

**REPORT**

# Foundation Investigation and Design Report

*Water and Wastewater Infrastructure (Cut-and-Cover Sections)*

*QEW Improvements from East of Cawthra Road to The East Mall, City of Mississauga, Region of Peel, Ontario*

*MTO GWP 2102-13-00*

Submitted to:

**AECOM**

30 Leek Crescent, 4th Floor  
Richmond Hill, Ontario  
L4B 4N4

Submitted by:

**Golder Associates Ltd.**

6925 Century Avenue, Suite #100, Mississauga, Ontario, L5N 7K2, Canada  
+1 905 567 4444

**GEOCRES NO.:** 30M11-321

**Latitude:** 43.596150°

**Longitude:** -79.569900°

1530382-WM

June 29, 2022

## Distribution List

- 1 Electronic Copy - MTO Central Region
- 1 Electronic Copy - MTO Foundations Section
- 1 Electronic Copy - AECOM
- 1 Electronic Copy - Golder Associates Ltd.

# Table of Contents

## PART A – FOUNDATION INVESTIGATION REPORT

<b>1.0 INTRODUCTION .....</b>	<b>1</b>
<b>2.0 SITE DESCRIPTION .....</b>	<b>1</b>
<b>3.0 INVESTIGATION PROCEDURES .....</b>	<b>2</b>
3.1 Borehole Drilling and Sampling, Well Installation, and Borehole Abandonment .....	2
3.2 Single-Well Response Testing .....	7
3.3 Geotechnical Laboratory Testing .....	8
3.4 Corrosivity Testing .....	8
3.5 Analytical Laboratory Testing .....	8
<b>4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS.....</b>	<b>10</b>
4.1 Regional Geology .....	10
4.2 Subsurface Conditions .....	10
4.2.1 Segment A – North Service Road from Westfield Drive to Stanfield Road .....	11
4.2.1.1 Topsoil and Asphalt .....	11
4.2.1.2 Fill – Sand and Gravel to Silty Sand to Gravelly Clayey Sand .....	11
4.2.1.3 Silty Sand to Sandy Silt.....	12
4.2.1.4 Cohesive Soil Complex (Clayey Silt to Clayey Sand, Clayey Silt Till, and Clayey Silt Residual Soil) .....	12
4.2.1.5 Shale Bedrock.....	13
4.2.2 Segment B – North Service Road from Stanfield Road to Harvest Drive .....	13
4.2.2.1 Topsoil and Asphalt .....	13
4.2.2.2 Fill – Silty Sand, Sand, Sand and Gravel and Silty Sand and Gravel .....	14
4.2.2.3 Silt to Sand.....	14
4.2.2.4 Cohesive Soil Complex (Clayey Silt, Silt to Silty Clay Till, and Clayey Silt Residual Soil) .....	14
4.2.2.5 Shale Bedrock.....	15
4.2.3 Segment C – South Service Road from Haig Boulevard to Dixie Road .....	16
4.2.3.1 Asphalt and Topsoil .....	16
4.2.3.2 Fill – Gravelly Sand to Silt and Sand, and Clayey Silt .....	17

4.2.3.3	Silty Sand to Sandy Silt.....	17
4.2.3.4	Cohesive Soil Complex (Clayey Silt, Clayey Silt Till, and Clayey Silt Residual Soil) .....	17
4.2.3.5	Shale Bedrock.....	18
4.2.4	Segment D – Dixie Road from North Service Road to Sherway Drive .....	19
4.2.4.1	Topsoil and Asphalt/Concrete.....	19
4.2.4.2	Fill – Sand to Sand and Gravel.....	19
4.2.4.3	Silty Sand to Sand .....	19
4.2.4.4	Cohesive Soil Complex (Clayey Silt Till and Clayey Silt Residual Soil) .....	20
4.2.4.5	Shale Bedrock.....	20
4.2.5	Segment E – Brentano Boulevard .....	21
4.2.5.1	Asphalt .....	21
4.2.5.2	Fill – Sand and Gravel, and Silty Sand to Sand .....	21
4.2.5.3	Sandy Silt to Sand and Gravel.....	21
4.2.5.4	Cohesive Soil Complex (Clayey Silt to Clayey Sand Till, and Clayey Silt to Clayey Gravel Residual Soil) .....	22
4.2.5.5	Shale Bedrock.....	22
4.2.6	Segment F – Dixie Road and South Service Road to East of Liveoak Drive .....	23
4.2.6.1	Topsoil and Asphalt .....	23
4.2.6.2	Fill – Silt, Silty Sand, Sand and Sand and Gravel .....	23
4.2.6.3	Silt and Sand to Sand and Gravel .....	24
4.2.6.4	Cohesive Soil Complex (Clayey Silt to Sandy Clayey Silt, Clayey Silt to Sandy Clayey Silt Till, and Clayey Silt Residual Soil) .....	24
4.2.6.5	Shale Bedrock.....	25
4.2.7	Geotechnical Laboratory Test Results for Shale Bedrock.....	26
4.3	Groundwater Conditions .....	28
4.3.1	Groundwater Levels .....	28
4.3.2	Results of Single-Well Response Testing.....	31
4.4	Corrosivity Test Results .....	32
4.5	Analytical Testing Results .....	33
4.5.1	Soil and Bedrock Sampling and Analysis .....	33
4.5.2	Groundwater Sampling and Analysis.....	34



## **5.0 CLOSURE .....35**

### **PART B – FOUNDATION DESIGN REPORT**

## **6.0 DISCUSSION AND ENGINEERING RECOMMENDATIONS .....36**

6.1	General.....	36
6.2	Summary of Anticipated Excavation and Subgrade Conditions .....	36
6.2.1	Segment A – North Service Road from Westfield Drive to Stanfield Road .....	36
6.2.2	Segment B – North Service Road from Stanfield Road to Harvest Drive .....	37
6.2.3	Segment C – South Service Road from Haig Boulevard to Dixie Road .....	37
6.2.4	Segment D – Dixie Road from North Service Road to Sherway Drive .....	38
6.2.5	Segment E – Brentano Boulevard .....	38
6.2.6	Segment F – Dixie Road and South Service Road to East of Liveoak Drive .....	38
6.3	Subgrade Preparation, Bedding, Cover and Trench Backfill .....	38
6.3.1	Subgrade Preparation .....	38
6.3.2	Pipe Bedding and Cover .....	39
6.3.3	Backfill .....	39
6.3.4	Trench Plugs .....	40
6.3.5	Special Considerations for Pipe Installed in Moderately Weathered to Fresh Bedrock .....	40
6.4	Corrosion Assessment and Protection.....	40
6.5	Construction Considerations .....	41
6.5.1	Excavation.....	41
6.5.2	Prefabricated Support Systems and Temporary Protection Systems .....	42
6.5.3	Groundwater Control.....	43
6.5.4	Piezometer Decommissioning .....	45

## **7.0 CLOSURE .....45**

### **REFERENCES**

## DRAWINGS

Drawing 1	Watermain and Sewer Segments A, B and C, Borehole Locations
Drawing 2	Watermain and Sewer Segments D and E, Borehole Locations
Drawing 3	Watermain and Sewer Segment F, Borehole Locations
Drawing 4	Watermain and Sewer Segment A and B, Soil and Bedrock Strata
Drawing 5	Watermain and Sewer Segment C and D, Soil and Bedrock Strata
Drawing 6	Watermain and Sewer Segment E, Soil and Bedrock Strata
Drawing 7	Watermain and Sewer Segment F, Soil and Bedrock Strata

## APPENDICES

Lists of Symbols and Abbreviations  
 Lithological and Geotechnical Rock Description Terminology  
 Field Estimation of Rock Hardness  
 Rock Weathering Classification

### APPENDIX A – Segment A: North Service Road from Westfield Drive to Stanfield Road – Borehole Records and Geotechnical Laboratory Test Results

Records of Boreholes/Drillholes 21-1, 21-2, 21-5, 21-6, 21-7, OPB-1, and NW3-1

Figure A1	Grain Size Distribution – Silty Sand to Gravelly Clayey Sand to Clayey Sand Fill
Figure A2	Plasticity Chart – Clayey Sand Fill
Figure A3	Grain Size Distribution – Silty Sand to Sandy Silt
Figure A4	Plasticity Chart – Sandy Silt
Figure A5	Grain Size Distribution – Cohesive Soil Complex (Clayey Silt to Clayey Sand, Clayey Silt Till, and Clayey Silt Residual Soil)
Figure A6	Plasticity Chart – Cohesive Soil Complex (Clayey Silt to Clayey Sand, Clayey Silt Till, and Clayey Silt Residual Soil)
Photograph A1	Bedrock Core Photographs – Borehole 21-1
Photograph A2	Bedrock Core Photographs – Borehole 21-2
Photograph A3	Bedrock Core Photographs – Borehole OPB-1

### APPENDIX B – Segment B: North Service Road from Stanfield Road to Harvest Drive – Borehole Records and Geotechnical Laboratory Test Results

Records of Boreholes/Drillholes 21-8, 21-13 to 21-18, CV02/03-1, NW3-2, and NW3-4 to NW3-6

Figure B1	Grain Size Distribution – Silty Sand Fill
Figure B2A/B	Grain Size Distribution – Sand, Silty Sand to Sandy Silt, and Silt
Figure B3	Plasticity Chart – Silt
Figure B4A/B	Grain Size Distribution – Cohesive Soil Complex (Clayey Silt, Silt to Silty Clay Till, and Clayey Silt Residual Soil)
Figure B5A/B	Plasticity Chart – Cohesive Soil Complex (Clayey Silt, Silt to Silty Clay Till, and Clayey Silt Residual Soil)
Photograph B1A-C	Bedrock Core Photographs – Borehole 21-8
Photograph B2	Bedrock Core Photographs – Borehole 21-13
Photograph B3	Bedrock Core Photographs – Borehole 21-14
Photograph B4	Bedrock Core Photographs – Borehole 21-15
Photograph B5	Bedrock Core Photographs – Borehole 21-16
Photograph B6A/B	Bedrock Core Photographs – Borehole 21-17
Photograph B7A/B	Bedrock Core Photographs – Borehole 21-18
Photograph B8	Bedrock Core Photographs – Borehole CV02/03-1

### **APPENDIX C – Segment C: South Service Road from Haig Boulevard to Dixie Road – Borehole Records and Geotechnical Laboratory Test Results**

Records of Boreholes/Drillholes 21-11, 21-23 to 21-28, and CV02/03-3

Figure C1	Grain Size Distribution – Silty Sand to Silt and Sand Fill
Figure C2	Grain Size Distribution – Silty Sand to Sandy Silt
Figure C3	Grain Size Distribution – Cohesive Soil Complex (Clayey Silt, Clayey Silt Till, and Clayey Silt Residual Soil)
Figure C4	Plasticity Chart – Cohesive Soil Complex (Clayey Silt, Clayey Silt Till, and Clayey Silt Residual Soil)
Photograph C1	Bedrock Core Photographs – Borehole 21-11
Photograph C2	Bedrock Core Photographs – Borehole 21-26
Photograph C3	Bedrock Core Photographs – Borehole 21-27
Photograph C4	Bedrock Core Photographs – Borehole 21-28

### **APPENDIX D – Segment D: Dixie Road from North Service Road to Sherway Drive – Borehole Records and Geotechnical Laboratory Test Results**

Records of Boreholes/Drillholes 21-19 to 21-22, and NW4-1 to NW4-3

Figure D1	Grain Size Distribution – Silty Sand to Sand
Figure D2	Grain Size Distribution – Cohesive Soil Complex (Clayey Silt Till)
Figure D3	Plasticity Chart – Cohesive Soil Complex (Clayey Silt Till)
Photograph D1	Bedrock Core Photographs – Borehole 21-19

### **APPENDIX E – Segment E: Brentano Boulevard – Borehole Records and Geotechnical Laboratory Test Results**

Records of Boreholes 21-38 to 21-43, and 17-1

Figure E1	Grain Size Distribution – Silty Sand Fill
Figure E2A/B	Grain Size Distribution – Sandy Silt to Sand and Gravel
Figure E3	Grain Size Distribution – Cohesive Soil Complex (Clayey Silt to Clayey Sand Till, and Clayey Silt to Clayey Gravel Residual Soil)
Figure E4	Plasticity Chart – Cohesive Soil Complex (Clayey Silt to Clayey Sand Till, and Clayey Silt to Clayey Gravel Residual Soil)

### **APPENDIX F – Dixie Road and South Service Road to East of Liveoak Drive – Borehole Records and Geotechnical Laboratory Test Results**

Records of Boreholes/Drillholes 21-29 to 21-31, 21-33, 21-37, NW6-3 to NW6-5, RW1-1 and RW1-2

Figure F1	Grain Size Distribution – Silt to Silty Sand Fill
Figure F2	Grain Size Distribution – Silt to Silty Sand to Sand to Sand and Gravel
Figure F3	Grain Size Distribution – Cohesive Soil Complex (Sandy Clayey Silt, and Sandy Clayey Silt to Clayey Silt Till)
Figure F4	Plasticity Chart – Cohesive Soil Complex (Sandy Clayey Silt, and Sandy Clayey Silt to Clayey Silt Till)
Photograph F1	Bedrock Core Photographs – Borehole 21-29
Photograph F2	Bedrock Core Photographs – Borehole 21-30
Photograph F3	Bedrock Core Photographs – Borehole 21-31
Photograph F4	Bedrock Core Photographs – Borehole 21-33
Photograph F5A-B	Bedrock Core Photographs – Borehole 21-37

### **APPENDIX G – Geotechnical Laboratory Test Results for Shale Bedrock**

Table G1	Point Load Test Results
Geomechanica Inc. – Rock Laboratory Testing Results	

**APPENDIX H – Single Well Response Test Results****APPENDIX I – Analytical Laboratory Test Results – Summary Tables**

Table I1	Soil Analytical Results – Metals
Table I2	Soil and Bedrock Analytical Results – Inorganics
Table I3	Soil Analytical Results – Volatile Organic Compounds (VOCs)
Table I4	Soil Analytical Results – Petroleum Hydrocarbons (PHCs)
Table I5	Soil Analytical Results – Polycyclic Aromatic Hydrocarbons (PAHs)
Table I6	Soil Analytical Results – Polychlorinated Biphenyls (PCBs)
Table I7	Soil Analytical Results – Toxicity Characteristic Leaching Procedure (TCLP)
Table I8	Soil Analytical Results – Synthetic Precipitation Leaching Procedure (SPLP)
Table I9	Groundwater Analytical Results – Metals and Inorganics
Table I10	Groundwater Analytical Results – Petroleum Hydrocarbons (PHCs)
Table I11	Groundwater Analytical Results – Polycyclic Aromatic Hydrocarbons (PAHs)
Table I12	Groundwater Analytical Results – Peel Sanitary and Storm Sewer Use By-Law

**APPENDIX J – Analytical Laboratory Test Results – Certificates of Analysis****APPENDIX K – Special Provisions**

NSSP – Piezometer Decommissioning

# PART A

**FOUNDATION INVESTIGATION REPORT  
WATER AND WASTEWATER INFRASTRUCTURE (CUT-AND-COVER SECTIONS)  
QEW IMPROVEMENTS FROM EAST OF CAWTHRA ROAD TO THE EAST MALL  
CITY OF MISSISSAUGA, REGION OF PEEL, ONTARIO  
MTO GWP 2102-13-00**

## 1.0 INTRODUCTION

Golder Associates Ltd. (Golder), member of WSP, has been retained by AECOM on behalf of the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services for the widening of Queen Elizabeth Way (QEW) from Cawthra Road to the East Mall in the Cities of Mississauga and Etobicoke, Regional Municipality of Peel/City of Toronto, Ontario.

This report presents the results of the geotechnical, hydrogeological and environmental investigations carried out along the proposed watermain and sewer installations and relocations that are to be carried out by cut-and-cover methods; trenchless installation works under the QEW are addressed in separate reports. These cut-and-cover water and wastewater infrastructure installations are as follows, as shown on Drawings 1 to 3 following the text of this report:

- **Segment A:** 525 mm/375 mm diameter sanitary sewer along North Service Road from Westfield Drive to Insley Road, and 300 mm diameter watermain along North Service Road from Insley Road to Stanfield Road
- **Segment B:** 200 mm/1,050 mm diameter sanitary sewer and 400 mm watermain along North Service Road from Stanfield Road to Harvest Drive
- **Segment C:** 400 mm diameter watermain along South Service Road from Haig Boulevard to Dixie Road
- **Segment D:** 400 mm diameter watermain along Dixie Road from North Service Road to north of Sherway Drive
- **Segment E:** Sanitary sewer replacement along Brentano Boulevard, north of QEW and east of Dixie Road
- **Segment F:** 300 mm to 400 mm diameter watermain from Dixie Road/Cormack Crescent along South Service Road to east of Liveoak Drive

## 2.0 SITE DESCRIPTION

Within the project limits, the QEW and the adjacent North and South Services Roads are generally oriented in a northeast-southwest direction; for the purpose of this report the QEW and North and South Service Roads are described as oriented in an east-west direction, and Dixie Road in a north-south direction.

The proposed watermains and sewers extend along North Service Road, South Service Road, Dixie Road, and Brentano Boulevard, beginning at Westfield Drive approximately 1.1 km west of Dixie Road, and extending to Laughton Avenue approximately 800 m east of the Dixie Road, as shown on the Key Plans on Drawings 1 to 3. The QEW in this area is currently a six-lane divided highway that has been constructed near the original ground surface; the existing Dixie Road is comprised of four lanes and has been constructed on an embankment approaching the bridge over QEW; and the other local roads are generally comprised of two lanes plus turning lanes, constructed near the original ground surface. Land use surrounding this area consists of residential neighbourhoods, intermixed with commercial properties.

## 3.0 INVESTIGATION PROCEDURES

### 3.1 Borehole Drilling and Sampling, Well Installation, and Borehole Abandonment

The subsurface investigation for the watermain and sewer works was carried out between January and August of 2021 and included advancing a total of 41 boreholes numbered 21-1 to 21-43 (excluding 21-12 and 21-32, which were not drilled due to utility conflicts); seven of these boreholes (21-3, 21-4, 21-9, 21-10, 21-34, 21-35, and 21-36) were advanced to support tunnelling works under QEW and are presented in separate Foundation Investigation Reports. The remaining 34 boreholes for the cut-and-cover portions of the watermain and sewer works are presented in this report. These boreholes are supplemented by 17 boreholes located in or near the proposed watermain and sewer areas that were drilled between October 2016 and February 2020 as part of Golder's foundation investigation services for the Ogden Avenue pedestrian bridge, Applewood Creek culvert, noise barrier walls, and retaining walls. The borehole locations are shown on Drawings 1 to 3.

The boreholes were advanced using truck- and track-mounted CME-55 and CME-75 drilling equipment supplied and operated by Davis Drilling Ltd. of Milton, Ontario, Altech Drilling Ltd. of Cambridge, Ontario, and Aardvark Drilling Inc. of Guelph, Ontario. The boreholes were advanced through the overburden using 108 mm to 150 mm outer diameter solid stem augers, or 184 mm to 216 mm outer diameter hollow stem augers. Soil samples were obtained at approximately 0.75 m and 1.5 m intervals of depth using a 50 mm outer diameter split-spoon sampler driven by an automatic hammer in accordance with the Standard Penetration Test (SPT) procedure. Bedrock coring was completed where applicable using HQ diamond drilling equipment.

Monitoring wells were installed in selected boreholes to measure the stabilised groundwater levels at the site, and to conduct single-well response testing in the wells installed as part of the 21-series boreholes. Selected monitoring wells were also used to collect groundwater samples. The monitoring wells consist of 50 mm outside diameter PVC tubing with a slotted screen installed within filter sand and sealed at a selected interval within the borehole.

The boreholes without monitoring wells were backfilled with bentonite within the bedrock, and bentonite mixed with soil cuttings within the overburden in general accordance with the intent of Ontario Regulation 903 (Wells, as amended). The boreholes were then capped with granular material or asphalt to match the surrounding surface cover, and the site conditions restored following completion of the field work.

The field work was supervised on a full-time basis by members of Golder's staff who located the boreholes in the field, directed the drilling, sampling, and in situ testing operations, logged the boreholes, and supervised the installation of monitoring wells. The soil and bedrock samples were identified in the field, placed in labelled containers, and transported to Golder's laboratory in Mississauga for further examination and testing as discussed further in Sections 3.3, 3.4, and 3.5.

The borehole locations and ground surface elevations were obtained using a global positioning system (GPS – Trimble GEO 7X for the 2021 investigation, and Trimble XH 3.5G for the earlier investigations) having an accuracy of 0.1 m in the vertical and horizontal directions, or were measured relative to identifiable site features and superimposed on the base plan. The locations given on the borehole records and shown on Drawings 1 to 3 are positioned relative to MTM NAD 83 (Zone 10) CGG2013N northing and easting coordinates and the ground surface elevations are referenced to Geodetic datum. The borehole locations in both MTM and geographic coordinates, ground surface elevations, total drilled depths, and bedrock coring length are summarized below.

Borehole No.	Location (MTM NAD 83 Zone 10)		Ground Surface Elevation (m)	Total Borehole Depth (m)	Bedrock Coring Length (m)
	Northing (m) (Latitude, °)	Easting (m) (Longitude, °)			
Segment A: North Service Road from Westfield Drive to Stanfield Road					
21-1	4827680.2 (43.589037)	298518.4 (-79.577795)	103.1	7.1	3.6
21-2	4827726.5 (43.589455)	298557.4 (-79.577312)	102.8	13.1	5.4
21-5	4827869.4 (43.590741)	298670.6 (-79.575912)	104.1	5.2	-
21-6	4827936.8 (43.591349)	298721.6 (-79.575280)	104.8	5.2	-
21-7	4828011.6 (43.592022)	298785.3 (-79.574493)	105.7	5.2	-
OPB-1	4827795.8 (43.596105)	298595.9 (-79.569451)	103.1	9.1	3.0
NW3-1	4,828,093.0 (43.592747)	298,865.6 (-79.573496)	105.5	5.2	-
Segment B: North Service Road from Stanfield Road to Harvest Drive					
21-8	4828146.0 (43.593233)	298892.2 (-79.573171)	105.4	15.8	6.3
21-13	4828177.2 (43.593514)	298907.7 (-79.572979)	106.3	10.7	1.6
21-14	4828186.3 (43.593597)	298924.7 (-79.572769)	106.1	11.4	3.2
21-15	4828209.7 (43.593807)	298955.4 (-79.572388)	105.3	10.7	4.1
21-16	4828285.5 (43.594489)	299001.2 (-79.571822)	105.6	10.1	5.6
21-17	4828302.9 (43.594646)	299028.6 (-79.571483)	105.0	10.9	6.9
21-18	4828377.6 (43.595320)	299071.7 (-79.570950)	105.1	10.0	6.2



Borehole No.	Location (MTM NAD 83 Zone 10)		Ground Surface Elevation (m)	Total Borehole Depth (m)	Bedrock Coring Length (m)
	Northing (m) (Latitude, °)	Easting (m) (Longitude, °)			
Segment A: North Service Road from Westfield Drive to Stanfield Road					
21-1	4827680.2 (43.589037)	298518.4 (-79.577795)	103.1	7.1	3.6
21-2	4827726.5 (43.589455)	298557.4 (-79.577312)	102.8	13.1	5.4
21-5	4827869.4 (43.590741)	298670.6 (-79.575912)	104.1	5.2	-
21-6	4827936.8 (43.591349)	298721.6 (-79.575280)	104.8	5.2	-
21-7	4828011.6 (43.592022)	298785.3 (-79.574493)	105.7	5.2	-
OPB-1	4827795.8 (43.596105)	298595.9 (-79.569451)	103.1	9.1	3.0
NW3-1	4,828,093.0 (43.592747)	298,865.6 (-79.573496)	105.5	5.2	-
Segment B: North Service Road from Stanfield Road to Harvest Drive					
21-8	4828146.0 (43.593233)	298892.2 (-79.573171)	105.4	15.8	6.3
21-13	4828177.2 (43.593514)	298907.7 (-79.572979)	106.3	10.7	1.6
21-14	4828186.3 (43.593597)	298924.7 (-79.572769)	106.1	11.4	3.2
21-15	4828209.7 (43.593807)	298955.4 (-79.572388)	105.3	10.7	4.1
21-16	4828285.5 (43.594489)	299001.2 (-79.571822)	105.6	10.1	5.6
21-17	4828302.9 (43.594646)	299028.6 (-79.571483)	105.0	10.9	6.9
21-18	4828377.6 (43.595320)	299071.7 (-79.570950)	105.1	10.0	6.2

Borehole No.	Location (MTM NAD 83 Zone 10)		Ground Surface Elevation (m)	Total Borehole Depth (m)	Bedrock Coring Length (m)
	Northing (m) (Latitude, °)	Easting (m) (Longitude, °)			
CV02/03-1	4,828,381.4 (43.595345)	299,091.3 (-79.570703)	104.5	7.7	3.2
NW3-2	4,828,152.0 (43.593279)	298,912.2 (-79.572919)	105.5	5.2	-
NW3-4	4,828,264.1 (43.594289)	299,000.1 (-79.571833)	105.0	5.0	-
NW3-5	4,828,334.1 (43.594919)	299,054.2 (-79.571163)	104.7	4.7	-
NW3-6	4,828,434.5 (43.595823)	299,136.6 (-79.570143)	105.0	4.7	-
<b>Segment C: South Service Road from Haig Boulevard to Dixie Road</b>					
21-11	4828031.9 (43.592207)	298928.7 (-79.572717)	104.7	13.1	2.6
21-23	4828038.0 (43.592261)	298880.2 (-79.573318)	105.4	5.2	-
21-24	4828132.4 (43.593113)	298979.3 (-79.572091)	104.7	6.7	-
21-25	4828195.9 (43.593683)	299031.6 (-79.571444)	104.0	6.2	-
21-26	4828270.6 (43.594356)	299098.6 (-79.570615)	103.8	6.1	2.3
21-27	4828333.0 (43.594919)	299168.6 (-79.569749)	101.8	6.9	4.6
21-28	4828324.4 (43.594842)	299195.3 (-79.569419)	103.4	7.2	3.1
CV02/03-3	4828335.4 (43.594932)	299149.6 (-79.569981)	103.2	5.0	-

Borehole No.	Location (MTM NAD 83 Zone 10)		Ground Surface Elevation (m)	Total Borehole Depth (m)	Bedrock Coring Length (m)
	Northing (m) (Latitude, °)	Easting (m) (Longitude, °)			
Segment D: Dixie Road from North Service Road to Sherway Drive					
21-19	4828485.1 (43.596288)	299155.1 (-79.569918)	105.9	4.8	1.5
21-20	4828744.5 (43.598622)	299135.4 (-79.570165)	108.3	4.8	-
21-21	4828828.6 (43.599380)	299098.7 (-79.570621)	109.3	4.0	-
21-22	4828896.7 (43.599992)	299097.9 (-79.570631)	109.7	4.0	-
NW4-1	4,828,595.5 (43.597273)	299,115.9 (-79.570402)	107.5	4.7	-
NW4-2	4,828,628.9 (43.597573)	299,093.7 (-79.570676)	107.7	4.7	-
NW4-3	4,828,683.3 (43.598063)	299,100.6 (-79.570592)	108.1	4.7	-
Segment E: Brentano Boulevard					
21-38	4828774.3 (43.598891)	299253.9 (-79.568697)	108.6	6.2	-
21-39	4828860.8 (43.599671)	299321.2 (-79.567865)	108.1	6.2	-
21-40	4828964.3 (43.600603)	299405.2 (-79.566825)	107.6	6.2	-
21-41	4829065.5 (43.601515)	299507.2 (-79.565562)	107.5	5.3	-
21-42	4829134.8 (43.602139)	299617.8 (-79.564193)	107.6	6.2	-
21-43	4829230.7 (43.603003)	299687.3 (-79.563333)	108.3	3.8	--
17-1	4829208.1 (43.602800)	299689.8 (-79.563321)	108.5	7.9	-

Borehole No.	Location (MTM NAD 83 Zone 10)		Ground Surface Elevation (m)	Total Borehole Depth (m)	Bedrock Coring Length (m)
	Northing (m) (Latitude, °)	Easting (m) (Longitude, °)			
Segment F: Dixie Road and South Service Road to East of Liveoak Drive					
21-29	4828449.9 (43.595972)	299399.6 (-79.566890)	105.0	5.3	2.7
21-30	4828504.8 (43.596467)	299394.1 (-79.566958)	105.6	5.5	2.2
21-31	4828580.5 (43.597147)	299337.1 (-79.567665)	106.0	6.6	3.0
21-33	4828730.9 (43.598502)	299427.8 (-79.566543)	106.6	6.4	2.3
21-37	4828560.0 (43.596964)	299365.4 (-79.567315)	105.4	11.3	5.1
NW6-3	4,828,635.2 (43.597632)	299,356.3 (79.567427)	107.0	4.7	-
NW6-4	4,828,676.7 (43.598005)	299,389.8 (-79.567010)	106.8	4.7	-
NW6-5	4,828,757.0 (43.598728)	299,446.5 (-79.566308)	106.5	4.7	-
RW1-1	4828384.5 (43.595385)	299442.5 (-79.566358)	103.5	3.7	-
RW2-2	4,829,107.3 (43.601883)	299,651.6 (-79.563771)	108.1	18.7	-

## 3.2 Single-Well Response Testing

In June and July 2021, single-well response tests (SWRTs) were completed by Golder in all wells installed within 21-series boreholes that had sufficient water for testing.

Prior to the start of each test, the depth to the water level was measured with an electronic water level meter and the monitoring well was instrumented with a pressure transducer datalogger (Solinst levellogger) to continuously monitor the water level. The single-well response testing comprised using a weighted “slug” to displace a known volume of groundwater as the slug is inserted into the water column to generate a falling head test, and then removed from the water column to generate a rising head test. The displacement of the water column for the falling and rising head tests was recorded using a data logger, and also checked manually throughout the test using a water level meter. Monitoring of water level recovery continued until the level had stabilised to the pre-

slug level. Exceptions to this process did occur during the slug testing where the time period for stabilisation was longer than practical.

Data loggers used for the slug testing were decontaminated between monitoring wells.

### 3.3 Geotechnical Laboratory Testing

Index and classification tests consisting of water contents, Atterberg Limits, and grain size distributions were carried out on selected soil samples and point load index testing was carried out on selected bedrock samples in Golder's Mississauga laboratory. Selected bedrock core samples were submitted to Geomechanica Inc. of Toronto, Ontario for uniaxial compressive strength testing, assessment of Young's modulus and bulk density, as well as tensile strength (Brazilian Disc) testing, CERCHAR abrasivity testing, and slake durability testing. In addition, point load index testing of selected bedrock core samples was completed in Golder's Mississauga laboratory. The laboratory tests were carried out to MTO and/or ASTM Standards, as appropriate.

### 3.4 Corrosivity Testing

Selected soil samples were submitted to Bureau Veritas Laboratories under chain-of-custody protocols for chemical analysis related to corrosion of exposed buried steel and sulphate attack on buried concrete elements.

### 3.5 Analytical Laboratory Testing

Soil, bedrock, and groundwater samples were collected and submitted for chemical analysis as part of the investigation program. Soil and bedrock samples were collected from selected boreholes at various depths. Soil samples were retrieved from split spoon samplers during the drilling program. Bedrock samples also retrieved from rock cores. Groundwater samples were obtained after development and recovery of the installed wells. Select soil and bedrock samples were submitted for environmental analysis in general accordance with the project scope for excess soil reuse and waste characterization. Selected groundwater samples were submitted for environmental analysis in support of Permit-To-Take-Water applications and to support identification of discharge options. The table below summarizes the environmental sampling and analysis plan completed during the investigation program; the results of these limited environmental soil analyses are presented in Section 4.5.

Borehole / Monitoring Well Location	Sample Matrix	Number of Samples Analyzed	Analytical Parameters
21-2	Soil	2	One or more of metals and inorganics
	Groundwater	1	Metals, inorganics, PHCs, PAHs and Peel Sewer Use By-Law
21-4	Soil	1	Metals and inorganics
	Groundwater	1	Metals, inorganics, PHCs, PAHs and Peel Sewer Use By-Law
	Bedrock	1	Inorganics
21-8	Soil	1	Metals and inorganics
21-11	Soil	2	One or more of metals and inorganics
	Groundwater	1	Metals, inorganics, PHCs, PAHs and Peel Sewer Use By-Law

Borehole / Monitoring Well Location	Sample Matrix	Number of Samples Analyzed	Analytical Parameters
21-16	Groundwater	1	Peel Sewer Use By-Law
21-17	Soil	1	SPLP
21-23	Soil	2	One or more of metals, inorganics, VOCs, PHCs, BTEX, PAHs, PCBs and SPLP
21-27	Soil	3	One or more of metals, inorganics, VOCs, PHCs, BTEX, PAHs, PCBs, TCLP and SPLP
21-28	Soil	1	Metals, inorganics, VOCs, PHCs, BTEX, PAHs and PCBs
21-31	Soil	3	One or more of metals, inorganics, VOCs, PHCs, BTEX, PAHs, PCBs, TCLP and SPLP
21-33	Soil	1	Metals, inorganics, VOCs, PHCs, BTEX, PAHs and PCBs
	Groundwater	1	Metals, inorganics, PHCs, PAHs,
21-34	Bedrock	1	Inorganics
	Groundwater	1	Metals, inorganics, PHCs, PAHs,
21-37	Soil	1	Inorganics
	Groundwater	1	Peel Sewer Use By-Law
21-38	Soil	1	Metals, inorganics, VOCs, PHCs, BTEX, PAHs and PCBs
21-39	Soil	3	One or more of metals, inorganics, VOCs, PHCs, BTEX, PAHs, PCBs and TCLP
21-40	Soil	4	One or more of metals, inorganics, VOCs, PHCs, BTEX, PAHs, PCBs, TCLP and SPLP
21-41	Soil	1	Metals, inorganics, VOCs, PHCs, BTEX, PAHs and PCBs
21-42	Soil	3	One or more of metals, inorganics, VOCs, PHCs, BTEX, PAHs, PCBs and SPLP
21-43	Soil	2	One or more of metals, inorganics, VOCs, PHCs, BTEX, PAHs, PCBs and SPLP

**Notes:**

PHCs: petroleum hydrocarbons

BTEX: benzene, toluene, ethylbenzene, total xylenes

VOCs: volatile organic compounds

PAHs: polycyclic aromatic hydrocarbons

PCBs: polychlorinated biphenyls

TCLP: toxicity characteristic leaching procedure

SPLP: synthetic precipitation leaching procedure

Peel Sewer Use By-Law: Peel Wastewater By-Law No. 53-100

Environmental sampling was carried out in accordance with Golder's standard operating procedures. Soil and groundwater samples were collected in pre-cleaned and labelled, laboratory-supplied containers. Soil and groundwater samples were handled with dedicated nitrile gloves and stored in coolers with ice following sample collection and prior to submission to the laboratory. Soil and groundwater samples were submitted to BV Labs under chain-of-custody procedures and sample holding times were in accordance with the Ministry of Environment, Conservation and Parks (MECP) document "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act", dated March 9, 2004 and amended as of July 1, 2011 (the "MECP Analytical Protocol").

## 4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

### 4.1 Regional Geology

As delineated in *The Physiography of Southern Ontario*<sup>1</sup> the project area is located within the Iroquois Plain physiographic region. The glacial Iroquois Plain stretches along the northern shoreline of Lake Ontario, extending from the Niagara Escarpment in the west to the Scarborough Bluffs in the east. The Iroquois Plain soils consist of glaciolacustrine sediments deposited in Lake Iroquois, primarily comprising sands, silts and gravels, with a shallow cover of till remaining over the bedrock.

The site is underlain by blue-grey shale bedrock of the Georgian Bay Formation that containing siltstone, sandstone and limestone interbeds. Outcrops of this formation are commonly found along water courses on the west side of Toronto and in Mississauga, notably in the Humber River, Mimico Creek, Etobicoke Creek and Credit River valleys.

### 4.2 Subsurface Conditions

The subsurface soil, bedrock and groundwater conditions encountered in the boreholes and the results of in-situ testing from the current investigation are given on the borehole and drillhole records presented in Appendices A to F, in which the appendices correspond to Segments A to F of the proposed watermain and/or sewer alignments. Lists of abbreviations and symbols, lithological and geotechnical rock description terminology, field estimation of rock hardness and rock weathering classification are also included before the appendices to assist in the interpretation of the borehole and drillhole records.

Photographs of the bedrock core, where applicable, are provided within Appendices A to F following the borehole/drillhole records. The results of geotechnical laboratory testing are presented on the borehole records and on figures contained within Appendices A to F for each section of watermain or sewer, except for geotechnical testing of bedrock samples which are summarized site-wide in Appendix G. The results of analytical testing on selected samples of soil and bedrock are contained in Appendix H, and the results of analytical testing on selected samples of groundwater are contained in Appendix I.

The borehole locations are shown on Drawings 1 to 3, and interpreted stratigraphic profiles projected along the proposed segments of watermain and sewer are provided on Profiles A to F on Drawings 4 to 7. The stratigraphic boundaries shown on the borehole records and on the interpreted stratigraphic sections on Drawings 4 to 7 are inferred from observations of drilling progress and noncontinuous sampling and therefore represent transitions

---

<sup>1</sup> Chapman, L.J. and Putman, D.F., 1984, *The Physiography of Southern Ontario*, Ontario Geological Society, Special Volume 2, Third Edition. Accompanied by Map p. 2715, Scale 1:600,000.)

between soil types rather than exact planes of geological change. The subsoil conditions will vary between and beyond the borehole locations.

#### **4.2.1 Segment A – North Service Road from Westfield Drive to Stanfield Road**

Boreholes 21-1, 21-2, 21-5 to 21-7, OPB-1 and NW3-1 were drilled in this watermain segment; the borehole locations are shown on Drawing 1 and the interpreted stratigraphic profile is shown on Profile A-A' on Drawing 4. The subsurface conditions in this segment consist of fill overlying silty sand to sandy silt, overlying a complex of cohesive soils (ranging from clayey silt, to clayey silt till, to clayey silt residual soil), underlain by shale bedrock. A more detailed description of the subsurface conditions along this segment is provided in the following sub-sections.

##### **4.2.1.1 Topsoil and Asphalt**

A layer of topsoil, about 70 to 180 mm in thickness, was encountered at the ground surface in Boreholes 21-5, 21-6 and 21-7, which were drilled on the north side of North Service Road.

Boreholes 21-1, OPB-1 and NW3-1 were advanced through the pavement structure on Westfield Drive, in the existing plaza parking lot and on North Service Road, respectively. The thickness of the asphalt was between about 100 and 230 mm.

##### **4.2.1.2 Fill – Sand and Gravel to Silty Sand to Gravelly Clayey Sand**

Fill was encountered in all boreholes in this segment, at the ground surface in Borehole 21-2, below the topsoil in Boreholes 21-5, 21-6 and 21-7, and below the pavement in Boreholes 21-1, OPB-1 and NW3-1. The fill consists predominantly of sand and gravel to sand to silty sand, which ranges in thickness from 0.3 m to 2.2 m, extending to depths of 0.7 m to 2.2 m corresponding to Elevation 105.0 m to 100.6 m, with this base elevation generally rising toward the east. This non-cohesive fill is underlain by cohesive fill consisting of gravelly clayey sand or clayey sand grading to silty and in the two boreholes near the western end of this segment; the cohesive fill is 0.7 m thick in Borehole 21-1 extending to Elevation 100.9 m, and 3.8 m thick in Borehole 21-2 extending to Elevation 96.8 m.

Standard Penetration Test (SPT) "N" values of 6 to 20 blows per 0.3 m of penetration were measured in the non-cohesive fill, indicating the fill is loose to compact, while SPT "N" values of 1 to 3 blows per 0.3 m of penetration were measured in the thicker clayey silt to silty sand fill material in Borehole 21-2, suggesting this material is soft/very loose.

The result of grain size distribution tests carried out on three selected samples from this layer are presented on Figure A1 in Appendix A. An Atterberg limits test was carried out on one sample from Borehole 21-2 and measured a liquid limit of about 22%, a plastic limit of about 16%, and a corresponding plasticity index of about 6%. These results, which are plotted on a plasticity chart on Figure A2 in Appendix A, combined with the results of the grain size distribution test suggest that this portion of the fill can be classified as clayey sand with low plasticity. The measured moisture content of selected fill samples tested was between approximately 7% and 20%.



### 4.2.1.3 Silty Sand to Sandy Silt

A native silty sand to sandy silt deposit was encountered underlying the fill layer in Boreholes OPB-1, 21-5, 21-6, 21-7 and NW3-1. This deposit extends to depths of approximately Elevation 100.9 m to 99.1 m, corresponding to about 3.2 m to 5.2 m below existing ground surface where it was fully penetrated in Boreholes 21-5, NW3-1 and OPB-1. Boreholes 21-6 and 21-7 were terminated within this deposit at depths of 5.2 m (Elevation 99.6 m and 100.5 m, respectively).

The SPT “N” values measured in this silty sand to sandy silt deposit range from about 6 to 33 blows per 0.3 m of penetration, indicating a generally loose to dense state of compactness.

The results of grain size distribution tests carried out on six selected samples from this deposit are presented on Figure A3 in Appendix A. An Atterberg limits test was carried out on one sample of sandy silt and measured a liquid limit of about 17%, a plastic limit of about 15%, and a corresponding plasticity index of about 2%. These results, which are plotted on a plasticity chart on Figure A4 in Appendix A, combined with the results of the grain size distribution tests indicate that the fines within this deposit can be classified as silt with slight plasticity. The water content of selected samples of the silty sand to sandy silt deposit ranged from about 8% to 26%.

### 4.2.1.4 Cohesive Soil Complex (Clayey Silt to Clayey Sand, Clayey Silt Till, and Clayey Silt Residual Soil)

Layers of cohesive soil were encountered below the silty sand to sandy silt deposit and above the shale bedrock in Boreholes 21-1, 21-2, 21-5, OPB-1 and NW3-1. These layers have been interpreted as non-till, till and residual soil, but all are thin and therefore for the purposes of developing a subsurface model for the cut-and-cover works, they have been grouped together. These layers vary in composition from clayey sand, to gravelly sandy clayey silt to clayey silt till, to clayey silt residual soil. The top of the cohesive soil complex was encountered between Elevation 100.9 m and 96.8 m (at depths of approximately 2.2 m to 6.0 m), and it is approximately 1.1 m to 1.6 m thick with its base at approximately 99.9 m to 95.2 m (at depths of approximately 3.3 m to 7.6 m) where the deposit was fully penetrated in Boreholes 21-1, 21-2 and OPB-1 near the western portion of this segment.

The SPT “N” values measured within these cohesive soils varies as follows:

- 4 to 15 blows per 0.3 m of penetration suggesting a firm to stiff consistency in the clayey sand to clayey silt layers in Boreholes 21-2, 21-5 and NW3-1;
- 16 to 27 blows per 0.3 m of penetration in the till layers in Boreholes 21-1 and OPB-1, suggesting a very stiff consistency, with one value of greater than 100 blows per 0.3 m of penetration at the transition to the underlying bedrock; and
- 40 blows per 0.3 m of penetration in the residual soil layer in Borehole OPB-1, indicating a hard consistency.

The results of grain size distribution tests carried out on four selected samples of these cohesive soils are presented on Figure A5 in Appendix A. Although not encountered within the boreholes in this investigation, larger particles including cobbles, boulders, or slabs of shale/limestone may be present within these cohesive soils based on their glacial origin and proximity to the surface of the bedrock.

Atterberg limits tests were carried out on five samples and measured liquid limits of about 19% to 25%, plastic limits of about 14% to 15%, and plasticity indices of about 5% to 10%. These results, which are plotted on a plasticity chart on Figure A6 in Appendix A, combined with the results of the grain size distribution tests indicate that these soils are classified as clayey silt of low plasticity. The water content of selected samples of these cohesive soils ranges from about 10% to 26%.

#### 4.2.1.5 Shale Bedrock

Bedrock was encountered below the cohesive soil layers in Boreholes 21-1, 21-2 and OPB-1 near the western end of this segment; the upper portion of the bedrock (less than 0.2 m) was penetrated by augering and split-spoon sampling, and coring was completed below this depth. The depth to bedrock and corresponding bedrock surface elevation are summarized below:

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)
21-1	3.3	99.9
21-2	7.6	95.2
OPB-1	5.8	97.3

The upper 0.2 m to 0.3 m of the bedrock is inferred to be moderately weathered, based on penetration of this zone by split-spoon sampling. Based on the review of the bedrock core samples (refer to bedrock core photographs in Appendix A), the bedrock consists of shale of the Georgian Bay Formation containing stronger limestone/siltstone layers. It is generally described as fresh to slightly weathered (W1 to W2), thinly bedded, grey, fine to very fine grained, non-porous to faintly porous, and very weak to weak (R1 to R2) shale, with slightly weathered to fresh, medium strong to very strong (R3 to R5) limestone/siltstone interbeds, as presented on the drillhole records in Appendix A. The limestone/siltstone interbeds are generally less than 20 cm and dispersed throughout the depth of the core.

The TCR and SCR of samples recovered are between 86% and 100% and between 61% and 100%, respectively. The RQD ranges from 42% to 95%, generally increasing with depth, indicative of a rock mass of poor to excellent quality, per Table 3.10 of the *Canadian Foundation Engineering Manual* (CFEM, 2006).

Further discussion regarding the results of laboratory testing in the shale bedrock throughout the project area is provided in Section 4.2.7.

#### 4.2.2 Segment B – North Service Road from Stanfield Road to Harvest Drive

Boreholes 21-8, 21-13 to 21-18, NW3-2, NW3-4 to NW3-6, and CV02/03-1 were drilled in this segment; the borehole locations are shown on Drawing 1 and the interpreted stratigraphic profile is shown on Profile B-B' on Drawing 4. The subsurface conditions in this segment consist of fill overlying sand, silty sand to sandy silt, overlying a complex of cohesive soils (ranging from clayey silt, to clayey silt till, to clayey silt residual soil), underlain by shale bedrock. A more detailed description of the subsurface conditions along this segment is provided in the following sub-sections.

##### 4.2.2.1 Topsoil and Asphalt

Layers of topsoil, about 50 to 225 mm in thickness, were encountered at the ground surface in Boreholes 21-13, 21-14 and 21-18, which were drilled on the north side of North Service Road.

Boreholes 21-15, 21-17, CV02/03-1, NW3-2 and NW3-4 to NW3-6 were advanced through the pavement structure on North Service Road. The thickness of the asphalt was between about 150 and 240 mm.

#### 4.2.2.2 *Fill – Silty Sand, Sand, Sand and Gravel and Silty Sand and Gravel*

Fill was encountered in all boreholes in this segment, at the ground surface in Boreholes 21-8 and 21-16, below the topsoil in Boreholes 21-13, 21-14 and 21-18, and below the pavement in Boreholes 21-15, 21-17, CV02/03-1, NW3-2 and NW3-4 to NW3-6. The fill consists predominantly of sand and gravel to sand to silty sand, which ranges in thickness from about 0.2 m to 2.1 m, extending to depths of 0.2 m to 2.2 m corresponding to Elevation 105.9 m to 103.3 m.

The SPT “N” values measured in this fill range from 2 to 95 blows per 0.3 m of penetration, indicating the fill is loose to very dense.

The result of a grain size distribution test carried out on one sample of fill is presented on Figure B1 in Appendix B. The measured moisture content of tested fill samples is between approximately 4% and 7%.

#### 4.2.2.3 *Silt to Sand*

A native non-cohesive deposit was encountered underlying the fill layer in all of the boreholes. The deposit varies in composition from silt, to sandy silt, to silty sand, to sand. This deposit extends to approximately Elevation 103.6 m to 98.2 m, corresponding to about 1.4 m to 7.2 m below existing ground surface where it was fully penetrated. Borehole NW3-2 was terminated within this deposit at a depth of 5.2 m (Elevation 100.3 m).

The SPT “N” values measured in this non-cohesive deposit range from about 2 to 64 blows per 0.3 m of penetration, indicating the deposit is generally very loose to very dense.

The results of grain size distribution tests carried out on fourteen selected samples from this deposit are presented on Figures B2A and B2B in Appendix B. An Atterberg limits test was carried out on one sample of silt and measured a liquid limit of about 18%, a plastic limit of about 15%, and a corresponding plasticity index of about 3%. This result is plotted on a plasticity chart on Figure B3 in Appendix B. The water content of selected samples of the non-cohesive deposit ranged from about 4% to 21%.

#### 4.2.2.4 *Cohesive Soil Complex (Clayey Silt, Silt to Silty Clay Till, and Clayey Silt Residual Soil)*

Layers of cohesive soil were encountered below the silt to sand deposit and above the shale bedrock in all of the boreholes except Borehole NW3-2. These layers have been interpreted as non-till, till and residual soil, but all are reasonably thin and therefore for the purposes of developing a subsurface model for the cut-and-cover works, they have been grouped together. These layers vary in composition from sandy clayey silt to clayey silt, sandy clayey silt to silty clay till, to clayey silt residual soil; a zone of silt till encountered in Borehole 21-2 has also been included in this deposit group. The top of the cohesive soil complex was encountered between Elevation 103.6 m and 98.2 m (at depths of approximately 1.4 m to 7.2 m), and it is approximately 0.6 m to 3.2 m thick with its base at approximately 102.6 m to 96.0 m (at depths of approximately 2.4 m to 9.4 m).

The SPT “N” values measured within these cohesive soils varies as follows:

- 3 to 32 blows per 0.3 m of penetration suggesting a soft to hard consistency in the clayey silt layers in Boreholes 21-8, 21-16, 21-17, NW3-4 and NW3-6;
- 7 to 52 blows per 0.3 m of penetration in the till layers in Boreholes 21-13 to 21-16, 21-18 and NW3-5, suggesting a firm to hard consistency, with one value of greater than 100 blows per 0.3 m of penetration at the transition to the underlying bedrock; and

- 15 to 69 blows per 0.3 m of penetration in the residual soil layer in Boreholes 21-8, CV02/02-1 and NW3-4, indicating a very stiff to hard consistency, with one value of 67 blows per 0.15 m of penetration at the transition to the underlying bedrock.

The results of grain size distribution tests carried out on nine selected samples of these soils are presented on Figures B4A and B4B in Appendix B. Although not encountered within the boreholes in this investigation, larger particles including cobbles, boulders, or slabs of shale/limestone may be present within these cohesive soils based on their glacial origin and proximity to the surface of the bedrock.

Atterberg limits tests were carried out on a total of eleven samples. For ten of these samples, the liquid limits range from about 21% to 42%, the plastic limits from about 15% to 23%, and the plasticity indices from about 6% to 19%; the silt till in Borehole 21-14 is also grouped with this soil complex, and one Atterberg limits test in this material measured a liquid limit of about 18%, a plastic limit of about 16%, and a plasticity index of about 2%. These results, which are plotted on plasticity charts on Figures B5A and B5B in Appendix B, combined with the results of the grain size distribution tests indicate that these soils are generally classified as clayey silt of low plasticity, with one sample a silty clay of intermediate plasticity, and the silt till sample displaying slight plasticity. The water content of selected samples of these soils ranges from about 11% to 32%.

#### 4.2.2.5 Shale Bedrock

Bedrock was encountered below the cohesive soil layers in all of the boreholes except NW3-2; in general, the upper portion of the bedrock was penetrated by augering and split-spoon sampling, and coring was completed below this depth. In the NW series boreholes, the bedrock was explored by augering. The depth to bedrock and corresponding bedrock surface elevation are summarized below:

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)	Notes
21-8	9.4	96.0	Bedrock penetrated 0.1 m by split-spoon sampling, then cored for 6.3 m
21-13	9.1	97.2	Bedrock penetrated 0.2 m by split-spoon sampling, then cored for 1.6 m
21-14	8.1	98.0	Bedrock penetrated 0.1 m by split-spoon sampling, then cored for 3.2 m
21-15	5.5	99.8	Bedrock penetrated 1.1 m by augering and split-spoon sampling, then cored for 4.1 m
21-16	4.1	101.5	Bedrock penetrated 0.3 m by augering and split-spoon sampling, then cored for 5.6 m
21-17	3.8	101.1	Bedrock penetrated 0.1 m by split-spoon sampling, then cored for 6.9 m
21-18	3.4	101.7	Bedrock penetrated 0.3 m by split-spoon sampling, then cored for 6.2 m

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)	Notes
CV02/03-1	3.7	100.8	Bedrock penetrated 2.2 m by augering and split-spoon sampling, then cored for 3.2 m
NW3-4	4.9	100.1	Bedrock penetrated 0.1 m by split-spoon sampling
NW3-5	2.4	102.3	Bedrock penetrated 2.3 m by augering and split-spoon sampling
NW3-6	2.4	102.6	Bedrock penetrated 2.3 m by augering and split-spoon sampling

In general, the upper 0.1 m to 0.4 m of the bedrock is inferred to be moderately to highly weathered, based on penetration of this zone by split-spoon sampling; thicker zones of weathered shale were also inferred from sampling in Boreholes 21-15, CV02/03-1, NW3-5 and NW3-6.

Based on the review of the bedrock core samples (refer to bedrock core photographs in Appendix B), the bedrock consists of shale of the Georgian Bay Formation containing stronger limestone/siltstone layers. It is generally described as fresh to moderately weathered (W1 to W3), thinly bedded, grey, fine to very fine grained, non-porous to faintly porous, and very weak to weak (R1 to R2) shale, with slightly weathered to fresh, medium strong to very strong (R3 to R5) limestone/siltstone interbeds, as presented on the drillhole records in Appendix B. The limestone/siltstone interbeds are generally less than 20 cm and dispersed throughout the depth of the core.

The upper portion of the bedrock in Boreholes 21-13, 21-15, 21-17 and 21-18 was generally highly weathered with a range in RQD from 0% to 11%. In the lower portions of the bedrock The TCR and SCR of samples recovered are between 43% and 100% with an average of about 93% and between 26% and 100% with an average of about 90%, respectively. The RQD ranges from 9% to 100% with an average of about 77%, indicative of a rock mass of poor to excellent quality, per Table 3.10 of the *Canadian Foundation Engineering Manual* (CFEM, 2006). The final core run in Borehole 21-14, from about 10.6 m depth, had an RQD of nil.

Further discussion regarding the results of laboratory testing in the shale bedrock throughout the project area is provided in Section 4.2.7.

### 4.2.3 Segment C – South Service Road from Haig Boulevard to Dixie Road

Boreholes 21-11, 21-23 to 21-28, and CV02/03-3 were drilled in this segment; the borehole locations are shown on Drawing 1 and the interpreted stratigraphic profile is shown on Profile C-C' on Drawing 5. The subsurface conditions in this segment consist of fill overlying silty sand to sandy silt, overlying a complex of cohesive soils (generally consisting of clayey silt, to clayey silt till, to clayey silt residual soil), underlain by shale bedrock. A more detailed description of the subsurface conditions along this segment is provided in the following sub-sections.

#### 4.2.3.1 Asphalt and Topsoil

Boreholes 21-11 and 21-23 through 21-26 were advanced through the pavement structure. The thickness of the asphalt is between approximately 100 and 330 mm in these boreholes.

A layer of topsoil measuring about 100 and 350 mm in thickness was encountered immediately below ground surface in Boreholes 21-27 and 21-28, respectively.

#### **4.2.3.2 Fill – Gravelly Sand to Silt and Sand, and Clayey Silt**

Fill was encountered below the asphalt in Boreholes 21-11 and BH21-23 through BH21-26, below the topsoil in Boreholes 21-27 and 21-28, and extending from ground surface in Borehole CV02/03-3. The encountered fill generally ranges from 0.3 m to 2.5 m in thickness, with its base between approximately Elevation 104.8 m and 100.1 m, although the fill is approximately 4.9 m thick in Borehole CV02/03-3 where it extends to Elevation 98.3 m, just above the shale bedrock at that location.

The fill is generally non-cohesive, ranging from gravelly sand, to sand, to silty sand, to silt and sand; however, in Borehole 21-27, the fill consists of clayey silt containing some sand and trace gravel. The measured SPT “N” values range from 2 to 39 blows per 0.3 m of penetration, indicating the non-cohesive fill is very loose to compact, and the cohesive fill is very stiff to hard. Higher SPT “N” values were measured at the base of the fill in Boreholes 21-27 and CV02/03-3, and these are attributed to the interface with the underlying shale bedrock.

The results of grain size distribution tests carried out on three selected samples of the non-cohesive fill are presented on Figure C1 in Appendix C. The measured water content on selected samples of fill ranges from about 4% to 21%.

#### **4.2.3.3 Silty Sand to Sandy Silt**

A silty sand to sandy silt deposit was encountered underlying the fill in Boreholes 21-11, 21-23 to 21-25 and 21-28; this deposit was not encountered in Borehole 21-26 where the fill directly overlies cohesive soil, or in Boreholes 21-27 and CV02/03-3 where the fill overlies shale bedrock. The silty sand to sand silt deposit varies in thickness from 1.2 m to 5.5 m where fully penetrated, with its base between approximately Elevation 100.6 m and 96.9 m (at depths of 1.9 m to 7.8 m below existing ground surface), generally rising from west to east.

The SPT “N” values measured in this deposit generally range from about 7 to 23 blows per 0.30 m of penetration, indicating the deposit is generally loose to compact. Lower values of “weight of hammer (WH)”, 2 and 3 blows per 0.3 m of penetration were measured in this deposit in Borehole 21-24, where they are attributable to disturbance by groundwater inflow to the borehole during sampling rather than a very loose condition, and at the top of this deposit in Boreholes 21-25. One higher SPT “N” value of 44 blows per 0.3 m of penetration was measured in this deposit suggesting locally dense zones.

The results of grain size distribution tests on seven samples from this deposit are presented on Figure C2 in Appendix C. An Atterberg limits test was carried out on one sample of sandy silt from this deposit, which was found to be non-plastic. The measured water content of selected samples of silty sand to sandy silt ranges from about 6% to 28%.

#### **4.2.3.4 Cohesive Soil Complex (Clayey Silt, Clayey Silt Till, and Clayey Silt Residual Soil)**

Layers of cohesive soil were encountered below the silty sand to sandy silt deposit in Boreholes 21-11, 21-25, and 21-28, and below the fill in Borehole 21-26. These layers have been interpreted as non-till, till and residual soil, but have been grouped together for the purposes of developing a subsurface model for the cut-and-cover works. These layers vary in composition from clayey silt to clayey sand, to clayey silt or sandy clayey silt till, to clayey silt residual soil. The top of the cohesive soil complex was encountered between Elevation 96.9 m (7.8 m depth) and 103.1 m (0.7 m depth), generally rising from west to east across the site. The total thickness of these layers is between 1.1 m and 3.1 m.



The SPT “N” values measured within these cohesive soils varies as follows:

- 2 to 7 blows per 0.3 m of penetration suggesting a soft to firm consistency in the thin clayey silt to clayey sand layers in Boreholes 21-11, 21-25, and 21-28;
- 6 to 29 blows per 0.3 m of penetration in the till layers in Boreholes 21-11 and 21-26, suggesting a firm to very stiff consistency; and
- 13 to 43 blows per 0.3 m of penetration in the residual soil layer in Borehole OPB-1, indicating a hard consistency.

The results of grain size distribution tests on three samples from the cohesive soil deposits are presented on Figure C3 in Appendix C. Atterberg limits tests were carried out on five samples from the cohesive layers and measured liquid limits of about 15% to 35%, plastic limits of about 2% to 17%, and plasticity indices of about 9% to 18%. These results, which are plotted on a plasticity chart on Figure C4 in Appendix C, combined with the results of the grain size distribution tests indicate that cohesive soils are generally classified as clayey silt of low plasticity, although one tested sample is silty clay of intermediate plasticity. The measured water content of selected samples of the cohesive soils ranges from about 8% to 32%.

#### 4.2.3.5 Shale Bedrock

Bedrock was encountered below the cohesive soil layers in Boreholes 21-11, 21-25, 21-26 and 21-28, and below the fill in Boreholes 21-27 and CV02/03-3. The depth to bedrock and corresponding bedrock surface elevation are summarized below:

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)	Notes
21-11	10.5	94.2	Bedrock cored for 2.6 m
21-25	6.1	97.9	Bedrock penetrated 0.1 m by split-spoon sampler
21-26	3.8	100.0	Bedrock cored for 2.3 m
21-27	2.3	100.1	Upper 0.6 m penetrated by augering, then cored for 4.6 m
21-28	3.0	100.4	Upper 1.1 m penetrated by augering and split-spoon sampling, then cored for 3.1 m
CV02/03-3	4.9	98.3	Bedrock penetrated 0.1 m by split-spoon sampler

In general, the upper 0.1 m to 0.7 m of the bedrock is inferred to be moderately to highly weathered, based on penetration of this zone by split-spoon sampling.

Based on the review of the bedrock core samples (refer to bedrock core photographs in Appendix C), the bedrock consists of shale of the Georgian Bay Formation containing stronger limestone/siltstone layers. It is generally described as slightly to moderately weathered (W2 to W3), thinly bedded, grey, fine to very fine grained, non-porous to faintly porous, and very weak to weak (R1 to R2) shale, with slightly weathered to fresh, medium

strong to very strong (R3 to R5) limestone/siltstone interbeds, as presented on the drillhole records in Appendix C. The limestone/siltstone interbeds are generally less than 20 cm and dispersed throughout the depth of the core.

The TCR is generally between 73% and 100% and the SCR is generally between 60% and 100%, with the exception of 33% TCR and 0% SCR in the first run in Borehole 21-1. The RQD ranges from 0% to 32% in the first run in all cored boreholes indicating very poor to poor quality rock, increasing to 71% to 100% in subsequent runs indicating good to excellent quality, per Table 3.10 of the *Canadian Foundation Engineering Manual* (CFEM, 2006).

Further discussion regarding the results of laboratory testing in the shale bedrock throughout the project area is provided in Section 4.2.7.

#### **4.2.4 Segment D – Dixie Road from North Service Road to Sherway Drive**

Boreholes 21-19 to 21-22, and NW4-1 to NW4-3 were drilled in this segment, which involves the realignment of North Service Road along the west side of the existing Dixie Road embankment, to connect to the new Dixie Road alignment. The borehole locations are shown on Drawings 1 and 2 and the interpreted stratigraphic profile is shown on Profile D-D' on Drawing 5. The subsurface conditions in this segment consist of fill overlying silty sand to sandy silt, overlying a thin cohesive soil layer (clayey silt till to clayey silt residual soil), underlain by shale bedrock. A more detailed description of the subsurface conditions along this segment is provided in the following sub-sections.

##### **4.2.4.1 Topsoil and Asphalt/Concrete**

A layer of topsoil, about 50 mm to 300 mm in thickness, was encountered immediately below ground surface in Boreholes 21-19 to 21-21 and NW4-1 to NW4-3, all of which were advanced outside of the existing North Service Road and Dixie Road alignments.

Borehole 21-22 was advanced through the existing Dixie Road pavement structure, and encountered approximately 100 mm of asphalt overlying 80 mm of concrete.

##### **4.2.4.2 Fill – Sand to Sand and Gravel**

A 0.1 m thick layer of sand fill was encountered below the topsoil in Borehole 21-19 to the north of North Service Road, and a 0.4 m thick layer of sand and gravel fill was encountered below the pavement in Borehole 21-22 on the existing Dixie Road. Thicker fill will be present in the existing Dixie Road embankment in this section.

##### **4.2.4.3 Silty Sand to Sand**

A 2.2 m to 3.2 m thick deposit of silty sand to sand, trace to some silt, was encountered below the topsoil or fill in all boreholes along this segment. The deposit extends to approximately Elevation 103.5 m to 106.0 m (at depths of about 2.3 m to 3.3 m below ground surface), generally rising from south to north.

The measured SPT “N” values are between 3 and 44 blows per 0.3 m of penetration in this layer, indicating the deposit is very loose to dense.

The results of grain size distribution tests carried out on eight samples from this deposit are presented on Figure D1 in Appendix D. The measured water content of selected samples of this deposit ranges from about 4% to 23%.



#### 4.2.4.4 Cohesive Soil Complex (Clayey Silt Till and Clayey Silt Residual Soil)

A thin cohesive soil layer was encountered below the silty sand to sand deposit in Boreholes 21-19, 21-21, NW4-1 and NW4-2. This deposit is comprised of clayey silt containing trace sand and gravel as well as shale fragments, and has been interpreted as a till or a residual soil in the boreholes; they have been grouped together for the purposes of developing a subsurface model for the cut-and-cover works. Where present, the top of this cohesive soil complex was encountered in the boreholes between Elevation 103.5 m and 106.0 m (at a depth of approximately 2.3 m to 3.3 m below ground surface), and the total thickness of these layers is approximately 0.1 m to 0.6 m.

The SPT “N” values measured in these cohesive layers range from 19 to 47 blows per 0.3 m of penetration, suggesting a very stiff to hard consistency; one higher SPT “N” value of 100 blows per 0.3 m of penetration is attributed to the underlying shale bedrock.

The result of a grain size distribution test carried out on one sample of clayey silt till is presented on Figure D2 in Appendix D. An Atterberg limits test was carried out on one sample and measured a liquid limit of about 28%, a plastic limit of about 15%, and a corresponding plasticity index of about 13%. These results, which are plotted on a plasticity chart on Figure D3 in Appendix D, combined with the results of the grain size distribution tests indicate that the cohesive soil can be classified as clayey silt of low plasticity. The water content of a selected sample of the cohesive till was about 15%.

#### 4.2.4.5 Shale Bedrock

Bedrock was encountered below the silty sand to sand or cohesive soil layers in all of the boreholes in this segment; in general, the bedrock was penetrated by augering and split-spoon sampling, with bedrock coring completed in Borehole 21-19. The depth to bedrock and corresponding bedrock surface elevation are summarized below:

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)	Notes
21-19	3.0	102.9	Upper 0.4 m penetrated by augering, then cored for 1.4 m
21-20	3.1	105.3	Bedrock penetrated 1.7 m by augering and split-spoon sampling
21-21	3.4	105.9	Bedrock penetrated 0.6 m by augering and split-spoon sampling
21-22	3.8	105.7	Bedrock penetrated 0.2 m by augering and split-spoon sampling
NW4-1	2.6	104.9	Bedrock penetrated 2.1 m by augering and split-spoon sampling
NW4-2	2.9	104.8	Bedrock penetrated 1.8 m by augering and split-spoon sampling
NW4-3	3.2	104.9	Bedrock penetrated 1.5 m by augering and split-spoon sampling

As elsewhere in the project area, the bedrock consists of shale of the Georgian Bay Formation containing stronger limestone/siltstone layers. Based on limited rock coring in this section together with rock coring along other segments, the bedrock is generally described as slightly to moderately weathered (W2 to W3), thinly bedded, grey, fine to very fine grained, non-porous to faintly porous, and very weak to weak (R1 to R2) shale, with slightly weathered to fresh, medium strong to very strong (R3 to R5) limestone/siltstone interbeds. The limestone/siltstone interbeds are generally less than 20 cm and dispersed throughout the depth of the core.

The TCR and SCR are 100% for the single run of rock coring in Borehole 21-19 in this segment, and the RQD is 75%, indicating excellent quality rock per Table 3.10 of the *Canadian Foundation Engineering Manual* (CFEM, 2006).

Further discussion regarding the results of laboratory testing in the shale bedrock throughout the project area is provided in Section 4.2.7.

#### **4.2.5 Segment E – Brentano Boulevard**

Boreholes 21-38 to 21-43 and 17-1 were drilled in this segment; the borehole locations are shown on Drawing 2 and the interpreted stratigraphic conditions are shown on Profiles E-E' and E1-E1' on Drawing 6. The subsurface conditions in this segment consist of fill overlying silty sand to sand, overlying a complex of cohesive soils (ranging from clayey silt to clayey sand till to clayey silt residual soil), underlain by shale bedrock. A more detailed description of the subsurface conditions along this segment is provided in the following sub-sections.

##### **4.2.5.1 Asphalt**

An approximately 100 mm to 180 mm thick layer of asphalt was found at ground surface in Boreholes 21-38 to 21-43 and 17-1.

##### **4.2.5.2 Fill – Sand and Gravel, and Silty Sand to Sand**

An approximately 0.1 to 0.5 m thick layer of fill was found below the asphalt in the boreholes in this segment. The fill ranges in composition from sand and gravel, to sand, to silty sand. Thicker fill, approximately 2.7 m in thickness extending to Elevation 105.5 m (3.0 m depth) was encountered below the sand and gravel fill in Borehole 17-1, which is located on Laughton Avenue immediately south of Brentano Boulevard.

The SPT “N” values measured in the silty sand to sand fill in Borehole 17-1 range from 16 to 3 blows per 0.3 m of penetration, decreasing with depth, suggesting the fill is compact to very loose at this location.

A grain size distribution test was completed on one sample of the fill from Borehole 17-1 and the result is shown on Figure E1 in Appendix E. The water content measured on samples of the fill from this borehole range from 8% to 17%.

##### **4.2.5.3 Sandy Silt to Sand and Gravel**

A non-cohesive deposit, approximately 1.5 m to more than 3.6 m in thickness, was encountered below the asphalt and fill in the boreholes in this segment. This deposit is typically comprised of silty sand to sand containing trace to some silt, but layers of sand and gravel and sandy silt were also encountered in the boreholes. The deposit extends to Elevation 104.9 m to 104.0 m (at depths of 3.2 m to 4.5 m below ground surface) where it was fully penetrated.

The SPT “N” values measured in this layer vary from “weight of hammer” (WH) to 45 blows per 0.3 m of penetration, indicating the deposit has a variable, very loose to dense relative density. The lower SPT “N” values

were generally measured near the upper portion of this deposit or near the groundwater level; the lower SPT “N” values near the

The result of grain size distribution tests carried out on eleven samples from this deposit are presented on Figures E2A and E2B in Appendix E. The measured moisture content of tested samples ranges from about 5% to 23%.

#### **4.2.5.4 Cohesive Soil Complex (Clayey Silt to Clayey Sand Till, and Clayey Silt to Clayey Gravel Residual Soil)**

Layers of cohesive soil were encountered below the sandy silt to sand and gravel deposit and above the shale bedrock in Boreholes 21-39 to 21-42, and 17-1. These layers vary in composition from clayey silt to clayey sand till, and clayey silt to clayey gravel residual soil; however, all have been grouped together for the purposes of developing a subsurface model for the cut-and-cover works. The top of the cohesive soil complex was encountered between approximately Elevation 104.6 m and 104.0 m (at depths of approximately 3.2 m to 4.5 m), and it is approximately 0.2 m to 3.4 m thick with its base at approximately 104.4 m to 101.3 m (at depths of approximately 3.7 m to 7.9 m).

The SPT “N” values measured within these cohesive soils vary as follows:

- 12 to 39 blows per 0.3 m of penetration in the till layers in Boreholes 21-40, 21-41, 21-42, and 17-1, suggesting a very stiff to hard consistency, with one value of greater than 100 blows per 0.2 m of penetration at the transition to the underlying bedrock; and
- 50 blows per 0.3 m of penetration and 50 blows for 0.1 m of penetration in the residual soil layer in Boreholes 21-39 and 17-1, suggesting a hard consistency.

The results of grain size distribution tests carried out on six samples of these cohesive soils are presented on Figure E3 in Appendix E. Although not encountered within the boreholes in this investigation, larger particles including cobbles, boulders, or slabs of shale/limestone may be present within these cohesive soils based on their glacial origin and proximity to the surface of the bedrock.

Atterberg limits tests were carried out on eight samples and measured liquid limits of about 23% to 30%, plastic limits of about 14% to 16%, and plasticity indices of about 7% to 13%. These results, which are plotted on a plasticity chart on Figure E4 in Appendix E, combined with the results of the grain size distribution tests indicate that these soils are classified as clayey silt of low plasticity. The water content of selected samples of these cohesive soils ranges from about 7% to 17%.

#### **4.2.5.5 Shale Bedrock**

Bedrock was encountered below the sandy silt to sand and gravel or cohesive soil layers in the majority of the boreholes in this segment, except Boreholes 21-43 and 17-1 near the east end of this segment which terminated in the overburden. The bedrock was penetrated by augering and split-spoon sampling in the boreholes in this segment. The bedrock surface generally declines from west to east in this area; the depth to bedrock and corresponding bedrock surface elevation are summarized below:

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)	Notes
21-38	3.7	104.9	Bedrock penetrated 2.5 m by augering and split-spoon sampling
21-39	3.7	104.4	Bedrock penetrated 2.5 m by augering and split-spoon sampling
21-40	4.4	103.2	Bedrock penetrated 1.8 m by augering and split-spoon sampling
21-41	5.2	102.3	Bedrock penetrated 0.1 m by augering and split-spoon sampling
21-42	5.8	101.8	Bedrock penetrated 0.4 m by augering and split-spoon sampling

As elsewhere in the project area, the bedrock consists of shale of the Georgian Bay Formation containing stronger limestone/siltstone layers. Based on rock coring along other segments, the bedrock is generally described as slightly to moderately weathered (W2 to W3), thinly bedded, grey, fine to very fine grained, non-porous to faintly porous, and very weak to weak (R1 to R2) shale, with slightly weathered to fresh, medium strong to very strong (R3 to R5) limestone/siltstone interbeds. The limestone/siltstone interbeds are generally less than 20 cm and dispersed throughout the depth of the core.

Further discussion regarding the results of laboratory testing in the shale bedrock throughout the project area is provided in Section 4.2.7.

## 4.2.6 Segment F – Dixie Road and South Service Road to East of Liveoak Drive

Boreholes 21-29 to 21-31, 21-33, 21-37, NW6-3 to NW6-5, RW1-1 and RW1-2 were drilled in this segment; the borehole locations are shown on Drawing 3 and the interpreted stratigraphic profile is shown on Profile F-F' on Drawing 7. The subsurface conditions in this segment consist of fill overlying silt to sand and gravel, overlying a complex of cohesive soils (ranging from clayey silt to sandy clayey silt, and clayey silt to sandy clayey silt till, and clayey silt residual soil), underlain by shale bedrock. A more detailed description of the subsurface conditions along this segment is provided in the following sub-sections.

### 4.2.6.1 Topsoil and Asphalt

A layer of topsoil, about 250 to 600 mm in thickness, was encountered at the ground surface in Boreholes 21-29, 21-30 and 21-37, which were drilled outside of the road surfaces.

Boreholes 21-33, NW6-3 to NW6-5, RW1-1 and RW1-2 were advanced through the pavement structure on Dixie Road and South Service Road. The thickness of the asphalt was between about 85 and 180 mm.

### 4.2.6.2 Fill – Silt, Silty Sand, Sand and Sand and Gravel

Fill was encountered at the ground surface in Borehole 21-31, and below the asphalt in Boreholes 21-33, NW6-3 to NW6-5, RW1-1 and RW1-2. The fill consists predominantly of sand and gravel to silty sand, except in Borehole RW1-1 where the encountered fill also includes silt, some sand, trace gravel. The fill ranges in thickness from 0.2 m to 2.3 m, extending to depths of 0.4 m to 2.4 m corresponding to Elevation 106.6 m to 101.1 m, with the deepest fill encountered in Boreholes RW1-1 and RW1-2 at Dixie Road.

The measured SPT “N” values range from 5 to 46 blows per 0.3 m of penetration, indicating the fill is loose to dense.

The result of grain size distribution tests carried out on two samples of the silt to silty sand portions of the fill are presented on Figure F1 in Appendix F. The measured moisture content of tested fill samples is between approximately 4% and 24%.

#### **4.2.6.3 Silt and Sand to Sand and Gravel**

A native non-cohesive soil deposit was encountered underlying the topsoil or fill layer in all boreholes in this segment except Boreholes RW1-1 and RW1-2, where the fill extends to the underlying cohesive soil complex. This deposit ranges in composition from silt and sand, to silty sand, to sand, to gravelly sand, to sand and gravel. The deposit is approximately 1.9 m to 3.3 m in thickness, extending to approximately Elevation 104.4 m to 102.4 m (at approximately 1.2 m to 3.7 m depth below ground surface).

The SPT “N” values measured in this deposit range from about 4 to 72 blows per 0.3 m of penetration, indicating that the silt to sand and gravel soils have a variable, loose to very dense relative density.

The results of grain size distribution tests carried out on twelve samples from this deposit are presented on Figures F2A and F2B in Appendix F. The water content measured on selected samples of this deposit ranges from about 7% to 21%.

#### **4.2.6.4 Cohesive Soil Complex (Clayey Silt to Sandy Clayey Silt, Clayey Silt to Sandy Clayey Silt Till, and Clayey Silt Residual Soil)**

Layers of cohesive soil were encountered below the fill in Boreholes RW1-1 and RW1-2, beneath the silt to silty sand deposit in Boreholes 21-29 and 21-33 and below the sand to sand and gravel deposit in Boreholes 21-31, 21-37 and NW6-3 to NW6-5. These layers vary in composition from clayey silt to sandy clayey silt, clayey silt to sandy clayey silt till, and clayey silt residual soil; however, all are thin and therefore have been grouped together for the purposes of developing a subsurface model for the cut-and-cover works. The top of the cohesive soil complex was encountered between Elevation 103.3 m and 101.1 m (at depths of approximately 2.2 m to 3.7 m), and it is approximately 0.2 m to 0.9 m thick with its base at approximately 103.0 m to 100.2 m (at depths of approximately 2.6 m to 4.1 m).

The SPT “N” values measured within these cohesive soils varies as follows:

- 12 and 24 blows per 0.3 m of penetration suggesting a stiff to very stiff consistency in the clayey silt to sandy clayey silt layers in Boreholes 21-29 and RW1-1; and
- 50 blows per 0.1 to 0.15 m of penetration and greater than 100 blows per 0.3 m of penetration in the till and residual soil layers, suggesting a hard consistency.

The results of grain size distribution tests carried out on three selected samples of these cohesive soils are presented on Figure F3 in Appendix F. Although not encountered within the boreholes in this investigation, larger particles including cobbles, boulders, or slabs of shale/limestone may be present within these cohesive soils based on their glacial origin and proximity to the surface of the bedrock.

Atterberg limits tests were carried out on four samples and measured liquid limits of about 24% to 29%, plastic limits of about 14% to 16%, and plasticity indices of about 10% to 13%. These results, which are plotted on a plasticity chart on Figure F4 in Appendix F, combined with the results of the grain size distribution tests indicate

that these soils are classified as clayey silt of low plasticity. The water content of selected samples of these cohesive soils ranges from about 10% to 18%.

#### 4.2.6.5 *Shale Bedrock*

Bedrock was encountered below the cohesive soil layers all of the boreholes; the upper portion of the bedrock (less than 0.2 m) was penetrated by augering and split-spoon sampling, and coring was completed below this depth in Boreholes 21-29 to 21-31, 21-33 and 21-37. In the other boreholes, the bedrock was explored by augering. The depth to bedrock and corresponding bedrock surface elevation are summarized below:

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)	Notes
21-29	5.3	99.7	Bedrock cored for 2.7 m
21-30	5.5	100.1	Bedrock penetrated 0.1 m by split-spoon sampling, then cored for 2.2 m
21-31	6.6	99.4	Bedrock penetrated 0.1 m by split-spoon sampling, then cored for 3.3 m
21-33	6.4	100.2	Bedrock penetrated 0.3 m by split-spoon sampling, then cored for 2.3 m
21-37	11.3	94.1	Bedrock penetrated 2.9 m by augering and split-spoon sampling, then cored for 5.1 m
NW6-3	4.7	102.3	Bedrock penetrated 0.7 m by augering and split-spoon sampling
NW6-4	4.7	102.1	Bedrock penetrated 0.6 m by augering and split-spoon sampling
NW6-5	4.7	101.8	Bedrock penetrated 0.6 m by augering and split-spoon sampling
RW1-1	3.7	99.8	Bedrock penetrated 0.4 m by augering and split-spoon sampling
RW1-2	3.3	100.5	Bedrock penetrated 0.2 m by augering and split-spoon sampling

In general, the upper 0.1 m to 1.0 m of the bedrock is inferred to be moderately to highly weathered, based on penetration of this zone by split-spoon sampling.

Based on review of the bedrock core samples (refer to bedrock core photographs in Appendix F), the bedrock consists of shale of the Georgian Bay Formation containing stronger limestone/siltstone layers. It is generally described as fresh to highly weathered (W1 to W4), thinly bedded, grey, fine to very fine grained, non-porous to faintly porous, and very weak to weak (R1 to R2) shale, with slightly weathered to fresh, medium strong to very strong (R3 to R5) limestone/siltstone interbeds, as presented on the drillhole records in Appendix F. The limestone/siltstone interbeds are generally less than 20 cm and dispersed throughout the depth of the core.

The upper portion of the bedrock in Boreholes 21-29, 21-33 and 21-37 was generally highly weathered with RQDs of 0%. In the lower portions of the bedrock, the TCR is between 78% and 100% with an average of about 93%, and the SCR is between 78% and 100% with an average of about 90%. The RQD ranges from 13% to 93% with an average of about 68%, indicative of a rock mass of poor to excellent quality, per Table 3.10 of the *Canadian Foundation Engineering Manual* (CFEM, 2006).

Further discussion regarding the results of laboratory testing in the shale bedrock throughout the project area is provided in Section 4.2.7.

#### 4.2.7 Geotechnical Laboratory Test Results for Shale Bedrock

Bedrock core samples from throughout the project area were submitted Geomechanica Inc. for further testing, which included eleven uniaxial compressive strength tests, eight indirect tensile strength tests, five CERCHAR Abrasivity tests, and three Slake Durability tests. It is noted that while some of these tests are from boreholes associated with the trenchless crossings of QEW (i.e., 21-3, 21-4, and 21-34 to 21-36) that are reported under separate cover, the test results have been included in this report to enhance the understanding of the bedrock properties. The test results are presented in Geomechanica's *Rock Laboratory Testing Results* reports in Appendix G, and summarized below.

The results of uniaxial compressive strength (UCS) testing completed on eleven shale bedrock core samples are summarized below and indicate UCS values ranging from approximately 6 MPa to 23 MPa, indicating a weak bedrock.

Borehole No.	Approx. Sample Depth Interval (m)	Approx. Sample Elevation Interval (m)	Uniaxial Compressive Strength (UCS) (MPa)	Bulk Density (g/cm <sup>3</sup> )	Tangent Young's Modulus (GPa)
21-3	6.6 – 6.7	96.8 – 96.6	6.3	2.621	1.2
21-4	7.4 – 7.6	95.2 – 95.0	23.0	2.632	3.4
21-16	8.9 – 9.1	96.7 – 96.5	8.6	2.600	1.3
21-17	5.4 – 5.6	99.5 – 99.3	13.2	2.603	1.4
21-34	7.8 – 7.9	99.9 – 99.8	19.1	2.620	2.5
21-35	7.4 – 7.6	99.0 – 98.8	7.3	2.585	0.4
21-36	9.9 – 10.1	97.2 – 97.0	8.5	2.541	0.6
21-37	7.1 – 7.3	98.3 – 98.1	20.1	2.627	2.0
CV02/03-1	7.5 – 7.7	95.6 – 95.4	17.6	2.60	1.2
OPB-1	7.1 – 7.3	96.0 – 95.8	21.1	2.588	1.1
OPB-2	6.3 – 6.4	96.9 – 96.8	16.2	2.582	0.7



In addition to the UCS laboratory testing by Geomechanica Inc., point load index tests were carried out by Golder on selected samples of the bedrock obtained during the field investigation, and the results are summarized in Table G-1 in Appendix G. The point load index test data suggest correlated uniaxial compressive strengths between about 14 MPa and 45 MPa for the shale samples, and between about 50 MPa and 150 MPa for the limestone samples. Based on both the UCS and point load index test values, the shale bedrock is weak to medium strong ( $5 \text{ MPa} < R_2 < 25 \text{ MPa}$  and  $25 \text{ MPa} < R_3 < 50 \text{ MPa}$ ) and the limestone layers are strong to very strong ( $50 \text{ MPa} < R_4 < 100 \text{ MPa}$  to  $100 \text{ MPa} < R_4 < 250 \text{ MPa}$ ) per Table 3.5 in *CFEM* (2006).

The results of indirect tensile strength (i.e., Brazilian tensile strength) testing carried out on selected bedrock core samples are summarized below. The tested tensile strength values range from 1.7 to 5.0 MPa.

Borehole No.	Approximate Depth (m)	Sample Elevation (m)	Disc No.	Bulk Density P (g/cm <sup>3</sup> )	Tensile Strength (MPa)	Failure Type
21-4	8.0 – 8.1	94.6 – 94.5	1	2.608	2.1	Diametric
			2	2.638	3.0	Diametric
21-34	7.3 – 7.4	100.4 – 100.3	1	2.578	2.7	Diametric
			2	2.602	2.4	Diametric
21-37	8.4 – 8.6	97.0 – 96.8	1	2.609	5.0	Partial diametric plus failure along pre-existing structure
			2	2.609	1.7	Non-diametric
			3	2.580	3.0	Diametric
			4	2.611	3.3	Non-diametric plus failure along pre-existing structure

The results of Cerchar Abrasivity (ASTM D7625) testing carried out on five shale bedrock core samples are summarized below, and indicate Cerchar Abrasivity Indices (CAI) ranging from 0.282 to 0.566, corresponding to a very low to low ASTM classification.

Borehole No.	Approximate Depth (m)	Sample Elevation (m)	Mean Wear (mm)	Cerchar Abrasivity Index (CAI= Mean Wear x10)	ASTM Classification
21-4	6.5 – 6.6	96.1 – 96.0	0.057	0.566	Low
21-34	6.4 – 6.5	101.3 – 101.2	0.030	0.299	< Very Low
21-35	7.6 – 7.9	98.8 – 98.5	0.028	0.282	< Very Low
21-36	9.0 – 9.1	98.1 – 98.0	0.043	0.430	Very Low
21-37	7.3 – 7.4	98.1 – 98.0	0.037	0.373	Very Low

The results of slake durability testing completed on shale bedrock core samples are summarized below.



Borehole	Depth (m)	Elevation (m)	Moisture Content (%)	Slake Durability Index (%)	
				1 <sup>st</sup> Cycle	2 <sup>nd</sup> Cycle
21-34	8.5 – 8.8	99.2 – 98.9	2.5	90.7	75.0
21-35	6.4 – 6.6	100.0 – 99.8	3.5	87.6	73.1
21-37	7.6 – 7.8	97.8 – 97.6	3.5	86.9	69.6

## 4.3 Groundwater Conditions

### 4.3.1 Groundwater Levels

Groundwater monitoring wells were installed in fourteen boreholes included within the cut-and-cover segments of the proposed watermain and sewer works. The following table summarizes the groundwater conditions observed in the open boreholes during drilling (using observations of wet soil samples or the water level on completion of overburden drilling, whichever is higher), and the water levels measured in the piezometers in the various segments of the project. In general, the silt to sand deposit that is present above the cohesive soil complex and shale bedrock is water-bearing, with groundwater “perched” above the underlying cohesive deposits; the groundwater level associated with the shale bedrock may differ slightly from that in the silt to sand deposit.

Borehole No.	Groundwater Level		Date	Comments
	Depth (m)	Elev. (m)		
Segment A: North Service Road from Westfield Drive to Stanfield Road				
21-1	Dry	Dry	May 11, 2021	Open borehole dry on completion of overburden drilling
21-2	3.3 3.4 3.3	99.5 99.4 99.5	Feb 11, 2021 Mar 30, 2021 May 13, 2021	Piezometer screened at base of silty sand fill (approx. Elevation 98.5 m to 96.1 m)
21-5	1.5	102.6	Apr 19, 2021	Open borehole – Silty sand soils wet below approx. 1.5 m (Elev. 102.6 m) during borehole sampling
21-6	2.9 2.0	101.9 102.8	Jul 8, 2021	Piezometer screened in silty sand to sandy silt
21-7	2.4	103.3	Apr 19, 2021	Open borehole – Silty sand soils wet below approx. 2.4 m (Elev. 103.3 m) during borehole sampling
OPB-1	1.5	101.6	Feb 12, 2020	Open borehole – Silty sand soils wet below approx. 1.5 m (Elev. 101.6 m) during borehole sampling
NW3-1	2.9	102.6	Oct 3, 2016	Open borehole – Silty sand soils wet below approx. 2.9 m (Elev. 102.6 m) during borehole sampling

Borehole No.	Groundwater Level		Date	Comments
	Depth (m)	Elev. (m)		
Segment B: North Service Road from Stanfield Road to Harvest Drive				
21-8	2.6	102.8	Feb 11, 2021	Piezometer screened in cohesive soil complex and upper portion of shale bedrock
	2.5	102.9	Mar 30, 2021	
	2.6	102.8	May 13, 2021	
	2.7	102.7	Jun 6, 2021	
21-13	3.0	103.3	Apr 22, 2021	Open borehole – Silty sand to sand and silt wet below approx. 3 m (Elev. 103.3 m) during borehole sampling
21-14	3.0	103.1	Apr 23, 2021	Open borehole – Silty sand to silt wet below approx. 3 m (Elev. 103.1 m) during borehole sampling
21-15	2.0	103.3	May 13, 2021	Open borehole – Silty sand wet below approx. 2 m (Elev. 103.3 m) during borehole sampling
21-16	2.3	103.3	Apr 29, 2021	Open borehole – Perched groundwater in sandy silt encountered at approx. 2 m (Elev. 103.6 m); piezometer screened in shale bedrock
	3.1	102.5	Jul 5, 2021	
	3.1	102.5	Jul 7, 2021	
21-17	1.8	103.1	May 12, 2021	Open borehole – Perched groundwater in sandy silt encountered at approx. 1.8 m (Elev. 103.1 m)
21-18	2.3	102.8	Apr 28, 2021	Open borehole – Silty sand wet below approx. 2.3 m (Elev. 102.8 m) during borehole sampling
CV02/03-1	Dry	Dry	Oct 5, 2016	Open borehole dry on completion of overburden drilling, with no perched water observed in sandy silt to silty sand deposit
NW3-2	2.3	103.2	Oct 3, 2016	Open borehole – Silty sand wet below approx. 2.3 m (Elev. 103.2 m) during borehole sampling
NW3-4	2.9	102.1	Oct 5, 2016	Open borehole – Silty sand wet below approx. 2.9 m (Elev. 102.1 m) during borehole sampling
NW3-5	Dry	Dry	Oct 5, 2016	Open borehole dry on completion of overburden drilling, with no perched water observed in silty sand
NW3-6	Dry	Dry	Oct 6, 2016	Open borehole dry on completion of overburden drilling, with no perched water observed in silty sand
Segment C: South Service Road from Haig Boulevard to Dixie Road				
21-11	2.9	101.8	Jun 15, 2021	Open borehole – Sandy silt wet below approx. 3 m (Elev. 101.7 m) during borehole sampling; piezometer screened in sandy silt
	2.9	101.8	Jun 28, 2021	
	3.0	101.7	Jun 29, 2021	
21-23	2.3	103.1	Jun 25, 2021	Open borehole – Silty sand wet below approx. 2.3 m (Elev. 103.1 m) during borehole sampling
21-24	1.5	103.2	Apr 28, 2021	Open borehole – Silty sand wet below approx. 1.5 m (Elev. 103.2 m) during borehole sampling
21-25	1.8	102.2	Apr 20, 2021	Open borehole – Sandy silt wet below approx. 2.1 m (Elev. 101.9 m) during borehole sampling; piezometer screened in sandy silt
	1.7	102.3	Jul 8, 2021	

Borehole No.	Groundwater Level		Date	Comments
	Depth (m)	Elev. (m)		
21-26	Dry	Dry	Apr 20, 2021	Open borehole dry during overburden drilling (predominantly cohesive soils encountered)
21-27	Dry	Dry	Jun 18, 2021	Open borehole dry during overburden drilling (predominantly cohesive soils encountered)
21-28	Dry	Dry	Jun 27, 2021	Open borehole dry during overburden drilling
CV02/03-3	3.8	99.4	Oct 17, 2016	Open borehole – Silt and sand fill wet below approx. 3.8 m (Elev. 99.4 m) during borehole sampling
<b>Segment D: Dixie Road from North Service Road to Sherway Drive</b>				
21-19	2.4	103.5	Jul 7, 2021	Open borehole – Silty sand wet below approx. 2.3 m (Elev. 103.6 m); piezometer screened in silty sand and cohesive soil complex
21-20	2.0	106.3	Apr 28, 2021	Open borehole – Silty sand to sand wet below approx. 2.0 m (106.3 m) during borehole sampling
21-21	2.3 2.6	107.0 106.7	Apr 28, 2021 Jul 7, 2021	Open borehole – Silty sand wet below approx. 2.3 m (Elev. 107.0 m) during borehole sampling; piezometer screened in silty sand and cohesive soil complex
21-22	2.3	107.4	May 14, 2021	Open borehole – Silty sand wet below approx. 2.3 m (Elev. 107.4 m) during borehole sampling
NW4-1	2.3	105.2	Oct 6, 2016	Open borehole – Sand wet below approx. 2.3 m (Elev. 105.2 m) during borehole sampling
NW4-2	2.3	105.4	Oct 6, 2016	Open borehole – Sand wet below approx. 2.3 m (Elev. 105.4 m) during borehole sampling
NW4-3	2.1	106.0	Oct 6, 2016	Open borehole – Sand wet below approx. 2.1 m (Elev. 106.0 m) during borehole sampling
<b>Segment E: Brentano Boulevard</b>				
21-38	2.3	106.3	Jul 27, 2021	Open borehole – Silty sand to sand wet below approx. 2.3 m (Elev 106.3 m) during borehole sampling
21-39	2.3	105.8	Jun 24, 2021	Open borehole – Silty sand wet below approx. 2.3 m (Elev. 105.8 m) during borehole sampling
21-40	2.1	105.5	Jun 24, 2021	Open borehole – Silty sand wet below approx. 2.1 m (Elev. 105.5 m) during borehole sampling
21-41	2.3	105.2	Jul 28, 2021	Open borehole – Gravelly silty sand wet below approx. 2.3 m (Elev 105.2 m) during borehole sampling
21-42	3.1	104.5	Jun 24, 2021	Open borehole – Silty sand wet below approx. 3.1 m (Elev. 104.5 m) during borehole sampling
21-43	Dry	Dry	Jul 28, 2021	Open borehole dry on completion of overburden drilling, with no perched water observed in sandy silt to sand; piezometer screened in this layer and is dry

Borehole No.	Groundwater Level		Date	Comments
	Depth (m)	Elev. (m)		
17-1	3.9 3.9 3.9	104.6 104.6 104.6	Apr 2, 2018	Open borehole – Sand and gravel wet below approx. 3.7 m (Elev. 104.8 m) during borehole sampling; piezometer screened in silty sand to sand and gravel
Segment F: Dixie Road and South Service Road to East of Liveoak Drive				
21-29	1.2 2.2	103.8 102.8	Apr 21, 2021 Jul 8, 2021	Open borehole – Silty sand wet below approx. 1.6 m (Elev. 103.4 m); piezometer screened in silty sand to upper portion of shale bedrock
21-30	2.3	103.3	Apr 21, 2021	Open borehole – Gravelly silty sand wet below approx. 2.3 m (Elev. 103.3 m) during borehole sampling
21-31	2.7	103.3	Aug 10, 2021	Open borehole – Sand and gravel wet at approx. 2.7 m (Elev. 103.3 m) during borehole sampling
21-33	3.0	103.6	Jun 15, 2021	Open borehole – Silty sand wet below approx. 3.1 m (Elev. 103.5 m); piezometer screened in shale
21-37	1.9 1.9 2.1	103.5 103.5 103.2	Feb 24, 2021 May 10, 2021 Jun 2, 2021	Open borehole – Sand wet below approx. 2.3 m (Elev. 103.1 m); piezometer screened in shale
NW6-3	2.6	104.4	Oct 14, 2016	Open borehole – Silt and sand to gravelly sand wet below approx. 2.6 m (Elev. 104.4 m) during borehole sampling
NW6-4	Dry	Dry	Oct 14, 2016	Open borehole dry on completion of drilling, with no perched water observed in sand to sand and gravel during overburden sampling
NW6-5	4.1	102.4	Oct 14, 2016	Open borehole – Water level measured at 4.1 m (Elev. 102.4 m) on completion of drilling
RW1-1	2.4 2.3	101.1 101.2	Dec 20, 2018 Jan 4, 2019	Open borehole – Silty sand fill wet below 2.2 m (Elev. 101.3 m) during borehole sampling; piezometer screened in lower fill, cohesive soil and shale
RW1-2	2.3	101.5	Nov 30, 2018	Open borehole – Water level measured at 2.3 m (Elev. 101.5 m) on completion of drilling

### 4.3.2 Results of Single-Well Response Testing

Analysis of the single-well response testing results was undertaken using Aqtesolv Pro software using the Bouwer-Rice method to estimate the hydraulic conductivity of the formation at each monitoring well screen interval. A summary of the SWRT results is provided below, and data plots of the test results are included in Appendix H.

Monitoring Well No.	Screened Lithology	Test Type	Hydraulic Conductivity Estimate (m/s)
21-2	Base of clayey sand fill, and native silty sand deposit	Falling Head Rising Head	$9 \times 10^{-6}$ $9 \times 10^{-6}$
21-4	Cohesive soil complex and upper portion of shale bedrock	Falling Head	$1 \times 10^{-5}$
21-6	Silty sand to sandy silt deposit	Falling Head Rising Head	$1 \times 10^{-5}$ $2 \times 10^{-5}$
21-8	Cohesive soil complex and upper portion of shale bedrock	Rising Head	$2 \times 10^{-8}$
21-11	Sandy silt deposit	Rising Head	$1 \times 10^{-5}$
21-16	Shale bedrock	Falling Head Rising Head	$1 \times 10^{-5}$ $2 \times 10^{-5}$
21-19	Silty sand deposit and cohesive soil complex	Rising Head	$2 \times 10^{-7}$
21-21	Silty sand deposit and cohesive soil complex	Rising Head	$1 \times 10^{-6}$
21-25	Sandy silt deposit	Falling Head Rising Head	$1 \times 10^{-5}$ $8 \times 10^{-6}$
21-29	Silty sand deposit, cohesive soil deposit and upper portion of shale bedrock	Rising Head	$3 \times 10^{-6}$
21-34	Shale bedrock	Rising Head	$5 \times 10^{-8}$
21-37	Shale bedrock	Rising Head	$5 \times 10^{-6}$

## 4.4 Corrosivity Test Results

Sixteen soil and bedrock samples were submitted to Bureau Veritas Laboratories (BV Labs) for analysis of parameters used to assess corrosion potential and sulphate attack. The test results are summarized below, and the laboratory certificates of analysis are provided in Appendix J.

Borehole / Sample No. (Elevation)	Soil/Rock Type	pH	Resistivity (ohm-cm)	Electrical Conductivity (umho/cm)	Soluble Chlorides (ug/g)	Soluble Sulphates (ug/g)
21-2 / Sa 7 (97.9 m)	Clayey sand to silty sand fill	7.54	2,800	363	56	<20
21-4 / RC 1 (97.4 m)	Shale bedrock	9.04	2,000	498	110	66
21-11 / Sa 6 (99.8 m)	Sandy silt	7.79	820	1,230	710	84
21-23 / Sa 3 (103.5 m)	Silty sand	8.08	920	1,090	620	<20

Borehole / Sample No. (Elevation)	Soil/Rock Type	pH	Resistivity (ohm-cm)	Electrical Conductivity (umho/cm)	Soluble Chlorides (ug/g)	Soluble Sulphates (ug/g)
21-27 / Sa 2 (100.7 m)	Clayey silt fill	7.40	3,800	262	53	<20
21-28 / Sa 4 (100.8 m)	Clayey sand	N/A	1,200	N/A	360	47
21-33 / Sa 4 (104.0 m)	Silty sand	8.13	880	1,140	660	38
21-34 / RC 2 (101.6 m)	Shale bedrock	8.62	3,400	295	<20	46
21-37 / Sa 4 (102.7 m)	Sand	7.74	1,400	705	350	47
21-39 / Sa 4 (104.6 m)	Clayey gravel residual soil	8.16	2,100	483	240	<20
21-40 / Sa 2 (105.8 m)	Silty sand	7.86	1,500	649	270	23
21-42 / Sa 3 (105.8 m)	Silty sand	7.83	1,000	1,000	520	<20
CV02/03-1 RC 1 (99.2 m)	Shale bedrock	8.01	1,500	682	100	250
OPB-1 / Sa 4B (99.6 m)	Clayey silt till	7.71	1,400	699	250	200
RW1-1 / Sa 3B (100.7 m)	Sandy clayey silt	7.82	1,300	765	290	87
RW1-2 / Sa 4 (100.8 m)	Clayey silt residual soil	7.79	2,100	475	95	97

## 4.5 Analytical Testing Results

Selected soil, bedrock, and groundwater samples were collected in general accordance with the project scope during the investigation program. Samples were submitted to an accredited laboratory for analytical testing to assess the environmental quality of the subsurface soil, bedrock and groundwater samples obtained during the foundation investigation. The sampling of soil and bedrock in this investigation was carried out in general accordance with the On-Site and Excess Soils Regulation (O. Reg. 406/19) to support determination of soil reuse options and with the O. Reg. 347 for waste characterization purposes. Groundwater samples were submitted for analysis to support Permit-To-Take-Water applications and to support identification of discharge options. The frequency of sampling and analytical parameters was in general accordance with the project scope of work.

Soil, bedrock, and groundwater samples were stored in coolers with ice and submitted under chain-of-custody procedures to Bureau Veritas Laboratories (BV Labs) of Mississauga, accredited laboratories under the Standards Council of Canada (SCC).

### 4.5.1 Soil and Bedrock Sampling and Analysis

Soil samples were retrieved from split spoon sampler and bedrock samples were collected from rock cores during drilling the boreholes. Samples were selected from 17 borehole locations as listed in the summary table in Section 3.5. The collected soil samples were analyzed for one or more of the following group of parameters: O. Reg. 406/19 metals and inorganics (M&I), petroleum hydrocarbons (PHCs), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyl (PCBs).

For the purpose of excess soil management and according to requirements of the O. Reg. 406/19 (as amended), selected soil samples were also collected and analyzed for synthetic precipitation leaching procedure (SPLP). For waste disposal purposes, selected soil samples were also collected and analyzed for toxicity characteristic leaching procedure (TCLP) in accordance with the O. Reg. 347 (as amended).

The analytical results of soil and bedrock samples are provided in Table I-1 to I-8 in Appendix I. The laboratory Certificates of Analysis for soil and bedrock samples are provided in Appendix J.

#### **4.5.2 Groundwater Sampling and Analysis**

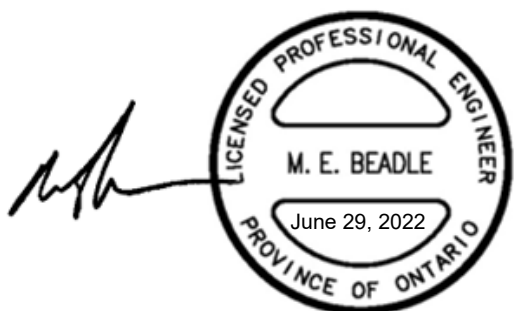
Groundwater sampling was carried out at monitoring wells located at 21-2, 21-4, 21-11, 21-16, 21-33, 21-34 and 21-37 in June and July of 2021. One sample was collected from each of the monitoring wells using low-flow sampling methodology. Before sampling, the monitoring wells were developed, using dedicated Waterra® tubing and a foot valve, up to 10 standing well-volumes of groundwater or until considered dry to ensure fine particles are removed from the sand pack and representative groundwater of the underlying formation was available for sampling. Water quality parameters (e.g., temperature, pH and conductivity) were recorded during the purging of each monitoring wells. After purging, one groundwater sample from each of the monitoring wells was collected in the pre-labeled sample bottles for select analysis. Groundwater samples were submitted under chain-of-custody protocol for chemical analysis of one or more of parameters including O. Reg. 153/04 metals and inorganics, PHCs, BTEX, and PAHs. Selected groundwater samples were also submitted for the parameters listed in the Peel Wastewater By-Law No. 53-100. A summary of the sampling and analysis plan for groundwater samples is provided in the table in Section 3.5.

The analytical results of groundwater samples are provided in Table I-9 to I-12 in Appendix I. The laboratory Certificates of Analysis for groundwater samples are provided in Appendix J.

## 5.0 CLOSURE

This Foundation Investigation Report was prepared by Mr. Eric Naylor, EIT, with hydrogeological inputs from Ms. Lisseth Benevente, and Mr. Syed Ali, and environmental inputs from Mr. Bryan Meyers, Mr. Saeed Kiaalhosseini, Ph.D., P.Eng., and Ms. Denise Lacchin, M.Sc., P.Eng., EP, QPESA. Mr. Michael Beadle, P.Eng., senior geotechnical engineer and Ms. Lisa Coyne, P.Eng., an MTO Foundations Designated Contact for Golder, conducted technical and quality control reviews of this report.

### Golder Associates Ltd.



Michael Beadle, P.Eng.  
*Senior Geotechnical Engineer*



Lisa Coyne, P.Eng.  
*MTO Designated Foundations Contact*

EN/MEB/LCC/ml

Golder and the G logo are trademarks of Golder Associates Corporation

[https://golderassociates.sharepoint.com/sites/19542g/1 foundations/09 - reports/22 - open cut water and sanitary 2021/3. final/1530382 fidr wm and sewer - june 2022.docx](https://golderassociates.sharepoint.com/sites/19542g/1%20foundations/09%20-%20reports/22%20-%20open%20cut%20water%20and%20sanitary%202021/3.%20final/1530382%20fidr%20wm%20and%20sewer%20-%20june%202022.docx)



# PART B

**FOUNDATION DESIGN REPORT  
WATER AND WASTEWATER INFRASTRUCTURE (CUT-AND-COVER SECTIONS)  
QEW IMPROVEMENTS FROM EAST OF CAWTHRA ROAD TO THE EAST MALL  
CITY OF MISSISSAUGA, REGION OF PEEL, ONTARIO  
MTO GWP 2102-13-00**

## 6.0 DISCUSSION AND ENGINEERING RECOMMENDATIONS

### 6.1 General

This section of the report provides foundation design recommendations for the installation of new watermain and sanitary sewers along the following segments, associated with widening of Queen Elizabeth Way (QEW) from Cawthra Road to the East Mall in the Cities of Mississauga and Etobicoke, Regional Municipality of Peel/City of Toronto, Ontario:

- **Segment A:** 525 mm/375 mm diameter sanitary sewer along North Service Road from Westfield Drive to Insley Road, and 300 mm diameter watermain along North Service Road from Insley Road to Stanfield Road
- **Segment B:** 200 mm/1,050 mm diameter sanitary sewer and 400 mm watermain along North Service Road from Stanfield Road to Harvest Drive
- **Segment C:** 400 mm diameter watermain along South Service Road from Haig Boulevard to Dixie Road
- **Segment D:** 400 mm diameter watermain along Dixie Road from North Service Road to north of Sherway Drive
- **Segment E:** Sanitary sewer replacement along Brentano Boulevard, north of QEW and east of Dixie Road
- **Segment F:** 300 mm to 400 mm diameter watermain from Dixie Road/Cormack Crescent along South Service Road to east of Liveoak Drive

It is understood that these proposed watermain and sanitary sewers will be installed by cut-and-cover construction methods with the use of temporary protection systems or engineered pre-fabricated systems. It is noted that three sections of sewer and one section of watermain that will be constructed using trenchless methods are addressed in separate Foundation Investigation and Design Reports, and Subsurface Condition Baseline Reports. The recommendations and discussion in the following sections are based on the watermain and sewer profiles provided by AECOM on February 15, 2022.

The discussion and recommendations provided herein is based on interpretation of the factual data obtained from the boreholes. The discussion and recommendations are intended for the use of the MTO and their designers, and shall not be used or relied upon for any other purpose or by any other parties, including the construction contractor. The contractor must make their own interpretation based on the factual data in Part A of this report (i.e., the Foundation Investigation Report). Where comments are made on construction, they are provided to highlight those aspects that could affect the design of the project and for which special provisions may be required in the Contract Documents. Those requiring information on the aspects of construction must make their own interpretation of the factual information provided as such interpretation may affect equipment selection, proposed construction methods, scheduling, and the like.

### 6.2 Summary of Anticipated Excavation and Subgrade Conditions

#### 6.2.1 Segment A – North Service Road from Westfield Drive to Stanfield Road

The work in Segment A consists of the installation of 525 mm/375 mm diameter sanitary sewer along North Service Road from Westfield Drive to Insley Road, and 300 mm diameter watermain along North Service Road from Insley Road to Stanfield Road. The sanitary sewer extends from about Station 9+990 to Station 10+110 with invert levels ranging from about Elevation 97.8 to 100.2 m. The watermain inverts range from about Elevation 100.0 m to 103.0 m. The sewer and watermain profiles are shown on Drawing 4.

Excavations for the sanitary sewer and watermain are expected to encounter surficial topsoil and/or the existing pavement structure, fill materials, silty sand to sandy silt and, west of about Sta. 10+050, the cohesive complex and shale bedrock. The excavations are expected to extend up to about 3 m below the groundwater levels in some areas.

The anticipated founding conditions along the proposed sanitary sewer alignment consist of primarily of shale bedrock to the west of SAN MH4 and non-cohesive/cohesive fill to the east with a short segment of cohesive complex immediately west of the manhole as shown on Drawing 4. The fill strata are considered generally suitable for supporting the pipes; however, loose material is identified beneath proposed SAN MH4 base elevation; as such, sub-excavation may be required to remove unsuitable materials in accordance with OPSS.PROV 401 (Trenching, Backfilling, and Compacting). The foundation conditions along the watermain alignment generally consist of non-cohesive/cohesive fill west of about Station 10+130 and compact silty sand to sandy silt to the east. The fill strata and native cohesionless soils are considered suitable for supporting the watermain.

### **6.2.2 Segment B – North Service Road from Stanfield Road to Harvest Drive**

The work in Segment B consists of the installation of 200 mm/1,050 mm diameter sanitary sewer and 400 mm watermain along North Service Road from Stanfield Road to Harvest Drive. The sanitary sewer extents from about Station 10+580 to Station 10+930 with invert levels ranging from about Elevation 97.7 m to 101.5 m. The watermain inverts range from about Elevation 101.0 m to 103.5 m. The sewer and watermain profiles are shown on Drawing 4.

Excavations for the sanitary sewer and watermain are expected to encounter surficial topsoil and/or the existing pavement structure, fill materials, sand to sandy silt, the cohesive complex and shale bedrock. The excavations are expected to extend up to about 6 m below the groundwater levels in some areas.

The anticipated founding conditions along the proposed 1,050 mm diameter sanitary sewer alignment consist of primarily of shale bedrock. The anticipated founding conditions for the 200 mm diameter sanitary sewer and watermain will consist of sand to sandy silt, the cohesive soil complex and shale bedrock depending on location. These strata are considered suitable for supporting the pipes and appurtenances.

### **6.2.3 Segment C – South Service Road from Haig Boulevard to Dixie Road**

The work in Segment C consists of the installation of 400 mm diameter watermain along South Service Road from Haig Boulevard to Dixie Road. The watermain extends throughout this segment and the inverts range from about Elevation 99.0 m to 103.0 m. The watermain profile is shown on Drawing 5.

Excavations for the sanitary sewer and watermain are expected to encounter surficial topsoil and/or the existing pavement structure, fill materials, sand to sandy silt, the cohesive complex and shale bedrock. The excavations are expected to extend up to about 2 m below the groundwater levels in some areas.

The anticipated founding conditions for the 400 mm diameter watermain will consist of primarily of silty sand to sandy silt west of about Station 10+260 and the cohesive soil complex to the east. Shale is expected to be present at founding level in the vicinity of Station 10+800. These strata are considered suitable for supporting the pipes and appurtenances.

### **6.2.4 Segment D – Dixie Road from North Service Road to Sherway Drive**

The work in Segment D consists of the installation of watermain along Dixie Road from North Service Road to north of Sherway Drive. The watermain inverts range from about Elevation 102.5 m to 107 m, rising toward the north. The watermain profile is shown on Drawing 5.

Excavations for the sanitary sewer and watermain are expected to encounter surficial topsoil, sand to silty sand, relatively thin layers of the cohesive complex and shale bedrock. The excavations are expected to extend up to about 1 m below the groundwater level near Station 11+000.

The anticipated founding conditions for the watermain will generally consist of shale bedrock south of approximately Station 11+150 and silty sand to sand to the north. These strata are considered suitable for supporting the pipes and appurtenances.

### **6.2.5 Segment E – Brentano Boulevard**

The work in Segment E consists of sanitary sewer replacement along Brentano Boulevard, north of QEW and east of Dixie Road. The sewer inverts range from about Elevation 103.5 m to 105.0 m. The sanitary sewer profile is shown on Drawing 6.

Excavations for the sanitary sewer are expected to encounter the existing pavement structure and fill materials, silty sand to sand, the cohesive complex and shale bedrock. The excavations are expected to extend about 1 to 2 m below the groundwater levels in some areas.

The anticipated founding conditions for the sanitary sewer will consist of silty sand to sand, the cohesive soil complex and shale bedrock. These strata are considered suitable for supporting the pipes and appurtenances.

### **6.2.6 Segment F – Dixie Road and South Service Road to East of Liveoak Drive**

The work in Segment F consists of 300 mm to 400 mm diameter watermain installation from Dixie Road/Cormack Crescent along South Service Road to east of Liveoak Drive. The watermain inverts range from about Elevation 103.5 m to 107.0 m. The watermain profile is shown on Drawing 7.

Excavations for the watermain are expected to encounter topsoil and/or the existing pavement structure and fill materials and the silt to sand and gravel. Based on the available water levels, excavation will approach the groundwater levels but are not, currently, expected to extend significantly below the groundwater level.

Adjacent to Dixie Road, the new watermain will be constructed within new fills for the connection of South Service Road to Dixie Road. The remainder of the watermain is anticipated to be founded in the silt to sand and gravel. These strata are considered suitable for supporting the pipes and appurtenances.

## **6.3 Subgrade Preparation, Bedding, Cover and Trench Backfill**

### **6.3.1 Subgrade Preparation**

In general, as described in Section 6.2, the soil or bedrock at the trench base is suitable for the subgrade support of the proposed water and wastewater infrastructure. Loose material was identified in boreholes in the vicinity of SAN MH4 in Segment A, and may be encountered at subgrade level in other segments, between and beyond the borehole locations. Per OPSS.PROV 401 (Trenching, Backfilling, and Compacting, the Contract Administrator shall be notified if unsuitable subgrade is encountered in the pipe trenches.

Where encountered at subgrade level, it is recommended that softened/loose, organic or otherwise deleterious materials be subexcavated and backfilled with granular material meeting OPSS.PROV 1010 (*Aggregates*) Granular 'A' or Granular 'B' Type II that is placed and compacted in accordance with OPSS.PROV 501 (*Compacting*), or with 19 mm clear stone that is fully encapsulated in a non-woven geotextile.

### 6.3.2 Pipe Bedding and Cover

The bedding, cover and backfill for the watermain and sewers should be compatible with the type and class of pipe, the surrounding soil and/or bedrock conditions and anticipated loading conditions, and should be designed in accordance with City of Mississauga or Region of Peel requirements and the applicable OPSS 802 series, as applicable.

The bedding and cover material should consist of material as specified in OPSS.PROV 401 (*Trenching, Backfilling, and Compacting*). It is recommended that bedding consist of OPSS.PROV1010 (*Aggregates*) Granular 'A' or OPSS 1359 unshrinkable fill; however, unshrinkable fill shall not be used for portions of the pipes that are embedded within the shale bedrock. All bedding and cover material should be placed in loose lifts not greater than 300 mm in thickness and uniformly compacted to at least 98 per cent of the standard Proctor maximum dry density in accordance with OPSS.PROV 501 (*Compacting*).

### 6.3.3 Backfill

Trench backfill under paved surfaces or up to 1.5 m beyond the curb and gutter shall consist of OPSS.PROV 1010 Granular B Type II. Outside of paved areas, native site soils or excavated cohesive and non-cohesive fills may be used for trench backfill provided they are free of topsoil, organic material or other deleterious materials and are at an appropriate water content for compaction. If water contents of the site soils at the time of construction excessive, or if there is a shortage of suitable in-situ material, then an approved imported material which meets the requirements for OPSS.PROV 1010 (*Aggregates*) Select Subgrade Material (SSM) or Granular 'B' Type I, II or Type III could be used for trench backfill outside of paved areas. The backfill should be placed in maximum 300 mm thick loose lifts and uniformly compacted to 95 per cent of standard Proctor maximum dry density. The upper 1 m of trench backfill that will form any new pavement subgrades should be placed in maximum 150 mm thick loose lifts and uniformly compacted to 98 per cent of standard Proctor maximum dry density.

Settlement of the compacted trench backfill should be anticipated, the majority of which is expected to occur within about 6 months of completion of trench backfilling operations. This settlement will be reflected at the ground surface and may be compensated for, where necessary, by placing additional granular material as required. Alternatively, if the asphalt binder course is placed shortly following the completion of trench backfilling operations in these areas, any settlement that may be reflected by subsidence of the surface of the binder asphalt should be addressed by placing an additional thickness of binder asphalt or by padding.

The design frost depth in the area is estimated to be 1.2 m below ground surface, as interpreted from OPSS 3090.101 (*Frost Penetration Depths for Southern Ontario*). To avoid undue differential movements or settlement of ground surface adjacent to and over the trench, the general backfill materials should match, as practically as possible, to the native or fill materials exposed in the trench walls, or granular materials should be used as backfill much of the settlement will occur during construction. Backfill within the zone of frost penetration below the bedrock surface should consist of non-frost susceptible material such as OPSS.PROV 1010 (*Aggregates*) Granular 'A' or Granular 'B' Type I or Type III.

### 6.3.4 Trench Plugs

Trench plugs should be installed in accordance with Region of Peel Standard 2-3-2, or OPSD 802.095 (*Trench Plug*) where applicable at a maximum spacing of approximately 100 m. Unshrinkable fill must not be used for trench plugs that extend within the shale bedrock, as discussed further in Section 6.3.5.

### 6.3.5 Special Considerations for Pipe Installed in Moderately Weathered to Fresh Bedrock

Where the wet utility will be installed within a trench in the moderately weathered to fresh portion of the shale, which is applicable for the deep sewer installation in Segment B, it is recommended that the trench width allow for a minimum 200 mm of granular backfill between the pipe and the shale bedrock at the sides and base of the trench. The backfill can consist of OPSS.PROV 1010 Granular A, B Type I or B Type II.

There should be no concrete saddles or thrust blocks, unshrinkable fill trench plugs, or other use of concrete or unshrinkable fill between the pipe and the shale, or between the maintenance hole and the shale, unless these are designed to accommodate swelling forces from the shale bedrock via design of the pipe or maintenance hole and incorporation of compressible foam.

Based on OPSD requirements, the trench width for pipes up to 900 mm in diameter shall be the pipe outside diameter plus 600 mm, while the trench width for pipes with a diameter equal to or greater than 900 mm shall be the pipe outside diameter plus 1000 mm. Therefore, the clear space between the outside of the pipe and the trench wall will be greater than 200 mm, and hence no other compressible materials are required to be incorporated in the granular backfill surrounding the pipe or maintenance holes within the moderately weathered to fresh shale bedrock.

## 6.4 Corrosion Assessment and Protection

Soil and rock corrosivity may affect the concrete pipes, steel pipes and reinforced steel and other concrete elements buried in the soil. The long-term performance and durability of the structures are directly related to their respective corrosion resistance. Generally, the corrosivity of a structure depends on the soil resistivity, hydrogen ion concentration, salts (chloride and sulphate) concentrations and redox potential.

Soil and bedrock corrosivity may affect the long-term performance and durability of buried concrete and steel pipes. Generally, the corrosivity of pipes depends on the soil resistivity, hydrogen ion concentration, salts (chloride and sulphate) concentrations and redox potential. Analytical testing was carried out on soil and bedrock samples obtained from the boreholes in these segments and the results, as presented in Section 4.5 and Appendices I and J, were used to assess the potential sulphate attack on concrete and corrosion potential of the proposed pipes.

The tested soil samples had a pH range between 7.3 and 9.0, with a single sample greater than 8.5, suggesting an alkaline condition per MTO's *Gravity Pipe Design Guidelines* (MTO, 2014) although this is not necessarily detrimental to pipe durability. The resistivity of the tested samples ranged from 625 to 3,800 ohm-cm with an average of 1,700 ohm-cm, with the majority of samples having resistivities less than 2,000 ohm-cm which indicates that the soil corrosiveness is generally Severe, per Table 3.2 of MTO's *Gravity Pipe Design Guidelines* (2014). Based on these results, some level of pipe protection (e.g. sacrificial thickness or other protection measures) will be required depending on the pipe material used. Based on the results of the samples tested and given that the pipes will be located beneath and/or adjacent to pavements and will be exposed to de-icing salt,

consideration should be given by the designer to designing for a “C” type exposure class as defined in CSA A23.1 Table 1.

The sulphate concentration measured in five groundwater samples ranged from 3 to 200 mg/L which correlates to exposure classes of “negligible” to “moderate” according to Table 7.2 of MTO’s *Gravity Pipe Design Guidelines* (2014). Therefore, based on the test results, when the designer is selecting the exposure class for pipes, the effects of sulphates from within the groundwater may not need to be considered.

These recommendations are provided as guidance only; it is ultimately up to the designer to select the appropriate exposure class and to ensure that all aspects of CSA A23.1 Section 4.1.1 “Durability Requirements” are followed.

## 6.5 Construction Considerations

### 6.5.1 Excavation

Excavations should be made in accordance with OPSS.PROV 401 (*Trenching, Backfilling and Compacting*) and OPSS.PROV 403 (*Rock Excavation for Pipelines, Utilities and Associated Structures in Open Cut*). Standard excavating equipment, such as backhoes, should be adequate for excavation of the trenches in the overburden soils. The cohesive complex is expected to contain random cobbles and boulders and can be hard, which may make conventional excavation slow and difficult within narrow trenches for these wet utilities. A hydraulic hammer (i.e. hoe-ram) is expected to be used for excavation of bedrock, and pneumatic breakers or chisels may be required to break and remove the stronger limestone layers that will be encountered within the shale bedrock.

All excavations must also be carried out in accordance with the guidelines outlined in the Occupational Health and Safety Act and Regulations (OHSA). The soil/rock classification per OHSA are as follows:

- The existing fill materials and the sandy silt to silty sand above the groundwater level would be considered Type 3 soils.
- The fill materials and sandy silt to silty sand below the groundwater level would be considered Type 4 soils, unless these are properly dewatered.
- The cohesive soil complex may be considered as a Type 2 soil.
- The completely to highly weathered shale should be considered analogous to a Type 2 soil; however, given the variable nature of this material, the soil behaviour and its relation to excavation support should be examined and judged for each exposure during construction.

Depending upon the construction procedures adopted by the contractor, actual groundwater seepage conditions, the success of the contractor’s groundwater control methods and weather conditions at the time of construction, some flattening and/or blanketing of any unsupported cut slopes (if and where sufficient space is available) may be required. Temporary excavations in the slightly weathered to fresh shale bedrock can be made near-vertical; however, the moderately weathered shale bedrock represents a transition between highly weathered and slightly weathered and, depending on the extent of weathering and the duration that the excavation remains open, temporary protections system or engineered pre-fabricated systems may be required to extend through this material.

Care must be taken during excavation to ensure that adequate support is provided for any structures, roadways and underground services located adjacent to the excavations.



## 6.5.2 Prefabricated Support Systems and Temporary Protection Systems

It is anticipated that some form of trench support will be required for the majority of the watermain and sewer excavations due to their location within or adjacent to roadways and proximal utilities. The excavations could be carried out using a vertical excavation with a properly engineered prefabricated support system (i.e., trench liner box) certified by an experienced engineer in open areas that can tolerate lateral movement of the soil deposits, or by a temporary protection system where restriction of lateral movements is required adjacent to sensitive structures or utilities. It must be emphasized that a prefabricated support system (trench liner box) provides protection for construction personnel but does not provide lateral support for adjacent excavation walls, underground services or existing structures. It is imperative that underground services and existing structures adjacent to the trench excavations be accurately located prior to construction and adequate support provided where required. Excavations supported by trench boxes should be left open for as short a duration as possible.

A driven interlocking sheet pile system fitted with internal bracing, anchors or rakers, could be considered, but may be difficult to install given the potential for encountering cobbles and/or boulders, the generally compact nature of the overburden cohesionless soils and the proximity to bedrock. Given these conditions, a soldier pile and lagging system may be more appropriate where temporary protection systems are required. An interlocking sheet pile system has an advantage with respect to controlling groundwater seepage in water-bearing soils; however, groundwater seepage and the potential loss of fine soil particles can be mitigated with soldier pile and lagging systems by backing the lagging with filter cloth through zones of water-bearing soil.

The temporary excavation support system should be designed and constructed in accordance with OPSS.PROV 539 (*Temporary Protection Systems*). The lateral movement of the temporary shoring system should meet Performance Level 2 as specified in OPSS.PROV 539, provided adjacent utilities or structures can tolerate this level of deformation. The design of temporary support systems is the responsibility of the contractor; however, the following recommendations and parameters are provided for the benefit of MTO and their Construction Contract Administrator regarding temporary protection system submittals.

Temporary protection system design for trenches should be based on a trapezoid-shaped apparent earth pressure distributions using the geotechnical design parameters given below; the design groundwater elevation should be selected by the contractor based on the information provided in Section 4.3. Any internal bracing or raker supports must be designed to accommodate the loads applied from earth pressures, water pressures and surcharge pressures from area, line or point loads, as well as the effects of sloping ground (if present) behind the system. Passive toe restraint to soldier piles may be assessed using conventional passive earth pressure distribution acting over an equivalent width equal to three times the soldier pile socket diameter provided that the soldier piles are separated by more than three times the socket diameter.

Soil Type	Coefficient of Lateral Earth Pressure			Angle of Internal Friction (Degrees)	Unit Weight (kN/m <sup>3</sup> )
	Active, Ka	At Rest, Ko	Passive, Kp		
Cohesive and non-cohesive fill	0.36	0.53	2.8	28	19
Non-cohesive native soils (silty sand to sandy silt)	0.33	0.50	3.0	30	19



Soil Type	Coefficient of Lateral Earth Pressure			Angle of Internal Friction (Degrees)	Unit Weight (kN/m <sup>3</sup> )
	Active, K <sub>a</sub>	At Rest, K <sub>o</sub>	Passive, K <sub>p</sub>		
Cohesive soil complex	0.31	0.47	3.1	32	19
Completely to highly weathered shale bedrock	0.22	0.36	4.56	40	22

**Notes:**

1. The lateral earth pressure coefficients presented above are based on a horizontal surface adjacent to the excavation. If sloped surfaces are present above the excavation, the coefficients must be adjusted accordingly.
2. The total passive resistance below the base of the excavation may be calculated based on the value of K<sub>p</sub> indicated above but reduced by an appropriate factor that considers the allowable wall movement in accordance with Figure C6.16 of CHBDC (2014) to account for the large strain that would be required to fully mobilize the passive resistance.

Temporary excavations in the slightly weathered to fresh shale bedrock may be developed with vertical sidewalls, provided that all loosened rock fragments are removed from the excavated rock faces.

