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GEOTECHNICAL INVESTIGATION REPORT ENVIRONMENTAL ASSESSMENT AND PRELIMINARY DESIGN FOR DRAINAGE IMPROVEMENTS OF HIGHWAY 50 FROM MAYFIELD ROAD TO HEALEY ROAD THE REGION OF PEEL

Report

to

R.V. Anderson Associates Limited

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APPENDICES

1. INTRODUCTION

This report presents the results of a geotechnical investigation carried out by Thurber Engineering Ltd. (Thurber) in support of the Class Environmental Assessment (Class EA) and Preliminary Design for stormwater management/drainage improvements of Highway 50 in the Town of Caledon, Ontario. The limits of the project are from Mayfield Road to Healey Road for a total length of approximately 2.4 km (Site).

The purpose of the investigation was to explore the subsurface conditions at the Site, and based on the data obtained, to provide record of borehole sheets, a borehole location plan, a written description of the subsurface conditions, and geotechnical recommendations regarding design of excavations, groundwater control, base stability, backfill, pipe bedding, and embankment slope stability.

A hydrogeological investigation was completed concurrently with the geotechnical investigation. The results of the hydrogeological investigation will be reported under separate cover and should be read in conjunction with this report.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2. SITE DESCRIPTION

This section of Highway 50 between Mayfield Road and Healey Road presently consists of a five-lane urban roadway with two lanes in the north bound direction, two lanes in the southbound direction, and a central turning lane. Concrete curbs and gutters abut the paved lanes on both sides of the road and shallow ditches lay beyond the curb on both sides.

A recent condition assessment of the roads drainage infrastructure has confirmed the need for a quick rehabilitation of 17 entrance culverts (and crossings) on the east and west side from McEwan Drive to Mayfield Road. The study area falls within the Humber River watershed which falls under the jurisdiction of Toronto and Region Conservation Authority (TRCA).

The north half of the study area from approximately Industrial Road to Healey Road, is located within the South Slope physiographic region, an area consisting primarily of till deposits forming the south slope of the Oak Ridges Moraine. The south half of the study area, from Industrial Road to Mayfield Road, is located within the Peel Plains physiographic region which also consist primarily of till deposits. Surficial geology maps indicate the surface soils to consist of clay to silt textured till derived from glaciolacustrine deposits. The bedrock underlying the corridor consists

of shale and limestone of the Georgian Bay formation, and is anticipated at depths of greater than 40 m.

The land use adjacent to the corridor is a mix of industrial and commercial properties, with a few residential properties located on the eastern side at the southern end of the site.

3. INVESTIGATION PROCEDURES

The field investigation was carried out between March 4 and May 26, 2020 and consisted of 25 boreholes drilled to depths of 3.7 to 4.4 m. The approximate locations of the boreholes are shown on the Borehole Location Plans in Appendix C.

The borehole locations were established in the field by Thurber relative to existing site features and using a handheld GPS receiver. The ground surface elevations at the borehole locations were interpreted using topographic survey data provided by R.V. Anderson Associates.

All borehole locations were cleared of utilities prior to commencement of drilling. The boreholes were repositioned as necessary in consideration of surface features, underground utilities, and restricted site access.

All boreholes were drilled using solid stem augers powered by a truck-mounted drill rig. Samples of the overburden soils were obtained from the boreholes at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT).

The field investigation was supervised on a full-time basis by a member of Thurber's technical staff who directed the drilling, sampling and in-situ testing operations, logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

Groundwater conditions were observed in the open boreholes throughout the drilling operations. Monitoring wells were installed in selected boreholes to permit monitoring of the groundwater levels at the site. The monitoring wells consisted of 50 mm diameter PVC pipe with a slotted screen sealed at a selected depth within the borehole. The installation details are summarized in Table 3.1 below.

Table 3.1 – Monitoring Well Details

Borehole No.	Monitoring Well Tip		Slotted Screen Length (m)
	Depth (m)	Elevation (m)	
19-02	3.6	223.3	1.5
19-06	3.8	227.2	1.5
19-08	3.6	229.4	1.5
19-12	4.0	234.7	1.5
19-16	3.8	235.9	1.5
20-19	3.6	238.8	1.5
20-20	3.6	239.4	1.5
20-24	3.8	242.1	1.5

The boreholes in which no monitoring wells/piezometers were installed were backfilled in general accordance with Ontario Regulation 903.

The results of the field drilling, sampling and geotechnical laboratory testing are presented on the Record of Borehole sheets in Appendix A.

4. LABORATORY TESTING

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to grain size distribution analyses (hydrometer and/or sieve) and Atterberg Limits testing, where appropriate. Laboratory testing results are summarized on the Record of Borehole sheets included in Appendix A and are presented on the figures included in Appendix B.

To evaluate the soils potential to cause corrosion to buried structures, selected soil samples recovered from the boreholes were submitted to SGS Laboratories for analysis of soil corrosivity properties. The sample locations and depths of the submitted samples are summarized below in Table 4.1.

Table 4.1- Samples Selected for Corrosivity Testing

Borehole	Sample No.	Depth (m)	Soil Type	Analysis
20-01	SS2	0.6 – 1.2	Silty Clay Till	Corrosivity
20-07	SS3	1.5 – 2.1	Silty Clay Till	Corrosivity
20-08	SS3	1.5 – 2.1	Silty Clay Till	Corrosivity
20-09	SS4	2.3 – 2.9	Silty Clay Till	Corrosivity

Borehole	Sample No.	Depth (m)	Soil Type	Analysis
20-11	SS3	1.5 – 2.1	Silty Sand	Corrosivity
20-13	SS3	1.5 – 2.1	Silty Clay Till	Corrosivity
20-17	SS2	0.6 – 1.2	Silty Clay Till	Corrosivity
20-20	SS3	1.5 – 2.1	Silty Clay Fill	Corrosivity
20-22	SS3	1.5 – 2.1	Silty Clay Till	Corrosivity
20-25	SS3	1.5 – 2.1	Silty Clay Till	Corrosivity

The results of the analyses are provided on the Certificates of Analysis in Appendix D.

5. DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix A. A general description of the stratigraphy, based on the conditions encountered in the boreholes, is given in the following paragraphs. However, the factual data presented on the Record of Borehole sheets takes precedence over this general description and must be used for interpretation of the site conditions. It should be recognized and expected that soil conditions will vary between and beyond borehole locations.

The subsurface stratigraphy encountered in the boreholes typically comprises a surficial pavement structure underlain by sand fill which is further underlain by native silty clay till.

More detailed descriptions of the individual strata encountered during the investigation are provided below.

5.1 Pavement Structure

The existing pavement structure encountered in the boreholes on Highway 50 consisted of 150 mm to 200 mm of asphalt over 0.4 to 1.9 m of sand and gravel to sand fill. The sand fill typically contained some gravel and trace to some silt.

SPT ‘N’ values obtained fully within the pavement granular material ranged from 7 to 85 blows per 0.3 m of penetration, indicating a loose to very dense condition. Moisture contents typically ranged from 3 to 10 percent with isolated values of up to 20 percent.

The results of a grain size distribution analysis carried out on a sample of the granular material are presented on the Record of Borehole sheet included in Appendix A and on Figure B1 of Appendix B. The results of the grain size distribution analysis are summarized below:

Soil Particle	Percentage (%)
Gravel	20 to 32
Sand	60 to 72
Silt & Clay	8

5.2 Sand to Gravelly Sand Fill

Sand fill containing some gravel to gravelly, trace silt to silty, was encountered in Boreholes 20-02, 20-04, 20-10, 20-11, 20-12, 20-13, and 20-16 beneath the pavement structure. Where fully penetrated the sand to gravelly sand fill ranged in thickness from 0.6 m to 3.3 m thick and extended to depths of between 1.5 and 3.7 m (Elevations 238.3 m and 225.0 m). Borehole 20-12 was terminated within the gravelly sand at a dept of approximately 4.4 m (Elevation 233.0 m).

SPT 'N' values within the sand fill typically ranged from 9 to 35 blows per 0.3 m of penetration, with a few values reaching as high as 100 blows per 0.15 m of penetration, indicating a loose to dense condition. Moisture contents typically ranged from 3 to 9 percent with isolated values of up to 22 percent.

The results of a grain size distribution analysis carried out on a sample of the sand to gravely sand fill are presented on the Record of Borehole sheet included in Appendix A and on Figure B2 of Appendix B. The results of the grain size distribution analysis are summarized below:

Soil Particle	Percentage (%)
Gravel	22 to 29
Sand	49 to 54
Silt & Clay	22 to 24

5.3 Silty Clay Fill

Silty clay fill containing trace sand to sandy and trace gravel was encountered in Boreholes 20-02 and 20-20 at depths of 0.9 and 1.4 m (Elevation 226.0 and 241.6 m), respectively. The silty clay fill was between 0.5 m to 0.9 m thick and extended to depths of 1.4 m and 2.3 m (Elevation 225.5 and 240.7 m) in Boreholes 20-02 and 20-20 respectively.

SPT 'N' values within the silty clay typically ranged from 6 to 10 blows per 0.3 m penetration indicating a stiff condition. Moisture contents typically ranged from 16 to 19 percent.

The results of a grain size distribution analyses carried out on a sample of the silty clay fill is presented on the Record of Borehole sheet included in Appendix A and on Figure B3 of Appendix B. The results of the grain size distribution analysis are summarized below:

Soil Particle	Percentage (%)
Gravel	6
Sand	23
Silt	44
Clay	27

5.4 Silty Clay Till

Silty clay till, containing some sand to sandy, and trace to some gravel, was encountered below the fill soils in all boreholes with the exception of Borehole 20-12. All boreholes, with the exception of Borehole 20-12, were terminated within the silty clay till at depths of between 3.7 to 4.4 m (Elevations 222.1 m to 242.3 m). While not encountered during the drilling, till soils in this area can often contain cobbles and boulders.

SPT 'N' values within the silty clay till ranged from 4 blows per 0.3 m penetration to 50 blows per 0.1 m penetration, with typical values between 15 to 50 blows indicating a very stiff to hard condition. Moisture contents typically ranged from 9 to 23 percent with isolated values of up to 33 percent.

The results of grain size distribution analyses carried out on selected samples of the silty clay till are presented on the Record of Borehole sheets included in Appendix A and on Figures B4 to B8 of Appendix B. The results of the grain size distribution analyses are summarized below:

Soil Particle	Percentage (%)
Gravel	0 to 16
Sand	10 to 39
Silt	37 to 49
Clay	19 to 42

The results of the Atterberg Limits testing are summarized below:

Index Property	Percentage (%)
Plastic Limit	14 to 21
Liquid Limit	25 to 46
Plasticity Index	10 to 25

The results of the Atterberg Limits testing indicate the till is of low to medium plasticity with group symbols of CL to CI.

5.5 Groundwater Conditions

Groundwater conditions were observed in the open boreholes throughout the drilling operations. Upon completion of augering, water levels were recorded in the open boreholes. Monitoring wells were installed in selected boreholes to permit monitoring of the groundwater levels. The groundwater levels measured in the open boreholes upon completion and subsequently in the monitoring wells are summarized in Table 5.1.

The groundwater levels are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater levels may be at a higher elevation after periods of significant or prolonged precipitation or during spring snowmelt.

Table 5.1 – Groundwater Levels and Observations

Borehole	Date	Details	Water Level (m)	
			Depth	Elevation
20-01	March 11, 2020	Open Borehole	Dry	-
20-02	May 26, 2020	Monitoring well	3.3	223.7
20-03	March 11, 2020	Open Borehole	Dry	-
20-04	April 6, 2020	Open Borehole	2.4	226.3
20-05	March 11, 2020	Open Borehole	Dry	-
20-06	May 26, 2020	Monitoring Well	3.0	228.0
20-07	March 11, 2020	Open Borehole	Dry	-
20-08	May 26, 2020	Monitoring Well	3.0	230.0
20-09	March 5, 2020	Open Borehole	Dry	-
20-10	March 5, 2020	Open Borehole	2.1	233.1
20-11	March 10, 2020	Open Borehole	Dry	-
20-12	May 26, 2020	Monitoring Well	2.8	234.6

Borehole	Date	Details	Water Level (m)	
			Depth	Elevation
20-13	March 10, 2020	Open Borehole	Dry	-
20-14	March 9, 2020	Open Borehole	Dry	-
20-15	April 7, 2020	Open Borehole	Dry	-
20-16	May 26, 2020	Monitoring Well	3.1	236.6
20-17	March 17, 2020	Open Borehole	Dry	-
20-18	March 9, 2020	Open Borehole	Dry	-
20-19	May 26, 2020	Monitoring Well	2.1	240.3
20-20	May 26, 2020	Monitoring Well	1.1	241.9
20-21	March 4, 2020	Open Borehole	Dry	-
20-22	March 4, 2020	Open Borehole	Dry	-
20-23	March 4, 2020	Open Borehole	Dry	-
20-24	May 26, 2020	Monitoring Well	2.2	243.7
20-25	March 4, 2020	Open Borehole	Dry	-

6. CORROSIVITY AND SULPHATE TEST RESULTS

During the investigation, samples of the native silty clay till and fill soils from across the site were submitted for analytical testing corrosivity parameters and sulphate. The results of the analytical tests are shown in Table 6.1. The laboratory certificates of analysis are presented in Appendix D.

