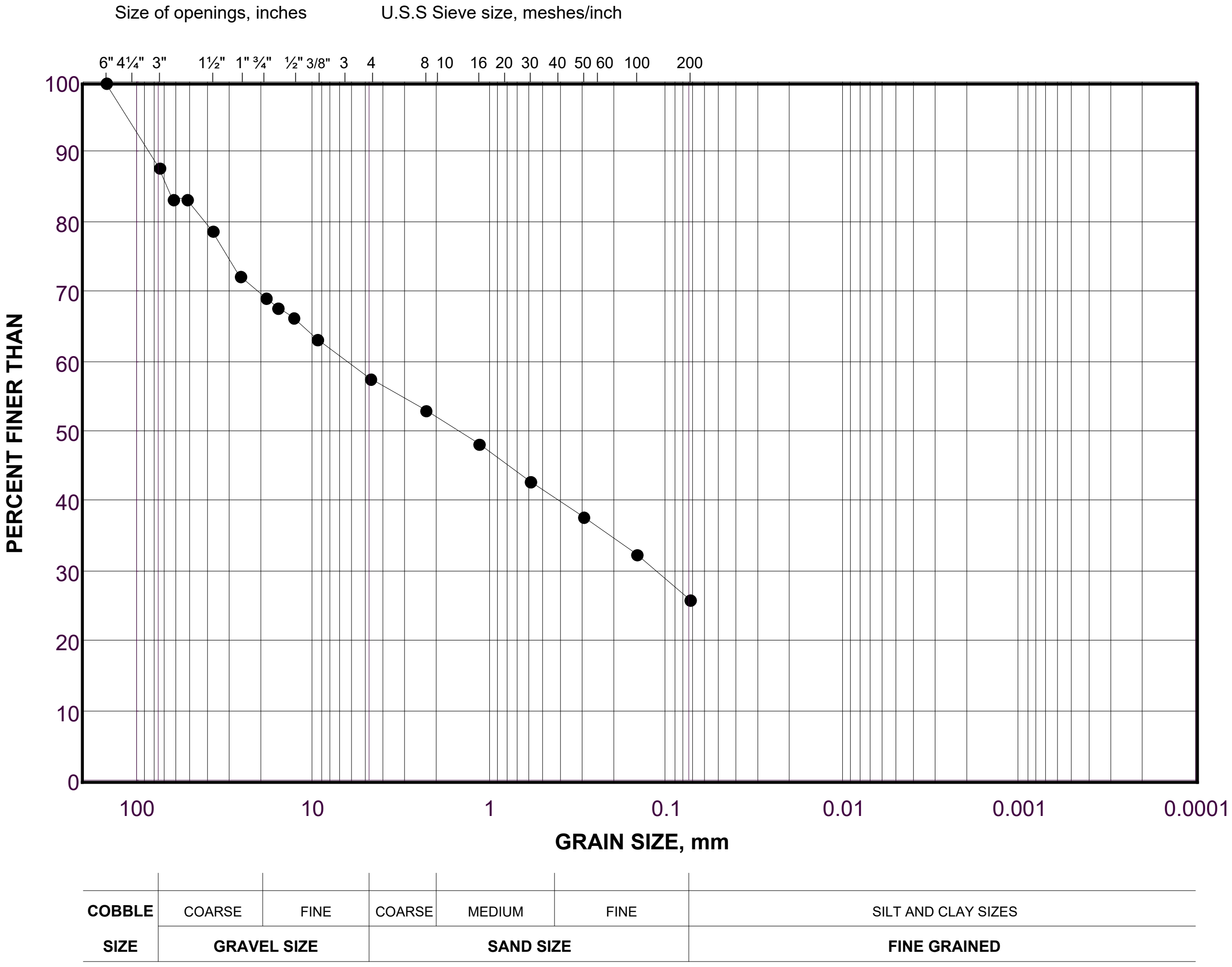
Project Number	21476582	Depth	33
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:39:40 AM
Sample Number	7	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-215

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	7	28.0 - 33.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17900(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	1416.00	7.91	63.00	92.1
53mm	1914.00	2.78	53.00	89.3
37.5mm	3648.00	9.69	37.50	79.6
26.5mm	4478.00	4.64	26.50	75.0
19.0mm	5234.00	4.22	19.00	70.8
16mm	5548.00	1.75	16.00	69.0
13.2mm	5966.00	2.34	13.20	66.7
9.5mm	6614.00	3.62	9.50	63.1
4.75mm	7652.00	5.80	4.75	57.3
PAN	10248.00	57.25	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	18.77	3.30	2.36	54.0
1.18mm	45.08	4.62	1.18	49.3
600µm	74.68	5.20	0.60	44.1
300µm	105.14	5.35	0.30	38.8
150µm	138.57	5.87	0.15	32.9
75µm	180.31	7.33	0.08	25.6

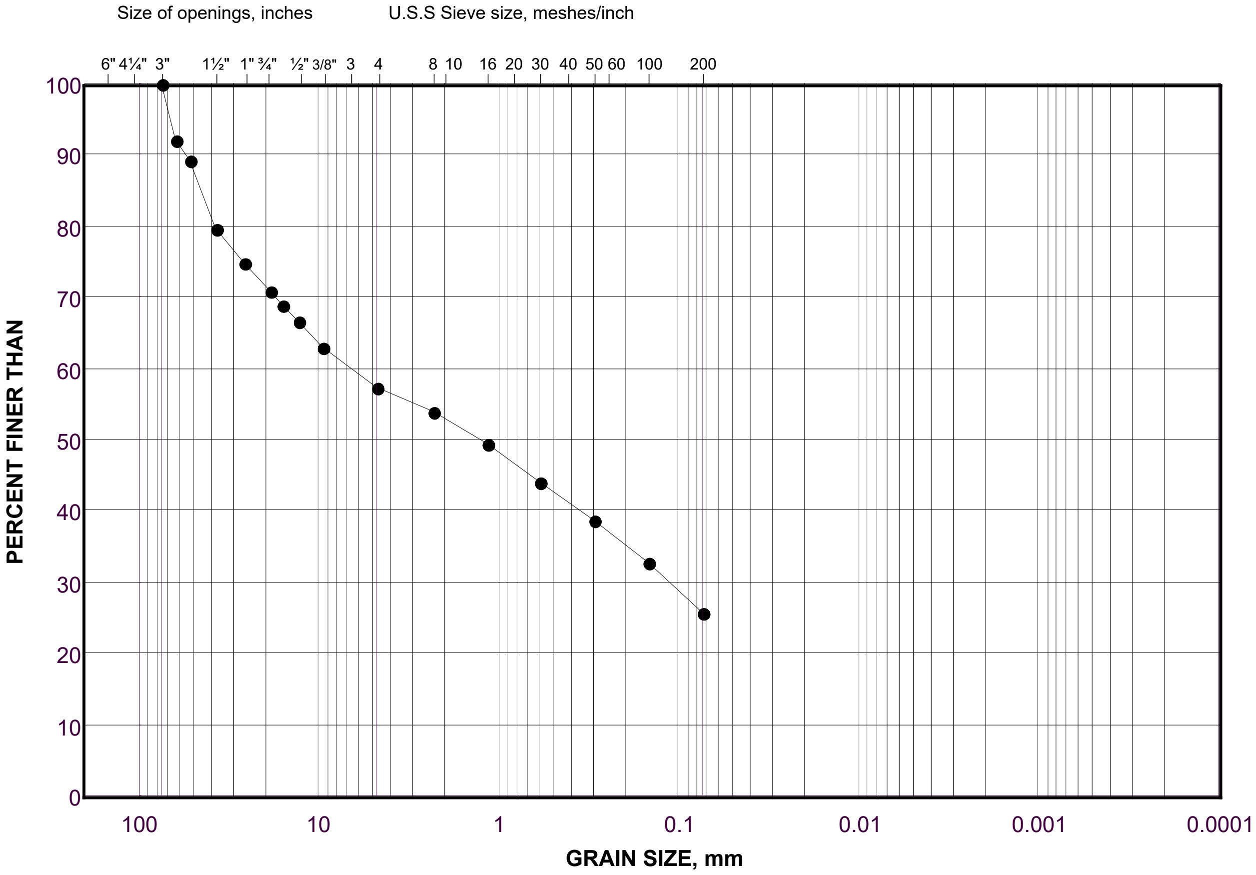
Project Number	21476582	Depth	38
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:42:27 AM
Sample Number	8	Tested By	Sieve - JB
Checked By	______________________	LabID	22-586

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	8	33.0 - 38.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17462.8(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	197.40	1.13	53.00	98.9
37.5mm	382.50	1.06	37.50	97.8
26.5mm	677.80	1.69	26.50	96.1
19.0mm	836.30	0.91	19.00	95.2
16mm	1050.00	1.22	16.00	94.0
13.2mm	1210.60	0.92	13.20	93.1
9.5mm	1651.10	2.52	9.50	90.6
4.75mm	3908.30	12.93	4.75	77.6
PAN	13496.20	77.62	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	44.80	12.52	2.36	65.1
1.18mm	77.90	9.25	1.18	55.9
600µm	99.50	6.04	0.60	49.8
300µm	123.10	6.59	0.30	43.2
150µm	150.20	7.57	0.15	35.7
75µm	171.80	6.04	0.08	29.6

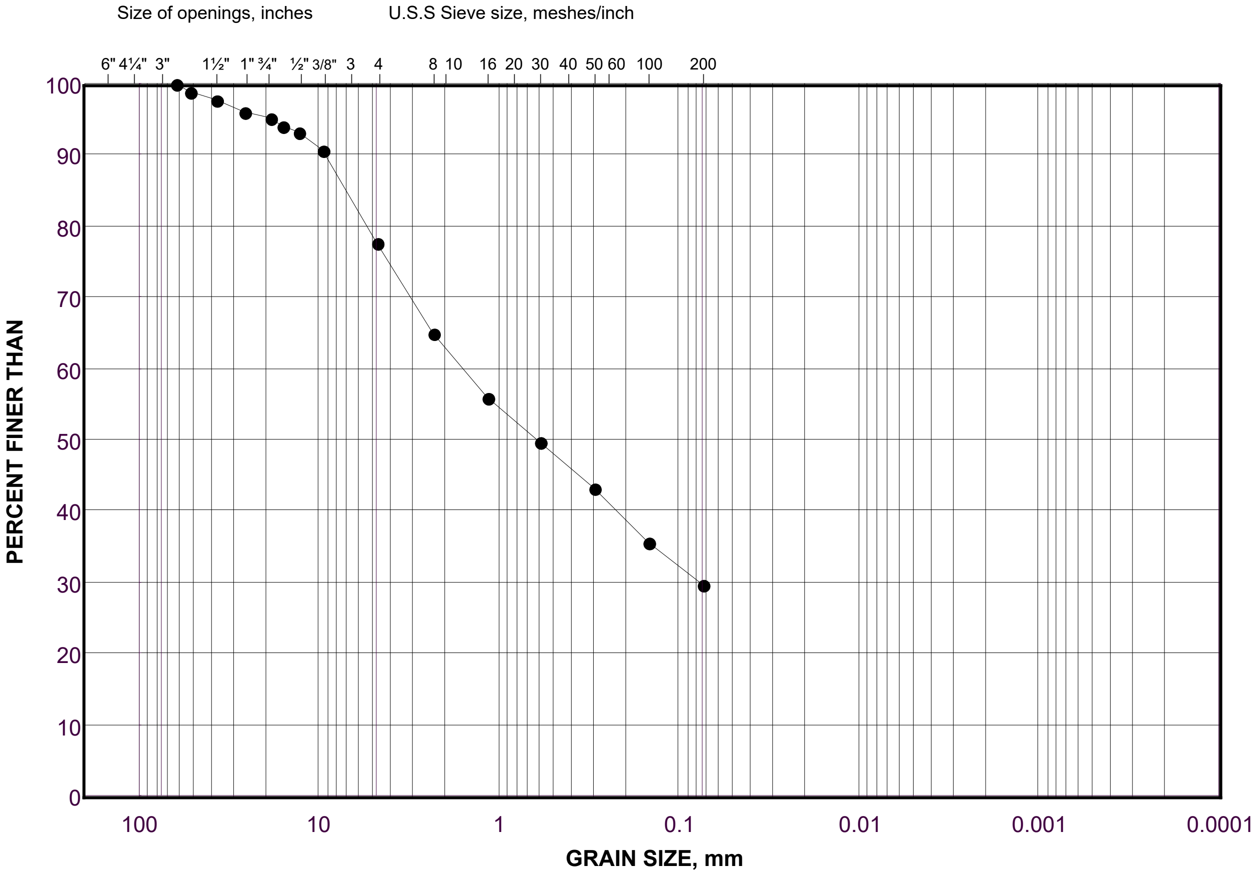
Project Number	21476582	Depth	43
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:45:36 AM
Sample Number	9	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-572

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	9	38.0 - 43.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 9315.4(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	0.00	0.00	37.50	100.0
26.5mm	75.70	0.81	26.50	99.2
19.0mm	222.90	1.58	19.00	97.6
16mm	353.10	1.40	16.00	96.2
13.2mm	428.90	0.81	13.20	95.4
9.5mm	915.30	5.22	9.50	90.2
4.75mm	2099.70	12.71	4.75	77.5
PAN	7179.00	77.47	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	47.70	13.87	2.36	63.6
1.18mm	84.40	10.67	1.18	52.9
600µm	109.30	7.24	0.60	45.7
300µm	132.30	6.69	0.30	39.0
150µm	159.50	7.91	0.15	31.1
75µm	185.30	7.50	0.08	23.6

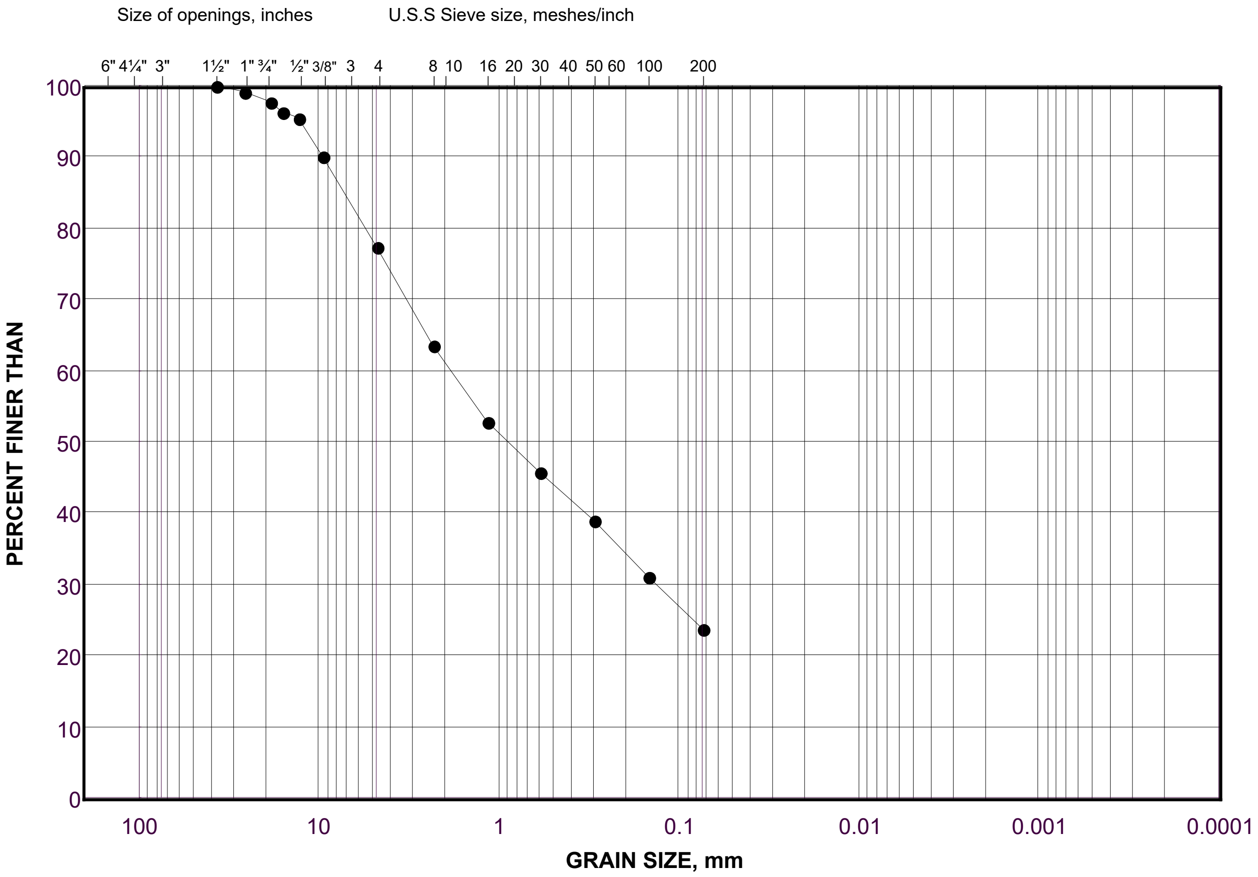
Project Number	21476582	Depth	46
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:47:52 AM
Sample Number	10A	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-441

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	10A	43.0 - 46.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 7570.7(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	818.70	10.81	75.00	89.2
63mm	818.70	0.00	63.00	89.2
53mm	818.70	0.00	53.00	89.2
37.5mm	1124.40	4.04	37.50	85.2
26.5mm	1275.70	2.00	26.50	83.2
19.0mm	1605.80	4.36	19.00	78.8
16mm	1737.80	1.74	16.00	77.1
13.2mm	1878.00	1.85	13.20	75.2
9.5mm	2155.20	3.66	9.50	71.5
4.75mm	2634.70	6.33	4.75	65.2
PAN	4913.80	65.21	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	25.00	6.10	2.36	59.1
1.18mm	50.40	6.19	1.18	52.9
600µm	72.80	5.46	0.60	47.5
300µm	94.70	5.34	0.30	42.1
150µm	120.70	6.34	0.15	35.8
75µm	150.50	7.27	0.08	28.5

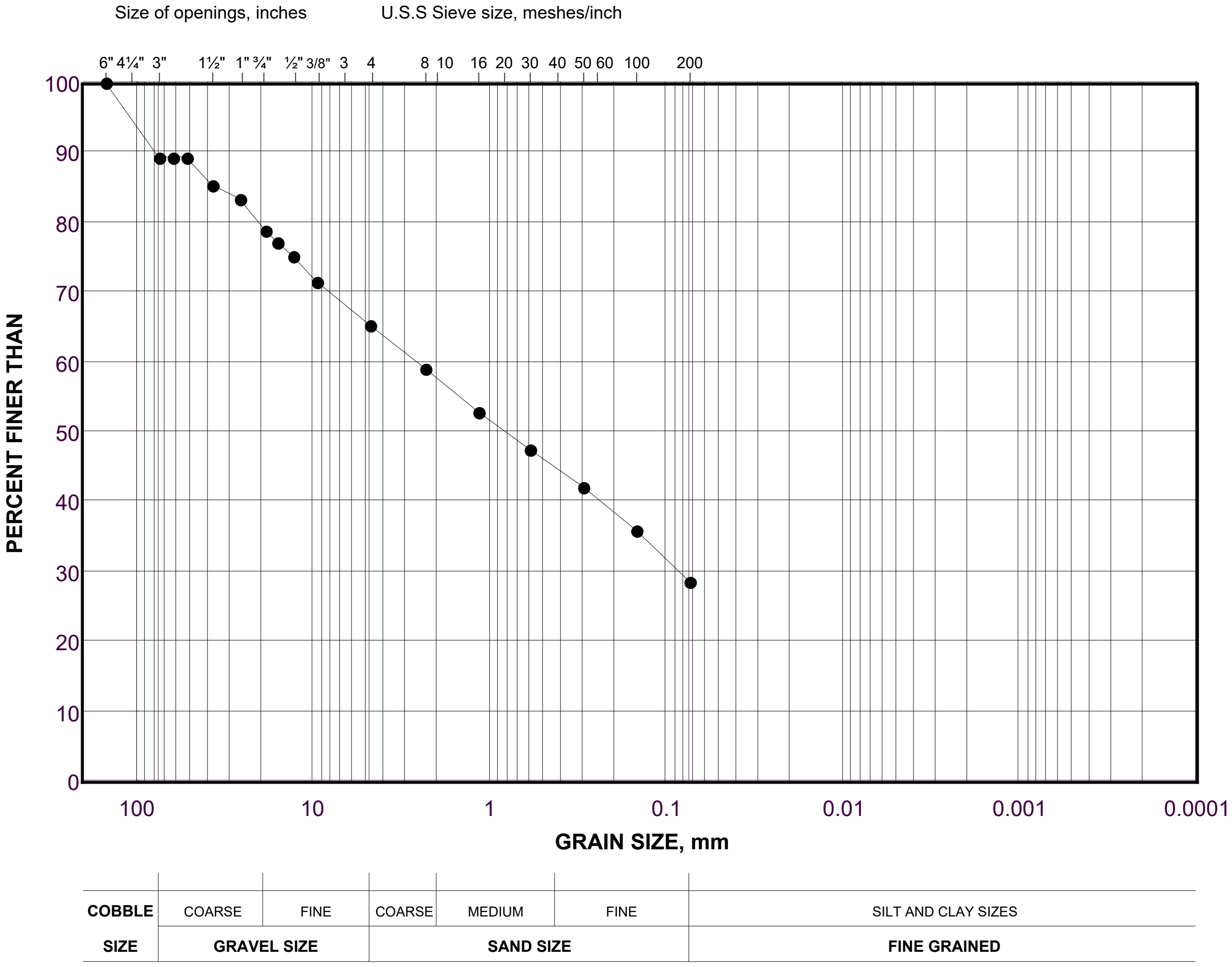
Project Number	21476582	Depth	48
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:54:06 AM
Sample Number	10B	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-442

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	10B	46.0 - 48.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 11722(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	462.00	3.94	63.00	96.1
53mm	1122.00	5.63	53.00	90.4
37.5mm	1478.00	3.04	37.50	87.4
26.5mm	2010.00	4.54	26.50	82.9
19.0mm	2456.00	3.80	19.00	79.1
16mm	2576.00	1.02	16.00	78.0
13.2mm	2824.00	2.12	13.20	75.9
9.5mm	3356.00	4.54	9.50	71.4
4.75mm	4280.00	7.88	4.75	63.5
PAN	7418.00	63.49	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	34.23	6.44	2.36	57.1
1.18mm	71.56	7.02	1.18	50.0
600µm	108.47	6.94	0.60	43.1
300µm	143.62	6.61	0.30	36.5
150µm	178.82	6.62	0.15	29.9
75µm	201.91	4.34	0.08	25.5

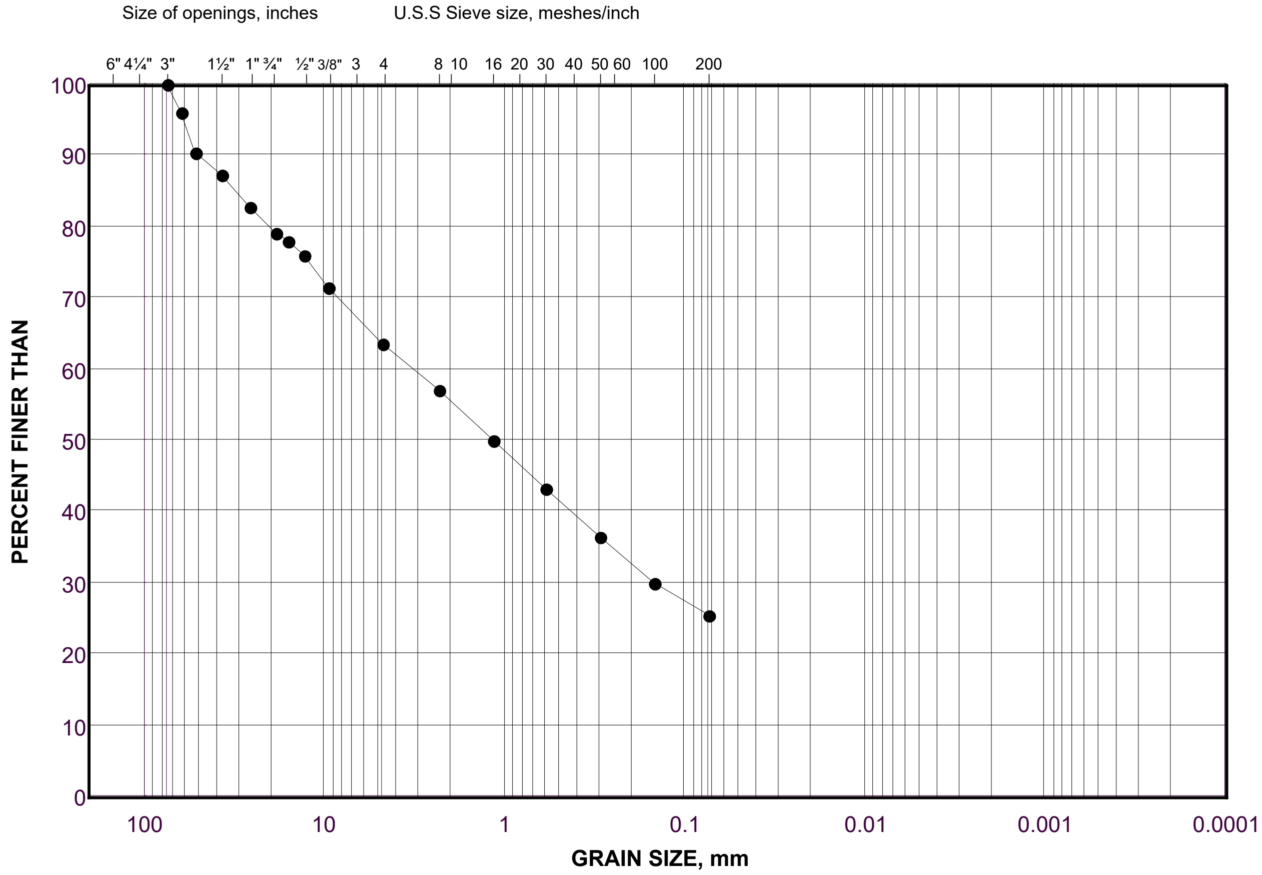
Project Number	21476582	Depth	53
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:56:26 AM
Sample Number	11	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-587

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	11	48.0 - 53.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 12030(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	604.00	5.02	63.00	95.0
53mm	604.00	0.00	53.00	95.0
37.5mm	1112.00	4.22	37.50	90.8
26.5mm	2012.00	7.48	26.50	83.3
19.0mm	2474.00	3.84	19.00	79.4
16mm	2668.00	1.61	16.00	77.8
13.2mm	2862.00	1.61	13.20	76.2
9.5mm	3320.00	3.81	9.50	72.4
4.75mm	4146.00	6.87	4.75	65.5
PAN	7872.00	65.54	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	27.66	5.22	2.36	60.3
1.18mm	56.49	5.44	1.18	54.9
600µm	86.52	5.67	0.60	49.2
300µm	117.01	5.75	0.30	43.5
150µm	150.21	6.26	0.15	37.2
75µm	189.54	7.42	0.08	29.8

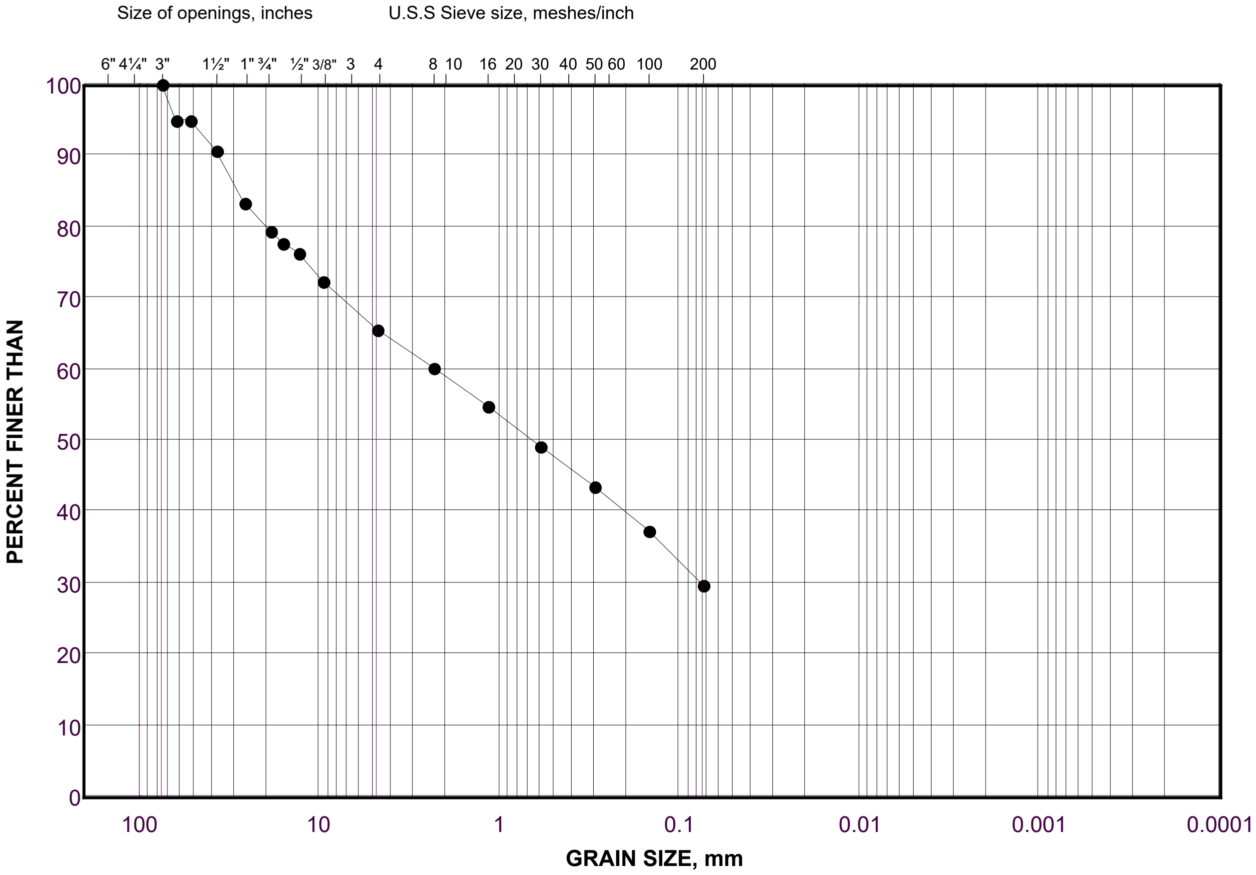
Project Number	21476582	Depth	58
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 8:59:20 AM
Sample Number	12	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-588

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	12	53.0 - 58.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15606.4(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	184.20	1.18	37.50	98.8
26.5mm	488.10	1.95	26.50	96.9
19.0mm	1119.00	4.04	19.00	92.8
16mm	1303.80	1.18	16.00	91.7
13.2mm	1526.60	1.43	13.20	90.2
9.5mm	1972.30	2.86	9.50	87.4
4.75mm	2903.70	5.97	4.75	81.4
PAN	12702.70	81.39	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	24.20	6.95	2.36	74.4
1.18mm	66.40	12.12	1.18	62.3
600µm	129.00	17.97	0.60	44.4
300µm	185.30	16.16	0.30	28.2
150µm	210.90	7.35	0.15	20.8
75µm	228.30	5.00	0.08	15.8

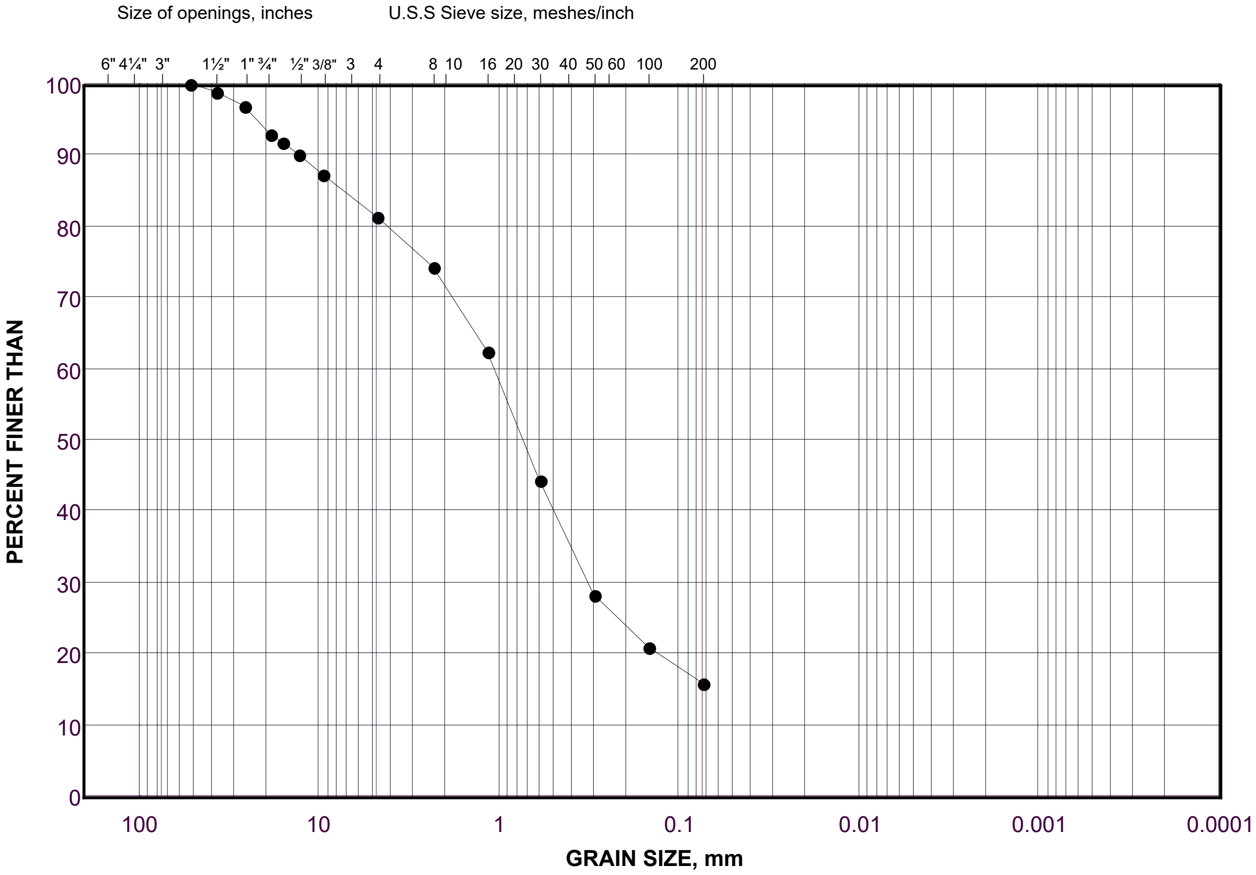
Project Number	21476582	Depth	63
Project Task	1000	Units	Metric
Borehole Number	MW 21-03	Testing Date	3/29/22 9:01:12 AM
Sample Number	13	Tested By	Sieve -
Checked By	______________________________	LabID	22-562

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	MW 21-03	13	58.0 - 63.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 5593.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	119.20	2.13	37.50	97.9
26.5mm	188.40	1.24	26.50	96.6
19.0mm	320.90	2.37	19.00	94.3
16mm	372.90	0.93	16.00	93.3
13.2mm	439.70	1.19	13.20	92.1
9.5mm	585.50	2.61	9.50	89.5
4.75mm	1148.00	10.06	4.75	79.5
PAN	4437.00	79.47	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	47.70	13.67	2.36	65.8
1.18mm	103.20	15.91	1.18	49.9
600µm	147.30	12.64	0.60	37.3
300µm	181.70	9.86	0.30	27.4
150µm	202.40	5.93	0.15	21.5
75µm	218.70	4.67	0.08	16.8

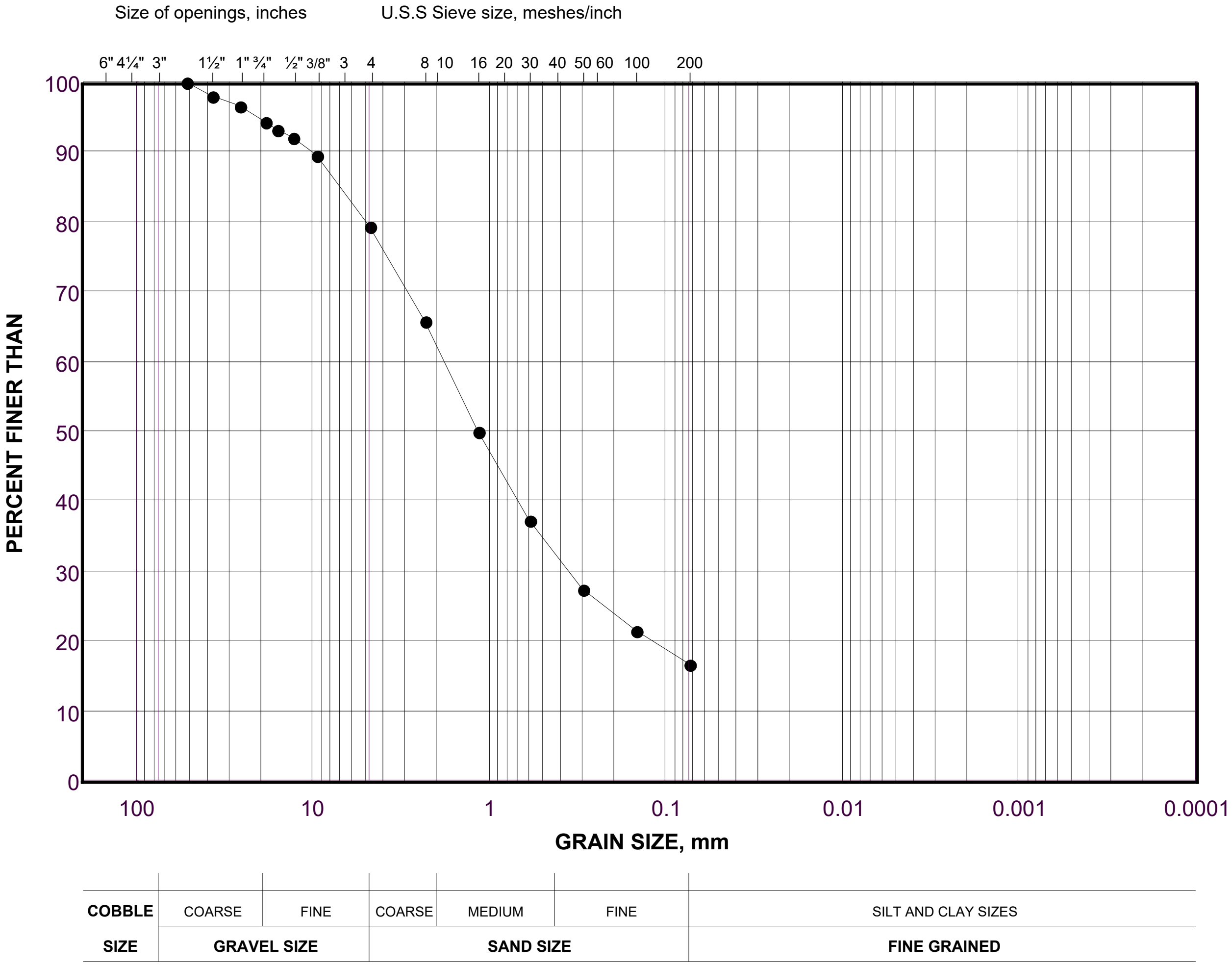
Project Number	21476582	Depth	65.5
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 9:14:01 AM
Sample Number	14A	Tested By	Sieve - TP
Checked By	______________________	LabID	22-222

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	14A	63.0 - 65.50

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 10929(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	2081.90	19.05	75.00	81.0
63mm	2604.60	4.78	63.00	76.2
53mm	2604.60	0.00	53.00	76.2
37.5mm	3446.40	7.70	37.50	68.5
26.5mm	4438.80	9.08	26.50	59.4
19.0mm	5172.00	6.71	19.00	52.7
16mm	5594.90	3.87	16.00	48.8
13.2mm	5802.40	1.90	13.20	46.9
9.5mm	6360.40	5.11	9.50	41.8
4.75mm	7161.10	7.33	4.75	34.5
PAN	3745.20	34.47	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	55.00	6.71	2.36	27.8
1.18mm	107.90	6.46	1.18	21.3
600µm	157.50	6.05	0.60	15.3
300µm	194.70	4.54	0.30	10.7
150µm	220.30	3.12	0.15	7.6
75µm	234.70	1.76	0.08	5.8

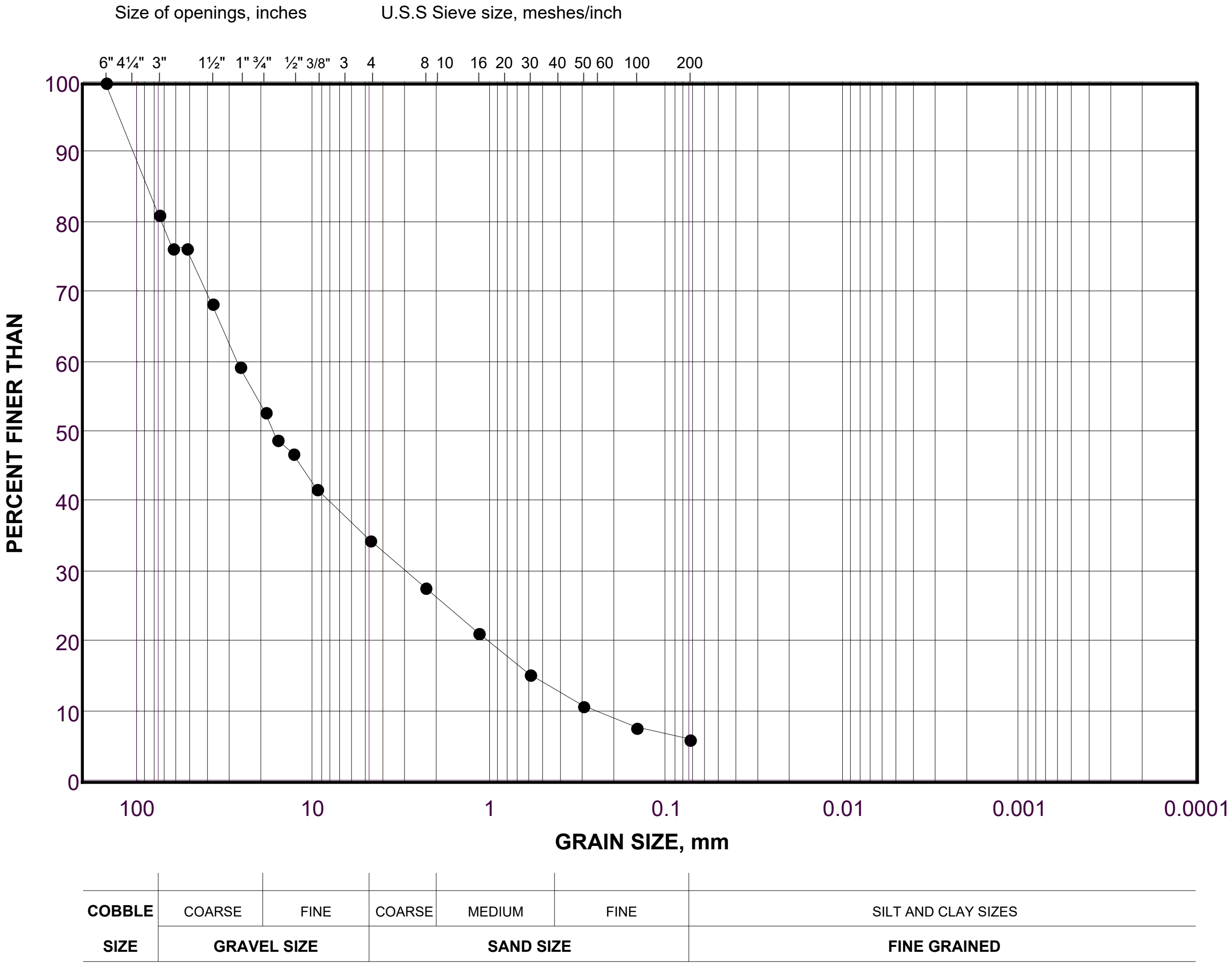
Project Number	21476582	Depth	68
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 9:19:41 AM
Sample Number	14B	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-202

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	14B	65.5 - 68.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 11406(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	1092.00	9.57	63.00	90.4
53mm	1838.00	6.54	53.00	83.9
37.5mm	2578.00	6.49	37.50	77.4
26.5mm	3248.00	5.87	26.50	71.5
19.0mm	3748.00	4.38	19.00	67.1
16mm	3990.00	2.12	16.00	65.0
13.2mm	4316.00	2.86	13.20	62.2
9.5mm	4904.00	5.16	9.50	57.0
4.75mm	5848.00	8.28	4.75	48.7
PAN	5528.00	48.73	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	47.38	6.56	2.36	42.2
1.18mm	97.58	6.95	1.18	35.2
600µm	146.05	6.71	0.60	28.5
300µm	189.76	6.05	0.30	22.5
150µm	223.19	4.63	0.15	17.8
75µm	250.90	3.83	0.08	14.0

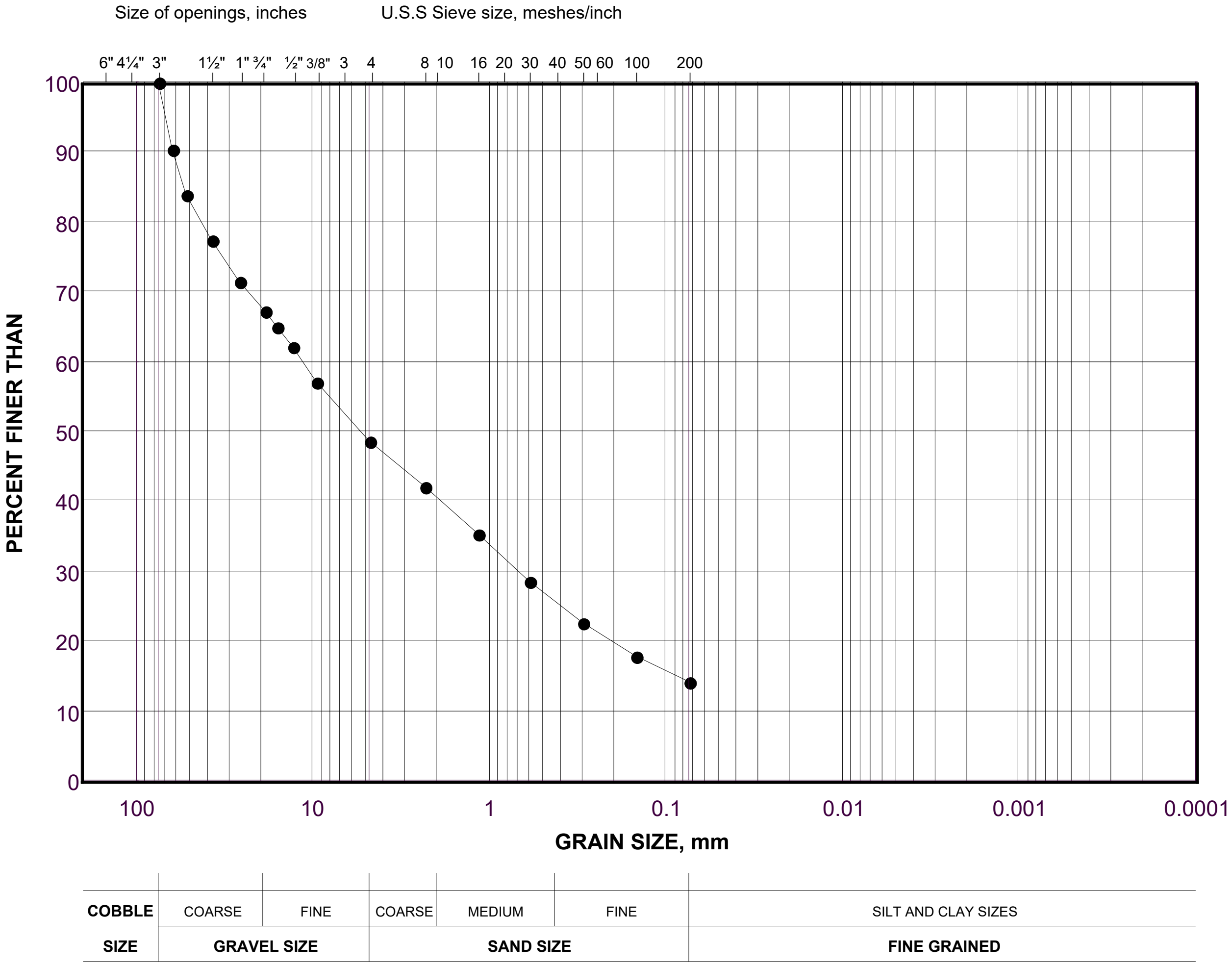
Project Number	21476582	Depth	73
Project Task	1000	Units	Imperial
Borehole Number	MW21-03	Testing Date	3/29/22 9:23:03 AM
Sample Number	15	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-589

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW21-03	15	68.0 - 73.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16900(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1024.00	6.06	75.00	93.9
63mm	2580.00	9.21	63.00	84.7
53mm	4628.00	12.12	53.00	72.6
37.5mm	6870.00	13.27	37.50	59.3
26.5mm	8406.00	9.09	26.50	50.3
19.0mm	10296.00	11.18	19.00	39.1
16mm	10880.00	3.46	16.00	35.6
13.2mm	11472.00	3.50	13.20	32.1
9.5mm	12382.00	5.38	9.50	26.7
4.75mm	13508.00	6.66	4.75	20.1
PAN	3354.00	20.07	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	64.35	3.90	2.36	16.2
1.18mm	122.11	3.50	1.18	12.7
600µm	173.65	3.12	0.60	9.5
300µm	214.47	2.47	0.30	7.1
150µm	243.16	1.74	0.15	5.3
75µm	263.15	1.21	0.08	4.1

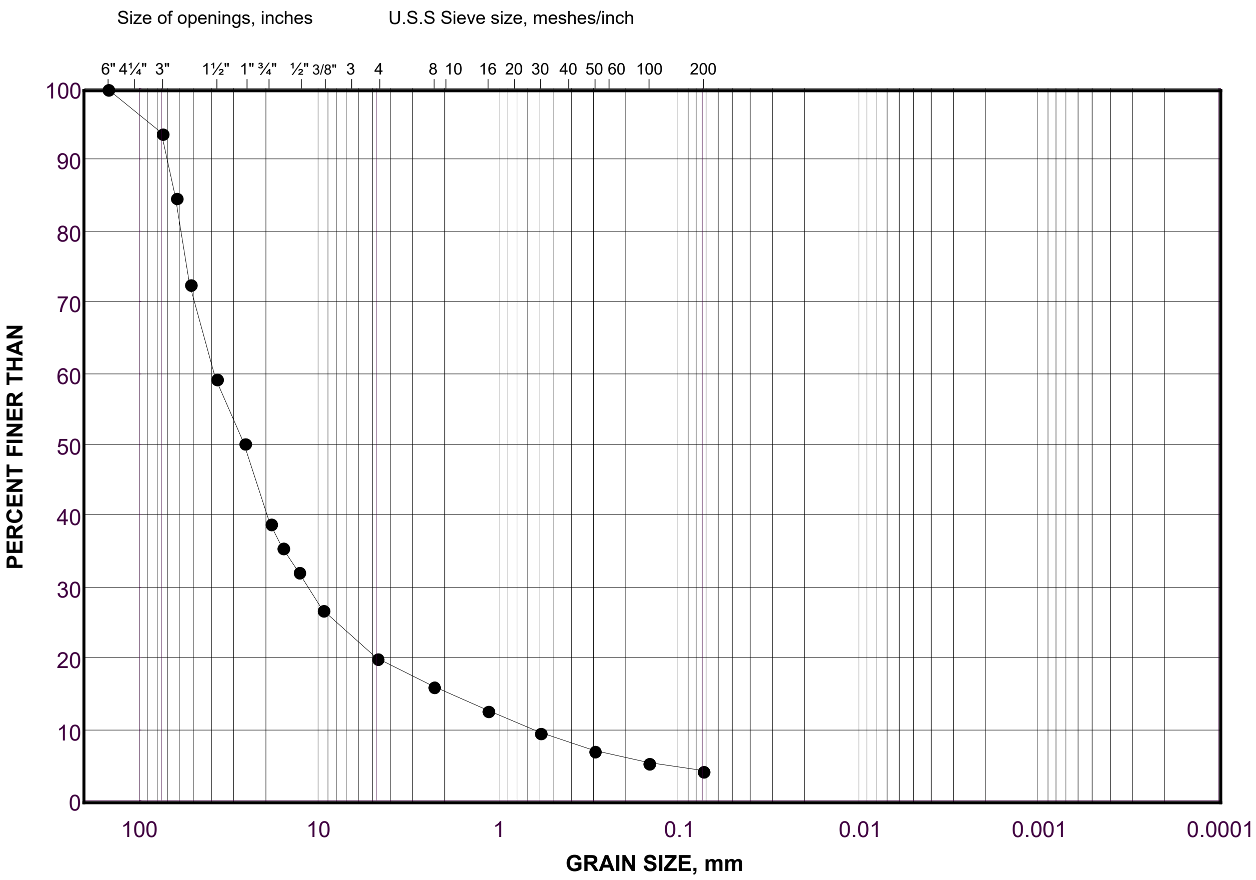
Project Number	21476582	Depth	73
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 9:28:30 AM
Sample Number	16	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-590