### 6.5.3 Groundwater Control

The potential for dewatering was estimated based on the target drawdown groundwater level relative to the sewer and watermain invert elevations or top of cohesive soil deposit within the excavation areas and based on available borehole and groundwater information from the investigation. The estimated groundwater elevations and approximate groundwater lowering or drawdown are summarized below:

Segment	Estimated Groundwater Elevation (m)	Approximate Required Drawdown <sup>1</sup> (m)	Comments
<b>Segment A:</b> North Service Road from Westfield Drive to Stanfield Road	102 - 103	Generally <2 m	Installation in overburden except sewer at west end of this segment extends into shale
<b>Segment B:</b> North Service Road from Stanfield Road to Harvest Drive	102 - 103	Generally 1 m to 3 m in overburden, plus up to about 5 m in shale	Watermain will be installed in overburden, and deeper sewer in shale
<b>Segment C:</b> West side of Dixie Road from North Service Road to north of Sherway Drive	103.5 – 107	<1 m – 2 m	Installation in overburden or slightly into shale
<b>Segment D:</b> South Service Road from Haig to Dixie Road	102 – 103	<1 m – 2 m	Installation in overburden except at east end where it will extend into shale
<b>Segment E:</b> Brentano Boulevard	104.5 – 106	2 m	Installation in overburden or slightly into shale

Segment	Estimated Groundwater Elevation (m)	Approximate Required Drawdown <sup>1</sup> (m)	Comments
<b>Segment F:</b> From Dixie/Cormack Crescent along South Service Road to east of Liveoak Drive	101 – 104	<1	Installation in overburden

**Note:**

1. The approximate maximum required drawdown is based on lowering the groundwater table to approximately 0.5 m to 1 m below invert level, or to the top of the cohesive soil complex, whichever is higher, where excavations will terminate in overburden soils. Where the excavation penetrates shale bedrock, such is noted in the Comments column and the approximate required drawdown reflects the measurement from static groundwater level to approximate base of excavation.

In general, the subsurface conditions throughout the project area consist of fill underlain by a deposit of silty sand to sandy silt that is generally compact, although limited zones of loose material were encountered in some boreholes. This deposit is water-bearing, and the water levels described above together with the estimated required drawdown will generally be based on controlling the water within this deposit. The silty sand to sandy silt is underlain by a “cohesive soil complex”, consisting of thin layers of generally very stiff to hard clayey silt, clayey silt till, and clayey silt residual soil, which will generally exhibit limited groundwater seepage. These soils are underlain by shale bedrock, in which groundwater seepage/flow is anticipated in weathered zones and through fractures/discontinuities in the bedrock.

As indicated in the table above, the construction works for much of the cut-and-cover watermain and sewer work will require groundwater drawdown of less than 1 m up to about 3 m in the silty sand to sandy silt overburden soils. Thus, groundwater control from an appropriate combination of sumps, well points, eductors and/or drilled wells will be required to permit construction in dry conditions. Even with good workmanship, it will likely not be possible to fully dewater the sandy silt to silty sand materials within about 0.5 m of the interface with the underlying cohesive soil complex and/or shale bedrock.

The radius of influence of dewatering in these soils has been estimated to be less than approximately 25 m, and often less than about 10 m, assuming that dewatering is completed in sections up to approximately 20 m to 30 m in length at a time. The stress increase associated with groundwater drawdown of less than 1 m to 3 m will be less than 10 kPa to 30 kPa. This negligible to small stress increase is expected to result in settlements that range from negligible to less than 5 mm in the generally compact silty sand to sandy silt deposit. Where deeper excavations are required extending into the shale bedrock at Segment B, the required groundwater drawdown will range from about 1 m to about 3 m in the overburden, plus dewatering of inflows in the shale bedrock, which will depend on the degree of weathering and discontinuities within the shale. The stress increase associated with groundwater drawdown in the overburden at Segment B will generally be less than 10 kPa to 30 kPa, which is estimated to result in settlements that range from negligible to less than 5 mm in the generally compact silty sand to sandy silt deposit. Dewatering of the shale bedrock for this segment is expected to result in negligible settlement.

These estimated settlements are expected to result in negligible impacts to existing the existing QEW, local roadways, and existing utilities. Therefore, no settlement monitoring is required associated with construction dewatering for the cut-and-cover portions of the watermain and sewer installation.

The above estimates assume the dewatering is carried out in accordance with OPSS.PROV 517, in such a way as to avoid loss of soil particles that could lead to settlements with magnitudes greater than the estimated settlements due to dewatering and increase in the effective stresses.

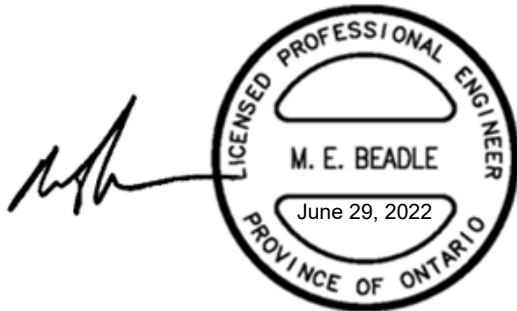
#### 6.5.4 Piezometer Decommissioning

Piezometers installed as part of the geotechnical/foundation investigations have been left in place to permit the contractor to measure groundwater levels closer to the time of construction. The contractor is to decommission the piezometers as part of the construction contract, and a Non-Standard Special Provision (NSSP) to address this requirement is included in the Contract Documents (see Appendix K).

## 7.0 CLOSURE

This Foundation Design Report was prepared by Mr. Michael Beadle, P.Eng. Ms. Lisa Coyne, P.Eng., an MTO Foundations Designated Contact for Golder, conducted an independent technical and quality control review of this report.

#### Golder Associates Ltd.



Michael Beadle, P.Eng.  
*Senior Geotechnical Engineer*



Lisa Coyne, P.Eng.  
*MTO Designated Foundations Contact*

MEB/LCC/ml

Golder and the G logo are trademarks of Golder Associates Corporation

[https://golderassociates.sharepoint.com/sites/19542g/1 foundations/09 - reports/22 - open cut water and sanitary 2021/3. final/1530382 fidr wm and sewer - june 2022.docx](https://golderassociates.sharepoint.com/sites/19542g/1%20foundations/09%20-%20reports/22%20-%20open%20cut%20water%20and%20sanitary%202021/3.%20final/1530382%20fidr%20wm%20and%20sewer%20-%20june%202022.docx)

## REFERENCES

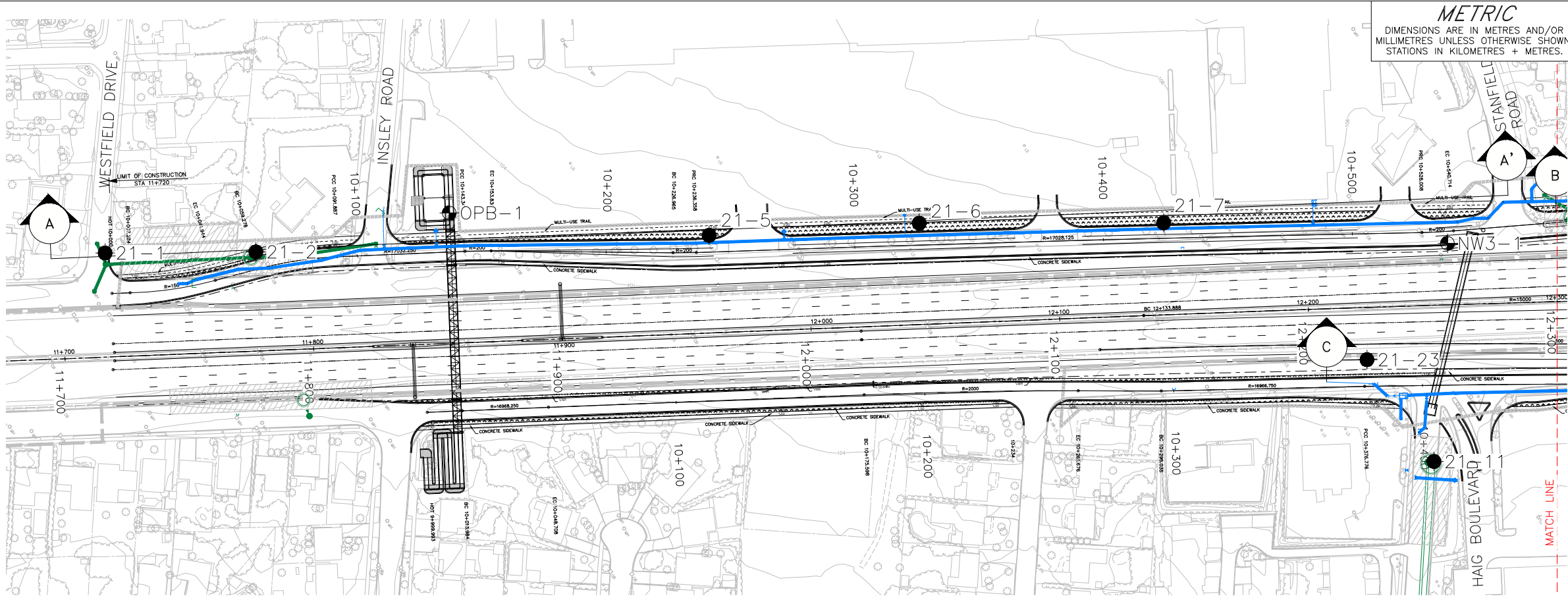
### Ontario Provincial Standard Drawings (OPSD)

OPSD 802.095	Trench Plug
OPSD 3090.101	Frost Penetration Depths for Southern Ontario

### Ontario Provincial Standard Specifications (OPSS)

OPSS.PROV 401	Construction Specification for Trenching, Backfilling, and Compacting)
OPSS.PROV 403	Construction Specification for Rock Excavation for Pipelines, Utilities and Associated Structures in Open Cut
OPSS.PROV 501	Construction Specification for Compacting
OPSS.PROV 517	Construction Specification for Dewatering
OPSS.PROV 539	Construction Specification for Temporary Protection Systems
OPSS.PROV 1010	Material Specification for <i>Aggregates</i>
OPSS 1359	Material Specification for Unshrinkable Backfill





**METRIC**  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN.  
STATIONS IN KILOMETRES + METRES.

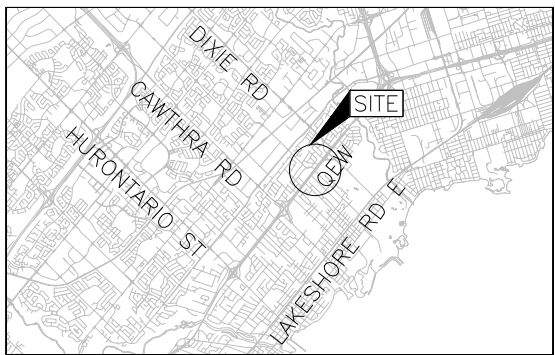
CONT No. 2021-2127  
WP No. 2102-13-00

WATERMAIN AND SEWER  
SEGMENTS A, B AND C

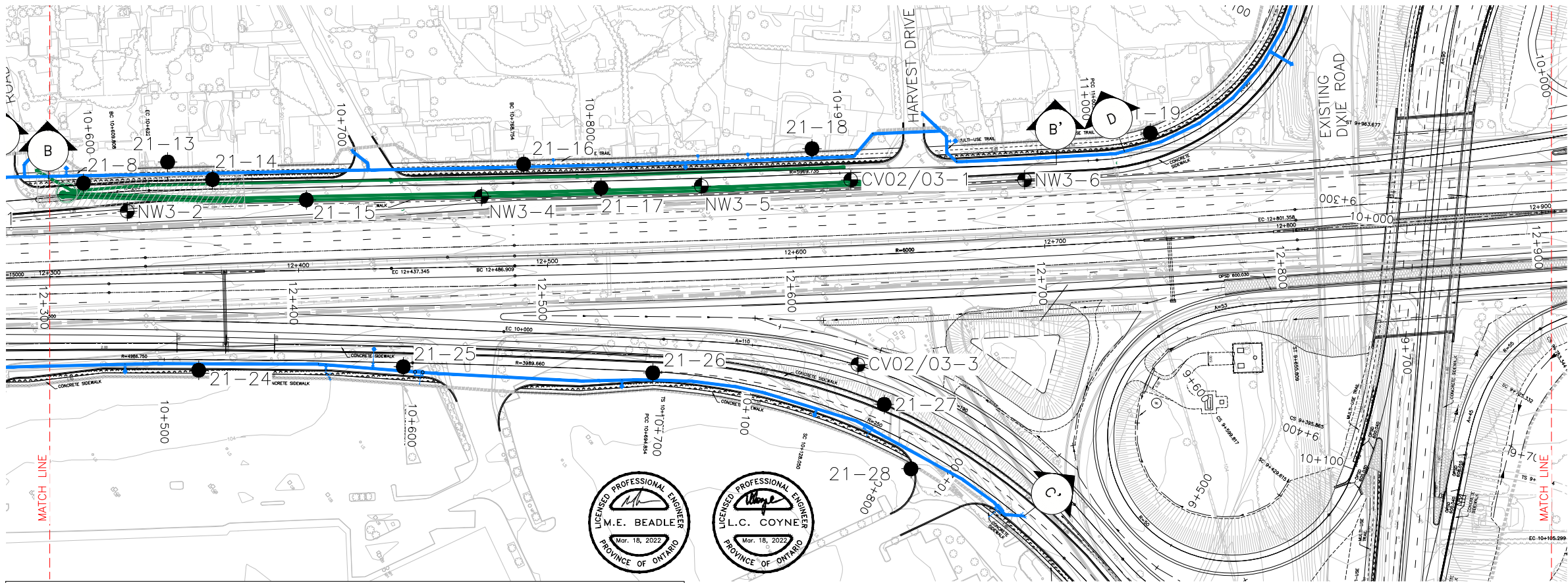
BOREHOLE LOCATIONS

**GOLDER**

SHEET



KEY PLAN  
SCALE  
2 0 2 4 km



**REFERENCE**

Sanitary and Watermain plans provided in digital format by AECOM, drawing file nos. QEW\_DixieC\_UTL\_PROP\_SANITARY.dwg and QEW\_DixieC\_UTL\_PROP\_WATERMAIN.dwg, received March 16, 2021.  
Design plans provided in digital format by AECOM, drawing file nos. QEW\_Dixie\_Cont1\_plan.dwg and QEW\_Dixie\_Cont2\_plan.dwg, received July 21, 2017.  
Existing ground contours provided in digital format by AECOM, drawing file no. QEW\_DixieC\_Contours3D.dwg, received Nov. 08, 2016, contour interval 0.5 m.  
Base plans provided in digital format by AECOM, drawing file nos. QEW\_DixieC\_base.dwg and QEW\_DixieC\_plan.dwg, dated July 20, 2016, received Dec. 06, 2016.  
Key plan base data - MNRF LIO, obtained 2015.

**NOTES**

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

**LEGEND**

	Borehole - Current Investigation
	Borehole - Previous Golder Investigation
	Proposed Watermain
	Proposed Sanitary Sewer

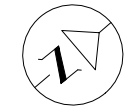
BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
CV02/03-1	104.5	4828381.4	299091.3
OPB-1	103.1	4827795.8	298595.9
NW3-1	105.5	4828093.0	298865.6
NW3-2	105.5	4828152.0	298912.2
NW3-4	105.0	4828264.1	299000.1
NW3-5	104.7	4828334.1	299054.2
NW3-6	105.0	4828434.5	299136.6
CV02/03-3	103.2	4828335.4	299149.6
21-1	103.1	4827680.2	298518.4
21-2	102.8	4827726.5	298557.4
21-5	104.1	4827869.4	298670.6
21-6	104.8	4827936.8	298721.6
21-7	105.7	4828011.6	298785.3
21-11	104.7	4828031.9	298928.7
21-23	105.4	4828038.0	298880.2
21-8	105.4	4828146.0	298892.2
21-13	106.3	4828177.2	298907.6
21-14	106.1	4828186.3	298924.7
21-15	105.3	4828209.7	298955.4
21-16	105.6	4828285.4	299001.2
21-17	104.9	4828302.9	299028.6
21-18	105.1	4828377.6	299071.7
21-19	105.9	4828485.1	299155.1
21-24	104.7	4828132.4	298979.3
21-25	104.0	4828195.9	299031.6
21-26	103.8	4828270.6	299098.6
21-27	101.8	4828333.0	299168.6
21-28	103.4	4828324.4	299195.3

NO.	DATE	BY	REVISION
Geocres No. 30M11-321			
HWY. QEW		PROJECT NO. 1530382	
SUBM'D. KN		CHKD. KN	DATE: 03/18/2022
DRAWN: DD/SA		CHKD. EN	APPD. LCC
		DIST. .	
		SITE: .	
		DWG. 1	



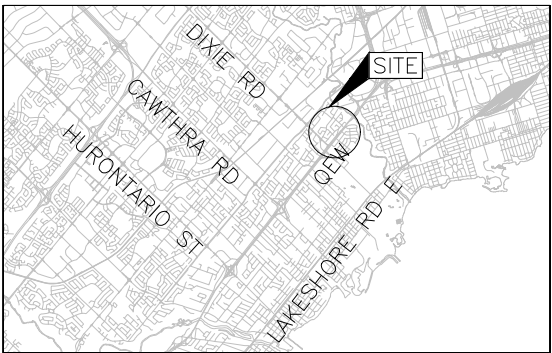
**METRIC**  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN.  
STATIONS IN KILOMETRES + METRES.

CONT No. 2021-2127  
WP No. 2102-13-00



WATERMAIN AND SEWER  
SEGMENTS D AND E  
  
BOREHOLE LOCATIONS

SHEET



KEY PLAN  
SCALE  
2 0 2 4 km

LEGEND

- Borehole – Current Investigation
- Borehole – Previous Golder Investigation
- Proposed Watermain
- Proposed Sanitary Sewer

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
NW4-1	107.5	4828595.5	299115.9
NW4-2	107.7	4828628.9	299093.7
NW4-3	108.1	4828683.3	299100.6
17-1	108.5	4829208.1	299689.8
21-22	109.7	4828896.7	299097.9
21-21	109.3	4828828.6	299098.7
21-20	108.3	4828744.5	299135.4
21-38	108.6	4828774.3	299253.9
21-39	108.1	4828860.8	299321.2
21-40	107.6	4828964.3	299405.2
21-41	107.5	4829065.5	299507.2
21-42	107.6	4829134.8	299617.8
21-43	108.3	4829230.7	299687.3

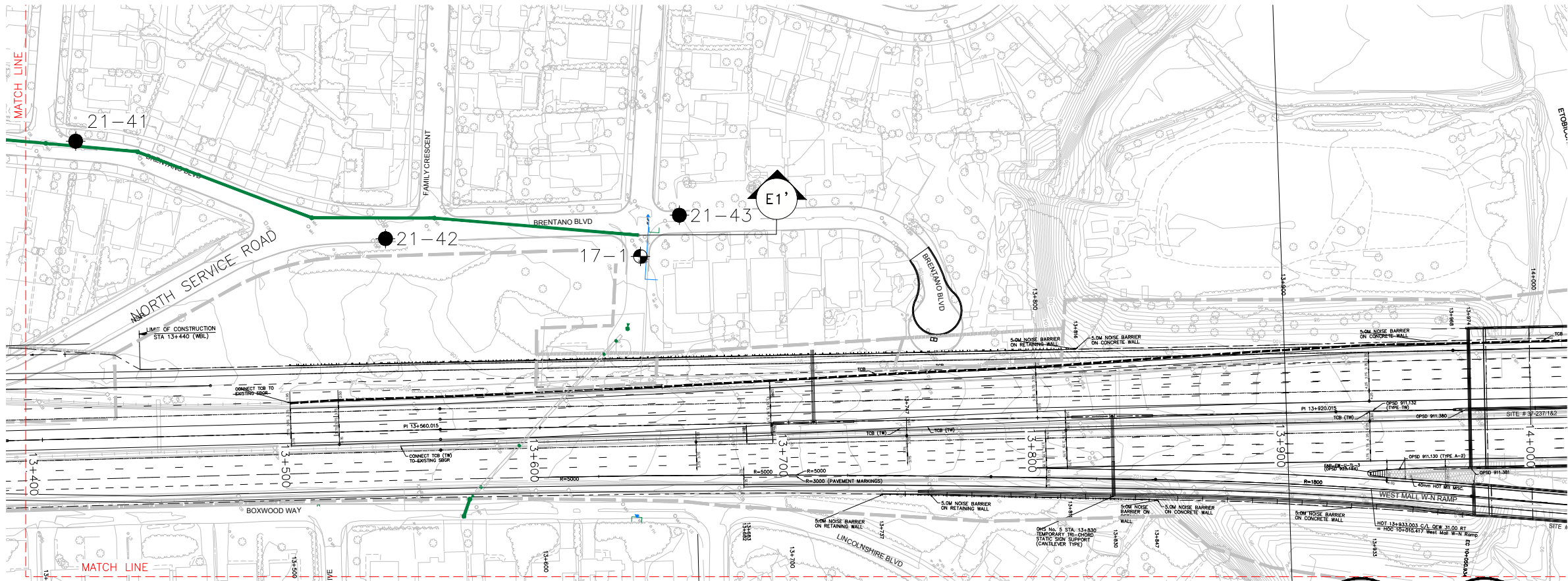
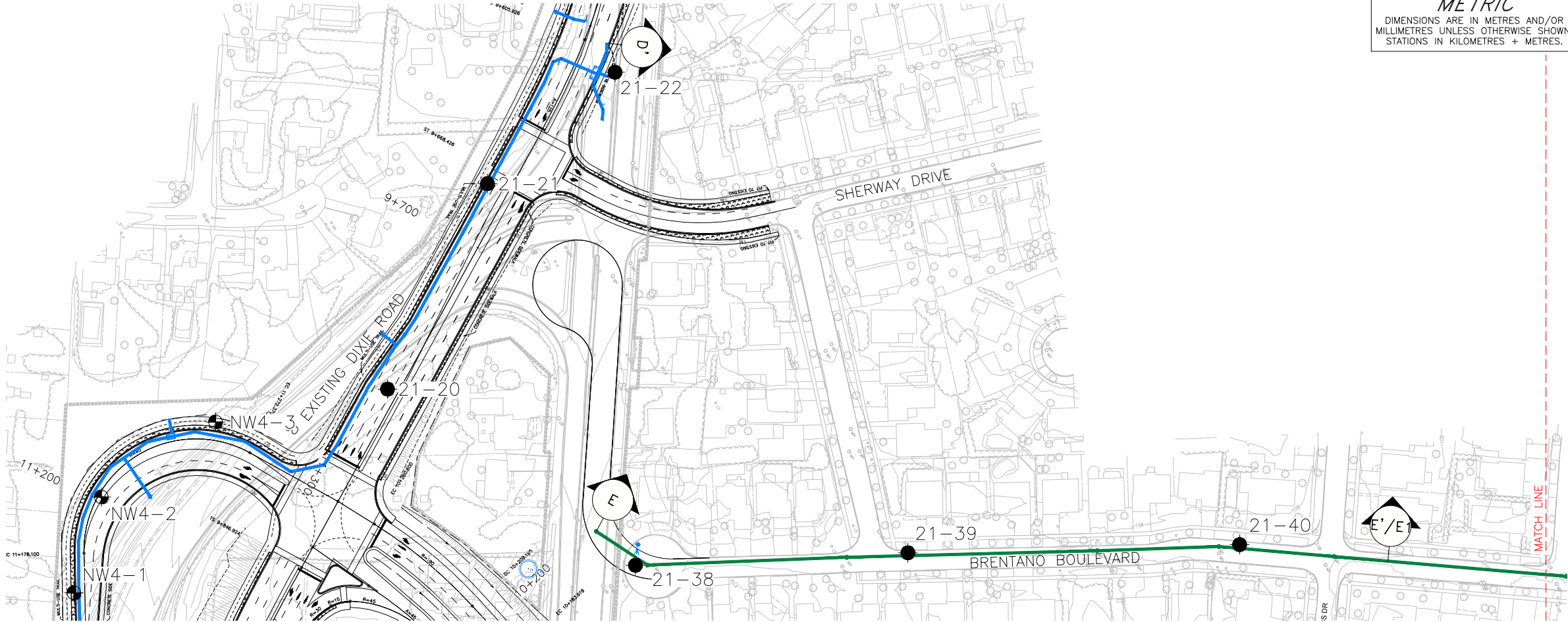
NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

REFERENCE

Sanitary and Watermain plans provided in digital format by AECOM, drawing file nos. QEW\_DixieIC\_UTL\_PROP\_SANITARY.dwg and QEW\_DixieIC\_UTL\_PROP\_WATERMAIN.dwg, received March 16, 2021.  
Design plans provided in digital format by AECOM, drawing file nos. QEW\_DixieCont1\_plan.dwg and QEW\_DixieCont2\_plan.dwg, received July 21, 2017.  
Existing ground contours provided in digital format by AECOM, drawing file no. QEW\_DixieIC\_Contours3D.dwg, received Nov. 08, 2016, contour interval 0.5 m.  
Base plans provided in digital format by AECOM, drawing file nos. QEW\_DixieIC\_base.dwg and QEW\_DixieIC\_plan.dwg, dated July 20, 2016, received Dec. 06, 2016.  
Key plan base data – MNR/LIO, obtained 2015.

NO.	DATE	BY	REVISION
Geocres No. 30M11-321			
HWY. QEW	PROJECT NO. 1530382		DIST. .
SUBM'D. KN	CHKD. KN	DATE: 03/18/2022	SITE: .
DRAWN: DD/SA	CHKD. EN	APPD. LCC	DWG. 2

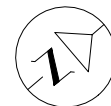


PLAN  
SCALE  
20 0 20 40 m



**METRIC**  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN.  
STATIONS IN KILOMETRES + METRES.

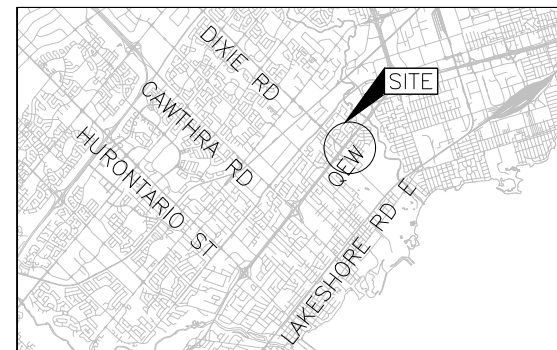
CONT No. 2021-2127  
WP No. 2102-13-00



WATERMAIN AND SEWER  
SEGMENT F  
BOREHOLE LOCATIONS

SHEET

**WSP** **GOLDER**



KEY PLAN  
SCALE  
2 0 2 4 km

#### LEGEND

- Borehole – Current Investigation
- Borehole – Previous Golder Investigation
- Proposed Watermain
- Proposed Sanitary Sewer

#### BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
RW1-1	103.5	4828384.5	299442.5
RW1-2	103.8	4828414.8	299411.1
NW6-3	107.0	4828635.2	299356.3
NW6-4	106.8	4828676.7	299389.8
NW6-5	106.5	4828757.0	299446.5
21-29	105.0	4828449.9	299399.6
21-30	105.6	4828504.8	299394.1
21-37	105.4	4828560.0	299365.4
21-33	106.6	4828730.9	299427.8
21-31	106.0	4828580.5	299337.1

#### NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

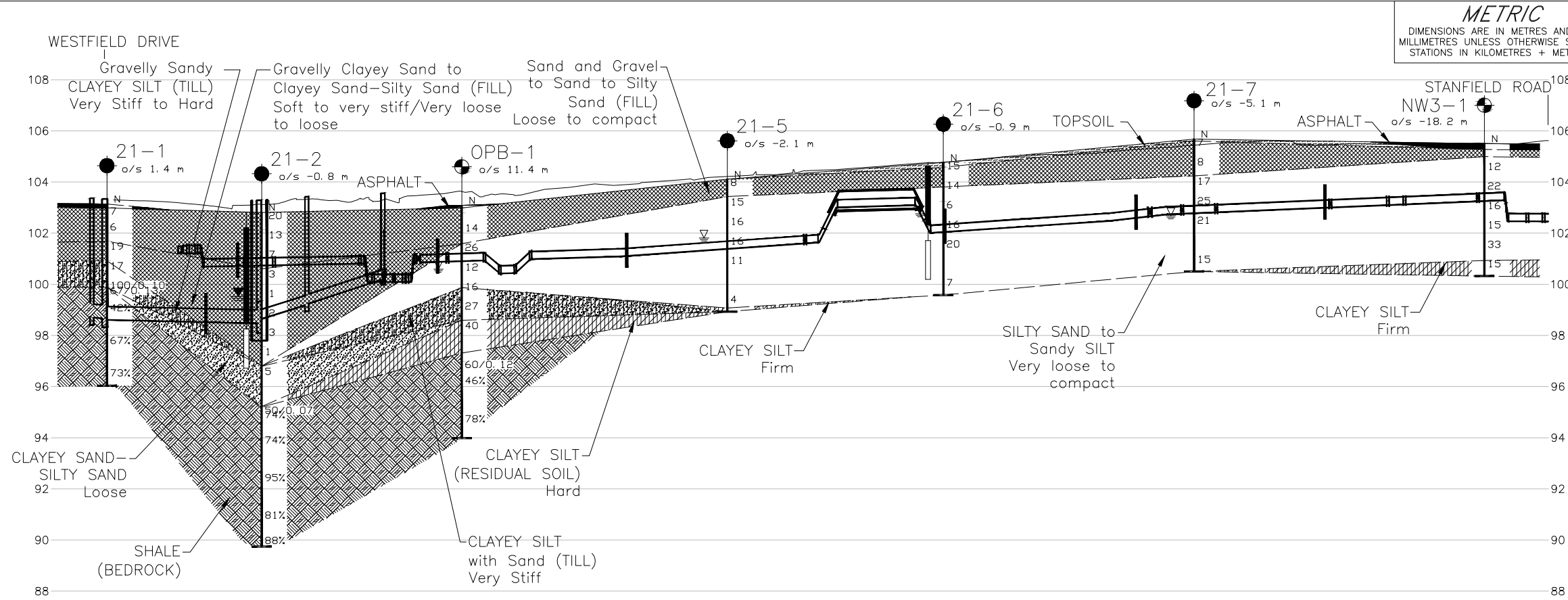
#### REFERENCE

Sanitary and Watermain plans provided in digital format by AECOM, drawing file nos. QEW\_DixielC\_UTL\_PROP\_SANITARY.dwg and QEW\_DixielC\_UTL\_PROP\_WATERMAIN.dwg, received March 16, 2021.  
Design plans provided in digital format by AECOM, drawing file nos. QEW\_Dixie\_Cont1\_plan.dwg and QEW\_Dixie\_Cont2\_plan.dwg, received July 21, 2017.  
Existing ground contours provided in digital format by AECOM, drawing file no. QEW\_DixielC\_Contours3D.dwg, received Nov. 08, 2016, contour interval 0.5 m.  
Base plans provided in digital format by AECOM, drawing file nos. QEW\_DixielC\_base.dwg and QEW\_DixielC\_plan.dwg, dated July 20, 2016, received Dec. 06, 2016.  
Key plan base data – MNR LIO, obtained 2015.

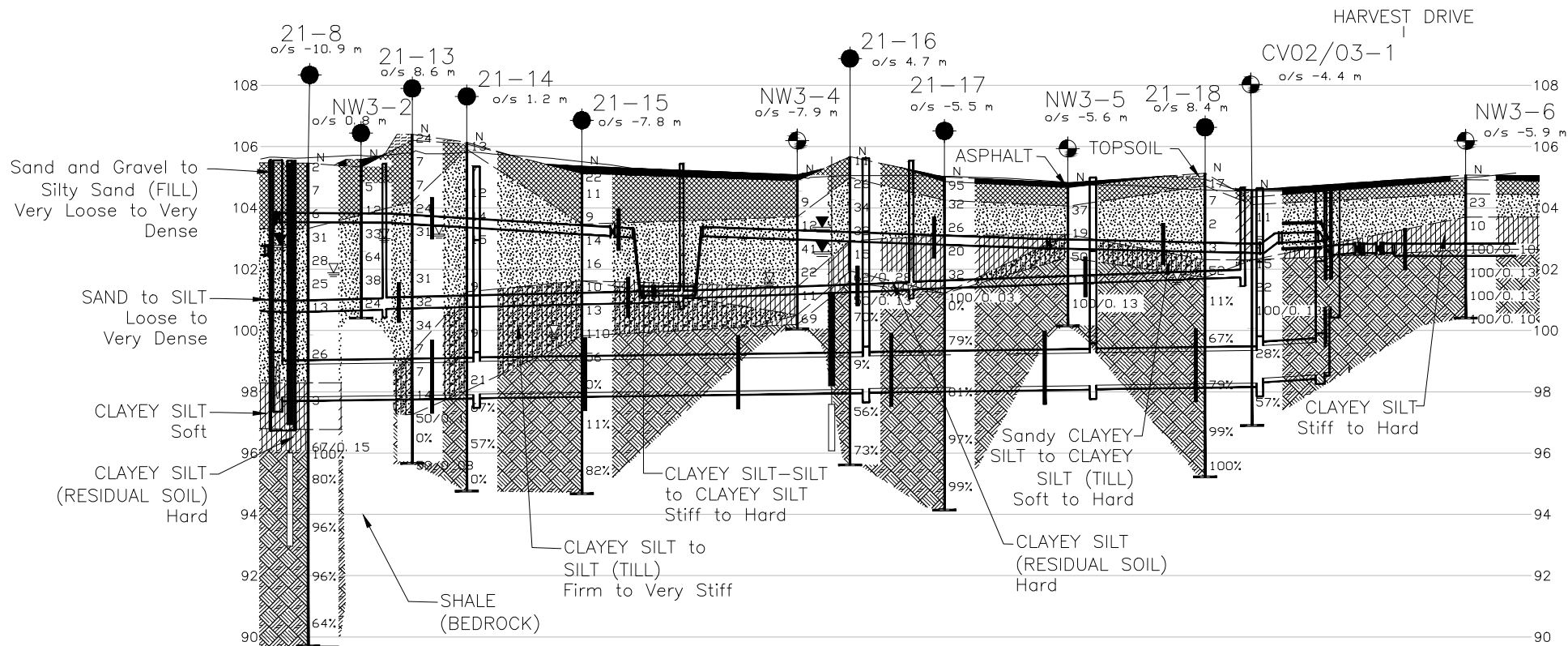


PLAN  
SCALE  
20 0 20 40 m





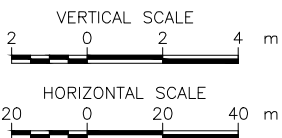
PROFILE A-A'



REFERENCE

Sanitary and Watermain profiles provided in digital format by AECOM, drawing file nos. N-SERVICE-PROP-PROFILE.dwg, received February 07, 2022.  
Sanitary and Watermain plans provided in digital format by AECOM, drawing file nos. QEW\_DixieC\_UTL\_PROP\_SANITARY.dwg and QEW\_DixieC\_UTL\_PROP\_WATERMAIN.dwg, received March 16, 2021.  
Design plans provided in digital format by AECOM, drawing file nos. QEW\_Dixie\_Cont1\_plan.dwg and QEW\_Dixie\_Cont2\_plan.dwg, received July 21, 2017.  
Existing ground contours provided in digital format by AECOM, drawing file no. QEW\_DixieC\_Contours3D.dwg, received Nov. 08, 2016, contour interval 0.5 m.  
Base plans provided in digital format by AECOM, drawing file nos. QEW\_DixieC\_base.dwg and QEW\_DixieC\_plan.dwg, dated July 20, 2016, received Dec. 06, 2016.  
Key plan base data - MNR/LIO, obtained 2015.

PROFILE B-B'



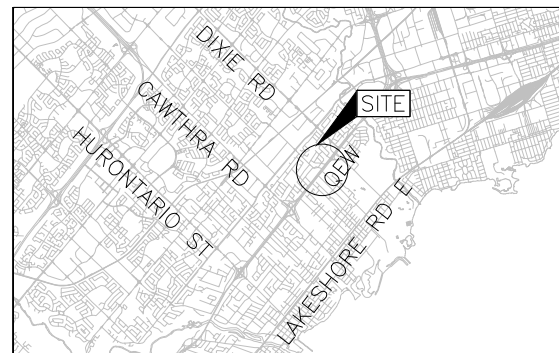
NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

CONT No. 2021-2127  
WP No. 2102-13-00

WATERMAIN AND SEWER  
SEGMENT A AND B

SOIL AND BEDROCK STRATA



KEY PLAN  
SCALE  
2 0 2 4 km

LEGEND

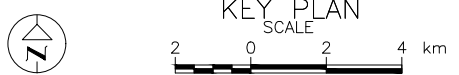
- Borehole - Current Investigation
- Borehole - Previous Golder Investigation
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- 100% Rock Quality Designation (RQD)
- WL in piezometer
- WL upon completion of drilling/Reference should be made to Foundation Investigation Report for further information

BOREHOLE CO-ORDINATES







No.	ELEVATION	NORTHING	EASTING
NW3-5	104.7	4828334.1	299054.2
CV02/03-1	104.5	4828381.4	299091.3
NW3-6	105.0	4828434.5	299136.6
NW3-4	105.0	4828264.1	299000.1
NW3-2	105.5	4828152.0	298912.2
NW3-1	105.5	4828093.0	298865.6
OPB-1	103.1	4827795.8	298595.9
21-18	105.1	4828377.6	299071.7
21-16	105.6	4828285.4	299001.2
21-17	104.9	4828302.9	299028.6
21-15	105.3	4828209.7	298955.4
21-14	106.1	4828186.3	298924.7
21-13	106.3	4828177.2	298907.6
21-8	105.4	4828146.0	298892.2
21-7	105.7	4828011.6	298785.3
21-6	104.8	4827936.8	298721.6
21-5	104.1	4827869.4	298670.6
21-2	102.8	4827726.5	298557.4
21-1	103.1	4827680.2	298518.4

NO.	DATE	BY	REVISION
1	03/18/2022	LCC	1
Geocres No. 30M11-321			
HWY. QEW	PROJECT NO. 1530382	DIST. .	
SUBM'D. KN	CHKD. KN	DATE: 03/18/2022	SITE: .
DRAWN: SA	CHKD. EN	APPD. LCC	DWG. 4





## LEGEND

- |   |  |
|---|--|
|    | Borehole – Current Investigation   |
|    | Borehole – Previous Golder Investigation   |
|    | Seal   |
|    | Piezometer   |
| N   | Standard Penetration Test Value  |
| 16  | Blows/0.3m unless otherwise stated<br>(Std. Pen. Test, 475 j/blow)   |
| 100%  | Rock Quality Designation (RQD)   |
|  | WL in piezometer   |
|  | WL upon completion of drilling/Reference should be<br>made to Foundation Investigation Report for further<br>information |

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
NW4-3	108.1	4828683.3	299100.6
NW4-2	107.7	4828628.9	299093.7
NW4-1	107.5	4828595.5	299115.9
21-27	101.8	4828333.0	299168.6
21-28	103.4	4828324.4	299195.3
21-26	103.8	4828270.6	299098.6
21-25	104.0	4828195.9	299031.6
21-24	104.7	4828132.4	298979.3
21-11	104.7	4828031.9	298928.7
21-23	105.4	4828038.0	298880.2
21-22	109.7	4828896.7	299097.9
21-21	109.3	4828828.6	299098.7
21-19	105.9	4828485.1	299155.1
21-20	108.3	4828744.5	299135.4



Sanitary and Watermain profiles provided in digital format by AECOM, drawing file nos. N-SERVICE-PROP-PROFILE.dwg and S-SERVICE-PROP-PROFILE.dwg and DIXIE-PROP-PROFILE.dwg, received February 07, 2022.  
Sanitary and Watermain plans provided in digital format by AECOM, drawing file nos. QEW\_DixieC\_UTL\_PROP\_SANITARY.dwg and QEW\_DixieC\_UTL\_PROP\_WATERMAIN.dwg, received March 16, 2021.  
Design plans provided in digital format by AECOM, drawing file nos. QEW\_DixieCont1\_plan.dwg and QEW\_DixieCont2\_plan.dwg, received July 21, 2017.  
Elevation contours provided in digital format by AECOM, drawing file no. QEW\_DixieC\_Contours3D.dwg, received Nov. 08, 2016, contour interval 0.5 m.  
Base plans provided in digital format by AECOM, drawing file nos. QEW\_DixieC\_base.dwg and QEW\_DixieC\_plan.dwg, dated July 20, 2016, received Dec. 06, 2016.  
Key plan base data – MNRF LIO, obtained 2015.

The diagram shows two scales. The top scale is labeled 'VERTICAL SCALE' and has markings at 2, 0, 2, and 4 m. The bottom scale is labeled 'HORIZONTAL SCALE' and has markings at 20, 0, 20, and 40 m.



## NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

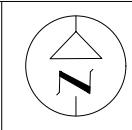
NO.	DATE	BY	REVISION	
<b>Geocres No. 30M11-321</b>				
HWY. QEW		PROJECT NO. 1530382		DIST.
SUBM'D. KN	CHKD. KN	DATE: 03/18/2022		SITE:
DRAWN: SA	CHKD. EN	APPD. LCC		DWG. 5

**METRIC**  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN.  
STATIONS IN KILOMETRES + METRES.

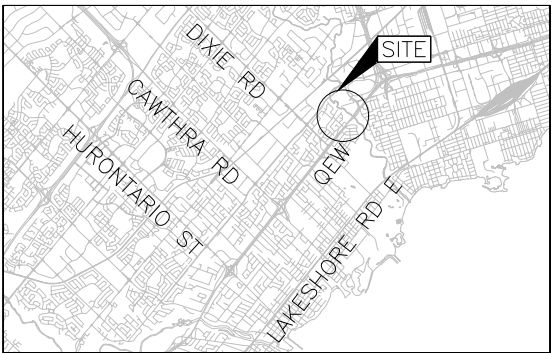
CONT No. 2021-2127  
WP No. 2102-13-00

WATERMAIN AND SEWER  
SEGMENT E

SOIL AND BEDROCK STRATA



SHEET

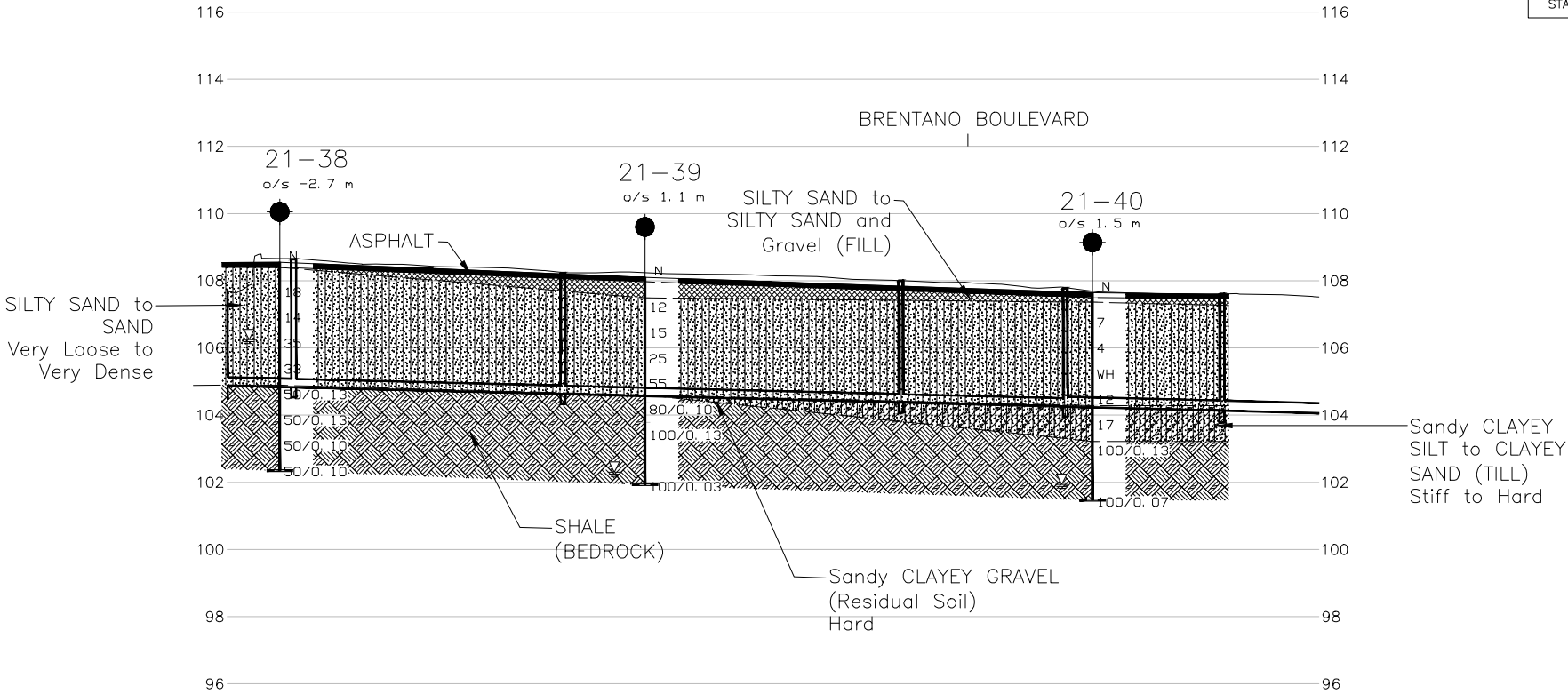


KEY PLAN  
SCALE  
2 0 2 4 km

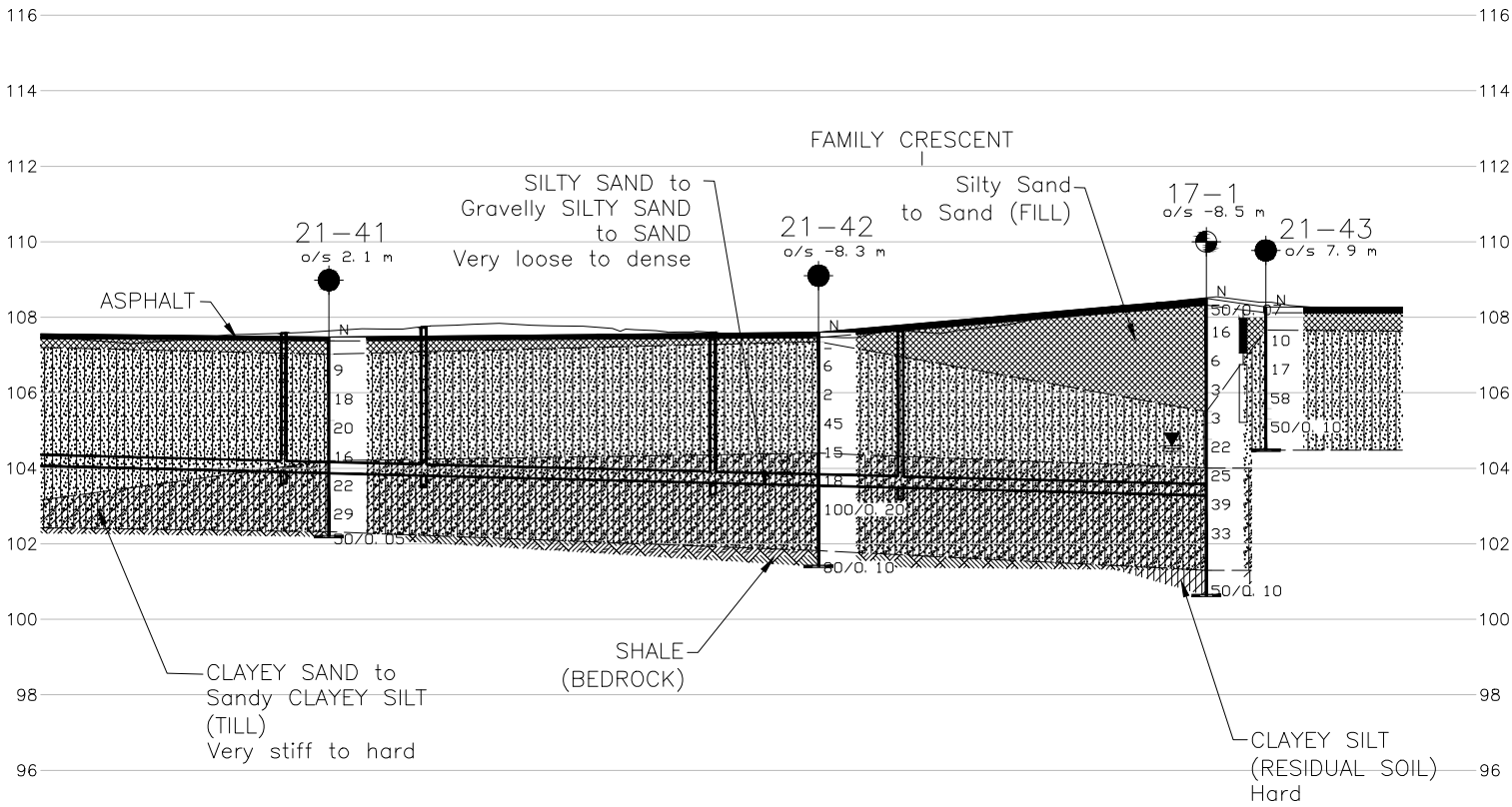
LEGEND

- Borehole - Current Investigation
- Borehole - Previous Golder Investigation
- ⊢ Seal
- ⊢ Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- 100% Rock Quality Designation (RQD)
- ≡ WL in piezometer
- ≡ WL upon completion of drilling/Reference should be made to Foundation Investigation Report for further information

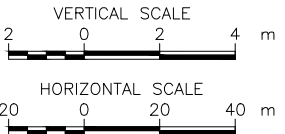
BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
17-1	108.5	4829208.1	299689.8
21-42	107.6	4829134.8	299617.8
21-41	107.5	4829065.5	299507.2
21-43	108.3	4829230.7	299687.3
21-39	108.1	4828860.8	299321.2
21-40	107.6	4828964.3	299405.2
21-38	108.6	4828774.3	299253.9



PROFILE E-E'



PROFILE E1-E1'



**REFERENCE**

Sanitary and Watermain profiles provided in digital format by AECOM, drawing file nos. DIXIE-BRENTANO-PROP-PROFILE.dwg, received February 07, 2022.

Sanitary and Watermain plans provided in digital format by AECOM, drawing file nos. QEW\_DixielC\_UTL\_PROP\_SANITARY.dwg and QEW\_DixielC\_UTL\_PROP\_WATERMAIN.dwg, received March 16, 2021.

Design plans provided in digital format by AECOM, drawing file nos. QEW\_Dixie\_Cont1\_plan.dwg and QEW\_Dixie\_Cont2\_plan.dwg, received July 21, 2017.

Existing ground contours provided in digital format by AECOM, drawing file no. QEW\_DixielC\_Contours3D.dwg, received Nov. 08, 2016, contour interval 0.5 m.

Base plans provided in digital format by AECOM, drawing file nos. QEW\_DixielC\_base.dwg and QEW\_DixielC\_plan.dwg, dated July 20, 2016, received Dec. 06, 2016.

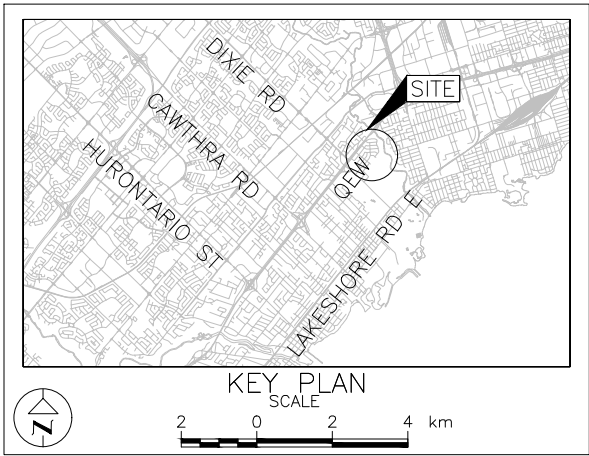
Key plan base data - MNR/LIO, obtained 2015.



**NOTES**

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

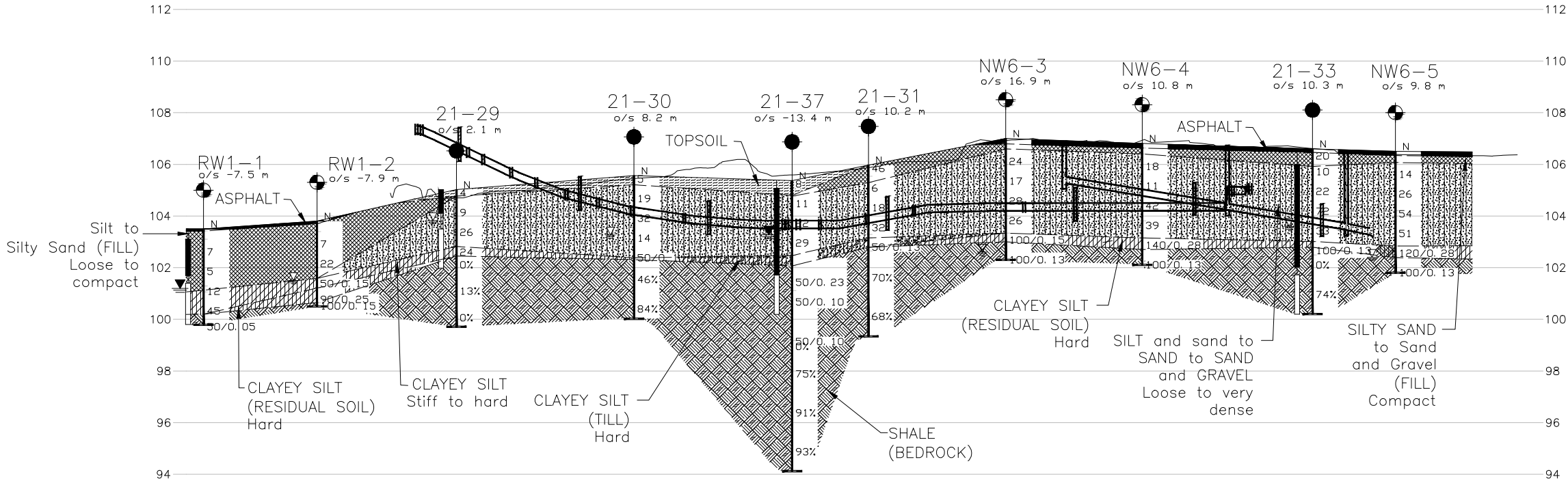
NO.	DATE	BY	REVISION
Geocres No. 30M11-321			
HWY. QEW		PROJECT NO. 1530382	
SUBM'D. KN		DATE: 03/18/2022	
DRAWN: SA		APPD. LCC	
CHKD. KN		SITE:	
CHKD. EN		DWG. 6	



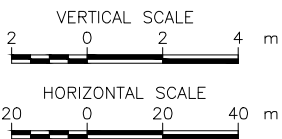
LEGEND

- Borehole - Current Investigation
- Borehole - Previous Golder Investigation
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- 100% Rock Quality Designation (RQD)
- WL in piezometer
- WL upon completion of drilling/Reference should be made to Foundation Investigation Report for further information

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
RW1-1	103.5	4828384.5	299442.5
RW1-2	103.8	4828414.8	299411.1
NW6-3	107.0	4828635.2	299356.3
NW6-4	106.8	4828676.7	299389.8
NW6-5	106.5	4828757.0	299446.5
21-29	105.0	4828449.9	299399.6
21-30	105.6	4828504.8	299394.1
21-37	105.4	4828560.0	299365.4
21-33	106.6	4828730.9	299427.8
21-31	106.0	4828580.5	299337.1



PROFILE F-F'



REFERENCE

Sanitary and Watermain profiles provided in digital format by AECOM, drawing file nos. S-SERVICE-PROP-PROFILE-2.dwg, received February 07, 2022.  
Sanitary and Watermain plans provided in digital format by AECOM, drawing file nos. QEW\_DixielC\_UTL\_PROP\_SANITARY.dwg and QEW\_DixielC\_UTL\_PROP\_WATERMAIN.dwg, received March 16, 2021.  
Design plans provided in digital format by AECOM, drawing file nos. QEW\_Dixie\_Cont1\_plan.dwg and QEW\_Dixie\_Cont2\_plan.dwg, received July 21, 2017.  
Existing ground contours provided in digital format by AECOM, drawing file no. QEW\_DixielC\_Contours3D.dwg, received Nov. 08, 2016, contour interval 0.5 m.  
Base plans provided in digital format by AECOM, drawing file nos. QEW\_DixielC\_base.dwg and QEW\_DixielC\_plan.dwg, dated July 20, 2016, received Dec. 06, 2016.  
Key plan base data - MNR/LIO, obtained 2015.



NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

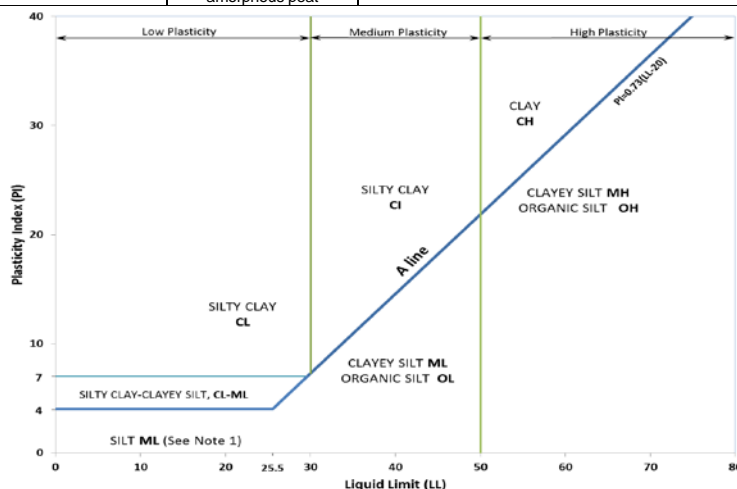
NO.	DATE	BY	REVISION
Geocres No. 30M11-321			
HWY. QEW	PROJECT NO. 1530382		DIST. .
SUBM'D. KN	CHKD. KN	DATE: 03/18/2022	SITE: .
DRAWN: SA	CHKD. EN	APPD. LCC	DWG. 7



# METHOD OF SOIL CLASSIFICATION

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

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$		$Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$			Organic Content	USCS Group Symbol	Group Name	
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4		≤1 or ≥3			≤30%	GP	GRAVEL	
				Well Graded	≥4		1 to 3				GW	GRAVEL	
			Gravels with >12% fines (by mass)	Below A Line	n/a						GM	SILTY GRAVEL	
				Above A Line	n/a						GC	CLAYEY GRAVEL	
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6		≤1 or ≥3				SP	SAND	
				Well Graded	≥6		1 to 3				SW	SAND	
			Sands with >12% fines (by mass)	Below A Line	n/a						SM	SILTY SAND	
				Above A Line	n/a						SC	CLAYEY SAND	
Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name		
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)					
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or Pl and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT		
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT		
			Liquid Limit ≥50	Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT		
				Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT		
		CLAYS (Pl and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30%	CL	SILTY CLAY		
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium	(see Note 2)	CI	SILTY CLAY		
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY		
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT		
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT		



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.

Note 2 – For soils with <5% organic content, include the descriptor “trace organics” for soils with between 5% and 30% organic content include the prefix “organic” before the Primary name.

**Dual Symbol** — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.

For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between “clean” and “dirty” sand or gravel.

For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

**Borderline Symbol** — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.

A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

## ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

### PARTICLE SIZES OF CONSTITUENTS

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

### MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

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

### PENETRATION RESISTANCE

#### Standard Penetration Resistance (SPT), N:

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

#### Cone Penetration Test (CPT)

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

#### Dynamic Cone Penetration Resistance (DCPT); N<sub>d</sub>:

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

**PH:** Sampler advanced by hydraulic pressure

**PM:** Sampler advanced by manual pressure

**WH:** Sampler advanced by static weight of hammer

**WR:** Sampler advanced by weight of sampler and rod

### SAMPLES

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

### SOIL TESTS

w	water content
PL , w <sub>p</sub>	plastic limit
LL , w <sub>L</sub>	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test <sup>1</sup>
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement <sup>1</sup>
D <sub>R</sub>	relative density (specific gravity, G <sub>s</sub> )
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO <sub>4</sub>	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

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

### NON-COHESIVE (COHESIONLESS) SOILS

#### Compactness<sup>2</sup>

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

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

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

#### Field Moisture Condition

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

### COHESIVE SOILS

#### Consistency

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

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

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

#### Water Content

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

## LIST OF SYMBOLS

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

### I. GENERAL

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

### II. STRESS AND STRAIN

$\gamma$	shear strain
$\Delta$	change in, e.g. in stress: $\Delta \sigma$
$\varepsilon$	linear strain
$\varepsilon_v$	volumetric strain
$\eta$	coefficient of viscosity
$\nu$	Poisson's ratio
$\sigma$	total stress
$\sigma'$	effective stress ( $\sigma' = \sigma - u$ )
$\sigma'_{vo}$	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
$\sigma_{oct}$	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
$\tau$	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

### III. SOIL PROPERTIES

#### (a) Index Properties

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

#### (a) Index Properties (continued)

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

#### (b) Hydraulic Properties

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

#### (c) Consolidation (one-dimensional)

$C_c$	compression index (normally consolidated range)
$C_r$	recompression index (over-consolidated range)
$C_s$	swelling index
$C_\alpha$	secondary compression index
$m_v$	coefficient of volume change
$C_v$	coefficient of consolidation (vertical direction)
$C_h$	coefficient of consolidation (horizontal direction)
$T_v$	time factor (vertical direction)
U	degree of consolidation
$\sigma'_p$	pre-consolidation stress
OCR	over-consolidation ratio = $\sigma'_p / \sigma'_{vo}$

#### (d) Shear Strength

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

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

Notes: 1  
2

$$\tau = c' + \sigma' \tan \phi'$$

$$\text{shear strength} = (\text{compressive strength})/2$$

## WEATHERINGS STATE

**Fresh:** no visible sign of weathering

**Faintly weathered:** weathering limited to the surface of major discontinuities.

**Slightly weathered:** penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

**Moderately weathered:** weathering extends throughout the rock mass but the rock material is not friable.

**Highly weathered:** weathering extends throughout rock mass and the rock material is partly friable.

**Completely weathered:** rock is wholly decomposed and in a friable condition but the rock and structure are preserved.

## BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 m to 2 m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	Less than 6 mm

## JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

## GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

Note: \* Grains greater than 60 microns diameter are visible to the naked eye.

## CORE CONDITION

### Total Core Recovery (TCR)

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

### Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

### Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varied from 0% for completely broken core to 100% for core in solid sticks.

## DISCONTINUITY DATA

### Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

### Dip with Respect to Core Axis

The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

### Description and Notes

An abbreviation description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

### Abbreviations

JN Joint	PL Planar
FLT Fault	CU Curved
SH Shear	UN Undulating
VN Vein	IR Irregular
FR Fracture	K Slickensided
SY Stylolite	PO Polished
BD Bedding	SM Smooth
FO Foliation	SR Slightly Rough
CO Contact	RO Rough
AXJ Axial Joint	VR Very Rough
KV Karstic Void	
MB Mechanical Break	

## FIELD ESTIMATION OF ROCK HARDNESS

Grade	Description	Field Identification	Approx. Range of UCS (MPa)
R0	Extremely Weak Rock	Indented by thumbnail	0.25 - 1
R1	Very Weak Rock	Material can be peeled or shaped with a knife. Crumbles under firm blows from geological hammer.	1 - 5
R2	Weak Rock	Knife cuts material but too hard to shape into triaxial specimens or material can be peeled with a knife with difficulty. Shallow (<5mm) indentations made by firm blows from pick of a geological hammer.	5 - 25
R3	Moderately Strong Rock	Cannot be peeled or scraped with a knife. Hand held specimens can be fractured with single firm blow of geological hammer.	25 - 50
R4	Strong Rock	Hand held specimen requires more than one blow of geological hammer to fracture.	50 - 100
R5	Very Strong Rock	Hand held specimen requires many blows of geological hammer to fracture.	100 - 250
R6	Extremely Strong Rock	Specimen can only be chipped under repeated hammer blows, rings when hit.	> 250

### Notes:

1. Hand held specimens should have height approximately 2 times the diameter.
2. Materials having a uniaxial compressive strength of less than approximately 0.5 MPa and cohesionless materials should be classified using soil classification systems.
3. Rocks with a uniaxial compressive strength below 25 MPa (i.e. below R2) are likely to yield highly ambiguous results under point load testing.

### Reference:

- Brown, 1981. "Suggested Methods for Rock Characterization Testing and Monitoring", International Society for Rock Mechanics.
- Hoek, E., Kaiser, P.K., Bawden, W.F., 1995. "Support of Underground Excavations in Hard Rock", Balkema, Rotterdam.



## ROCK WEATHERING CLASSIFICATION

Term	Symbol	Description	Discoloration Extent	Fracture Condition	Surface Characteristics
Residual soil	W6	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.	Throughout	N/A	Resembles soil
Completely weathered	W5	100% of rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.	Throughout	Filled with alteration minerals	Resembles soil
Highly weathered	W4	More than 50% of the rock material is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as corestones.	Throughout	Filled with alteration minerals	Friable and possibly pitted
Moderately weathered	W3	Less than 50% of the rock material is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as corestones. Visible texture of the host rock still preserved. Surface planes are weathered (oxidized or carbonate filling) even when breaking the "intact rock".	>20% of fracture spacing on both sides of fracture	Discoloured, may contain thick filling	Partial to complete discoloration, not friable except poorly cemented rocks
Slightly weathered	W2	Discoloration indicates weathering of rock material on discontinuity surfaces (usually oxidized). Less than 5% of rock mass altered.	<20% of fracture spacing on both sides of fracture	Discoloured, may contain thin filling	Partial discoloration
Fresh	W1	No visible sign of rock material weathering.	None	Closed or discoloured	Unchanged

### Reference:

Brown, 1981. "Suggested Methods for Rock Characterization Testing and Monitoring", International Society for Rock Mechanics.

**APPENDIX A**

**Segment A: North Service Road from  
Westfield Drive to Stanfield Road –  
Borehole Records and  
Geotechnical Laboratory Test Results**

PROJECT 1530382		RECORD OF BOREHOLE No 21-1		SHEET 1 OF 1		METRIC														
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4827680.2; E 298518.4 MTM NAD 83 ZONE 10 (LAT. 43.589037; LONG. -79.577795)		ORIGINATED BY AM																
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY KN																
DATUM Geodetic		DATE May 11, 2021		CHECKED BY KN																
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	GR SA SI CL			
							20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	10 20 30										
103.1	GROUND SURFACE																			
0.0	ASPHALT (150 mm)																			
0.2	SAND (SP), trace gravel, trace fines (FILL) Loose Moist		1	SS	7		103													
			2	SS	6		102													
101.7	Gravelly CLAYEY SAND (SC) (FILL) Compact Moist		3	SS	19		101											28 52 15 5		
100.9	Gravelly Sandy CLAYEY SILT (CL) (TILL) Very stiff to hard Grey		4	SS	17		100											22 23 38 17		
99.9			5	SS	100/0.10		100													
3.3	Inferred moderately weathered SHALE (BEDROCK)		6	SS	67/0.13															
99.6	Grey SHALE (BEDROCK)																			
3.5	Bedrock cored from depths of 3.5 m to 7.1 m ( Elev. 99.6 m to 96.0 m).  For bedrock coring details refer to Record of Drillhole 21-1.		1	RC	REC 86%		99											RQD = 42%		
			2	RC	REC 100%		98											RQD = 67%		
			3	RC	REC 96%		97											RQD = 73%		
96.0	END OF BOREHOLE																			
7.1	NOTE:  1. Open borehole dry upon completion of drilling prior to rock coring.																			

PROJECT: 1530382

## RECORD OF DRILLHOLE: 21-1

SHEET 1 OF 1

LOCATION: N 4827680.2 ;E 298518.4

DRILLING DATE: May 11, 2021

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 75 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage PL - Planar CU- Curved UN- Undulating ST - Stepped IR - Irregular PO- Polished K - Slickensided SM- Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.																		FEATURES	R0/R1 ZONES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA				ROCK STRENGTH INDEX		WEATH- ERING INDEX																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
						TOTAL CORE %	SOLID CORE %			B Angle	DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	R4	R3	R2	R1	W1	W2	W3	W4	W5			W6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		Continued from Record of Borehole 21-1		99.60																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				</

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



LOGGED: AM

CHECKED: KN

GTA-RCK 054 S:\CLIENTS\MTOW-OW-DIXIE\02 DATA\INTQEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

PROJECT		1530382		RECORD OF BOREHOLE No 21-2		SHEET 1 OF 2		METRIC											
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4827726.5; E 298557.4 MTM NAD 83 ZONE 10 (LAT. 43.589455; LONG. -79.577312)		ORIGINATED BY LM											
DIST		Central HWY QEW		BOREHOLE TYPE		CME 55, 150 mm O.D. Hollow Stem Augers (Auto Hammer)		COMPILED BY SK											
DATUM		Geodetic		DATE		January 11, 2021		CHECKED BY KN											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100	20	40
102.8	GROUND SURFACE																		
0.0	Gravelly SAND (SP), trace silt (FILL) Compact Brown Dry		1	SS	20														
102.1																			
0.7	SILTY SAND (SM), some gravel (FILL) Compact to loose Brown Moist		2	SS	13														
			3	SS	7														
100.6																			
2.2	CLAYEY SAND - SILTY SAND (SC-SM), some gravel, contains shale fragments (FILL) Very loose Grey Wet		4	SS	3														
			5	SS	1														
			6	SS	2														
			7	SS	3														
97.5																			
5.3	SILTY SAND (SM), brick fragments from 5.3 m to 5.9 m (FILL) Very loose Black/brown Wet		8	SS	1														
96.8																			
6.0	CLAYEY SAND - SILTY SAND (SC-SM), trace gravel Loose Grey Wet		9	SS	5														
95.2																			
7.6	SHALE (BEDROCK) Grey		10	SS	50/0.07														
	Bedrock cored from depths of 7.7 m to 13.1 m (between Elev. 95.1 m and 89.7 m).  For bedrock coring details refer to Record of Drillhole BH21-2.		1	RC	REC 100%														RQD = 74%
			2	RC	REC 100%														RQD = 74%
			3	RC	REC 100%														RQD = 95%

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE\02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT <u>1530382</u>		<b>RECORD OF BOREHOLE No 21-2</b>				SHEET 2 OF 2		<b>METRIC</b>																			
G.W.P. <u>2102-13-00; 2432-13-00</u>		LOCATION <u>N 4827726.5; E 298557.4 MTM NAD 83 ZONE 10 (LAT. 43.589455; LONG. -79.577312)</u>				ORIGINATED BY <u>LM</u>																					
DIST <u>Central</u> HWY <u>QEW</u>		BOREHOLE TYPE <u>CME 55, 150 mm O.D. Hollow Stem Augers (Auto Hammer)</u>				COMPILED BY <u>SK</u>																					
DATUM <u>Geodetic</u>		DATE <u>January 11, 2021</u>				CHECKED BY <u>KN</u>																					
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL											
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa																			
	--- CONTINUED FROM PREVIOUS PAGE ---						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)															
							20 40 60 80 100					10 20 30															
	SHALE (BEDROCK) Grey		3	RC	REC 100%												RQD = 95%										
	Bedrock cored from depths of 7.7 m to 13.1 m (between Elev. 95.1 m and 89.7 m).		4	RC	REC 100%												RQD = 81%										
	For bedrock coring details refer to Record of Drillhole BH21-2.		5	RC	REC 88%											RQD = 88%											
89.7 13.1	END OF BOREHOLE																										
	NOTES:  1. Water level measured at a depth of 3.7 m below ground surface (Elev. 99.1 m) upon completion of drilling.  2. Groundwater level measurements in piezometer:  <table style="margin-left: 20px;"> <tr> <td>Date</td> <td>Depth (m)</td> <td>Elev. (m)</td> </tr> <tr> <td>11-02-21</td> <td>3.3</td> <td>99.5</td> </tr> <tr> <td>30-03-21</td> <td>3.4</td> <td>99.4</td> </tr> <tr> <td>13-05-21</td> <td>3.3</td> <td>99.5</td> </tr> </table>	Date	Depth (m)	Elev. (m)	11-02-21	3.3	99.5	30-03-21	3.4	99.4	13-05-21	3.3	99.5														
Date	Depth (m)	Elev. (m)																									
11-02-21	3.3	99.5																									
30-03-21	3.4	99.4																									
13-05-21	3.3	99.5																									

GTA-MTO 001 S:\CLIENTS\MTQ\QEW-DIXIE\02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT: 1530382

## RECORD OF DRILLHOLE: 21-2

SHEET 1 OF 1

LOCATION: N 4827726.5 ;E 298557.4

DRILLING DATE: January 11, 2021

DATUM: Geodetic


INCLINATION: -90° AZIMUTH: —


DRILL RIG: CME 55 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.


DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.										FEATURES	R0/R1 ZONES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA				ROCK STRENGTH INDEX				WEATH- ERING INDEX																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
						TOTAL CORE %	SOLID CORE %			B Angle DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	R4 R3 R2 R1	W1 W2 W3 W4 W5 W6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
8	HQ3 Core Rotary drilling	Continued from Record of Borehole BH21-2		95.12																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									</

## FEATURES LEGEND

 BROKEN CORE

 CLAY SEAM

 LIMESTONE

 LOST CORE

DEPTH SCALE

1 : 50



LOGGED: LM

CHECKED: SK

GTA-RCK 054 S:\CLIENTS\MTOW\QEW-DIXIE\02 DATA\QEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

PROJECT 1530382		RECORD OF BOREHOLE No 21-5		SHEET 1 OF 1		METRIC											
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4827869.4; E 298670.6 MTM NAD 83 ZONE 10 (LAT. 43.590741; LONG. -79.575912)		ORIGINATED BY AM													
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY KN													
DATUM Geodetic		DATE April 19, 2021		CHECKED BY KN													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>	γ	GR	SA	SI	CL
104.1	GROUND SURFACE																
0.0	TOPSOIL (130 mm)																
0.1	SILTY SAND (SM), trace gravel (FILL) Loose to compact Brown Moist		1	SS	8		104										
103.4	SILTY SAND (SM), trace gravel Very loose to compact Brown Wet		2	SS	15		103										
0.7			3	SS	16		102										
			4	SS	16		101										
			5	SS	11		100										
	- Grey below a depth of 4.6 m		6A	SS	4		99										
99.1	CLAYEY SILT (CL), trace sand Firm Grey Wet		6B														
5.2	END OF BOREHOLE																
NOTES: 1. Groundwater level measured at a depth of approximately 2.3 m below ground surface (Elev. 101.9 m) upon completion of drilling. 2. Borehole caved to a depth of 2.3 m below ground surface (Elev. 101.9 m) upon removal of augers.																	



PROJECT 1530382		RECORD OF BOREHOLE No 21-6		SHEET 1 OF 1		METRIC											
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4827936.8; E 298721.6 MTM NAD 83 ZONE 10 (LAT. 43.591349; LONG. -79.575280)		ORIGINATED BY AM													
DIST Central HWY QEWE		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY KN													
DATUM Geodetic		DATE April 19, 2021		CHECKED BY KN													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ kN/m³	GR SA SI CL
								20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>				
104.8	GROUND SURFACE																
104.8	TOPSOIL (180 mm)																
0.2	SILTY SAND (SM), trace gravel (FILL) Compact Brown Moist		1	SS	15		104										
			2	SS	14												
103.3	SILTY SAND (SM) to Sandy SILT (ML), trace gravel, contains silt pockets Loose to compact Brown Moist to wet		3	SS	6		103										
			4	SS	16		102										
			5	SS	20		101										
			6	SS	7		100										
99.6	- Grey below a depth of 4.6 m																
5.2	END OF BOREHOLE																
NOTES:																	
1. Groundwater level measured at a depth of approximately 2.9 m (Elev. 101.86 m) upon completion of drilling.																	
2. Groundwater level measured in piezometer:																	
Date	Depth (m)	Elev. (m)															
04-19-21	2.9	101.9															
07-08-21	2.0	102.8															

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEQW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT		1530382		RECORD OF BOREHOLE No 21-7		SHEET 1 OF 1		METRIC								
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828011.6; E 298785.3 MTM NAD 83 ZONE 10 (LAT. 43.592022; LONG. -79.574493)		ORIGINATED BY								
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY								
DATUM		Geodetic		DATE		April 19, 2021		CHECKED BY								
KN								KN								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
105.7	GROUND SURFACE															
0.0	TOPSOIL (70 mm)															
0.1	SILTY SAND (SM), trace gravel (FILL) Loose Brown Moist		1	SS	7											
			2	SS	8											1 82 15 2
104.3	SILTY SAND (SM), trace gravel Compact Brown Moist		3	SS	17											
1.4																
	- Wet below a depth of 2.4 m		4	SS	25											
			5	SS	21											1 81 17 1
	- Grey below a depth of 4.6 m		6	SS	15											
100.5	END OF BOREHOLE															
5.2	NOTES:  1. Groundwater level measured at a depth of 3.0 m below ground surface (Elev. 102.7 m) upon completion of drilling.  2. Borehole caved at a depth of 3.0 m below the ground surface (Elev. 102.7 m) upon removal of augers.															

GTA-MTO 001 S:\CLIENTS\MTO\QEW-DIXIE\02 DATA\GINT\QEW-DIXIE.GPJ GAL-GTA.GDT 3/31/21

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

PROJECT <u>1530382</u>	<b>RECORD OF BOREHOLE No OPB-1</b>	SHEET 2 OF 2	<b>METRIC</b>
G.W.P. <u>2102-13-00; 2432-13-00</u>	LOCATION <u>N 4827795.8; E 298595.9 MTM NAD 83 ZONE 10 (LAT. 43.596105; LONG. -79.569451)</u>	ORIGINATED BY <u>KN</u>	
DIST <u>Central</u> HWY <u>QEW</u>	BOREHOLE TYPE <u>200 mm O.D. Hollow Stem Augers</u>	COMPILED BY <u>CC</u>	
DATUM <u>Geodetic</u>	DATE <u>February 11 to 12, 2020</u>	CHECKED BY <u>SMM</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			LIQUID LIMIT	UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W <sub>p</sub>	W	W <sub>L</sub>			WATER CONTENT (%)					
								20	40	60	80	100						10	20	30	GR	SA	SI
	— CONTINUED FROM PREVIOUS PAGE —																						
	NOTES:  1. Borehole open and dry to a depth of 6.1 m below ground surface (Elev. 97.0 m) on February 11, 2020.  2. Water level measured at a depth of 2.5 m below ground surface (Elev. 100.6 m) on February 12, 2020, prior to rock coring.																						

[illegible]

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



# GOLDER

LOGGED: KN

CHECKED: AK

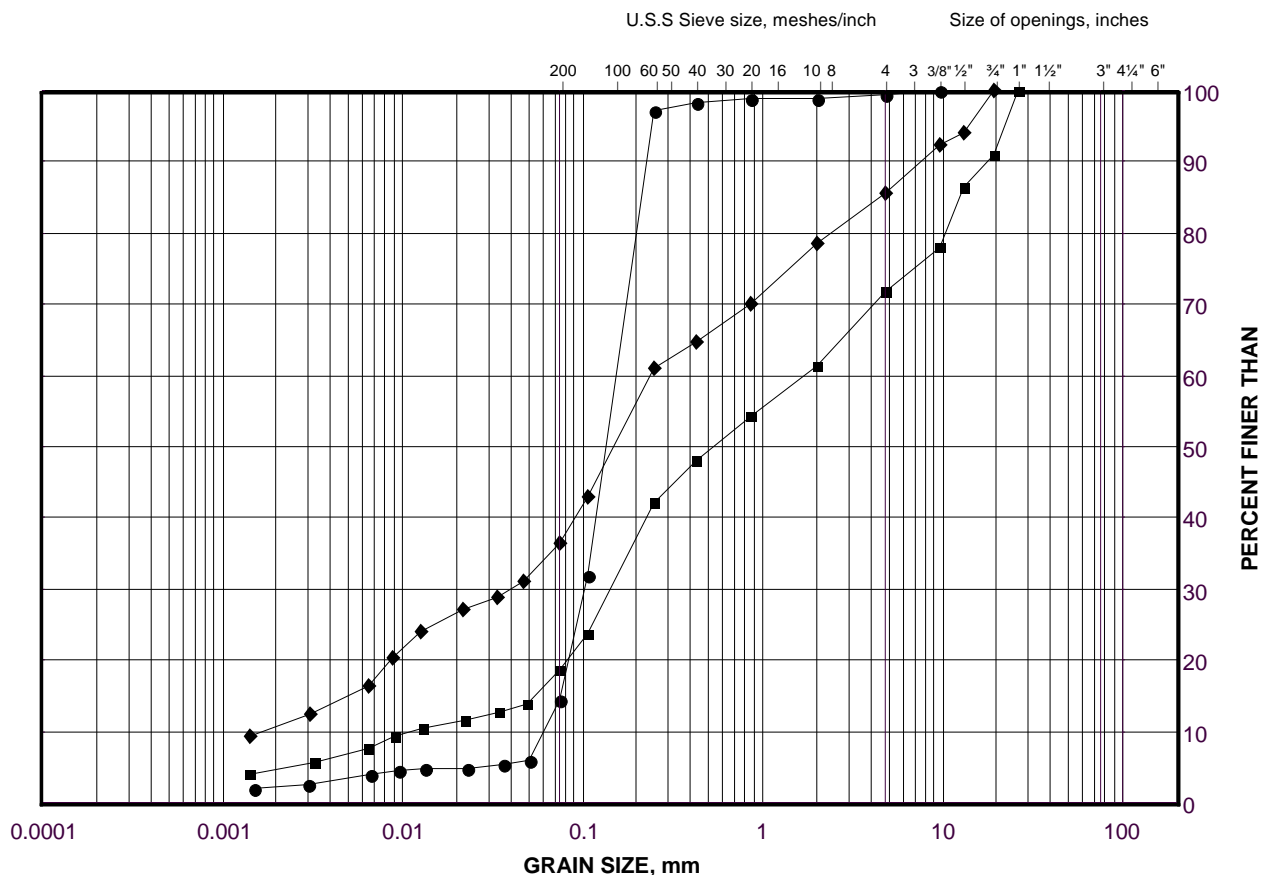
<b>PROJECT</b> 1530382		<b>RECORD OF BOREHOLE No NW3-1</b>		SHEET 1 OF 1		<b>METRIC</b>	
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828093.0; E 298865.6 MTM NAD 83 ZONE 10 (LAT. 43.592747; LONG. -79.573496)		ORIGINATED BY PKS			
DIST Central HWY QEW		BOREHOLE TYPE 108 mm O.D. Continuous Flight Solid Stem Augers		COMPILED BY ACK			
DATUM Geodetic		DATE October 3, 2016		CHECKED BY SMM			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL LIMIT   MOISTURE   CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W <sub>p</sub> W   W <sub>L</sub>				
								○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × REMOULDED					WATER CONTENT (%)				
							20	40	60	80	100	10	20	30			
105.5	GROUND SURFACE																
0.0	ASPHALT (230 mm)																
105.3																	
0.2	Sand and gravel (FILL)																
105.0	Brown																
0.5	Moist																
	Silty SAND, trace clay																
	Compact to dense																
	Brown																
	Moist to wet below 2.9 m		1	SS	12										○		
			2	SS	22												
			3	SS	16												
			4	SS	15										○		
	- Gravel seam from 3.7 m to 3.8 m depth																
			5	SS	33												
100.9																	
4.6	CLAYEY SILT, trace sand																
	Very stiff																
	Grey																
	Wet		6	SS	15										┌─○─┐		
100.3																	
5.2	END OF BOREHOLE																
	NOTE:																
	1. Water level not measured upon completion of drilling. Wet soil noted below a depth of 2.9 m (Elev. 102.6 m).																

# GRAIN SIZE DISTRIBUTION

Silty Sand to Gravelly Clayey Sand  
to Clayey Sand Fill

FIGURE A1



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

## LEGEND

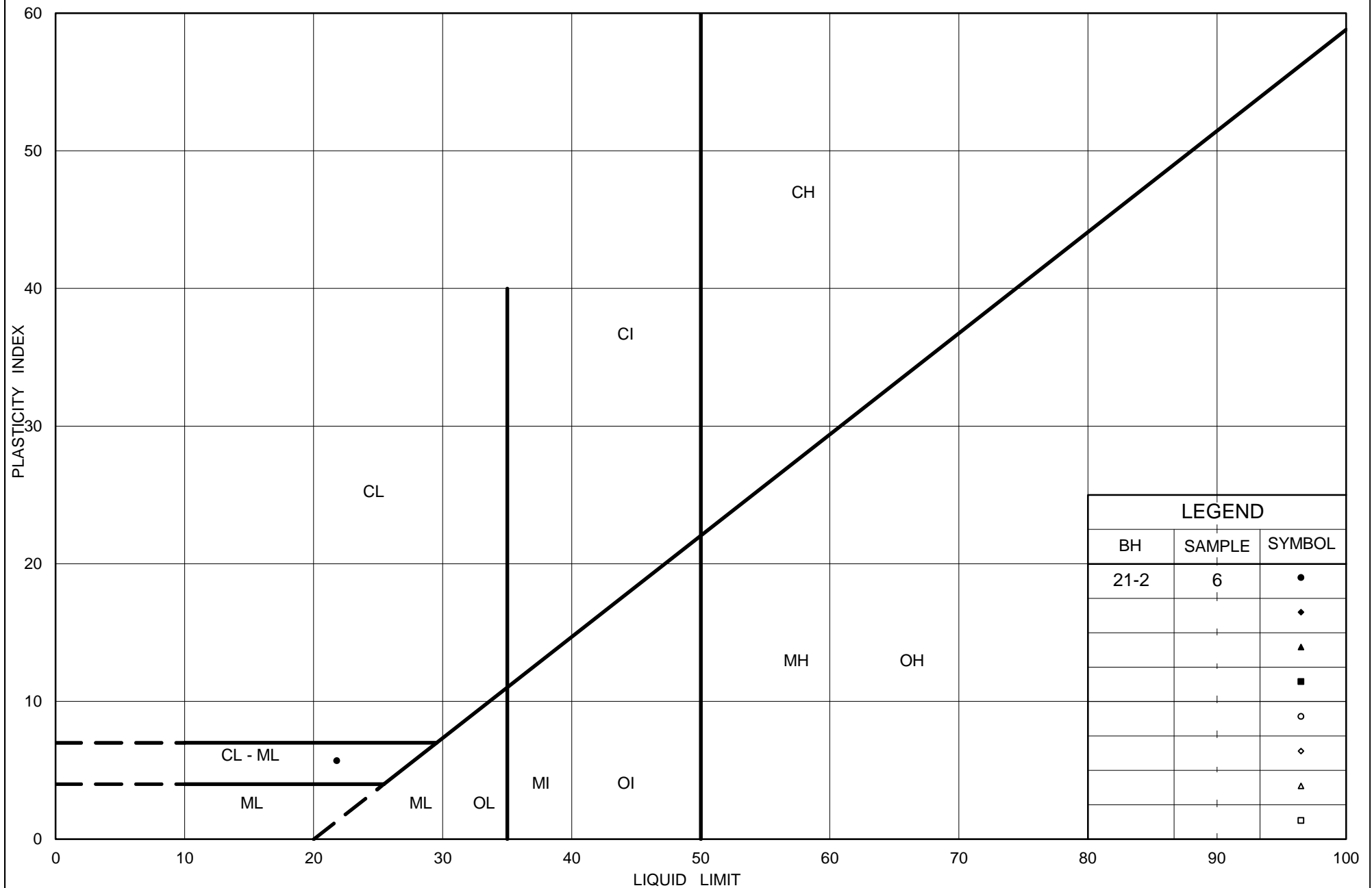
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-7	2	104.6
■	21-1	3	101.3
◆	21-2	6	99.7

Project Number: 1530382

Checked By: LCC

**Golder Associates**

Date: 05-Feb-22



Ministry of Transportation

Ontario

## PLASTICITY CHART

### Clayey Sand Fill

Figure No. A2

Project No. 1530382

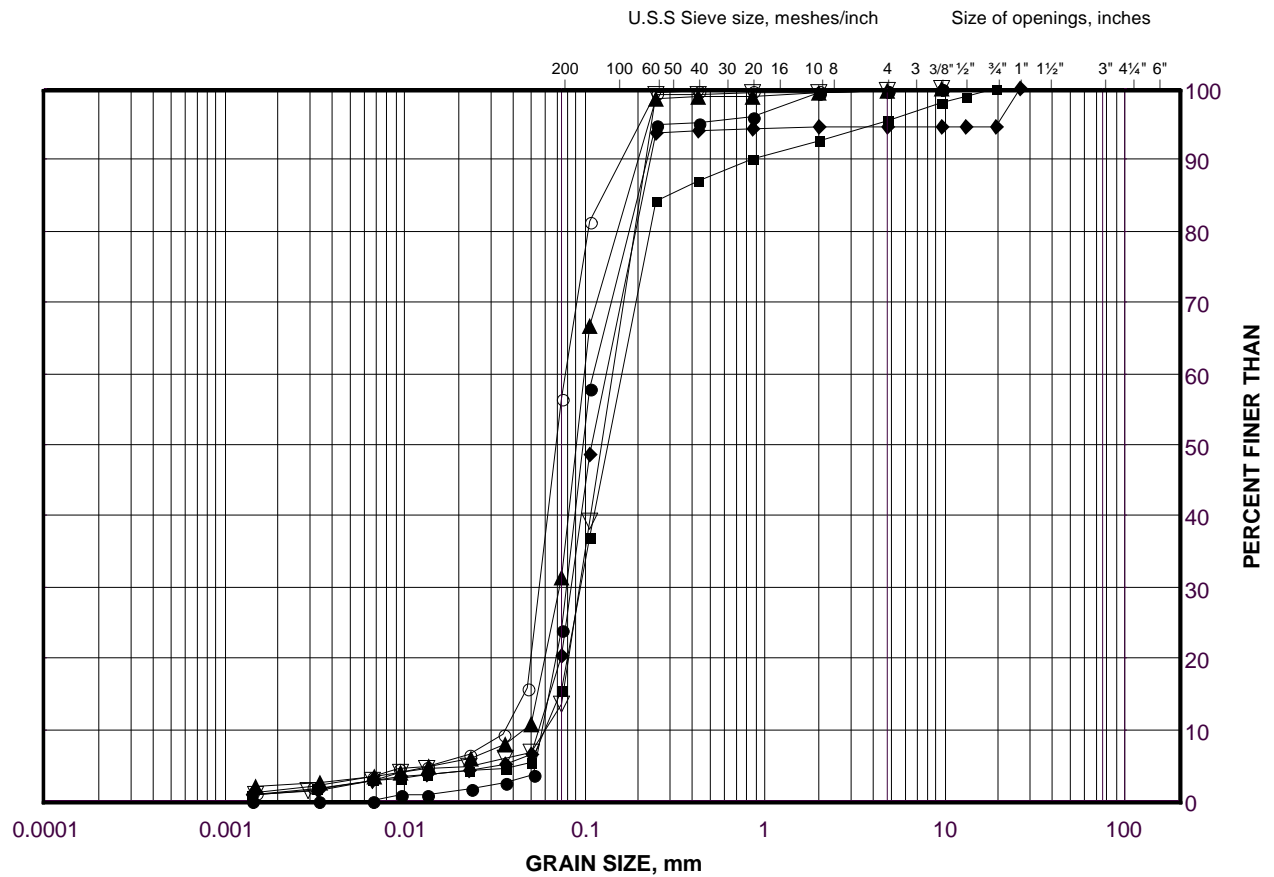
Checked By: LCC



# GRAIN SIZE DISTRIBUTION

Silty Sand to Sandy Silt

FIGURE A3



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

## LEGEND

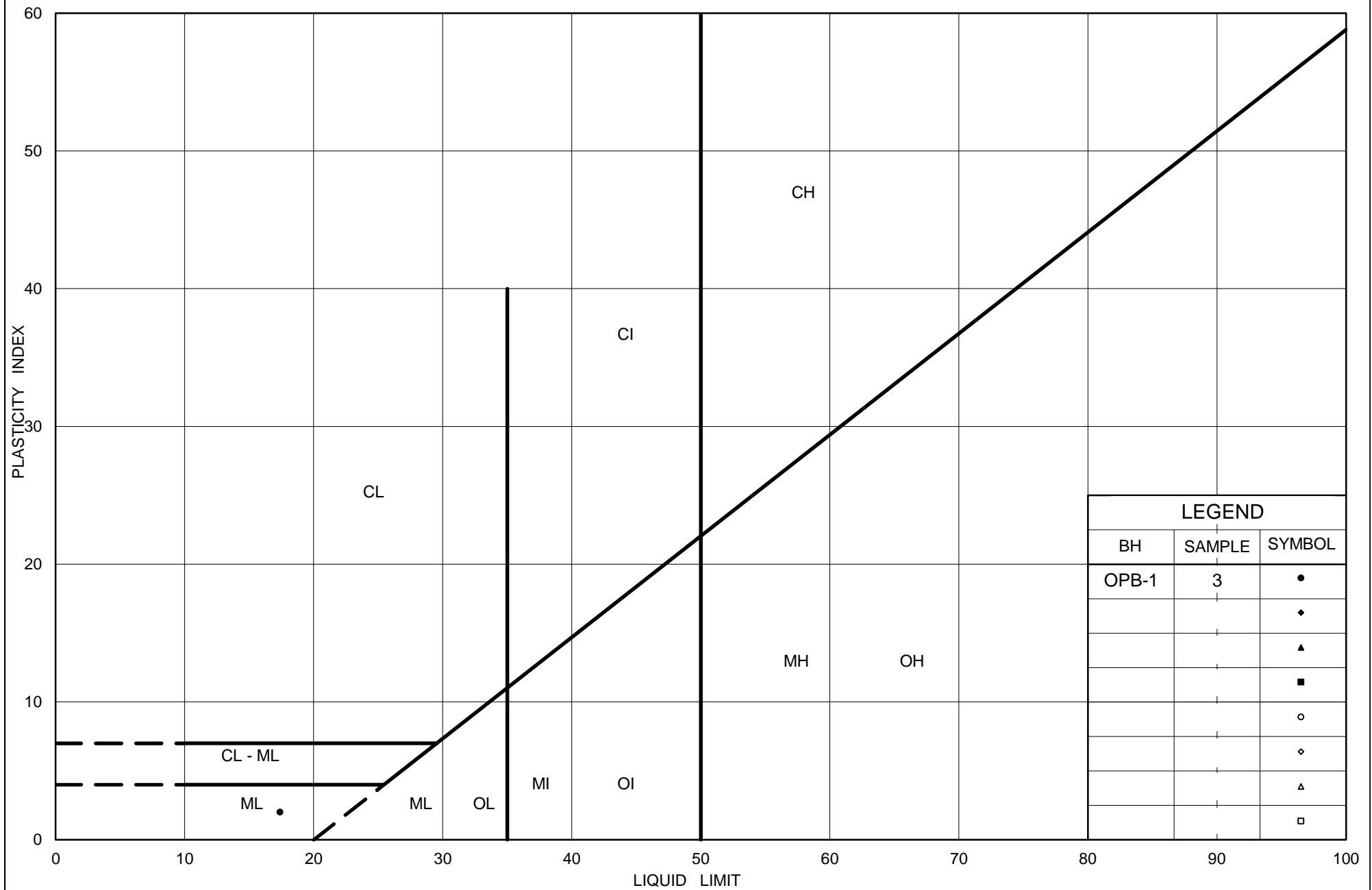
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	OPB-1	2	101.3
■	21-6	3	102.9
◆	21-5	3	102.3
▲	NW3-1	4	102.2
▽	21-7	5	102.3
○	21-6	5	101.4

Project Number: 1530382

Checked By: LCC

Golder Associates

Date: 05-Feb-22



Ministry of Transportation

Ontario

# PLASTICITY CHART

## Sandy Silt

Figure No. A4

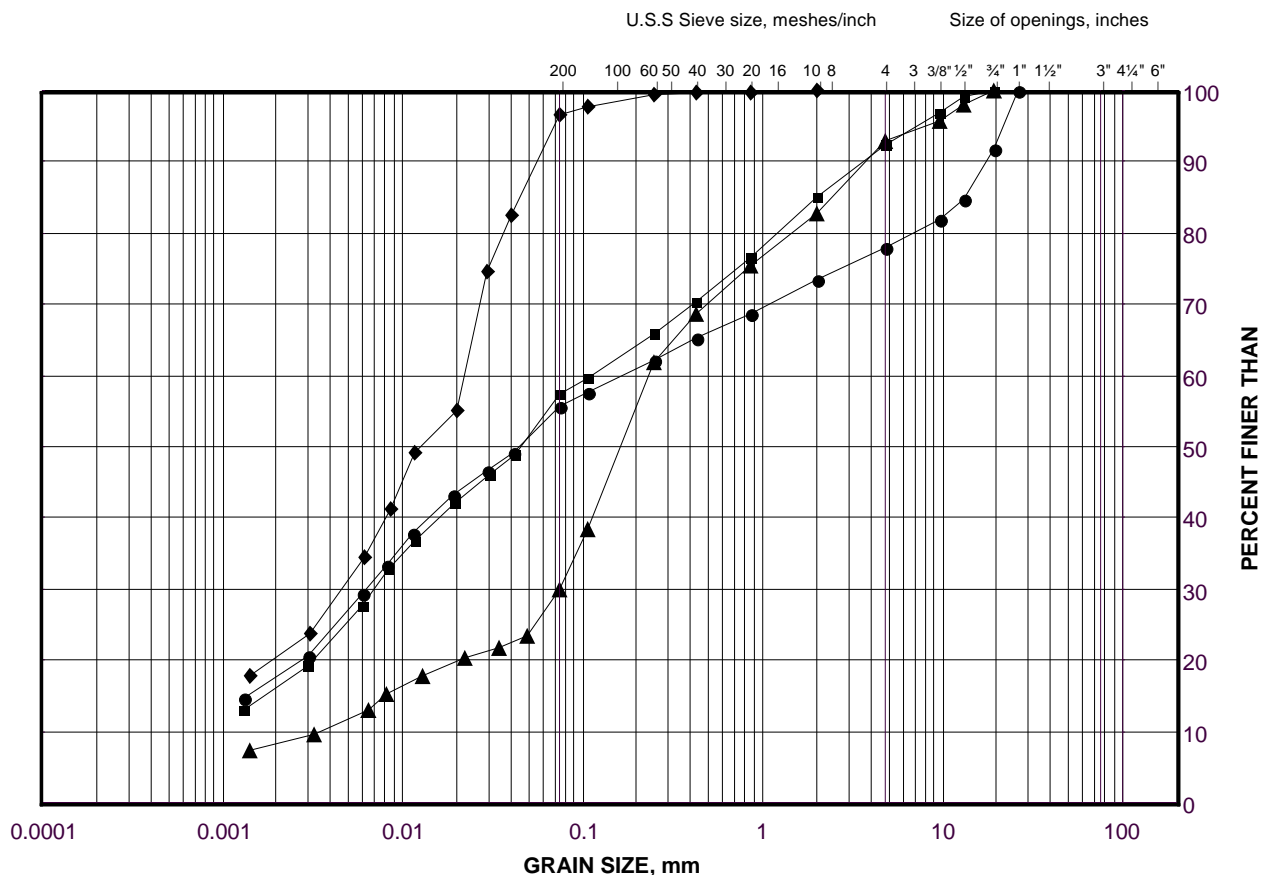
Project No. 1530382

Checked By: LCC

# GRAIN SIZE DISTRIBUTION

Cohesive Soil Complex (Clayey Silt to Clayey Sand, Clayey Silt Till and Clayey Silt Residual Soil)

FIGURE A5



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

## LEGEND

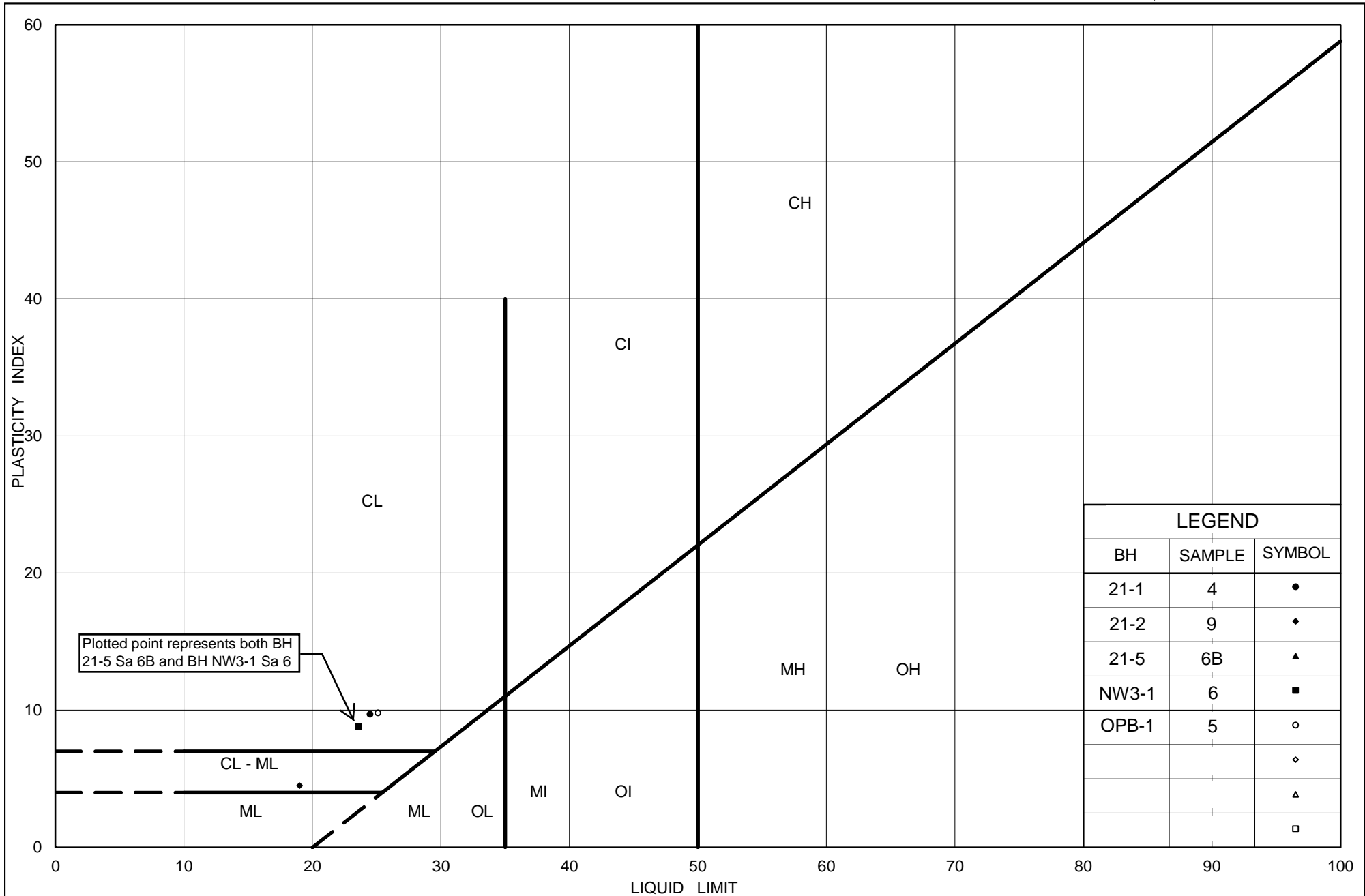
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-1	4	100.5
■	OPB-1	5	99.0
◆	NW3-1	6	100.6
▲	21-2	9	96.4

Project Number: 1530382

Checked By: LCC

Golder Associates

Date: 05-Feb-22



Ministry of Transportation

Ontario

## PLASTICITY CHART

Cohesive Soil Complex (Clayey Silt to Clayey Sand,  
Clayey Silt Till and Clayey Silt Residual Soil)

Figure No. A6

Project No. 1530382

Checked By: LCC

Start of Run No. 1  
(3.54 m)

Start of Run No. 2  
(4.57 m)

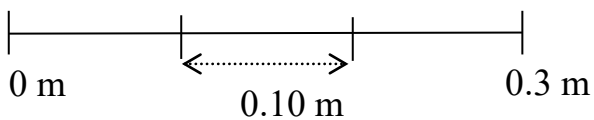
Start of Run No. 3  
(6.10 m)

End of Borehole  
(7.11 m)



**Borehole 21-01:** Bedrock cored between depths of about 3.54 m to 7.11 m

Scale



PROJECT

**QEW Improvements from East of Cawthra Road to  
The East Mall, Region of Peel  
Water and Wastewater Infrastructure**

TITLE

**BEDROCK CORE PHOTOGRAPHS  
BOREHOLE 21-1**



PROJECT No. 1530382.7000

FILE No. ----

DESIGN

KN

20210322

SCALE

NTS

VER. 1.

CADD

PT

02/04/22

CHECK

EN

02/07/22

REVIEW

LC

02/08/22

**PHOTOGRAPH  
A1**



Start of Run No. 1  
(7.70 m)



Start of Run No. 2  
(8.22 m)

Start of Run No. 3  
(10.22 m)



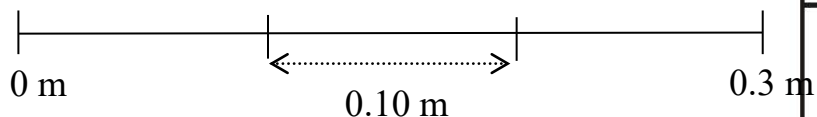
Start of Run No. 4  
(11.40 m)

Start of Run No. 5  
(12.64 m)

End of Borehole  
(13.08 m)

**Borehole 21-2:** Bedrock cored between depths of about 7.70 m to 13.08 m

Scale

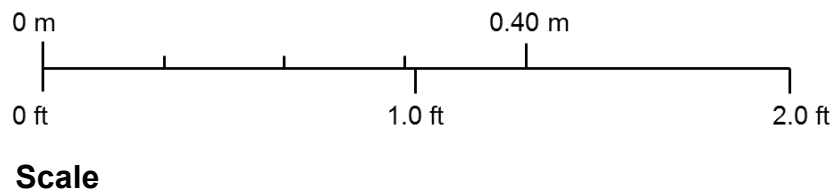



PROJECT <b>QEW Improvements from East of Cawthra Road to The East Mall, Region of Peel Water and Wastewater Infrastructure</b>					
TITLE <b>BEDROCK CORE PHOTOGRAPHS BOREHOLE 21-2</b>					
PROJECT No. 1530382.7000			FILE No. ----		
DESIGN	KN	20210322	SCALE	NTS	VER. 1.
CADD	PT	02/04/22	<b>PHOTOGRAPH A2</b>		
CHECK	EN	02/07/22			
REVIEW	LC	02/08/22			





OPB-1 Rock Core: 6.11 m to 9.11 m depth



PROJECT		QEW Improvements from East of Cawthra Road to The East Mall, Region of Peel Water and Wastewater Infrastructure				
TITLE		Bedrock Core Photographs Borehole OPB-1				
 <b>GOLDER</b> MEMBER OF WSP		PROJECT No. 1530382			FILE No. ----	
		DRAFT	KNN	20200303	SCALE	NTS
		CADD	--		<b>PHOTOGRAPH A3</b>	
		CHECK	SMM	20200310		
		REVIEW	JMAC	20200313		
					VER. 1.	

**APPENDIX B**

**Segment B: North Service Road from  
Stanfield Road to Harvest Drive –  
Borehole Records and  
Geotechnical Laboratory Test Results**



PROJECT		1530382		RECORD OF BOREHOLE No 21-8		SHEET 1 OF 2		METRIC												
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828146.0; E 298892.2 MTM NAD 83 ZONE 10 (LAT. 43.593233; LONG. -79.573171)		ORIGINATED BY LM												
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75 truck, 150 mm OD Hollow Stem Augers (Auto Hammer)		COMPILED BY KN/ML												
DATUM		Geodetic		DATE		January 12, 2021		CHECKED BY KN												
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100	20	40	60
105.4 0.0	GROUND SURFACE SILTY SAND (SM), trace gravel (FILL) Very loose to loose Brown Moist		1	SS	2															
			2	SS	7															
			3	SS	6															
103.3 2.1	SILTY SAND (SM), trace gravel Compact to dense Brown Wet		4	SS	31															
	- Grey below a depth of 3.4 m		5	SS	28															
			6	SS	25															
			7	SS	13															
99.8 5.6	SILT (ML), some sand Compact Grey Wet		8	SS	26															
98.2 7.2	CLAYEY SILT (CL), trace sand Soft Grey Wet		9	SS	3															
96.7 8.7	CLAYEY SILT (CL), some gravel, trace sand (RESIDUAL SOIL) Hard Grey Moist		10	SS	67/0.15															
96.0 9.4			1	RC	REC 100%															
			2	RC	REC 91%															

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE02\_DATA\INTQEQW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity      O 3% STRAIN AT FAILURE

PROJECT 1530382		<b>RECORD OF BOREHOLE No 21-8</b>				SHEET 2 OF 2		<b>METRIC</b>																				
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828146.0; E 298892.2 MTM NAD 83 ZONE 10 (LAT. 43.593233; LONG. -79.573171)				ORIGINATED BY LM																						
DIST Central HWY QEW		BOREHOLE TYPE CME 75 truck, 150 mm OD Hollow Stem Augers (Auto Hammer)				COMPILED BY KN/ML																						
DATUM Geodetic		DATE January 12, 2021				CHECKED BY KN																						
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)												
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)											
	--- CONTINUED FROM PREVIOUS PAGE ---						20	40	60	80	100																	
	SHALE (BEDROCK) Grey																											
	Bedrock cored from depths of 9.5 m to 15.8 m (between Elev. 95.9 m and 89.6 m).  For bedrock coring details refer to Record of Drillhole 21-8.		2	RC	REC 91%											RQD = 80%												
			3	RC	REC 100%											RQD = 96%												
			4	RC	REC 100%											RQD = 96%												
			5	RC	REC 100%											RQD = 64%												
89.6	END OF BOREHOLE																											
15.8	NOTES:  1. Water level measured at a depth of 2.1 m below ground surface (Elev. 103.3 m) prior to rock coring.  2. Groundwater level measurements in piezometer:  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Date</th> <th>Depth (m)</th> <th>Elev. (m)</th> </tr> </thead> <tbody> <tr> <td>11-02-21</td> <td>2.6</td> <td>102.8</td> </tr> <tr> <td>30-03-21</td> <td>2.5</td> <td>102.9</td> </tr> <tr> <td>13-05-21</td> <td>2.6</td> <td>102.8</td> </tr> <tr> <td>06-06-21</td> <td>2.7</td> <td>102.7</td> </tr> </tbody> </table>	Date	Depth (m)	Elev. (m)	11-02-21	2.6	102.8	30-03-21	2.5	102.9	13-05-21	2.6	102.8	06-06-21	2.7	102.7												
Date	Depth (m)	Elev. (m)																										
11-02-21	2.6	102.8																										
30-03-21	2.5	102.9																										
13-05-21	2.6	102.8																										
06-06-21	2.7	102.7																										

GTA-MTO 001 S:\CLIENTS\MTQ\QEW-DIXIE\02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT: 1530382

## RECORD OF DRILLHOLE: 21-8

SHEET 1 OF 1

LOCATION: N 4828146.0 ;E 298892.2

DRILLING DATE: January 12, 2021

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.										FEATURES	R0/R1 ZONES									
						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA				ROCK STRENGTH INDEX				WEATH- ERING INDEX								
						TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	Jr	Ja	R3	R2	R1			W1	W2	W3	W4	W5	W6			
						80 90 95 100	80 90 95 100																			
		Continued from Record of Borehole 21-8		95.93																						
10	HQ3 Core Rotary drilling	Slightly weathered to fresh, thinly laminated, grey, fine to very fine grained, non-porous, weak SHALE (Georgian Bay Formation) with medium strong to very strong LIMESTONE/SILTSTONE interbeds.		9.45	1																					
					2																					

PROJECT 1530382		RECORD OF BOREHOLE No 21-13		SHEET 1 OF 2		METRIC											
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828177.2; E 298907.7 MTM NAD 83 ZONE 10 (LAT. 43.593514; LONG. -79.572979)		ORIGINATED BY AM													
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY KN													
DATUM Geodetic		DATE April 22, 2021		CHECKED BY KN													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>	γ	GR	SA	SI	CL
106.3	GROUND SURFACE																
0.0	TOPSOIL (225 mm)																
106.1																	
0.2	SAND (SP) some silt, some gravel (FILL) Loose to dense Brown Moist to wet		1	SS	24		106										
			2	SS	7												
			3	SS	7		105										
104.1																	
2.2	SILTY SAND (SM), some to trace gravel (FILL) Compact to dense Moist to wet		4	SS	24		104										
			5	SS	31		103										
102.2																	
4.1	SAND and SILT (SP-ML), trace gravel to SILT (ML), some sand Dense Grey Wet		6	SS	31		102										
			7	SS	32		101										
			8	SS	34		100										
99.1			9A	SS	7		99										
7.2	CLAYEY SILT (CL), some sand, some gravel, contains shale fragments (TILL) Firm to very stiff Grey Moist		9B														
			10	SS	7		98										
			11	SS	14												
97.2																	
9.1	SHALE (BEDROCK) Grey		12A 12B	SS	50/0.1		97										
			1	RC	REC 19%												

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE\02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT 1530382		RECORD OF BOREHOLE No 21-13				SHEET 2 OF 2		METRIC									
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828177.2; E 298907.7 MTM NAD 83 ZONE 10 (LAT. 43.593514; LONG. -79.572979)				ORIGINATED BY AM											
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)				COMPILED BY KN											
DATUM Geodetic		DATE April 22, 2021				CHECKED BY KN											
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)
	--- CONTINUED FROM PREVIOUS PAGE ---						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					10 20 30				GR SA SI CL	
95.6	Inferred highly weathered SHALE (BEDROCK) Grey		1	RC	REC 19%	96											RQD = 0%
10.7	Bedrock cored from depths of 9.1 m to 10.7 m (Elev. 97.2 m to 95.6 m).  For bedrock coring details refer to Record of Drillhole 21-13. END OF BOREHOLE  NOTE:  1. Groundwater level measured at a depth of 3.4 m below ground surface (Elev. 102.9 m) prior to rock coring.		13	SS	50/0.08												

PROJECT: 1530382

**RECORD OF DRILLHOLE: 21-13**

SHEET 1 OF 1

LOCATION: N 4828177.2 ;E 298907.7

DRILLING DATE: April 22, 2021

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 75 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.																		FEATURES	R0/R1 ZONES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
							RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA						ROCK STRENGTH INDEX		WEATH- ERING INDEX																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
							TOTAL CORE %	SOLID CORE %			B Angle 0 10 20 30 40 50 60 70 80 90	DIP w.r.t CORE AXIS 0 10 20 30 40 50 60 70 80 90	TYPE AND SURFACE DESCRIPTION	Jr	Ja	R4	R3	R2	R1	W1	W2	W3	W4	W5			W6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		Continued from Record of Borehole 21-13		97.18																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															</

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



LOGGED: AM

CHECKED: KN


GTA-RCK 054 S:\CLIENTS\MTQ\QEW-DIXIE\02 DATA\INTQEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

PROJECT 1530382		<b>RECORD OF BOREHOLE No 21-14</b>		SHEET 1 OF 2		<b>METRIC</b>											
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828186.3; E 298924.7 MTM NAD 83 ZONE 10 (LAT. 43.593597; LONG. -79.572769)		ORIGINATED BY AM													
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY MPM													
DATUM Geodetic		DATE April 22-23, 2021		CHECKED BY KN													
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS		DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT		REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		ELEVATION SCALE	SHEAR STRENGTH kPa		WATER CONTENT (%)		γ	kN/m <sup>3</sup>	GR SA SI CL			
							20 40 60 80 100	○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	20 40 60 80 100	10 20 30							
106.1	GROUND SURFACE																
0.0	TOPSOIL (50 mm)																
105.9	Granular (FILL) (150 mm)																
0.2	SILTY SAND (SM) trace gravel Loose to compact Brown Moist to wet		1	SS	13		106										
			2	SS	7		105										
			3	SS	12		104									0 85 14 1	
			4	SS	14		103										
			5A	SS	15		102										
			5B				101										
			6A	SS	9		100										
101.2	SILT (ML), trace sand, trace gravel (TILL) Stiff to very stiff Wet		6B				99										
4.9			7	SS	9		98									1 4 84 11	
			8A	SS	21		97										
98.0	Inferred moderately weathered SHALE (BEDROCK) Grey		8B														
8.2	SHALE (BEDROCK) Grey		1	RC	REC 80%											RQD = 67%	
	Bedrock cored from depths of 8.2 m to 11.4 m (Elev. 97.9 m to 94.7 m).  For bedrock coring details refer to Record of Drillhole 21-14.		2	RC	REC 100%											RQD = 57%	

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE02\_DATA\INTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT 1530382		RECORD OF BOREHOLE No 21-14				SHEET 2 OF 2		METRIC										
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828186.3; E 298924.7 MTM NAD 83 ZONE 10 (LAT. 43.593597; LONG. -79.572769)				ORIGINATED BY AM												
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)				COMPILED BY MPM												
DATUM Geodetic		DATE April 22-23, 2021				CHECKED BY KN												
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
	--- CONTINUED FROM PREVIOUS PAGE ---							20	40	60	80	100						
	SHALE (BEDROCK) Grey		2	RC	REC 100%		96											RQD = 57%
	Bedrock cored from depths of 8.2 m to 11.4 m (Elev. 97.9 m to 94.7 m).  For bedrock coring details refer to Record of Drillhole 21-14.		3	RC	REC 100%		95											RQD = 0%
94.7 11.4	END OF BOREHOLE  NOTE:  1. Groundwater measured at a depth of approximately 3.0 m below ground surface (Elev. 103.1 m) prior to rock coring.																	

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEQW-DIXIE.GPJ GAL-GTA.GDT 2/1/22



PROJECT: 1530382

**RECORD OF DRILLHOLE: 21-14**

SHEET 1 OF 1

LOCATION: N 4828186.3 ;E 298924.7

DRILLING DATE: April 22-27, 2021

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 75 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage PL - Planar CU- Curved UN- Undulating ST - Stepped IR - Irregular PO- Polished K - Slickensided SM- Smooth Ro - Rough MB- Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.																FEATURES	R0/R1 ZONES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA						ROCK STRENGTH INDEX		WEATH- ERING INDEX																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
						TOTAL CORE %	SOLID CORE %			B Angle	DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	R4	R3	R2	R1	W1	W2	W3			W4	W5	W6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
		Continued from Record of Borehole 21-14		97.84																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



LOGGED: AM

CHECKED: KN

GTA-RCK 054 S:\CLIENTS\MTQ\QEW-DIXIE\02 DATA\QEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

<b>PROJECT</b> 1530382		<b>RECORD OF BOREHOLE No 21-15</b>		SHEET 1 OF 2		<b>METRIC</b>	
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828209.7; E 298955.4 MTM NAD 83 ZONE 10 (LAT. 43.593807; LONG. -79.572388)		ORIGINATED BY AM			
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY KN			
DATUM Geodetic		DATE May 13, 2021		CHECKED BY KN			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>					
105.3	GROUND SURFACE																			
0.0	ASPHALT (230 mm)																			
105.1																				
0.2	SILTY SAND (SM), some gravel (FILL) Loose to compact Brown Moist		1	SS	22												20	53	22	5
			2	SS	11															
			3A	SS	9															
103.4			3B																	
1.9	SILTY SAND (SM), trace gravel Loose to compact Brown to grey Moist to wet		4	SS	14												1	63	33	3
			5	SS	16															
101.6			6	SS	10												12	27	42	19
3.7	Sandy CLAYEY SILT (CL), some gravel (TILL) Stiff to hard Grey Moist		7	SS	13															
			8A																	
99.8			8B	SS	110															
5.5	Inferred completely to moderately weathered SHALE (BEDROCK) Grey		9A	SS	56															
			9B																	
98.7																				
6.6	SHALE (BEDROCK) Grey		1	RC	REC 51%															RQD = 0%
	Bedrock cored from depths of 6.6 m to 10.7 m (Elev. 98.7 m to 94.6 m).  For bedrock coring details refer to Record of Drillhole 21-15.		2	RC	REC 45%															RQD = 11%
			3	RC	REC 100%															RQD = 82%

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity      O 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEQW-DIXIE.GPJ GAL-GTA-GDT 2/1/22

PROJECT <u>1530382</u>		<b>RECORD OF BOREHOLE No 21-15</b>		SHEET 2 OF 2		<b>METRIC</b>	
G.W.P. <u>2102-13-00; 2432-13-00</u>		LOCATION <u>N 4828209.7; E 298955.4 MTM NAD 83 ZONE 10 (LAT. 43.593807; LONG. -79.572388)</u>				ORIGINATED BY <u>AM</u>	
DIST <u>Central</u> HWY <u>QEW</u>		BOREHOLE TYPE <u>CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)</u>				COMPILED BY <u>KN</u>	
DATUM <u>Geodetic</u>		DATE <u>May 13, 2021</u>				CHECKED BY <u>KN</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT      NATURAL MOISTURE      LIQUID CONTENT      LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × REMOULDED					W <sub>p</sub>	W	W <sub>L</sub>		WATER CONTENT (%)				GR	SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
	— CONTINUED FROM PREVIOUS PAGE —							20	40	60	80	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							</

PROJECT: 1530382

**RECORD OF DRILLHOLE: 21-15**

SHEET 1 OF 1

LOCATION: N 4828209.7 ;E 298955.4

DRILLING DATE: May 13, 2021

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 75 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.																FEATURES	R0/R1 ZONES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA						ROCK STRENGTH INDEX		WEATH- ERING INDEX																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
						TOTAL CORE %	SOLID CORE %			B Angle °	DIP w.r.t CORE AXIS °	TYPE AND SURFACE DESCRIPTION	Jr	Ja	R4 R3 R2 R1	W1 W2 W3 W4 W5 W6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
7	HQ3 Core Rotary Drilling	Continued from Record of Borehole 21-15		98.70 6.58																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



LOGGED: AM

CHECKED: KN

GTA-RCK 054 S:\CLIENTS\MTOW\QEW-DIXIE\02 DATA\GINTQEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

PROJECT		RECORD OF BOREHOLE				No 21-16		SHEET 1 OF 2		METRIC		
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828285.5; E 299001.2 MTM NAD 83 ZONE 10 (LAT. 43.594489; LONG. -79.571822)		ORIGINATED BY		AM		
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY		KN		
DATUM		Geodetic		DATE		April 29, 2021		CHECKED BY		KN		
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W		
105.6	GROUND SURFACE											
0.0	SAND (SP), trace gravel (FILL) Compact Brown Moist - Wet below of 0.15 m (Elev. 105.4 m)		1	SS	11							
104.9	SAND (SP), trace gravel, trace silt Compact Brown Moist		2	SS	26							
104.2	Sandy SILT (ML) Dense Brown Moist to wet		3	SS	34							
102.9	CLAYEY SILT-SILT (CL-ML), some sand Stiff to hard Grey Moist		4A 4B	SS	32							
2.7	CLAYEY SILT (CL), some gravel, trace sand (TILL) Hard Grey Moist		5	SS	15							
101.9	Inferred highly to moderately weathered SHALE (BEDROCK) Grey		6A 6B	SS	62/0.28							
101.5	SHALE (BEDROCK) Grey		7	SS	50/0.13							
4.1	Bedrock cored from depths of 4.4 m to 10.0 m (Elev. 101.2 m to 95.6 m).  For bedrock coring details refer to Record of Drillhole 21-16.		1	RC	REC 86%							
101.2			2	RC	REC 43%							
4.4			3	RC	REC 85%							
			4	RC	REC 73%							

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE\02\_DATA\INTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT 1530382		RECORD OF BOREHOLE No 21-16				SHEET 2 OF 2		METRIC									
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828285.5; E 299001.2 MTM NAD 83 ZONE 10 (LAT. 43.594489; LONG. -79.571822)				ORIGINATED BY AM											
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)				COMPILED BY KN											
DATUM Geodetic		DATE April 29, 2021				CHECKED BY KN											
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									
							<div style="display: flex; justify-content: space-between;"> <span>20 40 60 80 100</span> </div> <div style="display: flex; justify-content: space-between;"> <span>20 40 60 80 100</span> </div>										
98.9 10.1	END OF BOREHOLE  NOTES:  1. Groundwater level measured at a depth of approximately 4.1 m (Elev. 101.5 m) upon completion of drilling.  2. Groundwater level measured in piezometer:  <div style="display: flex; justify-content: space-between;"> <div>Date</div> <div>Depth (m)</div> <div>Elev. (m)</div> </div> <div style="display: flex; justify-content: space-between;"> <div>04-29-21</div> <div>2.3</div> <div>103.3</div> </div> <div style="display: flex; justify-content: space-between;"> <div>07-05-21</div> <div>3.1</div> <div>102.5</div> </div> <div style="display: flex; justify-content: space-between;"> <div>07-07-21</div> <div>3.1</div> <div>102.5</div> </div>	X X X															

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT: 1530382

**RECORD OF DRILLHOLE: 21-16**

SHEET 1 OF 1

LOCATION: N 4828285.5 ;E 299001.2

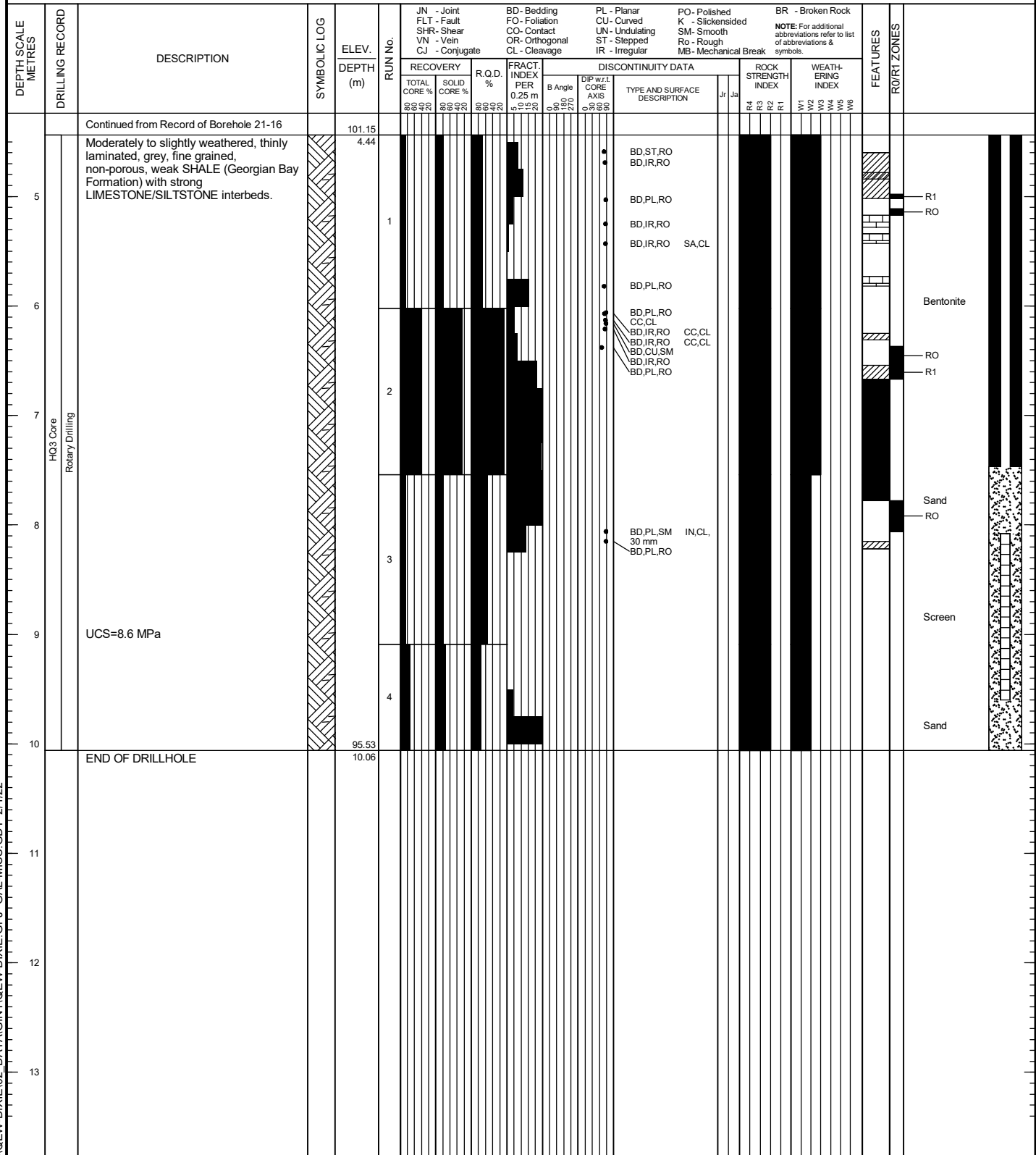
DRILLING DATE: April 27, 2021

DATUM: Geodetic

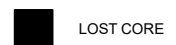
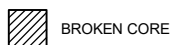
INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 75 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.