Table 6.1 – Analytical Test Results

Borehole	Test Results						
	Sulphide (%)	Chloride (µg/g)	Sulphate (µg/g)	pH	Electrical Conductivity (µS/cm)	Resistivity (Ohms.cm)	Redox Potential (mV)
20-01 SS2	<0.04	1600	110	8.10	2110	474	225
20-07 SS3	<0.04	1800	77	8.17	1300	769	244
20-08 SS3	<0.04	680	24	8.08	1350	740	276

Borehole	Test Results						
	Sulphide (%)	Chloride (µg/g)	Sulphate (µg/g)	pH	Electrical Conductivity (µS/cm)	Resistivity (Ohms.cm)	Redox Potential (mV)
20-09 SS4	<0.04	650	73	8.32	1350	743	275
20-11 SS3	<0.04	1300	79	8.21	1600	625	220
20-13 SS3	0.10	530	380	8.45	1680	596	231
20-17 SS2	<0.04	880	230	8.46	2580	388	186
20-20 SS3	<0.04	500	71	8.91	2280	439	237
20-22 SS3	<0.04	1100	68	8.42	1900	526	226
20-25 SS3	<0.04	1200	200	8.20	2570	389	284

7. ENGINEERING DISCUSSION AND RECOMMENDATIONS

This section of the report provides interpretation of the geotechnical data and presents comments and recommendations for design and construction of the low impact drainage improvements including pipe bedding and backfill, excavations and dewatering, culverts replacements, embankments and lateral earth pressures.

The recommendations are based on the subsurface soil and groundwater conditions encountered during the investigation. The soil conditions may vary between and beyond the borehole locations, and accordingly geotechnical inspection during construction is important to assess any variation of subsurface conditions and to provide additional recommendations if necessitated by such variations.

The interpretation and recommendations are intended for the use of the design consultant and shall not be relied upon by any other parties including the construction contractor or used for any purposes other than development of the project design. Comments on construction methodology and equipment, where presented, are provided only to highlight those aspects that could affect the design of the project. Contractors must make their own assessment of the factual information presented in previous sections of the report, and the implications on equipment selection, construction methodology, and scheduling.

7.1 Excavations and Dewatering

Installed monitoring wells across the site indicate the groundwater table typically ranged from 2.1 m to 3.3 m below existing ground surface elevation, with a localized water table as high as 1.1 m below ground surface at one location. Considering the consistency and relatively low permeability of the silty clay till soil, dewatering of shallow excavations using sumps and pumps is considered to be feasible. It is anticipated that most excavations for LID applications will not extend below the groundwater level, however provisions should be made for control of any surface water run-off and subsurface seepage from any wet water-bearing sandy fill soils above the till or sand seams within the till.

For excavations extending below the groundwater elevation, the hydrogeological reported completed by Thurber in tandem with the geotechnical investigation should be referred to for control on groundwater.

All excavations should conform with the requirements of the latest edition of the Ontario Occupations Health & safety Act (OHSA), its regulation and other applicable local regulations. For the purposes of OHSA, the native very stiff to hard silty clay encountered across the site can

be classified as Type 2 soil where above the groundwater level and can be classified as Type 4 soil when below the groundwater level. The overlying sand to gravelly sand fill can be classified as Type 3 soil.

The excavation and backfilling for culverts should be carried out in accordance with OPSS 902.

Slopes of temporarily unsupported cuts should conform with the requirements of OHSA. Flatter slopes may be required at locations where water seepage or sloughing occurs during excavation. Where space restrictions preclude excavation of inclined slopes, a trench box or braced excavation should be employed for worker protection.

Temporary shoring, if required, should be designed by a licensed Professional Engineer experienced in design of shoring systems. The design of all members in the shoring system should include the effects of surcharge loads such as those imposed by adjacent utilities and construction equipment. Soil should not be stockpiled adjacent to the excavation.

Use of a hydraulic excavator should be suitable for excavation in the overburden soils. The selection of the method of excavation is the responsibility of the contractor and must be based on their equipment, experience and interpretation of the site conditions. Provision must be made for the handling of pavement materials, potential obstructions in the fill, and possible cobbles, boulders and rock slabs in the till.

7.2 Pipe Bedding and Backfill

It is understood that storm sewers may be required as part of the LID applications. Prior to placement of the pipe bedding, the base of the sewer trenches should be maintained in a dry condition, free of loose, disturbed material. The pipe must be placed on a uniformly competent subgrade. Pipe bedding materials, compaction and cover should follow OPSD 802.030 to 803.034, and/or Region of Peel specifications.

In areas where a less competent subgrade is encountered, it may be necessary to increase the bedding thickness. Any excessively soft, loose or compressible materials at the pipe subgrade should be subexcavated and replaced with OPS Granular A material compacted to at least 95% of Standard Proctor maximum dry density (SPMDD).

Trench backfill materials should be placed in loose lift thicknesses not exceeding 200 mm. Where trenches are located beneath the roadway, OPSS Granular A or B material compacted to 100% SPMDD, 19 mm or 50 mm crusher run limestone, or unshrinkable fill should be used as backfill. For trenches located outside of the roadway, the portion of the trench above the pipe cover can

be backfilled with unfrozen excavated native soil provided it is free of organics, debris and other deleterious materials. Approved soil backfill should be compacted to at least 98% of its SPMMD at a placement moisture content within about 2% of the optimum moisture content for efficient compaction. The till must be adequately broken down and compacted in the trench.

7.3 Corrosion and Sulphate Attack Potential

The results of the corrosivity and sulphate analytical conducted on the native soil and sand fill indicate the following conditions at the locations tested:

- High chloride content of the silty clay till and fill soils, indicates the surrounding soil may be corrosive to concrete elements. The risk of sulphate attack on concrete from the native or fill soil is negligible. The effect of road deicing salt should also be considered when selecting the class of concrete.
- Due to the generally low resistivity of the soil encountered across the site, the potential for corrosion on steel, cast iron and other metals is considered to be very severe.
- Appropriate protection measures are recommended for concrete and metal structural elements. The effect of road deicing salt should be considered while selecting the corrosion protection measures.

7.4 Lateral Earth Pressures

Lateral earth pressures acting on any buried structures may be assumed to impose a triangularly distributed load. For a fully drained backfill, the pressures should be computed in accordance with the CHBDC, but are generally given by the expression:

$$p = K(\gamma H + q)$$

where p = lateral earth pressure acting at depth H, kPa

K = earth pressure coefficient

γ = unit weight of retained soil or backfill, kN/m^3

H = depth below top of wall where pressure is computed, m

q = surcharge pressure including traffic loads, kPa

Table 6.3 lists the unfactored parameters recommended for design, assuming an essentially level ground surface behind and in front of the walls:

Table 6.3 – Earth Pressure Parameters

Parameter	Retained Material	
	OPSS Granular A or Granular B Type II	OPSS Granular B Type I
Unit Weight, kN/m^3	22	21
Friction Angle, degrees	35	32
Active Pressure Coefficient, K_a	0.27	0.31
At-Rest Pressure Coefficient, K_0	0.43	0.47
Passive Pressure Coefficient, K_p	3.7	3.3

The use of a material with a high friction angle and low active pressure coefficient (e.g. Granular A, Granular B Type II) is preferred as it results in lower earth pressures acting on the structure.

The backfill should be placed and compacted in loose thin lifts to a minimum of 95 percent of the Standard Proctor Maximum Dry Density within 2 percent of its optimum moisture content (98 percent when within 300 mm of design subgrade surface in areas of proposed pavement surface). No dumping of backfill material should be permitted in such a way that the successive layers slope downward toward the wall. The layers should be horizontal or slope downward away from the wall.

If lateral movement is not permissible and/or the structure is restrained from lateral yielding, the at-rest earth pressure coefficient, K_o, should be used. If the wall design allows lateral yielding (non-rigid structure), the active earth pressure coefficient, K_a, may be used.

If the design includes a sloping ground surface behind or in front of the structure, the earth pressure parameters will require modification. Thurber should be contacted to provide appropriate earth pressure coefficients for a sloping ground situation.

The earth pressure coefficients in the table above do not include potential compaction effects that must be included in the design.

Design of the structures must incorporate measures to permit drainage of the backfill and avoid potential build-up of hydrostatic pressures behind the walls.

7.5 Pavement Reconstruction

The existing pavement structure encountered at the ground surface on highway 50 typically consisted of 150 mm to 200 mm of asphalt over 400 mm to 1900 mm of sand and gravel to sand fill.

It is understood that reconstruction of the pavement structure may be required in areas of trenching or excavations to construct LID applications and full width pavement reconstruction and/or rehabilitation is not within the terms of reference for this project. In this regard, it is recommended that the pavement structure for reconstruction should match the existing pavement structure thicknesses.

It is assumed that any permanent structure, pipe/sewer, or culvert placement will be backfilled with compacted granular fill, approved earth fill and/or unshrinkable fill (lean concrete) to the new top of subgrade. The subgrade level should allow for the thickness of the existing pavement to maintain lateral drainage at the top of subgrade. Where native backfill materials are used, the exposed subgrade should be compacted and proof-rolled with a heavy roller and examined to identify areas of unstable subgrade. Any soft/wet areas identified shall be subexcavated and replaced with approved material within 2% of Optimum Moisture Content (OMC), and compacted to at least 98% of Standard Proctor Maximum Dry Density (SPMDD).

All new granular subbase material should consist of OPSS Granular B Type II, while the granular base material should consist of OPSS Granular A. All new granular material should meet the requirements of OPSS 1010, and be compacted to 100 percent of the SPMDD within 2 percent of OMC. All granular material should be compacted in accordance with the requirements of OPSS.MUNI 501.

Portions of the existing pavement granular material may be suitable for re-use as a subbase in the new pavement structure, subject to further evaluation and testing during construction. If these materials are proposed for reuse, care must be taken to avoid mixing with underlying native soils during excavation. All materials should be stockpiled separately and protected from environmental disturbances.

For the pavement to function properly, provision must be made for water to drain out of, and not collect in, the granular courses on the pavement subgrade. In this regard, the top of the compacted subgrade should be graded smooth with a minimum crossfall of 3% towards subdrains, catch basins and/or manholes. Catch basins and manholes should be provided with

stub drains just above the drain level to permit drainage of the backfill. Continuity of drainage should be maintained at transitions from existing pavement to new pavement.

7.6 Culvert Replacements

It is understood that culvert replacement of up to 17 CSP entrance culverts along both sides of Highway 50 may be required as part of this project. The existing culverts range in size from 400 mm to 3000 mm.

Recommendations regarding bedding, backfill and foundation design for the culverts are presented below.

7.6.1 Culvert Foundations

Based on the borehole information, the anticipated subgrade for any of the proposed culvert replacements is expected to consist of very stiff to hard silty till or compact to dense gravelly sand to sand fill was encountered across the site. In general, the native till and compact gravelly sand to sand is considered suitable for support of the proposed culverts. To provide uniform support along the lengths of the culverts, in areas where both native till and sand fill is encountered, it is recommended that any loose sand fill be subexcavated and the bedding be placed on the till throughout.

Bedding and backfill to the culverts should be in accordance with OPSD 802.010 or 802.014 as applicable. A minimum 300 mm thickness of compacted Granular A bedding material is recommended below the culvert. The bedding thickness may need to be increased where sub excavation is required to remove deleterious materials below the design excavation level or a less competent subgrade is encountered.

The bedding material should be placed as soon as practical following inspection and approval of the final subgrade as protection from disturbance during construction.

7.6.2 Placement of Culvert Backfill

Culvert backfill should be placed in maximum 200 mm loose lifts and compacted to 98% of the material's Standard Proctor Maximum Dry Density (SPMDD). In order to achieve the desired density, the backfill material should have a moisture content within 2% of the Optimum Moisture Content (OMC).

The backfill should be placed and compacted in simultaneous equal lifts on both sides of the culvert, and the difference of the top of backfill elevation on either side of the culvert should not

be greater than 500 mm at any time. Heavy compaction equipment should not be used adjacent to the walls and roof of the culvert. Compaction equipment to be used adjacent to culverts and retaining walls should be restricted in accordance with OPSS.MUNI 501.