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	16	73.0 - 78.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 22242(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	3482.00	15.66	75.00	84.3
63mm	5460.00	8.89	63.00	75.5
53mm	5460.00	0.00	53.00	75.5
37.5mm	9250.00	17.04	37.50	58.4
26.5mm	11352.00	9.45	26.50	49.0
19.0mm	13118.00	7.94	19.00	41.0
16mm	13890.00	3.47	16.00	37.6
13.2mm	14418.00	2.37	13.20	35.2
9.5mm	15472.00	4.74	9.50	30.4
4.75mm	16910.00	6.47	4.75	24.0
PAN	5320.00	23.97	0.00	0.0

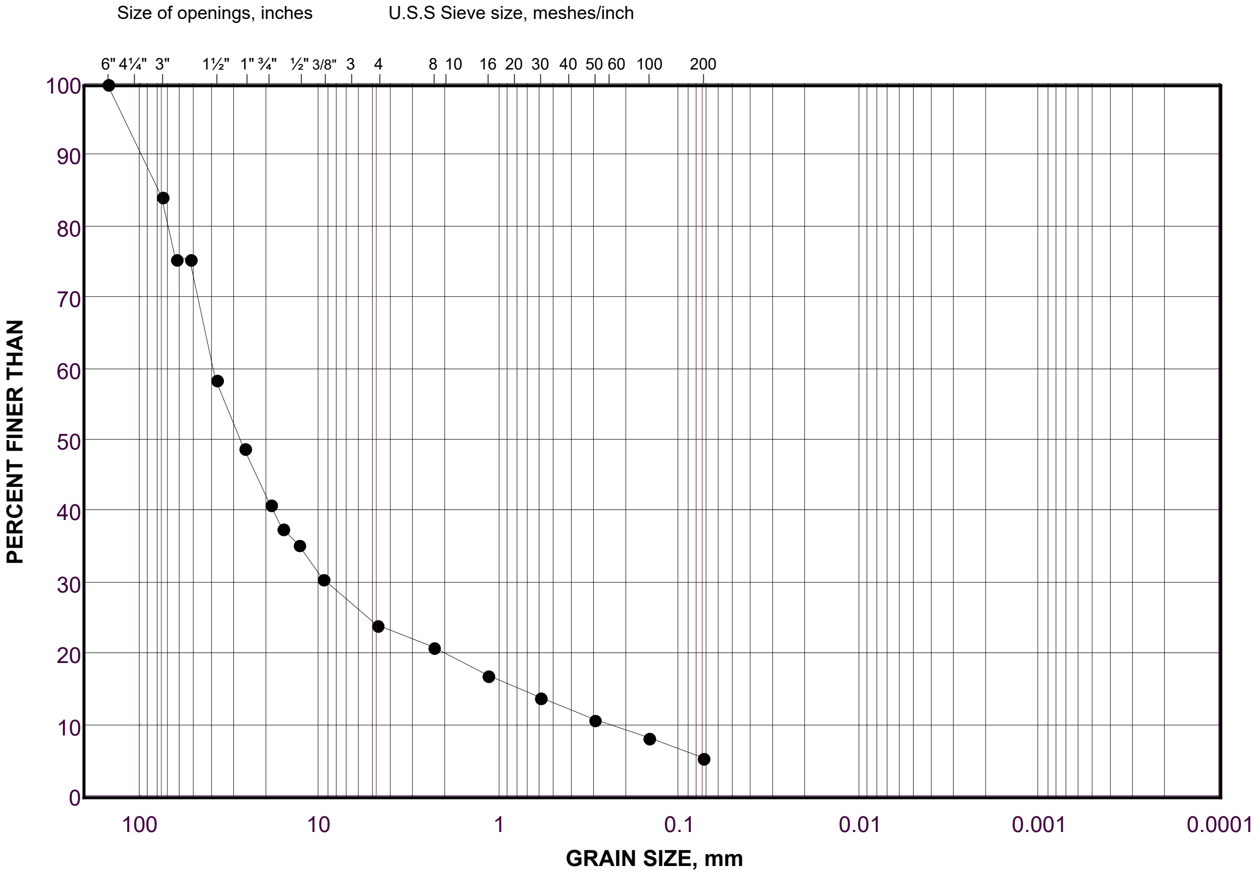
HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	43.24	3.10	2.36	20.9
1.18mm	96.76	3.83	1.18	17.0
600µm	140.26	3.11	0.60	13.9
300µm	186.60	3.32	0.30	10.6
150µm	220.55	2.43	0.15	8.2
75µm	259.02	2.75	0.08	5.4

Project Number	21476582	Depth	83
Project Task	1000	Units	Imperial
Borehole Number	MW 21-03	Testing Date	3/29/22 9:31:38 AM
Sample Number	17	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-591

Golder Associates

# GRAIN SIZE DISTRIBUTION MTO LS-602	FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-03	17	78.0 - 83.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 10428(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	872.00	8.36	63.00	91.6
53mm	872.00	0.00	53.00	91.6
37.5mm	1138.00	2.55	37.50	89.1
26.5mm	1422.00	2.72	26.50	86.4
19.0mm	1684.00	2.51	19.00	83.9
16mm	1864.00	1.73	16.00	82.1
13.2mm	1946.00	0.79	13.20	81.3
9.5mm	2156.00	2.01	9.50	79.3
4.75mm	2544.00	3.72	4.75	75.6
PAN	7882.00	75.61	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	12.97	2.93	2.36	72.7
1.18mm	28.30	3.46	1.18	69.2
600µm	44.17	3.58	0.60	65.6
300µm	64.02	4.48	0.30	61.2
150µm	88.33	5.48	0.15	55.7
75µm	112.81	5.52	0.08	50.2

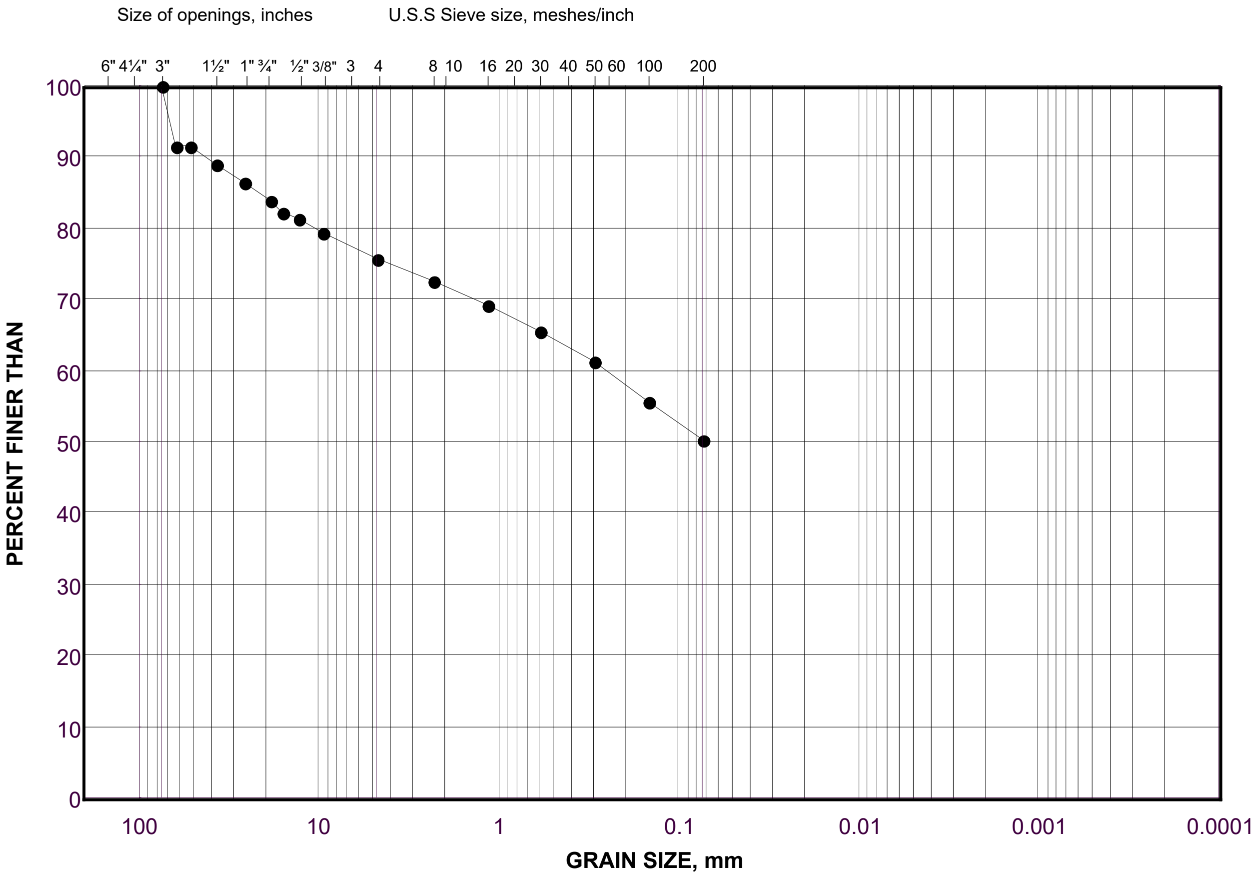
Project Number	21476582	Depth	4
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 9:56:16 AM
Sample Number	1	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-575

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	1	0.0 - 4.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 13008(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	888.00	6.83	53.00	93.2
37.5mm	1446.00	4.29	37.50	88.9
26.5mm	1970.00	4.03	26.50	84.9
19.0mm	2290.00	2.46	19.00	82.4
16mm	2464.00	1.34	16.00	81.1
13.2mm	2648.00	1.41	13.20	79.6
9.5mm	3014.00	2.81	9.50	76.8
4.75mm	3656.00	4.94	4.75	71.9
PAN	9292.00	71.89	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	18.20	3.96	2.36	67.9
1.18mm	38.14	4.34	1.18	63.6
600µm	62.19	5.23	0.60	58.4
300µm	89.89	6.03	0.30	52.3
150µm	117.51	6.01	0.15	46.3
75µm	143.05	5.56	0.08	40.8

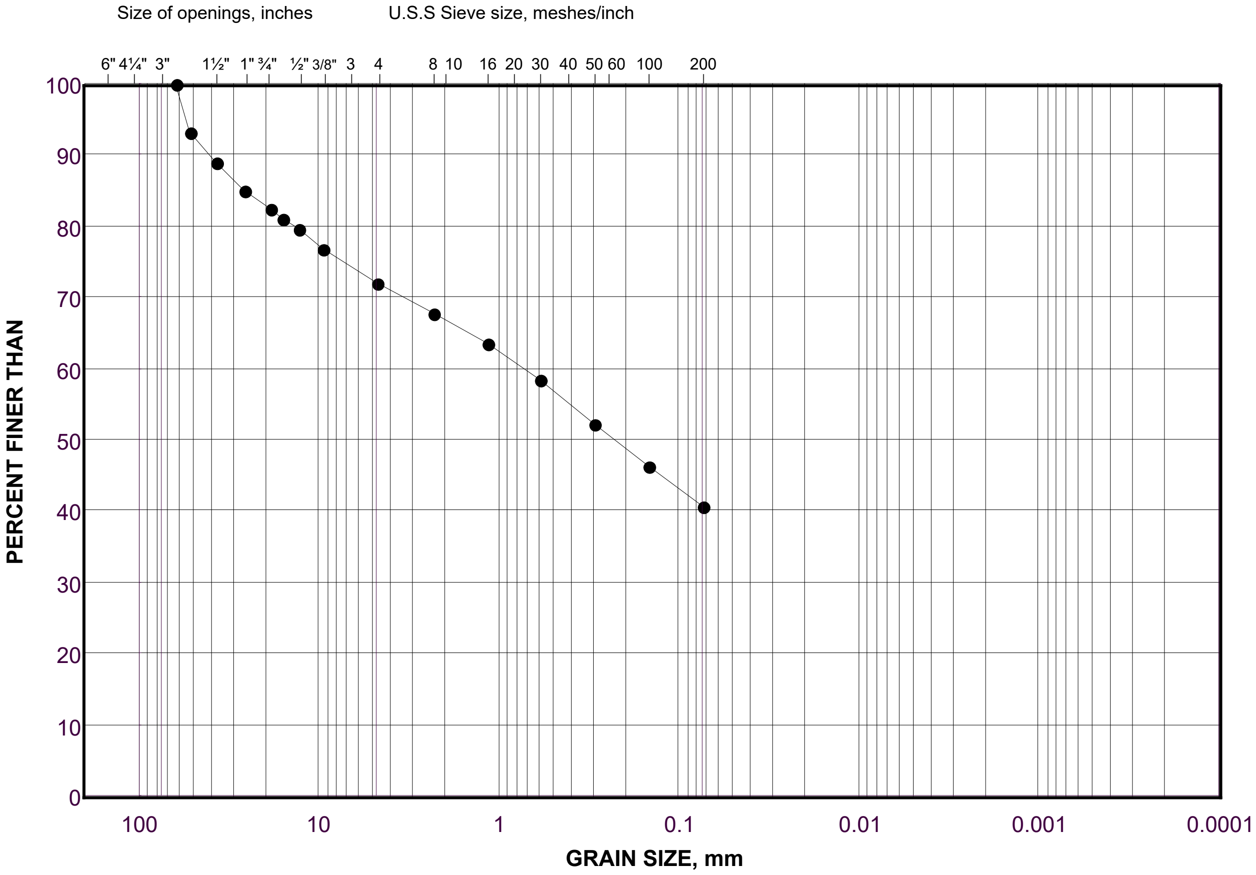
Project Number	21476582	Depth	9
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:11:10 AM
Sample Number	2	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-576

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	2	4.0 - 9.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 3951(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
26.5mm	0.00	0.00	26.50	100.0
19.0mm	20.10	0.51	19.00	99.5
16mm	36.20	0.41	16.00	99.1
13.2mm	48.30	0.31	13.20	98.8
9.5mm	81.90	0.85	9.50	97.9
4.75mm	227.30	3.68	4.75	94.2
PAN	3723.40	94.24	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	13.70	4.29	2.36	90.0
1.18mm	32.40	5.86	1.18	84.1
600µm	53.00	6.45	0.60	77.6
300µm	75.30	6.98	0.30	70.7
150µm	98.00	7.11	0.15	63.6
75µm	121.60	7.39	0.08	56.2

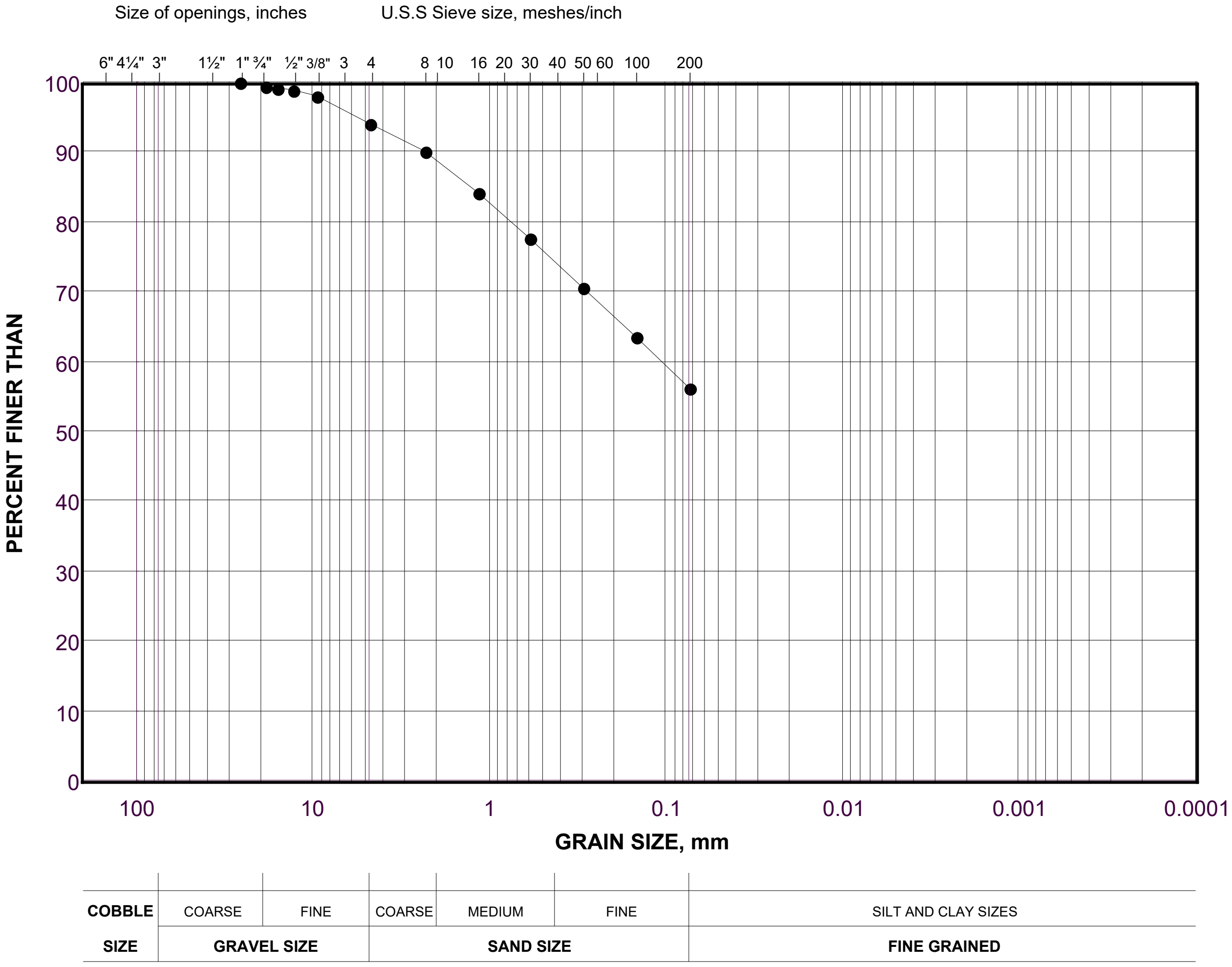
Project Number	21476582	Depth	10
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/08/22 2:00:46 PM
Sample Number	3A	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-432

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	3A	9.0 - 10.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14764.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	897.20	6.08	75.00	93.9
63mm	2469.00	10.65	63.00	83.3
53mm	3017.50	3.71	53.00	79.6
37.5mm	4308.40	8.74	37.50	70.8
26.5mm	5440.50	7.67	26.50	63.2
19.0mm	6563.50	7.61	19.00	55.5
16mm	6921.60	2.43	16.00	53.1
13.2mm	7289.90	2.49	13.20	50.6
9.5mm	7957.40	4.52	9.50	46.1
4.75mm	8901.70	6.40	4.75	39.7
PAN	5842.20	39.70	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	40.70	5.50	2.36	34.2
1.18mm	82.60	5.67	1.18	28.5
600µm	123.00	5.46	0.60	23.1
300µm	162.40	5.33	0.30	17.7
150µm	191.80	3.98	0.15	13.8
75µm	211.80	2.70	0.08	11.1

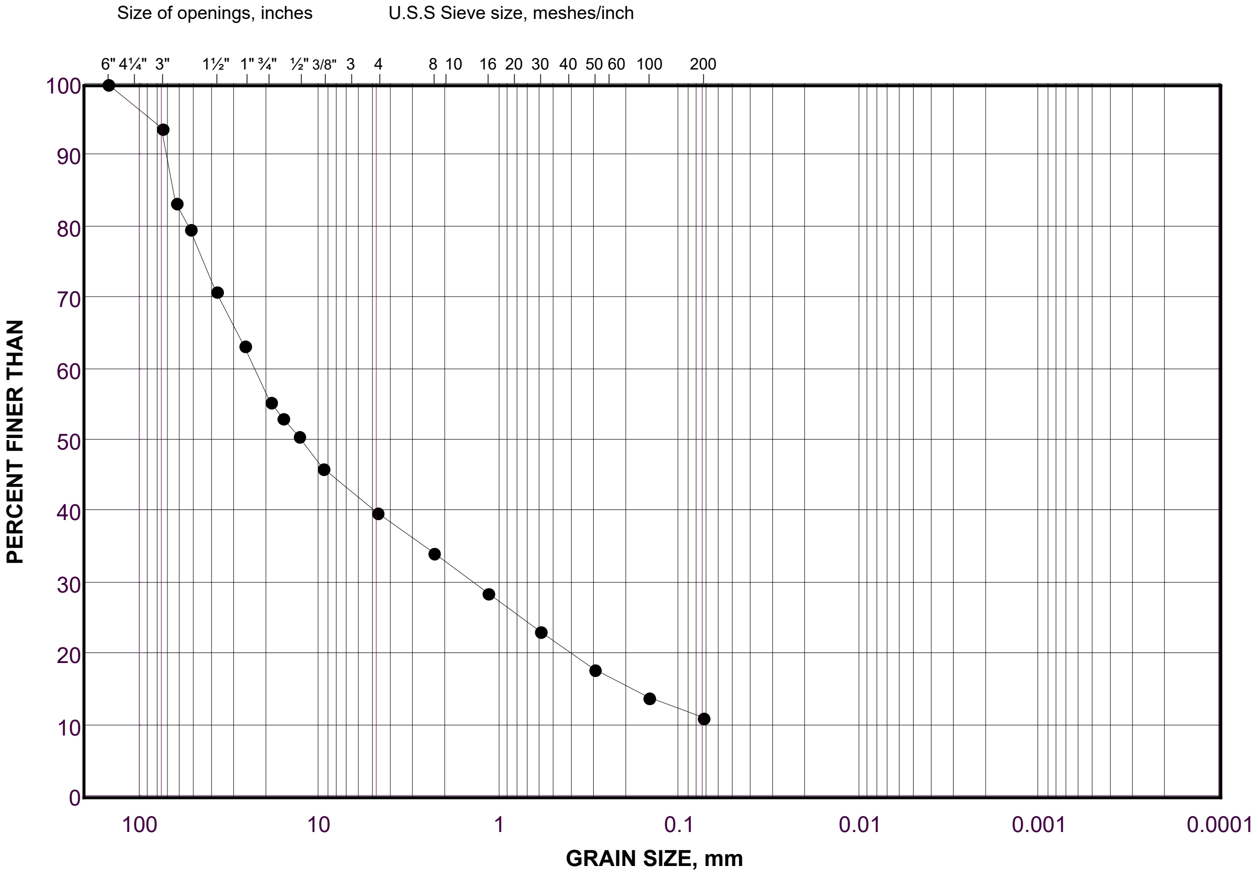
Project Number	21476582	Depth	14
Project Task	1000	Units	Imperial
Borehole Number	MW- 21-04	Testing Date	3/08/22 2:10:12 PM
Sample Number	3B	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-431

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW- 21-04	3B	10.0 - 14.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15690(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1400.00	8.92	75.00	91.1
63mm	2108.00	4.51	63.00	86.6
53mm	2916.00	5.15	53.00	81.4
37.5mm	5004.00	13.31	37.50	68.1
26.5mm	6584.00	10.07	26.50	58.0
19.0mm	7630.00	6.67	19.00	51.4
16mm	8200.00	3.63	16.00	47.7
13.2mm	8620.00	2.68	13.20	45.1
9.5mm	9378.00	4.83	9.50	40.2
4.75mm	10660.00	8.17	4.75	32.1
PAN	5012.00	32.06	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	63.69	5.88	2.36	26.2
1.18mm	119.77	5.18	1.18	21.0
600µm	166.56	4.32	0.60	16.7
300µm	214.45	4.42	0.30	12.3
150µm	252.89	3.55	0.15	8.7
75µm	274.87	2.03	0.08	6.7

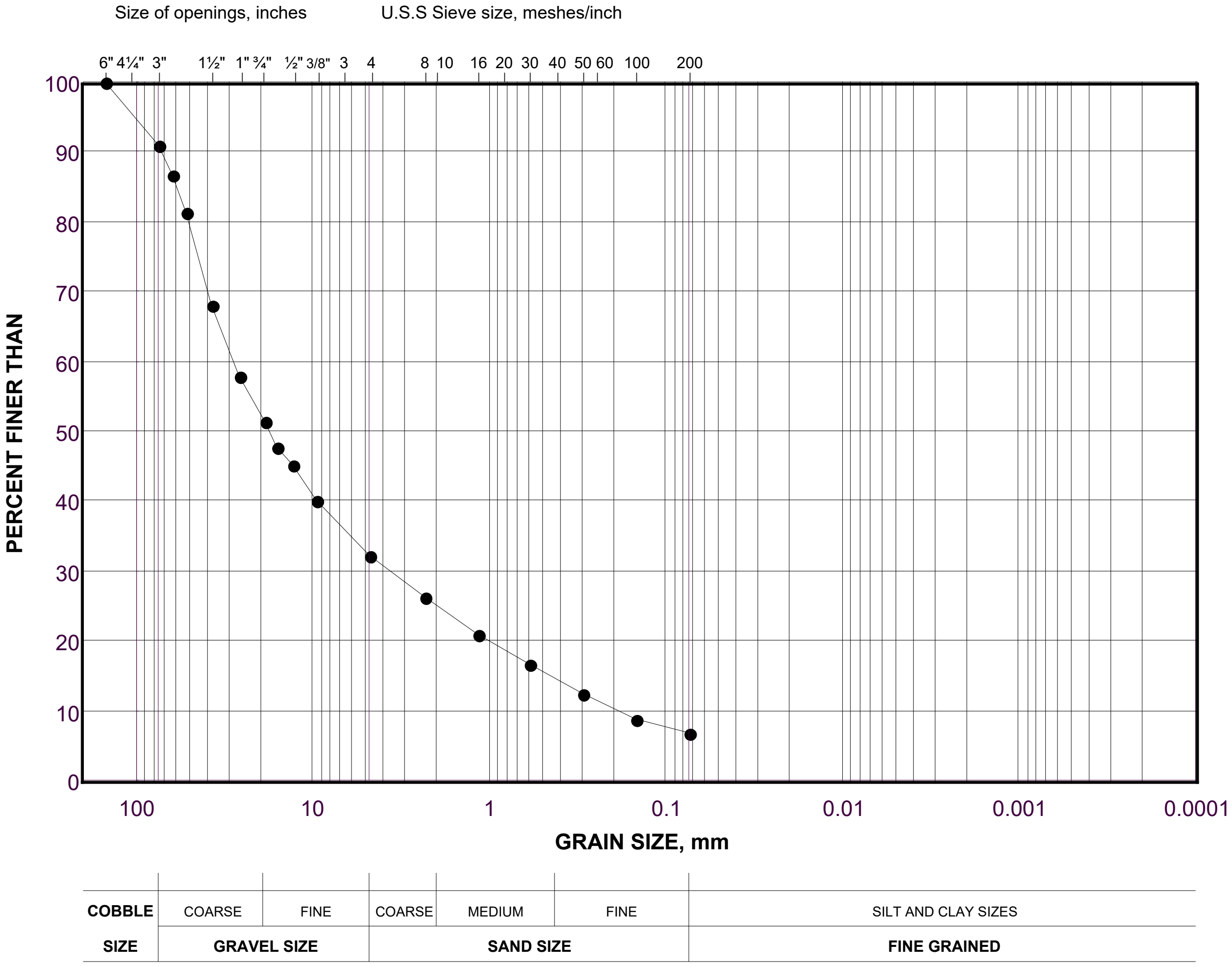
Project Number	21476582	Depth	19
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:14:02 AM
Sample Number	4	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-577

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	4	14.0 - 19.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 7998.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	315.00	3.94	53.00	96.1
37.5mm	579.80	3.31	37.50	92.8
26.5mm	1383.90	10.05	26.50	82.7
19.0mm	2041.40	8.22	19.00	74.5
16mm	2251.90	2.63	16.00	71.9
13.2mm	2540.10	3.60	13.20	68.3
9.5mm	3033.80	6.17	9.50	62.1
4.75mm	4016.30	12.28	4.75	49.8
PAN	3982.60	49.80	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	42.20	8.34	2.36	41.5
1.18mm	88.90	9.23	1.18	32.2
600µm	124.40	7.01	0.60	25.2
300µm	155.60	6.16	0.30	19.1
150µm	178.80	4.58	0.15	14.5
75µm	195.30	3.26	0.08	11.2

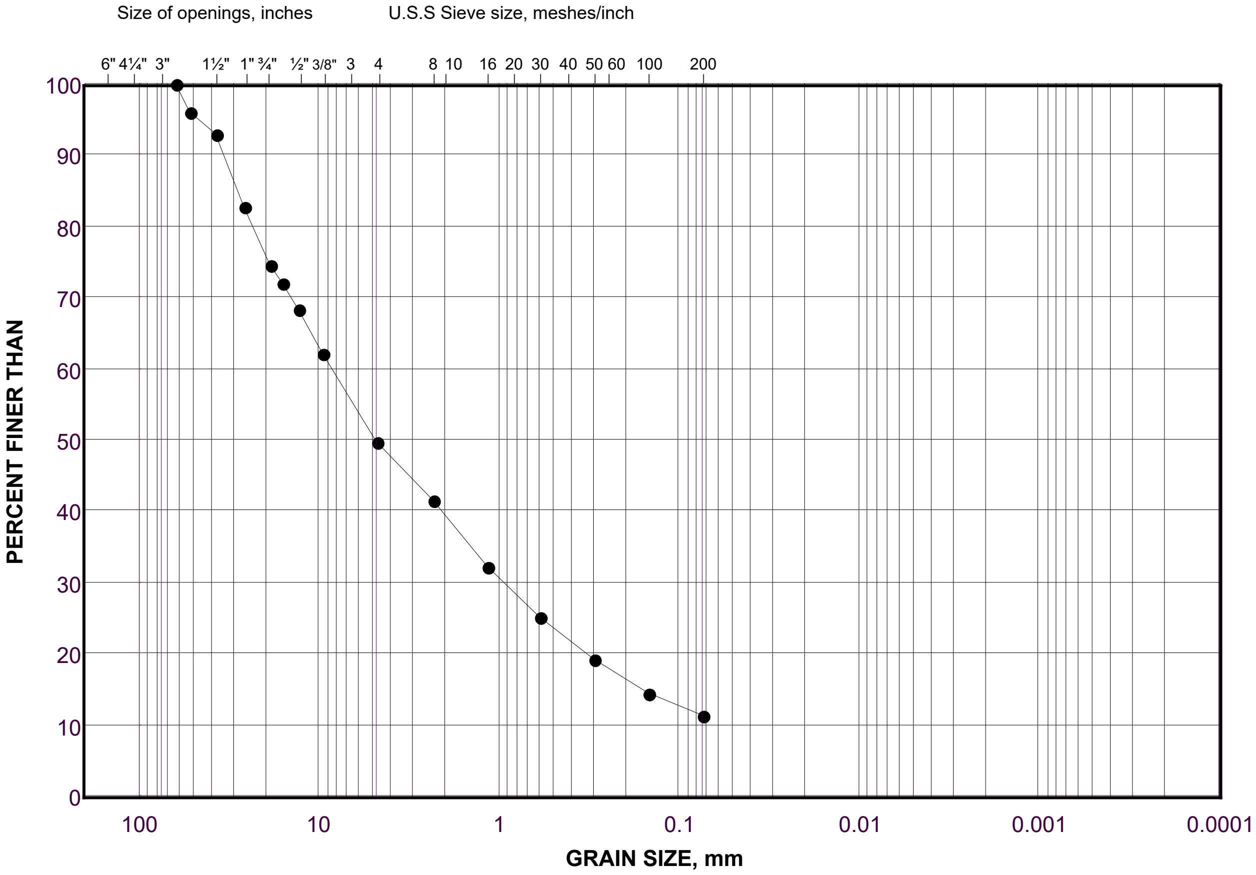
Project Number	21476582	Depth	24
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:19:40 AM
Sample Number	5	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-564

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	5	19.0 - 24.0

Project Number: 21476582

Checked By: ________________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 8771.1(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	1708.10	19.47	63.00	80.5
53mm	2795.80	12.40	53.00	68.1
37.5mm	2890.70	1.08	37.50	67.1
26.5mm	3457.70	6.46	26.50	60.6
19.0mm	3916.50	5.23	19.00	55.4
16mm	4119.70	2.32	16.00	53.0
13.2mm	4311.20	2.18	13.20	50.9
9.5mm	4756.00	5.07	9.50	45.8
4.75mm	5486.30	8.33	4.75	37.5
PAN	3275.00	37.46	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	42.10	5.76	2.36	31.7
1.18mm	84.60	5.81	1.18	25.9
600µm	121.20	5.00	0.60	20.9
300µm	153.00	4.35	0.30	16.5
150µm	179.90	3.68	0.15	12.9
75µm	202.00	3.02	0.08	9.8

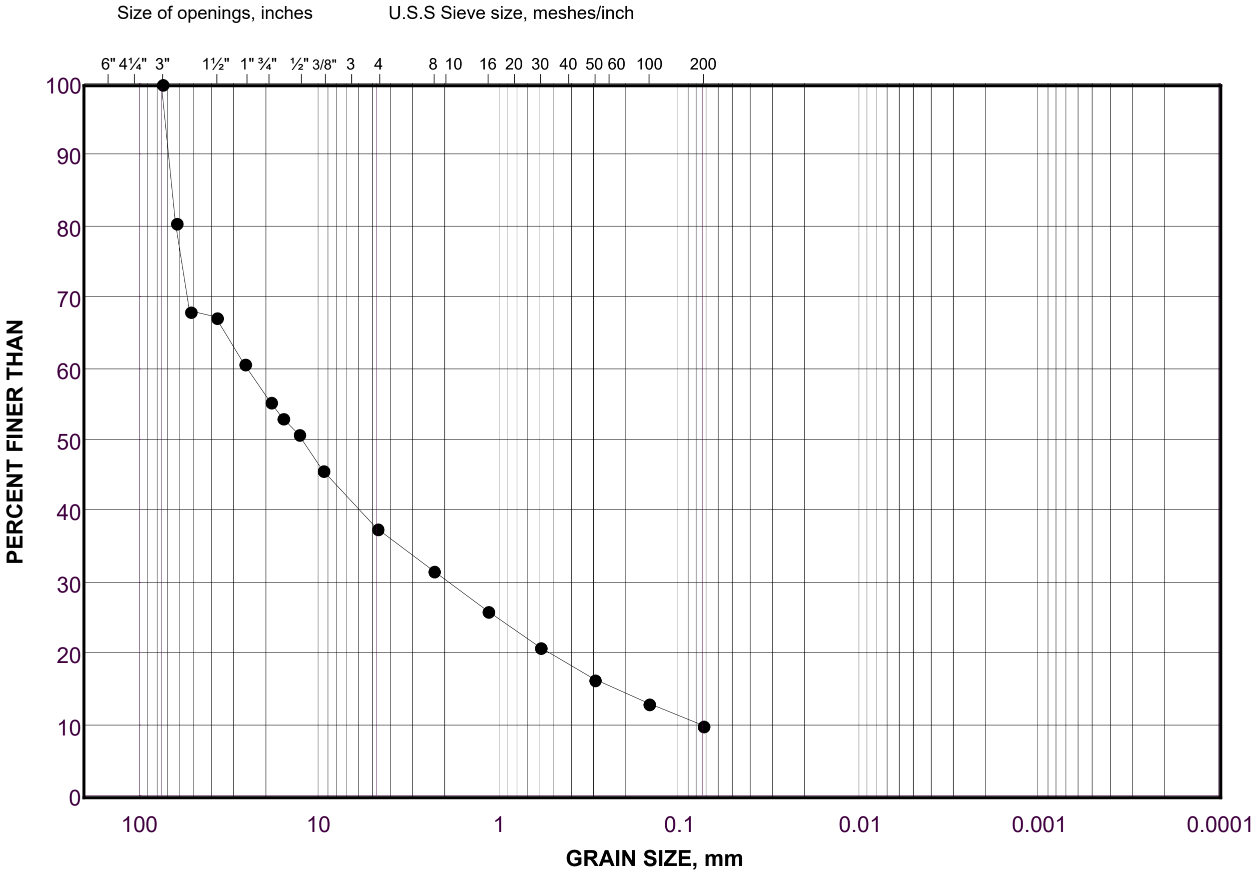
Project Number	21476582	Depth	27.5
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/08/22 2:20:33 PM
Sample Number	6A	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-434

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	6A	24.0 - 27.50

Project Number: 21476582

Checked By: ________________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 6294.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	308.80	4.91	37.50	95.1
26.5mm	439.40	2.07	26.50	93.0
19.0mm	573.80	2.14	19.00	90.9
16mm	612.00	0.61	16.00	90.3
13.2mm	695.50	1.33	13.20	88.9
9.5mm	880.60	2.94	9.50	86.0
4.75mm	1222.40	5.43	4.75	80.6
PAN	5062.20	80.57	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	15.00	4.61	2.36	76.0
1.18mm	32.80	5.48	1.18	70.5
600µm	49.90	5.26	0.60	65.2
300µm	71.30	6.58	0.30	58.6
150µm	100.60	9.01	0.15	49.6
75µm	128.40	8.55	0.08	41.1

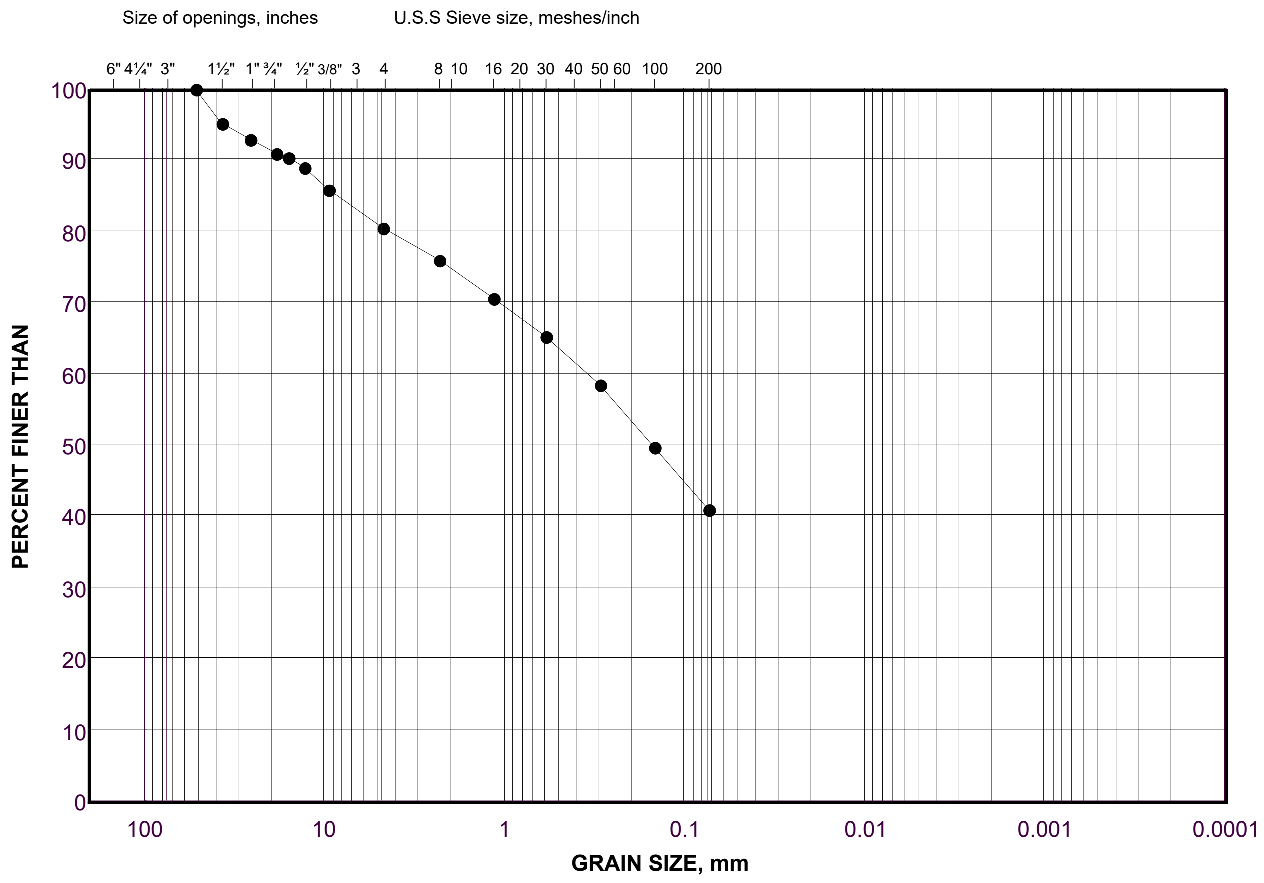
Project Number	21476582	Depth	29
Project Task	1000	Units	Metric
Borehole Number	MW 21-04	Testing Date	3/08/22 1:38:08 PM
Sample Number	6B	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-433

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	MW 21-04	6B	27.50 - 29.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 15986(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	776.00	4.85	75.00	95.2
63mm	1808.00	6.46	63.00	88.7
53mm	1808.00	0.00	53.00	88.7
37.5mm	2932.00	7.03	37.50	81.7
26.5mm	3626.00	4.34	26.50	77.3
19.0mm	4242.00	3.85	19.00	73.5
16mm	4618.00	2.35	16.00	71.1
13.2mm	4952.00	2.09	13.20	69.0
9.5mm	5540.00	3.68	9.50	65.4
4.75mm	6728.00	7.43	4.75	57.9
PAN	9186.00	57.92	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	25.16	4.40	2.36	53.5
1.18mm	57.01	5.57	1.18	48.0
600µm	89.99	5.77	0.60	42.2
300µm	124.22	5.99	0.30	36.2
150µm	159.02	6.09	0.15	30.1
75µm	196.02	6.47	0.08	23.6

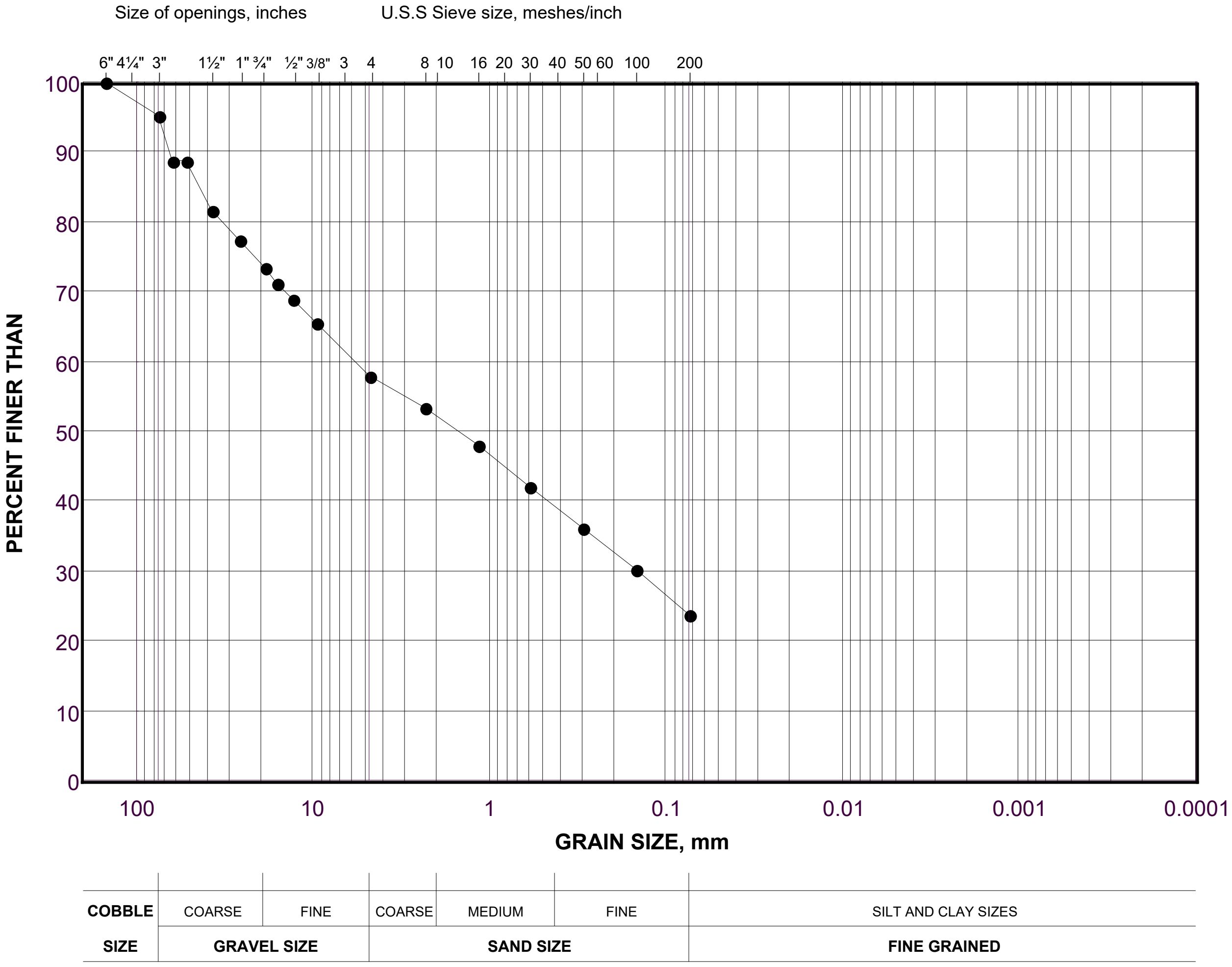
Project Number	21476582	Depth	34
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:23:52 AM
Sample Number	7	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-578

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	7	29.0 - 34.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 5553(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	585.00	10.53	75.00	89.5
63mm	585.00	0.00	63.00	89.5
53mm	862.40	5.00	53.00	84.5
37.5mm	1042.10	3.24	37.50	81.2
26.5mm	1371.60	5.93	26.50	75.3
19.0mm	1692.40	5.78	19.00	69.5
16mm	1824.50	2.38	16.00	67.1
13.2mm	1978.00	2.76	13.20	64.4
9.5mm	2302.80	5.85	9.50	58.5
4.75mm	2919.70	11.11	4.75	47.4
PAN	2628.30	47.42	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	49.70	7.65	2.36	39.8
1.18mm	95.20	7.00	1.18	32.8
600µm	131.20	5.54	0.60	27.2
300µm	161.90	4.73	0.30	22.5
150µm	189.10	4.19	0.15	18.3
75µm	212.10	3.54	0.08	14.8

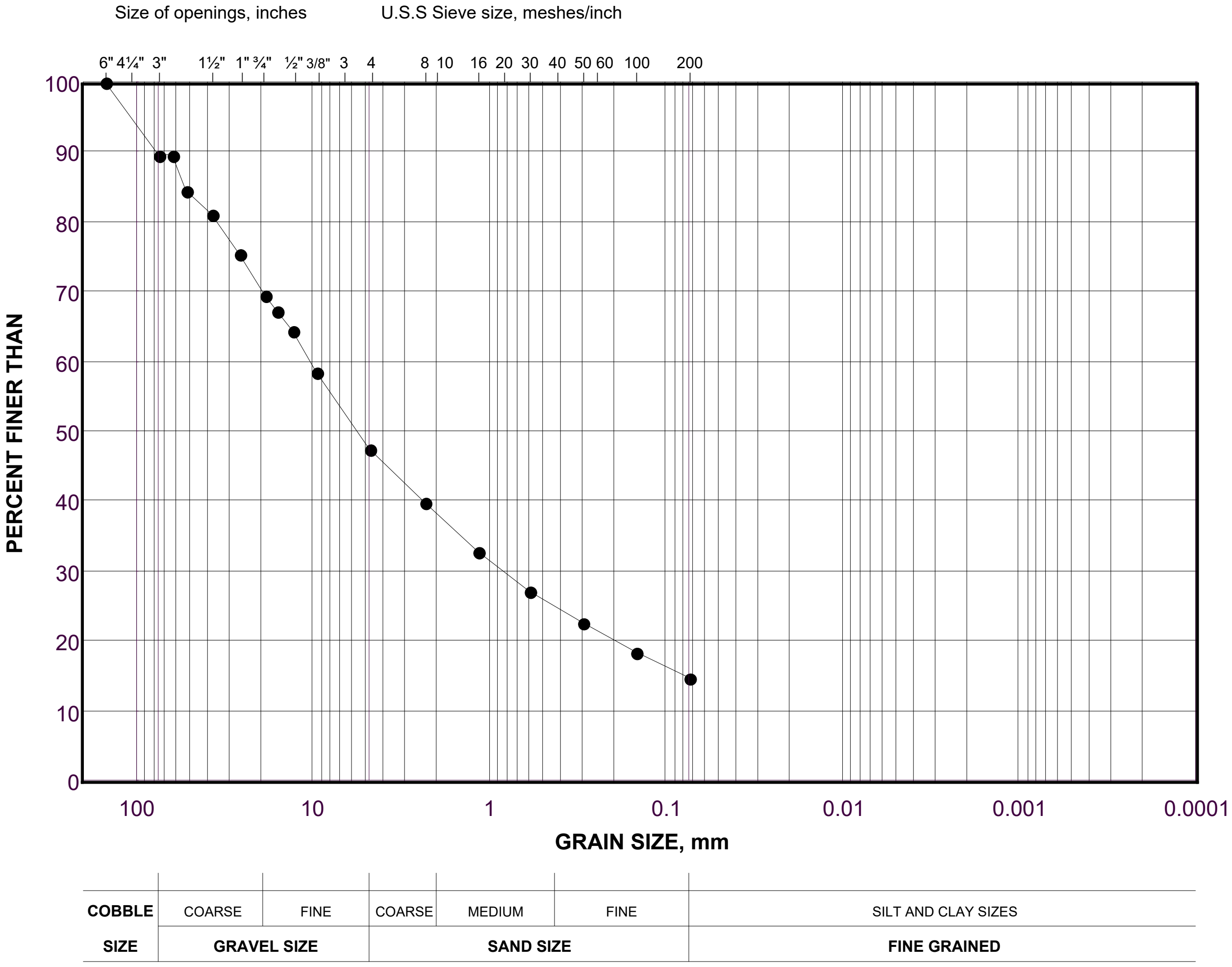
Project Number	21476582	Depth	38.5
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/08/22 2:31:29 PM
Sample Number	8A	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-212

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	8A	36.0 - 38.50

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 11713.6(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	1381.80	11.80	63.00	88.2
53mm	1381.80	0.00	53.00	88.2
37.5mm	2169.70	6.73	37.50	81.5
26.5mm	2698.70	4.52	26.50	77.0
19.0mm	3191.80	4.21	19.00	72.7
16mm	3423.80	1.98	16.00	70.8
13.2mm	3587.80	1.40	13.20	69.4
9.5mm	4042.00	3.88	9.50	65.5
4.75mm	4747.40	6.02	4.75	59.5
PAN	6950.00	59.46	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	26.10	5.62	2.36	53.8
1.18mm	46.50	4.39	1.18	49.5
600µm	63.10	3.57	0.60	45.9
300µm	79.10	3.44	0.30	42.4
150µm	96.30	3.70	0.15	38.7
75µm	114.20	3.85	0.08	34.9

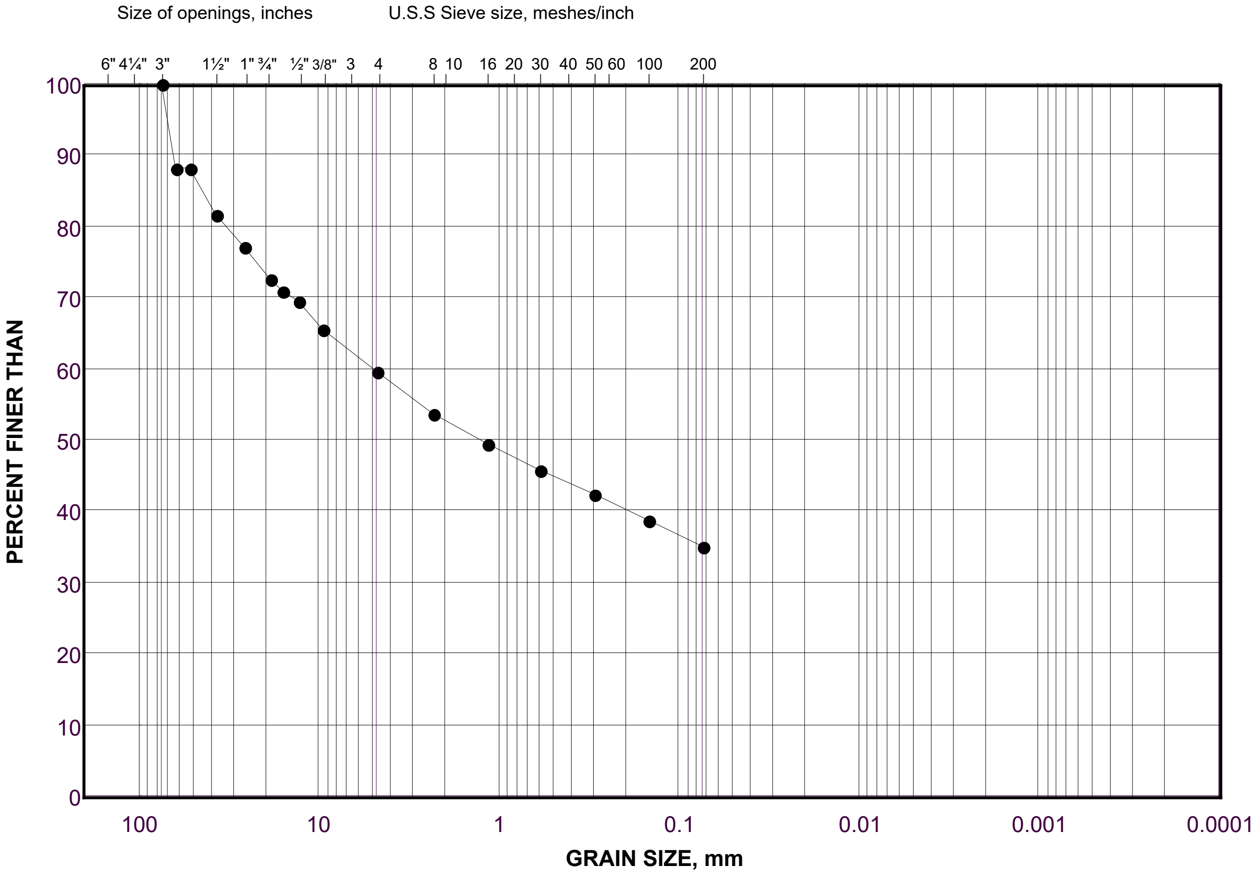
Project Number	21476582	Depth	39
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/08/22 2:23:59 PM
Sample Number	8B	Tested By	Sieve - JT
Checked By	______________________________	LabID	22-221