## FEATURES LEGEND



DEPTH SCALE

1 : 50



LOGGED: AM

CHECKED: KN

GTA-RCK 054 S:\CLIENTS\MTQ\QEW-DIXIE\02 DATA\QINT\QEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

PROJECT		1530382		RECORD OF BOREHOLE No 21-17		SHEET 1 OF 2		METRIC					
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828302.9; E 299028.6 MTM NAD 83 ZONE 10 (LAT. 43.594646; LONG. -79.571483)		ORIGINATED BY					
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75, 185 mm O.D., Hollow Stem Auger		COMPILED BY					
DATUM		Geodetic		DATE		May 12, 2021		CHECKED BY					
KN								KN					
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	GR SA SI CL
104.9	GROUND SURFACE												
0.0	ASPHALT (150 mm)												
0.2	SAND (SW), some gravel, trace fines (FILL) Very dense Brown Moist		1	SS	95								
104.1	SANDY SILT (ML) Compact to dense Brown Moist to wet		2	SS	32		104						0 28 69 3
103.0	CLAYEY SILT (CL), trace sand, trace gravel, contains shale fragments Stiff to hard Grey Moist		3A	SS	26		103						1 9 51 39
101.1	Inferred highly weathered SHALE (BEDROCK) Grey		3B										
100.9	SHALE (BEDROCK) Grey		4	SS	20		102						
4.0	Bedrock cored from depths of 4.0 m to 10.9 m (Elev. 100.9 m to 94.0 m).  For bedrock coring details refer to Record of Drillhole 21-17.		5	SS	32		101						
			6	SS	100/0.03		100						
			1	RC	REC 86%		99						RQD = 0%
			2	RC	REC 100%		98						RQD = 79%
			3	RC	REC 100%		97						RQD = 81%
			4	RC	REC 100%		96						RQD = 97%
			5	RC	REC 100%		95						RQD = 99%

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity      O 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE02\_DATA\INTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22



PROJECT 1530382		RECORD OF BOREHOLE No 21-17				SHEET 2 OF 2		METRIC								
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828302.9; E 299028.6 MTM NAD 83 ZONE 10 (LAT. 43.594646; LONG. -79.571483)				ORIGINATED BY AM										
DIST Central HWY QEWS		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Auger				COMPILED BY KN										
DATUM Geodetic		DATE May 12, 2021				CHECKED BY KN										
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
	--- CONTINUED FROM PREVIOUS PAGE ---						20	40	60	80	100					
94.0	SHALE (BEDROCK) Grey		5	RC	REC 100%											
10.9	Bedrock cored from depths of 4.0 m to 10.9 m (Elev. 100.9 m to 94.0 m).  For bedrock coring details refer to Record of Drillhole 21-17. END OF BOREHOLE															
	NOTES:  1. Open borehole dry upon completion of borehole prior to coring.  2. Borehole caved to a depth of 3.7 m (Elevation 101.2 m) prior to coring.															

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEQW-DIXIE.GPJ GAL-GTA.GDT 2/1/22



PROJECT		21530382		RECORD OF BOREHOLE No 21-18		SHEET 1 OF 2		METRIC																
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828377.6; E 299071.7 MTM NAD 83 ZONE 10 (LAT. 43.595320; LONG. -79.570950)		ORIGINATED BY																
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY																
DATUM		Geodetic		DATE		April 27 and 28, 2021		CHECKED BY																
KN								KN																
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV	DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ	GR	SA	SI	CL			
								20 40 60 80 100	○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× REMOULDED	W <sub>p</sub>	W	W <sub>L</sub>	20 40 60 80 100						10 20 30	42	
105.1	0.0	GROUND SURFACE						105																
104.9	0.0	TOPSOIL (200 mm)																						
104.7	0.4	SAND (SP), some gravel (FILL) Compact Brown Dry		1A 1B	SS	17																		
		SILTY SAND (SM), trace gravel Very loose to compact Brown Moist		2	SS	7		104																
				3	SS	2		103													4	64	29	3
		- Wet below a depth of 2.3 m (Elev. 102.8 m)		4A 4B	SS	3																		
102.3	2.8	SILTY CLAY (CI), trace sand, trace gravel (TILL) Soft to hard Grey Moist		5A 5B	SS	52		102																
101.7	3.4	Inferred slightly weathered SHALE (BEDROCK)																						
101.4	3.7	SHALE (BEDROCK) Grey		1	RC	REC 99%		101																RQD = 11%
		Bedrock cored from depths of 3.7 m to 9.91 m ( Elev. 101.4 m to 95.2 m).		2	RC	REC 100%		100																RQD = 67%
		For bedrock coring details refer to Record of Drillhole 21-18.		3	RC	REC 100%		99																RQD = 79%
				4	RC	REC 99%		97																RQD = 99%
				5	RC	REC 100%		96																RQD = 100%
95.2																								

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE\02\_DATA\INTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT <u>1530382</u>	<b>RECORD OF BOREHOLE No 21-18</b>	SHEET 2 OF 2	<b>METRIC</b>
G.W.P. <u>2102-13-00; 2432-13-00</u>	LOCATION <u>N 4828377.6; E 299071.7 MTM NAD 83 ZONE 10 (LAT. 43.595320; LONG. -79.570950)</u>	ORIGINATED BY <u>AM</u>	
DIST <u>Central</u> HWY <u>QEW</u>	BOREHOLE TYPE <u>CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)</u>	COMPILED BY <u>KN</u>	
DATUM <u>Geodetic</u>	DATE <u>April 27 and 28, 2021</u>	CHECKED BY <u>KN</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	w <sub>p</sub>	w	w <sub>L</sub>		GR	SA	SI	CL	
9.9	END OF BOREHOLE  NOTE:  1. Groundwater level measured at a depth of approximately 3.5 m below ground surface (Elev. 101.6 m) prior to rock coring.																				

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

SHEET 1 OF 1

DATUM: Geodetic

DRILLING CONTRACTOR: Davis Drilling Ltd.

[illegible]

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



LOGGED: AM

CHECKED: KN

GTA-RCK 054 S:\CLIENTS\IMTO\QEW-DIXIE\02 DATA\GINT\QEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

PROJECT		RECORD OF BOREHOLE				No CV02/03-1		SHEET 1 OF 1		METRIC							
G.W.P. 2102-13-00; 2432-13-00		LOCATION		N 4828381.4; E 299091.3 MTM NAD 83 ZONE 10 (LAT. 43.595345; LONG. -79.570703)				ORIGINATED BY									
DIST Central HWY QEW		BOREHOLE TYPE		CME 75, 108 mm O.D. Continuous Flight Solid Stem Augers				COMPILED BY									
DATUM Geodetic		DATE		October 5, 2016				CHECKED BY									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
104.5	GROUND SURFACE																
0.0	ASPHALT (150mm)																
104.3																	
104.0	Sand and gravel (FILL) Brown Moist																
0.5																	
	Sandy SILT to Silty SAND Loose to compact Brown Moist		1	SS	11												
			2	SS	5												
102.2																	
2.3	Inferred completely to moderately weathered, grey, extremely weak to weak SHALE (BEDROCK) (Georgian Bay Formation)		3	SS	15												
			4	SS	22												
			5	SS	100/0.13												
100.0																	
4.5	Moderately weathered																
	Bedrock cored from depths of 4.5 m to 7.7 m.																
	For bedrock coring details refer to Record of Drillhole CV02/3-1.		1	RC	REC 100%												
			2	RC	REC 72%												
96.8																	
7.7	END OF BOREHOLE																
	NOTE:																
	1. Open borehole dry upon completion of drilling and prior to rock coring.																



PROJECT		1530382		RECORD OF BOREHOLE No NW3-2				SHEET 1 OF 1		METRIC							
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828152.0; E 298912.2 MTM NAD 83 ZONE 10 (LAT. 43.593279; LONG. -79.572919)		ORIGINATED BY		PKS							
DIST		Central HWY QEW		BOREHOLE TYPE		108 mm O.D. Continuous Flight Solid Stem Augers		COMPILED BY		ACK							
DATUM		Geodetic		DATE		October 3, 2016		CHECKED BY		SMM							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
105.5	GROUND SURFACE																
0.0	ASPHALT (240 mm)																
105.3																	
0.2	Sand and gravel (FILL) Brown Moist																
104.7																	
0.8	Silty SAND Loose to dense Brown to grey Moist to wet below 2.3 m		1	SS	5												
			2	SS	12												
			3	SS	33												
102.5																	
3.0	SAND, trace to some gravel, some silt, trace clay Dense to very dense Grey Wet		4	SS	64												
			5	SS	38												
100.9																	
4.6	SILT, trace sand Compact Grey Wet		6	SS	24												
100.3																	
5.2	END OF BOREHOLE																
	NOTE:  1. Water level in open borehole at a depth of 3.7 m below ground surface (Elev. 101.8 m) upon completion of drilling.																



+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

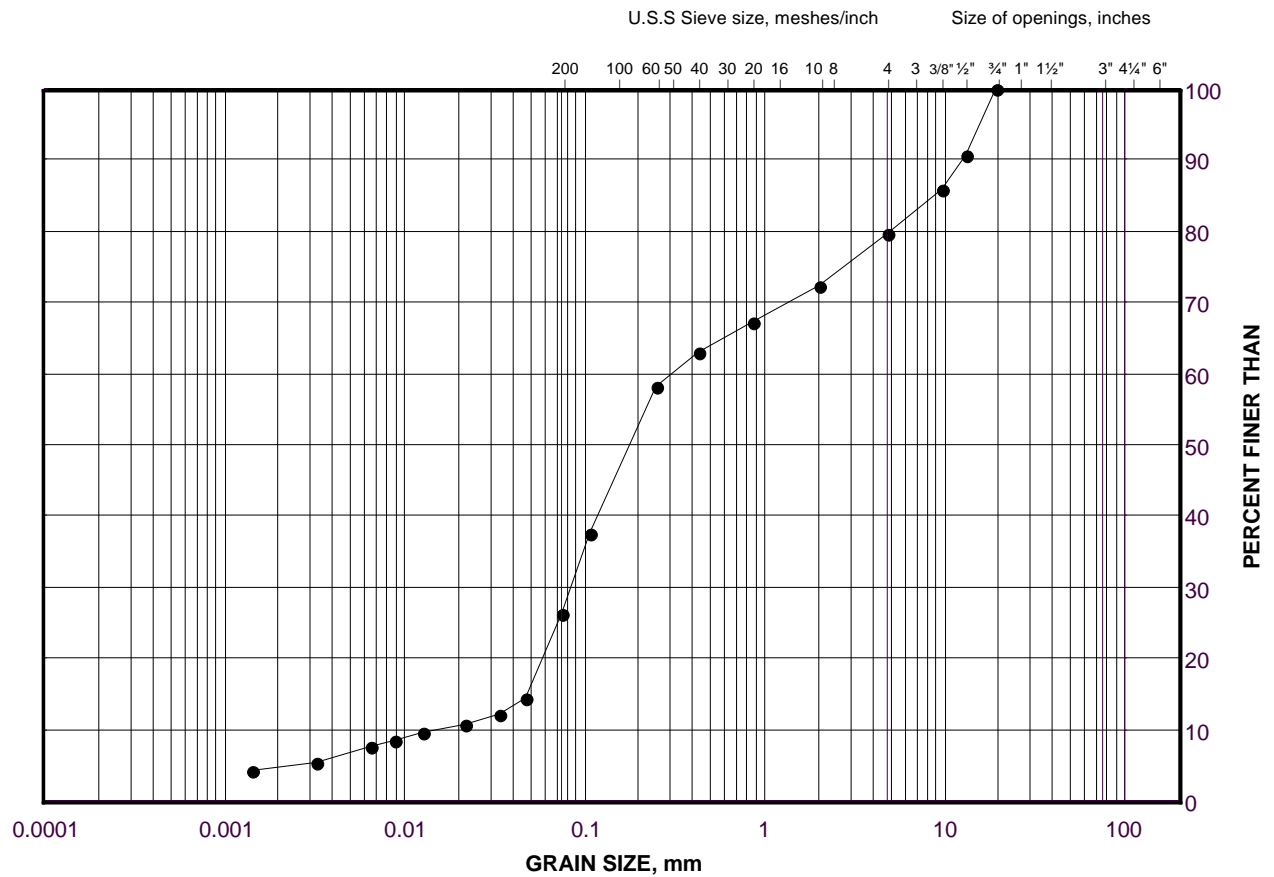
PROJECT		1530382		RECORD OF BOREHOLE No NW3-5		SHEET 1 OF 1		METRIC								
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828334.1; E 299054.2 MTM NAD 83 ZONE 10 (LAT. 43.594919; LONG. -79.571163)		ORIGINATED BY								
DIST		Central HWY QEW		BOREHOLE TYPE		108 mm O.D. Continuous Flight Solid Stem Augers		COMPILED BY								
DATUM		Geodetic		DATE		October 5, 2016		CHECKED BY								
								SMM								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
104.7	GROUND SURFACE															
0.0	ASPHALT (150 mm)															
0.2	Sand and gravel (FILL) Brown Moist															
103.9																
0.8	Silty SAND Dense Brown Moist		1	SS	37											
103.0																
1.7	Sandy CLAYEY SILT, some shale fragments (TILL) Very stiff Grey Moist		2	SS	19											
102.3																
2.4	SHALE (BEDROCK)		3	SS	50											
			4	SS	110											
			5	SS	100/0.13											
100.0			6	SS	-											
4.7	END OF BOREHOLE															
	NOTE: 1. Open borehole dry upon completion of drilling.															

PROJECT		1530382		RECORD OF BOREHOLE No NW3-6				SHEET 1 OF 1		METRIC							
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828434.5; E 299136.6 MTM NAD 83 ZONE 10 (LAT. 43.595823; LONG. -79.570143)		ORIGINATED BY		PKS							
DIST		Central HWY QEW		BOREHOLE TYPE		108 mm O.D. Continuous Flight Solid Stem Augers		COMPILED BY		ACK							
DATUM		Geodetic		DATE		October 6, 2016		CHECKED BY		SMM							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
105.0	GROUND SURFACE																
0.0	ASPHALT (150 mm)																
0.2	Sand and gravel (FILL) Brown Moist																
104.4	Silty SAND Compact Brown Moist																
0.6			1	SS	23		104										
103.6	CLAYEY SILT, trace to some sand, trace gravel Stiff to hard Brown Moist - Containing shale pieces below a depth of 1.8 m																
1.4			2	SS	10		103										3 11 51 35
102.6	SHALE (BEDROCK)																
2.4			3	SS	100/0.10												
			4	SS	100/0.13		102										
			5	SS	100/0.13		101										
100.3	END OF BOREHOLE		6	SS	100/0.10												
4.7	NOTE: 1. Open borehole dry upon completion of drilling.																

# GRAIN SIZE DISTRIBUTION

Silty Sand Fill

FIGURE B1



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
•	21-15	2	104.2

Project Number: 1530382

Checked By: LCC

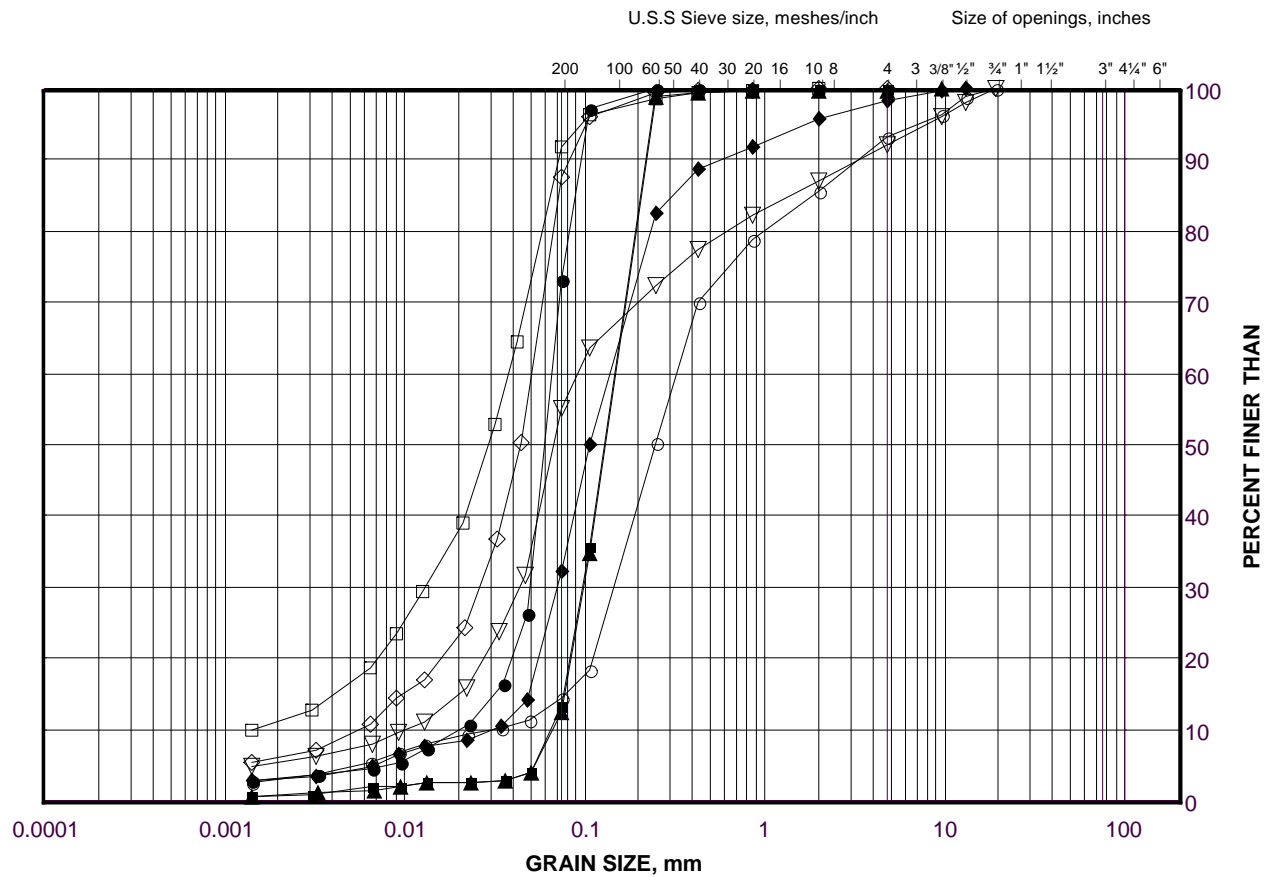
**Golder Associates**

Date: 05-Feb-22

# GRAIN SIZE DISTRIBUTION

Sand, Silty Sand to Sandy Silt, and Silt

FIGURE B2A



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-16	3	103.7
■	21-14	3	104.3
◆	21-15	4	102.7
▲	21-13	4	103.7
▽	21-13	6	101.5
○	21-8	6	101.3
□	21-8	8	99.0
△	21-13	9A	99.3

Project Number: 1530382

Checked By: LCC

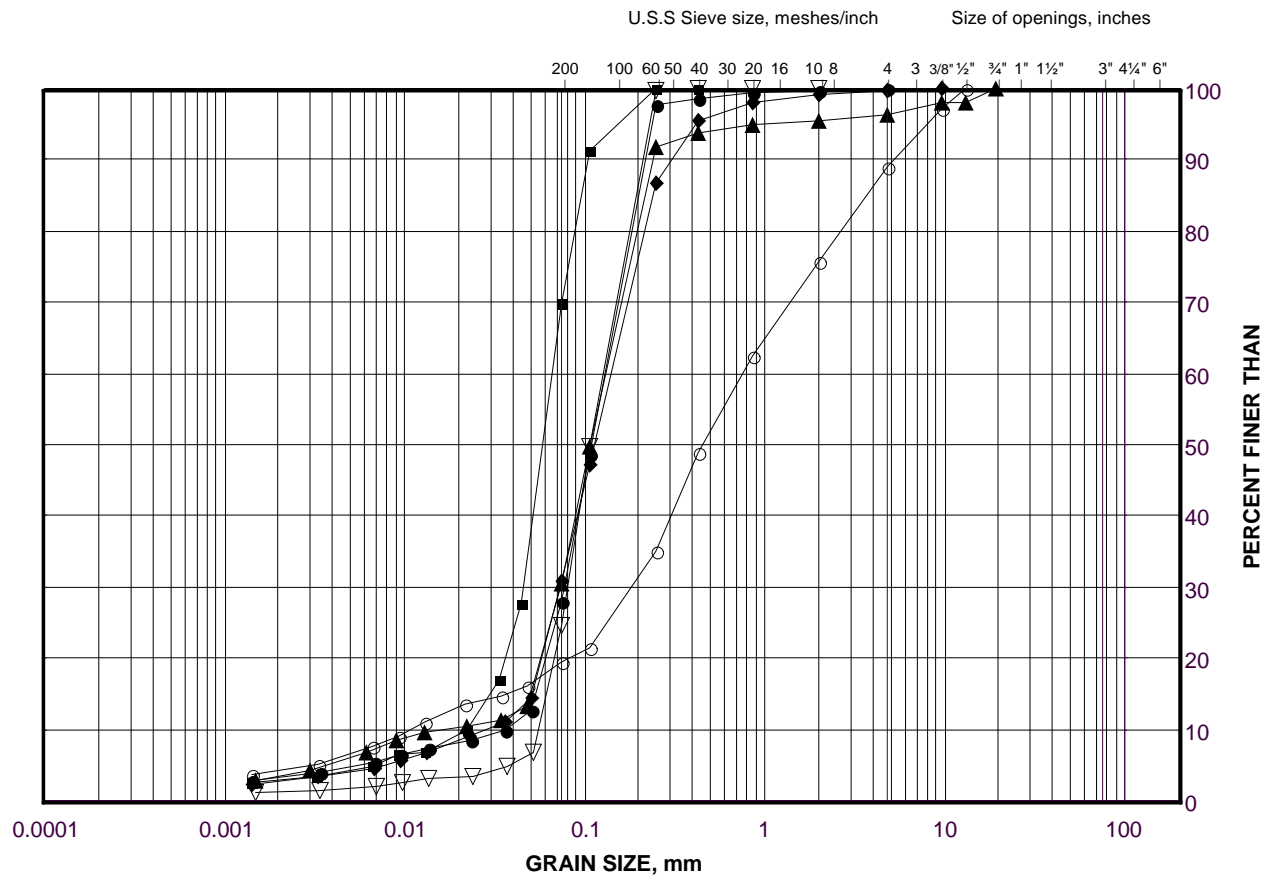
**Golder Associates**

Date: 05-Feb-22

# GRAIN SIZE DISTRIBUTION

Sand, Silty Sand to Sandy Silt, and Silt

FIGURE B2B



## LEGEND

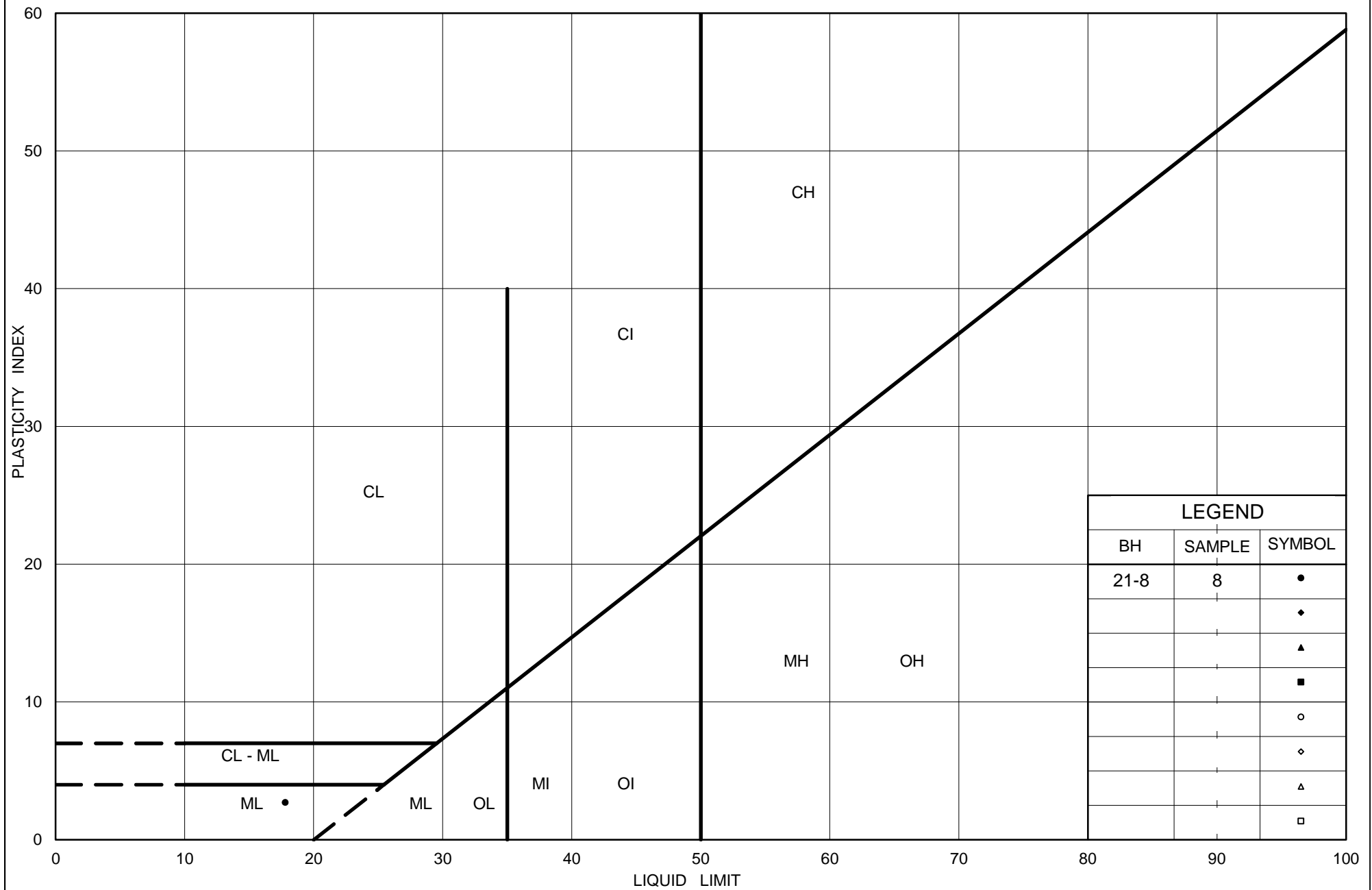
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	CV02/03-1	2	102.7
■	21-17	2	103.8
◆	NW3-4	3	102.4
▲	21-18	3	103.3
▽	NW3-2	3	102.9
○	NW3-2	5	101.4

Project Number: 1530382

Checked By: LCC

**Golder Associates**

Date: 05-Feb-22



Ministry of Transportation

Ontario

# PLASTICITY CHART

## Silt

Figure No. B3

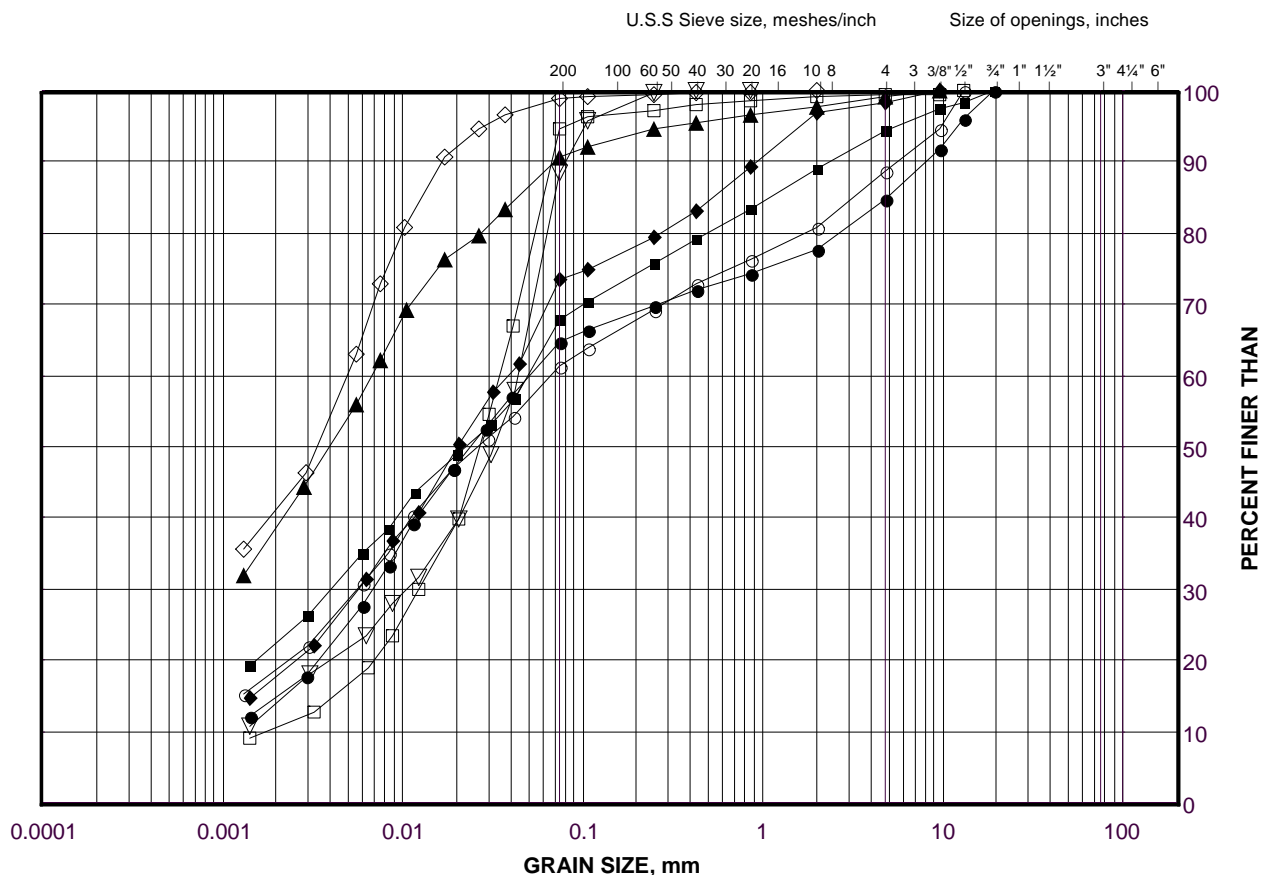
Project No. 1530382

Checked By: LCC

# GRAIN SIZE DISTRIBUTION

Cohesive Soil Complex (Clayey Silt, Silt to Silty Clay Till, and Clayey Silt Residual Soil)

FIGURE B4A



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-13	11	97.6
■	NW3-5	2	102.9
◆	CV02/03-1	3	101.9
▲	21-17	3B	102.9
▽	21-16	4B	103.0
○	21-15	6	101.2
□	21-14	7	99.7
△	21-8	9	97.5

Project Number: 1530382

Checked By: LCC

Golder Associates

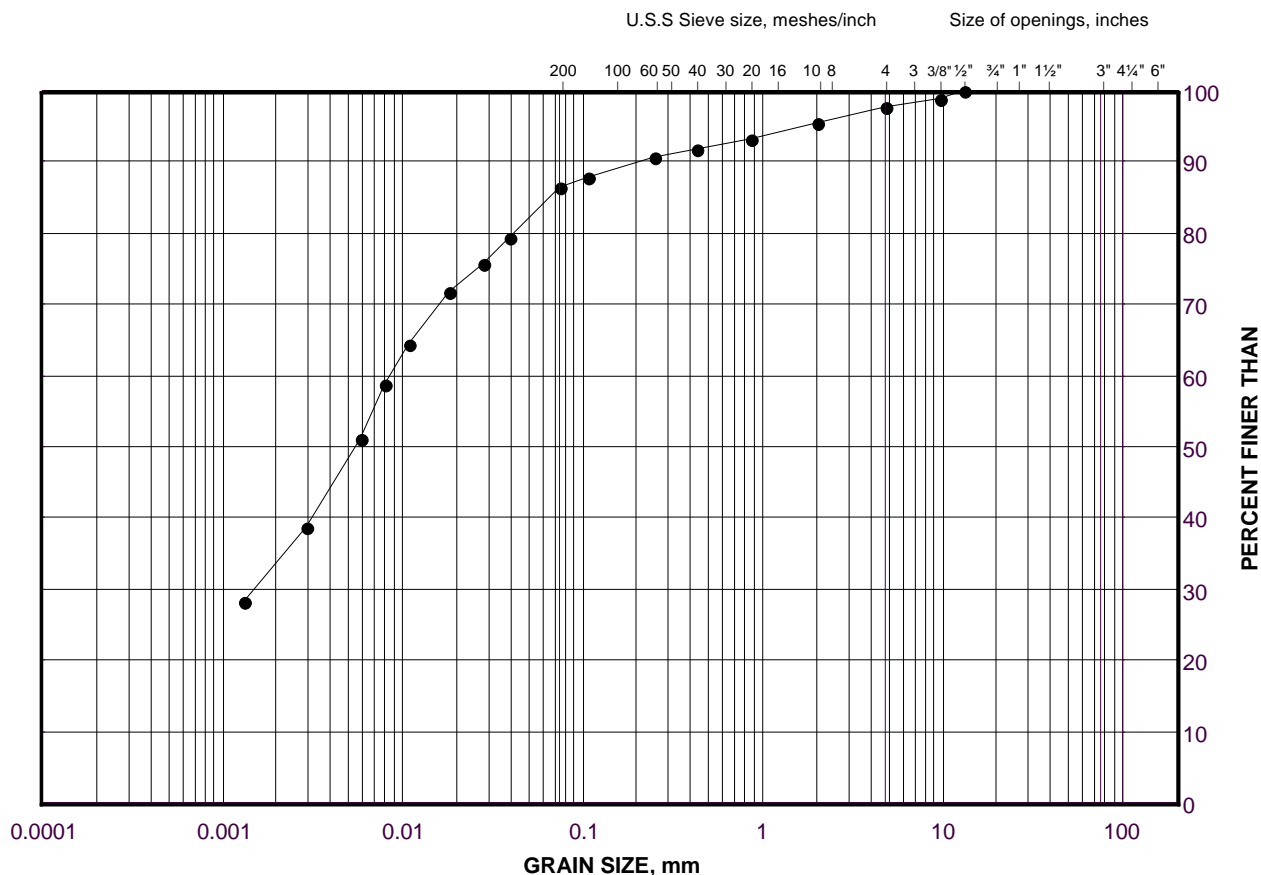
Date: 05-Feb-22



# GRAIN SIZE DISTRIBUTION

Cohesive Soil Complex (Clayey Silt, Silt to Silty Clay Till, and Clayey Silt Residual Soil)

FIGURE B4B



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

## LEGEND

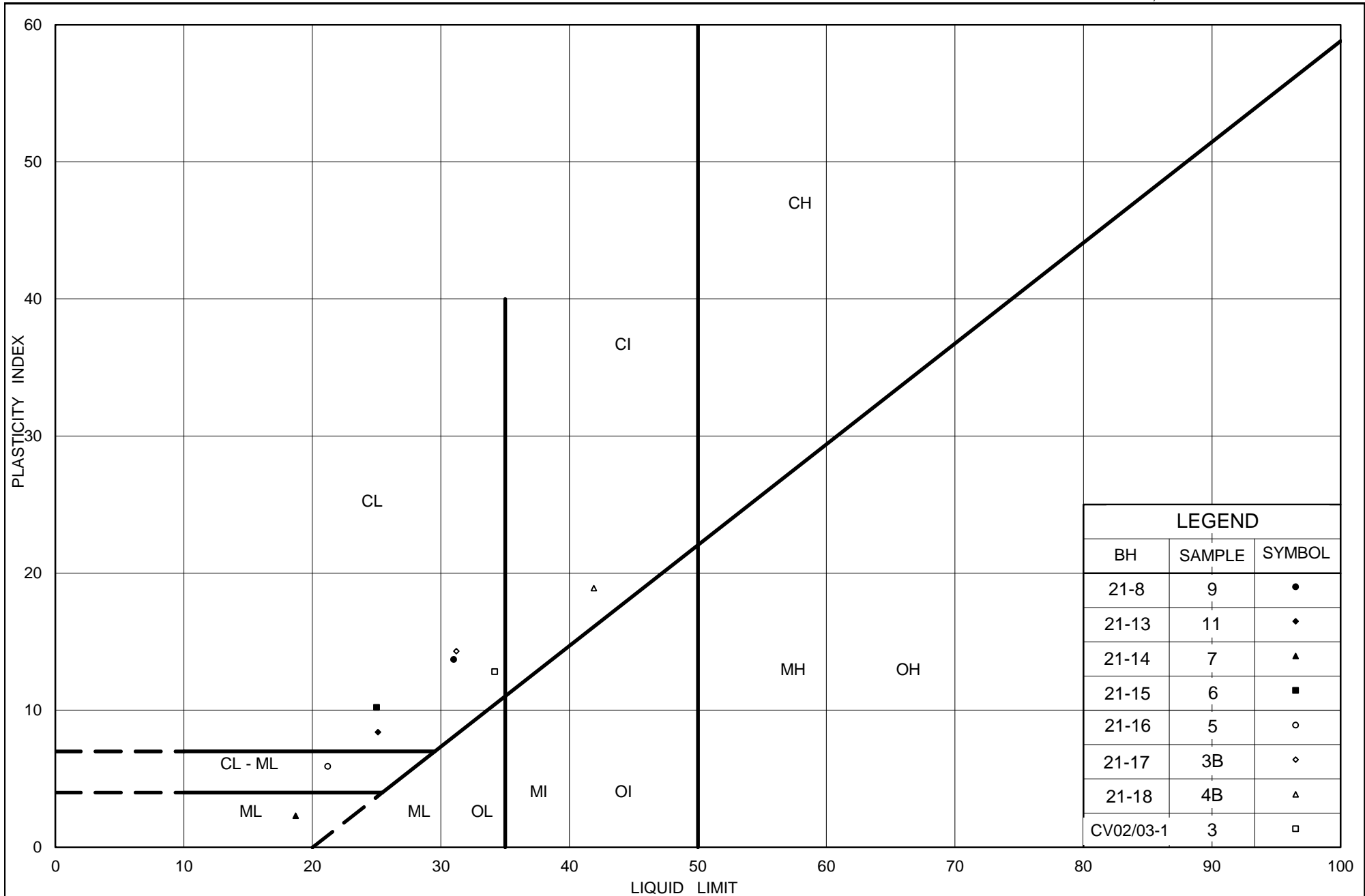
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
•	NW3-6	2	103.2

Project Number: 1530382

Checked By: LCC

**Golder Associates**

Date: 05-Feb-22



Ministry of Transportation

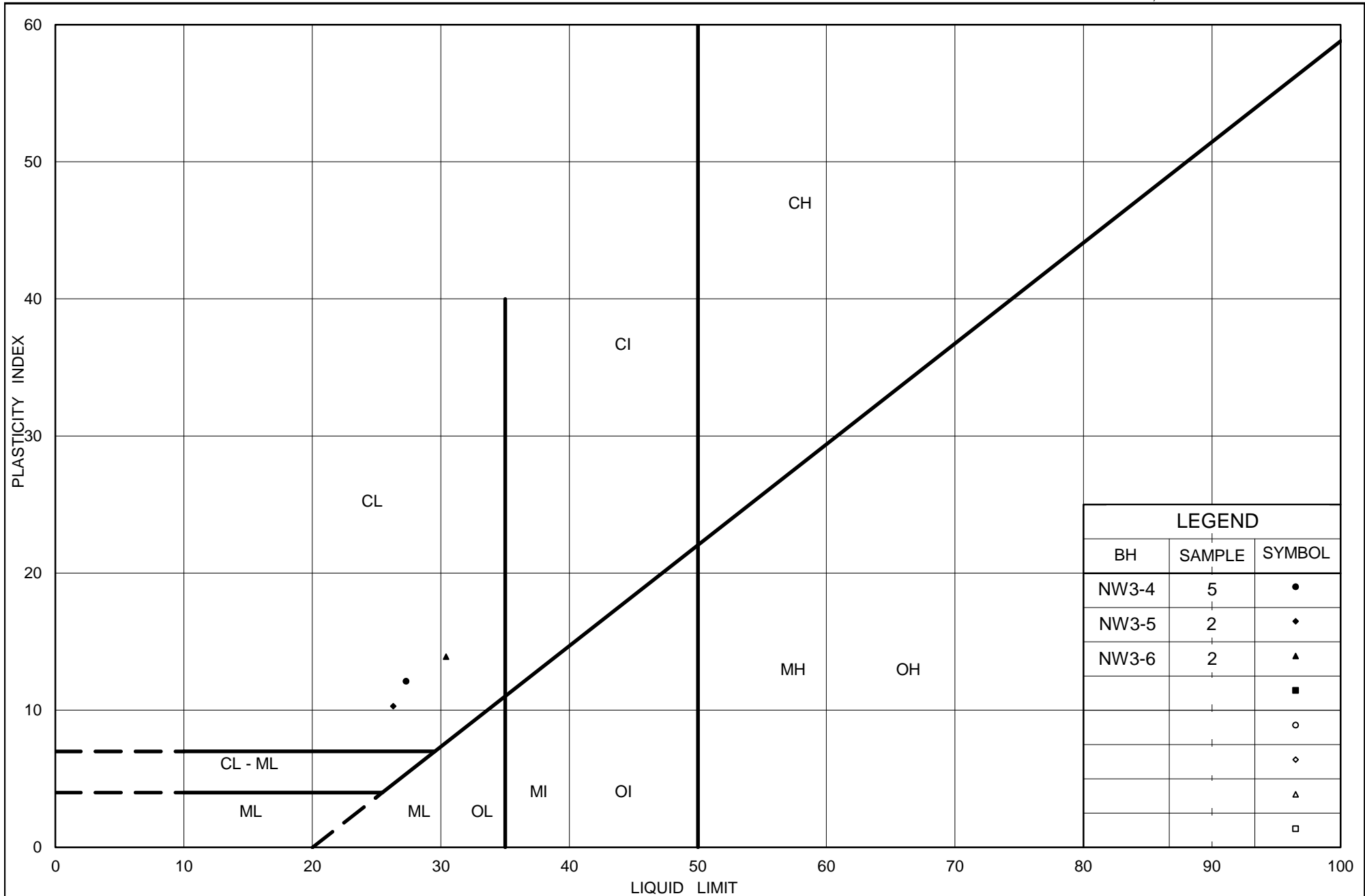
Ontario

# **PLASTICITY CHART** Cohesive Soil Complex (Clayey Silt, Silt to Silty Clay Till, and Clayey Silt Residual Soil)

Figure No. B5A

Project No. 1530382

Checked By: LCC



Ministry of Transportation

Ontario

# **PLASTICITY CHART** Cohesive Soil Complex (Clayey Silt, Silt to Silty Clay Till, and Clayey Silt Residual Soil)

Figure No. B5B

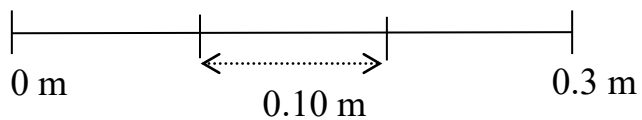
Project No. 1530382

Checked By: LCC



**Borehole CV02/03-1:** Bedrock cored between depths of about 4.52 m to 7.69 m

Scale




PROJECT

QEW Improvements from East of Cawthra Road  
to The East Mall, Region of Peel  
Water and Wastewater Infrastructure  
(Cut-and-Cover Sections)

TITLE

BEDROCK CORE PHOTOGRAPHS  
BOREHOLE CV02/03-1

  
GOLDER

PROJECT No. 1530382

FILE No. ----

DESIGN

KN

20210823

SCALE

NTS

VER. 1.

CADD

--

--

CHECK

LCC

20210831

REVIEW

LCC

20210831

PHOTOGRAPH  
B8

**APPENDIX C**


**Segment C: South Service Road from  
Haig Boulevard to Dixie Road –  
Borehole Records and  
Geotechnical Laboratory Test Results**

PROJECT 1530382		RECORD OF BOREHOLE No 21-11		SHEET 1 OF 2		METRIC							
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828031.9; E 298928.7 MTM NAD 83 ZONE 10 (LAT. 43.592207; LONG. -79.572717)		ORIGINATED BY LM									
DIST Central HWY QEW		BOREHOLE TYPE CME 55, 150 mm O.D. Hollow Stem Augers (Auto Hammer)		COMPILED BY AK									
DATUM Geodetic		DATE February 17, 2021		CHECKED BY KN									
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT		REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>	γ	GR SA SI CL
104.7	GROUND SURFACE												
0.0	ASPHALT (150 mm)												
0.2	Granular (FILL) (460 mm)												
104.1	SILTY SAND (SM), trace gravel (FILL) Very loose to loose Brown Moist		1	SS	6		104						7 57 29 7
0.6	- Clayey silt pockets below 1.5 m (Elev.103.2 m)		2	SS	2		103						
			3	SS	6		102						
102.0	Sandy SILT (ML) Very loose to compact Brown Wet		4	SS	WH		101						
2.7			5	SS	2		100						
			6	SS	3		99						
	- Grey below a depth of 6.1 m		7	SS	14		98						0 33 53 4
			8	SS	2		97						
96.9	CLAYEY SILT (CL), trace gravel Very soft Grey Moist		9	SS	6		96						8 33 41 18
96.4	Sandy CLAYEY SILT (CL), trace gravel (TILL) Firm to very stiff Grey Wet		10	SS	29		95						
8.3													
94.9													
9.8													

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT 1530382		RECORD OF BOREHOLE No 21-11				SHEET 2 OF 2		METRIC									
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828031.9; E 298928.7 MTM NAD 83 ZONE 10 (LAT. 43.592207; LONG. -79.572717)				ORIGINATED BY LM											
DIST Central HWY QE		BOREHOLE TYPE CME 55, 150 mm O.D. Hollow Stem Augers (Auto Hammer)				COMPILED BY AK											
DATUM Geodetic		DATE February 17, 2021				CHECKED BY KN											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	--- CONTINUED FROM PREVIOUS PAGE ---							20	40	60	80	100					
94.2	CLAYEY SILT (CL), trace gravel, containing shale fragments (RESIDUAL SOIL) Hard Grey Wet		11	SS	43												
10.5	Grey SHALE (BEDROCK)  Bedrock cored from depths of 10.5 m to 13.1 m (between Elev. 94.2 m and 91.6 m).  For bedrock coring details refer to Record of Drillhole 21-11.		1	RC	REC 33%												RQD = 0%
			2	RC	REC 100%												RQD = 100%
			3	RC	REC 100%												RQD = 100%
91.6	END OF BOREHOLE																
13.1	NOTES:  1. Groundwater level measured at a depth of approximately 2.3 m below ground surface (Elev. 102.4 m) prior to rock coring.  2. Groundwater level measurements in piezometer:  Date      Depth (m)      Elev. (m) 15-06-21      2.9      101.8 28-06-21      2.9      101.8 29-06-21      3.0      101.7																

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT: 1530382

**RECORD OF DRILLHOLE: 21-11**

SHEET 1 OF 1

LOCATION: N 4828031.9 ;E 298928.7

DRILLING DATE: February 17, 2021

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.																FEATURES	R0/R1 ZONES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA				ROCK STRENGTH INDEX		WEATH- ERING INDEX																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
						TOTAL CORE %	SOLID CORE %			B Angle	DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	R4	R3	R2	R1	W1	W2	W3			W4	W5	W6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		Continued from Record of Borehole 21-11		94.17																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



LOGGED: LM

CHECKED: AK

GTA-RCK 054 S:\CLIENTS\MTOW\QEW-DIXIE\02 DATA\QINTQEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22



PROJECT		1530382		RECORD OF BOREHOLE No 21-23		SHEET 1 OF 1		METRIC								
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828038.0; E 298880.2 MTM NAD 83 ZONE 10 (LAT. 43.592261; LONG. -79.573318)		ORIGINATED BY								
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75 truck, 200 mm OD Hollow Stem Augers (Auto Hammer)		COMPILED BY								
DATUM		Geodetic		DATE		June 25, 2021		CHECKED BY								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
105.4	GROUND SURFACE															
0.0	ASPHALT (125 mm)															
0.1	SAND (SP), some gravel, trace fines (FILL)		1A	SS	39											
104.8	Dense Brown Moist		1B													
0.6	SILTY SAND (SM)		2	SS	9											
	Loose to dense Brown to grey Moist															
			3	SS	16											
	- Wet below a depth of about 2.3 m (Elev. 103.1 m)		4	SS	21											
			5	SS	23											
			6A	SS	17											
	- Gravelly below a depth of 4.3 m (Elev. 101.1 m)		6B													
100.9																
4.5	Sandy SILT (ML)															
	Compact Grey Wet to moist		7	SS	22											
100.2																
5.2	END OF BOREHOLE															
	NOTES:															
	1. Groundwater level measured in borehole at a depth of 3.0 m below ground surface (Elev. 102.4 m) upon completion of drilling.															
	2. Borehole caved to a depth of 3.4 m below ground surface (Elev. 102.0 m) upon removal of augers.															

PROJECT 1530382		RECORD OF BOREHOLE No 21-24		SHEET 1 OF 1		METRIC										
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828132.4; E 298979.3 MTM NAD 83 ZONE 10 (LAT. 43.593112; LONG. -79.572091)		ORIGINATED BY AM												
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY KN												
DATUM Geodetic		DATE April 28, 2021		CHECKED BY KN												
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
104.7	GROUND SURFACE															
104.8	ASPHALT (180 mm)															
0.2	Gravelly SAND (SP) (FILL) Brown Moist		0	AS	-											
103.9																
0.8	SILTY SAND (SM) trace gravel (FILL) Loose Brown Moist		1	SS	8											
103.3																
1.5	SILTY SAND (SM), trace to some gravel Compact to dense Brown to grey Wet		2	SS	12											
			3	SS	22											
			4A	SS	23											
			4B													
			5	SS	44											
			6	SS	18											
98.0	END OF BOREHOLE															
6.7	NOTES:  1. Groundwater level measured at a depth of approximately 3.1 m below ground surface (Elev. 101.6 m) upon completion of drilling.  2. Borehole caved at a depth of approximately 3.4 m below ground surface (Elev. 101.3 m) upon removal of augers.															

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEQW-DIXIE.GPJ GAL-GTA.GDT 27/22

PROJECT		2150382		RECORD OF BOREHOLE No 21-25		SHEET 1 OF 1		METRIC														
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828195.9; E 299031.6 MTM NAD 83 ZONE 10 (LAT. 43.593683; LONG. -79.571444)		ORIGINATED BY														
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY														
DATUM		Geodetic		DATE		April 20, 2021		CHECKED BY														
KN								KN														
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)							
ELEV	DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ			GR SA SI CL		
104.0	0.0	GROUND SURFACE ASPHALT (330 mm)							20 40 60 80 100	20 40 60 80 100	10 20 30											
103.7	0.3	SAND (SP), trace gravel (FILL) Brown																				
103.2	0.8	Sandy SILT (ML), trace gravel, contains organics and silt pockets Loose Black to greenish, black Moist		1	SS	3		103														
				2	SS	9		102														
		- Wet below a depth of 2.1 m		3	SS	8		101														
				4A	SS	4																
100.6	3.4	CLAYEY SILT (CL), trace sand Firm Grey Wet		4B				100														
99.9	4.1	CLAYEY SILT (CL), trace gravel, contains shale fragments (REDISUAL SOIL) Stiff Grey Wet		5	SS	13		99														
97.9	6.2	Inferred moderately weathered SHALE (BEDROCK) Grey END OF BOREHOLE		6	SS	50/0.10		98														
		NOTES: 1. Groundwater level measured at a depth of 2.1 m below ground surface (Elev. 101.9 m) upon completion of drilling. 2. Groundwater level measurements in piezometer: Date Depth (m) Elev. (m) 04-20-21 1.8 102.2 07-08-21 1.7 102.3																				

PROJECT		21530382		RECORD OF BOREHOLE		No 21-26		SHEET 1 OF 1		METRIC							
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828270.6; E 299098.6 MTM NAD 83 ZONE 10 (LAT. 43.594356; LONG. -79.570615)		ORIGINATED BY		AM							
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY		KN							
DATUM		Geodetic		DATE		April 20, 2021		CHECKED BY		KN							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
103.8	GROUND SURFACE																
0.0	ASPHALT (100 mm)																
0.1	Gravelly SILTY SAND (SM) (FILL) Brown Moist		0	AS													32 38 26 4
103.1	CLAYEY SILT (CL), some sand, trace gravel (TILL) Very stiff Grey Moist		1	SS	17												5 11 57 27
			2	SS	20												
101.6	CLAYEY SILT (CL), trace to some sand, contains shale and limestone fragments (RESIDUAL SOIL) Very stiff to hard Grey Moist		3	SS	24												
			4	SS	18												
100.0	SHALE (BEDROCK) Grey		1	RC	REC 100%												RQD = 32%
3.8	Bedrock cored from depths of 3.8 m to 6.1 m (Elev. 100.0 m to 97.7 m).  For bedrock coring details refer to Record of Drillhole 21-26.		2	RC	REC 100%												RQD = 71%
97.7	END OF BOREHOLE																
6.1	NOTE:  1. Borehole open and dry prior to bedrock coring.																

GTA-MTO 001 S:\CLIENTS\MTQ\QEW-DIXIE\02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

SHEET 1 OF 1

DATUM: Geodetic

DRILLING CONTRACTOR: Davis Drilling Ltd.

[illegible]

BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50

LOGGED: AM

CHECKED: KN

PROJECT 1530382		RECORD OF BOREHOLE No 21-27		SHEET 1 OF 1		METRIC											
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828333.0; E 299168.6 MTM NAD 83 ZONE 10 (LAT. 43.594919; LONG. -79.569749)		ORIGINATED BY AM													
DIST Central HWY QEW		BOREHOLE TYPE Geoprobe 6620DT		COMPILED BY ML/KN													
DATUM Geodetic		DATE June 18, 2021		CHECKED BY KN													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%) W <sub>p</sub> W W <sub>L</sub>			γ	GR SA SI CL
101.8	GROUND SURFACE							20 40 60 80 100									
0.0	TOPSOIL (100 mm)		1A														
0.1	CLAYEY SILT (CL), trace to some sand, trace gravel (FILL) Very stiff to hard Grey to brown		1B	SS	18												
							101										
			2	SS	26												
100.1			3	SS	50/0.28												
1.7	Inferred moderately to highly weathered SHALE (BEDROCK) Grey		4	AS	-		100										
99.5	SHALE (BEDROCK) Grey		5	SS	135		99										
2.3	Bedrock cored from depths of 2.3 m to 6.9 m (Elev. 99.5 m to 94.9 m).  For bedrock coring details refer to Record of Drillhole 21-27.		1	RC	REC 73%												RQD = 20%
							98										
			2	RC	REC 100%		97										RQD = 83%
							96										
			3	RC	REC 100%												RQD = 94%
94.9	END OF BOREHOLE						95										
6.9	NOTE:  1. Borehole open and dry prior to bedrock coring.																

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEQW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

SHEET 1 OF 1

DATUM: Geodetic

DRILLING CONTRACTOR: Altech Drilling

[illegible]

BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50

LOGGED: AM

CHECKED: AK

PROJECT 1530382		RECORD OF BOREHOLE No 21-28		SHEET 1 OF 1		METRIC															
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828324.4; E 299195.3 MTM NAD 83 ZONE 10 (LAT. 43.594842; LONG. -79.569419)		ORIGINATED BY KN/ML																	
DIST Central HWY QEW		BOREHOLE TYPE CME 75 truck, 150 mm OD Hollow Stem Augers (Auto Hammer)		COMPILED BY KN/ML																	
DATUM Geodetic		DATE June 27, 2021		CHECKED BY																	
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ			GR SA SI CL		
103.4	GROUND SURFACE							20 40 60 80 100					10 20 30								
0.0	TOPSOIL (356 mm)							20 40 60 80 100					10 20 30								
103.0			1A	SS	21		103														
0.4	Gravelly SAND (SP), trace fines (FILL)		1B																		
102.7	Compact Brown Moist																				
0.7	SILTY SAND (SM), trace gravel		2	SS	19		102												2 67 29 2		
	Loose to compact Brown Moist																				
101.5			3A	SS	7																
1.9	CLAYEY SAND (SC), trace gravel, contains rootlets		3B																6 45 32 17		
	Firm Grey to black Moist																				
	- Organic odour below 2.3 m (Elev. 101.1 m)		4	SS	4		101														
100.4																					
3.0	Inferred completely weathered SHALE (BEDROCK)		5	SS	26		100														
99.7																					
3.7	Inferred slightly weathered SHALE (BEDROCK)		6	SS	50/0.10																
99.3																					
4.1	SHALE (BEDROCK)																				
	Bedrock cored from depths of 4.1 m to 7.2 m (Elev. 99.3 m to 96.2 m).		1	RC	REC 95%		99												RQD = 24%		
	For bedrock coring details refer to Record of Drillhole 21-28.																				
			2	RC	REC 96%		98												RQD = 75%		
			3	RC	REC 100%		97												RQD = 56%		
96.2																					
7.2	END OF BOREHOLE																				
	NOTE:																				
	1. Borehole open and dry prior to bedrock coring.																				

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22



SHEET 1 OF 1

DATUM: Geodetic

DRILLING CONTRACTOR: Davis Drilling Ltd.

[illegible]

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE




LOST CORE

DEPTH SCALE

1 : 50

LOGGED: KN/ML

CHECKED: DH

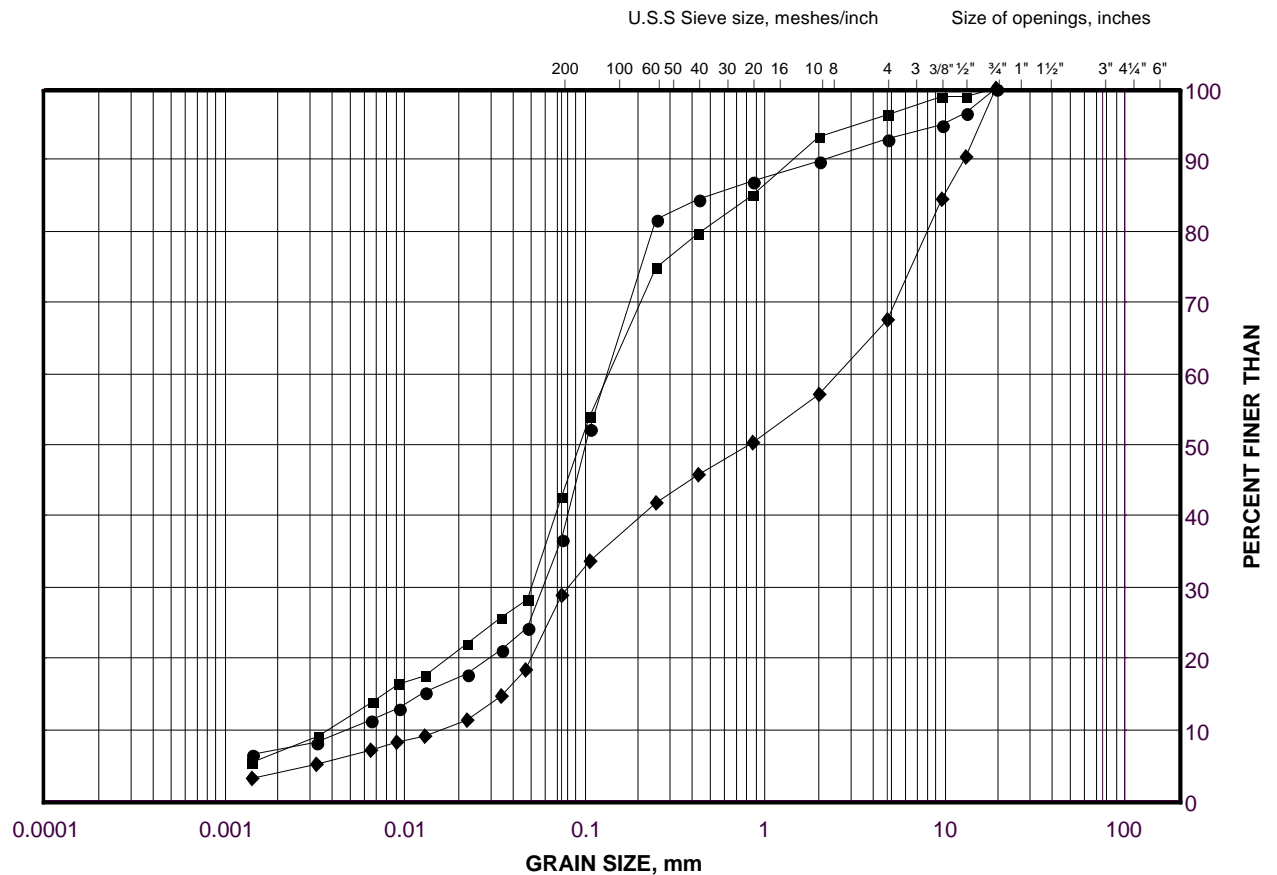
PROJECT		RECORD OF BOREHOLE				No CV02/03-3		SHEET 1 OF 1		METRIC							
G.W.P. 2102-13-00; 2432-13-00		LOCATION		N 4828335.4; E 299149.6 MTM NAD 83 ZONE 10 (LAT. 43.594932; LONG. -79.569981)				ORIGINATED BY									
DIST Central HWY QEW		BOREHOLE TYPE		CME 75, 108 mm O.D. Continuous Flight Solid Stem Augers				COMPILED BY									
DATUM Geodetic		DATE		October 17, 2016				CHECKED BY									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
103.2	GROUND SURFACE							20	40	60	80	100					
0.0	Silt and sand, trace to some clay, trace gravel to silty sand and gravel (FILL) Loose to compact Brown Moist		1	SS	14												
			2	SS	7												
			3	SS	4												
			4	SS	6												
			5	SS	10												
			6	SS	4												
			7	SS	103												
98.3	Inferred highly weathered, grey SHALE (BEDROCK) (Georgian Bay Formation) END OF BOREHOLE																
5.0	NOTE: 1. Water level not measured upon completion of drilling. Wet soil below a depth of 3.8 m (Elev. 99.4 m).																

GTA-MTO 001 S:\CLIENTS\MTQ\QEW-DIXIE02\_DATA\GINT\QEW-DIXIE.GPJ GAL-GTA.GDT 19-5-27

# GRAIN SIZE DISTRIBUTION

Silty Sand to Silt and Sand Fill

FIGURE C1



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-11	1	103.6
■	CV 02/3-3	4	100.5
◆	21-26	AS0	103.4

Project Number: 1530382

Checked By: LCC

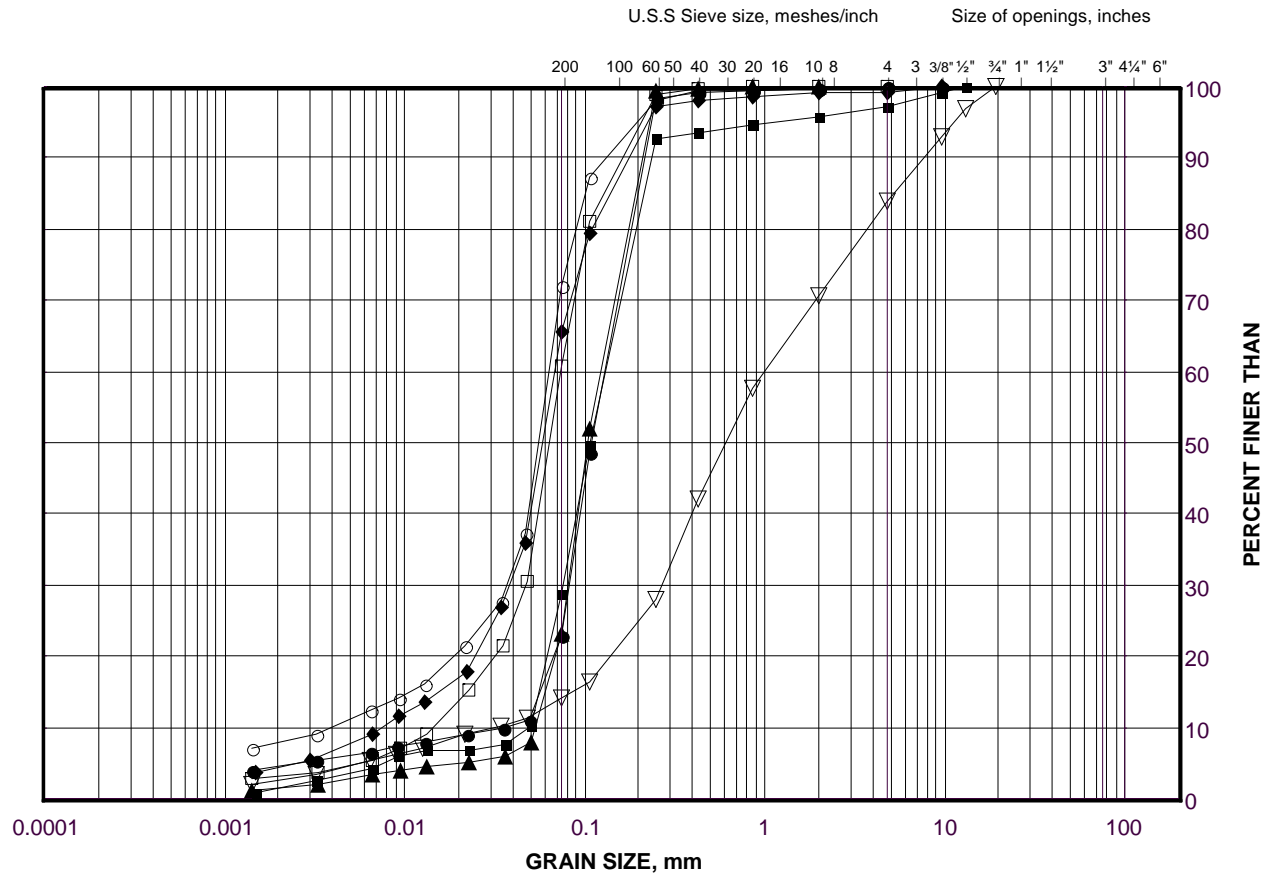
**Golder Associates**

Date: 07-Feb-22

# GRAIN SIZE DISTRIBUTION

Silty Sand to Sandy Silt

FIGURE C2



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-24	2	102.9
■	21-28	2	102.4
◆	21-25	3	101.4
▲	21-23	4	102.8
▽	21-24	4B	101.2
○	21-23	7	100.5
□	21-11	7	98.4

Project Number: 1530382

Checked By: LCC

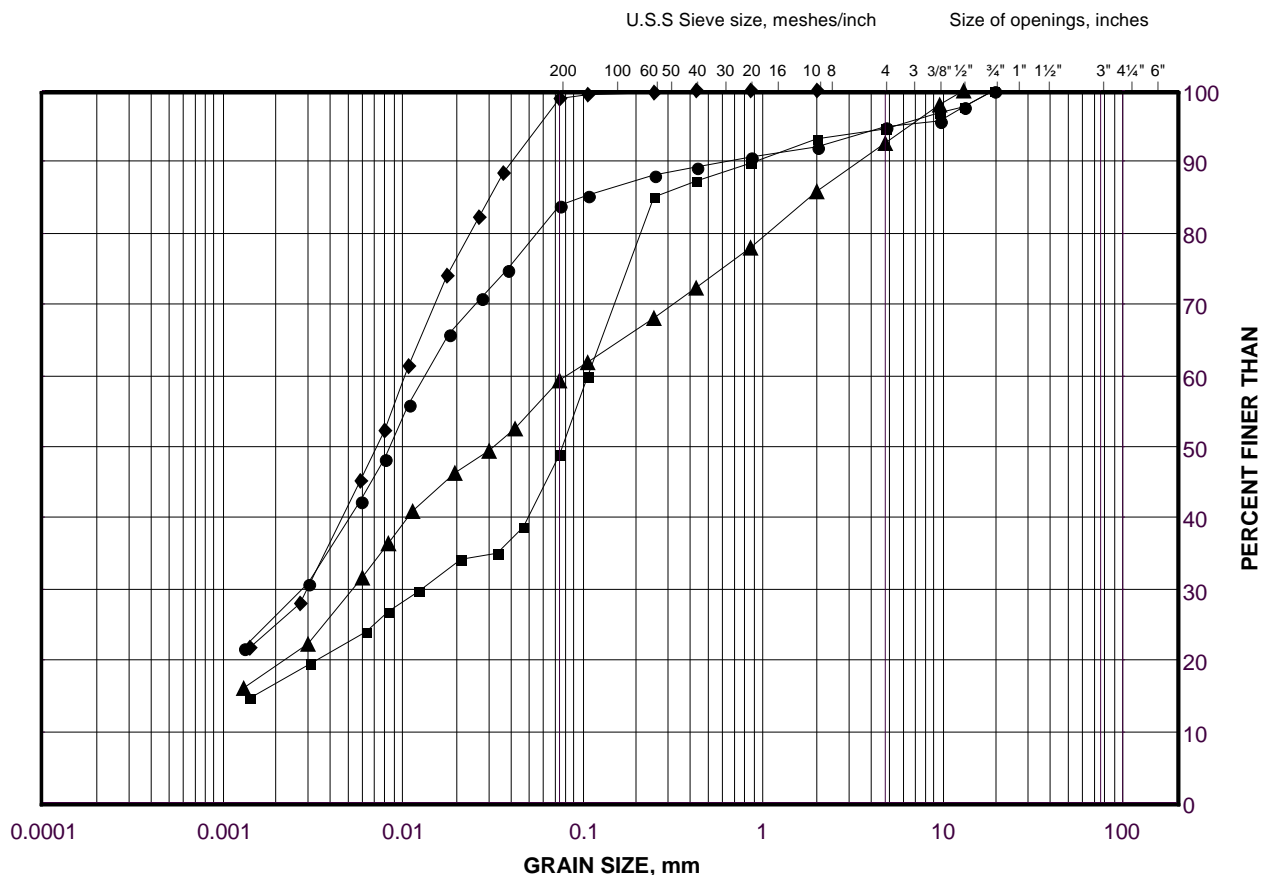
**Golder Associates**

Date: 07-Feb-22

# GRAIN SIZE DISTRIBUTION

Cohesive Soil Complex (Clayey Silt, Clayey Silt Till, and Clayey Silt Residual Soil)

FIGURE C3



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

## LEGEND

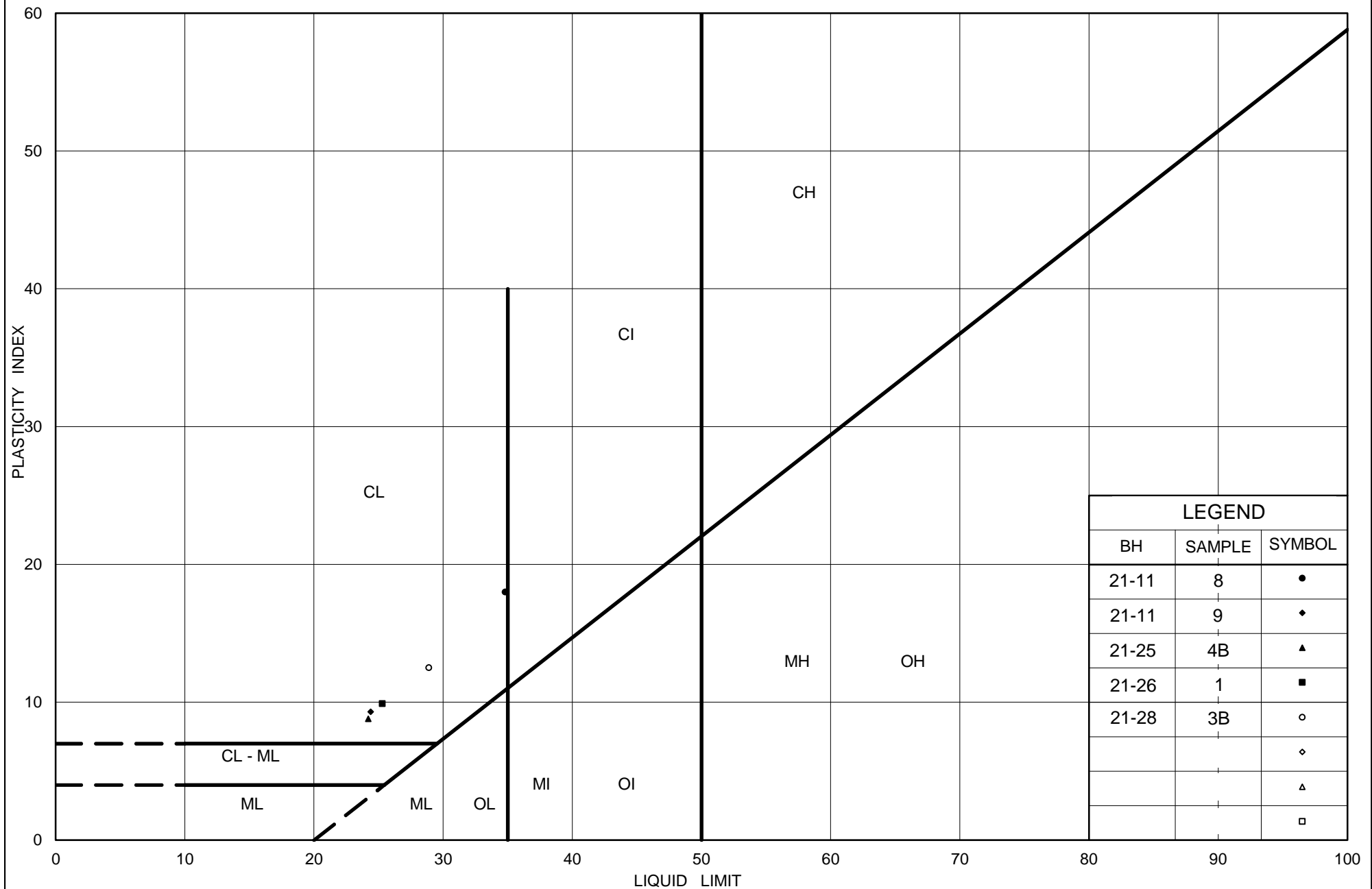
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-26	1	102.6
■	21-28	3B	101.4
◆	21-25	4B	100.5
▲	21-11	9	96.0

Project Number: 1530382

Checked By: LCC

Golder Associates

Date: 05-Feb-22



Ministry of Transportation

Ontario

# **PLASTICITY CHART** Cohesive Soil Complex (Clayey Silt, Clayey Silt Till, and Clayey Silt Residual Soil)

Figure No. C4

Project No. 1530382

Checked By: LCC

**APPENDIX D**

**Segment D: Dixie Road from  
North Service Road to Sherway Drive –  
Borehole Records and  
Geotechnical Laboratory Test Results**

PROJECT		1530382		RECORD OF BOREHOLE		No 21-19		SHEET 1 OF 1		METRIC				
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828485.1; E 299155.1 MTM NAD 83 ZONE 10 (LAT. 43.596288; LONG. -79.569918)		ORIGINATED BY		KN				
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75, 185 mm O.D., Hollow Stem Auger (Auto Hammer)		COMPILED BY		MPM				
DATUM		Geodetic		DATE		May 3, 2021		CHECKED BY		KN				
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
105.9	GROUND SURFACE													
0.0	TOPSOIL													
0.2	SAND (SP), some gravel, trace silt (FILL) Loose Grey Moist		1A 1B	SS	6									0 75 20 5
	SILTY SAND (SM), trace gravel, contains rootlets Loose to compact Brown to grey Moist to wet		2	SS	9									
			3	SS	15									
103.5	CLAYEY SILT (CL), trace sand, trace gravel (TILL) Very stiff Grey Moist		4A 4B 4C	SS	19									1 9 57 33
2.5														
102.9	CLAYEY SILT (CL), trace gravel, contains shale fragments (RESIDUAL SOIL) Very stiff Grey Moist		5	SS	100/0.1									
3.0														
102.6	Inferred moderately weathered SHALE (BEDROCK) Grey		1	RC	REC 100%									RQD = 75%
3.4	SHALE (BEDROCK) Grey													
	Bedrock cored from depths of 3.3 m to 4.8 m ( Elev. 102.6 m to 101.1 m).													
101.1	For bedrock coring details refer to Record of Drillhole 21-19.													
4.8	END OF BOREHOLE													
NOTES: 1. Groundwater level measured at a depth of approximately 2.4 m below the ground surface (Elev. 103.5 m) prior to rock coring. 2. Groundwater level measurements in piezometer: Date      Depth (m)      Elev. (m) 07-07-21      2.4      103.5														

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEQW-DIXIE.GPJ GAL-GTA.GDT 2/1/22





PROJECT 1530382		RECORD OF BOREHOLE No 21-20		SHEET 1 OF 1		METRIC											
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828744.5; E 299135.4 MTM NAD 83 ZONE 10 (LAT. 43.598622; LONG. -79.570165)		ORIGINATED BY AM													
DIST Central HWY QEW		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY KN													
DATUM Geodetic		DATE April 28, 2021		CHECKED BY KN													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	GR SA SI CL
							20 40 60 80 100	20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>	10 20 30					
108.3 0.0	GROUND SURFACE TOPSOIL (300 mm)																
108.0 0.3	SILTY SAND (SM) to SAND (SP), some silt, trace rootlets Loose to dense Brown Moist to wet at a depth of 2.0 m (Elev.106.3 m)		1A	SS	5		108										
			1B														
			2	SS	11												0 64 34 2
							107										
			3	SS	26												
							106										
			4	SS	30												0 87 12 1
105.3 3.1	Inferred moderately weathered SHALE (BEDROCK) Grey		5	SS	50/0.03		105										
			6	SS	50/0.08												
							104										
103.5 4.8	END OF BOREHOLE		7	SS	76/0.08												
NOTES:																	
1. Groundwater level measured at a depth of approximately 2.1 m below the ground surface (Elev. 106.2 m) upon completion of drilling.																	
2. Borehole caved to a depth of 2.4 m (105.9 m) upon completion of drilling.																	

PROJECT 1530382			RECORD OF BOREHOLE No 21-21			SHEET 1 OF 1			METRIC																				
G.W.P. 2102-13-00; 2432-13-00			LOCATION N 4828828.6; E 299098.7 MTM NAD 83 ZONE 10 (LAT. 43.599380; LONG. -79.570621)			ORIGINATED BY AM																							
DIST Central HWY QEW			BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)			COMPILED BY KN																							
DATUM Geodetic			DATE April 28, 2021			CHECKED BY KN																							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS			ELEVATION SCALE			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			SHEAR STRENGTH kPa			WATER CONTENT (%)			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV	DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES																							
109.3	0.0	GROUND SURFACE																											
		TOPSOIL (50 mm)																											
		SILTY SAND (SM), trace gravel, trace rootlets		1	SS	4																							
		Compact		2A	SS	10																							
		Brown		2B																									
		Moist to wet		3	SS	27																							
				4	SS	20																							
				5A																									
				5B	SS	47																							
				5C																									
106.0	3.4	CLAYEY SILT (CL), contains shale fragments (RESIDUAL SOIL)																											
		Hard																											
		Grey																											
		Moist																											
105.3	4.0	Inferred highly weathered SHALE (BEDROCK)																											
		Grey																											
		END OF BOREHOLE																											
		NOTE:																											
		1. Groundwater level measurements in piezometer:																											
		Date Depth (m) Elev. (m)																											
		04-28-21 2.3 107.0																											
		07-07-21 2.6 106.7																											

PROJECT		2102-13-00; 2432-13-00		LOCATION		N 4828896.7; E 299097.9 MTM NAD 83 ZONE 10 (LAT. 43.599992; LONG. -79.570631)		SHEET 1 OF 1		METRIC							
G.W.P.		2102-13-00; 2432-13-00		BOREHOLE TYPE		CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)		ORIGINATED BY		AM							
DIST		Central HWY QEW		COMPILED BY		KN		DATE		May 14, 2021							
DATUM		Geodetic		CHECKED BY		KN											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
109.7	GROUND SURFACE																
0.0	ASPHALT (100 mm)																
0.2	CONCRETE (80 mm)																
	SAND (SP) and Gravel (FILL)																
109.1	SILTY SAND (SM)																
0.6	Compact to dense Brown Moist to wet		1	SS	22												
			2	SS	44												
			3	SS	41												
			4A	SS	33												
			4B														
105.9	Inferred highly weathered SHALE (BEDROCK)																
105.7	Grey		5	SS	100/0.07												
4.0	END OF BOREHOLE																
NOTES:																	
1. Groundwater level measured at a depth of approximately 2.9 m below ground surface (Elev. 106.8 m) upon completion of drilling.																	
2. Borehole caved to a depth of approximately 3.0 m below ground surface (Elev. 106.7 m) upon removal of augers.																	

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEQW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT		1530382		RECORD OF BOREHOLE No NW4-1		SHEET 1 OF 1		METRIC									
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828595.5; E 299115.9 MTM NAD 83 ZONE 10 (LAT. 43.597273; LONG. -79.570402)		ORIGINATED BY									
DIST		Central HWY QEW		BOREHOLE TYPE		108 mm O.D. Continuous Flight Solid Stem Augers		COMPILED BY									
DATUM		Geodetic		DATE		October 6, 2016		CHECKED BY									
								SMM									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
107.5	GROUND SURFACE																
0.0	Sandy TOPSOIL																
0.1	SAND, trace to some silt, trace clay Compact Brown Moist to wet below 2.3 m depth		1	SS	10												
			2	SS	12												
			3	SS	30												
105.2																	
2.3	CLAYEY SILT, some sand, trace to some gravel, some shale fragments (RESIDUAL SOIL)		4	SS	100												
104.9	Hard Grey Moist SHALE (BEDROCK)		5	SS	100/0.15												
2.6			6	SS	100/0.15												
102.8			7	SS	100/0.15												
4.7	END OF BOREHOLE																
	NOTE: 1. Water level in open borehole at a depth of 4.4 m below ground surface (Elev. 103.1 m) upon completion of drilling.																

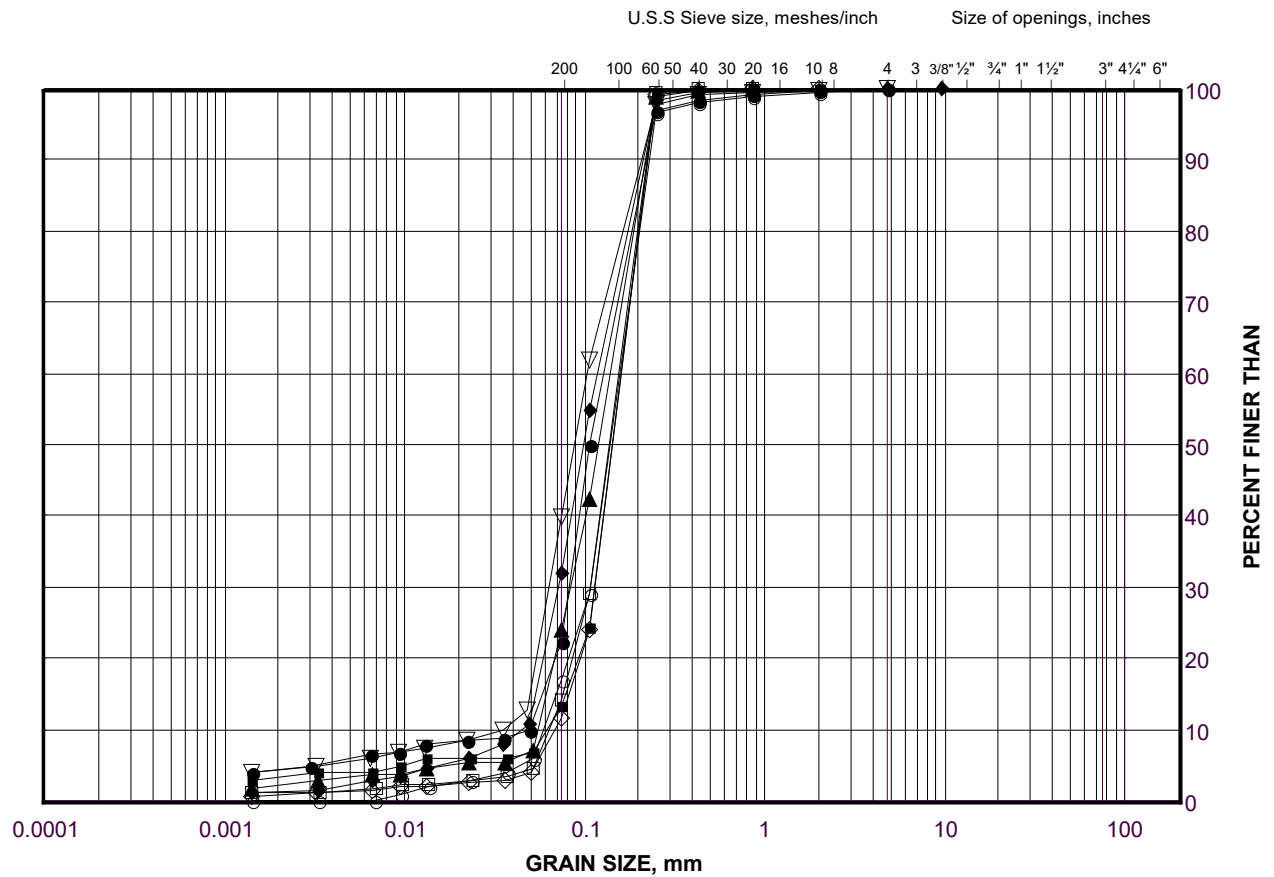
PROJECT		2102-13-00; 2432-13-00		LOCATION		N 4828628.9; E 299093.7 MTM NAD 83 ZONE 10 (LAT. 43.597573; LONG. -79.570676)		SHEET 1 OF 1		METRIC							
G.W.P.		2102-13-00; 2432-13-00		BOREHOLE TYPE		108 mm O.D. Continuous Flight Solid Stem Augers		ORIGINATED BY		PKS							
DIST		Central HWY QEW		COMPILED BY		ACK		DATE		October 6, 2016							
DATUM		Geodetic		CHECKED BY		SMM											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
107.7	GROUND SURFACE																
0.0	TOPSOIL																
0.2	SAND, trace to some silt, trace clay Very loose to compact Brown to grey Moist to wet below 2.3 m depth		1	SS	8												
			2	SS	8												
			3	SS	3												
			4	SS	26												
105.0	CLAYEY SILT, some shale fragments (RESIDUAL SOIL) Very stiff Grey Moist SHALE (BEDROCK)		5	SS	100/0.20												
2.9			6	SS	100/0.13												
			7	SS	100/0.10												
103.0	END OF BOREHOLE																
4.7	NOTE: 1. Water level in open borehole at a depth of 4.1 m below ground surface (Elev. 103.6 m) upon completion of drilling.																

PROJECT		1530382		RECORD OF BOREHOLE No NW4-3				SHEET 1 OF 1		METRIC								
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828683.3; E 299100.6 MTM NAD 83 ZONE 10 (LAT. 43.598063; LONG. -79.570592)		ORIGINATED BY		PKS								
DIST		Central HWY QEW		BOREHOLE TYPE		108 mm O.D. Continuous Flight Solid Stem Augers		COMPILED BY		ACK								
DATUM		Geodetic		DATE		October 6, 2016		CHECKED BY		SMM								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
108.1	GROUND SURFACE							20	40	60	80	100						
0.0	TOPSOIL							20	40	60	80	100						
0.2	SAND, some silt Very loose to dense Brown to grey Moist		1	SS	3													
			2	SS	9													
			3	SS	36													
	- Becoming wet below 2.1 m depth		4	SS	42													
104.9	SHALE (BEDROCK)		5	SS	163/0.28													
3.2			6	SS	100/0.15													
103.4	END OF BOREHOLE		7	SS	100/0.13													
4.7	NOTE: 1. Water level in open borehole at a depth of 4.1 m below ground surface (Elev. 104.0 m) upon completion of drilling.																	

# GRAIN SIZE DISTRIBUTION

Silty Sand to Sand

FIGURE D1



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-19	1B	105.6
■	NW4-1	2	106.5
◆	21-22	2	107.8
▲	21-20	2	107.3
▽	21-21	2A	108.2
○	NW4-3	3	106.3
□	NW4-2	3	105.8
△	21-20	4	105.7

Project Number: 1530382

Checked By: LCC

**Golder Associates**

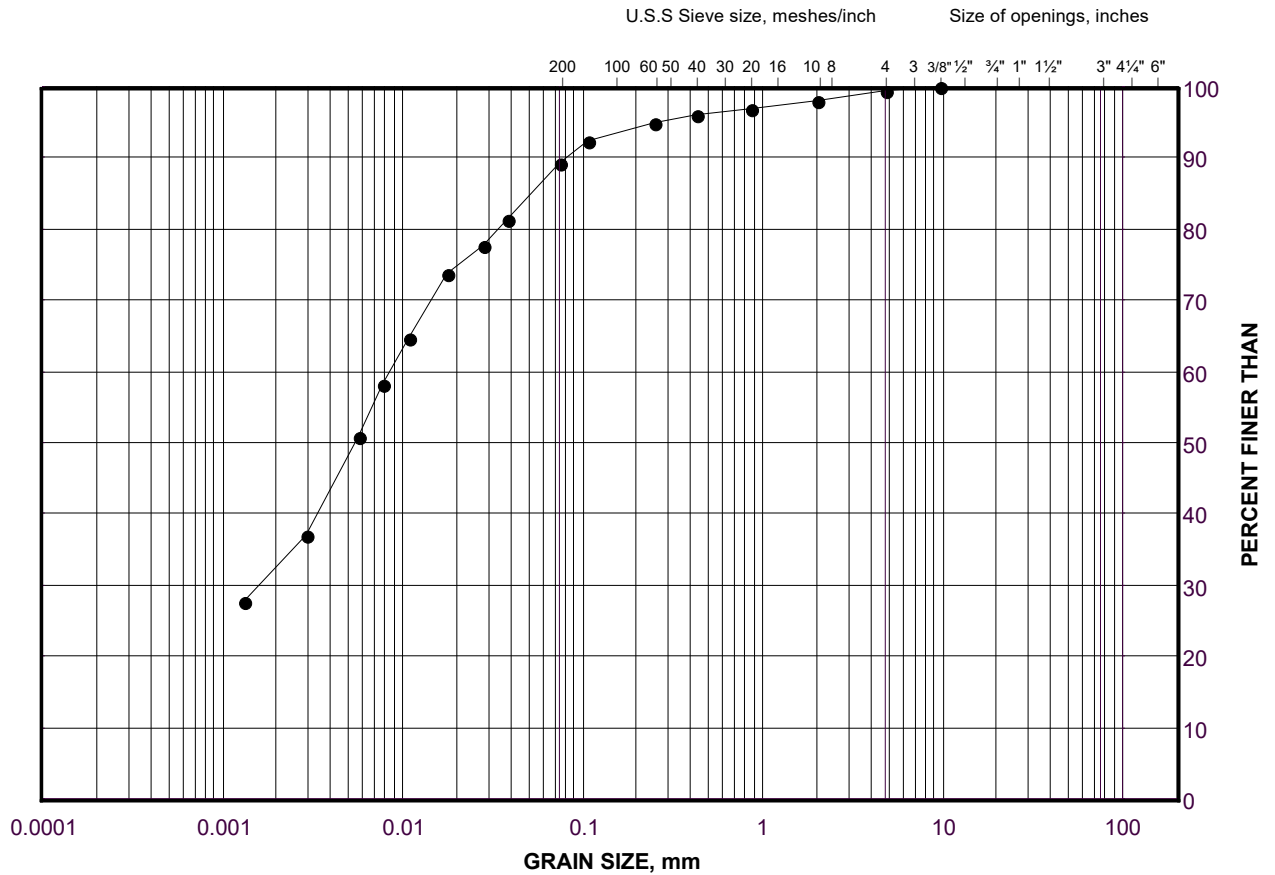
Date: 07-Feb-22



# GRAIN SIZE DISTRIBUTION

Cohesive Soil Complex (Clayey Silt Till)

FIGURE D2



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

## LEGEND

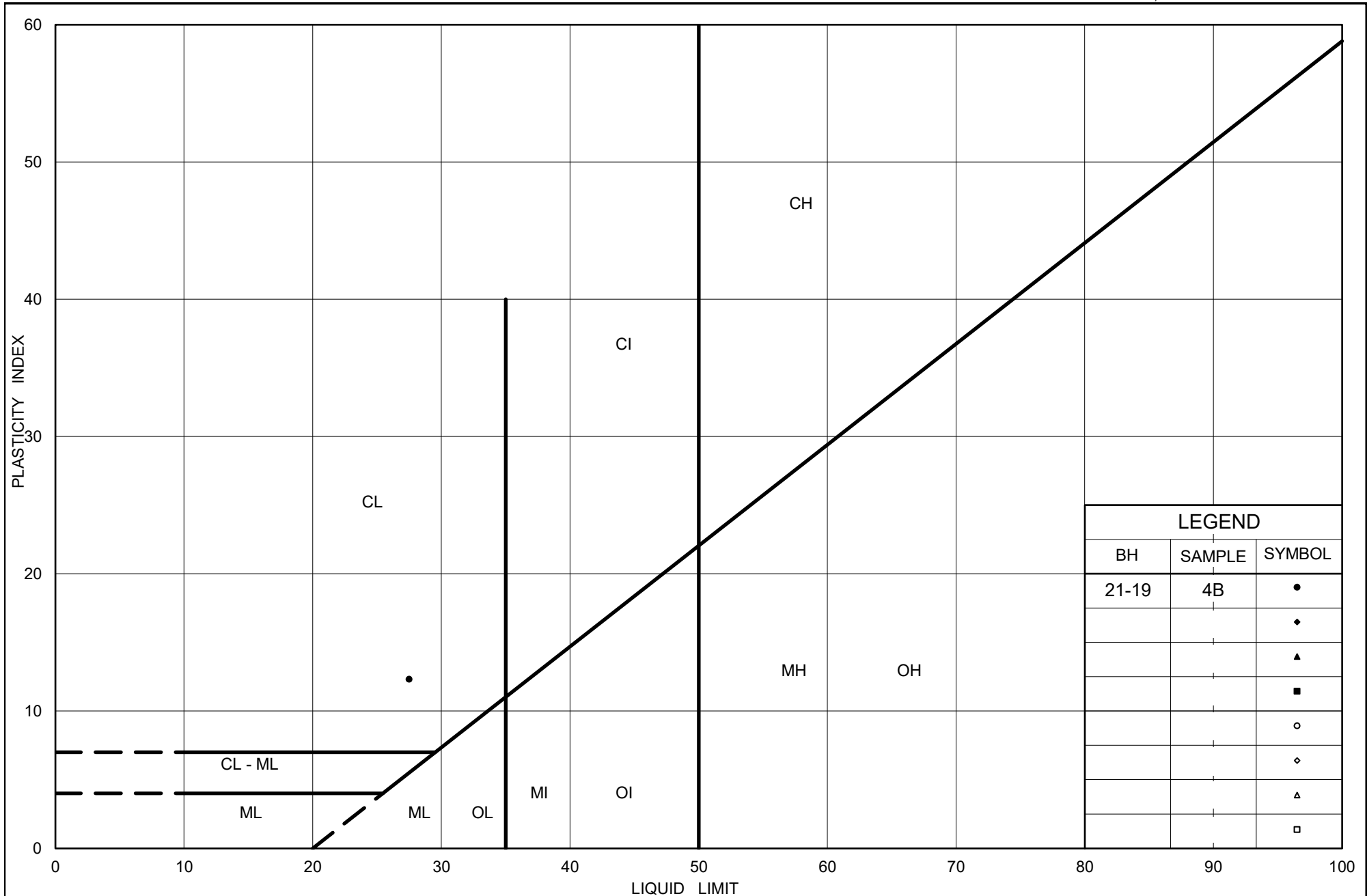
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
•	21-19	4B	103.5

Project Number: 1530382

Checked By: LCC

**Golder Associates**

Date: 07-Feb-22



Ministry of Transportation

Ontario

# PLASTICITY CHART Cohesive Soil Complex (Clayey Silt Till)

Figure No. D3

Project No. 1530382

Checked By: LCC

**APPENDIX E**

**Segment E: Brentano Boulevard –  
Borehole Records and  
Geotechnical Laboratory Test Results**

PROJECT <u>1530382-7000</u>		<b>RECORD OF BOREHOLE No 21-38</b>		SHEET 1 OF 1		<b>METRIC</b>	
G.W.P. <u>2102-13-00; 2432-13-00</u>		LOCATION <u>N 4828774.3; E 299253.9 MTM NAD 83 ZONE 10 (LAT. 43.598891; LONG. -79.568697)</u>		ORIGINATED BY <u>ML/KN</u>			
DIST <u>Central</u> HWY <u>QEW</u>		BOREHOLE TYPE <u>CME 75 truck, 150 mm OD Hollow Stem Augers (Auto Hammer)</u>		COMPILED BY <u>ML/KN</u>			
DATUM <u>Geodetic</u>		DATE <u>July 27, 2021</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>					
108.6	GROUND SURFACE																			
0.0	ASPHALT (150 mm)																			
0.2	SILTY SAND (SM), trace gravel to SAND (SP), trace fines Compact to dense Brown to grey Moist to wet																			
			1	SS	18												1	56 40 3		
			2	SS	14															
			3	SS	35															
			4	SS	33												0	91 8 1		
104.9	Inferred moderately to slightly weathered SHALE (BEDROCK) Grey		5	SS	50/0.13															
			6	SS	50/0.13															
			7	SS	50/0.10															
102.4	END OF BOREHOLE		8	SS	50/0.10															
6.2	NOTES:  1. Groundwater level measured in borehole at a depth of 2.3 m below ground surface (Elev. 106.3 m) upon completion of drilling.  2. Borehole open upon completion of drilling.																			

PROJECT		1530382		RECORD OF BOREHOLE No 21-39		SHEET 1 OF 1		METRIC													
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828860.8; E 299321.2 MTM NAD 83 ZONE 10 (LAT. 43.599671; LONG. -79.567865)		ORIGINATED BY KN													
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75 truck, 200 mm OD Hollow Stem Augers (Auto Hammer)		COMPILED BY ML/KN													
DATUM		Geodetic		DATE		June 24, 2021		CHECKED BY													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV	DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>	γ	GR	SA	SI	CL
108.1	0.0	GROUND SURFACE																			
	0.0	ASPHALT (130 mm)																			
	0.1	Granular (FILL) (480 mm)																			
107.5	0.6	SILTY SAND (SM), trace gravel Compact to very dense Brown Moist		1	SS	12															
				2	SS	15															
				3	SS	25															
		- Wet below a depth of about 2.3 m (Elev. 105.8 m)		4A	SS	55															
104.6	3.7	SANDY CLAYEY GRAVEL (GC) (RESIDUAL SOIL), contains shale fragments Hard Wet		5	SS	80/0.10															
103.8	4.3	Inferred highly weathered to fresh SHALE (BEDROCK)		6	SS	100/0.13															
		Grey Inferred moderately weathered to fresh SHALE (BEDROCK) Grey		7	SS	100/0.08															
101.9	6.2	END OF BOREHOLE																			
NOTES: 1. Groundwater level measured in borehole at a depth of 5.8 m below ground surface (Elev. 102.3 m) upon completion of drilling. 2. Borehole caved to a depth of 5.2 m below ground surface (Elev. 102.9 m) upon removal of augers.																					

PROJECT 1530382		RECORD OF BOREHOLE No 21-40		SHEET 1 OF 1		METRIC												
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828964.3; E 299405.2 MTM NAD 83 ZONE 10 (LAT. 43.600603; LONG. -79.566825)		ORIGINATED BY KN														
DIST Central HWY QEW		BOREHOLE TYPE CME 75 truck, 200 mm OD Hollow Stem Augers		COMPILED BY ML/KN														
DATUM Geodetic		DATE June 24, 2021		CHECKED BY														
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)					
107.6	GROUND SURFACE							20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					W <sub>p</sub> W W <sub>L</sub> 10 20 30			GR SA SI CL		
0.0	ASPHALT (130 mm)																	
	Granular (FILL) (150 mm)																	
0.3	SILTY SAND (SM), trace gravel, contains clayey silt layers (25 mm) Very loose to loose Brown Moist		1	SS	7		107											
	- Wet below a depth of about 2.1 m (Elev. 105.5 m)		2	SS	4		106						○			1 66 27 6		
			3	SS	WH		105						○					
104.3	CLAYEY SILT (CL), some sand, trace gravel (TILL) Stiff to very stiff Brown to grey Moist		4A	SS	12		104						○			3 18 46 33		
3.4			4B										e					
			5	SS	17													
103.2	Inferred moderately weathered SHALE (BEDROCK) Grey		6	SS	100/0.13		103											
4.4							102											
101.4	END OF BOREHOLE		7	SS	100/0.07													
6.2	NOTES:  1. Groundwater level measured in borehole at a depth of 5.7 m below ground surface (Elev. 101.9 m) upon completion of drilling.  2. Borehole caved to a depth of 5.2 m below ground surface (Elev. 102.4 m) upon removal of augers.																	

PROJECT <u>1530382</u>		<b>RECORD OF BOREHOLE No 21-41</b>		SHEET 1 OF 1		<b>METRIC</b>	
G.W.P. <u>2102-13-00; 2432-13-00</u>		LOCATION <u>N 4829065.5; E 299507.2 MTM NAD 83 ZONE 10 (LAT. 43.601515; LONG. -79.565562)</u>		ORIGINATED BY <u>ML/KN</u>			
DIST <u>Central</u> HWY <u>QEW</u>		BOREHOLE TYPE <u>CME 75 truck, 200 mm OD Hollow Stem Augers (Auto Hammer)</u>		COMPILED BY <u>ML/KN</u>			
DATUM <u>Geodetic</u>		DATE <u>July 28, 2021</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								20   40   60   80   100	20   40   60   80   100	W <sub>p</sub>	W	W <sub>L</sub>					
						○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × REMOULDED											
107.5	GROUND SURFACE					▽	107							0   88   10   2			
0.0	ASPHALT (100 mm)		1	AS													
0.1	SILTY SAND (SM), trace gravel (FILL)																
107.0	Brown Moist																
0.5	SAND (SP-SM), some fines some fines Loose to compact Brown Moist		2	SS	9												
			3	SS	18						○						
105.3	Gravelly SILTY SAND (SM) Compact Brown Wet to moist		4	SS	20		105						37   50   11   2				
104.2	CLAYEY SAND (SC), some gravel (TILL) Compact Grey Moist		5A	SS	16		104			○							
3.3			5B						○	—	—						
			6	SS	22								16   43   30   11				
	- Grinding at a depth of 4.4 m (Elev.103.1 m)						103										
			7	SS	29					○	—	—					
102.3	Inferred slightly weathered SHALE Grey		8	SS	50/0.05												
5.3	END OF BOREHOLE																
NOTES:  1. Groundwater level measured in borehole at a depth of 2.4 m below ground surface (Elev. 105.1 m) upon completion of drilling.  2. Borehole open upon completion of drilling.																	

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE\02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT		1530382		RECORD OF BOREHOLE		No 21-42		SHEET 1 OF 1		METRIC							
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4829134.8; E 299617.8 MTM NAD 83 ZONE 10 (LAT. 43.602139; LONG. -79.564193)		ORIGINATED BY		KN							
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75 truck, 200 mm OD Hollow Stem Augers (Auto Hammer)		COMPILED BY		ML/KN							
DATUM		Geodetic		DATE		June 24, 2021		CHECKED BY									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
107.6	GROUND SURFACE																
0.0	ASPHALT (130 mm)																
	Granular (FILL) (130 mm)																
0.3	SILTY SAND (SM), trace gravel Very loose to dense Brown to grey Moist to wet at 3.1 m		1	AS	-												
			2	SS	6												
			3	SS	2												
	- Grey below a depth of 2.3 m below ground surface (Elev. 105.3 m)		4	SS	45												
104.4			5A														
3.2	Sandy CLAYEY SILT (CL), trace gravel (TILL) Very stiff to hard Grey Moist		5B	SS	15												
			6	SS	18												
			7	SS	100/0.20												
101.8																	
5.8	Inferred moderately weathered SHALE (BEDROCK) Grey		8	SS	80/0.10												
101.4																	
6.2	END OF BOREHOLE																
NOTES:																	
1. Groundwater level measured in borehole at a depth of 3.7 m below ground surface (Elev. 103.9 m) upon completion of drilling.																	
2. Borehole caved at a depth of 4.7 m below ground surface (Elev. 102.9 m) upon removal of augers.																	

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\INTQEQW-DIXIE.GPJ GAL-GTA.GDT 3/18/22



PROJECT		1530382		RECORD OF BOREHOLE No 21-43		SHEET 1 OF 1		METRIC									
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4829230.7; E 299687.3 MTM NAD 83 ZONE 10 (LAT. 43.603003; LONG. -79.563333)		ORIGINATED BY ML/KN									
DIST		Central HWY QEW		BOREHOLE TYPE		CME 75 truck, 200 mm OD Hollow Stem Augers (Auto Hammer)		COMPILED BY ML/KN									
DATUM		Geodetic		DATE		July 28, 2021		CHECKED BY									
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	20 40 60 80 100	W <sub>p</sub>	W	W <sub>L</sub>	γ	GR	SA	SI	CL
108.3	GROUND SURFACE																
0.0	ASPHALT (150 mm)																
0.2	SAND (SP), some gravel, trace fines (FILL) Brown Moist		1	AS			108										
107.7																	
0.6	SILTY SAND (SM) Loose to compact Brown Moist		2	SS	10		107										
			3	SS	17					o					0	83	15 2
106.0							106										
2.3	SAND (SP) and gravel Very dense Brown Moist		4A	SS	58					o							
105.6			4B														
2.7	Sandy SILT (ML), Very dense																
105.3																	
3.0	Grey Moist																
	SAND (SP-SM), trace gravel, some fines Dense to very dense Brown Moist		5A	SS	50/0.10		105			o					2	86	10 2
104.5			5B														
3.8	END OF BOREHOLE																
	NOTE: 1. Borehole open and dry upon completion of drilling.																

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE02\_DATA\INTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

<b>PROJECT</b> 1530382		<b>RECORD OF BOREHOLE No 17-1</b>		SHEET 1 OF 2	<b>METRIC</b>
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4829208.1; E 299689.8 MTM NAD 83 ZONE 10 (LAT. 43.602800; LONG. -79.563321)		ORIGINATED BY DB	
DIST Central HWY QEW		BOREHOLE TYPE 180 mm O.D. Continuous Flight Hollow Stem Augers		COMPILED BY KN	
DATUM Geodetic		DATE January 10, 2018		CHECKED BY SMM	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W <sub>p</sub>	W	W <sub>L</sub>		
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × REMOULDED	WATER CONTENT (%)					
108.5	GROUND SURFACE							20 40 60 80 100						
108.3	ASPHALT (180 mm)													
0.3	Sand and gravel (FILL) Very dense (Frozen) Light brown Moist		1	SS	50/0.07									
	Silty sand, trace clay, trace gravel to Sand, some silt, trace to some gravel, trace clay, trace organics at a depth of 1.1 m, trace clay pockets (FILL) Very loose to compact Brown Moist		2	SS	16									
			3	SS	6									
			4A	SS	3								11 69 17 3	
			4B											
105.5														
3.0	Silty SAND, trace organics Dark brown Very loose Moist		5A											
105.2			5B	SS	3									
3.3			5C										3 69 25 3	
	Silty SAND, trace gravel, trace pockets of clayey silt Very loose Brown Moist		5D											
104.8														
3.7			6	SS	22								42 45 11 2	
	SAND and GRAVEL, trace to some silt, trace clay Compact Brown Wet													
104.0														
4.5			7	SS	25								5 35 44 16	
	CLAYEY SILT, with SAND, trace to some gravel, trace shale fragments (TILL) Very stiff to hard Grey Moist		8	SS	39									
			9	SS	33									
101.3														
7.2	CLAYEY SILT with SAND and GRAVEL (shale fragments) (RESIDUAL SOIL) Hard Grey Moist													
100.6			10	SS	50/0.10								30 31 32 7	
7.9														

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE\GPJ GAL-GTA.GDT 2/2/22

PROJECT <u>1530382</u>	<b>RECORD OF BOREHOLE No 17-1</b>	SHEET 2 OF 2	<b>METRIC</b>
G.W.P. <u>2102-13-00; 2432-13-00</u>	LOCATION <u>N 4829208.1; E 299689.8 MTM NAD 83 ZONE 10 (LAT. 43.602800; LONG. -79.563321)</u>	ORIGINATED BY <u>DB</u>	
DIST <u>Central</u> HWY <u>QEW</u>	BOREHOLE TYPE <u>180 mm O.D. Continuous Flight Hollow Stem Augers</u>	COMPILED BY <u>KN</u>	
DATUM <u>Geodetic</u>	DATE <u>January 10, 2018</u>	CHECKED BY <u>SMM</u>	

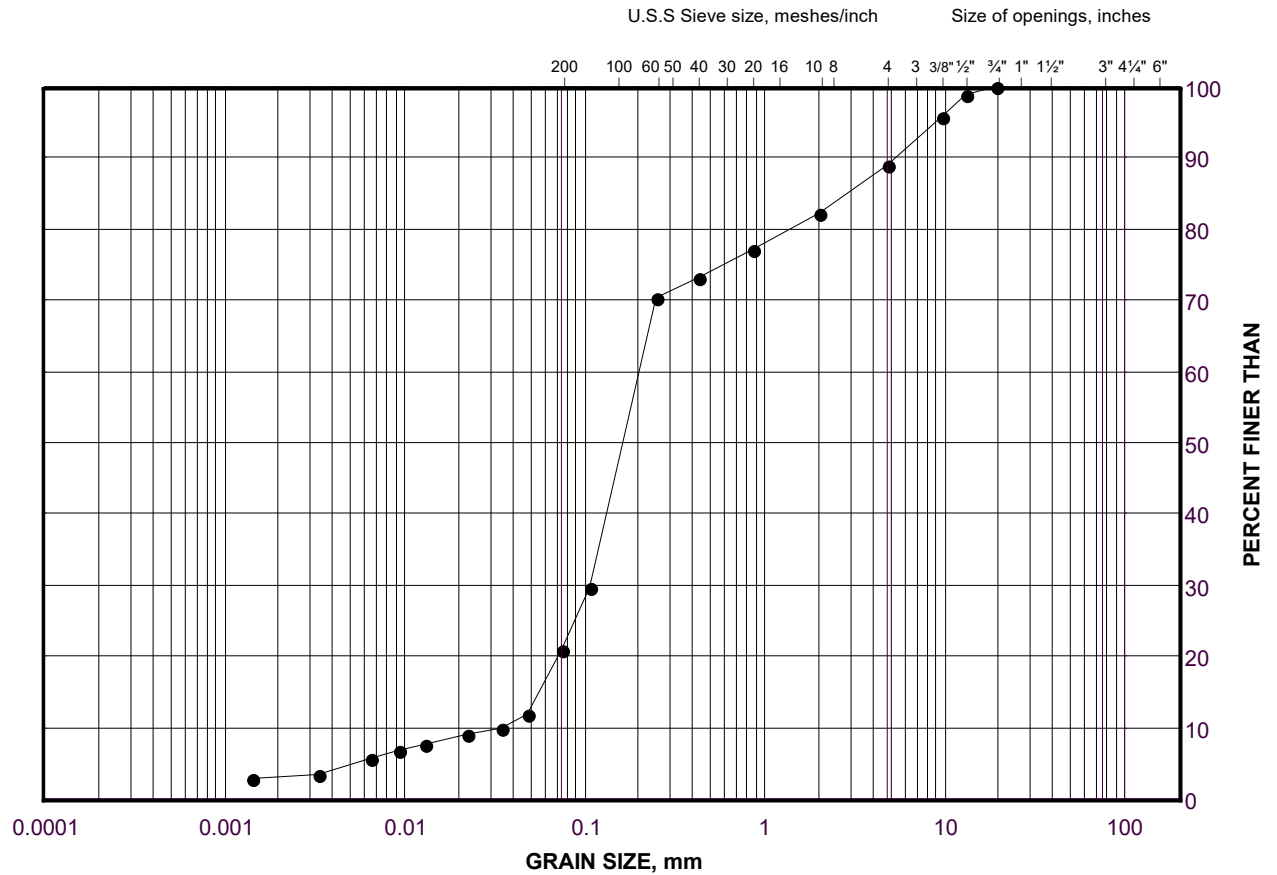
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	w <sub>p</sub>	w	w <sub>L</sub>		GR	SA	SI	CL
	<div>— CONTINUED FROM PREVIOUS PAGE —</div> <div>SPLIT SPOON REFUSAL END OF BOREHOLE</div> <div>NOTES:</div> <div>1. Water level measured at a depth of 4.0 m below ground surface (Elev. 104.4 m) upon completion of drilling.</div> <div>2. Water level in standpipe piezometer measured at depths of:</div> <div><div>Date</div><div>Depth (m)</div><div>Elev. (m)</div><div>Mar 16/183.9104.5</div><div>Mar 28/183.9104.5</div><div>Apr 02/183.9104.5</div></div>																			

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/2/22

# GRAIN SIZE DISTRIBUTION

Silty Sand Fill

FIGURE E1



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
•	17-1	4A	106

Project Number: 1530382

Checked By: LCC

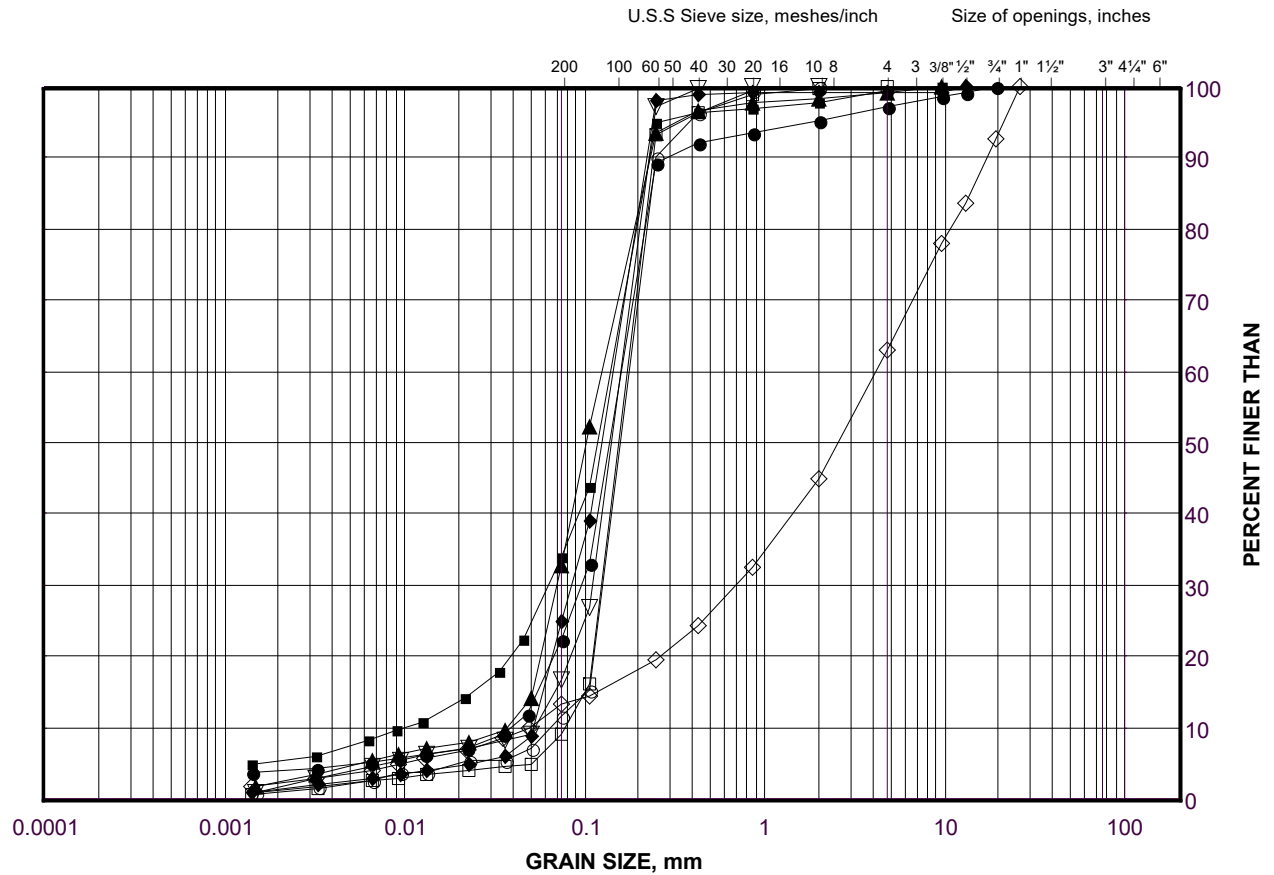
**Golder Associates**

Date: 07-Feb-22

# GRAIN SIZE DISTRIBUTION

Sandy Silt to Sand and Gravel

FIGURE E2A



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-42	2	106.5
■	21-40	2	105.8
◆	21-39	3	105.5
▲	21-38	1	107.5
▽	21-43	3	106.4
○	21-41	3	105.6
□	21-38	4	105.3
△	21-41	5A	104.3

Project Number: 1530382

Checked By: LCC

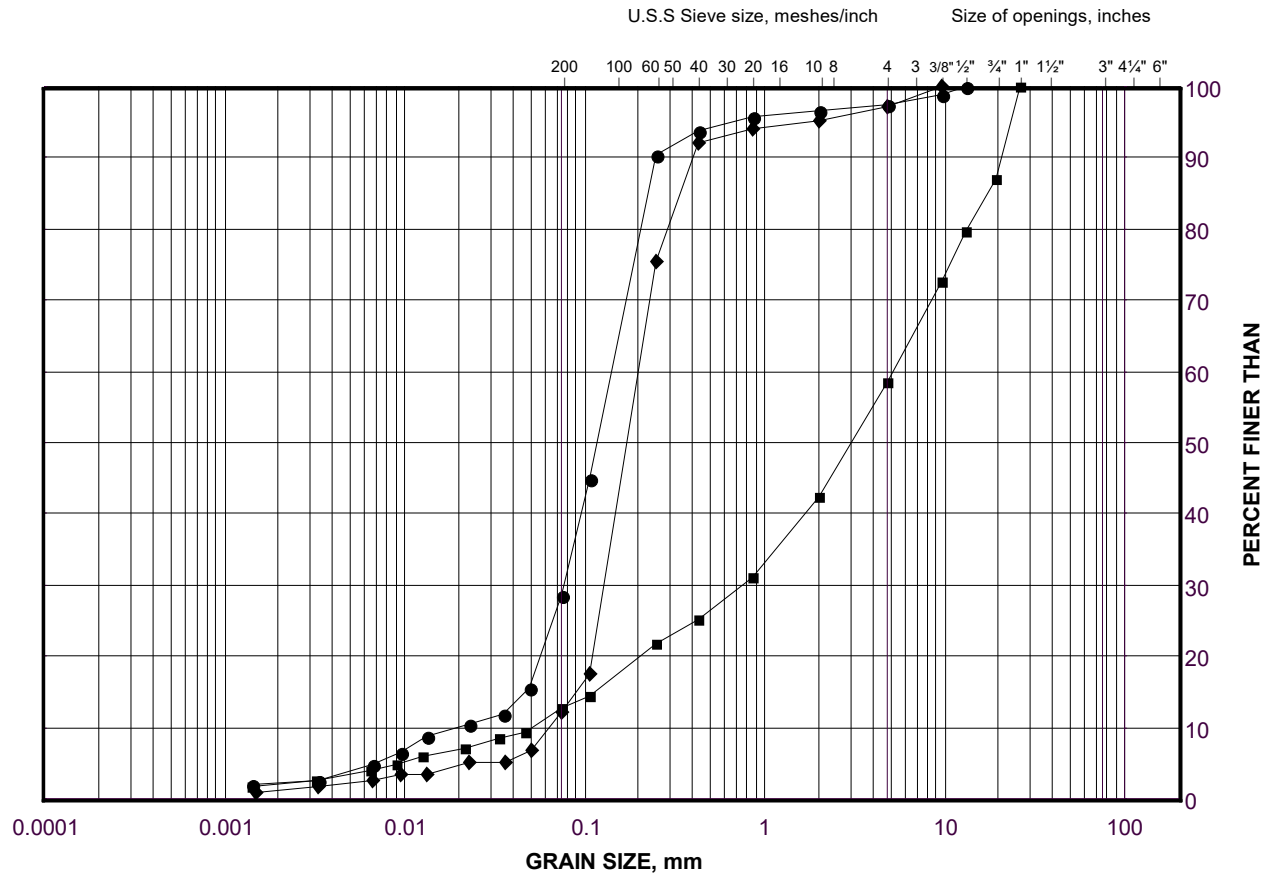
**Golder Associates**

Date: 08-Feb-22

# GRAIN SIZE DISTRIBUTION

Sandy Silt to Sand and Gravel

FIGURE E2B



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	17-1	5C	105.0
■	17-1	6	104.4
◆	21-43	5A	104.9

Project Number: 1530382

Checked By: LCC

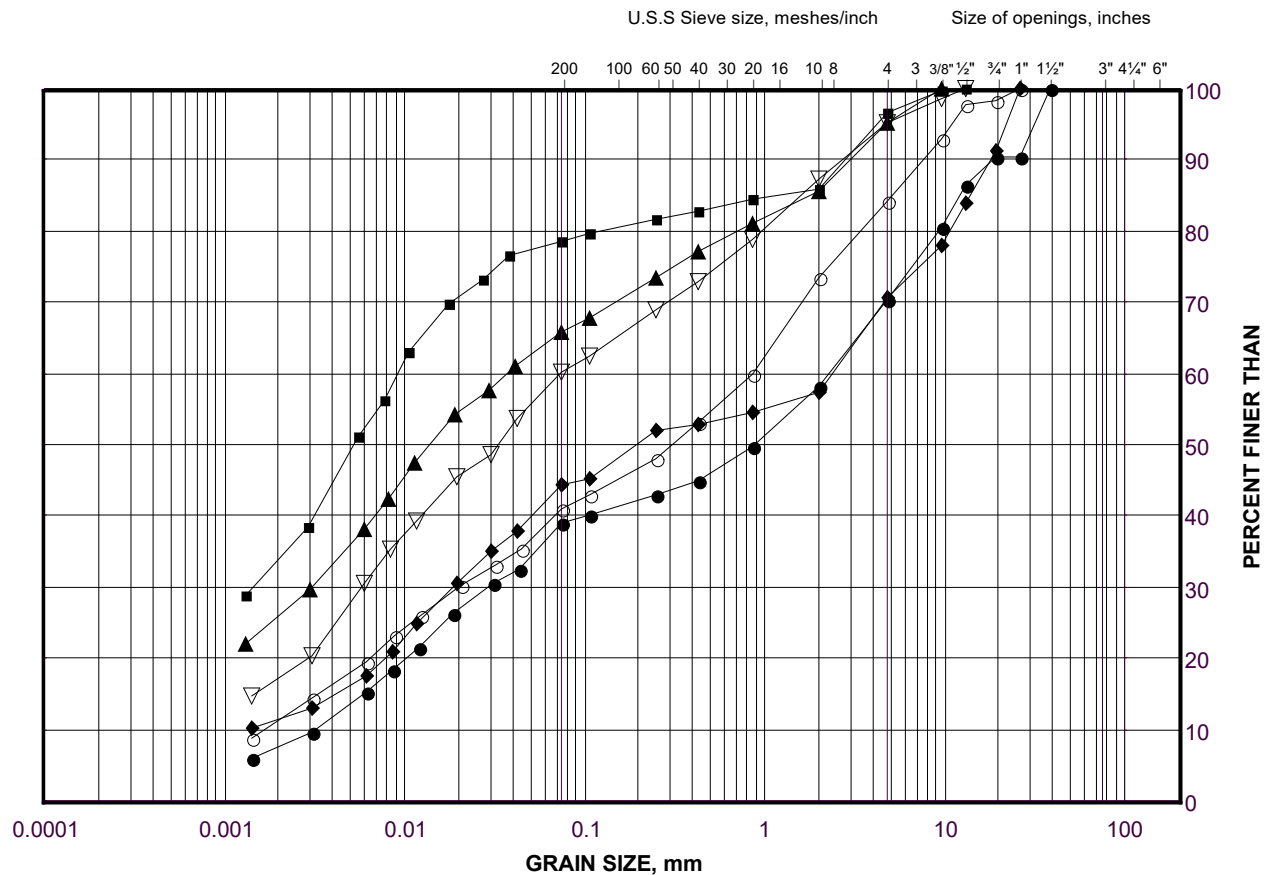
**Golder Associates**

Date: 08-Feb-22

# GRAIN SIZE DISTRIBUTION

Cohesive Soil Complex (Clayey Silt to Clayey  
Sand Till, and Clayey Silt to Clayey Gravel Residual Soil)

FIGURE E3



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

## LEGEND

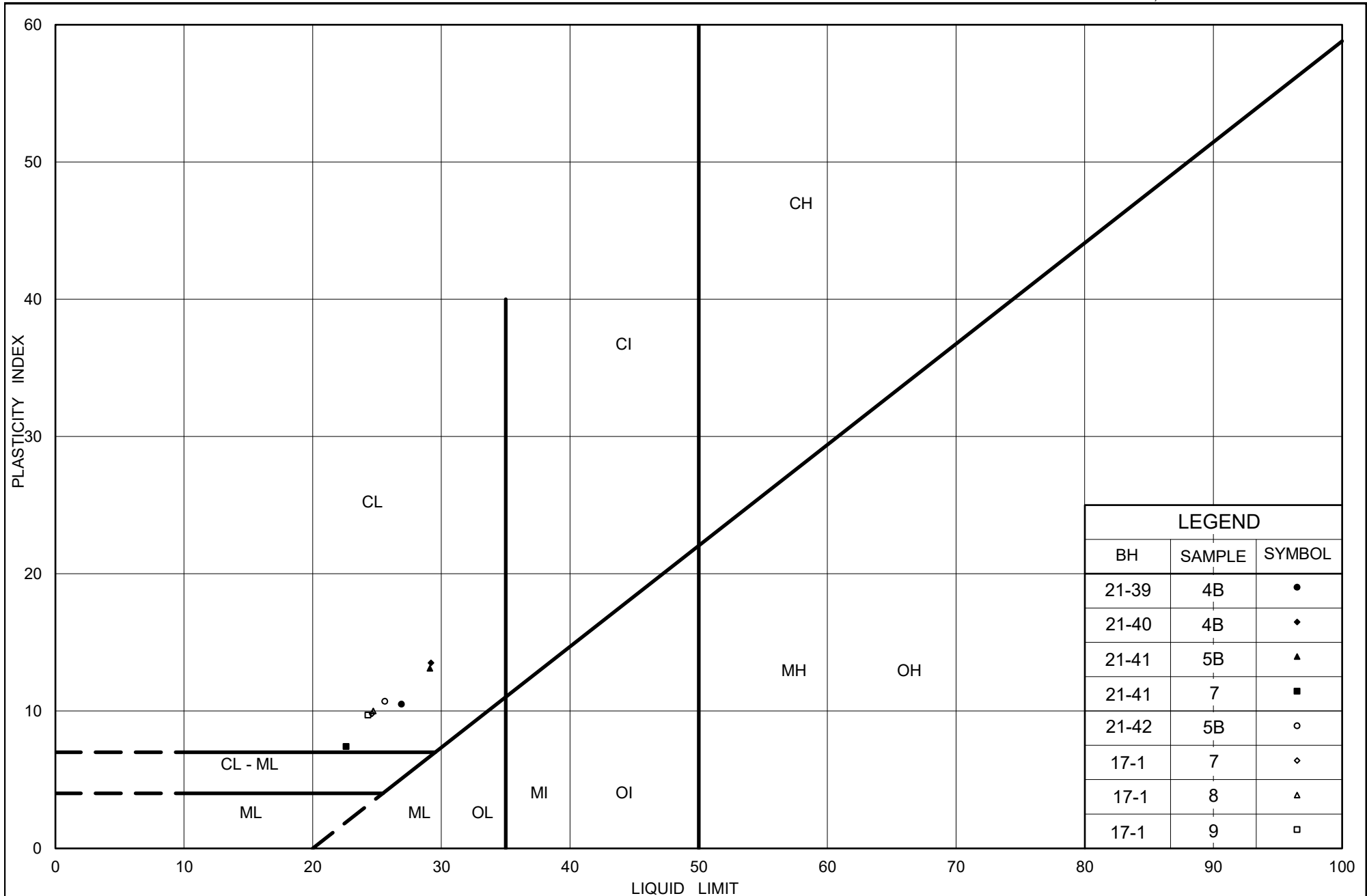
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	17-1	10	100.7
■	21-40	4B	104.1
◆	21-39	4B	104.6
▲	21-42	5B	104.0
▽	17-1	7	103.6
○	21-41	7	102.6

Project Number: 1530382

Checked By: LCC

**Golder Associates**

Date: 07-Feb-22



Ministry of Transportation

Ontario

## PLASTICITY CHART

Cohesive Soil Complex (Clayey Silt to Clayey Sand Till, and  
Clayey Silt to Clayey Gravel Residual Soil)

Figure No. E4

Project No. 1530382

Checked By: LCC



**APPENDIX F**

**Dixie Road and South Service Road to  
East of Liveoak Drive –  
Borehole Records and  
Geotechnical Laboratory Test Results**

PROJECT 1530382		RECORD OF BOREHOLE No 21-29				SHEET 1 OF 1		METRIC												
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828449.9; E 299399.6 MTM NAD 83 ZONE 10 (LAT. 43.595972; LONG. -79.566890)				ORIGINATED BY AM														
DIST Central HWY QEWS		BOREHOLE TYPE CME 75, 185 mm O.D., Hollow Stem Augers (Auto Hammer)				COMPILED BY KN														
DATUM Geodetic		DATE April 21, 2021				CHECKED BY KN														
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)									
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	W <sub>p</sub> W W <sub>L</sub>			20 40 60 80 100	10 20 30							
105.0	GROUND SURFACE																			
0.0	TOPSOIL (250 mm)																			
104.8																				
0.3	SILTY SAND (SM) Very loose to compact Brown Moist to wet		1	SS	4															
			2	SS	9															
	- Wet below a depth of 1.6 m (Elev. 103.4 m)		3	SS	26															
102.8																				
2.2	CLAYEY SILT (CL), some sand, trace gravel Very stiff		4	SS	24															
102.4																				
2.6	SHALE (BEDROCK) Grey		1	RC	REC 10%															
	Bedrock cored from depths of 2.6 m to 5.31 m (Elev. 102.4 m to 99.7 m).  For bedrock coring details refer to Record of Drillhole 21-29.		2	RC	REC 97%															
			3	RC	REC 90%															
99.7																				
5.3	END OF BOREHOLE																			
NOTES: 1. Groundwater level measured at a depth of approximately 2.0 m below ground surface (Elev. 103.0 m) prior to rock coring. 2. Groundwater level measurements in piezometer: <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Date</th> <th>Depth (m)</th> <th>Elev. (m)</th> </tr> </thead> <tbody> <tr> <td>04-21-21</td> <td>1.2</td> <td>103.8</td> </tr> <tr> <td>07-08-21</td> <td>2.2</td> <td>102.8</td> </tr> </tbody> </table>												Date	Depth (m)	Elev. (m)	04-21-21	1.2	103.8	07-08-21	2.2	102.8
Date	Depth (m)	Elev. (m)																		
04-21-21	1.2	103.8																		
07-08-21	2.2	102.8																		

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\GINTQEQW-DIXIE.GPJ GAL-GTA.GDT 2/4/22

SHEET 1 OF 1

DATUM: Geodetic

DRILLING CONTRACTOR: Davis Drilling Ltd.