7.7 Construction Inspection and Testing

The successful performance of the pavement, roadwork, and culvert installation will depend largely on good workmanship and quality control during construction. It is therefore recommended that materials testing and inspection by qualified personnel be provided during construction. The inspection and testing should include observation and inspection of foundation and embankment subgrade conditions, compaction testing of road subgrade fill and retaining wall/culvert backfill, asphalt paving and sampling, and concrete testing.

8. CLOSURE

We trust that this report provides the information you require at this time. If you have any questions regarding this report, please contact the undersigned at your earliest convenience.

Yours truly,

Thurber Engineering Ltd.

Cory Zanatta, P.Eng.
Geotechnical Engineer

Renato Pasqualoni, P.Eng.
Review Principal

THURBER

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a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

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Appendix A

Record of Borehole Sheets

RECORD OF BOREHOLE 20-01

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 11, 2020
COMPLETED : March 11, 2020
N 4 855 949.5 E 604 798.4

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		226.50							
		ASPHALT: (200mm)		0.00							
		SAND and **GRAVEL**, brown, moist: (FILL)		0.20	1	GS					
				225.74							
1	Solid Stem Augers	**CLAY**, silty, some to trace sand, trace gravel, firm to hard, brown to grey, moist: (TILL)		0.76	2	SS	6				
2					3	SS	10	Grain Size Analysis: Gr 0%/ Sa 18%/ Si 47%/ Cl 35%			
3					4	SS	21				
4					5	SS	55				
					6	SS	47				
				222.08							
5		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42							
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SZ
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-02

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 11, 2020
COMPLETED : March 11, 2020
N 4 856 017.3 E 604 712.0

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		226.90				
	Solid Stem Augers	**ASPHALT:** (200mm)		0.00				
		SAND and **GRAVEL**, grey, moist: (FILL)		0.20	1	GS		
		SAND, some gravel, brown, moist: (FILL)		226.29 0.61				
1		**CLAY**, silty, sandy, trace gravel, stiff, brown, moist: (FILL)		225.99 0.91	2	SS	10	Grain Size Analysis: Gr 6%/ Sa 23%/ Si 44%/ Cl 27%
		SAND, some gravel, loose, brown, moist: (FILL)		225.53 1.37				
2		**CLAY**, some sand, trace gravel, stiff to hard, grey, moist		225.07 1.83	3	SS	7	
					4	SS	39	
3					5	SS	39	
4					6	SS	29	
				222.48				
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) May 26/20 3.25 223.65		4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION
Bentonite
Filter Sand
Slotted Screen
Sand

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : SZ
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-03

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 11, 2020 — SHEET 1 OF 1
COMPLETED : March 11, 2020 — N 4 856 103.1 E 604 652.0 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		228.20				
		ASPHALT: (200mm)		0.00				
		SAND, some gravel, dense, brown, moist: (FILL)		0.20	1	GS		
1					2	SS	36	
				226.68				
	Solid Stem Augers	**CLAY**, silty, some sand, trace gravel, stiff to hard, brown to grey, moist: (TILL)		1.52	3	SS	12	
2					4	SS	15	
3					5	SS	44	Grain Size Analysis: Gr 1%/ Sa 14%/ Si 44%/ Cl 41%
4					6	SS	44	
				223.78				
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42				
5								
6								
7								
8								
9								

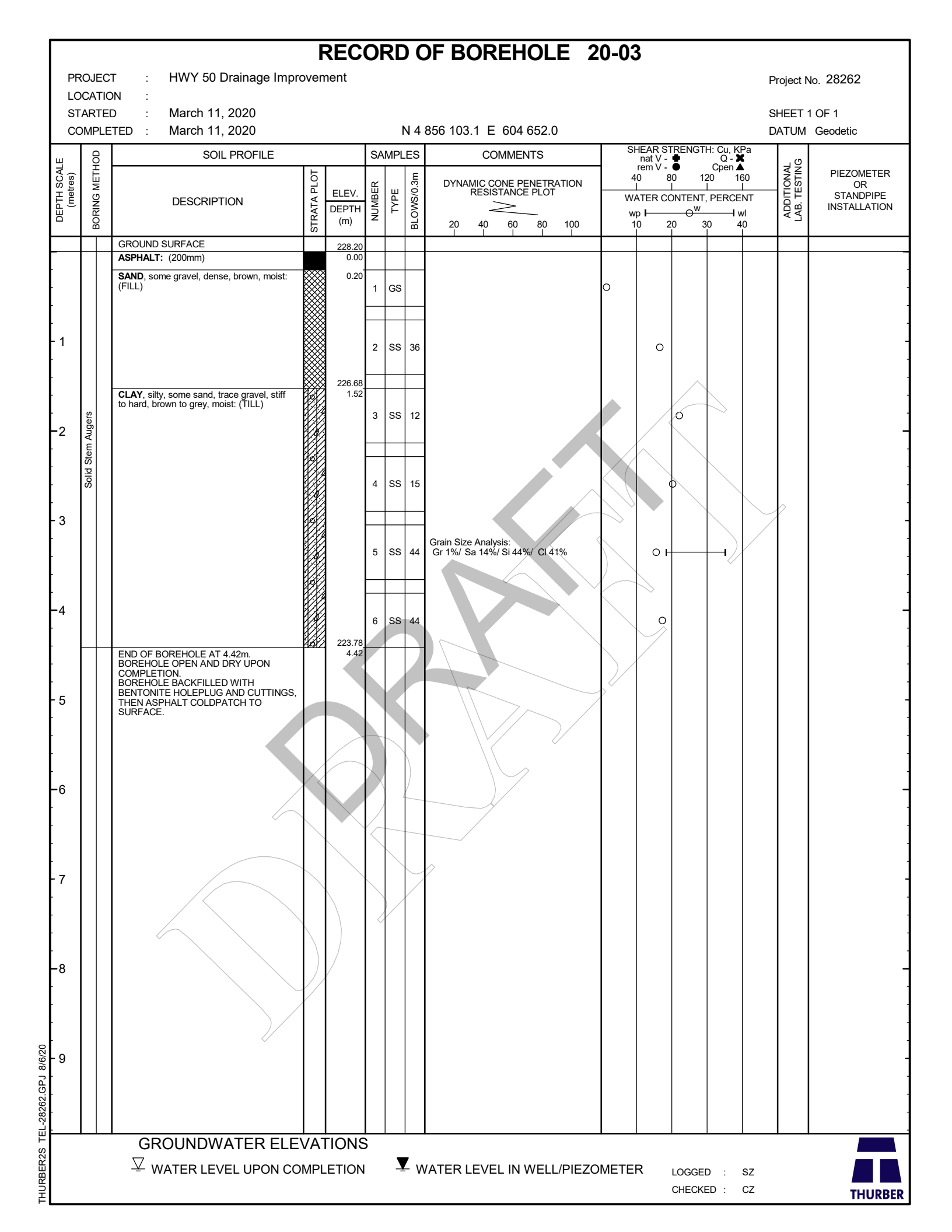
DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SZ
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-04

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : April 6, 2020 — SHEET 1 OF 1
COMPLETED : April 6, 2020 — N 4 856 162.3 E 604 569.3 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		228.70				
		ASPHALT: (150mm)		0.00				
		SAND and **GRAVEL**, trace silt, brown, moist: (FILL)		0.15	1	SS	85	Grain Size Analysis: Gr 32%/ Sa 60%/ Si & Cl 8%
				227.95				
1		**SAND**, trace silt and gravel, cobbles, very dense, brown, moist: (FILL)		0.75	2	SS	50/ 0.150	
					3	SS	100/ 0.150	
2	Solid Stem Augers			226.31				
		SAND, gravelly, very dense to loose, grey, wet: (FILL)		2.39	4	SS	34	
3					5	SS	4	
				225.04				
		CLAY, silty, some sand, stiff, brown, wet: (TILL)		3.66	6	SS	10	
4				224.28				
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND WATER LEVEL AT 2.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SB
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-05

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 11, 2020
COMPLETED : March 11, 2020
N 4 856 244.6 E 604 507.7

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		230.00							
		ASPHALT: (200mm)		0.00							
		SAND, some gravel, brown, moist		0.20	1	GS			○		
				229.39							
	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, stiff to hard, grey to brown, moist: (TILL)		0.61	2	SS	11		○		
1											
					3	SS	32	Grain Size Analysis: Gr 6%/ Sa 21%/ Si 49%/ Cl 24%	○ wp–w–wl		
2											
					4	SS	32		○		
3											
					5	SS	34		○		
4											
					6	SS	24		○		
				225.58							
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SZ
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-06

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : April 6, 2020 — SHEET 1 OF 1
COMPLETED : April 6, 2020 — N 4 856 315.4 E 604 407.8 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		231.00							
		ASPHALT: (150mm)		0.00							Asphalt Concrete
		SAND, trace silt, some gravel, very dense, grey, dry: (FILL)		0.15	1	SS	84		○		
1	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, very stiff to hard, brown, moist: (TILL)		230.09 0.91	2	SS	16		○	>>	Bentonite
2					3	SS	23		○	>>	Filter Sand
					4	SS	33	Grain Size Analysis: Gr 2%/ Sa 23%/ Si 49%/ Cl 26%	○ —	>>	
3					5	SS	58		○	>>	Slotted Screen
4					6	SS	38		○	>>	Sand
				226.58							
5		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.42							
6		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) — Apr 06/20 Dry - ; May 26/20 3.00 228.00									
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER May 26, 2020

LOGGED : SB
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-07

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 11, 2020 — SHEET 1 OF 1
COMPLETED : March 11, 2020 — N 4 856 382.3 E 604 369.0 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp w wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		231.40							
		ASPHALT: (200mm)		0.00							
	Solid Stem Augers	**SAND** and **GRAVEL**, grey, moist		0.20	1	GS					
				230.64							
		SAND, some gravel, brown, moist		0.76							
1		**CLAY**, silty, some to trace sand, trace gravel, very stiff to hard, brown to grey, moist: (TILL)		0.91	2	SS	11				
					3	SS	34				
2					4	SS	27	Grain Size Analysis: Gr 2%/ Sa 17%/ Si 41%/ Cl 40%			
3					5	SS	40				
4					6	SS	25				
				226.98							
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SZ
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-08

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 5, 2020 — SHEET 1 OF 1
COMPLETED : March 5, 2020 — N 4 856 471.9 E 604 254.7 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		233.00				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, very stiff to hard, brown, moist: (TILL)		232.09 0.91	2	SS	15	Grain Size Analysis: Gr 4%/ Sa 24%/ Si 45%/ Cl 27%
2					3	SS	35	
		Very Stiff			4	SS	26	
3					5	SS	24	
4		Hard			6	SS	42	
				228.58				
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 05/20 Dry - May 26/20 3.00 230.00						
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Bentonite; Filter Sand; Slotted Screen; Sand

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : AF
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-09

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 5, 2020 — SHEET 1 OF 1
COMPLETED : March 5, 2020 — N 4 856 526.0 E 604 223.0 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS (DYNAMIC CONE PENETRATION RESISTANCE PLOT)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) / WATER CONTENT, PERCENT (wp, w, wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		234.30							
	Solid Stem Augers	**ASPHALT:** (175mm)		0.00							
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS			○		
1		**CLAY**, silty, sandy to some sand, trace gravel, stiff to firm, brown, moist: (TILL)		233.39 0.91	2	SS	8	Grain Size Analysis: Gr 4%/ Sa 31%/ Si 44%/ Cl 21%	○		
2					3	SS	4		○		
		Very stiff to hard			4	SS	20		○		
3					5	SS	31		○		
4				230.24	6	SS	50/ 0.100		○		
		END OF BOREHOLE AT 4.06m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.06							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-10

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 5, 2020 — SHEET 1 OF 1
COMPLETED : March 5, 2020 — N 4 856 567.9 E 604 157.8 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		235.80				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel to gravelly, brown, moist: (FILL)		0.20	1	GS		
1	Solid Stem Augers	Dense			2	SS	35	
		Compact			3	SS	13	Grain Size Analysis: Gr 22%/Sa 54%/ Si & Cl 24%
2		Loose, wet			4	SS	9	
3		Very loose		232.29	5	SS	3	
		CLAY, silty, some sand, trace gravel, stiff to very stiff, brown to grey, moist: (TILL)		3.51				
4					6	SS	29	
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND WATER LEVEL AT 2.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		231.38 4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-11

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 10, 2020 — SHEET 1 OF 1
COMPLETED : March 10, 2020 — N 4 856 638.0 E 604 108.5 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		236.90				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS		
1		**SAND**, some silt, some gravel, trace clay, dense to loose, brown, moist: (FILL)		235.99 0.91	2	SS	31	
	Solid Stem Augers				3	SS	10	
2		**CLAY**, silty, some sand to sandy, trace gravel, firm to stiff, brown, moist		234.61 2.29	4	SS	7	Grain Size Analysis: Gr 6%/ Sa 24%/ Si 42%/ Cl 28%
3					5	SS	14	
4					6	SS	11	
		END OF BOREHOLE AT 4.06m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		232.48 4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✤ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-12