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	8B	34.0 - 36.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14306(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	550.00	3.84	53.00	96.2
37.5mm	1046.00	3.47	37.50	92.7
26.5mm	1778.00	5.12	26.50	87.6
19.0mm	2522.00	5.20	19.00	82.4
16mm	2956.00	3.03	16.00	79.3
13.2mm	3424.00	3.27	13.20	76.1
9.5mm	4312.00	6.21	9.50	69.9
4.75mm	6016.00	11.91	4.75	58.0
PAN	8264.00	57.95	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	55.90	9.42	2.36	48.5
1.18mm	105.31	8.33	1.18	40.2
600µm	156.02	8.55	0.60	31.6
300µm	208.56	8.86	0.30	22.8
150µm	252.68	7.44	0.15	15.3
75µm	280.20	4.64	0.08	10.7

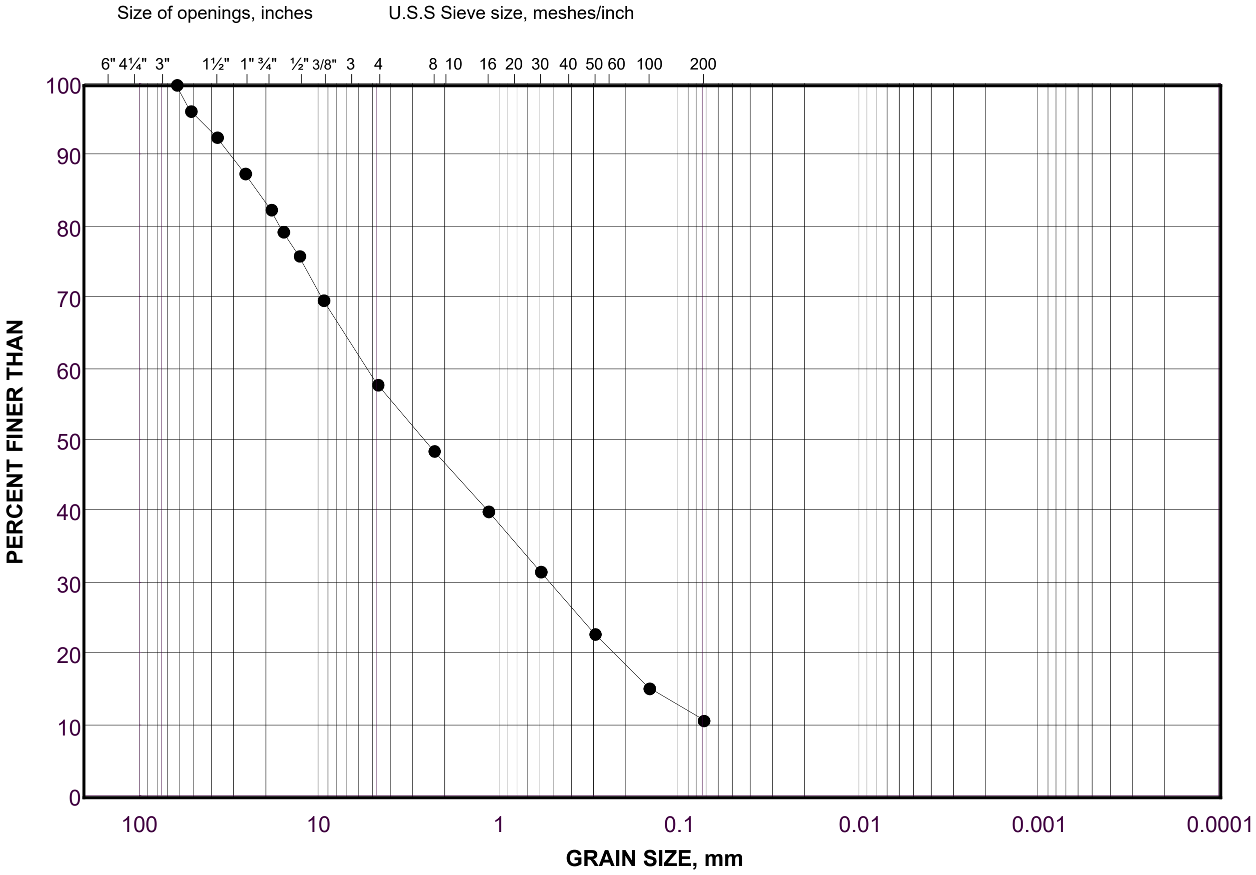
Project Number	21476582	Depth	44
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:27:23 AM
Sample Number	9	Tested By	Sieve - JB
Checked By	______________________	LabID	22-579

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	9	34.0 - 44.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 12902(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	718.00	5.57	53.00	94.4
37.5mm	1308.00	4.57	37.50	89.9
26.5mm	2124.00	6.32	26.50	83.5
19.0mm	2996.00	6.76	19.00	76.8
16mm	3380.00	2.98	16.00	73.8
13.2mm	3830.00	3.49	13.20	70.3
9.5mm	4792.00	7.46	9.50	62.9
4.75mm	6306.00	11.73	4.75	51.1
PAN	6576.00	51.12	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	52.04	7.50	2.36	43.6
1.18mm	102.98	7.34	1.18	36.3
600µm	149.37	6.68	0.60	29.6
300µm	194.21	6.46	0.30	23.1
150µm	235.58	5.96	0.15	17.2
75µm	265.74	4.35	0.08	12.8

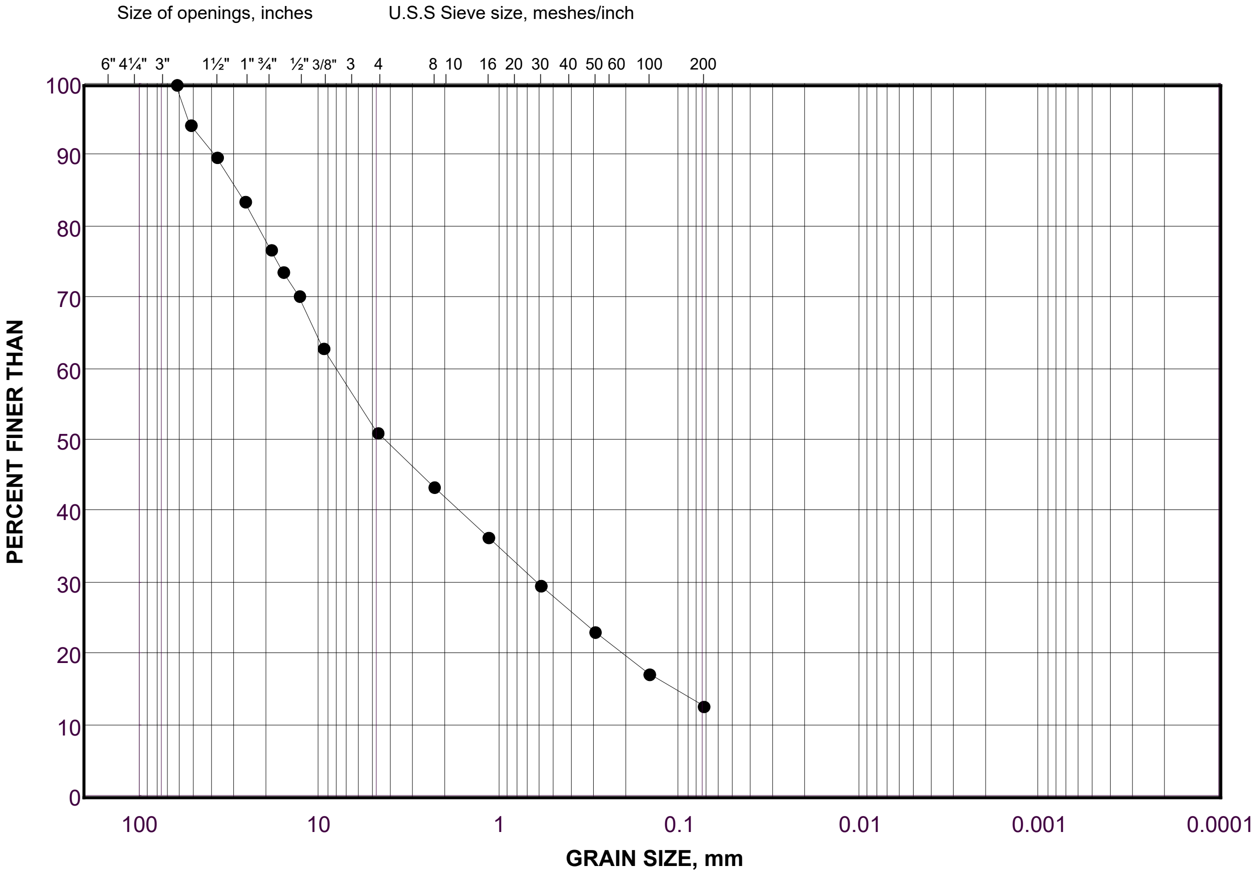
Project Number	21476582	Depth	49
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:29:39 AM
Sample Number	10	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-580

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	10	44.0 - 49.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14219.1(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	761.60	5.36	75.00	94.6
63mm	761.60	0.00	63.00	94.6
53mm	1239.80	3.36	53.00	91.3
37.5mm	2171.20	6.55	37.50	84.7
26.5mm	2775.30	4.25	26.50	80.5
19.0mm	3901.30	7.92	19.00	72.6
16mm	4409.00	3.57	16.00	69.0
13.2mm	4914.70	3.56	13.20	65.4
9.5mm	5786.40	6.13	9.50	59.3
4.75mm	7248.50	10.28	4.75	49.0
PAN	6935.30	49.02	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	42.10	7.86	2.36	41.2
1.18mm	79.50	6.98	1.18	34.2
600µm	113.10	6.27	0.60	27.9
300µm	145.70	6.08	0.30	21.8
150µm	173.00	5.09	0.15	16.7
75µm	192.80	3.69	0.08	13.1

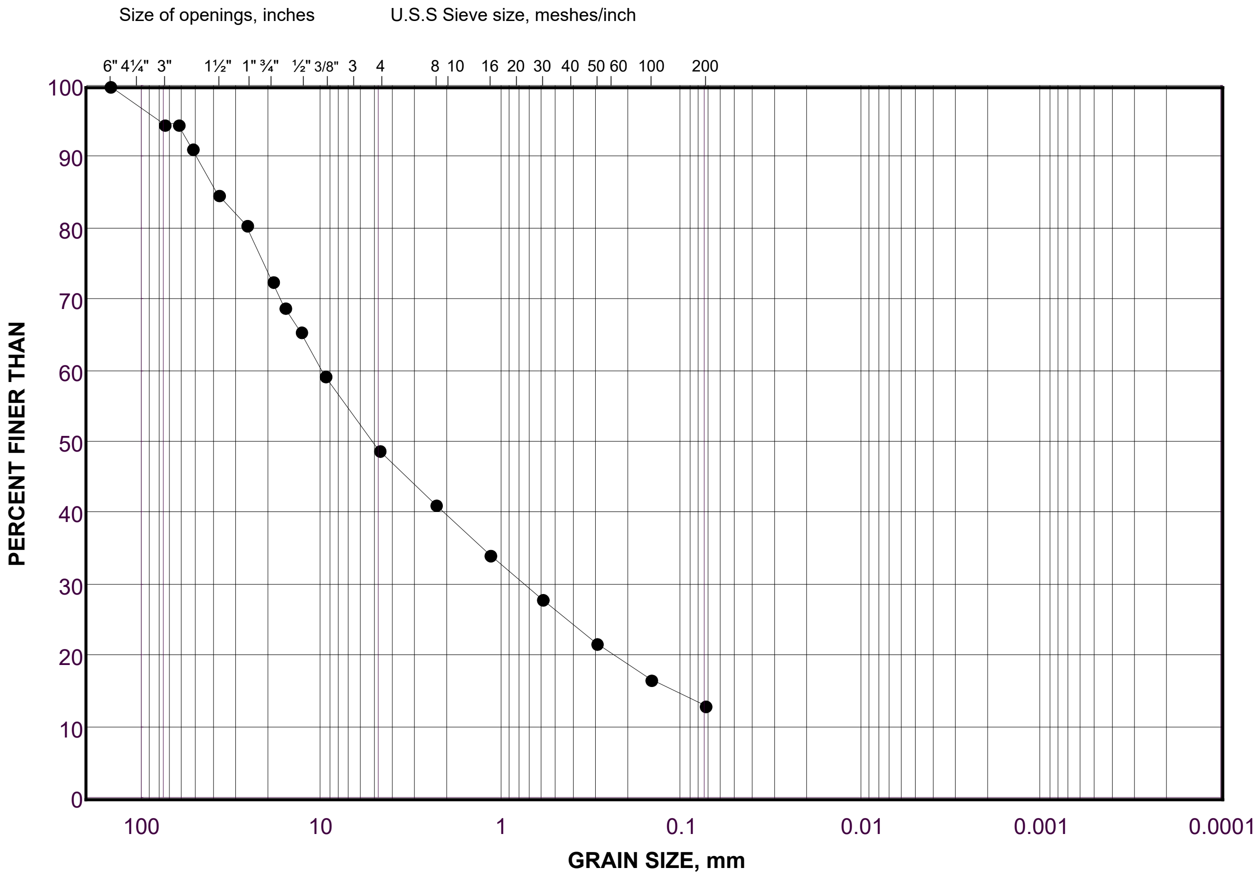
Project Number	21476582	Depth	54
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/08/22 2:34:37 PM
Sample Number	11A	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-207

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	11A	49.0 - 54.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 2405.1(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
26.5mm	0.00	0.00	26.50	100.0
19.0mm	0.00	0.00	19.00	100.0
16mm	39.50	1.64	16.00	98.4
13.2mm	41.90	0.10	13.20	98.3
9.5mm	64.90	0.96	9.50	97.3
4.75mm	141.70	3.19	4.75	94.1
PAN	2263.40	94.11	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	13.70	4.81	2.36	89.3
1.18mm	34.20	7.19	1.18	82.1
600µm	58.20	8.42	0.60	73.7
300µm	82.50	8.52	0.30	65.2
150µm	108.20	9.01	0.15	56.2
75µm	139.20	10.87	0.08	45.3

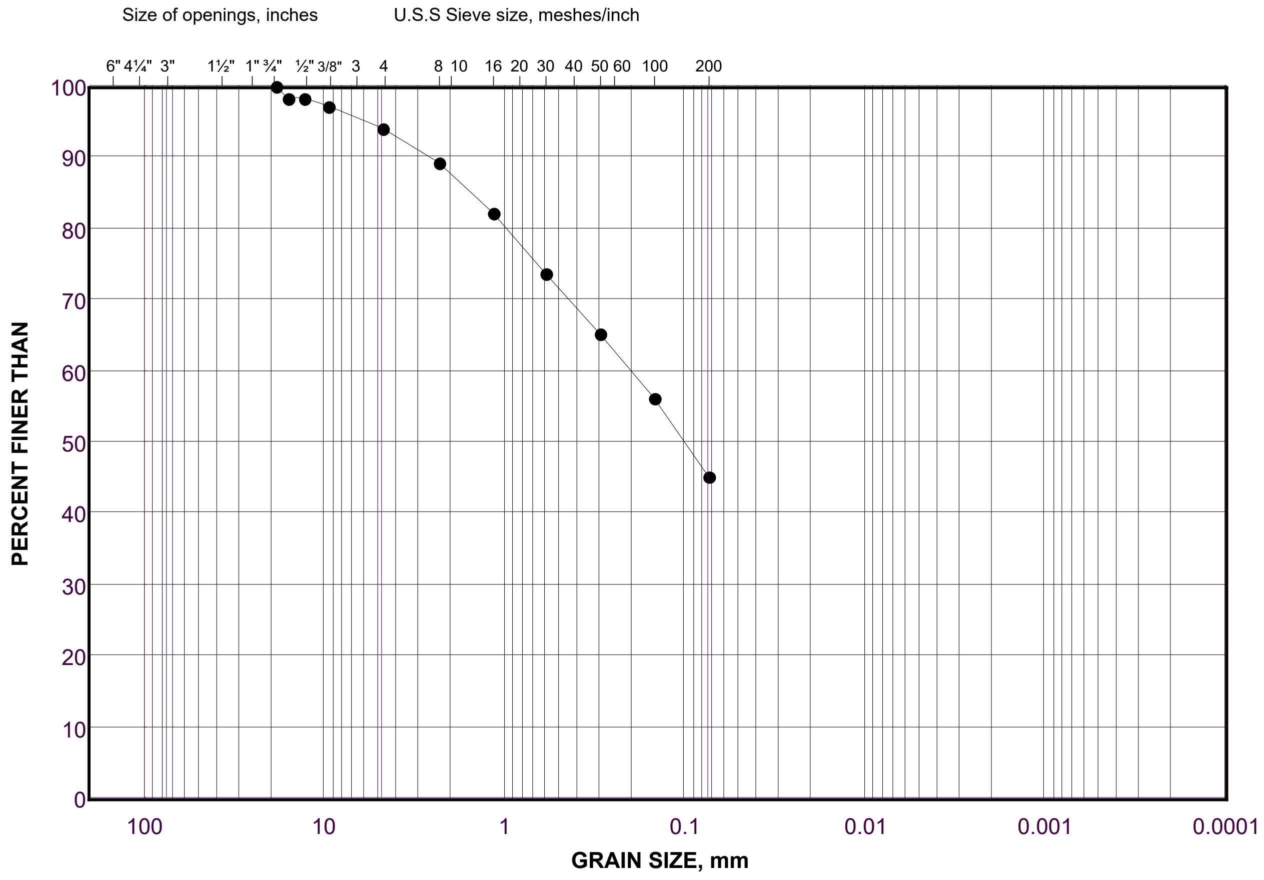
Project Number	21476582	Depth	52
Project Task	1000	Units	Metric
Borehole Number	MW 21-04	Testing Date	3/08/22 3:01:38 PM
Sample Number	11B	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-193

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	MW 21-04	11B	51.50 - 52.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 14724.3(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	572.40	3.89	53.00	96.1
37.5mm	1375.40	5.45	37.50	90.7
26.5mm	2556.00	8.02	26.50	82.6
19.0mm	4004.70	9.84	19.00	72.8
16mm	4390.50	2.62	16.00	70.2
13.2mm	4902.60	3.48	13.20	66.7
9.5mm	6079.40	7.99	9.50	58.7
4.75mm	7825.10	11.86	4.75	46.8
PAN	6899.20	46.85	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	50.00	8.66	2.36	38.2
1.18mm	94.20	7.65	1.18	30.5
600µm	134.40	6.96	0.60	23.6
300µm	166.30	5.52	0.30	18.1
150µm	189.40	4.00	0.15	14.1
75µm	205.80	2.84	0.08	11.2

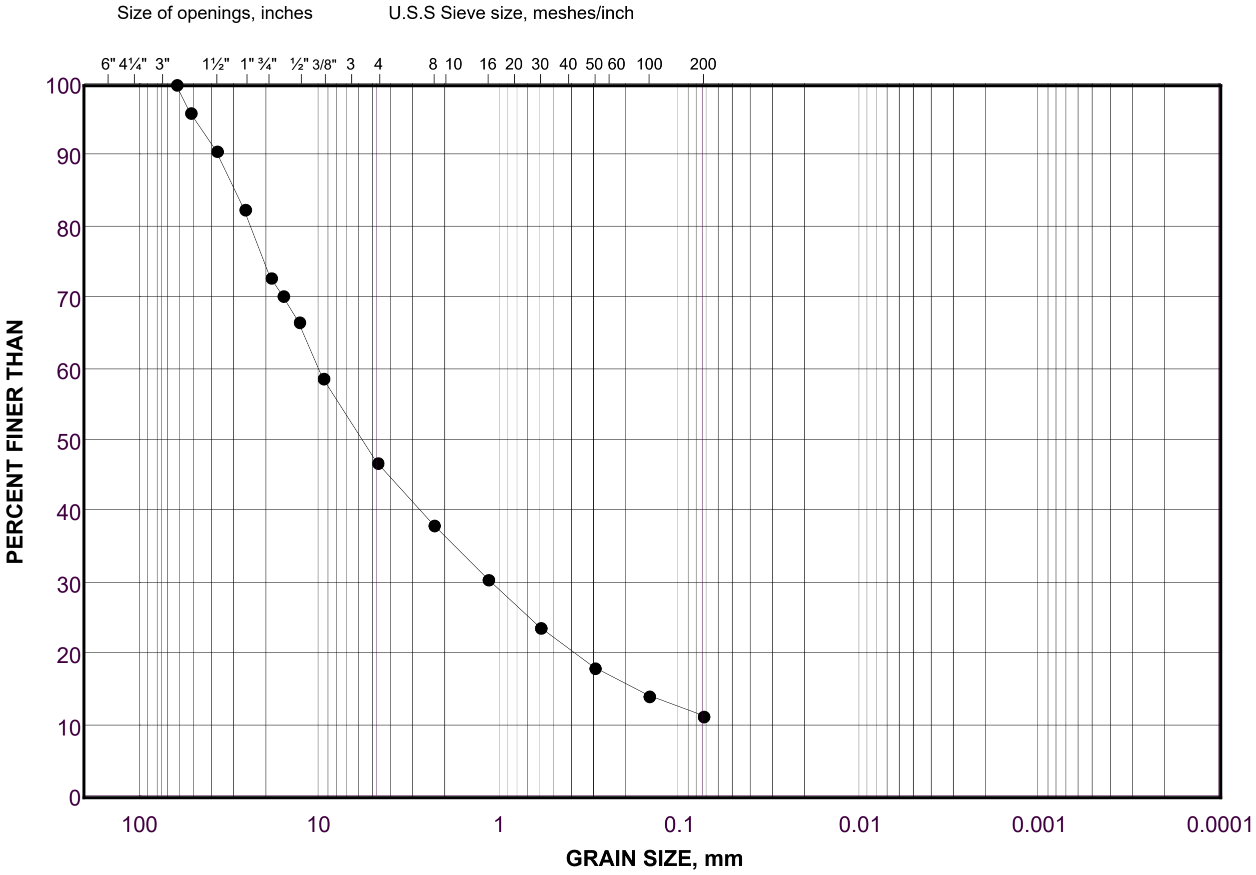
Project Number	21476582	Depth	59
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:35:31 AM
Sample Number	12	Tested By	Sieve - TP
Checked By	______________________	LabID	22-565

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	12	54.0 - 59.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16182.4(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	709.20	4.38	75.00	95.6
63mm	1725.90	6.28	63.00	89.3
53mm	2373.10	4.00	53.00	85.3
37.5mm	3103.20	4.51	37.50	80.8
26.5mm	4445.30	8.29	26.50	72.5
19.0mm	5560.50	6.89	19.00	65.6
16mm	6218.30	4.06	16.00	61.6
13.2mm	6693.20	2.93	13.20	58.7
9.5mm	7521.10	5.12	9.50	53.5
4.75mm	9109.90	9.82	4.75	43.7
PAN	7049.70	43.72	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	47.50	7.83	2.36	35.9
1.18mm	91.80	7.30	1.18	28.6
600µm	126.00	5.64	0.60	23.0
300µm	154.80	4.75	0.30	18.2
150µm	178.50	3.91	0.15	14.3
75µm	198.50	3.30	0.08	11.0

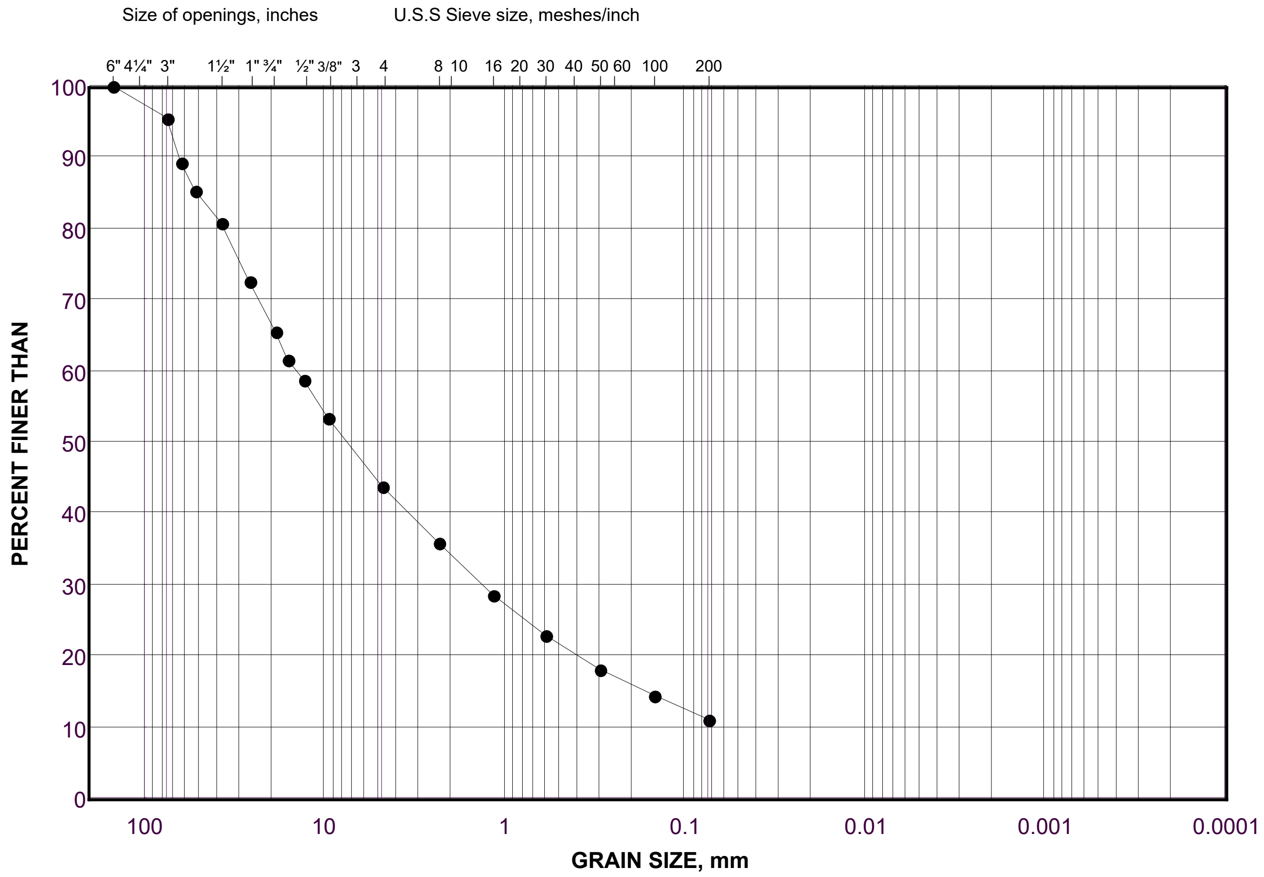
Project Number	21476582	Depth	64
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/08/22 3:05:20 PM
Sample Number	13	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-435

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	13	59.0 - 64.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17383.2(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	499.50	2.87	63.00	97.1
53mm	1144.10	3.71	53.00	93.4
37.5mm	1968.40	4.74	37.50	88.7
26.5mm	3364.90	8.03	26.50	80.7
19.0mm	4930.90	9.01	19.00	71.6
16mm	5562.40	3.63	16.00	68.0
13.2mm	6035.30	2.72	13.20	65.3
9.5mm	7182.30	6.60	9.50	58.7
4.75mm	8976.60	10.32	4.75	48.4
PAN	8387.50	48.37	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	58.30	9.58	2.36	38.8
1.18mm	109.80	8.46	1.18	30.3
600µm	149.50	6.52	0.60	23.8
300µm	175.20	4.22	0.30	19.6
150µm	194.90	3.24	0.15	16.4
75µm	216.80	3.60	0.08	12.8

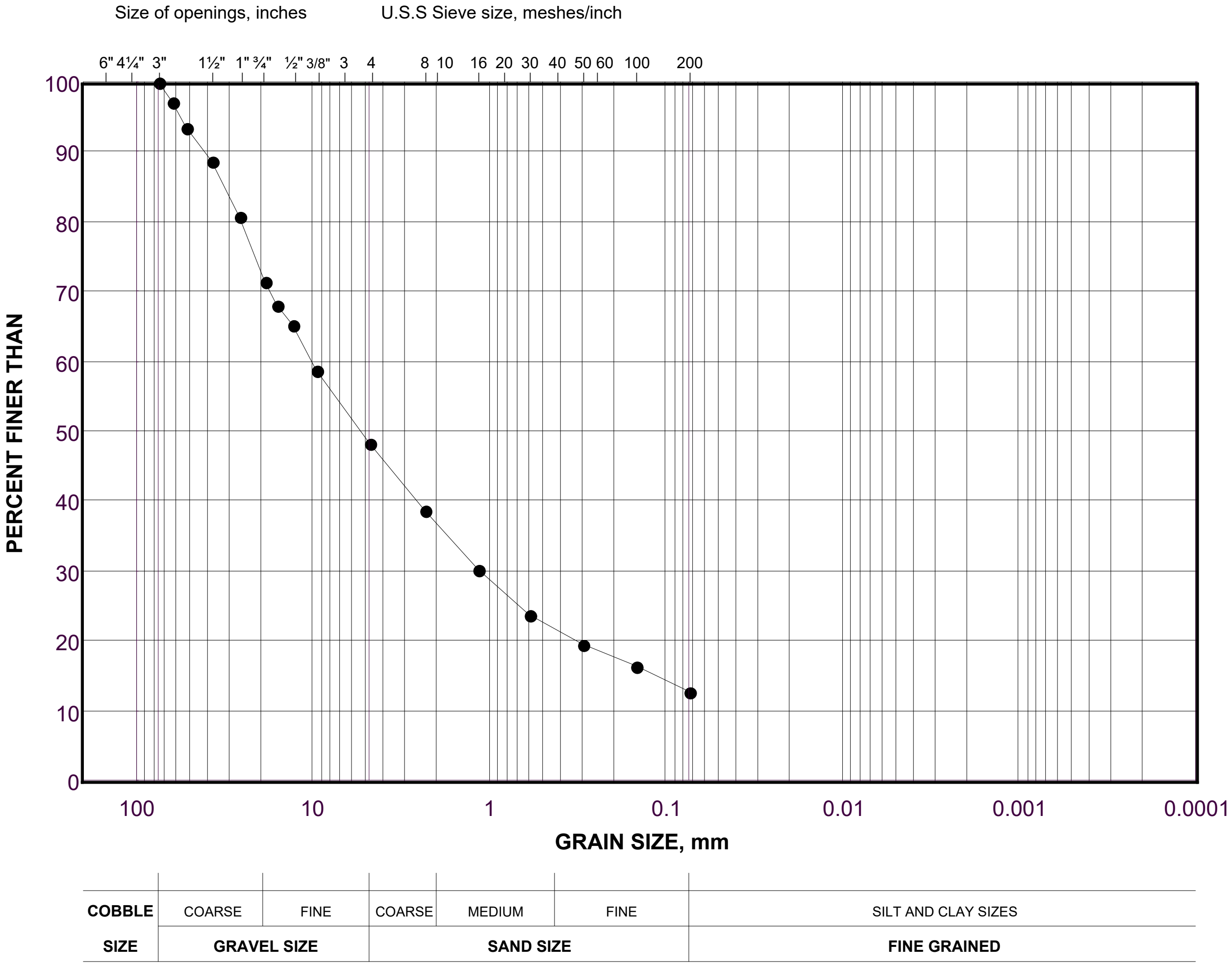
Project Number	21476582	Depth	69
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/07/22 4:50:25 PM
Sample Number	14	Tested By	Sieve - LB
Checked By	______________________________	LabID	22-436

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	14	64.0 - 69.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18962.5(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	400.30	2.11	63.00	97.9
53mm	1138.70	3.89	53.00	94.0
37.5mm	2581.30	7.61	37.50	86.4
26.5mm	4163.40	8.34	26.50	78.1
19.0mm	5573.40	7.44	19.00	70.6
16mm	6060.70	2.57	16.00	68.0
13.2mm	6712.60	3.44	13.20	64.6
9.5mm	8033.00	6.96	9.50	57.6
4.75mm	10301.90	11.97	4.75	45.7
PAN	8651.00	45.67	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	55.60	9.01	2.36	36.7
1.18mm	110.30	8.87	1.18	27.8
600µm	165.70	8.98	0.60	18.8
300µm	215.40	8.06	0.30	10.8
150µm	236.90	3.49	0.15	7.3
75µm	249.40	2.03	0.08	5.2

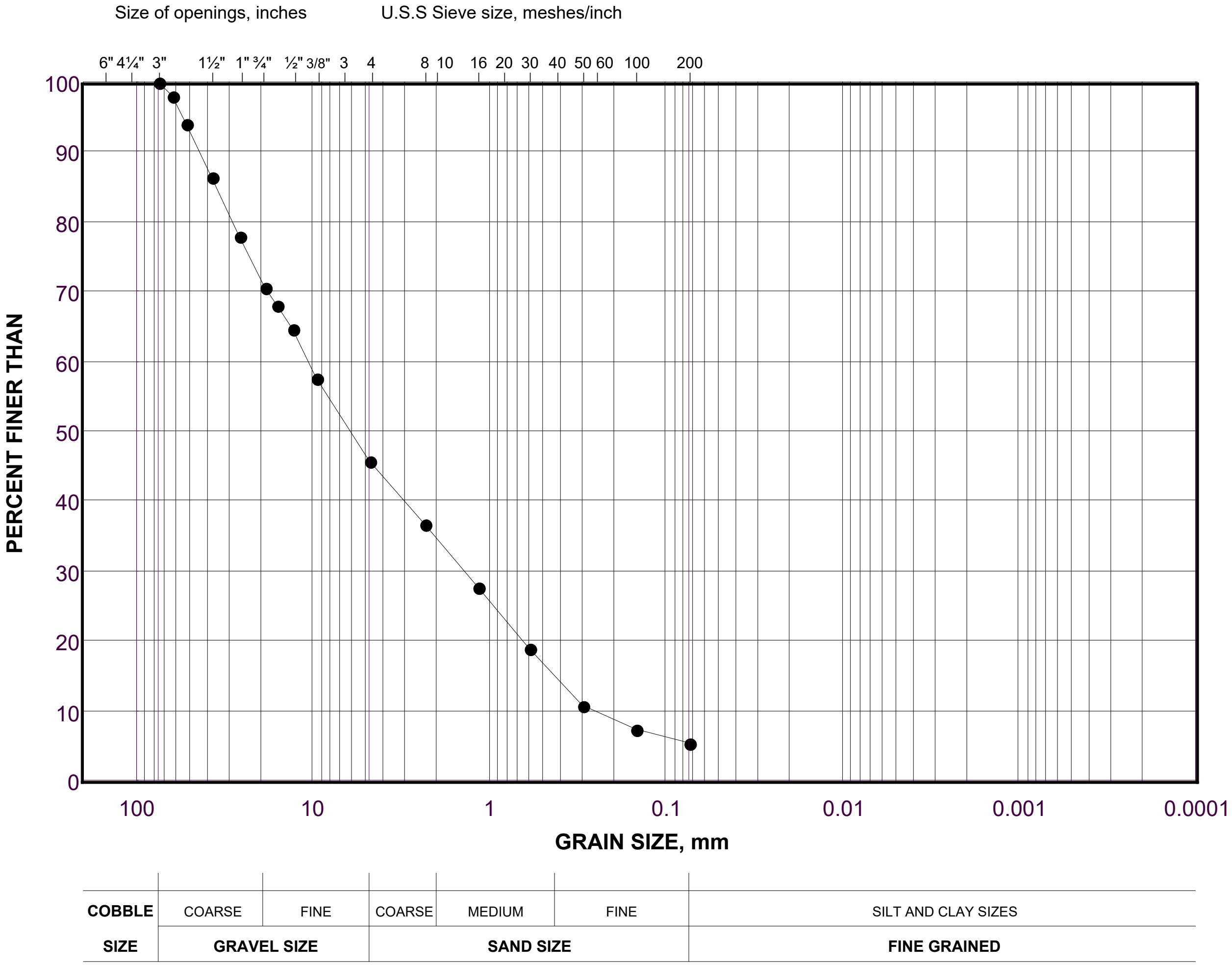
Project Number	21476582	Depth	74
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:37:19 AM
Sample Number	15	Tested By	Sieve - IC
Checked By	____________________	LabID	22-566

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	15	69.0 - 74.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17517.1(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1697.00	9.69	75.00	90.3
63mm	2864.30	6.66	63.00	83.7
53mm	3930.00	6.08	53.00	77.6
37.5mm	5484.10	8.87	37.50	68.7
26.5mm	6974.90	8.51	26.50	60.2
19.0mm	7773.40	4.56	19.00	55.6
16mm	8375.40	3.44	16.00	52.2
13.2mm	8831.70	2.60	13.20	49.6
9.5mm	9946.60	6.36	9.50	43.2
4.75mm	11433.10	8.49	4.75	34.7
PAN	6063.10	34.74	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	44.10	6.01	2.36	28.7
1.18mm	92.50	6.60	1.18	22.1
600µm	138.50	6.27	0.60	15.9
300µm	169.36	4.21	0.30	11.7
150µm	188.80	2.65	0.15	9.0
75µm	205.60	2.29	0.08	6.7

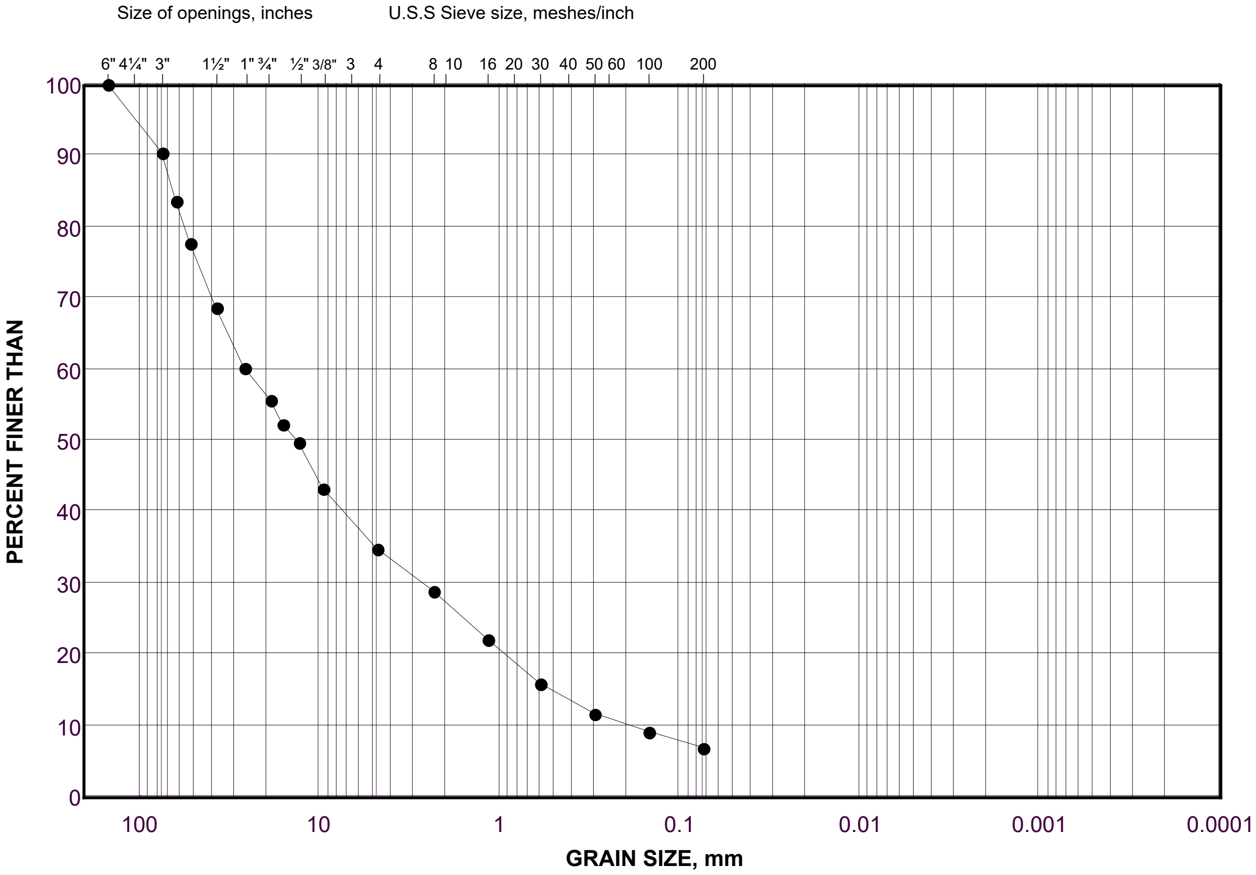
Project Number	21476582	Depth	79
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/08/22 11:42:05 AM
Sample Number	16	Tested By	Sieve -
Checked By	______________________________	LabID	22-210

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	16	74.0 - 79.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 19989.1(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	1702.10	8.52	75.00	91.5
63mm	2153.80	2.26	63.00	89.2
53mm	2153.80	0.00	53.00	89.2
37.5mm	4408.90	11.28	37.50	77.9
26.5mm	6153.20	8.73	26.50	69.2
19.0mm	7899.60	8.74	19.00	60.5
16mm	8816.20	4.59	16.00	55.9
13.2mm	9180.80	1.82	13.20	54.1
9.5mm	10548.30	6.84	9.50	47.2
4.75mm	12695.60	10.74	4.75	36.5
PAN	7204.70	36.48	0.00	0.0

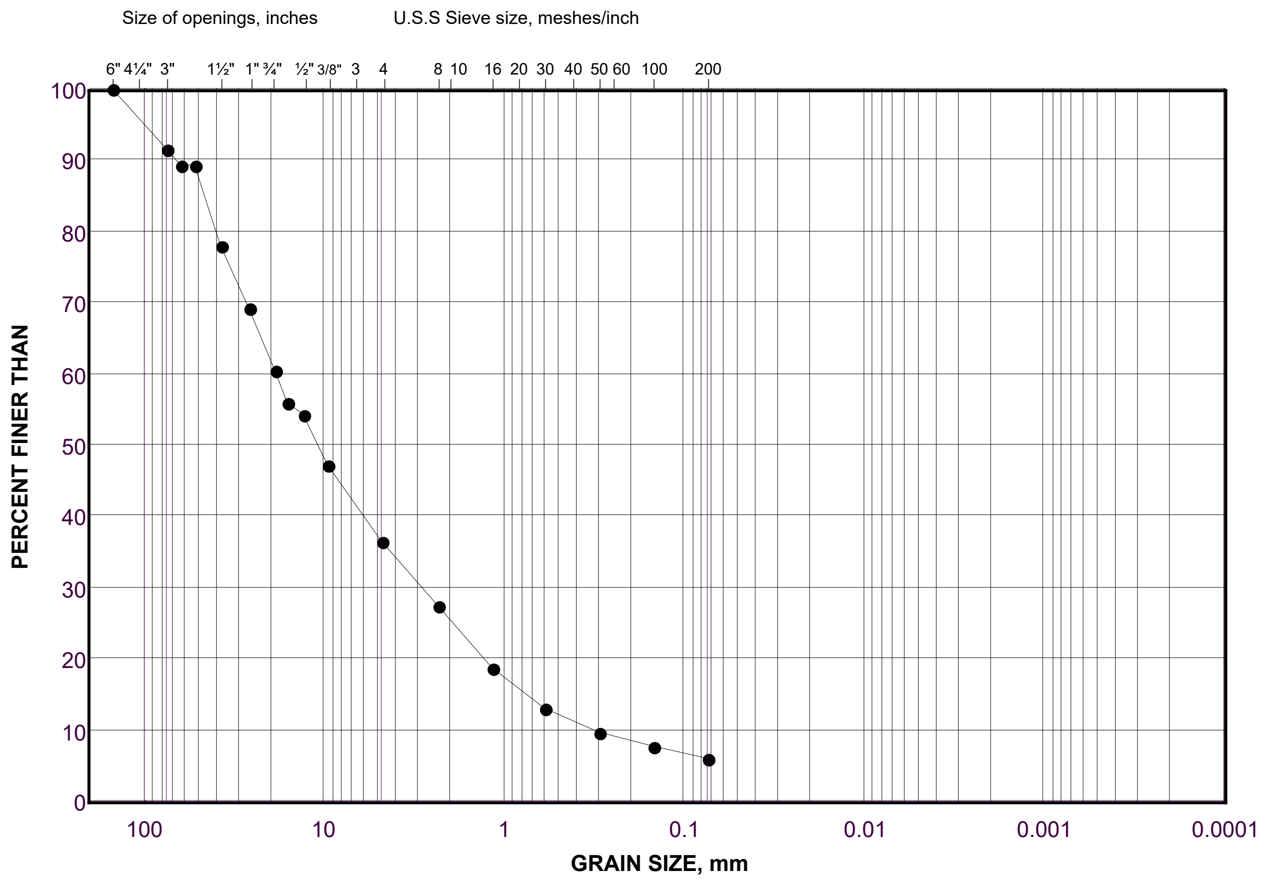
HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	64.30	9.08	2.36	27.4
1.18mm	126.30	8.76	1.18	18.6
600µm	166.40	5.67	0.60	13.0
300µm	190.40	3.39	0.30	9.6
150µm	204.60	2.01	0.15	7.6
75µm	215.70	1.57	0.08	6.0

Project Number	21476582	Depth	84
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:40:31 AM
Sample Number	17	Tested By	Sieve - AM
Checked By	______________________________	LabID	22-570

Golder Associates

# GRAIN SIZE DISTRIBUTION MTO LS-602	FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	17	79.0 - 84.0

Project Number: 21476582

Checked By: ______________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 17120.9(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
150mm	0.00	0.00	150.00	100.0
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	522.70	3.05	53.00	97.0
37.5mm	2593.90	12.10	37.50	84.9
26.5mm	3692.50	6.42	26.50	78.4
19.0mm	4854.00	6.78	19.00	71.7
16mm	5198.40	2.01	16.00	69.6
13.2mm	5673.90	2.78	13.20	66.9
9.5mm	6643.40	5.66	9.50	61.2
4.75mm	8370.10	10.09	4.75	51.1
PAN	8750.80	51.11	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	51.80	9.62	2.36	41.5
1.18mm	127.00	13.96	1.18	27.5
600µm	185.90	10.93	0.60	16.6
300µm	212.80	4.99	0.30	11.6
150µm	225.00	2.26	0.15	9.3
75µm	234.10	1.69	0.08	7.7

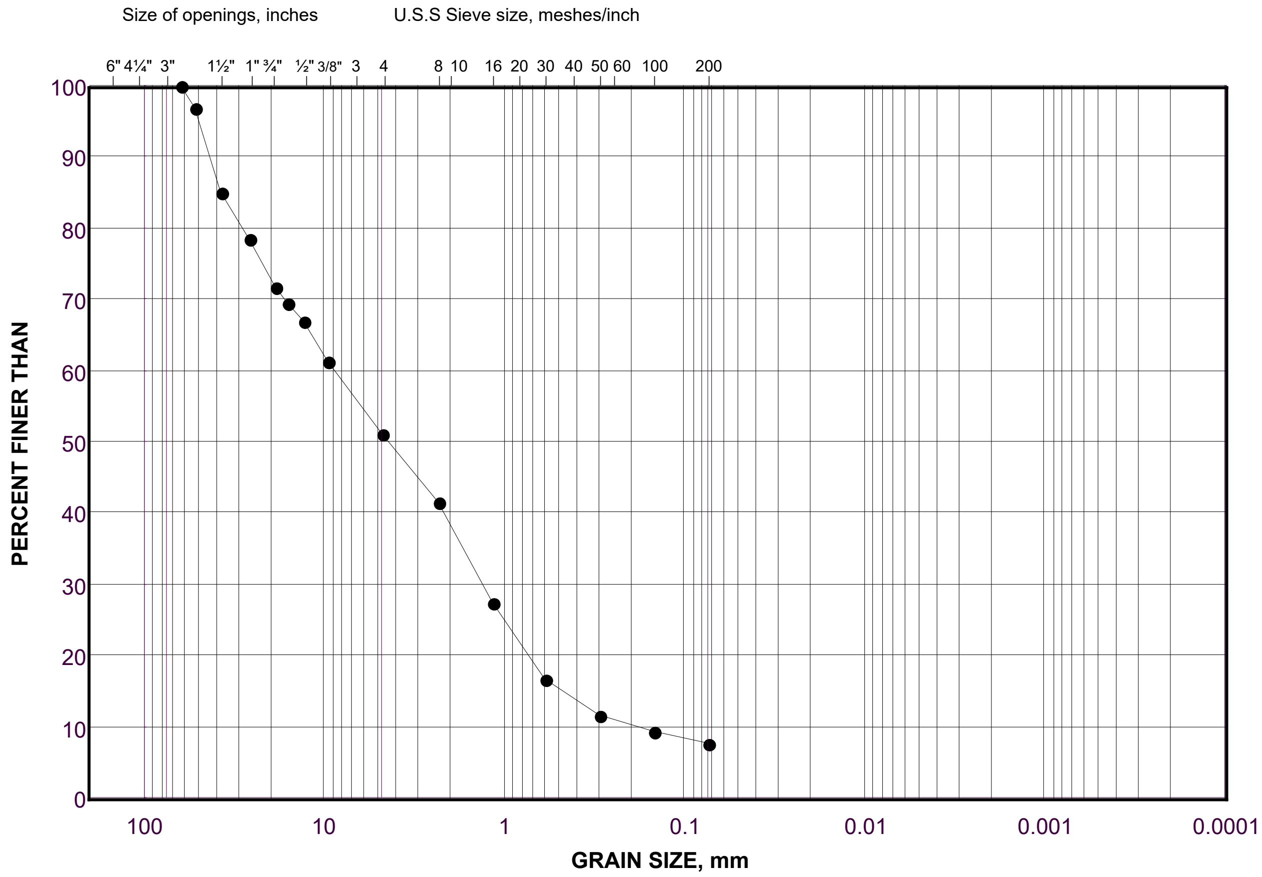
Project Number	21476582	Depth	89
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:42:59 AM
Sample Number	18	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-567

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	18	84.0 - 89.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 11852(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	0.00	0.00	53.00	100.0
37.5mm	1478.00	12.47	37.50	87.5
26.5mm	2920.00	12.17	26.50	75.4
19.0mm	3864.00	7.96	19.00	67.4
16mm	4236.00	3.14	16.00	64.3
13.2mm	4642.00	3.43	13.20	60.8
9.5mm	5370.00	6.14	9.50	54.7
4.75mm	6536.00	9.84	4.75	44.9
PAN	5267.00	44.85	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	54.55	7.26	2.36	37.6
1.18mm	121.10	8.86	1.18	28.7
600µm	176.24	7.34	0.60	21.4
300µm	206.57	4.04	0.30	17.4
150µm	224.48	2.38	0.15	15.0
75µm	242.53	2.40	0.08	12.6