LOGGED: AM  
CHECKED: KN

PROJECT 1530382		RECORD OF BOREHOLE No 21-30		SHEET 1 OF 1		METRIC											
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828504.8; E 299394.1 MTM NAD 83 ZONE 10 (LAT. 43.596467; LONG. -79.566958)		ORIGINATED BY AM													
DIST Central HWY QEW		BOREHOLE TYPE CME 75. 185 mm O.D., Hollow Stem Augers (Auto Hammer)		COMPILED BY KN													
DATUM Geodetic		DATE April 21, 2021		CHECKED BY KN													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%) W <sub>p</sub> W W <sub>L</sub>			γ	GR SA SI CL
105.6	GROUND SURFACE							20 40 60 80 100									
0.0	TOPSOIL (350 mm)																
105.3			1	SS	5		105										
0.4	SAND (SP), trace silt Loose to compact Brown Moist		2	SS	19												
104.2							104										
1.5	Gravelly SILTY SAND (SM) to Gravelly SAND (SW), trace to some silt Compact to very dense Brown Moist		3	SS	32												
	- Wet below a depth of 2.3 m (Elev. 103.3 m)		4	SS	14		103									29 59 9 3	
102.4			5A 5B	SS	50/0.1											21 58 15 6	
3.3	Inferred completely weathered SHALE (BEDROCK) Grey SHALE (BEDROCK)  Bedrock cored from depths of 3.3 m to 5.5 m (Elev. 102.3 m to 100.1 m).  For bedrock coring details refer to Record of Drillhole 21-30.		1	RC	REC 82%		102									RQD = 46%	
			2	RC	REC 100%		101									RQD = 84%	
100.1																	
5.5	END OF BOREHOLE  NOTE:  1. Groundwater level measured at a depth of approximately 2.3 m below ground surface (Elev. 103.3 m) prior to rock coring.																

PROJECT: 1530382

## RECORD OF DRILLHOLE: 21-30

SHEET 1 OF 1

LOCATION: N 4828504.8 ;E 299394.1

DRILLING DATE: April 21, 2021

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 75 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD		DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage PL - Planar CU- Curved UN- Undulating ST - Stepped IR - Irregular PO- Polished K - Slickensided SM- Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock  NOTE: For additional abbreviations refer to list of abbreviations & symbols.																FEATURES	R0/R1 ZONES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
							RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA				ROCK STRENGTH INDEX		WEATH- ERING INDEX																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
							TOTAL CORE %	SOLID CORE %			B Angle °	DIP w.r.t CORE AXIS °	TYPE AND SURFACE DESCRIPTION	Jr	Ja	R4	R3	R2	R1	W1	W2	W3			W4	W5	W6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		Continued from Record of Borehole BH21-30		102.31																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50

LOGGED: AM

CHECKED: KN

PROJECT		1530382		RECORD OF BOREHOLE No 21-31		SHEET 1 OF 1		METRIC						
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828580.5; E 299337.1 MTM NAD 83 ZONE 10 (LAT. 43.597147; LONG. -79.567665)		ORIGINATED BY ML/KN						
DIST		Central HWY QEW		BOREHOLE TYPE		CME 55 track, 190 mm OD Hollow Stem Augers (Auto Hammer)		COMPILED BY ML/KN						
DATUM		Geodetic		DATE		August 10, 2021		CHECKED BY						
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
106.0	GROUND SURFACE													
0.0	SAND (SP/GP) and gravel, trace fines (FILL)		1A	SS	46									
105.6	Dense Light brown Dry		1B											
105.3	SILTY SAND (SM) (FILL)													
0.7	Dense Brown Dry		2	SS	6									
	SILT (ML/SM) and sand Loose to dense Brown to grey Moist													
			3	SS	18									
103.3	SAND (SP/GP) and gravel Dense Grey Wet		4A	SS	32									
2.8			4B											
102.8			4C											
	CLAYEY SILT (CL), trace gravel, trace sand (TILL) Hard Grey Moist		5A	SS	50/0.13									
3.3			5B											
	Inferred slightly weathered SHALE (BEDROCK) Grey													
	SHALE (BEDROCK) Grey		1	RC	REC 78%									
	Bedrock cored from depths of 3.3 m to 6.3 m (Elev. 102.7 m to 99.3 m).													
	For bedrock coring details refer to Record of Drillhole 21-31.													
			2	RC	REC 92%									
99.4														
6.6	END OF BOREHOLE													
	NOTE:													
	1. Borehole open and dry prior to bedrock coring.													

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\INTQEQW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

SHEET 1 OF 1

DATUM: Geodetic

DRILLING CONTRACTOR: Davis Drilling Ltd.

[illegible]

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



LOGGED: ML/KN

CHECKED: DH

GTA-RCK 054 S:\CLIENTS\IMTO\QEW-DIXIE\02 DATA\GINT\QEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

PROJECT		2102-13-00; 2432-13-00		LOCATION		N 4828730.9; E 299427.8 MTM NAD 83 ZONE 10 (LAT. 43.598502; LONG. -79.566543)		SHEET 1 OF 1		METRIC							
G.W.P.		2102-13-00; 2432-13-00		DIST		Central HWY QE		BOREHOLE TYPE		CME 75 truck, 190 mm OD Hollow Stem Augers (Auto Hammer)							
DATE		Geodetic		DATE		June 15, 2021		COMPILED BY		ML/KN							
CHECKED BY																	
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
106.6	GROUND SURFACE																
0.0	ASPHALT (130 mm)																
0.1	SILTY SAND (SM), some gravel (FILL) Compact Brown Moist		1A	SS	20										Non-plastic	18 64 12 6	
105.9	SILTY SAND (SM), trace gravel Loose to very dense Brown Moist		2	SS	10											1 83 13 3	
0.7																	
			3	SS	22												
			4	SS	72												
	- Gravelly below a depth of about 3.0 m (Elev. 103.6 m) - Wet below a depth of 3.1 m (Elev. 103.5 m)		5A	SS	33											36 51 10 3	
103.0			5B														
102.8	CLAYEY SILT-SILT (CL-ML) (RESIDUAL SOIL), contains shale fragments																
3.8	Hard Grey Moist		6	SS	100/0.1												
102.5	Inferred highly weathered SHALE Grey		1	RC	REC 43%											RQD = 0%	
4.1	SHALE (BEDROCK) Grey																
	Bedrock cored from depths of 4.1 m to 6.4 m (Elev. 102.5 m to 100.2 m).																
	For bedrock coring details refer to Record of Drillhole 21-33.		2	RC	REC 95%											RQD = 74%	
100.2	END OF BOREHOLE																
6.4	NOTES: 1. Groundwater level measured in borehole at a depth of 3.1 m (Elev. 103.5 m) prior to bedrock coring. 2. Borehole caved to a depth of 3.35 m (Elev. 103.3 m) prior to coring. 3. Groundwater level measurements in peizometer: Date      Depth (m)      Elev. (m) 15-06-21      3.0      103.6																



PROJECT: 1530382

## RECORD OF DRILLHOLE: 21-33

SHEET 1 OF 1

LOCATION: N 4828730.9 ;E 299427.8

DRILLING DATE: June 13, 2021

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 75 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.															FEATURES	R0/R1 ZONES				
						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	B Angle °	DIP w.r.t CORE AXIS °	TYPE AND SURFACE DESCRIPTION	Jr	Ja	ROCK STRENGTH INDEX			WEATH- ERING INDEX								
						TOTAL CORE %	SOLID CORE %								R4	R3	R2	R1	W1	W2			W3	W4	W5	W6
5  6  7  8  9  10  11  12  13	HQ3 Core Rotary Drilling	Continued from Record of Borehole BH21-33		102.49																						
		Slightly weathered, thinly laminated, grey, fine grained, non-porous, weak SHALE (Georgian Bay Formation) with strong to very strong LIMESTONE/SILTSTONE interbeds.		4.11	1																					
				2																						
		100.20																								
END OF DRILLHOLE			6.40																							

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



LOGGED: AM

CHECKED: AK

GTA-RCK 054 S:\CLIENTS\MTQ\QEW-DIXIE\02 DATA\GINTQEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

PROJECT 1530382-7000		<b>RECORD OF BOREHOLE No 21-37</b>		SHEET 1 OF 2	<b>METRIC</b>
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828560.0; E 299365.4 MTM NAD 83 ZONE 10 (LAT. 43.596964; LONG. -79.567315)		ORIGINATED BY LM	
DIST Central HWY QEW		BOREHOLE TYPE CME 55, 150 mm O.D. Hollow Stem Augers (Auto Hammer)		COMPILED BY KN	
DATUM Geodetic		DATE February 2, 2021		CHECKED BY KCP	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × REMOULDED					
105.4 0.0	GROUND SURFACE TOPSOIL		1	SS	8									
104.8 0.6	SAND (SM) some silt, contains silty clay pockets Compact Brown Moist		2	SS	11									
			3	SS	22									0 86 13 1
	- Wet below 2.3 m		4	SS	29									
102.5 2.9	- Grey below 2.7 m													
102.1 3.3	Sandy CLAYEY SILT (CL), some gravel (TILL) Hard Grey Inferred moderately weathered, grey SHALE		5	SS	50/0.10									14 20 38 28
			6	SS	50/0.23									
101.1 4.3	Inferred slightly weathered to fresh, grey SHALE		7	SS	50/0.10									
			8	SS	50/0.10									
99.2 6.2	Grey SHALE (BEDROCK)  Bedrock cored from depths of 6.2 m to 11.3 m (between Elev. 99.2 m and 94.1 m).  For bedrock coring details refer to Record of Drillhole BH21-37.		1	RC	REC 41%									RQD = 0%
			2	RC	REC 100%									RQD = 75%
			3	RC	REC 100%									RQD = 91%
			4	RC	REC 100%									RQD = 93%

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTQEW-DIXIE\02\_DATA\INTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT <u>1530382-7000</u>		<b>RECORD OF BOREHOLE No 21-37</b>		SHEET 2 OF 2		<b>METRIC</b>	
G.W.P. <u>2102-13-00; 2432-13-00</u>		LOCATION <u>N 4828560.0; E 299365.4 MTM NAD 83 ZONE 10 (LAT. 43.596964; LONG. -79.567315)</u>		ORIGINATED BY <u>LM</u>			
DIST <u>Central</u> HWY <u>QEW</u>		BOREHOLE TYPE <u>CME 55, 150 mm O.D. Hollow Stem Augers (Auto Hammer)</u>		COMPILED BY <u>KN</u>			
DATUM <u>Geodetic</u>		DATE <u>February 2, 2021</u>		CHECKED BY <u>KCP</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			LIQUID LIMIT	UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)					GR	SA	SI	CL
								○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×	REMOULDED	W <sub>p</sub>	W			W <sub>L</sub>			
	— CONTINUED FROM PREVIOUS PAGE —						20	40	60	80	100										
	Grey SHALE (BEDROCK)																				
	Bedrock cored from depths of 6.2 m to 11.3 m (between Elev. 99.2 m and 94.1 m).  For bedrock coring details refer to Record of Drillhole BH21-37.		4	RC	REC 100%														RQD = 93%		
94.2																					
11.3	END OF BOREHOLE																				
	NOTES:  1. Groundwater level measured at a depth of 2.4 m below ground surface (Elev. 103.0 m) prior to rock coring.  2. Groundwater level measurements in piezometer:  Date      Depth (m)      Elev. (m) 24-02-21      1.9      103.5 10-05-21      1.9      103.5 02-07-21      2.1      103.3																				

GTA-MTO 001 S:\CLIENTS\MTQ\QEW-DIXIE\02\_DATA\GINTQEW-DIXIE.GPJ GAL-GTA.GDT 2/1/22

PROJECT: 1530382-7000

## RECORD OF DRILLHOLE: 21-37

SHEET 1 OF 1

LOCATION: N 4828560.0 ;E 299365.4

DRILLING DATE: February 2, 2021

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55 Truck Mounted

DRILLING CONTRACTOR: Davis Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Stickensided SM - Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.																		FEATURES	R0/R1 ZONES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA				ROCK STRENGTH INDEX			WEATH- ERING INDEX																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
						TOTAL CORE %	SOLID CORE %			B Angle	DIP w/L CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	R4 R3 R2 R1	W1 W2 W3 W4 W5 W6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		Continued from Record of Borehole BH21-37		99.27																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

## FEATURES LEGEND



BROKEN CORE



CLAY SEAM



LIMESTONE



LOST CORE

DEPTH SCALE

1 : 50



LOGGED: LM

CHECKED: KN

GTA-RCK 054 S:\CLIENTS\MTOW-QEW-DIXIE\02 DATA\INTQEW-DIXIE.GPJ GAL-MISS.GDT 2/1/22

<b>PROJECT</b> 1530382		<b>RECORD OF BOREHOLE No NW6-3</b>		SHEET 1 OF 1		<b>METRIC</b>	
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828635.2; E 299356.3 MTM NAD 83 ZONE 10 (LAT. 43.597632; LONG. -79.567427)		ORIGINATED BY PKS			
DIST Central HWY QEW		BOREHOLE TYPE 108 mm O.D. Continuous Flight Solid Stem Augers		COMPILED BY ACK			
DATUM Geodetic		DATE October 14, 2016		CHECKED BY SMM			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL LIMIT   MOISTURE   CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × REMOULDED	20   40   60   80   100	20   40   60   80   100	10   20   30						
107.0	GROUND SURFACE																
0.0	ASPHALT (180 mm)																
106.8																	
106.6	Sand and gravel (FILL)																
0.4	Brown Moist																
	SILT and SAND																
	Compact																
	Brown																
	Moist to wet below 2.6 m depth		1	SS	24												
			2	SS	17												
			3	SS	28												
103.9																	
3.1	Gravelly SAND, some silt, trace clay Compact Brown Wet		4	SS	26												
103.3																	
3.7	CLAYEY SILT, some sand, some gravel, shale fragments (RESIDUAL SOIL)		5	SS	100/0.15												
103.0																	
4.0	Hard Brown Wet																
	SHALE (BEDROCK)																
102.3			6	SS	100/0.13												
4.7	END OF BOREHOLE																
	NOTE:  1. Water level in open borehole at a depth of 4.4 m below ground surface (Elev. 102.6 m) upon completion of drilling.																

<b>PROJECT</b> 1530382		<b>RECORD OF BOREHOLE No NW6-4</b>		SHEET 1 OF 1		<b>METRIC</b>	
G.W.P. 2102-13-00; 2432-13-00		LOCATION N 4828676.7; E 299389.8 MTM NAD 83 ZONE 10 (LAT. 43.598005; LONG. -79.567010)		ORIGINATED BY PKS			
DIST Central HWY QEW		BOREHOLE TYPE 108 mm O.D. Continuous Flight Solid Stem Augers		COMPILED BY ACK			
DATUM Geodetic		DATE October 14, 2016		CHECKED BY SMM			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W <sub>p</sub>	W	W <sub>L</sub>		GR	SA	SI	CL	
					○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × REMOULDED					WATER CONTENT (%)											
106.8	GROUND SURFACE							20	40	60	80	100									
106.6	ASPHALT (180 mm)																				
106.4	Sand and gravel (FILL) Brown Moist																				
0.4	SAND, some silt, trace clay Compact to dense Brown Moist		1	SS	18								○					0	83	15	2
			2	SS	11																
			3	SS	42																
103.8																					
3.0	SAND and GRAVEL, some silt, trace clay Dense Brown Moist		4	SS	39								○								
103.1																					
3.7	CLAYEY SILT, trace sand, trace gravel, shale fragments (RESIDUAL SOIL) Hard Brown Moist		5	SS	140/0.28																
102.7																					
4.1	SHALE (BEDROCK)																				
102.1			6	SS	100/0.13																
4.7	END OF BOREHOLE																				
	NOTE:  1. Open borehole dry upon completion of drilling.																				

PROJECT		1530382		RECORD OF BOREHOLE No NW6-5		SHEET 1 OF 1		METRIC								
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828757.0; E 299446.5 MTM NAD 83 ZONE 10 (LAT. 43.598728; LONG. -79.566308)		ORIGINATED BY								
DIST		Central HWY QEW		BOREHOLE TYPE		108 mm O.D. Continuous Flight Solid Stem Augers		COMPILED BY								
DATUM		Geodetic		DATE		October 14, 2016		CHECKED BY								
								SMM								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
106.5	GROUND SURFACE															
0.0	ASPHALT (180 mm)															
0.2	Sand and gravel (FILL)															
106.1	Brown Moist															
0.4	SILT and SAND Compact Brown Moist															
			1	SS	14											
			2	SS	26											
104.2	SAND and GRAVEL, trace to some silt, trace clay, trace shale fragments below 3.1 m depth Very dense Grey Moist															
2.3			3	SS	54											
			4	SS	51											
102.8	CLAYEY SILT, trace sand, shale fragments (RESIDUAL SOIL) Hard Grey Wet															
3.7			5	SS	120/0.28											
102.4	SHALE (BEDROCK)															
4.1																
			6	SS	100/0.13											
101.8	END OF BOREHOLE															
4.7	NOTE: 1. Water level in open borehole at a depth of 4.1 m below ground surface (Elev. 102.4 m) upon completion of drilling.															

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTO\QEW-DIXIE\02 DATA\GINT\QEW-DIXIE.GPJ GAL-GTA.GDT 19-2-21



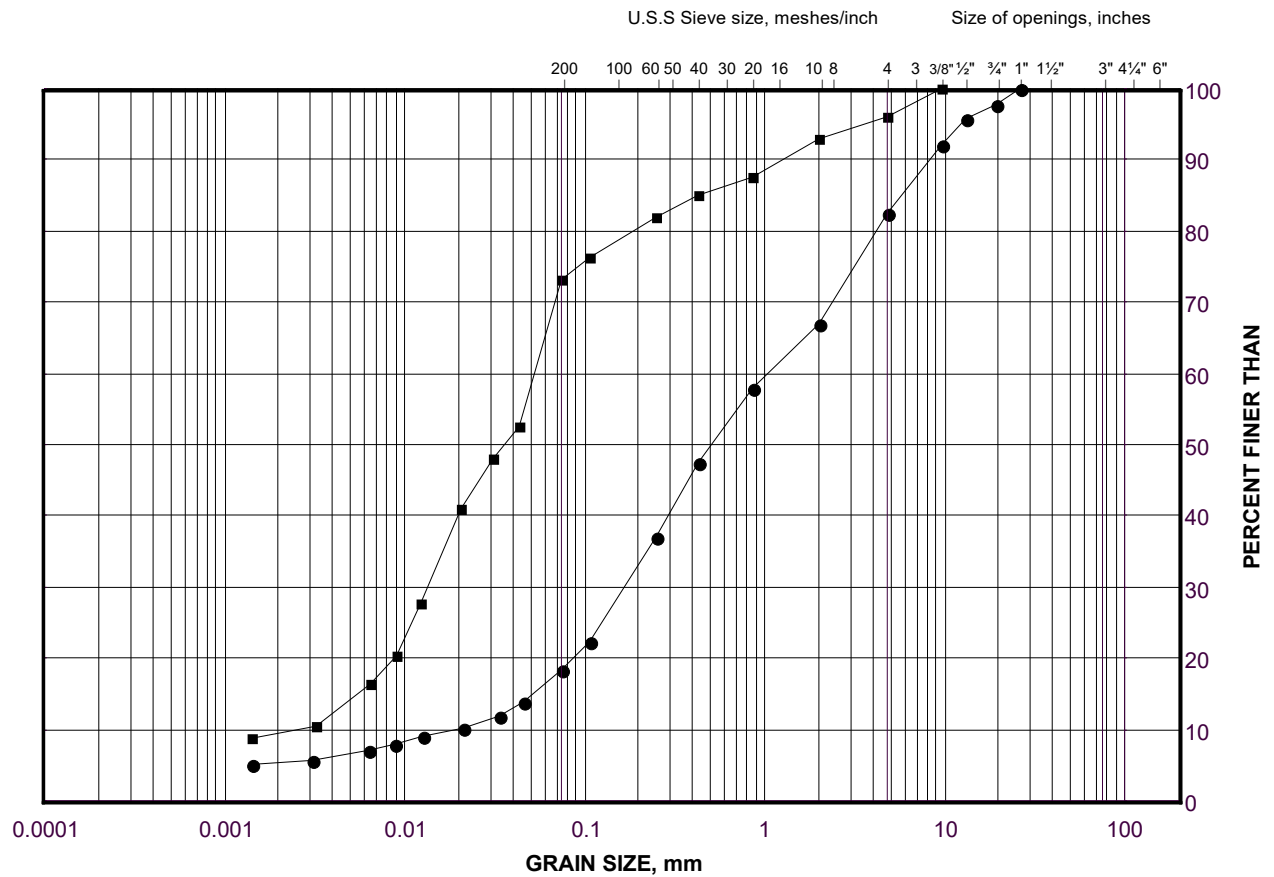
PROJECT		1530382		RECORD OF BOREHOLE No RW1-2		SHEET 1 OF 1		METRIC						
G.W.P.		2102-13-00; 2432-13-00		LOCATION		N 4828414.8; E 299411.1 MTM NAD 83 ZONE 10 (LAT. 43.595656; LONG. -79.566747)		ORIGINATED BY						
DIST		Central HWY QEW		BOREHOLE TYPE		Power Auger, 102 mm O.D. Solid Stem		COMPILED BY						
DATUM		Geodetic		DATE		November 30, 2018		CHECKED BY						
								MWK						
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
103.8	GROUND SURFACE													
0.0	ASPHALT (100 mm)													
0.1	Sand and gravel (FILL)													
103.4														
0.4	Silty sand, some gravel, trace organics from 0.7 m - 1.4 m (FILL) Loose to compact Brown with oxidation staining Moist		1	SS	7									
			2	SS	22									
101.6														
2.2	CLAYEY SILT with SAND, some gravel Hard Brown Moist		3A	SS	50/0.15									
101.2			3B	SS	50/0.15									
2.6	CLAYEY SILT, some shale fragments (RESIDUAL SOIL) Hard Grey Moist		4	SS	90/0.25									
100.7			5	SS	100/0.15									
3.3	SHALE (BEDROCK) Grey													
	END OF BOREHOLE AUGER REFUSAL													
	NOTES:  1. Water level in open borehole measured at a depth of 2.3 m (Elev. 101.5 m) on completion of drilling.													

GTA-MTO 001 S:\CLIENTS\MTQEQW-DIXIE\02\_DATA\INTQEQW-DIXIE.GPJ GAL-GTA.GDT 19-2-21

# GRAIN SIZE DISTRIBUTION

Silt to Silty Sand Fill

FIGURE F1



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-33	1A	106.4
■	RW1-1	2	101.7

Project Number: 1530382

Checked By: LCC

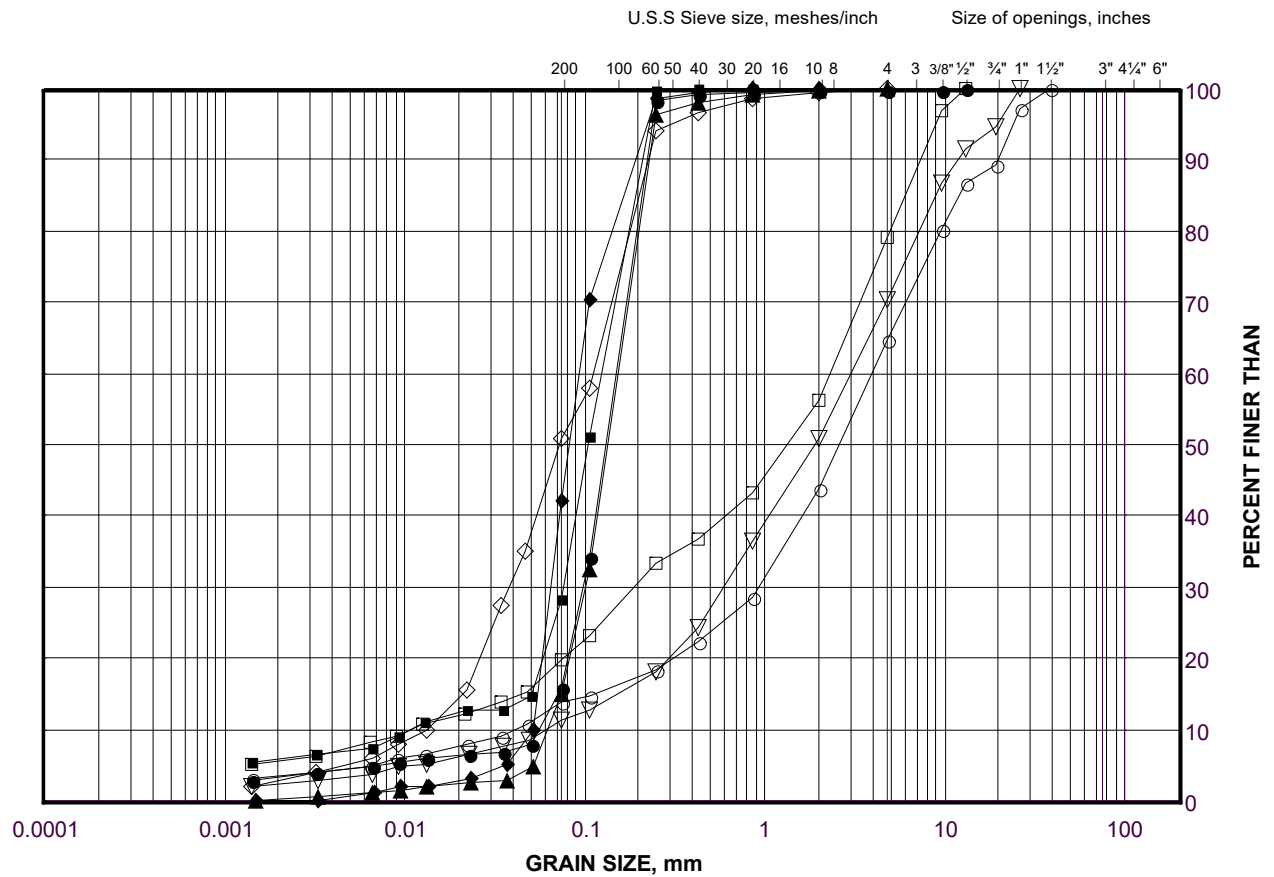
Golder Associates

Date: 09-Feb-22

# GRAIN SIZE DISTRIBUTION

Silt to Silty Sand to Sand to Sand and Gravel

FIGURE F2A



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	21-33	2	105.5
■	21-29	2	103.9
◆	NW6-3	2	105.2
▲	21-37	3	103.5
▽	21-30	4	102.9
○	21-33	5A	103.3
□	21-30	5A	102.5
△	21-31	4A	103.5

Project Number: 1530382

Checked By: LCC

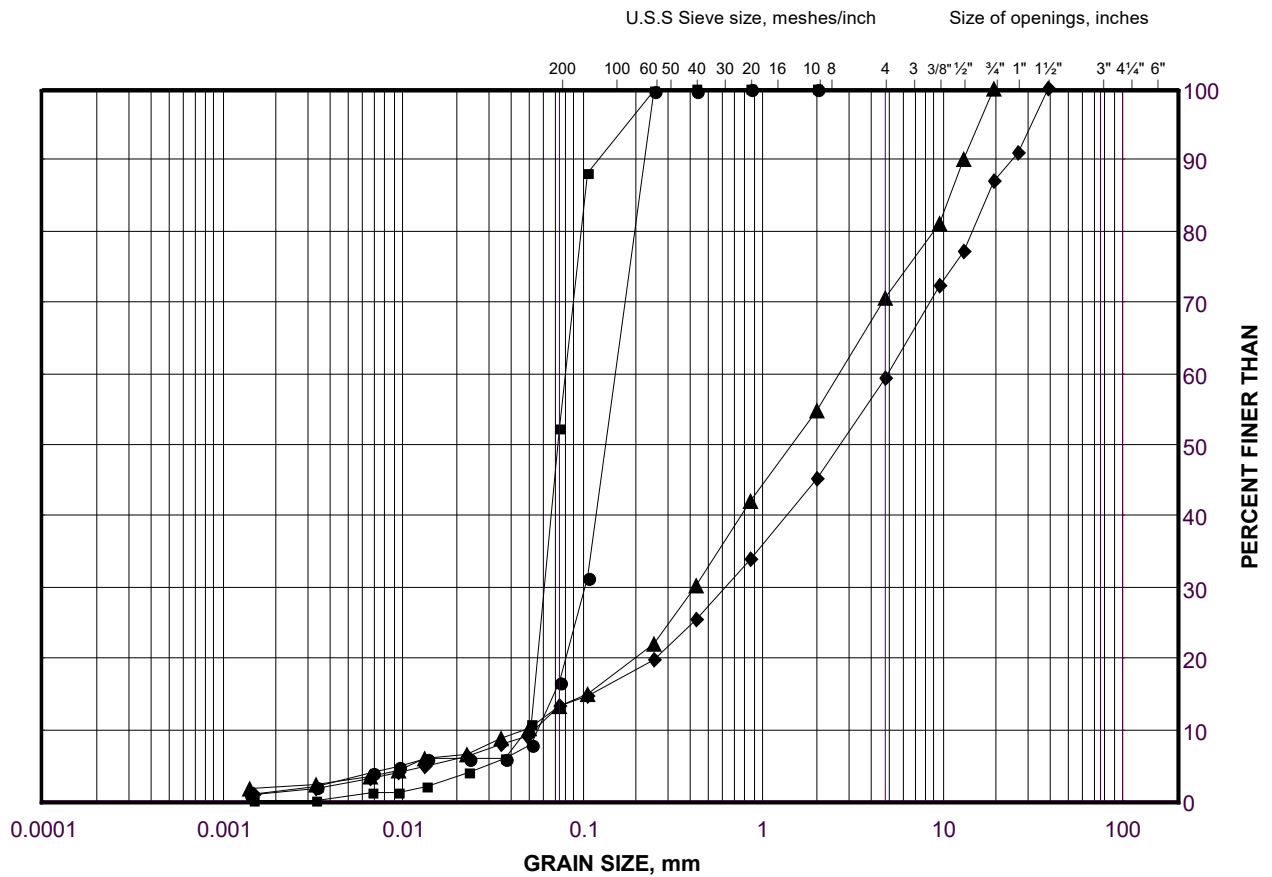
**Golder Associates**

Date: 09-Feb-22

# GRAIN SIZE DISTRIBUTION

Silt to Silty Sand to Sand to Sand and Gravel

FIGURE F2B



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

## LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	NW6-4	1	105.7
■	NW6-5	2	104.7
◆	NW6-5	4	103.2
▲	NW6-3	4	103.6

Project Number: 1530382

Checked By: LCC

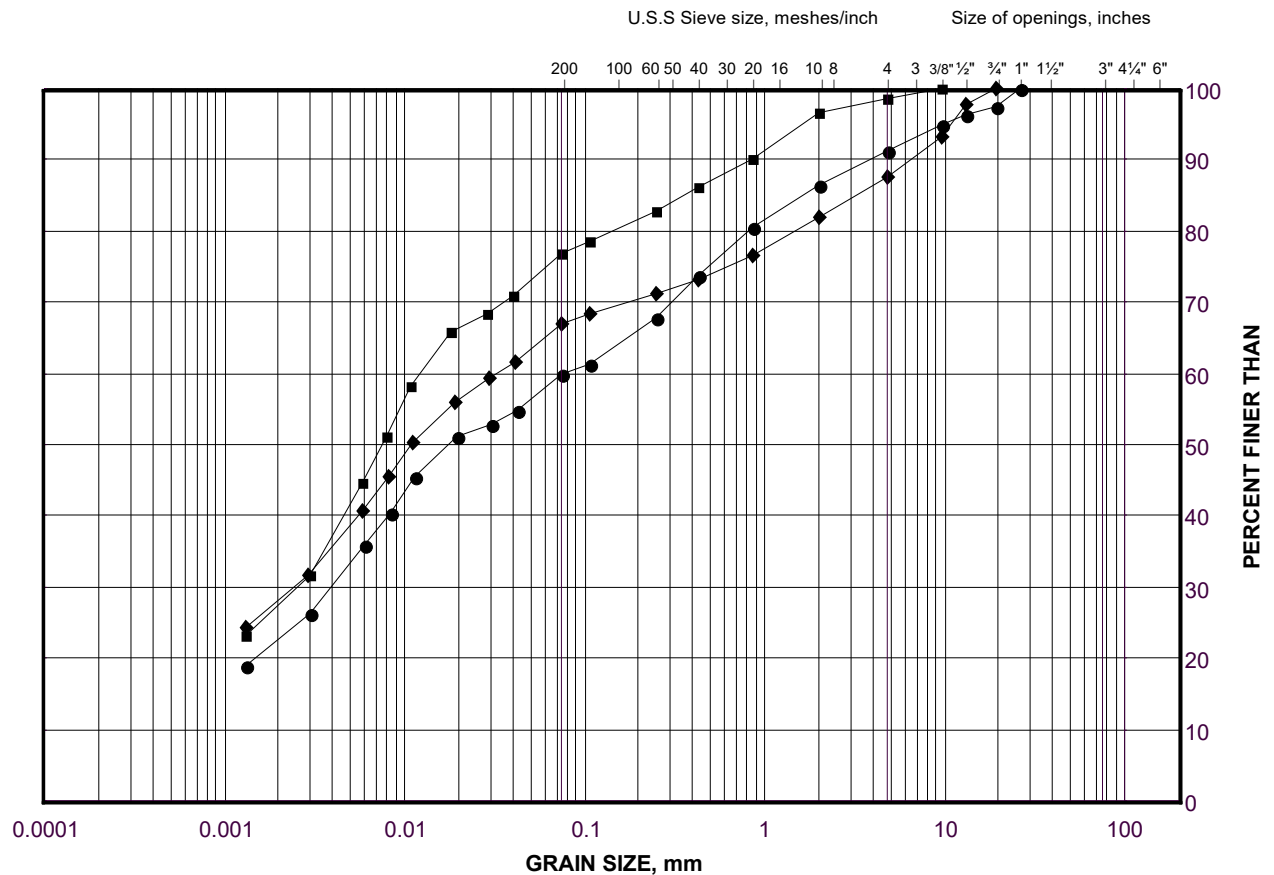
Golder Associates

Date: 09-Feb-22

# GRAIN SIZE DISTRIBUTION

Cohesive Soil Complex (Sandy Clayey Silt, and  
Sandy Clayey Silt to Clayey Silt Till)

FIGURE F3



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

## LEGEND

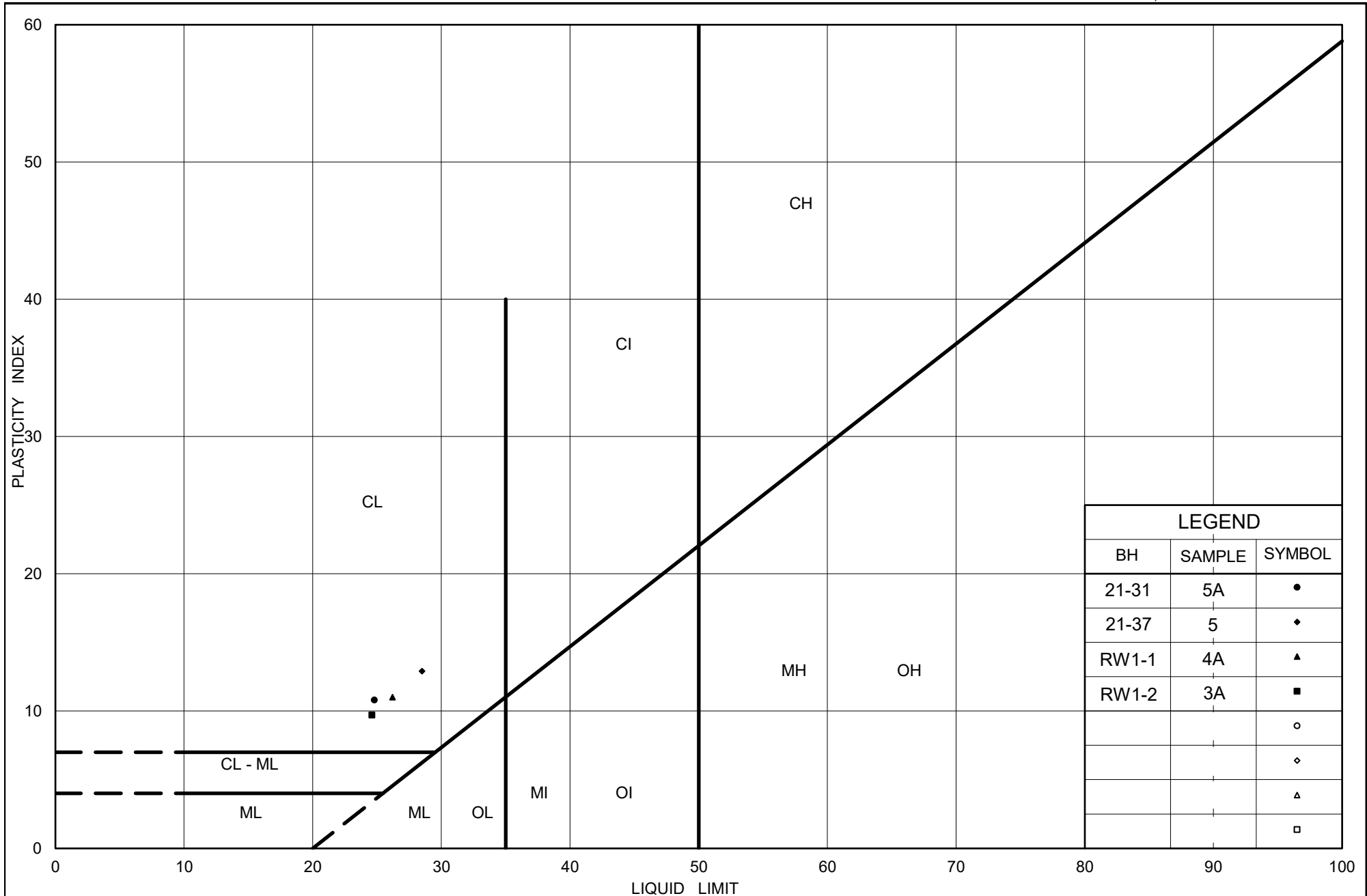
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	RW1-2	3A	101.4
■	RW1-1	4A	100.3
◆	21-37	5	102.2

Project Number: 1530382

Checked By: LCC

**Golder Associates**

Date: 09-Feb-22



Ministry of Transportation

Ontario

## PLASTICITY CHART

Cohesive Soil Complex (Sandy Clayey Silt, and Sandy Clayey Silt to Clayey Silt Till)

Figure No. F4

Project No. 1530382

Checked By: LCC

**APPENDIX G**

# Geotechnical Laboratory Test Results for Shale Bedrock

**TABLE G-1: SUMMARY OF POINT LOAD TEST RESULTS ON ROCK CORE SAMPLES**

Borehole Number	Sample Depth (m)	Test Type	Core Length (mm)	Core <sup>(2)</sup> Diameter (mm)	Equivalent Diameter (mm)	Ram Pressure (kPa)	Load (P) (kN)	Is Axial (MPa)	Is Diametral (MPa)	Is (50mm) (MPa)	Approx. <sup>(1)</sup> UCS (MPa)
21-3	5.70-5.79	A	21.40	59.21	40.17	2,800.00	2.65	1.645	-	1.491	31
21-3	6.00-6.09	A	22.66	59.75	41.52	2,210.00	2.10	1.215	-	1.118	23
21-4	6.66-6.70	A	21.94	60.15	40.99	12,380.00	11.74	6.985	-	6.388	134
21-4	6.70-6.75	A	26.08	60.17	44.70	3,780.00	3.58	1.794	-	1.705	36
21-27	4.25-4.32	A	23.72	60.02	42.58	7,320.00	6.94	3.828	-	3.561	75
21-27	4.50-4.60	A	25.10	60.13	43.84	5,980.00	5.67	2.950	-	2.781	58
21-28	4.99-5.09	A	25.07	59.90	43.73	1,510.00	1.43	0.749	-	0.705	15
21-28	5.75-5.81	A	26.96	60.11	45.42	1,520.00	1.44	0.698	-	0.669	14
21-31	5.80-5.86	A	30.66	59.19	48.07	4,350.00	4.12	1.785	-	1.753	40
21-31	5.47-5.50	A	26.56	59.64	44.91	1,930.00	1.83	0.907	-	0.864	18
21-31	5.54-5.63	A	23.15	59.90	42.02	6,490.00	6.15	3.485	-	3.223	68
21-33	5.47-5.67	A	23.47	60.16	42.40	14,540.00	13.78	7.668	-	7.119	150
21-34	6.22-6.28	A	29.83	60.32	47.86	4,820.00	4.57	1.995	-	1.956	45
21-34	6.78-6.85	A	21.35	59.04	40.06	4,710.00	4.47	2.782	-	2.518	53
21-35	5.58-5.64	A	22.37	60.17	41.40	10,020.00	9.50	5.543	-	5.091	107
21-35	6.12-6.17	A	22.64	59.05	41.26	4,850.00	4.60	2.701	-	2.477	52
21-36	6.41-6.44	A	24.49	60.16	43.31	1,460.00	1.38	0.738	-	0.692	15
21-36	7.24-7.27	A	23.53	60.09	42.43	10,850.00	10.29	5.714	-	5.307	111
21-37	6.86-6.92	A	22.81	60.17	41.80	3,790.00	3.59	2.056	-	1.897	40
21-37	7.00-7.05	A	29.22	60.01	47.25	4,950.00	4.69	2.102	-	2.049	47

<sup>(1)</sup>  $Is_{50} \times C$  from ISRM ("Suggested Methods for Determining Point Load Strength", International Society for Rock Mechanics Commission on Testing Methods, Int. J. Rock. Mech. Min. Sci. and Geomechanical Abstr., Vol 22, No. 2 1985, pp. 51-60.

<sup>(2)</sup> Actual distance between point load cones at time of failure.



April 8, 2021

Ms. Katie Nero  
Golder Associates Ltd.  
6925 Century Avenue, Suite #100  
Mississauga, Ontario  
Canada L5N 7K2

Re: UCS, BD, CERCHAR, and Slake testing (Golder Project No. 1530382-7000)

Dear Ms. Nero

On March 19<sup>th</sup>, 2021, a total of seventeen (17) HQ-sized rock core samples were received by Geomechanica Inc. via drop-off by Golder personnel. These samples were identified as being from project 1530382-7000. From these samples, six (6) UCS, three (3) BD, five (5) CERCHAR Abrasivity, and three (3) Slake Durability were prepared and tested.

Details regarding the steps of specimen preparation and testing are presented in the accompanying laboratory report and summary spreadsheets.

Sincerely,



Bryan Tatone Ph.D., P. Eng.

Geomechanica Inc.  
Tel: (647) 478-9767  
Email: [bryan.tatone@geomechanica.com](mailto:bryan.tatone@geomechanica.com)

# Rock Laboratory Testing Results

**A report submitted to:**

Katie Nero  
Golder Associates Ltd.  
6925 Century Avenue, Suite #100  
Mississauga, Ontario  
Canada L5N 7K2

**Prepared by:**

Bryan Tatone, PhD, PEng  
Omid Mahabadi, PhD, PEng  
Geomechanica Inc.  
#900-390 Bay St.  
Toronto ON  
M5H 2Y2 Canada  
Tel: +1-647-478-9767  
lab@geomechanica.com

**April 8, 2021**

Project number: 1530382-7000

**Abstract**

This document summarizes the results of rock laboratory testing, including 6 Uniaxial Compression Strength (UCS) tests, 3 Brazilian Disc (BD) tensile strength tests, 5 CERCHAR Abrasivity tests, and 3 Slake Durability tests. The results for each test type presented in separate sub-sections herein.

**In this document:**

1	Uniaxial Compressive Strength Tests	1
2	Brazilian Disc Tests	4
3	CERCHAR Abrasivity Tests	6
4	Slake Durability	10
	Appendices	12
A	UCS specimen sheets	12
B	BD specimen sheets	19

# 1 Uniaxial Compressive Strength Tests

## 1.1 Overview

This section summarizes the results of uniaxial compressive strength (UCS) testing of HQ3-sized specimens. The testing was performed in Geomechanica's rock testing laboratory using a 150 ton (1.3 MN) Forney loading frame equipped with pressure-compensated control valve to maintain an axial displacement rate of approximately 0.150 mm/min (Figure 1). The preparation and testing procedure for each specimen included the following:

1. Unwrapping the core sample, inspecting it for damage, and re-wrapping it in electrical tape to minimize exposure to moisture during subsequent specimen preparation.
2. Diamond cutting the core sample to obtain cylindrical specimens with an appropriate length (length:diameter = 2:1) and nearly parallel end faces.
3. Diamond grinding of the specimen to obtain flat (within  $\pm 0.025$  mm) and parallel end faces (within  $0.25^\circ$ ).
4. Placing the specimen into the loading frame, applying a 1 kN axial load, and removing the electrical tape.
5. Axially loading the specimens to rupture while continuously recording axial force and axial deformation to determine the peak strength (UCS) and tangent Young's modulus.



Figure 1: Forney loading frame setup for UCS testing.

Using a precision V-block mounted on the magnetic chuck of the surface grinder, test specimens met the end flatness, end parallelism, and perpendicularity criteria set out in ASTM D4543-19. The side straightness criteria, as checked with a feeler gauge, and the minimum length:diameter criteria were met for all specimens unless noted otherwise in Table 1. Testing of the specimens followed ASTM D7012-14 with the following note:

- Testing included measurement of the UCS and elastic modulus, but not the Poisson's ratio. This represents a hybrid between Methods C and D of ASTM D7012-14.

## 1.2 Results

The results of UCS testing are summarized in Table 1. The corresponding stress-strain curves for the uniaxial compression tests are presented in Figure 2. The Young's modulus is the tangent modulus calculated as the slope of the best-fit line through 600 data points defining the stress-strain curve. Typically the modulus is defined at 50% of the UCS strength. However, due to prevalent non-linear stress-strain behaviour, custom stress ranges (where specimens deformed linearly) were selected for moduli determination. These stress ranges are provided in the summary spreadsheet that accompanies this report. Please note that additional specimen details and measurements are provided in the summary spreadsheet that accompanies this report.

Table 1: Summary of Uniaxial Compression test results.

Sample	Depth (m)	Bulk density $\rho$ (g/cm <sup>3</sup> )	UCS (MPa)	Young's modulus $E$ (GPa)	Lithology	Failure description
21-34-7.82to7.95m	7.82 - 7.95	2.620	19.1	2.5	Siltstone, Limestone and Shale	1
21-35-7.4to7.56m	7.40 - 7.56	2.585	7.3	0.4	Shale and Siltstone	2, 3, 4
21-37-7.08to7.3m	7.08 - 7.30	2.627	20.1	2.0	Siltstone, Limestone, and Shale	5, 3
21-36-9.92to10.07m	9.92 - 10.07	2.541	8.5	0.6	Siltstone, Limestone, and Shale	1, 3, 6
21-3-6.47to6.7m	6.47 - 6.70	2.621	6.3	1.2	Siltstone and Shale	1
21-4-7.44to7.58m	7.44 - 7.58	2.632	23.0	3.4	Siltstone, Limestone, and Shale	5

<sup>1</sup> Axial splitting failure

<sup>2</sup> Inclined shear failure

<sup>3</sup> Specimen emitted saline pore water upon loading

<sup>4</sup> Failure partly along pre-existing structure

<sup>5</sup> Partial hourglass failure

<sup>6</sup> Failure localized in softer shale layer

## 1.3 Specimen photographs

Photographs of the specimens before and after testing are presented in the Appendix of this report.

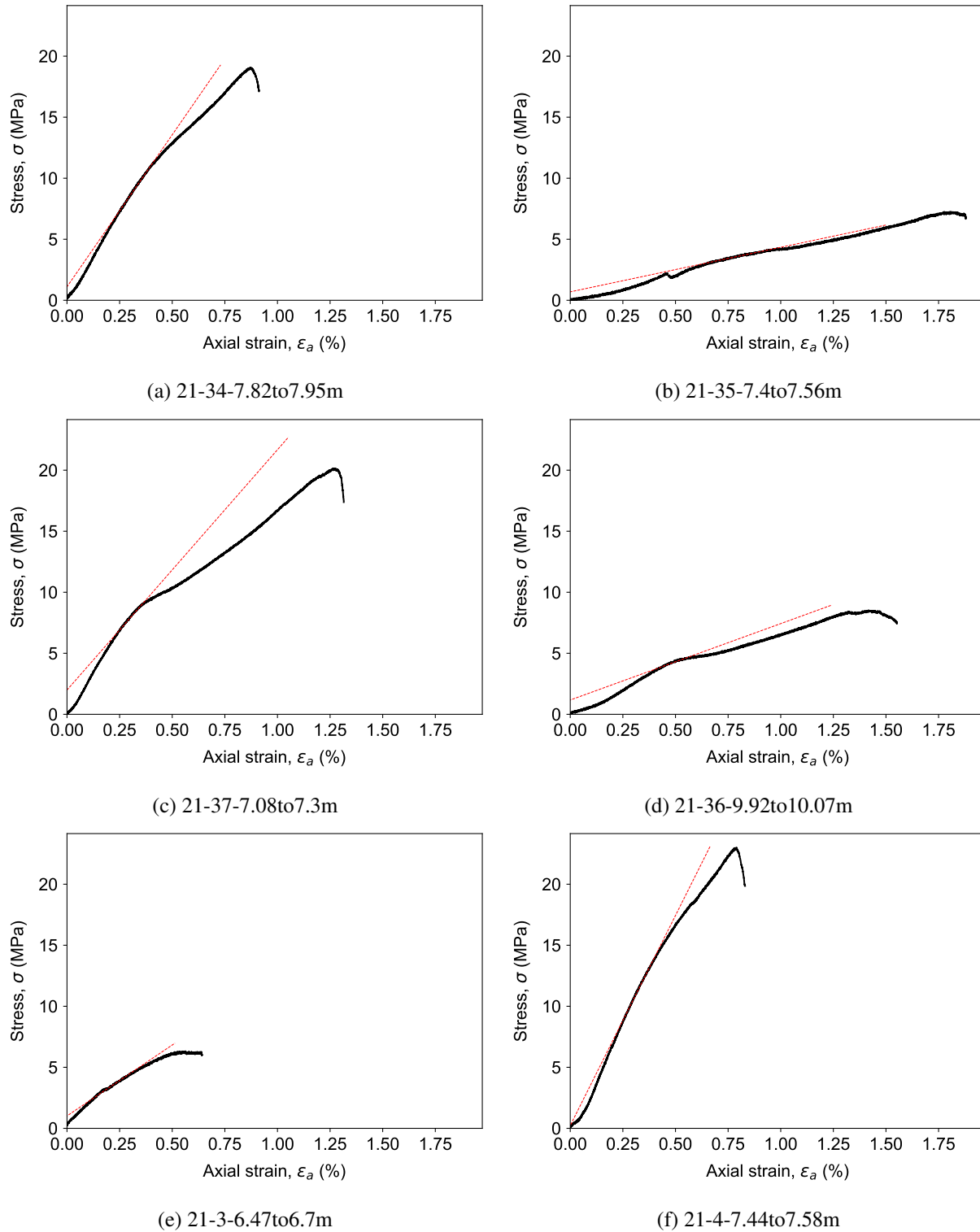


Figure 2: Measured stress-strain curves.

## 2 Brazilian Disc Tests

### 2.1 Overview

This section summarizes the results of Brazilian disc testing. The tests were performed using a 12 ton Carver hydraulic loading frame coupled to a SPX hydraulic pump fitted with a pressure-compensated flow control valve (Figure 3). A consistent displacement rate of approximately 0.175 mm/min was employed for all tests. The specimen preparation and testing procedure included the following:

1. Unwrapping of the core sample, inspecting it for damage, and re-wrapping it in electrical tape to minimize exposure to moisture and possible damage during subsequent specimen preparation.
2. Diamond cutting of core samples to obtain disc specimens with nearly flat (within 0.5 mm) and parallel (within 0.5° end faces and a thickness approximately equal to the core radius. From each core sample as many discs as possible (given the available core sample length) were prepared and tested.
3. Diametric loading of disc specimens to rupture using a hydraulic loading frame equipped with fixed flat loading platens. The applied force and diametric displacement were continuously measured to calculate the indirect tensile strength. Note that a strip of tape and cardboard was placed on the specimens at the platen contact points to act as a cushion to distribute the applied load over the thickness of the sample.

The above Brazilian disc testing procedure adhered to ASTM D3967-16.

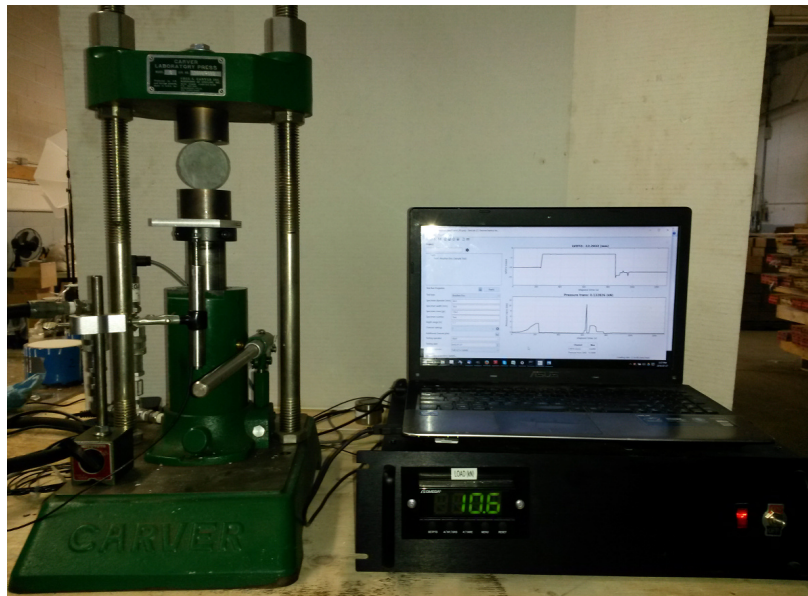


Figure 3: Brazilian disc testing setup.

## 2.2 Results

A summary of the Brazilian disc testing results are provided in Table 2. Additional details and measurements for the test specimens are included in the accompanying summary spreadsheet. The indirect tensile strength,  $\sigma_t$ , was calculated, as:

$$\sigma_t = \frac{2P}{\pi Dt} \quad (1)$$

where  $P$  is the peak diametric load;  $D$  is the specimen diameter; and  $t$  is the specimen thickness.

It must be noted that some Brazilian disc specimen did not fail via diametric splitting. Some failed via a combination of diametric splitting and fissility delamination, while others simply failed at the platen contact points or by fissility delamination alone. The failure mode of each disc is noted in the last column of the summary table.

Table 2: Summary of Brazilian Disc test results.

Borehole	Sample	Disc	Depth (m)	Bulk density $\rho$ (g/cm <sup>3</sup> )	Tensile strength (MPa)	Lithology	Failure description
21-34	21-34-7.29to7.4m	1	7.29 - 7.40	2.578	2.7	Siltstone and Limestone	1
		2		2.602	2.4	Siltstone and Limestone	1
				Average	2.5		
				Standard deviation	0.1		
21-37	21-37-8.42to8.56m	1	8.42 - 8.56	2.609	5.0	Limestone and Siltstone	2, 3
		2		2.609	1.7	Siltstone	4
		3		2.580	3.0	Siltstone and Limestone	1
		4		2.611	3.3	Limestone	4, 3
				Average	3.3		
				Standard deviation	1.2		
21-4	21-4-8.04to8.14m	1	8.04 - 8.14	2.608	2.1	Siltstone and Limestone	1
		2		2.638	3.0	Siltstone and Limestone	1
				Average	2.5		
				Standard deviation	0.4		

<sup>1</sup> Diametric failure

<sup>2</sup> Partial diametric failure

<sup>3</sup> Failure along pre-existing structure

<sup>4</sup> Non-diametric failure

## 2.3 Specimen photographs

Photographs of the specimens prior to and after testing are presented in the Appendix of this report.

### 3 CERCHAR Abrasivity Tests

#### 3.1 Overview

This section summarizes the results of CERCHAR abrasivity testing. The tests were performed using a Type-2 CERCHAR apparatus as shown in Figure 4a. The tips of the styluses were sharpened to a conical angle of  $90^\circ$  using the setup shown in Figure 4b. The styluses used to perform the tests are shown in Figure 4c-d (Rockwell hardness  $55 \pm 1$ ). A static force of 70 N was applied on top of the stylus by using a combination of weights. Details of the testing procedure for each sample, which followed ASTM D7625-10, proceeded as follows:

1. The tips of the five styluses were sharpened using the grinding apparatus (Figure 4b).
2. The styluses were placed under a microscope (60x magnification) and three scaled photos ( $120^\circ$  apart) are captured before the test is conducted to ensure the  $90^\circ$  point has been properly formed.
3. The test specimens consisted of pieces HQ core with fresh fracture surface perpendicular to the core axis.
4. The specimen was secured in the cross-slide vise of the testing apparatus and the stylus carefully lowered on to the surface of the rock.
5. A scratch measuring 10 mm in length was created over a duration of 10 seconds. This process was repeated with all five styluses on undisturbed parts of the specimen surface (e.g., Figure 5a).
6. Lastly, the worn tips were re-examined under the microscope. From three scaled photos ( $120^\circ$  apart), the wear flat,  $d$ , was measured (e.g., Figure 5c).

The length or the diameter of the wear flat,  $d$ , was measured from scaled microscope images using the image processing software Fiji (e.g., Figure 5b-c). The mean wear of the tip is calculated by taking the average  $d$  of all tests. The CERCHAR-Abrasivity-Index ( $CAI$ ) of the sample is subsequently calculated by taking the mean wear and multiplying it by 10.

#### 3.2 Results

The results of the CERCHAR abrasivity tests are summarized in Table 3. Further specimen and testing details are included in the summary spreadsheet that accompanies this report.



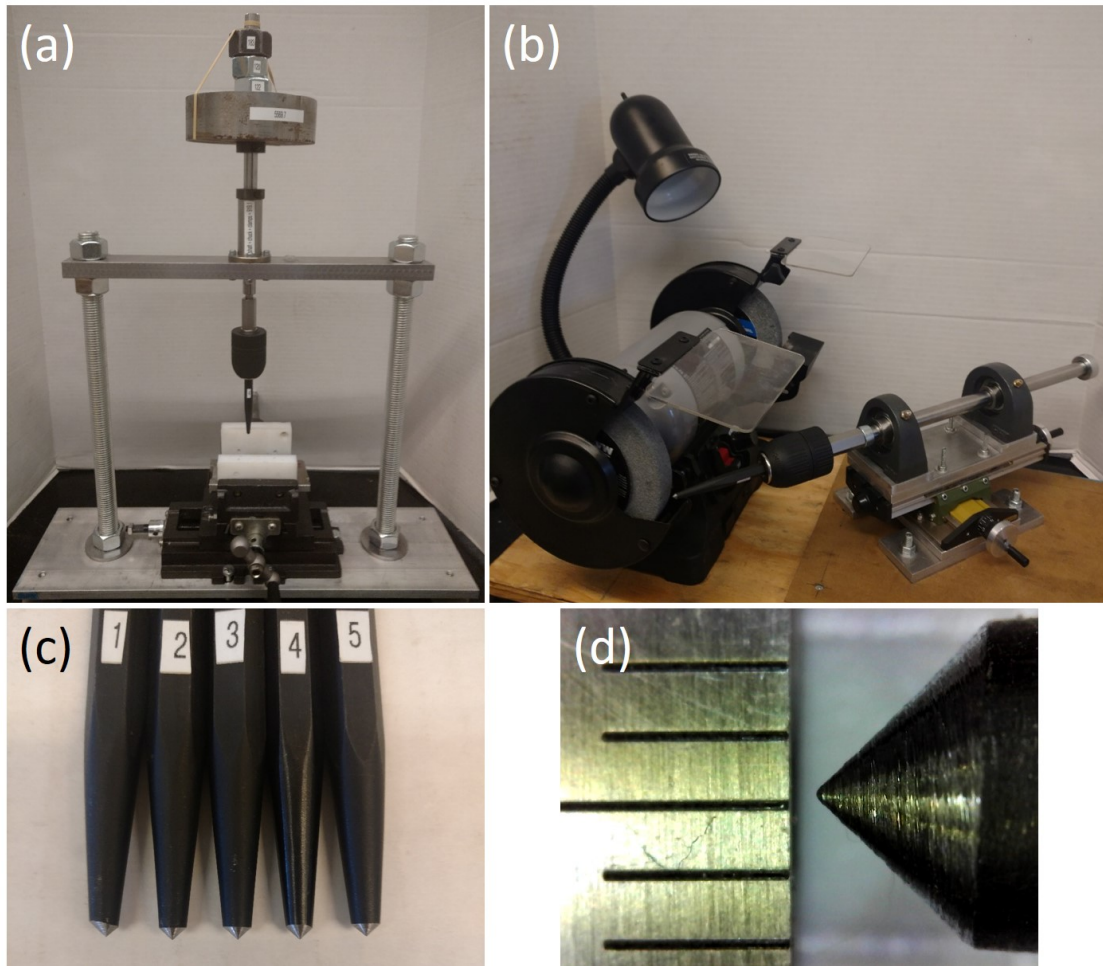


Figure 4: Photos showing (a) the CERCHAR apparatus, (b) tip sharpening setup, (c) the five styluses used to perform the test and (d) a microscope image of one of the stylus tips.

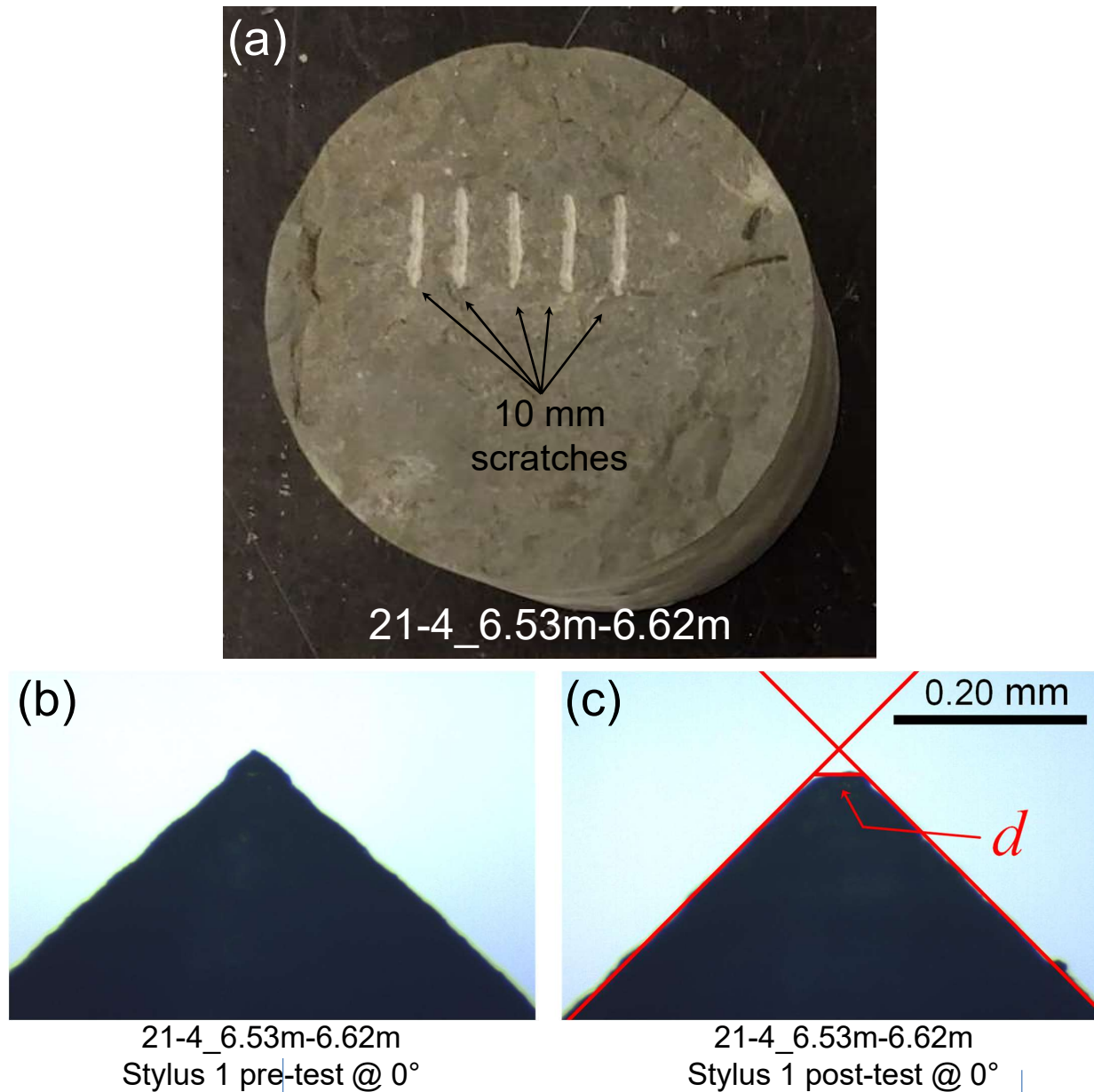


Figure 5: (a) Photograph showing an example of the five 10 mm scratches on a select test specimen; (b) microscope image of select stylus prior to testing at the noted position; and (c) microscope image of the same stylus at the same position following testing with the wear flat,  $d$ , denoted.

Table 3: Summary of CERCHAR abrasivity test results.

Sample	Depth (m)	Test 1 Mean (mm)	Test 2 Mean (mm)	Test 3 Mean (mm)	Test 4 Mean (mm)	Test 5 Mean (mm)	Mean Wear (mm)	CAI	Lithology	ASTM Classification
21-4-6.53m-6.62m	6.53 - 6.62	0.056	0.066	0.053	0.034	0.073	0.057	0.566	Siltstone	Low
21-34-6.38m-6.48m	6.38 - 6.48	0.036	0.028	0.032	0.024	0.030	0.030	0.299	Shale	< Very Low
21-35-7.63m-7.90m	7.63 - 7.90	0.028	0.026	0.026	0.034	0.028	0.028	0.282	Shale	< Very Low
21-36-8.97m-9.09m	8.97 - 9.09	0.050	0.047	0.033	0.043	0.041	0.043	0.430	Shale	Very Low
21-37-7.30m-7.45m	7.30 - 7.45	0.032	0.028	0.028	0.059	0.039	0.037	0.373	Shale	Very Low

## 4 Slake Durability

### 4.1 Overview

This section summarizes the results of slake durability testing. The tests were performed using an M&L Testing Equipment Slake Durability apparatus capable of simultaneously performing four slake durability tests (Figure 6). The test was conducted using the following procedure:

1. The core was broken using a hammer and point load testing apparatus into 40-60 g lumps. The sharp edges of the lumps were removed by lightly hammering and/or filing the edges.
2. Approximately 10 lumps weighing 450-550 g were inserted into the drum and dried in the oven at 110 °C until reaching a constant mass.
3. The drum was removed from the oven and allowed to cool to room temperature, weighed, and subsequently rotated in room temperature distilled water at 20 revolutions per minute for 10 minutes.
4. The drum was returned to the oven to dry for approximately one day and weighed again.
5. Steps 3 and 4 were then repeated for a second cycle.
6. The drum was thoroughly cleaned, dried, and weighed.

The above slake durability testing procedure adhered to ASTM D4644-16.

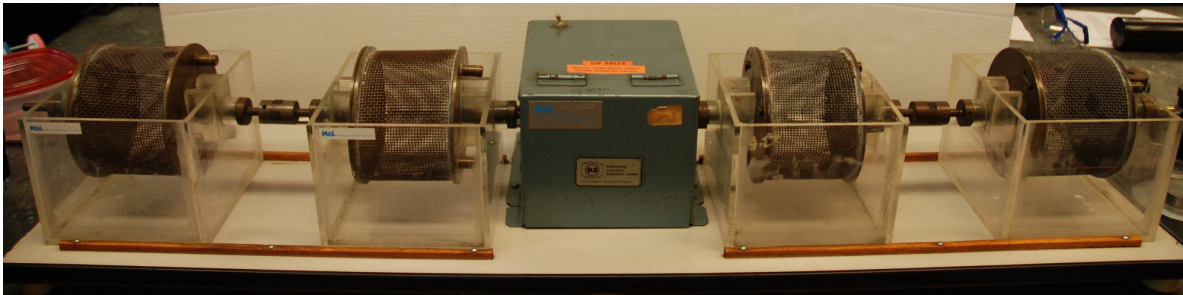


Figure 6: Test setup showing the slake durability apparatus.

### 4.2 Results

The results of the tests are summarized in Table 4. Additional measurements and sample descriptions are provided the summary spreadsheet that accompanies this report. The slake durability index after one and two cycles was calculated as follows, respectively:

$$I_{d1} = \frac{B - D}{A - D} \times 100\% \quad (2)$$

$$I_{d2} = \frac{C - D}{A - D} \times 100\% \quad (3)$$

where  $A$  is the mass of the specimen and drum before the first test cycle,  $B$  is the mass of the specimen and drum after oven drying the first cycle,  $C$  is the mass of the specimen and drum after oven drying the second cycle and  $D$  is the mass of the drum.

Table 4: Summary of slake durability testing results.

Sample	Depth (m)	Moisture content (%)	Pre-First Cycle, $A$ (g)	Post-First Cycle, $B$ (g)	Post-Second Cycle, $C$ (g)	Mass of Drum, $D$ (g)	Slake Durability Index, (1st Cycle) $I_{d1}$ (%)	Slake Durability Index (2nd Cycle), $I_{d2}$ (%)	Lithology
21-34-8.53to8.79	8.53 - 7.79	2.54	2439.01	2388.61	2303.35	1895.48	90.73	75.04	Shale & Limestone
21-35-6.39to6.62	6.39 - 6.62	3.46	2357.54	2295.54	2223.12	1857.24	87.61	73.13	Shale & Limestone
21-37-7.62to7.83	7.62 - 7.83	3.54	2282.26	2225.27	2149.97	1847.18	86.90	69.59	Shale

### 4.3 Specimen Photographs

Photographs of the specimens before testing and after testing are shown in Figure 7.

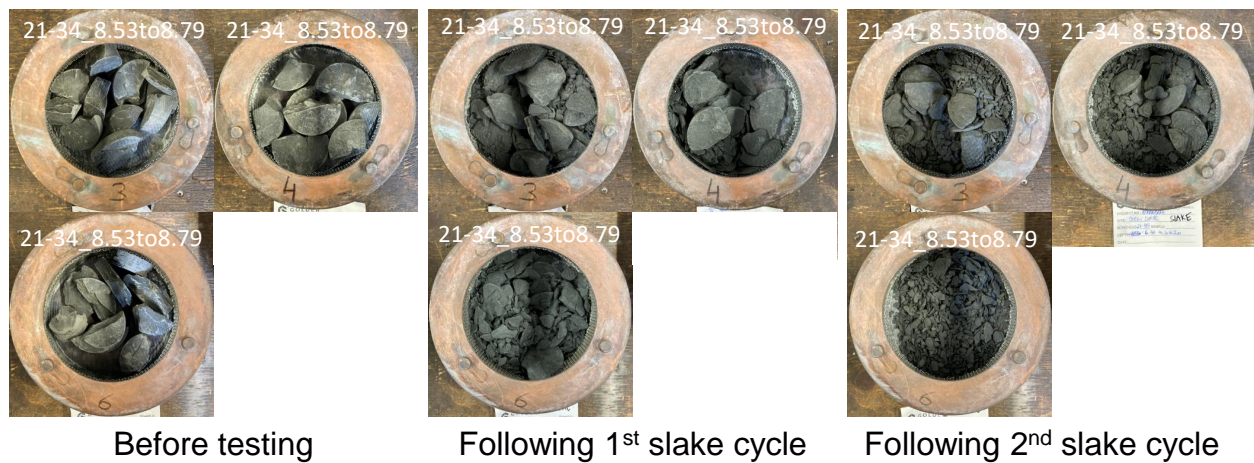


Figure 7: Photographs of slake durability specimens before and after testing.



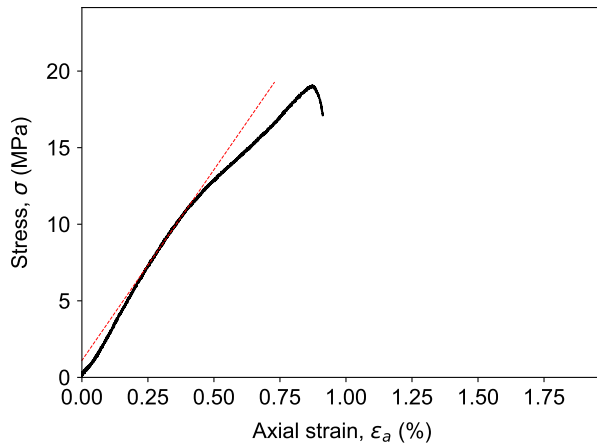
# Appendices

## A UCS specimen sheets



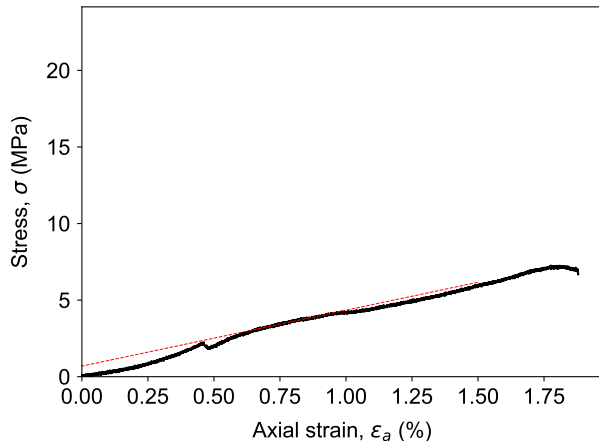
- 21-34-7.82to7.95m
- 21-35-7.4to7.56m
- 21-37-7.08to7.3m
- 21-36-9.92to10.07m
- 21-3-6.47to6.7m
- 21-4-7.44to7.58m



## Uniaxial Compression Test



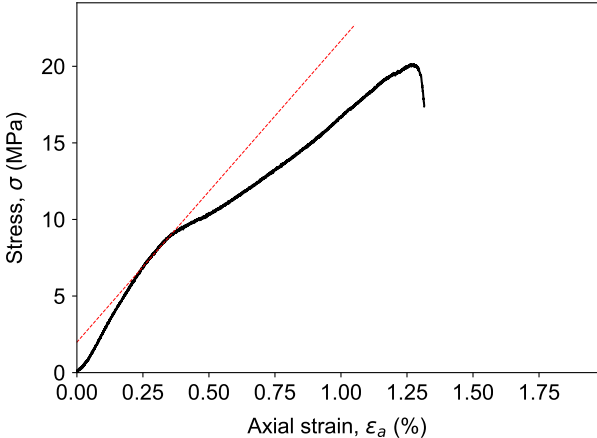
Client	Golder Associates Ltd.	Project	1530382-7000														
Sample	21-34-7.82to7.95m	Depth	7.82 - 7.95														
<div>Specimen parameters</div> <table><tr><td>Diameter (mm)<sup>a</sup></td><td>59.76</td></tr><tr><td>Length (mm)<sup>a</sup></td><td>121.00</td></tr><tr><td>Bulk density <math>\rho</math> (g/cm<sup>3</sup>)</td><td>2.620</td></tr><tr><td>UCS (MPa)</td><td>19.1</td></tr><tr><td>Young's modulus <math>E</math> (GPa)<sup>b</sup></td><td>2.5</td></tr><tr><td>Lithology</td><td>Siltstone, Limestone and Shale</td></tr><tr><td>Failure description<sup>c</sup></td><td>1</td></tr></table>		Diameter (mm) <sup>a</sup>	59.76	Length (mm) <sup>a</sup>	121.00	Bulk density $\rho$ (g/cm <sup>3</sup> )	2.620	UCS (MPa)	19.1	Young's modulus $E$ (GPa) <sup>b</sup>	2.5	Lithology	Siltstone, Limestone and Shale	Failure description <sup>c</sup>	1	<div>Prior to testing</div> 	<div>After testing</div> 
Diameter (mm) <sup>a</sup>	59.76																
Length (mm) <sup>a</sup>	121.00																
Bulk density $\rho$ (g/cm <sup>3</sup> )	2.620																
UCS (MPa)	19.1																
Young's modulus $E$ (GPa) <sup>b</sup>	2.5																
Lithology	Siltstone, Limestone and Shale																
Failure description <sup>c</sup>	1																
<div><div><div><sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.</div><div><sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through <math>\pm 300</math> data points on either side of the point representing 50.0% of the peak strength.</div><div><sup>c</sup> Failure description: <sup>1</sup> Axial splitting failure;</div></div><div></div></div>																	
Remarks:																	
Remarks: Displacement Rate: 0.15mm/min																	
Performed by	PL/SL	Date	2021-03-30														

## Uniaxial Compression Test



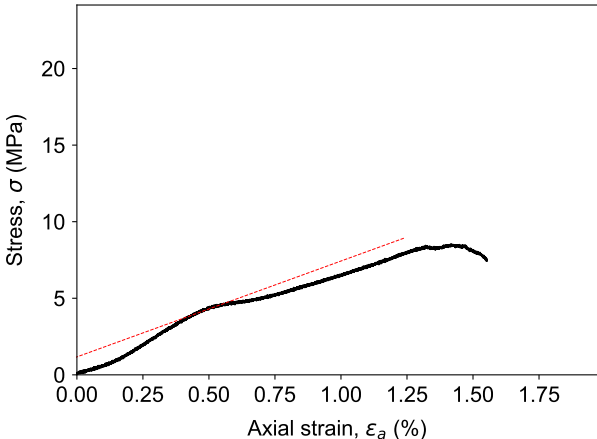
Client	Golder Associates Ltd.	Project	1530382-7000														
Sample	21-35-7.4to7.56m	Depth	7.40 - 7.56														
<div>Specimen parameters</div> <table><tr><td>Diameter (mm) <sup>a</sup></td><td>59.97</td></tr><tr><td>Length (mm) <sup>a</sup></td><td>126.74</td></tr><tr><td>Bulk density <math>\rho</math> (g/cm<sup>3</sup>)</td><td>2.585</td></tr><tr><td>UCS (MPa)</td><td>7.3</td></tr><tr><td>Young's modulus <math>E</math> (GPa) <sup>b</sup></td><td>0.4</td></tr><tr><td>Lithology</td><td>Shale and Siltstone</td></tr><tr><td>Failure description <sup>c</sup></td><td>2, 3, 4</td></tr></table>		Diameter (mm) <sup>a</sup>	59.97	Length (mm) <sup>a</sup>	126.74	Bulk density $\rho$ (g/cm <sup>3</sup> )	2.585	UCS (MPa)	7.3	Young's modulus $E$ (GPa) <sup>b</sup>	0.4	Lithology	Shale and Siltstone	Failure description <sup>c</sup>	2, 3, 4	<div>Prior to testing</div> 	<div>After testing</div> 
Diameter (mm) <sup>a</sup>	59.97																
Length (mm) <sup>a</sup>	126.74																
Bulk density $\rho$ (g/cm <sup>3</sup> )	2.585																
UCS (MPa)	7.3																
Young's modulus $E$ (GPa) <sup>b</sup>	0.4																
Lithology	Shale and Siltstone																
Failure description <sup>c</sup>	2, 3, 4																
<div><div><div><sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.</div><div><sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through <math>\pm 300</math> data points on either side of the point representing 50.0% of the peak strength.</div><div><sup>c</sup> Failure description: <sup>2</sup> Inclined shear failure; <sup>3</sup> Specimen emitted saline pore water upon loading; <sup>4</sup> Failure partly along pre-existing structure;</div></div><div></div></div>																	
Remarks:																	
Performed by	PL/SL	Date	2021-03-30														





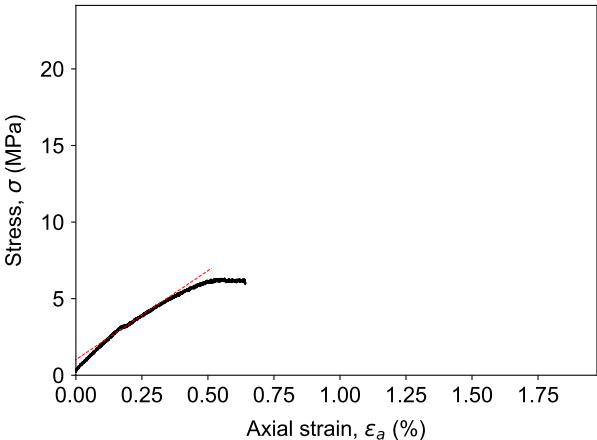
## Uniaxial Compression Test

Client	Golder Associates Ltd.	Project	1530382-7000														
Sample	21-37-7.08to7.3m	Depth	7.08 - 7.30														
<div>Specimen parameters</div> <table><tr><td>Diameter (mm) <sup>a</sup></td><td>59.90</td></tr><tr><td>Length (mm) <sup>a</sup></td><td>126.69</td></tr><tr><td>Bulk density <math>\rho</math> (g/cm<sup>3</sup>)</td><td>2.627</td></tr><tr><td>UCS (MPa)</td><td>20.1</td></tr><tr><td>Young's modulus <math>E</math> (GPa) <sup>b</sup></td><td>2.0</td></tr><tr><td>Lithology</td><td>Siltstone, Limestone, and Shale</td></tr><tr><td>Failure description <sup>c</sup></td><td>5, 3</td></tr></table>		Diameter (mm) <sup>a</sup>	59.90	Length (mm) <sup>a</sup>	126.69	Bulk density $\rho$ (g/cm <sup>3</sup> )	2.627	UCS (MPa)	20.1	Young's modulus $E$ (GPa) <sup>b</sup>	2.0	Lithology	Siltstone, Limestone, and Shale	Failure description <sup>c</sup>	5, 3	<div>Prior to testing</div> 	<div>After testing</div> 
Diameter (mm) <sup>a</sup>	59.90																
Length (mm) <sup>a</sup>	126.69																
Bulk density $\rho$ (g/cm <sup>3</sup> )	2.627																
UCS (MPa)	20.1																
Young's modulus $E$ (GPa) <sup>b</sup>	2.0																
Lithology	Siltstone, Limestone, and Shale																
Failure description <sup>c</sup>	5, 3																
<div><div><div><sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.</div><div><sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through <math>\pm 300</math> data points on either side of the point representing 40.0% of the peak strength.</div><div><sup>c</sup> Failure description: <sup>5</sup> Partial hourglass failure; <sup>3</sup> Specimen emitted saline pore water upon loading;</div></div><div></div></div>																	
Remarks:																	
Performed by	PL/SL	Date	2021-03-30														



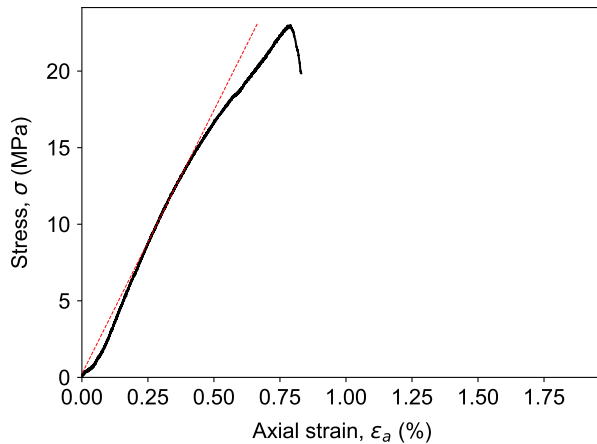
## Uniaxial Compression Test

Client	Golder Associates Ltd.	Project	1530382-7000
Sample	21-36-9.92to10.07m	Depth	9.92 - 10.07
Specimen parameters		Prior to testing	After testing
Diameter (mm) <sup>a</sup>	59.99		
Length (mm) <sup>a</sup>	120.65		
Bulk density $\rho$ (g/cm <sup>3</sup> )	2.541		
UCS (MPa)	8.5		
Young's modulus $E$ (GPa) <sup>b</sup>	0.6		
Lithology	Siltstone, Limestone, and Shale		
Failure description <sup>c</sup>	1, 3, 6		
<sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.			
<sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through $\pm 300$ data points on either side of the point representing 50.0% of the peak strength.			
<sup>c</sup> Failure description: <sup>1</sup> Axial splitting failure; <sup>3</sup> Specimen emitted saline pore water upon loading; <sup>6</sup> Failure localized in softer shale layer;			
			
Remarks:			
Performed by	PL/SL	Date	2021-03-30

## Uniaxial Compression Test

Client	Golder Associates Ltd.	Project	1530382-7000														
Sample	21-3-6.47to6.7m	Depth	6.47 - 6.70														
<div>Specimen parameters</div> <table><tr><td>Diameter (mm)<sup>a</sup></td><td>59.81</td></tr><tr><td>Length (mm)<sup>a</sup></td><td>126.69</td></tr><tr><td>Bulk density <math>\rho</math> (g/cm<sup>3</sup>)</td><td>2.621</td></tr><tr><td>UCS (MPa)</td><td>6.3</td></tr><tr><td>Young's modulus <math>E</math> (GPa)<sup>b</sup></td><td>1.2</td></tr><tr><td>Lithology</td><td>Siltstone and Shale</td></tr><tr><td>Failure description<sup>c</sup></td><td>1</td></tr></table>		Diameter (mm) <sup>a</sup>	59.81	Length (mm) <sup>a</sup>	126.69	Bulk density $\rho$ (g/cm <sup>3</sup> )	2.621	UCS (MPa)	6.3	Young's modulus $E$ (GPa) <sup>b</sup>	1.2	Lithology	Siltstone and Shale	Failure description <sup>c</sup>	1	<div>Prior to testing</div> 	<div>After testing</div> 
Diameter (mm) <sup>a</sup>	59.81																
Length (mm) <sup>a</sup>	126.69																
Bulk density $\rho$ (g/cm <sup>3</sup> )	2.621																
UCS (MPa)	6.3																
Young's modulus $E$ (GPa) <sup>b</sup>	1.2																
Lithology	Siltstone and Shale																
Failure description <sup>c</sup>	1																
<div><div><div><div><div><sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.</div><div><sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through <math>\pm 300</math> data points on either side of the point representing 50.0% of the peak strength.</div><div><sup>c</sup> Failure description: <sup>1</sup> Axial splitting failure;</div></div></div><div></div></div></div>																	
Remarks:																	
Performed by	PL/SL	Date	2021-03-30														

## Uniaxial Compression Test

Client	Golder Associates Ltd.	Project	1530382-7000														
Sample	21-4-7.44to7.58m	Depth	7.44 - 7.58														
<div>Specimen parameters</div> <table><tr><td>Diameter (mm)<sup>a</sup></td><td>60.05</td></tr><tr><td>Length (mm)<sup>a</sup></td><td>126.77</td></tr><tr><td>Bulk density <math>\rho</math> (g/cm<sup>3</sup>)</td><td>2.632</td></tr><tr><td>UCS (MPa)</td><td>23.0</td></tr><tr><td>Young's modulus <math>E</math> (GPa)<sup>b</sup></td><td>3.4</td></tr><tr><td>Lithology</td><td>Siltstone, Limestone, and Shale</td></tr><tr><td>Failure description<sup>c</sup></td><td>5</td></tr></table>		Diameter (mm) <sup>a</sup>	60.05	Length (mm) <sup>a</sup>	126.77	Bulk density $\rho$ (g/cm <sup>3</sup> )	2.632	UCS (MPa)	23.0	Young's modulus $E$ (GPa) <sup>b</sup>	3.4	Lithology	Siltstone, Limestone, and Shale	Failure description <sup>c</sup>	5	<div>Prior to testing</div> 	<div>After testing</div> 
Diameter (mm) <sup>a</sup>	60.05																
Length (mm) <sup>a</sup>	126.77																
Bulk density $\rho$ (g/cm <sup>3</sup> )	2.632																
UCS (MPa)	23.0																
Young's modulus $E$ (GPa) <sup>b</sup>	3.4																
Lithology	Siltstone, Limestone, and Shale																
Failure description <sup>c</sup>	5																
<div><div><div><sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.</div><div><sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through <math>\pm 300</math> data points on either side of the point representing 50.0% of the peak strength.</div><div><sup>c</sup> Failure description: <sup>5</sup> Partial hourglass failure;</div></div><div></div></div>																	
Remarks:																	
Performed by	PL/SL	Date	2021-03-30														

## **B BD specimen sheets**

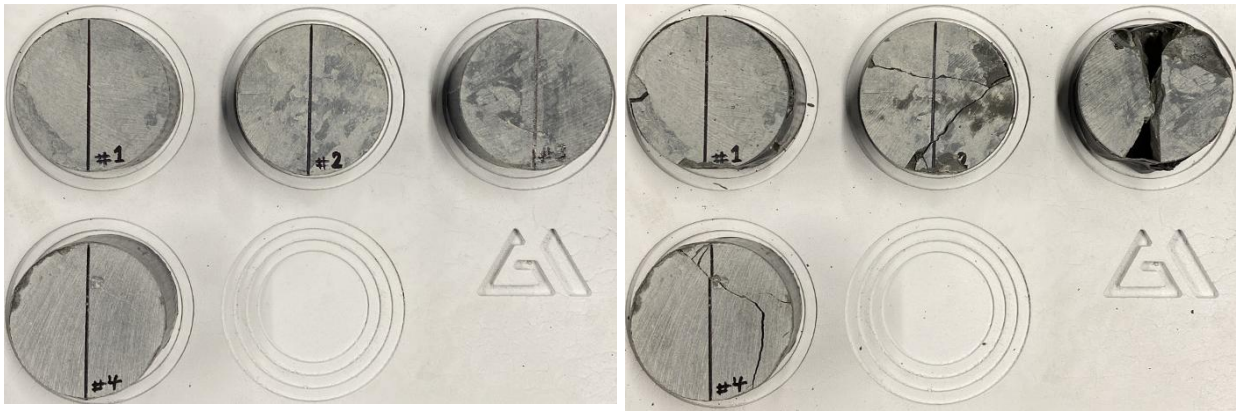
- 21-34-21-34-7.29to7.4m
- 21-37-21-37-8.42to8.56m
- 21-4-21-4-8.04to8.14m

## Brazilian Disc Test

Client	Golder Associates Ltd.	Project	1530382-7000																		
Sample	21-34-21-34-7.29to7.4m	Depth	7.29 - 7.40																		
<div>Specimen parameters</div> <table><tr><td>Disc</td><td>1</td><td>2</td></tr><tr><td>Thickness (mm) <sup>a</sup></td><td>33.41</td><td>33.60</td></tr><tr><td>Diameter (mm) <sup>a</sup></td><td>59.98</td><td>59.98</td></tr><tr><td>Tensile strength (MPa)</td><td>2.7</td><td>2.4</td></tr><tr><td>Lithology</td><td colspan="2">Siltstone and Limestone</td></tr><tr><td>Failure description <sup>b</sup></td><td>1</td><td>1</td></tr></table>				Disc	1	2	Thickness (mm) <sup>a</sup>	33.41	33.60	Diameter (mm) <sup>a</sup>	59.98	59.98	Tensile strength (MPa)	2.7	2.4	Lithology	Siltstone and Limestone		Failure description <sup>b</sup>	1	1
Disc	1	2																			
Thickness (mm) <sup>a</sup>	33.41	33.60																			
Diameter (mm) <sup>a</sup>	59.98	59.98																			
Tensile strength (MPa)	2.7	2.4																			
Lithology	Siltstone and Limestone																				
Failure description <sup>b</sup>	1	1																			
<div><sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.</div> <div><sup>b</sup> Failure description: <sup>1</sup> Diametric failure;</div>																					
<div>Average tensile strength (MPa) 2.6</div>																					
<div><div>Prior to testing</div><div>After testing</div></div>																					
<div>Performed by PL/SL</div> <div>Date 2021-03-20</div>																					



## Brazilian Disc Test

Client	Golder Associates Ltd.		Project	1530382-7000
Sample	21-37-21-37-8.42to8.56m		Depth	8.42 - 8.56
Specimen parameters				
Disc	1	2	3	4
Thickness (mm) <sup>a</sup>	33.32	33.18	33.72	33.42
Diameter (mm) <sup>a</sup>	59.88	59.83	59.78	59.92
Tensile strength (MPa)	5.0	1.7	3.0	3.3
Lithology	Limestone and Siltstone	Siltstone	Siltstone and Limestone	Limestone
Failure description <sup>b</sup>	2, 3	4	1	4, 3
<sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet. <sup>b</sup> Failure description: <sup>2</sup> Partial diametric failure; <sup>3</sup> Failure along pre-existing structure; <sup>4</sup> Non-diametric failure; <sup>1</sup> Diametric failure;				
<div><div>Average tensile strength (MPa)</div><div>3.2</div></div>				
<div><div>Prior to testing</div><div>After testing</div></div> <div></div>				
Performed by	PL/SL		Date	2021-03-20

## Brazilian Disc Test

Client	Golder Associates Ltd.	Project	1530382-7000																		
Sample	21-4-21-4-8.04to8.14m	Depth	8.04 - 8.14																		
<div>Specimen parameters</div> <table><tr><td>Disc</td><td>1</td><td>2</td></tr><tr><td>Thickness (mm) <sup>a</sup></td><td>33.29</td><td>32.80</td></tr><tr><td>Diameter (mm) <sup>a</sup></td><td>60.21</td><td>60.09</td></tr><tr><td>Tensile strength (MPa)</td><td>2.1</td><td>3.0</td></tr><tr><td>Lithology</td><td colspan="2">Siltstone and Limestone</td></tr><tr><td>Failure description <sup>b</sup></td><td>1</td><td>1</td></tr></table>				Disc	1	2	Thickness (mm) <sup>a</sup>	33.29	32.80	Diameter (mm) <sup>a</sup>	60.21	60.09	Tensile strength (MPa)	2.1	3.0	Lithology	Siltstone and Limestone		Failure description <sup>b</sup>	1	1
Disc	1	2																			
Thickness (mm) <sup>a</sup>	33.29	32.80																			
Diameter (mm) <sup>a</sup>	60.21	60.09																			
Tensile strength (MPa)	2.1	3.0																			
Lithology	Siltstone and Limestone																				
Failure description <sup>b</sup>	1	1																			
<div><sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.</div> <div><sup>b</sup> Failure description: <sup>1</sup> Diametric failure;</div>																					
<div>Average tensile strength (MPa) 2.6</div>																					
<div><div>Prior to testing</div><div>After testing</div></div>																					
<div>Performed by PL/SL</div> <div>Date 2021-03-20</div>																					



June 15, 2021

Ms. Katie Nero  
Golder Associates Ltd.  
6925 Century Avenue, Suite #100  
Mississauga, Ontario  
Canada L5N 7K2

Re: UCS testing (Golder Project No. 1530382-7000)

Dear Ms. Nero

On June 8<sup>th</sup>, 2021, a total of three (3) HQ-sized rock core samples were received by Geomechanica Inc. via drop-off by Golder personnel. These samples were identified as being from project 1530382-7000. From these samples, two (2) UCS specimens were prepared and tested.

Details regarding the steps of specimen preparation and testing are presented in the accompanying laboratory report and summary spreadsheets.

Sincerely,



Bryan Tatone Ph.D., P. Eng.

Geomechanica Inc.  
Tel: (647) 478-9767  
Email: [bryan.tatone@geomechanica.com](mailto:bryan.tatone@geomechanica.com)

# Rock Laboratory Testing Results

**A report submitted to:**

Katie Nero  
Golder Associates Ltd.  
6925 Century Avenue, Suite #100  
Mississauga, Ontario  
Canada L5N 7K2

**Prepared by:**

Bryan Tatone, PhD, PEng  
Omid Mahabadi, PhD, PEng  
Geomechanica Inc.  
#900-390 Bay St.  
Toronto ON  
M5H 2Y2 Canada  
Tel: +1-647-478-9767  
lab@geomechanica.com

**June 15, 2021**

Project number: 1530382-7000

**Abstract**

This document summarizes the results of rock laboratory testing, including 2 Uniaxial Compression Strength (UCS) tests. The UCS values and Young's modulus along with photographs of samples before and after testing are presented herein.

**In this document:**

1 Uniaxial Compressive Strength Tests	1
Appendices	4

# 1 Uniaxial Compressive Strength Tests

## 1.1 Overview

This section summarizes the results of uniaxial compressive strength (UCS) testing of HQ3-sized specimens. The testing was performed in Geomechanica's rock testing laboratory using a 150 ton (1.3 MN) Forney loading frame equipped with pressure-compensated control valve to maintain an axial displacement rate of approximately 0.150 mm/min (Figure 1). The preparation and testing procedure for each specimen included the following:

1. Unwrapping the core sample, inspecting it for damage, and re-wrapping it in electrical tape to minimize exposure to moisture during subsequent specimen preparation.
2. Diamond cutting the core sample to obtain cylindrical specimens with an appropriate length (length:diameter = 2:1) and nearly parallel end faces.
3. Diamond grinding of the specimen to obtain flat (within  $\pm 0.025$  mm) and parallel end faces (within  $0.25^\circ$ ).
4. Placing the specimen into the loading frame, applying a 1 kN axial load, and removing the electrical tape.
5. Axially loading the specimens to rupture while continuously recording axial force and axial deformation to determine the peak strength (UCS) and tangent Young's modulus.



Figure 1: Forney loading frame setup for UCS testing.

Using a precision V-block mounted on the magnetic chuck of the surface grinder, test specimens met the end flatness, end parallelism, and perpendicularity criteria set out in ASTM D4543-19. The side straightness criteria, as checked with a feeler gauge, and the minimum length:diameter criteria were met for all specimens unless noted otherwise in Table 1. Testing of the specimens followed ASTM D7012-14 with the following note:

- Testing included measurement of the UCS and elastic modulus, but not the Poisson's ratio. This represents a hybrid between Methods C and D of ASTM D7012-14.

## 1.2 Results

The results of UCS testing are summarized in Table 1. The corresponding stress-strain curves for the uniaxial compression tests are presented in Figure 2. The Young's modulus is the tangent modulus calculated as the slope of the best-fit line through 600 data points defining the stress-strain curve. Typically the modulus is defined at 50% of the UCS strength. However, due to prevalent non-linear stress-strain behaviour, custom stress ranges (where specimens deformed linearly) were selected for moduli determination. These stress ranges are provided in the summary spreadsheet that accompanies this report. Please note that additional specimen details and measurements are provided in the summary spreadsheet that accompanies this report.

Table 1: Summary of Uniaxial Compression test results.

Sample	Depth (m)	Bulk density $\rho$ (g/cm <sup>3</sup> )	UCS (MPa)	Young's modulus $E$ (GPa)	Lithology	Failure description
21-16-8.92to9.06m	8.92 - 9.06	2.600	8.6	1.3	Shale	1, 2
21-17-5.42to5.62m	5.42 - 5.62	2.603	13.2	1.4	Shale	3

<sup>1</sup> Axial splitting failure  
<sup>2</sup> Failure localized in softer shale layer  
<sup>3</sup> Partial hourglass failure

## 1.3 Specimen photographs

Photographs of the specimens before and after testing are presented in the Appendix of this report.

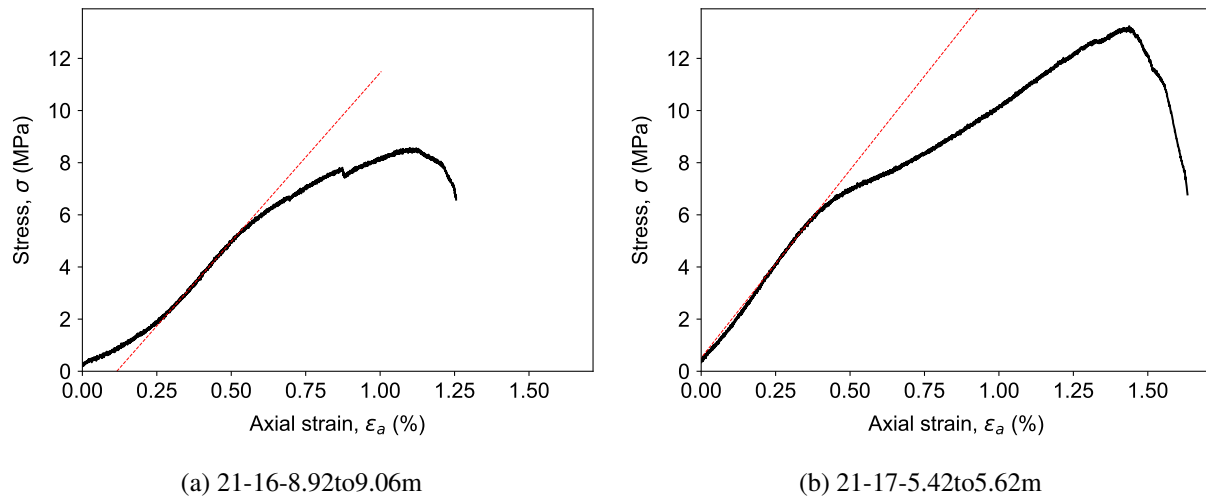




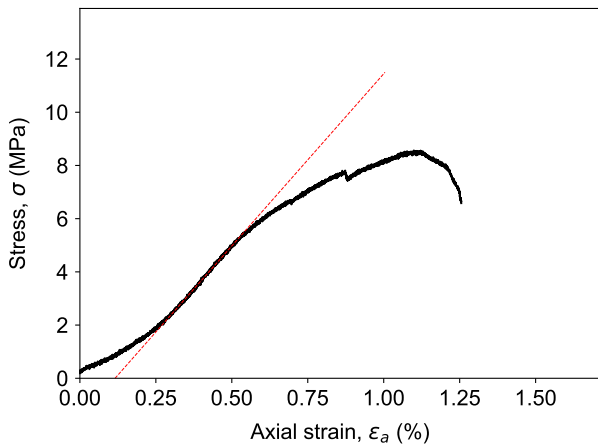
Figure 2: Measured stress-strain curves.

# Appendices



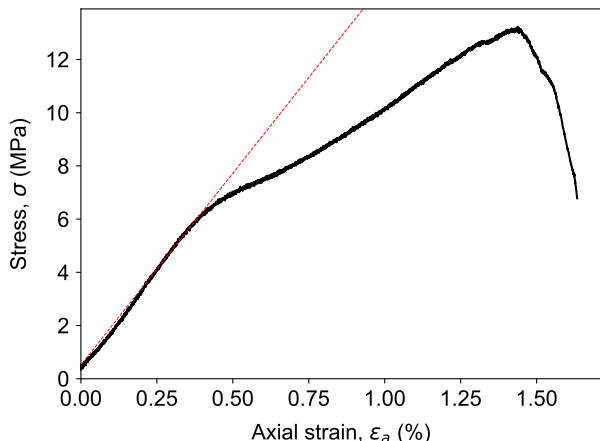
## Specimen sheets

- 21-16-8.92to9.06m
- 21-17-5.42to5.62m

## Uniaxial Compression Test

Client	Golder Associates Ltd.	Project	1530382-7000														
Sample	21-16-8.92to9.06m	Depth	8.92 - 9.06														
<div>Specimen parameters</div> <table><tr><td>Diameter (mm)<sup>a</sup></td><td>60.02</td></tr><tr><td>Length (mm)<sup>a</sup></td><td>121.64</td></tr><tr><td>Bulk density <math>\rho</math> (g/cm<sup>3</sup>)</td><td>2.600</td></tr><tr><td>UCS (MPa)</td><td>8.6</td></tr><tr><td>Young's modulus <math>E</math> (GPa)<sup>b</sup></td><td>1.3</td></tr><tr><td>Lithology</td><td>Shale</td></tr><tr><td>Failure description<sup>c</sup></td><td>1, 2</td></tr></table>		Diameter (mm) <sup>a</sup>	60.02	Length (mm) <sup>a</sup>	121.64	Bulk density $\rho$ (g/cm <sup>3</sup> )	2.600	UCS (MPa)	8.6	Young's modulus $E$ (GPa) <sup>b</sup>	1.3	Lithology	Shale	Failure description <sup>c</sup>	1, 2	<div>Prior to testing</div> 	<div>After testing</div> 
Diameter (mm) <sup>a</sup>	60.02																
Length (mm) <sup>a</sup>	121.64																
Bulk density $\rho$ (g/cm <sup>3</sup> )	2.600																
UCS (MPa)	8.6																
Young's modulus $E$ (GPa) <sup>b</sup>	1.3																
Lithology	Shale																
Failure description <sup>c</sup>	1, 2																
<div><div><div><sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.</div><div><sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through <math>\pm 300</math> data points on either side of the point representing 50.0% of the peak strength.</div><div><sup>c</sup> Failure description: <sup>1</sup> Axial splitting failure; <sup>2</sup> Failure localized in softer shale layer;</div></div><div></div></div>																	
Remarks: Loading Rate: 0.15 mm/min																	
Performed by	AG	Date	2021-06-11														

## Uniaxial Compression Test

Client	Golder Associates Ltd.	Project	1530382-7000														
Sample	21-17-5.42to5.62m	Depth	5.42 - 5.62														
<div>Specimen parameters</div> <table><tr><td>Diameter (mm) <sup>a</sup></td><td>59.95</td></tr><tr><td>Length (mm) <sup>a</sup></td><td>123.51</td></tr><tr><td>Bulk density <math>\rho</math> (g/cm<sup>3</sup>)</td><td>2.603</td></tr><tr><td>UCS (MPa)</td><td>13.2</td></tr><tr><td>Young's modulus <math>E</math> (GPa) <sup>b</sup></td><td>1.4</td></tr><tr><td>Lithology</td><td>Shale</td></tr><tr><td>Failure description <sup>c</sup></td><td>3</td></tr></table>		Diameter (mm) <sup>a</sup>	59.95	Length (mm) <sup>a</sup>	123.51	Bulk density $\rho$ (g/cm <sup>3</sup> )	2.603	UCS (MPa)	13.2	Young's modulus $E$ (GPa) <sup>b</sup>	1.4	Lithology	Shale	Failure description <sup>c</sup>	3	<div>Prior to testing</div> 	<div>After testing</div> 
Diameter (mm) <sup>a</sup>	59.95																
Length (mm) <sup>a</sup>	123.51																
Bulk density $\rho$ (g/cm <sup>3</sup> )	2.603																
UCS (MPa)	13.2																
Young's modulus $E$ (GPa) <sup>b</sup>	1.4																
Lithology	Shale																
Failure description <sup>c</sup>	3																
<div><div><div><sup>a</sup> Additional specimen measurement/details provided in accompanying summary spreadsheet.</div><div><sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through <math>\pm 300</math> data points on either side of the point representing 38.0% of the peak strength.</div><div><sup>c</sup> Failure description: <sup>3</sup> Partial hourglass failure;</div></div><div></div></div>																	
Remarks: Loading Rate: 0.15 mm/min																	
Performed by	AG	Date	2021-06-14														



December 16, 2016

Ms. Sandra McGaghran  
Golder Associates Ltd.  
6925 Century Avenue, Suite #100  
Mississauga, Ontario  
Canada L5N 7K2

Re: UCS Testing of shale samples - Golder Associates Project No. 1530382

Dear Ms. McGaghran:

On December 2, 2016 three (3) NQ-sized core samples were received by Geomechanica Inc. via drop-off. These samples were identified as shale from a drilling investigation near the QEW and Dixie Road in Mississauga, Ontario. Three (3) uniaxial compressive strength (UCS) test specimens were prepared and tested (one from each sample). The tangent elastic modulus was measured during one (1) of these three tests.

Details regarding the steps of specimen preparation and testing along with the test results and photographs of specimens before and after testing are presented in the accompanying laboratory report.

Sincerely,



Giovanni Grasselli Ph.D., P. Eng.

Geomechanica Inc.  
Tel: (647) 478-9767  
Email: [giovanni.grasselli@geomechanica.com](mailto:giovanni.grasselli@geomechanica.com)

# Rock Laboratory Testing Results

**A report submitted to:**

Ms. Sandra McGaghran  
Golder Associates Ltd.  
6925 Century Avenue, Suite #100  
Mississauga, Ontario  
Canada L5N 7K2

**Prepared by:**

Bryan Tatone, PhD  
Omid Mahabadi, PhD  
Giovanni Grasselli, PhD, PEng  
Geomechanica Inc  
#900-390 Bay St  
Toronto ON  
M5H 3V9 Canada  
Tel: +1-647-478-9767  
info@geomechanica.com

**December 16, 2016**

Project number: 1530382

**Abstract**

This document summarizes the results of Uniaxial Compressive Strength (UCS) testing of 3 NQ-sized rock core samples for Golder Associates Ltd. (Golder Project No. 1530382). The samples were identified as shale from a drilling investigation near the QEW and Dixie Road in Mississauga Ontario. The results, including the tabulated values of the UCS, bulk density, and elastic modulus along with photos of the test specimens before and after testing, are presented herein.

**In this document:**

1	Uniaxial Compressive Strength Tests	1
---	-------------------------------------	---

# 1 Uniaxial Compressive Strength Tests

## 1.1 Introduction

This section summarizes the results of rock laboratory testing of NQ-sized shale samples under unconfined uniaxial compression. The tests were performed in Geomechanica's rock testing laboratory in Vaughan, Ontario using a 150 ton (1.3 MN) Forney hydraulic loading frame equipped with pressure-compensated control valve to maintain a nearly constant axial displacement rate of 0.1 mm/min (Figure 1). The specimen preparation and testing procedure included the following:

1. Unwrapping of the core samples, inspecting them for damage, and re-wrapping them in electrical tape to maintain the moisture content and avoid breakage during handling and preparation.
2. Diamond sawing the core samples to length such that cylindrical specimens with nearly parallel end faces were obtained. When possible, specimens were cut such that they had a length:diameter ratio of at least 2:1. For this project, 1 out of the 3 core samples provided was too short to obtain the desired length to diameter ratio.
3. Surface grinding of specimens to obtain flat and parallel end faces within  $\pm 0.025$  mm.
4. Loading the specimens into a stiff hydraulic loading frame and applying a small axial load of 0.5-1.0 kN, removing of the electrical tape, and subsequently loading the specimen to rupture while continuously recording axial force and axial deformation (for select specimens) to determine the peak strength (UCS) and (tangent) Young's modulus ( $E$ ) (for select specimens).



Figure 1: Forney loading frame used for uniaxial compression testing.

## 1.2 Results

The results of UCS testing are summarized in Table 1. The stress-strain curve for CV 02/03-1 is shown in Figure 2. The Young's modulus value presented in Table 1 represents the tangent modulus, calculated as the slope of the best fit line through  $\pm 300$  data points on either side of the point representing 50% of the UCS.

Table 1: Summary of UCS test results.

Sample	Rock type	Depth from (m)	Depth to (m)	Bulk density (g/cm <sup>3</sup> )	UCS (MPa)	Young's modulus, $E_{50}$ (GPa)	Notes
SWM-A-2	Shale	5.10	5.30	2.59	17.7	-	
CV 02/03-1	Shale	7.47	7.70	2.60	17.6	1.2	<sup>1</sup>
HML-1	Shale	7.41	7.50	2.59	17.8	-	<sup>2</sup>
Min				2.59	17.6	1.2	
Max				2.60	17.8	1.2	
Mean				2.59	17.7	1.2	
Standard Deviation				0.01	0.1	-	

<sup>1</sup> Top 25 mm of specimen is limestone  
<sup>2</sup> Specimen length:diameter < 2:1

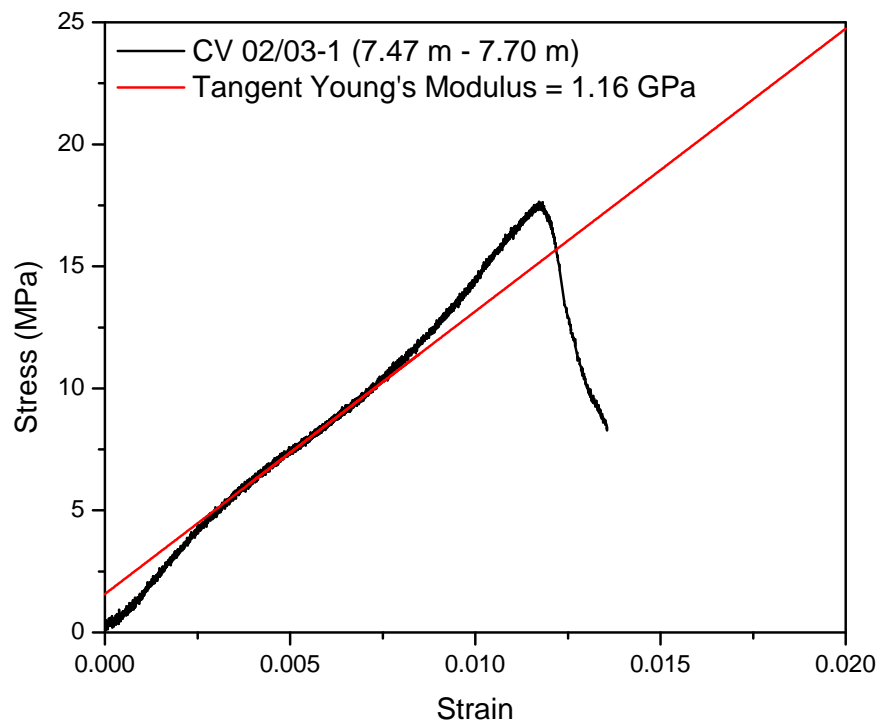


Figure 2: Measured stress-strain curves for samples from different boreholes.

### 1.3 Specimen photographs

Photographs of the specimens before and after testing are shown in Figure 3.



Figure 3: Photographs of test specimens before testing (top) and after testing (bottom).

March 11, 2020

Ms. Katelyn Nero  
Golder Associates Ltd.  
6925 Century Avenue, Suite #100  
Mississauga, Ontario  
Canada L5N 7K2

Re: QEW/Dixie UCS, testing  
(Golder Project 153082)

Dear Ms. Nero:

On February 24<sup>th</sup>, 2020 three(3) HQ-sized core samples were received by Geomechanica Inc. via drop-off by Golder personnel. These samples were identified as being from the QEW/Dixie Project (Golder Project No. 153082). From these samples, two (2) UCS specimens were prepared and tested.

Details regarding the steps of specimen preparation and testing along with the results and photographs of the test specimens before and after testing are presented in the accompanying laboratory report and summary spreadsheet(s).

Sincerely,



Bryan Tatone Ph.D., P. Eng.

Geomechanica Inc.  
Tel: (647) 478-9767  
Email: [bryan.tatone@geomechanica.com](mailto:bryan.tatone@geomechanica.com)



# Rock Laboratory Testing Results

**A report submitted to:**

Katelyn Nero  
Golder Associates Ltd.  
6925 Century Avenue, Suite #100  
Mississauga, Ontario  
Canada L5N 7K2

**Prepared by:**

Bryan Tatone, PhD, PEng  
Omid Mahabadi, PhD, PEng  
Geomechanica Inc.  
#900-390 Bay St.  
Toronto ON  
M5H 2Y2 Canada  
Tel: +1-647-478-9767  
lab@geomechanica.com

**March 11, 2020**

Project number: 1530382

**Abstract**

This document summarizes the results of rock laboratory testing, including the results of 2 Uniaxial Compressive Strength (UCS) tests. Along with the UCS values, the tangent Young's modulus along with photographs of specimens before and after testing are presented.

**In this document:**

1 Uniaxial Compressive Strength Tests	1
Appendices	4

# 1 Uniaxial Compressive Strength Tests

## 1.1 Overview

This section summarizes the results of uniaxial compressive strength testing. The testing was performed in Geomechanica's rock testing laboratory using a 150 ton (1.3 MN) Forney loading frame equipped with pressure-compensated control valve to maintain an axial displacement rate of approximately 0.2 mm/min (Figure 1). The specimen preparation and testing procedure included the following:

1. Unwrapping of the core sample, inspecting it for damage, and re-wrapping it in electrical tape to minimize exposure to moisture during subsequent specimen preparation.
2. Diamond cutting of the core sample to obtain cylindrical specimens with an appropriate length (length:diameter = 2:1) and nearly parallel end faces.
3. Diamond grinding of the specimen to obtain flat (within  $\pm 0.025$  mm) and parallel end faces (within  $0.25^\circ$ ).
4. Placing of the specimen into the loading frame, applying a 1 kN axial load, and removing the electrical tape.
5. Axially loading the specimens to rupture while continuously recording axial force and axial deformation to determine the peak strength (UCS) and tangent Young's modulus.



Figure 1: Forney loading frame setup for UCS testing.



Using a precision V-block mounted on the magnetic chuck of the surface grinder, the test specimens met the end flatness, end parallelism, and perpendicularity criteria set out in ASTM D4543-08. The side straightness criteria, as checked with a feeler gauge, was met for all samples and the minimum length:diameter criteria was met for all specimens unless noted otherwise in Table 1. Testing of the specimens followed ASTM D7012-14 with the following exceptions:

- These tests included measurement of the UCS and tangent Young' (elastic) modulus, but not the Poisson's ratio. This represents a hybrid between Methods C and D of ASTM D7012-14.

## 1.2 Results

The results of the UCS tests are summarized in Table 1. Additional specimen details and measurements are provided in the summary spreadsheet that accompanies this report. The corresponding stress-strain curves are presented in Figure 2. The Young's modulus is the tangent modulus, calculated as the slope of the best fit line through  $\pm 300$  data points on either side of the point representing 50.0% of the peak strength.

Table 1: Summary of UCS results.

Sample	Depth (m)	Bulk density $\rho$ (g/cm <sup>3</sup> )	UCS (MPa)	Young's modulus $E$ (GPa)	Lithology	Failure description
OPB-1, UC1	7.13 - 7.29	2.588	21.1	1.1	Georgian Bay Formation - Shale	1, 2
OPB-2, UC2	6.31 - 6.41	2.582	16.2	0.7	Georgian Bay Formation - Shale	3, 2, 4
Average		2.585	18.6	0.9		
Standard deviation		0.003	2.5	0.2		

<sup>1</sup> Hourglass failure

<sup>2</sup> Specimen emitted pore water upon loading

<sup>3</sup> Axial splitting failure

<sup>4</sup> Length:Diameter ratio less than 2

## 1.3 Specimen photographs

Photographs of the specimens before and after testing are presented in the Appendix of this report.

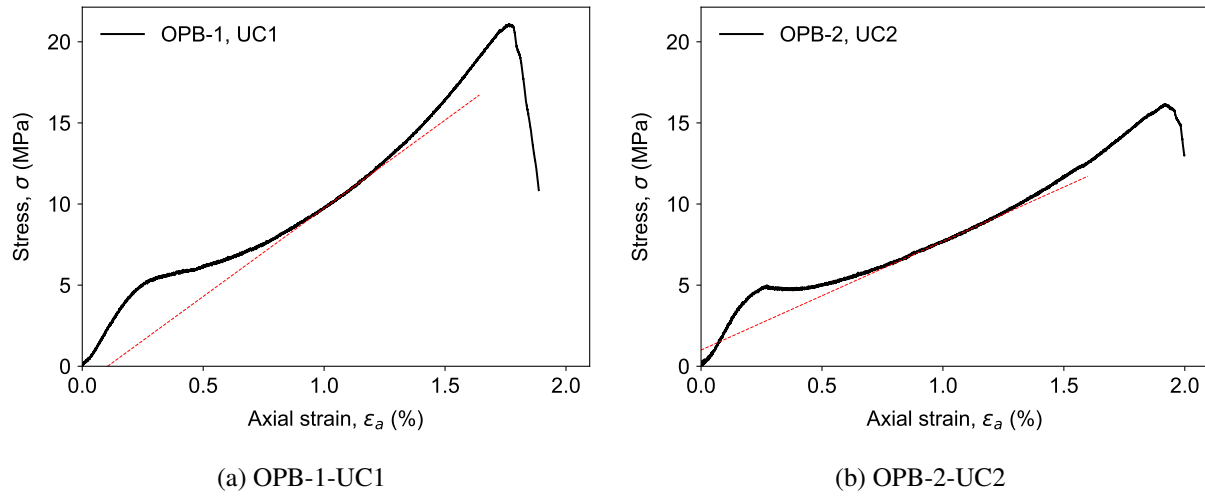




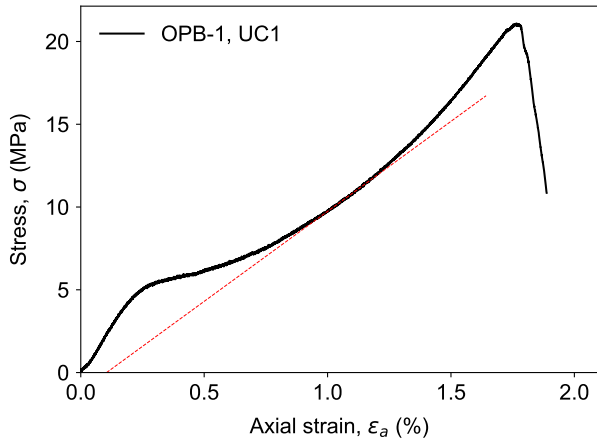
Figure 2: Measured stress-strain curves.