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 9, 2020
COMPLETED : March 9, 2020
N 4 856 678.3 E 604 043.7

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		237.40				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, and gravel, brown, moist: (FILL)		0.20	1	GS		
				236.49				
1	Solid Stem Augers	**SAND**, gravelly, some silt, trace clay, compact, brown, moist: (FILL)		0.91	2	SS	14	
					3	SS	20	
2					4	SS	16	Grain Size Analysis: Gr 29%/ Sa 49%/ Si & Cl 22%
3					5	SS	15	
4					6	SS	13	
				232.98				
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 09/20 Dry - May 26/20 2.80 234.60						
6								
7								
8								
9								

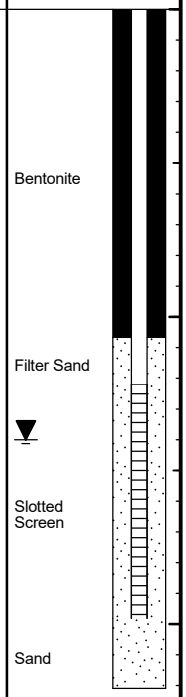
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : MA
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-13

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 10, 2020
COMPLETED : March 10, 2020
N 4 856 744.4 E 603 998.8

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		237.80							
		ASPHALT: (200mm)		0.00							
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS			○		
1		**SAND**, silty, some clay, trace gravel, compact, brown, moist: (FILL)		236.89 0.91	2	SS	25		○		
	Solid Stem Augers	**CLAY**, silty, sandy, trace gravel, stiff to very stiff, brown, moist: (TILL)		236.28 1.52	3	SS	11	Grain Size Analysis: Gr 4%/ Sa 23%/ Si 46%/ Cl 27%	○		
2					4	SS	30		○		
3					5	SS	27		○		
4		Hard			6	SS	71		○		
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		233.38 4.42							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-14

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 9, 2020
COMPLETED : March 9, 2020
N 4 856 800.8 E 603 918.1

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		237.90							
		ASPHALT: (175mm)		0.00							
		SAND and **SILT**, trace gravel, brown, moist: (FILL)		0.18	1	GS			○		
1	Solid Stem Augers	**CLAY**, silty, sandy, trace gravel, very stiff, brown, moist: (TILL)		236.99 0.91	2	SS	19	Grain Size Analysis: Gr 2%/ Sa 26%/ Si 41%/ Cl 31%	○		
2					3	SS	27		○		
		Hard to very stiff			4	SS	34		○		
3					5	SS	36		○		
4					6	SS	23		○		
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		233.48 4.42							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-15

PROJECT : HWY 50 Drainage Improvement
Project No. 28262
LOCATION :
STARTED : April 7, 2020
SHEET 1 OF 1
COMPLETED : April 7, 2020
N 4 856 888.0 E 603 850.7
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		238.60				
		ASPHALT: (150mm)		0.00				
		SAND, trace silt and gravel, trace oxide, dense, brown, moist: (FILL)		0.15	1	SS	46	
1	Solid Stem Augers	**CLAY**, silty, sandy, trace to some gravel, very stiff to hard, brown, moist: (TILL)		237.53 1.07	2	SS	24	
2					3	SS	48	
3					4	SS	63	
					5	SS	66	Grain Size Analysis: Gr 16%/ Sa 21%/ Si 40%/ Cl 23%
4		END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		234.94 3.66				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

>>

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : SB
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-16

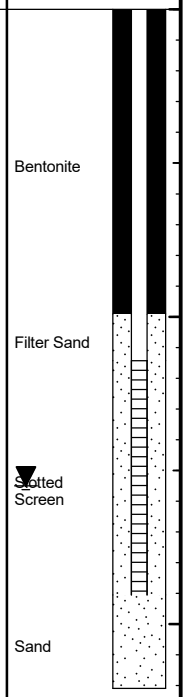
PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 10, 2020 — SHEET 1 OF 1
COMPLETED : March 10, 2020 — N 4 856 940.1 E 603 773.5 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		239.70				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1		**SAND**, silty, some clay, trace gravel, compact, brown, moist: (FILL)		238.79 0.91	2	SS	13	
	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace to some gravel, hard, brown, moist: (TILL)		238.25 1.45	3	SS	30	Grain Size Analysis: Gr 5%/ Sa 21%/ Si 46%/ Cl 28%
2					4	SS	47	
3					5	SS	42	
4		Very Stiff			6	SS	20	
				235.28				
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 10/20 Dry - May 26/20 3.10 236.60						
6								
7								
8								
9								

SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲)
40 80 120 160
WATER CONTENT, PERCENT
wp w wl
10 20 30 40
DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : MA
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-17

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 10, 2020
COMPLETED : March 10, 2020
N 4 857 011.7 E 603 723.6

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		240.90				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand, trace to some gravel, stiff to very stiff, brown, moist: (TILL)		239.99 0.91	2	SS	13	
2					3	SS	26	Grain Size Analysis: Gr 1%/ Sa 17%/ Si 47%/ Cl 35%
		Hard			4	SS	45	
3					5	SS	47	
4					6	SS	34	
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		236.48 4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-18

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 9, 2020
COMPLETED : March 9, 2020
N 4 857 054.5 E 603 656.9

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		241.60							
		ASPHALT: (200mm)		0.00							
		SAND, some silt, trace gravel, brown, moist: (FILL)		0.20	1	GS			○		
1	Solid Stem Augers	**CLAY**, silty, trace sand and gravel, very stiff to hard, brown, moist: (TILL)		240.69 0.91	2	SS	18		○		
2					3	SS	25	Grain Size Analysis: Gr 4%/ Sa 10%/ Si 49%/ Cl 37%	○ —		
3					4	SS	45		○		
					5	SS	44		○		
4					6	SS	31		○		
				237.18 4.42							
5		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.									
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : MA
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-19

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : April 7, 2020
COMPLETED : April 7, 2020

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

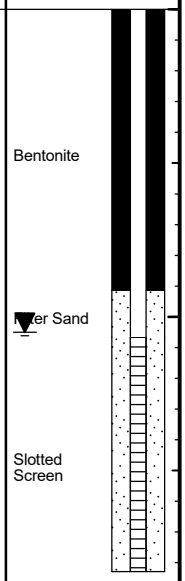
N 4 857 127.1 E 603 605.7

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		242.40				
		ASPHALT: (150mm)		0.00				
		SAND, gravelly, trace silt, very dense, brown, dry: (FILL)		0.15	1	SS	52	Grain Size Analysis: Gr 20%/ Sa 72%/ Si & Cl 8%
	Solid Stem Augers			241.64				
1		**CLAY**, silty, some sand to sandy, trace gravel, very stiff, brown, moist: (TILL)		0.76	2	SS	29	
2					3	SS	47	Grain Size Analysis: Gr 8%/ Sa 25%/ Si 45%/ Cl 22%
					4	SS	87	
3					5	SS	72	
				238.74				
4		END OF BOREHOLE AT 3.66m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		3.66				
5		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) Apr 07/20 / Dry / - May 26/20 / 2.10 / 240.30						
6								
7								
8								
9								

SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160
DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
WATER CONTENT, PERCENT wp w wl 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER May 26, 2020

LOGGED : SB
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-20

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 5, 2020
COMPLETED : March 5, 2020

Project No. 28262
SHEET 1 OF 1
N 4 857 184.7 E 603 516.6
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		243.00				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, trace gravel, brown, moist: (FILL)		0.20	1	GS		
1		Loose			2	SS	9	
		CLAY, silty, trace sand and gravel, firm, grey, moist: (FILL)		241.63 1.37				
2	Solid Stem Augers				3	SS	6	
		CLAY, silty, some sand to sandy, trace gravel, very stiff to hard, grey, wet: (TILL)		240.71 2.29	4	SS	16	
3					5	SS	31	Grain Size Analysis: Gr 5%/ Sa 24%/ Si 45%/ Cl 26%
4					6	SS	28	
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		238.58 4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 05/20 3.73 239.27 May 26/20 1.10 241.90						
6								
7								
8								
9								

COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH: Cu, KPa (nat V - ✚ Q - ✖ rem V - ● Cpen ▲)
40 80 120 160
WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Bentonite; Filter Sand; Slotted Screen; Sand

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION
▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-21

PROJECT : HWY 50 Drainage Improvement — Project No. 28262
LOCATION :
STARTED : March 4, 2020 — SHEET 1 OF 1
COMPLETED : March 4, 2020 — N 4 857 262.5 E 603 469.9 — DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		243.70				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS		
1		Dense to compact			2	SS	33	
2	Solid Stem Augers				3	SS	16	Grain Size Analysis: Gr 20%/Sa 68%/ Si & Cl 12%
		CLAY, silty, some sand, trace gravel, very stiff, grey, moist: (TILL)		241.57 2.13				
3					4	SS	24	
					5	SS	26	
4					6	SS	26	
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		239.28 4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ — rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp w wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-22

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 4, 2020
COMPLETED : March 4, 2020
N 4 857 326.8 E 603 375.2

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		244.90				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand. trace gravel, very stiff, brown, moist		243.99 0.91	2	SS	21	Grain Size Analysis: Gr 2%/ Sa 15%/ Si 46%/ Cl 37%
2					3	SS	27	
3					4	SS	27	
4					5	SS	28	
					6	SS	28	
5		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		240.48 4.42				
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-23

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 4, 2020
COMPLETED : March 4, 2020
N 4 857 397.9 E 603 330.7

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		245.30				
		ASPHALT: (200mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1		Loose			2	SS	7	
				243.78				
	Solid Stem Augers	**CLAY**, silty, some sand, trace gravel, firm to very stiff, grey, moist: (TILL)		1.52	3	SS	7	Grain Size Analysis: Gr 0%/ Sa 14%/ Si 44%/ Cl 42%
2					4	SS	21	
3					5	SS	21	
4					6	SS	18	
				240.88				
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		4.42				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

RECORD OF BOREHOLE 20-24

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 9, 2020
COMPLETED : March 9, 2020
N 4 857 448.1 E 603 249.8

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		245.90				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.18	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, very stiff to hard, brown, moist: (TILL)		244.99 0.91	2	SS	14	Grain Size Analysis: Gr 5%/ Sa 39%/ Si 37%/ Cl 19%
2					3	SS	18	
3					4	SS	34	
4					5	SS	52	
					6	SS	34	
		END OF BOREHOLE AT 4.42m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		241.48 4.42				
5		WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Mar 09/20 Dry - May 26/20 2.20 243.70						
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Bentonite
Filter Sand
Slotted Screen
Sand

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
May 26, 2020

LOGGED : MA
CHECKED : CZ

THURBER

THURBER2S TEL-28262.GPJ 8/6/20

RECORD OF BOREHOLE 20-25

PROJECT : HWY 50 Drainage Improvement
LOCATION :
STARTED : March 4, 2020
COMPLETED : March 4, 2020
N 4 857 530.1 E 603 184.3

Project No. 28262
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		246.70				
		ASPHALT: (175mm)		0.00				
		SAND, some silt, some gravel, brown, moist: (FILL)		0.20	1	GS		
1	Solid Stem Augers	**CLAY**, silty, some sand to sandy, trace gravel, very stiff, brown, moist: (TILL)		245.79 0.91	2	SS	17	Grain Size Analysis: Gr 3%/ Sa 26%/ Si 45%/ Cl 26%
2					3	SS	24	
3					4	SS	34	
4		Stiff			5	SS	31	
					6	SS	12	
		END OF BOREHOLE AT 4.42m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT COLDPATCH TO SURFACE.		242.28 4.42				