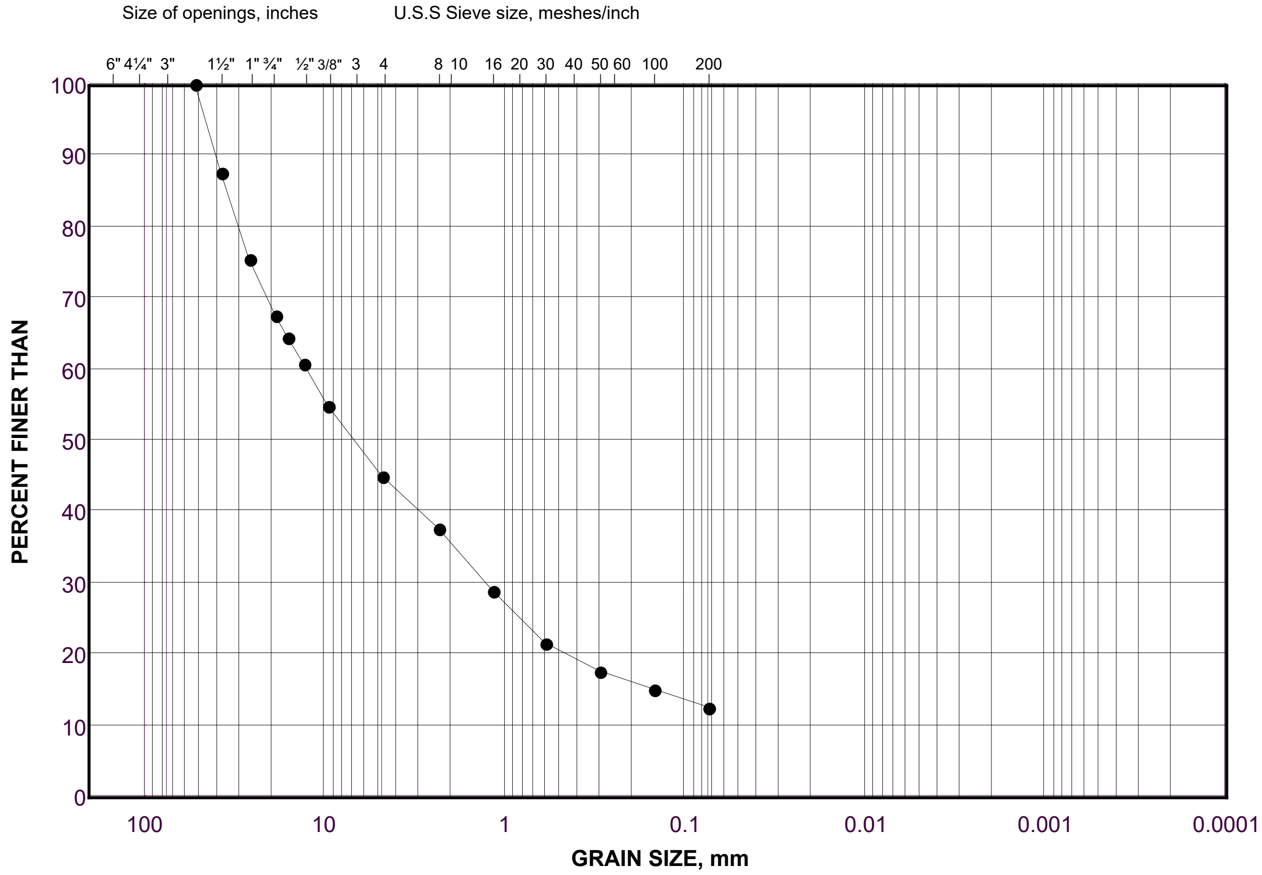
Project Number	21476582	Depth	94
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:45:27 AM
Sample Number	19	Tested By	Sieve - JB
Checked By	______________________	LabID	22-581

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	19	89.0 - 94.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 18031.2(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	1119.10	6.21	63.00	93.8
53mm	3192.30	11.50	53.00	82.3
37.5mm	4386.70	6.62	37.50	75.7
26.5mm	6095.90	9.48	26.50	66.2
19.0mm	7919.40	10.11	19.00	56.1
16mm	8768.80	4.71	16.00	51.4
13.2mm	9722.40	5.29	13.20	46.1
9.5mm	10786.70	5.90	9.50	40.2
4.75mm	12048.90	7.00	4.75	33.2
PAN	5961.30	33.18	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	46.70	5.46	2.36	27.7
1.18mm	108.40	7.21	1.18	20.5
600µm	176.80	7.99	0.60	12.5
300µm	211.60	4.07	0.30	8.4
150µm	225.70	1.65	0.15	6.8
75µm	235.60	1.16	0.08	5.6

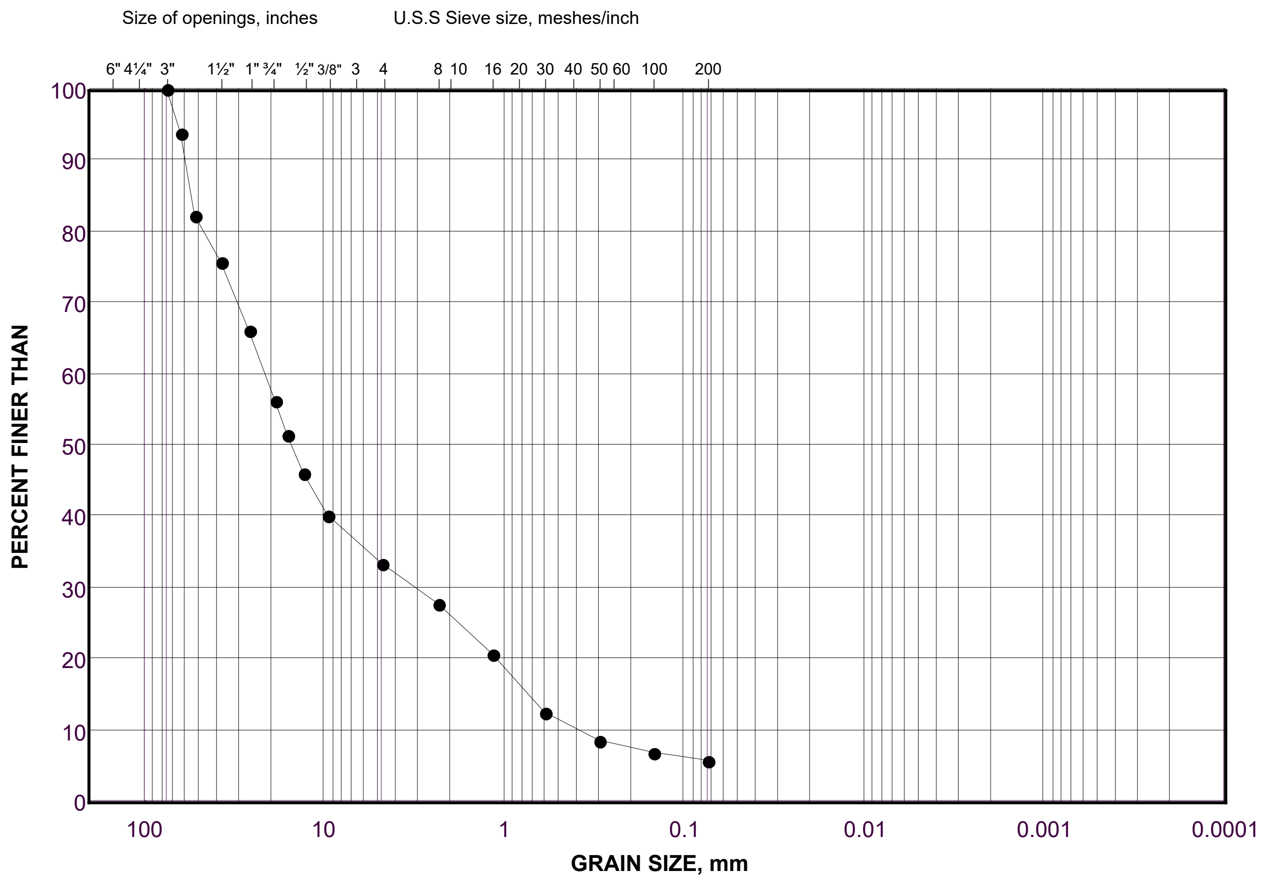
Project Number	21476582	Depth	99
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/08/22 1:27:27 PM
Sample Number	20	Tested By	Sieve - TP
Checked By	______________________________	LabID	22-440

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	20	94.0 - 99.0

Project Number: 21476582

Checked By: ____________________

Golder Associates

Date: 06-Apr-22

SOIL SIEVE ANALYSIS

Initial weight of dry sample = 16148(g)

COARSE SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
75mm	0.00	0.00	75.00	100.0
63mm	0.00	0.00	63.00	100.0
53mm	360.00	2.23	53.00	97.8
37.5mm	814.00	2.81	37.50	95.0
26.5mm	1940.00	6.97	26.50	88.0
19.0mm	2680.00	4.58	19.00	83.4
16mm	3070.00	2.42	16.00	81.0
13.2mm	3366.00	1.83	13.20	79.2
9.5mm	4084.00	4.45	9.50	74.7
4.75mm	5076.00	6.14	4.75	68.6
PAN	10996.00	68.57	0.00	0.0

HYDROMETER BACK SIEVING

SIEVE	CUM. MASS RETAINED (g)	% RETAINED	PARTICLE SIZE(mm)	% PASSING
2.36mm	39.87	7.64	2.36	60.9
1.18mm	121.96	15.73	1.18	45.2
600µm	228.07	20.34	0.60	24.9
300µm	289.95	11.86	0.30	13.0
150µm	311.75	4.18	0.15	8.8
75µm	323.05	2.17	0.08	6.7

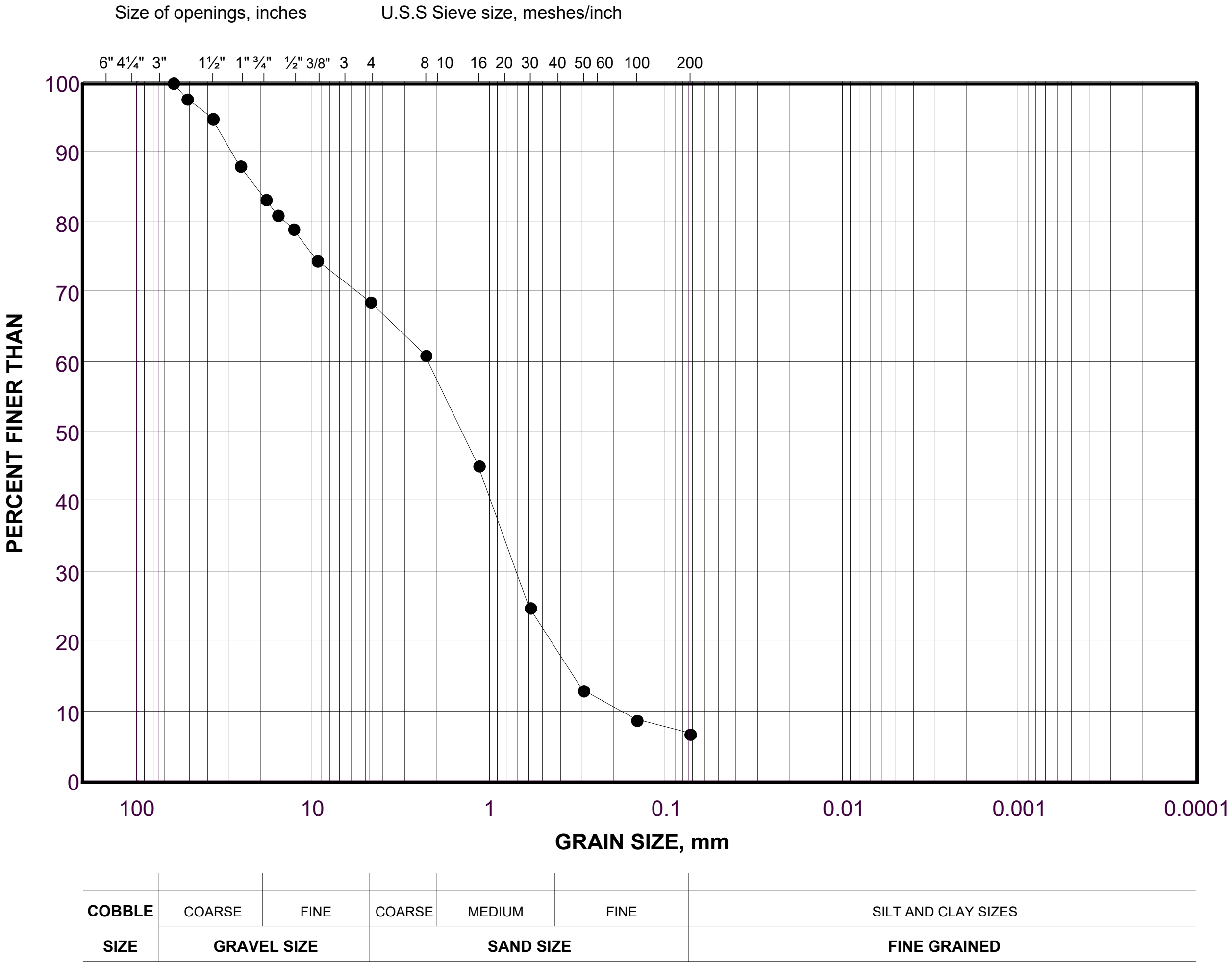
Project Number	21476582	Depth	104
Project Task	1000	Units	Imperial
Borehole Number	MW 21-04	Testing Date	3/29/22 10:49:37 AM
Sample Number	21	Tested By	Sieve - JB
Checked By	______________________________	LabID	22-582

Golder Associates

GRAIN SIZE DISTRIBUTION

MTO LS-602

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(ft)
●	MW 21-04	21	99.0 - 104.0

Project Number: 21476582

Checked By: ______________________

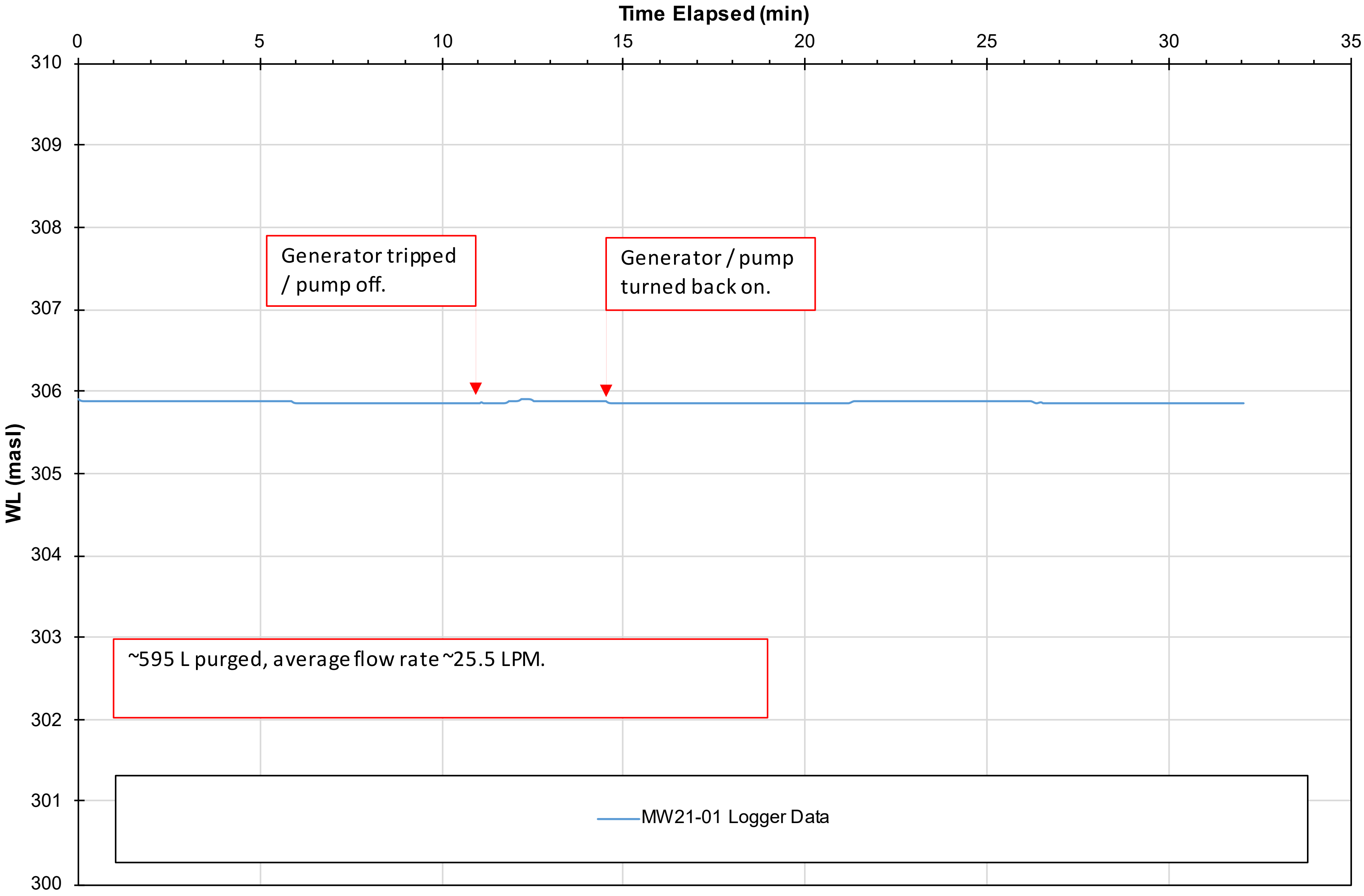
Golder Associates

Date: 06-Apr-22

APPENDIX D

Hydraulic Conductivity Testing Data

Figure D-1 - MW21-01 Hydrograph
Short-Term Pumping Test - Aug. 23, 2022



SAFARIK PIT

https://wsponline.sharepoint.com/sites/GLD-148930/Project Files/6 Deliverables/Ph 2000 - Hydrogeology/App D_Slug Testing/Slug Test Data/Slug Test Analyses/Short-term pump tests/MW21-01

Figure D-2

MW21-02

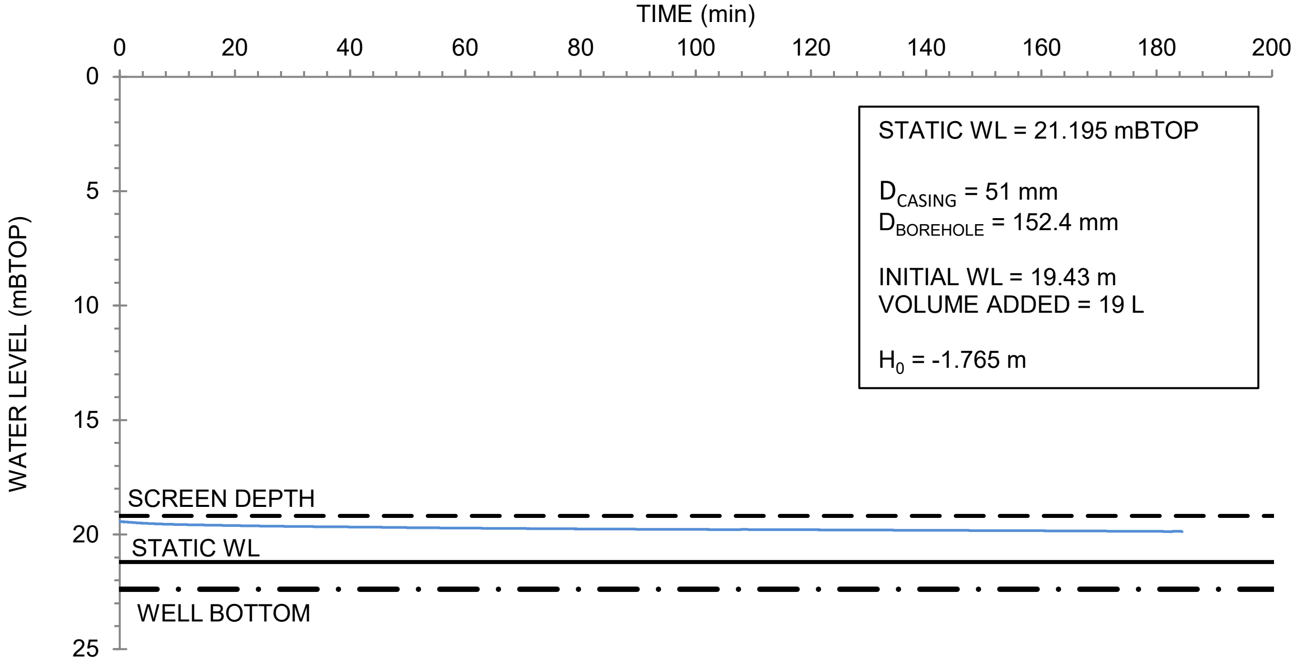
Falling Head Slug Test Analysis

Hvorslev Method

Safarik Pit

Date: August 23, 2022

Performed by: BC / JD

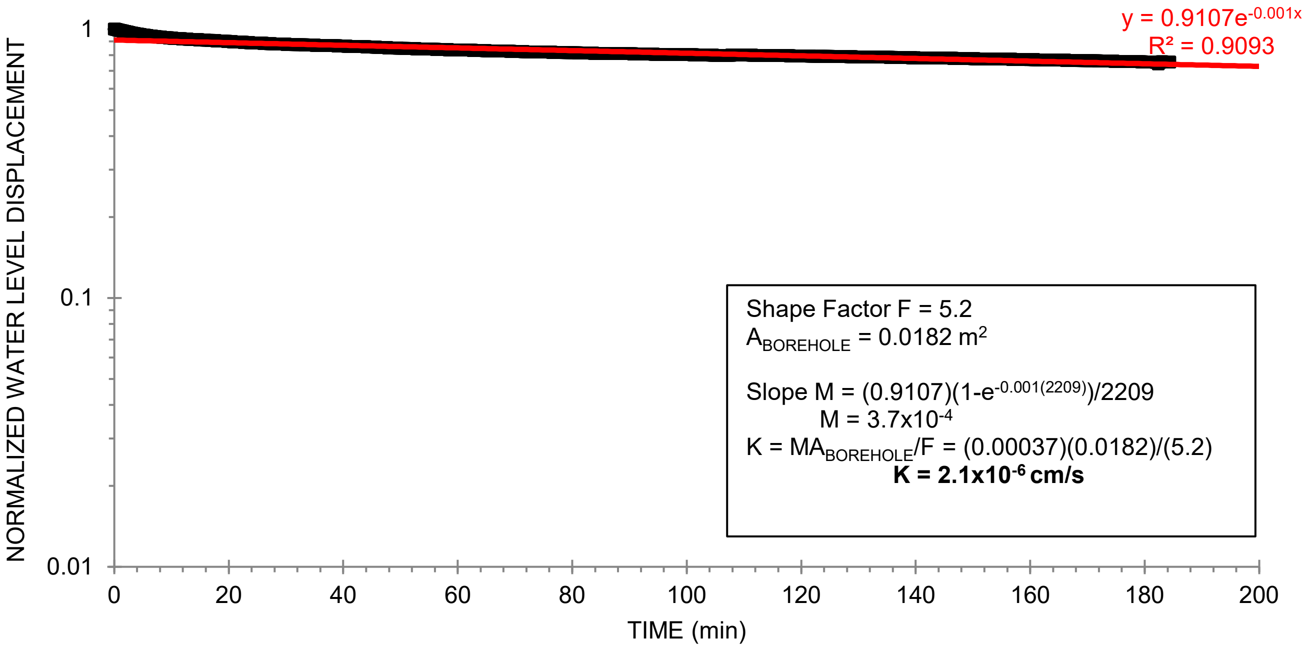


STATIC WL = 21.195 mBTOP

D_{CASING} = 51 mm
$D_{BOREHOLE}$ = 152.4 mm

INITIAL WL = 19.43 m
VOLUME ADDED = 19 L

H_0 = -1.765 m



Shape Factor F = 5.2
$A_{BOREHOLE}$ = 0.0182 m^2

Slope M = $(0.9107)(1\text{-}e^{-0.001(2209)})/2209$
M = $3.7\text{x}10^{-4}$
K = $MA_{BOREHOLE}/F$ = (0.00037)(0.0182)/(5.2)
K = $2.1\text{x}10^{-6}$ cm/s

Figure D-3a

MW21-03 (shallow)

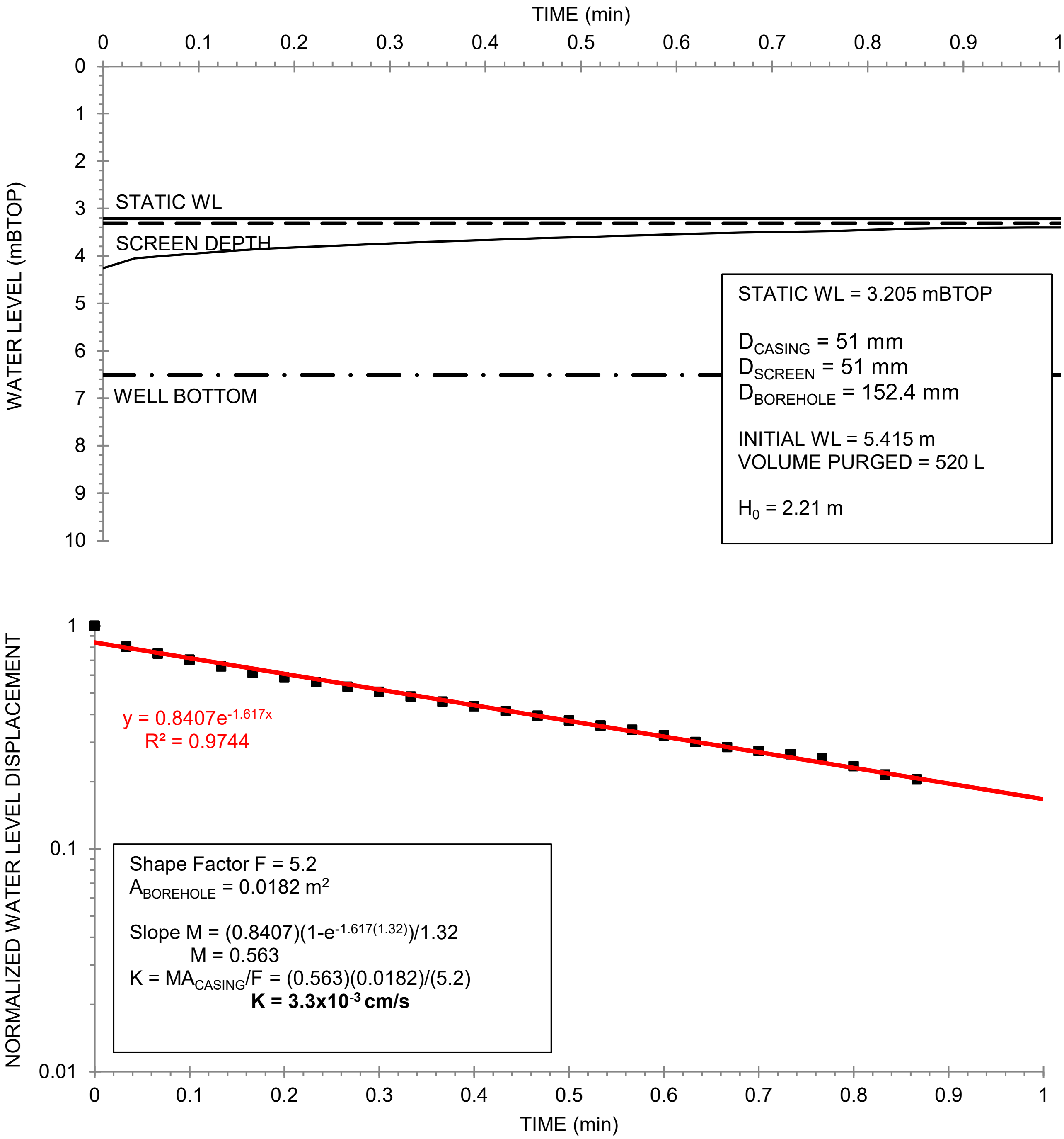
Rising Head Slug Test Analysis

Hvorslev Method

Safarik Pit

Date: August 23, 2022

Performed by: BC & JD



STATIC WL = 3.205 mBTOP

D_{CASING} = 51 mm
D_{SCREEN} = 51 mm
$D_{BOREHOLE}$ = 152.4 mm

INITIAL WL = 5.415 m
VOLUME PURGED = 520 L

H_0 = 2.21 m

Shape Factor F = 5.2
$A_{BOREHOLE}$ = 0.0182 m^2

Slope M = $(0.8407)(1-e^{-1.617(1.32)})/1.32$
M = 0.563
K = MA_{CASING}/F = (0.563)(0.0182)/(5.2)
K = 3.3x10^{-3} cm/s

Figure D-3b

MW21-03 (shallow)

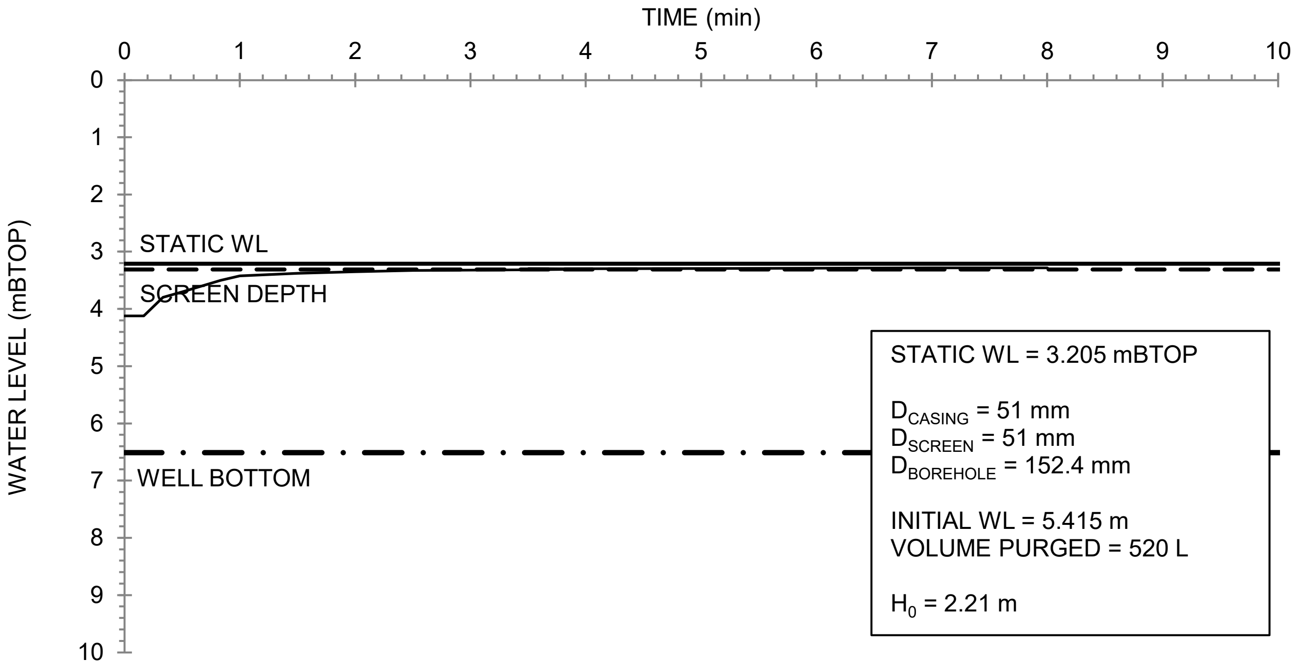
Rising Head Slug Test Analysis

Hvorslev Method

Safarik Pit

Date: August 23, 2022

Performed by: BC & JD

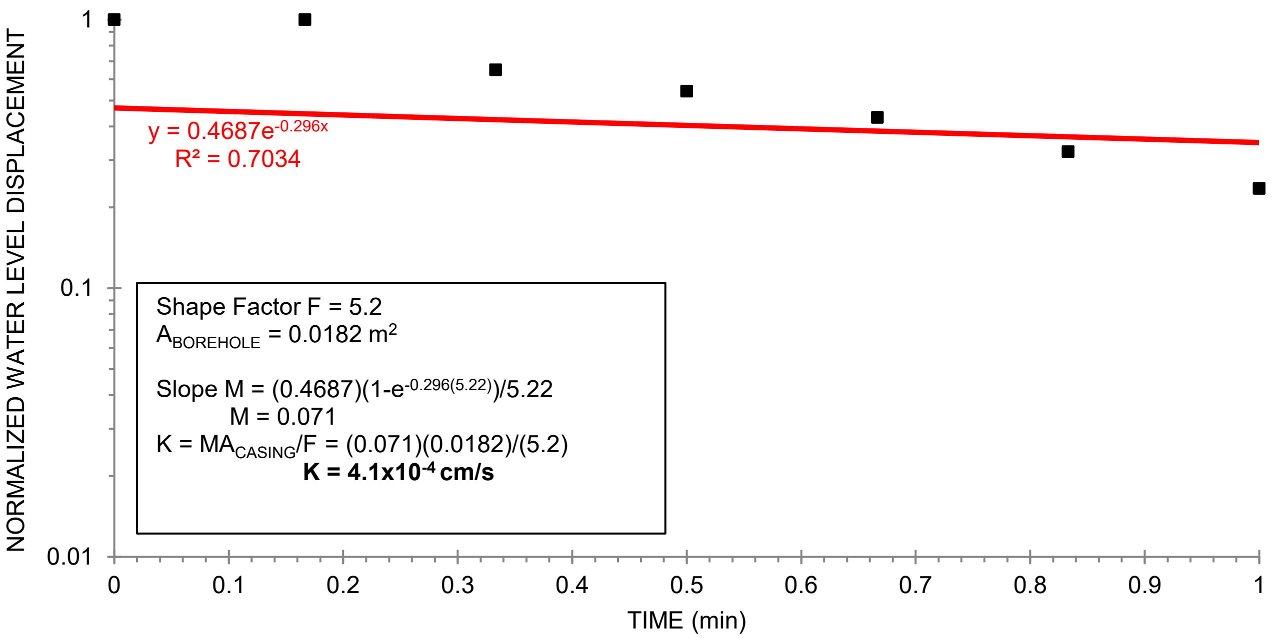


STATIC WL = 3.205 mBTOP

D_{CASING} = 51 mm
D_{SCREEN} = 51 mm
$D_{BOREHOLE}$ = 152.4 mm

INITIAL WL = 5.415 m
VOLUME PURGED = 520 L

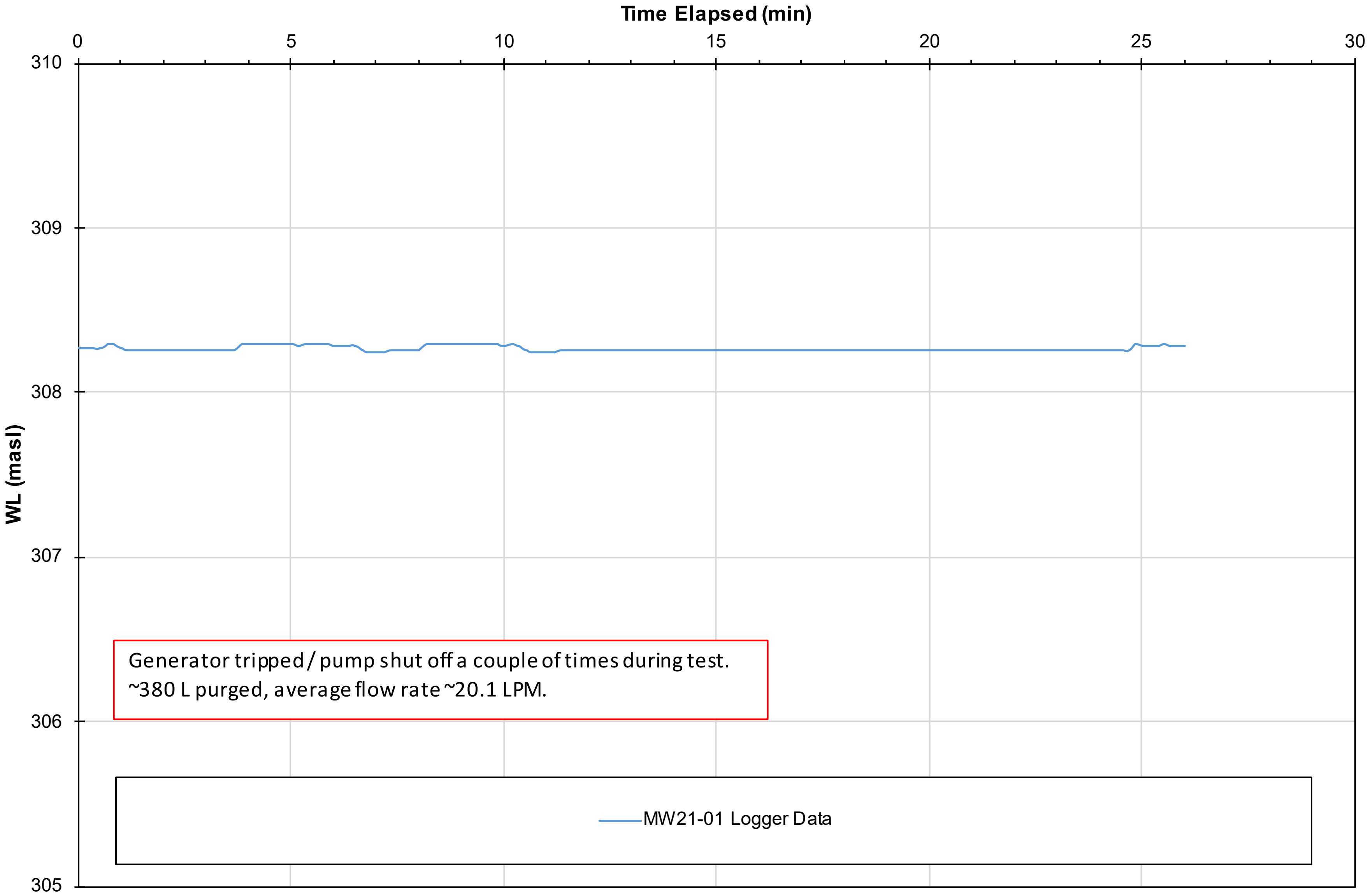
H_0 = 2.21 m



Shape Factor F = 5.2
$A_{BOREHOLE}$ = 0.0182 m^2

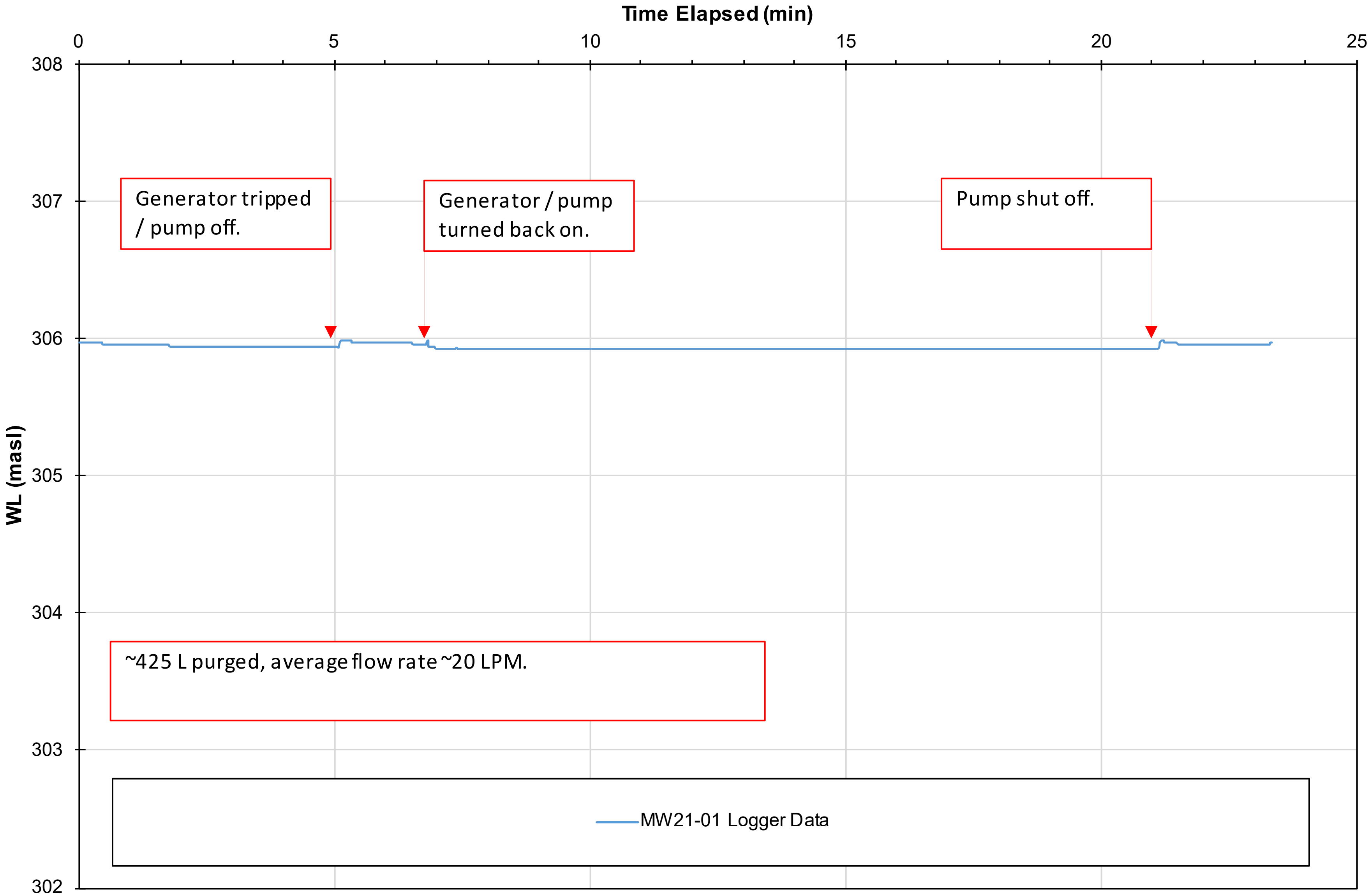
Slope M = $(0.4687)(1-e^{-0.296(5.22)})/5.22$
M = 0.071
K = MA_{CASING}/F = (0.071)(0.0182)/(5.2)
K = $4.1\text{x}10^{-4}$ cm/s

Figure D-4 - MW21-03 (deep) Hydrograph
Short-Term Pumping Test - Aug. 23, 2022



Generator tripped / pump shut off a couple of times during test.
~380 L purged, average flow rate ~20.1 LPM.

Figure D-5 - MW21-04 Hydrograph
Short-Term Pumping Test - Aug. 23, 2022



Generator tripped / pump off.

Generator / pump turned back on.

Pump shut off.

~425 L purged, average flow rate ~20 LPM.

SAFARIK PIT

https://wsponline.sharepoint.com/sites/GLD-148930/Project Files/6 Deliverables/Ph 2000 - Hydrogeology/App D_Slug Testing/Slug Test Data/Slug Test Analyses/Short-term pump tests/MW21-04

APPENDIX E

Monitor Construction Details and Water Level Data

Table E-1: Monitoring Well Construction Details
Safarik Pit

Well ID	UTM		Top of Pipe Elevation (mASL)	Ground Surface Elevation (mASL)	Stick-up (m)	Measured Depth (mbTOP)	Screened Interval (mbgs)			Screened Interval (mASL)		
MW21-01 (SAF)	4810093.943	569526.217	317.82	316.95	0.76	16.01	12.0	-	15.2	305.0	-	301.8
MW21-02 (SAF)	4810014.468	569931.985	328.63	327.98	0.65	22.38	18.4	-	21.6	309.6	-	306.4
MW21-03-D (SAF)	4810679.784	570037.809	322.39	321.42	0.95	25.22	21.2	-	24.4	300.2	-	297.0
MW21-03-S (SAF)	4810677.934	570039.545	322.33	321.38	0.97	6.51	2.3	-	5.5	319.1	-	315.9
MW21-04 (SAF)	4810448.223	570309.851	328.82	327.87	0.88	25.26	21.2	-	24.4	306.7	-	303.5

Table E-2: Manual Groundwater Level Elevations
Safarik Pit

Well ID:	**MW21-01 (SAF)**		**MW21-02 (SAF)**		**MW21-03-D (SAF)**		**MW21-03-S (SAF)**		**MW21-04 (SAF)**	
Top of Pipe Elevation (mASL):	317.82		328.63		322.39		322.33		328.82	
Date of Water Level Measurement	(mbtop)	(mASL)	(mbtop)	(mASL)	(mbtop)	(mASL)	(mbtop)	(mASL)	(mbtop)	(mASL)
15-Dec-21 (after well install)	11.61	306.21	19.94	308.70	14.97	307.43	2.90	319.43	21.83	306.99
22-Dec-21 (during logger install)	11.61	306.21	21.67	306.97	14.95	307.44	2.86	319.48	21.82	307.00
28-Mar-22	11.16	306.67	21.07	307.56	14.44	307.95	1.07	321.26	21.27	307.55
16-Jun-22	10.97	306.85	20.88	307.75	14.20	308.19	2.02	320.31	20.91	307.91
23-Aug-22	11.36	306.47	21.20	307.44	14.67	307.72	3.20	319.13	21.40	307.42
08-Dec-22	11.83	305.99	21.63	307.00	15.31	307.09	3.93	318.40	22.07	306.75
24-Mar-23	11.81	306.01	21.76	306.87	15.27	307.12	2.95	319.38	22.19	306.63
22-Jun-23	11.24	306.58	21.05	307.58	14.44	307.95	2.03	320.30	21.22	307.60
12-Sep-23	11.23	306.59	21.07	307.56	14.44	307.95	2.50	319.83	21.20	307.62
15-Dec-23	11.53	306.29	21.35	307.28	14.85	307.54	2.84	319.50	21.65	307.18
26-Mar-24	11.24	306.58	21.14	307.49	14.54	307.85	1.63	320.70	21.35	307.47
10-Jun-24	11.00	306.82	20.90	307.73	14.22	308.17	1.84	320.49	20.95	307.87
20-Sep-24	10.93	306.89	20.84	307.79	14.04	308.35	2.61	319.72	20.79	308.03
03-Dec-24	11.27	306.55	21.16	307.47	14.53	307.86	3.07	319.27	21.32	307.50
19-Mar-25	11.43	306.39	21.41	307.22	14.83	307.56	2.19	320.14	21.73	307.09

Figure E-1: Groundwater Hydrograph - Perched MW21-03-S (SAF)
Safarik Pit

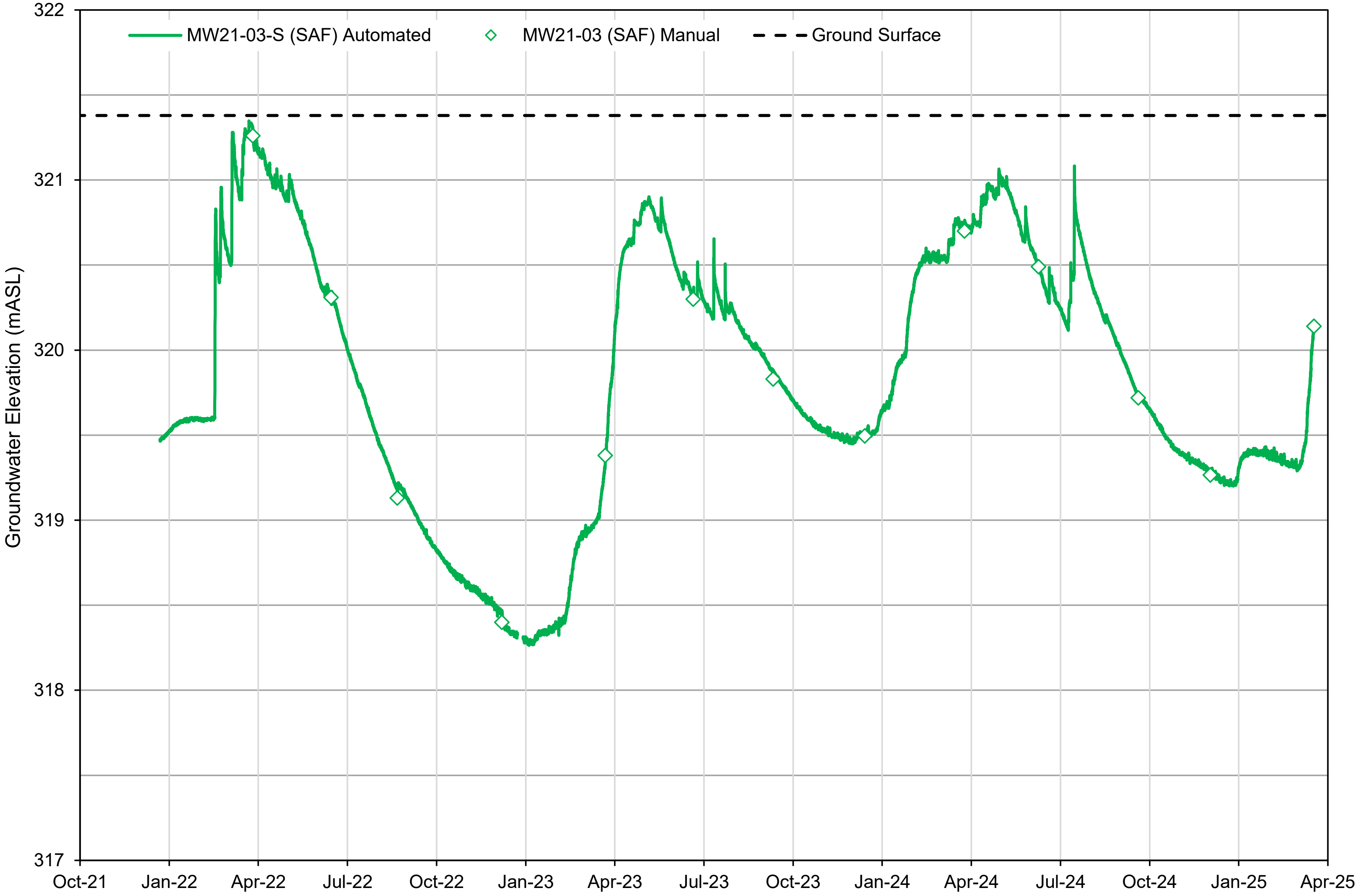


Figure E-2: Groundwater Hydrograph
Safarik Pit

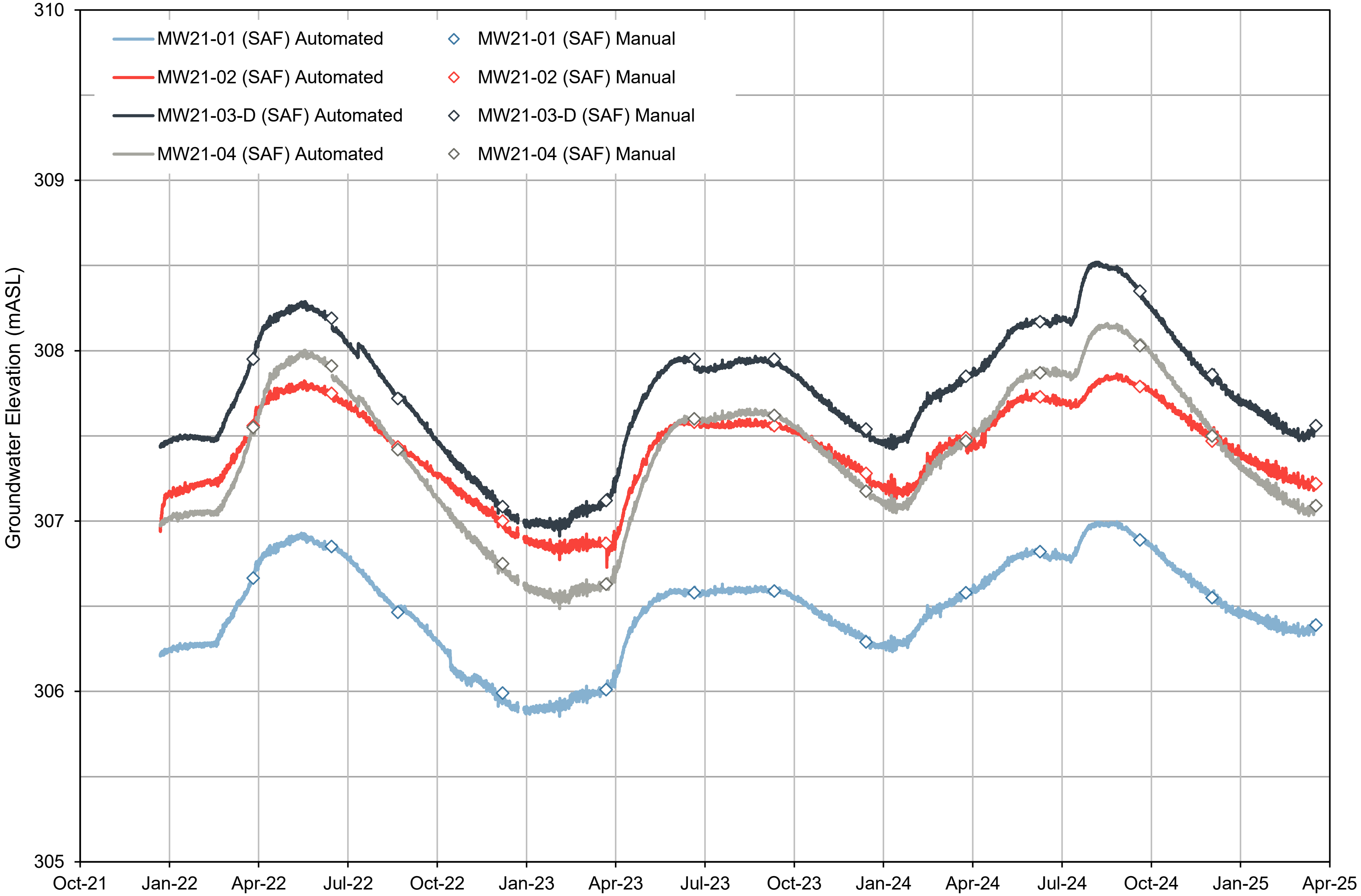
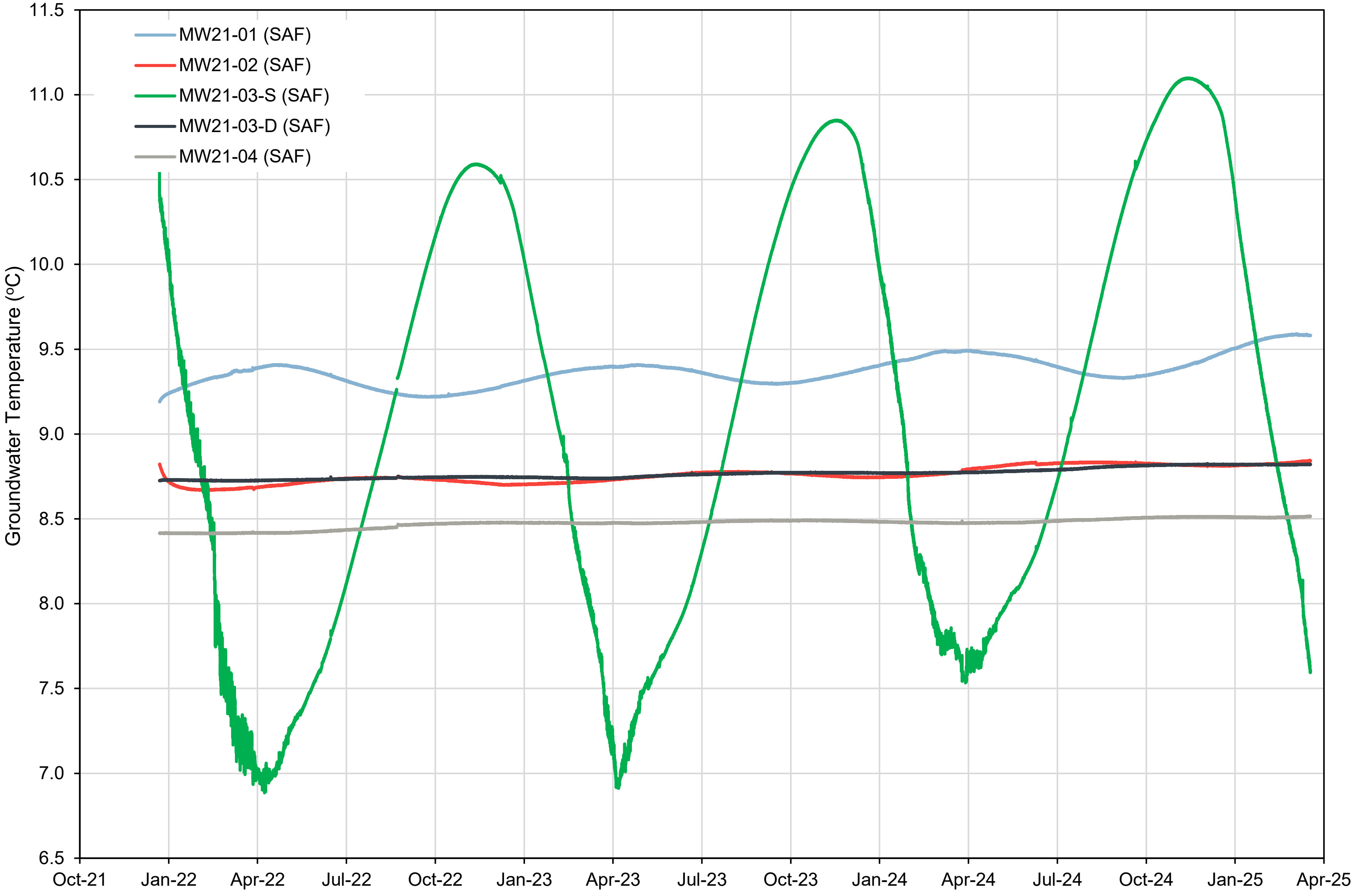