# Appendices



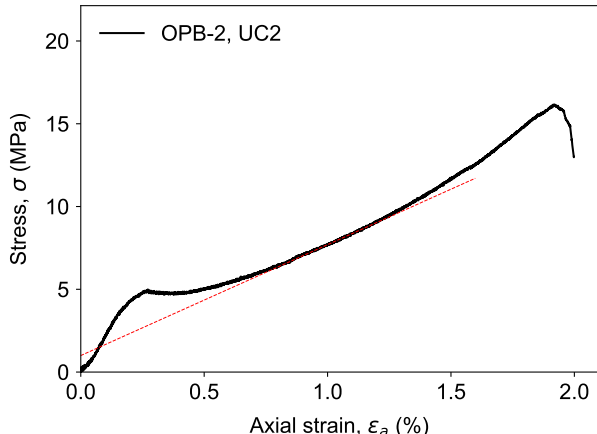
## Specimen sheets

- OPB-1, UC1
- OPB-2, UC2

## Uniaxial Compression Test

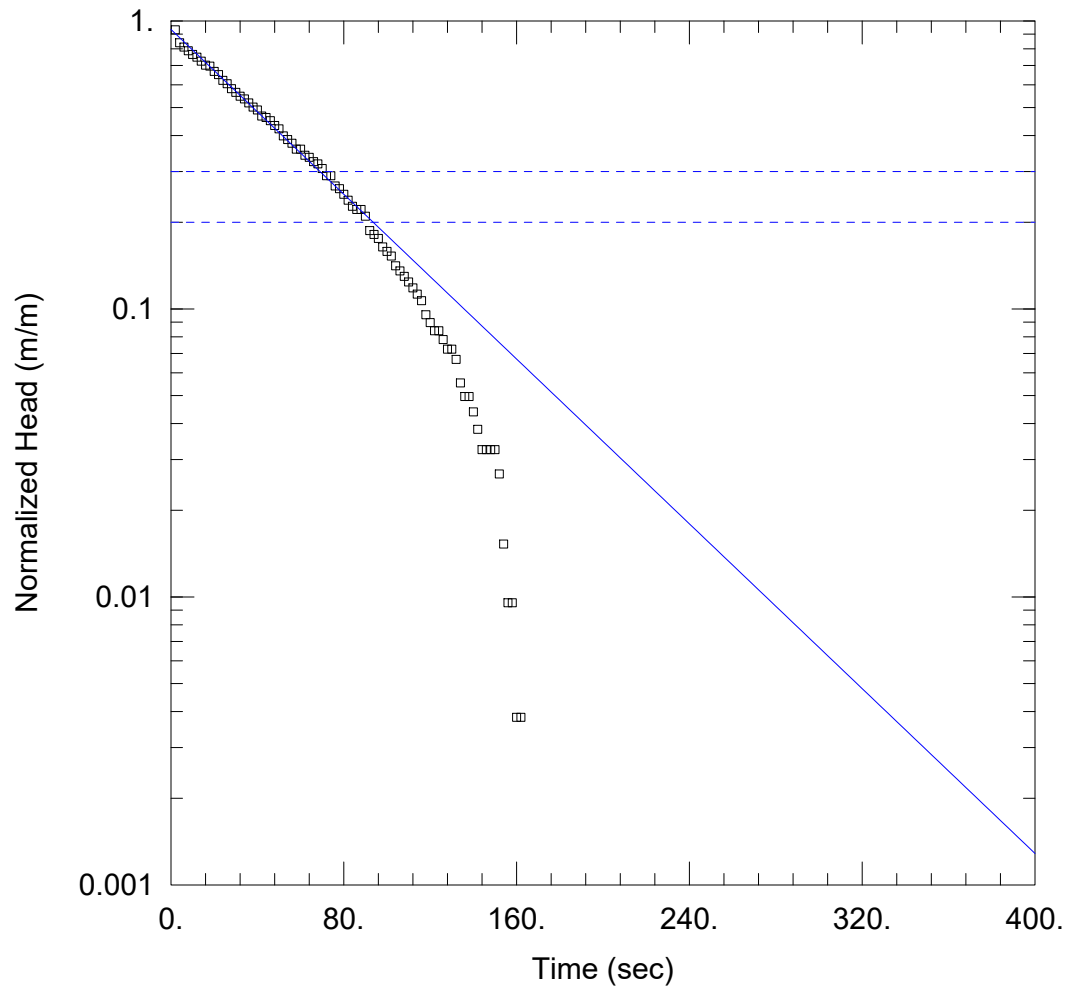
Client	Golder Associates Ltd.	Project	1530382
Sample	OPB-1, UC1	Depth	7.13 - 7.29
Specimen parameters		Prior to testing	After testing
Diameter (mm) <sup>a</sup>	63.02		
Length (mm) <sup>a</sup>	127.18		
Bulk density ρ (g/cm³)	2.588		
UCS (MPa)	21.1		
Young's modulus E (GPa) <sup>b</sup>	1.1		
Lithology	Georgian Bay Formation - Shale		
Failure description <sup>c</sup>	1, 2		
<sup>a</sup> Additional specimen measurement/details provides in accompanying summary spreadsheet.			
<sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through ±300 data points on either side of the point representing 50.0% of the peak strength.			
<sup>c</sup> Failure description: <sup>1</sup> Hourglass failure; <sup>2</sup> Specimen emitted pore water upon loading;			
			
Remarks:			
Performed by	BSAT	Date	2020-03-10

## Uniaxial Compression Test

Client	Golder Associates Ltd.	Project	1530382
Sample	OPB-2, UC2	Depth	6.31 - 6.41
Specimen parameters		Prior to testing	After testing
Diameter (mm) <sup>a</sup>	62.92		
Length (mm) <sup>a</sup>	101.03		
Bulk density ρ (g/cm³)	2.582		
UCS (MPa)	16.2		
Young's modulus E (GPa) <sup>b</sup>	0.7		
Lithology	Georgian Bay Formation - Shale		
Failure description <sup>c</sup>	3, 2, 4		
<sup>a</sup> Additional specimen measurement/details provides in accompanying summary spreadsheet.			
<sup>b</sup> Tangent modulus, calculated as the slope of the best fit line through ±300 data points on either side of the point representing 50.0% of the peak strength.			
<sup>c</sup> Failure description: <sup>3</sup> Axial splitting failure; <sup>2</sup> Specimen emitted pore water upon loading; <sup>4</sup> Length:Diameter ratio less than 2;			
			
Remarks:			
Performed by	BSAT	Date	2020-03-10

**APPENDIX H**

# Single Well Response Test Results



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-02\_FHT\_LB.aqt

Date: 02/03/22

Time: 19:40:30

### PROJECT INFORMATION

Company: Golder Associates

Client: AECOM/QEW CAWTHRA

Project: 1530382

Location: Mississauga

Test Well: BH21-02

Test Date: 07/05/2021

### AQUIFER DATA

Saturated Thickness: 2.61 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-02)

Initial Displacement: -0.524 m

Static Water Column Height: 2.61 m

Total Well Penetration Depth: 2.61 m

Screen Length: 1.52 m

Casing Radius: 0.0254 m

Well Radius: 0.075 m

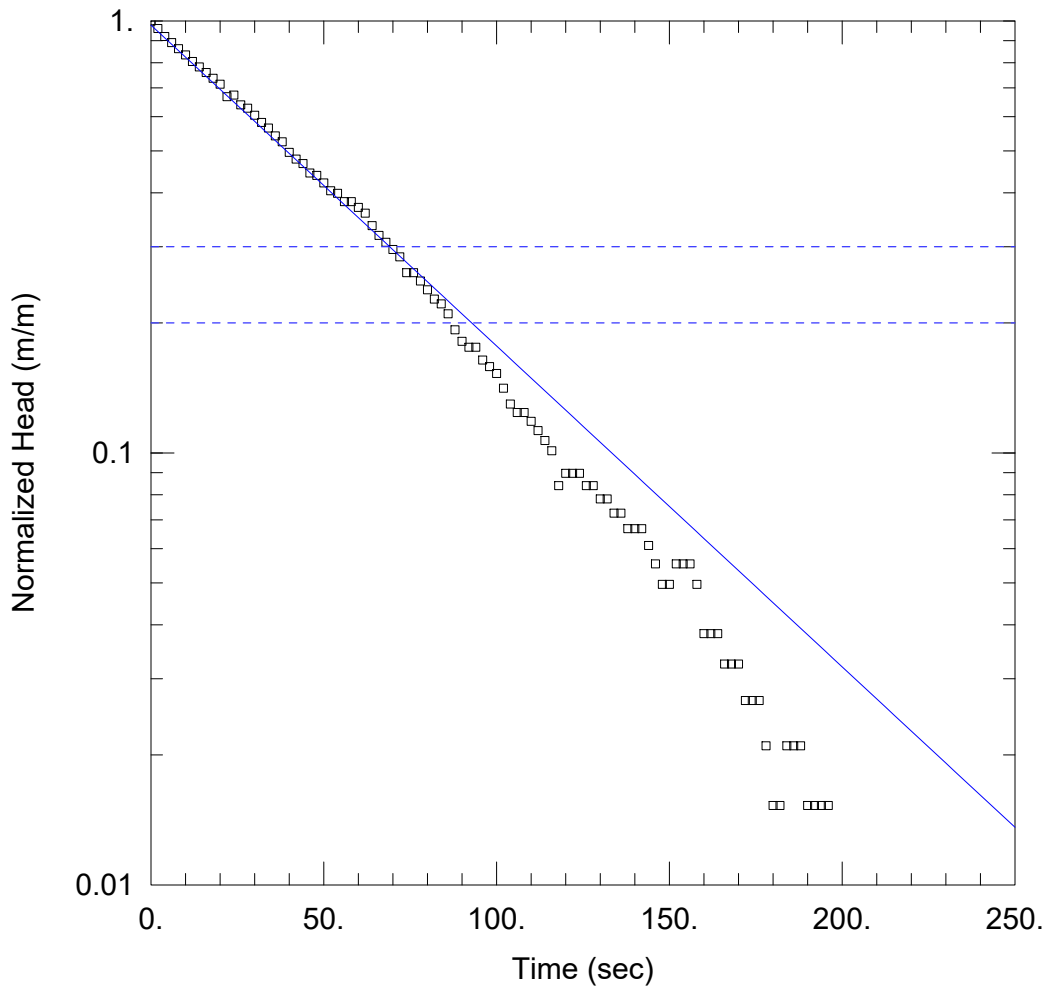
### SOLUTION

Aquifer Model: Confined

Solution Method: Bouwer-Rice

$K = 8.911E-6$  m/sec

$y_0 = -0.4893$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-02\_RHT\_LB.aqt

Date: 02/03/22

Time: 19:41:07

### PROJECT INFORMATION

Company: Golder Associates

Client: AECOM/QEW CAWTHRA

Project: 1530382

Location: Mississauga

Test Well: BH21-02

Test Date: 07/05/2021

### AQUIFER DATA

Saturated Thickness: 2.61 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-02)

Initial Displacement: 0.524 m

Static Water Column Height: 2.61 m

Total Well Penetration Depth: 2.61 m

Screen Length: 1.52 m

Casing Radius: 0.0254 m

Well Radius: 0.075 m

### SOLUTION

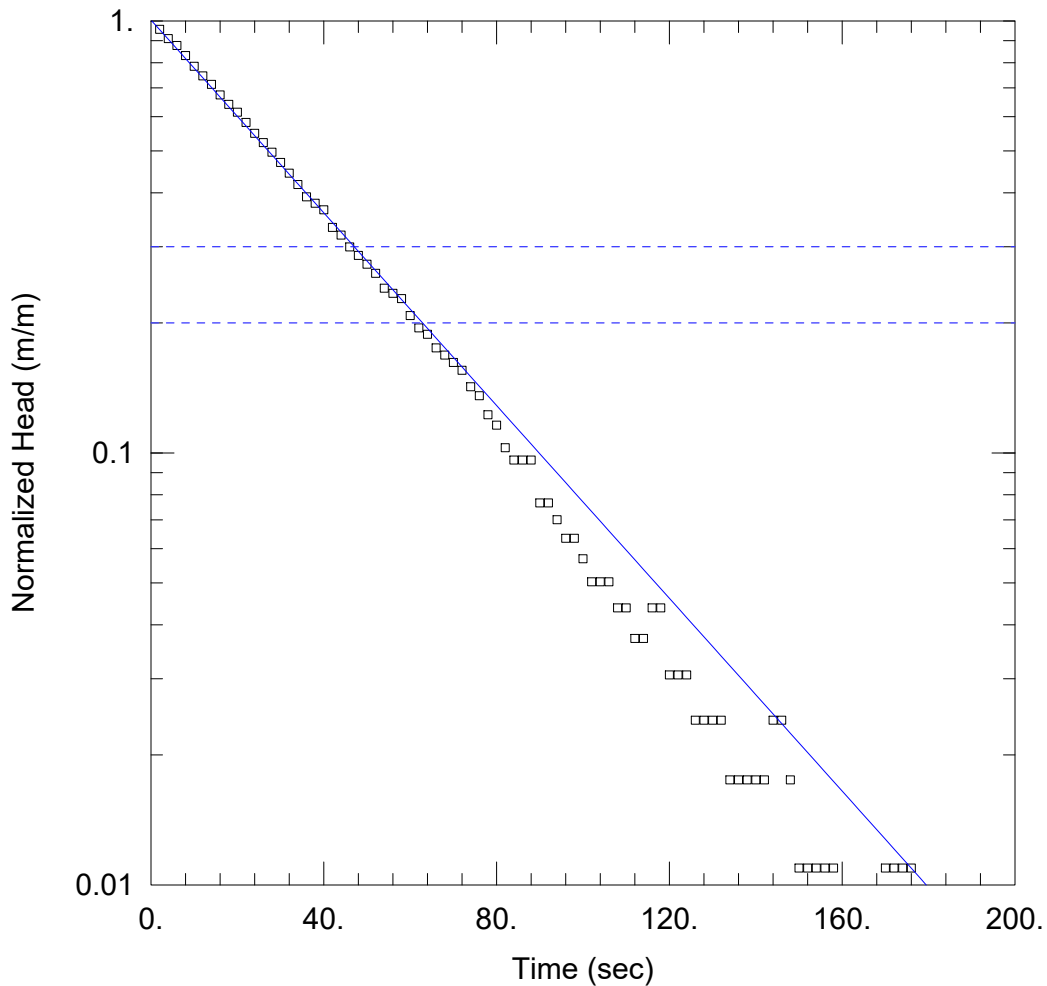
Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 9.254E-6$  m/sec

$y_0 = 0.5124$  m





### WELL TEST ANALYSIS

Data Set: C:\...\BH21-04\_FHT\_LB.aqt

Date: 02/04/22

Time: 13:35:12

### PROJECT INFORMATION

Company: Golder Associates

Client: AECOM/QEW CAWTHRA

Project: 1530382

Location: Mississauga

Test Well: BH21-04 FHT

Test Date: 06/29/2021

### AQUIFER DATA

Saturated Thickness: 3.32 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-04 FHT)

Initial Displacement: -0.457 m

Static Water Column Height: 3.32 m

Total Well Penetration Depth: 3.32 m

Screen Length: 1.83 m

Casing Radius: 0.0254 m

Well Radius: 0.075 m

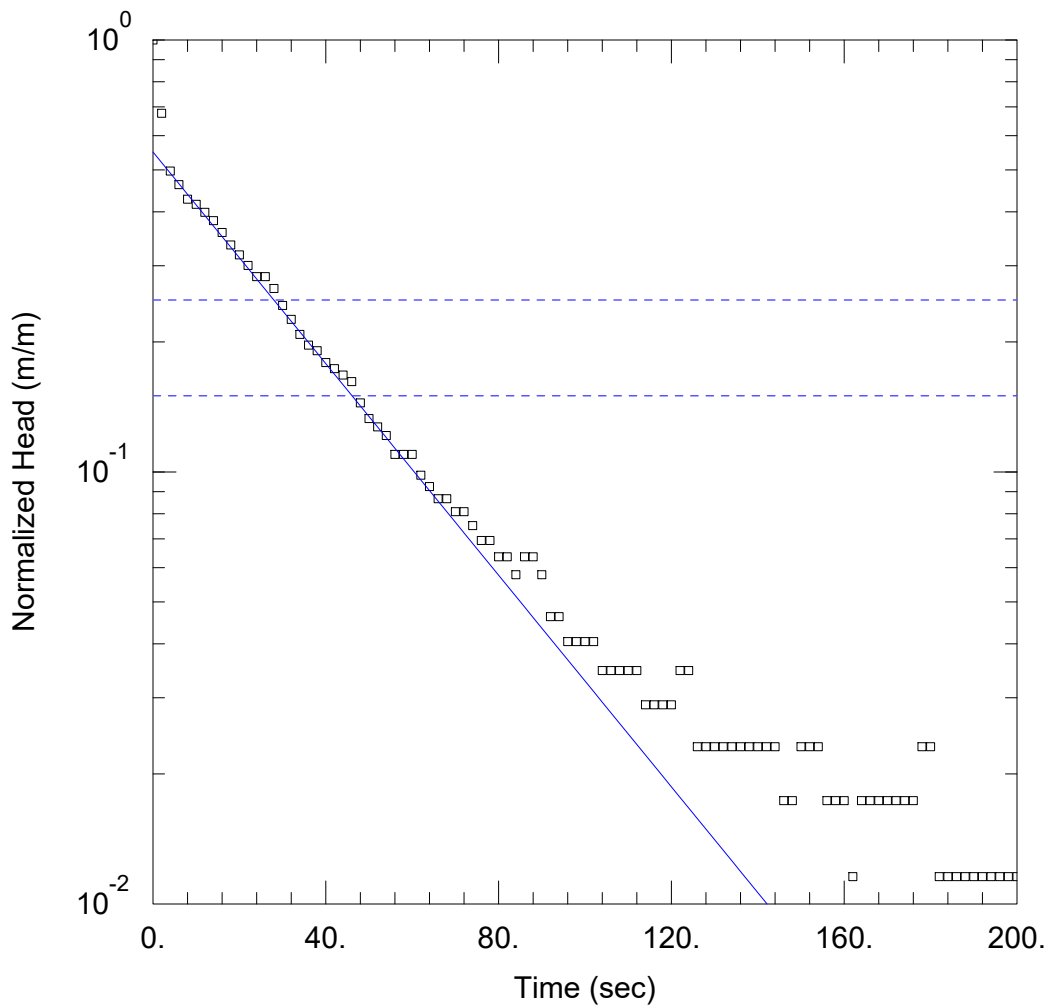
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.245E-5$  m/sec

$y_0 = -0.4593$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-06\_FHT\_LB.aqt

Date: 02/08/22

Time: 19:52:49

### PROJECT INFORMATION

Company: Golder Associates

Client: AECOM/QEW CAWTHRA

Project: 1530382

Location: Mississauga

Test Well: BH21-06 FHT

Test Date: 07/08/2021

### AQUIFER DATA

Saturated Thickness: 3.18 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-06 FHT)

Initial Displacement: -0.519 m

Static Water Column Height: 3.18 m

Total Well Penetration Depth: 3.18 m

Screen Length: 2.46 m

Casing Radius: 0.0254 m

Well Radius: 0.075 m

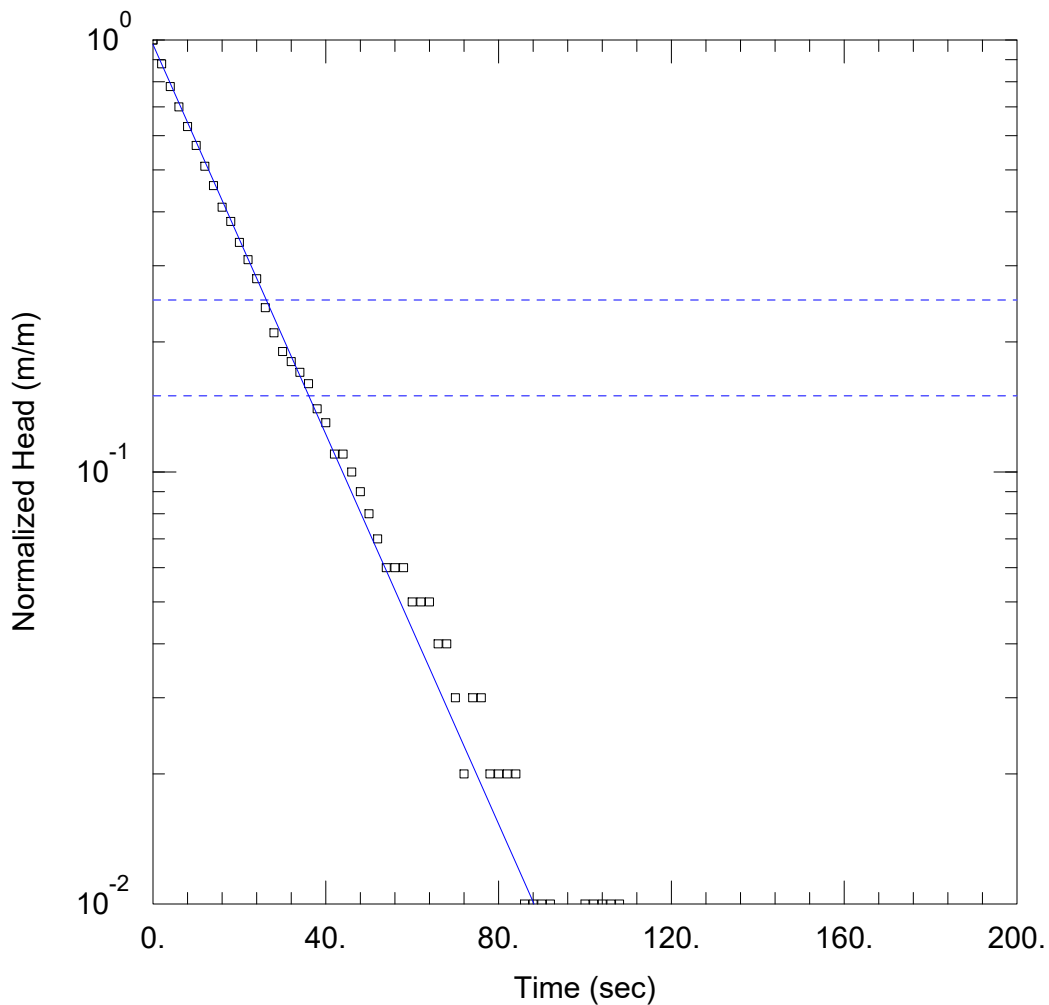
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 1.291E-5$  m/sec

$y_0 = -0.2856$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-06\_RHT\_LB.aqt

Date: 02/08/22

Time: 19:47:43

### PROJECT INFORMATION

Company: Golder Associates

Client: AECOM/QEW CAWTHRA

Project: 1530382

Location: Mississauga

Test Well: BH21-06 RHT

Test Date: 07/08/2021

### AQUIFER DATA

Saturated Thickness: 3.18 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-06 RHT)

Initial Displacement: 0.3 m

Static Water Column Height: 3.18 m

Total Well Penetration Depth: 3.18 m

Screen Length: 2.46 m

Casing Radius: 0.0254 m

Well Radius: 0.075 m

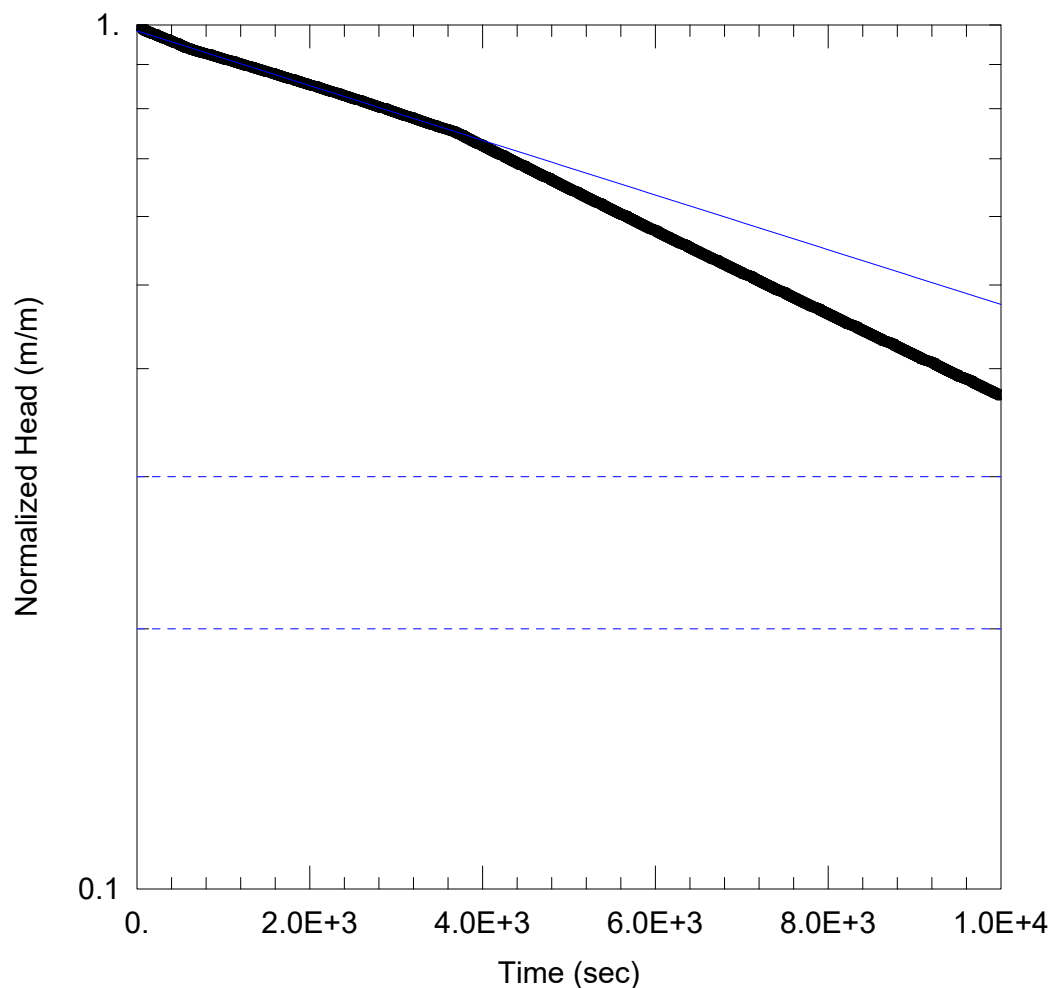
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 2.378E-5$  m/sec

$y_0 = 0.2928$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-08\_RHT\_LB.aqt

Date: 02/04/22

Time: 13:32:52

### PROJECT INFORMATION

Company: Golder Associates

Client: AECOM/QEW CAWTHRA

Project: 1530382

Location: Mississauga

Test Well: BH21-08 RHT

Test Date: 07/06/2021

### AQUIFER DATA

Saturated Thickness: 9.79 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-08 RHT)

Initial Displacement: 8.976 m

Static Water Column Height: 9.79 m

Total Well Penetration Depth: 9.79 m

Screen Length: 3.36 m

Casing Radius: 0.0254 m

Well Radius: 0.075 m

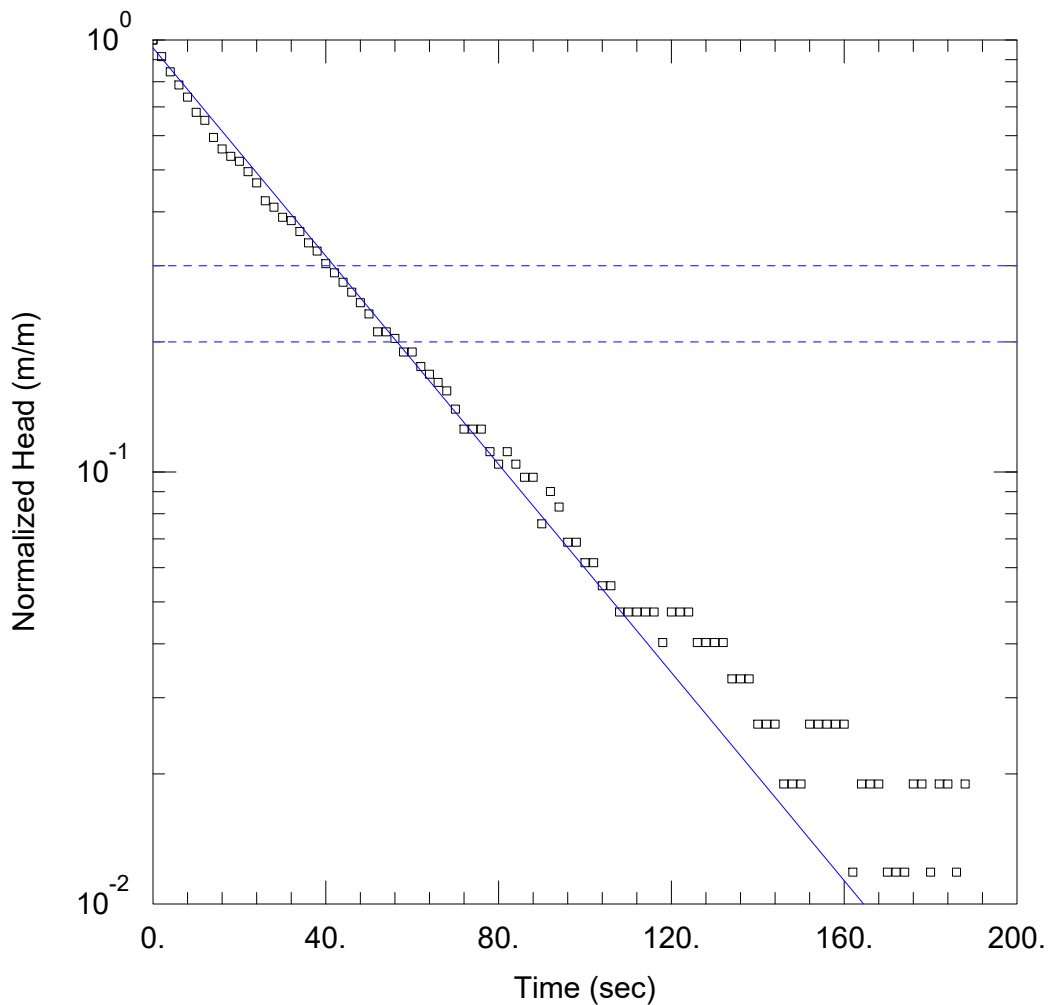
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 2.492E-8$  m/sec

$y_0 = 8.834$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-11\_RHT\_LB.aqt

Date: 02/04/22

Time: 13:52:11

### PROJECT INFORMATION

Company: Golder Associates

Client: AECOM/QEW CAWTHRA

Project: 1530382

Location: Mississauga

Test Well: BH21-11 RHT

Test Date: 06/29/2021

### AQUIFER DATA

Saturated Thickness: 3.4 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-11 RHT)

Initial Displacement: 0.422 m

Static Water Column Height: 3.4 m

Total Well Penetration Depth: 3.4 m

Screen Length: 1.83 m

Casing Radius: 0.0254 m

Well Radius: 0.075 m

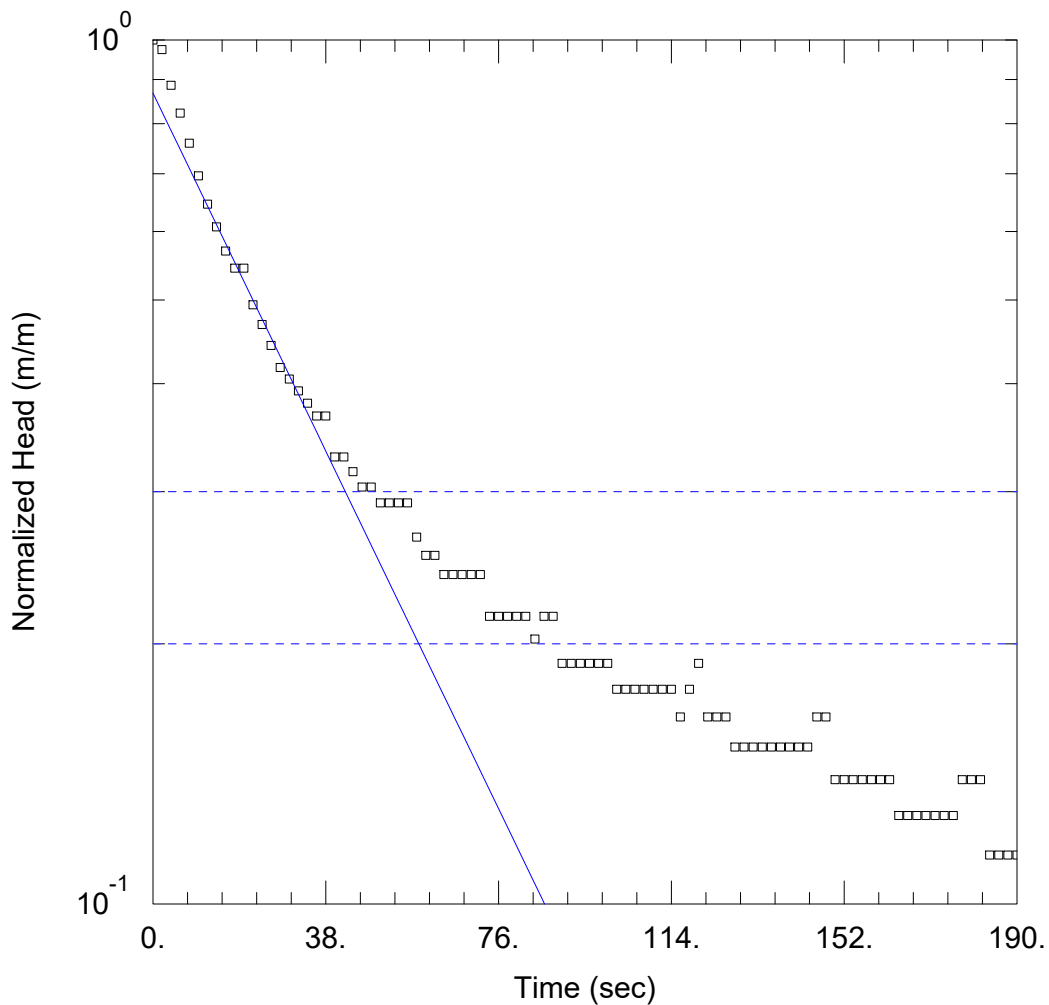
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.351E-5$  m/sec

$y_0 = 0.4045$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-16\_FHT\_LB.aqt

Date: 02/04/22

Time: 13:57:11

### PROJECT INFORMATION

Company: Golder Associates

Client: AECOM/QEW CAWTHRA

Project: 1530382

Location: Mississauga

Test Well: BH21-16 FHT

Test Date: 07/07/2021

### AQUIFER DATA

Saturated Thickness: 6.46 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-16 FHT)

Initial Displacement: -0.237 m

Static Water Column Height: 6.46 m

Total Well Penetration Depth: 6.46 m

Screen Length: 1.83 m

Casing Radius: 0.0254 m

Well Radius: 0.075 m

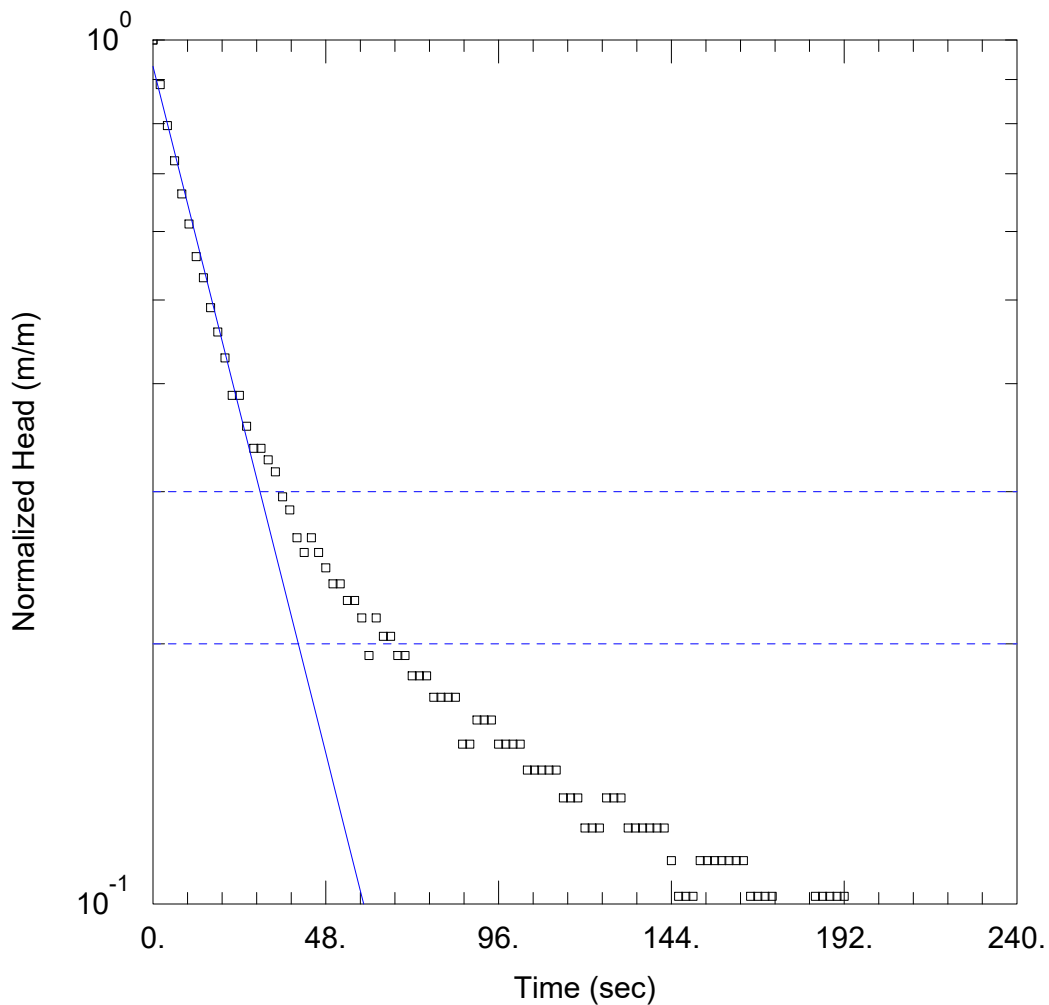
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.38E-5$  m/sec

$y_0 = -0.2057$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-16\_RHT\_LB.aqt

Date: 02/04/22

Time: 13:59:54

### PROJECT INFORMATION

Company: Golder Associates

Client: AECOM/QEW CAWTHRA

Project: 1530382

Location: Mississauga

Test Well: BH21-16 FHT

Test Date: 07/07/2021

### AQUIFER DATA

Saturated Thickness: 6.46 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-16 RHT)

Initial Displacement: 0.294 m

Static Water Column Height: 6.46 m

Total Well Penetration Depth: 6.46 m

Screen Length: 1.83 m

Casing Radius: 0.0254 m

Well Radius: 0.075 m

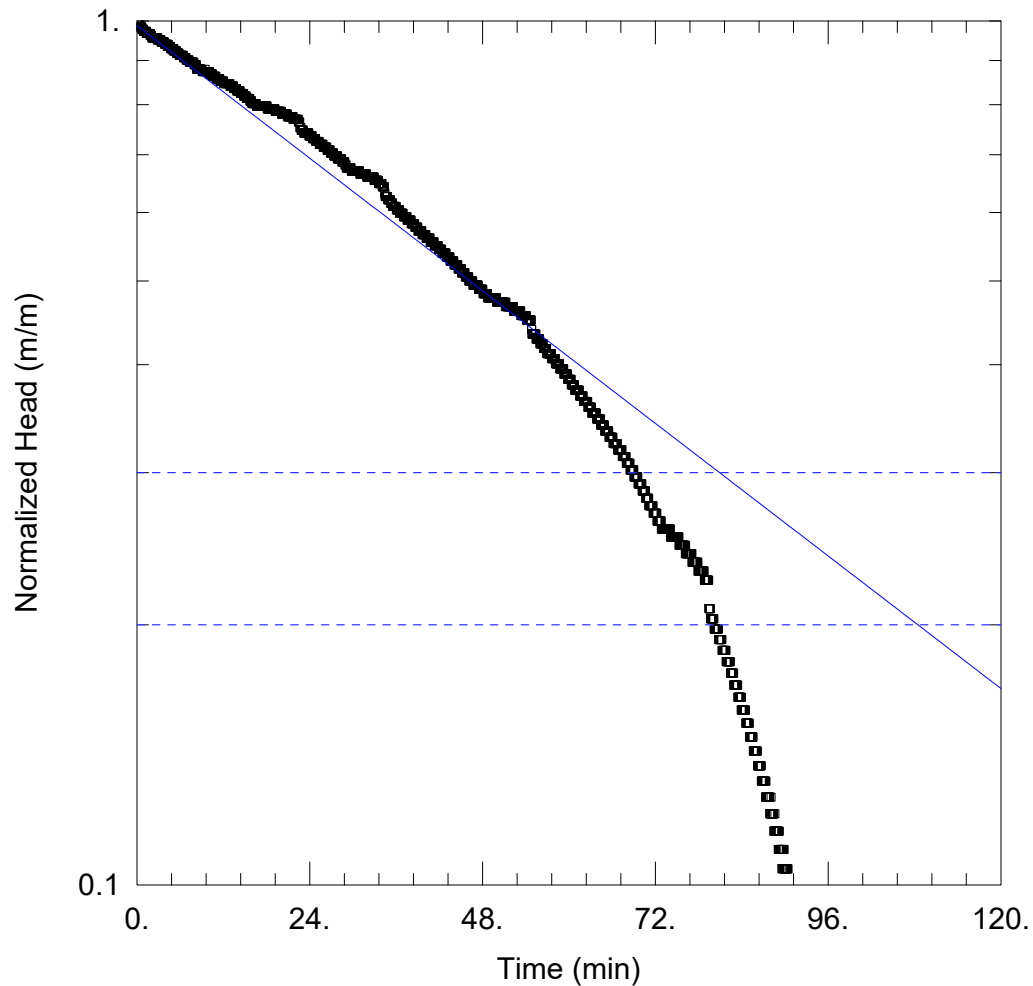
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 2.097E-5$  m/sec

$y_0 = 0.274$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-19\_VRP.aqt  
Date: 02/03/22

Time: 20:50:36

### PROJECT INFORMATION

Company: Golder  
Project: 1530382  
Test Well: BH21-19  
Test Date: July 7, 2021

### AQUIFER DATA

Saturated Thickness: 0.67 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-19)

Initial Displacement: 0.546 m  
Total Well Penetration Depth: 0.67 m  
Casing Radius: 0.0254 m

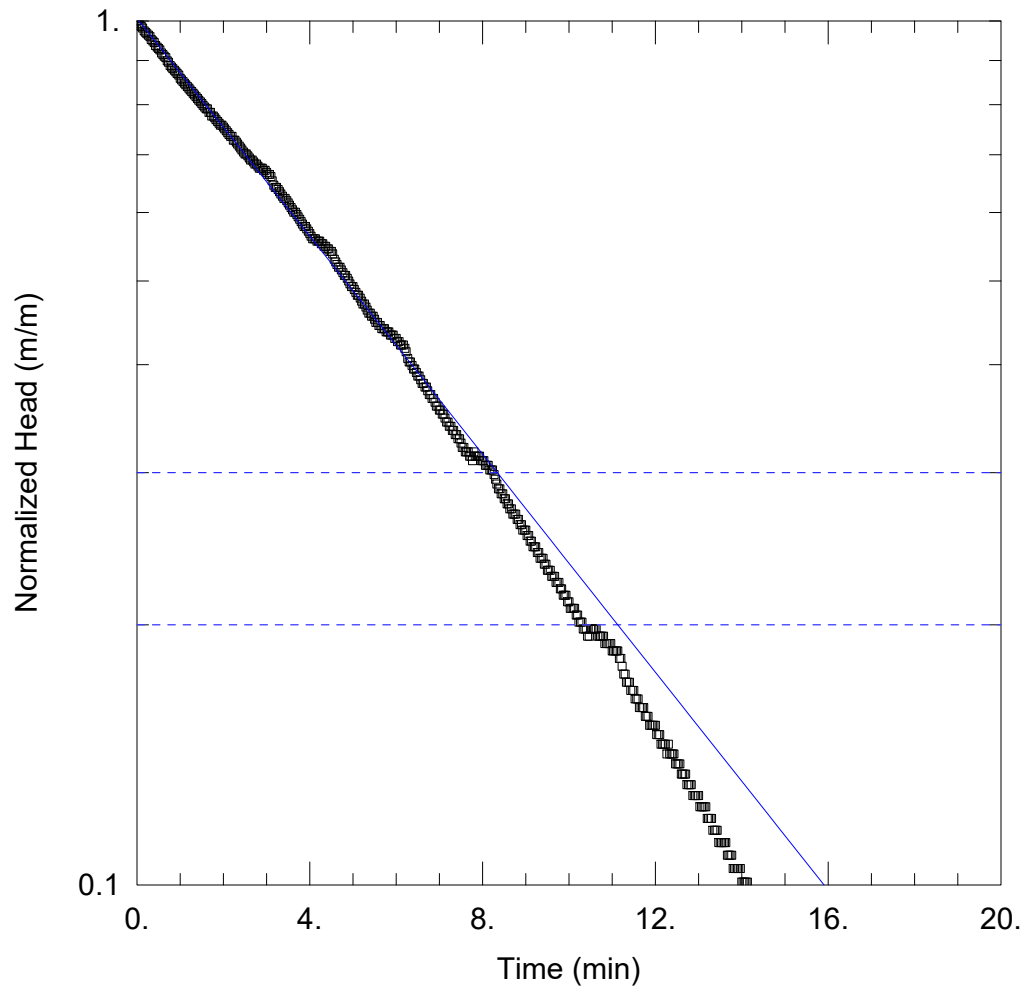
Static Water Column Height: 0.67 m  
Screen Length: 0.67 m  
Well Radius: 0.05494 m

### SOLUTION

Aquifer Model: Unconfined  
 $K = 2.134E-7$  m/sec

Solution Method: Bouwer-Rice  
 $y_0 = 0.5392$  m





### WELL TEST ANALYSIS

Data Set: C:\...\BH21-21\_VRP.aqt  
Date: 02/03/22

Time: 20:51:47

### PROJECT INFORMATION

Company: Golder  
Project: 1530382  
Test Well: BH21-21  
Test Date: July 7, 2021

### AQUIFER DATA

Saturated Thickness: 1.2 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-21)

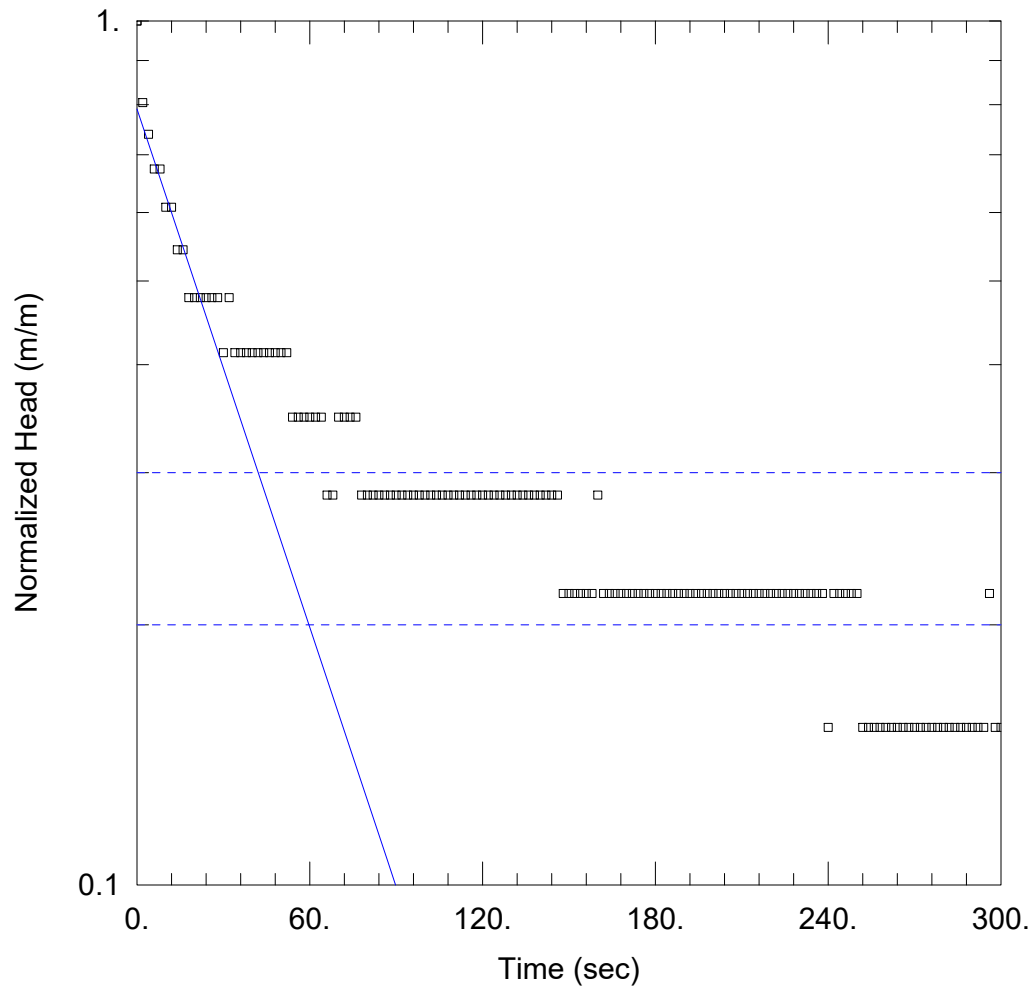
Initial Displacement: 0.804 m  
Total Well Penetration Depth: 1.2 m  
Casing Radius: 0.0254 m

Static Water Column Height: 1.2 m  
Screen Length: 1.2 m  
Well Radius: 0.05494 m

### SOLUTION

Aquifer Model: Unconfined  
 $K = 1.494\text{E-}6$  m/sec

Solution Method: Bouwer-Rice  
 $y_0 = 0.8096$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-25\_Test1 (Slug)\_VRP.aqt

Date: 02/03/22

Time: 21:00:55

### PROJECT INFORMATION

Company: Golder

Project: 1530382

Test Well: BH21-25

Test Date: July 8, 2021

### AQUIFER DATA

Saturated Thickness: 1.32 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-25)

Initial Displacement: 0.046 m

Static Water Column Height: 1.32 m

Total Well Penetration Depth: 1.32 m

Screen Length: 1.32 m

Casing Radius: 0.0254 m

Well Radius: 0.05494 m

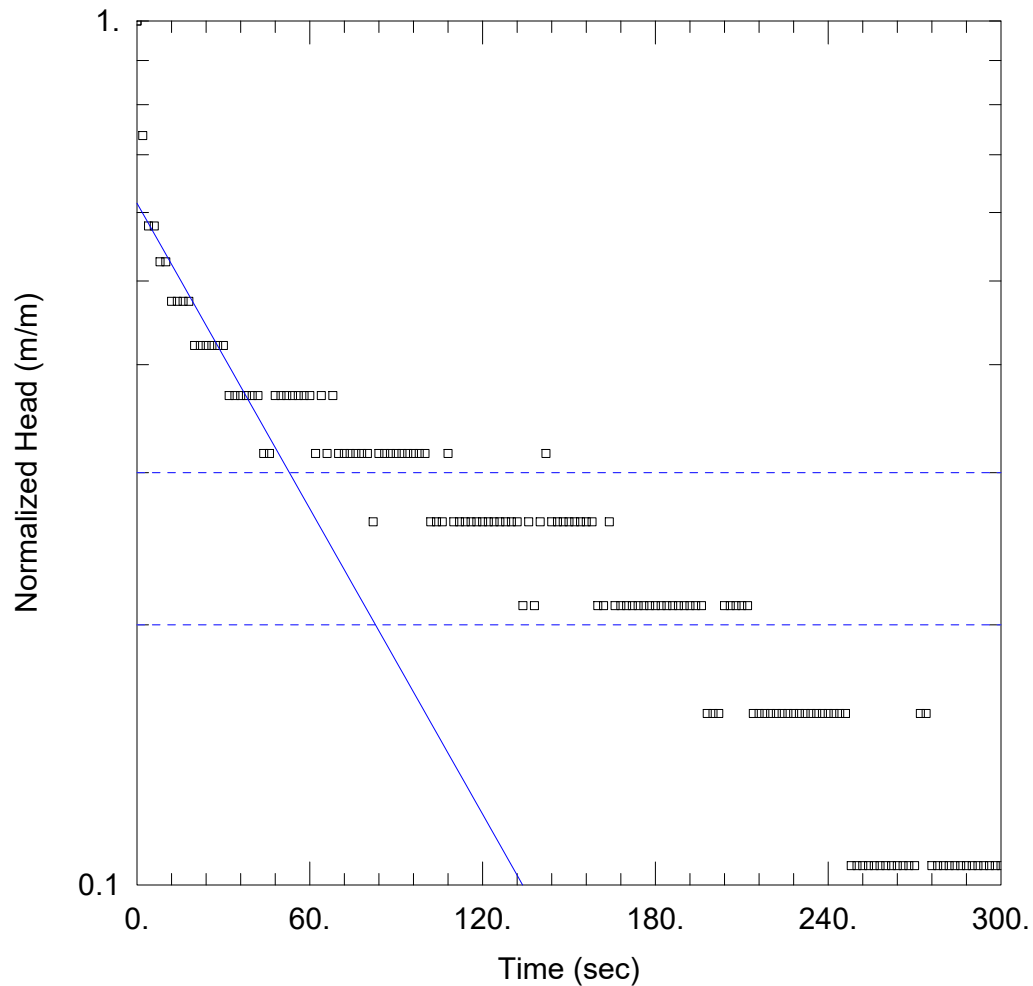
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.339\text{E-}5$  m/sec

$y_0 = 0.03638$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-25\_Test2 (Bailer)\_VRP.aqt

Date: 02/03/22

Time: 20:58:55

### PROJECT INFORMATION

Company: Golder

Project: 1530382

Test Well: BH21-25

Test Date: July 8, 2021

### AQUIFER DATA

Saturated Thickness: 1.31 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-25)

Initial Displacement: 0.057 m

Static Water Column Height: 1.31 m

Total Well Penetration Depth: 1.31 m

Screen Length: 1.31 m

Casing Radius: 0.0254 m

Well Radius: 0.05494 m

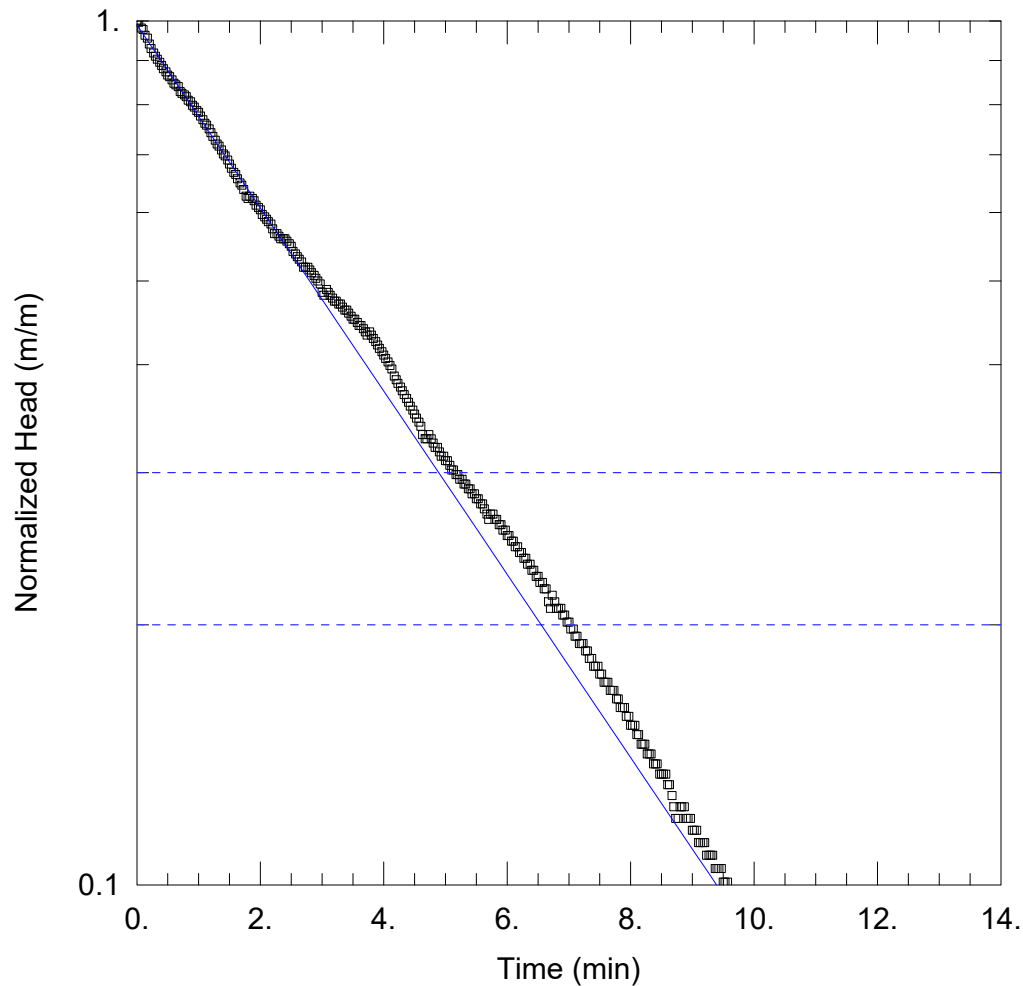
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 7.928E-6$  m/sec

$y_0 = 0.03506$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-29\_VRP.aqt  
Date: 02/03/22

Time: 21:05:47

### PROJECT INFORMATION

Company: Golder  
Project: 1530382  
Test Well: BH21-29  
Test Date: July 8, 2021

### AQUIFER DATA

Saturated Thickness: 0.84 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-29)

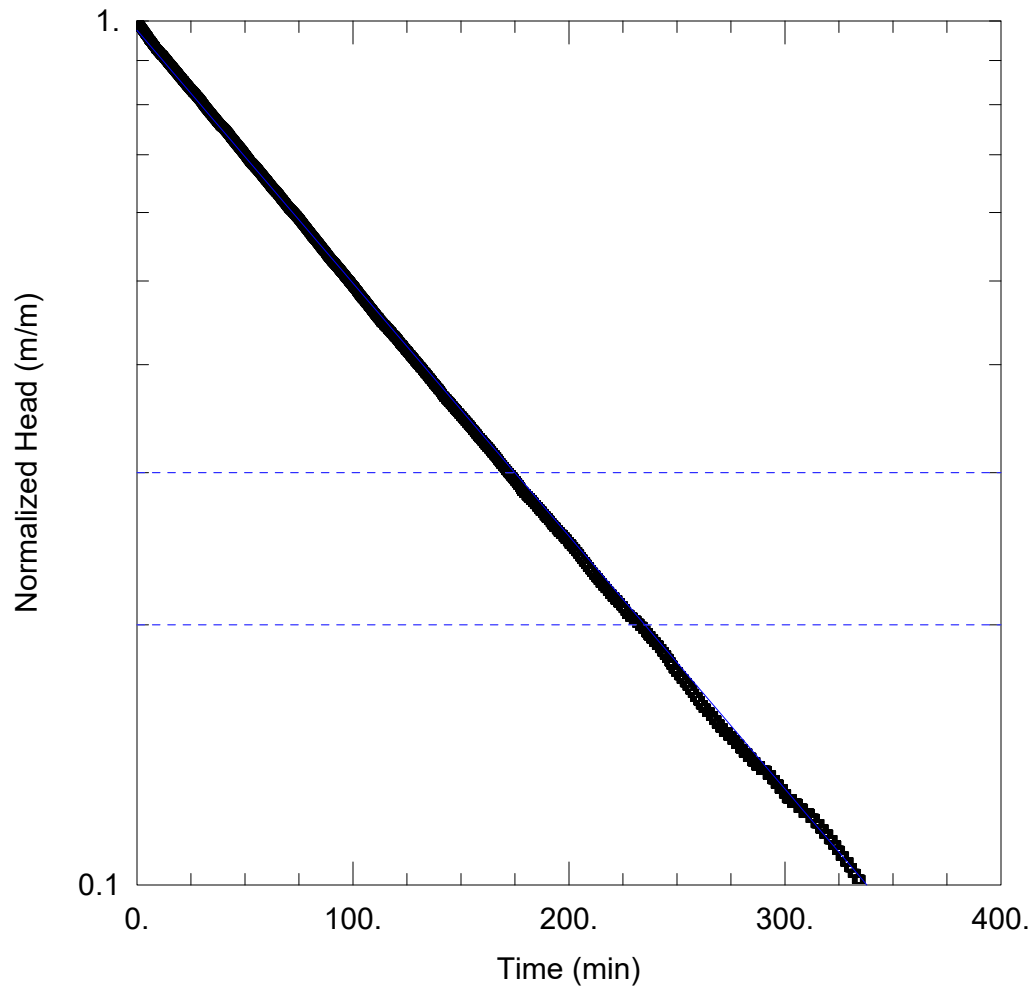
Initial Displacement: 0.804 m  
Total Well Penetration Depth: 0.84 m  
Casing Radius: 0.0254 m

Static Water Column Height: 0.84 m  
Screen Length: 0.84 m  
Well Radius: 0.05494 m

### SOLUTION

Aquifer Model: Unconfined  
 $K = 3.111\text{E-}6$  m/sec

Solution Method: Bouwer-Rice  
 $y_0 = 0.7953$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-34\_VRP.aqt  
Date: 02/03/22

Time: 21:10:05

### PROJECT INFORMATION

Company: Golder  
Project: 1530382  
Test Well: BH21-34  
Test Date: July 5, 2021

### AQUIFER DATA

Saturated Thickness: 2.66 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-34)

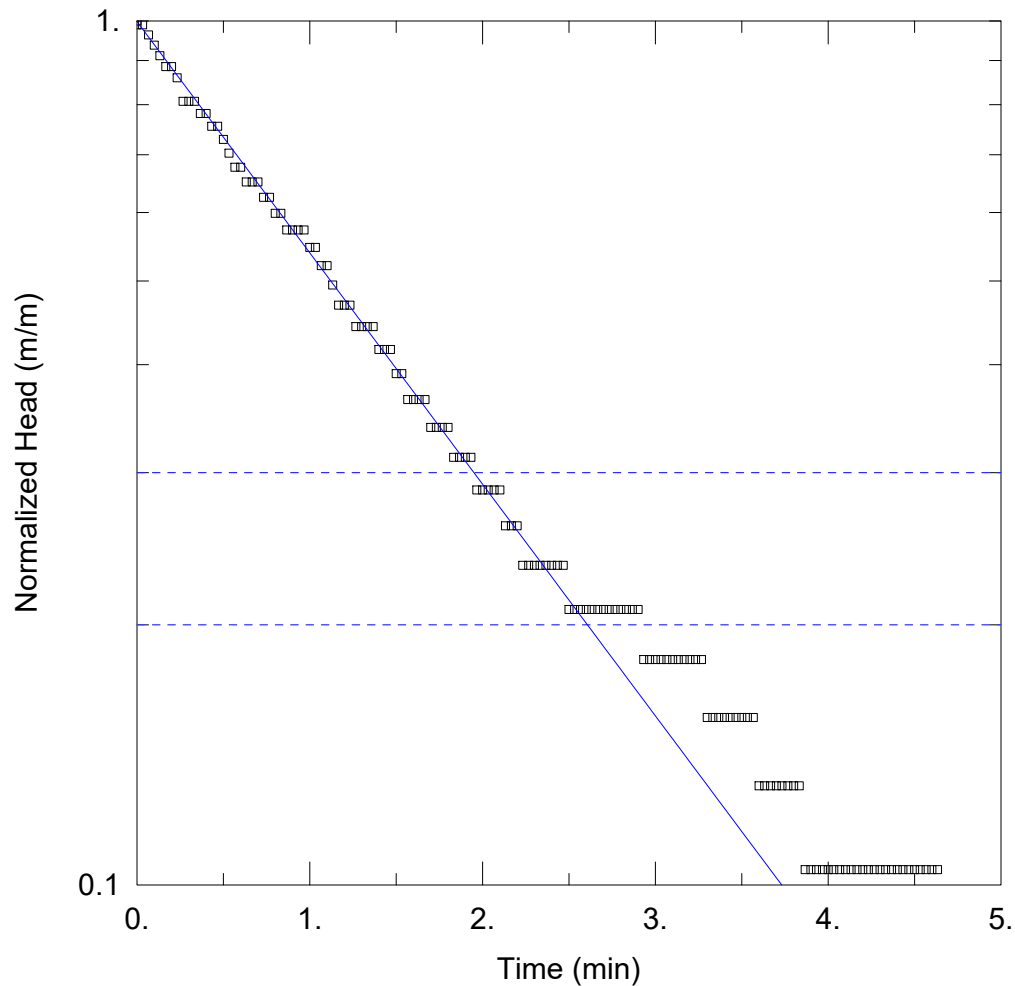
Initial Displacement: 1.843 m  
Total Well Penetration Depth: 2.66 m  
Casing Radius: 0.0254 m

Static Water Column Height: 2.66 m  
Screen Length: 2.13 m  
Well Radius: 0.075 m

### SOLUTION

Aquifer Model: Unconfined  
 $K = 4.527\text{E-}8$  m/sec

Solution Method: Bouwer-Rice  
 $y_0 = 1.798$  m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-37\_VRP.aqt  
Date: 02/03/22

Time: 21:15:13

### PROJECT INFORMATION

Company: Golder  
Project: 1530382  
Test Well: BH21-37  
Test Date: July 2, 2021

### AQUIFER DATA

Saturated Thickness: 3.12 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH21-37)

Initial Displacement: 0.384 m  
Total Well Penetration Depth: 3.12 m  
Casing Radius: 0.0254 m

Static Water Column Height: 3.12 m  
Screen Length: 1.52 m  
Well Radius: 0.0925 m

### SOLUTION

Aquifer Model: Unconfined  
K = 5.361E-6 m/sec

Solution Method: Bouwer-Rice  
 $y_0$  = 0.3834 m

**APPENDIX I**

**Analytical Laboratory Test Results –  
Summary Tables**

TABLE 11  
SOIL ANALYTICAL RESULTS - METALS  
QEW Improvements from East of Cawthra Road to The East Mall  
City of Mississauga, Region of Peel, Ontario

Location	21-2	21-4	21-8	21-11	21-23	21-27	21-28	21-31	21-33	21-38	21-39	21-40	21-41	21-42	21-43
Sample Name	21-2_SA8	21-4_SA5	21-8_SA9	21-11-SA3	21-23 SA2	21-27 SA4	21-28 SS4	21-31 SS3	21-33 SA4	21-38 SS2	21-39 SA2	21-40 SA5	21-41 SS4	21-42 SA4	21-43 SS2
Sample Date	11-January-2021	10-February-2021	12-January-2021	17-February-2021	25-June-2021	18-June-2021	27-July-2021	10-August-2021	15-June-2021	28-July-2021	24-June-2021	24-June-2021	28-July-2021	24-June-2021	28-July-2021
Laboratory Sample ID	OTU461	OXC963	OTU462	OXC965	PYK384	PYK385	QIZ416	QIZ418	PYK445	QIZ412	PYK386	PYK387	QIZ413	PYK388	QIZ414
Sample Depth (mbgs)	5.33 - 5.94	3.81 - 4.42	7.62 - 8.23	2.29 - 2.9	0.76 - 1.37	1.83 - 2.29	2.29 - 2.9	1.52 - 2.13	2.29 - 2.9	1.52 - 2.13	1.52 - 2.13	3.81 - 4.42	2.29 - 2.9	2.29 - 2.9	0.76 - 1.37
Parameter	Unit	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Antimony	µg/g	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Arsenic	µg/g	3.8	5.4	3.4	<1.0	1.1	7.3	3.2	<1.0	4.6	<1.0	4.9	4.1	1.1	<1.0
Barium	µg/g	41	41	91	12	5	27	81	5.5	39	5.6	6.2	48	26	17
Beryllium	µg/g	0.3	0.84	0.57	<0.20	<0.20	1	0.52	<0.20	0.25	<0.20	<0.20	0.72	0.37	0.2
Boron (Hot Water Soluble)	µg/g	1.4	1.2	0.75	0.2	0.093	0.4	0.8	<0.050	0.097	0.05	<0.050	0.77	0.087	0.094
Boron (Total)	µg/g	5.5	15	10	<5.0	<5.0	14	6.1	<5.0	<5.0	<5.0	13	6.1	<5.0	<5.0
Cadmium	µg/g	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	0.18	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chromium	µg/g	11	23	19	10	7.1	29	14	7.6	9.4	8.2	4.5	23	12	8.1
Chromium VI	µg/g	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18	<0.18
Cobalt	µg/g	4.2	14	9.7	2.7	1.4	18	8.6	1.8	4.8	1.9	1.5	13	6.2	3.8
Copper	µg/g	9.5	27	21	4.1	5.7	28	12	5.3	37	5.3	3.2	24	48	31
Lead	µg/g	9.3	7.7	7.3	3.2	2.4	21	4.3	2.4	8	2.6	2	7.3	8.8	7.5
Mercury	µg/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Molybdenum	µg/g	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nickel	µg/g	8.7	31	21	4.9	2.6	38	13	3.8	11	4	3.2	28	16	8.6
Selenium	µg/g	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Silver	µg/g	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium	µg/g	0.062	0.098	0.12	<0.050	<0.050	0.11	0.073	<0.050	0.079	<0.050	<0.050	0.12	0.14	0.055
Uranium	µg/g	0.49	0.49	0.61	0.47	0.38	0.79	0.54	0.34	0.36	0.42	0.31	0.56	0.43	0.35
Vanadium	µg/g	21	29	28	28	14	37	29	22	16	19	11	29	19	15
Zinc	µg/g	33	68	49	13	7.7	79	48	8.5	34	9.8	16	68	46	26

**Notes:**

µg/g = microgram per gram

mbgs = meters below ground surface

&lt; = less than reportable detection limit



TABLE I2  
SOIL AND BEDROCK ANALYTICAL RESULTS - INORGANICS  
QEW Improvements from East of Cawthra Road to The East Mall  
City of Mississauga, Region of Peel, Ontario

Location		21-2	21-2	21-4		21-8	21-11		21-23		21-27		21-28	21-31	21-33		21-34	21-37	21-38	21-39		21-40		21-41	21-42		21-43
Sample Name		21-2_SA7	21-2_SA8	21-4_SA5	21-4-5.18TO 5.28	21-8_SA9	21-11-SA3	21-11-SA6	21-23 SA2	21-23 SA3	21-27 SA2	21-27 SA4	21-28 SS4	21-31 SS3	21-33 SA4	21-33 SA4	21-34-6.08 TO 6.16	21-37_SA4	21-38 SS2	21-39 SA2	21-39 SA4	21-40 SA2	21-40 SA5	21-41 SS4	21-42 SA3	21-42 SA4	21-43 SS2
Sample Date		11-January-2021	11-January-2021	10-February- 2021	11-February- 2021	12-January-2021	17-February- 2021	17-February- 2021	25-June-2021	25-June-2021	18-June-2021	18-June-2021	27-July-2021	10-August-2021	15-June-2021	15-June-2021	15-January-2021	02-February- 2021	28-July-2021	24-June-2021	24-June-2021	24-June-2021	24-June-2021	28-July-2021	24-June-2021	24-June-2021	28-July-2021
Laboratory Sample ID		OTU460	OTU461	OXC963	PCT996	OTU462	OXC985	OXC964	PYK384	PYK393	PYK390	PYK385	QIZ416	QIZ418	PYK389	PYK445	PCT995	OTU463	QIZ412	PYK386	PYK437	PYK391	PYK387	QIZ413	PYK392	PYK388	QIZ414
Sample Depth (mbgs)		4.57 - 5.18	5.33 - 5.94	3.81 - 4.42	5.18-2.28	7.62 - 8.23	2.29 - 2.9	4.57 - 5.18	0.76 - 1.37	1.52 - 2.13	0.76 - 1.37	1.83 - 2.29	2.29 - 2.9	1.52 - 2.13	2.29 - 2.9	2.29 - 2.9	6.08-6.16	2.29 - 2.9	1.52 - 2.13	1.52 - 2.13	3.05 - 3.66	1.52 - 2.13	3.81 - 4.42	2.29 - 2.9	1.52 - 2.13	2.29 - 2.9	0.76 - 1.37
Parameter	Unit	Soil	Soil	Soil	Bedrock	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Bedrock	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
pH (pH Units)	pH	7.54	7.47	7.83	9.04	7.67	7.66	7.79	7.9	8.08	7.4	8	7.3	8.02	8.13	8.12	8.62	7.74	7.72	7.87	8.16	7.86	7.94	7.96	7.83	8.11	7.66
Conductivity (mS/cm)	mS/cm	0.363	0.51	0.63	0.498	0.39	1.6	1.23	1.2	1.09	0.262	0.41	0.86	0.42	1.14	1.4	0.295	0.705	0.54	0.35	0.483	0.649	0.28	0.24	1	0.69	1
Sodium Adsorption Ratio	NV	-	2.9	2.6	-	2	11	-	41	-	-	7.1	9.9	8.4	-	35	-	-	8.7	6.5	-	-	0.92	2.8	-	22	17
Cyanide, Free	µg/g	-	0.02	<0.01	-	<0.01	<0.01	-	<0.01	-	-	<0.01	<0.01	<0.01	-	<0.01	-	-	<0.01	<0.01	-	-	<0.01	<0.01	-	<0.01	<0.01
Chloride	µg/g	56	-	-	110	-	-	710	-	620	53	-	360	-	660	-	<20	350	-	-	240	270	-	-	520	-	-

Notes:  
µg/g = microgram per gram  
mS/cm = millisiemens per centimeter  
mbgs = meters below ground surface  
NV = no value  
"-" = not analyzed  
< = less than reportable detection limit

TABLE I3  
**SOIL ANALYTICAL RESULTS - VOLATILE ORGANIC COMPOUNDS (VOCs)**  
**QEW Improvements from East of Cawthra Road to The East Mall**  
**City of Mississauga, Region of Peel, Ontario**

Location	21-23	21-27	21-28	21-31	21-33	21-38	21-39	21-40	21-41	21-42	21-43
Sample Name	21-23 SA2	21-27 AS4	21-28 SS4	21-31 SS3	21-33 SA4	21-38 SS2	21-39 SA2	21-40 SA5	21-41 SS4	21-42 SA4	21-43 SS2
Sample Date	25-June-2021	18-June-2021	27-July-2021	10-August-2021	15-June-2021	28-July-2021	24-June-2021	24-June-2021	28-July-2021	24-June-2021	28-July-2021
Laboratory Sample ID	PYK384	PYK385	QIZ416	QIZ418	PYK445	QIZ412	PYK386	PYK387	QIZ413	PYK388	QIZ414
Sample Depth (mbgs)	0.76 - 1.37	1.83 - 2.29	2.29 - 2.9	1.52 - 2.13	2.29 - 2.9	1.52 - 2.13	1.52 - 2.13	3.81 - 4.42	2.29 - 2.9	2.29 - 2.9	0.76 - 1.37
Parameter	Unit	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
1,1,1,2-Tetrachloroethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
1,1,1-Trichloroethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
1,1,2,2-Tetrachloroethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
1,1,2-Trichloroethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
1,1-Dichloroethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
1,1-Dichloroethylene	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
1,2-Dichlorobenzene	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
1,2-Dichloroethane	µg/g	<0.050	<0.050	<0.049	<0.049	<0.050	<0.049	<0.050	<0.049	<0.050	<0.049
1,2-Dichloropropane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
1,3-Dichlorobenzene	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
1,3-Dichloropropene (cis + trans)	µg/g	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
1,4-Dichlorobenzene	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Acetone	µg/g	<0.50	<0.50	<0.49	<0.49	<0.50	<0.49	<0.50	<0.49	<0.50	<0.49
Benzene	µg/g	<0.020	<0.020	<0.0060	<0.0060	<0.020	<0.0060	<0.020	<0.0060	<0.020	<0.0060
Bromodichloromethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Bromoform	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Bromomethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Carbon Tetrachloride	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Chlorobenzene	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Chloroform	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Cis-1,2-Dichloroethylene	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Cis-1,3-Dichloropropylene	µg/g	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Dibromochloromethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Dichlorodifluoromethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Ethylbenzene	µg/g	<0.020	<0.020	<0.010	<0.010	<0.020	<0.010	<0.020	<0.010	<0.020	<0.010
Ethylene Dibromide	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Hexane(n)	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Methyl Ethyl Ketone	µg/g	<0.50	<0.50	<0.40	<0.40	<0.50	<0.40	<0.50	<0.40	<0.50	<0.40
Methyl Isobutyl Ketone	µg/g	<0.50	<0.50	<0.40	<0.40	<0.50	<0.40	<0.50	<0.40	<0.50	<0.40
Methylene Chloride	µg/g	<0.050	<0.050	<0.049	<0.049	<0.050	<0.049	<0.050	<0.049	<0.050	<0.049
Methyl-t-Butyl Ether	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
m-Xylene & p-Xylene	µg/g	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
o-Xylene	µg/g	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Styrene	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Tetrachloroethylene	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Toluene	µg/g	0.033	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total Xylenes	µg/g	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Trans-1,2-Dichloroethylene	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Trans-1,3-Dichloropropylene	µg/g	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Trichloroethylene	µg/g	<0.050	<0.050	<0.010	<0.010	<0.050	<0.010	<0.050	<0.010	<0.050	<0.010
Trichlorofluoromethane	µg/g	<0.050	<0.050	<0.040	<0.040	<0.050	<0.040	<0.050	<0.040	<0.050	<0.040
Vinyl Chloride	µg/g	<0.020	<0.020	<0.019	<0.019	<0.020	<0.019	<0.020	<0.019	<0.020	<0.019

**Notes:**

µg/g = microgram per gram

mbgs = meters below ground surface

&lt; = less than reportable detection limit

**TABLE I4**  
**SOIL ANALYTICAL RESULTS - PETROLEUM HYDROCARBONS (PHCs)**  
**QEW Improvements from East of Cawthra Road to The East Mall**  
**City of Mississauga, Region of Peel, Ontario**

Location		21-23	21-27	21-28	21-31	21-33	21-38	21-39	21-40	21-41	21-42	21-43
Sample Name		21-23 SA2	21-27 AS4	21-28 SS4	21-31 SS3	21-33 SA4	21-38 SS2	21-39 SA2	21-40 SA5	21-41 SS4	21-42 SA4	21-43 SS2
Sample Date		25-June-2021	18-June-2021	27-July-2021	10-August-2021	15-June-2021	28-July-2021	24-June-2021	24-June-2021	28-July-2021	24-June-2021	28-July-2021
Laboratory Sample ID		PYK384	PYK385	QIZ416	QIZ418	PYK445	QIZ412	PYK386	PYK387	QIZ413	PYK388	QIZ414
Sample Depth (mbgs)		0.76 - 1.37	1.83 - 2.29	2.29 - 2.9	1.52 - 2.13	2.29 - 2.9	1.52 - 2.13	1.52 - 2.13	3.81 - 4.42	2.29 - 2.9	2.29 - 2.9	0.76 - 1.37
Parameter	Unit	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
<b>BTEX</b>												
Benzene	µg/g	<0.020	<0.020	<0.0060	<0.0060	<0.020	<0.0060	<0.020	<0.020	<0.0060	<0.020	<0.0060
Toluene	µg/g	0.033	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Ethylbenzene	µg/g	<0.020	<0.020	<0.010	<0.010	<0.020	<0.010	<0.020	<0.020	<0.010	<0.020	<0.010
Total Xylenes	µg/g	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
<b>PHCs</b>												
F1 (C6-C10)	µg/g	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
F1 (C6-C10) - BTEX	µg/g	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
F2 (C10-C16)	µg/g	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
F3 (C16-C34)	µg/g	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
F4 (C34-C50)	µg/g	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50

**Notes:**

µg/g = microgram per gram

mbgs = meters below ground surface

&lt; = less than reportable detection limit

TABLE 15  
**SOIL ANALYTICAL RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)**  
**QEW Improvements from East of Cawthra Road to The East Mall**  
**City of Mississauga, Region of Peel, Ontario**

Location		21-23	21-27	21-28	21-31	21-33	21-38	21-39	21-40	21-41	21-42	21-43
Sample Name		21-23 SA2	21-27 AS4	21-28 SS4	21-31 SS3	21-33 SA4	21-38 SS2	21-39 SA2	21-40 SA5	21-41 SS4	21-42 SA4	21-43 SS2
Sample Date		25-June-2021	18-June-2021	27-July-2021	10-August-2021	15-June-2021	28-July-2021	24-June-2021	24-June-2021	28-July-2021	24-June-2021	28-July-2021
Laboratory Sample ID		PYK384	PYK385	QIZ416	QIZ418	PYK445	QIZ412	PYK386	PYK387	QIZ413	PYK388	QIZ414
Sample Depth (mbgs)		0.76 - 1.37	1.83 - 2.29	2.29 - 2.9	1.52 - 2.13	2.29 - 2.9	1.52 - 2.13	1.52 - 2.13	3.81 - 4.42	2.29 - 2.9	2.29 - 2.9	0.76 - 1.37
Parameter	Unit	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
1-Methylnaphthalene	µg/g	<0.0050	0.017	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2-Methylnaphthalene	µg/g	<0.0050	0.01	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Acenaphthene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Acenaphthylene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Anthracene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(a)anthracene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(a)pyrene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(b)fluoranthene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(ghi)perylene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(k)fluoranthene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Chrysene	µg/g	<0.0050	0.0073	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dibenzo(a,h)anthracene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluorene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Indeno(1,2,3-cd)pyrene	µg/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Naphthalene	µg/g	<0.0050	0.044	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Phenanthrene	µg/g	<0.0050	0.04	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0066	<0.0050	<0.0050	<0.0050
Pyrene	µg/g	<0.0050	0.0062	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

**Notes:**

µg/g = microgram per gram

mbgs = metres below ground surface

&lt; = less than reportable detection limit

**TABLE I6**  
**SOIL ANALYTICAL RESULTS - POLYCHLORINATED BIPHENYLS (PCBs)**  
**QEW Improvements from East of Cawthra Road to The East Mall**  
**City of Mississauga, Region of Peel, Ontario**

Location	21-23	21-27	21-28	21-31	21-33	21-38	21-39	21-40	21-41	21-42	21-43
Sample Name	21-23 SA2	21-27 AS4	21-28 SS4	21-31 SS3	21-33 SA4	21-38 SS2	21-39 SA2	21-40 SA5	21-41 SS4	21-42 SA4	21-43 SS2
Sample Date	25-June-2021	18-June-2021	27-July-2021	10-August-2021	15-June-2021	28-July-2021	24-June-2021	24-June-2021	28-July-2021	24-June-2021	28-July-2021
Laboratory Sample ID	PYK384	PYK385	QIZ416	QIZ418	PYK445	QIZ412	PYK386	PYK387	QIZ413	PYK388	QIZ414
Sample Depth (mbgs)	0.76 - 1.37	1.83 - 2.29	2.29 - 2.9	1.52 - 2.13	2.29 - 2.9	1.52 - 2.13	1.52 - 2.13	3.81 - 4.42	2.29 - 2.9	2.29 - 2.9	0.76 - 1.37
Parameter	Unit	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Total PCB	µg/g	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010

**Notes:**

µg/g = microgram per gram

mbgs = meters below ground surface

&lt; = less than reportable detection limit

**SOIL ANALYTICAL RESULTS - TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)**  
**QEW Improvements from East of Cawthra Road to The East Mall**  
**City of Mississauga, Region of Peel, Ontario**

Location		21-27	21-31	21-39	21-40
Sample Name		21-27 SA2	21-31 SS4	21-39 SA3	21-40 SA1
Sample Date		2021-06-18	2021-08-10	2021-06-24	2021-06-24
Laboratory Sample ID		PYK442	QIZ417	PYK443	PYK444
Sample Depth (mbgs)		0.76 - 1.37	2.29 - 2.9	2.29 - 2.9	0.76 - 1.37
Parameter	Unit	Soil	Soil	Soil	Soil
<b>Inorganics</b>					
Leachable Fluoride (F-)	mg/L	<0.10	0.19	0.20	0.17
Leachable Nitrate (N)	mg/L	<1.0	<1.0	<1.0	<1.0
Leachable Nitrate + Nitrite (N)	mg/L	<1.0	<1.0	<1.0	<1.0
Leachable Nitrite (N)	mg/L	<0.10	<0.10	<0.10	<0.10
Leachable WAD Cyanide (Free)	mg/L	<0.010	<0.010	<0.010	<0.010
<b>Metals</b>					
Leachable Arsenic (As)	mg/L	<0.2	<0.2	<0.2	<0.2
Leachable Barium (Ba)	mg/L	0.3	0.3	<0.2	1.0
Leachable Boron (B)	mg/L	0.2	0.1	0.1	0.2
Leachable Cadmium (Cd)	mg/L	<0.05	<0.05	<0.05	<0.05
Leachable Chromium (Cr)	mg/L	<0.1	<0.1	<0.1	<0.1
Leachable Lead (Pb)	mg/L	<0.1	<0.1	<0.1	<0.1
Leachable Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001
Leachable Selenium (Se)	mg/L	<0.1	<0.1	<0.1	<0.1
Leachable Silver (Ag)	mg/L	<0.01	<0.01	<0.01	<0.01
Leachable Uranium (U)	mg/L	<0.01	<0.01	<0.01	<0.01
<b>Volatile Organics</b>					
Leachable 1,1-Dichloroethylene	mg/L	<0.020	<0.020	<0.020	<0.020
Leachable 1,2-Dichlorobenzene	mg/L	<0.050	<0.050	<0.050	<0.050
Leachable 1,2-Dichloroethane	mg/L	<0.050	<0.050	<0.050	<0.050
Leachable 1,4-Dichlorobenzene	mg/L	<0.050	<0.050	<0.050	<0.050
Leachable Benzene	mg/L	<0.020	<0.020	<0.020	<0.020
Leachable Carbon Tetrachloride	mg/L	<0.020	<0.020	<0.020	<0.020
Leachable Chlorobenzene	mg/L	<0.020	<0.020	<0.020	<0.020
Leachable Chloroform	mg/L	<0.020	<0.020	<0.020	<0.020
Leachable Methyl Ethyl Ketone (2-Butanone)	mg/L	<1.0	<1.0	<1.0	<1.0
Leachable Methylene Chloride(Dichloromethane)	mg/L	<0.20	<0.20	<0.20	<0.20
Leachable Tetrachloroethylene	mg/L	<0.020	<0.020	<0.020	<0.020
Leachable Trichloroethylene	mg/L	<0.020	<0.020	<0.020	<0.020
Leachable Vinyl Chloride	mg/L	<0.020	<0.020	<0.020	<0.020
<b>Polyaromatic Hydrocarbons</b>					
Leachable Benzo(a)pyrene	µg/L	<0.10	<0.10	<0.10	<0.10

**Notes:**

mg/L = milligram per liter

µg/L = microgram per liter

mbgs = meters below ground surface

&lt; = less than reportable detection limit

**SOIL ANALYTICAL RESULTS - SYNTHETIC PRECIPITATION LEACHING PROCEDURE (SPLP)**  
**QEW Improvements from East of Cawthra Road to The East Mall**  
**City of Mississauga, Region of Peel, Ontario**

Location		21-17	21-23	21-27	21-31	21-40	21-42	21-43
Sample Name		21-17 SA2	21-23 SA3	21-27 SA3	21-31 SS2	21-40 SA3	21-42 SA5B	21-43 SS3
Sample Date		2021-05-12	2021-06-25	2021-06-18	2021-08-10	2021-06-24	2021-06-24	2021-07-28
Laboratory Sample ID		PYK446	PYK441	PYK438	QIZ419	PYK439	PYK440	QIZ415
Sample Depth (mbgs)		0.76 - 1.37	1.52 - 2.13	1.52 - 1.7	0.76 - 1.37	2.29 - 2.9	3.2 - 3.66	1.52 - 2.13
Parameter	Unit	Soil	Soil	Soil	Soil	Soil	Soil	Soil
<b>Metals</b>								
Leachable (SPLP) Antimony (Sb)	µg/L	<0.5	<0.5	<0.5	-	<0.5	1.0	-
Leachable (SPLP) Arsenic (As)	µg/L	<1	<1	<1	-	<1	2	-
Leachable (SPLP) Barium (Ba)	µg/L	<5	<5	<5	-	<5	10	-
Leachable (SPLP) Beryllium (Be)	µg/L	<0.5	<0.5	<0.5	-	<0.5	<0.5	-
Leachable (SPLP) Boron (B)	µg/L	<10	<10	<10	-	<10	<10	-
Leachable (SPLP) Cadmium (Cd)	µg/L	<0.1	<0.1	<0.1	-	<0.1	<0.1	-
Leachable (SPLP) Chromium (Cr)	µg/L	<5	<5	<5	-	<5	<5	-
Leachable (SPLP) Cobalt (Co)	µg/L	<0.5	<0.5	<0.5	-	<0.5	<0.5	-
Leachable (SPLP) Copper (Cu)	µg/L	1	<1	2	-	<1	1	-
Leachable (SPLP) Lead (Pb)	µg/L	<0.5	<0.5	<0.5	-	<0.5	<0.5	-
Leachable (SPLP) Molybdenum (Mo)	µg/L	<1	<1	<1	-	<1	1	-
Leachable (SPLP) Nickel (Ni)	µg/L	<1	<1	<1	-	<1	<1	-
Leachable (SPLP) Selenium (Se)	µg/L	<2	<2	<2	-	<2	<2	-
Leachable (SPLP) Silver (Ag)	µg/L	<0.1	<0.1	<0.1	-	<0.1	<0.1	-
Leachable (SPLP) Thallium (Tl)	µg/L	<0.05	<0.05	<0.05	-	<0.05	<0.05	-
Leachable (SPLP) Uranium (U)	µg/L	<0.1	<0.1	<0.1	-	<0.1	0.3	-
Leachable (SPLP) Vanadium (V)	µg/L	1	1	<1	-	2	2	-
Leachable (SPLP) Zinc (Zn)	µg/L	<5	<5	<5	-	<5	<5	-
<b>Volatile Organics</b>								
Leachable (SPLP) Bromomethane	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) Carbon Tetrachloride	µg/L	<0.19	<0.19	<0.19	-	<0.19	<0.19	-
Leachable (SPLP) Chloroform	µg/L	<1.2	<1.2	<1.2	-	<1.2	<1.2	-
Leachable (SPLP) 1,2-Dichlorobenzene	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) 1,4-Dichlorobenzene	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) 1,1-Dichloroethane	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) 1,2-Dichloroethane	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) 1,1-Dichloroethylene	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) cis-1,2-Dichloroethylene	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) trans-1,2-Dichloroethylene	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) 1,2-Dichloropropane	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) cis-1,3-Dichloropropene	µg/L	<0.30	<0.30	<0.30	-	<0.30	<0.30	-
Leachable (SPLP) trans-1,3-Dichloropropene	µg/L	<0.30	<0.30	<0.30	-	<0.30	<0.30	-
Leachable (SPLP) Ethylene Dibromide	µg/L	<0.19	<0.19	<0.19	-	<0.19	<0.19	-
Leachable (SPLP) 1,1,1,2-Tetrachloroethane	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) 1,1,2,2-Tetrachloroethane	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) Tetrachloroethylene	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) 1,1,2-Trichloroethane	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
Leachable (SPLP) Trichloroethylene	µg/L	<0.40	<0.40	<0.40	-	<0.40	<0.40	-
<b>Semivolatile Organics</b>								
Leachable (SPLP) Bis(2-chloroethyl)ether	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Leachable (SPLP) Bis(2-chloroisopropyl)ether	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Leachable (SPLP) p-Chloroaniline	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Leachable (SPLP) 3,3'-Dichlorobenzidine	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Leachable (SPLP) Diethyl phthalate	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Leachable (SPLP) Dimethyl phthalate	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Leachable (SPLP) 2,4-Dinitrophenol	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Leachable (SPLP) 2,4-Dinitrotoluene	µg/L	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Leachable (SPLP) 2,6-Dinitrotoluene	µg/L	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Leachable (SPLP) 2,4,6-Trichlorophenol	µg/L	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
<b>Pesticides &amp; Herbicides</b>								
Leachable (SPLP) Dieldrin	µg/L	<0.006	<0.006	<0.006	-	<0.006	<0.006	-
Leachable (SPLP) Endrin	µg/L	<0.006	<0.006	<0.006	-	<0.006	<0.006	-
Leachable (SPLP) Heptachlor	µg/L	<0.006	<0.006	<0.006	-	<0.006	<0.006	-
Leachable (SPLP) Heptachlor epoxide	µg/L	<0.006	<0.006	<0.006	-	<0.006	<0.006	-
<b>Calculated Parameters</b>								
Leachable (ZHE) 1,3-Dichloropropene (cis+trans)	µg/L	<0.42	<0.42	<0.42		<0.42	<0.42	
Leachable 2,4- & 2,6-Dinitrotoluene	µg/L	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2	<4.2
Leachable Heptachlor + Heptachlor epoxide	µg/L	<0.0060	<0.0060	<0.0060		<0.0060	<0.0060	
Final pH	pH	9.68	9.72	9.01	9.07	9.08	9.23	9.56

**Notes:**

µg/L = microgram per liter

mbgs = meters below ground surface

"- " = not analyzed

&lt; = less than reportable detection limit

**GROUNDWATER ANALYTICAL RESULTS - METALS AND INORGANICS**  
**QEW Improvements from East of Cawthra Road to The East Mall**  
**City of Mississauga, Region of Peel, Ontario**

Location		21-2	21-4	21-11	21-33	21-34
Sample Name		BH21-02	21-4	21-11	21-33	BH21-34
Sample Date		05-July-2021	29-June-2021	29-June-2021	29-June-2021	05-July-2021
Laboratory Sample ID		PZW265	PYX390	PYX388	PYX389	PZW266
Screened Interval (mbgs)		4.57 - 6.1	4.88 - 6.4	4.88 - 6.4	4.88 - 6.4	4.88 - 6.4
Parameter	Unit	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
<b>Metals</b>						
Antimony	µg/L	<0.50	<0.50	<0.50	1.7	<0.50
Arsenic	µg/L	5	5	<1.0	2.8	<1.0
Barium	µg/L	420	620	100	160	240
Beryllium	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Boron	µg/L	430	2300	92	2100	480
Cadmium	µg/L	<0.090	<0.090	<0.090	<0.090	<0.090
Chromium	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Chromium VI	µg/L	<0.50	<0.50	0.82	<0.50	1.6
Cobalt	µg/L	<0.50	<0.50	0.54	<0.50	<0.50
Copper	µg/L	<0.90	<0.90	2.1	2.6	<0.90
Lead	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
Mercury	µg/L	<0.10	<0.1	<0.1	<0.10	<0.10
Molybdenum	µg/L	<0.50	13	5	30	18
Nickel	µg/L	<1.0	<1.0	1.6	<1.0	<1.0
Sodium	µg/L	310000	840000	1700000	480000	180000
Selenium	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Silver	µg/L	<0.090	<0.090	<0.090	<0.090	<0.090
Thallium	µg/L	<0.050	<0.050	<0.050	0.064	<0.050
Uranium	µg/L	<0.10	8.2	1.7	5	<0.10
Vanadium	µg/L	1.2	<0.50	<0.50	0.8	7.4
Zinc	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
<b>Inorganics</b>						
Cyanide, Free	µg/L	<1	<1	<1	<1	<1
Chloride	mg/L	1300	1500	2300	860	530

**Notes:**

µg/L = microgram per litre

mg/L = milligram per litre

mbgs = metres below ground surface

&lt; = less than reportable detection limit



**GROUNDWATER ANALYTICAL RESULTS - PETROLEUM HYDROCARBONS (PHCs)**  
**QEW Improvements from East of Cawthra Road to The East Mall**  
**City of Mississauga, Region of Peel, Ontario**

Location		21-2	21-4	21-11	21-33	21-34
Sample Name		BH21-02	21-4	21-11	21-33	BH21-34
Sample Date		05-July-2021	29-June-2021	29-June-2021	29-June-2021	05-July-2021
Laboratory Sample ID		PZW265	PYX390	PYX388	PYX389	PZW266
Screened Interval (mbgs)		4.57 - 6.1	4.88 - 6.4	4.88 - 6.4	4.88 - 6.4	4.88 - 6.4
Parameter	Unit	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
<b>BTEX</b>						
Benzene	µg/L	-	-	-	-	<0.20
Toluene	µg/L	-	-	-	-	<0.20
Ethylbenzene	µg/L	-	-	-	-	<0.20
m/p xylenes	µg/L	-	-	-	-	<0.40
o xylene	µg/L	-	-	-	-	<0.20
Total Xylenes	µg/L	-	-	-	-	<0.40
<b>PHCs</b>						
F1 (C6-C10)	µg/L	<25	<25	<25	<25	<25
F1 (C6-C10) - BTEX	µg/L	<25	<25	<25	<25	<25
F2 (C10-C16)	µg/L	<100	<100	<100	<100	<100
F3 (C16-C34)	µg/L	<200	<200	<200	<200	<200
F4 (C34-C50)	µg/L	<200	<200	<200	<200	<200
Reached Baseline at C50	NV	YES	YES	YES	YES	YES

**Notes:**

µg/L = microgram per litre

mbgs = metres below ground surface

NV = no value

"-" = not analyzed

&lt; = less than reportable detection limit

## GROUNDWATER ANALYTICAL RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

QEW Improvements from East of Cawthra Road to The East Mall

City of Mississauga, Region of Peel, Ontario

Location		21-2	21-4	21-11	21-33	21-34
Sample Name		BH21-02	21-4	21-11	21-33	BH21-34
Sample Date		05-July-2021	29-June-2021	29-June-2021	29-June-2021	05-July-2021
Laboratory Sample ID		PZW265	PYX390	PYX388	PYX389	PZW266
Screened Interval (mbgs)		4.57 - 6.1	4.88 - 6.4	4.88 - 6.4	4.88 - 6.4	4.88 - 6.4
Parameter	Unit	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Acenaphthene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Anthracene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)anthracene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene	µg/L	<0.0090	<0.0090	<0.0090	<0.0090	<0.0090
Benzo(b/j)fluoranthene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(ghi)perylene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Chrysene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Dibenzo(a,h)anthracene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Fluorene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-cd)pyrene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
1-Methylnaphthalene	µg/L	<0.050	0.22	<0.050	<0.050	<0.050
2-Methylnaphthalene	µg/L	<0.050	0.29	<0.050	<0.050	<0.050
Naphthalene	µg/L	<0.050	0.094	<0.050	<0.050	<0.050
Phenanthrene	µg/L	<0.030	<0.030	<0.030	<0.030	<0.030
Pyrene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050

**Notes:**

µg/L = microgram per litre

mbgs = metres below ground surface

"- " = not analyzed

&lt; = less than reportable detection limit

**TABLE I12**  
**GROUNDWATER ANALYTICAL RESULTS - PEEL SANITARY STORM SEWER USE BY-LAW (53-2010)**  
**QEW Improvements from East of Cawthra Road to The East Mall**  
**City of Mississauga, Region of Peel, Ontario**

Location		21-2	21-4	21-11	21-16	21-37
Sample Name		BH21-02	21-4	21-11	BH21-16	BH21-37
Sample Date		05-July-2021	29-June-2021	29-June-2021	2021-07-06	2021-07-06
Laboratory Sample ID		PZW265	PYX390	PYX388	QAE201	QAE202
Screened Interval (mbgs)		4.57 - 6.1	4.88 - 6.4	4.88 - 6.4	8.08 - 9.6	3.66 - 5.18
Parameter	Unit	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
<b>Inorganics</b>						
Total Carbonaceous BOD	mg/L	<2	43	<2	<40	<2
Fluoride (F-)	mg/L	0.36	0.61	0.40	0.31	0.10
Total Kjeldahl Nitrogen (TKN)	mg/L	8.8	4.1	0.10	12	3.1
pH		7.49	7.74	7.81	7.31	7.52
Phenols-4AAP	mg/L	<0.0010	<0.0010	<0.0010	0.0020	<0.0010
Total Suspended Solids	mg/L	45	11	66	48	16
Dissolved Sulphate (SO4)	mg/L	36	3.1	200	3.6	120
Total Cyanide (CN)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
<b>Petroleum Hydrocarbons</b>						
Total Oil & Grease	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50
Total Oil & Grease Mineral/Synthetic	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50
<b>Miscellaneous Parameters</b>						
Nonylphenol Ethoxylate (Total)	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025
Nonylphenol (Total)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
<b>Metals</b>						
Mercury (Hg)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Aluminum (Al)	µg/L	390	98	1100	92	41
Total Antimony (Sb)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
Total Arsenic (As)	µg/L	3.2	<1.0	<1.0	<1.0	<1.0
Total Cadmium (Cd)	µg/L	<0.090	<0.090	<0.090	<0.090	<0.090
Total Chromium (Cr)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Total Cobalt (Co)	µg/L	<0.50	<0.50	1.2	<0.50	<0.50
Total Copper (Cu)	µg/L	<0.90	<0.90	3.9	<0.90	<0.90
Total Lead (Pb)	µg/L	<0.50	<0.50	0.92	<0.50	<0.50
Total Manganese (Mn)	µg/L	690	200	280	850	260
Total Molybdenum (Mo)	µg/L	<0.50	1.3	5.4	<0.50	<0.50
Total Nickel (Ni)	µg/L	<1.0	<1.0	3.2	<1.0	<1.0
Total Phosphorus (P)	µg/L	210	<100	<100	<100	<100
Total Selenium (Se)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Total Silver (Ag)	µg/L	<0.090	<0.090	<0.090	<0.090	<0.090
Total Tin (Sn)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Total Titanium (Ti)	µg/L	14	<5.0	29	<5.0	<5.0
Total Zinc (Zn)	µg/L	<5.0	<5.0	5.0	<5.0	<5.0
<b>Semivolatile Organics</b>						
Bis(2-ethylhexyl)phthalate	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Di-N-butyl phthalate	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
<b>Volatile Organics</b>						
Benzene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroform	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
1,2-Dichlorobenzene	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
1,4-Dichlorobenzene	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
cis-1,2-Dichloroethylene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,3-Dichloropropene	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Ethylbenzene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Methylene Chloride(Dichloromethane)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Methyl Ethyl Ketone (2-Butanone)	µg/L	<10	300	<10	<10	<10
Styrene	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
1,1,2,2-Tetrachloroethane	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Tetrachloroethylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Trichloroethylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
p+m-Xylene	µg/L	<0.20	0.20	<0.20	<0.20	<0.20
o-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Total Xylenes	µg/L	<0.20	0.20	<0.20	<0.20	<0.20
<b>PCBs</b>						
Total PCB	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
<b>Microbiological</b>						
Escherichia coli	CFU/100mL	<10	0	0	<10	<10
<b>Calculated Parameters</b>						
Total Animal/Vegetable Oil and Grease	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50

**Notes:**

µg/L = microgram per litre

mg/L = milligram per litre

CFU/100mL = colony-forming units per 100 milliliters

mbgs = metres below ground surface

"-." = not analyzed

&lt; = less than reportable detection limit

**APPENDIX J**

# Analytical Laboratory Test Results – Certificates of Analysis



Your Project #: 1530382 (7000)  
Site Location: OEW/DIXIE  
Your C.O.C. #: 657051-08-01

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/02/12**  
Report #: R6516604  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C131632**

**Received: 2021/02/04, 16:47**

Sample Matrix: Soil  
# Samples Received: 4

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Hot Water Extractable Boron	2	2021/02/08	2021/02/08	CAM SOP-00408	R153 Ana. Prot. 2011
Chloride (20:1 extract)	2	2021/02/09	2021/02/10	CAM SOP-00463	SM 23 4500-Cl E m
Free (WAD) Cyanide	2	2021/02/08	2021/02/09	CAM SOP-00457	OMOE E3015 m
Conductivity	2	2021/02/09	2021/02/09	CAM SOP-00414	OMOE E3530 v1 m
Conductivity	2	2021/02/09	2021/02/09	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	2	2021/02/08	2021/02/09	CAM SOP-00436	EPA 3060/7199 m
Strong Acid Leachable Metals by ICPMS	2	2021/02/08	2021/02/08	CAM SOP-00447	EPA 6020B m
Moisture	2	N/A	2021/02/05	CAM SOP-00445	Carter 2nd ed 51.2 m
pH CaCl <sub>2</sub> EXTRACT	4	2021/02/09	2021/02/09	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	2	2021/02/04	2021/02/09	CAM SOP-00414	SM 23 2510 m
Sodium Adsorption Ratio (SAR)	2	N/A	2021/02/09	CAM SOP-00102	EPA 6010C
Sulphate (20:1 Extract)	2	2021/02/09	2021/02/10	CAM SOP-00464	EPA 375.4 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 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.



Your Project #: 1530382 (7000)  
Site Location: OEWD/DIXIE  
Your C.O.C. #: 657051-08-01

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/02/12**  
Report #: R6516604  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C131632**

**Received: 2021/02/04, 16:47**

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) Soils are reported on a dry weight basis unless otherwise specified.

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: emese.gitej@bureauveritas.com

Phone# (905)817-5829

=====

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU  
VERITAS

BV Labs Job #: C131632  
Report Date: 2021/02/12

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: OEW/DIXIE  
Sampler Initials: LM

### SOIL CORROSIVITY PACKAGE (SOIL)

<b>BV Labs ID</b>		OTU460		OTU463			OTU463		
<b>Sampling Date</b>		2021/01/11		2021/02/02			2021/02/02		
<b>COC Number</b>		657051-08-01		657051-08-01			657051-08-01		
	<b>UNITS</b>	<b>21-2_SA7</b>	<b>QC Batch</b>	<b>21-37_SA4</b>	<b>RDL</b>	<b>QC Batch</b>	<b>21-37_SA4 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>									
Resistivity	ohm-cm	2800	7185326	1400		7185326			
<b>Inorganics</b>									
Soluble (20:1) Chloride (Cl-)	ug/g	56	7191591	350	20	7191591			
Conductivity	umho/cm	363	7191480	705	2	7192297	702	2	7192297
Available (CaCl <sub>2</sub> ) pH	pH	7.54	7191436	7.74		7191436	7.76		7191436
Soluble (20:1) Sulphate (SO <sub>4</sub> )	ug/g	<20	7191597	47	20	7191597			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate									

BUREAU  
VERITASBV Labs Job #: C131632  
Report Date: 2021/02/12Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: OEW/DIXIE  
Sampler Initials: LM**O.REG 153 METALS & INORGANICS PKG (SOIL)**

BV Labs ID		OTU461			OTU461			OTU462		
Sampling Date		2021/01/11			2021/01/11			2021/01/12		
COC Number		657051-08-01			657051-08-01			657051-08-01		
	UNITS	21-2_SA8	RDL	QC Batch	21-2_SA8 Lab-Dup	RDL	QC Batch	21-8_SA9	RDL	QC Batch

**Calculated Parameters**

Sodium Adsorption Ratio	N/A	2.9		7186111				2.0		7186111
-------------------------	-----	-----	--	---------	--	--	--	-----	--	---------

**Inorganics**

Conductivity	mS/cm	0.51	0.002	7191836				0.39	0.002	7191836
Moisture	%	19	1.0	7187631				21	1.0	7187631
Available (CaCl <sub>2</sub> ) pH	pH	7.47		7191436				7.67		7191436
WAD Cyanide (Free)	ug/g	0.02	0.01	7189884				<0.01	0.01	7189884
Chromium (VI)	ug/g	<0.18	0.18	7189477				<0.18	0.18	7189477

**Metals**

Hot Water Ext. Boron (B)	ug/g	1.4	0.050	7189614	1.3	0.050	7189614	0.75	0.050	7189614
Acid Extractable Antimony (Sb)	ug/g	<0.20	0.20	7189411				<0.20	0.20	7189411
Acid Extractable Arsenic (As)	ug/g	3.8	1.0	7189411				3.4	1.0	7189411
Acid Extractable Barium (Ba)	ug/g	41	0.50	7189411				91	0.50	7189411
Acid Extractable Beryllium (Be)	ug/g	0.30	0.20	7189411				0.57	0.20	7189411
Acid Extractable Boron (B)	ug/g	5.5	5.0	7189411				10	5.0	7189411
Acid Extractable Cadmium (Cd)	ug/g	0.12	0.10	7189411				<0.10	0.10	7189411
Acid Extractable Chromium (Cr)	ug/g	11	1.0	7189411				19	1.0	7189411
Acid Extractable Cobalt (Co)	ug/g	4.2	0.10	7189411				9.7	0.10	7189411
Acid Extractable Copper (Cu)	ug/g	9.5	0.50	7189411				21	0.50	7189411
Acid Extractable Lead (Pb)	ug/g	9.3	1.0	7189411				7.3	1.0	7189411
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	0.50	7189411				<0.50	0.50	7189411
Acid Extractable Nickel (Ni)	ug/g	8.7	0.50	7189411				21	0.50	7189411
Acid Extractable Selenium (Se)	ug/g	<0.50	0.50	7189411				<0.50	0.50	7189411
Acid Extractable Silver (Ag)	ug/g	<0.20	0.20	7189411				<0.20	0.20	7189411
Acid Extractable Thallium (Tl)	ug/g	0.062	0.050	7189411				0.12	0.050	7189411
Acid Extractable Uranium (U)	ug/g	0.49	0.050	7189411				0.61	0.050	7189411
Acid Extractable Vanadium (V)	ug/g	21	5.0	7189411				28	5.0	7189411
Acid Extractable Zinc (Zn)	ug/g	33	5.0	7189411				49	5.0	7189411
Acid Extractable Mercury (Hg)	ug/g	<0.050	0.050	7189411				<0.050	0.050	7189411

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate





BV Labs Job #: C131632  
Report Date: 2021/02/12

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: OEW/DIXIE  
Sampler Initials: LM

## TEST SUMMARY

**BV Labs ID:** OTU460  
**Sample ID:** 21-2\_SA7  
**Matrix:** Soil

**Collected:** 2021/01/11  
**Shipped:**  
**Received:** 2021/02/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7191591	2021/02/09	2021/02/10	Deonarine Ramnarine
Conductivity	AT	7191480	2021/02/09	2021/02/09	Tarunpreet Kaur
pH CaCl2 EXTRACT	AT	7191436	2021/02/09	2021/02/09	Neil Dassanayake
Resistivity of Soil		7185326	2021/02/09	2021/02/09	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7191597	2021/02/09	2021/02/10	Deonarine Ramnarine

**BV Labs ID:** OTU461  
**Sample ID:** 21-2\_SA8  
**Matrix:** Soil

**Collected:** 2021/01/11  
**Shipped:**  
**Received:** 2021/02/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7189614	2021/02/08	2021/02/08	Archana Patel
Free (WAD) Cyanide	TECH	7189884	2021/02/08	2021/02/09	Gnana Thomas
Conductivity	AT	7191836	2021/02/09	2021/02/09	Tarunpreet Kaur
Hexavalent Chromium in Soil by IC	IC/SPEC	7189477	2021/02/08	2021/02/09	Violeta Porcila
Strong Acid Leachable Metals by ICPMS	ICP/MS	7189411	2021/02/08	2021/02/08	Daniel Teclu
Moisture	BAL	7187631	N/A	2021/02/05	Min Yang
pH CaCl2 EXTRACT	AT	7191436	2021/02/09	2021/02/09	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7186111	N/A	2021/02/09	Automated Statchk

**BV Labs ID:** OTU461 Dup  
**Sample ID:** 21-2\_SA8  
**Matrix:** Soil

**Collected:** 2021/01/11  
**Shipped:**  
**Received:** 2021/02/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7189614	2021/02/08	2021/02/08	Archana Patel

**BV Labs ID:** OTU462  
**Sample ID:** 21-8\_SA9  
**Matrix:** Soil

**Collected:** 2021/01/12  
**Shipped:**  
**Received:** 2021/02/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7189614	2021/02/08	2021/02/08	Archana Patel
Free (WAD) Cyanide	TECH	7189884	2021/02/08	2021/02/09	Gnana Thomas
Conductivity	AT	7191836	2021/02/09	2021/02/09	Tarunpreet Kaur
Hexavalent Chromium in Soil by IC	IC/SPEC	7189477	2021/02/08	2021/02/09	Violeta Porcila
Strong Acid Leachable Metals by ICPMS	ICP/MS	7189411	2021/02/08	2021/02/08	Daniel Teclu
Moisture	BAL	7187631	N/A	2021/02/05	Min Yang
pH CaCl2 EXTRACT	AT	7191436	2021/02/09	2021/02/09	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7186111	N/A	2021/02/09	Automated Statchk



BUREAU  
VERITAS

BV Labs Job #: C131632  
Report Date: 2021/02/12

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: OEW/DIXIE  
Sampler Initials: LM

## TEST SUMMARY

**BV Labs ID:** OTU463  
**Sample ID:** 21-37\_SA4  
**Matrix:** Soil

**Collected:** 2021/02/02  
**Shipped:**  
**Received:** 2021/02/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7191591	2021/02/09	2021/02/10	Deonarine Ramnarine
Conductivity	AT	7192297	2021/02/09	2021/02/09	Tarunpreet Kaur
pH CaCl2 EXTRACT	AT	7191436	2021/02/09	2021/02/09	Neil Dassanayake
Resistivity of Soil		7185326	2021/02/09	2021/02/09	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7191597	2021/02/09	2021/02/10	Deonarine Ramnarine

**BV Labs ID:** OTU463 Dup  
**Sample ID:** 21-37\_SA4  
**Matrix:** Soil

**Collected:** 2021/02/02  
**Shipped:**  
**Received:** 2021/02/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	7192297	2021/02/09	2021/02/09	Tarunpreet Kaur
pH CaCl2 EXTRACT	AT	7191436	2021/02/09	2021/02/09	Neil Dassanayake



BUREAU  
VERITAS

BV Labs Job #: C131632  
Report Date: 2021/02/12

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: OEW/DIXIE  
Sampler Initials: LM

### GENERAL COMMENTS

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

Package 1	5.0°C
-----------	-------

Sample OTU461 [21-2\_SA8] : Cyanide analysis: Sample received and analyzed past the recommended hold time.

Sample OTU462 [21-8\_SA9] : Cyanide analysis: Sample received and analyzed past the recommended hold time.

**Results relate only to the items tested.**

BUREAU  
VERITAS

BV Labs Job #: C131632

Report Date: 2021/02/12

## QUALITY ASSURANCE REPORT

Golder Associates Ltd  
Client Project #: 1530382 (7000)

Site Location: OEW/DIXIE

Sampler Initials: LM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7187631	Moisture	2021/02/05							5.9	20
7189411	Acid Extractable Antimony (Sb)	2021/02/08	91	75 - 125	96	80 - 120	<0.20	ug/g	NC	30
7189411	Acid Extractable Arsenic (As)	2021/02/08	92	75 - 125	97	80 - 120	<1.0	ug/g	NC	30
7189411	Acid Extractable Barium (Ba)	2021/02/08	93	75 - 125	97	80 - 120	<0.50	ug/g	3.7	30
7189411	Acid Extractable Beryllium (Be)	2021/02/08	94	75 - 125	95	80 - 120	<0.20	ug/g	NC	30
7189411	Acid Extractable Boron (B)	2021/02/08	91	75 - 125	91	80 - 120	<5.0	ug/g	NC	30
7189411	Acid Extractable Cadmium (Cd)	2021/02/08	93	75 - 125	97	80 - 120	<0.10	ug/g	NC	30
7189411	Acid Extractable Chromium (Cr)	2021/02/08	89	75 - 125	94	80 - 120	<1.0	ug/g	1.0	30
7189411	Acid Extractable Cobalt (Co)	2021/02/08	92	75 - 125	97	80 - 120	<0.10	ug/g	0.038	30
7189411	Acid Extractable Copper (Cu)	2021/02/08	92	75 - 125	97	80 - 120	<0.50	ug/g	0.23	30
7189411	Acid Extractable Lead (Pb)	2021/02/08	85	75 - 125	96	80 - 120	<1.0	ug/g	NC	30
7189411	Acid Extractable Mercury (Hg)	2021/02/08	79	75 - 125	88	80 - 120	<0.050	ug/g		
7189411	Acid Extractable Molybdenum (Mo)	2021/02/08	92	75 - 125	94	80 - 120	<0.50	ug/g	NC	30
7189411	Acid Extractable Nickel (Ni)	2021/02/08	93	75 - 125	100	80 - 120	<0.50	ug/g	4.9	30
7189411	Acid Extractable Selenium (Se)	2021/02/08	96	75 - 125	100	80 - 120	<0.50	ug/g	NC	30
7189411	Acid Extractable Silver (Ag)	2021/02/08	94	75 - 125	97	80 - 120	<0.20	ug/g	NC	30
7189411	Acid Extractable Thallium (Tl)	2021/02/08	85	75 - 125	96	80 - 120	<0.050	ug/g	NC	30
7189411	Acid Extractable Uranium (U)	2021/02/08	81	75 - 125	92	80 - 120	<0.050	ug/g	3.7	30
7189411	Acid Extractable Vanadium (V)	2021/02/08	90	75 - 125	95	80 - 120	<5.0	ug/g	0.82	30
7189411	Acid Extractable Zinc (Zn)	2021/02/08	93	75 - 125	98	80 - 120	<5.0	ug/g	5.3	30
7189477	Chromium (VI)	2021/02/09	70	70 - 130	97	80 - 120	<0.18	ug/g	NC	35
7189614	Hot Water Ext. Boron (B)	2021/02/08	96	75 - 125	109	75 - 125	<0.050	ug/g	6.9	40
7189884	WAD Cyanide (Free)	2021/02/09	80	75 - 125	97	80 - 120	<0.01	ug/g	NC	35
7191436	Available (CaCl2) pH	2021/02/09			100	97 - 103			0.25	N/A
7191480	Conductivity	2021/02/09			103	90 - 110	<2	umho/cm	3.2	10
7191591	Soluble (20:1) Chloride (Cl-)	2021/02/10	NC	70 - 130	102	70 - 130	<20	ug/g	14	35
7191597	Soluble (20:1) Sulphate (SO4)	2021/02/10	NC	70 - 130	108	70 - 130	<20	ug/g	3.5	35
7191836	Conductivity	2021/02/09			104	90 - 110	<0.002	mS/cm	1.0	10



BUREAU  
VERITAS

BV Labs Job #: C131632

Report Date: 2021/02/12

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: OEW/DIXIE

Sampler Initials: LM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7192297	Conductivity	2021/02/09			104	90 - 110	<2	umho/cm	0.43	10

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.

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.

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  $\leq 2 \times \text{RDL}$ ).



BUREAU  
VERITAS

BV Labs Job #: C131632  
Report Date: 2021/02/12

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: OEW/DIXIE  
Sampler Initials: LM

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ewa Pranjić, M.Sc., C.Chem, Scientific Specialist

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

## Page 1 of 1

Maxxam Analytics International Corporation o/a Maxxam Analytics



Your Project #: 1530382  
Site Location: QEW / DIXIE  
Your C.O.C. #: 808525-01-01

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/02/26**  
Report #: R6534387  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C147255**

**Received: 2021/02/22, 17:38**

Sample Matrix: Soil  
# Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Hot Water Extractable Boron	1	2021/02/24	2021/02/24	CAM SOP-00408	R153 Ana. Prot. 2011
Hot Water Extractable Boron	1	2021/02/25	2021/02/25	CAM SOP-00408	R153 Ana. Prot. 2011
Chloride (20:1 extract)	1	2021/02/24	2021/02/24	CAM SOP-00463	SM 23 4500-Cl E m
Free (WAD) Cyanide	2	2021/02/24	2021/02/25	CAM SOP-00457	OMOE E3015 m
Conductivity	1	2021/02/25	2021/02/25	CAM SOP-00414	OMOE E3530 v1 m
Conductivity	2	2021/02/25	2021/02/25	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	2	2021/02/24	2021/02/25	CAM SOP-00436	EPA 3060/7199 m
Strong Acid Leachable Metals by ICPMS	2	2021/02/24	2021/02/24	CAM SOP-00447	EPA 6020B m
Moisture	2	N/A	2021/02/23	CAM SOP-00445	Carter 2nd ed 51.2 m
pH CaCl <sub>2</sub> EXTRACT	3	2021/02/24	2021/02/24	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	1	2021/02/22	2021/02/25	CAM SOP-00414	SM 23 2510 m
Sodium Adsorption Ratio (SAR)	2	N/A	2021/02/26	CAM SOP-00102	EPA 6010C
Sulphate (20:1 Extract)	1	2021/02/24	2021/02/25	CAM SOP-00464	EPA 375.4 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 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.





Your Project #: 1530382  
Site Location: QEW / DIXIE  
Your C.O.C. #: 808525-01-01

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/02/26**  
Report #: R6534387  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C147255**

**Received: 2021/02/22, 17:38**

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) Soils are reported on a dry weight basis unless otherwise specified.

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: emese.gitej@bureauveritas.com

Phone# (905)817-5829

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU  
VERITAS

BV Labs Job #: C147255  
Report Date: 2021/02/26

Golder Associates Ltd  
Client Project #: 1530382  
Site Location: QEW / DIXIE  
Sampler Initials: LM

### SOIL CORROSIVITY PACKAGE (SOIL)

<b>BV Labs ID</b>		OXC964			OXC964		
<b>Sampling Date</b>		2021/02/17			2021/02/17		
<b>COC Number</b>		808525-01-01			808525-01-01		
	<b>UNITS</b>	<b>21-11-SA6</b>	<b>RDL</b>	<b>QC Batch</b>	<b>21-11-SA6 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Resistivity	ohm-cm	820		7212116			
<b>Inorganics</b>							
Soluble (20:1) Chloride (Cl-)	ug/g	710	20	7215342			
Conductivity	umho/cm	1230	2	7217633			
Available (CaCl2) pH	pH	7.79		7215151			
Soluble (20:1) Sulphate (SO4)	ug/g	84	20	7215361	77	20	7215361
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							

BUREAU  
VERITASBV Labs Job #: C147255  
Report Date: 2021/02/26Golder Associates Ltd  
Client Project #: 1530382  
Site Location: QEW / DIXIE  
Sampler Initials: LM**O.REG 153 METALS & INORGANICS PKG (SOIL)**

<b>BV Labs ID</b>		OXC963		OXC965		
<b>Sampling Date</b>		2021/02/10		2021/02/17		
<b>COC Number</b>		808525-01-01		808525-01-01		
	<b>UNITS</b>	<b>21-4-SA5</b>	<b>QC Batch</b>	<b>21-11-SA3</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>						
Sodium Adsorption Ratio	N/A	2.6	7211706	11		7211706
<b>Inorganics</b>						
Conductivity	mS/cm	0.63	7217591	1.6	0.002	7217591
Moisture	%	10	7212928	18	1.0	7212928
Available (CaCl <sub>2</sub> ) pH	pH	7.83	7215151	7.66		7215151
WAD Cyanide (Free)	ug/g	<0.01	7216332	<0.01	0.01	7216332
Chromium (VI)	ug/g	<0.18	7215680	<0.18	0.18	7215680
<b>Metals</b>						
Hot Water Ext. Boron (B)	ug/g	1.2	7214745	0.20	0.050	7217233
Acid Extractable Antimony (Sb)	ug/g	<0.20	7215032	<0.20	0.20	7215032
Acid Extractable Arsenic (As)	ug/g	5.4	7215032	<1.0	1.0	7215032
Acid Extractable Barium (Ba)	ug/g	41	7215032	12	0.50	7215032
Acid Extractable Beryllium (Be)	ug/g	0.84	7215032	<0.20	0.20	7215032
Acid Extractable Boron (B)	ug/g	15	7215032	<5.0	5.0	7215032
Acid Extractable Cadmium (Cd)	ug/g	<0.10	7215032	<0.10	0.10	7215032
Acid Extractable Chromium (Cr)	ug/g	23	7215032	10	1.0	7215032
Acid Extractable Cobalt (Co)	ug/g	14	7215032	2.7	0.10	7215032
Acid Extractable Copper (Cu)	ug/g	27	7215032	4.1	0.50	7215032
Acid Extractable Lead (Pb)	ug/g	7.7	7215032	3.2	1.0	7215032
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	7215032	<0.50	0.50	7215032
Acid Extractable Nickel (Ni)	ug/g	31	7215032	4.9	0.50	7215032
Acid Extractable Selenium (Se)	ug/g	<0.50	7215032	<0.50	0.50	7215032
Acid Extractable Silver (Ag)	ug/g	<0.20	7215032	<0.20	0.20	7215032
Acid Extractable Thallium (Tl)	ug/g	0.098	7215032	<0.050	0.050	7215032
Acid Extractable Uranium (U)	ug/g	0.49	7215032	0.47	0.050	7215032
Acid Extractable Vanadium (V)	ug/g	29	7215032	28	5.0	7215032
Acid Extractable Zinc (Zn)	ug/g	68	7215032	13	5.0	7215032
Acid Extractable Mercury (Hg)	ug/g	<0.050	7215032	<0.050	0.050	7215032
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



BUREAU  
VERITAS

BV Labs Job #: C147255

Report Date: 2021/02/26

Golder Associates Ltd

Client Project #: 1530382

Site Location: QEW / DIXIE

Sampler Initials: LM

## TEST SUMMARY

**BV Labs ID:** OXC963  
**Sample ID:** 21-4-SA5  
**Matrix:** Soil

**Collected:** 2021/02/10  
**Shipped:**  
**Received:** 2021/02/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7214745	2021/02/24	2021/02/24	Meghaben Patel
Free (WAD) Cyanide	TECH	7216332	2021/02/24	2021/02/25	Louise Harding
Conductivity	AT	7217591	2021/02/25	2021/02/25	Tarunpreet Kaur
Hexavalent Chromium in Soil by IC	IC/SPEC	7215680	2021/02/24	2021/02/25	Violeta Porcila
Strong Acid Leachable Metals by ICPMS	ICP/MS	7215032	2021/02/24	2021/02/24	Viviana Canzonieri
Moisture	BAL	7212928	N/A	2021/02/23	Mithunaa Sasitheepan
pH CaCl2 EXTRACT	AT	7215151	2021/02/24	2021/02/24	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7211706	N/A	2021/02/26	Automated Statchk

**BV Labs ID:** OXC964  
**Sample ID:** 21-11-SA6  
**Matrix:** Soil

**Collected:** 2021/02/17  
**Shipped:**  
**Received:** 2021/02/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7215342	2021/02/24	2021/02/24	Alina Dobreanu
Conductivity	AT	7217633	2021/02/25	2021/02/25	Tarunpreet Kaur
pH CaCl2 EXTRACT	AT	7215151	2021/02/24	2021/02/24	Neil Dassanayake
Resistivity of Soil		7212116	2021/02/25	2021/02/25	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7215361	2021/02/24	2021/02/25	Avneet Kour Sudan

**BV Labs ID:** OXC964 Dup  
**Sample ID:** 21-11-SA6  
**Matrix:** Soil

**Collected:** 2021/02/17  
**Shipped:**  
**Received:** 2021/02/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	7215361	2021/02/24	2021/02/25	Avneet Kour Sudan

**BV Labs ID:** OXC965  
**Sample ID:** 21-11-SA3  
**Matrix:** Soil

**Collected:** 2021/02/17  
**Shipped:**  
**Received:** 2021/02/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7217233	2021/02/25	2021/02/25	Medhat Nasr
Free (WAD) Cyanide	TECH	7216332	2021/02/24	2021/02/25	Louise Harding
Conductivity	AT	7217591	2021/02/25	2021/02/25	Tarunpreet Kaur
Hexavalent Chromium in Soil by IC	IC/SPEC	7215680	2021/02/24	2021/02/25	Violeta Porcila
Strong Acid Leachable Metals by ICPMS	ICP/MS	7215032	2021/02/24	2021/02/24	Viviana Canzonieri
Moisture	BAL	7212928	N/A	2021/02/23	Mithunaa Sasitheepan
pH CaCl2 EXTRACT	AT	7215151	2021/02/24	2021/02/24	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7211706	N/A	2021/02/26	Automated Statchk



BUREAU  
VERITAS

BV Labs Job #: C147255  
Report Date: 2021/02/26

Golder Associates Ltd  
Client Project #: 1530382  
Site Location: QEW / DIXIE  
Sampler Initials: LM

### GENERAL COMMENTS

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

Package 1	5.3°C
-----------	-------

Results relate only to the items tested.



BUREAU  
VERITAS

BV Labs Job #: C147255

Report Date: 2021/02/26

## QUALITY ASSURANCE REPORT

Golder Associates Ltd

Client Project #: 1530382

Site Location: QEW / DIXIE

Sampler Initials: LM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7212928	Moisture	2021/02/23							2.8	20
7214745	Hot Water Ext. Boron (B)	2021/02/24	93	75 - 125	95	75 - 125	<0.050	ug/g	NC	40
7215032	Acid Extractable Antimony (Sb)	2021/02/24	98	75 - 125	103	80 - 120	<0.20	ug/g		
7215032	Acid Extractable Arsenic (As)	2021/02/24	NC	75 - 125	99	80 - 120	<1.0	ug/g	7.1	30
7215032	Acid Extractable Barium (Ba)	2021/02/24	91	75 - 125	98	80 - 120	<0.50	ug/g		
7215032	Acid Extractable Beryllium (Be)	2021/02/24	101	75 - 125	102	80 - 120	<0.20	ug/g		
7215032	Acid Extractable Boron (B)	2021/02/24	98	75 - 125	101	80 - 120	<5.0	ug/g		
7215032	Acid Extractable Cadmium (Cd)	2021/02/24	98	75 - 125	102	80 - 120	<0.10	ug/g		
7215032	Acid Extractable Chromium (Cr)	2021/02/24	94	75 - 125	96	80 - 120	<1.0	ug/g		
7215032	Acid Extractable Cobalt (Co)	2021/02/24	97	75 - 125	99	80 - 120	<0.10	ug/g		
7215032	Acid Extractable Copper (Cu)	2021/02/24	93	75 - 125	99	80 - 120	<0.50	ug/g		
7215032	Acid Extractable Lead (Pb)	2021/02/24	93	75 - 125	101	80 - 120	<1.0	ug/g		
7215032	Acid Extractable Mercury (Hg)	2021/02/24	84	75 - 125	94	80 - 120	<0.050	ug/g		
7215032	Acid Extractable Molybdenum (Mo)	2021/02/24	94	75 - 125	97	80 - 120	<0.50	ug/g		
7215032	Acid Extractable Nickel (Ni)	2021/02/24	96	75 - 125	99	80 - 120	<0.50	ug/g		
7215032	Acid Extractable Selenium (Se)	2021/02/24	98	75 - 125	103	80 - 120	<0.50	ug/g		
7215032	Acid Extractable Silver (Ag)	2021/02/24	98	75 - 125	104	80 - 120	<0.20	ug/g		
7215032	Acid Extractable Thallium (Tl)	2021/02/24	94	75 - 125	100	80 - 120	<0.050	ug/g		
7215032	Acid Extractable Uranium (U)	2021/02/24	95	75 - 125	100	80 - 120	<0.050	ug/g	4.0	30
7215032	Acid Extractable Vanadium (V)	2021/02/24	93	75 - 125	96	80 - 120	<5.0	ug/g		
7215032	Acid Extractable Zinc (Zn)	2021/02/24	98	75 - 125	101	80 - 120	<5.0	ug/g		
7215151	Available (CaCl <sub>2</sub> ) pH	2021/02/24			100	97 - 103			0.32	N/A
7215342	Soluble (20:1) Chloride (Cl <sup>-</sup> )	2021/02/24	NC	70 - 130	105	70 - 130	<20	ug/g	6.5	35
7215361	Soluble (20:1) Sulphate (SO <sub>4</sub> )	2021/02/25	NC	70 - 130	106	70 - 130	<20	ug/g	8.6	35
7215680	Chromium (VI)	2021/02/25	85	70 - 130	94	80 - 120	<0.18	ug/g	NC	35
7216332	WAD Cyanide (Free)	2021/02/25	93	75 - 125	96	80 - 120	<0.01	ug/g	NC	35
7217233	Hot Water Ext. Boron (B)	2021/02/25	106	75 - 125	100	75 - 125	<0.050	ug/g	3.0	40
7217591	Conductivity	2021/02/25			101	90 - 110	<0.002	mS/cm	1.5	10



BUREAU  
VERITAS

BV Labs Job #: C147255

Report Date: 2021/02/26

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382

Site Location: QEW / DIXIE

Sampler Initials: LM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7217633	Conductivity	2021/02/25			103	90 - 110	<2	umho/cm	1.2	10
<p>N/A = Not Applicable</p> <p>Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.</p> <p>Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.</p> <p>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.</p> <p>Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.</p> <p>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)</p> <p>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 &lt;= 2x RDL).</p>										



BUREAU  
VERITAS

BV Labs Job #: C147255  
Report Date: 2021/02/26

Golder Associates Ltd  
Client Project #: 1530382  
Site Location: QEW / DIXIE  
Sampler Initials: LM

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.