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

>>▲ >>▲

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

THURBER

Region of Peel
working with you

Appendix B

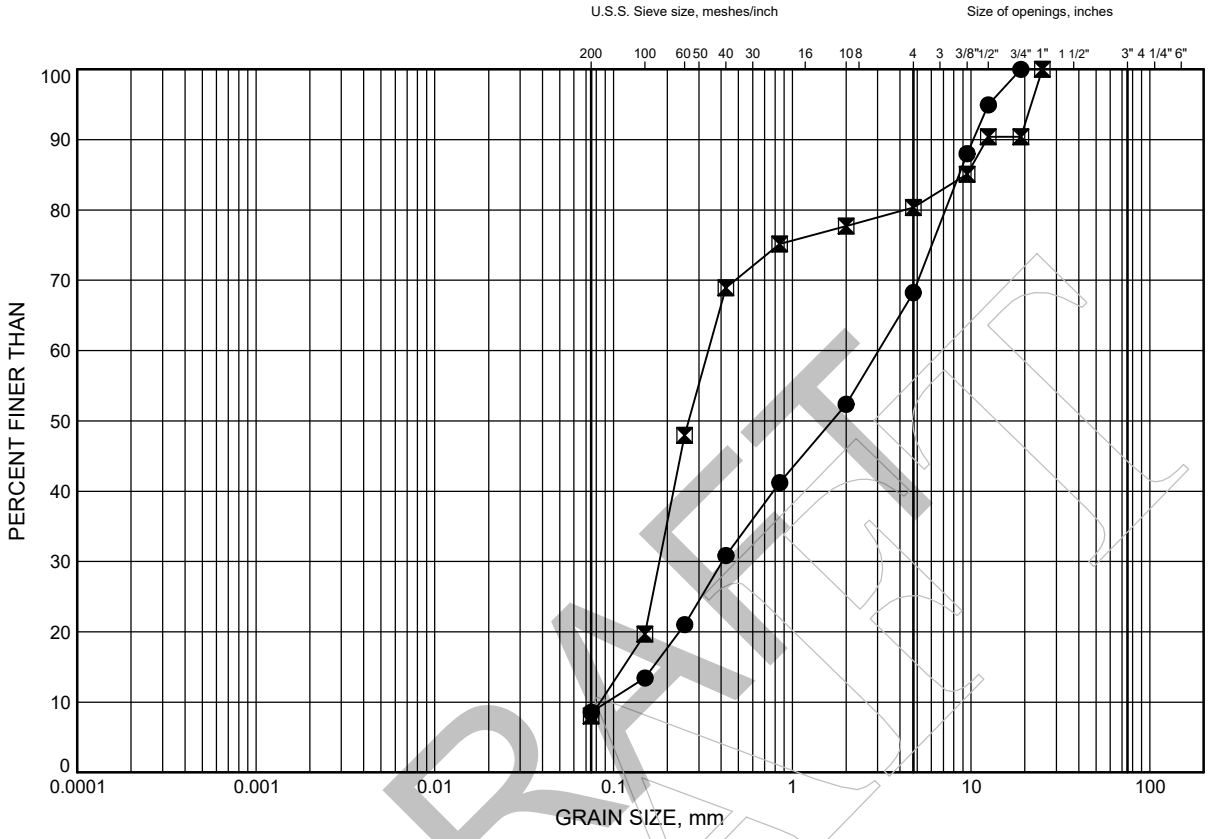
Laboratory Test Results

HWY 50 Drainage Improvement

GRAIN SIZE DISTRIBUTION

FIGURE B1

Gravely SAND FILL (Road Base)



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-04	0.30	228.40
⊠	20-19	0.30	242.10

Date August 2020

Project 28262

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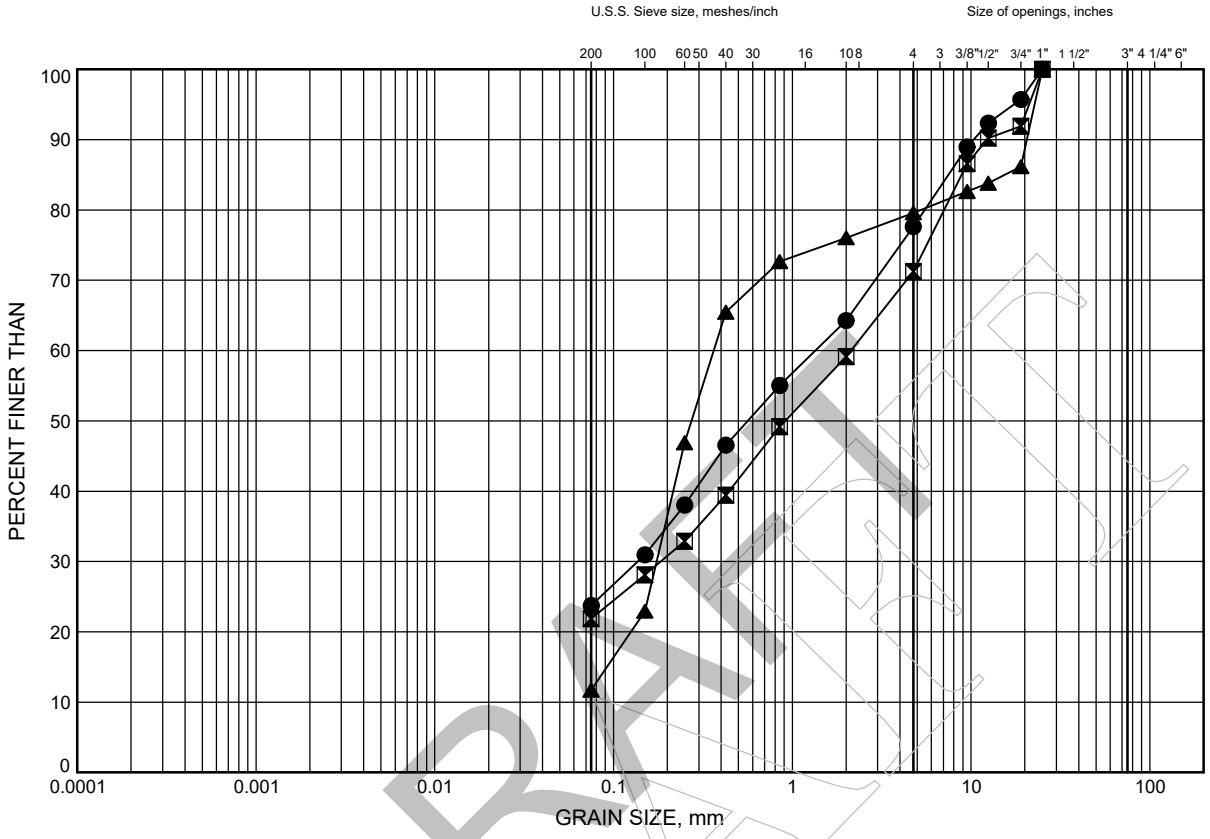
GRAIN SIZE DISTRIBUTION - THURBER TEL-28262.GPJ 8/7/20

HWY 50 Drainage Improvement

GRAIN SIZE DISTRIBUTION

FIGURE B2

SAND to Gravelly SAND FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-10	1.83	233.97
⊠	20-12	2.59	234.81
▲	20-21	1.83	241.87

Date August 2020

Project 28262

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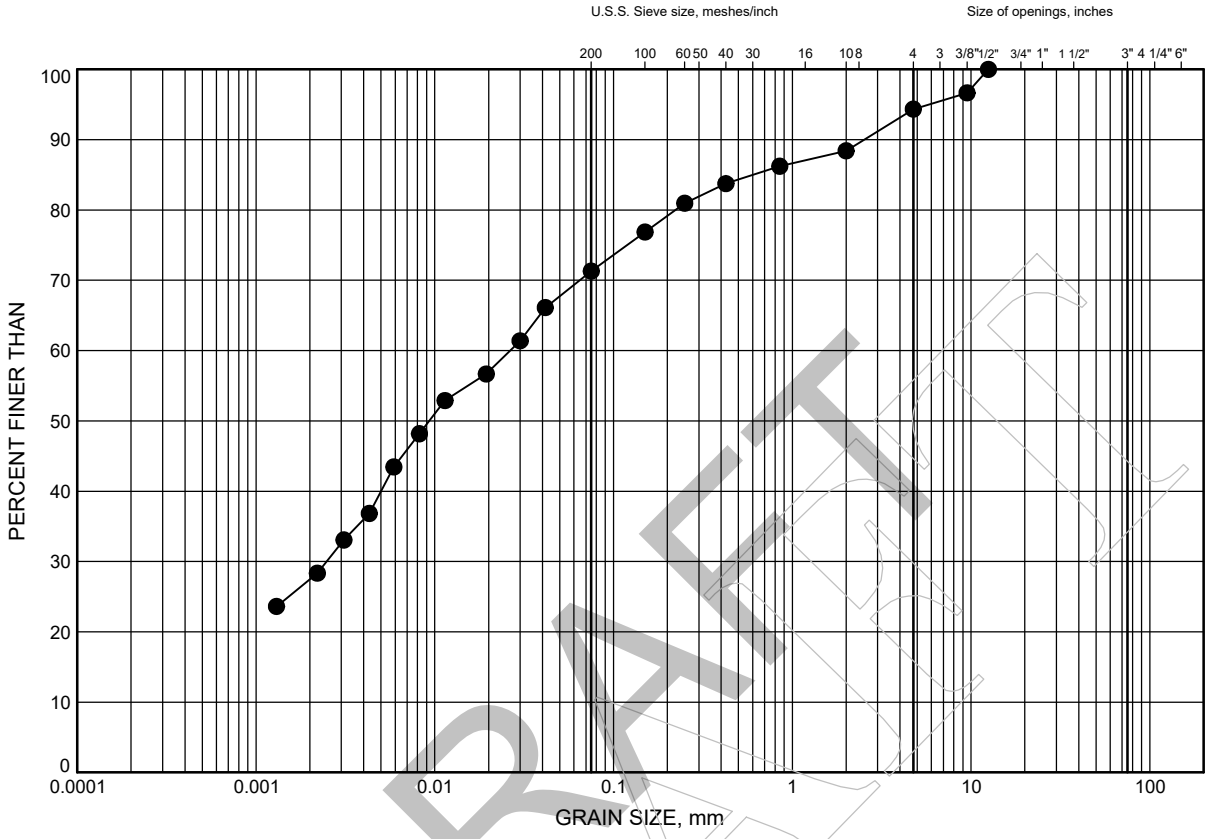
GRAIN SIZE DISTRIBUTION - THURBER TEL-28262.GPJ 8/7/20

HWY 50 Drainage Improvement

GRAIN SIZE DISTRIBUTION

FIGURE B3

Silty CLAY FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-02	1.14	225.76

Date August 2020

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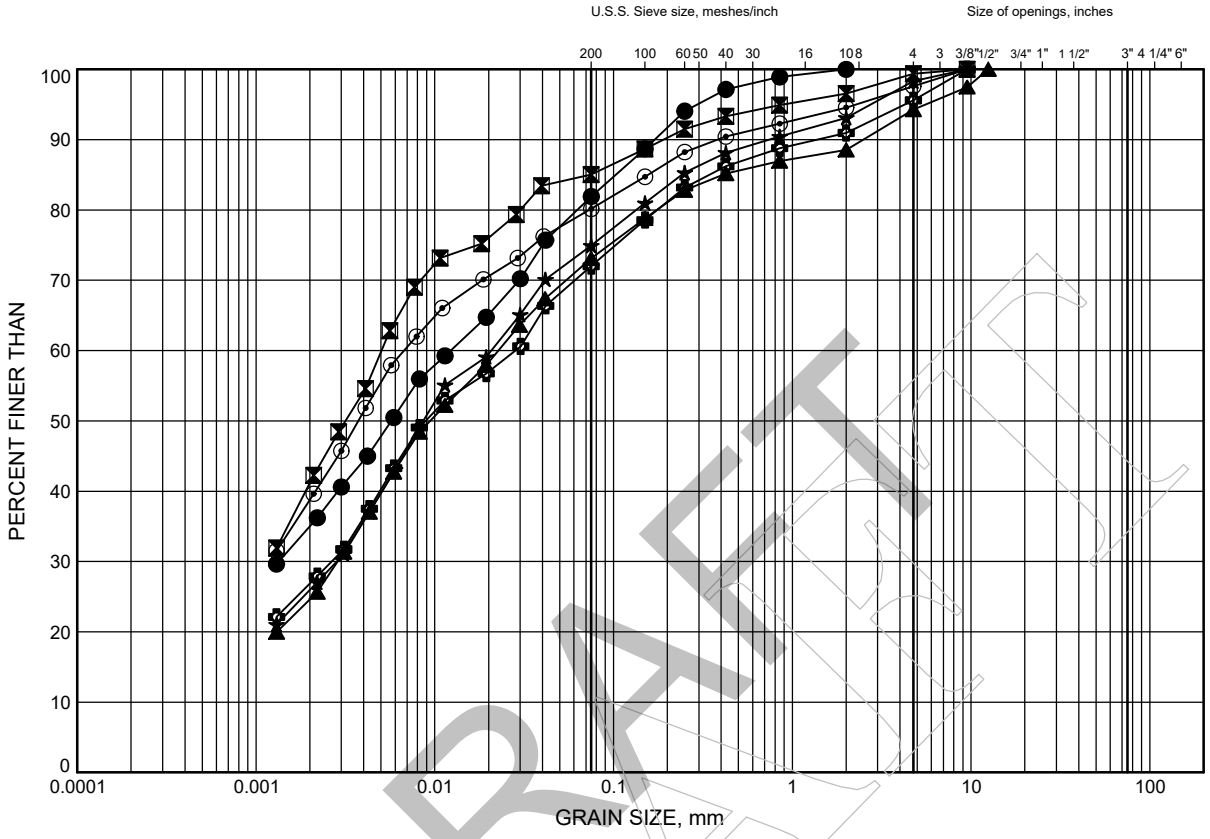
GRAIN SIZE DISTRIBUTION - THURBER TEL-28262.GPJ 8/7/20