Figure E-3: Groundwater Thermograph
Safarik Pit



APPENDIX F

Groundwater Chemical Results

Appendix F Table Notation for Groundwater Chemical Results

Notation	*Description*
mg/L	milligrams per Litre • values in mg/L unless otherwise noted
µg/L	micrograms per Litre
SU	Scientific Units
µS/cm	microSiemens per centimetre
ºC	degrees Celsius
T K N	Total Kjehldahl Nitrogen
D O C	Dissolved Organic Carbon
ODWQS	Ontario Drinking Water Quality Standards (June 2003 and updates)
MAC	Maximum Acceptable Concentration
IMAC	Interim Maximum Acceptable Concentration
AO	Aesthetic objective
OG	Operational Guideline
nc	no ODWQS criteria
▨	shading indicates an exceedance of the ODWQS criteria
A	When both nitrate and nitrite are present, the total of the two should not exceed 10.0 mg/L.
B	When sulphate concentrations exceed 500 mg/L, the water may have a laxative effect on some people.
C	The aesthetic objective for sodium is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information can be
blank	data not available
< value	parameter not detected above associated laboratory reported detection limit

Table F-1: Water Quality Results - General Chemistry and Metals
Safarik Pit

Sample Location	Date	*Field*			*General Chemistry*												
		pH	Conductivity	Temperature	pH	Conductivity	Alkalinity	Ammonia	Chloride	D O C	Hardness	Nitrate	Nitrite	Orthophosphate	Sulphate	T K N	Total Phosphorus
	Units	SU	µS/cm	°C	SU	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	ODWQS	6.5 - 8.5 OG	nc	15 AO	6.5 - 8.5 OG	nc	30 - 500 OG	nc	250 AO	5 AO	80 - 100 OG	10 MAC^{A}	1 MAC^{A}	nc	500 AO^{B}	nc	nc
MW21-01 (SAF)	28-Mar-22	7.59	1,471	8.0	7.79	1,600	300	0.23	**310**	0.63	**400**	3.32	<0.010	<0.010	31	0.95	0.38
MW21-02 (SAF)	28-Mar-22	Insufficient Volume to Sample															
MW21-03-S (SAF)	28-Mar-22	7.56	555	4.1	7.95	540	290	0.38	5.9	0.72	**320**	0.47	<0.010	<0.010	6.0	0.44	6.7
MW21-03-D (SAF)	28-Mar-22	7.49	2,288	7.3	7.72	2,500	330	0.24	**610**	0.61	**470**	1.08	<0.010	<0.010	37	0.40	0.64
MW21-04 (SAF)	28-Mar-22	7.55	1,526	7.1	7.79	1,600	300	0.25	**330**	0.91	**480**	0.59	<0.010	<0.010	33	0.51	1.5

Table F-1: Water Quality Results - General Chemistry and Metals
Safarik Pit

Sample Location	Date	Dissolved Metals															
		Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Molybdenum
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	ODWQS	0.1 OG	0.006 MAC	0.01 MAC	1 MAC	nc	5 IMAC	0.005 MAC	nc	0.05 MAC	nc	1 AO	0.3 AO	0.01 MAC	nc	0.05 AO	nc
MW21-01 (SAF)	28-Mar-22	<0.0049	<0.00050	<0.0010	0.170	<0.00040	0.012	0.00016	100	<0.0050	<0.00050	<0.00090	<0.100	<0.00050	35	0.0028	<0.00050
MW21-02 (SAF)	28-Mar-22																
MW21-03-S (SAF)	28-Mar-22	<0.0049	<0.00050	<0.0010	0.016	<0.00040	<0.010	<0.000090	94	<0.0050	<0.00050	<0.00090	<0.100	<0.00050	21	<0.0020	<0.00050
MW21-03-D (SAF)	28-Mar-22	0.020	<0.00050	<0.0010	0.220	<0.00040	0.018	0.00017	120	<0.0050	<0.00050	0.0013	<0.100	0.00095	39	0.014	0.00052
MW21-04 (SAF)	28-Mar-22	0.084	<0.00050	<0.0010	0.200	<0.00040	0.011	0.00030	120	<0.0050	0.0047	0.0040	0.290	0.0059	44	**0.073**	0.00072

Table F-1: Water Quality Results - General Chemistry and Metals
Safarik Pit

Sample Location	Date	Dissolved Metals												
		Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Thallium	Titanium	Uranium	Vanadium	Zinc
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	ODWQS	nc	nc	nc	0.05 MAC	nc	nc	200 AO^C	nc	nc	nc	0.02 MAC	nc	5 AO
MW21-01 (SAF)	28-Mar-22	<0.0010	<0.100	2.3	<0.0020	5.1	<0.000090	180	0.140	<0.000050	<0.0050	0.00047	<0.00050	0.110
MW21-02 (SAF)	28-Mar-22													
MW21-03-S (SAF)	28-Mar-22	<0.0010	<0.100	0.37	<0.0020	2.6	<0.000090	3.2	0.094	<0.000050	<0.0050	0.00023	<0.00050	<0.0050
MW21-03-D (SAF)	28-Mar-22	<0.0010	0.100	2.5	<0.0020	5.0	<0.000090	**350**	0.180	<0.000050	<0.0050	0.00054	<0.00050	0.087
MW21-04 (SAF)	28-Mar-22	0.0012	0.120	2.0	<0.0020	5.4	<0.000090	190	0.150	<0.000050	0.0053	0.00054	<0.00050	0.099

Table F-2: Groundwater Quality Results - Volatile Organic Compounds
Safarik Pit

Sample Location	Date	*Volatile Organic Compounds (µg/L)*					
		Benzene	Ethylbenzene	Toluene	o-Xylene	m&p-Xylene	Xylenes (Total)
	ODWQS	1 MAC	1.6 AO 140 MAC	24 AO 60 MAC	nc	nc	20 AO 90 MAC
MW21-01 (SAF)	28-Mar-22	<0.20	<0.20	<0.20	<0.40	<0.20	<0.40
MW21-02 (SAF)	28-Mar-22	Insufficient Volume to Sample					
MW21-03-S (SAF)	28-Mar-22	<0.20	<0.20	**0.36**	<0.40	<0.20	<0.40
MW21-03-D (SAF)	28-Mar-22	<0.20	<0.20	<0.20	<0.40	<0.20	<0.40
MW21-04 (SAF)	28-Mar-22	<0.20	<0.20	<0.20	<0.40	<0.20	<0.40

Notes: Bold indicates concentration reported above laboratory detection limit
Shading indicates concentration exceeds ODWQS

Your Project #: 211-12522-00
Your C.O.C. #: 859244-01-01

Attention: Rebecca Warrack

WSP Canada Inc
55 King St
Suite 700
St. Catharines, ON
CANADA L2R3H5

Report Date: 2022/04/05
Report #: R7074096
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C280819
Received: 2022/03/28, 14:31

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	4	N/A	2022/04/01	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	4	N/A	2022/04/04	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	4	N/A	2022/04/01	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	4	N/A	2022/04/01	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	4	N/A	2022/03/31	CAM SOP-00446	SM 23 5310 B m
Petroleum Hydro. CCME F1 & BTEX in Water	4	N/A	2022/04/04	CAM SOP-00315	CCME PHC-CWS m
Hardness (calculated as CaCO3)	4	N/A	2022/04/04	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	4	N/A	2022/04/01	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	4	N/A	2022/04/05		
Anion and Cation Sum	4	N/A	2022/04/04		
Total Ammonia-N	2	N/A	2022/03/31	CAM SOP-00441	USGS I-2522-90 m
Total Ammonia-N	2	N/A	2022/04/01	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	4	N/A	2022/04/01	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	4	2022/03/31	2022/04/01	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	4	N/A	2022/04/01	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	4	N/A	2022/04/05		Auto Calc
Sat. pH and Langelier Index (@ 4C)	4	N/A	2022/04/05		Auto Calc
Sulphate by Automated Colourimetry	4	N/A	2022/04/01	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	4	N/A	2022/04/05		Auto Calc
Total Kjeldahl Nitrogen in Water	4	2022/03/31	2022/04/04	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	4	2022/04/04	2022/04/04	CAM SOP-00407	SM 23 4500 P B H m

Remarks:

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

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

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Uncertainty has not been accounted for when stating conformity to the referenced standard.

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

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: Ashton.Gibson@bureauveritas.com
Phone# (905)817-5765
===
This report has been generated and distributed using a secure automated process.
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For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 2

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		SEZ610			SEZ611		SEZ612		
Sampling Date		2022/03/28			2022/03/28		2022/03/28		
COC Number		859244-01-01			859244-01-01		859244-01-01		
	UNITS	**MW21-01**	**RDL**	**QC Batch**	**MW21-04**	**RDL**	**MW21-03 SHALLOW**	**RDL**	**QC Batch**
Calculated Parameters									
Anion Sum	me/L	15.8	N/A	7909755	16.1	N/A	6.09	N/A	7909755
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	300	1.0	7909756	290	1.0	290	1.0	7909756
Calculated TDS	mg/L	870	1.0	7909760	910	1.0	310	1.0	7909760
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.8	1.0	7909756	1.7	1.0	2.4	1.0	7909756
Cation Sum	me/L	15.9	N/A	7909755	17.8	N/A	6.55	N/A	7909755
Hardness (CaCO3)	mg/L	400	1.0	7910528	480	1.0	320	1.0	7910528
Ion Balance (% Difference)	%	0.610	N/A	7909577	5.23	N/A	3.66	N/A	7909577
Langelier Index (@ 20C)	N/A	0.753		7909757	0.808		0.959		7909757
Langelier Index (@ 4C)	N/A	0.506		7909758	0.562		0.710		7909758
Saturation pH (@ 20C)	N/A	7.04		7909757	6.98		6.99		7909757
Saturation pH (@ 4C)	N/A	7.29		7909758	7.23		7.24		7909758
Inorganics									
Total Ammonia-N	mg/L	0.23	0.050	7914841	0.25	0.050	0.38	0.050	7916524
Conductivity	umho/cm	1600	1.0	7914870	1600	1.0	540	1.0	7914870
Total Kjeldahl Nitrogen (TKN)	mg/L	0.95	0.10	7914878	0.51	0.10	0.44	0.10	7914878
Dissolved Organic Carbon	mg/L	0.63	0.40	7912192	0.91	0.40	0.72	0.40	7912192
Orthophosphate (P)	mg/L	<0.010	0.010	7915040	<0.010	0.010	<0.010	0.010	7915040
pH	pH	7.79		7914872	7.79		7.95		7914872
Total Phosphorus	mg/L	0.38	0.10	7919882	1.5	0.10	6.7	0.20	7919882
Dissolved Sulphate (SO4)	mg/L	31	1.0	7915039	33	1.0	6.0	1.0	7915039
Alkalinity (Total as CaCO3)	mg/L	300	1.0	7914853	300	1.0	290	1.0	7914853
Dissolved Chloride (Cl-)	mg/L	310	4.0	7915026	330	5.0	5.9	1.0	7915026
Nitrite (N)	mg/L	<0.010	0.010	7914810	<0.010	0.010	<0.010	0.010	7914810
Nitrate (N)	mg/L	3.32	0.10	7914810	0.59	0.10	0.47	0.10	7914810
Nitrate + Nitrite (N)	mg/L	3.32	0.10	7914810	0.59	0.10	0.47	0.10	7914810

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		SEZ613		
Sampling Date		2022/03/28		
COC Number		859244-01-01		
	UNITS	**MW21-03 DEEP**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	me/L	24.7	N/A	7909755
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	330	1.0	7909756
Calculated TDS	mg/L	1400	1.0	7909760
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.6	1.0	7909756
Cation Sum	me/L	24.9	N/A	7909755
Hardness (CaCO3)	mg/L	470	1.0	7910528
Ion Balance (% Difference)	%	0.290	N/A	7909577
Langelier Index (@ 20C)	N/A	0.736		7909757
Langelier Index (@ 4C)	N/A	0.492		7909758
Saturation pH (@ 20C)	N/A	6.99		7909757
Saturation pH (@ 4C)	N/A	7.23		7909758
Inorganics				
Total Ammonia-N	mg/L	0.24	0.050	7914841
Conductivity	umho/cm	2500	1.0	7914870
Total Kjeldahl Nitrogen (TKN)	mg/L	0.40	0.10	7914878
Dissolved Organic Carbon	mg/L	0.61	0.40	7912192
Orthophosphate (P)	mg/L	<0.010	0.010	7915040
pH	pH	7.72		7914872
Total Phosphorus	mg/L	0.64	0.10	7919882
Dissolved Sulphate (SO4)	mg/L	37	1.0	7915039
Alkalinity (Total as CaCO3)	mg/L	330	1.0	7914853
Dissolved Chloride (Cl-)	mg/L	610	7.0	7915026
Nitrite (N)	mg/L	<0.010	0.010	7914810
Nitrate (N)	mg/L	1.08	0.10	7914810
Nitrate + Nitrite (N)	mg/L	1.08	0.10	7914810

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		SEZ610	SEZ611	SEZ612	SEZ613		
Sampling Date		2022/03/28	2022/03/28	2022/03/28	2022/03/28		
COC Number		859244-01-01	859244-01-01	859244-01-01	859244-01-01		
	UNITS	**MW21-01**	**MW21-04**	**MW21-03 SHALLOW**	**MW21-03 DEEP**	**RDL**	**QC Batch**
Metals							
Dissolved Aluminum (Al)	ug/L	<4.9	84	<4.9	20	4.9	7913919
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7913919
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7913919
Dissolved Barium (Ba)	ug/L	170	200	16	220	2.0	7913919
Dissolved Beryllium (Be)	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	7913919
Dissolved Boron (B)	ug/L	12	11	<10	18	10	7913919
Dissolved Cadmium (Cd)	ug/L	0.16	0.30	<0.090	0.17	0.090	7913919
Dissolved Calcium (Ca)	ug/L	100000	120000	94000	120000	200	7913919
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7913919
Dissolved Cobalt (Co)	ug/L	<0.50	4.7	<0.50	<0.50	0.50	7913919
Dissolved Copper (Cu)	ug/L	<0.90	4.0	<0.90	1.3	0.90	7913919
Dissolved Iron (Fe)	ug/L	<100	290	<100	<100	100	7913919
Dissolved Lead (Pb)	ug/L	<0.50	5.9	<0.50	0.95	0.50	7913919
Dissolved Magnesium (Mg)	ug/L	35000	44000	21000	39000	50	7913919
Dissolved Manganese (Mn)	ug/L	2.8	73	<2.0	14	2.0	7913919
Dissolved Molybdenum (Mo)	ug/L	<0.50	0.72	<0.50	0.52	0.50	7913919
Dissolved Nickel (Ni)	ug/L	<1.0	1.2	<1.0	<1.0	1.0	7913919
Dissolved Phosphorus (P)	ug/L	<100	120	<100	100	100	7913919
Dissolved Potassium (K)	ug/L	2300	2000	370	2500	200	7913919
Dissolved Selenium (Se)	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	7913919
Dissolved Silicon (Si)	ug/L	5100	5400	2600	5000	50	7913919
Dissolved Silver (Ag)	ug/L	<0.090	<0.090	<0.090	<0.090	0.090	7913919
Dissolved Sodium (Na)	ug/L	180000	190000	3200	350000	100	7913919
Dissolved Strontium (Sr)	ug/L	140	150	94	180	1.0	7913919
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7913919
Dissolved Titanium (Ti)	ug/L	<5.0	5.3	<5.0	<5.0	5.0	7913919
Dissolved Uranium (U)	ug/L	0.47	0.54	0.23	0.54	0.10	7913919
Dissolved Vanadium (V)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7913919
Dissolved Zinc (Zn)	ug/L	110	99	<5.0	87	5.0	7913919

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

PETROLEUM HYDROCARBONS (CCME)

Bureau Veritas ID		SEZ610	SEZ611	SEZ612	SEZ613		
Sampling Date		2022/03/28	2022/03/28	2022/03/28	2022/03/28		
COC Number		859244-01-01	859244-01-01	859244-01-01	859244-01-01		
	UNITS	**MW21-01**	**MW21-04**	**MW21-03 SHALLOW**	**MW21-03 DEEP**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons							
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7918935
Toluene	ug/L	<0.20	<0.20	0.36	<0.20	0.20	7918935
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7918935
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7918935
p+m-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	7918935
Total Xylenes	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	7918935
Surrogate Recovery (%)							
1,4-Difluorobenzene	%	105	94	100	118		7918935
4-Bromofluorobenzene	%	78	86	78	84		7918935
D10-o-Xylene	%	76	76	77	80		7918935
D4-1,2-Dichloroethane	%	116	103	109	126		7918935

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

GENERAL COMMENTS

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7912192	AGD	Matrix Spike	Dissolved Organic Carbon	2022/03/31		96	%	80 - 120
7912192	AGD	Spiked Blank	Dissolved Organic Carbon	2022/03/31		100	%	80 - 120
7912192	AGD	Method Blank	Dissolved Organic Carbon	2022/03/31	<0.40		mg/L	
7912192	AGD	RPD	Dissolved Organic Carbon	2022/03/31	8.5		%	20
7913919	PBA	Matrix Spike	Dissolved Aluminum (Al)	2022/04/01		108	%	80 - 120
			Dissolved Antimony (Sb)	2022/04/01		109	%	80 - 120
			Dissolved Arsenic (As)	2022/04/01		102	%	80 - 120
			Dissolved Barium (Ba)	2022/04/01		106	%	80 - 120
			Dissolved Beryllium (Be)	2022/04/01		103	%	80 - 120
			Dissolved Boron (B)	2022/04/01		99	%	80 - 120
			Dissolved Cadmium (Cd)	2022/04/01		105	%	80 - 120
			Dissolved Calcium (Ca)	2022/04/01		NC	%	80 - 120
			Dissolved Chromium (Cr)	2022/04/01		99	%	80 - 120
			Dissolved Cobalt (Co)	2022/04/01		105	%	80 - 120
			Dissolved Copper (Cu)	2022/04/01		107	%	80 - 120
			Dissolved Iron (Fe)	2022/04/01		104	%	80 - 120
			Dissolved Lead (Pb)	2022/04/01		97	%	80 - 120
			Dissolved Magnesium (Mg)	2022/04/01		103	%	80 - 120
			Dissolved Manganese (Mn)	2022/04/01		103	%	80 - 120
			Dissolved Molybdenum (Mo)	2022/04/01		107	%	80 - 120
			Dissolved Nickel (Ni)	2022/04/01		99	%	80 - 120
			Dissolved Phosphorus (P)	2022/04/01		113	%	80 - 120
			Dissolved Potassium (K)	2022/04/01		106	%	80 - 120
			Dissolved Selenium (Se)	2022/04/01		102	%	80 - 120
			Dissolved Silicon (Si)	2022/04/01		107	%	80 - 120
			Dissolved Silver (Ag)	2022/04/01		98	%	80 - 120
			Dissolved Sodium (Na)	2022/04/01		NC	%	80 - 120
			Dissolved Strontium (Sr)	2022/04/01		103	%	80 - 120
			Dissolved Thallium (Tl)	2022/04/01		100	%	80 - 120
			Dissolved Titanium (Ti)	2022/04/01		105	%	80 - 120
			Dissolved Uranium (U)	2022/04/01		101	%	80 - 120
			Dissolved Vanadium (V)	2022/04/01		102	%	80 - 120
			Dissolved Zinc (Zn)	2022/04/01		101	%	80 - 120
7913919	PBA	Spiked Blank	Dissolved Aluminum (Al)	2022/04/01		105	%	80 - 120
			Dissolved Antimony (Sb)	2022/04/01		107	%	80 - 120
			Dissolved Arsenic (As)	2022/04/01		100	%	80 - 120
			Dissolved Barium (Ba)	2022/04/01		103	%	80 - 120
			Dissolved Beryllium (Be)	2022/04/01		104	%	80 - 120
			Dissolved Boron (B)	2022/04/01		102	%	80 - 120
			Dissolved Cadmium (Cd)	2022/04/01		104	%	80 - 120
			Dissolved Calcium (Ca)	2022/04/01		105	%	80 - 120
			Dissolved Chromium (Cr)	2022/04/01		97	%	80 - 120
			Dissolved Cobalt (Co)	2022/04/01		102	%	80 - 120
			Dissolved Copper (Cu)	2022/04/01		106	%	80 - 120
			Dissolved Iron (Fe)	2022/04/01		102	%	80 - 120
			Dissolved Lead (Pb)	2022/04/01		98	%	80 - 120
			Dissolved Magnesium (Mg)	2022/04/01		106	%	80 - 120
			Dissolved Manganese (Mn)	2022/04/01		102	%	80 - 120
			Dissolved Molybdenum (Mo)	2022/04/01		96	%	80 - 120
			Dissolved Nickel (Ni)	2022/04/01		98	%	80 - 120
			Dissolved Phosphorus (P)	2022/04/01		129 (1)	%	80 - 120
			Dissolved Potassium (K)	2022/04/01		104	%	80 - 120
			Dissolved Selenium (Se)	2022/04/01		100	%	80 - 120

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Silicon (Si)	2022/04/01		107	%	80 - 120
			Dissolved Silver (Ag)	2022/04/01		98	%	80 - 120
			Dissolved Sodium (Na)	2022/04/01		104	%	80 - 120
			Dissolved Strontium (Sr)	2022/04/01		100	%	80 - 120
			Dissolved Thallium (Tl)	2022/04/01		101	%	80 - 120
			Dissolved Titanium (Ti)	2022/04/01		104	%	80 - 120
			Dissolved Uranium (U)	2022/04/01		101	%	80 - 120
			Dissolved Vanadium (V)	2022/04/01		100	%	80 - 120
			Dissolved Zinc (Zn)	2022/04/01		100	%	80 - 120
7913919	PBA	Method Blank	Dissolved Aluminum (Al)	2022/04/01	<4.9		ug/L	
			Dissolved Antimony (Sb)	2022/04/01	<0.50		ug/L	
			Dissolved Arsenic (As)	2022/04/01	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/04/01	<2.0		ug/L	
			Dissolved Beryllium (Be)	2022/04/01	<0.40		ug/L	
			Dissolved Boron (B)	2022/04/01	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/04/01	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/04/01	<200		ug/L	
			Dissolved Chromium (Cr)	2022/04/01	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/04/01	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/04/01	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/04/01	<100		ug/L	
			Dissolved Lead (Pb)	2022/04/01	<0.50		ug/L	
			Dissolved Magnesium (Mg)	2022/04/01	<50		ug/L	
			Dissolved Manganese (Mn)	2022/04/01	<2.0		ug/L	
			Dissolved Molybdenum (Mo)	2022/04/01	<0.50		ug/L	
			Dissolved Nickel (Ni)	2022/04/01	<1.0		ug/L	
			Dissolved Phosphorus (P)	2022/04/01	<100		ug/L	
			Dissolved Potassium (K)	2022/04/01	<200		ug/L	
			Dissolved Selenium (Se)	2022/04/01	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/04/01	<50		ug/L	
			Dissolved Silver (Ag)	2022/04/01	<0.090		ug/L	
			Dissolved Sodium (Na)	2022/04/01	<100		ug/L	
			Dissolved Strontium (Sr)	2022/04/01	<1.0		ug/L	
			Dissolved Thallium (Tl)	2022/04/01	<0.050		ug/L	
			Dissolved Titanium (Ti)	2022/04/01	<5.0		ug/L	
			Dissolved Uranium (U)	2022/04/01	<0.10		ug/L	
			Dissolved Vanadium (V)	2022/04/01	<0.50		ug/L	
			Dissolved Zinc (Zn)	2022/04/01	<5.0		ug/L	
7913919	PBA	RPD	Dissolved Antimony (Sb)	2022/04/01	14		%	20
			Dissolved Arsenic (As)	2022/04/01	NC		%	20
			Dissolved Barium (Ba)	2022/04/01	1.2		%	20
			Dissolved Beryllium (Be)	2022/04/01	NC		%	20
			Dissolved Boron (B)	2022/04/01	3.5		%	20
			Dissolved Cadmium (Cd)	2022/04/01	NC		%	20
			Dissolved Chromium (Cr)	2022/04/01	NC		%	20
			Dissolved Cobalt (Co)	2022/04/01	NC		%	20
			Dissolved Copper (Cu)	2022/04/01	0.70		%	20
			Dissolved Lead (Pb)	2022/04/01	NC		%	20
			Dissolved Molybdenum (Mo)	2022/04/01	0.20		%	20
			Dissolved Nickel (Ni)	2022/04/01	1.7		%	20
			Dissolved Selenium (Se)	2022/04/01	NC		%	20
			Dissolved Silver (Ag)	2022/04/01	NC		%	20
			Dissolved Sodium (Na)	2022/04/01	0.070		%	20

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Thallium (Tl)	2022/04/01	NC		%	20
			Dissolved Uranium (U)	2022/04/01	2.1		%	20
			Dissolved Vanadium (V)	2022/04/01	1.4		%	20
			Dissolved Zinc (Zn)	2022/04/01	4.1		%	20
7914810	S1L	Matrix Spike	Nitrite (N)	2022/04/01		106	%	80 - 120
			Nitrate (N)	2022/04/01		97	%	80 - 120
7914810	S1L	Spiked Blank	Nitrite (N)	2022/04/01		105	%	80 - 120
			Nitrate (N)	2022/04/01		95	%	80 - 120
7914810	S1L	Method Blank	Nitrite (N)	2022/04/01	<0.010		mg/L	
			Nitrate (N)	2022/04/01	<0.10		mg/L	
7914810	S1L	RPD	Nitrite (N)	2022/04/01	NC		%	20
			Nitrate (N)	2022/04/01	NC		%	20
7914841	RKF	Matrix Spike	Total Ammonia-N	2022/03/31		101	%	75 - 125
7914841	RKF	Spiked Blank	Total Ammonia-N	2022/03/31		100	%	80 - 120
7914841	RKF	Method Blank	Total Ammonia-N	2022/03/31	<0.050		mg/L	
7914841	RKF	RPD	Total Ammonia-N	2022/03/31	NC		%	20
7914853	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2022/04/01		95	%	85 - 115
7914853	SAU	Method Blank	Alkalinity (Total as CaCO3)	2022/04/01	<1.0		mg/L	
7914853	SAU	RPD [SEZ611-01]	Alkalinity (Total as CaCO3)	2022/04/01	6.2		%	20
7914870	SAU	Spiked Blank	Conductivity	2022/04/01		99	%	85 - 115
7914870	SAU	Method Blank	Conductivity	2022/04/01	<1.0		umho/cm	
7914870	SAU	RPD [SEZ611-01]	Conductivity	2022/04/01	0.57		%	25
7914872	SAU	Spiked Blank	pH	2022/04/01		102	%	98 - 103
7914872	SAU	RPD [SEZ611-01]	pH	2022/04/01	0.34		%	N/A
7914878	MJ1	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/04/04		NC	%	80 - 120
7914878	MJ1	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/04/04		98	%	80 - 120
7914878	MJ1	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/04/04		105	%	80 - 120
7914878	MJ1	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/04/04	<0.10		mg/L	
7914878	MJ1	RPD	Total Kjeldahl Nitrogen (TKN)	2022/04/04	3.9		%	20
7915026	ADB	Matrix Spike [SEZ610-02]	Dissolved Chloride (Cl-)	2022/04/01		NC	%	80 - 120
7915026	ADB	Spiked Blank	Dissolved Chloride (Cl-)	2022/04/01		103	%	80 - 120
7915026	ADB	Method Blank	Dissolved Chloride (Cl-)	2022/04/01	<1.0		mg/L	
7915026	ADB	RPD [SEZ610-02]	Dissolved Chloride (Cl-)	2022/04/01	3.2		%	20
7915039	ADB	Matrix Spike [SEZ610-02]	Dissolved Sulphate (SO4)	2022/04/01		NC	%	75 - 125
7915039	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2022/04/01		101	%	80 - 120
7915039	ADB	Method Blank	Dissolved Sulphate (SO4)	2022/04/01	<1.0		mg/L	
7915039	ADB	RPD [SEZ610-02]	Dissolved Sulphate (SO4)	2022/04/01	2.8		%	20
7915040	C_N	Matrix Spike [SEZ610-02]	Orthophosphate (P)	2022/04/01		111	%	75 - 125
7915040	C_N	Spiked Blank	Orthophosphate (P)	2022/04/01		100	%	80 - 120
7915040	C_N	Method Blank	Orthophosphate (P)	2022/04/01	<0.010		mg/L	
7915040	C_N	RPD [SEZ610-02]	Orthophosphate (P)	2022/04/01	NC		%	25
7916524	RKF	Matrix Spike	Total Ammonia-N	2022/04/01		96	%	75 - 125
7916524	RKF	Spiked Blank	Total Ammonia-N	2022/04/01		99	%	80 - 120
7916524	RKF	Method Blank	Total Ammonia-N	2022/04/01	<0.050		mg/L	
7916524	RKF	RPD	Total Ammonia-N	2022/04/01	6.7		%	20
7918935	DAN	Matrix Spike	1,4-Difluorobenzene	2022/04/04		103	%	70 - 130
			4-Bromofluorobenzene	2022/04/04		98	%	70 - 130
			D10-o-Xylene	2022/04/04		108	%	70 - 130
			D4-1,2-Dichloroethane	2022/04/04		105	%	70 - 130
			Benzene	2022/04/04		115	%	50 - 140
			Toluene	2022/04/04		118	%	50 - 140
			Ethylbenzene	2022/04/04		129	%	50 - 140
			o-Xylene	2022/04/04		127	%	50 - 140

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			p+m-Xylene	2022/04/04		127	%	50 - 140
7918935	DAN	Spiked Blank	1,4-Difluorobenzene	2022/04/04		90	%	70 - 130
			4-Bromofluorobenzene	2022/04/04		100	%	70 - 130
			D10-o-Xylene	2022/04/04		95	%	70 - 130
			D4-1,2-Dichloroethane	2022/04/04		96	%	70 - 130
			Benzene	2022/04/04		101	%	50 - 140
			Toluene	2022/04/04		105	%	50 - 140
			Ethylbenzene	2022/04/04		116	%	50 - 140
			o-Xylene	2022/04/04		114	%	50 - 140
			p+m-Xylene	2022/04/04		127	%	50 - 140
7918935	DAN	Method Blank	1,4-Difluorobenzene	2022/04/04		109	%	70 - 130
			4-Bromofluorobenzene	2022/04/04		85	%	70 - 130
			D10-o-Xylene	2022/04/04		81	%	70 - 130
			D4-1,2-Dichloroethane	2022/04/04		115	%	70 - 130
			Benzene	2022/04/04	<0.20		ug/L	
			Toluene	2022/04/04	<0.20		ug/L	
			Ethylbenzene	2022/04/04	<0.20		ug/L	
			o-Xylene	2022/04/04	<0.20		ug/L	
			p+m-Xylene	2022/04/04	<0.40		ug/L	
			Total Xylenes	2022/04/04	<0.40		ug/L	
7919882	SSV	Matrix Spike	Total Phosphorus	2022/04/04		107	%	80 - 120
7919882	SSV	QC Standard	Total Phosphorus	2022/04/04		105	%	80 - 120
7919882	SSV	Spiked Blank	Total Phosphorus	2022/04/04		108	%	80 - 120
7919882	SSV	Method Blank	Total Phosphorus	2022/04/04	<0.020		mg/L	
7919882	SSV	RPD	Total Phosphorus	2022/04/04	0.23		%	20

N/A = Not Applicable

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

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

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

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

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

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

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

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

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

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

APPENDIX G

Numerical Groundwater Model Report

REPORT

Appendix G - Numerical Groundwater Model Report

Level One and Two Water Study Report
Safarik Pit

Submitted to:

CBM AGGREGRATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

55 Industrial Street
Toronto, ON M4G 3W9

Submitted by:

WSP Canada Inc.

55 King St., Suite 700 St. Catharines, ON L2R 3H5

905-687-1771

GLD-21476582

July 29 2025

Study Limitations

MODFLOW-USG was used to simulate steady-state groundwater flow conditions under various phases of quarry development and rehabilitated conditions. The steady-state model provides a reasonable representation of groundwater conditions and allows for the simulation of changes to these groundwater conditions as a result of the proposed quarry deepening.

Services performed by WSP Canada Inc. were conducted in a manner consistent with a level of care and skill ordinarily exercised by members of the environmental engineering and consulting profession. This report presents the results of data compilation and computer simulations of a geologic setting. Subsurface investigations explore a relatively large volume of material with a fixed number of boreholes. Computer models represent a deliberate simplification of the actual geologic conditions. Models constructed from these data reflect the quality and completeness of the information available at the time the work was performed.

Environmental conditions and the amount of data available can change over time. Results and discussions relating to the baseline conditions are based upon information that existed at the time the model was constructed.

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FIGURES

G.1 INTRODUCTION

This report summarizes the numerical groundwater modeling activities undertaken as part of the Level 1 and 2 Water Study report prepared to meet the study requirements for the proposed Safarik Pit. The purpose of the groundwater modeling is to predict the potential effects of the pit development during the operational phase and final rehabilitation to a lake on the local groundwater users and surface water features.

The calibrated baseline model incorporates an extensive data set consisting of borehole stratigraphy, hydraulic testing results, groundwater elevations, and surface water elevations that has been collected. Climatic data from local Environment and Climate Change Canada (ECCC) stations was used to estimate recharge to the groundwater system from infiltration of water surplus (precipitation less evapotranspiration). This dataset utilizes the 30-year ECCC climate normal in order to closely match other local numerical groundwater models. We note that additional longer term climate data was utilized for the hydrologic evaluation of the Safarik Pit. These datasets are comparable and do not impact the findings of the report.

G.1.1 Model Objectives

The primary objectives of the numerical groundwater modeling are as follows.

- Formulate the conceptual hydrogeologic setting of the Site and construct a steady-state numerical groundwater flow model representing the conceptualization. Calibrate the model to observed baseline groundwater conditions.
- Complete an analysis of uncertainty and sensitivity of the calibrated baseline model parameters in order to aid in the calibration and determine if the model is significantly robust to generate reliable predictions.
- Modify the baseline model to simulate the proposed pit development and the maximum radius of influence, the contribution of groundwater inflows to the pit and assess any changes to the water balance during the operational phase.
- Use the modified model to simulate groundwater conditions under final rehabilitation to a lake to assess any long-term changes to the water balance.

G.1.2 Previous Investigations

A number of existing operational and inactive and / or rehabilitated pits are situated within the model domain, operated both by CBM and others. Data obtained by CBM as part of the on-going monitoring programs was incorporated into the numerical model. Publicly available data from the Mill Creek Pit operated by Dufferin Aggregates was also incorporated.

During the course of this study, a number of additional publicly available reports were reviewed as input to the model construction and calibration process. The Mill Creek Subwatershed Plan (Watershed Report) (CH2M Gore & Storrie Ltd. et al, June 1996) contains a detailed writeup on the conceptual setting, including aquifer properties and inferred regional flow patterns in the shallow overburden. The City of Guelph Tier 3 Water Budget and Local Area Risk Assessment (Matrix Solutions Inc., March 2017) includes the Groundwater Flow Model Report (Tier 3 Model Report) (AquaResource, July 2014) as Appendix B. It is noted that a FEFLOW model (Tier 3 Model) was used to complete the Tier 3 study; nonetheless, the model properties and boundary conditions included in the Tier 3 Model Report were reviewed to determine appropriate initial values during the calibration process. More recently, a Hydrogeological Level 1 and 2 Assessment (Golder Associates Ltd. (now WSP), April 2020) was completed for the proposed Lanci Pit extension, situated within the model domain to the west of the proposed

Safarik Pit, operated by CBM. The conceptual setting and summary of findings were also considered during the numerical model construction and calibration for the proposed Safarik Pit.

G.2 CONCEPTUAL MODEL

The first step in constructing a numerical groundwater model is to create a “conceptual model” that describes in general terms the hydrogeologic conditions and water budget of the natural system to be simulated and other physical elements of the undertaking to be considered. Some components of the conceptual model include:

- A decision on the areal extent to be studied;
- Identification of the geologic framework and hydrogeologic properties of the subsurface;
- Derivation of hydrostratigraphic units (aquifers and aquitards) in the subsurface;
- An understanding of the regional movement of groundwater, including groundwater elevations and trends as well as hydraulic gradients;
- Identification of hydrologic features, such as watershed divides, groundwater seeps and springs and watercourses; and
- A basic understanding of water budget components that include recharge and discharge conditions and controls.

The conceptual understanding is used to make decisions regarding the construction of the numerical model to provide adequately representative simulations. The initial decision relates to the extent of the overall model domain and the scale to be used in representing the hydrogeologic systems in both the horizontal and vertical dimensions.

In formulating the conceptual model there are three key steps (Anderson and Woessner, 1992):

- Defining hydrostratigraphic units;
- Defining the groundwater and surface water system; and
- Analyzing elements of the water budget.

The conceptual model and the subsequent construction of the computer model involve some simplification and categorization of the data to represent the groundwater system in sufficient detail to provide reasonably representative results. Ultimately, model accuracy depends on the ability of the conceptual model to approximate observed conditions. Calibration statistics show how well the numerical model simulates these observed conditions.

The conceptual model for the Site is based on the topography, physiography, geology, hydrogeology and water budget outlined in **Section 2** of the main report.

G.3 SIMULATION CODE SELECTION

The numerical simulation code selected for this study was MODFLOW-USG (**U**n-**S**tructured **G**rid) developed in part by the United States Geological Survey (USGS) (Panday, S., et al, 2013). Like previous versions of MODFLOW (USGS 1988-2005), MODFLOW-USG is a modular numerical groundwater flow simulator capable of representing the complex three-dimensional multi-layer systems for steady-state conditions in the confined and unconfined aquifers within the study area using the finite-difference method. However, MODFLOW-USG allows for more robust grid refinement in areas of increased interest. The MODFLOW family of software is the most widely used groundwater modeling code in the world and has been extensively tested and applied in the research and consulting communities. The MODFLOW-USG code is public domain and freely distributed. For this study, version 2.3.0 of the MODFLOW-USG code (released in March 2024) was used.

Model input datasets include the physical geometry of the system, boundary conditions (no-flow, recharge or discharge) and aquifer properties (hydraulic conductivity). Groundwater flow can be modeled for many different types of sources or sinks, including lakes, rivers, drains, recharge from infiltration of precipitation, and pumping wells, among others. The code is flexible when modeling aquifer properties, allowing heterogeneity and anisotropy in three dimensions.

The flow system being modeled is split up into layers comprised of many smaller blocks referred to as nodes (or cells for previous versions of MODFLOW) based on the conceptual hydrogeological understanding of the model domain. The MODFLOW-USG code solves the groundwater flow mass balance equation for each node using the model input parameters. The general mass balance equation can be expressed as:

Sum of Boundary Inflows + Sum of Internal Sources of Water = Sum of Boundary Outflows + Sum of Internal Sinks of Water

The mass balance equation for an unconfined aquifer with recharge, discharge and leakage (Bear, 1979) can be written as:

$$\frac{\partial}{\partial x}\left[(h-b)\left(K_{xx}\frac{\partial}{\partial x}\right)\right]+\frac{\partial}{\partial y}\left[(h-b)\left(K_{yy}\frac{\partial}{\partial y}\right)\right]+\frac{K'}{B'}(H_0-h)+N-W=0$$

Where: K_{xx} = hydraulic conductivity in the x direction;
K_{yy} = hydraulic conductivity in the y direction;
h = hydraulic head;
b = elevation of the unit bottom;
K' = vertical hydraulic conductivity of an underlying confining unit;
B' = thickness of the confining unit;
H_0 = head in the aquifer underlying the confining unit;
N = a general source term representing groundwater recharge; and
W = a general sink term representing groundwater discharge.

Similar equations can be written for each aquifer in a layered sequence of aquifers / aquitards. When an aquifer is confined, the saturated thickness (h-b) is replaced with the total aquifer thickness.

MODFLOW-USG computes a mass balance for each time step specified by the model input, as well as cumulative flow volumes for each type of source / sink included in the model.

The solution to the mass balance equation is obtained by iteratively solving the system of equations for each model node. Initial conditions for the hydraulic head in each node are specified in the model input. A calculation procedure is used to adjust the initial head estimates and produce a new estimate of the heads which are closer to the solution of the system of equations. The procedure is repeated until the maximum head change in a model node between successive iterations falls below a closure criterion which is user specified. MODFLOW-USG provides two solver modules to obtain the model solution. For this study, the χMD solver was used with a closure criterion of 0.001 m.

MODFLOW-USG is accompanied by a utility program called ZONBUDUSG, a water budget calculator which sums the flow volumes from the various groundwater sources / sinks over a zone of interest. The program was modified from the earlier ZoneBudget version 3.01 (Harbaugh, 1990) to work with un-structured grid models. ZONBUDUSG was used in this study to calculate the water balance components of the study area.

The model construction and calibration process was completed using Groundwater Vistas version 9.04 (Environmental Simulations Inc., 2024). Groundwater Vistas is a pre- and post-processor that is capable of creating MODFLOW-USG input files as well as reading output files in a user-friendly graphical user interface. Groundwater Vistas is also capable of importing model input datasets created by third-party software, including ArcGIS (ESRI, 2019). Both of these software programs were used to interactively prepare, edit and manage the information needed for model development.

To calibrate the baseline model, PEST (**P**arameter **EST**imation) version 17.0 (Doherty, May 2019) software was used. PEST facilitates computer-assisted calibration of MODFLOW-USG models by back-calculating model parameters to match observation data such as groundwater elevation data, surface watercourse baseflow rates and horizontal and vertical hydraulic gradients. This procedure is referred to as “inverse modeling”. Additional utilities included in the Groundwater Data Utilities suite (Doherty, 2015b) were also used in tandem with PEST during the calibration process.

Particle tracking analysis was completed using mod-PATH3DU (Muffels et al, 2018), a particle-tracking model that uses MODFLOW-USG groundwater flow velocity vector output to delineate the travel path and time-of-travel for unstructured model grids.

G.3.1 Equivalent Porous Media Approach

Numerical modeling of groundwater flow through saturated porous media typically simulates water movement through a continuous fully-saturated medium such as sand and gravel with assigned distributions of porosity and hydraulic conductivity. Within fractured bedrock, the groundwater movement is typically greater within the fractures than within the surrounding matrix. Assuming sufficient fracture density and hydraulic connectivity among fractures, the fractured rock can be simulated as an “equivalent porous media” using a model constructed to simulate flow through porous media with appropriate hydraulic properties. On a small scale, actual groundwater movement and simulated groundwater movement can be different. With simulations at a larger scale, the equivalent porous media approach provides a reasonable representation of groundwater flow patterns that is accepted by industry.

G.4 MODEL CONSTRUCTION

The groundwater model construction consisted of the following four phases:

- Spatial domain and grid discretization;
- Input of model layers;
- Boundary condition implementation; and
- Selection and input of hydraulic properties.

The following sub-sections describe each stage of the groundwater model construction.

G.4.1 Spatial Domain and Grid Discretization

The model domain was set to encompass approximately 17,685 ha, with the proposed pit footprint located in the approximate centre of the domain, as shown in **Figure G-1**. The dimensions of the model are 13,100 metres (m) on the north and south sides, and 13,500 m on the east and west sides. The lower left corner of the model is located at UTM coordinates 569,900 E and 4,800,600 N (NAD83 Zone 17N), and the grid is rotated 40° in a counter-clockwise direction such that the main channel of Mill Creek is roughly perpendicular to the model y-axis.

The size of the domain was set to incorporate GRCA staff gauge locations along the main channel of Mill Creek, which itself was inferred to represent a natural groundwater boundary condition for the northwestern extent of the model domain. The Site is situated at the headwaters of three relatively large subwatersheds (i.e., Mill Creek, Fletcher Creek / Spencer Creek to the southwest and Bronte Creek to the southeast) as shown in **Figure 3** in the main report. To maintain the model domain to a reasonable size, only a portion of these subwatersheds were simulated, and the lateral model boundaries were selected to be sufficiently distant from the Site such that boundary effects do not affect the model results within close proximity to the Site. Outside of these boundaries, the model cells were set as no-flow boundaries (inactive). Groundwater Vistas was set to remove inactive model cells from the MODFLOW-USG input files to reduce the model numerical burden.

Quadtree grid refinement was used at the Site and for other features of interest as shown in **Figure G-1**. Quadtree grid refinement is compatible with MODFLOW-USG and is implemented in Groundwater Vistas. For a quadtree-refined grid, parent grid cells are divided into smaller cells by powers of 2 (i.e., 2x where x is the order of the desired refinement). The grid is then “smoothed” around the refined cells, such that no cell is refined by more than a factor of 2 compared to any adjacent cell. The quadtree approach provides numerical stability and reduces the number of unnecessary grid cells that are typically present in more traditional grid refinement methods.

Initially, a uniform grid of 135 rows by 131 columns was set up, resulting in grid spacing of 100 m in the x- and y-directions. Third order refinement (i.e., 8x8 sub-divided cells) was used for the model cells at the Site, existing nearby pit operations and other surface water features of interest, resulting in a local grid spacing of 12.5 m square as shown in **Figure G-1A**.

G.4.2 Model Layers

Five (5) hydrostratigraphic layers were established in the model, representing the overburden and bedrock stratigraphy outlined in **Section 2.4** of the main report, as summarized in **Table G.4.1** below.

Table G.4.1: Model Layer Thicknesses

Model Layer	Description	Layer Thickness (m)	Layer Type
1	Surficial Soils	1.0	Upstream Water Table (Type 4)
2	Deeper Overburden	Varies	
3			
4			
5	Contact Aquifer	4.0	

In the Tier 3 Model, the overburden is partitioned into two units, with two model layers used to simulate the upper “A” unit, and one model layer to simulate the lower “B” unit. For this study, the overburden was grouped into surficial soils and deeper overburden. One (1) model layer was used to simulate surficial soils as the layer thickness is only 1 m thick, while three (3) layers were used to simulate the deeper overburden due to the greater thickness (generally more than 30 m thick at the Site). The contact aquifer is simulated in the same manner as the Tier 3 Model, where the layer top elevation is calculated as 2 m above the bedrock contact and the layer bottom elevation is calculated as 2 m below the bedrock contact. The formula used to calculate the layer 2 to 4 thicknesses was the total overburden thickness less 3 m divided into three (3) equal thicknesses.

Layer 5 of the model represents the basal deposits and upper weathered portion of the Guelph Formation dolostone extending across the entire model domain, below which is an inferred lower no-flow boundary. Although the Tier 3 Model includes lower model layers representing the entire Lockport Group stratigraphy, for the purpose of this study it was assumed that impacts from the proposed pit would not extend deeper than the contact aquifer. All of the layers were set as type 4 upstream water table (i.e., the conductivity of the model cells is computed using the upstream weighting method included in MODFLOW-USG).

The ground surface elevation (top of layer 1) is based on the LIDAR-derived Digital Terrain Model (DTM) hosted on the Land Information Ontario (LIO) Warehouse Open Data ARCGis server (https://ws.geoservices.lrc.gov.on.ca/arcgis5/rest/services), retrieved in July 2023. The DTM raster was extracted for the model domain extent using ArcGIS Desktop (ESRI, 2020). The raster data was verified using ground surface spot elevation data acquired during the Site monitoring well surveys.

The top of bedrock was interpolated using Site data, high-quality data from other Sites within the model domain, outcrops, oil and gas well data and the MECP water well database. The raster calculator tool included in ArcGIS Desktop was used to ensure the interpolated top of bedrock was equal to or below the ground surface elevation.

It is interpreted that the surficial soils mapping applies to the upper 1 m of overburden, as such the conductivity zones corresponding to surficial soil types are only present in layer 1.

A 3-dimensional oblique view of the model domain showing the model layers and hydraulic conductivity zones is provided in **Figure G-2**.

G.4.3 Boundary Conditions

The boundary conditions assigned to the model are shown in **Figure G-3**. In Groundwater Vistas, boundary types may be grouped together into “reaches” to represent different features of interest and to make it easier to calibrate the model.

The active model domain consists of the local study area. As noted above, all model cells outside of this lateral extent are set as no-flow boundaries (inactive).

G.4.3.1 Constant Head Boundaries

Constant head boundaries are used for model cells for which the head is specified in advance of the simulation and held at the specified value through all model time steps. Flow to or from constant head boundaries is a function of the hydraulic conductivity of the model cells and the gradient between the simulated groundwater elevation and the defined elevation of the constant head boundary.

Constant head boundaries were used to represent inferred regional groundwater contours as shown in Figure 3-13 (page 3-48) of the Watershed Report. These boundaries simulate lateral groundwater flow from the upstream portion and to the downstream portion the Mill Creek subwatershed that are truncated by the model domain. The 81 constant head boundaries used in the model are summarized in **Table G.4.2** below.

Table G.4.2: Constant Head Boundary Parameter Values

Reach	Description	No. of Cells	Layer	Stage Elevation (masl)
1	Regional Groundwater Contour (northeast)	60	4	325.0
2	Regional Groundwater Contour (northwest)	21		300.0

G.4.3.2 Rivers

River boundaries are capable of simulating both discharge from and recharge to the groundwater system (i.e., groundwater sinks or sources) depending on the specified stage elevation of the boundary. Each river boundary requires three parameters which must be specified in the MODFLOW-USG input file: stage elevation, bottom elevation and conductance. The stage elevation determines the gradient between the boundary condition and the adjacent model cell. The bottom elevation dictates which model layer the boundary condition is placed in. Finally, the conductance of the river boundary governs the rate of flux to or from the groundwater system. River conductance is an aggregate of several parameters including stream width, bed thickness and bed vertical hydraulic conductivity of the streambed the river boundary represents.