22-Feb-21 17:38

Page of

Ema Gitej

<b>INVOICE TO:</b> Company Name: #1326 Golder Associates Ltd Attention: Accounts Payable Address: 6925 Century Ave Suite 100 Mississauga ON L5N 7K2 Tel: (905) 567-4444 Fax: (905) 567-6561 Email: CanadaAccountsPayableInvoices@golder.com			<b>REPORT TO:</b> Company Name: <u>GOLDER ASSOCIATES</u> Attention: <u>Sandra McGaghran Katelyn Nero</u> Address: <u>6925 Century Ave, Suite 100</u> <u>MISSISSAUGA ON L5N 7K2</u> <u>905 567 4444</u> Fax: _____ Tel: _____ Email: <u>smcgaghran@golder.com</u> <u>knero@golder.com</u>			<b>PROJECT INFORMATION:</b> Quotation #: <u>B80683</u> P.O. #: _____ Project: <u>1530382</u> Project Name: <u>CREW/DIXIE</u> Site #: _____ Sampled By: <u>LM/ACK</u>			C147255 MAF ENV-678 COC #: _____  Project Manager: _____ Ema Gitej _____										
<b>MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY</b>																			
<b>Regulation 153 (2011)</b> <input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Medium/Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> For RSC <input type="checkbox"/> Table _____			<b>Other Regulations</b> <input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> Reg 558 <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> MISA Municipality _____ <input type="checkbox"/> PWQO <input type="checkbox"/> Reg 406 Table _____ <input type="checkbox"/> Other _____			<b>Special Instructions</b>													
Include Criteria on Certificate of Analysis (Y/N)? _____																			
	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle) Metals / Hg / Cr VI	O Reg 558 TCLP Inorganics Package	O Reg 153 Metals & Inorganics Pkg	Soil Corrosivity Package (short list)										
1		21-4-SAS	2021/02/12	PM	SOIL			X											
2		<del>21-4-SAS</del>	<del>2021/02/17</del>	<del>PM</del>	<del>SOIL</del>			<del>X</del>											
3		<del>21-4-SAS</del>	<del>2021/02/17</del>	<del>PM</del>	<del>SOIL</del>			<del>X</del>											
4																			
5		21-11-SAG	2021/02/17	PM	SOIL				X										
6		21-11-SAG	2021/02/17	PM	SOIL			X											
7																			
8																			
9																			
10																			
* RELINQUISHED BY: (Signature/Print) <u>Alysha Kobylinski Alysha Kobylinski</u>			Date: (YY/MM/DD) Time <u>21/02/22 5:34PM</u>		RECEIVED BY: (Signature/Print) <u>[Signature]</u>		Date: (YY/MM/DD) Time <u>21/02/22 1:38</u>		# jars used and not submitted _____		Laboratory Use Only Time Sensitive _____ Temperature (°C) on Recl <u>7/17/22</u> Custody Seal Present _____ Yes _____ No <u>✓</u> Intact _____								
* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.										* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.									
** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.										SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS									



Your Project #: 1530382 (7000)  
 Site Location: QEW/DIXIE  
 Your C.O.C. #: 657051-10-01, 657051-11-01

**Attention: Katelyn Nero**

Golder Associates Ltd  
 6925 Century Ave  
 Suite 100  
 Mississauga, ON  
 CANADA L5N 7K2

**Report Date: 2021/07/10**  
 Report #: R6713209  
 Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1H7791**

**Received: 2021/06/28, 09:18**

Sample Matrix: Soil  
 # Samples Received: 20

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Methylnaphthalene Sum	4	N/A	2021/07/06	CAM SOP-00301	EPA 8270D m
Methylnaphthalene Sum	2	N/A	2021/07/07	CAM SOP-00301	EPA 8270D m
ABN Compounds in SPLP Leachates	1	2021/07/05	2021/07/08	CAM SOP-00301	EPA 8270 m
ABN Compounds in SPLP Leachates	4	2021/07/07	2021/07/08	CAM SOP-00301	EPA 8270 m
Hot Water Extractable Boron	1	2021/07/05	2021/07/05	CAM SOP-00408	R153 Ana. Prot. 2011
Hot Water Extractable Boron	5	2021/07/05	2021/07/06	CAM SOP-00408	R153 Ana. Prot. 2011
1,3-Dichloropropene Sum	5	N/A	2021/07/08		EPA 8260D m
1,3-Dichloropropene Sum	6	N/A	2021/07/07		EPA 8260C m
Chloride (20:1 extract)	5	2021/07/05	2021/07/05	CAM SOP-00463	SM 23 4500-Cl E m
Chloride (20:1 extract)	1	2021/07/05	2021/07/06	CAM SOP-00463	SM 23 4500-Cl E m
Free (WAD) Cyanide	6	2021/07/05	2021/07/05	CAM SOP-00457	OMOE E3015 m
Cyanide (WAD) in Leachates	3	N/A	2021/07/06	CAM SOP-00457	OMOE 3015 m
Conductivity	5	2021/07/05	2021/07/05	CAM SOP-00414	OMOE E3530 v1 m
Conductivity	1	2021/07/06	2021/07/06	CAM SOP-00414	OMOE E3530 v1 m
Conductivity	6	2021/07/06	2021/07/06	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	6	2021/07/05	2021/07/06	CAM SOP-00436	EPA 3060/7199 m
Dinitrotoluene Sum	5	N/A	2021/07/08	CAM SOP - 00301	EPA 8270
Petroleum Hydrocarbons F2-F4 in Soil (2)	2	2021/07/02	2021/07/02	CAM SOP-00316	CCME CWS m
Petroleum Hydrocarbons F2-F4 in Soil (2)	4	2021/07/05	2021/07/05	CAM SOP-00316	CCME CWS m
Fluoride by ISE in Leachates	3	2021/07/06	2021/07/06	CAM SOP-00449	SM 23 4500-F- C m
Acid Extractable Metals by ICPMS	6	2021/07/05	2021/07/07	CAM SOP-00447	EPA 6020B m
Total Metals in TCLP Leachate by ICPMS	3	2021/07/06	2021/07/06	CAM SOP-00447	EPA 6020B m
Total Metals in SPLP Leachate by ICPMS	5	2021/07/07	2021/07/08	CAM SOP-00447	EPA 6020B m
Ignitability of a Sample	3	2021/07/06	2021/07/06	CAM SOP-00432	EPA 1030 Rev. 1 m
Moisture	6	N/A	2021/07/02	CAM SOP-00445	Carter 2nd ed 51.2 m
Modified SPLP extraction - pH	5	N/A	2021/07/07	CAM SOP-00941	OMOECP LaSB E9003 R3
Modified SPLP extraction - Weight	5	N/A	2021/07/07	CAM SOP-00941	OMOECP LaSB E9003 R3
Nitrate(NO3) + Nitrite(NO2) in Leachate	3	N/A	2021/07/06	CAM SOP-00440	SM 23 4500-NO3I/NO2B
OC Pesticides/PCB (SPLP Leachable)	5	2021/07/07	2021/07/08	CAM SOP-00307	EPA 8081/8082 m
OC Pesticides Summed Parameters	5	N/A	2021/07/07	CAM SOP-00307	EPA 8081/8082 m



Your Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Your C.O.C. #: 657051-10-01, 657051-11-01

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/10**  
Report #: R6713209  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1H7791**

**Received: 2021/06/28, 09:18**

Sample Matrix: Soil  
# Samples Received: 20

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
PAH Compounds in Leachate by GC/MS (SIM)	3	2021/07/06	2021/07/07	CAM SOP-00318	EPA 8270D m
PAH Compounds in Soil by GC/MS (SIM)	4	2021/07/05	2021/07/05	CAM SOP-00318	EPA 8270D m
PAH Compounds in Soil by GC/MS (SIM)	2	2021/07/05	2021/07/06	CAM SOP-00318	EPA 8270D m
Polychlorinated Biphenyl in Soil	6	2021/07/04	2021/07/05	CAM SOP-00309	EPA 8082A m
pH CaCl2 EXTRACT	12	2021/07/05	2021/07/05	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	5	2021/07/02	2021/07/05	CAM SOP-00414	SM 23 2510 m
Resistivity of Soil	1	2021/07/02	2021/07/06	CAM SOP-00414	SM 23 2510 m
Sodium Adsorption Ratio (SAR)	6	N/A	2021/07/07	CAM SOP-00102	EPA 6010C
Sulphate (20:1 Extract)	5	2021/07/05	2021/07/05	CAM SOP-00464	EPA 375.4 m
Sulphate (20:1 Extract)	1	2021/07/05	2021/07/06	CAM SOP-00464	EPA 375.4 m
TCLP Zero Headspace Extraction	3	2021/07/06	2021/07/07	CAM SOP-00430	EPA 1311 m
Volatile Organic Compounds and F1 PHCs	6	N/A	2021/07/07	CAM SOP-00230	EPA 8260C m
VOCs in ZHE Leachates	3	2021/07/07	2021/07/07	CAM SOP-00228	EPA 8260C m
Volatile organics in SPL leachates	5	N/A	2021/07/08	CAM SOP-00228	EPA 8260D 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 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



Your Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Your C.O.C. #: 657051-10-01, 657051-11-01

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/10**  
Report #: R6713209  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1H7791**

**Received: 2021/06/28, 09:18**

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) Soils are reported on a dry weight basis unless otherwise specified.

(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: emese.gitej@bureauveritas.com

Phone# (905)817-5829

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

**SOIL CORROSIVITY PACKAGE (SOIL)**

<b>BV Labs ID</b>		PYK389		PYK390	PYK391	PYK392		
<b>Sampling Date</b>		2021/06/15		2021/06/18	2021/06/24	2021/06/24		
<b>COC Number</b>		657051-10-01		657051-10-01	657051-10-01	657051-10-01		
	<b>UNITS</b>	<b>21-33 SA4</b>	<b>QC Batch</b>	<b>21-27 SA2</b>	<b>21-40 SA2</b>	<b>21-42 SA3</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Calculated Parameters</b>								
Resistivity	ohm-cm	880	7441545	3800	1500	1000		7441545
<b>Inorganics</b>								
Soluble (20:1) Chloride (Cl-)	ug/g	660	7443990	53	270	520	20	7443645
Conductivity	umho/cm	1140	7443483	262	649	1000	2	7443483
Available (CaCl2) pH	pH	8.13	7444166	7.40	7.86	7.83		7444166
Soluble (20:1) Sulphate (SO4)	ug/g	38	7444013	<20	23	<20	20	7443646
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								

<b>BV Labs ID</b>		PYK393			PYK393			PYK437		
<b>Sampling Date</b>		2021/06/25			2021/06/25			2021/06/24		
<b>COC Number</b>		657051-10-01			657051-10-01			657051-11-01		
	<b>UNITS</b>	<b>21-23 SA3</b>	<b>RDL</b>	<b>QC Batch</b>	<b>21-23 SA3 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>	<b>21-39 SA4</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Calculated Parameters</b>										
Resistivity	ohm-cm	920		7441545				2100		7441545
<b>Inorganics</b>										
Soluble (20:1) Chloride (Cl-)	ug/g	620	20	7443645	660	20	7443645	240	20	7443645
Conductivity	umho/cm	1090	2	7446235	1100	2	7446235	483	2	7443483
Available (CaCl2) pH	pH	8.08		7444166				8.16		7444166
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	7443646				<20	20	7443646
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

**O.REG 406 EXCESS SOIL BULK INORGANICS (SOIL)**

BV Labs ID		PYK384			PYK384			PYK385		
Sampling Date		2021/06/25			2021/06/25			2021/06/18		
COC Number		657051-10-01			657051-10-01			657051-10-01		
	UNITS	21-23 SA2	RDL	QC Batch	21-23 SA2 Lab-Dup	RDL	QC Batch	21-27 AS4	RDL	QC Batch

**Calculated Parameters**

Sodium Adsorption Ratio	N/A	41		7440876				7.1		7440876
-------------------------	-----	----	--	---------	--	--	--	-----	--	---------

**Inorganics**

Conductivity	mS/cm	1.2	0.002	7446285				0.41	0.002	7446285
Available (CaCl <sub>2</sub> ) pH	pH	7.90		7444166				8.00		7444166
WAD Cyanide (Free)	ug/g	<0.01	0.01	7443462				<0.01	0.01	7443462
Chromium (VI)	ug/g	<0.18	0.18	7443554				<0.18	0.18	7443554

**Metals**

Hot Water Ext. Boron (B)	ug/g	0.093	0.050	7444001	0.086	0.050	7444001	0.40	0.050	7444001
Acid Extractable Antimony (Sb)	ug/g	<0.20	0.20	7444438				<0.20	0.20	7444438
Acid Extractable Arsenic (As)	ug/g	1.1	1.0	7444438				7.3	1.0	7444438
Acid Extractable Barium (Ba)	ug/g	5.0	0.50	7444438				27	0.50	7444438
Acid Extractable Beryllium (Be)	ug/g	<0.20	0.20	7444438				1.0	0.20	7444438
Acid Extractable Boron (B)	ug/g	<5.0	5.0	7444438				14	5.0	7444438
Acid Extractable Cadmium (Cd)	ug/g	<0.10	0.10	7444438				<0.10	0.10	7444438
Acid Extractable Chromium (Cr)	ug/g	7.1	1.0	7444438				29	1.0	7444438
Acid Extractable Cobalt (Co)	ug/g	1.4	0.10	7444438				18	0.10	7444438
Acid Extractable Copper (Cu)	ug/g	5.7	0.50	7444438				28	0.50	7444438
Acid Extractable Lead (Pb)	ug/g	2.4	1.0	7444438				21	1.0	7444438
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	0.50	7444438				<0.50	0.50	7444438
Acid Extractable Nickel (Ni)	ug/g	2.6	0.50	7444438				38	0.50	7444438
Acid Extractable Selenium (Se)	ug/g	<0.50	0.50	7444438				<0.50	0.50	7444438
Acid Extractable Silver (Ag)	ug/g	<0.20	0.20	7444438				<0.20	0.20	7444438
Acid Extractable Thallium (Tl)	ug/g	<0.050	0.050	7444438				0.11	0.050	7444438
Acid Extractable Uranium (U)	ug/g	0.38	0.050	7444438				0.79	0.050	7444438
Acid Extractable Vanadium (V)	ug/g	14	5.0	7444438				37	5.0	7444438
Acid Extractable Zinc (Zn)	ug/g	7.7	5.0	7444438				79	5.0	7444438
Acid Extractable Mercury (Hg)	ug/g	<0.050	0.050	7444438				<0.050	0.050	7444438

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

**O.REG 406 EXCESS SOIL BULK INORGANICS (SOIL)**

BV Labs ID		PYK386	PYK387	PYK388			PYK388		
Sampling Date		2021/06/24	2021/06/24	2021/06/24			2021/06/24		
COC Number		657051-10-01	657051-10-01	657051-10-01			657051-10-01		
	UNITS	21-39 SA2	21-40 SA5	21-42 SA4	RDL	QC Batch	21-42 SA4 Lab-Dup	RDL	QC Batch

Calculated Parameters									
Sodium Adsorption Ratio	N/A	6.5	0.92	22		7440876			
Inorganics									
Conductivity	mS/cm	0.35	0.28	0.69	0.002	7446285	0.69	0.002	7446285
Available (CaCl <sub>2</sub> ) pH	pH	7.87	7.94	8.11		7444166			
WAD Cyanide (Free)	ug/g	<0.01	<0.01	<0.01	0.01	7443462			
Chromium (VI)	ug/g	<0.18	<0.18	<0.18	0.18	7443554			
Metals									
Hot Water Ext. Boron (B)	ug/g	<0.050	0.77	0.094	0.050	7444001			
Acid Extractable Antimony (Sb)	ug/g	<0.20	<0.20	<0.20	0.20	7444438			
Acid Extractable Arsenic (As)	ug/g	<1.0	4.9	1.1	1.0	7444438			
Acid Extractable Barium (Ba)	ug/g	6.2	48	17	0.50	7444438			
Acid Extractable Beryllium (Be)	ug/g	<0.20	0.72	0.20	0.20	7444438			
Acid Extractable Boron (B)	ug/g	<5.0	13	<5.0	5.0	7444438			
Acid Extractable Cadmium (Cd)	ug/g	<0.10	<0.10	<0.10	0.10	7444438			
Acid Extractable Chromium (Cr)	ug/g	4.5	23	8.1	1.0	7444438			
Acid Extractable Cobalt (Co)	ug/g	1.5	13	3.8	0.10	7444438			
Acid Extractable Copper (Cu)	ug/g	3.2	24	31	0.50	7444438			
Acid Extractable Lead (Pb)	ug/g	2.0	7.3	7.5	1.0	7444438			
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	<0.50	<0.50	0.50	7444438			
Acid Extractable Nickel (Ni)	ug/g	3.2	28	8.6	0.50	7444438			
Acid Extractable Selenium (Se)	ug/g	<0.50	<0.50	<0.50	0.50	7444438			
Acid Extractable Silver (Ag)	ug/g	<0.20	<0.20	<0.20	0.20	7444438			
Acid Extractable Thallium (Tl)	ug/g	<0.050	0.12	0.055	0.050	7444438			
Acid Extractable Uranium (U)	ug/g	0.31	0.56	0.35	0.050	7444438			
Acid Extractable Vanadium (V)	ug/g	11	29	15	5.0	7444438			
Acid Extractable Zinc (Zn)	ug/g	16	68	26	5.0	7444438			
Acid Extractable Mercury (Hg)	ug/g	<0.050	<0.050	<0.050	0.050	7444438			
RDL = Reportable Detection Limit									
QC Batch = Quality Control Batch									
Lab-Dup = Laboratory Initiated Duplicate									



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### O.REG 406 EXCESS SOIL BULK INORGANICS (SOIL)

<b>BV Labs ID</b>		PYK445		
<b>Sampling Date</b>		2021/06/15		
<b>COC Number</b>		657051-11-01		
	<b>UNITS</b>	<b>21-33 SA4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>				
Sodium Adsorption Ratio	N/A	35		7440876
<b>Inorganics</b>				
Conductivity	mS/cm	1.4	0.002	7446285
Available (CaCl <sub>2</sub> ) pH	pH	8.12		7444166
WAD Cyanide (Free)	ug/g	<0.01	0.01	7443462
Chromium (VI)	ug/g	<0.18	0.18	7443554
<b>Metals</b>				
Hot Water Ext. Boron (B)	ug/g	0.097	0.050	7444351
Acid Extractable Antimony (Sb)	ug/g	<0.20	0.20	7444438
Acid Extractable Arsenic (As)	ug/g	4.6	1.0	7444438
Acid Extractable Barium (Ba)	ug/g	39	0.50	7444438
Acid Extractable Beryllium (Be)	ug/g	0.25	0.20	7444438
Acid Extractable Boron (B)	ug/g	<5.0	5.0	7444438
Acid Extractable Cadmium (Cd)	ug/g	<0.10	0.10	7444438
Acid Extractable Chromium (Cr)	ug/g	9.4	1.0	7444438
Acid Extractable Cobalt (Co)	ug/g	4.8	0.10	7444438
Acid Extractable Copper (Cu)	ug/g	37	0.50	7444438
Acid Extractable Lead (Pb)	ug/g	8.0	1.0	7444438
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	0.50	7444438
Acid Extractable Nickel (Ni)	ug/g	11	0.50	7444438
Acid Extractable Selenium (Se)	ug/g	<0.50	0.50	7444438
Acid Extractable Silver (Ag)	ug/g	<0.20	0.20	7444438
Acid Extractable Thallium (Tl)	ug/g	0.079	0.050	7444438
Acid Extractable Uranium (U)	ug/g	0.36	0.050	7444438
Acid Extractable Vanadium (V)	ug/g	16	5.0	7444438
Acid Extractable Zinc (Zn)	ug/g	34	5.0	7444438
Acid Extractable Mercury (Hg)	ug/g	<0.050	0.050	7444438
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

**O.REG 406 EXCESS SOIL BULK PAHS (SOIL)**

BV Labs ID		PYK384		PYK385		PYK386	PYK387		
Sampling Date		2021/06/25		2021/06/18		2021/06/24	2021/06/24		
COC Number		657051-10-01		657051-10-01		657051-10-01	657051-10-01		
	UNITS	21-23 SA2	QC Batch	21-27 AS4	QC Batch	21-39 SA2	21-40 SA5	RDL	QC Batch
<b>Calculated Parameters</b>									
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	7440873	0.027	7440873	<0.0071	<0.0071	0.0071	7440873
<b>Polyaromatic Hydrocarbons</b>									
Acenaphthene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Acenaphthylene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Anthracene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Benzo(a)anthracene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Benzo(a)pyrene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Benzo(b,j)fluoranthene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Benzo(g,h,i)perylene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Benzo(k)fluoranthene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Chrysene	ug/g	<0.0050	7443487	0.0073	7443509	<0.0050	<0.0050	0.0050	7443487
Dibenzo(a,h)anthracene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Fluoranthene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Fluorene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	7443487	<0.0050	7443509	<0.0050	<0.0050	0.0050	7443487
1-Methylnaphthalene	ug/g	<0.0050	7443487	0.017	7443509	<0.0050	<0.0050	0.0050	7443487
2-Methylnaphthalene	ug/g	<0.0050	7443487	0.010	7443509	<0.0050	<0.0050	0.0050	7443487
Naphthalene	ug/g	<0.0050	7443487	0.044	7443509	<0.0050	<0.0050	0.0050	7443487
Phenanthrene	ug/g	<0.0050	7443487	0.040	7443509	<0.0050	0.0066	0.0050	7443487
Pyrene	ug/g	<0.0050	7443487	0.0062	7443509	<0.0050	<0.0050	0.0050	7443487
Biphenyl	ug/g	<0.0050	7443487	0.030	7443509	<0.0050	<0.0050	0.0050	7443487
<b>Surrogate Recovery (%)</b>									
D10-Anthracene	%	107	7443487	93	7443509	109	107		7443487
D14-Terphenyl (FS)	%	99	7443487	92	7443509	95	99		7443487
D8-Acenaphthylene	%	79	7443487	88	7443509	76	83		7443487
RDL = Reportable Detection Limit									
QC Batch = Quality Control Batch									

BUREAU  
VERITASBV Labs Job #: C1H7791  
Report Date: 2021/07/10Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM**O.REG 406 EXCESS SOIL BULK PAHS (SOIL)**

BV Labs ID		PYK388		PYK445		
Sampling Date		2021/06/24		2021/06/15		
COC Number		657051-10-01		657051-11-01		
	UNITS	21-42 SA4	QC Batch	21-33 SA4	RDL	QC Batch
<b>Calculated Parameters</b>						
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	7440873	<0.0071	0.0071	7440873
<b>Polyaromatic Hydrocarbons</b>						
Acenaphthene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Acenaphthylene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Anthracene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Benzo(a)anthracene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Benzo(a)pyrene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Benzo(b,j)fluoranthene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Benzo(g,h,i)perylene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Benzo(k)fluoranthene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Chrysene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Dibenzo(a,h)anthracene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Fluoranthene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Fluorene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
1-Methylnaphthalene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
2-Methylnaphthalene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Naphthalene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Phenanthrene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Pyrene	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
Biphenyl	ug/g	<0.0050	7443487	<0.0050	0.0050	7443509
<b>Surrogate Recovery (%)</b>						
D10-Anthracene	%	109	7443487	96		7443509
D14-Terphenyl (FS)	%	104	7443487	95		7443509
D8-Acenaphthylene	%	83	7443487	89		7443509
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

### O.REG 406 EXCESS SOIL BULK VOCs/F1-F4 (SOIL)

BV Labs ID		PYK384			PYK384			PYK385		
Sampling Date		2021/06/25			2021/06/25			2021/06/18		
COC Number		657051-10-01			657051-10-01			657051-10-01		
	UNITS	21-23 SA2	RDL	QC Batch	21-23 SA2 Lab-Dup	RDL	QC Batch	21-27 AS4	RDL	QC Batch

#### Inorganics

Moisture	%	7.0	1.0	7441990				5.7	1.0	7441990
----------	---	-----	-----	---------	--	--	--	-----	-----	---------

#### Calculated Parameters

1,3-Dichloropropene (cis+trans)	ug/g	<0.050	0.050	7440874				<0.050	0.050	7440874
---------------------------------	------	--------	-------	---------	--	--	--	--------	-------	---------

#### Volatile Organics

Acetone (2-Propanone)	ug/g	<0.50	0.50	7442303	<0.50	0.50	7442303	<0.50	0.50	7442303
Benzene	ug/g	<0.020	0.020	7442303	<0.020	0.020	7442303	<0.020	0.020	7442303
Bromodichloromethane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Bromoform	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Bromomethane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Carbon Tetrachloride	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Chlorobenzene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Chloroform	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Dibromochloromethane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,2-Dichlorobenzene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,3-Dichlorobenzene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,4-Dichlorobenzene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Dichlorodifluoromethane (FREON 12)	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,1-Dichloroethane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,2-Dichloroethane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,1-Dichloroethylene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
cis-1,2-Dichloroethylene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
trans-1,2-Dichloroethylene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,2-Dichloropropane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
cis-1,3-Dichloropropene	ug/g	<0.030	0.030	7442303	<0.030	0.030	7442303	<0.030	0.030	7442303
trans-1,3-Dichloropropene	ug/g	<0.040	0.040	7442303	<0.040	0.040	7442303	<0.040	0.040	7442303
Ethylbenzene	ug/g	<0.020	0.020	7442303	<0.020	0.020	7442303	<0.020	0.020	7442303
Ethylene Dibromide	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Hexane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Methylene Chloride(Dichloromethane)	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.50	0.50	7442303	<0.50	0.50	7442303	<0.50	0.50	7442303

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

**O.REG 406 EXCESS SOIL BULK VOCs/F1-F4 (SOIL)**

BV Labs ID		PYK384			PYK384			PYK385		
Sampling Date		2021/06/25			2021/06/25			2021/06/18		
COC Number		657051-10-01			657051-10-01			657051-10-01		
	UNITS	21-23 SA2	RDL	QC Batch	21-23 SA2 Lab-Dup	RDL	QC Batch	21-27 AS4	RDL	QC Batch
Methyl Isobutyl Ketone	ug/g	<0.50	0.50	7442303	<0.50	0.50	7442303	<0.50	0.50	7442303
Methyl t-butyl ether (MTBE)	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Styrene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,1,1,2-Tetrachloroethane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,1,2,2-Tetrachloroethane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Tetrachloroethylene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Toluene	ug/g	0.033	0.020	7442303	0.033	0.020	7442303	<0.020	0.020	7442303
1,1,1-Trichloroethane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
1,1,2-Trichloroethane	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Trichloroethylene	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Trichlorofluoromethane (FREON 11)	ug/g	<0.050	0.050	7442303	<0.050	0.050	7442303	<0.050	0.050	7442303
Vinyl Chloride	ug/g	<0.020	0.020	7442303	<0.020	0.020	7442303	<0.020	0.020	7442303
p+m-Xylene	ug/g	<0.020	0.020	7442303	<0.020	0.020	7442303	<0.020	0.020	7442303
o-Xylene	ug/g	<0.020	0.020	7442303	<0.020	0.020	7442303	<0.020	0.020	7442303
Total Xylenes	ug/g	<0.020	0.020	7442303	<0.020	0.020	7442303	<0.020	0.020	7442303
F1 (C6-C10)	ug/g	<10	10	7442303	<10	10	7442303	<10	10	7442303
F1 (C6-C10) - BTEX	ug/g	<10	10	7442303	<10	10	7442303	<10	10	7442303
<b>F2-F4 Hydrocarbons</b>										
F2 (C10-C16 Hydrocarbons)	ug/g	<10	10	7443540				<10	10	7441781
F3 (C16-C34 Hydrocarbons)	ug/g	<50	50	7443540				<50	50	7441781
F4 (C34-C50 Hydrocarbons)	ug/g	<50	50	7443540				<50	50	7441781
Reached Baseline at C50	ug/g	Yes		7443540				Yes		7441781
<b>Surrogate Recovery (%)</b>										
o-Terphenyl	%	91		7443540				97		7441781
4-Bromofluorobenzene	%	99		7442303	98		7442303	97		7442303
D10-o-Xylene	%	88		7442303	88		7442303	85		7442303
D4-1,2-Dichloroethane	%	98		7442303	98		7442303	99		7442303
D8-Toluene	%	97		7442303	98		7442303	98		7442303
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

### O.REG 406 EXCESS SOIL BULK VOCS/F1-F4 (SOIL)

BV Labs ID		PYK386	PYK387	PYK388		PYK445		
Sampling Date		2021/06/24	2021/06/24	2021/06/24		2021/06/15		
COC Number		657051-10-01	657051-10-01	657051-10-01		657051-11-01		
	UNITS	21-39 SA2	21-40 SA5	21-42 SA4	QC Batch	21-33 SA4	RDL	QC Batch

<b>Inorganics</b>								
Moisture	%	13	11	5.1	7441990	6.3	1.0	7441990
<b>Calculated Parameters</b>								
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	<0.050	<0.050	7440874	<0.050	0.050	7440874
<b>Volatile Organics</b>								
Acetone (2-Propanone)	ug/g	<0.50	<0.50	<0.50	7442303	<0.50	0.50	7442303
Benzene	ug/g	<0.020	<0.020	<0.020	7442303	<0.020	0.020	7442303
Bromodichloromethane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Bromoform	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Bromomethane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Carbon Tetrachloride	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Chlorobenzene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Chloroform	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Dibromochloromethane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,2-Dichlorobenzene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,3-Dichlorobenzene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,4-Dichlorobenzene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Dichlorodifluoromethane (FREON 12)	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,1-Dichloroethane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,2-Dichloroethane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,1-Dichloroethylene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
cis-1,2-Dichloroethylene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
trans-1,2-Dichloroethylene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,2-Dichloropropane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
cis-1,3-Dichloropropene	ug/g	<0.030	<0.030	<0.030	7442303	<0.030	0.030	7442303
trans-1,3-Dichloropropene	ug/g	<0.040	<0.040	<0.040	7442303	<0.040	0.040	7442303
Ethylbenzene	ug/g	<0.020	<0.020	<0.020	7442303	<0.020	0.020	7442303
Ethylene Dibromide	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Hexane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Methylene Chloride(Dichloromethane)	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.50	<0.50	<0.50	7442303	<0.50	0.50	7442303
Methyl Isobutyl Ketone	ug/g	<0.50	<0.50	<0.50	7442303	<0.50	0.50	7442303
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

### O.REG 406 EXCESS SOIL BULK VOCS/F1-F4 (SOIL)

BV Labs ID		PYK386	PYK387	PYK388		PYK445		
Sampling Date		2021/06/24	2021/06/24	2021/06/24		2021/06/15		
COC Number		657051-10-01	657051-10-01	657051-10-01		657051-11-01		
	UNITS	21-39 SA2	21-40 SA5	21-42 SA4	QC Batch	21-33 SA4	RDL	QC Batch
Methyl t-butyl ether (MTBE)	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Styrene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,1,1,2-Tetrachloroethane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,1,2,2-Tetrachloroethane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Tetrachloroethylene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Toluene	ug/g	<0.020	<0.020	<0.020	7442303	<0.020	0.020	7442303
1,1,1-Trichloroethane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
1,1,2-Trichloroethane	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Trichloroethylene	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Trichlorofluoromethane (FREON 11)	ug/g	<0.050	<0.050	<0.050	7442303	<0.050	0.050	7442303
Vinyl Chloride	ug/g	<0.020	<0.020	<0.020	7442303	<0.020	0.020	7442303
p+m-Xylene	ug/g	<0.020	<0.020	<0.020	7442303	<0.020	0.020	7442303
o-Xylene	ug/g	<0.020	<0.020	<0.020	7442303	<0.020	0.020	7442303
Total Xylenes	ug/g	<0.020	<0.020	<0.020	7442303	<0.020	0.020	7442303
F1 (C6-C10)	ug/g	<10	<10	<10	7442303	<10	10	7442303
F1 (C6-C10) - BTEX	ug/g	<10	<10	<10	7442303	<10	10	7442303
<b>F2-F4 Hydrocarbons</b>								
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	<10	7443540	<10	10	7441781
F3 (C16-C34 Hydrocarbons)	ug/g	<50	<50	<50	7443540	<50	50	7441781
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	<50	7443540	<50	50	7441781
Reached Baseline at C50	ug/g	Yes	Yes	Yes	7443540	Yes		7441781
<b>Surrogate Recovery (%)</b>								
o-Terphenyl	%	90	90	91	7443540	94		7441781
4-Bromofluorobenzene	%	96	96	96	7442303	96		7442303
D10-o-Xylene	%	84	83	80	7442303	83		7442303
D4-1,2-Dichloroethane	%	100	98	98	7442303	101		7442303
D8-Toluene	%	98	98	97	7442303	97		7442303
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### O.REG 406 EXCESS SOIL SPLP ABNS (SOIL)

BV Labs ID		PYK438		PYK439		PYK440		
Sampling Date		2021/06/18		2021/06/24		2021/06/24		
COC Number		657051-11-01		657051-11-01		657051-11-01		
	UNITS	21-27 SA3	QC Batch	21-40 SA3	QC Batch	21-42 SA5B	RDL	QC Batch
<b>Semivolatile Organics</b>								
Leachable (SPLP) Bis(2-chloroethyl)ether	ug/L	<2.0	7449697	<2.0	7449697	<2.0	2.0	7449697
Leachable (SPLP) Bis(2-chloroisopropyl)ether	ug/L	<2.0	7449697	<2.0	7449697	<2.0	2.0	7449697
Leachable (SPLP) p-Chloroaniline	ug/L	<5.0	7449697	<5.0	7449697	<5.0	5.0	7449697
Leachable (SPLP) 3,3'-Dichlorobenzidine	ug/L	<0.40	7449697	<0.40	7449697	<0.40	0.40	7449697
Leachable (SPLP) Diethyl phthalate	ug/L	<1.0	7449697	<1.0	7449697	<1.0	1.0	7449697
Leachable (SPLP) Dimethyl phthalate	ug/L	<1.0	7449697	<1.0	7449697	<1.0	1.0	7449697
Leachable (SPLP) 2,4-Dinitrophenol	ug/L	<5.0	7449697	<5.0	7449697	<5.0	5.0	7449697
Leachable (SPLP) 2,4-Dinitrotoluene	ug/L	<3.0	7449697	<3.0	7449697	<3.0	3.0	7449697
Leachable (SPLP) 2,6-Dinitrotoluene	ug/L	<3.0	7449697	<3.0	7449697	<3.0	3.0	7449697
Leachable (SPLP) 2,4,6-Trichlorophenol	ug/L	<0.70	7449697	<0.70	7449697	<0.70	0.70	7449697
<b>Calculated Parameters</b>								
Leachable 2,4- & 2,6-Dinitrotoluene	ug/L	<4.2	7441548	<4.2	7441550	<4.2	4.2	7441548
<b>Surrogate Recovery (%)</b>								
Leachable (SPLP) 2,4,6-Tribromophenol	%	79	7449697	83	7449697	75		7449697
Leachable (SPLP) 2-Fluorobiphenyl	%	58	7449697	55	7449697	52		7449697
Leachable (SPLP) D14-Terphenyl (FS)	%	71	7449697	73	7449697	70		7449697
Leachable (SPLP) D5-Nitrobenzene	%	67	7449697	66	7449697	56		7449697
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### O.REG 406 EXCESS SOIL SPLP ABNS (SOIL)

BV Labs ID		PYK441	PYK446		
Sampling Date		2021/06/25	2021/05/12		
COC Number		657051-11-01	657051-11-01		
	UNITS	21-23 SA3	21-17 SA2	RDL	QC Batch
<b>Semivolatile Organics</b>					
Leachable (SPLP) Bis(2-chloroethyl)ether	ug/L	<2.0	<2.0	2.0	7449697
Leachable (SPLP) Bis(2-chloroisopropyl)ether	ug/L	<2.0	<2.0	2.0	7449697
Leachable (SPLP) p-Chloroaniline	ug/L	<5.0	<5.0	5.0	7449697
Leachable (SPLP) 3,3'-Dichlorobenzidine	ug/L	<0.40	<0.40	0.40	7449697
Leachable (SPLP) Diethyl phthalate	ug/L	<1.0	<1.0	1.0	7449697
Leachable (SPLP) Dimethyl phthalate	ug/L	<1.0	<1.0	1.0	7449697
Leachable (SPLP) 2,4-Dinitrophenol	ug/L	<5.0	<5.0	5.0	7449697
Leachable (SPLP) 2,4-Dinitrotoluene	ug/L	<3.0	<3.0	3.0	7449697
Leachable (SPLP) 2,6-Dinitrotoluene	ug/L	<3.0	<3.0	3.0	7449697
Leachable (SPLP) 2,4,6-Trichlorophenol	ug/L	<0.70	<0.70	0.70	7449697
<b>Calculated Parameters</b>					
Leachable 2,4- & 2,6-Dinitrotoluene	ug/L	<4.2	<4.2	4.2	7441550
<b>Surrogate Recovery (%)</b>					
Leachable (SPLP) 2,4,6-Tribromophenol	%	83	81		7449697
Leachable (SPLP) 2-Fluorobiphenyl	%	58	53		7449697
Leachable (SPLP) D14-Terphenyl (FS)	%	73	70		7449697
Leachable (SPLP) D5-Nitrobenzene	%	67	62		7449697
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					





BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### O.REG 406 EXCESS SOIL SPLP METALS (SOIL)

BV Labs ID		PYK438	PYK439	PYK440	PYK441	PYK446		
Sampling Date		2021/06/18	2021/06/24	2021/06/24	2021/06/25	2021/05/12		
COC Number		657051-11-01	657051-11-01	657051-11-01	657051-11-01	657051-11-01		
	UNITS	21-27 SA3	21-40 SA3	21-42 SA5B	21-23 SA3	21-17 SA2	RDL	QC Batch
<b>Metals</b>								
Leachable (SPLP) Antimony (Sb)	ug/L	<0.5	<0.5	1.0	<0.5	<0.5	0.5	7449698
Leachable (SPLP) Arsenic (As)	ug/L	<1	<1	2	<1	<1	1	7449698
Leachable (SPLP) Barium (Ba)	ug/L	<5	<5	10	<5	<5	5	7449698
Leachable (SPLP) Beryllium (Be)	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	7449698
Leachable (SPLP) Boron (B)	ug/L	<10	<10	<10	<10	<10	10	7449698
Leachable (SPLP) Cadmium (Cd)	ug/L	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	7449698
Leachable (SPLP) Chromium (Cr)	ug/L	<5	<5	<5	<5	<5	5	7449698
Leachable (SPLP) Cobalt (Co)	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	7449698
Leachable (SPLP) Copper (Cu)	ug/L	2	<1	1	<1	1	1	7449698
Leachable (SPLP) Lead (Pb)	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	7449698
Leachable (SPLP) Molybdenum (Mo)	ug/L	<1	<1	1	<1	<1	1	7449698
Leachable (SPLP) Nickel (Ni)	ug/L	<1	<1	<1	<1	<1	1	7449698
Leachable (SPLP) Selenium (Se)	ug/L	<2	<2	<2	<2	<2	2	7449698
Leachable (SPLP) Silver (Ag)	ug/L	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	7449698
Leachable (SPLP) Thallium (Tl)	ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	7449698
Leachable (SPLP) Uranium (U)	ug/L	<0.1	<0.1	0.3	<0.1	<0.1	0.1	7449698
Leachable (SPLP) Vanadium (V)	ug/L	<1	2	2	1	1	1	7449698
Leachable (SPLP) Zinc (Zn)	ug/L	<5	<5	<5	<5	<5	5	7449698
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

**O.REG 406 EXCESS SOIL SPLP OC PESTICIDES (SOIL)**

BV Labs ID		PYK438	PYK439	PYK440	PYK441		
Sampling Date		2021/06/18	2021/06/24	2021/06/24	2021/06/25		
COC Number		657051-11-01	657051-11-01	657051-11-01	657051-11-01		
	UNITS	21-27 SA3	21-40 SA3	21-42 SA5B	21-23 SA3	RDL	QC Batch
<b>Calculated Parameters</b>							
Leachable Heptachlor + Heptachlor epoxide	ug/L	<0.0060	<0.0060	<0.0060	<0.0060	0.0060	7441546
<b>Pesticides &amp; Herbicides</b>							
Leachable (SPLP) Dieldrin	ug/L	<0.006	<0.006	<0.006	<0.006	0.006	7450443
Leachable (SPLP) Endrin	ug/L	<0.006	<0.006	<0.006	<0.006	0.006	7450443
Leachable (SPLP) Heptachlor	ug/L	<0.006	<0.006	<0.006	<0.006	0.006	7450443
Leachable (SPLP) Heptachlor epoxide	ug/L	<0.006	<0.006	<0.006	<0.006	0.006	7450443
<b>Surrogate Recovery (%)</b>							
Leachable (SPLP) 2,4,5,6-Tetrachloro-m-xylene	%	77	60	68	71		7450443
Leachable (SPLP) Decachlorobiphenyl	%	84	77	76	87		7450443
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							

BV Labs ID		PYK441			PYK446		
Sampling Date		2021/06/25			2021/05/12		
COC Number		657051-11-01			657051-11-01		
	UNITS	21-23 SA3 Lab-Dup	RDL	QC Batch	21-17 SA2	RDL	QC Batch
<b>Calculated Parameters</b>							
Leachable Heptachlor + Heptachlor epoxide	ug/L				<0.0060	0.0060	7441546
<b>Pesticides &amp; Herbicides</b>							
Leachable (SPLP) Dieldrin	ug/L	<0.006	0.006	7450443	<0.006	0.006	7450443
Leachable (SPLP) Endrin	ug/L	<0.006	0.006	7450443	<0.006	0.006	7450443
Leachable (SPLP) Heptachlor	ug/L	<0.006	0.006	7450443	<0.006	0.006	7450443
Leachable (SPLP) Heptachlor epoxide	ug/L	<0.006	0.006	7450443	<0.006	0.006	7450443
<b>Surrogate Recovery (%)</b>							
Leachable (SPLP) 2,4,5,6-Tetrachloro-m-xylene	%	63		7450443	59		7450443
Leachable (SPLP) Decachlorobiphenyl	%	83		7450443	69		7450443
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### O.REG 406 EXCESS SOIL SPLP PREP (SOIL)

BV Labs ID		PYK438	PYK439	PYK440	PYK441	PYK446	
Sampling Date		2021/06/18	2021/06/24	2021/06/24	2021/06/25	2021/05/12	
COC Number		657051-11-01	657051-11-01	657051-11-01	657051-11-01	657051-11-01	
	UNITS	21-27 SA3	21-40 SA3	21-42 SA5B	21-23 SA3	21-17 SA2	QC Batch
<b>Inorganics</b>							
Dry Weight	g	100	100	100	100	100	7447245
Final pH	pH	9.01	9.08	9.23	9.72	9.68	7447253
QC Batch = Quality Control Batch							



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

### O.REG 406 EXCESS SOIL SPLP VOCS (SOIL)

BV Labs ID		PYK438			PYK438			PYK439		
Sampling Date		2021/06/18			2021/06/18			2021/06/24		
COC Number		657051-11-01			657051-11-01			657051-11-01		
	UNITS	21-27 SA3	RDL	QC Batch	21-27 SA3 Lab-Dup	RDL	QC Batch	21-40 SA3	RDL	QC Batch
<b>Calculated Parameters</b>										
Leachable (ZHE) 1,3-Dichloropropene (cis+trans)	ug/L	<0.42	0.42	7441139				<0.42	0.42	7441139
<b>Volatile Organics</b>										
Leachable (SPLP) Bromomethane	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) Carbon Tetrachloride	ug/L	<0.19	0.19	7448614	<0.19	0.19	7448614	<0.19	0.19	7448614
Leachable (SPLP) Chloroform	ug/L	<1.2	1.2	7448614	<1.2	1.2	7448614	<1.2	1.2	7448614
Leachable (SPLP) 1,2-Dichlorobenzene	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) 1,4-Dichlorobenzene	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) 1,1-Dichloroethane	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) 1,2-Dichloroethane	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) 1,1-Dichloroethylene	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) cis-1,2-Dichloroethylene	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) trans-1,2-Dichloroethylene	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) 1,2-Dichloropropane	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) cis-1,3-Dichloropropene	ug/L	<0.30	0.30	7448614	<0.30	0.30	7448614	<0.30	0.30	7448614
Leachable (SPLP) trans-1,3-Dichloropropene	ug/L	<0.30	0.30	7448614	<0.30	0.30	7448614	<0.30	0.30	7448614
Leachable (SPLP) Ethylene Dibromide	ug/L	<0.19	0.19	7448614	<0.19	0.19	7448614	<0.19	0.19	7448614
Leachable (SPLP) 1,1,1,2-Tetrachloroethane	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) 1,1,2,2-Tetrachloroethane	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) Tetrachloroethylene	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) 1,1,2-Trichloroethane	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
Leachable (SPLP) Trichloroethylene	ug/L	<0.40	0.40	7448614	<0.40	0.40	7448614	<0.40	0.40	7448614
<b>Surrogate Recovery (%)</b>										
Leachable (SPLP) 4-Bromofluorobenzene	%	92		7448614	94		7448614	92		7448614
Leachable (SPLP) D4-1,2-Dichloroethane	%	111		7448614	113		7448614	118		7448614
Leachable (SPLP) D8-Toluene	%	93		7448614	94		7448614	93		7448614
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### O.REG 406 EXCESS SOIL SPLP VOCS (SOIL)

BV Labs ID		PYK440	PYK441	PYK446		
Sampling Date		2021/06/24	2021/06/25	2021/05/12		
COC Number		657051-11-01	657051-11-01	657051-11-01		
	UNITS	21-42 SA5B	21-23 SA3	21-17 SA2	RDL	QC Batch
<b>Calculated Parameters</b>						
Leachable (ZHE) 1,3-Dichloropropene (cis+trans)	ug/L	<0.42	<0.42	<0.42	0.42	7441139
<b>Volatile Organics</b>						
Leachable (SPLP) Bromomethane	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) Carbon Tetrachloride	ug/L	<0.19	<0.19	<0.19	0.19	7448614
Leachable (SPLP) Chloroform	ug/L	<1.2	<1.2	<1.2	1.2	7448614
Leachable (SPLP) 1,2-Dichlorobenzene	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) 1,4-Dichlorobenzene	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) 1,1-Dichloroethane	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) 1,2-Dichloroethane	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) 1,1-Dichloroethylene	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) cis-1,2-Dichloroethylene	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) trans-1,2-Dichloroethylene	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) 1,2-Dichloropropane	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) cis-1,3-Dichloropropene	ug/L	<0.30	<0.30	<0.30	0.30	7448614
Leachable (SPLP) trans-1,3-Dichloropropene	ug/L	<0.30	<0.30	<0.30	0.30	7448614
Leachable (SPLP) Ethylene Dibromide	ug/L	<0.19	<0.19	<0.19	0.19	7448614
Leachable (SPLP) 1,1,1,2-Tetrachloroethane	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) 1,1,2,2-Tetrachloroethane	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) Tetrachloroethylene	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) 1,1,2-Trichloroethane	ug/L	<0.40	<0.40	<0.40	0.40	7448614
Leachable (SPLP) Trichloroethylene	ug/L	<0.40	<0.40	<0.40	0.40	7448614
<b>Surrogate Recovery (%)</b>						
Leachable (SPLP) 4-Bromofluorobenzene	%	94	93	93		7448614
Leachable (SPLP) D4-1,2-Dichloroethane	%	116	116	118		7448614
Leachable (SPLP) D8-Toluene	%	92	94	92		7448614
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### O.REG 153 PCBS (SOIL)

BV Labs ID		PYK384	PYK385	PYK386	PYK387	PYK388	PYK445		
Sampling Date		2021/06/25	2021/06/18	2021/06/24	2021/06/24	2021/06/24	2021/06/15		
COC Number		657051-10-01	657051-10-01	657051-10-01	657051-10-01	657051-10-01	657051-11-01		
	UNITS	21-23 SA2	21-27 AS4	21-39 SA2	21-40 SA5	21-42 SA4	21-33 SA4	RDL	QC Batch
<b>PCBs</b>									
Aroclor 1242	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7443259
Aroclor 1248	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7443259
Aroclor 1254	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7443259
Aroclor 1260	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7443259
Total PCB	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7443259
<b>Surrogate Recovery (%)</b>									
Decachlorobiphenyl	%	92	89	90	83	89	86		7443259
RDL = Reportable Detection Limit QC Batch = Quality Control Batch									



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### O.REG 558 TCLP BENZO(A)PYRENE

BV Labs ID		PYK442	PYK443	PYK444		
Sampling Date		2021/06/18	2021/06/24	2021/06/24		
COC Number		657051-11-01	657051-11-01	657051-11-01		
	UNITS	21-27 SA2	21-39 SA3	21-40 SA1	RDL	QC Batch
<b>Polyaromatic Hydrocarbons</b>						
Leachable Benzo(a)pyrene	ug/L	<0.10	<0.10	<0.10	0.10	7447577
<b>Surrogate Recovery (%)</b>						
Leachable D10-Anthracene	%	94	95	93		7447577
Leachable D14-Terphenyl (FS)	%	83	82	78		7447577
Leachable D8-Acenaphthylene	%	99	91	91		7447577
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### O.REG 558 TCLP INORGANICS PACKAGE (SOIL)

BV Labs ID		PYK442	PYK443	PYK444		
Sampling Date		2021/06/18	2021/06/24	2021/06/24		
COC Number		657051-11-01	657051-11-01	657051-11-01		
	UNITS	21-27 SA2	21-39 SA3	21-40 SA1	RDL	QC Batch
<b>Inorganics</b>						
Leachable Fluoride (F-)	mg/L	<0.10	0.20	0.17	0.10	7446441
Leachable WAD Cyanide (Free)	mg/L	<0.010	<0.010	<0.010	0.010	7446451
Leachable Nitrite (N)	mg/L	<0.10	<0.10	<0.10	0.10	7446445
Leachable Nitrate (N)	mg/L	<1.0	<1.0	<1.0	1.0	7446445
Leachable Nitrate + Nitrite (N)	mg/L	<1.0	<1.0	<1.0	1.0	7446445
<b>Metals</b>						
Leachable Arsenic (As)	mg/L	<0.2	<0.2	<0.2	0.2	7446163
Leachable Barium (Ba)	mg/L	0.3	<0.2	1.0	0.2	7446163
Leachable Boron (B)	mg/L	0.2	0.1	0.2	0.1	7446163
Leachable Cadmium (Cd)	mg/L	<0.05	<0.05	<0.05	0.05	7446163
Leachable Chromium (Cr)	mg/L	<0.1	<0.1	<0.1	0.1	7446163
Leachable Lead (Pb)	mg/L	<0.1	<0.1	<0.1	0.1	7446163
Leachable Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	0.001	7446163
Leachable Selenium (Se)	mg/L	<0.1	<0.1	<0.1	0.1	7446163
Leachable Silver (Ag)	mg/L	<0.01	<0.01	<0.01	0.01	7446163
Leachable Uranium (U)	mg/L	<0.01	<0.01	<0.01	0.01	7446163
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

**O.REG 558 TCLP VOCs BY HS (SOIL)**

BV Labs ID		PYK442	PYK443	PYK444		
Sampling Date		2021/06/18	2021/06/24	2021/06/24		
COC Number		657051-11-01	657051-11-01	657051-11-01		
	UNITS	21-27 SA2	21-39 SA3	21-40 SA1	RDL	QC Batch
<b>Charge/Prep Analysis</b>						
Amount Extracted (Wet Weight) (g)	N/A	25	25	25	N/A	7446933
<b>Volatile Organics</b>						
Leachable Benzene	mg/L	<0.020	<0.020	<0.020	0.020	7448583
Leachable Carbon Tetrachloride	mg/L	<0.020	<0.020	<0.020	0.020	7448583
Leachable Chlorobenzene	mg/L	<0.020	<0.020	<0.020	0.020	7448583
Leachable Chloroform	mg/L	<0.020	<0.020	<0.020	0.020	7448583
Leachable 1,2-Dichlorobenzene	mg/L	<0.050	<0.050	<0.050	0.050	7448583
Leachable 1,4-Dichlorobenzene	mg/L	<0.050	<0.050	<0.050	0.050	7448583
Leachable 1,2-Dichloroethane	mg/L	<0.050	<0.050	<0.050	0.050	7448583
Leachable 1,1-Dichloroethylene	mg/L	<0.020	<0.020	<0.020	0.020	7448583
Leachable Methylene Chloride(Dichloromethane)	mg/L	<0.20	<0.20	<0.20	0.20	7448583
Leachable Methyl Ethyl Ketone (2-Butanone)	mg/L	<1.0	<1.0	<1.0	1.0	7448583
Leachable Tetrachloroethylene	mg/L	<0.020	<0.020	<0.020	0.020	7448583
Leachable Trichloroethylene	mg/L	<0.020	<0.020	<0.020	0.020	7448583
Leachable Vinyl Chloride	mg/L	<0.020	<0.020	<0.020	0.020	7448583
<b>Surrogate Recovery (%)</b>						
Leachable 4-Bromofluorobenzene	%	90	91	90		7448583
Leachable D4-1,2-Dichloroethane	%	116	117	116		7448583
Leachable D8-Toluene	%	86	86	86		7448583
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						
N/A = Not Applicable						



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

### MISCELLANEOUS (SOIL)

<b>BV Labs ID</b>		PYK442	PYK443	PYK444	
<b>Sampling Date</b>		2021/06/18	2021/06/24	2021/06/24	
<b>COC Number</b>		657051-11-01	657051-11-01	657051-11-01	
	<b>UNITS</b>	<b>21-27 SA2</b>	<b>21-39 SA3</b>	<b>21-40 SA1</b>	<b>QC Batch</b>
<b>Inorganics</b>					
Ignitability	N/A	NF/NI	NF/NI	NF/NI	7446222
QC Batch = Quality Control Batch					



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

## TEST SUMMARY

**BV Labs ID:** PYK384  
**Sample ID:** 21-23 SA2  
**Matrix:** Soil

**Collected:** 2021/06/25  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7440873	N/A	2021/07/06	Automated Statchk
Hot Water Extractable Boron	ICP	7444001	2021/07/05	2021/07/06	Jolly John
1,3-Dichloropropene Sum	CALC	7440874	N/A	2021/07/07	Automated Statchk
Free (WAD) Cyanide	TECH	7443462	2021/07/05	2021/07/05	Aditiben Patel
Conductivity	AT	7446285	2021/07/06	2021/07/06	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	7443554	2021/07/05	2021/07/06	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7443540	2021/07/05	2021/07/05	Jeevaraj Jeevaratnam
Acid Extractable Metals by ICPMS	ICP/MS	7444438	2021/07/05	2021/07/07	Daniel Teclu
Moisture	BAL	7441990	N/A	2021/07/02	Harry Harry
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7443487	2021/07/05	2021/07/05	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7443259	2021/07/04	2021/07/05	Sarah Huang
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7440876	N/A	2021/07/07	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7442303	N/A	2021/07/07	Anna Gabrielyan

**BV Labs ID:** PYK384 Dup  
**Sample ID:** 21-23 SA2  
**Matrix:** Soil

**Collected:** 2021/06/25  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7444001	2021/07/05	2021/07/06	Jolly John
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7442303	N/A	2021/07/07	Anna Gabrielyan

**BV Labs ID:** PYK385  
**Sample ID:** 21-27 AS4  
**Matrix:** Soil

**Collected:** 2021/06/18  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7440873	N/A	2021/07/07	Automated Statchk
Hot Water Extractable Boron	ICP	7444001	2021/07/05	2021/07/06	Jolly John
1,3-Dichloropropene Sum	CALC	7440874	N/A	2021/07/07	Automated Statchk
Free (WAD) Cyanide	TECH	7443462	2021/07/05	2021/07/05	Aditiben Patel
Conductivity	AT	7446285	2021/07/06	2021/07/06	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	7443554	2021/07/05	2021/07/06	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7441781	2021/07/02	2021/07/02	Ravinder Gaidhu
Acid Extractable Metals by ICPMS	ICP/MS	7444438	2021/07/05	2021/07/07	Daniel Teclu
Moisture	BAL	7441990	N/A	2021/07/02	Harry Harry
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7443509	2021/07/05	2021/07/06	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7443259	2021/07/04	2021/07/05	Sarah Huang
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7440876	N/A	2021/07/07	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7442303	N/A	2021/07/07	Anna Gabrielyan



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

## TEST SUMMARY

**BV Labs ID:** PYK386  
**Sample ID:** 21-39 SA2  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7440873	N/A	2021/07/06	Automated Statchk
Hot Water Extractable Boron	ICP	7444001	2021/07/05	2021/07/06	Jolly John
1,3-Dichloropropene Sum	CALC	7440874	N/A	2021/07/07	Automated Statchk
Free (WAD) Cyanide	TECH	7443462	2021/07/05	2021/07/05	Aditiben Patel
Conductivity	AT	7446285	2021/07/06	2021/07/06	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	7443554	2021/07/05	2021/07/06	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7443540	2021/07/05	2021/07/05	Jeevaraj Jeevaratnam
Acid Extractable Metals by ICPMS	ICP/MS	7444438	2021/07/05	2021/07/07	Daniel Teclu
Moisture	BAL	7441990	N/A	2021/07/02	Harry Harry
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7443487	2021/07/05	2021/07/05	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7443259	2021/07/04	2021/07/05	Sarah Huang
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7440876	N/A	2021/07/07	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7442303	N/A	2021/07/07	Anna Gabrielyan

**BV Labs ID:** PYK387  
**Sample ID:** 21-40 SA5  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7440873	N/A	2021/07/06	Automated Statchk
Hot Water Extractable Boron	ICP	7444001	2021/07/05	2021/07/06	Jolly John
1,3-Dichloropropene Sum	CALC	7440874	N/A	2021/07/07	Automated Statchk
Free (WAD) Cyanide	TECH	7443462	2021/07/05	2021/07/05	Aditiben Patel
Conductivity	AT	7446285	2021/07/06	2021/07/06	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	7443554	2021/07/05	2021/07/06	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7443540	2021/07/05	2021/07/05	Jeevaraj Jeevaratnam
Acid Extractable Metals by ICPMS	ICP/MS	7444438	2021/07/05	2021/07/07	Daniel Teclu
Moisture	BAL	7441990	N/A	2021/07/02	Harry Harry
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7443487	2021/07/05	2021/07/05	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7443259	2021/07/04	2021/07/05	Sarah Huang
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7440876	N/A	2021/07/07	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7442303	N/A	2021/07/07	Anna Gabrielyan

**BV Labs ID:** PYK388  
**Sample ID:** 21-42 SA4  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7440873	N/A	2021/07/06	Automated Statchk
Hot Water Extractable Boron	ICP	7444001	2021/07/05	2021/07/06	Jolly John
1,3-Dichloropropene Sum	CALC	7440874	N/A	2021/07/07	Automated Statchk
Free (WAD) Cyanide	TECH	7443462	2021/07/05	2021/07/05	Aditiben Patel



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

## TEST SUMMARY

**BV Labs ID:** PYK388  
**Sample ID:** 21-42 SA4  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	7446285	2021/07/06	2021/07/06	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	7443554	2021/07/05	2021/07/06	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7443540	2021/07/05	2021/07/05	Jeevaraj Jeevaratnam
Acid Extractable Metals by ICPMS	ICP/MS	7444438	2021/07/05	2021/07/07	Daniel Teclu
Moisture	BAL	7441990	N/A	2021/07/02	Harry Harry
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7443487	2021/07/05	2021/07/05	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7443259	2021/07/04	2021/07/05	Sarah Huang
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7440876	N/A	2021/07/07	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7442303	N/A	2021/07/07	Anna Gabrielyan

**BV Labs ID:** PYK388 Dup  
**Sample ID:** 21-42 SA4  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	7446285	2021/07/06	2021/07/06	Neil Dassanayake

**BV Labs ID:** PYK389  
**Sample ID:** 21-33 SA4  
**Matrix:** Soil

**Collected:** 2021/06/15  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7443990	2021/07/05	2021/07/06	Alina Dobreanu
Conductivity	AT	7443483	2021/07/05	2021/07/05	Yogesh Patel
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Resistivity of Soil		7441545	2021/07/05	2021/07/05	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7444013	2021/07/05	2021/07/06	Alina Dobreanu

**BV Labs ID:** PYK390  
**Sample ID:** 21-27 SA2  
**Matrix:** Soil

**Collected:** 2021/06/18  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7443645	2021/07/05	2021/07/05	Alina Dobreanu
Conductivity	AT	7443483	2021/07/05	2021/07/05	Yogesh Patel
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Resistivity of Soil		7441545	2021/07/05	2021/07/05	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7443646	2021/07/05	2021/07/05	Alina Dobreanu



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

## TEST SUMMARY

**BV Labs ID:** PYK391  
**Sample ID:** 21-40 SA2  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7443645	2021/07/05	2021/07/05	Alina Dobreanu
Conductivity	AT	7443483	2021/07/05	2021/07/05	Yogesh Patel
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Resistivity of Soil		7441545	2021/07/05	2021/07/05	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7443646	2021/07/05	2021/07/05	Alina Dobreanu

**BV Labs ID:** PYK392  
**Sample ID:** 21-42 SA3  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7443645	2021/07/05	2021/07/05	Alina Dobreanu
Conductivity	AT	7443483	2021/07/05	2021/07/05	Yogesh Patel
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Resistivity of Soil		7441545	2021/07/05	2021/07/05	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7443646	2021/07/05	2021/07/05	Alina Dobreanu

**BV Labs ID:** PYK393  
**Sample ID:** 21-23 SA3  
**Matrix:** Soil

**Collected:** 2021/06/25  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7443645	2021/07/05	2021/07/05	Alina Dobreanu
Conductivity	AT	7446235	2021/07/06	2021/07/06	Neil Dassanayake
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Resistivity of Soil		7441545	2021/07/06	2021/07/06	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7443646	2021/07/05	2021/07/05	Alina Dobreanu

**BV Labs ID:** PYK393 Dup  
**Sample ID:** 21-23 SA3  
**Matrix:** Soil

**Collected:** 2021/06/25  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7443645	2021/07/05	2021/07/05	Alina Dobreanu
Conductivity	AT	7446235	2021/07/06	2021/07/06	Neil Dassanayake

**BV Labs ID:** PYK437  
**Sample ID:** 21-39 SA4  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7443645	2021/07/05	2021/07/05	Alina Dobreanu
Conductivity	AT	7443483	2021/07/05	2021/07/05	Yogesh Patel
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Resistivity of Soil		7441545	2021/07/05	2021/07/05	Automated Statchk



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

## TEST SUMMARY

**BV Labs ID:** PYK437  
**Sample ID:** 21-39 SA4  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	7443646	2021/07/05	2021/07/05	Alina Dobreanu

**BV Labs ID:** PYK438  
**Sample ID:** 21-27 SA3  
**Matrix:** Soil

**Collected:** 2021/06/18  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in SPLP Leachates	GC/MS	7449697	2021/07/05	2021/07/08	Anh Lieu
1,3-Dichloropropene Sum	CALC	7441139	N/A	2021/07/08	Automated Statchk
Dinitrotoluene Sum	CALC	7441548	N/A	2021/07/08	Automated Statchk
Total Metals in SPLP Leachate by ICPMS	ICP/MS	7449698	2021/07/07	2021/07/08	Arefa Dabhad
Modified SPLP extraction - pH	PH	7447253	N/A	2021/07/07	Jian (Ken) Wang
Modified SPLP extraction - Weight		7447245	N/A	2021/07/07	Jian (Ken) Wang
OC Pesticides/PCB (SPLP Leachable)	GC/ECD	7450443	2021/07/07	2021/07/08	Mahmudul Khan
OC Pesticides Summed Parameters	CALC	7441546	N/A	2021/07/07	Ewa Pranjic
Volatile organics in SPLP leachates	HS/MS	7448614	N/A	2021/07/08	Juan Pangilinan

**BV Labs ID:** PYK438 Dup  
**Sample ID:** 21-27 SA3  
**Matrix:** Soil

**Collected:** 2021/06/18  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile organics in SPLP leachates	HS/MS	7448614	N/A	2021/07/08	Juan Pangilinan

**BV Labs ID:** PYK439  
**Sample ID:** 21-40 SA3  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in SPLP Leachates	GC/MS	7449697	2021/07/07	2021/07/08	Anh Lieu
1,3-Dichloropropene Sum	CALC	7441139	N/A	2021/07/08	Automated Statchk
Dinitrotoluene Sum	CALC	7441550	N/A	2021/07/08	Automated Statchk
Total Metals in SPLP Leachate by ICPMS	ICP/MS	7449698	2021/07/07	2021/07/08	Arefa Dabhad
Modified SPLP extraction - pH	PH	7447253	N/A	2021/07/07	Jian (Ken) Wang
Modified SPLP extraction - Weight		7447245	N/A	2021/07/07	Jian (Ken) Wang
OC Pesticides/PCB (SPLP Leachable)	GC/ECD	7450443	2021/07/07	2021/07/08	Mahmudul Khan
OC Pesticides Summed Parameters	CALC	7441546	N/A	2021/07/07	Ewa Pranjic
Volatile organics in SPLP leachates	HS/MS	7448614	N/A	2021/07/08	Juan Pangilinan

**BV Labs ID:** PYK440  
**Sample ID:** 21-42 SA5B  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in SPLP Leachates	GC/MS	7449697	2021/07/07	2021/07/08	Anh Lieu



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

## TEST SUMMARY

**BV Labs ID:** PYK440  
**Sample ID:** 21-42 SA5B  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	7441139	N/A	2021/07/08	Automated Statchk
Dinitrotoluene Sum	CALC	7441548	N/A	2021/07/08	Automated Statchk
Total Metals in SPLP Leachate by ICPMS	ICP/MS	7449698	2021/07/07	2021/07/08	Arefa Dabhad
Modified SPLP extraction - pH	PH	7447253	N/A	2021/07/07	Jian (Ken) Wang
Modified SPLP extraction - Weight		7447245	N/A	2021/07/07	Jian (Ken) Wang
OC Pesticides/PCB (SPLP Leachable)	GC/ECD	7450443	2021/07/07	2021/07/08	Mahmudul Khan
OC Pesticides Summed Parameters	CALC	7441546	N/A	2021/07/07	Ewa Pranjić
Volatile organics in SPLP leachates	HS/MS	7448614	N/A	2021/07/08	Juan Pangilinan

**BV Labs ID:** PYK441  
**Sample ID:** 21-23 SA3  
**Matrix:** Soil

**Collected:** 2021/06/25  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in SPLP Leachates	GC/MS	7449697	2021/07/07	2021/07/08	Anh Lieu
1,3-Dichloropropene Sum	CALC	7441139	N/A	2021/07/08	Automated Statchk
Dinitrotoluene Sum	CALC	7441550	N/A	2021/07/08	Automated Statchk
Total Metals in SPLP Leachate by ICPMS	ICP/MS	7449698	2021/07/07	2021/07/08	Arefa Dabhad
Modified SPLP extraction - pH	PH	7447253	N/A	2021/07/07	Jian (Ken) Wang
Modified SPLP extraction - Weight		7447245	N/A	2021/07/07	Jian (Ken) Wang
OC Pesticides/PCB (SPLP Leachable)	GC/ECD	7450443	2021/07/07	2021/07/08	Mahmudul Khan
OC Pesticides Summed Parameters	CALC	7441546	N/A	2021/07/07	Ewa Pranjić
Volatile organics in SPLP leachates	HS/MS	7448614	N/A	2021/07/08	Juan Pangilinan

**BV Labs ID:** PYK441 Dup  
**Sample ID:** 21-23 SA3  
**Matrix:** Soil

**Collected:** 2021/06/25  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
OC Pesticides/PCB (SPLP Leachable)	GC/ECD	7450443	2021/07/07	2021/07/08	Mahmudul Khan

**BV Labs ID:** PYK442  
**Sample ID:** 21-27 SA2  
**Matrix:** Soil

**Collected:** 2021/06/18  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cyanide (WAD) in Leachates	SKAL/CN	7446451	N/A	2021/07/06	Aditiben Patel
Fluoride by ISE in Leachates	ISE	7446441	2021/07/06	2021/07/06	Surinder Rai
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	7446163	2021/07/06	2021/07/06	Nan Raykha
Ignitability of a Sample	BAL	7446222	2021/07/06	2021/07/06	Min Yang
Nitrate(NO3) + Nitrite(NO2) in Leachate	LACH	7446445	N/A	2021/07/06	Chandra Nandlal
PAH Compounds in Leachate by GC/MS (SIM)	GC/MS	7447577	2021/07/06	2021/07/07	Mitesh Raj
TCLP Zero Headspace Extraction		7446933	2021/07/06	2021/07/07	Omer Imtiaz Uddin
VOCs in ZHE Leachates	GC/MS	7448583	2021/07/07	2021/07/07	Juan Pangilinan





BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

## TEST SUMMARY

**BV Labs ID:** PYK443  
**Sample ID:** 21-39 SA3  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cyanide (WAD) in Leachates	SKAL/CN	7446451	N/A	2021/07/06	Aditiben Patel
Fluoride by ISE in Leachates	ISE	7446441	2021/07/06	2021/07/06	Surinder Rai
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	7446163	2021/07/06	2021/07/06	Nan Raykha
Ignitability of a Sample	BAL	7446222	2021/07/06	2021/07/06	Min Yang
Nitrate(NO3) + Nitrite(NO2) in Leachate	LACH	7446445	N/A	2021/07/06	Chandra Nandlal
PAH Compounds in Leachate by GC/MS (SIM)	GC/MS	7447577	2021/07/06	2021/07/07	Mitesh Raj
TCLP Zero Headspace Extraction		7446933	2021/07/06	2021/07/07	Omer Imtiaz Uddin
VOCs in ZHE Leachates	GC/MS	7448583	2021/07/07	2021/07/07	Juan Pangilinan

**BV Labs ID:** PYK444  
**Sample ID:** 21-40 SA1  
**Matrix:** Soil

**Collected:** 2021/06/24  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cyanide (WAD) in Leachates	SKAL/CN	7446451	N/A	2021/07/06	Aditiben Patel
Fluoride by ISE in Leachates	ISE	7446441	2021/07/06	2021/07/06	Surinder Rai
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	7446163	2021/07/06	2021/07/06	Nan Raykha
Ignitability of a Sample	BAL	7446222	2021/07/06	2021/07/06	Min Yang
Nitrate(NO3) + Nitrite(NO2) in Leachate	LACH	7446445	N/A	2021/07/06	Chandra Nandlal
PAH Compounds in Leachate by GC/MS (SIM)	GC/MS	7447577	2021/07/06	2021/07/07	Mitesh Raj
TCLP Zero Headspace Extraction		7446933	2021/07/06	2021/07/07	Omer Imtiaz Uddin
VOCs in ZHE Leachates	GC/MS	7448583	2021/07/07	2021/07/07	Juan Pangilinan

**BV Labs ID:** PYK445  
**Sample ID:** 21-33 SA4  
**Matrix:** Soil

**Collected:** 2021/06/15  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7440873	N/A	2021/07/07	Automated Statchk
Hot Water Extractable Boron	ICP	7444351	2021/07/05	2021/07/05	Medhat Nasr
1,3-Dichloropropene Sum	CALC	7440874	N/A	2021/07/07	Automated Statchk
Free (WAD) Cyanide	TECH	7443462	2021/07/05	2021/07/05	Aditiben Patel
Conductivity	AT	7446285	2021/07/06	2021/07/06	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	7443554	2021/07/05	2021/07/06	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7441781	2021/07/02	2021/07/02	Ravinder Gaidhu
Acid Extractable Metals by ICPMS	ICP/MS	7444438	2021/07/05	2021/07/07	Daniel Teclu
Moisture	BAL	7441990	N/A	2021/07/02	Harry Harry
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7443509	2021/07/05	2021/07/06	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7443259	2021/07/04	2021/07/05	Sarah Huang
pH CaCl2 EXTRACT	AT	7444166	2021/07/05	2021/07/05	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7440876	N/A	2021/07/07	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7442303	N/A	2021/07/07	Anna Gabrielyan



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

## TEST SUMMARY

**BV Labs ID:** PYK446  
**Sample ID:** 21-17 SA2  
**Matrix:** Soil

**Collected:** 2021/05/12  
**Shipped:**  
**Received:** 2021/06/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in SPLP Leachates	GC/MS	7449697	2021/07/07	2021/07/08	Anh Lieu
1,3-Dichloropropene Sum	CALC	7441139	N/A	2021/07/08	Automated Statchk
Dinitrotoluene Sum	CALC	7441550	N/A	2021/07/08	Automated Statchk
Total Metals in SPLP Leachate by ICPMS	ICP/MS	7449698	2021/07/07	2021/07/08	Arefa Dabhad
Modified SPLP extraction - pH	PH	7447253	N/A	2021/07/07	Jian (Ken) Wang
Modified SPLP extraction - Weight		7447245	N/A	2021/07/07	Jian (Ken) Wang
OC Pesticides/PCB (SPLP Leachable)	GC/ECD	7450443	2021/07/07	2021/07/08	Mahmudul Khan
OC Pesticides Summed Parameters	CALC	7441546	N/A	2021/07/07	Ewa Pranjic
Volatile organics in SPLP leachates	HS/MS	7448614	N/A	2021/07/08	Juan Pangilinan



## GENERAL COMMENTS

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

Package 1	6.7°C
-----------	-------

Detection limit of Chloroform was raised due to a higher than usual background level present.

Sample PYK385 [21-27 SA4] : VOCF1 Analysis: The sample extract was transferred from the soil before 14 days. Analysis was completed within the 40 day specified hold time.

Sample PYK438 [21-27 SA3] : SPLP VOCs Extraction: Sample extracted past holding time. Analysis was performed past sample holding time. This may increase the variability associated with these results. Reported result in a minimum concentration and is not acceptable for establishing that the waste does not exceed the regulatory level.

Sample PYK442 [21-27 SA2] : NF/NI = Non Flammable and Non Ignitable.

TCLP VOCs Extraction: Sample extracted past holding time. Analysis was performed past sample holding time. This may increase the variability associated with these results. Reported result in a minimum concentration and is not acceptable for establishing that the waste does not exceed the regulatory level.

Sample PYK443 [21-39 SA3] : NF/NI = Non Flammable and Non Ignitable.

Sample PYK444 [21-40 SA1] : Sample has been analyzed for TCLP VOC, TCLP Metals & Inorganics, TCLP Benzo(a)Pyrene and Ignitability as per client request.

NF/NI = Non Flammable and Non Ignitable.

Sample PYK445 [21-33 SA4] : VOCF1 Analysis: The sample was analyzed after the 14 day holding time specified by the method had expired.

Sample PYK446 [21-17 SA2] : SPLP VOCs Extraction: Sample extracted past holding time. Analysis was performed past sample holding time. This may increase the variability associated with these results. Reported result in a minimum concentration and is not acceptable for establishing that the waste does not exceed the regulatory level.

**Results relate only to the items tested.**

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

## QUALITY ASSURANCE REPORT

Golder Associates Ltd  
Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7441781	o-Terphenyl	2021/07/02	103	60 - 130	101	60 - 130	98	%				
7442303	4-Bromofluorobenzene	2021/07/06	104	60 - 140	103	60 - 140	99	%				
7442303	D10-o-Xylene	2021/07/06	92	60 - 130	113	60 - 130	85	%				
7442303	D4-1,2-Dichloroethane	2021/07/06	97	60 - 140	98	60 - 140	97	%				
7442303	D8-Toluene	2021/07/06	104	60 - 140	104	60 - 140	98	%				
7443259	Decachlorobiphenyl	2021/07/05	92	60 - 130	99	60 - 130	89	%				
7443487	D10-Anthracene	2021/07/05	103	50 - 130	102	50 - 130	105	%				
7443487	D14-Terphenyl (FS)	2021/07/05	99	50 - 130	102	50 - 130	90	%				
7443487	D8-Acenaphthylene	2021/07/05	86	50 - 130	86	50 - 130	73	%				
7443509	D10-Anthracene	2021/07/06	82	50 - 130	88	50 - 130	84	%				
7443509	D14-Terphenyl (FS)	2021/07/06	83	50 - 130	90	50 - 130	82	%				
7443509	D8-Acenaphthylene	2021/07/06	76	50 - 130	90	50 - 130	64	%				
7443540	o-Terphenyl	2021/07/05	88	60 - 130	91	60 - 130	89	%				
7447577	Leachable D10-Anthracene	2021/07/07	93	50 - 130	95	50 - 130	96	%				
7447577	Leachable D14-Terphenyl (FS)	2021/07/07	82	50 - 130	85	50 - 130	82	%				
7447577	Leachable D8-Acenaphthylene	2021/07/07	93	50 - 130	94	50 - 130	93	%				
7448583	Leachable 4-Bromofluorobenzene	2021/07/07	107	70 - 130	111	70 - 130	91	%				
7448583	Leachable D4-1,2-Dichloroethane	2021/07/07	104	70 - 130	103	70 - 130	113	%				
7448583	Leachable D8-Toluene	2021/07/07	107	70 - 130	105	70 - 130	86	%				
7448614	Leachable (SPLP) 4-Bromofluorobenzene	2021/07/07	106	70 - 130	105	70 - 130	93	%				
7448614	Leachable (SPLP) D4-1,2-Dichloroethane	2021/07/07	107	70 - 130	104	70 - 130	112	%				
7448614	Leachable (SPLP) D8-Toluene	2021/07/07	110	70 - 130	111	70 - 130	94	%				
7449697	Leachable (SPLP) 2,4,6-Tribromophenol	2021/07/08			NA (2)	30 - 130	70	%				
7449697	Leachable (SPLP) 2-Fluorobiphenyl	2021/07/08			NA (2)	30 - 130	49	%				
7449697	Leachable (SPLP) D14-Terphenyl (FS)	2021/07/08			NA (2)	30 - 130	67	%				
7449697	Leachable (SPLP) D5-Nitrobenzene	2021/07/08			NA (2)	30 - 130	62	%				
7450443	Leachable (SPLP) 2,4,5,6-Tetrachloro-m-xylene	2021/07/08	70	30 - 130	77	30 - 130	72	%				
7450443	Leachable (SPLP) Decachlorobiphenyl	2021/07/08	78	30 - 130	82	30 - 130	86	%				
7441781	F2 (C10-C16 Hydrocarbons)	2021/07/03	112	50 - 130	109	80 - 120	<10	ug/g	NC	30		
7441781	F3 (C16-C34 Hydrocarbons)	2021/07/03	110	50 - 130	106	80 - 120	<50	ug/g	NC	30		
7441781	F4 (C34-C50 Hydrocarbons)	2021/07/03	114	50 - 130	110	80 - 120	<50	ug/g	NC	30		

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7441990	Moisture	2021/07/02							1.1	20		
7442303	1,1,1,2-Tetrachloroethane	2021/07/07	95	60 - 140	109	60 - 130	<0.050	ug/g	NC	50		
7442303	1,1,1-Trichloroethane	2021/07/07	97	60 - 140	110	60 - 130	<0.050	ug/g	NC	50		
7442303	1,1,2,2-Tetrachloroethane	2021/07/07	88	60 - 140	101	60 - 130	<0.050	ug/g	NC	50		
7442303	1,1,2-Trichloroethane	2021/07/07	96	60 - 140	110	60 - 130	<0.050	ug/g	NC	50		
7442303	1,1-Dichloroethane	2021/07/07	90	60 - 140	103	60 - 130	<0.050	ug/g	NC	50		
7442303	1,1-Dichloroethylene	2021/07/07	98	60 - 140	112	60 - 130	<0.050	ug/g	NC	50		
7442303	1,2-Dichlorobenzene	2021/07/07	92	60 - 140	109	60 - 130	<0.050	ug/g	NC	50		
7442303	1,2-Dichloroethane	2021/07/07	89	60 - 140	102	60 - 130	<0.050	ug/g	NC	50		
7442303	1,2-Dichloropropane	2021/07/07	88	60 - 140	100	60 - 130	<0.050	ug/g	NC	50		
7442303	1,3-Dichlorobenzene	2021/07/07	93	60 - 140	109	60 - 130	<0.050	ug/g	NC	50		
7442303	1,4-Dichlorobenzene	2021/07/07	108	60 - 140	126	60 - 130	<0.050	ug/g	NC	50		
7442303	Acetone (2-Propanone)	2021/07/07	100	60 - 140	114	60 - 140	<0.50	ug/g	NC	50		
7442303	Benzene	2021/07/07	87	60 - 140	100	60 - 130	<0.020	ug/g	NC	50		
7442303	Bromodichloromethane	2021/07/07	93	60 - 140	106	60 - 130	<0.050	ug/g	NC	50		
7442303	Bromoform	2021/07/07	92	60 - 140	106	60 - 130	<0.050	ug/g	NC	50		
7442303	Bromomethane	2021/07/07	83	60 - 140	93	60 - 140	<0.050	ug/g	NC	50		
7442303	Carbon Tetrachloride	2021/07/07	96	60 - 140	110	60 - 130	<0.050	ug/g	NC	50		
7442303	Chlorobenzene	2021/07/07	96	60 - 140	110	60 - 130	<0.050	ug/g	NC	50		
7442303	Chloroform	2021/07/07	92	60 - 140	105	60 - 130	<0.050	ug/g	NC	50		
7442303	cis-1,2-Dichloroethylene	2021/07/07	95	60 - 140	108	60 - 130	<0.050	ug/g	NC	50		
7442303	cis-1,3-Dichloropropene	2021/07/07	77	60 - 140	86	60 - 130	<0.030	ug/g	NC	50		
7442303	Dibromochloromethane	2021/07/07	92	60 - 140	106	60 - 130	<0.050	ug/g	NC	50		
7442303	Dichlorodifluoromethane (FREON 12)	2021/07/07	85	60 - 140	99	60 - 140	<0.050	ug/g	NC	50		
7442303	Ethylbenzene	2021/07/07	92	60 - 140	105	60 - 130	<0.020	ug/g	NC	50		
7442303	Ethylene Dibromide	2021/07/07	89	60 - 140	102	60 - 130	<0.050	ug/g	NC	50		
7442303	F1 (C6-C10) - BTEX	2021/07/07					<10	ug/g	NC	30		
7442303	F1 (C6-C10)	2021/07/07	92	60 - 140	86	80 - 120	<10	ug/g	NC	30		
7442303	Hexane	2021/07/07	99	60 - 140	111	60 - 130	<0.050	ug/g	NC	50		
7442303	Methyl Ethyl Ketone (2-Butanone)	2021/07/07	100	60 - 140	114	60 - 140	<0.50	ug/g	NC	50		
7442303	Methyl Isobutyl Ketone	2021/07/07	95	60 - 140	110	60 - 130	<0.50	ug/g	NC	50		

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7442303	Methyl t-butyl ether (MTBE)	2021/07/07	91	60 - 140	104	60 - 130	<0.050	ug/g	NC	50		
7442303	Methylene Chloride(Dichloromethane)	2021/07/07	88	60 - 140	100	60 - 130	<0.050	ug/g	NC	50		
7442303	o-Xylene	2021/07/07	93	60 - 140	107	60 - 130	<0.020	ug/g	NC	50		
7442303	p+m-Xylene	2021/07/07	97	60 - 140	111	60 - 130	<0.020	ug/g	NC	50		
7442303	Styrene	2021/07/07	102	60 - 140	117	60 - 130	<0.050	ug/g	NC	50		
7442303	Tetrachloroethylene	2021/07/07	92	60 - 140	105	60 - 130	<0.050	ug/g	NC	50		
7442303	Toluene	2021/07/07	89	60 - 140	101	60 - 130	<0.020	ug/g	0.37	50		
7442303	Total Xylenes	2021/07/07					<0.020	ug/g	NC	50		
7442303	trans-1,2-Dichloroethylene	2021/07/07	96	60 - 140	109	60 - 130	<0.050	ug/g	NC	50		
7442303	trans-1,3-Dichloropropene	2021/07/07	79	60 - 140	88	60 - 130	<0.040	ug/g	NC	50		
7442303	Trichloroethylene	2021/07/07	100	60 - 140	115	60 - 130	<0.050	ug/g	NC	50		
7442303	Trichlorofluoromethane (FREON 11)	2021/07/07	96	60 - 140	109	60 - 130	<0.050	ug/g	NC	50		
7442303	Vinyl Chloride	2021/07/07	92	60 - 140	105	60 - 130	<0.020	ug/g	NC	50		
7443259	Aroclor 1242	2021/07/05					<0.010	ug/g	NC	50		
7443259	Aroclor 1248	2021/07/05					<0.010	ug/g	NC	50		
7443259	Aroclor 1254	2021/07/05					<0.010	ug/g	NC	50		
7443259	Aroclor 1260	2021/07/05	105	30 - 130	116	30 - 130	<0.010	ug/g	NC	50		
7443259	Total PCB	2021/07/05	105	30 - 130	116	30 - 130	<0.010	ug/g	NC	50		
7443462	WAD Cyanide (Free)	2021/07/05	89	75 - 125	89	80 - 120	<0.01	ug/g	NC	35		
7443483	Conductivity	2021/07/05			100	90 - 110	<2	umho/cm	2.3	10		
7443487	1-Methylnaphthalene	2021/07/05	91	50 - 130	98	50 - 130	<0.0050	ug/g	NC	40		
7443487	2-Methylnaphthalene	2021/07/05	87	50 - 130	91	50 - 130	<0.0050	ug/g	NC	40		
7443487	Acenaphthene	2021/07/05	91	50 - 130	91	50 - 130	<0.0050	ug/g	NC	40		
7443487	Acenaphthylene	2021/07/05	84	50 - 130	86	50 - 130	<0.0050	ug/g	NC	40		
7443487	Anthracene	2021/07/05	95	50 - 130	95	50 - 130	<0.0050	ug/g	NC	40		
7443487	Benzo(a)anthracene	2021/07/05	95	50 - 130	93	50 - 130	<0.0050	ug/g	NC	40		
7443487	Benzo(a)pyrene	2021/07/05	78	50 - 130	83	50 - 130	<0.0050	ug/g	NC	40		
7443487	Benzo(b,j)fluoranthene	2021/07/05	95	50 - 130	95	50 - 130	<0.0050	ug/g	NC	40		
7443487	Benzo(g,h,i)perylene	2021/07/05	96	50 - 130	99	50 - 130	<0.0050	ug/g	NC	40		
7443487	Benzo(k)fluoranthene	2021/07/05	88	50 - 130	102	50 - 130	<0.0050	ug/g	NC	40		



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7443487	Biphenyl	2021/07/05	92	50 - 130	93	50 - 130	<0.0050	ug/g				
7443487	Chrysene	2021/07/05	94	50 - 130	96	50 - 130	<0.0050	ug/g	NC	40		
7443487	Dibenzo(a,h)anthracene	2021/07/05	93	50 - 130	93	50 - 130	<0.0050	ug/g	NC	40		
7443487	Fluoranthene	2021/07/05	99	50 - 130	107	50 - 130	<0.0050	ug/g	NC	40		
7443487	Fluorene	2021/07/05	92	50 - 130	92	50 - 130	<0.0050	ug/g	NC	40		
7443487	Indeno(1,2,3-cd)pyrene	2021/07/05	94	50 - 130	102	50 - 130	<0.0050	ug/g	NC	40		
7443487	Naphthalene	2021/07/05	80	50 - 130	88	50 - 130	<0.0050	ug/g	NC	40		
7443487	Phenanthrene	2021/07/05	90	50 - 130	92	50 - 130	<0.0050	ug/g	NC	40		
7443487	Pyrene	2021/07/05	98	50 - 130	105	50 - 130	<0.0050	ug/g	NC	40		
7443509	1-Methylnaphthalene	2021/07/06	84	50 - 130	94	50 - 130	<0.0050	ug/g	NC	40		
7443509	2-Methylnaphthalene	2021/07/06	80	50 - 130	86	50 - 130	<0.0050	ug/g	NC	40		
7443509	Acenaphthene	2021/07/06	76	50 - 130	84	50 - 130	<0.0050	ug/g	NC	40		
7443509	Acenaphthylene	2021/07/06	76	50 - 130	88	50 - 130	<0.0050	ug/g	111 (1)	40		
7443509	Anthracene	2021/07/06	83	50 - 130	89	50 - 130	<0.0050	ug/g	114 (1)	40		
7443509	Benzo(a)anthracene	2021/07/06	92	50 - 130	96	50 - 130	<0.0050	ug/g	127 (1)	40		
7443509	Benzo(a)pyrene	2021/07/06	57	50 - 130	84	50 - 130	<0.0050	ug/g	131 (1)	40		
7443509	Benzo(b,j)fluoranthene	2021/07/06	NC	50 - 130	90	50 - 130	<0.0050	ug/g	125 (1)	40		
7443509	Benzo(g,h,i)perylene	2021/07/06	67	50 - 130	88	50 - 130	<0.0050	ug/g	120 (1)	40		
7443509	Benzo(k)fluoranthene	2021/07/06	96	50 - 130	84	50 - 130	<0.0050	ug/g	125 (1)	40		
7443509	Biphenyl	2021/07/06	81	50 - 130	89	50 - 130	<0.0050	ug/g				
7443509	Chrysene	2021/07/06	85	50 - 130	93	50 - 130	<0.0050	ug/g	124 (1)	40		
7443509	Dibenzo(a,h)anthracene	2021/07/06	81	50 - 130	100	50 - 130	<0.0050	ug/g	122 (1)	40		
7443509	Fluoranthene	2021/07/06	127	50 - 130	97	50 - 130	<0.0050	ug/g	105 (1)	40		
7443509	Fluorene	2021/07/06	80	50 - 130	88	50 - 130	<0.0050	ug/g	NC	40		
7443509	Indeno(1,2,3-cd)pyrene	2021/07/06	75	50 - 130	102	50 - 130	<0.0050	ug/g	124 (1)	40		
7443509	Naphthalene	2021/07/06	71	50 - 130	79	50 - 130	<0.0050	ug/g	NC	40		
7443509	Phenanthrene	2021/07/06	97	50 - 130	89	50 - 130	<0.0050	ug/g	140 (1)	40		
7443509	Pyrene	2021/07/06	112	50 - 130	97	50 - 130	<0.0050	ug/g	104 (1)	40		
7443540	F2 (C10-C16 Hydrocarbons)	2021/07/05	94	50 - 130	99	80 - 120	<10	ug/g	NC	30		
7443540	F3 (C16-C34 Hydrocarbons)	2021/07/05	93	50 - 130	98	80 - 120	<50	ug/g	NC	30		
7443540	F4 (C34-C50 Hydrocarbons)	2021/07/05	93	50 - 130	99	80 - 120	<50	ug/g	NC	30		

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7443554	Chromium (VI)	2021/07/06	72	70 - 130	87	80 - 120	<0.18	ug/g	NC	35		
7443645	Soluble (20:1) Chloride (Cl-)	2021/07/05	NC	70 - 130	105	70 - 130	<20	ug/g	6.6	35		
7443646	Soluble (20:1) Sulphate (SO4)	2021/07/05	NC	70 - 130	107	70 - 130	<20	ug/g	7.0	35		
7443990	Soluble (20:1) Chloride (Cl-)	2021/07/06	NC	70 - 130	103	70 - 130	<20	ug/g	2.1	35		
7444001	Hot Water Ext. Boron (B)	2021/07/06	107	75 - 125	102	75 - 125	<0.050	ug/g	7.3	40		
7444013	Soluble (20:1) Sulphate (SO4)	2021/07/06	NC	70 - 130	104	70 - 130	<20	ug/g	4.8	35		
7444166	Available (CaCl2) pH	2021/07/05			100	97 - 103			0.68	N/A		
7444351	Hot Water Ext. Boron (B)	2021/07/05	94	75 - 125	91	75 - 125	<0.050	ug/g	4.7	40		
7444438	Acid Extractable Antimony (Sb)	2021/07/07	97	75 - 125	105	80 - 120	<0.20	ug/g	NC	30		
7444438	Acid Extractable Arsenic (As)	2021/07/07	98	75 - 125	103	80 - 120	<1.0	ug/g	1.6	30		
7444438	Acid Extractable Barium (Ba)	2021/07/07	110	75 - 125	101	80 - 120	<0.50	ug/g	2.1	30		
7444438	Acid Extractable Beryllium (Be)	2021/07/07	93	75 - 125	95	80 - 120	<0.20	ug/g	NC	30		
7444438	Acid Extractable Boron (B)	2021/07/07	92	75 - 125	97	80 - 120	<5.0	ug/g	NC	30		
7444438	Acid Extractable Cadmium (Cd)	2021/07/07	102	75 - 125	101	80 - 120	<0.10	ug/g	NC	30		
7444438	Acid Extractable Chromium (Cr)	2021/07/07	103	75 - 125	102	80 - 120	<1.0	ug/g	6.1	30		
7444438	Acid Extractable Cobalt (Co)	2021/07/07	98	75 - 125	101	80 - 120	<0.10	ug/g	7.6	30		
7444438	Acid Extractable Copper (Cu)	2021/07/07	96	75 - 125	101	80 - 120	<0.50	ug/g	2.8	30		
7444438	Acid Extractable Lead (Pb)	2021/07/07	98	75 - 125	103	80 - 120	<1.0	ug/g	0.28	30		
7444438	Acid Extractable Mercury (Hg)	2021/07/07	92	75 - 125	101	80 - 120	<0.050	ug/g				
7444438	Acid Extractable Molybdenum (Mo)	2021/07/07	102	75 - 125	102	80 - 120	<0.50	ug/g	NC	30		
7444438	Acid Extractable Nickel (Ni)	2021/07/07	99	75 - 125	101	80 - 120	<0.50	ug/g	7.9	30		
7444438	Acid Extractable Selenium (Se)	2021/07/07	102	75 - 125	104	80 - 120	<0.50	ug/g	NC	30		
7444438	Acid Extractable Silver (Ag)	2021/07/07	99	75 - 125	102	80 - 120	<0.20	ug/g	NC	30		
7444438	Acid Extractable Thallium (Tl)	2021/07/07	97	75 - 125	101	80 - 120	<0.050	ug/g	NC	30		
7444438	Acid Extractable Uranium (U)	2021/07/07	103	75 - 125	105	80 - 120	<0.050	ug/g	1.0	30		
7444438	Acid Extractable Vanadium (V)	2021/07/07	100	75 - 125	103	80 - 120	<5.0	ug/g	13	30		
7444438	Acid Extractable Zinc (Zn)	2021/07/07	100	75 - 125	107	80 - 120	<5.0	ug/g	0.31	30		
7446163	Leachable Arsenic (As)	2021/07/06	101	80 - 120	98	80 - 120	<0.2	mg/L	NC	35	<0.2	mg/L
7446163	Leachable Barium (Ba)	2021/07/06	NC	80 - 120	102	80 - 120	<0.2	mg/L	3.1	35	<0.2	mg/L
7446163	Leachable Boron (B)	2021/07/06	103	80 - 120	105	80 - 120	<0.1	mg/L	2.0	35	<0.1	mg/L
7446163	Leachable Cadmium (Cd)	2021/07/06	103	80 - 120	101	80 - 120	<0.05	mg/L	NC	35	<0.05	mg/L



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7446163	Leachable Chromium (Cr)	2021/07/06	100	80 - 120	99	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L
7446163	Leachable Lead (Pb)	2021/07/06	96	80 - 120	97	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L
7446163	Leachable Mercury (Hg)	2021/07/06	99	80 - 120	101	80 - 120	<0.001	mg/L	NC	35	<0.001	mg/L
7446163	Leachable Selenium (Se)	2021/07/06	97	80 - 120	100	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L
7446163	Leachable Silver (Ag)	2021/07/06	104	80 - 120	104	80 - 120	<0.01	mg/L	NC	35	<0.01	mg/L
7446163	Leachable Uranium (U)	2021/07/06	96	80 - 120	95	80 - 120	<0.01	mg/L	NC	35	<0.01	mg/L
7446235	Conductivity	2021/07/06			99	90 - 110	<2	umho/cm	0.92	10		
7446285	Conductivity	2021/07/06			99	90 - 110	<0.002	mS/cm	0	10		
7446441	Leachable Fluoride (F-)	2021/07/06	122 (1)	80 - 120	99	80 - 120	<0.10	mg/L	1.9	25	<0.10	mg/L
7446445	Leachable Nitrate (N)	2021/07/06	99	80 - 120	94	80 - 120	<1.0	mg/L	NC	25	<1.0	mg/L
7446445	Leachable Nitrate + Nitrite (N)	2021/07/06	101	80 - 120	97	80 - 120	<1.0	mg/L	NC	25	<1.0	mg/L
7446445	Leachable Nitrite (N)	2021/07/06	109	80 - 120	105	80 - 120	<0.10	mg/L	NC	25	<0.10	mg/L
7446451	Leachable WAD Cyanide (Free)	2021/07/06	98	80 - 120	97	80 - 120	<0.0020	mg/L	NC	20	<0.010	mg/L
7447577	Leachable Benzo(a)pyrene	2021/07/07	78	50 - 130	80	50 - 130	<0.10	ug/L	NC	40		
7448583	Leachable 1,1-Dichloroethylene	2021/07/07	102	70 - 130	99	70 - 130	<0.020	mg/L	NC	30		
7448583	Leachable 1,2-Dichlorobenzene	2021/07/07	97	70 - 130	90	70 - 130	<0.050	mg/L	NC	30		
7448583	Leachable 1,2-Dichloroethane	2021/07/07	102	70 - 130	99	70 - 130	<0.050	mg/L	NC	30		
7448583	Leachable 1,4-Dichlorobenzene	2021/07/07	115	70 - 130	106	70 - 130	<0.050	mg/L	NC	30		
7448583	Leachable Benzene	2021/07/07	96	70 - 130	93	70 - 130	<0.020	mg/L	NC	30		
7448583	Leachable Carbon Tetrachloride	2021/07/07	110	70 - 130	105	70 - 130	<0.020	mg/L	NC	30		
7448583	Leachable Chlorobenzene	2021/07/07	101	70 - 130	97	70 - 130	<0.020	mg/L	NC	30		
7448583	Leachable Chloroform	2021/07/07	105	70 - 130	101	70 - 130	<0.020	mg/L	NC	30		
7448583	Leachable Methyl Ethyl Ketone (2-Butanone)	2021/07/07	108	60 - 140	107	60 - 140	<1.0	mg/L	NC	30		
7448583	Leachable Methylene Chloride (Dichloromethane)	2021/07/07	103	70 - 130	99	70 - 130	<0.20	mg/L	NC	30		
7448583	Leachable Tetrachloroethylene	2021/07/07	103	70 - 130	97	70 - 130	<0.020	mg/L	NC	30		
7448583	Leachable Trichloroethylene	2021/07/07	111	70 - 130	107	70 - 130	<0.020	mg/L	NC	30		
7448583	Leachable Vinyl Chloride	2021/07/07	104	70 - 130	99	70 - 130	<0.020	mg/L	NC	30		
7448614	Leachable (SPLP) 1,1,1,2-Tetrachloroethane	2021/07/08	95	70 - 130	97	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) 1,1,2,2-Tetrachloroethane	2021/07/08	99	70 - 130	100	70 - 130	<0.40	ug/L	NC	30		

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7448614	Leachable (SPLP) 1,1,2-Trichloroethane	2021/07/08	106	70 - 130	108	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) 1,1-Dichloroethane	2021/07/08	94	70 - 130	96	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) 1,1-Dichloroethylene	2021/07/08	94	70 - 130	98	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) 1,2-Dichlorobenzene	2021/07/08	89	70 - 130	93	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) 1,2-Dichloroethane	2021/07/08	98	70 - 130	98	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) 1,2-Dichloropropane	2021/07/08	99	70 - 130	101	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) 1,4-Dichlorobenzene	2021/07/08	98	70 - 130	105	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) Bromomethane	2021/07/08	91	60 - 140	91	60 - 140	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) Carbon Tetrachloride	2021/07/08	95	70 - 130	99	70 - 130	<0.19	ug/L	NC	30		
7448614	Leachable (SPLP) Chloroform	2021/07/08	99	70 - 130	100	70 - 130	<1.2	ug/L	NC	30		
7448614	Leachable (SPLP) cis-1,2-Dichloroethylene	2021/07/08	99	70 - 130	101	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) cis-1,3-Dichloropropene	2021/07/08	94	70 - 130	91	70 - 130	<0.30	ug/L	NC	30		
7448614	Leachable (SPLP) Ethylene Dibromide	2021/07/08	99	70 - 130	99	70 - 130	<0.19	ug/L	NC	30		
7448614	Leachable (SPLP) Tetrachloroethylene	2021/07/08	87	70 - 130	91	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) trans-1,2-Dichloroethylene	2021/07/08	94	70 - 130	99	70 - 130	<0.40	ug/L	NC	30		
7448614	Leachable (SPLP) trans-1,3-Dichloropropene	2021/07/08	104	70 - 130	99	70 - 130	<0.30	ug/L	NC	30		
7448614	Leachable (SPLP) Trichloroethylene	2021/07/08	97	70 - 130	100	70 - 130	<0.40	ug/L	NC	30		
7449697	Leachable (SPLP) 2,4,6-Trichlorophenol	2021/07/08			81	10 - 130	<0.70	ug/L	1.4	40		
7449697	Leachable (SPLP) 2,4-Dinitrophenol	2021/07/08			108	10 - 130	<5.0	ug/L	0.87	40		
7449697	Leachable (SPLP) 2,4-Dinitrotoluene	2021/07/08			85	30 - 130	<3.0	ug/L	0.66	40		
7449697	Leachable (SPLP) 2,6-Dinitrotoluene	2021/07/08			77	30 - 130	<3.0	ug/L	0.31	40		
7449697	Leachable (SPLP) 3,3'-Dichlorobenzidine	2021/07/08			86	30 - 130	<0.40	ug/L	1.1	40		
7449697	Leachable (SPLP) Bis(2-chloroethyl)ether	2021/07/08			74	30 - 130	<2.0	ug/L	1.9	40		
7449697	Leachable (SPLP) Bis(2-chloroisopropyl)ether	2021/07/08			67	30 - 130	<2.0	ug/L	0.89	40		
7449697	Leachable (SPLP) Diethyl phthalate	2021/07/08			85	30 - 130	<1.0	ug/L	1.3	40		
7449697	Leachable (SPLP) Dimethyl phthalate	2021/07/08			90	30 - 130	<1.0	ug/L	0.50	40		
7449697	Leachable (SPLP) p-Chloroaniline	2021/07/08			100	30 - 130	<5.0	ug/L	1.5	40		
7449698	Leachable (SPLP) Antimony (Sb)	2021/07/08	98	80 - 120	98	80 - 120	<0.5	ug/L			<0.5	ug/L
7449698	Leachable (SPLP) Arsenic (As)	2021/07/08	97	80 - 120	98	80 - 120	<1	ug/L			<1	ug/L
7449698	Leachable (SPLP) Barium (Ba)	2021/07/08	90	80 - 120	96	80 - 120	<5	ug/L			<5	ug/L
7449698	Leachable (SPLP) Beryllium (Be)	2021/07/08	92	80 - 120	100	80 - 120	<0.5	ug/L			<0.5	ug/L



BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382 (7000)

Site Location: QEW/DIXIE

Sampler Initials: AM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7449698	Leachable (SPLP) Boron (B)	2021/07/08	91	80 - 120	97	80 - 120	<10	ug/L			<10	ug/L
7449698	Leachable (SPLP) Cadmium (Cd)	2021/07/08	97	80 - 120	98	80 - 120	<0.1	ug/L			<0.1	ug/L
7449698	Leachable (SPLP) Chromium (Cr)	2021/07/08	91	80 - 120	94	80 - 120	<5	ug/L			<5	ug/L
7449698	Leachable (SPLP) Cobalt (Co)	2021/07/08	94	80 - 120	99	80 - 120	<0.5	ug/L			<0.5	ug/L
7449698	Leachable (SPLP) Copper (Cu)	2021/07/08	94	80 - 120	97	80 - 120	<1	ug/L			<1	ug/L
7449698	Leachable (SPLP) Lead (Pb)	2021/07/08	94	80 - 120	100	80 - 120	<0.5	ug/L			<0.5	ug/L
7449698	Leachable (SPLP) Molybdenum (Mo)	2021/07/08	95	80 - 120	95	80 - 120	<1	ug/L			<1	ug/L
7449698	Leachable (SPLP) Nickel (Ni)	2021/07/08	93	80 - 120	97	80 - 120	<1	ug/L			<1	ug/L
7449698	Leachable (SPLP) Selenium (Se)	2021/07/08	100	80 - 120	103	80 - 120	<2	ug/L			<2	ug/L
7449698	Leachable (SPLP) Silver (Ag)	2021/07/08	93	80 - 120	94	80 - 120	<0.1	ug/L			<0.1	ug/L
7449698	Leachable (SPLP) Thallium (Tl)	2021/07/08	92	80 - 120	99	80 - 120	<0.05	ug/L			<0.05	ug/L
7449698	Leachable (SPLP) Uranium (U)	2021/07/08	103	80 - 120	103	80 - 120	<0.1	ug/L			<0.1	ug/L
7449698	Leachable (SPLP) Vanadium (V)	2021/07/08	95	80 - 120	96	80 - 120	<1	ug/L			<1	ug/L
7449698	Leachable (SPLP) Zinc (Zn)	2021/07/08	94	80 - 120	99	80 - 120	<5	ug/L			<5	ug/L
7450443	Leachable (SPLP) Dieldrin	2021/07/08	95	50 - 130	99	50 - 130	<0.006	ug/L	NC	40		
7450443	Leachable (SPLP) Endrin	2021/07/08	87	50 - 130	88	50 - 130	<0.006	ug/L	NC	40		
7450443	Leachable (SPLP) Heptachlor epoxide	2021/07/08	84	50 - 130	87	50 - 130	<0.006	ug/L	NC	40		

BUREAU  
VERITAS

BV Labs Job #: C1H7791

Report Date: 2021/07/10

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
 Client Project #: 1530382 (7000)  
 Site Location: QEW/DIXIE  
 Sampler Initials: AM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7450443	Leachable (SPLP) Heptachlor	2021/07/08	73	50 - 130	77	50 - 130	<0.006	ug/L	NC	40		

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.

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

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  $\leq 2 \times \text{RDL}$ ).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(2) Surrogate recovery was not available (NA). The data quality is not affected since all Target Analyte recoveries were within the limits.



BUREAU  
VERITAS

BV Labs Job #: C1H7791  
Report Date: 2021/07/10

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Site Location: QEW/DIXIE  
Sampler Initials: AM

### VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Eva Pranjić, M.Sc., C.Chem, Scientific Specialist

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

<b>INVOICE TO:</b>		<b>REPORT TO:</b>		<b>PROJECT INFORMATION:</b>		<b>Laboratory Use Only:</b>	
Company Name: #1326 Golder Associates Ltd		Company Name: Brad Crowe Kate Nero		Quotation #: B80683		Maxxam Job #:	
Attention: Accounts Payable		Attention: Brad Crowe Kate Nero		P.O. #: 1668975 1330382/7000		Bottle Order #:	
Address: 6925 Century Ave Suite 100		Address:		Project: CREW/DIXIE		657051	
Mississauga ON L5N 7K2				Project Name:		COC #:	
Tel: (905) 567-4444 x Fax: (905) 567-6561 x		Tel: (905) 567-6100 x1486 Fax:		Site #:		Project Manager:	
Email: AP_CustomerService@golder.com		Email: bcrowe@golder.com knero@golder.com		Sampled By: ATM		Ema Gitej	

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY						ANALYSIS REQUESTED (PLEASE BE SPECIFIC)						Turnaround Time (TAT) Required:	
<b>Regulation 153 (2011)</b> <input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Medium/Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> For RSC <input type="checkbox"/> Table			<b>Other Regulations</b> <input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> Reg 558 <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> MISA Municipality <input type="checkbox"/> PWQO <input type="checkbox"/> Other			<b>Special Instructions</b>			Field Filtered (please circle): Metals / Hg / Cr / V O Reg 153 Metals & Inorganics Pkg (Soil) O Reg 153 VOCs by HS & F1-F4 (Soil) O Reg 153 PAHs (Soil) O Reg 153 PCBs O Reg 153 PCBs/PAHs/PCBS Corrosive/HF package			Regular (Standard) TAT: (will be applied if Rush TAT is not specified). Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.	
Include Criteria on Certificate of Analysis (Y/N)?						Job Specific Rush TAT (if applies to entire submission)		Date Required:		Time Required:		Rush Confirmation Number:	
Sample Barcode Label		Sample (Location) Identification		Date Sampled		Time Sampled		Matrix		# of Bottles		Comments	
1		21-23 SA2		2021/6/25		AM		SOIL		5			
2		21-27 AS4		2021/6/18				SOIL		5			
3		21-39 SA2		2021/6/24				SOIL		5			
4		21-40 SAS		2021/6/24				SOIL		5			
5		21-42 SA4		2021/6/24				SOIL		5			
6		21-33 SA4		2021/6/15		AM		SOIL		1			
7		21-27 SA2		2021/6/18		AM		SOIL		1			
8		21-40 SA2		2021/6/24		11		11		1			
9		21-42 SA3		2021/6/24		AM		SOIL		1			
10		21-23 SA3		2021/6/25		AM		SOIL		1			

28-Jun-21 09:18  
Ema Gitej  
C1H7791  
ATM ENV-571

* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)		Time		RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)		Time		# jars used and not submitted		Laboratory Use Only	
[Signature]		21/6/28		9:15 AM		[Signature]		2021/6/28		09:18				Time Sensitive Temperature (°C) on Receipt 7/2/16	
														Custody Seal Present Intact	

\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

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

\*\* SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/MP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

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

White: Maxxa Yellow: Client



## Page 2 of 2

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#1326 Golder Associates Ltd	Company Name:	Brad Crowe Katie Nero	Quotation #:	B80683	Maxxam Job #:	Bottle Order #:
Attention:	Accounts Payable	Attention:		P.O. #:			
Address:	6925 Century Ave Suite 100	Address:		Project:	1008976-153038217040		
	Mississauga ON L5N 7K2			Project Name:	QEW/DIXIE	COC #:	Project Manager:
Tel:	(905) 567-4444 x	Tel:	(905) 567-6100 x1100	Site #:			
Fax:	(905) 567-6561 x	Fax:		Sampled By:	AM		
Email:	AP_CustomerService@golder.com	Email:	bcrowe@golder.com knero@golder.com				

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

Regulation 153 (2011)			Other Regulations		Special Instructions	Field Filtered (please circle):	Metals / Hg / Cr VI	O Reg 153 Metals & Inorganics Pkg (Soil)	O Reg 153 VOCs by HS & F1-F4 (Soil)	O Reg 153 PAHs (Soil)	Consistency Package 01/09/406/119 SPLP SHIP TCLP	O Reg 406 MSL 1/10/05/PHCS PL BSL PART	Regular (Standard) TAT:					
Table 1	Table 2	Table 3	Table	Res/Park									Ind/Comm	Agri/Other	Medium/Fine	Coarse	For RSC	CCME
Include Criteria on Certificate of Analysis (Y/N)?												Job Specific Rush TAT (if applies to entire submission)						
												Date Required:	Time Required:					
												Rush Confirmation Number:		(call lab for #)				
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix									# of Bottles	Comments				
1	21-39 SA4	2021/6/24	AM	SOIL							X		1					
2	21-27 SA3	2021/6/18	AM	SOIL							X		2					
3	21-40 SA3	2021/6/24	AM	SOIL							X		2					
4	21-42 SA5B	2021/6/24	AM	SOIL							X		2					
5	21-23 SA3	2021/6/25	AM	SOIL							X		2					
6	21-27 SA2	2021/6/18	AM	SOIL							X		2					
7	21-39 SA3	2021/6/24	AM	SOIL							X		2					
8	21-40 SA1	2021/6/24	AM	SOIL							X		2					
9	21-33 SA4	2021/6/15	AM	SOIL								X	5					
10	21-17 SA2	2021/5/12	AM	SOIL							X		2					

RELINQUISHED BY: (Signature/Print) <i>[Signature]</i>	Date: (YY/MM/DD) 21/6/28	Time 9:15 AM	RECEIVED BY: (Signature/Print) <i>[Signature]</i>	Date: (YY/MM/DD) 21/6/28	Time 0918	# jars used and not submitted	Laboratory Use Only					
							Time Sensitive	Temperature (°C) (°F) (°K) 7/16	5/16	24/6/28	Yes	No
									Custody Seal Present Intact			
* UNLESS OTHERWISE LOGGED TO A BUREAU FILE												

\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT [WWW.MAXXAM.CA/TERMS](http://WWW.MAXXAM.CA/TERMS).

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

\*\* SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT [HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF](http://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF).