HWY 50 Drainage Improvement

GRAIN SIZE DISTRIBUTION

FIGURE B4

Silty CLAY TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-01	1.83	224.67
⊠	20-03	3.35	224.85
▲	20-05	1.83	228.17
★	20-06	2.59	228.41
⊙	20-07	2.59	228.81
✿	20-08	1.07	231.93

Date August 2020

Project 28262

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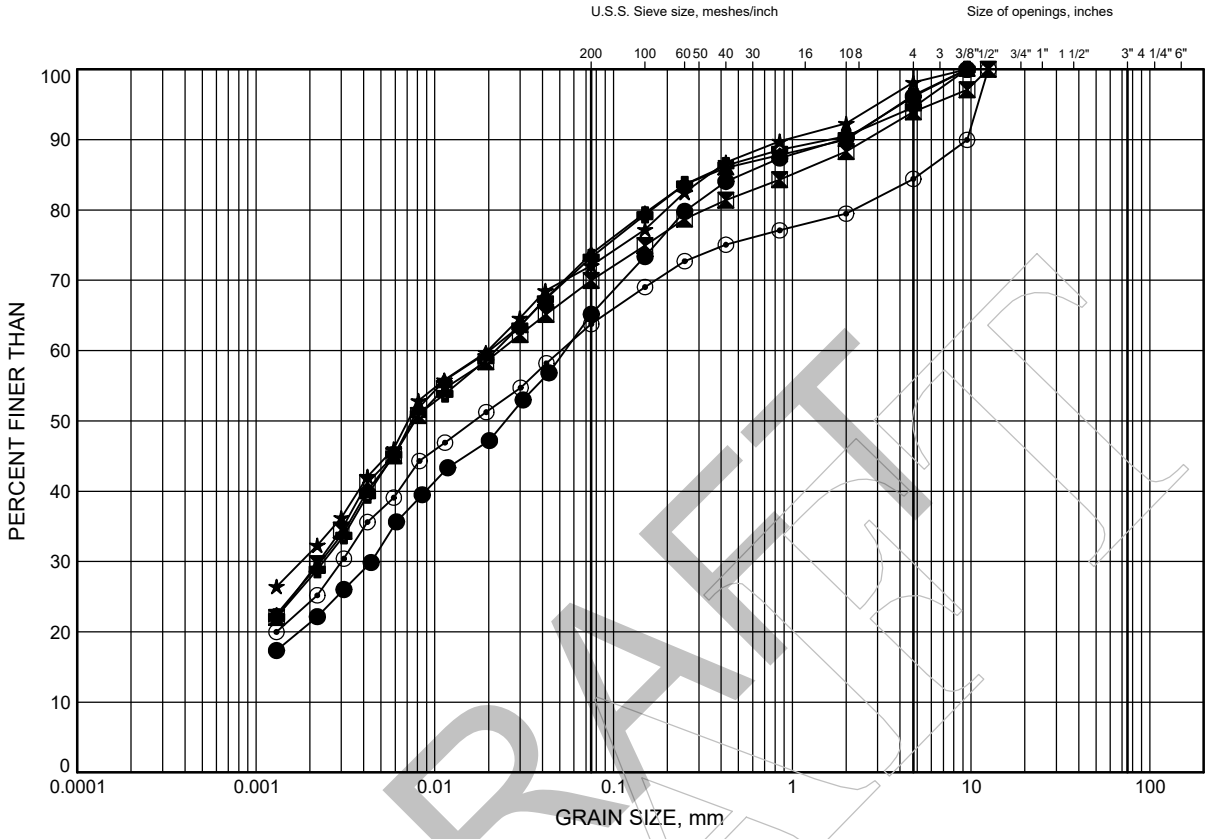
GRAIN SIZE DISTRIBUTION - THURBER TEL-28262.GPJ 8/7/20

HWY 50 Drainage Improvement

GRAIN SIZE DISTRIBUTION

FIGURE B5

Silty CLAY TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-09	1.07	233.23
⊠	20-11	2.59	234.31
▲	20-13	1.83	235.97
★	20-14	1.07	236.83
⊙	20-15	3.35	235.25
✿	20-16	1.83	237.87

Date August 2020

Project 28262

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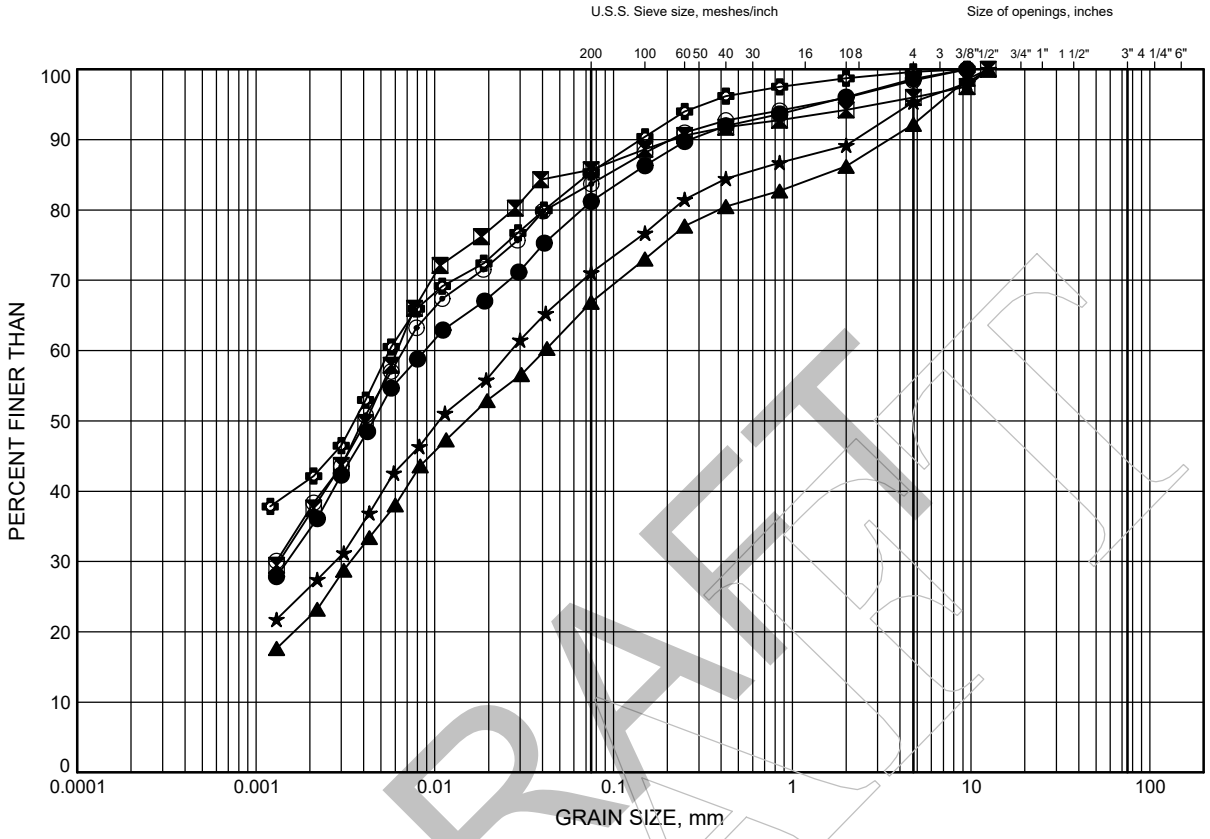
GRAIN SIZE DISTRIBUTION - THURBER TEL-28262.GPJ 8/7/20

HWY 50 Drainage Improvement

GRAIN SIZE DISTRIBUTION

FIGURE B6

Silty CLAY TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-17	1.83	239.07
⊠	20-18	1.83	239.77
▲	20-19	1.83	240.57
★	20-20	3.35	239.65
⊙	20-22	1.07	243.83
✿	20-23	1.83	243.47

Date August 2020

Project 28262

THURBER

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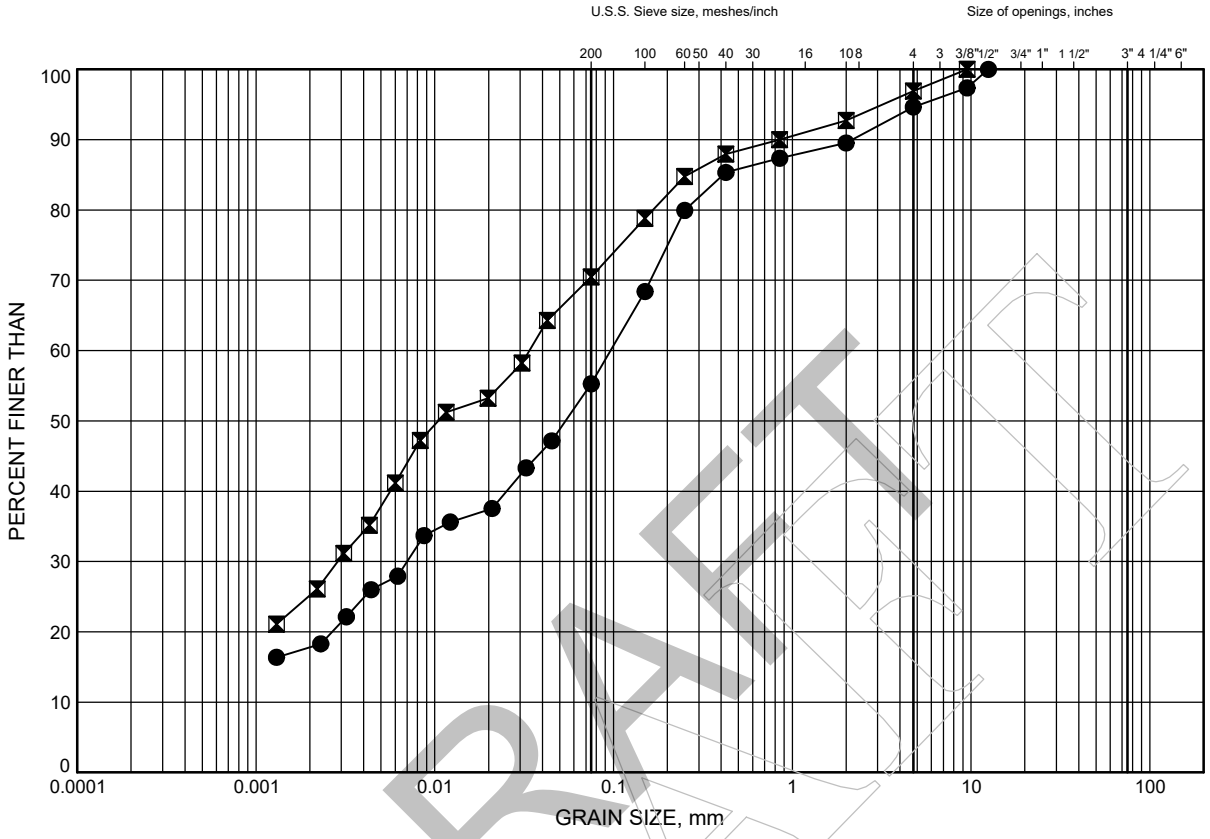
GRAIN SIZE DISTRIBUTION - THURBER TEL-28262.GPJ 8/7/20

HWY 50 Drainage Improvement

GRAIN SIZE DISTRIBUTION

FIGURE B7

Silty CLAY TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-24	1.07	244.83
⊠	20-25	1.07	245.63