River boundary cells were used to represent the watercourses and miscellaneous water bodies within the model domain. The 3,848 river boundaries used in the model are summarized in **Table G.4.3** below.

Table G.4.3: River Boundary Parameter Values

Reach	Description	No. of Cells	Layer	Stage Elevation (masl)	Bottom Elevation (masl)	Conductance (m^2/day)
1	Mill Creek above Sideroad 10 (GRCA staff gauge 151)	405	1	GS	GS – 0.5 m	54
2	Mill Creek above Hanlon Expressway (GRCA staff gauge 144)	1,035				
3	Spencer Creek upstream of EC staff gauge 02HB015	857				100
4	Bronte Creek upstream of EC staff gauge 02HB022	873				
5	Miscellaneous Waterbodies	678				250

Note: GS – denotes ground surface elevation

All river boundaries in the baseline model are assigned a stage elevation equivalent to the interpolated ground surface, and a bottom elevation 0.5 m below ground surface. The calibration of the model to the monitoring well data was found to be sensitive to the conductance of the river boundaries used to simulate Mill Creek and was therefore refined during the model calibration process, with a final calibrated conductance value of 54 m^2/day. Both Spencer Creek and Bronte Creek, as well as the smaller miscellaneous waterbodies were found to be relatively insensitive to the model calibration and therefore conductance values of 100 m^2/day and 250 m^2/day were adopted based on model cell area, a representative hydraulic conductivity for assumed silty stream bed conditions and an assumed stream bed thickness of 1.0 m.

G.4.3.3 Drains

Drain boundaries are only capable of simulating discharge from the groundwater system (i.e., groundwater sinks). Each drain boundary requires two parameters which must be specified in the MODFLOW-USG input file: stage elevation and conductance. As noted above, the stage elevation determines the gradient between the boundary condition and the adjacent model cell. Finally, the conductance of the drain boundary serves the same purpose as that of river boundaries.

Drain boundary cells were used to represent the wetland features in the model domain. The 19,202 drain boundaries used in the model are summarized in **Table G.4.4** below.

Table G.4.4: Drain Boundary Parameter Values

Reach	Description	No. of Cells	Layer	Stage Elevation (masl)	Conductance (m^2/day)
1	Wetlands	19,202	1	GS	250

Note: GS – denotes ground surface elevation

The stage elevation of the wetlands were assumed to be equal to ground surface, with a conductance of 250 m^2/day based on model cell area, a representative hydraulic conductivity for assumed silty conditions and an assumed bed thickness of 1.0 m.

G.4.3.4 Wells

Well boundaries are capable of simulating both discharge from and recharge to the groundwater system (i.e., pumping wells or injection wells) and require two parameters which must be specified in the MODFLOW-USG input file: pumping rate and model layer. The well bottom elevation determines the model layer that the well boundary condition is placed in. Positive pumping rates represent recharge to the groundwater system (i.e., injection wells), while negative pumping rates represent discharge from the groundwater system (i.e., pumping wells).

Well boundaries were used to simulate assumed private drinking water supply wells in the community of Morriston as well as aggregate extraction and permitted water takings from the various pit ponds for wash operations (further discussion is provided below). The 216 well boundaries used in the model are summarized in **Table G.4.5** below.

Table G.4.5: Well Boundary Parameter Values

Reach	Description (ALPS ID) (PTTW No.)	Layer	No. of Wells	Simulated Pumping Rate (m^3/day)	Licenced Aggregate Extraction Limit (m^3/day) (Tonnes/day)	Maximum Permitted Water Takings (m^3/day) (L/min)	2020 Average Reported Daily Takings (m^3/day)
1	Morriston Private Supply Wells	5	206	0.3	*(n/a)*	*(n/a)*	*(n/a)*
2	CBM Neubauer Pit (625284)	4	1	996	996 (750,000)	*(n/a)*	*(n/a)*
3	CBM Puslinch Quality Aggregates (PQA) North Pit Pond (17600)		1	332	664 (500,000)	*(n/a)*	*(n/a)*
4	CBM Puslinch Quality Aggregates (PQA) South Pit Pond (17600)		1	332		*(n/a)*	*(n/a)*
5	Lafarge Warren Pit (10671)		1	1,594	1,594 (1,200,000)	*(n/a)*	*(n/a)*
6	CBM McNally Pit (5497 / 624864) (4031-BCGP9H)		1	507	1,328 * (1,000,000)	23,568 (16,366)	10,145
7	Dufferin Mill Creek Pit Phase I Pond (5378) (5597-B93NZ5)		1	1,503	2,657 (2,000,000)	8,183 (11,366)	3,507
8	Dufferin Mill Creek Pit Phase IV Pond (5378) (5597-B93NZ5)		1	1,330		17,000 (11,806)	45
9	CBM Aberfoyle Pit (5520) (8417-B5WQLE)		1	1,740	1,328 (1,000,000)	23,568 (16,366)	8,246
10	Dufferin Aberfoyle Pit 1 (5483) (2852-BDPNK5)		1	709	664 (500,000)	8,183 (11,365)	901
11	Dufferin Aberfoyle Pit 2 (5609)		1	1,328	1,328 (1,000,000)	*(n/a)*	*(n/a)*

Notes: (n/a) – denotes not applicable; ALPS – Aggregate Licensing and Permitting System; PTTW – Permit-to-Take-Water

** Minimal extraction currently occurring in McNally Pit as reported by CBM.*

Non-permitted private water wells for the community of Morriston were simulated in the model as they are in close proximity to the Site, and there are a relatively large number of wells concentrated in a small area. Rural water well users were not included in the simulation as the takings are spread out and not expected to have a significant influence on model results. For the community of Morriston, one (1) well was assumed per parcel within the Morriston settlement area with a visible structure on the latest available air photos, with an average of two (2) users per well. The wells were also assumed to be completed into the shallow bedrock; as such, the boundaries were assigned to model layer 5. In Section 3.3.2 (page 86) of the *Integrated Water Budget Report* for the Grand River watershed (AquaResource Inc., 2009), a per capita water use rate of 160 Litres/day (0.16 m3/day) is used to represent un-serviced domestic water takings. Therefore, a pumping rate of 0.3 m3/day was specified for the 206 Morriston private wells simulated in the model for this study.

The Aggregate Licensing and Permitting System (ALPS) ID and licensed annual extraction limits for the active pits in the model domain were obtained using the interactive pits and quarries map maintained by the Ministry of Natural Resources and Forestry (MNRF) (https://www.ontario.ca/page/find-pits-and-quarries). It is noted that aggregate extraction at the pit operations in the model is completed by dragline and therefore dewatering of the excavation is not required. However, aggregate extraction (i.e., removal of the aquifer matrix) results in a one-time increase in void space which must be backfilled by groundwater, thus inducing an apparent pumping effect during the operational phase of the pits. The well boundary conditions included in the model are used to simulate both the aggregate removal (at the maximum permitted rate) as well as permitted water takings for wash plant operations.

Actual aggregate extraction rates for recent years were confirmed for CBM sites. Minimal extraction has occurred recently at CBM's McNally Pit and Lanci Pit and therefore aggregate extraction at these sites was not included in the simulation of baseline conditions. For pits operated by others, it was assumed that extraction is no longer occurring at Dufferin's Mill Creek Pit phases II and III, while the extraction rates at Lafarge's Warren Pit and Dufferin's Aberfoyle Pit 1 and 2 were conservatively assumed equal to the licensed extraction limit as no other information was available. In the case of CBM's Puslinch Quality Aggregates (PQA) and Dufferin's Mill Creek Pit phases I and IV, aggregate extraction is assumed to occur in multiple pits and the total estimated annual extraction rates for each site are split equally between the operating pits. The estimated annual extraction rates are converted to volumetric rates by assuming a specific gravity of 1.65 for the sand and gravel aggregate and a porosity of 0.2.

The wash plant operations at CBM's McNally Pit and Aberfoyle Pit and at Dufferin's Mill Creek Pit and Aberfoyle Pit 1 are approved by an MECP Permit-to-Take-Water (PTTW). The MECP PTTW database is publicly available on the Ontario Data Catalogue (https://data.ontario.ca/) and includes source information and maximum permitted water taking rates. Reported daily water takings for 2019 and 2020 are also publicly available on the Ontario Data Catalogue. As shown in **Table G.4.5**, the reported average daily water takings are typically well below the permitted maximum rates; therefore, the reported average daily water takings were used to develop pumping rates included in the simulation. It is assumed that 95% of the water takings for wash plant operations return to the pit ponds via direct runoff from the stockpiles, while the remaining 5% is lost to evaporation / sorption to aggregate products leaving site and not returned to the aquifer. Therefore, the simulated pumping rates in the model are equivalent to 5% of the average daily reported water takings for 2020.

A number of additional PTTWs are situated within the model domain, including the supply well for Triton Water Canada Holdings (formerly Nestle Waters Canada) for bottled water, communal water supply wells for two rural subdivisions and several industrial supply wells. The PTTW source information was cross-referenced with the MECP water well record database, and it was determined that all of these additional permitted water takings obtain groundwater from the deeper bedrock (i.e., below the base of the model domain). As such, these additional PTTWs were not included in the baseline or predictive models for this study.

G.4.3.5 Recharge

Recharge boundaries were used in the uppermost active model cell to represent infiltration to the groundwater system. It is noted that for this study, infiltration to the groundwater system is defined as total precipitation less evapotranspiration and runoff to surface water features. In the model, the recharge boundaries were applied to the uppermost active cell in the vertical column (i.e., NRCHOP = 3).

Seven (7) zones were used to define areas of similar surficial soil types based on the surficial geology mapping shown in **Figure 5** of the main report. The recharge zones are shown in **Figure G-4**, and the calibrated baseline model parameter values are summarized in **Table G.4.6** below.

Table G.4.6: Recharge Zone Parameter Values

Zone	Description	Recharge	
		mm/year	m/day
1	Paleozoic Bedrock Outcrops (3)	340	9.3×10^{-4}
2	Silty / Sandy Till (5b)	338	9.3×10^{-4}
3	Ice-Contact Stratified Deposits (6)	350	9.6×10^{-4}
4	Glaciofluvial Sands (7a)	375	1.0×10^{-3}
5	Glaciofluvial Gravels (7b)	405	1.1×10^{-3}
6	Organic Deposits (20)	105	2.9×10^{-4}
7	Pit Ponds	116	3.2×10^{-4}

Note: Numbers in brackets in the zone description correspond to legend nomenclature in Ontario Geological Survey (OGS) surficial geology mapping.

The recharge zone values are based on the Precipitation-Runoff Modeling System (PRMS) results for GRCA, publicly available on the Grand River Information Network (GRIN) (https://data.grandriver.ca/). Previous modeling completed for the Fairchild Creek subwatershed (southwest of Mill Creek subwatershed) partially overlaps the present study model domain. The zone extents in the PRMS recharge mapping appear to directly correspond to surficial geology mapping. It is noted that the PRMS recharge values for each surficial geology type are similar but not identical for each zone; therefore, the zone values for surficial geology within the present study model domain are based on the PRMS recharge zone values closest to the Site. The recharge values for zones 1 through 6 were held constant throughout the model calibration process.

To estimate the recharge value for the pit pond footprints (recharge zone 7), the most recently published 30-year climate normal data (1981-2010) from Waterloo Wellington A ECCC climate station (climate ID 6149387) were used, as shown in **Table H-1**, **Appendix H** of the main report. In summary, the average annual precipitation at the Site is approximately 916 mm, with an annual evapotranspiration rate of approximately 589 mm. This leaves approximately 327 mm/year of water surplus available as surface water runoff or recharge to the groundwater system. However, open water bodies generally experience higher rates of evaporation in comparison to evapotranspiration. An annual evaporation rate of 800 mm was assumed (Hydrogeological Atlas of Canada, 1978, Plate 17, Mean Annual Lake Evaporation). Subtracting the evaporation rate from the average annual precipitation leaves approximately 116 mm/year as net recharge to the pit ponds.

G.4.4 Hydraulic Properties

Zones were used to represent hydraulic conductivity and vertical anisotropy for the various hydrostratigraphic units present within the model domain. The calibrated model values for each of the ten (10) zones used in the model are summarized below in **Table G.4.7** below.

Table G.4.7: Hydraulic Conductivity Zone Parameter Values

Layer	Description	Zone	Horizontal Hydraulic Conductivity (KH) (m/day) (m/second)	Vertical Anisotropy (KZ / KH) (Unitless)
1	Paleozoic Bedrock Outcrops (3)	1	2.2 (2.5x10^{-5})	0.1
	Silty / Sandy Till (5b)	2	86 (1.0x10^{-3})	0.1
	Ice-Contact Stratified Deposits (6)	3	260 (3.0x10^{-3})	0.5
	Glaciofluvial Sands (7a)	4	260 (3.0x10^{-3})	0.5
	Glaciofluvial Gravels (7b)	5	2,600 (3.0x10^{-2})	0.5
	Organic Deposits (20)	6	43 (5.0x10^{-4})	0.5
2 – 4	Paleozoic Bedrock Outcrops (3)	1	*(refer to Zone 1 above)*	
	Sand and Gravel	7	260 (3.0x10^{-3})	0.5
	Wentworth Till	8	8.6x10^{-4} (1.0x10^{-8})	0.1
5	Contact Aquifer	9	2.2 (2.5x10^{-5})	0.1
--	Pit Pond High Conductivity Zones	10	100,000	1.0

Note: Numbers in brackets in the zone description correspond to legend nomenclature in Ontario Geological Survey (OGS) surficial geology mapping.

Zones 1 to 6 were used to represent hydraulic conductivity and vertical anisotropy of similar surficial soil types in model layer 1 based on the surficial geology mapping provided in **Figure 5** of the main report. The zones in model layer 1 are shown in **Figure G-5**. The sand and gravel and Wentworth Till zones in the deeper overburden layers 2 to 4 as shown in **Figure G-6** are based on OGS quaternary geology mapping (supported by Site borehole data). The paleozoic bedrock outcrop extent (zone 1) was extended from layer 1 down through to the base of layer 4. The contact aquifer was simulated using a single zone in layer 5. The hydraulic conductivity of zone 10 was set at a relatively high value to simulate instantaneous flow across the pit ponds which allows simulation of the effects of aggregate extraction and water takings for wash operations on the pit pond stage elevations, as well as the effects of increased evaporation rates for the ponds.

Initial horizontal hydraulic conductivity and anisotropy values were based on results from previous studies and published ranges available in the literature. The Watershed Report notes that previous pumping test results yield hydraulic conductivity ranges between 1.3x10^{-5} m/s to 7.1x10^{-4} m/s for the bedrock and between 2x10^{-4} m/s to 2x10^{-3} m/s for the sand and gravel overburden. Horizontal hydraulic conductivity values were adjusted during the course of the model calibration to improve the fit with observation data, while the vertical anisotropy values remained fixed. The final calibrated values are consistent with published ranges for the geological material they represent.

G.5 MODEL CALIBRATION

G.5.1 Objectives and Methodology

The objective of the groundwater flow model calibration is to achieve an approximation of the observed baseline groundwater elevation and flow patterns within the study area. The quantification of the model fit to calibration targets is evaluated using “residuals”. Residuals are calculated as the difference between the calibration target values and the simulated model output (i.e., observed minus simulated).

Model calibration statistics typically include max / min residual values, residual mean, absolute residual mean, sum of squared error (SSE), root mean square error (RMSE), and normalized root mean sum of squares (NRMS). The residual mean is an average of the residuals; a value approaching zero is desired (i.e., there is a balance of over-prediction and under-prediction occurring in the model). The spatial distribution of residuals is also considered; randomly distributed positive and negative residuals are desired. The mean of the absolute value of residuals provides an estimate of the total error of the model output. The SSE is calculated by summing the squares of the residuals. RMSE is calculated by taking the square root of the SSE divided by the total number of calibration targets. Another indicator of a successful model calibration is if the RMSE is comparable to the variance of the calibration target values. Finally, NRMS is calculated by dividing the RMSE by the total range in the calibration target values. An industry accepted target for the NRMS is less than or equal to 10% (Spitz and Moreno, 1996).

The model calibration was also evaluated using the volumetric water budget output summarized by MODFLOW-USG at the end of each simulation. The volumetric water budget provides the simulated water balance (groundwater flow into and out of the model domain) broken down by boundary condition type. An acceptable water balance error is less than 0.1%.

As noted in **Section 2.5** of the main report, natural fluctuations in groundwater elevations occur as a result of seasonal climatic conditions. However, the potential impacts from proposed pit are inferred to be worst during the drier period of the year (i.e., September to November). Therefore, the study area is simulated using a single steady-state stress period representing average conditions in autumn. The mean and variance of the baseline water level data for autumn were used as the calibration targets for the monitoring wells. For pit pond stage elevations and Township of Puslinch monitoring wells, representative autumn water level data were used as the calibration targets, where available.

As noted above, PEST was used to assist in the model calibration, along with various utility programs developed by Watermark Numerical Computing. Groundwater Vistas was used to import calibration targets into the model in order to provide PEST with the observation data required to perform the inverse modeling. Sensitivity analyses of the model parameters were completed throughout the calibration process to determine which parameters were most sensitive to the model output.

The following sections describe the calibration target data and model parameters used in the PEST calibration.

G.5.2 Calibration Targets

For this study, a total of 578 targets were used to calibrate the model to baseline conditions, described in the sections below. The target locations are shown in **Figure G-7**. Summary tables of the target values and calibrated residuals are provided in **Section G.5.3** below.

G.5.2.1 Monitoring Well Data

Baseline monitoring well water level data were obtained from the on-going annual reporting completed for the pits operated by CBM. A statistical analysis was completed on the baseline water level data for the monitoring wells to calculate the mean groundwater elevation and associated variance for autumn months. These elevations were imported to Groundwater Vistas as head targets, designated as Group 1. There are a total of twenty-four (24) groundwater monitoring wells situated at the various CBM sites within the model domain. The overall variance (σ^2) for the autumn baseline water level data is calculated as 1.7 m^2 (standard deviation s = 1.3 m).

G.5.2.2 Water Well Records

Lower-quality water level data from MECP water well records within the study area were imported to Groundwater Vistas as head targets, designated as Group 2. The water well record data was parsed to remove data of low reliability and for wells with well screens / static water levels below the base of the model domain. A total of 528 water levels were included in Group 2.

It is noted that the MECP water well record target data represent a single “snapshot” in time. Calculated residuals of up to ± 5 m between the model simulated head and water level reported on the record are therefore not unexpected. The reasons for such a relatively large discrepancy include, among others, (1) seasonal variance at the well during the period in which the level was measured, (2) incomplete recovery after the well was installed, (3) poor (or no) elevation control on the data and (4) inaccuracy in the reported well location.

G.5.2.3 Pit Pond Stage Data

Autumn pit pond stage elevation data from staff gauges installed at CBM sites within the study area were imported to Groundwater Vistas as head targets, designated as Group 3. For non-CBM sites, pond stage elevations were estimated using the DTM raster data (see **Section G.4.2**). Stage elevations for a total of seventeen (17) pit ponds is included in Group 3.

G.5.2.4 Township of Puslinch Monitoring Program Data

The Township of Puslinch has completed manual groundwater level monitoring at a network of ten (10) wells within the Mill Creek subwatershed since 1989. Hydrographs of the historical water level data are publicly available online at a website hosted by Harden Environmental Services Limited (https://www.hardenv.com/mill_creek.html). Representative autumn water levels were selected for five (5) wells situated in the model domain, and imported to Groundwater Vistas as head targets, designated as Group 5.

G.5.2.5 Watercourse Staff Gauge Data

Two staff gauges operated by the GRCA are situated along Mill Creek within the model domain: Mill Creek Station (no. 151) located at the western extent of the model domain and Aberfoyle Station (no. 144) upstream of the

Hanlon Expressway. The locations are shown in **Figure G-7**. Historical flow data are publicly available on GRIN. Hourly data since 2010 for these two staff gauges were used to calculate monthly average flow values. The lowest average monthly flow rates were observed for the period between July and September; as such, the baseflow due to groundwater discharge was estimated for these two staff gauges using the average monthly flow rates during this period. Since the model domain is truncated northwest of the main channel of Mill Creek, the baseflow values were prorated by 50%.

Similarly, staff gauges operated by EC are situated along Spencer Creek (02HB015) and Bronte Creek (02HB022), located outside of the model domain. The ratio of the modeled watershed area to the total watershed area upstream of the staff gauges was computed, and the baseflow values for these two gauges were prorated by 70% and 80%, respectively. The lowest average monthly flow rates were also observed between July and September for these two gauges and were used to represent baseflow due to groundwater discharge.

These baseflow estimates were included as “flux” targets in the model, designated as Group 4.

G.5.3 Calibration Results

G.5.3.1 Calculated Residuals

Group 1 Head Targets

The Group 1 (monitoring well) head targets and calculated residuals from the calibrated baseline model are summarized in **Table G.5.1** below.

Table G.5.1: Group 1 Head Targets Calculated Residuals

No.	Description	Location	Easting	Northing	Model Layer	Head Target			Calculated Residual (m)
						Autumn Baseline Data		Simulated (masl)	
						Mean (masl)	Standard Deviation (m)		
1	MW21-01	Safarik Pit	569526	4810094	4	306.6	0.12	308.9	-2.3
2	MW21-02		569932	4810014	4	307.5	0.13	309.3	-1.8
3	MW21-03-D		570038	4810680	4	307.8	0.18	310.0	-2.2
4	MW21-03-S		570037	4810680	2	319.4	0.35	310.0	9.4
5	MW21-04		570310	4810448	4	307.5	0.19	310.1	-2.6
6	BH1	Neubauer Pit	568860	4809710	4	306.1	0.30	307.5	-1.4
7	BH2		568812	4809878	4	306.6	0.18	307.5	-0.9
8	BH3		568763	4809973	4	306.8	0.13	307.5	-0.7
9	East1		568653	4810407	4	307.0	0.12	307.4	-0.4
10	BH4		569008	4809917	4	306.5	0.32	307.9	-1.4
11	BH5		569032	4809385	4	306.2	0.31	307.8	-1.6
12	GL-7	Lanci Pit	567937	4809275	4	306.0	0.33	306.5	-0.5
13	GL-8		568308	4809410	4	306.2	0.31	306.9	-0.7
14	GL-11		568238	4809533	4	306.0	0.31	306.8	-0.8
15	GL-6		568073	4810195	4	306.2	0.30	306.9	-0.7
16	GL-9		568210	4809712	4	306.0	0.32	306.8	-0.8
17	GL-10		567770	4809878	4	305.9	0.30	306.6	-0.7
18	MP1	Puslinch Quality Aggregates	568183	4810221	4	306.6	0.29	307.0	-0.4
19	MP2		568199	4809877	4	306.2	0.28	306.8	-0.6
20	MP3	Puslinch Quality Aggregates	568320	4809491	4	306.1	0.28	306.9	-0.8
21	MP4		568656	4809450	4	306.2	0.29	307.1	-0.9
22	MC3	McNally Pit	567682	4810158	4	306.3	0.27	306.9	-0.6
23	MC5		567424	4810967	4	306.7	0.24	307.0	-0.3
24	MC6		567796	4811060	4	306.7	0.27	307.2	-0.5

Group 2 Head Targets

Due to the large number of targets in Group 2 (water well record data), the summary of residuals is not included in the report. Only the calibration statistics are presented below in **Section G.5.4**.

Group 3 Head Targets

The Group 3 (pit pond stage data) head targets and calculated residuals from the calibrated baseline model are summarized in **Table G.5.2** below.

Table G.5.2: Group 3 Head Targets Calculated Residuals

No.	Description	Easting	Northing	Model Layer	Head Target (masl)		Calculated Residual (m)
					Representative Autumn Groundwater Elevation	Simulated	
1	Neubauer Pit Pond	568619	4810250	4	306.3	307.4	-1.1
2	PQA North Pit Pond	568446	4810162	4	306.9	307.2	-0.3
3	PQA South Pit Pond	568460	4809757	4	306.4	307.0	-0.6
4	Lanci Pit Pond	567929	4809978	4	306.1	306.7	-0.6
5	Mill Ck Phase II Pond	567552	4809833	4	305.2	306.3	-1.1
6	Warren Pit Pond	567158	4809719	4	305.1	305.9	-0.8
7	McMillan Pit Pond	566815	4809510	4	304.8	305.6	-0.8
8	McNally East Pit Pond	568533	4810607	4	306.5	307.4	-0.9
9	McNally Pit Pond	567969	4810484	4	306.5	307.1	-0.6
10	Mill Ck Phase I Pond	567420	4810432	4	305.8	306.8	-1.0
11	Mill Ck Phase IV Pond	567020	4810244	4	305.5	306.1	-0.6
12	Mill Ck Phase III Pond	566425	4810157	4	304.2	304.7	-0.5
13	Aberfoyle Area 1 Pond	568690	4811848	4	306.8	309.2	-2.4
14	Aberfoyle Pit Pond	568135	4811490	4	306.8	308.4	-1.6
15	Aberfoyle Area 4 Pond	568432	4811386	4	307.6	308.5	-0.9
16	Dufferin Aberfoyle Pit 1 Pond	568924	4812049	4	306.8	309.5	-2.7
17	Dufferin Aberfoyle Pit 2 Pond	571000	4815173	4	323.7	323.6	0.1

Group 5 Head Targets

The Group 5 (Township of Puslinch monitoring program data) head targets and calculated residuals from the calibrated baseline model are summarized in **Table G.5.3** below.

Table G.5.3: Group 5 Head Targets Calculated Residuals

No.	Description	Easting	Northing	Model Layer	Head Target (masl)		Calculated Residual (m)
					Representative Autumn Groundwater Elevation	Simulated	
1	MW4-deep	571516	4813791	3	325.3	320.9	4.3
2	MW3-deep	570986	4811443	4	311.0	312.4	-1.4
3	MW6-deep	569524	4814872	3	322.3	322.1	0.2
4	16-79	566086	4809724	4	303.6	303.9	-0.3
5	MW1-deep	562777	4806832	4	299.2	299.9	-0.7

Group 4 Flux Targets

The Group 4 flux targets for the calibrated baseline model are summarized in **Table G.5.4** below.

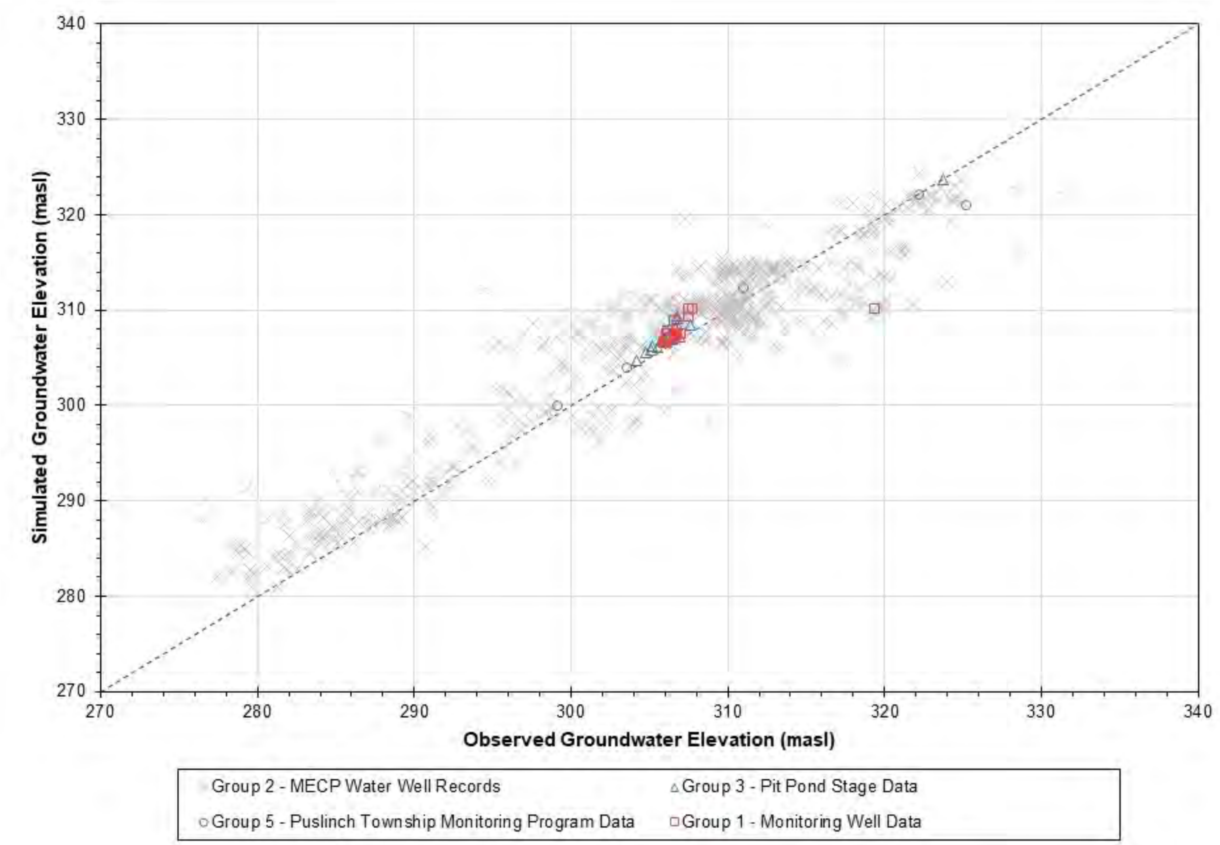
Table G.5.4: Flux Targets

No.	Description	River Boundary Reach No.	Flux Target (m^3/day)	
			Observed	Simulated
1	Mill Creek above Sideroad 10 (GRCA no. 151)	1	15,600	13,018
2	Mill Creek above Hanlon Expressway (GRCA no. 144)	2	9,450	-2,506
3	Spencer Creek upstream of 02HB015	3	5,670	467
4	Bronte Creek upstream of 02HB022	4	8,350	273

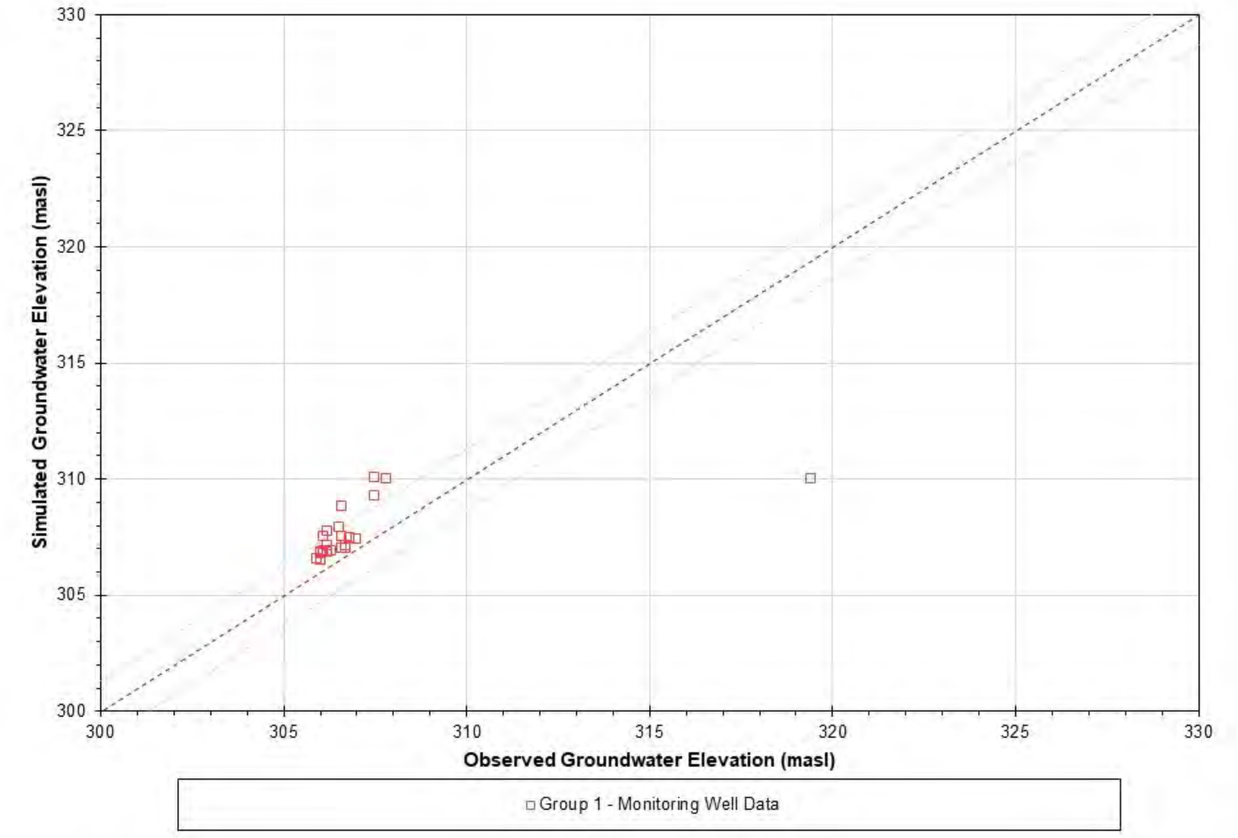
Note: Negative flux indicates flow from river boundary into groundwater system.

G.5.3.2 Diagnostic Residual Plots

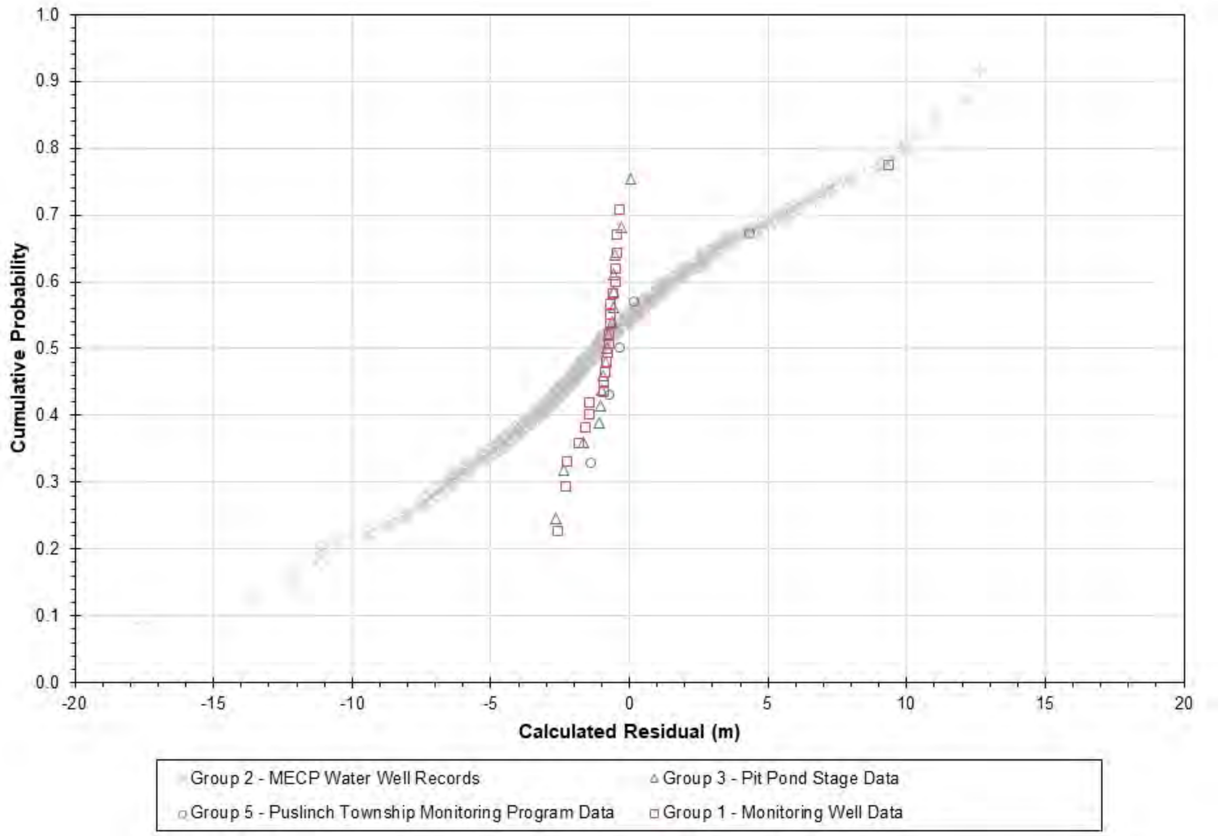
A scatterplot of the weighted calculated residuals for the calibrated baseline model is shown below, with different symbols representing the different head target groups discussed above.



A scatterplot of the calculated residuals for the calibrated baseline model for the Site well data only is shown below. The standard deviation of the autumn data is also shown on the scatterplot (i.e., the upper and lower dotted blue lines).



Cumulative probability plots for Group 1, Group 2, Group 3 and Group 5 head targets for the calibrated baseline model are provided below.



The spatial distribution of calculated residuals from the calibrated baseline model is shown in **Figure G-7**.

G.5.3.3 Calibration Statistics

The calibration statistics for the various target groups in the calibrated baseline model are summarized in **Table G.5.5** below.

Table G.5.5: Calibration Statistics

Statistical Measurement	Unit	Overall	Head Targets			
			Group 1	Group 2	Group 3	Group 5
Number of Observations	--	574	24	528	17	5
Min Residual	m	-17.6	-2.6	-17.6	-2.7	-1.4
Max Residual	m	+12.5	+9.4	+12.5	+0.06	+4.3
Residual Mean	m	-0.9	-0.6	-0.9	-1.0	+0.4
Absolute Residual Mean	m	3.0	1.4	3.2	1.0	1.4
SSE	m^2	9,230	120	9,060	23	21
RMSE	m	4.0	2.3	4.1	1.2	2.1
Range of Observations	m	55.0	13.5	55.0	19.5	26.1
NRMS	**%**	**7.3**	**16.7**	**7.5**	**6.0**	**7.9**

G.5.3.4 Mass Balance Error

The mass balance for the calibrated baseline model is shown in **Table G.5.6** below.

Table G.5.6: Baseline Calibrated Model Mass Balance

Boundary Type	Mass Balance (m^3/day)		
	Inflows	Outflows	Outflow – Inflow
Recharge (RCH)	59,920.9	0	-59,920.9
Constant Head (CHD)	196,216.8	0	-196,216.8
River (RIV)	79,167.0	55,515.9	-23,651.1
Drain (DRN)	0	269,360.6	269,360.6
Well (WEL)	0	10,432.8	10,432.8
TOTAL	**335,304.8**	**335,309.3**	**4.5**
Discrepancy (%)			**0.0014**

G.5.4 Calibrated Baseline Model Sensitivity Analysis

PEST was used to complete a sensitivity analysis to estimate the calibrated baseline model parameter correlation and sensitivity (i.e., NOPTMAX set to -1).

Parameter Correlation

Parameter correlation coefficients (PCCs) are used to evaluate whether parameter values can be estimated uniquely and are calculated for each parameter pair. PCCs can be expressed as the covariance of a parameter pair divided by the product of the square roots of the variances of the parameters. The calibrated baseline model PCC matrix for horizontal hydraulic conductivity is shown in **Table G.5.7**.

Generally, a correlation coefficient with an absolute value greater than about 0.95 indicates that the two parameters involved likely cannot be estimated uniquely with the available data.

Composite Scaled Sensitivity

Composite scaled sensitivity (CSS) values are used to evaluate the overall sensitivity of a parameter and are calculated as the sum of the square roots of the dimensionless scaled sensitivity (DSS) divided by the number of observations. The DSS is the partial derivative of the simulated observation with respect to the parameter, multiplied by the square root of the weight assigned to the observation. DSS is used to evaluate the importance of an observation relative to the estimation of a single parameter.

The CSS typically is a good measure of the information that observations contribute to the estimation of parameters. The relative size of CSS values can be used to assess whether additional parameters can be estimated. A relatively large CSS value indicates that observations contain enough information to represent that aspect of the system. A relatively small CSS value (about two orders of magnitude less than the largest CSS value) indicates that the observations provide insufficient information with which to estimate the parameter. CSS values are useful in identifying those parameters which may be degrading, or are likely to degrade, the performance of the parameter estimation process through lack of sensitivity to model outcomes.

It is noted that some hydrogeological model parameters, such as hydraulic conductivity, are log transformed in PEST for easier processing. Therefore, sensitivity is expressed with respect to the log of the parameter. The relative composite sensitivity of a log-transformed parameter is determined by multiplying the composite sensitivity of that parameter by the absolute log of the value of that parameter. The CSS values for model parameters included in the calibration process are shown in **Table G.5.8** below.

Table G.5.7: Horizontal Hydraulic Conductivity Correlation Coefficients

		Horizontal Hydraulic Conductivity Zone							
		9	8	7	6	5	4	3	2
		Contact Aquifer	Wentworth Till	Sand and Gravel	Organic Deposits	Glaciofluvial Gravels	Glaciofluvial Sands	Ice-Contact Stratified Deposits	Silty / Sandy Till
Horizontal Hydraulic Conductivity Zone	1	-0.34	-0.26	-0.05	-0.26	-0.03	-0.09	0.07	-0.29
	2	0.51	0.36	-0.05	-0.18	-0.03	-0.14	-0.41	
	3	-0.01	-0.03	0.004	-0.05	-0.001	-0.24		
	4	-0.15	-0.10	-0.05	0.02	-0.22			
	5	0.13	0.12	-0.46	0.01				
	6	0.08	-0.18	0.03					
	7	0.25	0.29						
	8	0.61							

Table G.5.8: Composite Scaled Sensitivities for Calibrated Parameters

			All Targets	Group 1 Targets Only
Horizontal Hydraulic Conductivity Zone	1	**Paleozoic Bedrock Outcrops**	0.017	0.002
	2	**Silty / Sandy Till**	0.035	0.014
	3	**Ice-Contact Stratified Deposits**	0.006	0.003
	4	**Glaciofluvial Sands**	0.002	0.002
	5	**Glaciofluvial Gravels**	0.014	0.085
	6	**Organic Deposits**	0.001	0.003
	7	**Sand and Gravel**	0.023	0.093
	8	**Wentworth Till**	0.029	0.0005
	9	**Contact Aquifer**	0.032	0.005

G.5.5 Calibration Summary

A number of calibration targets and statistics related to different aspects of the conceptual understanding of the study area have been provided above. The objective of the calibration process for this study was to achieve a reasonable balance of these various targets.

The target residuals for each of the target groups presented in **Section G.5.2** are summarized by the calibration statistics given in **Table G.5.5**. The overall statistics for the head targets show that the model NRMS of 7.3% is within the industry accepted value of 10%. The residual mean error of -0.9 m indicates that there is a reasonable balance of over- and under-prediction of groundwater elevation within the model. The NRMS for the individual groups of targets is generally higher than the overall model NRMS, which demonstrates the difficultly with fitting a deliberately simplified regional model to different collections of local target data. Of note, the RMSE for the Site well head targets (Group 1) is approximately 2.3 m, which is marginally above the standard deviation of the autumn baseline water level data (approximately 1.3 m).

Flux targets (Group 4) were also considered in the model calibration, as summarized in **Table G.5.4**. As shown in the table, the simulated flux values for Reach 1 (Mill Creek staff gauge 151) from the calibrated baseline model are a reasonable match to the observed flux targets. The calibrated baseline model underpredicts baseflow for the remaining reaches, which may, in part, be related to the truncation of these subwatersheds by the model domain (i.e., baseflow is not evenly distributed across the watershed boundaries and more flux occurs outside of the simulated area).

Target residuals were plotted on scatterplots as shown in **Section G.5.3.2**. If a model were perfectly calibrated to fit the observation data, all of the points on the scatterplot would fall along the 45º line (i.e., the dotted red line on the plots). The scatterplot of all of the head targets (Groups 1 through 5) indicates that there is a reasonable balance between over- and underprediction in the calibrated baseline model. The scatterplot for the Site wells (Group 1) only indicates that most of the residuals are within the standard deviation for the autumn baseline water level data.

The spatial distributions of head target residuals are shown in **Figure G-7**. The simulated groundwater elevation contours are also shown. Model over- and under-predictions generally appear to be randomly dispersed throughout the active model domain and are not spatially correlated.

Cumulative probability plots for the monitoring well head targets (Group 1), MECP water well record data (Group 2), pit pond stage data (Group 3) and Township of Puslinch monitoring data (Group 5) are provided in **Section G.5.3.2**. In practice, error is inherent in all numerical models due to various factors. However, it is desirable that the model error is not biased to one extreme. Cumulative probability plots are an indication of whether the error in the model simulated groundwater elevation is randomly distributed. If this is the case, all of the calibration targets tend to plot along a straight line. For this study, the majority of head target residuals in the cumulative probability plots for these two groups generally plot along a straight line, which indicates that the model error is generally randomly distributed.

At the two extremes of the cumulative probability plots, outlier targets (i.e., targets with extreme residual values which a reasonably calibrated model may not be capable of reproducing) tend to plot off of the straight line. For the plot of Group 1 targets, the residual for MW21-03-S (approximately +9.4 m) is the largest absolute residual for the Site well data, and it plots off of the upper end of the straight line. It is inferred that the water table at this monitoring well is perched due to a localized silt till lense and is not representative of the sand and gravel aquifer. For the plot of Group 5 targets, the residual for MW4-deep (approximately +4.3 m) is the largest absolute residual for the Township of Puslinch monitoring data, and also plots off of the upper end of the straight line. It is inferred that the truncation of the model domain may be the cause of the discrepancy between the observed and simulated water levels; however, the well is located sufficiently distant from the Site that the model overprediction is not expected to have a significant influence on the model predictions.

The mass balance error for the calibrated baseline model is approximately 0.001% as shown in **Table G.5.6**, which indicates that there are no significant mass-balance issues in the calibrated model.

A sensitivity analysis was completed on the calibrated baseline model and included 9 horizontal hydraulic conductivity zones. The purpose of the sensitivity analysis was to identify parameters which are highly correlated (i.e., different combinations of the correlated parameters may result in similar model predictions), and to quantify the sensitivity of the different parameters to the model calibration. **Table G.5.7** indicates that the model parameters are not correlated to a high degree.

Parameter sensitivities for the overall model calibration and the model calibration to monitoring well data only (Group 1 head targets) are shown in **Table G.5.8**. The most sensitive parameters for the overall model calibration are the horizontal hydraulic conductivities of the silty / sandy till (zone 2), the contact aquifer (zone 9) and the Wentworth till (zone 8). For the monitoring wells, the most sensitive parameters are the horizontal hydraulic conductivities of the sand and gravel aquifer (zone 7), glaciofluvial gravels (zone 5) and the silty / sandy till (zone 2).

For both target groups, the horizontal hydraulic conductivities of the ice-contact stratified deposits (zone 3), glaciofluvial sands (zone 4) and organic deposits (zone 6) were relatively insensitive to the model calibration.

Similar to other locations in southern Ontario, the hydrogeological setting of the study area is complex. The numerical model is a deliberate simplification of a complex natural system and has been calibrated to achieve a best-fit with the available data at the time this report was published. The objective of the numerical model is to achieve a reasonable balance between over- and under-prediction of the simulated groundwater elevations. In practice, all models have some degree of error; however, ensuring that model error is randomly distributed helps to reduce the possibility of bias in the model predictions.

The calibrated baseline model represents the best-fit to the available data, with a reasonable balance between over- and under-prediction of the simulated groundwater elevations and a random distribution of error. The parameters that are most sensitive to the model calibration have physically realistic values based on the available data. Parameters which are relatively insensitive and cannot be inferred through the model calibration process have been assigned values which are physically realistic and within the ranges of published data. As such, the calibrated baseline model can be used to simulate the predicted effects of the proposed pit with a high degree of confidence in the results.

G.6 CALIBRATED BASELINE MODEL

The baseline Site water balance is shown in **Table G.6.1** below. Flow terms are shown both in the model units (m^3/day), as well as values normalized by the Site area (approximately 0.4 km^2) in mm/year.

Table G.6.1: Site Water Balance – Baseline Conditions

Boundary Type	Inflows		Outflows		Outflow – Inflow (m³/day)
	(m^3/day)	(mm/year)	(m^3/day)	(mm/year)	
Recharge (RCH)	370.3	339.5	0	0	-370.3
Lateral GW Flow	9,158.5	8,396.5	9,528.7	8,735.9	370.3
TOTAL	**9,528.8**	**8,736.0**	**9,528.7**	**8,735.9**	**0.0**
Discrepancy (%)					**<0.001**

The baseline water balance for the Site indicates that about 4% of the total inflow to the Site originates as recharge with the remaining ~96% originating as lateral groundwater inflow from the surrounding areas. There is an overall net outflow of groundwater from the Site to the surrounding areas, at a rate of approximately 370.3 m^3/day, or 339.5 mm/year, equivalent to the recharge inflow to the Site.

The model's water balance for the portion of Mill Creek subwatershed simulated in the calibrated baseline model is shown in **Table G.6.2** below. Flow terms are shown both in the model units (m^3/day), as well as values normalized by the modeled subwatershed area (approximately 29.4 km^2) in mm/year.

Table G.6.2: Mill Creek Subwatershed Water Balance – Baseline Conditions

Boundary Type	Inflows		Outflows		Outflow – Inflow (m³/day)
	(m^3/day)	(mm/year)	(m^3/day)	(mm/year)	
Recharge (RCH)	24,367.6	302.9	0	0	-24,367.6
Constant Head (CHD)	196,216.8	2,439.2	0	0	-196,216.8
River (RIV)	55,040.9	684.2	40,612.3	504.9	-14,428.6
Drain (DRN)	0	0	225,444.8	2,802.5	225,444.8
Well (WEL)	0	0	10,371.0	128.9	10,371.0
Lateral GW Flow	34,348.1	427.0	33,549.8	417.1	-798.3
TOTAL	**309,973.4**	**3,853.3**	**309,977.9**	**3,853.4**	**4.5**
Discrepancy (%)					**-0.001**

The baseline water balance for the simulated portion of Mill Creek subwatershed indicates that approximately 8% of the total inflow to the subwatershed originates as recharge, while an additional 63% of the inflow (2,439 mm/year) originates from outside of the truncated watershed area (represented by constant head boundary conditions). In the model domain, Mill Creek functions as both a losing / gaining stream with an overall recharge to the groundwater system of 14,429 m^3/day (179 mm/year). Approximately 73% of the total outflow from the subwatershed discharges to the wetland features, equivalent to a rate of 2,803 mm/year. An additional 3.3% of the total outflow discharges to the simulated Morriston private supply wells and the aggregate extraction and wash plant operations.

Finally, it is noted that the groundwater model predicts an overall net outflow of groundwater from the subwatershed to the surrounding areas, at a rate of approximately 798 m^3/day, or 10 mm/year.

G.7 FULL DEVELOPMENT MODEL

The calibrated baseline model was modified to simulate conditions when extraction has proceeded to the full extent of the proposed extraction limits (i.e., the pond surface area is at its maximum extent and extraction is occurring at the proposed maximum annual extraction rate of 1,000,000 Tonnes).

Dewatering of the pit is not required as it is proposed as a dragline operation. However, at full development, there are two important changes that occur:

- Once the aggregate has been extracted from the pit footprint, the pit pond will be subject to direct evaporation at a rate that is higher than the baseline evapotranspiration rate. This reduces the net groundwater flow from within the pit footprint relative to baseline conditions and will result in changes to the surrounding groundwater flow patterns to compensate for the increased loss of water from the pit. These changes will permanently affect the aquifer even after the operations have ceased.

- During the operational phase, the removal of aggregate in the proposed extraction limit will result in a one-time increase in void space in the aquifer which must be back-filled with groundwater and precipitation inputs. The groundwater flow into the pit footprint will increase to compensate for the increase in void space, which induces an apparent pumping effect. It was assumed that there will be no wash plant operation at the proposed pit.

The apparent pumping affects from the above noted changes will manifest as an additional ‘stress’ to the baseline water balance. The overburden and contact aquifers will be impacted as a result of the additional stress, and a cone of depression will expand radially from the proposed pit to reach a new equilibrium. The ultimate size of the cone of depression (i.e., radius of influence) is dependent on the properties of the hydrostratigraphic layers present in the model. The cone of depression will expand such that the total groundwater inflow over the radius of influence will be equal to the increased evaporative losses from the pit pond and increase in void space.

To simulate the pit pond, a new hydraulic conductivity zone (zone 11) was set within the proposed extraction limit, similar to zone 10 to simulate the existing pit licences in the model domain. A new recharge zone (zone 8) was also set within the proposed extraction limit to simulate the higher evaporation rates from the pit pond, with a similar recharge rate as zone 7 representing the existing pit ponds, as described in **Section G.4.3.5**.

To simulate the proposed aggregate extraction, a new well boundary (reach 12) was set, similar to the methodology for existing pits as described previously in **Section G.4.3.4**. A total pumping rate of 1,328 m^3/day was simulated to represent the maximum annual extraction rate.