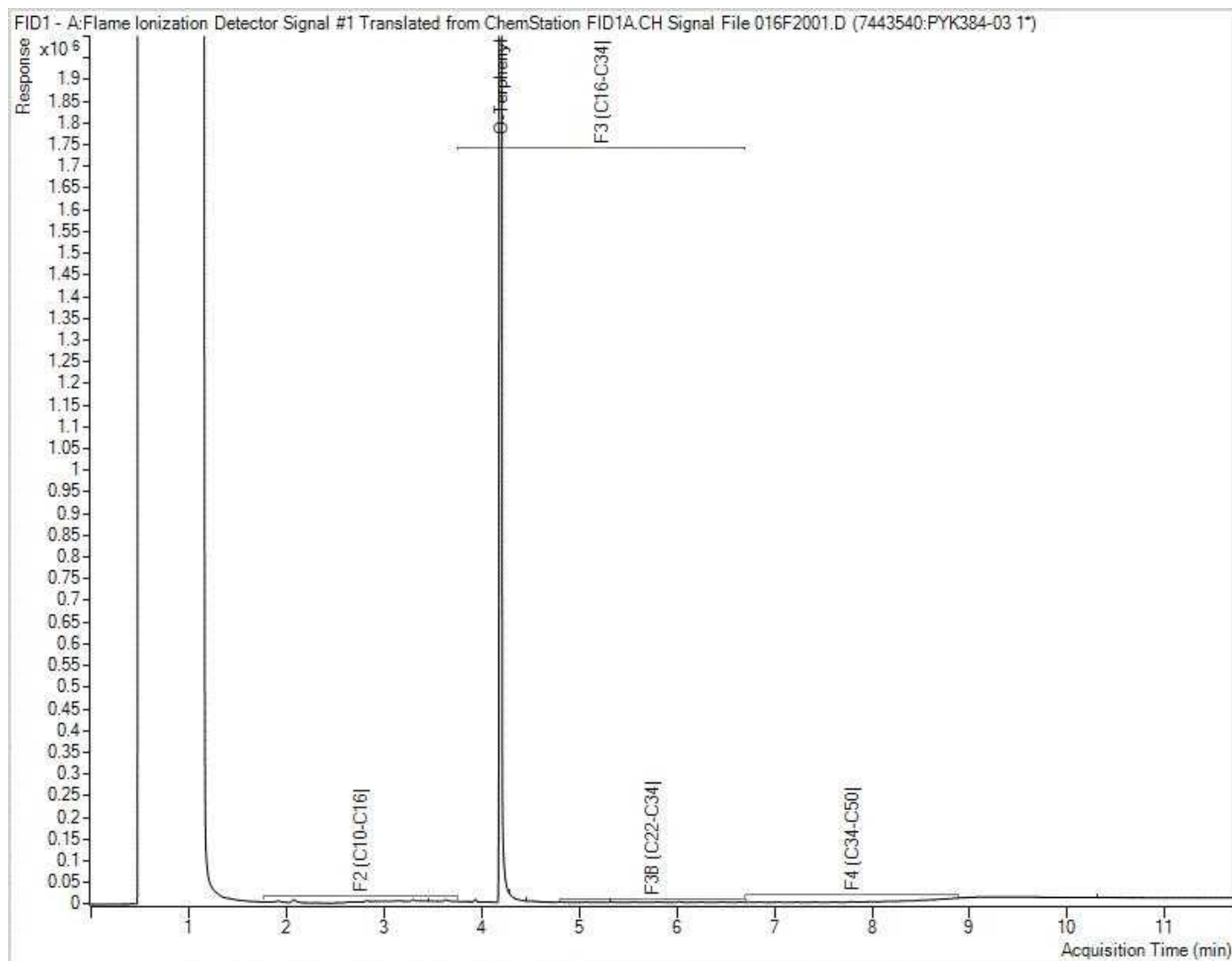
SAMPLES MUST BE KEPT COOL ( < 10° C ) FROM TIME OF SAMPLING  
UNTIL DELIVERY TO MAXXAM

White: Maxxa      Yellow: Client

BV Labs Job #: C1H7791  
Report Date: 2021/07/10  
BV Labs Sample: PYK384

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Project name: QEW/DIXIE  
Client ID: 21-23 SA2

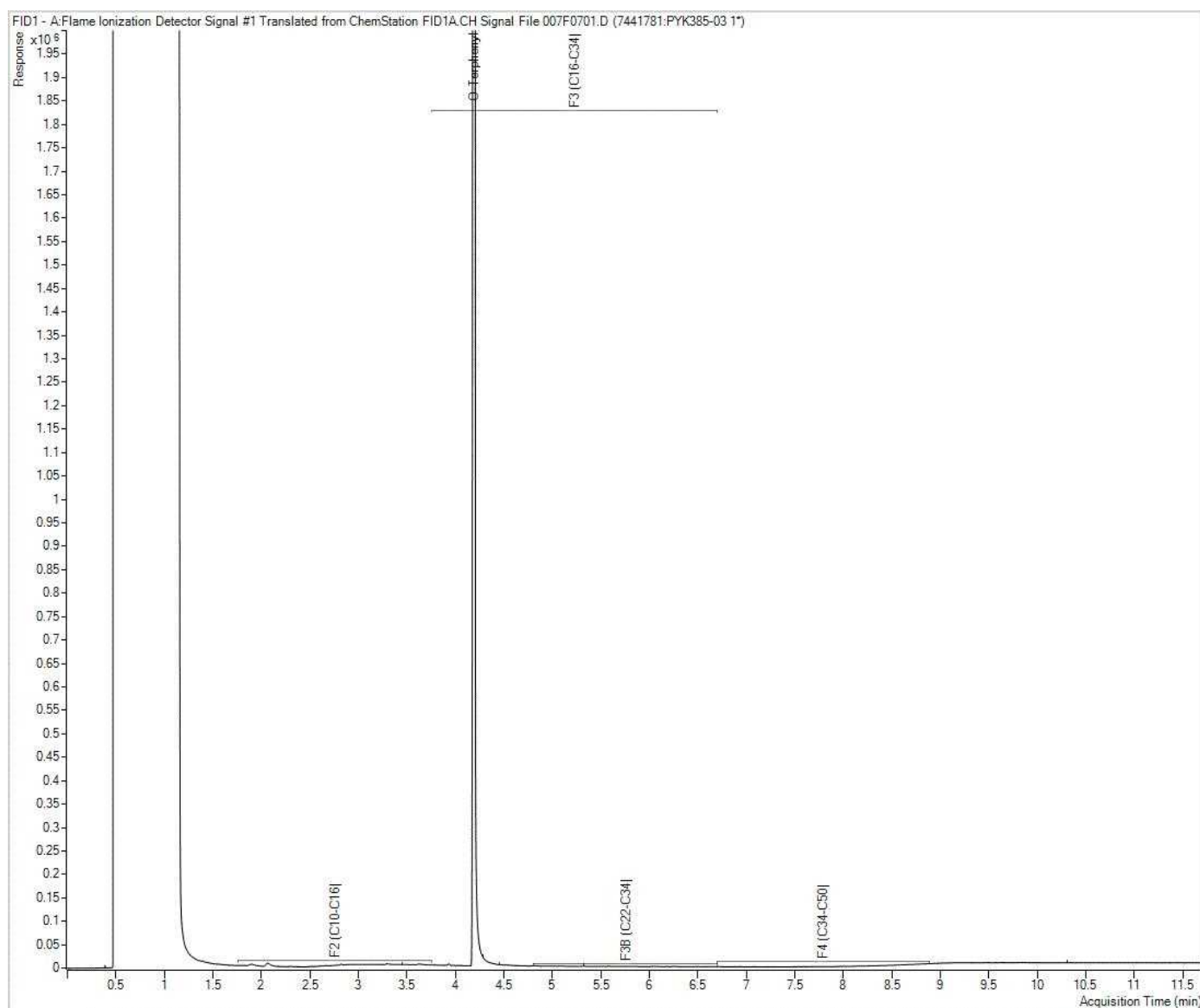
**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

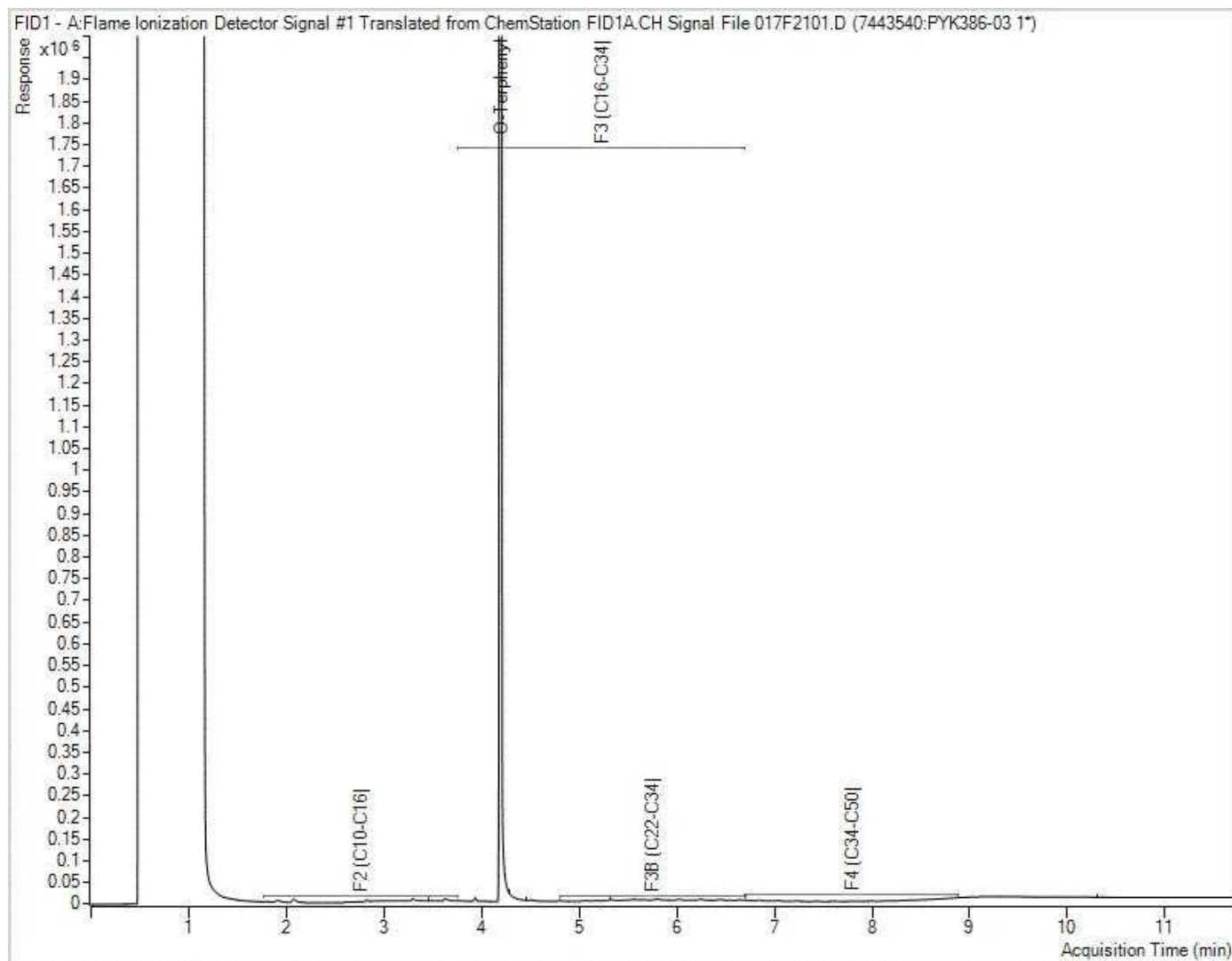


**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**



**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**

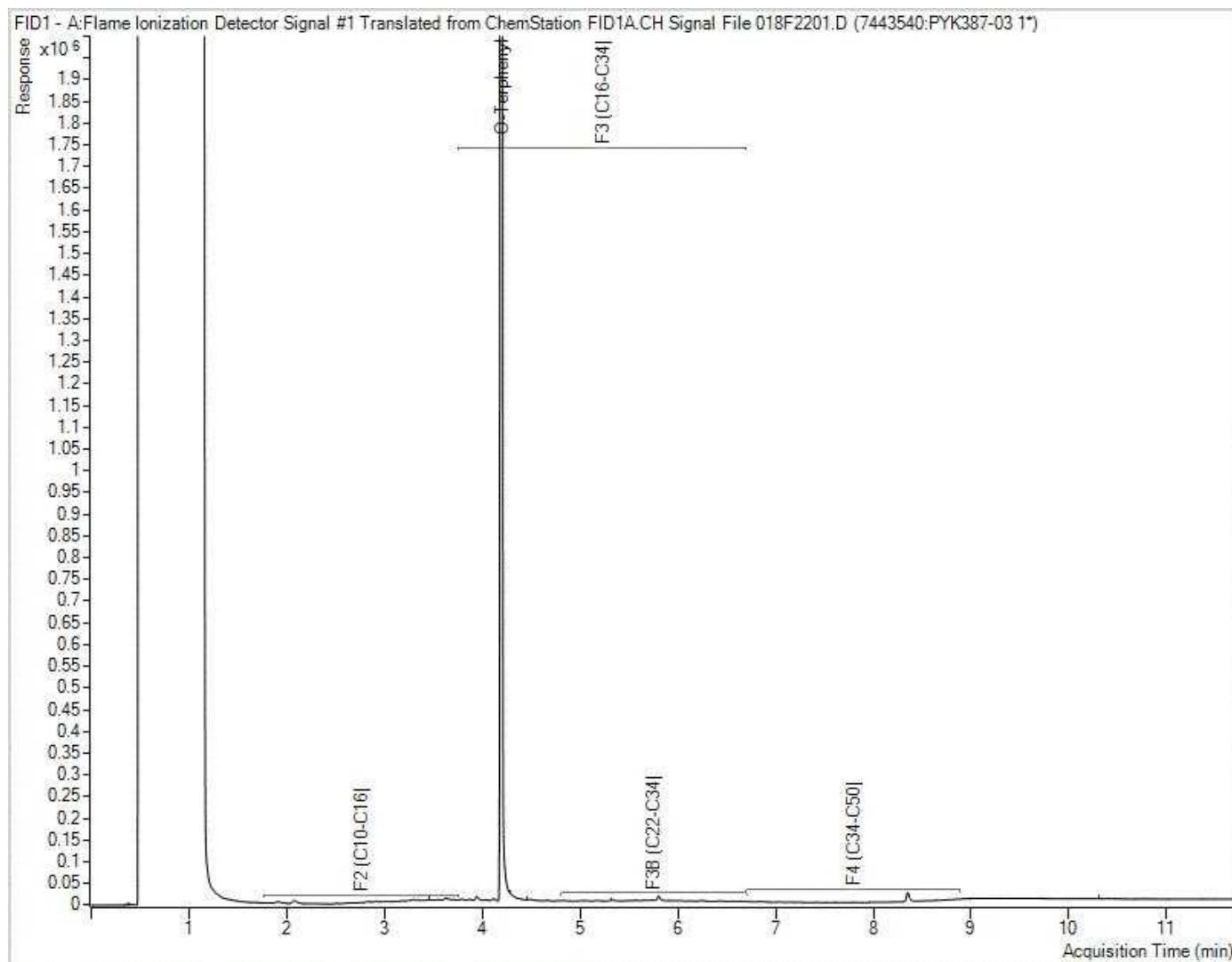


**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C1H7791  
Report Date: 2021/07/10  
BV Labs Sample: PYK387

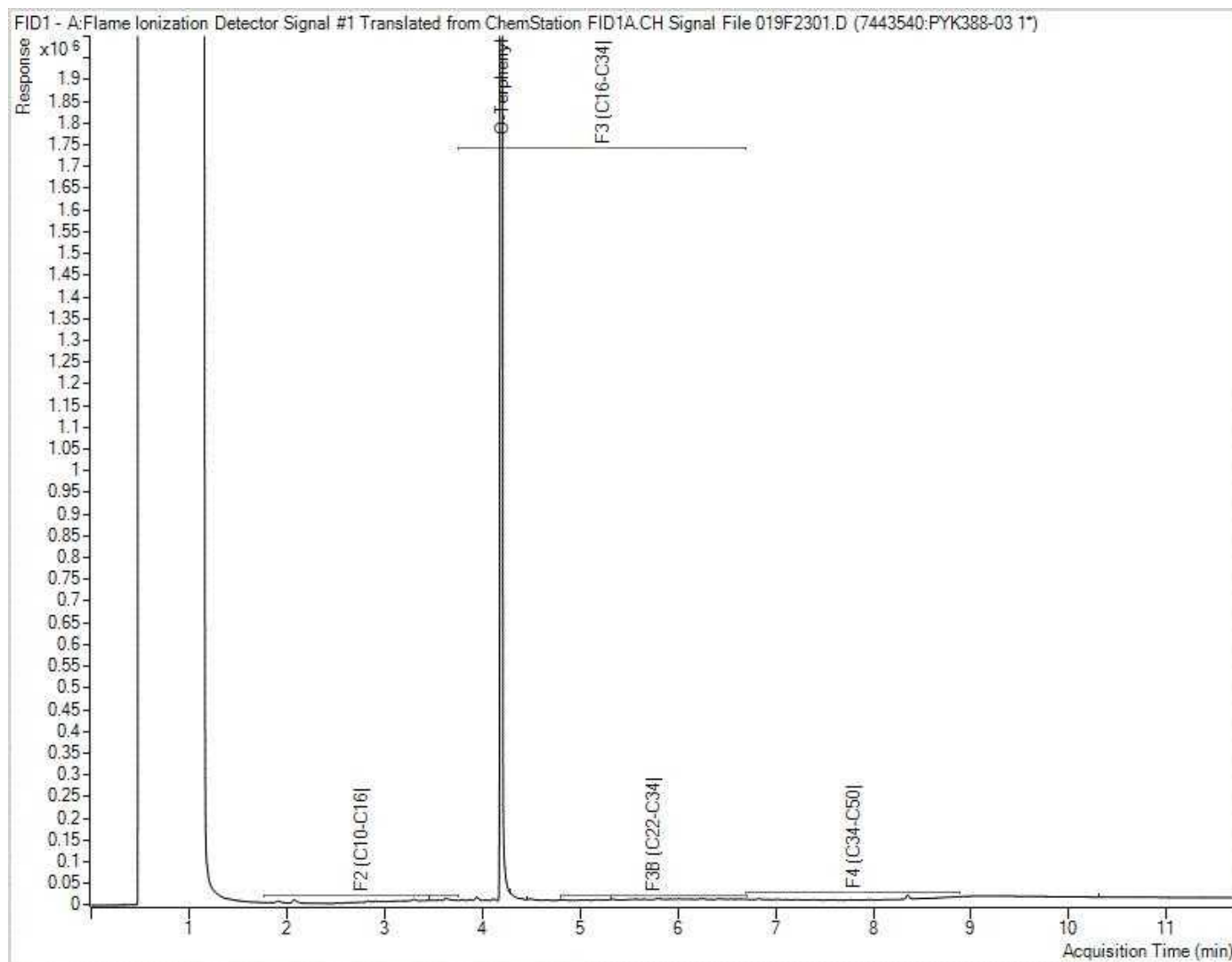
Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Project name: QEW/DIXIE  
Client ID: 21-40 SA5

**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**

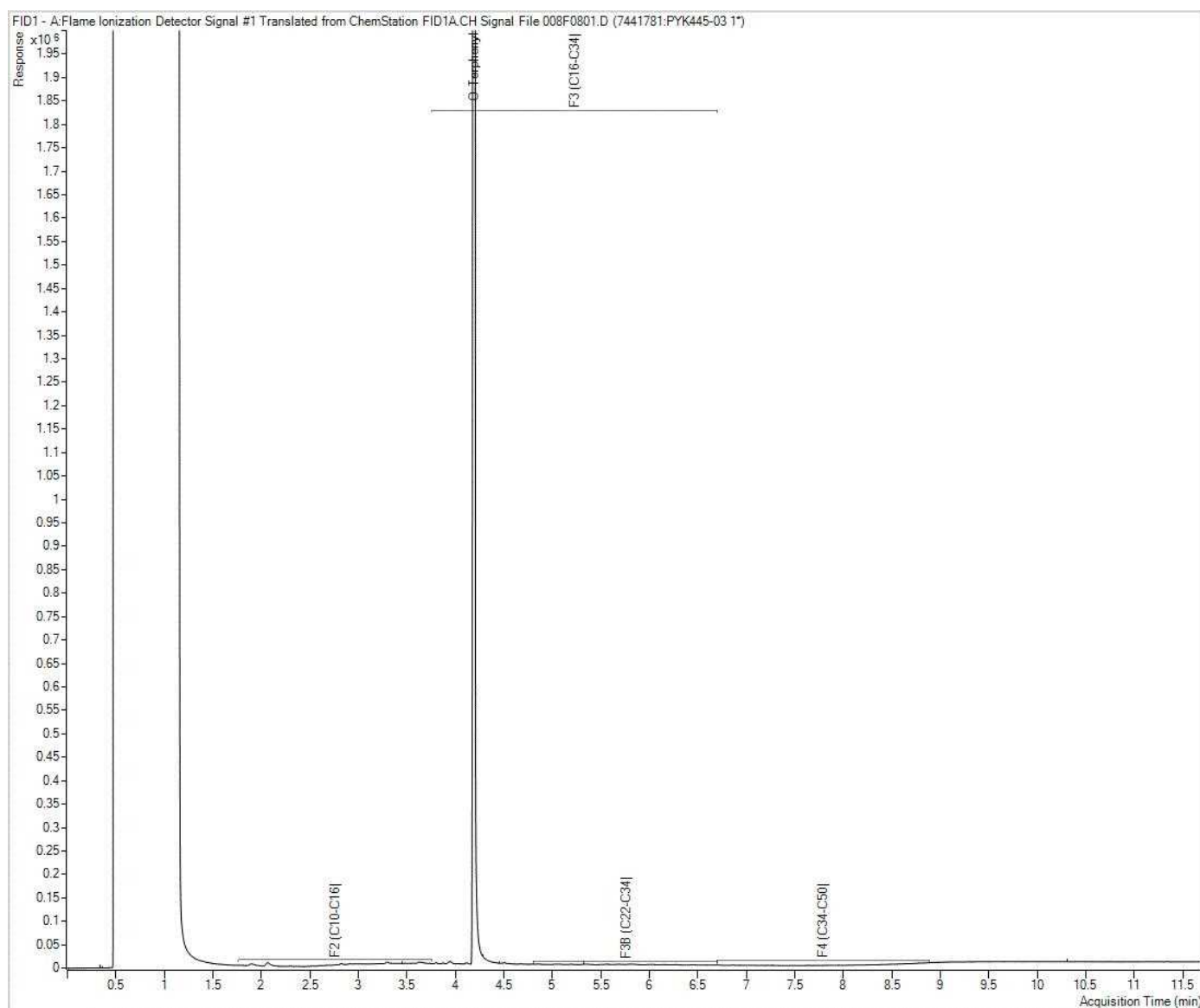


**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C1H7791  
Report Date: 2021/07/10  
BV Labs Sample: PYK445

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Project name: QEW/DIXIE  
Client ID: 21-33 SA4

**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**



**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**



Your Project #: 1530382/7000  
 Site Location: QEW/DIXIE  
 Your C.O.C. #: n/a

**Attention: Katelyn Nero**

Golder Associates Ltd  
 6925 Century Ave  
 Suite 100  
 Mississauga, ON  
 CANADA L5N 7K2

**Report Date: 2021/08/24**  
 Report #: R6780356  
 Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1M7958**

**Received: 2021/08/12, 08:44**

Sample Matrix: Soil  
 # Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Methylnaphthalene Sum	5	N/A	2021/08/19	CAM SOP-00301	EPA 8270D m
ABN Compounds in SPLP Leachates	2	2021/08/19	2021/08/20	CAM SOP-00301	EPA 8270 m
Hot Water Extractable Boron	5	2021/08/17	2021/08/18	CAM SOP-00408	R153 Ana. Prot. 2011
1,3-Dichloropropene Sum	5	N/A	2021/08/16		EPA 8260C m
Chloride (20:1 extract)	1	2021/08/17	2021/08/18	CAM SOP-00463	SM 23 4500-Cl E m
Free (WAD) Cyanide	5	2021/08/17	2021/08/18	CAM SOP-00457	OMOE E3015 m
Cyanide (WAD) in Leachates	1	N/A	2021/08/19	CAM SOP-00457	OMOE 3015 m
Conductivity	4	2021/08/18	2021/08/19	CAM SOP-00414	OMOE E3530 v1 m
Conductivity	1	2021/08/19	2021/08/19	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	5	2021/08/17	2021/08/20	CAM SOP-00436	EPA 3060/7199 m
Dinitrotoluene Sum	2	N/A	2021/08/20	CAM SOP - 00301	EPA 8270
Petroleum Hydrocarbons F2-F4 in Soil (2)	5	2021/08/16	2021/08/16	CAM SOP-00316	CCME CWS m
Fluoride by ISE in Leachates	1	2021/08/19	2021/08/19	CAM SOP-00449	SM 23 4500-F- C m
Acid Extractable Metals by ICPMS	5	2021/08/17	2021/08/20	CAM SOP-00447	EPA 6020B m
Total Metals in TCLP Leachate by ICPMS	1	2021/08/19	2021/08/19	CAM SOP-00447	EPA 6020B m
Ignitability of a Sample	1	2021/08/18	2021/08/18	CAM SOP-00432	EPA 1030 Rev. 1 m
Moisture	5	N/A	2021/08/14	CAM SOP-00445	Carter 2nd ed 51.2 m
Modified SPLP extraction - pH	2	N/A	2021/08/18	CAM SOP-00941	OMOECPLaSB E9003 R3
Modified SPLP extraction - Weight	2	N/A	2021/08/18	CAM SOP-00941	OMOECPLaSB E9003 R3
Nitrate(NO3) + Nitrite(NO2) in Leachate	1	N/A	2021/08/19	CAM SOP-00440	SM 23 4500-NO3I/NO2B
PAH Compounds in Leachate by GC/MS (SIM)	1	2021/08/20	2021/08/21	CAM SOP-00318	EPA 8270D m
PAH Compounds in Soil by GC/MS (SIM)	5	2021/08/18	2021/08/19	CAM SOP-00318	EPA 8270D m
Polychlorinated Biphenyl in Soil	5	2021/08/17	2021/08/18	CAM SOP-00309	EPA 8082A m
pH CaCl2 EXTRACT	5	2021/08/18	2021/08/18	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	1	2021/08/13	2021/08/19	CAM SOP-00414	SM 23 2510 m
Sodium Adsorption Ratio (SAR)	5	N/A	2021/08/19	CAM SOP-00102	EPA 6010C
Sulphate (20:1 Extract)	1	2021/08/17	2021/08/18	CAM SOP-00464	EPA 375.4 m
TCLP Zero Headspace Extraction	1	2021/08/18	2021/08/19	CAM SOP-00430	EPA 1311 m
Volatile Organic Compounds and F1 PHCs	5	N/A	2021/08/15	CAM SOP-00230	EPA 8260C m
VOCs in ZHE Leachates	1	2021/08/19	2021/08/19	CAM SOP-00228	EPA 8260C m



Your Project #: 1530382/7000  
Site Location: QEW/DIXIE  
Your C.O.C. #: n/a

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/08/24**

Report #: R6780356

Version: 1 - Final

## **CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1M7958**

**Received: 2021/08/12, 08:44**

**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 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) Soils are reported on a dry weight basis unless otherwise specified.

(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.



Your Project #: 1530382/7000  
Site Location: QEW/DIXIE  
Your C.O.C. #: n/a

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/08/24**  
Report #: R6780356  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1M7958**  
**Received: 2021/08/12, 08:44**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Ema Gitej, Senior Project Manager  
Email: emese.gitej@bureauveritas.com  
Phone# (905)817-5829

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.





BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### SOIL CORROSIVITY PACKAGE (SOIL)

<b>BV Labs ID</b>		QIZ416		
<b>Sampling Date</b>		2021/07/27		
<b>COC Number</b>		n/a		
	<b>UNITS</b>	<b>21-28 SS4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>				
Resistivity	ohm-cm	1200		7519960
<b>Inorganics</b>				
Soluble (20:1) Chloride (Cl-)	ug/g	360	20	7524801
Soluble (20:1) Sulphate (SO4)	ug/g	47	20	7524788
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				

BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

**O.REG 406 EXCESS SOIL BULK INORGANICS (SOIL)**

BV Labs ID		QIZ412		QIZ413		QIZ414		QIZ416		
Sampling Date		2021/07/28		2021/07/28		2021/07/28		2021/07/27		
COC Number		n/a		n/a		n/a		n/a		
	UNITS	21-38 SS2	QC Batch	21-41 SS4	QC Batch	21-43 SS2	QC Batch	21-28 SS4	RDL	QC Batch

Calculated Parameters										
Sodium Adsorption Ratio	N/A	8.7	7519910	2.8	7519910	17	7519910	9.9		7519910
Inorganics										
Conductivity	mS/cm	0.54	7526828	0.24	7526847	1.0	7529161	0.86	0.002	7526828
Available (CaCl <sub>2</sub> ) pH	pH	7.72	7526262	7.96	7526262	7.66	7526262	7.30		7526262
WAD Cyanide (Free)	ug/g	<0.01	7525112	<0.01	7525112	<0.01	7525112	<0.01	0.01	7525112
Chromium (VI)	ug/g	<0.18	7525281	<0.18	7525281	<0.18	7525281	<0.18	0.18	7525281
Metals										
Hot Water Ext. Boron (B)	ug/g	0.050	7524512	0.087	7524512	0.056	7524512	0.80	0.050	7524512
Acid Extractable Antimony (Sb)	ug/g	<0.20	7524494	<0.20	7524494	<0.20	7524494	<0.20	0.20	7524494
Acid Extractable Arsenic (As)	ug/g	<1.0	7524494	4.1	7524494	<1.0	7524494	3.2	1.0	7524494
Acid Extractable Barium (Ba)	ug/g	5.6	7524494	26	7524494	11	7524494	81	0.50	7524494
Acid Extractable Beryllium (Be)	ug/g	<0.20	7524494	0.37	7524494	0.20	7524494	0.52	0.20	7524494
Acid Extractable Boron (B)	ug/g	<5.0	7524494	6.1	7524494	<5.0	7524494	6.1	5.0	7524494
Acid Extractable Cadmium (Cd)	ug/g	<0.10	7524494	<0.10	7524494	<0.10	7524494	0.18	0.10	7524494
Acid Extractable Chromium (Cr)	ug/g	8.2	7524494	12	7524494	10	7524494	14	1.0	7524494
Acid Extractable Cobalt (Co)	ug/g	1.9	7524494	6.2	7524494	2.1	7524494	8.6	0.10	7524494
Acid Extractable Copper (Cu)	ug/g	5.3	7524494	48	7524494	3.8	7524494	12	0.50	7524494
Acid Extractable Lead (Pb)	ug/g	2.6	7524494	8.8	7524494	2.8	7524494	4.3	1.0	7524494
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	7524494	<0.50	7524494	<0.50	7524494	<0.50	0.50	7524494
Acid Extractable Nickel (Ni)	ug/g	4.0	7524494	16	7524494	4.7	7524494	13	0.50	7524494
Acid Extractable Selenium (Se)	ug/g	<0.50	7524494	<0.50	7524494	<0.50	7524494	<0.50	0.50	7524494
Acid Extractable Silver (Ag)	ug/g	<0.20	7524494	<0.20	7524494	<0.20	7524494	<0.20	0.20	7524494
Acid Extractable Thallium (Tl)	ug/g	<0.050	7524494	0.14	7524494	<0.050	7524494	0.073	0.050	7524494
Acid Extractable Uranium (U)	ug/g	0.42	7524494	0.43	7524494	0.41	7524494	0.54	0.050	7524494
Acid Extractable Vanadium (V)	ug/g	19	7524494	19	7524494	23	7524494	29	5.0	7524494
Acid Extractable Zinc (Zn)	ug/g	9.8	7524494	46	7524494	9.9	7524494	48	5.0	7524494
Acid Extractable Mercury (Hg)	ug/g	<0.050	7524494	<0.050	7524494	<0.050	7524494	<0.050	0.050	7524494
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										

BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

**O.REG 406 EXCESS SOIL BULK INORGANICS (SOIL)**

BV Labs ID		QIZ416			QIZ418			QIZ418		
Sampling Date		2021/07/27			2021/08/10			2021/08/10		
COC Number		n/a			n/a			n/a		
	UNITS	21-28 SS4 Lab-Dup	RDL	QC Batch	21-31 SS3	RDL	QC Batch	21-31 SS3 Lab-Dup	RDL	QC Batch

Calculated Parameters										
Sodium Adsorption Ratio	N/A				8.4		7519910			
Inorganics										
Conductivity	mS/cm				0.42	0.002	7526828			
Available (CaCl <sub>2</sub> ) pH	pH				8.02		7526262			
WAD Cyanide (Free)	ug/g				<0.01	0.01	7525112			
Chromium (VI)	ug/g				<0.18	0.18	7525281			
Metals										
Hot Water Ext. Boron (B)	ug/g	0.76	0.050	7524512	<0.050	0.050	7524512			
Acid Extractable Antimony (Sb)	ug/g				<0.20	0.20	7524494	<0.20	0.20	7524494
Acid Extractable Arsenic (As)	ug/g				<1.0	1.0	7524494	<1.0	1.0	7524494
Acid Extractable Barium (Ba)	ug/g				5.5	0.50	7524494	5.2	0.50	7524494
Acid Extractable Beryllium (Be)	ug/g				<0.20	0.20	7524494	<0.20	0.20	7524494
Acid Extractable Boron (B)	ug/g				<5.0	5.0	7524494	<5.0	5.0	7524494
Acid Extractable Cadmium (Cd)	ug/g				<0.10	0.10	7524494	<0.10	0.10	7524494
Acid Extractable Chromium (Cr)	ug/g				7.6	1.0	7524494	8.8	1.0	7524494
Acid Extractable Cobalt (Co)	ug/g				1.8	0.10	7524494	1.9	0.10	7524494
Acid Extractable Copper (Cu)	ug/g				5.3	0.50	7524494	5.2	0.50	7524494
Acid Extractable Lead (Pb)	ug/g				2.4	1.0	7524494	2.5	1.0	7524494
Acid Extractable Molybdenum (Mo)	ug/g				<0.50	0.50	7524494	<0.50	0.50	7524494
Acid Extractable Nickel (Ni)	ug/g				3.8	0.50	7524494	3.9	0.50	7524494
Acid Extractable Selenium (Se)	ug/g				<0.50	0.50	7524494	<0.50	0.50	7524494
Acid Extractable Silver (Ag)	ug/g				<0.20	0.20	7524494	<0.20	0.20	7524494
Acid Extractable Thallium (Tl)	ug/g				<0.050	0.050	7524494	<0.050	0.050	7524494
Acid Extractable Uranium (U)	ug/g				0.34	0.050	7524494	0.37	0.050	7524494
Acid Extractable Vanadium (V)	ug/g				22	5.0	7524494	29	5.0	7524494
Acid Extractable Zinc (Zn)	ug/g				8.5	5.0	7524494	9.2	5.0	7524494
Acid Extractable Mercury (Hg)	ug/g				<0.050	0.050	7524494	<0.050	0.050	7524494
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### O.REG 406 EXCESS SOIL BULK PAHS (SOIL)

BV Labs ID		QIZ412	QIZ413	QIZ414	QIZ416	QIZ418		
Sampling Date		2021/07/28	2021/07/28	2021/07/28	2021/07/27	2021/08/10		
COC Number		n/a	n/a	n/a	n/a	n/a		
	UNITS	21-38 SS2	21-41 SS4	21-43 SS2	21-28 SS4	21-31 SS3	RDL	QC Batch
<b>Calculated Parameters</b>								
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	0.0071	7519431
<b>Polyaromatic Hydrocarbons</b>								
Acenaphthene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Acenaphthylene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Anthracene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Benzo(a)anthracene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Benzo(a)pyrene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Benzo(b,j)fluoranthene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Benzo(g,h,i)perylene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Benzo(k)fluoranthene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Chrysene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Dibenzo(a,h)anthracene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Fluoranthene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Fluorene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
1-Methylnaphthalene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
2-Methylnaphthalene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Naphthalene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Phenanthrene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Pyrene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
Biphenyl	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7527453
<b>Surrogate Recovery (%)</b>								
D10-Anthracene	%	88	82	90	81	89		7527453
D14-Terphenyl (FS)	%	86	83	88	82	87		7527453
D8-Acenaphthylene	%	78	75	80	76	78		7527453
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### O.REG 406 EXCESS SOIL BULK VOCS/F1-F4 (SOIL)

BV Labs ID		QIZ412	QIZ413	QIZ414	QIZ416	QIZ418		
Sampling Date		2021/07/28	2021/07/28	2021/07/28	2021/07/27	2021/08/10		
COC Number		n/a	n/a	n/a	n/a	n/a		
	UNITS	21-38 SS2	21-41 SS4	21-43 SS2	21-28 SS4	21-31 SS3	RDL	QC Batch
<b>Inorganics</b>								
Moisture	%	13	9.2	7.2	19	10	1.0	7520880
<b>Calculated Parameters</b>								
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	7519432
<b>Volatile Organics</b>								
Acetone (2-Propanone)	ug/g	<0.49	<0.49	<0.49	<0.49	<0.49	0.49	7520799
Benzene	ug/g	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060	0.0060	7520799
Bromodichloromethane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Bromoform	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Bromomethane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Carbon Tetrachloride	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Chlorobenzene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Chloroform	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Dibromochloromethane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
1,2-Dichlorobenzene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
1,3-Dichlorobenzene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
1,4-Dichlorobenzene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Dichlorodifluoromethane (FREON 12)	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
1,1-Dichloroethane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
1,2-Dichloroethane	ug/g	<0.049	<0.049	<0.049	<0.049	<0.049	0.049	7520799
1,1-Dichloroethylene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
cis-1,2-Dichloroethylene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
trans-1,2-Dichloroethylene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
1,2-Dichloropropane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
cis-1,3-Dichloropropene	ug/g	<0.030	<0.030	<0.030	<0.030	<0.030	0.030	7520799
trans-1,3-Dichloropropene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Ethylbenzene	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7520799
Ethylene Dibromide	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Hexane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Methylene Chloride(Dichloromethane)	ug/g	<0.049	<0.049	<0.049	<0.049	<0.049	0.049	7520799
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	7520799
Methyl Isobutyl Ketone	ug/g	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	7520799
Methyl t-butyl ether (MTBE)	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### O.REG 406 EXCESS SOIL BULK VOCS/F1-F4 (SOIL)

BV Labs ID		QIZ412	QIZ413	QIZ414	QIZ416	QIZ418		
Sampling Date		2021/07/28	2021/07/28	2021/07/28	2021/07/27	2021/08/10		
COC Number		n/a	n/a	n/a	n/a	n/a		
	UNITS	21-38 SS2	21-41 SS4	21-43 SS2	21-28 SS4	21-31 SS3	RDL	QC Batch
Styrene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
1,1,1,2-Tetrachloroethane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
1,1,2,2-Tetrachloroethane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Tetrachloroethylene	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Toluene	ug/g	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	7520799
1,1,1-Trichloroethane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
1,1,2-Trichloroethane	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Trichloroethylene	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7520799
Trichlorofluoromethane (FREON 11)	ug/g	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	7520799
Vinyl Chloride	ug/g	<0.019	<0.019	<0.019	<0.019	<0.019	0.019	7520799
p+m-Xylene	ug/g	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	7520799
o-Xylene	ug/g	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	7520799
Total Xylenes	ug/g	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	7520799
F1 (C6-C10)	ug/g	<10	<10	<10	<10	<10	10	7520799
F1 (C6-C10) - BTEX	ug/g	<10	<10	<10	<10	<10	10	7520799
<b>F2-F4 Hydrocarbons</b>								
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	<10	<10	<10	10	7521396
F3 (C16-C34 Hydrocarbons)	ug/g	<50	<50	<50	<50	<50	50	7521396
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	<50	<50	<50	50	7521396
Reached Baseline at C50	ug/g	Yes	Yes	Yes	Yes	Yes		7521396
<b>Surrogate Recovery (%)</b>								
o-Terphenyl	%	84	87	85	88	87		7521396
4-Bromofluorobenzene	%	83	86	84	85	83		7520799
D10-o-Xylene	%	76	72	66	68	70		7520799
D4-1,2-Dichloroethane	%	98	98	99	99	100		7520799
D8-Toluene	%	96	96	96	95	95		7520799
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### O.REG 406 EXCESS SOIL SPLP ABNS (SOIL)

BV Labs ID		QIZ415	QIZ419		
Sampling Date		2021/07/28	2021/08/10		
COC Number		n/a	n/a		
	UNITS	21-43 SS3	21-31 SS2	RDL	QC Batch
<b>Semivolatile Organics</b>					
Leachable (SPLP) Bis(2-chloroethyl)ether	ug/L	<2.0	<2.0	2.0	7530287
Leachable (SPLP) Bis(2-chloroisopropyl)ether	ug/L	<2.0	<2.0	2.0	7530287
Leachable (SPLP) p-Chloroaniline	ug/L	<5.0	<5.0	5.0	7530287
Leachable (SPLP) 3,3'-Dichlorobenzidine	ug/L	<0.40	<0.40	0.40	7530287
Leachable (SPLP) Diethyl phthalate	ug/L	<1.0	<1.0	1.0	7530287
Leachable (SPLP) Dimethyl phthalate	ug/L	<1.0	<1.0	1.0	7530287
Leachable (SPLP) 2,4-Dinitrophenol	ug/L	<5.0	<5.0	5.0	7530287
Leachable (SPLP) 2,4-Dinitrotoluene	ug/L	<3.0	<3.0	3.0	7530287
Leachable (SPLP) 2,6-Dinitrotoluene	ug/L	<3.0	<3.0	3.0	7530287
Leachable (SPLP) 2,4,6-Trichlorophenol	ug/L	<0.70	<0.70	0.70	7530287
<b>Calculated Parameters</b>					
Leachable 2,4- & 2,6-Dinitrotoluene	ug/L	<4.2	<4.2	4.2	7519958
<b>Surrogate Recovery (%)</b>					
Leachable (SPLP) 2,4,6-Tribromophenol	%	85	87		7530287
Leachable (SPLP) 2-Fluorobiphenyl	%	72	75		7530287
Leachable (SPLP) D14-Terphenyl (FS)	%	84	85		7530287
Leachable (SPLP) D5-Nitrobenzene	%	78	81		7530287
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### O.REG 406 EXCESS SOIL SPLP PREP (SOIL)

<b>BV Labs ID</b>		QIZ415	QIZ419	
<b>Sampling Date</b>		2021/07/28	2021/08/10	
<b>COC Number</b>		n/a	n/a	
	<b>UNITS</b>	<b>21-43 SS3</b>	<b>21-31 SS2</b>	<b>QC Batch</b>
<b>Inorganics</b>				
Dry Weight	g	100	100	7524553
Final pH	pH	9.56	9.07	7524537
QC Batch = Quality Control Batch				





BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### O.REG 153 PCBS (SOIL)

BV Labs ID		QIZ412	QIZ413	QIZ414	QIZ416	QIZ418		
Sampling Date		2021/07/28	2021/07/28	2021/07/28	2021/07/27	2021/08/10		
COC Number		n/a	n/a	n/a	n/a	n/a		
	UNITS	21-38 SS2	21-41 SS4	21-43 SS2	21-28 SS4	21-31 SS3	RDL	QC Batch
<b>PCBs</b>								
Aroclor 1242	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7524760
Aroclor 1248	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7524760
Aroclor 1254	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7524760
Aroclor 1260	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7524760
Total PCB	ug/g	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7524760
<b>Surrogate Recovery (%)</b>								
Decachlorobiphenyl	%	99	111	107	109	122		7524760
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### O.REG 558 TCLP BENZO(A)PYRENE

<b>BV Labs ID</b>		QIZ417		
<b>Sampling Date</b>		2021/08/10		
<b>COC Number</b>		n/a		
	<b>UNITS</b>	<b>21-31 SS4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Polyaromatic Hydrocarbons</b>				
Leachable Benzo(a)pyrene	ug/L	<0.10	0.10	7533860
<b>Surrogate Recovery (%)</b>				
Leachable D10-Anthracene	%	108		7533860
Leachable D14-Terphenyl (FS)	%	95		7533860
Leachable D8-Acenaphthylene	%	93		7533860
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### O.REG 558 TCLP INORGANICS PACKAGE (SOIL)

<b>BV Labs ID</b>		QIZ417		
<b>Sampling Date</b>		2021/08/10		
<b>COC Number</b>		n/a		
	<b>UNITS</b>	<b>21-31 SS4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Inorganics</b>				
Leachable Fluoride (F-)	mg/L	0.19	0.10	7529414
Leachable WAD Cyanide (Free)	mg/L	<0.010	0.010	7529419
Leachable Nitrite (N)	mg/L	<0.10	0.10	7529420
Leachable Nitrate (N)	mg/L	<1.0	1.0	7529420
Leachable Nitrate + Nitrite (N)	mg/L	<1.0	1.0	7529420
<b>Metals</b>				
Leachable Arsenic (As)	mg/L	<0.2	0.2	7529507
Leachable Barium (Ba)	mg/L	0.3	0.2	7529507
Leachable Boron (B)	mg/L	0.1	0.1	7529507
Leachable Cadmium (Cd)	mg/L	<0.05	0.05	7529507
Leachable Chromium (Cr)	mg/L	<0.1	0.1	7529507
Leachable Lead (Pb)	mg/L	<0.1	0.1	7529507
Leachable Mercury (Hg)	mg/L	<0.001	0.001	7529507
Leachable Selenium (Se)	mg/L	<0.1	0.1	7529507
Leachable Silver (Ag)	mg/L	<0.01	0.01	7529507
Leachable Uranium (U)	mg/L	<0.01	0.01	7529507
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### O.REG 558 TCLP VOCs BY HS (SOIL)

<b>BV Labs ID</b>		QIZ417		
<b>Sampling Date</b>		2021/08/10		
<b>COC Number</b>		n/a		
	<b>UNITS</b>	<b>21-31 SS4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Charge/Prep Analysis</b>				
Amount Extracted (Wet Weight) (g)	N/A	25	N/A	7527082
<b>Volatile Organics</b>				
Leachable Benzene	mg/L	<0.020	0.020	7529246
Leachable Carbon Tetrachloride	mg/L	<0.020	0.020	7529246
Leachable Chlorobenzene	mg/L	<0.020	0.020	7529246
Leachable Chloroform	mg/L	<0.020	0.020	7529246
Leachable 1,2-Dichlorobenzene	mg/L	<0.050	0.050	7529246
Leachable 1,4-Dichlorobenzene	mg/L	<0.050	0.050	7529246
Leachable 1,2-Dichloroethane	mg/L	<0.050	0.050	7529246
Leachable 1,1-Dichloroethylene	mg/L	<0.020	0.020	7529246
Leachable Methylene Chloride(Dichloromethane)	mg/L	<0.20	0.20	7529246
Leachable Methyl Ethyl Ketone (2-Butanone)	mg/L	<1.0	1.0	7529246
Leachable Tetrachloroethylene	mg/L	<0.020	0.020	7529246
Leachable Trichloroethylene	mg/L	<0.020	0.020	7529246
Leachable Vinyl Chloride	mg/L	<0.020	0.020	7529246
<b>Surrogate Recovery (%)</b>				
Leachable 4-Bromofluorobenzene	%	93		7529246
Leachable D4-1,2-Dichloroethane	%	109		7529246
Leachable D8-Toluene	%	98		7529246
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable				



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### MISCELLANEOUS (SOIL)

<b>BV Labs ID</b>		QIZ417	
<b>Sampling Date</b>		2021/08/10	
<b>COC Number</b>		n/a	
	<b>UNITS</b>	<b>21-31 SS4</b>	<b>QC Batch</b>
<b>Inorganics</b>			
Ignitability	N/A	NF/NI	7527017
QC Batch = Quality Control Batch			



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

## TEST SUMMARY

**BV Labs ID:** QIZ412  
**Sample ID:** 21-38 SS2  
**Matrix:** Soil

**Collected:** 2021/07/28  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7519431	N/A	2021/08/19	Automated Statchk
Hot Water Extractable Boron	ICP	7524512	2021/08/17	2021/08/18	Jolly John
1,3-Dichloropropene Sum	CALC	7519432	N/A	2021/08/16	Automated Statchk
Free (WAD) Cyanide	TECH	7525112	2021/08/17	2021/08/18	Louise Harding
Conductivity	AT	7526828	2021/08/18	2021/08/19	Massarat Jan
Hexavalent Chromium in Soil by IC	IC/SPEC	7525281	2021/08/17	2021/08/20	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7521396	2021/08/16	2021/08/16	Dennis Ngundu
Acid Extractable Metals by ICPMS	ICP/MS	7524494	2021/08/17	2021/08/20	Viviana Canzonieri
Moisture	BAL	7520880	N/A	2021/08/14	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7527453	2021/08/18	2021/08/19	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7524760	2021/08/17	2021/08/18	Svitlana Shaula
pH CaCl2 EXTRACT	AT	7526262	2021/08/18	2021/08/18	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7519910	N/A	2021/08/19	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7520799	N/A	2021/08/15	Xueming Jiang

**BV Labs ID:** QIZ413  
**Sample ID:** 21-41 SS4  
**Matrix:** Soil

**Collected:** 2021/07/28  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7519431	N/A	2021/08/19	Automated Statchk
Hot Water Extractable Boron	ICP	7524512	2021/08/17	2021/08/18	Jolly John
1,3-Dichloropropene Sum	CALC	7519432	N/A	2021/08/16	Automated Statchk
Free (WAD) Cyanide	TECH	7525112	2021/08/17	2021/08/18	Louise Harding
Conductivity	AT	7526847	2021/08/18	2021/08/19	Massarat Jan
Hexavalent Chromium in Soil by IC	IC/SPEC	7525281	2021/08/17	2021/08/20	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7521396	2021/08/16	2021/08/16	Dennis Ngundu
Acid Extractable Metals by ICPMS	ICP/MS	7524494	2021/08/17	2021/08/20	Viviana Canzonieri
Moisture	BAL	7520880	N/A	2021/08/14	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7527453	2021/08/18	2021/08/19	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7524760	2021/08/17	2021/08/18	Svitlana Shaula
pH CaCl2 EXTRACT	AT	7526262	2021/08/18	2021/08/18	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7519910	N/A	2021/08/19	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7520799	N/A	2021/08/15	Xueming Jiang

**BV Labs ID:** QIZ414  
**Sample ID:** 21-43 SS2  
**Matrix:** Soil

**Collected:** 2021/07/28  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7519431	N/A	2021/08/19	Automated Statchk
Hot Water Extractable Boron	ICP	7524512	2021/08/17	2021/08/18	Jolly John
1,3-Dichloropropene Sum	CALC	7519432	N/A	2021/08/16	Automated Statchk
Free (WAD) Cyanide	TECH	7525112	2021/08/17	2021/08/18	Louise Harding



BV Labs Job #: C1M7958  
Report Date: 2021/08/24

Golder Associates Ltd  
Client Project #: 1530382/7000  
Site Location: QEW/DIXIE  
Sampler Initials: KN

## TEST SUMMARY

**BV Labs ID:** QIZ414  
**Sample ID:** 21-43 SS2  
**Matrix:** Soil

**Collected:** 2021/07/28  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	7529161	2021/08/19	2021/08/19	Massarat Jan
Hexavalent Chromium in Soil by IC	IC/SPEC	7525281	2021/08/17	2021/08/20	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7521396	2021/08/16	2021/08/16	Dennis Ngundu
Acid Extractable Metals by ICPMS	ICP/MS	7524494	2021/08/17	2021/08/20	Viviana Canzonieri
Moisture	BAL	7520880	N/A	2021/08/14	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7527453	2021/08/18	2021/08/19	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7524760	2021/08/17	2021/08/18	Svitlana Shaula
pH CaCl2 EXTRACT	AT	7526262	2021/08/18	2021/08/18	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7519910	N/A	2021/08/19	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7520799	N/A	2021/08/15	Xueming Jiang

**BV Labs ID:** QIZ415  
**Sample ID:** 21-43 SS3  
**Matrix:** Soil

**Collected:** 2021/07/28  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in SPLP Leachates	GC/MS	7530287	2021/08/19	2021/08/20	Kathy Horvat
Dinitrotoluene Sum	CALC	7519958	N/A	2021/08/20	Automated Statchk
Modified SPLP extraction - pH	PH	7524537	N/A	2021/08/18	Omer Imtiaz Uddin
Modified SPLP extraction - Weight		7524553	N/A	2021/08/18	Omer Imtiaz Uddin

**BV Labs ID:** QIZ416  
**Sample ID:** 21-28 SS4  
**Matrix:** Soil

**Collected:** 2021/07/27  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7519431	N/A	2021/08/19	Automated Statchk
Hot Water Extractable Boron	ICP	7524512	2021/08/17	2021/08/18	Jolly John
1,3-Dichloropropene Sum	CALC	7519432	N/A	2021/08/16	Automated Statchk
Chloride (20:1 extract)	KONE/EC	7524801	2021/08/17	2021/08/18	Alina Dobreanu
Free (WAD) Cyanide	TECH	7525112	2021/08/17	2021/08/18	Louise Harding
Conductivity	AT	7526828	2021/08/18	2021/08/19	Massarat Jan
Hexavalent Chromium in Soil by IC	IC/SPEC	7525281	2021/08/17	2021/08/20	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7521396	2021/08/16	2021/08/16	Dennis Ngundu
Acid Extractable Metals by ICPMS	ICP/MS	7524494	2021/08/17	2021/08/20	Viviana Canzonieri
Moisture	BAL	7520880	N/A	2021/08/14	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7527453	2021/08/18	2021/08/19	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7524760	2021/08/17	2021/08/18	Svitlana Shaula
pH CaCl2 EXTRACT	AT	7526262	2021/08/18	2021/08/18	Neil Dassanayake
Resistivity of Soil		7519960	2021/08/19	2021/08/19	Automated Statchk
Sodium Adsorption Ratio (SAR)	CALC/MET	7519910	N/A	2021/08/19	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7524788	2021/08/17	2021/08/18	Avneet Kour Sudan
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7520799	N/A	2021/08/15	Xueming Jiang

BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

## TEST SUMMARY

**BV Labs ID:** QIZ416 Dup  
**Sample ID:** 21-28 SS4  
**Matrix:** Soil

**Collected:** 2021/07/27  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7524512	2021/08/17	2021/08/18	Jolly John

**BV Labs ID:** QIZ417  
**Sample ID:** 21-31 SS4  
**Matrix:** Soil

**Collected:** 2021/08/10  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cyanide (WAD) in Leachates	SKAL/CN	7529419	N/A	2021/08/19	Aditiben Patel
Fluoride by ISE in Leachates	ISE	7529414	2021/08/19	2021/08/19	Yogesh Patel
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	7529507	2021/08/19	2021/08/19	Nan Raykha
Ignitability of a Sample	BAL	7527017	2021/08/18	2021/08/18	Min Yang
Nitrate(NO3) + Nitrite(NO2) in Leachate	LACH	7529420	N/A	2021/08/19	Chandra Nandlal
PAH Compounds in Leachate by GC/MS (SIM)	GC/MS	7533860	2021/08/20	2021/08/21	Jonghan Yoon
TCLP Zero Headspace Extraction		7527082	2021/08/18	2021/08/19	Mohammed Abdul Nafay Shoeb
VOCs in ZHE Leachates	GC/MS	7529246	2021/08/19	2021/08/19	Ancheol Jeong

**BV Labs ID:** QIZ418  
**Sample ID:** 21-31 SS3  
**Matrix:** Soil

**Collected:** 2021/08/10  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7519431	N/A	2021/08/19	Automated Statchk
Hot Water Extractable Boron	ICP	7524512	2021/08/17	2021/08/18	Jolly John
1,3-Dichloropropene Sum	CALC	7519432	N/A	2021/08/16	Automated Statchk
Free (WAD) Cyanide	TECH	7525112	2021/08/17	2021/08/18	Louise Harding
Conductivity	AT	7526828	2021/08/18	2021/08/19	Massarat Jan
Hexavalent Chromium in Soil by IC	IC/SPEC	7525281	2021/08/17	2021/08/20	Rupinder Sihota
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7521396	2021/08/16	2021/08/16	Dennis Ngundu
Acid Extractable Metals by ICPMS	ICP/MS	7524494	2021/08/17	2021/08/20	Viviana Canzonieri
Moisture	BAL	7520880	N/A	2021/08/14	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7527453	2021/08/18	2021/08/19	Mitesh Raj
Polychlorinated Biphenyl in Soil	GC/ECD	7524760	2021/08/17	2021/08/18	Svitlana Shaula
pH CaCl2 EXTRACT	AT	7526262	2021/08/18	2021/08/18	Neil Dassanayake
Sodium Adsorption Ratio (SAR)	CALC/MET	7519910	N/A	2021/08/19	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7520799	N/A	2021/08/15	Xueming Jiang

**BV Labs ID:** QIZ418 Dup  
**Sample ID:** 21-31 SS3  
**Matrix:** Soil

**Collected:** 2021/08/10  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Acid Extractable Metals by ICPMS	ICP/MS	7524494	2021/08/17	2021/08/20	Viviana Canzonieri





BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

## TEST SUMMARY

**BV Labs ID:** QIZ419  
**Sample ID:** 21-31 SS2  
**Matrix:** Soil

**Collected:** 2021/08/10  
**Shipped:**  
**Received:** 2021/08/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in SPLP Leachates	GC/MS	7530287	2021/08/19	2021/08/20	Kathy Horvat
Dinitrotoluene Sum	CALC	7519958	N/A	2021/08/20	Automated Statchk
Modified SPLP extraction - pH	PH	7524537	N/A	2021/08/18	Omer Imtiaz Uddin
Modified SPLP extraction - Weight		7524553	N/A	2021/08/18	Omer Imtiaz Uddin



## GENERAL COMMENTS

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

Package 1	5.3°C
-----------	-------

Sampling date updated for samples 21-31 SS4, 21-31 SS3 and 21-31 SS2 as per client request.

Sample QIZ417 [21-31 SS4] : NF/Ni = Non Flammable and Non Ignitable

**Results relate only to the items tested.**

BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

## QUALITY ASSURANCE REPORT

Golder Associates Ltd  
 Client Project #: 1530382/7000  
 Site Location: QEW/DIXIE  
 Sampler Initials: KN

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7520799	4-Bromofluorobenzene	2021/08/15	107	60 - 140	107	60 - 140	86	%				
7520799	D10-o-Xylene	2021/08/15	84	60 - 130	82	60 - 130	71	%				
7520799	D4-1,2-Dichloroethane	2021/08/15	95	60 - 140	96	60 - 140	98	%				
7520799	D8-Toluene	2021/08/15	102	60 - 140	101	60 - 140	96	%				
7521396	o-Terphenyl	2021/08/16	81	60 - 130	85	60 - 130	87	%				
7524760	Decachlorobiphenyl	2021/08/18	106	60 - 130	112	60 - 130	102	%				
7527453	D10-Anthracene	2021/08/19	82	50 - 130	88	50 - 130	86	%				
7527453	D14-Terphenyl (FS)	2021/08/19	83	50 - 130	87	50 - 130	82	%				
7527453	D8-Acenaphthylene	2021/08/19	76	50 - 130	85	50 - 130	78	%				
7529246	Leachable 4-Bromofluorobenzene	2021/08/19	98	70 - 130	98	70 - 130	95	%				
7529246	Leachable D4-1,2-Dichloroethane	2021/08/19	105	70 - 130	106	70 - 130	107	%				
7529246	Leachable D8-Toluene	2021/08/19	105	70 - 130	106	70 - 130	99	%				
7530287	Leachable (SPLP) 2,4,6-Tribromophenol	2021/08/20			109	30 - 130	89	%				
7530287	Leachable (SPLP) 2-Fluorobiphenyl	2021/08/20			82	30 - 130	77	%				
7530287	Leachable (SPLP) D14-Terphenyl (FS)	2021/08/20			91	30 - 130	83	%				
7530287	Leachable (SPLP) D5-Nitrobenzene	2021/08/20			87	30 - 130	86	%				
7533860	Leachable D10-Anthracene	2021/08/21	98	50 - 130	104	50 - 130	99	%				
7533860	Leachable D14-Terphenyl (FS)	2021/08/21	89	50 - 130	96	50 - 130	90	%				
7533860	Leachable D8-Acenaphthylene	2021/08/21	90	50 - 130	95	50 - 130	88	%				
7520799	1,1,1,2-Tetrachloroethane	2021/08/15	107	60 - 140	103	60 - 130	<0.040	ug/g	NC	50		
7520799	1,1,1-Trichloroethane	2021/08/15	101	60 - 140	97	60 - 130	<0.040	ug/g	NC	50		
7520799	1,1,2,2-Tetrachloroethane	2021/08/15	99	60 - 140	95	60 - 130	<0.040	ug/g	NC	50		
7520799	1,1,2-Trichloroethane	2021/08/15	99	60 - 140	95	60 - 130	<0.040	ug/g	NC	50		
7520799	1,1-Dichloroethane	2021/08/15	101	60 - 140	97	60 - 130	<0.040	ug/g	NC	50		
7520799	1,1-Dichloroethylene	2021/08/15	95	60 - 140	92	60 - 130	<0.040	ug/g	NC	50		
7520799	1,2-Dichlorobenzene	2021/08/15	99	60 - 140	96	60 - 130	<0.040	ug/g	NC	50		
7520799	1,2-Dichloroethane	2021/08/15	88	60 - 140	85	60 - 130	<0.049	ug/g	NC	50		
7520799	1,2-Dichloropropane	2021/08/15	93	60 - 140	90	60 - 130	<0.040	ug/g	NC	50		
7520799	1,3-Dichlorobenzene	2021/08/15	102	60 - 140	99	60 - 130	<0.040	ug/g	NC	50		
7520799	1,4-Dichlorobenzene	2021/08/15	107	60 - 140	104	60 - 130	<0.040	ug/g	NC	50		
7520799	Acetone (2-Propanone)	2021/08/15	89	60 - 140	85	60 - 140	<0.49	ug/g	NC	50		



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7520799	Benzene	2021/08/15	94	60 - 140	91	60 - 130	<0.0060	ug/g	NC	50		
7520799	Bromodichloromethane	2021/08/15	101	60 - 140	97	60 - 130	<0.040	ug/g	NC	50		
7520799	Bromoform	2021/08/15	102	60 - 140	97	60 - 130	<0.040	ug/g	NC	50		
7520799	Bromomethane	2021/08/15	111	60 - 140	107	60 - 140	<0.040	ug/g	NC	50		
7520799	Carbon Tetrachloride	2021/08/15	102	60 - 140	98	60 - 130	<0.040	ug/g	NC	50		
7520799	Chlorobenzene	2021/08/15	97	60 - 140	94	60 - 130	<0.040	ug/g	NC	50		
7520799	Chloroform	2021/08/15	101	60 - 140	97	60 - 130	<0.040	ug/g	NC	50		
7520799	cis-1,2-Dichloroethylene	2021/08/15	102	60 - 140	99	60 - 130	<0.040	ug/g	NC	50		
7520799	cis-1,3-Dichloropropene	2021/08/15	83	60 - 140	80	60 - 130	<0.030	ug/g	NC	50		
7520799	Dibromochloromethane	2021/08/15	97	60 - 140	93	60 - 130	<0.040	ug/g	NC	50		
7520799	Dichlorodifluoromethane (FREON 12)	2021/08/15	95	60 - 140	92	60 - 140	<0.040	ug/g	NC	50		
7520799	Ethylbenzene	2021/08/15	80	60 - 140	78	60 - 130	<0.010	ug/g	NC	50		
7520799	Ethylene Dibromide	2021/08/15	95	60 - 140	91	60 - 130	<0.040	ug/g	NC	50		
7520799	F1 (C6-C10) - BTEX	2021/08/15					<10	ug/g	NC	30		
7520799	F1 (C6-C10)	2021/08/15	84	60 - 140	96	80 - 120	<10	ug/g	NC	30		
7520799	Hexane	2021/08/15	96	60 - 140	93	60 - 130	<0.040	ug/g	NC	50		
7520799	Methyl Ethyl Ketone (2-Butanone)	2021/08/15	92	60 - 140	89	60 - 140	<0.40	ug/g	NC	50		
7520799	Methyl Isobutyl Ketone	2021/08/15	83	60 - 140	80	60 - 130	<0.40	ug/g	NC	50		
7520799	Methyl t-butyl ether (MTBE)	2021/08/15	81	60 - 140	78	60 - 130	<0.040	ug/g	NC	50		
7520799	Methylene Chloride(Dichloromethane)	2021/08/15	123	60 - 140	119	60 - 130	<0.049	ug/g	NC	50		
7520799	o-Xylene	2021/08/15	84	60 - 140	81	60 - 130	<0.020	ug/g	NC	50		
7520799	p+m-Xylene	2021/08/15	83	60 - 140	80	60 - 130	<0.020	ug/g	NC	50		
7520799	Styrene	2021/08/15	94	60 - 140	91	60 - 130	<0.040	ug/g	NC	50		
7520799	Tetrachloroethylene	2021/08/15	108	60 - 140	101	60 - 130	<0.040	ug/g	NC	50		
7520799	Toluene	2021/08/15	90	60 - 140	87	60 - 130	<0.020	ug/g	NC	50		
7520799	Total Xylenes	2021/08/15					<0.020	ug/g	NC	50		
7520799	trans-1,2-Dichloroethylene	2021/08/15	109	60 - 140	105	60 - 130	<0.040	ug/g	NC	50		
7520799	trans-1,3-Dichloropropene	2021/08/15	84	60 - 140	82	60 - 130	<0.040	ug/g	NC	50		
7520799	Trichloroethylene	2021/08/15	111	60 - 140	107	60 - 130	<0.010	ug/g	8.6	50		
7520799	Trichlorofluoromethane (FREON 11)	2021/08/15	105	60 - 140	101	60 - 130	<0.040	ug/g	NC	50		
7520799	Vinyl Chloride	2021/08/15	104	60 - 140	101	60 - 130	<0.019	ug/g	NC	50		



BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7520880	Moisture	2021/08/14							3.2	20		
7521396	F2 (C10-C16 Hydrocarbons)	2021/08/17	92	50 - 130	90	80 - 120	<10	ug/g	NC	30		
7521396	F3 (C16-C34 Hydrocarbons)	2021/08/17	88	50 - 130	90	80 - 120	<50	ug/g	NC	30		
7521396	F4 (C34-C50 Hydrocarbons)	2021/08/17	86	50 - 130	88	80 - 120	<50	ug/g	NC	30		
7524494	Acid Extractable Antimony (Sb)	2021/08/20	100	75 - 125	101	80 - 120	<0.20	ug/g	NC	30		
7524494	Acid Extractable Arsenic (As)	2021/08/20	100	75 - 125	100	80 - 120	<1.0	ug/g	NC	30		
7524494	Acid Extractable Barium (Ba)	2021/08/20	94	75 - 125	97	80 - 120	<0.50	ug/g	5.0	30		
7524494	Acid Extractable Beryllium (Be)	2021/08/20	100	75 - 125	97	80 - 120	<0.20	ug/g	NC	30		
7524494	Acid Extractable Boron (B)	2021/08/20	97	75 - 125	100	80 - 120	<5.0	ug/g	NC	30		
7524494	Acid Extractable Cadmium (Cd)	2021/08/20	99	75 - 125	96	80 - 120	<0.10	ug/g	NC	30		
7524494	Acid Extractable Chromium (Cr)	2021/08/20	103	75 - 125	99	80 - 120	<1.0	ug/g	14	30		
7524494	Acid Extractable Cobalt (Co)	2021/08/20	95	75 - 125	96	80 - 120	<0.10	ug/g	1.7	30		
7524494	Acid Extractable Copper (Cu)	2021/08/20	94	75 - 125	95	80 - 120	<0.50	ug/g	0.85	30		
7524494	Acid Extractable Lead (Pb)	2021/08/20	95	75 - 125	97	80 - 120	<1.0	ug/g	3.7	30		
7524494	Acid Extractable Mercury (Hg)	2021/08/20	92	75 - 125	92	80 - 120	<0.050	ug/g	NC	30		
7524494	Acid Extractable Molybdenum (Mo)	2021/08/20	102	75 - 125	101	80 - 120	<0.50	ug/g	NC	30		
7524494	Acid Extractable Nickel (Ni)	2021/08/20	100	75 - 125	105	80 - 120	<0.50	ug/g	2.1	30		
7524494	Acid Extractable Selenium (Se)	2021/08/20	101	75 - 125	104	80 - 120	<0.50	ug/g	NC	30		
7524494	Acid Extractable Silver (Ag)	2021/08/20	94	75 - 125	98	80 - 120	<0.20	ug/g	NC	30		
7524494	Acid Extractable Thallium (Tl)	2021/08/20	95	75 - 125	98	80 - 120	<0.050	ug/g	NC	30		
7524494	Acid Extractable Uranium (U)	2021/08/20	97	75 - 125	99	80 - 120	<0.050	ug/g	7.4	30		
7524494	Acid Extractable Vanadium (V)	2021/08/20	112	75 - 125	99	80 - 120	<5.0	ug/g	24	30		
7524494	Acid Extractable Zinc (Zn)	2021/08/20	103	75 - 125	112	80 - 120	<5.0	ug/g	8.8	30		
7524512	Hot Water Ext. Boron (B)	2021/08/18	110	75 - 125	97	75 - 125	<0.050	ug/g	5.9	40		
7524760	Aroclor 1242	2021/08/18					<0.010	ug/g	NC	50		
7524760	Aroclor 1248	2021/08/18					<0.010	ug/g	NC	50		
7524760	Aroclor 1254	2021/08/18					<0.010	ug/g	NC	50		
7524760	Aroclor 1260	2021/08/18	120	30 - 130	123	30 - 130	<0.010	ug/g	NC	50		
7524760	Total PCB	2021/08/18	120	30 - 130	123	30 - 130	<0.010	ug/g	NC	50		
7524788	Soluble (20:1) Sulphate (SO4)	2021/08/18	43	70 - 130	83	70 - 130	<20	ug/g	NC	35		
7524801	Soluble (20:1) Chloride (Cl-)	2021/08/18	109	70 - 130	105	70 - 130	<20	ug/g	19	35		

BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7525112	WAD Cyanide (Free)	2021/08/18	101	75 - 125	99	80 - 120	<0.01	ug/g	NC	35		
7525281	Chromium (VI)	2021/08/20	84	70 - 130	89	80 - 120	<0.18	ug/g	NC	35		
7526262	Available (CaCl2) pH	2021/08/18			100	97 - 103			0.89	N/A		
7526828	Conductivity	2021/08/19			98	90 - 110	<0.002	mS/cm	1.9	10		
7526847	Conductivity	2021/08/19			99	90 - 110	<0.002	mS/cm	0	10		
7527453	1-Methylnaphthalene	2021/08/19	91	50 - 130	92	50 - 130	<0.0050	ug/g	NC	40		
7527453	2-Methylnaphthalene	2021/08/19	89	50 - 130	90	50 - 130	<0.0050	ug/g	NC	40		
7527453	Acenaphthene	2021/08/19	85	50 - 130	87	50 - 130	<0.0050	ug/g	NC	40		
7527453	Acenaphthylene	2021/08/19	80	50 - 130	83	50 - 130	<0.0050	ug/g	NC	40		
7527453	Anthracene	2021/08/19	89	50 - 130	89	50 - 130	<0.0050	ug/g	NC	40		
7527453	Benzo(a)anthracene	2021/08/19	96	50 - 130	97	50 - 130	<0.0050	ug/g	NC	40		
7527453	Benzo(a)pyrene	2021/08/19	82	50 - 130	84	50 - 130	<0.0050	ug/g	NC	40		
7527453	Benzo(b/j)fluoranthene	2021/08/19	86	50 - 130	90	50 - 130	<0.0050	ug/g	NC	40		
7527453	Benzo(g,h,i)perylene	2021/08/19	82	50 - 130	84	50 - 130	<0.0050	ug/g	NC	40		
7527453	Benzo(k)fluoranthene	2021/08/19	92	50 - 130	92	50 - 130	<0.0050	ug/g	NC	40		
7527453	Biphenyl	2021/08/19	89	50 - 130	89	50 - 130	<0.0050	ug/g				
7527453	Chrysene	2021/08/19	94	50 - 130	95	50 - 130	<0.0050	ug/g	NC	40		
7527453	Dibenzo(a,h)anthracene	2021/08/19	87	50 - 130	87	50 - 130	<0.0050	ug/g	NC	40		
7527453	Fluoranthene	2021/08/19	96	50 - 130	96	50 - 130	<0.0050	ug/g	NC	40		
7527453	Fluorene	2021/08/19	90	50 - 130	91	50 - 130	<0.0050	ug/g	NC	40		
7527453	Indeno(1,2,3-cd)pyrene	2021/08/19	88	50 - 130	89	50 - 130	<0.0050	ug/g	NC	40		
7527453	Naphthalene	2021/08/19	76	50 - 130	81	50 - 130	<0.0050	ug/g	NC	40		
7527453	Phenanthrene	2021/08/19	89	50 - 130	90	50 - 130	<0.0050	ug/g	NC	40		
7527453	Pyrene	2021/08/19	94	50 - 130	94	50 - 130	<0.0050	ug/g	NC	40		
7529161	Conductivity	2021/08/19			100	90 - 110	<0.002	mS/cm	1.7	10		
7529246	Leachable 1,1-Dichloroethylene	2021/08/19	99	70 - 130	99	70 - 130	<0.020	mg/L	NC	30		
7529246	Leachable 1,2-Dichlorobenzene	2021/08/19	92	70 - 130	94	70 - 130	<0.050	mg/L	NC	30		
7529246	Leachable 1,2-Dichloroethane	2021/08/19	95	70 - 130	96	70 - 130	<0.050	mg/L	NC	30		
7529246	Leachable 1,4-Dichlorobenzene	2021/08/19	105	70 - 130	106	70 - 130	<0.050	mg/L	NC	30		
7529246	Leachable Benzene	2021/08/19	90	70 - 130	90	70 - 130	<0.020	mg/L	NC	30		
7529246	Leachable Carbon Tetrachloride	2021/08/19	103	70 - 130	103	70 - 130	<0.020	mg/L	NC	30		

BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7529246	Leachable Chlorobenzene	2021/08/19	94	70 - 130	94	70 - 130	<0.020	mg/L	NC	30		
7529246	Leachable Chloroform	2021/08/19	99	70 - 130	99	70 - 130	<0.020	mg/L	NC	30		
7529246	Leachable Methyl Ethyl Ketone (2-Butanone)	2021/08/19	104	60 - 140	98	60 - 140	<1.0	mg/L	NC	30		
7529246	Leachable Methylene Chloride (Dichloromethane)	2021/08/19	97	70 - 130	98	70 - 130	<0.20	mg/L	NC	30		
7529246	Leachable Tetrachloroethylene	2021/08/19	94	70 - 130	94	70 - 130	<0.020	mg/L	NC	30		
7529246	Leachable Trichloroethylene	2021/08/19	101	70 - 130	101	70 - 130	<0.020	mg/L	NC	30		
7529246	Leachable Vinyl Chloride	2021/08/19	98	70 - 130	99	70 - 130	<0.020	mg/L	NC	30		
7529414	Leachable Fluoride (F-)	2021/08/19	94	80 - 120	96	80 - 120	<0.10	mg/L	NC	25	<0.10	mg/L
7529419	Leachable WAD Cyanide (Free)	2021/08/19	101	80 - 120	101	80 - 120	<0.0020	mg/L	NC	20	<0.010	mg/L
7529420	Leachable Nitrate (N)	2021/08/19	66 (1)	80 - 120	95	80 - 120	<1.0	mg/L	NC	25	<1.0	mg/L
7529420	Leachable Nitrate + Nitrite (N)	2021/08/19	75 (1)	80 - 120	98	80 - 120	<1.0	mg/L	NC	25	<1.0	mg/L
7529420	Leachable Nitrite (N)	2021/08/19	110	80 - 120	107	80 - 120	<0.10	mg/L	NC	25	<0.10	mg/L
7529507	Leachable Arsenic (As)	2021/08/19	101	80 - 120	97	80 - 120	<0.2	mg/L	NC	35	<0.2	mg/L
7529507	Leachable Barium (Ba)	2021/08/19	107	80 - 120	103	80 - 120	<0.2	mg/L	NC	35	<0.2	mg/L
7529507	Leachable Boron (B)	2021/08/19	92	80 - 120	91	80 - 120	<0.1	mg/L	3.7	35	<0.1	mg/L
7529507	Leachable Cadmium (Cd)	2021/08/19	100	80 - 120	100	80 - 120	<0.05	mg/L	NC	35	<0.05	mg/L
7529507	Leachable Chromium (Cr)	2021/08/19	100	80 - 120	96	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L
7529507	Leachable Lead (Pb)	2021/08/19	96	80 - 120	98	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L
7529507	Leachable Mercury (Hg)	2021/08/19	98	80 - 120	103	80 - 120	<0.001	mg/L	NC	35	<0.001	mg/L
7529507	Leachable Selenium (Se)	2021/08/19	97	80 - 120	100	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L
7529507	Leachable Silver (Ag)	2021/08/19	94	80 - 120	97	80 - 120	<0.01	mg/L	NC	35	<0.01	mg/L
7529507	Leachable Uranium (U)	2021/08/19	94	80 - 120	95	80 - 120	<0.01	mg/L	NC	35	<0.01	mg/L
7530287	Leachable (SPLP) 2,4,6-Trichlorophenol	2021/08/20			91	10 - 130	<0.70	ug/L	7.8	40		
7530287	Leachable (SPLP) 2,4-Dinitrophenol	2021/08/20			96	10 - 130	<5.0	ug/L	2.4	40		
7530287	Leachable (SPLP) 2,4-Dinitrotoluene	2021/08/20			102	30 - 130	<3.0	ug/L	3.1	40		
7530287	Leachable (SPLP) 2,6-Dinitrotoluene	2021/08/20			98	30 - 130	<3.0	ug/L	5.8	40		
7530287	Leachable (SPLP) 3,3'-Dichlorobenzidine	2021/08/20			105	30 - 130	<0.40	ug/L	3.5	40		
7530287	Leachable (SPLP) Bis(2-chloroethyl)ether	2021/08/20			80	30 - 130	<2.0	ug/L	7.5	40		
7530287	Leachable (SPLP) Bis(2-chloroisopropyl)ether	2021/08/20			58	30 - 130	<2.0	ug/L	20	40		
7530287	Leachable (SPLP) Diethyl phthalate	2021/08/20			95	30 - 130	<1.0	ug/L	1.8	40		



BUREAU  
VERITAS

BV Labs Job #: C1M7958  
Report Date: 2021/08/24

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382/7000  
Site Location: QEW/DIXIE  
Sampler Initials: KN

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7530287	Leachable (SPLP) Dimethyl phthalate	2021/08/20			99	30 - 130	<1.0	ug/L	3.7	40		
7530287	Leachable (SPLP) p-Chloroaniline	2021/08/20			99	30 - 130	<5.0	ug/L	6.7	40		
7533860	Leachable Benzo(a)pyrene	2021/08/21	80	50 - 130	78	50 - 130	<0.10	ug/L				

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.

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

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 (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  $\leq 2 \times \text{RDL}$ ).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.





BUREAU  
VERITAS

BV Labs Job #: C1M7958

Report Date: 2021/08/24

Golder Associates Ltd

Client Project #: 1530382/7000

Site Location: QEW/DIXIE

Sampler Initials: KN

### VALIDATION SIGNATURE PAGE

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

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

Eva Pranjić, M.Sc., C.Chem, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



6740 Campobello Road, Mississauga, Ontario L5N 2L8  
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266  
CAM FCD-01191/6

## CHAIN OF CUSTODY RECORD

Page 1

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required												
Company Name: <b>Golder Associates LTD</b>		Company Name:		Quotation #:		<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses												
Contact Name: <b>Accounts Payable</b>		Contact Name: <b>Katie Nero</b>		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS												
Address: <b>6925 Century Ave Suite 100</b>		Address:		Project #: <b>1530382/7000</b>		Rush TAT (Surcharges will be applied)												
Mississauga ON L5N 7K2		Phone:		Site Location: <b>QEW/Dixie</b>		<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days												
Phone: <b>905-567-4444</b> Fax:		Fax:		Site #:		Date Required:												
Email: <b>AP_CustomerService@golder.com</b>		Email: <b>knero@golder.com</b>		Site Location Province:		Rush Confirmation #:												
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY				Sampled By: <b>KN</b>		LABORATORY USE ONLY												
<b>Regulation 153</b>		<b>Other Regulations</b>		<b>Analysis Requested</b>		<b>CUSTODY SEAL</b>												
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/ Fine		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw				<b>Y / N</b>												
<input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse		<input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw				<b>Present</b> <b>Intact</b>												
<input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/ Other		<input type="checkbox"/> PWUQ <input type="checkbox"/> Region				<b>N</b> <b>N</b>												
<input type="checkbox"/> Table _____		<input type="checkbox"/> Other (Specify) _____				<b>5/5/16</b>												
FOR RSC (PLEASE CIRCLE) <b>Y / N</b>		<input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED)				COOLING MEDIA PRESENT: <b>Y / N</b>												
<input type="checkbox"/> REG 406 Table _____		<input type="checkbox"/> REG 406 Table _____				<b>COMMENTS</b>												
Include Criteria on Certificate of Analysis: <b>Y / N</b>																		
SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS																		
SAMPLE IDENTIFICATION		DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / Cr VI	BTX/ PHC F1	PHCs P2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMs METALS	REG 153 METALS (Hg, Cr VI, ICPMs Metals, HWS - B)	REG 406/19	REG 406 SPUP	TCLP (VOC, TCLP Metals & Inorganics, TCLP Benzol(Dibylene, Ignitability)	Basic Soil Corrosivity Package	HOLD- DO NOT ANALYZE	
1	21-38 SS2	2021-07-28		SOIL	5								X					
2	21-41 SS4	2021-07-28		SOIL	5								X					
3	21-43 SS2	2021-07-28		SOIL	5								X					
4	21-43 SS3	2021-07-28		SOIL	2									X				
5	21-28 SS4	2021-07-27		SOIL	6								X			X		
6	21-31 SS4	2021-08-21		SOIL	1										X			
7	21-31 SS3	2021-08-21		SOIL	5								X					
8	21-31 SS2	2021-08-21		SOIL	2									X				
9																		
10																		
RELINQUISHED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)											
<b>Katie Nero</b>		<b>2021/10/12</b>	<b>8:40 AM</b>	<b>[Signature]</b>		<b>2021/08/12</b>	<b>0844</b>											

12-Aug-21 08:44

Ema Gitej

C1M7958

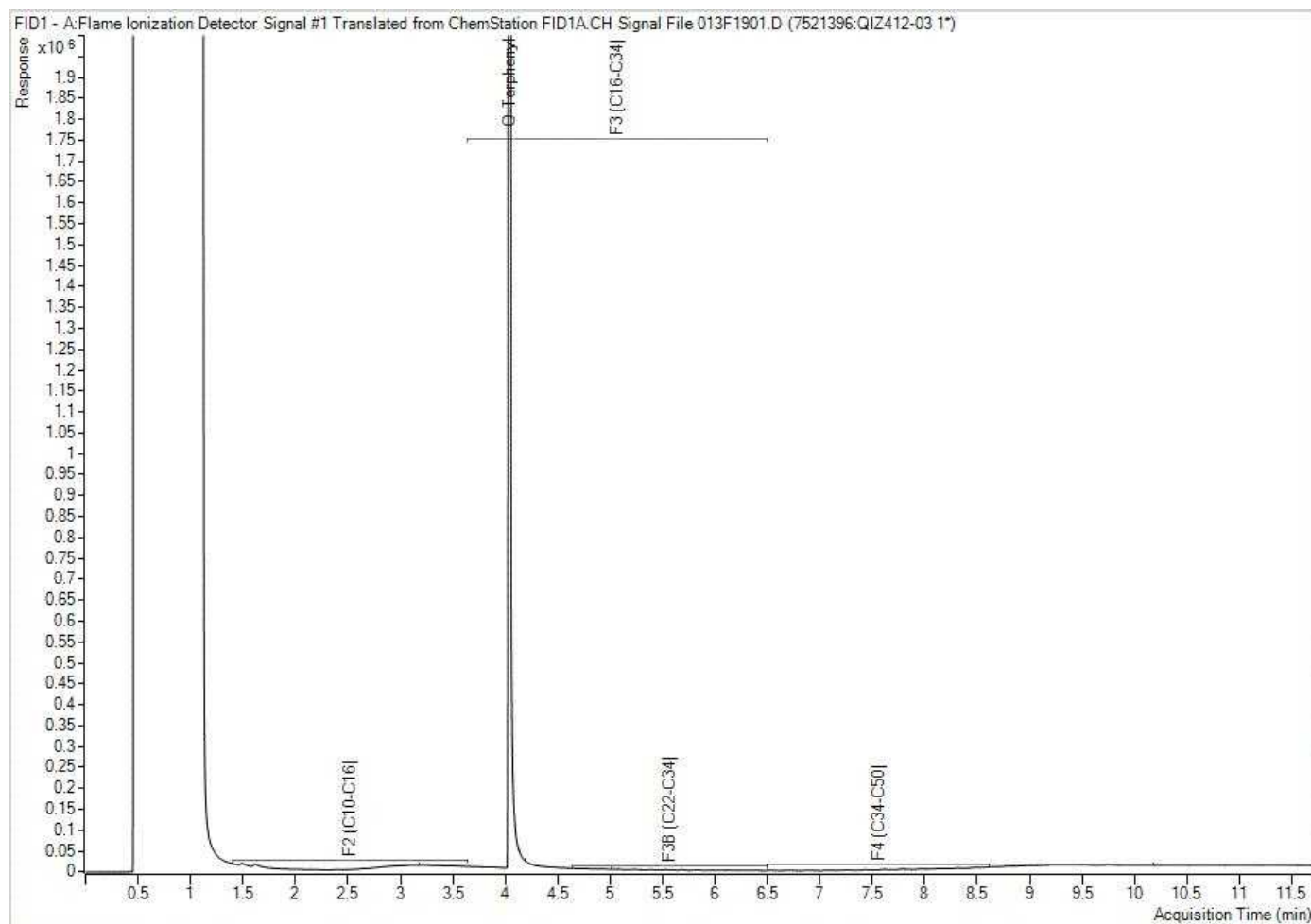
M2K

ENV-680

BV Labs Job #: C1M7958  
Report Date: 2021/08/24  
BV Labs Sample: QIZ412

Golder Associates Ltd  
Client Project #: 1530382/7000  
Project name: QEW/DIXIE  
Client ID: 21-38 SS2

**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**

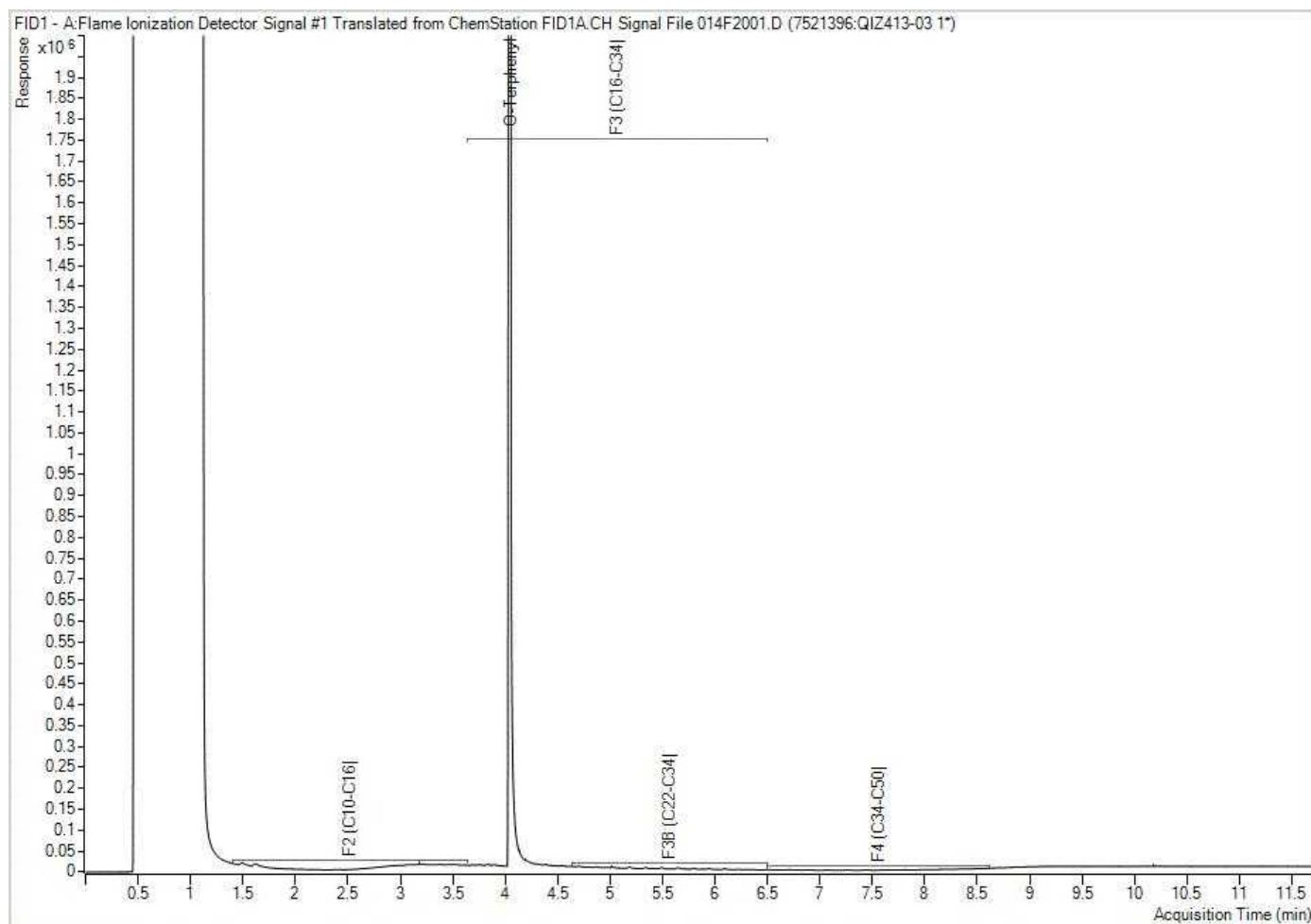


**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C1M7958  
Report Date: 2021/08/24  
BV Labs Sample: QIZ413

Golder Associates Ltd  
Client Project #: 1530382/7000  
Project name: QEW/DIXIE  
Client ID: 21-41 SS4

**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**

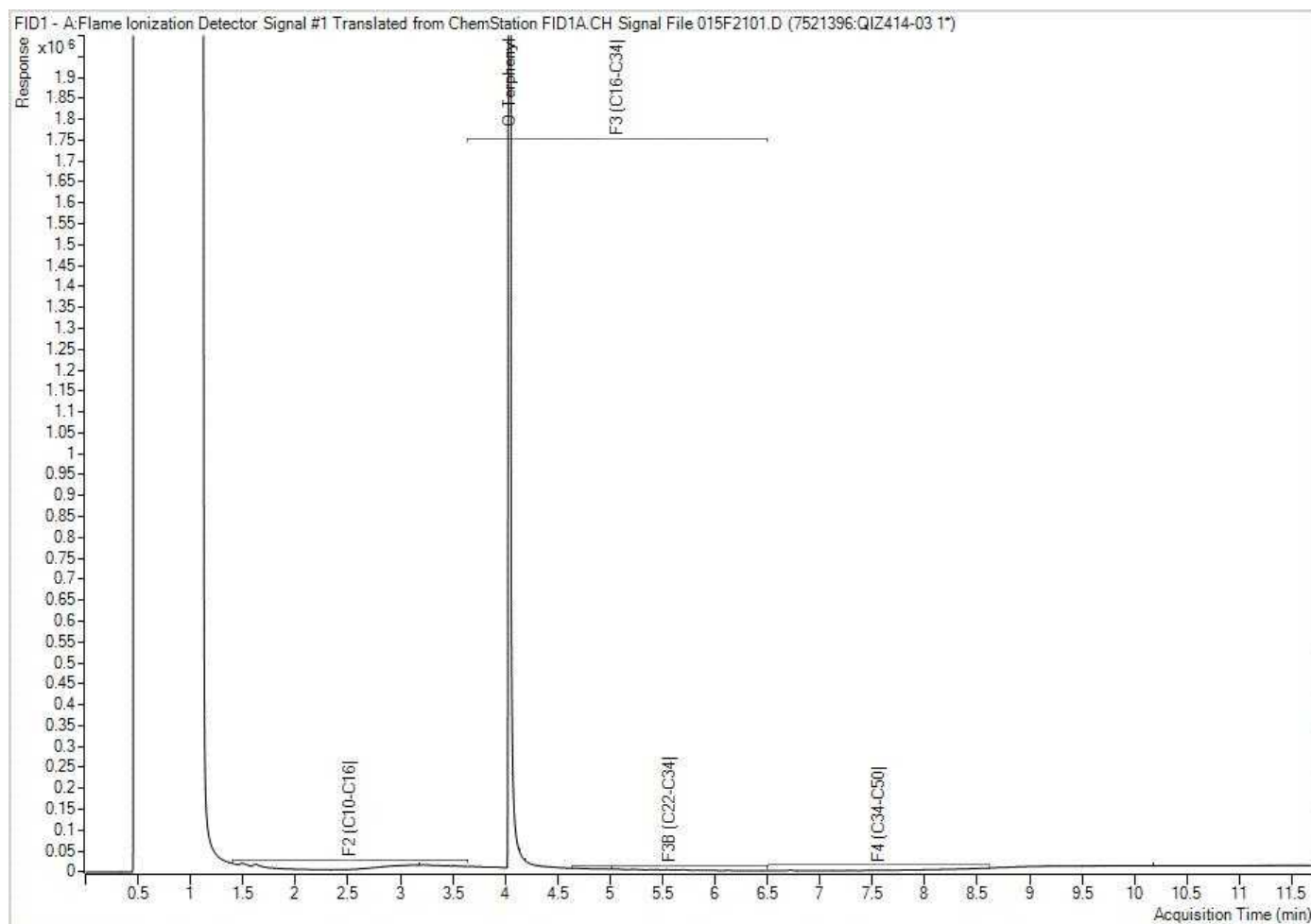


**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C1M7958  
Report Date: 2021/08/24  
BV Labs Sample: QIZ414

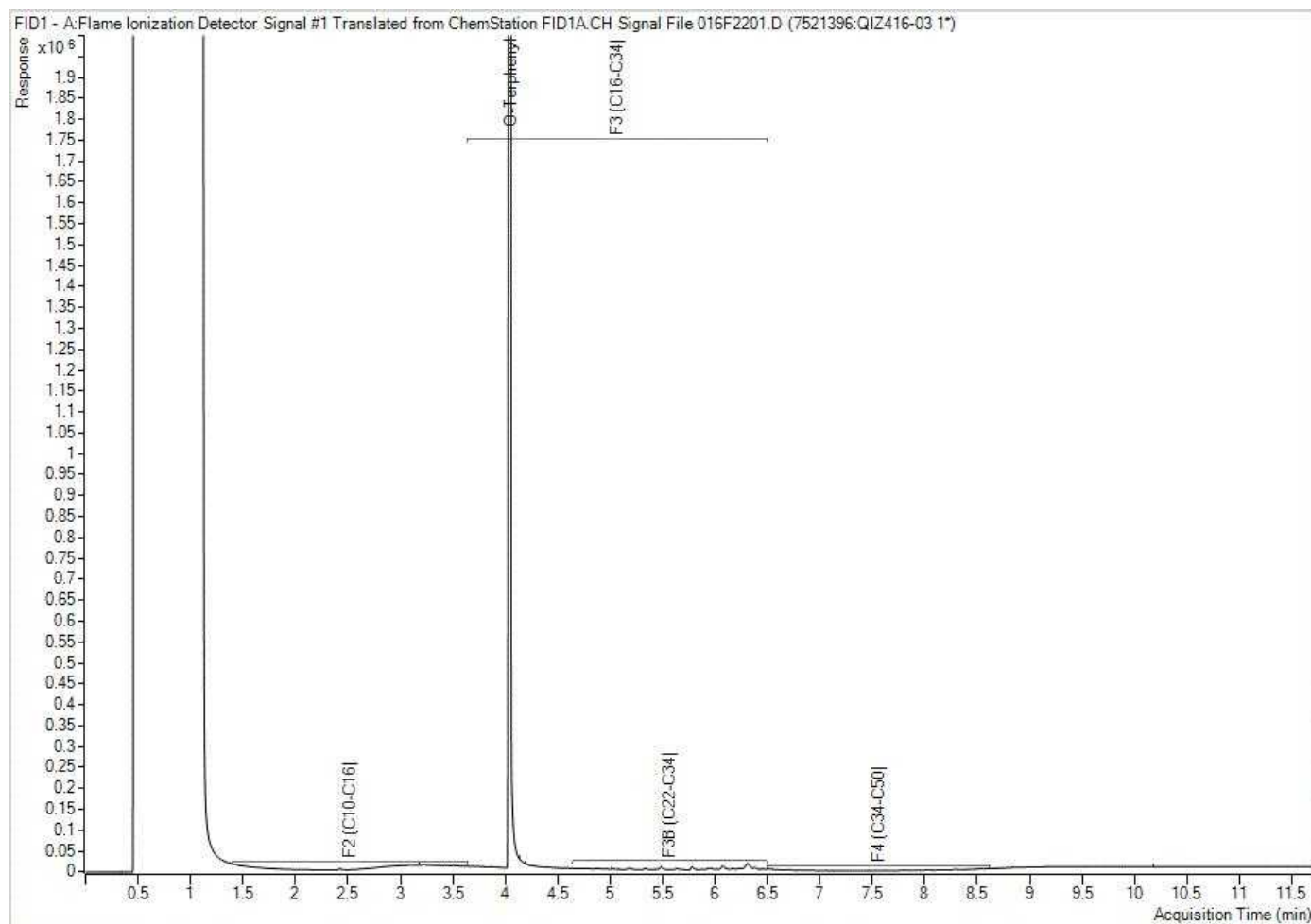
Golder Associates Ltd  
Client Project #: 1530382/7000  
Project name: QEW/DIXIE  
Client ID: 21-43 SS2

**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**



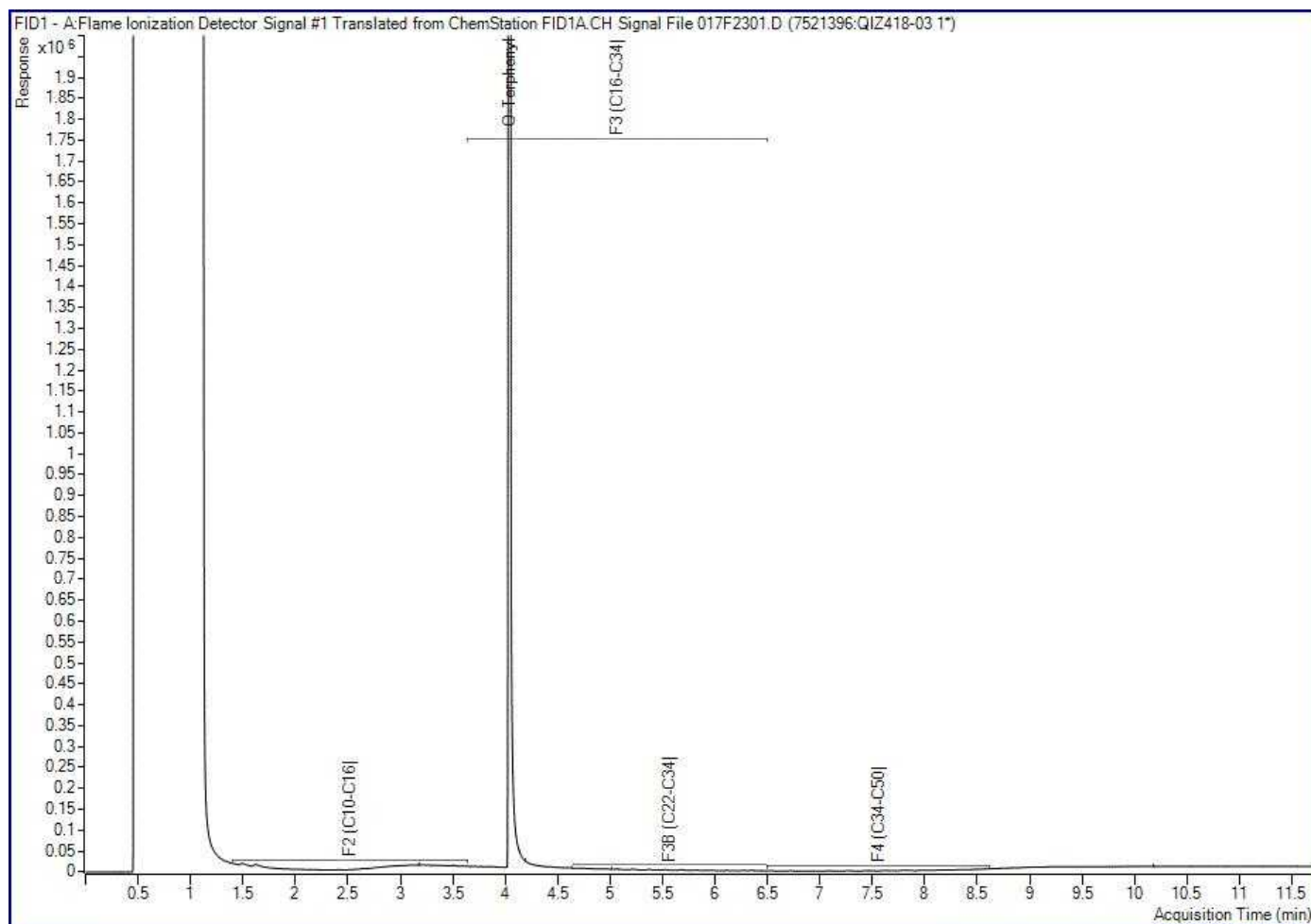
**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

**Petroleum Hydrocarbons F2-F4 in Soil Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.





Your Project #: 1530382  
Site Location: QEW DIXIE  
Your C.O.C. #: 808525-02-01

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/03/25**  
Report #: R6568677  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C173818**

**Received: 2021/03/19, 14:00**

Sample Matrix: Rock  
# Samples Received: 2

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	2	2021/03/24	2021/03/24	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	2021/03/24	2021/03/24	CAM SOP-00414	OMOE E3530 v1 m
pH CaCl2 EXTRACT	2	2021/03/23	2021/03/23	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	2	2021/03/19	2021/03/24	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	2	2021/03/24	2021/03/24	CAM SOP-00464	EPA 375.4 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 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.





Your Project #: 1530382  
Site Location: QEW DIXIE  
Your C.O.C. #: 808525-02-01

**Attention: Katelyn Nero**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/03/25**  
Report #: R6568677  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C173818**  
**Received: 2021/03/19, 14:00**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Ema Gitej, Senior Project Manager  
Email: emese.gitej@bureauveritas.com  
Phone# (905)817-5829

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU  
VERITAS

BV Labs Job #: C173818  
Report Date: 2021/03/25

Golder Associates Ltd  
Client Project #: 1530382  
Site Location: QEW DIXIE  
Sampler Initials: LM

### SOIL CORROSIVITY PACKAGE (ROCK)

<b>BV Labs ID</b>		PCT995	PCT996		
<b>Sampling Date</b>		2021/01/15	2021/02/11		
<b>COC Number</b>		808525-02-01	808525-02-01		
	<b>UNITS</b>	<b>21-34-6.08 TO 6.16</b>	<b>21-4-5.18 TO 5.28</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>					
Resistivity	ohm-cm	3400	2000		7258172
<b>Inorganics</b>					
Soluble (20:1) Chloride (Cl <sup>-</sup> )	ug/g	<20	110	20	7264059
Conductivity	umho/cm	295	498	2	7264243
Available (CaCl <sub>2</sub> ) pH	pH	8.62	9.04		7261447
Soluble (20:1) Sulphate (SO <sub>4</sub> )	ug/g	46	66	20	7264104
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					



BUREAU  
VERITAS

BV Labs Job #: C173818  
Report Date: 2021/03/25

Golder Associates Ltd  
Client Project #: 1530382  
Site Location: QEW DIXIE  
Sampler Initials: LM

## TEST SUMMARY

**BV Labs ID:** PCT995  
**Sample ID:** 21-34-6.08 TO 6.16  
**Matrix:** Rock

**Collected:** 2021/01/15  
**Shipped:**  
**Received:** 2021/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7264059	2021/03/24	2021/03/24	Avneet Kour Sudan
Conductivity	AT	7264243	2021/03/24	2021/03/24	Tarunpreet Kaur
pH CaCl2 EXTRACT	AT	7261447	2021/03/23	2021/03/23	Surinder Rai
Resistivity of Soil		7258172	2021/03/24	2021/03/24	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7264104	2021/03/24	2021/03/24	Avneet Kour Sudan

**BV Labs ID:** PCT996  
**Sample ID:** 21-4-5.18TO 5.28  
**Matrix:** Rock

**Collected:** 2021/02/11  
**Shipped:**  
**Received:** 2021/03/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	7264059	2021/03/24	2021/03/24	Avneet Kour Sudan
Conductivity	AT	7264243	2021/03/24	2021/03/24	Tarunpreet Kaur
pH CaCl2 EXTRACT	AT	7261447	2021/03/23	2021/03/23	Surinder Rai
Resistivity of Soil		7258172	2021/03/24	2021/03/24	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	7264104	2021/03/24	2021/03/24	Avneet Kour Sudan



BUREAU  
VERITAS

BV Labs Job #: C173818  
Report Date: 2021/03/25

Golder Associates Ltd  
Client Project #: 1530382  
Site Location: QEW DIXIE  
Sampler Initials: LM

### GENERAL COMMENTS

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

Package 1	3.0°C
-----------	-------

**Results relate only to the items tested.**



BUREAU  
VERITAS

BV Labs Job #: C173818

Report Date: 2021/03/25

## QUALITY ASSURANCE REPORT

Golder Associates Ltd

Client Project #: 1530382

Site Location: QEW DIXIE

Sampler Initials: LM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7261447	Available (CaCl <sub>2</sub> ) pH	2021/03/23			100	97 - 103			0.10	N/A
7264059	Soluble (20:1) Chloride (Cl <sup>-</sup> )	2021/03/24	NC	70 - 130	98	70 - 130	<20	ug/g	13	35
7264104	Soluble (20:1) Sulphate (SO <sub>4</sub> )	2021/03/24	118	70 - 130	104	70 - 130	<20	ug/g	NC	35
7264243	Conductivity	2021/03/24			103	90 - 110	<2	umho/cm	4.0	10

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.

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.

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).



BUREAU  
VERITAS

BV Labs Job #: C173818  
Report Date: 2021/03/25

Golder Associates Ltd  
Client Project #: 1530382  
Site Location: QEW DIXIE  
Sampler Initials: LM



### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

INVOICE TO:			REPORT TO:			PROJECT INFORMATION:			Laboratory Use Only:																				
Company Name: #1326 Golder Associates Ltd			Company Name: <u>Golder</u>			Quotation #: <u>B80683</u>			BV Labs Job #:		Bottle Order #:																		
Attention: <u>Accounts Payable</u>			Attention: <u>Sandra McGaghrihan</u> <u>Katie Nero</u>			P.O. #:																							
Address: <u>6925 Century Ave Suite 100</u>			Address:			Project: <u>1530382</u>			COC #:		Project Manager:																		
<u>Mississauga ON L5N 7K2</u>						Project Name: <u>QEW DIXIE</u>					Ema Gitej																		
Tel: <u>(905) 567-4444</u> Fax: <u>(905) 567-6561</u>			Tel: <u>smcgaghrihan@golder.com</u> Fax: <u>knero@golder.com</u>			Site #:			C#806525-02-01																				
Email: <u>CanadaAccountsPayableInvoices@golder.com</u>			Email:			Sampled By: <u>LM</u>																							
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY						ANALYSIS REQUESTED (PLEASE BE SPECIFIC)						Turnaround Time (TAT) Required: Please provide advance notice for rush projects																	
Regulation 153 (2011)			Other Regulations			Special Instructions			Field Filtered (please circle): Metals / Hg / Cr VI			O Reg 558 TCLP Inorganics Package			O Reg 153 Metals & Inorganics Pkg			Soil Corrosivity Package (short list)			Rock Corrosivity			Regular (Standard) TAT: (will be applied if Rush TAT is not specified): Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details					
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Medium/Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> For RSC <input type="checkbox"/> Table: _____			<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary/Sewer Bylaw <input type="checkbox"/> Reg 558 <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> MISA Municipality _____ <input type="checkbox"/> PWQO <input type="checkbox"/> Reg 406 Table <input type="checkbox"/> Other _____																					Job Specific Rush TAT (if applies to entire submission) Date Required: _____ Time Required: _____ Rush Confirmation Number: _____ (call lab for #): _____					
Include Criteria on Certificate of Analysis (Y/N)?																													
Sample Barcode Label		Sample (Location) Identification		Date Sampled		Time Sampled		Matrix														# of Bottles		Comments					
1		21-34-6.98 to 6.16		Jan 15 2021		PM		ROCK														1 bag							
2		21-4-5.18 to 5.28		Feb 11 2021		PM		ROCK														1 bag							
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
* RELINQUISHED BY: (Signature/Print)				Date: (YY/MM/DD)		Time		RECEIVED BY: (Signature/Print)				Date: (YY/MM/DD)		Time		# jars used and not submitted		Laboratory Use Only											
<u>Katie Nero</u>				<u>21/03/19</u>				<u>[Signature]</u>				<u>21/03/19</u>		<u>19W</u>				Time Sensitive		Temperature (°C) on Receipt		Custody Seal		Yes		No			
																				<u>5/113</u>		Present							
																						Intact							
* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.																													
* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.																													
** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.																													
SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS																													
White: BV Labs Yellow: Client																													



Your Project #: 1530382 (7000)  
Your C.O.C. #: 833689-01-01

**Attention: Liseth Benavente**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/20**  
Report #: R6728020  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C110277**

**Received: 2021/06/29, 17:02**

Sample Matrix: Water  
# Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Methylnaphthalene Sum	3	N/A	2021/07/07	CAM SOP-00301	EPA 8270D m
ABN Compounds in Water by GC/MS	2	2021/07/07	2021/07/08	CAM SOP-00301	EPA 8270 m
Carbonaceous BOD	2	2021/07/02	2021/07/07	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	2	N/A	2021/07/06	CAM SOP-00463	SM 23 4500-Cl E m
Chloride by Automated Colourimetry	1	N/A	2021/07/07	CAM SOP-00463	SM 23 4500-Cl E m
Chromium (VI) in Water	2	N/A	2021/07/20	CAM SOP-00436	EPA 7199 m
Chromium (VI) in Water	1	N/A	2021/07/05	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	3	N/A	2021/07/05	CAM SOP-00457	OMOE E3015 m
Total Cyanide	2	2021/07/05	2021/07/05	CAM SOP-00457	OMOE E3015 5 m
Petroleum Hydro. CCME F1 & BTEX in Water	3	N/A	2021/07/06	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (1)	3	2021/07/06	2021/07/07	CAM SOP-00316	CCME PHC-CWS m
Fluoride	1	2021/07/05	2021/07/05	CAM SOP-00449	SM 23 4500-F C m
Fluoride	1	2021/07/06	2021/07/07	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	2	2021/07/19	2021/07/19	CAM SOP-00453	EPA 7470A m
Mercury	2	2021/07/19	2021/07/19	CAM SOP-00453	EPA 7470A m
Mercury	1	2021/07/06	2021/07/06	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	2	N/A	2021/07/19	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	1	N/A	2021/07/05	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	2	N/A	2021/07/20	CAM SOP-00447	EPA 6020B m
E.coli, (CFU/100mL)	2	N/A	2021/07/02	CAM SOP-00552	MOE LSB E3371
Total Nonylphenol in Liquids by HPLC	1	2021/07/03	2021/07/06	CAM SOP-00313	In-house Method
Total Nonylphenol in Liquids by HPLC	1	2021/07/04	2021/07/06	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2021/07/03	2021/07/06	CAM SOP-00313	BV Labs Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2021/07/04	2021/07/06	CAM SOP-00313	BV Labs Method
Animal and Vegetable Oil and Grease	2	N/A	2021/07/07	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	2	2021/07/07	2021/07/07	CAM SOP-00326	EPA1664B m,SM5520B m
PAH Compounds in Water by GC/MS (SIM)	3	2021/07/06	2021/07/06	CAM SOP-00318	EPA 8270D m
Polychlorinated Biphenyl in Water	2	2021/07/04	2021/07/04	CAM SOP-00309	EPA 8082A m
pH	1	2021/07/05	2021/07/05	CAM SOP-00413	SM 4500H+ B m
pH	1	2021/07/06	2021/07/07	CAM SOP-00413	SM 4500H+ B m





Your Project #: 1530382 (7000)  
Your C.O.C. #: 833689-01-01

**Attention: Liseth Benavente**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/20**  
Report #: R6728020  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C110277**

**Received: 2021/06/29, 17:02**

Sample Matrix: Water  
# Samples Received: 3

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Phenols (4AAP)	2	N/A	2021/07/03	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2021/07/06	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	1	N/A	2021/07/07	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	2	2021/07/05	2021/07/05	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (2)	2	2021/07/07	2021/07/07	CAM SOP-00326	EPA1664B m, SM5520F m
Total Suspended Solids	2	2021/07/05	2021/07/06	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	2	N/A	2021/07/07	CAM SOP-00228	EPA 8260C 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 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) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods



Your Project #: 1530382 (7000)  
Your C.O.C. #: 833689-01-01

**Attention: Liseth Benavente**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/20**  
Report #: R6728020  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C110277**

**Received: 2021/06/29, 17:02**

September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

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

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: emese.gitej@bureauveritas.com

Phone# (905)817-5829

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

<b>BV Labs ID</b>		PYX388			PYX388		
<b>Sampling Date</b>		2021/06/29 09:00			2021/06/29 09:00		
<b>COC Number</b>		833689-01-01			833689-01-01		
	<b>UNITS</b>	<b>21-11</b>	<b>RDL</b>	<b>QC Batch</b>	<b>21-11 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Total Animal/Vegetable Oil and Grease	mg/L	<0.50	0.50	7441312			
<b>Inorganics</b>							
Total Carbonaceous BOD	mg/L	<2	2	7440676			
Fluoride (F-)	mg/L	0.40	0.10	7447371			
Total Kjeldahl Nitrogen (TKN)	mg/L	0.10	0.10	7444048			
pH	pH	7.81		7447376	7.84		7447376
Phenols-4AAP	mg/L	<0.0010	0.0010	7442528	<0.0010	0.0010	7442528
Total Suspended Solids	mg/L	66	10	7442999			
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	200	1.0	7447268			
Total Cyanide (CN)	mg/L	<0.0050	0.0050	7444193			
<b>Petroleum Hydrocarbons</b>							
Total Oil & Grease	mg/L	<0.50	0.50	7448079			
Total Oil & Grease Mineral/Synthetic	mg/L	<0.50	0.50	7448081			
<b>Miscellaneous Parameters</b>							
Nonylphenol Ethoxylate (Total)	mg/L	<0.025	0.025	7442826	<0.025	0.025	7442826
Nonylphenol (Total)	mg/L	<0.001	0.001	7442813			
<b>Metals</b>							
Mercury (Hg)	mg/L	<0.00010	0.00010	7469714			
Total Aluminum (Al)	ug/L	1100	4.9	7470705			
Total Antimony (Sb)	ug/L	<0.50	0.50	7470705			
Total Arsenic (As)	ug/L	<1.0	1.0	7470705			
Total Cadmium (Cd)	ug/L	<0.090	0.090	7470705			
Total Chromium (Cr)	ug/L	<5.0	5.0	7470705			
Total Cobalt (Co)	ug/L	1.2	0.50	7470705			
Total Copper (Cu)	ug/L	3.9	0.90	7470705			
Total Lead (Pb)	ug/L	0.92	0.50	7470705			
Total Manganese (Mn)	ug/L	280	2.0	7470705			
Total Molybdenum (Mo)	ug/L	5.4	0.50	7470705			
Total Nickel (Ni)	ug/L	3.2	1.0	7470705			
Total Phosphorus (P)	ug/L	<100	100	7470705			
Total Selenium (Se)	ug/L	<2.0	2.0	7470705			
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		PYX388			PYX388		
Sampling Date		2021/06/29 09:00			2021/06/29 09:00		
COC Number		833689-01-01			833689-01-01		
	UNITS	21-11	RDL	QC Batch	21-11 Lab-Dup	RDL	QC Batch
Total Silver (Ag)	ug/L	<0.090	0.090	7470705			
Total Tin (Sn)	ug/L	<1.0	1.0	7470705			
Total Titanium (Ti)	ug/L	29	5.0	7470705			
Total Zinc (Zn)	ug/L	5.0	5.0	7470705			
<b>Semivolatile Organics</b>							
Bis(2-ethylhexyl)phthalate	ug/L	<2.0	2.0	7449014			
Di-N-butyl phthalate	ug/L	<2.0	2.0	7449014			
<b>Volatile Organics</b>							
Benzene	ug/L	<0.20	0.20	7446299	<0.20	0.20	7446299
Chloroform	ug/L	<0.20	0.20	7446299	<0.20	0.20	7446299
1,2-Dichlorobenzene	ug/L	<0.40	0.40	7446299	<0.40	0.40	7446299
1,4-Dichlorobenzene	ug/L	<0.40	0.40	7446299	<0.40	0.40	7446299
cis-1,2-Dichloroethylene	ug/L	<0.50	0.50	7446299	<0.50	0.50	7446299
trans-1,3-Dichloropropene	ug/L	<0.40	0.40	7446299	<0.40	0.40	7446299
Ethylbenzene	ug/L	<0.20	0.20	7446299	<0.20	0.20	7446299
Methylene Chloride(Dichloromethane)	ug/L	<2.0	2.0	7446299	<2.0	2.0	7446299
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	10	7446299	<10	10	7446299
Styrene	ug/L	<0.40	0.40	7446299	<0.40	0.40	7446299
1,1,2,2-Tetrachloroethane	ug/L	<0.40	0.40	7446299	<0.40	0.40	7446299
Tetrachloroethylene	ug/L	<0.20	0.20	7446299	<0.20	0.20	7446299
Toluene	ug/L	<0.20	0.20	7446299	<0.20	0.20	7446299
Trichloroethylene	ug/L	<0.20	0.20	7446299	<0.20	0.20	7446299
p+m-Xylene	ug/L	<0.20	0.20	7446299	<0.20	0.20	7446299
o-Xylene	ug/L	<0.20	0.20	7446299	<0.20	0.20	7446299
Total Xylenes	ug/L	<0.20	0.20	7446299	<0.20	0.20	7446299
<b>PCBs</b>							
Total PCB	ug/L	<0.05	0.05	7443205			
<b>Microbiological</b>							
Escherichia coli	CFU/100mL	0	N/A	7442522			
<b>Surrogate Recovery (%)</b>							
2,4,6-Tribromophenol	%	79		7449014			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable							



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		PYX388			PYX388		
Sampling Date		2021/06/29 09:00			2021/06/29 09:00		
COC Number		833689-01-01			833689-01-01		
	UNITS	21-11	RDL	QC Batch	21-11 Lab-Dup	RDL	QC Batch
2-Fluorobiphenyl	%	42		7449014			
2-Fluorophenol	%	27		7449014			
D14-Terphenyl	%	94		7449014			
D5-Nitrobenzene	%	43		7449014			
D5-Phenol	%	23		7449014			
Decachlorobiphenyl	%	79		7443205			
4-Bromofluorobenzene	%	94		7446299	93		7446299
D4-1,2-Dichloroethane	%	112		7446299	112		7446299
D8-Toluene	%	95		7446299	95		7446299
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		PYX390			PYX390		
Sampling Date		2021/06/29 11:10			2021/06/29 11:10		
COC Number		833689-01-01			833689-01-01		
	UNITS	21-4	RDL	QC Batch	21-4 Lab-Dup	RDL	QC Batch
<b>Calculated Parameters</b>							
Total Animal/Vegetable Oil and Grease	mg/L	<0.50	0.50	7441312			
<b>Inorganics</b>							
Total Carbonaceous BOD	mg/L	43	2	7440676			
Fluoride (F-)	mg/L	0.61	0.10	7444035	0.61	0.10	7444035
Total Kjeldahl Nitrogen (TKN)	mg/L	4.1	0.10	7444048			
pH	pH	7.74		7444040			
Phenols-4AAP	mg/L	<0.0010	0.0010	7442528			
Total Suspended Solids	mg/L	11	10	7442999	11	10	7442999
Dissolved Sulphate (SO4)	mg/L	3.1	1.0	7444360			
Total Cyanide (CN)	mg/L	<0.0050	0.0050	7444193			
<b>Petroleum Hydrocarbons</b>							
Total Oil & Grease	mg/L	<0.50	0.50	7448079			
Total Oil & Grease Mineral/Synthetic	mg/L	<0.50	0.50	7448081			
<b>Miscellaneous Parameters</b>							
Nonylphenol Ethoxylate (Total)	mg/L	<0.025	0.025	7443261			
Nonylphenol (Total)	mg/L	<0.001	0.001	7443258			
<b>Metals</b>							
Mercury (Hg)	mg/L	<0.00010	0.00010	7469714			
Total Aluminum (Al)	ug/L	98	4.9	7470705			
Total Antimony (Sb)	ug/L	<0.50	0.50	7470705			
Total Arsenic (As)	ug/L	<1.0	1.0	7470705			
Total Cadmium (Cd)	ug/L	<0.090	0.090	7470705			
Total Chromium (Cr)	ug/L	<5.0	5.0	7470705			
Total Cobalt (Co)	ug/L	<0.50	0.50	7470705			
Total Copper (Cu)	ug/L	<0.90	0.90	7470705			
Total Lead (Pb)	ug/L	<0.50	0.50	7470705			
Total Manganese (Mn)	ug/L	200	2.0	7470705			
Total Molybdenum (Mo)	ug/L	1.3	0.50	7470705			
Total Nickel (Ni)	ug/L	<1.0	1.0	7470705			
Total Phosphorus (P)	ug/L	<100	100	7470705			
Total Selenium (Se)	ug/L	<2.0	2.0	7470705			
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		PYX390			PYX390		
Sampling Date		2021/06/29 11:10			2021/06/29 11:10		
COC Number		833689-01-01			833689-01-01		
	UNITS	21-4	RDL	QC Batch	21-4 Lab-Dup	RDL	QC Batch
Total Silver (Ag)	ug/L	<0.090	0.090	7470705			
Total Tin (Sn)	ug/L	<1.0	1.0	7470705			
Total Titanium (Ti)	ug/L	<5.0	5.0	7470705			
Total Zinc (Zn)	ug/L	<5.0	5.0	7470705			
<b>Semivolatile Organics</b>							
Bis(2-ethylhexyl)phthalate	ug/L	<2.0	2.0	7449014			
Di-N-butyl phthalate	ug/L	<2.0	2.0	7449014			
<b>Volatile Organics</b>							
Benzene	ug/L	<0.20	0.20	7446299			
Chloroform	ug/L	<0.20	0.20	7446299			
1,2-Dichlorobenzene	ug/L	<0.40	0.40	7446299			
1,4-Dichlorobenzene	ug/L	<0.40	0.40	7446299			
cis-1,2-Dichloroethylene	ug/L	<0.50	0.50	7446299			
trans-1,3-Dichloropropene	ug/L	<0.40	0.40	7446299			
Ethylbenzene	ug/L	<0.20	0.20	7446299			
Methylene Chloride(Dichloromethane)	ug/L	<2.0	2.0	7446299			
Methyl Ethyl Ketone (2-Butanone)	ug/L	300	10	7446299			
Styrene	ug/L	<0.40	0.40	7446299			
1,1,2,2-Tetrachloroethane	ug/L	<0.40	0.40	7446299			
Tetrachloroethylene	ug/L	<0.20	0.20	7446299			
Toluene	ug/L	<0.20	0.20	7446299			
Trichloroethylene	ug/L	<0.20	0.20	7446299			
p+m-Xylene	ug/L	0.20	0.20	7446299			
o-Xylene	ug/L	<0.20	0.20	7446299			
Total Xylenes	ug/L	0.20	0.20	7446299			
<b>PCBs</b>							
Total PCB	ug/L	<0.05	0.05	7443205			
<b>Microbiological</b>							
Escherichia coli	CFU/100mL	0	N/A	7442522			
<b>Surrogate Recovery (%)</b>							
2,4,6-Tribromophenol	%	74		7449014			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable							



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		PYX390			PYX390		
Sampling Date		2021/06/29 11:10			2021/06/29 11:10		
COC Number		833689-01-01			833689-01-01		
	UNITS	21-4	RDL	QC Batch	21-4 Lab-Dup	RDL	QC Batch
2-Fluorobiphenyl	%	22 (1)		7449014			
2-Fluorophenol	%	18		7449014			
D14-Terphenyl	%	91		7449014			
D5-Nitrobenzene	%	28 (1)		7449014			
D5-Phenol	%	12		7449014			
Decachlorobiphenyl	%	80		7443205			
4-Bromofluorobenzene	%	95		7446299			
D4-1,2-Dichloroethane	%	108		7446299			
D8-Toluene	%	94		7446299			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Surrogate recovery was below the lower control limit. This may represent a low bias in some results.							





BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### O.REG 153 METALS & INORGANICS PKG (WTR)

BV Labs ID		PYX388			PYX388			PYX389		
Sampling Date		2021/06/29 09:00			2021/06/29 09:00			2021/06/29 09:27		
COC Number		833689-01-01			833689-01-01			833689-01-01		
	UNITS	21-11	RDL	QC Batch	21-11 Lab-Dup	RDL	QC Batch	21-33	RDL	QC Batch
<b>Inorganics</b>										
WAD Cyanide (Free)	ug/L	<1	1	7444124				<1	1	7444124
Dissolved Chloride (Cl-)	mg/L	2300	30	7447260				860	10	7442854
<b>Metals</b>										
Chromium (VI)	ug/L	0.82	0.50	7471996	0.81	0.50	7471996	<0.50	0.50	7442106
Mercury (Hg)	ug/L	<0.10	0.10	7469720				<0.10	0.10	7445796
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	7467756				1.7	0.50	7442800
Dissolved Arsenic (As)	ug/L	<1.0	1.0	7467756				2.8	1.0	7442800
Dissolved Barium (Ba)	ug/L	100	2.0	7467756				160	2.0	7442800
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	7467756				<0.40	0.40	7442800
Dissolved Boron (B)	ug/L	92	10	7467756				2100	10	7442800
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	7467756				<0.090	0.090	7442800
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	7467756				<5.0	5.0	7442800
Dissolved Cobalt (Co)	ug/L	0.54	0.50	7467756				<0.50	0.50	7442800
Dissolved Copper (Cu)	ug/L	2.1	0.90	7467756				2.6	0.90	7442800
Dissolved Lead (Pb)	ug/L	<0.50	0.50	7467756				<0.50	0.50	7442800
Dissolved Molybdenum (Mo)	ug/L	5.0	0.50	7467756				30	0.50	7442800
Dissolved Nickel (Ni)	ug/L	1.6	1.0	7467756				<1.0	1.0	7442800
Dissolved Selenium (Se)	ug/L	<2.0	2.0	7467756				<2.0	2.0	7442800
Dissolved Silver (Ag)	ug/L	<0.090	0.090	7467756				<0.090	0.090	7442800
Dissolved Sodium (Na)	ug/L	1700000	500	7467756				480000	100	7442800
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7467756				0.064	0.050	7442800
Dissolved Uranium (U)	ug/L	1.7	0.10	7467756				5.0	0.10	7442800
Dissolved Vanadium (V)	ug/L	<0.50	0.50	7467756				0.80	0.50	7442800
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	7467756				<5.0	5.0	7442800
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### O.REG 153 METALS & INORGANICS PKG (WTR)

<b>BV Labs ID</b>		PYX390		
<b>Sampling Date</b>		2021/06/29 11:10		
<b>COC Number</b>		833689-01-01		
	<b>UNITS</b>	<b>21-4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Inorganics</b>				
WAD Cyanide (Free)	ug/L	<1	1	7444124
Dissolved Chloride (Cl-)	mg/L	1500	20	7444363
<b>Metals</b>				
Chromium (VI)	ug/L	<0.50	0.50	7471996
Mercury (Hg)	ug/L	<0.10	0.10	7469720
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	7467756
Dissolved Arsenic (As)	ug/L	5.0	1.0	7467756
Dissolved Barium (Ba)	ug/L	620	2.0	7467756
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	7467756
Dissolved Boron (B)	ug/L	2300	10	7467756
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	7467756
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	7467756
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	7467756
Dissolved Copper (Cu)	ug/L	<0.90	0.90	7467756
Dissolved Lead (Pb)	ug/L	<0.50	0.50	7467756
Dissolved Molybdenum (Mo)	ug/L	13	0.50	7467756
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	7467756
Dissolved Selenium (Se)	ug/L	<2.0	2.0	7467756
Dissolved Silver (Ag)	ug/L	<0.090	0.090	7467756
Dissolved Sodium (Na)	ug/L	840000	500	7467756
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7467756
Dissolved Uranium (U)	ug/L	8.2	0.10	7467756
Dissolved Vanadium (V)	ug/L	<0.50	0.50	7467756
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	7467756
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### O.REG 153 PAHS (WATER)

BV Labs ID		PYX388	PYX389			PYX389		
Sampling Date		2021/06/29 09:00	2021/06/29 09:27			2021/06/29 09:27		
COC Number		833689-01-01	833689-01-01			833689-01-01		
	UNITS	21-11	21-33	RDL	QC Batch	21-33 Lab-Dup	RDL	QC Batch
<b>Calculated Parameters</b>								
Methylnaphthalene, 2-(1-)	ug/L	<0.071	<0.071	0.071	7440919			
<b>Polyaromatic Hydrocarbons</b>								
Acenaphthene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Acenaphthylene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Anthracene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Benzo(a)anthracene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Benzo(a)pyrene	ug/L	<0.0090	<0.0090	0.0090	7446782	<0.0090	0.0090	7446782
Benzo(b/j)fluoranthene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Benzo(g,h,i)perylene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Benzo(k)fluoranthene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Chrysene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Dibenzo(a,h)anthracene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Fluoranthene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Fluorene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Indeno(1,2,3-cd)pyrene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
1-Methylnaphthalene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
2-Methylnaphthalene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Naphthalene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
Phenanthrene	ug/L	<0.030	<0.030	0.030	7446782	<0.030	0.030	7446782
Pyrene	ug/L	<0.050	<0.050	0.050	7446782	<0.050	0.050	7446782
<b>Surrogate Recovery (%)</b>								
D10-Anthracene	%	105	92		7446782	101		7446782
D14-Terphenyl (FS)	%	115	97		7446782	104		7446782
D8-Acenaphthylene	%	91	82		7446782	94		7446782
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								
Lab-Dup = Laboratory Initiated Duplicate								



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### O.REG 153 PAHS (WATER)

<b>BV Labs ID</b>		PYX390		
<b>Sampling Date</b>		2021/06/29 11:10		
<b>COC Number</b>		833689-01-01		
	<b>UNITS</b>	<b>21-4</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>				
Methylnaphthalene, 2-(1-)	ug/L	0.51	0.071	7440919
<b>Polyaromatic Hydrocarbons</b>				
Acenaphthene	ug/L	<0.050	0.050	7446782
Acenaphthylene	ug/L	<0.050	0.050	7446782
Anthracene	ug/L	<0.050	0.050	7446782
Benzo(a)anthracene	ug/L	<0.050	0.050	7446782
Benzo(a)pyrene	ug/L	<0.0090	0.0090	7446782
Benzo(b/j)fluoranthene	ug/L	<0.050	0.050	7446782
Benzo(g,h,i)perylene	ug/L	<0.050	0.050	7446782
Benzo(k)fluoranthene	ug/L	<0.050	0.050	7446782
Chrysene	ug/L	<0.050	0.050	7446782
Dibenzo(a,h)anthracene	ug/L	<0.050	0.050	7446782
Fluoranthene	ug/L	<0.050	0.050	7446782
Fluorene	ug/L	<0.050	0.050	7446782
Indeno(1,2,3-cd)pyrene	ug/L	<0.050	0.050	7446782
1-Methylnaphthalene	ug/L	0.22	0.050	7446782
2-Methylnaphthalene	ug/L	0.29	0.050	7446782
Naphthalene	ug/L	0.094	0.050	7446782
Phenanthrene	ug/L	<0.030	0.030	7446782
Pyrene	ug/L	<0.050	0.050	7446782
<b>Surrogate Recovery (%)</b>				
D10-Anthracene	%	94		7446782
D14-Terphenyl (FS)	%	102		7446782
D8-Acenaphthylene	%	88		7446782
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				

BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

**O.REG 153 PHCS, BTEX/F1-F4 (WATER)**

BV Labs ID		PYX388	PYX389			PYX389			PYX390		
Sampling Date		2021/06/29 09:00	2021/06/29 09:27			2021/06/29 09:27			2021/06/29 11:10		
COC Number		833689-01-01	833689-01-01			833689-01-01			833689-01-01		
	UNITS	21-11	21-33	RDL	QC Batch	21-33 Lab-Dup	RDL	QC Batch	21-4	RDL	QC Batch
<b>BTEX &amp; F1 Hydrocarbons</b>											
F1 (C6-C10)	ug/L	<25	<25	25	7445528				<25	25	7445528
F1 (C6-C10) - BTEX	ug/L	<25	<25	25	7445528				<25	25	7445528
<b>F2-F4 Hydrocarbons</b>											
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	100	7446805	<100	100	7446805	<100	100	7446805
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	200	7446805	<200	200	7446805	<200	200	7446805
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	200	7446805	<200	200	7446805	<200	200	7446805
Reached Baseline at C50	ug/L	Yes	Yes		7446805	Yes		7446805	Yes		7446805
<b>Surrogate Recovery (%)</b>											
1,4-Difluorobenzene	%	98	96		7445528				97		7445528
4-Bromofluorobenzene	%	91	92		7445528				91		7445528
D10-o-Xylene	%	100	98		7445528				99		7445528
D4-1,2-Dichloroethane	%	92	93		7445528				91		7445528
o-Terphenyl	%	87	89		7446805	92		7446805	88		7446805
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate											

BV Labs ID		PYX390		
Sampling Date		2021/06/29 11:10		
COC Number		833689-01-01		
	UNITS	21-4 Lab-Dup	RDL	QC Batch
<b>BTEX &amp; F1 Hydrocarbons</b>				
F1 (C6-C10)	ug/L	<25	25	7445528
F1 (C6-C10) - BTEX	ug/L	<25	25	7445528
<b>Surrogate Recovery (%)</b>				
1,4-Difluorobenzene	%	97		7445528
4-Bromofluorobenzene	%	92		7445528
D10-o-Xylene	%	97		7445528
D4-1,2-Dichloroethane	%	93		7445528
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate				



BUREAU  
VERITAS

BV Labs Job #: C1I0277  
Report Date: 2021/07/20

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Sampler Initials: VP

## TEST SUMMARY

**BV Labs ID:** PYX388  
**Sample ID:** 21-11  
**Matrix:** Water

**Collected:** 2021/06/29  
**Shipped:**  
**Received:** 2021/06/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7440919	N/A	2021/07/07	Automated Statchk
ABN Compounds in Water by GC/MS	GC/MS	7449014	2021/07/07	2021/07/08	Anh Lieu
Carbonaceous BOD	DO	7440676	2021/07/02	2021/07/07	Surleen Kaur Romana
Chloride by Automated Colourimetry	KONE	7447260	N/A	2021/07/07	Alina Dobreanu
Chromium (VI) in Water	IC	7471996	N/A	2021/07/20	Lang Le
Free (WAD) Cyanide	SKAL/CN	7444124	N/A	2021/07/05	Aditiben Patel
Total Cyanide	SKAL/CN	7444193	2021/07/05	2021/07/05	Aditiben Patel
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7445528	N/A	2021/07/06	Domnica Andronescu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7446805	2021/07/06	2021/07/07	(Kent) Maolin Li
Fluoride	ISE	7447371	2021/07/06	2021/07/07	Surinder Rai
Mercury in Water by CVAA	CV/AA	7469714	2021/07/19	2021/07/19	Gagandeep Rai
Mercury	CV/AA	7469720	2021/07/19	2021/07/19	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7467756	N/A	2021/07/19	Arefa Dabhad
Total Metals Analysis by ICPMS	ICP/MS	7470705	N/A	2021/07/20	Arefa Dabhad
E.coli, (CFU/100mL)	PL	7442522	N/A	2021/07/02	Soham Patel
Total Nonylphenol in Liquids by HPLC	LC/FLU	7442813	2021/07/03	2021/07/06	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7442826	2021/07/03	2021/07/06	Dennis Boodram
Animal and Vegetable Oil and Grease	BAL	7441312	N/A	2021/07/07	Automated Statchk
Total Oil and Grease	BAL	7448079	2021/07/07	2021/07/07	Mitul Patel
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7446782	2021/07/06	2021/07/06	Mitesh Raj
Polychlorinated Biphenyl in Water	GC/ECD	7443205	2021/07/04	2021/07/04	Dawn Howard
pH	AT	7447376	2021/07/06	2021/07/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7442528	N/A	2021/07/03	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7447268	N/A	2021/07/07	Alina Dobreanu
Total Kjeldahl Nitrogen in Water	SKAL	7444048	2021/07/05	2021/07/05	Massarat Jan
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7448081	2021/07/07	2021/07/07	Mitul Patel
Total Suspended Solids	BAL	7442999	2021/07/05	2021/07/06	Sandeep Kaur
Volatile Organic Compounds in Water	GC/MS	7446299	N/A	2021/07/07	Ancheol Jeong

**BV Labs ID:** PYX388 Dup  
**Sample ID:** 21-11  
**Matrix:** Water

**Collected:** 2021/06/29  
**Shipped:**  
**Received:** 2021/06/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	7471996	N/A	2021/07/20	Lang Le
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7442826	2021/07/03	2021/07/06	Dennis Boodram
pH	AT	7447376	2021/07/06	2021/07/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7442528	N/A	2021/07/03	Deonarine Ramnarine
Volatile Organic Compounds in Water	GC/MS	7446299	N/A	2021/07/07	Ancheol Jeong



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

## TEST SUMMARY

**BV Labs ID:** PYX389

**Sample ID:** 21-33

**Matrix:** Water

**Collected:** 2021/06/29

**Shipped:**

**Received:** 2021/06/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7440919	N/A	2021/07/07	Automated Statchk
Chloride by Automated Colourimetry	KONE	7442854	N/A	2021/07/06	Alina Dobreanu
Chromium (VI) in Water	IC	7442106	N/A	2021/07/05	Lang Le
Free (WAD) Cyanide	SKAL/CN	7444124	N/A	2021/07/05	Aditiben Patel
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7445528	N/A	2021/07/06	Domnica Andronesco
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7446805	2021/07/06	2021/07/07	(Kent) Maolin Li
Mercury	CV/AA	7445796	2021/07/06	2021/07/06	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7442800	N/A	2021/07/05	Arefa Dabhad
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7446782	2021/07/06	2021/07/06	Mitesh Raj

**BV Labs ID:** PYX389 Dup

**Sample ID:** 21-33

**Matrix:** Water

**Collected:** 2021/06/29

**Shipped:**

**Received:** 2021/06/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7446805	2021/07/06	2021/07/07	(Kent) Maolin Li
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7446782	2021/07/06	2021/07/06	Mitesh Raj

**BV Labs ID:** PYX390

**Sample ID:** 21-4

**Matrix:** Water

**Collected:** 2021/06/29

**Shipped:**

**Received:** 2021/06/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7440919	N/A	2021/07/07	Automated Statchk
ABN Compounds in Water by GC/MS	GC/MS	7449014	2021/07/07	2021/07/08	Anh Lieu
Carbonaceous BOD	DO	7440676	2021/07/02	2021/07/07	Surleen Kaur Romana
Chloride by Automated Colourimetry	KONE	7444363	N/A	2021/07/06	Alina Dobreanu
Chromium (VI) in Water	IC	7471996	N/A	2021/07/20	Lang Le
Free (WAD) Cyanide	SKAL/CN	7444124	N/A	2021/07/05	Aditiben Patel
Total Cyanide	SKAL/CN	7444193	2021/07/05	2021/07/05	Aditiben Patel
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7445528	N/A	2021/07/06	Domnica Andronesco
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7446805	2021/07/06	2021/07/07	(Kent) Maolin Li
Fluoride	ISE	7444035	2021/07/05	2021/07/05	Surinder Rai
Mercury in Water by CVAA	CV/AA	7469714	2021/07/19	2021/07/19	Gagandeep Rai
Mercury	CV/AA	7469720	2021/07/19	2021/07/19	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7467756	N/A	2021/07/19	Arefa Dabhad
Total Metals Analysis by ICPMS	ICP/MS	7470705	N/A	2021/07/20	Arefa Dabhad
E.coli, (CFU/100mL)	PL	7442522	N/A	2021/07/02	Soham Patel
Total Nonylphenol in Liquids by HPLC	LC/FLU	7443258	2021/07/04	2021/07/06	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7443261	2021/07/04	2021/07/06	Dennis Boodram
Animal and Vegetable Oil and Grease	BAL	7441312	N/A	2021/07/07	Automated Statchk
Total Oil and Grease	BAL	7448079	2021/07/07	2021/07/07	Mitul Patel
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7446782	2021/07/06	2021/07/06	Mitesh Raj
Polychlorinated Biphenyl in Water	GC/ECD	7443205	2021/07/04	2021/07/04	Dawn Howard
pH	AT	7444040	2021/07/05	2021/07/05	Surinder Rai



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

## TEST SUMMARY

**BV Labs ID:** PYX390

**Sample ID:** 21-4

**Matrix:** Water

**Collected:** 2021/06/29

**Shipped:**

**Received:** 2021/06/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Phenols (4AAP)	TECH/PHEN	7442528	N/A	2021/07/03	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7444360	N/A	2021/07/06	Alina Dobreanu
Total Kjeldahl Nitrogen in Water	SKAL	7444048	2021/07/05	2021/07/05	Massarat Jan
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7448081	2021/07/07	2021/07/07	Mitul Patel
Total Suspended Solids	BAL	7442999	2021/07/05	2021/07/06	Sandeep Kaur
Volatile Organic Compounds in Water	GC/MS	7446299	N/A	2021/07/07	Ancheol Jeong

**BV Labs ID:** PYX390 Dup

**Sample ID:** 21-4

**Matrix:** Water

**Collected:** 2021/06/29

**Shipped:**

**Received:** 2021/06/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7445528	N/A	2021/07/06	Domnica Andronescu
Fluoride	ISE	7444035	2021/07/05	2021/07/05	Surinder Rai
Total Suspended Solids	BAL	7442999	2021/07/05	2021/07/06	Sandeep Kaur





## GENERAL COMMENTS

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

Package 1	22.3°C
Package 2	23.0°C
Package 3	23.7°C

### PEEL SANITARY & STORM SEWER (53-2010)

Nonylphenol Ethoxylates in Liquids: HPLC: MATRIX SPIKE: (NC)

NPE recovery in the matrix spike was not calculated (NC).