Date August 2020

Project 28262

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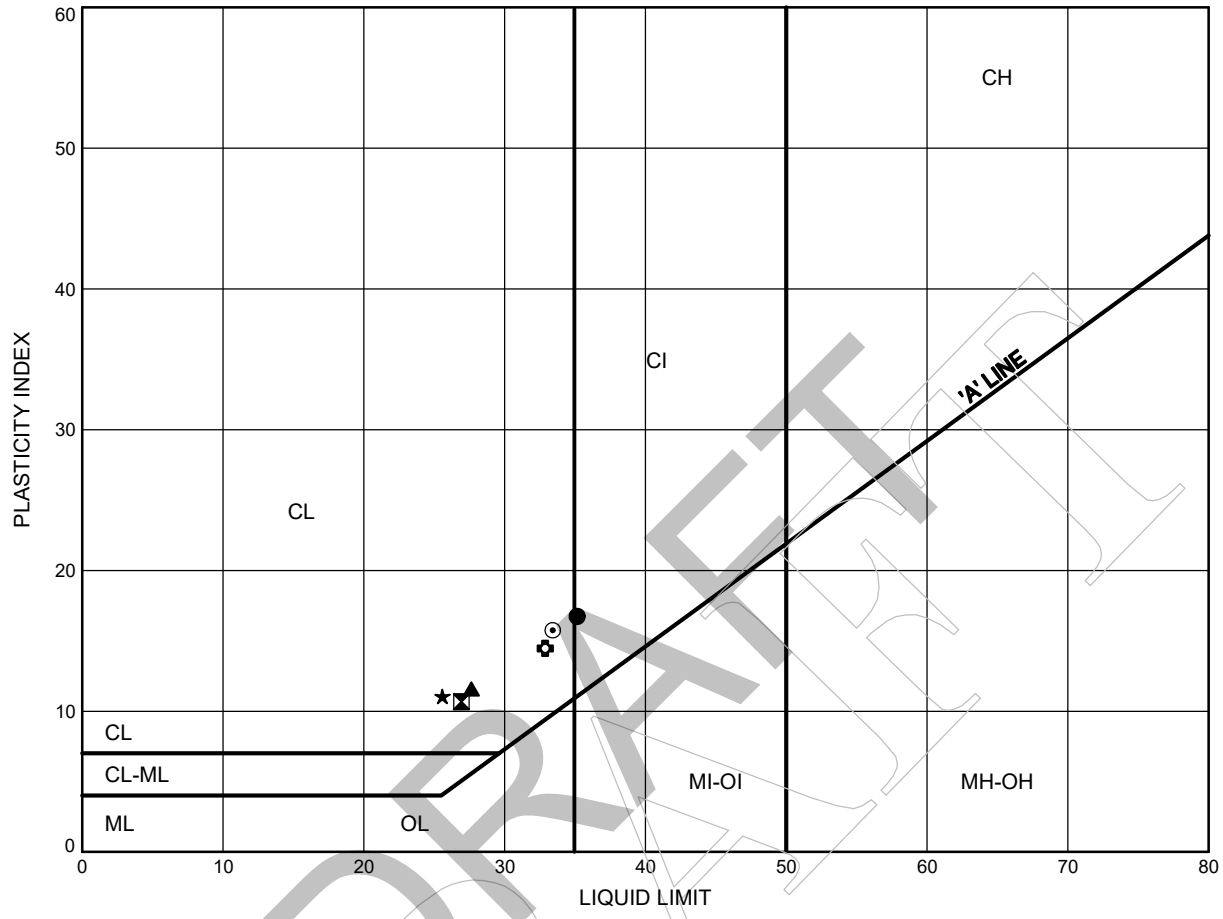
GRAIN SIZE DISTRIBUTION - THURBER TEL-28262.GPJ 8/7/20

HWY 50 Drainage Improvement

ATTERBERG LIMITS TEST RESULTS

FIGURE B8

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-03	3.35	224.85
⊠	20-05	1.83	228.17
▲	20-06	2.59	228.41
★	20-11	2.59	234.31
⊙	20-17	1.83	239.07
✿	20-18	1.83	239.77

Date August 2020

Project 28262

THURBER

Prep'd AN

Chkd. CZ

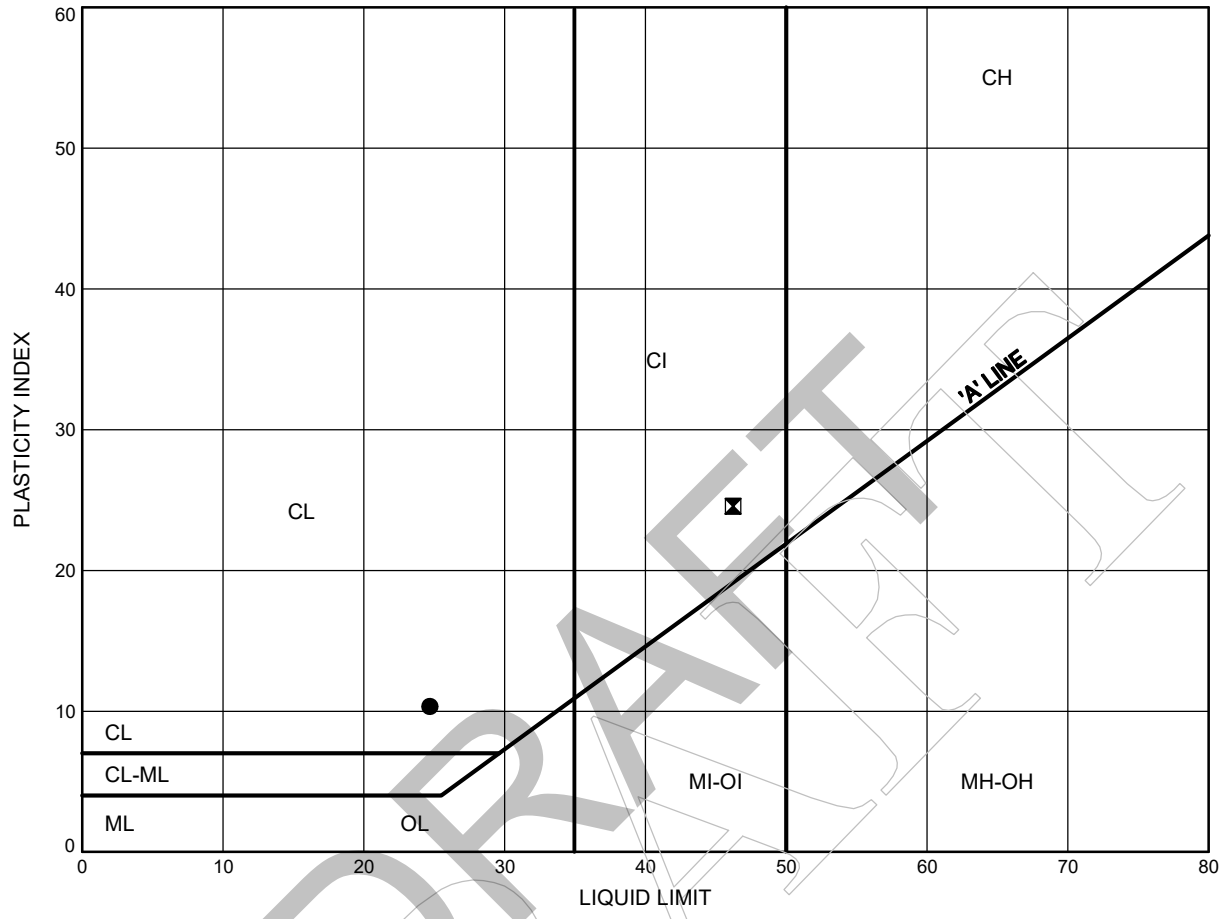
THURBALT TEL-28262.GPJ 8/7/20

HWY 50 Drainage Improvement

ATTERBERG LIMITS TEST RESULTS

FIGURE B9

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-20	3.35	239.65
⊠	20-23	1.83	243.47