Since the proposed extraction is split into two separate areas, three (3) extraction scenarios were considered for the full development conditions: (a) all extraction occurs within the west pit to the maximum annual limit, (b) all extraction occurs within the east pit to the maximum annual limit, and (c) extraction is split evenly between the two pits and sums to the maximum annual limit. The areas of influence for these three scenarios were superimposed to determine the predicted pit effects.

G.7.1 Predicted Pit Effects

The predicted cone of depression induced by the proposed pit is shown on **Figure G-8**. It is noted that the maximum radius of influence was observed within the contact aquifer (model layer 5), and this is the radius that was used to determine impacts.

A drawdown of up to approximately 0.25 m relative to baseline water levels in the contact aquifer is predicted for a relatively small area adjacent to the north of the proposed pit. The radius of influence (i.e., 0.25 m drawdown contour) in the contact aquifer extends to the east and northeast by approximately 600 m and 400 m, respectively. It is noted that private wells at some rural residences in the western portion of the community of Morriston may be subject to drawdown of 0.25 m due to the effects of the proposed pit operation.

Since the groundwater levels at the Site monitoring wells vary seasonally by about 1 m, drawdown of less than 0.25 m was not considered as it is a relatively small impact which likely be difficult to distinguish from the natural variation due to prevailing climate conditions.

G.7.2 Full Development Water Balance

The full development Site water balance is shown in **Table G.7.1** below. Flow terms are shown both in the model units (m^3/day), as well as values normalized by the Site area (approximately 0.4 km^2) in mm/year.

Table G.7.1: Site Water Balance – Full Development Conditions

Boundary Type	Inflows		Outflows		Outflow – Inflow (m^3/day)
	(m^3/day)	(mm/year)	(m^3/day)	(mm/year)	
Recharge (RCH)	240.2	220.2	0	0	-240.2
Well (WEL)	0	0	1,328.0	1,217.5	1,328.0
Lateral GW Flow	14,663.0	13,443.0	13,588.7	12,458.1	-1,074.3
TOTAL	**14,903.2**	**13,663.2**	**14,916.7**	**13,675.6**	**13.5**
Discrepancy (%)					**0.09**

The full development Site water balance indicates that the total inflow from recharge decreases to about 220 mm/year due to the increased rate of evaporation within the pit footprint. This represents a drop of 35% compared to baseline conditions. Also, aggregate extraction is simulated with a well operating at a pumping rate of 1,328 m^3/day, which is equivalent to 1,218 mm/year over the Site area. Together, these two effects under operating conditions lead to a change in net outward flow from the Site to the surrounding aquifer of 370 m^3/day under baseline conditions, to a net inward flow from the surrounding aquifer of 1,074 m^3/day during operating conditions.

The water balance for the portion of Mill Creek subwatershed simulated in the full development model is shown in **Table G.7.2** below. Flow terms are shown both in the model units (m^3/day), as well as values normalized by the modeled subwatershed area (approximately 29.4 km^2) in mm/year.

Table G.7.2: Mill Creek Subwatershed Water Balance – Full Development Conditions

Boundary Type	Inflows		Outflows		Outflow – Inflow (m^3/day)
	(m^3/day)	(mm/year)	(m^3/day)	(mm/year)	
Recharge (RCH)	24,238.8	301.3	0	0	-24,238.8
Constant Head (CHD)	196,293.1	2,440.1	0	0	-196,293.1
River (RIV)	55,150.6	685.6	40,303.8	501.0	-14,846.9
Drain (DRN)	0	0	224,648.3	2,792.6	224,648.3
Well (WEL)	0	0	11,699.0	145.4	11,699.0
Lateral GW Flow	35,470.4	440.9	34,597.1	430.1	-873.4
TOTAL	**311,152.9**	**3,867.9**	**311,248.1**	**3,869.1**	**95.2**
Discrepancy (%)					**0.03**

The notable decrease in recharge at the Site is equivalent to a decrease of 1.6 mm/year averaged over the simulated portion of the Mill Creek watershed. Groundwater inflows from outside of the watershed (simulated using constant head boundaries and lateral groundwater flow), and from the local watercourses (simulated using river boundaries) all marginally increase to compensate for the increased inward groundwater flows toward the Site. Discharge to wetlands (simulated using drain boundaries) also marginally decreases compared to baseline conditions.

G.8 REHABILITATED CONDITION MODEL

To create the rehabilitation condition model for the Site, the full development model described in **Section G.7.2** was modified by shutting off the simulated aggregate extraction (i.e., well reach 12) to simulate only the effects of increased evaporation in the final pit lake. This scenario was simulated to characterize the effects of the proposed development at the Site in isolation from other licenced pits in the model domain.

G.8.1 Predicted Final Lake Effects

The predicted cone of depression induced by the proposed pit is shown on **Figure G-9**. It is noted that the maximum radius of influence was observed within the contact aquifer (model layer 5), and this is the radius that was used to determine impacts.

A drawdown of up to approximately 0.25 m relative to baseline water levels in the contact aquifer is predicted for a relatively small area adjacent to the southeast of the proposed pit. The radius of influence (i.e., 0.25 m drawdown contour) in the contact aquifer extends to the southeast by approximately 200 m. It is noted that are of influence does not extend to the rural residences in the community of Morriston and as such, impacts to these private wells are not anticipated.

G.8.2 Rehabilitated Condition Water Balance

The final rehabilitation Site water balance is shown in **Table G.8.1** below. Flow terms are shown both in the model units (m^3/day), as well as values normalized by the Site area (approximately 0.4 km^2) in mm/year.

Table G.8.1: Site Water Balance – Final Rehabilitation Conditions

Boundary Type	Inflows		Outflows		Outflow – Inflow (m^3/day)
	(m^3/day)	(mm/year)	(m^3/day)	(mm/year)	
Recharge (RCH)	240.2	220.2	0	0	-240.2
Well (WEL)	0	0	0	0	0.0
Lateral GW Flow	14,116.2	12,941.7	14,361.8	13,166.9	245.6
TOTAL	**14,356.4**	**13,161.9**	**14,361.8**	**13,166.9**	**5.4**
Discrepancy (%)					**0.04**

Recharge in the rehabilitated condition Site water balance is the same as the full development conditions model as the increased rate of evaporation within the pit footprint is permanent. At final rehabilitation, the Site reverts to a net outward flow to the surrounding aquifer of 246 m^3/day, a decrease of 34% compared to baseline conditions.

The water balance for the portion of Mill Creek subwatershed simulated in the final rehabilitation model is shown in **Table G.8.2** below. Flow terms are shown both in the model units (m^3/day), as well as values normalized by the modeled subwatershed area (approximately 29.4 km^2) in mm/year.

Table G.8.2: Mill Creek Subwatershed Water Balance – Final Rehabilitation Conditions

Boundary Type	Inflows		Outflows		Outflow – Inflow (m^3/day)
	(m^3/day)	(mm/year)	(m^3/day)	(mm/year)	
Recharge (RCH)	24,328.8	302.4	0	0	-24,328.8
Constant Head (CHD)	196,272.5	2,439.9	0	0	-196,272.5
River (RIV)	55,065.6	684.5	40,454.6	502.9	-14,611.0
Drain (DRN)	0	0	225,559.7	2,804.0	225,559.7
Well (WEL)	0	0	10,371.0	128.9	10,371.0
Lateral GW Flow	35,218.0	437.8	34,396.6	427.6	-821.4
TOTAL	**310,884.9**	**3,864.6**	**310,781.9**	**3,863.4**	**-103.0**
Discrepancy (%)					**-0.004**

Similar to the Site water balance above, recharge in the rehabilitated condition Mill Creek watershed balance is the same as the full development conditions model as the increased rate of evaporation within the pit footprint is permanent. Groundwater inflows from outside of the watershed (simulated using constant head boundaries and lateral groundwater flow) and from the local watercourses (simulated using river boundaries) return to near baseline conditions. Groundwater discharge to wetlands (simulated using drain boundaries) also returns to near baseline conditions.

G.8.3 Temperature Effects

The underlying equation representing solute transport in an aquifer is analogous to that of heat transport in an aquifer; as such, these two processes are similar and thermal plume migration in groundwater can be simulated using various solute transport models provided that the model inputs are adapted appropriately (Langevin et al, 2008). Although changes in groundwater temperature affect the density and viscosity of water which can alter the groundwater flow field, if the simplifying assumption that groundwater flow is not affected by temperature is employed, the model results provide a good approximation (Neville and Wang, 2024).

The thermal plume emanating from the final pit lake was modelled to estimate the extent of off-site temperature impacts using a 2-D plume model developed by Domenico (1987) and Domenico and Schwartz (1998), as described in the Ontario Ministry of the Environment, Conservation and Parks (MECP)'s *"Rationale for the Development of Soil and Groundwater Standards for Use at Contaminated Sites in Ontario"* (MECP, 2011). Advection, dispersion and retardation (i.e., sorption) were included in the simulation while thermal diffusion was ignored and decay is not applicable for heat transport.

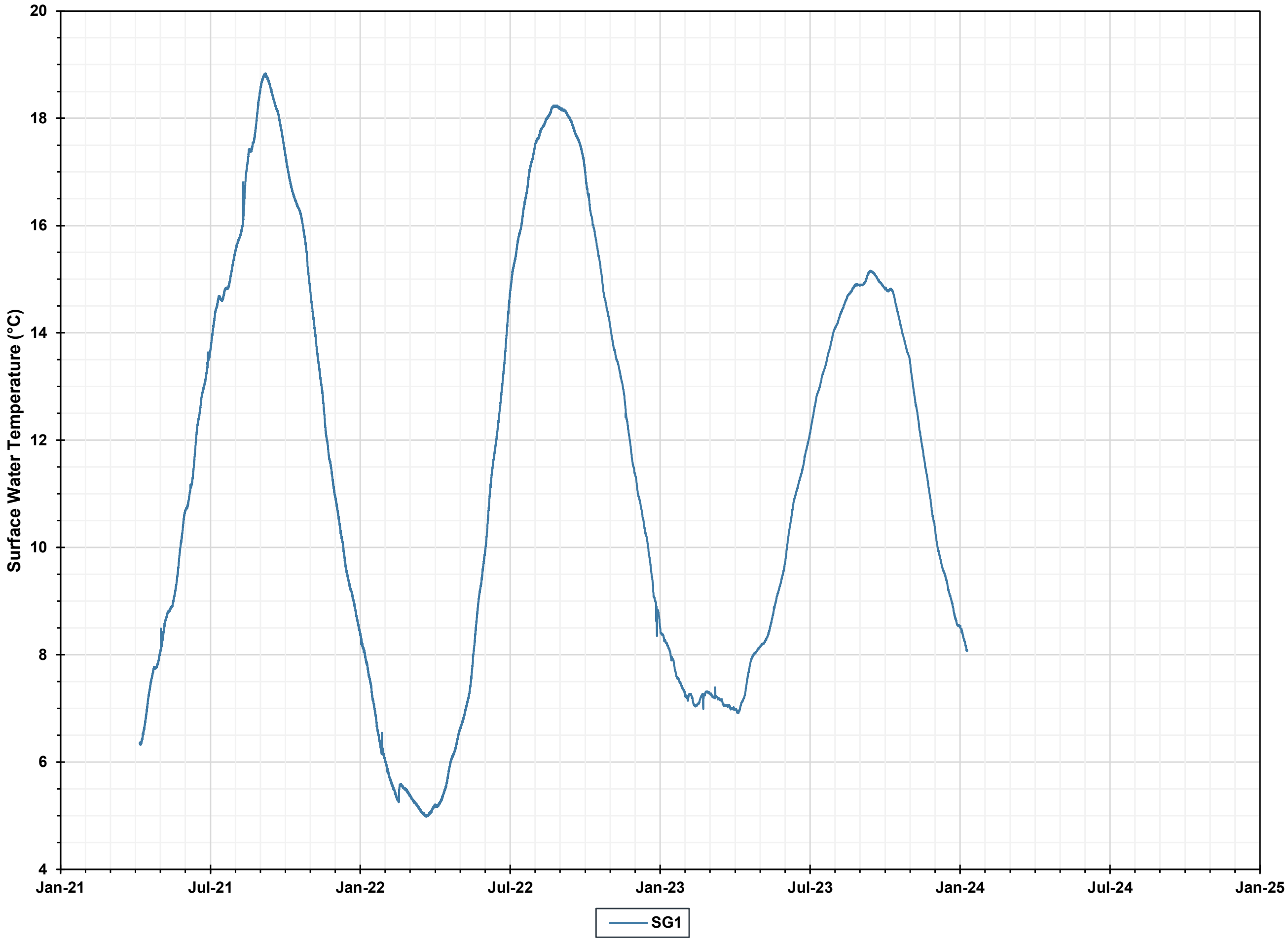
The model was used to estimate the size of the thermal plume downgradient from the lake where impacts would not be distinguishable from the ambient groundwater temperatures. Surface water temperatures were monitored at the existing Neubauer Pit pond staff gauge SG1 using dataloggers during the baseline monitoring period, as shown in the first graph below. Average monthly temperatures are summarized in **Table G.8.3**. Average pond surface water temperature varies seasonally from about 5.6°C in March to 17.7°C in September, with an average annual pond temperature of 11.2°C. The thermal plume extent was simulated using an assumed surface temperature of 25°C over a period of six months. Compared to the baseline temperature data from SG1, this is an overly conservative approach. In reality, the surface water temperatures would only be expected to reach this value during short periods in the summer.

Ambient groundwater temperatures at the Site were monitored using dataloggers during the baseline monitoring period, as shown in the second graph below (the results from shallow well MW21-03-S were not considered as the water table at this location is inferred to be perched and not representative of the aquifer). Average monthly temperatures for each well are summarized in **Table G.8.3**. The highest temperatures and seasonal variability were observed at MW21-01 in the downgradient western portion of the Site. Lower temperatures and less seasonal variability were observed at the remaining wells, with the lowest temperatures occurring at MW21-04 in the upgradient eastern portion of the Site. For the purpose of the thermal plume model, an ambient groundwater temperature of 8.46°C was assumed.

To simulate advective heat transport, the calibrated hydraulic conductivity of the sand and gravel aquifer (i.e., hydraulic conductivity zone 7 in **Table G.4.7**) was adopted. The hydraulic gradient was estimated based on the June 2022 groundwater elevation contours. Finally, a porosity of 0.3 was used to calculate groundwater velocity. For the dispersion term, longitudinal and transverse dispersivities of 10 m and 1 m, respectively, were used. A width of 400 m was used to represent the pit lake extent perpendicular to the groundwater flow path.

For heat transport, the thermal distribution coefficient is used (in place of the distribution coefficient for solute transport). Equations and published values for groundwater and sand and gravel are provided in the manual for SEAWAT Version 4 (Langevin et al, 2008). A thermal distribution coefficient of 0.17 milliLitres / gram was calculated using the published values.

The results of the 2-D thermal plume modeling suggest that temperature effects from the final pit lake would extend to a maximum distance of about 110 m. It is noted that at its closest point to the final pit lake, Mill Creek is situated over 2 km downgradient of the Site. Therefore, temperature impacts to Mill Creek surface water from the proposed pit are not expected, even using conservative assumptions. The closest downgradient surface water body to the Site is the future Safarik Pit pond, which is situated about 400 m away at its closest point and also is not expected to be impacted by the proposed pit.



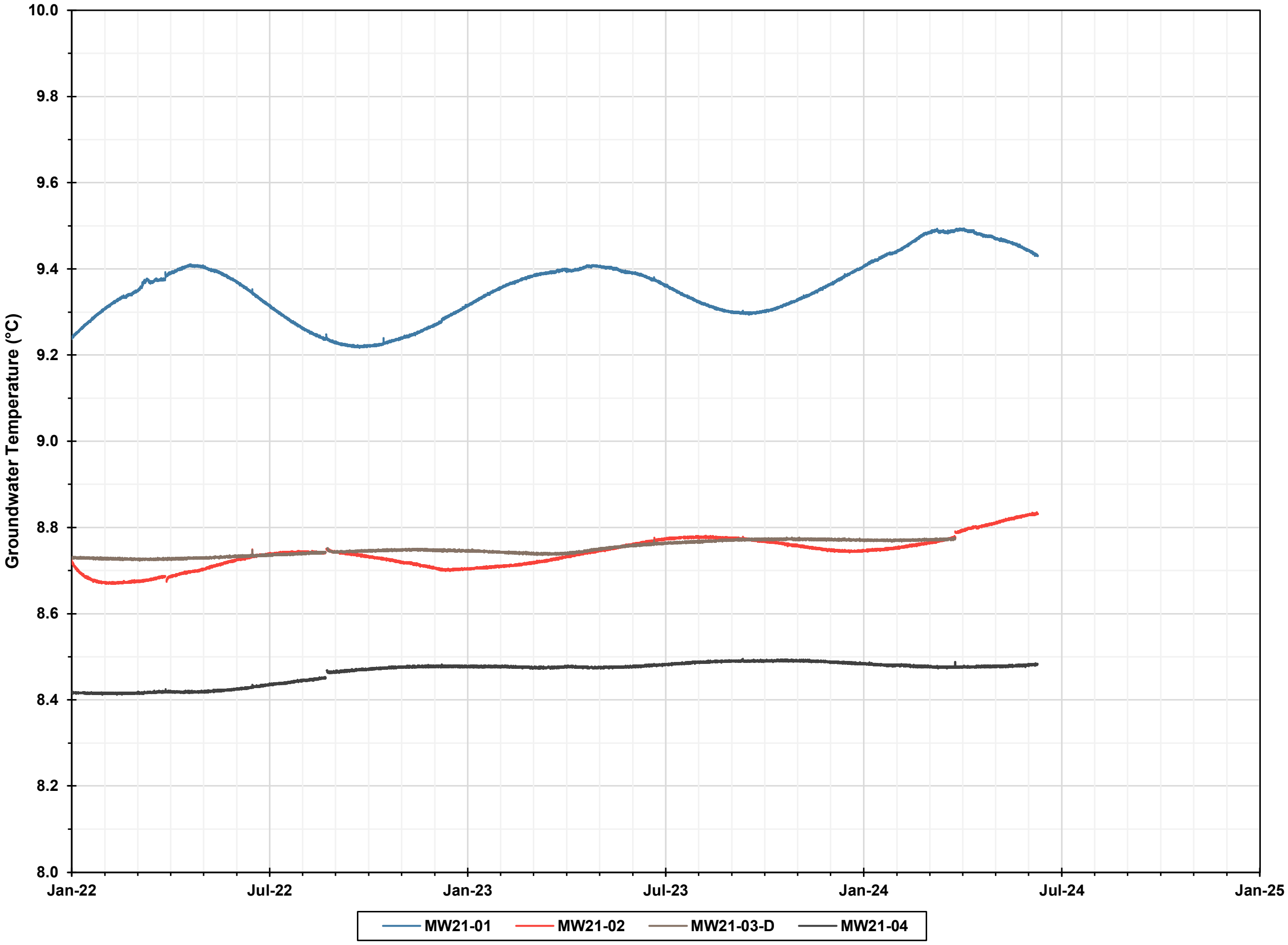

Groundwater Temperature (°C)
10.0
9.8
9.6
9.4
9.2
9.0
8.8
8.6
8.4
8.2
8.0
Jan-22
Jul-22
Jan-23
Jul-23
Jan-24
Jul-24
Jan-25
MW21-01
MW21-02
MW21-03-D
MW21-04

Table G.8.3: Baseline Average Monthly Temperatures

Month	Average Monthly Temperature (°C)				
	Groundwater				Surface Water
	MW21-01	MW21-02	MW21-03-D	MW21-04	SG1
January	9.35	8.71	8.75	8.46	7.37
February	9.39	8.71	8.75	8.46	5.88
March	9.42	8.73	8.74	8.46	5.55
April	9.43	8.74	8.74	8.46	6.49
May	9.42	8.76	8.74	8.46	8.50
June	9.37	8.76	8.75	8.46	11.9
July	9.32	8.76	8.75	8.46	15.1
August	9.28	8.76	8.76	8.47	17.1
September	9.26	8.76	8.76	8.48	17.7
October	9.27	8.74	8.76	8.48	15.9
November	9.30	8.73	8.76	8.48	12.7
December	9.32	8.73	8.76	8.47	9.64
Minimum	**9.19**	**8.67**	**8.72**	**8.41**	**4.99**
Maximum	**9.49**	**8.84**	**8.78**	**8.50**	**18.8**
Annual Average	**9.34**	**8.74**	**8.75**	**8.47**	**11.2**

Signature Page

WSP Canada Inc.

Leigh Davis Kevin Fitzpatrick

Leigh Davis, M.A.Sc., P.Eng.
Project Engineer

Kevin Fitzpatrick, P.Eng.
Senior Project Engineer

JLD/kjf/jld

https://wsponline.sharepoint.com/sites/gld-148930/project files/6 deliverables/ph 2000 - hydrogeology/app g_numerical model/safarik - gw model report_d.docx

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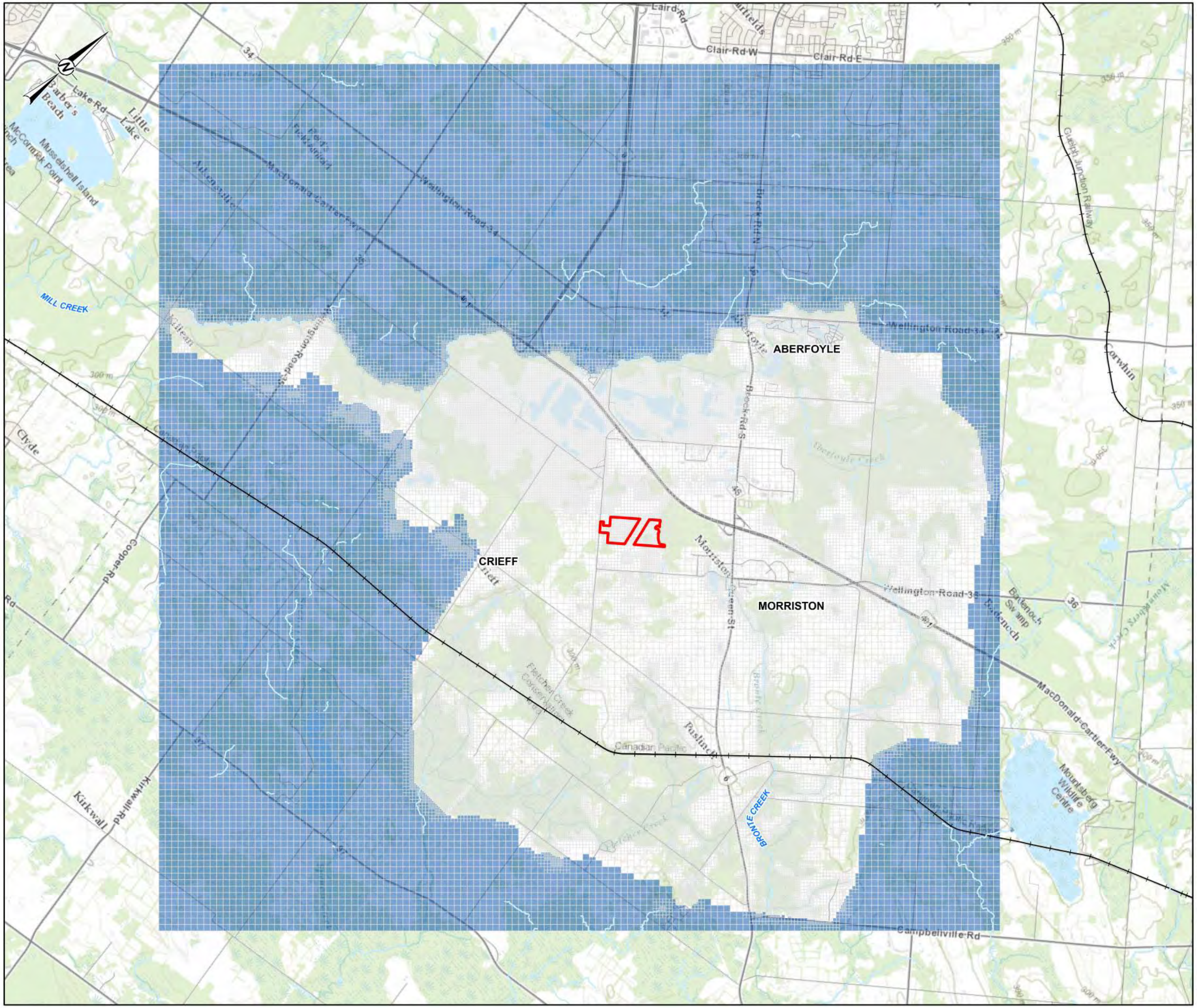
Figures

Appendix G - Numerical Groundwater Model Report



KEY MAP

SCALE 1:300,000

LEGEND

- ROADWAY
- WATERCOURSE
- RAILWAY
- 🟥 LICENCE BOUNDARY
- ☐ ACTIVEMODEL GRID
- 🟩 WOODED AREA
- 🟦 NO-FLOW BOUNDARY
- 🟦 WATERBODY

0 750 1,500 3,000

1:60,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT

CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT

SAFARIK PIT

TITLE

MODEL DOMAIN GRID

CONSULTANT

wsp

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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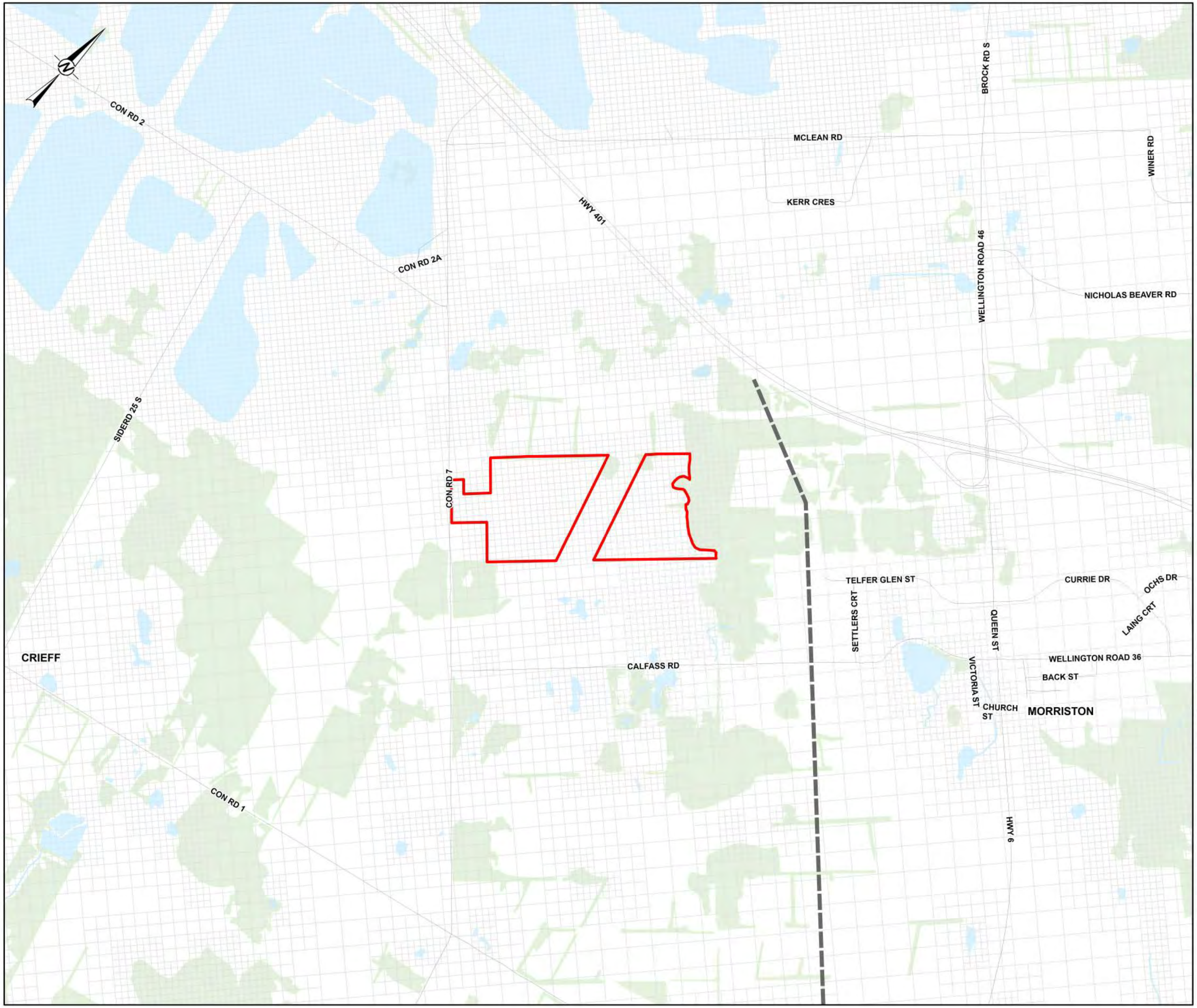

KEY MAP

SCALE 1:300,000

LEGEND

	ROADWAY
	WATERCOURSE
▬ ▬	APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
	WATERBODY
☐	ACTIVE MODEL GRID
🟥	LICENCE BOUNDARY
	WOODED AREA

0 175 350 700
1:15,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

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CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
LOCAL MODEL GRID

CONSULTANT
wsp

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REVIEWED	RW
APPROVED	LD

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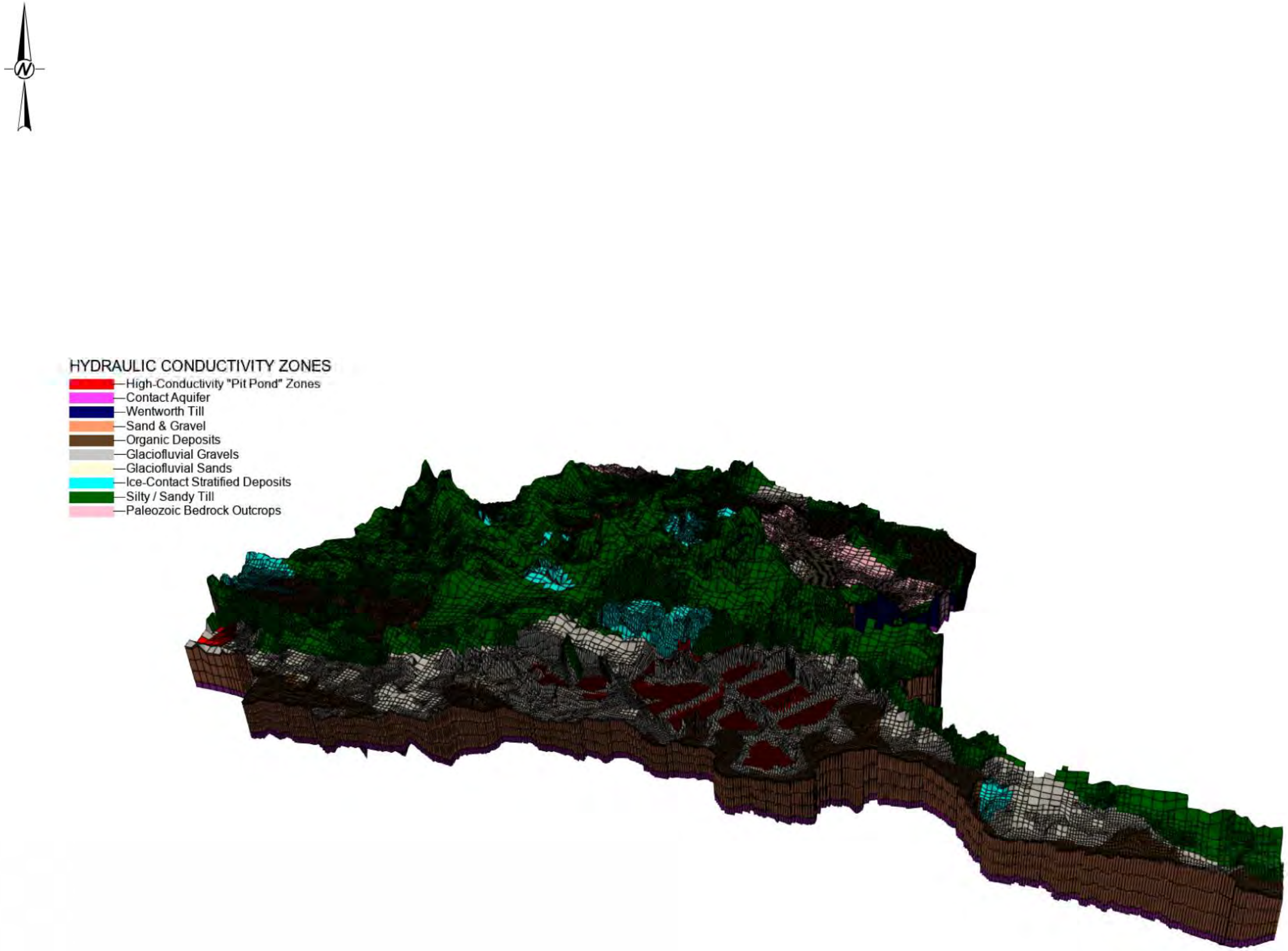

KEY MAP

SCALE 1:300,000

0 5 10 20

1:600 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

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CLIENT

CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT

NUMERICAL GROUNDWATER MODEL,
PROPOSED NEUBAUER PIT EXTENSION,PUSLINCH, ONTARIO

TITLE

3-DIMENSIONAL VIEW OF MODEL LAYERS

CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	AR
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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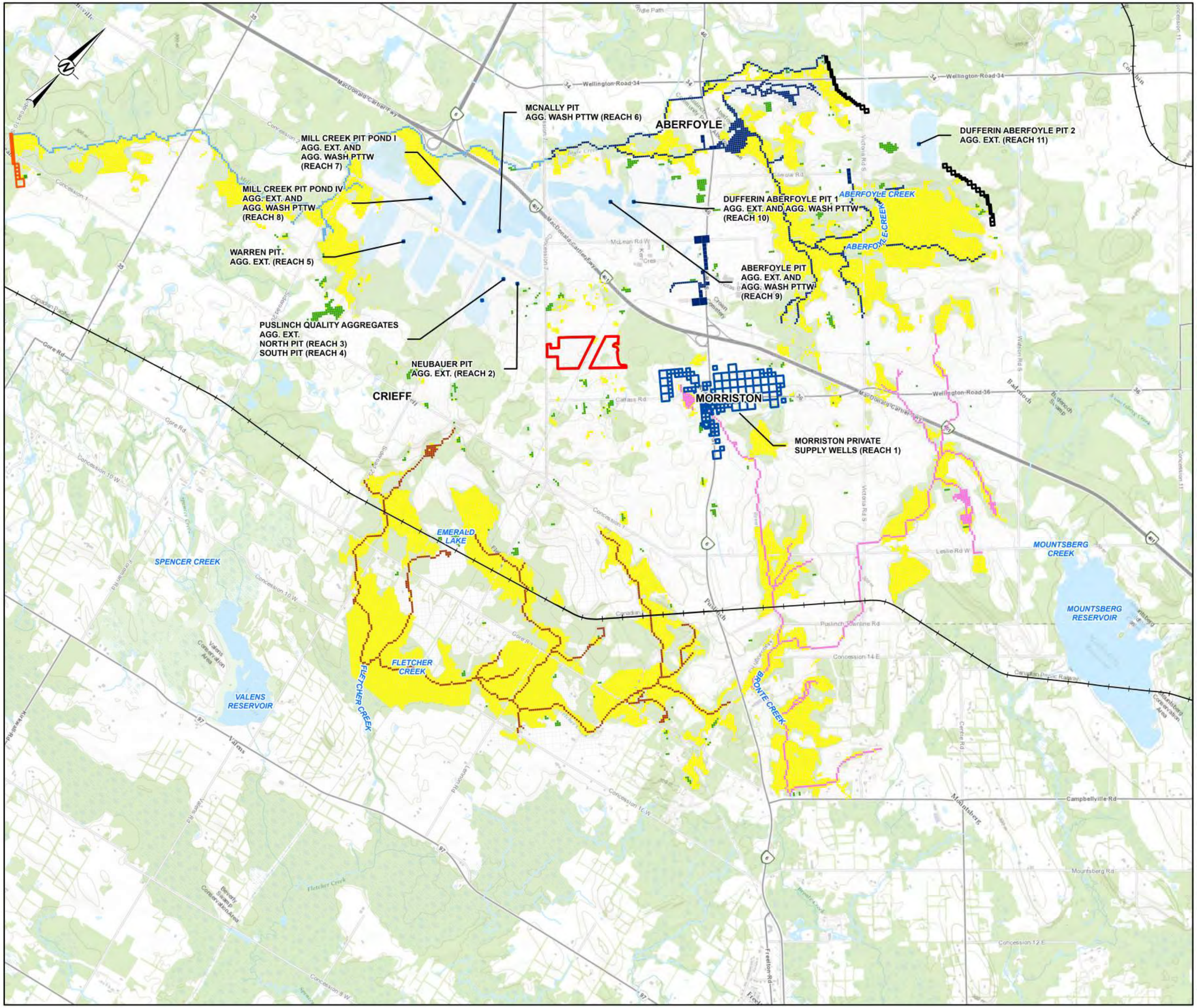

KEY MAP

SCALE 1:300,000

LEGEND

- ┼ RAILWAY
- 🟥 LICENCE BOUNDARY
- 🟦 WELL BOUNDARY CONDITION (LAYER 4/5)

CONSTANT HEAD BOUNDARY (REACH / DESCRIPTION)

- ⬛ 1 REGIONAL GROUNDWATER CONTOUR (325 MASL) - LAYER 4
- 🟧 2 REGIONAL GROUNDWATER CONTOUR (300 MASL) - LAYER 4
- ACTIVE MODEL GRID

RIVERS (REACH / DESCRIPTION)

- 🟦 1 MILL CREEK ABOVE SIDEROAD 10 - LAYER 1
- 🟦 2 MILL CREEK ABOVE HANLON EXPRESSWAY - LAYER 1
- 🟫 3 SPENCER CREEK UPSTREAM OF 02HB015 - LAYER 1
- 🟪 4 BRONTE CREEK UPSTREAM OF 02HB022 - LAYER 1
- 🟩 5 MISCELLANEOUS WATERBODIES - LAYER 1

DRAINS (REACH / DESCRIPTION)

- 🟨 1 WETLANDS (LAYER 1)
- WATERCOURSE
- WATERBODY

0 500 1,000 2,000
1:50,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

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4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
BOUNDARY CONDITIONS

CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

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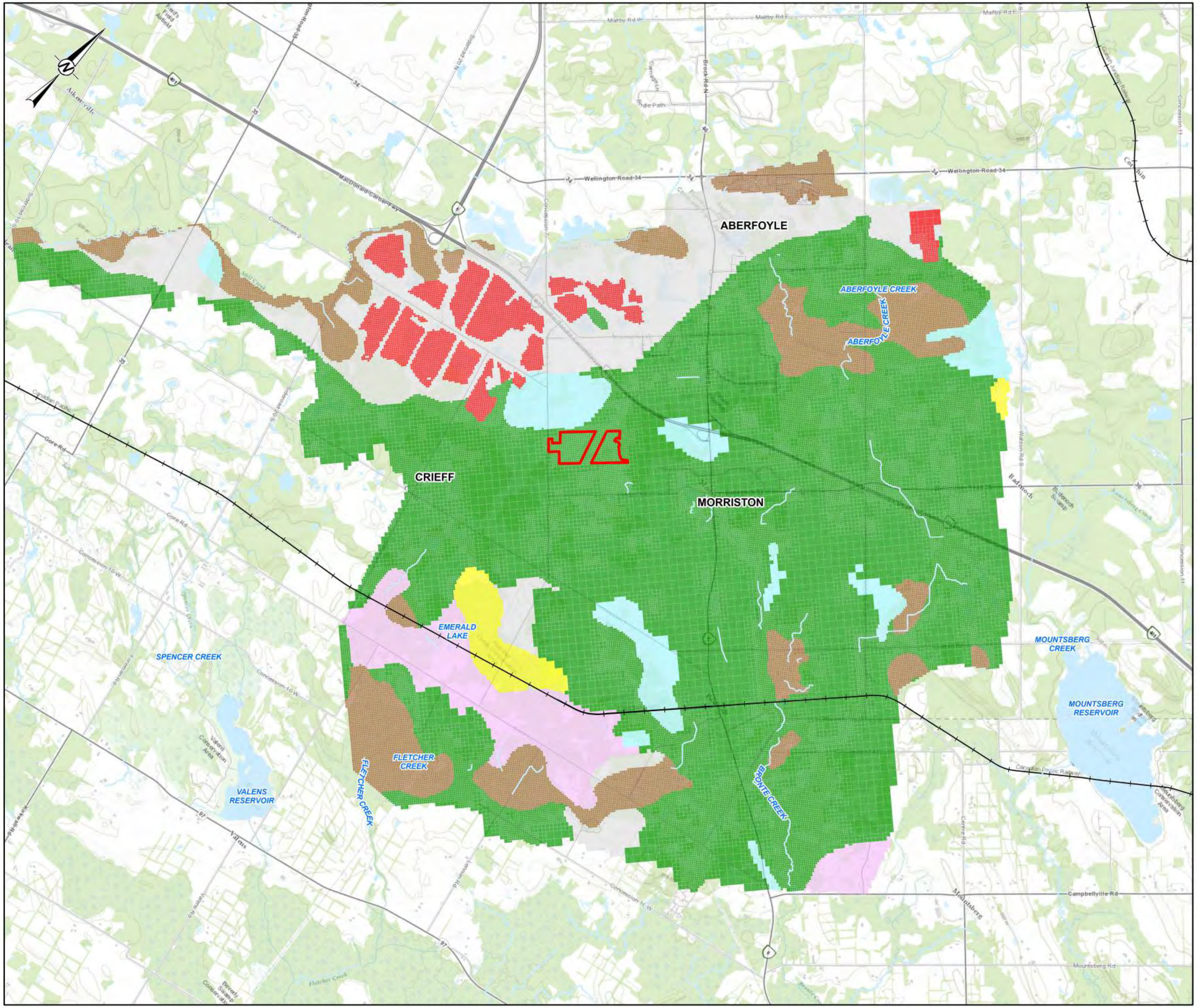

KEY MAP

SCALE 1:300,000

LEGEND

- WATERCOURSE
- ROADWAY
- RAILWAY
- 🟥 LICENCE BOUNDARY
- ACTIVE MODEL GRID

RECHARGE BOUNDARY (ZONE / DESCRIPTION)

- 🟪 1 PALEOZOIC BEDROCK OUTCROPS (3)
- 🟩 2 SILTY / SANDY TILL (5b)
- 🟦 3 ICE-CONTACT STRATIFIED DEPOSITS (6)
- 🟨 4 GLACIOFLUVIAL SANDS (7a)
- ⬜ 5 GLACIOFLUVIAL GRAVELS (7b)
- 🟫 6 ORGANIC DEPOSITS (20)
- 🟥 7 PIT PONDS
- 🟦 WATERBODY

0 500 1,000 2,000

1:50,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
RECHARGE ZONES

CONSULTANT
wsp

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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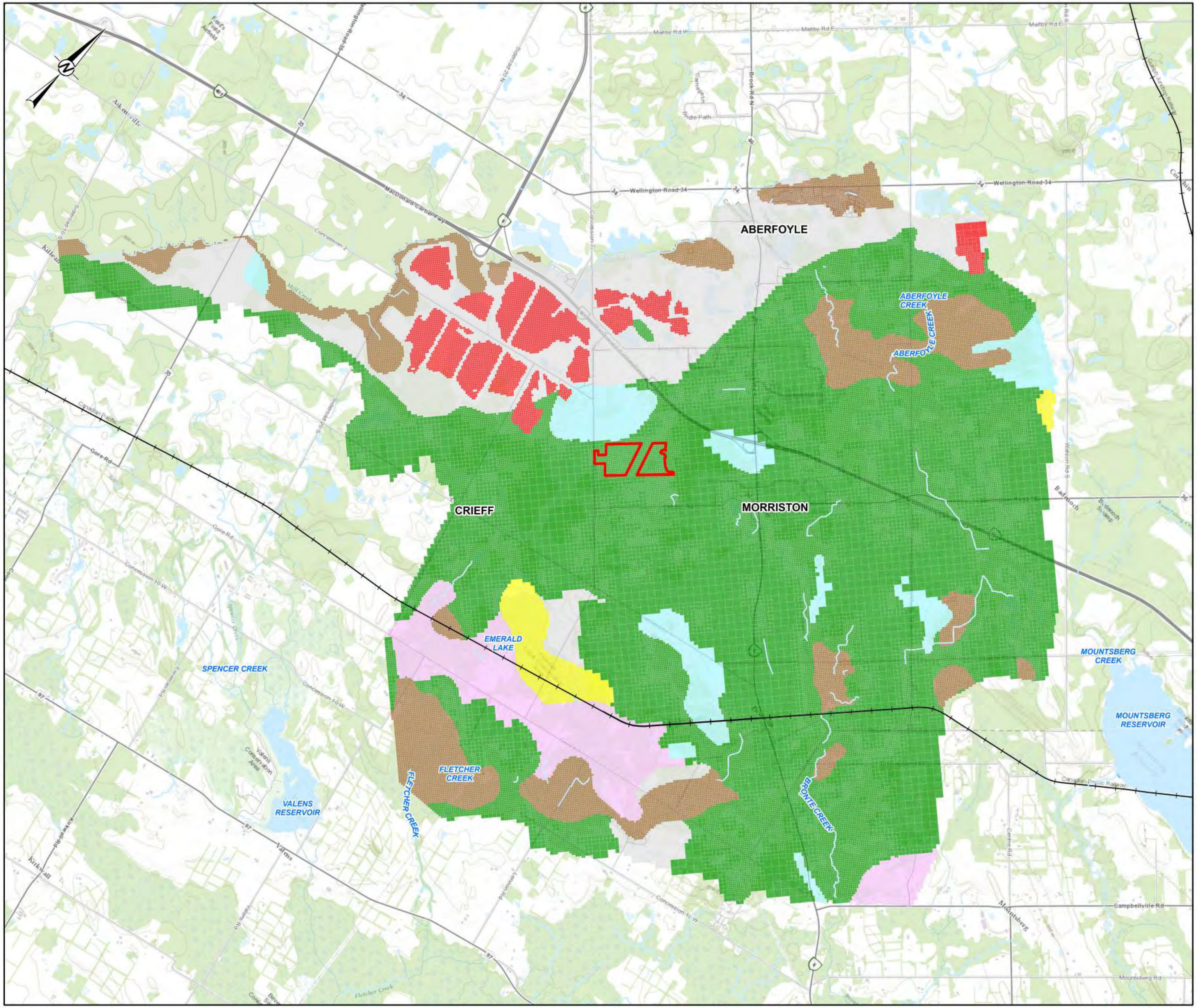

KEY MAP

SCALE 1:300,000

LEGEND

ROADWAY

WATERCOURSE

RAILWAY

🟥 LICENCE BOUNDARY

ACTIVE MODEL GRID

HYDRAULIC CONDUCTIVITY (ZONE / DESCRIPTION)

🟪	1 PALEOZOIC BEDROCK OUTCROPS (3)
🟩	2 SILTY / SANDY TILL (5b)
🟦	3 ICE-CONTACT STRATIFIED DEPOSITS (6)
🟨	4 GLACIOFLUVIAL SANDS (7a)
⬜	5 GLACIOFLUVIAL GRAVELS (7b)
🟫	6 ORGANIC DEPOSITS (20)
🟥	10 PIT POND HIGH CONDUCTIVITY ZONES
🟦	WATERBODY

0 500 1,000 2,000

1:50,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

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4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
LAYER 1 HYDRAULIC CONDUCTIVITY ZONES

CONSULTANT

YYYY-MM-DD	2025-07-15
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APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	0	G-5

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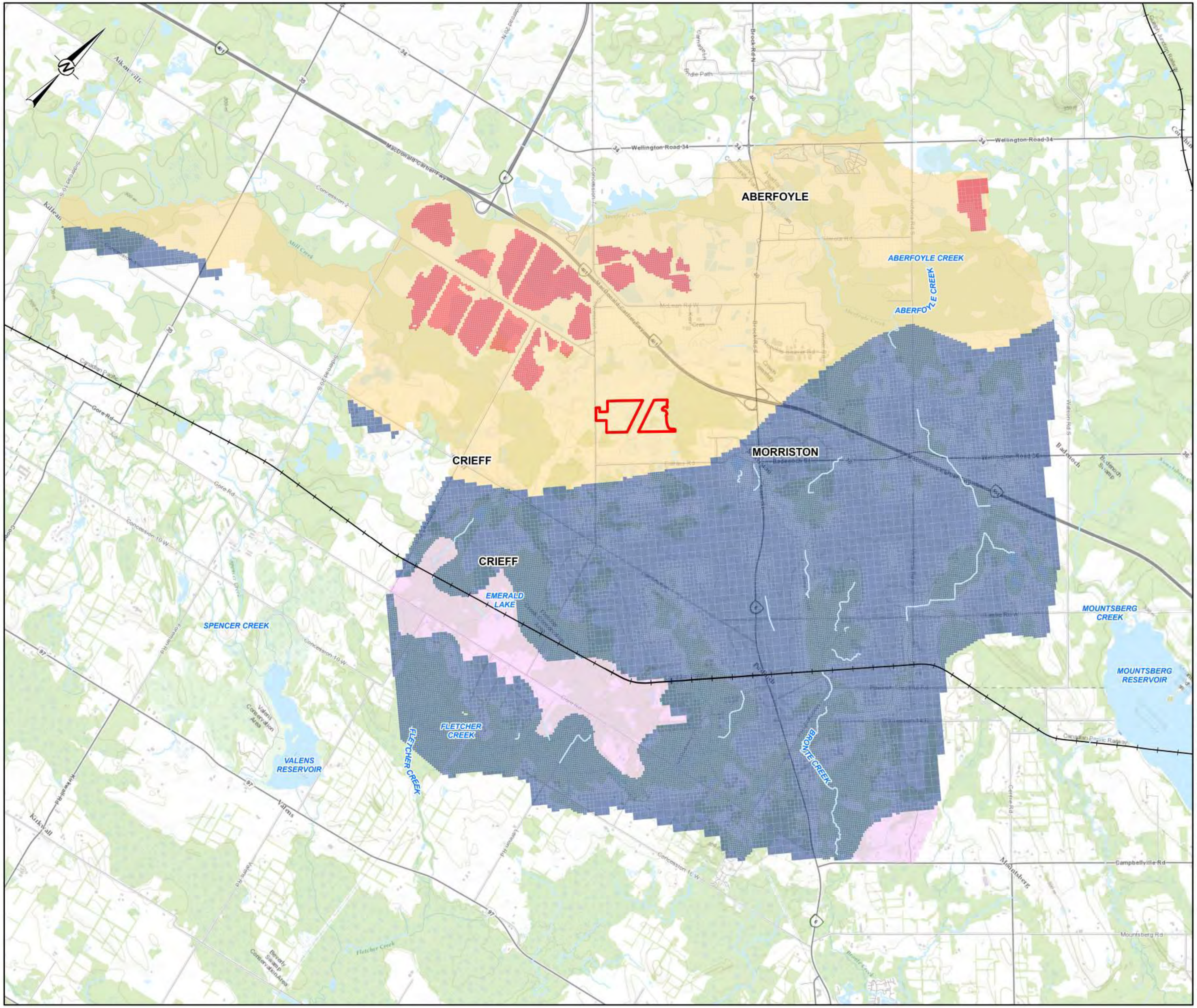

KEY MAP

SCALE 1:300,000

LEGEND

- ROADWAY
- WATERCOURSE
- RAILWAY
- 🟥 LICENCE BOUNDARY
- ACTIVE MODEL GRID

HYDRAULIC CONDUCTIVITY (ZONE / DESCRIPTION)

- 1 PALEOZOIC BEDROCK OUTCROPS (3)
- 7 SAND AND GRAVEL
- 8 WENTWORTH TILL
- 10 PIT POND HIGH CONDUCTIVITY ZONES
- WATERBODY

0 500 1,000 2,000

1:50,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
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3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
LAYER 2 TO 4 HYDRAULIC CONDUCTIVITY ZONES

CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	0	G-6

PATH: S:\Clients\Votorantim_Cimentos\Neubauer_Pit\99_PROJ\21476582_Safarik_Pit_Expansion\40_PROD\0006_HydroG\CA21476582-0006-CH-0000\CA21476582-0006-CH-0000.aprx PRINTED ON: AT: 9:44:44 AM