Date August 2020

Project 28262

THURBER

Prep'd AN

Chkd. CZ

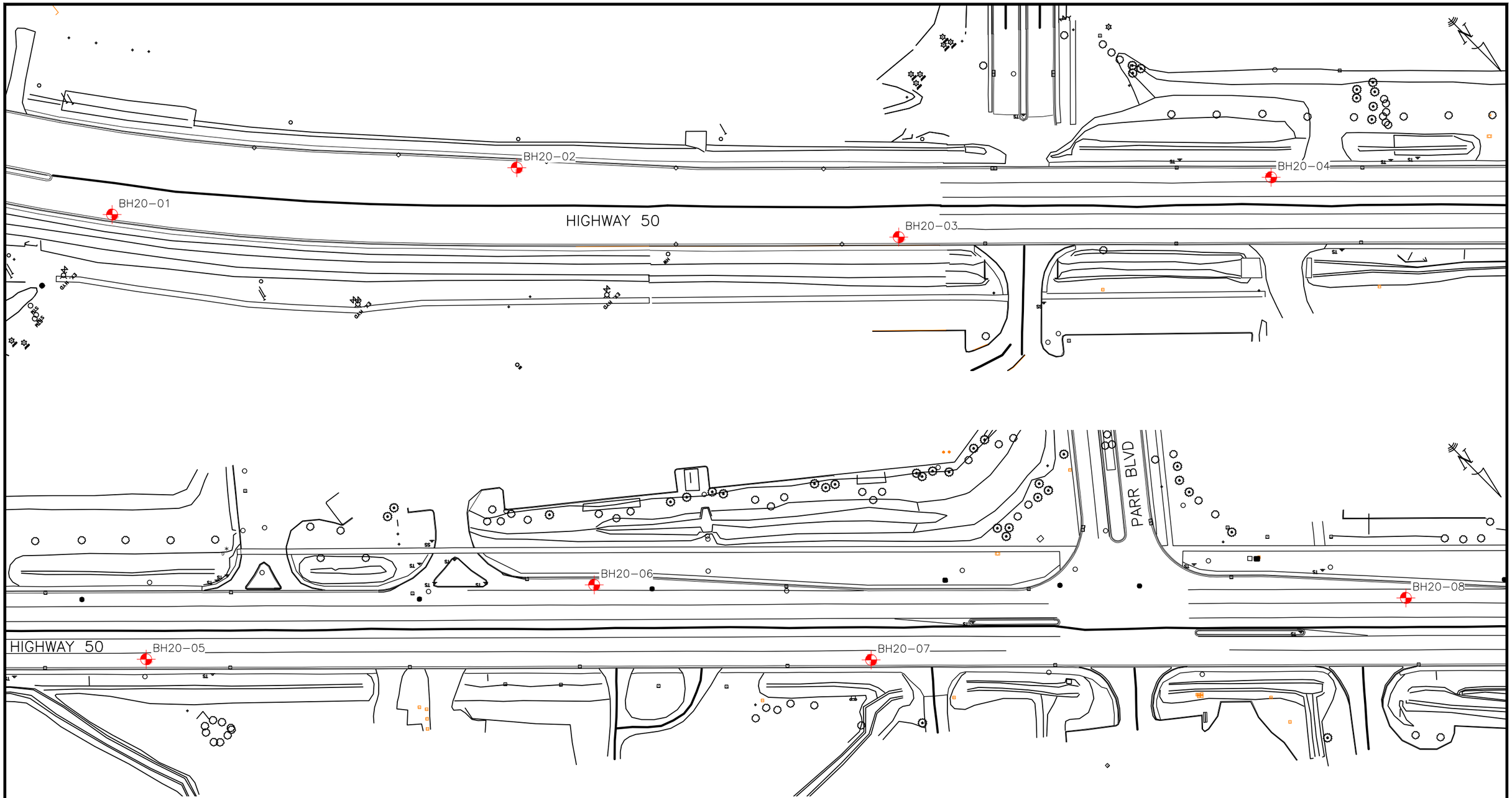
THURBALT TEL-28262.GPJ 8/7/20

THURBER

Region of Peel
working with you

Appendix C

Borehole Location Plan



LEGEND

BOREHOLE LOCATION

20 0 20 40m

SCALE 1:1000

R.V. Anderson & Associates

HIGHWAY 50 DRAINAGE IMPROVEMENT

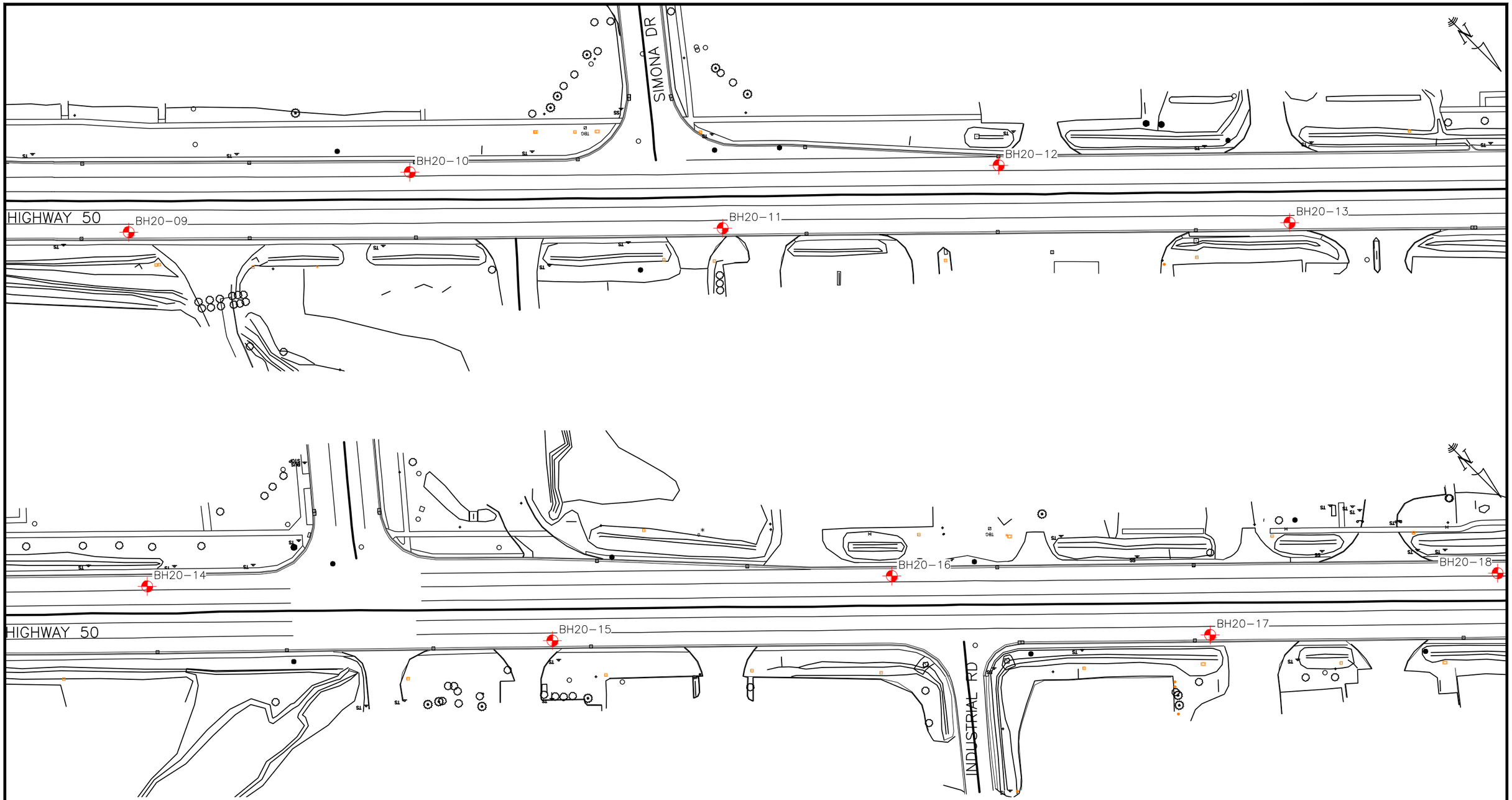
BOREHOLE LOCATION PLAN

JOB# 28262

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
CZ	BH	
DATE :	SCALE :	DRAWING No.
AUGUST 2020	1:1000	28262-1

FILENAME: H:\Drafting\28000\28262\TED-28262-BHPL.dwg
PLOTDATE: Aug 6, 2020 - 4:21 PM



LEGEND

BOREHOLE LOCATION

20 0 20 40m

SCALE 1:1000

R.V. Anderson & Associates

HIGHWAY 50 DRAINAGE IMPROVEMENT

BOREHOLE LOCATION PLAN

JOB# 28262

THURBER ENGINEERING LTD.

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HIGHWAY 50

BH20-19

BH20-20

BH20-21

BH20-22

MCEWAN DR

HIGHWAY 50

BH20-23

BH20-24

BH20-25

HEALEY RD

LEGEND

BOREHOLE LOCATION

20 0 20 40m

SCALE 1:1000

R.V. Anderson & Associates

HIGHWAY 50 DRAINAGE IMPROVEMENT

BOREHOLE LOCATION PLAN

JOB# 28262

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
CZ	BH	
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AUGUST 2020	1:1000	28262-3

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PLOTDATE: Aug 6, 2020 - 4:21 PM

Appendix D

Laboratory Certificate of Analysis

FINAL REPORT

CA14951-MAY20 R1

28262

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

CA14951-MAY20 R1

First Page

CLIENT DETAILS

Client	Thurber Engineering Ltd.
Address	103, 2010 Winston Park Drive Oakville, ON L6H 5R7. Canada
Contact	Cory Zanatta
Telephone	905-829-8666
Facsimile	
Email	czanatta@thurber.ca
Project	28262
Order Number	
Samples	Soil (10)

LABORATORY DETAILS

Project Specialist	Jill Campbell, B.Sc.,GISAS
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	2165
Facsimile	705-652-6365
Email	jill.campbell@sgs.com
SGS Reference	CA14951-MAY20
Received	05/27/2020
Approved	06/03/2020
Report Number	CA14951-MAY20 R1
Date Reported	06/03/2020

COMMENTS

Temperature of Sample upon Receipt: 2 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:013656

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

SIGNATORIES

Jill Campbell, B.Sc.,GISAS

TABLE OF CONTENTS

Client: Thurber Engineering Ltd.
Project: 28262
Project Manager: Cory Zanatta
Samplers: N/A

PACKAGE: **- Corrosivity Index** (SOIL)

Sample Number			5	6	7	8	9	10	11	12
Sample Name			20-08 SS3	20-25 SS3	20-22 SS3	20-11 SS3	20-20 SS3	20-09 SS4	20-17 SS2	20-13 SS3
Sample Matrix			Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date			26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Corrosivity Index										
Corrosivity Index	none	1	11	11	11	11	14	11	11	14
Soil Redox Potential	mV	-	276	284	226	220	237	275	186	231
Sulphide	%	0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.10
pH	pH Units	0.05	8.08	8.20	8.42	8.21	8.91	8.32	8.46	8.45
Resistivity (calculated)	ohms.cm	-9999	740	389	526	625	439	743	388	596

PACKAGE: **- Corrosivity Index** (SOIL)

Sample Number			13	14
Sample Name			20-07 SS3	20-01 SS2
Sample Matrix			Soil	Soil
Sample Date			26/05/2020	26/05/2020
Parameter	**Units**	**RL**	**Result**	**Result**
Corrosivity Index				
Corrosivity Index	none	1	11	11
Soil Redox Potential	mV	-	244	225
Sulphide	%	0.04	< 0.04	< 0.04
pH	pH Units	0.05	8.17	8.10
Resistivity (calculated)	ohms.cm	-9999	769	474

Client: Thurber Engineering Ltd.
Project: 28262
Project Manager: Cory Zanatta
Samplers: N/A

PACKAGE: **- General Chemistry** (SOIL)

			Sample Number	5	6	7	8	9	10	11	12
			Sample Name	20-08 SS3	20-25 SS3	20-22 SS3	20-11 SS3	20-20 SS3	20-09 SS4	20-17 SS2	20-13 SS3
			Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
			Sample Date	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
General Chemistry											
Conductivity	uS/cm	2		1350	2570	1900	1600	2280	1350	2580	1680

PACKAGE: **- General Chemistry** (SOIL)

			Sample Number	13	14
			Sample Name	20-07 SS3	20-01 SS2
			Sample Matrix	Soil	Soil
			Sample Date	26/05/2020	26/05/2020
Parameter	**Units**	**RL**		**Result**	**Result**
General Chemistry					
Conductivity	uS/cm	2		1300	2110

PACKAGE: **- Metals and Inorganics** (SOIL)

			Sample Number	5	6	7	8	9	10	11	12
			Sample Name	20-08 SS3	20-25 SS3	20-22 SS3	20-11 SS3	20-20 SS3	20-09 SS4	20-17 SS2	20-13 SS3
			Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
			Sample Date	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics											
Moisture Content	%	0.1		13.2	14.6	14.1	12.2	15.2	11.6	16.0	11.0
Sulphate	µg/g	0.4		24	200	68	79	71	73	230	380

PACKAGE: **- Metals and Inorganics** (SOIL)

			Sample Number	13	14
			Sample Name	20-07 SS3	20-01 SS2
			Sample Matrix	Soil	Soil
			Sample Date	26/05/2020	26/05/2020
Parameter	**Units**	**RL**		**Result**	**Result**

Client: Thurber Engineering Ltd.
Project: 28262
Project Manager: Cory Zanatta
Samplers: N/A

PACKAGE: **- Metals and Inorganics** (SOIL)

			Sample Number	13	14
			Sample Name	20-07 SS3	20-01 SS2
			Sample Matrix	Soil	Soil
			Sample Date	26/05/2020	26/05/2020
Parameter	**Units**	**RL**		**Result**	**Result**
Metals and Inorganics					
Moisture Content	%	0.1		14.6	10.6
Sulphate	µg/g	0.4		77	110

PACKAGE: **- Other (ORP)** (SOIL)

			Sample Number	5	6	7	8	9	10	11	12
			Sample Name	20-08 SS3	20-25 SS3	20-22 SS3	20-11 SS3	20-20 SS3	20-09 SS4	20-17 SS2	20-13 SS3
			Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
			Sample Date	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020	26/05/2020
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Other (ORP)											
Chloride	µg/g	0.4		680	1200	1100	1300	500	650	880	530

PACKAGE: **- Other (ORP)** (SOIL)

			Sample Number	13	14
			Sample Name	20-07 SS3	20-01 SS2
			Sample Matrix	Soil	Soil
			Sample Date	26/05/2020	26/05/2020
Parameter	**Units**	**RL**		**Result**	**Result**
Other (ORP)					
Chloride	µg/g	0.4		1800	1600

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0528-MAY20	µg/g	0.4	<0.4	0	20	97	80	120	103	75	125
Sulphate	DIO0528-MAY20	µg/g	0.4	<0.4	3	20	95	80	120	98	75	125

Carbon/Sulphur

Method: ASTM E1915-07A | Internal ref.: ME-CA-[ENV]ARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	ECS0035-MAY20	%	0.04	< 0.04	ND	20	103	80	120			

QC SUMMARY

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0007-JUN20	uS/cm	2	< 0.002	0	20	99	90	110	NA		
Conductivity	EWL0009-JUN20	uS/cm	2	< 0.002	0	20	99	90	110	NA		

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0007-JUN20	pH Units	0.05	NA	0		101			NA		
pH	EWL0009-JUN20	pH Units	0.05	NA	0		101			NA		

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

SGS Request for Laboratory Services and CHAIN OF CUSTODY

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

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Laboratory Information Section - Lab use only

Received By: Ahmed Al-Mandalawi
Received Date: 05/27/2020 (mm/dd/yy)
Received Time: 13:36 (hr : min)
Received By (signature):
Custody Seal Present: Yes ☒ No ☐
Custody Seal Intact: Yes ☒ No ☐
Cooling Agent Present: Yes ☒ No ☐ Type: ice
Temperature Upon Receipt (°C): 2.0 2.0
LAB LIMS #: CA14951-May20

REPORT INFORMATION

Company: Thurber Engineering
Contact: Cory Zanatta
Address: 3010 Winston Park Drive, Oakville
Phone: 905-829-8666
Fax:
Email: czanatta@thurber.ca

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email: czanatta@thurber.ca

Quotation #:
P.O. #:
Project #: 28262
Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)
TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

Regulation 153/04:
☑ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☑ Ind/Com ☐ Medium
☑ Table 3 ☐ Agri/Other ☑ Fine
☐ Table ____

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX
1	20-08 SS3	May 26/20		1	
2	20-25 SS3			1	
3	20-22 SS3			1	
4	20-11 SS3			1	
5	20-20 SS3			1	
6	20-04 SS4			1	
7	20-17 SS2			1	
8	20-13 SS3			1	
9	20-07 SS3			1	
10	20-01 SS2			1	
11					
12					

	Field Filtered (Y/N)	Metals & Inorganics incl CrVI, CN, Hg or I, (B(HWS), EC, SAR–soil) (Cl, Na–water)	Full Metals Suite ICP metals plus B(HWS–soil only) Hg, CrVI	ICP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni, Se,Ag,Tl,U,V,Zn	PAHs only	SVOCs all incl PAHs, ABNs, CPs	PCBs Total ☐ Aroclor ☐	F1-F4 + BTEX	F1-F4 only no BTEX	VOCs all incl BTEX	BTEX only	Pesticides Organochlorine or specify other	Other (please specify)						Sewer Use: Specify pkg:	Water Characterization Pkg ☐ General ☐ Extended ☐	TCLP Specify TCLP tests ☐M&I ☐VOC ☐PCB ☐B(a)P ☐ABN ☐Ignit.	COMMENTS:
													Corrosivity	Reactivity							
1													✓								
2													✓								
3													✓								
4													✓								
5													✓								
6													✓								
7													✓								
8													✓								
9													✓								
10													✓								
11																					
12																					

Observations/Comments/Special Instructions

Sampled By (NAME): **Signature:** Date: ____/____/____ (mm/dd/yy)
Relinquished by (NAME): **Signature:** Date: ____/____/____ (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.2
Date of Issue: 09 Sept, 2019