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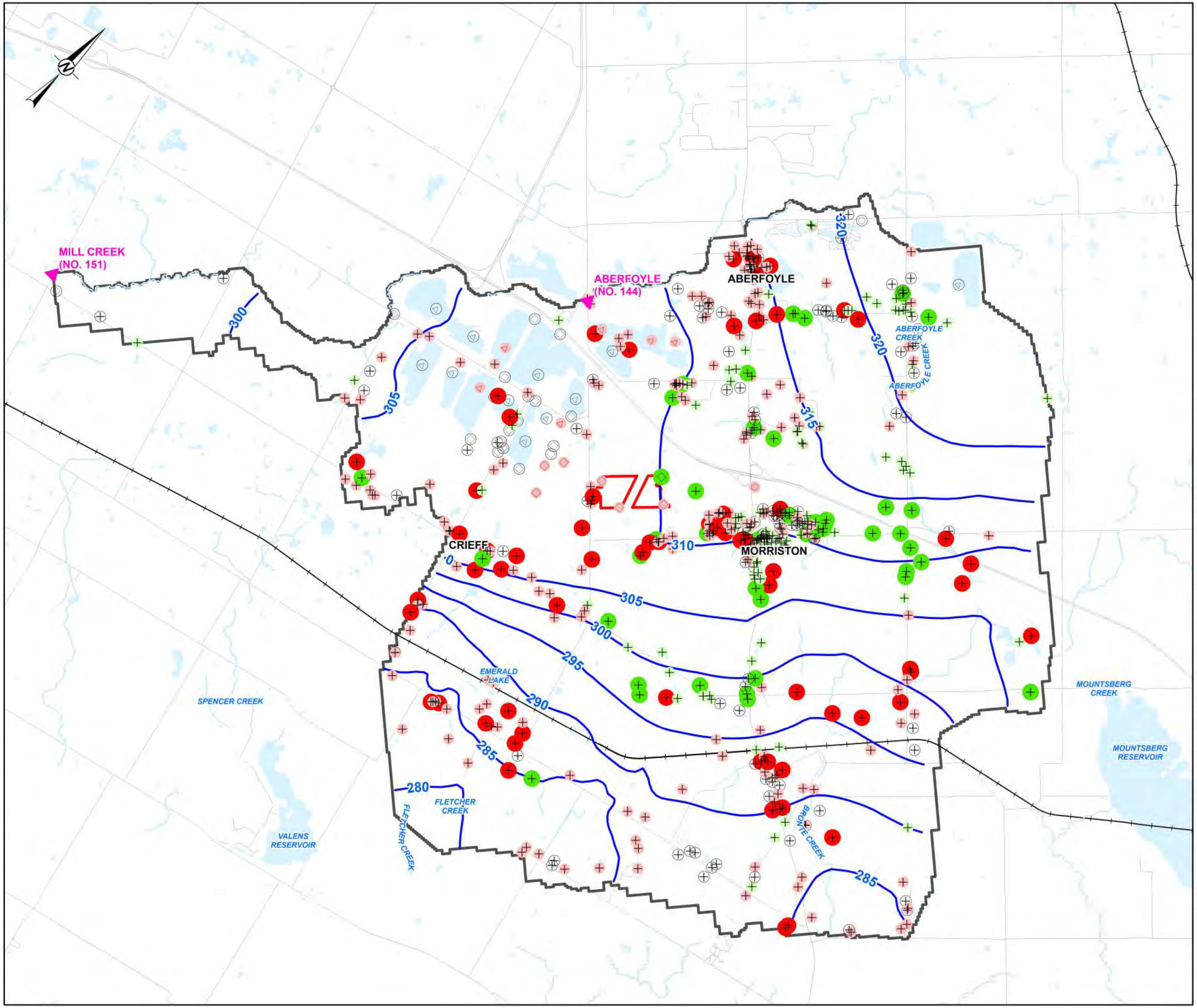

KEY MAP

SCALE 1:300,000

LEGEND

▲ GRCA STAFF GAUGE

TARGET TYPE (GROUP / DESCRIPTION)

☐	1 MONITORING WELL DATA
×	2 MECP WATER WELL RECORDS
△	3 PIT POND STAGE DATA
○	5 PUSLINCH TOWNSHIP MONITORING PROGRAM DATA

RESIDUAL

●	OVER-PREDICTION > 5 M
●	OVER-PREDICTION 1 M - 5 M
○	± 1 M
●	UNDER-PREDICTION 1 M - 5 M
●	UNDER-PREDICTION > 5 M
—	SIMULATED GROUNDWATER CONTOURS, 5M INTERVALS (MASL)
—	WATERCOURSE
—	ROADWAY
—+—	RAILWAY
☐	LICENCE BOUNDARY
☐	ACTIVE MODEL GRID
▨	WATERBODY

0 500 1,000 2,000

1:50,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
SPATIAL DISTRIBUTION OF CALIBRATED RESIDUALS

CONSULTANT

wsp

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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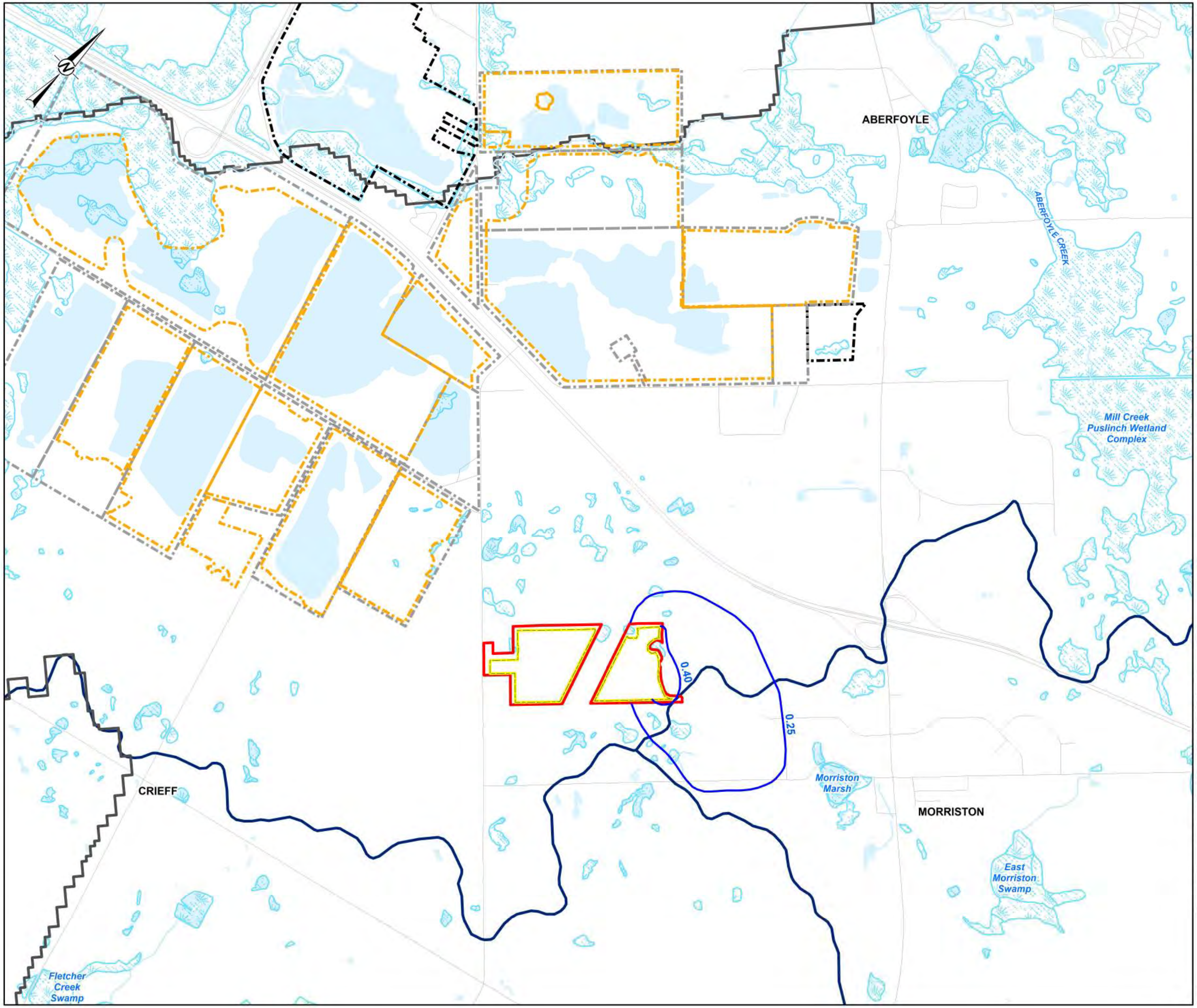


KEY MAP

SCALE 1:300,000

LEGEND

—	ROADWAY
—	WATERCOURSE
—	DRAWDOWN CONTOURS (m)
🟥	LICENCE BOUNDARY
🟨	EXTRACTION LIMIT
▭	LICENCED EXTRACTION AREA
▭	EXISTING PIT / QUARRY LICENCE
▭	FORMER PIT / QUARRY (INACTIVE)
▭	ACTIVE MODEL DOMAIN
▭	WATERSHED BOUNDARY
▨	WATERBODY

0 250 500 1,000

1:20,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: CITY OF HAMILTON, TOWN OF MILTON, ONTARIO BASE MAP, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, © OPENSTREETMAP CONTRIBUTORS, HERE, GARMIN, USGS, NGA, EPA, USDA, NPS, AAFC, NRCAN
3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. EXTRACTION LIMIT PROVIDED BY MHBC JUNE 2025
5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
PREDICTED DRAWDOWN AT FULL PIT DEVELOPMENT

CONSULTANT

wsp

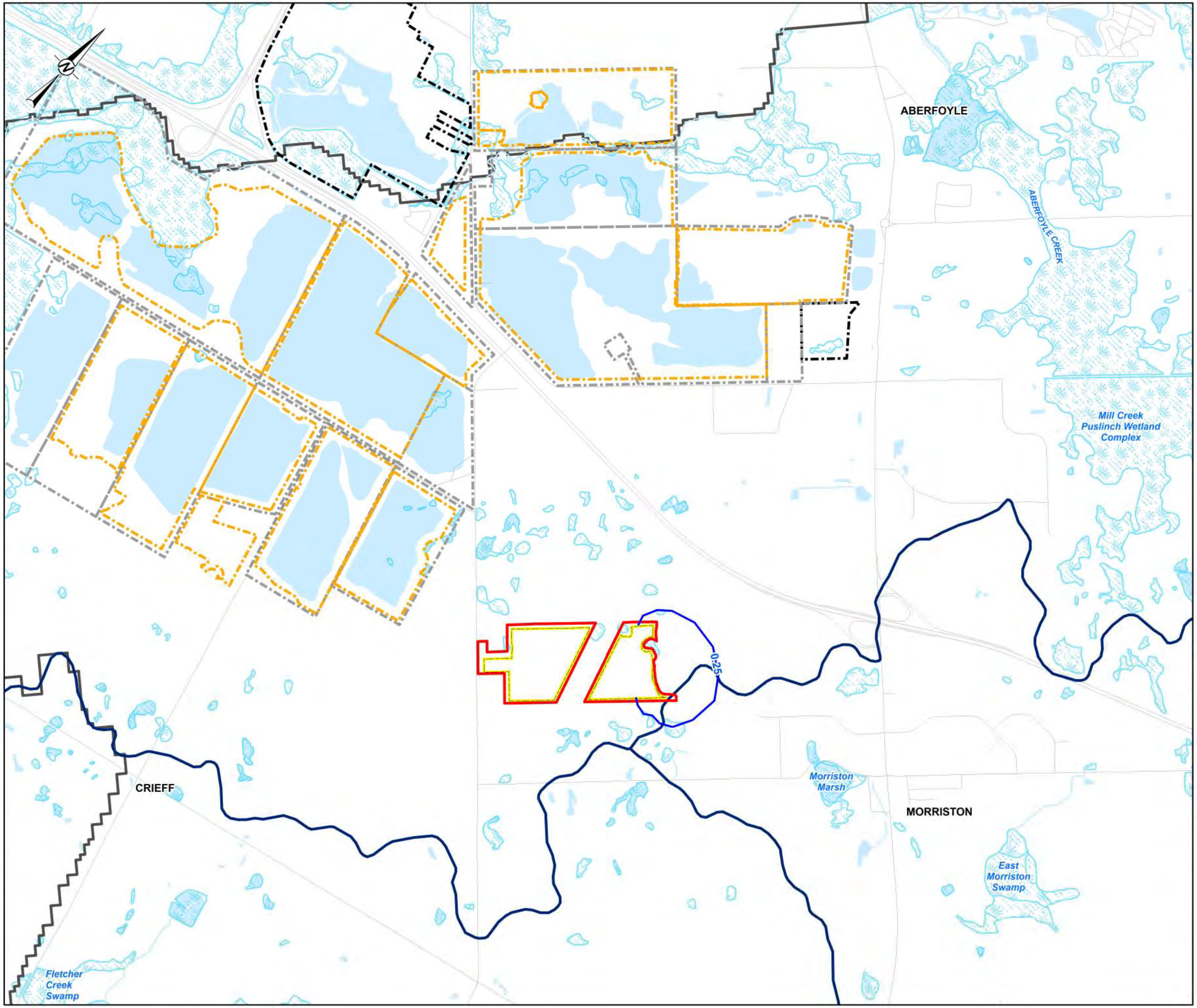
YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/MC
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	0	G-8

PATH: S:\Clients\Votorantim_Cimentos\Neubauer_Pit\99_PROJ\21476582_Safarik_Pit_Expansion\40_PROD\0006_HydroG\CA21476582-0006-CH-0000\CA21476582-0006-CH-0000.aprx PRINTED ON: AT: 9:39:06 AM

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

25mm



KEY MAP

SCALE 1:300,000

LEGEND

WATERCOURSE
ROADWAY
SIMULATED DRAWDOWN CONTOURS (M)
LICENCE BOUNDARY
EXTRACTION LIMIT
LICENCED EXTRACTION AREA
EXISTING PIT / QUARRY LICENCE
FORMER PIT / QUARRY (INACTIVE)
WATERSHED BOUNDARY
ACTIVE MODEL DOMAIN
WATERBODY

0 250 500 1,000
1:20,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: CITY OF HAMILTON, TOWN OF MILTON, ONTARIO BASE MAP, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, © OPENSTREETMAP CONTRIBUTORS, HERE, GARMIN, USGS, NGA, EPA, USDA, NPS, AAFC, NRCAN
3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. EXTRACTION LIMIT PROVIDED BY MHBC JUNE 2025
5. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
PREDICTED DRAWDOWN AT FINAL REHABILITATION

CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/MC
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
21476582	0006	0	G-9

wsp.com

APPENDIX H

Climate Data

Table H-1: 30 Year Climate Normal (1981 - 2010) - Waterloo Wellington A Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-6.5	0.0	0.0	0.8	0.0	65.2	100.0	65.2	0.0
February	-5.5	0.0	0.0	0.8	0.0	54.9	100.0	54.9	0.0
March	-1	0.0	0.0	1.0	0.0	61	100.0	61.0	0.0
April	6.2	1.4	29.4	1.1	33.0	74.5	100.0	41.5	0.0
May	12.5	4.0	61.4	1.3	78.0	82.3	100.0	4.3	0.0
June	17.6	6.7	87.9	1.3	112.5	82.4	69.9	0.0	0.0
July	20	8.1	100.5	1.3	130.7	98.6	37.8	0.0	0.0
August	18.9	7.4	94.7	1.2	113.7	83.9	8.1	0.0	0.0
September	14.5	5.0	71.7	1.0	74.6	87.8	21.3	0.0	0.0
October	8.2	2.1	39.5	1.0	37.5	67.4	51.2	0.0	0.0
November	2.5	0.4	11.4	0.8	9.2	87.1	100.0	29.1	0.0
December	-3.3	0.0	0.0	0.8	0.0	71.2	100.0	71.2	0.0
Total	**7.0**	**35.1**			**589.1**	**916.3**		**327.2**	**0.0**
					Net Water Surplus	**327.2**	**mm**		

Table H-2: 2011 Water Budget - Kitchener/Waterloo Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-8.6	0.0	0.0	0.8	0.0	21.1	100.0	21.1	0.0
February	-6.6	0.0	0.0	0.8	0.0	30.1	100.0	30.1	0.0
March	-2.2	0.0	0.0	1.0	0.0	80.8	100.0	80.8	0.0
April	6.1	1.3	26.5	1.1	29.7	60.0	100.0	30.3	0.0
May	13.5	4.5	64.1	1.3	81.5	160.0	100.0	78.5	0.0
June	17.1	6.4	83.4	1.3	106.7	66.0	59.3	0.0	0.0
July	22.2	9.5	111.3	1.3	144.7	19.5	0.0	0.0	65.9
August	19.7	7.9	97.4	1.2	116.8	64.2	0.0	0.0	52.6
September	15.4	5.5	74.5	1.0	77.4	101.5	24.1	0.0	0.0
October	9.0	2.4	41.0	1.0	38.9	124.7	100.0	9.8	0.0
November	5.3	1.1	22.7	0.8	18.4	110.6	100.0	92.2	0.0
December	-0.5	0.0	0.0	0.8	0.0	84.1	100.0	84.1	0.0
Total	**7.5**	**38.6**			**614.2**	**922.6**		**426.9**	**118.6**
					Net Water Surplus	**308.4**	**mm**		

Notes:
- calculations based on Thornthwaite Mather Method
- °C calculated mean of daily temperatures for the month, in degrees Celcius
- I denotes Heat Index
- E denotes Evapotranspiration
- WHC denotes Water Holding Capacity
- A value of 100 mm was used for the water holding capacity of the soils
- Climate normal data from the Environment Canada Waterloo Wellington A climatological station located at latitude 43°27'00"N, longitude 80°23'00"W
- 2011 temperature and precipitation data from the Environment Canada Kitchener-Waterloo climatological station located at latitude 43°27'39"N, longitude 80°22'4

Table H-3: 2012 Water Budget - Kitchener/Waterloo Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-3.2	0.0	0.0	0.8	0.0	41.9	100.0	41.9	0.0
February	-1.8	0.0	0.0	0.8	0.0	22.9	100.0	22.9	0.0
March	6.1	1.3	25.9	1.0	26.5	29.6	100.0	3.1	0.0
April	5.8	1.3	24.8	1.1	27.7	29.3	100.0	1.6	0.0
May	15.1	5.3	72.2	1.3	91.7	11.3	19.6	0.0	0.0
June	18.6	7.3	91.0	1.3	116.5	111.1	14.2	0.0	0.0
July	22.0	9.4	109.7	1.3	142.6	31.9	0.0	0.0	96.5
August	19.3	7.7	94.6	1.2	113.5	58.7	0.0	0.0	54.8
September	14.4	4.9	68.0	1.0	70.8	101.2	30.4	0.0	0.0
October	9.0	2.4	40.3	1.0	38.3	140.0	100.0	32.2	0.0
November	1.9	0.2	7.0	0.8	5.7	13.7	100.0	8.0	0.0
December	-0.2	0.0	0.0	0.8	0.0	63.9	100.0	63.9	0.0
Total	**8.9**	**39.9**			**633.3**	**655.5**		**173.5**	**151.4**
					Net Water Surplus	**22.2**	**mm**		

Table H-4: 2013 Water Budget - Kitchener/Waterloo Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-4.0	0.0	0.0	0.8	0.0	77.9	100.0	77.9	0.0
February	-6.9	0.0	0.0	0.8	0.0	47.8	100.0	47.8	0.0
March	-1.7	0.0	0.0	1.0	0.0	26.1	100.0	26.1	0.0
April	5.3	1.1	24.8	1.1	27.8	99.2	100.0	71.4	0.0
May *	13.7	4.6	67.6	1.3	85.8	68.7	82.9	0.0	0.0
June *	17.4	6.6	87.0	1.3	111.3	121.7	93.2	0.0	0.0
July *	20.4	8.3	102.3	1.3	133.0	137.6	97.8	0.0	0.0
August *	18.3	7.1	91.5	1.2	109.8	52.4	40.4	0.0	0.0
September *	14.3	4.9	70.5	1.0	73.3	71.0	38.1	0.0	0.0
October *	9.5	2.6	45.8	1.0	43.5	128.4	100.0	23.0	0.0
November	0.7	0.1	3.2	0.8	2.6	32.9	100.0	30.3	0.0
December	-5.5	0.0	0.0	0.8	0.0	50.0	100.0	50.0	0.0
Total	**6.8**	**35.3**			**587.1**	**913.7**		**326.6**	**0.0**
					Net Water Surplus	**326.6**	**mm**		

Notes:
- calculations based on Thornthwaite Mather Method
- °C calculated mean of daily temperatures for the month, in degrees Celcius
- I denotes Heat Index
- E denotes Evapotranspiration
- WHC denotes Water Holding Capacity
- A value of 100 mm was used for the water holding capacity of the soils
- Temperature and precipitation data from the Environment Canada Kitchener-Waterloo climatological station located at latitude 43°27'39"N, longitude 80°22'43"W

Table H-5: 2014 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-9.5	0.0	0.0	0.8	0.0	90.7	100.0	90.7	0.0
February	-9.8	0.0	0.0	0.8	0.0	70.5	100.0	70.5	0.0
March	-5.9	0.0	0.0	1.0	0.0	45.0	100.0	45.0	0.0
April	6.2	1.4	26.2	1.1	29.4	87.2	100.0	57.8	0.0
May *	14.3	4.9	67.3	1.3	85.5	79.1	93.6	0.0	0.0
June *	20.7	8.5	102.2	1.3	130.8	51.6	14.4	0.0	0.0
July *	20.4	8.4	100.5	1.3	130.7	127.9	11.6	0.0	0.0
August *	20.0	8.1	98.3	1.2	118.0	25.2	0.0	0.0	81.1
September *	16.5	6.1	79.1	1.0	82.3	144.2	61.9	0.0	0.0
October *	10.3	3.0	46.5	1.0	44.2	71.8	89.5	0.0	0.0
November	1.0	0.1	3.4	0.8	2.7	78.2	100.0	65.0	0.0
December	-0.4	0.0	0.0	0.8	0.0	27.3	100.0	27.3	0.0
Total	**7.0**	**40.4**			**623.5**	**898.7**		**356.3**	**81.1**
					Net Water Surplus	**275.2**	**mm**		

Table H-6: 2015 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-8.6	0.0	0.0	0.8	0.0	35.0	100.0	35.0	0.0
February	-14.2	0.0	0.0	0.8	0.0	56.3	100.0	56.3	0.0
March	-3.3	0.0	0.0	1.0	0.0	14.0	100.0	14.0	0.0
April	6.7	1.6	25.9	1.1	29.0	98.9	100.0	69.9	0.0
May	17.1	6.4	79.8	1.3	101.3	69.4	68.1	0.0	0.0
June	18.4	7.2	87.1	1.3	111.5	160.3	100.0	16.8	0.0
July	21.5	9.0	105.0	1.3	136.5	69.7	33.2	0.0	0.0
August	20.5	8.4	99.2	1.2	119.0	85.0	0.0	0.0	0.9
September	19.7	7.9	94.6	1.0	98.4	72.6	0.0	0.0	25.8
October	9.7	2.7	40.4	1.0	38.4	84.0	45.6	0.0	0.0
November	6.5	1.5	25.0	0.8	20.2	54.4	79.8	0.0	0.0
December	3.5	0.6	11.9	0.8	9.3	59.2	100.0	29.7	0.0
Total	**8.1**	**45.3**			**663.7**	**858.8**		**221.7**	**26.6**
					Net Water Surplus	**195.1**	**mm**		

Notes:
- calculations based on Thornthwaite Mather Method
- °C calculated mean of daily temperatures for the month, in degrees Celcius
- I denotes Heat Index
- E denotes Evapotranspiration
- WHC denotes Water Holding Capacity
- A value of 100 mm was used for the water holding capacity of the soils
- Temperature and precipitation data from the Grand River Conservation Authority Shade's Mills climatological station located at latitude 43°23'00"N, longitude 80°17'00"W

Table H-7: 2016 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-4.5	0.0	0.0	0.8	0.0	44.8	100.0	44.8	0.0
February	-3.0	0.0	0.0	0.8	0.0	52.4	100.0	52.4	0.0
March	2.4	0.3	6.9	1.0	7.1	99.5	100.0	92.4	0.0
April	4.7	0.9	15.8	1.1	17.7	90.8	100.0	73.1	0.0
May	14.9	5.2	66.2	1.3	84.0	31.8	47.8	0.0	0.0
June	19.7	7.9	93.5	1.3	119.7	42.2	0.0	0.0	29.7
July	23.4	10.3	115.7	1.3	150.4	93.0	0.0	0.0	57.4
August	23.8	10.5	118.2	1.2	141.8	183.3	41.5	0.0	0.0
September	19.1	7.6	90.0	1.0	93.6	68.8	16.7	0.0	0.0
October	11.8	3.7	49.6	1.0	47.1	45.8	15.4	0.0	0.0
November	6.3	1.4	22.8	0.8	18.5	67.6	64.6	0.0	0.0
December	-2.0	0.0	0.0	0.8	0.0	113.5	100.0	78.1	0.0
Total	**9.7**	**47.8**			**679.9**	**933.5**		**340.7**	**87.1**
					Net Water Surplus	**253.6**	**mm**		

Table H-8: 2017 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-2.2	0.0	0.0	0.8	0.0	110.2	100.0	110.2	0.0
February	-0.3	0.0	0.0	0.8	0.0	77.1	100.0	77.1	0.0
March	-0.3	0.0	0.0	1.0	0.0	93.4	100.0	93.4	0.0
April	9.3	2.6	39.2	1.1	43.9	120.3	100.0	76.4	0.0
May	12.5	4.0	55.6	1.3	70.6	137.1	100.0	66.5	0.0
June	19.5	7.8	94.0	1.3	120.3	78.9	58.6	0.0	0.0
July	21.6	9.1	106.1	1.3	137.9	92.6	13.3	0.0	0.0
August	20.4	8.4	99.1	1.2	119.0	138.0	32.3	0.0	0.0
September	18.8	7.4	90.0	1.0	93.6	25.5	0.0	0.0	35.8
October	13.1	4.3	58.8	1.0	55.8	76.6	20.8	0.0	0.0
November	3.0	0.5	10.3	0.8	8.4	88.7	100.0	1.1	0.0
December	-4.7	0.0	0.0	0.8	0.0	53.4	100.0	53.4	0.0
Total	**9.2**	**44.0**			**649.6**	**1091.8**		**478.0**	**35.8**
					Net Water Surplus	**442.2**	**mm**		

Notes:
- calculations based on Thornthwaite Mather Method
- °C calculated mean of daily temperatures for the month, in degrees Celcius
- I denotes Heat Index
- E denotes Evapotranspiration
- WHC denotes Water Holding Capacity
- A value of 100 mm was used for the water holding capacity of the soils
- Temperature and precipitation data from the Grand River Conservation Authority Shade's Mills climatological station located at latitude 43°23'00"N, longitude 80°17'00"W
- Missing data was infilled with data from the Grand River Conservation Authority's Guelph Lake climatological station

Table H-9: 2018 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-6.9	0.0	0.0	0.8	0.0	87.4	100.0	87.4	0.0
February	-2.5	0.0	0.0	0.8	0.0	81.5	100.0	81.5	0.0
March	-0.5	0.0	0.0	1.0	0.0	32.5	100.0	32.5	0.0
April	3.0	0.5	8.7	1.1	9.7	139.7	100.0	130.0	0.0
May	17.9	6.9	82.4	1.3	104.6	57.3	52.7	0.0	0.0
June	24.4	11.0	121.7	1.3	155.7	86.5	0.0	0.0	16.5
July	23.4	10.3	115.4	1.3	150.0	71.1	0.0	0.0	78.9
August	23.3	10.2	114.8	1.2	137.8	165.5	27.7	0.0	0.0
September	19.4	7.7	91.1	1.0	94.8	51.1	0.0	0.0	15.9
October	9.3	2.6	36.1	1.0	34.3	92.9	58.6	0.0	0.0
November	1.5	0.2	3.6	0.8	2.9	121.4	100.0	77.1	0.0
December	-0.5	0.0	0.0	0.8	0.0	55.3	100.0	55.3	0.0
Total	**9.3**	**49.2**			**689.9**	**1042.2**		**463.8**	**111.4**
					Net Water Surplus	**352.3**	**mm**		

Table H-10: 2019 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-6.7	0.0	0.0	0.8	0.0	74.7	100.0	74.7	0.0
February	-4.8	0.0	0.0	0.8	0.0	66.4	100.0	66.4	0.0
March	-1.5	0.0	0.0	1.0	0.0	73.4	100.0	73.4	0.0
April	5.9	1.3	23.9	1.1	26.7	99.3	100.0	72.6	0.0
May	12.8	4.1	58.3	1.3	74.0	123.3	100.0	49.3	0.0
June	18.8	7.4	90.8	1.3	116.3	79.8	63.5	0.0	0.0
July	23.7	10.5	118.7	1.3	154.3	143.0	52.2	0.0	0.0
August	21.3	8.9	104.9	1.2	125.9	64.6	0.0	0.0	9.1
September	17.8	6.8	85.3	1.0	88.7	79.5	0.0	0.0	9.2
October	10.6	3.1	46.9	1.0	44.6	141.1	96.5	0.0	0.0
November	0.9	0.1	2.7	0.8	2.2	62.4	100.0	56.7	0.0
December	-0.9	0.0	0.0	0.8	0.0	55.6	100.0	55.6	0.0
Total	**8.2**	**42.2**			**632.7**	**1063.1**		**448.7**	**18.3**
					Net Water Surplus	**430.4**	**mm**		

Notes:
- calculations based on Thornthwaite Mather Method
- °C calculated mean of daily temperatures for the month, in degrees Celcius
- I denotes Heat Index
- E denotes Evapotranspiration
- WHC denotes Water Holding Capacity
- A value of 100 mm was used for the water holding capacity of the soils
- Temperature and precipitation data from the Grand River Conservation Authority Shade's Mills climatological station located at latitude 43°23'00"N, longitude 80°17'00"W
- Missing data was infilled with data from the Grand River Conservation Authority's Guelph Lake climatological station

Table H-11: 2020 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-1.4	0.0	0.0	0.8	0.0	130.9	100.0	130.9	0.0
February	-3.6	0.0	0.0	0.8	0.0	38.6	100.0	38.6	0.0
March	2.4	0.3	7.7	1.0	7.9	83.4	100.0	75.5	0.0
April	5.8	1.3	22.0	1.1	24.7	43.3	100.0	18.6	0.0
May	12.7	4.1	56.1	1.3	71.3	52.7	81.4	0.0	0.0
June	20.5	8.4	99.4	1.3	127.2	61.7	15.9	0.0	0.0
July	25.0	11.4	125.9	1.3	163.7	58.9	0.0	0.0	88.9
August	22.2	9.5	109.3	1.2	131.2	72.6	0.0	0.0	58.6
September	16.1	5.8	74.5	1.0	77.5	46.4	0.0	0.0	31.1
October	9.3	2.6	38.7	1.0	36.8	91.4	54.6	0.0	0.0
November	6.4	1.5	24.8	0.8	20.1	57.7	92.2	0.0	0.0
December	-0.6	0.0	0.0	0.8	0.0	110.0	100.0	102.2	0.0
Total	**9.6**	**44.8**			**660.3**	**847.6**		**365.9**	**178.6**
					Net Water Surplus	**187.3**	**mm**		

Table H-12: 2021 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-2.7	0.0	0.0	0.8	0.0	32.6	100.0	32.6	0.0
February	-6.1	0.0	0.0	0.8	0.0	54.2	100.0	54.2	0.0
March	3.4	0.6	10.3	1.0	10.5	53.4	100.0	42.9	0.0
April	8.9	2.4	34.4	1.1	38.5	64.9	100.0	26.4	0.0
May	14.1	4.8	61.4	1.3	78.0	33.0	55.0	0.0	0.0
June	22.1	9.5	107.8	1.3	137.9	132.2	49.2	0.0	0.0
July	21.3	8.9	102.9	1.3	133.8	95.3	10.7	0.0	0.0
August	23.8	10.6	118.2	1.2	141.8	83.5	0.0	0.0	47.6
September	17.5	6.6	80.2	1.0	83.4	222.7	100.0	39.3	0.0
October	13.9	4.7	60.4	1.0	57.4	129.7	100.0	72.3	0.0
November	3.6	0.6	11.0	0.8	8.9	46.1	100.0	37.2	0.0
December	0.9	0.1	2.0	0.8	1.6	72.4	100.0	70.8	0.0
Total	**10.1**	**48.7**			**691.9**	**1020.0**		**375.7**	**47.6**
					Net Water Surplus	**328.1**	**mm**		

Notes:
- calculations based on Thornthwaite Mather Method
- °C calculated mean of daily temperatures for the month, in degrees Celcius
- I denotes Heat Index
- E denotes Evapotranspiration
- WHC denotes Water Holding Capacity
- A value of 100 mm was used for the water holding capacity of the soils
- Temperature and precipitation data from the Grand River Conservation Authority Shade's Mills climatological station located at latitude 43°23'00"N, longitude 80°17'00"W
- Missing data was infilled with data from the Grand River Conservation Authority's Guelph Lake climatological station

Table H-13: 2022 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-8.4	0.0	0.0	0.8	0.0	36.6	100.0	36.6	0.0
February	-5.4	0.0	0.0	0.8	0.0	109.7	100.0	109.7	0.0
March	1.0	0.1	2.6	1.0	2.7	64.4	100.0	61.7	0.0
April	6.9	1.6	26.7	1.1	29.9	36.6	100.0	6.7	0.0
May	16.1	5.8	74.0	1.3	94.0	55.1	61.1	0.0	0.0
June	19.8	8.0	95.2	1.3	121.9	57.2	0.0	0.0	3.6
July	22.7	9.8	112.1	1.3	145.7	33.0	0.0	0.0	112.7
August	22.3	9.6	109.8	1.2	131.8	87.2	0.0	0.0	44.6
September	17.8	6.8	83.8	1.0	87.1	28.2	0.0	0.0	58.9
October	10.0	2.8	41.6	1.0	39.5	52.5	13.0	0.0	0.0
November	4.7	0.9	16.9	0.8	13.7	39.7	39.0	0.0	0.0
December	-0.9	0.0	0.0	0.8	0.0	82.1	100.0	21.1	0.0
Total	**8.9**	**45.5**			**666.3**	**682.3**		**235.8**	**219.8**
					Net Water Surplus	**16.0**	**mm**		

Table H-14: 2023 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-2.3	0.0	0.0	0.8	0.0	71.2	100.0	71.2	0.0
February	-2.8	0.0	0.0	0.8	0.0	45.2	100.0	45.2	0.0
March	-0.6	0.0	0.0	1.0	0.0	121.3	100.0	121.3	0.0
April	7.8	1.9	36.4	1.1	40.8	87.2	100.0	46.4	0.0
May	12.2	3.9	59.1	1.3	75.1	55.6	80.5	0.0	0.0
June	17.4	6.6	86.4	1.3	110.6	81.1	51.0	0.0	0.0
July	19.5	7.8	97.3	1.3	126.4	203.2	100.0	27.8	0.0
August	17.8	6.8	88.5	1.2	106.1	116.5	100.0	10.4	0.0
September	16.2	5.9	80.0	1.0	83.2	22.1	38.9	0.0	0.0
October	10.2	2.9	48.5	1.0	46.1	61.0	53.8	0.0	0.0
November	2.2	0.3	9.3	0.8	7.6	42.7	89.0	0.0	0.0
December	1.8	0.2	7.7	0.8	6.0	75.9	100.0	58.9	0.0
Total	**8.3**	**36.4**			**601.8**	**983.0**		**381.2**	**0.0**
					Net Water Surplus	**381.2**	**mm**		

Notes:

- calculations based on Thornthwaite Mather Method
- °C calculated mean of daily temperatures for the month, in degrees Celcius
- I denotes Heat Index
- E denotes Evapotranspiration
- WHC denotes Water Holding Capacity
- A value of 100 mm was used for the water holding capacity of the soils
- Precipitation data from the Grand River Conservation Authority Shade's Mills climatological station located at latitude 43°23'00"N, longitude 80°17'00"W
- 2022 Temperature data from the Grand River Conservation Authority Shade's Mills climatological station located at latitude 43°23'00"N, longitude 80°17'00"W
- 2023 Temperature data from the Environment and Climate Change Canada Kitchener/Waterloo climatological station located at latitude 43°27'39"N, longitude 80

Table H-15: 2024 Water Budget - Shade's Mills Climate Station

Month	Mean Temperature °C	I	E mm	Daylight Factor	E Adj. mm	Total Precipitation mm	WHC mm	Surplus mm	Deficit mm
January	-3.2	0.0	0.0	0.8	0.0	118.0	100.0	118.0	0.0
February	0.5	0.0	0.9	0.8	0.7	26.9	100.0	26.2	0.0
March	3.3	0.5	9.7	1.0	10.0	71.4	100.0	61.4	0.0
April	8.5	2.2	32.1	1.1	36.0	116.4	100.0	80.4	0.0
May	16.5	6.1	74.2	1.3	94.3	99.7	100.0	5.4	0.0
June	21.0	8.7	100.6	1.3	128.8	81.8	53.0	0.0	0.0
July	22.9	10.0	112.3	1.3	146.0	153.3	60.3	0.0	0.0
August	21.9	9.3	106.1	1.2	127.3	104.3	37.3	0.0	0.0
September	19.0	7.5	88.7	1.0	92.3	28.8	0.0	0.0	26.2
October	11.6	3.6	47.6	1.0	45.2	35.2	0.0	0.0	10.0
November	6.5	1.5	22.9	0.8	18.6	53.1	34.5	0.0	0.0
December	-1.5	0.0	0.0	0.8	0.0	87.5	100.0	22.0	0.0
Total	**10.6**	**49.4**			**699.1**	**976.4**		**313.5**	**36.2**
					Net Water Surplus	**277.3**	**mm**		

Notes:
- calculations based on Thornthwaite Mather Method
- °C calculated mean of daily temperatures for the month, in degrees Celcius
- I denotes Heat Index
- E denotes Evapotranspiration
- WHC denotes Water Holding Capacity
- A value of 100 mm was used for the water holding capacity of the soils
- Temperature and precipitation data from the Grand River Conservation Authority Shade's Mills climatological station located at latitude 43°23'00"N, longitude 80°17'00"W
- Missing data was infilled with data from the Grand River Conservation Authority's Guelph Lake climatological station

APPENDIX I

Monthly Water Balance Results

Table I1: Existing Conditions Water Balance Results

					Forested Area			Treed Swamp			Agricultural			Impervious Built-Up Area									
					WHC	300 mm		WHC	250 mm		WHC	150 mm		WHC	90% Precip								
					Total Area (m^2)	49,120		Total Area (m^2)	6,300		Total Area (m^2)	268,588		Total Area (m^2)	402								
					Infiltration Factor	0.9		Infiltration Factor	0.8		Infiltration Factor	0.8		Infiltration Factor	0.0								
Month	Days	Temp	Precipitation	Potential Evapotranspiration	Actual Evapotranspiration	Surplus		Actual Evapotranspiration	Surplus		Actual Evapotranspiration	Surplus		Actual Evapotranspiration	Surplus		Total Surplus	Total Surplus (Runoff and Infiltration)		Total Infiltration		Total Runoff	
		(°C)	(mm)	(mm)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(m^3)	(L/s)	(L/min)	(m^3)	(L/s)	(m^3)	(L/s)
January	31	-6.7	57.0	1	1	22	1,081	1	24	151	1	33	8,863	0	57	23	10,118	3.8	227	8,184	3.1	1,933.8	1
February	28	-6.2	49.0	1	1	36	1,768	1	37	233	1	41	11,012	0	49	20	13,033	5.4	323	10,588	4.4	2,445.5	1
March	31	-1.1	62.0	9	9	71	3,487	9	72	454	9	76	20,413	1	61	24	24,378	9.1	546	19,832	7.4	4,546.4	2
April	30	5.9	76.0	33	33	51	2,505	32	52	328	33	52	13,967	5	71	29	16,828	6.5	390	13,690	5.3	3,138.0	1
May	31	12.5	76.0	77	77	14	688	77	14	88	77	14	3,760	11	65	26	4,562	1.7	102	3,698	1.4	864.6	0
June	30	17.5	76.0	110	110	2	98	110	2	13	110	2	537	16	60	24	672	0.3	16	528	0.2	144.0	0
July	31	20.0	91.0	129	129	1	49	129	1	6	122	1	269	18	73	29	353	0.1	8	264	0.1	89.1	0
August	31	19.0	80.0	113	109	2	98	107	2	13	96	2	537	16	64	26	674	0.3	15	528	0.2	145.4	0
September	30	14.9	82.0	76	72	5	246	70	5	32	65	5	1,343	11	71	29	1,649	0.6	38	1,321	0.5	328.0	0
October	31	8.5	72.0	39	38	7	344	37	7	44	38	7	1,880	6	66	27	2,295	0.9	51	1,849	0.7	445.9	0
November	30	2.5	75.0	13	13	23	1,130	13	23	145	13	25	6,715	2	73	29	8,019	3.1	186	6,504	2.5	1,514.3	1
December	31	-3.1	66.0	3	3	30	1,474	3	31	195	3	35	9,401	0	66	26	11,096	4.1	249	9,003	3.4	2,092.9	1
Total			***862.0***	***604.0***	***595***	***264***	***12,968***	***589***	***270***	***1,701***	***568***	***293***	***78,696***	***86***	***776***	***312***	***93,677***	***36***	***2,150***	***75,989***	***29.1***	***17,688***	***7***
Average		***7.0***																***5.5***	***179***		***4.5***		***1.0***

Notes:

The Surplus values in (mm) are calculated using rainfall, melt and Actual Evapotranspiration

P = ET + R + I + S

Table I2: Operational Conditions Water Balance Results

Forested Area		Treed Swamp		Agricultural (Setback)		Above Water Table Extraction Area (Bare)		Below Water Extraction Area		
WHC	300 mm	WHC	250 mm	WHC	150 mm	WHC	75 mm	WHC	Precip.-Lake Evap	
Total Area (m^2)	49,120	Total Area (m^2)	6,300	Total Area (m^2)	53,911	Total Area (m^2)	6,100	Total Area (m^2)	208,979	215,079
Infiltration Factor	0.9	Infiltration Factor	0.8	Infiltration Factor	0.8	Infiltration Factor	0.5	Infiltration Factor	1.0	

Month	Days	Temp	Precipitation	Potential Evapotranspiration	Actual Evapotranspiration	Surplus		Actual Evapotranspiration	Surplus		Actual Evapotranspiration	Surplus		Actual Evapotranspiration	Surplus		Actual Evapotranspiration	Surplus		Total Surplus	Total Surplus (Runoff and Infiltration)		Total Infiltration		Total Runoff	
		(°C)	(mm)	(mm)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(m^3)	(L/s)	(L/min)	(m^3)	(L/s)	(m^3)	(L/s)
January	31	-6.7	57.0	1	1	22	1,081	1	24	151	1	33	1,779	1	40	244	93	-36	-7,514	-4,259	-1.6	-95	-4,875	-1.8	616.1	0
February	28	-6.2	49.0	1	1	36	1,768	1	37	233	1	41	2,210	1	43	262	52	-3	-690	3,784	1.6	94	2,987	1.2	796.7	0
March	31	-1.1	62.0	9	9	71	3,487	9	72	454	9	76	4,097	9	77	470	37	25	5,170	13,678	5.1	306	12,184	4.5	1,493.8	1
April	30	5.9	76.0	33	33	51	2,505	32	52	328	33	52	2,803	32	52	317	16	60	12,463	18,416	7.1	426	17,381	6.7	1,035.3	0
May	31	12.5	76.0	77	77	14	688	77	14	88	77	14	755	77	14	85	7	69	14,442	16,058	6.0	360	15,778	5.9	280.1	0
June	30	17.5	76.0	110	110	2	98	110	2	13	110	2	108	103	2	12	15	61	12,666	12,897	5.0	299	12,857	5.0	40.0	0
July	31	20.0	91.0	129	129	1	49	129	1	6	122	1	54	101	2	12	37	54	11,277	11,399	4.3	255	11,376	4.2	23.1	0
August	31	19.0	80.0	113	109	2	98	107	2	13	96	2	108	83	2	12	65	15	3,230	3,460	1.3	78	3,420	1.3	40.0	0
September	30	14.9	82.0	76	72	5	246	70	5	32	65	5	270	63	6	37	77	5	1,064	1,648	0.6	38	1,544	0.6	103.1	0
October	31	8.5	72.0	39	38	7	344	37	7	44	38	7	377	37	14	85	82	-10	-2,033	-1,182	-0.4	-26	-1,344	-0.5	161.4	0
November	30	2.5	75.0	13	13	23	1,130	13	23	145	13	25	1,348	13	40	244	82	-7	-1,449	1,418	0.5	33	884	0.3	533.5	0
December	31	-3.1	66.0	3	3	30	1,474	3	31	195	3	35	1,887	3	47	287	100	-34	-7,038	-3,196	-1.2	-72	-3,903	-1.5	707.2	0
Total			***862.0***	***604.0***	***595***	***264***	***12,968***	***589***	***270***	***1,701***	***568***	***293***	***15,796***	***523***	***339***	***2,068***	***663***	***199***	***41,588***	***74,120***	***28***	***1,695***	***68,290***	***26.0***	***5,830***	***2***
Average		***7.0***																			***2.4***	***141***		***2.2***		***0.2***

Notes:

The Surplus values in (mm) are calculated using rainfall, melt and Actual Evapotranspiration

P = ET + R + I + S

Table I3: Rehabilitated Conditions Water Balance Results

					Forested Area			Treed Swamp			Agricultural (Setback)			Revegetated Above Water Table Extraction Area (Bare)			Below Water Extraction Area									
					WHC	300 mm		WHC	250 mm		WHC	150 mm		WHC	150 mm		WHC	Precip.-Lake Evap								
					Total Area (m^2)	49,120		Total Area (m^2)	6,300		Total Area (m^2)	53,911		Total Area (m^2)	6,100		Total Area (m^2)	208,979								
					Infiltration Factor	0.9		Infiltration Factor	0.8		Infiltration Facto	0.8		Infiltration Factor	0.8		Infiltration Factor	1.00								
Month	**Days**	**Temp**	**Precipitation**	**Potential Evapotranspiration**	**Actual Evapotranspiration**	**Surplus**		**Actual Evapotranspiration**	**Surplus**		**Actual Evapotranspiration**	**Surplus**		**Actual Evapotranspiration**	**Surplus**		**Actual Evapotranspiration**	**Surplus**		**Total Surplus**	**Total Surplus (Runoff and Infiltration)**		**Total Infiltration**		**Total Runoff**	
		(°C)	(mm)	(mm)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(mm)	(mm)	(m^3)	(m^3)	(L/s)	(L/min)	(m^3)	(L/s)	(m^3)	(L/s)
January	31	-6.7	57	1	1	22	1,081	1	24	151	1	33	1,779	1	33	201	93	-36	-7,514	-4,302	-1.6	-96	-4,836	-1.8	534.4	0
February	28	-6.2	49	1	1	36	1,768	1	37	233	1	41	2,210	1	41	250	52	-3	-690	3,772	1.6	94	3,056	1.3	715.5	0
March	31	-1.1	62	9	9	71	3,487	9	72	454	9	76	4,097	9	76	464	37	25	5,170	13,672	5.1	306	12,320	4.6	1,351.7	1
April	30	5.9	76	33	33	51	2,505	33	52	328	33	52	2,803	33	52	317	16	60	12,463	18,416	7.1	426	17,476	6.7	940.2	0
May	31	12.5	76	77	77	14	688	77	14	88	77	14	755	77	14	85	7	69	14,442	16,058	6.0	360	15,804	5.9	254.4	0
June	30	17.5	76	110	110	2	98	110	2	13	110	2	108	110	2	12	15	61	12,666	12,897	5.0	299	12,860	5.0	36.3	0
July	31	20.0	91	129	129	1	49	128	1	6	122	1	54	122	1	6	37	54	11,277	11,393	4.3	255	11,375	4.2	18.2	0
August	31	19.0	80	113	109	2	98	107	2	13	96	2	108	96	2	12	65	15	3,230	3,460	1.3	78	3,424	1.3	36.3	0
September	30	14.9	82	76	72	5	246	70	5	32	65	5	270	65	5	31	77	5	1,064	1,641	0.6	38	1,551	0.6	90.9	0
October	31	8.5	72	39	38	7	344	38	7	44	38	7	377	38	7	43	82	-10	-2,033	-1,225	-0.5	-27	-1,352	-0.5	127.2	0
November	30	2.5	75	13	13	23	1,130	13	23	145	13	25	1,348	13	25	153	82	-7	-1,449	1,326	0.5	31	884	0.3	442.0	0
December	31	-3.1	66	3	3	30	1,474	3	31	195	3	35	1,887	3	35	214	100	-34	-7,038	-3,269	-1.2	-73	-3,875	-1.4	606.5	0
Total			***862.0***	***604.0***	***595***	***264***	***12,968***	***590***	***270***	***1,701***	***568***	***293***	***15,796***	***568***	***293***	***1,787***	***663***	***199***	***41,588***	***73,840***	***28***	***1,689***	***68,686***	***26.2***	***5,154***	***2***
Average		***7.0***																			***2.3***	***141***		***2.2***		***0.2***

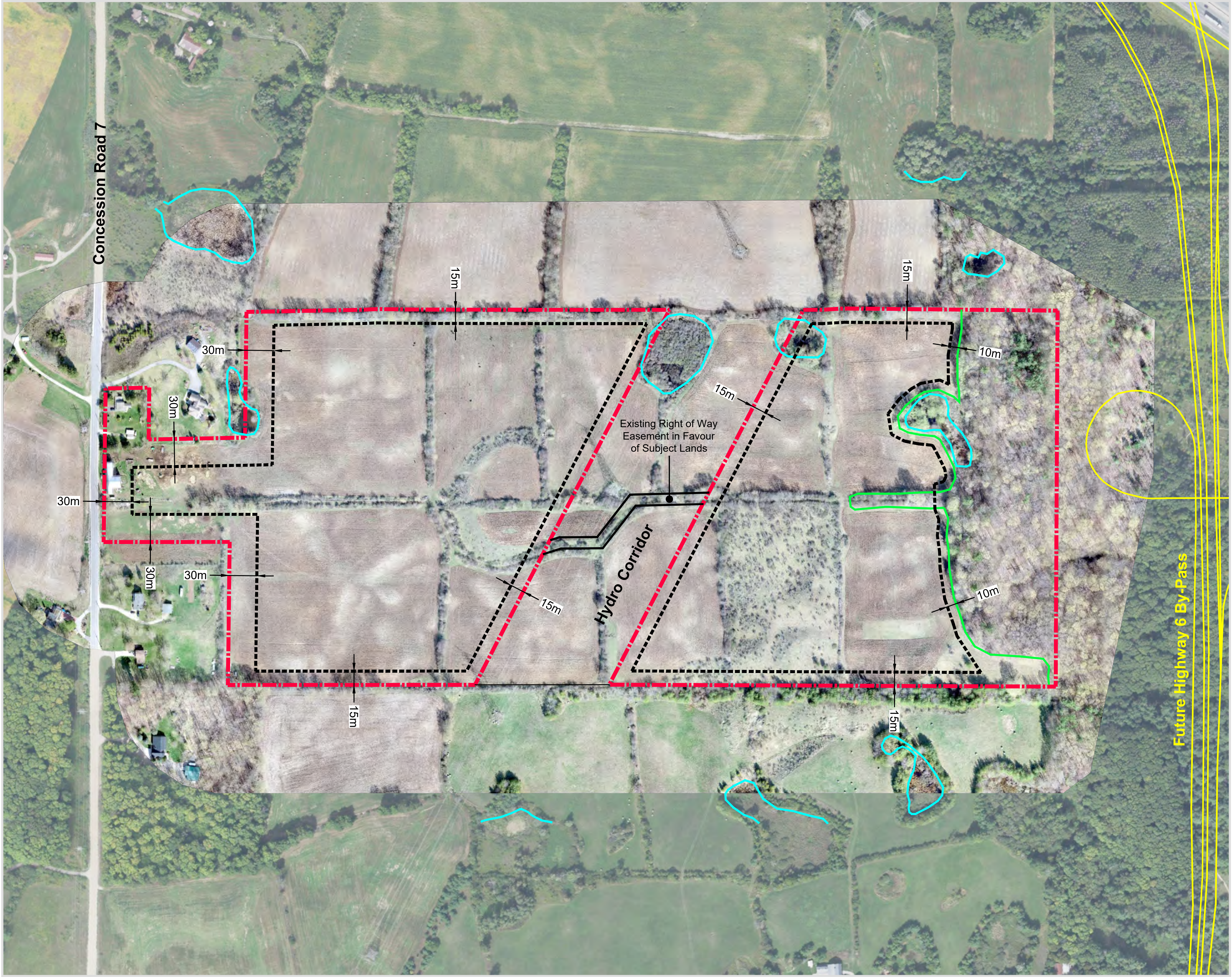
Notes:

The Surplus v The Surplus values in (mm) are calculated using rainfall, melt and Actual Evapotranspiration

P = ET + R + ***P = ET + R + I + S***

APPENDIX J

Operational Conditions Footprint



Safarik Pit Concept Plan

CBM
Part of Lot 29
Concession 7
Township of Puslinch
County of Wellington

Legend

- 🟥 Proposed Licensed Area (±32 ha/ 80 ac)
- ⬚ Preliminary Limit of Extraction (± 22 ha/ 54 ac) (Subject to Further Details/Studies)
- 🟦 Wetland (GRCA)
- 🟩 Greenlands System (OP)

*The extraction limit is subject to further review and technical study.

Base Map Sources:
Imagery - Bing 2020, Drone Survey 2023
Boundary - Parcel Fabric (vuMap - First Base Solutions)

DATE: January 11, 2024

SCALE: ±1:4,000

FILE: Y321AR

DRAWN: DGS

north

K:\Y321AR-CBM-Neubauer Pit Expansion-Puslinch\Rpt\Neubauer Pit Expansion Above Water Table Extraction Concept Plan January11 2024.dwg

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