The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation.

Total Nonylphenol in Liquids by HPLC: Recovery in the matrix spike was not calculated (NC). The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation.

**Results relate only to the items tested.**



**BUREAU  
VERITAS**

BV Labs Job #: C1I0277

Report Date: 2021/07/20

## QUALITY ASSURANCE REPORT

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7443205	Decachlorobiphenyl	2021/07/04	72	60 - 130	58 (1)	60 - 130	75	%				
7445528	1,4-Difluorobenzene	2021/07/06	95	70 - 130	97	70 - 130	96	%				
7445528	4-Bromofluorobenzene	2021/07/06	93	70 - 130	92	70 - 130	91	%				
7445528	D10-o-Xylene	2021/07/06	90	70 - 130	89	70 - 130	100	%				
7445528	D4-1,2-Dichloroethane	2021/07/06	91	70 - 130	87	70 - 130	90	%				
7446299	4-Bromofluorobenzene	2021/07/07	102	70 - 130	104	70 - 130	97	%				
7446299	D4-1,2-Dichloroethane	2021/07/07	106	70 - 130	104	70 - 130	108	%				
7446299	D8-Toluene	2021/07/07	106	70 - 130	106	70 - 130	96	%				
7446782	D10-Anthracene	2021/07/06	103	50 - 130	129	50 - 130	94	%				
7446782	D14-Terphenyl (FS)	2021/07/06	108	50 - 130	144 (3)	50 - 130	105	%				
7446782	D8-Acenaphthylene	2021/07/06	96	50 - 130	118	50 - 130	86	%				
7446805	o-Terphenyl	2021/07/07	88	60 - 130	90	60 - 130	86	%				
7449014	2,4,6-Tribromophenol	2021/07/08	45	10 - 130	85	10 - 130	78	%				
7449014	2-Fluorobiphenyl	2021/07/08	22 (4)	30 - 130	63	30 - 130	65	%				
7449014	2-Fluorophenol	2021/07/08	9.4 (4)	10 - 130	45	10 - 130	44	%				
7449014	D14-Terphenyl	2021/07/08	89	30 - 130	94	30 - 130	94	%				
7449014	D5-Nitrobenzene	2021/07/08	27 (4)	30 - 130	79	30 - 130	76	%				
7449014	D5-Phenol	2021/07/08	0.00 (4)	10 - 130	32	10 - 130	29	%				
7440676	Total Carbonaceous BOD	2021/07/07					<2	mg/L	12	30	89	85 - 115
7442106	Chromium (VI)	2021/07/05	106	80 - 120	104	80 - 120	<0.50	ug/L	NC	20		
7442528	Phenols-4AAP	2021/07/03	103	80 - 120	102	80 - 120	<0.0010	mg/L	NC	20		
7442800	Dissolved Antimony (Sb)	2021/07/05	105	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		
7442800	Dissolved Arsenic (As)	2021/07/05	100	80 - 120	95	80 - 120	<1.0	ug/L	NC	20		
7442800	Dissolved Barium (Ba)	2021/07/05	98	80 - 120	97	80 - 120	<2.0	ug/L	3.8	20		
7442800	Dissolved Beryllium (Be)	2021/07/05	100	80 - 120	90	80 - 120	<0.40	ug/L	NC	20		
7442800	Dissolved Boron (B)	2021/07/05	96	80 - 120	86	80 - 120	<10	ug/L	0.21	20		
7442800	Dissolved Cadmium (Cd)	2021/07/05	101	80 - 120	96	80 - 120	<0.090	ug/L	NC	20		
7442800	Dissolved Chromium (Cr)	2021/07/05	95	80 - 120	93	80 - 120	<5.0	ug/L	NC	20		
7442800	Dissolved Cobalt (Co)	2021/07/05	98	80 - 120	96	80 - 120	<0.50	ug/L	0.60	20		
7442800	Dissolved Copper (Cu)	2021/07/05	98	80 - 120	95	80 - 120	<0.90	ug/L	NC	20		
7442800	Dissolved Lead (Pb)	2021/07/05	96	80 - 120	93	80 - 120	<0.50	ug/L	NC	20		

BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7442800	Dissolved Molybdenum (Mo)	2021/07/05	102	80 - 120	93	80 - 120	<0.50	ug/L	8.4	20		
7442800	Dissolved Nickel (Ni)	2021/07/05	93	80 - 120	95	80 - 120	<1.0	ug/L	NC	20		
7442800	Dissolved Selenium (Se)	2021/07/05	104	80 - 120	100	80 - 120	<2.0	ug/L	NC	20		
7442800	Dissolved Silver (Ag)	2021/07/05	95	80 - 120	92	80 - 120	<0.090	ug/L	NC	20		
7442800	Dissolved Sodium (Na)	2021/07/05	NC	80 - 120	96	80 - 120	<100	ug/L	0.13	20		
7442800	Dissolved Thallium (Tl)	2021/07/05	98	80 - 120	98	80 - 120	<0.050	ug/L	NC	20		
7442800	Dissolved Uranium (U)	2021/07/05	100	80 - 120	96	80 - 120	<0.10	ug/L	NC	20		
7442800	Dissolved Vanadium (V)	2021/07/05	97	80 - 120	94	80 - 120	<0.50	ug/L	NC	20		
7442800	Dissolved Zinc (Zn)	2021/07/05	94	80 - 120	94	80 - 120	<5.0	ug/L	NC	20		
7442813	Nonylphenol (Total)	2021/07/06	101	50 - 130	99	50 - 130	<0.001	mg/L	9.9	40		
7442826	Nonylphenol Ethoxylate (Total)	2021/07/06	67	50 - 130	94	50 - 130	<0.025	mg/L	NC	40		
7442854	Dissolved Chloride (Cl-)	2021/07/06	NC	80 - 120	102	80 - 120	<1.0	mg/L	5.5	20		
7442999	Total Suspended Solids	2021/07/06					<10	mg/L	0	25	96	85 - 115
7443205	Total PCB	2021/07/04	77	60 - 130	58 (2)	60 - 130	<0.05	ug/L	NC	40		
7443258	Nonylphenol (Total)	2021/07/06	NC	50 - 130	91	50 - 130	<0.001	mg/L	NC	40		
7443261	Nonylphenol Ethoxylate (Total)	2021/07/06	NC	50 - 130	87	50 - 130	<0.025	mg/L	NC	40		
7444035	Fluoride (F-)	2021/07/05	104	80 - 120	96	80 - 120	<0.10	mg/L	0.46	20		
7444040	pH	2021/07/05			102	98 - 103			1.6	N/A		
7444048	Total Kjeldahl Nitrogen (TKN)	2021/07/05	98	80 - 120	103	80 - 120	<0.10	mg/L	NC	20	97	80 - 120
7444124	WAD Cyanide (Free)	2021/07/05	105	80 - 120	100	80 - 120	<1	ug/L	NC	20		
7444193	Total Cyanide (CN)	2021/07/05	69 (1)	80 - 120	101	80 - 120	<0.0050	mg/L	NC	20		
7444360	Dissolved Sulphate (SO4)	2021/07/06	NC	75 - 125	105	80 - 120	<1.0	mg/L	1.6	20		
7444363	Dissolved Chloride (Cl-)	2021/07/06	NC	80 - 120	100	80 - 120	<1.0	mg/L	0.64	20		
7445528	F1 (C6-C10) - BTEX	2021/07/06					<25	ug/L	NC	30		
7445528	F1 (C6-C10)	2021/07/06	91	60 - 140	87	60 - 140	<25	ug/L	NC	30		
7445796	Mercury (Hg)	2021/07/06	95	75 - 125	97	80 - 120	<0.10	ug/L	NC	20		
7446299	1,1,2,2-Tetrachloroethane	2021/07/07	98	70 - 130	93	70 - 130	<0.40	ug/L	NC	30		
7446299	1,2-Dichlorobenzene	2021/07/07	94	70 - 130	89	70 - 130	<0.40	ug/L	NC	30		
7446299	1,4-Dichlorobenzene	2021/07/07	108	70 - 130	102	70 - 130	<0.40	ug/L	NC	30		
7446299	Benzene	2021/07/07	92	70 - 130	90	70 - 130	<0.20	ug/L	NC	30		
7446299	Chloroform	2021/07/07	96	70 - 130	94	70 - 130	<0.20	ug/L	NC	30		

BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7446299	cis-1,2-Dichloroethylene	2021/07/07	96	70 - 130	94	70 - 130	<0.50	ug/L	NC	30		
7446299	Ethylbenzene	2021/07/07	92	70 - 130	91	70 - 130	<0.20	ug/L	NC	30		
7446299	Methyl Ethyl Ketone (2-Butanone)	2021/07/07	114	60 - 140	111	60 - 140	<10	ug/L	NC	30		
7446299	Methylene Chloride(Dichloromethane)	2021/07/07	108	70 - 130	105	70 - 130	<2.0	ug/L	NC	30		
7446299	o-Xylene	2021/07/07	90	70 - 130	92	70 - 130	<0.20	ug/L	NC	30		
7446299	p+m-Xylene	2021/07/07	98	70 - 130	97	70 - 130	<0.20	ug/L	NC	30		
7446299	Styrene	2021/07/07	103	70 - 130	103	70 - 130	<0.40	ug/L	NC	30		
7446299	Tetrachloroethylene	2021/07/07	85	70 - 130	85	70 - 130	<0.20	ug/L	NC	30		
7446299	Toluene	2021/07/07	96	70 - 130	95	70 - 130	<0.20	ug/L	NC	30		
7446299	Total Xylenes	2021/07/07					<0.20	ug/L	NC	30		
7446299	trans-1,3-Dichloropropene	2021/07/07	115	70 - 130	102	70 - 130	<0.40	ug/L	NC	30		
7446299	Trichloroethylene	2021/07/07	95	70 - 130	95	70 - 130	<0.20	ug/L	NC	30		
7446782	1-Methylnaphthalene	2021/07/06	82	50 - 130	95	50 - 130	<0.050	ug/L	NC	30		
7446782	2-Methylnaphthalene	2021/07/06	79	50 - 130	93	50 - 130	<0.050	ug/L	NC	30		
7446782	Acenaphthene	2021/07/06	87	50 - 130	98	50 - 130	<0.050	ug/L	NC	30		
7446782	Acenaphthylene	2021/07/06	83	50 - 130	94	50 - 130	<0.050	ug/L	NC	30		
7446782	Anthracene	2021/07/06	92	50 - 130	105	50 - 130	<0.050	ug/L	NC	30		
7446782	Benzo(a)anthracene	2021/07/06	103	50 - 130	120	50 - 130	<0.050	ug/L	NC	30		
7446782	Benzo(a)pyrene	2021/07/06	89	50 - 130	104	50 - 130	<0.0090	ug/L	NC	30		
7446782	Benzo(b/j)fluoranthene	2021/07/06	94	50 - 130	112	50 - 130	<0.050	ug/L	NC	30		
7446782	Benzo(g,h,i)perylene	2021/07/06	94	50 - 130	113	50 - 130	<0.050	ug/L	NC	30		
7446782	Benzo(k)fluoranthene	2021/07/06	99	50 - 130	123	50 - 130	<0.050	ug/L	NC	30		
7446782	Chrysene	2021/07/06	93	50 - 130	109	50 - 130	<0.050	ug/L	NC	30		
7446782	Dibenzo(a,h)anthracene	2021/07/06	110	50 - 130	130	50 - 130	<0.050	ug/L	NC	30		
7446782	Fluoranthene	2021/07/06	111	50 - 130	126	50 - 130	<0.050	ug/L	NC	30		
7446782	Fluorene	2021/07/06	102	50 - 130	116	50 - 130	<0.050	ug/L	NC	30		
7446782	Indeno(1,2,3-cd)pyrene	2021/07/06	99	50 - 130	122	50 - 130	<0.050	ug/L	NC	30		
7446782	Naphthalene	2021/07/06	71	50 - 130	80	50 - 130	<0.050	ug/L	NC	30		
7446782	Phenanthrene	2021/07/06	92	50 - 130	106	50 - 130	<0.030	ug/L	NC	30		
7446782	Pyrene	2021/07/06	106	50 - 130	120	50 - 130	<0.050	ug/L	NC	30		
7446805	F2 (C10-C16 Hydrocarbons)	2021/07/07	85	60 - 130	95	60 - 130	<100	ug/L	NC	30		

BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7446805	F3 (C16-C34 Hydrocarbons)	2021/07/07	84	60 - 130	97	60 - 130	<200	ug/L	NC	30		
7446805	F4 (C34-C50 Hydrocarbons)	2021/07/07	83	60 - 130	94	60 - 130	<200	ug/L	NC	30		
7447260	Dissolved Chloride (Cl-)	2021/07/07	NC	80 - 120	103	80 - 120	<1.0	mg/L	1.7	20		
7447268	Dissolved Sulphate (SO4)	2021/07/07	NC	75 - 125	103	80 - 120	<1.0	mg/L	0.35	20		
7447371	Fluoride (F-)	2021/07/07	99	80 - 120	107	80 - 120	<0.10	mg/L	15	20		
7447376	pH	2021/07/07			102	98 - 103			0.30	N/A		
7448079	Total Oil & Grease	2021/07/07			99	85 - 115	<0.50	mg/L	2.0	25		
7448081	Total Oil & Grease Mineral/Synthetic	2021/07/07			97	85 - 115	<0.50	mg/L	2.6	25		
7449014	Bis(2-ethylhexyl)phthalate	2021/07/08	100	30 - 130	98	30 - 130	<2.0	ug/L	NC	40		
7449014	Di-N-butyl phthalate	2021/07/08	84	30 - 130	100	30 - 130	<2.0	ug/L	NC	40		
7467756	Dissolved Antimony (Sb)	2021/07/19	102	80 - 120	105	80 - 120	<0.50	ug/L				
7467756	Dissolved Arsenic (As)	2021/07/19	98	80 - 120	99	80 - 120	<1.0	ug/L				
7467756	Dissolved Barium (Ba)	2021/07/19	99	80 - 120	100	80 - 120	<2.0	ug/L				
7467756	Dissolved Beryllium (Be)	2021/07/19	103	80 - 120	99	80 - 120	<0.40	ug/L				
7467756	Dissolved Boron (B)	2021/07/19	96	80 - 120	96	80 - 120	<10	ug/L				
7467756	Dissolved Cadmium (Cd)	2021/07/19	101	80 - 120	102	80 - 120	<0.090	ug/L				
7467756	Dissolved Chromium (Cr)	2021/07/19	95	80 - 120	97	80 - 120	<5.0	ug/L				
7467756	Dissolved Cobalt (Co)	2021/07/19	99	80 - 120	100	80 - 120	<0.50	ug/L				
7467756	Dissolved Copper (Cu)	2021/07/19	98	80 - 120	100	80 - 120	<0.90	ug/L				
7467756	Dissolved Lead (Pb)	2021/07/19	98	80 - 120	102	80 - 120	<0.50	ug/L				
7467756	Dissolved Molybdenum (Mo)	2021/07/19	100	80 - 120	100	80 - 120	<0.50	ug/L				
7467756	Dissolved Nickel (Ni)	2021/07/19	96	80 - 120	99	80 - 120	<1.0	ug/L				
7467756	Dissolved Selenium (Se)	2021/07/19	97	80 - 120	101	80 - 120	<2.0	ug/L				
7467756	Dissolved Silver (Ag)	2021/07/19	96	80 - 120	97	80 - 120	<0.090	ug/L				
7467756	Dissolved Sodium (Na)	2021/07/19	NC	80 - 120	103	80 - 120	<100	ug/L				
7467756	Dissolved Thallium (Tl)	2021/07/19	99	80 - 120	103	80 - 120	<0.050	ug/L				
7467756	Dissolved Uranium (U)	2021/07/19	101	80 - 120	103	80 - 120	<0.10	ug/L				
7467756	Dissolved Vanadium (V)	2021/07/19	98	80 - 120	101	80 - 120	<0.50	ug/L				
7467756	Dissolved Zinc (Zn)	2021/07/19	97	80 - 120	100	80 - 120	<5.0	ug/L				
7469714	Mercury (Hg)	2021/07/19	101	75 - 125	98	80 - 120	<0.00010	mg/L	NC	20		
7469720	Mercury (Hg)	2021/07/19	96	75 - 125	101	80 - 120	<0.10	ug/L	NC	20		



BUREAU  
VERITAS

BV Labs Job #: C1I0277  
Report Date: 2021/07/20

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7470705	Total Aluminum (Al)	2021/07/20	104	80 - 120	98	80 - 120	<4.9	ug/L	8.4	20		
7470705	Total Antimony (Sb)	2021/07/20	98	80 - 120	94	80 - 120	<0.50	ug/L	NC	20		
7470705	Total Arsenic (As)	2021/07/20	102	80 - 120	96	80 - 120	<1.0	ug/L	NC	20		
7470705	Total Cadmium (Cd)	2021/07/20	99	80 - 120	95	80 - 120	<0.090	ug/L	NC	20		
7470705	Total Chromium (Cr)	2021/07/20	97	80 - 120	93	80 - 120	<5.0	ug/L	NC	20		
7470705	Total Cobalt (Co)	2021/07/20	98	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		
7470705	Total Copper (Cu)	2021/07/20	99	80 - 120	95	80 - 120	<0.90	ug/L	7.5	20		
7470705	Total Lead (Pb)	2021/07/20	95	80 - 120	92	80 - 120	<0.50	ug/L	0.44	20		
7470705	Total Manganese (Mn)	2021/07/20	98	80 - 120	95	80 - 120	<2.0	ug/L	6.1	20		
7470705	Total Molybdenum (Mo)	2021/07/20	97	80 - 120	92	80 - 120	<0.50	ug/L	7.0	20		
7470705	Total Nickel (Ni)	2021/07/20	99	80 - 120	95	80 - 120	<1.0	ug/L	NC	20		
7470705	Total Phosphorus (P)	2021/07/20	98	80 - 120	89	80 - 120	<100	ug/L				
7470705	Total Selenium (Se)	2021/07/20	103	80 - 120	102	80 - 120	<2.0	ug/L	NC	20		
7470705	Total Silver (Ag)	2021/07/20	95	80 - 120	92	80 - 120	<0.090	ug/L	NC	20		
7470705	Total Tin (Sn)	2021/07/20	96	80 - 120	94	80 - 120	<1.0	ug/L				
7470705	Total Titanium (Ti)	2021/07/20	95	80 - 120	92	80 - 120	<5.0	ug/L	NC	20		
7470705	Total Zinc (Zn)	2021/07/20	101	80 - 120	97	80 - 120	<5.0	ug/L	NC	20		

BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382 (7000)  
Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7471996	Chromium (VI)	2021/07/20	118	80 - 120	107	80 - 120	<0.50	ug/L	1.9	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  $\leq 2 \times \text{RDL}$ ).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(2) The recovery for the flagged target analyte was below the control limit as stipulated by Ontario Regulation 153, however, this recovery is still within Bureau Veritas Laboratories' performance based limits. Results reported for this specific analyte with spike recoveries within this range are still valid but may have an associated low bias.

(3) Surrogate recovery was above the upper control limit. This may represent a high bias in some results.

(4) Surrogate recovery was below the lower control limit. This may represent a low bias in some results.



BUREAU  
VERITAS

BV Labs Job #: C1I0277

Report Date: 2021/07/20

Golder Associates Ltd

Client Project #: 1530382 (7000)

Sampler Initials: VP

### VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

Ewa Pranjić, M.Sc., C.Chem, Scientific Specialist

Soham Patel, Analyst 2

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.





## ADDITIONAL COOLER TEMPERATURE RECORD

## CHAIN-OF-CUSTODY RECORD

CHAIN OF CUSTODY #		COOLER OBSERVATIONS:				MAXXAM JOB#: <u>CIT0277</u>			
Page <u>1</u> of <u>1</u>	<u>833689-01-01</u>	CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	TEMP <u>43</u> <u>43</u> <u>41</u>	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input checked="" type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	
Page _____ of _____		CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	TEMP <u>47</u> <u>43</u> <u>42</u>	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input checked="" type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	
Page _____ of _____		CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	TEMP <u>6</u> <u>25</u> <u>26</u>	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input checked="" type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	
Page _____ of _____		CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	
Page _____ of _____		CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	
Page _____ of _____		CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	
Page _____ of _____		CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	
Page _____ of _____		CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	
Page _____ of _____		CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	
Page _____ of _____		CUSTODY SEAL	YES	NO	COOLER ID	CUSTODY SEAL	YES	NO	COOLER ID
Page _____ of _____		PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____	PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	TEMP _____
Page _____ of _____		INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3	INTACT	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3
Page _____ of _____		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>		ICE PRESENT	<input type="checkbox"/>	<input type="checkbox"/>	

RECEIVED BY (SIGN & PRINT)	DATE (YYYY/MM/DD)	TIME (HH:MM)
	<u>02/15/2019</u>	<u>1202</u>

29-Jun-21 17:02

Ema Gitej

C110277

ATM

ENV-804

## Presence of Visible Particulate/Sediment

Maxxam Analytics

CAM FCD-01013/5

Page 1 of 1

When there is &gt;1cm of visible particulate/sediment, the amount will be recorded in the field below

## Bottle Types

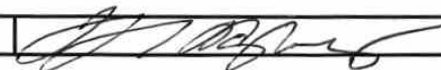
ATM		ENV-804		Inorganics							Organics										Hydrocarbons							Volatiles				Other
	Sample ID	All	CrVI	CN	General	Hg	Metals (Diss.)	Organic 1 of 2	Organic 2 of 2	PCB 1 of 2	PCB 2 of 2	Pest/ Herb 1 of 2	Pest/ Herb 2 of 2	SVOC/ ABN 1 of 2	SVOC/ ABN 2 of 2	PAH 1 of 2	PAH 2 of 2	Dioxin /Furan	F1 Vial 1	F1 Vial 2	F1 Vial 3	F1 Vial 4	F2-F4 1 of 2	F2-F4 2 of 2	F4G	VOC Vial 1	VOC Vial 2	VOC Vial 3	VOC Vial 4			
1	21-11	P																														
2																																
3																																
4																																
5																																
6																																
7																																
8																																
9																																
10																																

Comments:

## Legend:

P	Suspended Particulate
TS	Trace Settled Sediment (just covers bottom of container or less)
S	Sediment greater than (>) Trace, but less than (<) 1 cm

Recorded By: (signature/print)





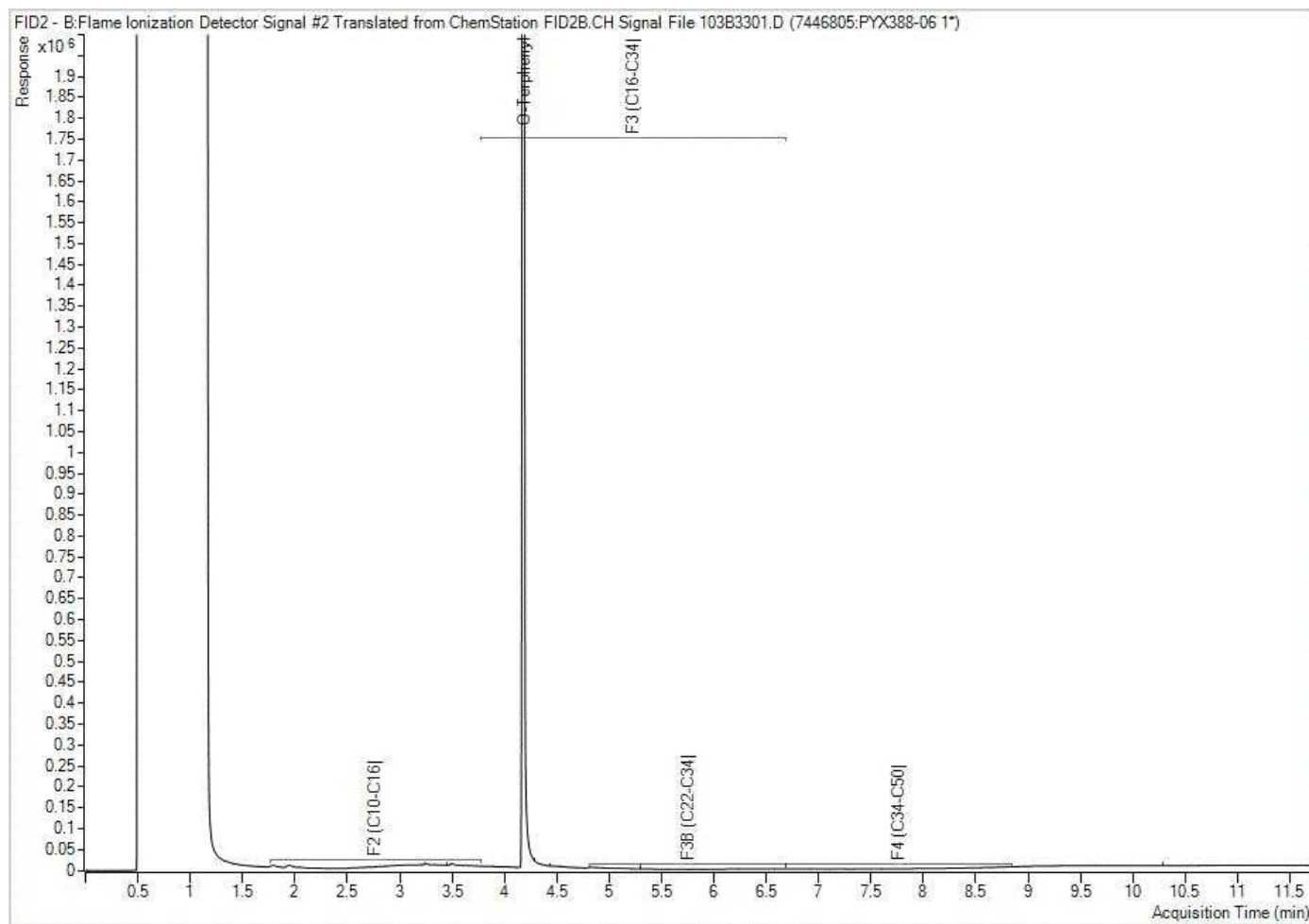
Bureau Veritas Laboratories  
6740 Campbell Road, Mississauga, Ontario Canada L5N 2L8 Tel: (905) 817-5700 Toll-free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

# CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name: #1326 Golder Associates Ltd		Company Name: Lisseth Benavente		Quotation #: B80683		BV Labs Job #:	
Attention: Accounts Payable		Attention:		P.O. #:		Bottle Order #:	
Address: 6925 Century Ave Suite 100		Address:		Project: 1530382 (7000)		833689	
Mississauga ON L5N 7K2				Project Name:		COC #:	
Tel: (905) 567-4444 Fax: (905) 567-6561		Tel: (905) 567-6100 Ext: 1718 Fax:		Site #:		Project Manager: Ema Gitej	
Email: CanadaAccountsPayableInvoices@golder.com		Email: Lisseth_Benavente@golder.com		Sampled By:		C#833689-01-01	
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY				Turnaround Time (TAT) Required: Please provide advance notice for rush projects			
Regulation 153 (2011)		Other Regulations		ANALYSIS REQUESTED (PLEASE BE SPECIFIC)		Regular (Standard) TAT: (will be applied if Rush TAT is not specified): Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.	
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Medium/Fine		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw		<input type="checkbox"/> Field Filtered (please circle): Metals / Hg / Cr / V		<input checked="" type="checkbox"/> Job Specific Rush TAT (if applies to entire submission)	
<input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse		<input type="checkbox"/> Reg 558 <input type="checkbox"/> Storm Sewer Bylaw		<input type="checkbox"/> O Reg 153 Metals & Inorganics Pig		Date Required: Time Required: <input type="checkbox"/>	
<input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> For RSC		<input type="checkbox"/> MISA Municipality		<input type="checkbox"/> O Reg 153 PAHs		Rush Confirmation Number: (call lab for #)	
<input type="checkbox"/> Table <input type="checkbox"/> PWQO <input type="checkbox"/> Reg 406 Table		<input type="checkbox"/> Other		<input type="checkbox"/> O Reg 153 PHCs, BTEX/F1-F4		# of Bottles Comments	
Include Criteria on Certificate of Analysis (Y/N)?				<input type="checkbox"/> Peel Sanitary & Storm Sewer (53-2010)			
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix			
1	21-2						
2	21-11	JUNE 29 2021	9:00AM GW	YES	✓	✓	27
3	21-33	JUNE 29 2021	9:27AM GW	YES	✓	✓	9
4	21-34 21-4	JUNE 29 2021	11:10AM GW	YES	✓	✓	27
5	21-43						
6	21-2						
7	21-11						
8	21-16						
9	21-37						
10	21-43						
* RELINQUISHED BY: (Signature/Print) J. P. Papp		Date: (YY/MM/DD) 2021/06/29	Time: 5:00PM	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD) 06/29/21	Time: 17:02	# jars used and not submitted
						Laboratory Use Only	
						Time Sensitive	
						Temperature (°C) on Receipt	
						Custody Seal Present <input checked="" type="checkbox"/> Intact <input checked="" type="checkbox"/>	
						Yes <input checked="" type="checkbox"/> No <input checked="" type="checkbox"/>	
						White: BV Labs Yellow: Client	
						SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS	

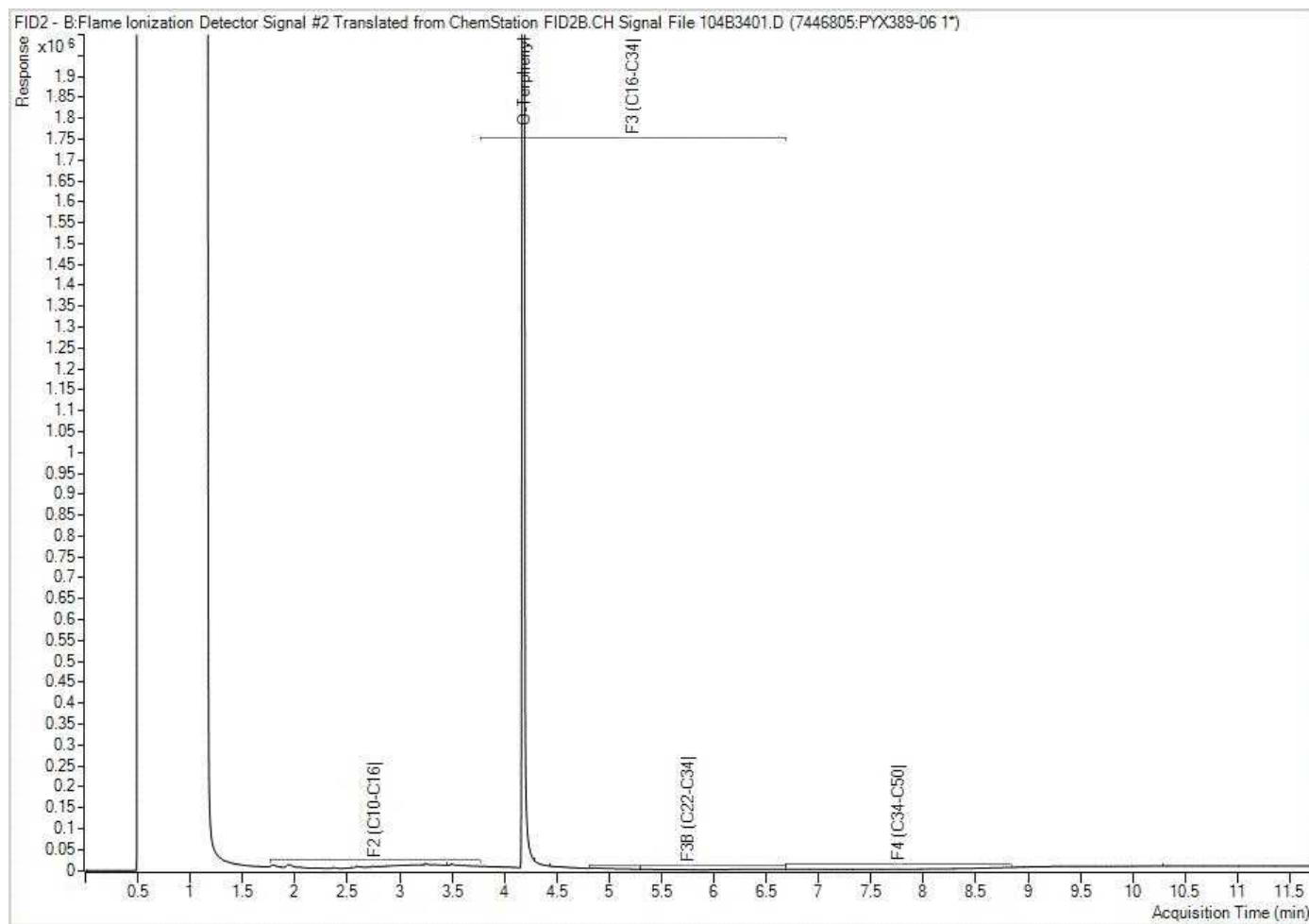
Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

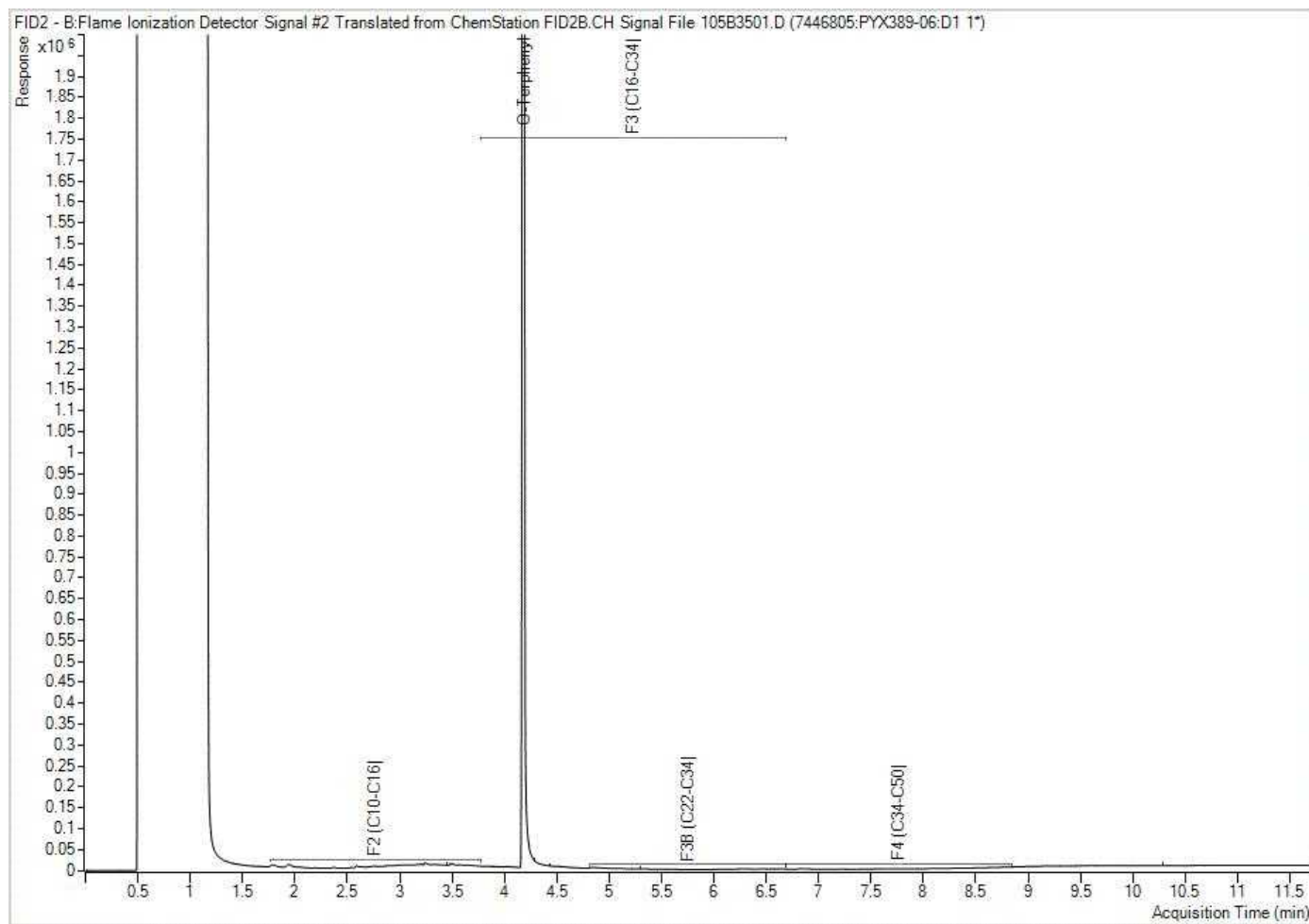


Petroleum Hydrocarbons F2-F4 in Water Chromatogram



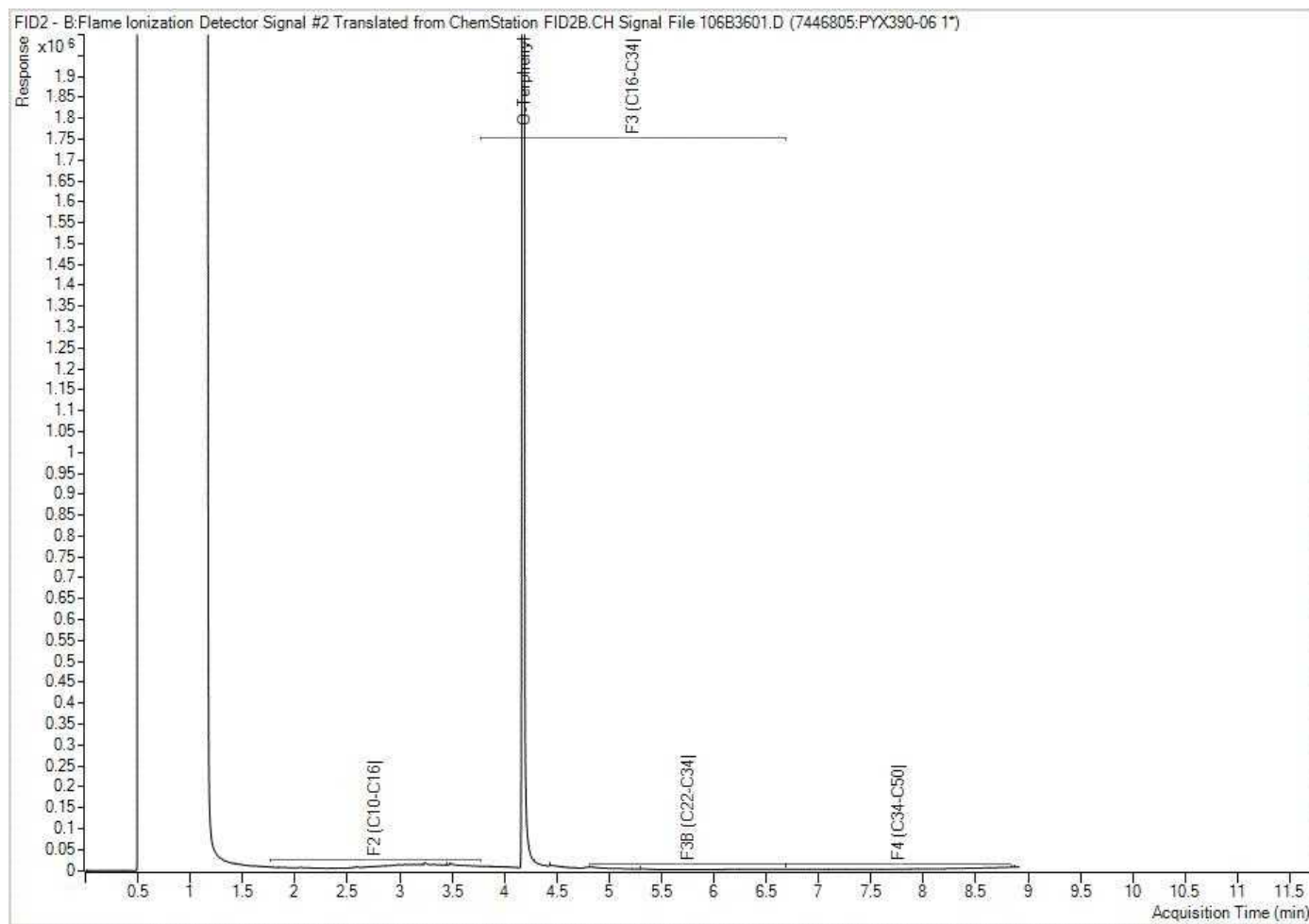
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.



Your Project #: 1530382(7000)  
Your C.O.C. #: 165483

**Attention: Liseth Benavente**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/13**  
Report #: R6717033  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C114674**

**Received: 2021/07/05, 16:56**

Sample Matrix: Water  
# Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Methylnaphthalene Sum	2	N/A	2021/07/08	CAM SOP-00301	EPA 8270D m
ABN Compounds in Water by GC/MS	1	2021/07/07	2021/07/08	CAM SOP-00301	EPA 8270 m
Carbonaceous BOD	1	2021/07/06	2021/07/11	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	2	N/A	2021/07/07	CAM SOP-00463	SM 23 4500-Cl E m
Chromium (VI) in Water	2	N/A	2021/07/07	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	2	N/A	2021/07/06	CAM SOP-00457	OMOE E3015 m
Total Cyanide	1	2021/07/06	2021/07/06	CAM SOP-00457	OMOE E3015 5 m
Petroleum Hydro. CCME F1 & BTEX in Water	2	N/A	2021/07/08	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (1)	2	2021/07/07	2021/07/08	CAM SOP-00316	CCME PHC-CWS m
Fluoride	1	2021/07/06	2021/07/07	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2021/07/07	2021/07/07	CAM SOP-00453	EPA 7470A m
Mercury	2	2021/07/07	2021/07/07	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	2	N/A	2021/07/07	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	1	N/A	2021/07/08	CAM SOP-00447	EPA 6020B m
E.coli, (CFU/100mL)	1	N/A	2021/07/05	CAM SOP-00552	MOE LSB E3371
Total Nonylphenol in Liquids by HPLC	1	2021/07/08	2021/07/08	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2021/07/08	2021/07/08	CAM SOP-00313	BV Labs Method
Animal and Vegetable Oil and Grease	1	N/A	2021/07/08	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2021/07/08	2021/07/08	CAM SOP-00326	EPA1664B m,SM5520B m
PAH Compounds in Water by GC/MS (SIM)	2	2021/07/07	2021/07/08	CAM SOP-00318	EPA 8270D m
Polychlorinated Biphenyl in Water	1	2021/07/06	2021/07/07	CAM SOP-00309	EPA 8082A m
pH	1	2021/07/06	2021/07/07	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2021/07/06	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2021/07/07	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2021/07/06	2021/07/08	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (2)	1	2021/07/08	2021/07/08	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2021/07/07	2021/07/08	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2021/07/09	CAM SOP-00228	EPA 8260C m

**Remarks:**





Your Project #: 1530382(7000)  
Your C.O.C. #: 165483

**Attention: Liseth Benavente**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/13**  
Report #: R6717033  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C114674**

**Received: 2021/07/05, 16:56**

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 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) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

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



Your Project #: 1530382(7000)  
Your C.O.C. #: 165483

**Attention: Liseth Benavente**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/13**  
Report #: R6717033  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C114674**  
**Received: 2021/07/05, 16:56**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Ema Gitej, Senior Project Manager  
Email: emese.gitej@bureauveritas.com  
Phone# (905)817-5829

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU  
VERITAS

BV Labs Job #: C1I4674

Report Date: 2021/07/13

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

<b>BV Labs ID</b>		PZW265			PZW265		
<b>Sampling Date</b>		2021/07/05 10:00			2021/07/05 10:00		
<b>COC Number</b>		165483			165483		
	<b>UNITS</b>	<b>BH21-02</b>	<b>RDL</b>	<b>QC Batch</b>	<b>BH21-02 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Total Animal/Vegetable Oil and Grease	mg/L	<0.50	0.50	7444589			
<b>Inorganics</b>							
Total Carbonaceous BOD	mg/L	<2	2	7445446			
Fluoride (F-)	mg/L	0.36	0.10	7447371			
Total Kjeldahl Nitrogen (TKN)	mg/L	8.8	0.50	7446914			
pH	pH	7.49		7447376			
Phenols-4AAP	mg/L	<0.0010	0.0010	7445760			
Total Suspended Solids	mg/L	45	10	7448464			
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	36	1.0	7447468			
Total Cyanide (CN)	mg/L	<0.0050	0.0050	7446270			
<b>Petroleum Hydrocarbons</b>							
Total Oil & Grease	mg/L	<0.50	0.50	7452407			
Total Oil & Grease Mineral/Synthetic	mg/L	<0.50	0.50	7452410			
<b>Miscellaneous Parameters</b>							
Nonylphenol Ethoxylate (Total)	mg/L	<0.025	0.025	7450708	<0.025	0.025	7450708
Nonylphenol (Total)	mg/L	<0.001	0.001	7450639	<0.001	0.001	7450639
<b>Metals</b>							
Mercury (Hg)	mg/L	<0.00010	0.00010	7448192			
Total Aluminum (Al)	ug/L	390	4.9	7450556			
Total Antimony (Sb)	ug/L	<0.50	0.50	7450556			
Total Arsenic (As)	ug/L	3.2	1.0	7450556			
Total Cadmium (Cd)	ug/L	<0.090	0.090	7450556			
Total Chromium (Cr)	ug/L	<5.0	5.0	7450556			
Total Cobalt (Co)	ug/L	<0.50	0.50	7450556			
Total Copper (Cu)	ug/L	<0.90	0.90	7450556			
Total Lead (Pb)	ug/L	<0.50	0.50	7450556			
Total Manganese (Mn)	ug/L	690	2.0	7450556			
Total Molybdenum (Mo)	ug/L	<0.50	0.50	7450556			
Total Nickel (Ni)	ug/L	<1.0	1.0	7450556			
Total Phosphorus (P)	ug/L	210	100	7450556			
Total Selenium (Se)	ug/L	<2.0	2.0	7450556			
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1I4674

Report Date: 2021/07/13

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

<b>BV Labs ID</b>		PZW265			PZW265		
<b>Sampling Date</b>		2021/07/05 10:00			2021/07/05 10:00		
<b>COC Number</b>		165483			165483		
	<b>UNITS</b>	<b>BH21-02</b>	<b>RDL</b>	<b>QC Batch</b>	<b>BH21-02 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
Total Silver (Ag)	ug/L	<0.090	0.090	7450556			
Total Tin (Sn)	ug/L	<1.0	1.0	7450556			
Total Titanium (Ti)	ug/L	14	5.0	7450556			
Total Zinc (Zn)	ug/L	<5.0	5.0	7450556			
<b>Semivolatile Organics</b>							
Bis(2-ethylhexyl)phthalate	ug/L	<2.0	2.0	7449014			
Di-N-butyl phthalate	ug/L	<2.0	2.0	7449014			
<b>Volatile Organics</b>							
Benzene	ug/L	<0.20	0.20	7447657			
Chloroform	ug/L	<0.20	0.20	7447657			
1,2-Dichlorobenzene	ug/L	<0.40	0.40	7447657			
1,4-Dichlorobenzene	ug/L	<0.40	0.40	7447657			
cis-1,2-Dichloroethylene	ug/L	<0.50	0.50	7447657			
trans-1,3-Dichloropropene	ug/L	<0.40	0.40	7447657			
Ethylbenzene	ug/L	<0.20	0.20	7447657			
Methylene Chloride(Dichloromethane)	ug/L	<2.0	2.0	7447657			
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	10	7447657			
Styrene	ug/L	<0.40	0.40	7447657			
1,1,2,2-Tetrachloroethane	ug/L	<0.40	0.40	7447657			
Tetrachloroethylene	ug/L	<0.20	0.20	7447657			
Toluene	ug/L	<0.20	0.20	7447657			
Trichloroethylene	ug/L	<0.20	0.20	7447657			
p+m-Xylene	ug/L	<0.20	0.20	7447657			
o-Xylene	ug/L	<0.20	0.20	7447657			
Total Xylenes	ug/L	<0.20	0.20	7447657			
<b>PCBs</b>							
Total PCB	ug/L	<0.05	0.05	7446841			
<b>Microbiological</b>							
Escherichia coli	CFU/100mL	<10	10	7445231			
<b>Surrogate Recovery (%)</b>							
2,4,6-Tribromophenol	%	82		7449014			
2-Fluorobiphenyl	%	43		7449014			
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1I4674

Report Date: 2021/07/13

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

<b>BV Labs ID</b>		PZW265			PZW265		
<b>Sampling Date</b>		2021/07/05 10:00			2021/07/05 10:00		
<b>COC Number</b>		165483			165483		
	<b>UNITS</b>	<b>BH21-02</b>	<b>RDL</b>	<b>QC Batch</b>	<b>BH21-02 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
2-Fluorophenol	%	35		7449014			
D14-Terphenyl	%	92		7449014			
D5-Nitrobenzene	%	53		7449014			
D5-Phenol	%	24		7449014			
Decachlorobiphenyl	%	107		7446841			
4-Bromofluorobenzene	%	89		7447657			
D4-1,2-Dichloroethane	%	121		7447657			
D8-Toluene	%	93		7447657			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							

BUREAU  
VERITAS

BV Labs Job #: C1I4674

Report Date: 2021/07/13

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

**O.REG 153 METALS & INORGANICS PKG (WTR)**

BV Labs ID		PZW265			PZW265			PZW266		
Sampling Date		2021/07/05 10:00			2021/07/05 10:00			2021/07/05 13:15		
COC Number		165483			165483			165483		
	UNITS	BH21-02	RDL	QC Batch	BH21-02 Lab-Dup	RDL	QC Batch	BH21-34	RDL	QC Batch
<b>Inorganics</b>										
WAD Cyanide (Free)	ug/L	<1	1	7446193	<1	1	7446193	<1	1	7446193
Dissolved Chloride (Cl-)	mg/L	1300	15	7447459				530	7.0	7447260
<b>Metals</b>										
Chromium (VI)	ug/L	<0.50	0.50	7447821				1.6	0.50	7447821
Mercury (Hg)	ug/L	<0.10	0.10	7448279				<0.10	0.10	7448279
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	7446635				<0.50	0.50	7446199
Dissolved Arsenic (As)	ug/L	5.0	1.0	7446635				<1.0	1.0	7446199
Dissolved Barium (Ba)	ug/L	420	2.0	7446635				240	2.0	7446199
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	7446635				<0.40	0.40	7446199
Dissolved Boron (B)	ug/L	430	10	7446635				480	10	7446199
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	7446635				<0.090	0.090	7446199
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	7446635				<5.0	5.0	7446199
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	7446635				<0.50	0.50	7446199
Dissolved Copper (Cu)	ug/L	<0.90	0.90	7446635				<0.90	0.90	7446199
Dissolved Lead (Pb)	ug/L	<0.50	0.50	7446635				<0.50	0.50	7446199
Dissolved Molybdenum (Mo)	ug/L	<0.50	0.50	7446635				18	0.50	7446199
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	7446635				<1.0	1.0	7446199
Dissolved Selenium (Se)	ug/L	<2.0	2.0	7446635				<2.0	2.0	7446199
Dissolved Silver (Ag)	ug/L	<0.090	0.090	7446635				<0.090	0.090	7446199
Dissolved Sodium (Na)	ug/L	310000	100	7446635				180000	100	7446199
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7446635				<0.050	0.050	7446199
Dissolved Uranium (U)	ug/L	<0.10	0.10	7446635				<0.10	0.10	7446199
Dissolved Vanadium (V)	ug/L	1.2	0.50	7446635				7.4	0.50	7446199
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	7446635				<5.0	5.0	7446199
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										

BUREAU  
VERITAS

BV Labs Job #: C1I4674

Report Date: 2021/07/13

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

**O.REG 153 PAHS (WATER)**

<b>BV Labs ID</b>		PZW265	PZW266		
<b>Sampling Date</b>		2021/07/05 10:00	2021/07/05 13:15		
<b>COC Number</b>		165483	165483		
	<b>UNITS</b>	<b>BH21-02</b>	<b>BH21-34</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>					
Methylnaphthalene, 2-(1-)	ug/L	<0.071	<0.071	0.071	7444414
<b>Polyaromatic Hydrocarbons</b>					
Acenaphthene	ug/L	<0.050	<0.050	0.050	7449283
Acenaphthylene	ug/L	<0.050	<0.050	0.050	7449283
Anthracene	ug/L	<0.050	<0.050	0.050	7449283
Benzo(a)anthracene	ug/L	<0.050	<0.050	0.050	7449283
Benzo(a)pyrene	ug/L	<0.0090	<0.0090	0.0090	7449283
Benzo(b/j)fluoranthene	ug/L	<0.050	<0.050	0.050	7449283
Benzo(g,h,i)perylene	ug/L	<0.050	<0.050	0.050	7449283
Benzo(k)fluoranthene	ug/L	<0.050	<0.050	0.050	7449283
Chrysene	ug/L	<0.050	<0.050	0.050	7449283
Dibenzo(a,h)anthracene	ug/L	<0.050	<0.050	0.050	7449283
Fluoranthene	ug/L	<0.050	<0.050	0.050	7449283
Fluorene	ug/L	<0.050	<0.050	0.050	7449283
Indeno(1,2,3-cd)pyrene	ug/L	<0.050	<0.050	0.050	7449283
1-Methylnaphthalene	ug/L	<0.050	<0.050	0.050	7449283
2-Methylnaphthalene	ug/L	<0.050	<0.050	0.050	7449283
Naphthalene	ug/L	<0.050	<0.050	0.050	7449283
Phenanthrene	ug/L	<0.030	<0.030	0.030	7449283
Pyrene	ug/L	<0.050	<0.050	0.050	7449283
<b>Surrogate Recovery (%)</b>					
D10-Anthracene	%	119	119		7449283
D14-Terphenyl (FS)	%	101	103		7449283
D8-Acenaphthylene	%	95	96		7449283
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					



BUREAU  
VERITAS

BV Labs Job #: C1I4674

Report Date: 2021/07/13

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### O.REG 153 PHCS, BTEX/F1-F4 (WATER)

<b>BV Labs ID</b>		PZW265			PZW266		
<b>Sampling Date</b>		2021/07/05 10:00			2021/07/05 13:15		
<b>COC Number</b>		165483			165483		
	<b>UNITS</b>	<b>BH21-02</b>	<b>RDL</b>	<b>QC Batch</b>	<b>BH21-34</b>	<b>RDL</b>	<b>QC Batch</b>
<b>BTEX &amp; F1 Hydrocarbons</b>							
Benzene	ug/L				<0.20	0.20	7450553
Toluene	ug/L				<0.20	0.20	7450553
Ethylbenzene	ug/L				<0.20	0.20	7450553
o-Xylene	ug/L				<0.20	0.20	7450553
p+m-Xylene	ug/L				<0.40	0.40	7450553
Total Xylenes	ug/L				<0.40	0.40	7450553
F1 (C6-C10)	ug/L	<25	25	7450553	<25	25	7450553
F1 (C6-C10) - BTEX	ug/L	<25	25	7450553	<25	25	7450553
<b>F2-F4 Hydrocarbons</b>							
F2 (C10-C16 Hydrocarbons)	ug/L	<100	100	7449311	<100	100	7449311
F3 (C16-C34 Hydrocarbons)	ug/L	<200	200	7449311	<200	200	7449311
F4 (C34-C50 Hydrocarbons)	ug/L	<200	200	7449311	<200	200	7449311
Reached Baseline at C50	ug/L	Yes		7449311	Yes		7449311
<b>Surrogate Recovery (%)</b>							
1,4-Difluorobenzene	%	104		7450553	101		7450553
4-Bromofluorobenzene	%	96		7450553	97		7450553
D10-o-Xylene	%	95		7450553	94		7450553
D4-1,2-Dichloroethane	%	102		7450553	106		7450553
o-Terphenyl	%	95		7449311	95		7449311
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							





BV Labs Job #: C1I4674  
Report Date: 2021/07/13

Golder Associates Ltd  
Client Project #: 1530382(7000)  
Sampler Initials: VP

## TEST SUMMARY

**BV Labs ID:** PZW265  
**Sample ID:** BH21-02  
**Matrix:** Water

**Collected:** 2021/07/05  
**Shipped:**  
**Received:** 2021/07/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7444414	N/A	2021/07/08	Automated Statchk
ABN Compounds in Water by GC/MS	GC/MS	7449014	2021/07/07	2021/07/08	Anh Lieu
Carbonaceous BOD	DO	7445446	2021/07/06	2021/07/11	Nusrat Naz
Chloride by Automated Colourimetry	KONE	7447459	N/A	2021/07/07	Alina Dobreanu
Chromium (VI) in Water	IC	7447821	N/A	2021/07/07	Lang Le
Free (WAD) Cyanide	SKAL/CN	7446193	N/A	2021/07/06	Aditiben Patel
Total Cyanide	SKAL/CN	7446270	2021/07/06	2021/07/06	Aditiben Patel
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7450553	N/A	2021/07/08	Anca Ganea
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7449311	2021/07/07	2021/07/08	Jeevaraj Jeevaratnam
Fluoride	ISE	7447371	2021/07/06	2021/07/07	Surinder Rai
Mercury in Water by CVAA	CV/AA	7448192	2021/07/07	2021/07/07	Gagandeep Rai
Mercury	CV/AA	7448279	2021/07/07	2021/07/07	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7446635	N/A	2021/07/07	Arefa Dabhad
Total Metals Analysis by ICPMS	ICP/MS	7450556	N/A	2021/07/08	Nan Raykha
E.coli, (CFU/100mL)	PL	7445231	N/A	2021/07/05	Soham Patel
Total Nonylphenol in Liquids by HPLC	LC/FLU	7450639	2021/07/08	2021/07/08	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7450708	2021/07/08	2021/07/08	Dennis Boodram
Animal and Vegetable Oil and Grease	BAL	7444589	N/A	2021/07/08	Automated Statchk
Total Oil and Grease	BAL	7452407	2021/07/08	2021/07/08	Karamjeet Randhawa
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7449283	2021/07/07	2021/07/08	Mitesh Raj
Polychlorinated Biphenyl in Water	GC/ECD	7446841	2021/07/06	2021/07/07	Dawn Howard
pH	AT	7447376	2021/07/06	2021/07/07	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7445760	N/A	2021/07/06	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7447468	N/A	2021/07/07	Alina Dobreanu
Total Kjeldahl Nitrogen in Water	SKAL	7446914	2021/07/06	2021/07/08	Massarat Jan
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7452410	2021/07/08	2021/07/08	Karamjeet Randhawa
Total Suspended Solids	BAL	7448464	2021/07/07	2021/07/08	Sandeep Kaur
Volatile Organic Compounds in Water	GC/MS	7447657	N/A	2021/07/09	Chandni Khawas

**BV Labs ID:** PZW265 Dup  
**Sample ID:** BH21-02  
**Matrix:** Water

**Collected:** 2021/07/05  
**Shipped:**  
**Received:** 2021/07/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Free (WAD) Cyanide	SKAL/CN	7446193	N/A	2021/07/06	Aditiben Patel
Total Nonylphenol in Liquids by HPLC	LC/FLU	7450639	2021/07/08	2021/07/08	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7450708	2021/07/08	2021/07/08	Dennis Boodram

**BV Labs ID:** PZW266  
**Sample ID:** BH21-34  
**Matrix:** Water

**Collected:** 2021/07/05  
**Shipped:**  
**Received:** 2021/07/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7444414	N/A	2021/07/08	Automated Statchk
Chloride by Automated Colourimetry	KONE	7447260	N/A	2021/07/07	Alina Dobreanu



BUREAU  
VERITAS

BV Labs Job #: C1I4674  
Report Date: 2021/07/13

Golder Associates Ltd  
Client Project #: 1530382(7000)  
Sampler Initials: VP

## TEST SUMMARY

**BV Labs ID:** PZW266  
**Sample ID:** BH21-34  
**Matrix:** Water

**Collected:** 2021/07/05  
**Shipped:**  
**Received:** 2021/07/05

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chromium (VI) in Water	IC	7447821	N/A	2021/07/07	Lang Le
Free (WAD) Cyanide	SKAL/CN	7446193	N/A	2021/07/06	Aditiben Patel
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	7450553	N/A	2021/07/08	Anca Ganea
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7449311	2021/07/07	2021/07/08	Jeevaraj Jeevaratnam
Mercury	CV/AA	7448279	2021/07/07	2021/07/07	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7446199	N/A	2021/07/07	Azita Fazaeli
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7449283	2021/07/07	2021/07/08	Mitesh Raj



BUREAU  
VERITAS

BV Labs Job #: C1I4674

Report Date: 2021/07/13

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### GENERAL COMMENTS

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

Package 1	15.3°C
-----------	--------

#### O.REG 153 METALS & INORGANICS PKG (WTR)

Dissolved Metals by ICPMS: Matrix Spike exceeds acceptance limits, probable matrix interference.

**Results relate only to the items tested.**

BUREAU  
VERITAS

BV Labs Job #: C114674

Report Date: 2021/07/13

## QUALITY ASSURANCE REPORT

Golder Associates Ltd  
Client Project #: 1530382(7000)  
Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7446841	Decachlorobiphenyl	2021/07/07	104	60 - 130	64	60 - 130	86	%				
7447657	4-Bromofluorobenzene	2021/07/08	104	70 - 130	105	70 - 130	97	%				
7447657	D4-1,2-Dichloroethane	2021/07/08	105	70 - 130	104	70 - 130	112	%				
7447657	D8-Toluene	2021/07/08	109	70 - 130	110	70 - 130	94	%				
7449014	2,4,6-Tribromophenol	2021/07/08	45	10 - 130	85	10 - 130	78	%				
7449014	2-Fluorobiphenyl	2021/07/08	22 (3)	30 - 130	63	30 - 130	65	%				
7449014	2-Fluorophenol	2021/07/08	9.4 (3)	10 - 130	45	10 - 130	44	%				
7449014	D14-Terphenyl	2021/07/08	89	30 - 130	94	30 - 130	94	%				
7449014	D5-Nitrobenzene	2021/07/08	27 (3)	30 - 130	79	30 - 130	76	%				
7449014	D5-Phenol	2021/07/08	0.00 (3)	10 - 130	32	10 - 130	29	%				
7449283	D10-Anthracene	2021/07/08	147 (1)	50 - 130	126	50 - 130	121	%				
7449283	D14-Terphenyl (FS)	2021/07/08	134 (1)	50 - 130	113	50 - 130	109	%				
7449283	D8-Acenaphthylene	2021/07/08	129	50 - 130	107	50 - 130	98	%				
7449311	o-Terphenyl	2021/07/08	97	60 - 130	96	60 - 130	94	%				
7450553	1,4-Difluorobenzene	2021/07/08	98	70 - 130	100	70 - 130	102	%				
7450553	4-Bromofluorobenzene	2021/07/08	103	70 - 130	103	70 - 130	96	%				
7450553	D10-o-Xylene	2021/07/08	83	70 - 130	93	70 - 130	98	%				
7450553	D4-1,2-Dichloroethane	2021/07/08	105	70 - 130	97	70 - 130	102	%				
7445446	Total Carbonaceous BOD	2021/07/11					<2	mg/L	NC	30	105	85 - 115
7445760	Phenols-4AAP	2021/07/06	94	80 - 120	99	80 - 120	<0.0010	mg/L	NC	20		
7446193	WAD Cyanide (Free)	2021/07/06	104	80 - 120	98	80 - 120	<1	ug/L	NC	20		
7446199	Dissolved Antimony (Sb)	2021/07/07	80	80 - 120	101	80 - 120	<0.50	ug/L				
7446199	Dissolved Arsenic (As)	2021/07/07	75 (1)	80 - 120	96	80 - 120	<1.0	ug/L				
7446199	Dissolved Barium (Ba)	2021/07/08	76 (2)	80 - 120	97	80 - 120	<2.0	ug/L	2.6	20		
7446199	Dissolved Beryllium (Be)	2021/07/07	88	80 - 120	96	80 - 120	<0.40	ug/L				
7446199	Dissolved Boron (B)	2021/07/08	NC	80 - 120	95	80 - 120	<10	ug/L	0.78	20		
7446199	Dissolved Cadmium (Cd)	2021/07/08	76 (2)	80 - 120	97	80 - 120	<0.090	ug/L	NC	20		
7446199	Dissolved Chromium (Cr)	2021/07/08	77 (2)	80 - 120	97	80 - 120	<5.0	ug/L	NC	20		
7446199	Dissolved Cobalt (Co)	2021/07/07	74 (1)	80 - 120	95	80 - 120	<0.50	ug/L				
7446199	Dissolved Copper (Cu)	2021/07/08	76 (2)	80 - 120	94	80 - 120	<0.90	ug/L	NC	20		
7446199	Dissolved Lead (Pb)	2021/07/08	68 (2)	80 - 120	94	80 - 120	<0.50	ug/L	NC	20		

BUREAU  
VERITAS

BV Labs Job #: C114674

Report Date: 2021/07/13

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7446199	Dissolved Molybdenum (Mo)	2021/07/07	85	80 - 120	97	80 - 120	<0.50	ug/L				
7446199	Dissolved Nickel (Ni)	2021/07/07	73 (1)	80 - 120	95	80 - 120	<1.0	ug/L				
7446199	Dissolved Selenium (Se)	2021/07/07	73 (1)	80 - 120	99	80 - 120	<2.0	ug/L				
7446199	Dissolved Silver (Ag)	2021/07/08	64 (2)	80 - 120	94	80 - 120	<0.090	ug/L	NC	20		
7446199	Dissolved Sodium (Na)	2021/07/08	NC	80 - 120	97	80 - 120	<100	ug/L	3.8	20		
7446199	Dissolved Thallium (Tl)	2021/07/07	69 (1)	80 - 120	95	80 - 120	<0.050	ug/L				
7446199	Dissolved Uranium (U)	2021/07/07	78 (1)	80 - 120	100	80 - 120	<0.10	ug/L				
7446199	Dissolved Vanadium (V)	2021/07/07	81	80 - 120	97	80 - 120	<0.50	ug/L				
7446199	Dissolved Zinc (Zn)	2021/07/08	68 (2)	80 - 120	96	80 - 120	<5.0	ug/L	NC	20		
7446270	Total Cyanide (CN)	2021/07/06	103	80 - 120	101	80 - 120	<0.0050	mg/L	NC	20		
7446635	Dissolved Antimony (Sb)	2021/07/07	107	80 - 120	100	80 - 120	<0.50	ug/L	NC	20		
7446635	Dissolved Arsenic (As)	2021/07/07	102	80 - 120	97	80 - 120	<1.0	ug/L	NC	20		
7446635	Dissolved Barium (Ba)	2021/07/07	102	80 - 120	98	80 - 120	<2.0	ug/L	4.8	20		
7446635	Dissolved Beryllium (Be)	2021/07/07	95	80 - 120	90	80 - 120	<0.40	ug/L	NC	20		
7446635	Dissolved Boron (B)	2021/07/07	93	80 - 120	89	80 - 120	<10	ug/L	2.6	20		
7446635	Dissolved Cadmium (Cd)	2021/07/07	106	80 - 120	100	80 - 120	<0.090	ug/L	NC	20		
7446635	Dissolved Chromium (Cr)	2021/07/07	98	80 - 120	93	80 - 120	<5.0	ug/L	NC	20		
7446635	Dissolved Cobalt (Co)	2021/07/07	100	80 - 120	97	80 - 120	<0.50	ug/L	NC	20		
7446635	Dissolved Copper (Cu)	2021/07/07	97	80 - 120	94	80 - 120	<0.90	ug/L	NC	20		
7446635	Dissolved Lead (Pb)	2021/07/07	100	80 - 120	96	80 - 120	<0.50	ug/L	NC	20		
7446635	Dissolved Molybdenum (Mo)	2021/07/07	101	80 - 120	94	80 - 120	<0.50	ug/L	3.5	20		
7446635	Dissolved Nickel (Ni)	2021/07/07	96	80 - 120	95	80 - 120	<1.0	ug/L	NC	20		
7446635	Dissolved Selenium (Se)	2021/07/07	102	80 - 120	100	80 - 120	<2.0	ug/L	NC	20		
7446635	Dissolved Silver (Ag)	2021/07/07	99	80 - 120	95	80 - 120	<0.090	ug/L	NC	20		
7446635	Dissolved Sodium (Na)	2021/07/07	100	80 - 120	96	80 - 120	<100	ug/L	0.13	20		
7446635	Dissolved Thallium (Tl)	2021/07/07	105	80 - 120	97	80 - 120	<0.050	ug/L	NC	20		
7446635	Dissolved Uranium (U)	2021/07/07	103	80 - 120	97	80 - 120	<0.10	ug/L	0.84	20		
7446635	Dissolved Vanadium (V)	2021/07/07	101	80 - 120	96	80 - 120	<0.50	ug/L	NC	20		
7446635	Dissolved Zinc (Zn)	2021/07/07	102	80 - 120	98	80 - 120	<5.0	ug/L	NC	20		
7446841	Total PCB	2021/07/07	91	60 - 130	71	60 - 130	<0.05	ug/L	NC	40		
7446914	Total Kjeldahl Nitrogen (TKN)	2021/07/07	102	80 - 120	104	80 - 120	<0.10	mg/L	NC	20	105	80 - 120

BUREAU  
VERITAS

BV Labs Job #: C114674

Report Date: 2021/07/13

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382(7000)  
Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7447260	Dissolved Chloride (Cl-)	2021/07/07	NC	80 - 120	103	80 - 120	<1.0	mg/L	1.7	20		
7447371	Fluoride (F-)	2021/07/07	99	80 - 120	107	80 - 120	<0.10	mg/L	15	20		
7447376	pH	2021/07/07			102	98 - 103			0.30	N/A		
7447459	Dissolved Chloride (Cl-)	2021/07/07	NC	80 - 120	105	80 - 120	<1.0	mg/L	0.29	20		
7447468	Dissolved Sulphate (SO4)	2021/07/07	117	75 - 125	103	80 - 120	<1.0	mg/L	NC	20		
7447657	1,1,2,2-Tetrachloroethane	2021/07/08	102	70 - 130	100	70 - 130	<0.40	ug/L	NC	30		
7447657	1,2-Dichlorobenzene	2021/07/08	93	70 - 130	94	70 - 130	<0.40	ug/L	NC	30		
7447657	1,4-Dichlorobenzene	2021/07/08	104	70 - 130	107	70 - 130	<0.40	ug/L	NC	30		
7447657	Benzene	2021/07/08	93	70 - 130	94	70 - 130	<0.20	ug/L	NC	30		
7447657	Chloroform	2021/07/08	99	70 - 130	101	70 - 130	<0.20	ug/L	NC	30		
7447657	cis-1,2-Dichloroethylene	2021/07/08	102	70 - 130	102	70 - 130	<0.50	ug/L	NC	30		
7447657	Ethylbenzene	2021/07/08	87	70 - 130	88	70 - 130	<0.20	ug/L	NC	30		
7447657	Methyl Ethyl Ketone (2-Butanone)	2021/07/08	124	60 - 140	118	60 - 140	<10	ug/L	NC	30		
7447657	Methylene Chloride(Dichloromethane)	2021/07/08	113	70 - 130	116	70 - 130	<2.0	ug/L	NC	30		
7447657	o-Xylene	2021/07/08	85	70 - 130	90	70 - 130	<0.20	ug/L	NC	30		
7447657	p+m-Xylene	2021/07/08	92	70 - 130	93	70 - 130	<0.20	ug/L	3.4	30		
7447657	Styrene	2021/07/08	79	70 - 130	83	70 - 130	<0.40	ug/L	NC	30		
7447657	Tetrachloroethylene	2021/07/08	88	70 - 130	92	70 - 130	<0.20	ug/L	3.6	30		
7447657	Toluene	2021/07/08	100	70 - 130	99	70 - 130	<0.20	ug/L	5.1	30		
7447657	Total Xylenes	2021/07/08					<0.20	ug/L	3.4	30		
7447657	trans-1,3-Dichloropropene	2021/07/08	109	70 - 130	104	70 - 130	<0.40	ug/L	NC	30		
7447657	Trichloroethylene	2021/07/08	98	70 - 130	101	70 - 130	<0.20	ug/L	2.9	30		
7447821	Chromium (VI)	2021/07/07	108	80 - 120	108	80 - 120	<0.50	ug/L	NC	20		
7448192	Mercury (Hg)	2021/07/07	95	75 - 125	96	80 - 120	<0.00010	mg/L	NC	20		
7448279	Mercury (Hg)	2021/07/07	95	75 - 125	95	80 - 120	<0.10	ug/L	NC	20		
7448464	Total Suspended Solids	2021/07/08					<10	mg/L	7.4	25	98	85 - 115
7449014	Bis(2-ethylhexyl)phthalate	2021/07/08	100	30 - 130	98	30 - 130	<2.0	ug/L	NC	40		
7449014	Di-N-butyl phthalate	2021/07/08	84	30 - 130	100	30 - 130	<2.0	ug/L	NC	40		
7449283	1-Methylnaphthalene	2021/07/08	97	50 - 130	86	50 - 130	<0.050	ug/L	NC	30		
7449283	2-Methylnaphthalene	2021/07/08	92	50 - 130	82	50 - 130	<0.050	ug/L	NC	30		
7449283	Acenaphthene	2021/07/08	115	50 - 130	101	50 - 130	<0.050	ug/L	NC	30		

BUREAU  
VERITAS

BV Labs Job #: C114674

Report Date: 2021/07/13

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382(7000)  
Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7449283	Acenaphthylene	2021/07/08	112	50 - 130	98	50 - 130	<0.050	ug/L	NC	30		
7449283	Anthracene	2021/07/08	127	50 - 130	110	50 - 130	<0.050	ug/L	NC	30		
7449283	Benzo(a)anthracene	2021/07/08	126	50 - 130	108	50 - 130	<0.050	ug/L	NC	30		
7449283	Benzo(a)pyrene	2021/07/08	102	50 - 130	87	50 - 130	<0.0090	ug/L	NC	30		
7449283	Benzo(b,j)fluoranthene	2021/07/08	116	50 - 130	99	50 - 130	<0.050	ug/L	NC	30		
7449283	Benzo(g,h,i)perylene	2021/07/08	116	50 - 130	100	50 - 130	<0.050	ug/L	NC	30		
7449283	Benzo(k)fluoranthene	2021/07/08	104	50 - 130	89	50 - 130	<0.050	ug/L	NC	30		
7449283	Chrysene	2021/07/08	125	50 - 130	109	50 - 130	<0.050	ug/L	NC	30		
7449283	Dibenzo(a,h)anthracene	2021/07/08	101	50 - 130	84	50 - 130	<0.050	ug/L	NC	30		
7449283	Fluoranthene	2021/07/08	136 (1)	50 - 130	118	50 - 130	<0.050	ug/L	NC	30		
7449283	Fluorene	2021/07/08	118	50 - 130	102	50 - 130	<0.050	ug/L	NC	30		
7449283	Indeno(1,2,3-cd)pyrene	2021/07/08	128	50 - 130	109	50 - 130	<0.050	ug/L	NC	30		
7449283	Naphthalene	2021/07/08	101	50 - 130	93	50 - 130	<0.050	ug/L	NC	30		
7449283	Phenanthrene	2021/07/08	123	50 - 130	106	50 - 130	<0.030	ug/L	NC	30		
7449283	Pyrene	2021/07/08	136 (1)	50 - 130	117	50 - 130	<0.050	ug/L	NC	30		
7449311	F2 (C10-C16 Hydrocarbons)	2021/07/08	102	60 - 130	102	60 - 130	<100	ug/L	NC	30		
7449311	F3 (C16-C34 Hydrocarbons)	2021/07/08	102	60 - 130	102	60 - 130	<200	ug/L	NC	30		
7449311	F4 (C34-C50 Hydrocarbons)	2021/07/08	102	60 - 130	100	60 - 130	<200	ug/L	NC	30		
7450553	Benzene	2021/07/08	89	50 - 140	102	50 - 140	<0.20	ug/L	NC	30		
7450553	Ethylbenzene	2021/07/08	94	50 - 140	113	50 - 140	<0.20	ug/L	NC	30		
7450553	F1 (C6-C10) - BTEX	2021/07/08					<25	ug/L	NC	30		
7450553	F1 (C6-C10)	2021/07/08	77	60 - 140	89	60 - 140	<25	ug/L	NC	30		
7450553	o-Xylene	2021/07/08	93	50 - 140	109	50 - 140	<0.20	ug/L	NC	30		
7450553	p+m-Xylene	2021/07/08	92	50 - 140	112	50 - 140	<0.40	ug/L	NC	30		
7450553	Toluene	2021/07/08	85	50 - 140	99	50 - 140	<0.20	ug/L	NC	30		
7450553	Total Xylenes	2021/07/08					<0.40	ug/L	NC	30		
7450556	Total Aluminum (Al)	2021/07/08	NC	80 - 120	99	80 - 120	<4.9	ug/L	10	20		
7450556	Total Antimony (Sb)	2021/07/08	101	80 - 120	96	80 - 120	<0.50	ug/L				
7450556	Total Arsenic (As)	2021/07/08	101	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
7450556	Total Cadmium (Cd)	2021/07/08	101	80 - 120	98	80 - 120	<0.090	ug/L	12	20		
7450556	Total Chromium (Cr)	2021/07/08	97	80 - 120	97	80 - 120	<5.0	ug/L	NC	20		

BUREAU  
VERITAS

BV Labs Job #: C114674

Report Date: 2021/07/13

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7450556	Total Cobalt (Co)	2021/07/08	98	80 - 120	99	80 - 120	<0.50	ug/L	NC	20		
7450556	Total Copper (Cu)	2021/07/08	99	80 - 120	99	80 - 120	<0.90	ug/L	1.8	20		
7450556	Total Lead (Pb)	2021/07/08	96	80 - 120	95	80 - 120	<0.50	ug/L	1.9	20		
7450556	Total Manganese (Mn)	2021/07/08	97	80 - 120	97	80 - 120	<2.0	ug/L	1.3	20		
7450556	Total Molybdenum (Mo)	2021/07/08	102	80 - 120	99	80 - 120	<0.50	ug/L	0.090	20		
7450556	Total Nickel (Ni)	2021/07/08	96	80 - 120	97	80 - 120	<1.0	ug/L	4.5	20		
7450556	Total Phosphorus (P)	2021/07/08	90	80 - 120	96	80 - 120	<100	ug/L				
7450556	Total Selenium (Se)	2021/07/08	103	80 - 120	102	80 - 120	<2.0	ug/L	NC	20		
7450556	Total Silver (Ag)	2021/07/08	102	80 - 120	101	80 - 120	<0.090	ug/L	NC	20		
7450556	Total Tin (Sn)	2021/07/08	99	80 - 120	94	80 - 120	<1.0	ug/L				
7450556	Total Titanium (Ti)	2021/07/08	89	80 - 120	90	80 - 120	<5.0	ug/L				
7450556	Total Zinc (Zn)	2021/07/08	100	80 - 120	101	80 - 120	<5.0	ug/L	0.89	20		
7450639	Nonylphenol (Total)	2021/07/08	69	50 - 130	79	50 - 130	<0.001	mg/L	NC	40		
7450708	Nonylphenol Ethoxylate (Total)	2021/07/08	81	50 - 130	83	50 - 130	<0.025	mg/L	NC	40		
7452407	Total Oil & Grease	2021/07/08			97	85 - 115	<0.50	mg/L	0.52	25		
7452410	Total Oil & Grease Mineral/Synthetic	2021/07/08			96	85 - 115	<0.50	mg/L	1.6	25		

N/A = Not Applicable

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

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

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

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

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

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

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

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

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(2) Matrix Spike exceeds acceptance limits, probable matrix interference.

(3) Surrogate recovery was below the lower control limit. This may represent a low bias in some results.





BUREAU  
VERITAS

BV Labs Job #: C114674

Report Date: 2021/07/13

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

Soham Patel, Analyst 2

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

05-Jul-21 16:56

Ema Gitej



C114674

# Presence of Visible Particulate/Sediment

Maxxam Analytics  
CAM FCD-01013/5  
Page 1 of 1

When there is >1cm of visible particulate/sediment, the amount will be recorded in the field below

## Bottle Types

VTN: ENM 1171

C114674		Inorganics										Organics										Hydrocarbons										Volatiles				Other
Sample ID	All	CrVI	CN	General	Hg	Metals (Diss.)	Organic 1 of 2	Organic 2 of 2	PCB 1 of 2	PCB 2 of 2	Pest/ Herb 1 of 2	Pest/ Herb 2 of 2	SVOC/ ABN 1 of 2	SVOC/ ABN 2 of 2	PAH 1 of 2	PAH 2 of 2	Dioxin /Furan	F1 Vial 1	F1 Vial 2	F1 Vial 3	F1 Vial 4	F2-F4 1 of 2	F2-F4 2 of 2	F4G	VOC Vial 1	VOC Vial 2	VOC Vial 3	VOC Vial 4	Voc Vial 2							
1	BH21-02																													TS	TS					
2																																				
3																																				
4																																				
5																																				
6																																				
7																																				
8																																				
9																																				
10																																				

Comments:

### Legend:

P	Suspended Particulate
TS	Trace Settled Sediment (just covers bottom of container or less)
S	Sediment greater than (>) Trace, but less than (<) 1 cm

Recorded By: (signature/print)

VI TRAP



05-Jul-21 16:56

Ema Gitej

ad, Mississauga, Ontario L5N 2L8

IO Fax: 905-817-5779 Toll Free: 800-563-6266

C114674

CHAIN OF CUSTODY RECORD 165483 Page 1 of 1

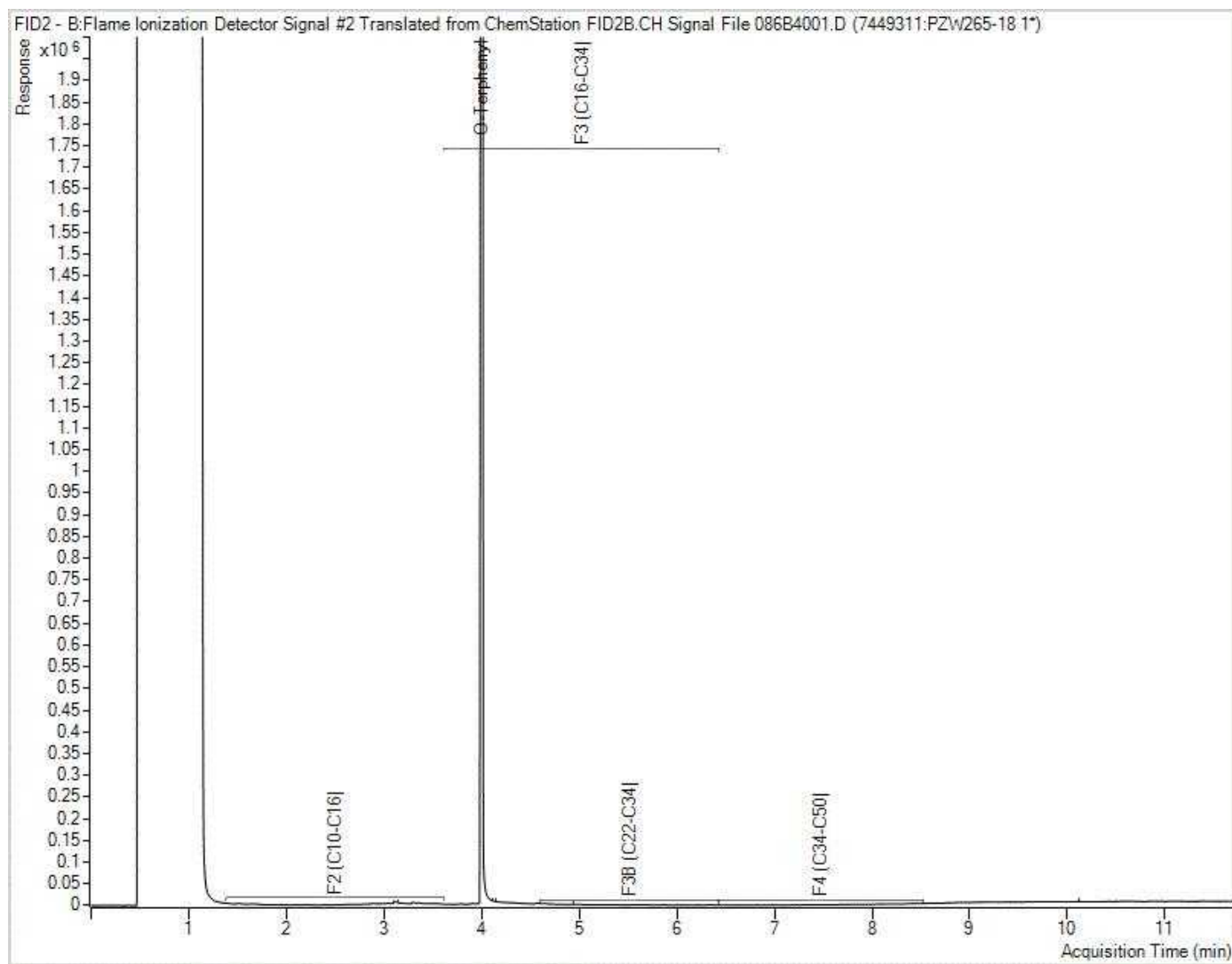
Report Information (if differs from invoice)				Project Information (where applicable)				Turnaround Time (TAT) Required			
Company Name: <u>Golder</u>				Quotation #: <u>B80683</u>				<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses			
Contact Name: <u>Accounts Payable</u>				P.O. #/ AFER:				PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS			
Address: <u>6925 Century Ave. Suite 100</u>				Project #: <u>1530382 (7000)</u>				Rush TAT (Surcharges will be applied)			
Address: <u>MISSISSAUGA ON L5N 7K2</u>				Site Location:				<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days			
Phone: <u>905 567 4444</u> Fax: <u>905 567 6561</u>				Site #:				Date Required:			
Email: <u>CanadaAccountsPayableInvoices@Golder.com</u>				Site Location Province:				Rush Confirmation #:			
Email: <u>Lisseth_Benavente@Golder.com</u>				Sampled By:				LABORATORY USE ONLY			
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS LABORATORIES' DRINKING WATER CHAIN OF CUSTODY											
Regulation 153				Other Regulations				Analysis Requested			
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/Fine				<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw				FIELD FILTERED (CIRC) (Metal / NH <sub>4</sub> / CVI) BTEX / PHC F1 PHC F2 F4 VOCs REG 153 METALS & INORGANICS REG 153 METALS REG 153 METALS (H <sub>2</sub> Cr VI, CPMS Metals, HWS - B) 0 Reg 153 PATHS 0 Reg 153 AICS BTEX F1-F4 Per 1 Sanitary Sewer			
<input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse				<input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw							
<input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/ Other				<input type="checkbox"/> PWQO Region							
<input type="checkbox"/> Table _____				<input type="checkbox"/> Other (Specify)							
FOR RSC (PLEASE CIRCLE) Y / N				<input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED)							
Include Criteria on Certificate of Analysis: Y / N								CUSTODY SEAL			
SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS								Present Intact			
								COOLER TEMPERATURES			
								16/07/17			
								COOLING MEDIA PRESENT: <input checked="" type="checkbox"/> Y / N			
								COMMENTS			
RELINQUISHED BY: (Signature/Print)				DATE: (YYYY/MM/DD)				TIME: (HH:MM)			
BV JOB #											
Vicepres VProp				2021/07/05 16:50				2021/07/05 16:56			

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Bureau Veritas Laboratories' standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgment and acceptance of our terms available at: <http://www.bvlab.com/terms-and-conditions>

COC-1004 (06/19)

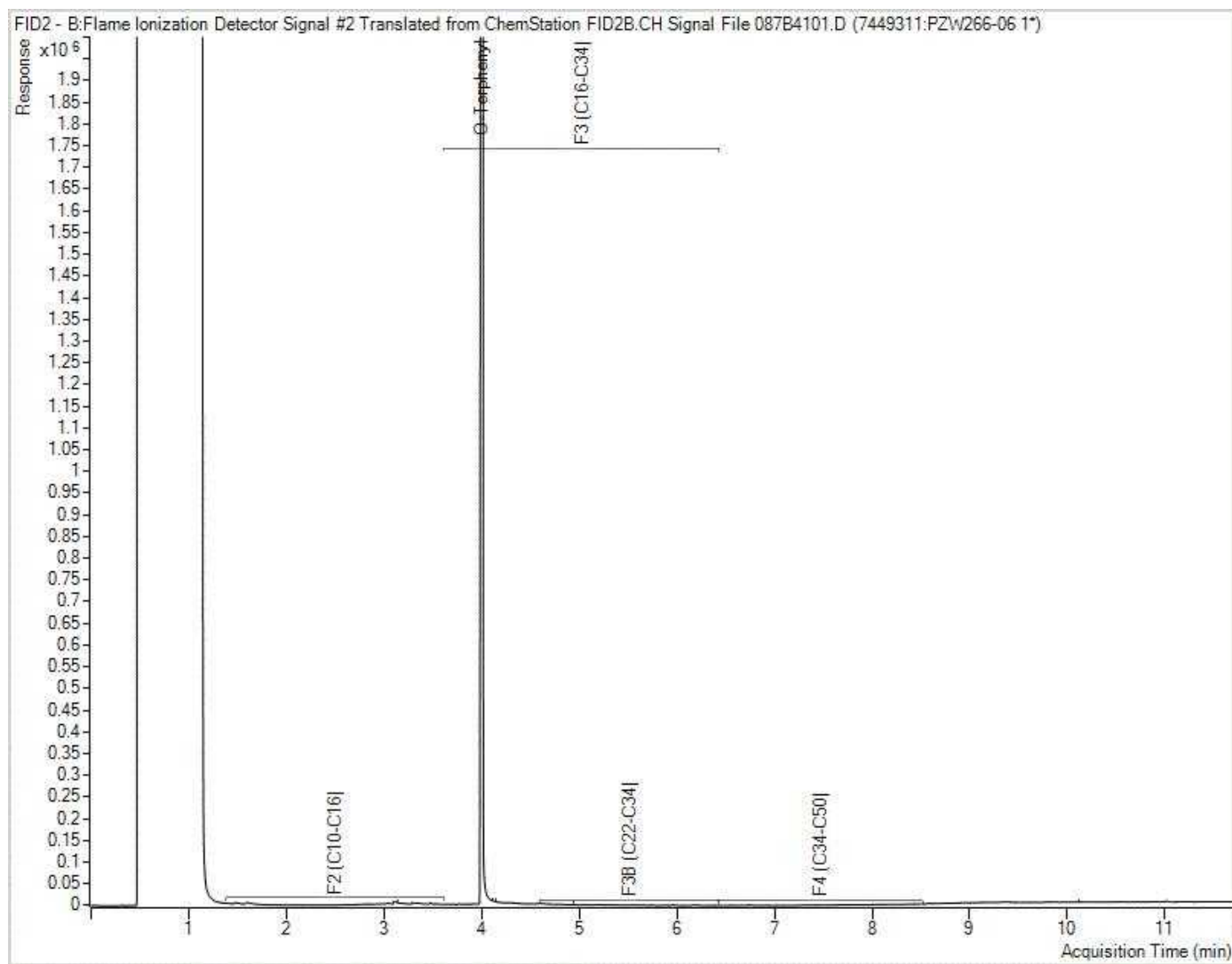
White: BV Labs - Yellow: Client

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.



Your Project #: 1530382(7000)  
Your C.O.C. #: 165285

**Attention: Liseth Benavente**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/15**  
Report #: R6720020  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1I6134**

**Received: 2021/07/06, 16:35**

Sample Matrix: Water  
# Samples Received: 2

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
ABN Compounds in Water by GC/MS	2	2021/07/07	2021/07/08	CAM SOP-00301	EPA 8270 m
Carbonaceous BOD	2	2021/07/07	2021/07/12	CAM SOP-00427	SM 23 5210B m
Total Cyanide	2	2021/07/08	2021/07/08	CAM SOP-00457	OMOE E3015 5 m
Fluoride	2	2021/07/07	2021/07/08	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	2	2021/07/08	2021/07/08	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	2	N/A	2021/07/12	CAM SOP-00447	EPA 6020B m
E.coli, (CFU/100mL)	2	N/A	2021/07/06	CAM SOP-00552	MOE LSB E3371
Total Nonylphenol in Liquids by HPLC	1	2021/07/11	2021/07/13	CAM SOP-00313	In-house Method
Total Nonylphenol in Liquids by HPLC	1	2021/07/08	2021/07/09	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2021/07/11	2021/07/13	CAM SOP-00313	BV Labs Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2021/07/08	2021/07/09	CAM SOP-00313	BV Labs Method
Animal and Vegetable Oil and Grease	2	N/A	2021/07/11	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	2	2021/07/11	2021/07/11	CAM SOP-00326	EPA1664B m,SM5520B m
Polychlorinated Biphenyl in Water	2	2021/07/09	2021/07/10	CAM SOP-00309	EPA 8082A m
pH	2	2021/07/07	2021/07/08	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	2	N/A	2021/07/07	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	2	N/A	2021/07/08	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	2	2021/07/07	2021/07/08	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (1)	2	2021/07/11	2021/07/11	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	2	2021/07/09	2021/07/12	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	2	N/A	2021/07/09	CAM SOP-00228	EPA 8260C 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 Uncertainty has not been accounted for when stating conformity to the referenced standard.



Your Project #: 1530382(7000)  
Your C.O.C. #: 165285

**Attention: Liseth Benavente**

Golder Associates Ltd  
6925 Century Ave  
Suite 100  
Mississauga, ON  
CANADA L5N 7K2

**Report Date: 2021/07/15**  
Report #: R6720020  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C116134**

**Received: 2021/07/06, 16:35**

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

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ema Gitej, Senior Project Manager

Email: emese.gitej@bureauveritas.com

Phone# (905)817-5829

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

<b>BV Labs ID</b>		QAE201			QAE201		
<b>Sampling Date</b>		2021/07/06 14:00			2021/07/06 14:00		
<b>COC Number</b>		165285			165285		
	<b>UNITS</b>	<b>BH21-16</b>	<b>RDL</b>	<b>QC Batch</b>	<b>BH21-16 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Total Animal/Vegetable Oil and Grease	mg/L	<0.50	0.50	7445790			
<b>Inorganics</b>							
Total Carbonaceous BOD	mg/L	<40	40	7448653			
Fluoride (F-)	mg/L	0.31	0.10	7450307			
Total Kjeldahl Nitrogen (TKN)	mg/L	12	0.50	7449576			
pH	pH	7.31		7450314			
Phenols-4AAP	mg/L	0.0020	0.0010	7448638			
Total Suspended Solids	mg/L	48	10	7451924			
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	3.6	1.0	7450322			
Total Cyanide (CN)	mg/L	<0.0050	0.0050	7451191			
<b>Petroleum Hydrocarbons</b>							
Total Oil & Grease	mg/L	<0.50	0.50	7456297			
Total Oil & Grease Mineral/Synthetic	mg/L	<0.50	0.50	7456298			
<b>Miscellaneous Parameters</b>							
Nonylphenol Ethoxylate (Total)	mg/L	<0.025	0.025	7456369	<0.025	0.025	7456369
Nonylphenol (Total)	mg/L	<0.001	0.001	7456366	<0.001	0.001	7456366
<b>Metals</b>							
Mercury (Hg)	mg/L	<0.00010	0.00010	7451497			
Total Aluminum (Al)	ug/L	92	4.9	7454712			
Total Antimony (Sb)	ug/L	<0.50	0.50	7454712			
Total Arsenic (As)	ug/L	<1.0	1.0	7454712			
Total Cadmium (Cd)	ug/L	<0.090	0.090	7454712			
Total Chromium (Cr)	ug/L	<5.0	5.0	7454712			
Total Cobalt (Co)	ug/L	<0.50	0.50	7454712			
Total Copper (Cu)	ug/L	<0.90	0.90	7454712			
Total Lead (Pb)	ug/L	<0.50	0.50	7454712			
Total Manganese (Mn)	ug/L	850	2.0	7454712			
Total Molybdenum (Mo)	ug/L	<0.50	0.50	7454712			
Total Nickel (Ni)	ug/L	<1.0	1.0	7454712			
Total Phosphorus (P)	ug/L	<100	100	7454712			
Total Selenium (Se)	ug/L	<2.0	2.0	7454712			
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							





BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		QAE201			QAE201		
Sampling Date		2021/07/06 14:00			2021/07/06 14:00		
COC Number		165285			165285		
	UNITS	BH21-16	RDL	QC Batch	BH21-16 Lab-Dup	RDL	QC Batch
Total Silver (Ag)	ug/L	<0.090	0.090	7454712			
Total Tin (Sn)	ug/L	<1.0	1.0	7454712			
Total Titanium (Ti)	ug/L	<5.0	5.0	7454712			
Total Zinc (Zn)	ug/L	<5.0	5.0	7454712			
<b>Semivolatile Organics</b>							
Bis(2-ethylhexyl)phthalate	ug/L	<2.0	2.0	7449014			
Di-N-butyl phthalate	ug/L	<2.0	2.0	7449014			
<b>Volatile Organics</b>							
Benzene	ug/L	<0.20	0.20	7448879			
Chloroform	ug/L	<0.20	0.20	7448879			
1,2-Dichlorobenzene	ug/L	<0.40	0.40	7448879			
1,4-Dichlorobenzene	ug/L	<0.40	0.40	7448879			
cis-1,2-Dichloroethylene	ug/L	<0.50	0.50	7448879			
trans-1,3-Dichloropropene	ug/L	<0.40	0.40	7448879			
Ethylbenzene	ug/L	<0.20	0.20	7448879			
Methylene Chloride(Dichloromethane)	ug/L	<2.0	2.0	7448879			
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	10	7448879			
Styrene	ug/L	<0.40	0.40	7448879			
1,1,2,2-Tetrachloroethane	ug/L	<0.40	0.40	7448879			
Tetrachloroethylene	ug/L	<0.20	0.20	7448879			
Toluene	ug/L	<0.20	0.20	7448879			
Trichloroethylene	ug/L	<0.20	0.20	7448879			
p+m-Xylene	ug/L	<0.20	0.20	7448879			
o-Xylene	ug/L	<0.20	0.20	7448879			
Total Xylenes	ug/L	<0.20	0.20	7448879			
<b>PCBs</b>							
Total PCB	ug/L	<0.05	0.05	7453637			
<b>Microbiological</b>							
Escherichia coli	CFU/100mL	<10	10	7447845			
<b>Surrogate Recovery (%)</b>							
2,4,6-Tribromophenol	%	54		7449014			
2-Fluorobiphenyl	%	35		7449014			
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		QAE201			QAE201		
Sampling Date		2021/07/06 14:00			2021/07/06 14:00		
COC Number		165285			165285		
	UNITS	BH21-16	RDL	QC Batch	BH21-16 Lab-Dup	RDL	QC Batch
2-Fluorophenol	%	26		7449014			
D14-Terphenyl	%	95		7449014			
D5-Nitrobenzene	%	47		7449014			
D5-Phenol	%	18		7449014			
Decachlorobiphenyl	%	96		7453637			
4-Bromofluorobenzene	%	100		7448879			
D4-1,2-Dichloroethane	%	107		7448879			
D8-Toluene	%	98		7448879			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		QAE202			QAE202		
Sampling Date		2021/07/06 15:15			2021/07/06 15:15		
COC Number		165285			165285		
	UNITS	BH21-37	RDL	QC Batch	BH21-37 Lab-Dup	RDL	QC Batch
<b>Calculated Parameters</b>							
Total Animal/Vegetable Oil and Grease	mg/L	<0.50	0.50	7445790			
<b>Inorganics</b>							
Total Carbonaceous BOD	mg/L	<2	2	7448653			
Fluoride (F-)	mg/L	0.10	0.10	7450307			
Total Kjeldahl Nitrogen (TKN)	mg/L	3.1	0.10	7449576			
pH	pH	7.52		7450314			
Phenols-4AAP	mg/L	<0.0010	0.0010	7448638			
Total Suspended Solids	mg/L	16	10	7451924	12	10	7451924
Dissolved Sulphate (SO4)	mg/L	120	1.0	7450322			
Total Cyanide (CN)	mg/L	<0.0050	0.0050	7451191			
<b>Petroleum Hydrocarbons</b>							
Total Oil & Grease	mg/L	<0.50	0.50	7456297			
Total Oil & Grease Mineral/Synthetic	mg/L	<0.50	0.50	7456298			
<b>Miscellaneous Parameters</b>							
Nonylphenol Ethoxylate (Total)	mg/L	<0.025	0.025	7450708			
Nonylphenol (Total)	mg/L	<0.001	0.001	7450639			
<b>Metals</b>							
Mercury (Hg)	mg/L	<0.00010	0.00010	7451497	<0.00010	0.00010	7451497
Total Aluminum (Al)	ug/L	41	4.9	7454712			
Total Antimony (Sb)	ug/L	<0.50	0.50	7454712			
Total Arsenic (As)	ug/L	<1.0	1.0	7454712			
Total Cadmium (Cd)	ug/L	<0.090	0.090	7454712			
Total Chromium (Cr)	ug/L	<5.0	5.0	7454712			
Total Cobalt (Co)	ug/L	<0.50	0.50	7454712			
Total Copper (Cu)	ug/L	<0.90	0.90	7454712			
Total Lead (Pb)	ug/L	<0.50	0.50	7454712			
Total Manganese (Mn)	ug/L	260	2.0	7454712			
Total Molybdenum (Mo)	ug/L	<0.50	0.50	7454712			
Total Nickel (Ni)	ug/L	<1.0	1.0	7454712			
Total Phosphorus (P)	ug/L	<100	100	7454712			
Total Selenium (Se)	ug/L	<2.0	2.0	7454712			
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		QAE202			QAE202		
Sampling Date		2021/07/06 15:15			2021/07/06 15:15		
COC Number		165285			165285		
	UNITS	BH21-37	RDL	QC Batch	BH21-37 Lab-Dup	RDL	QC Batch
Total Silver (Ag)	ug/L	<0.090	0.090	7454712			
Total Tin (Sn)	ug/L	<1.0	1.0	7454712			
Total Titanium (Ti)	ug/L	<5.0	5.0	7454712			
Total Zinc (Zn)	ug/L	<5.0	5.0	7454712			
<b>Semivolatile Organics</b>							
Bis(2-ethylhexyl)phthalate	ug/L	<2.0	2.0	7449014	<2.0	2.0	7449014
Di-N-butyl phthalate	ug/L	<2.0	2.0	7449014	<2.0	2.0	7449014
<b>Volatile Organics</b>							
Benzene	ug/L	<0.20	0.20	7448879			
Chloroform	ug/L	<0.20	0.20	7448879			
1,2-Dichlorobenzene	ug/L	<0.40	0.40	7448879			
1,4-Dichlorobenzene	ug/L	<0.40	0.40	7448879			
cis-1,2-Dichloroethylene	ug/L	<0.50	0.50	7448879			
trans-1,3-Dichloropropene	ug/L	<0.40	0.40	7448879			
Ethylbenzene	ug/L	<0.20	0.20	7448879			
Methylene Chloride(Dichloromethane)	ug/L	<2.0	2.0	7448879			
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	10	7448879			
Styrene	ug/L	<0.40	0.40	7448879			
1,1,2,2-Tetrachloroethane	ug/L	<0.40	0.40	7448879			
Tetrachloroethylene	ug/L	<0.20	0.20	7448879			
Toluene	ug/L	<0.20	0.20	7448879			
Trichloroethylene	ug/L	<0.20	0.20	7448879			
p+m-Xylene	ug/L	<0.20	0.20	7448879			
o-Xylene	ug/L	<0.20	0.20	7448879			
Total Xylenes	ug/L	<0.20	0.20	7448879			
<b>PCBs</b>							
Total PCB	ug/L	<0.05	0.05	7453637			
<b>Microbiological</b>							
Escherichia coli	CFU/100mL	<10	10	7447845			
<b>Surrogate Recovery (%)</b>							
2,4,6-Tribromophenol	%	64		7449014	80		7449014
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### PEEL SANITARY & STORM SEWER (53-2010)

BV Labs ID		QAE202			QAE202		
Sampling Date		2021/07/06 15:15			2021/07/06 15:15		
COC Number		165285			165285		
	UNITS	BH21-37	RDL	QC Batch	BH21-37 Lab-Dup	RDL	QC Batch
2-Fluorobiphenyl	%	27 (1)		7449014	45		7449014
2-Fluorophenol	%	22		7449014	31		7449014
D14-Terphenyl	%	92		7449014	94		7449014
D5-Nitrobenzene	%	35		7449014	57		7449014
D5-Phenol	%	17		7449014	25		7449014
Decachlorobiphenyl	%	88		7453637			
4-Bromofluorobenzene	%	98		7448879			
D4-1,2-Dichloroethane	%	105		7448879			
D8-Toluene	%	96		7448879			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Surrogate recovery was below the lower control limit. This may represent a low bias in some results.							



BUREAU  
VERITAS

BV Labs Job #: C1I6134  
Report Date: 2021/07/15

Golder Associates Ltd  
Client Project #: 1530382(7000)  
Sampler Initials: VP

## TEST SUMMARY

**BV Labs ID:** QAE201  
**Sample ID:** BH21-16  
**Matrix:** Water

**Collected:** 2021/07/06  
**Shipped:**  
**Received:** 2021/07/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in Water by GC/MS	GC/MS	7449014	2021/07/07	2021/07/08	Anh Lieu
Carbonaceous BOD	DO	7448653	2021/07/07	2021/07/12	Nusrat Naz
Total Cyanide	SKAL/CN	7451191	2021/07/08	2021/07/08	Aditiben Patel
Fluoride	ISE	7450307	2021/07/07	2021/07/08	Surinder Rai
Mercury in Water by CVAA	CV/AA	7451497	2021/07/08	2021/07/08	Gagandeep Rai
Total Metals Analysis by ICPMS	ICP/MS	7454712	N/A	2021/07/12	Arefa Dabhad
E.coli, (CFU/100mL)	PL	7447845	N/A	2021/07/06	Ranju Chaudhari
Total Nonylphenol in Liquids by HPLC	LC/FLU	7456366	2021/07/11	2021/07/13	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7456369	2021/07/11	2021/07/13	Dennis Boodram
Animal and Vegetable Oil and Grease	BAL	7445790	N/A	2021/07/11	Automated Statchk
Total Oil and Grease	BAL	7456297	2021/07/11	2021/07/11	Mitul Patel
Polychlorinated Biphenyl in Water	GC/ECD	7453637	2021/07/09	2021/07/10	Svitlana Shaula
pH	AT	7450314	2021/07/07	2021/07/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7448638	N/A	2021/07/07	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7450322	N/A	2021/07/08	Alina Dobreanu
Total Kjeldahl Nitrogen in Water	SKAL	7449576	2021/07/07	2021/07/08	Rajni Tyagi
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7456298	2021/07/11	2021/07/11	Mitul Patel
Total Suspended Solids	BAL	7451924	2021/07/09	2021/07/12	Sandeep Kaur
Volatile Organic Compounds in Water	GC/MS	7448879	N/A	2021/07/09	Manpreet Sarao

**BV Labs ID:** QAE201 Dup  
**Sample ID:** BH21-16  
**Matrix:** Water

**Collected:** 2021/07/06  
**Shipped:**  
**Received:** 2021/07/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Nonylphenol in Liquids by HPLC	LC/FLU	7456366	2021/07/11	2021/07/13	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7456369	2021/07/11	2021/07/13	Dennis Boodram

**BV Labs ID:** QAE202  
**Sample ID:** BH21-37  
**Matrix:** Water

**Collected:** 2021/07/06  
**Shipped:**  
**Received:** 2021/07/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in Water by GC/MS	GC/MS	7449014	2021/07/07	2021/07/08	Anh Lieu
Carbonaceous BOD	DO	7448653	2021/07/07	2021/07/12	Nusrat Naz
Total Cyanide	SKAL/CN	7451191	2021/07/08	2021/07/08	Aditiben Patel
Fluoride	ISE	7450307	2021/07/07	2021/07/08	Surinder Rai
Mercury in Water by CVAA	CV/AA	7451497	2021/07/08	2021/07/08	Gagandeep Rai
Total Metals Analysis by ICPMS	ICP/MS	7454712	N/A	2021/07/12	Arefa Dabhad
E.coli, (CFU/100mL)	PL	7447845	N/A	2021/07/06	Ranju Chaudhari
Total Nonylphenol in Liquids by HPLC	LC/FLU	7450639	2021/07/08	2021/07/09	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7450708	2021/07/08	2021/07/09	Dennis Boodram
Animal and Vegetable Oil and Grease	BAL	7445790	N/A	2021/07/11	Automated Statchk
Total Oil and Grease	BAL	7456297	2021/07/11	2021/07/11	Mitul Patel
Polychlorinated Biphenyl in Water	GC/ECD	7453637	2021/07/09	2021/07/10	Svitlana Shaula



BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

## TEST SUMMARY

**BV Labs ID:** QAE202  
**Sample ID:** BH21-37  
**Matrix:** Water

**Collected:** 2021/07/06  
**Shipped:**  
**Received:** 2021/07/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH	AT	7450314	2021/07/07	2021/07/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7448638	N/A	2021/07/07	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7450322	N/A	2021/07/08	Alina Dobreanu
Total Kjeldahl Nitrogen in Water	SKAL	7449576	2021/07/07	2021/07/08	Rajni Tyagi
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7456298	2021/07/11	2021/07/11	Mitul Patel
Total Suspended Solids	BAL	7451924	2021/07/09	2021/07/12	Sandeep Kaur
Volatile Organic Compounds in Water	GC/MS	7448879	N/A	2021/07/09	Manpreet Sarao

**BV Labs ID:** QAE202 Dup  
**Sample ID:** BH21-37  
**Matrix:** Water

**Collected:** 2021/07/06  
**Shipped:**  
**Received:** 2021/07/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in Water by GC/MS	GC/MS	7449014	2021/07/07	2021/07/08	Anh Lieu
Mercury in Water by CVAA	CV/AA	7451497	2021/07/08	2021/07/08	Gagandeep Rai
Total Suspended Solids	BAL	7451924	2021/07/09	2021/07/12	Sandeep Kaur



### GENERAL COMMENTS

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

Package 1	22.7°C
Package 2	21.0°C

Sample QAE201 [BH21-16] : Carbonaceous Biochemical Oxygen Demand (C.BOD) Analysis: Elevated DL reported using the lowest dilution of sample.

**Results relate only to the items tested.**



BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

## QUALITY ASSURANCE REPORT

Golder Associates Ltd  
Client Project #: 1530382(7000)  
Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7448879	4-Bromofluorobenzene	2021/07/08	99	70 - 130	101	70 - 130	100	%				
7448879	D4-1,2-Dichloroethane	2021/07/08	103	70 - 130	99	70 - 130	103	%				
7448879	D8-Toluene	2021/07/08	98	70 - 130	101	70 - 130	96	%				
7449014	2,4,6-Tribromophenol	2021/07/08	45	10 - 130	85	10 - 130	78	%				
7449014	2-Fluorobiphenyl	2021/07/08	22 (1)	30 - 130	63	30 - 130	65	%				
7449014	2-Fluorophenol	2021/07/08	9.4 (1)	10 - 130	45	10 - 130	44	%				
7449014	D14-Terphenyl	2021/07/08	89	30 - 130	94	30 - 130	94	%				
7449014	D5-Nitrobenzene	2021/07/08	27 (1)	30 - 130	79	30 - 130	76	%				
7449014	D5-Phenol	2021/07/08	0.00 (1)	10 - 130	32	10 - 130	29	%				
7453637	Decachlorobiphenyl	2021/07/09	75	60 - 130	76	60 - 130	83	%				
7448638	Phenols-4AAP	2021/07/07	100	80 - 120	97	80 - 120	<0.0010	mg/L	0	20		
7448653	Total Carbonaceous BOD	2021/07/12					<2	mg/L	6.7	30	96	85 - 115
7448879	1,1,2,2-Tetrachloroethane	2021/07/08	94	70 - 130	92	70 - 130	<0.40	ug/L	NC	30		
7448879	1,2-Dichlorobenzene	2021/07/08	93	70 - 130	94	70 - 130	<0.40	ug/L	NC	30		
7448879	1,4-Dichlorobenzene	2021/07/08	106	70 - 130	108	70 - 130	<0.40	ug/L	NC	30		
7448879	Benzene	2021/07/08	87	70 - 130	89	70 - 130	<0.20	ug/L	NC	30		
7448879	Chloroform	2021/07/08	93	70 - 130	94	70 - 130	<0.20	ug/L	NC	30		
7448879	cis-1,2-Dichloroethylene	2021/07/08	98	70 - 130	97	70 - 130	<0.50	ug/L	NC	30		
7448879	Ethylbenzene	2021/07/08	89	70 - 130	93	70 - 130	<0.20	ug/L	NC	30		
7448879	Methyl Ethyl Ketone (2-Butanone)	2021/07/08	110	60 - 140	106	60 - 140	<10	ug/L	NC	30		
7448879	Methylene Chloride(Dichloromethane)	2021/07/08	111	70 - 130	109	70 - 130	<2.0	ug/L	NC	30		
7448879	o-Xylene	2021/07/08	86	70 - 130	91	70 - 130	<0.20	ug/L	NC	30		
7448879	p+m-Xylene	2021/07/08	94	70 - 130	98	70 - 130	<0.20	ug/L	NC	30		
7448879	Styrene	2021/07/08	98	70 - 130	102	70 - 130	<0.40	ug/L	NC	30		
7448879	Tetrachloroethylene	2021/07/08	85	70 - 130	89	70 - 130	<0.20	ug/L	NC	30		
7448879	Toluene	2021/07/08	88	70 - 130	91	70 - 130	<0.20	ug/L	NC	30		
7448879	Total Xylenes	2021/07/08					<0.20	ug/L	NC	30		
7448879	trans-1,3-Dichloropropene	2021/07/08	109	70 - 130	90	70 - 130	<0.40	ug/L	NC	30		
7448879	Trichloroethylene	2021/07/08	96	70 - 130	100	70 - 130	<0.20	ug/L	NC	30		
7449014	Bis(2-ethylhexyl)phthalate	2021/07/08	100	30 - 130	98	30 - 130	<2.0	ug/L	NC	40		
7449014	Di-N-butyl phthalate	2021/07/08	84	30 - 130	100	30 - 130	<2.0	ug/L	NC	40		

BUREAU  
VERITAS

BV Labs Job #: C116134

Report Date: 2021/07/15

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd  
Client Project #: 1530382(7000)  
Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7449576	Total Kjeldahl Nitrogen (TKN)	2021/07/08	105	80 - 120	102	80 - 120	<0.10	mg/L	NC	20	104	80 - 120
7450307	Fluoride (F-)	2021/07/08	97	80 - 120	93	80 - 120	<0.10	mg/L	1.4	20		
7450314	pH	2021/07/08			102	98 - 103			1.2	N/A		
7450322	Dissolved Sulphate (SO4)	2021/07/08	NC	75 - 125	100	80 - 120	<1.0	mg/L	1.5	20		
7450639	Nonylphenol (Total)	2021/07/08	69	50 - 130	79	50 - 130	<0.001	mg/L	NC	40		
7450708	Nonylphenol Ethoxylate (Total)	2021/07/08	81	50 - 130	83	50 - 130	<0.025	mg/L	NC	40		
7451191	Total Cyanide (CN)	2021/07/08	95	80 - 120	97	80 - 120	<0.0050	mg/L	NC	20		
7451497	Mercury (Hg)	2021/07/08	96	75 - 125	97	80 - 120	<0.00010	mg/L	NC	20		
7451924	Total Suspended Solids	2021/07/12					<10	mg/L	NC	25	96	85 - 115
7453637	Total PCB	2021/07/10	86	60 - 130	84	60 - 130	<0.05	ug/L	NC	40		
7454712	Total Aluminum (Al)	2021/07/12	NC	80 - 120	95	80 - 120	<4.9	ug/L	2.5	20		
7454712	Total Antimony (Sb)	2021/07/12	102	80 - 120	95	80 - 120	<0.50	ug/L	NC	20		
7454712	Total Arsenic (As)	2021/07/12	98	80 - 120	94	80 - 120	<1.0	ug/L	NC	20		
7454712	Total Cadmium (Cd)	2021/07/12	98	80 - 120	95	80 - 120	<0.090	ug/L	NC	20		
7454712	Total Chromium (Cr)	2021/07/12	94	80 - 120	90	80 - 120	<5.0	ug/L	NC	20		
7454712	Total Cobalt (Co)	2021/07/12	98	80 - 120	94	80 - 120	<0.50	ug/L	1.2	20		
7454712	Total Copper (Cu)	2021/07/12	93	80 - 120	90	80 - 120	<0.90	ug/L	2.0	20		
7454712	Total Lead (Pb)	2021/07/12	93	80 - 120	93	80 - 120	<0.50	ug/L	6.9	20		
7454712	Total Manganese (Mn)	2021/07/12	98	80 - 120	93	80 - 120	<2.0	ug/L	0.79	20		
7454712	Total Molybdenum (Mo)	2021/07/12	101	80 - 120	93	80 - 120	<0.50	ug/L	NC	20		
7454712	Total Nickel (Ni)	2021/07/12	94	80 - 120	93	80 - 120	<1.0	ug/L	3.5	20		
7454712	Total Phosphorus (P)	2021/07/12	102	80 - 120	94	80 - 120	<100	ug/L	NC	20		
7454712	Total Selenium (Se)	2021/07/12	98	80 - 120	98	80 - 120	<2.0	ug/L	NC	20		
7454712	Total Silver (Ag)	2021/07/12	96	80 - 120	94	80 - 120	<0.090	ug/L	NC	20		
7454712	Total Tin (Sn)	2021/07/12	101	80 - 120	94	80 - 120	<1.0	ug/L	NC	20		
7454712	Total Titanium (Ti)	2021/07/12	107	80 - 120	90	80 - 120	<5.0	ug/L	2.7	20		
7454712	Total Zinc (Zn)	2021/07/12	95	80 - 120	95	80 - 120	<5.0	ug/L	NC	20		
7456297	Total Oil & Grease	2021/07/11			100	85 - 115	<0.50	mg/L	1.3	25		
7456298	Total Oil & Grease Mineral/Synthetic	2021/07/11			98	85 - 115	<0.50	mg/L	2.1	25		
7456366	Nonylphenol (Total)	2021/07/13	131 (2)	50 - 130	82	50 - 130	<0.001	mg/L	NC	40		



BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

## QUALITY ASSURANCE REPORT(CONT'D)

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7456369	Nonylphenol Ethoxylate (Total)	2021/07/13	124	50 - 130	92	50 - 130	<0.025	mg/L	NC	40		

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  $\leq 2 \times$  RDL).

(1) Surrogate recovery was below the lower control limit. This may represent a low bias in some results.

(2) The recovery was above the upper control limit. This may represent a high bias in some results for this specific analyte.



BUREAU  
VERITAS

BV Labs Job #: C1I6134

Report Date: 2021/07/15

Golder Associates Ltd

Client Project #: 1530382(7000)

Sampler Initials: VP

### VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

Ranju Chaudhari, Senior Analyst

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



# MICRO

40 Campbell Road, Mississauga, Ontario L5N 2L8  
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266  
CAMTCD-01191/6

2 Coolers

## CHAIN OF CUSTODY RECORD

165285

Page 1 of 1

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required	
Company Name: <u>Goldor</u>	Company Name: <u>Goldor</u>	Quotation #: <u>B80683</u>	<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS		
Contact Name: <u>Accounts Payable</u>	Contact Name: <u>Liseth Benavente</u>	P.O. #/ A/EH:	Project #: <u>1530382 (7000)</u>		Rush TAT (Surcharges will be applied)		
Address: <u>6925 Century Ave Suite 100</u>	Address:	Site Location:	<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days		Date Required:		
Phone: <u>905 567 4444</u> Fax: <u>905 567 6561</u>	Phone: <u>905 567 6100</u> Fax: <u>ext 1718</u>	Site #:	Site Location Province:		Rush Confirmation #:		
Email: <u>CanadaAccountsPayableInvoices@Goldor.com</u>	Email: <u>Liseth-Benavente@Goldor.com</u>	Sampled By:		MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS LABORATORIES' DRINKING WATER CHAIN OF CUSTODY			
<b>Regulation 153</b>		<b>Other Regulations</b>		<b>Analysis Requested</b>		<b>LABORATORY USE ONLY</b>	
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/ Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/ Other <input type="checkbox"/> Table _____ FOR RSC (PLEASE CIRCLE) Y / N		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> PWQO Region <input type="checkbox"/> Other (Specify) <input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED) <input type="checkbox"/> REG 406 Table _____		<input type="checkbox"/> FIELD FILTERED (CIRCLE) Metals / Hg / Cu <input type="checkbox"/> BTEX / PHC F1 <input type="checkbox"/> PHC F2 - F4 <input type="checkbox"/> VOCs <input type="checkbox"/> REG 153 METALS & INORGANICS <input type="checkbox"/> REG 153 ICPMS METALS <input type="checkbox"/> REG 153 METALS (Hg, Cr, V, ICPMS Metals, HWS - B) <input checked="" type="checkbox"/> Peel Sanitary & storm Sewer		<b>CUSTOMER SEAL</b> Y / N <b>COOLER TEMPERATURES</b> Present Intact <u>N</u> <u>N</u> <u>23.2/23.3</u> <u>N</u> <u>N</u> <u>21.1/21.9</u> <b>COOLING MEDIA PRESENT:</b> <input checked="" type="checkbox"/> Y / N <b>COMMENTS</b>	
Include Criteria on Certificate of Analysis: Y / N		SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS					
SAMPLE IDENTIFICATION		DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX			
1	BH21-16	2021/07/06	14:00	GW	18	N	
2	BH21-37	2021/07/06	15:15	GW	18	N	
3							
4							
5							
6							
7							
8							
9							
10							
RELINQUISHED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)
<u>V. Propp</u>		2021/07/06	16:30	<u>Mayank Nigam</u>		2021/07/06	16:35

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Bureau Veritas Laboratories' standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgment and acceptance of conditions.

COC-1004 (06/19)

M1K

ENV-584

White: BV Labs - Yellow: Client

**APPENDIX K**

# Special Provisions

## **WELL DECOMMISSIONING - Item No.**

---

Special Provision

---

### **1.0 SCOPE**

This specification covers the requirements for the decommissioning of wells/piezometers identified in Table 1 below, for which the registered owner is Ministry of Transportation, Ontario.

**Table 1 – Well/Piezometer Information**

<b>Well / Piezometer Identification</b>	<b>Location (Northing / Easting)</b>	<b>PVC Pipe and Screen Diameter / Borehole Diameter</b>	<b>Approx. Depth to Tip of Screen / Total Borehole Depth</b>
21-2	4,827,726.5 / 298,557.4	50 mm / 200 mm	6.1 m / 13.1 m
21-4	4,827,702.9 / 298,617.6	50 mm / 200 mm	6.4 m / 12.4 m
21-6	4,827,936.8 / 298,721.6	50 mm / 200 mm	4.6 m / 5.2 m
21-8	4,828,146.0 / 298,892.2	50 mm / 200 mm	12.5 m / 15.8 m
21-11	4,828,031.9 / 298,928.7	50 mm / 200 mm	6.4 m / 13.1 m
21-16	4,828,285.5 / 299,001.2	50 mm / 200 mm	9.6 m / 10.1 m
21-19	4,828,485.1 / 299,155.1	50 mm / 200 mm	3.0 m / 4.8 m
21-21	4,828,828.6 / 299,098.7	50 mm / 200 mm	3.8 m / 4.0 m
21-25	4,828,195.9 / 299,031.6	50 mm / 200 mm	3.1 m / 6.2 m
21-29	4,828,449.9 / 299,399.6	50 mm / 200 mm	3.0 m / 5.3 m
21-33	4,828,730.9 / 299,427.8	50 mm / 200 mm	4.6 m / 6.4 m
21-34	4,828,735.4 / 299,235.7	50 mm / 200 mm	5.2 m / 12.8 m
21-37	4,828,560.0 / 299,365.4	50 mm / 200 mm	5.2 m / 11.3 m
21-43	4,829,230.7 / 299,687.3	50 mm / 200 mm	3.1 m / 3.8 m
NW2-4	4,827,918.2 / 298,790.8	50 mm / 200 mm	4.6 m / 5.2 m
NW6-11	4,829,101.0 / 299,728.3	50 mm / 200 mm	7.4 m / 10.5 m
RW1-1	4,828,384.5 / 299,442.5	50 mm / 200 mm	3.7 m / 3.7 m
RW2-7	4,829,276.6 / 299,794.9	50 mm / 200 mm	12.3 m / 20.2 m
STM-3	4,828,775.1 / 299,379.2	50 mm / 200 mm	5.3 m / 12.8 m
STM-9	4,829,046.9 / 299,604.4	50 mm / 200 mm	11.4 m / 18.0 m
STM-10	4,829,178.8 / 299,715.1	50 mm / 200 mm	12.2 m / 17.4 m
SWM-A-2	4,828,383.6 / 299,214.1	50 mm / 200 mm	6.0 m / 6.0 m
SWM-B-2	4,828,656.8 / 299,252.8	50 mm / 200 mm	7.7 m / 7.7 m

### **2.0 REFERENCES**

This specification refers to the following standards, specifications, or publications:

Ontario Water Resources Act, R.S.O. 1990; Regulation 903

### **3.0 DEFINITIONS – Not Used**

### **4.0 DESIGN AND SUBMISSION REQUIREMENTS – Not Used**

### **5.0 MATERIALS – Not Used**

## **6.0 EQUIPMENT - Not Used**

## **7.0 CONSTRUCTION**

Each well must be decommissioned/abandoned (sealed) by a licensed well contractor in accordance with regulations of the Ontario Water Resources Act (O.Reg. 903). The Contractor shall obtain said information from the Ministry of Environment, Conservation and Parks and bear liability for compliance to the regulation. As a minimum, the existing casing shall be removed to a depth of 1.2 m below the original ground surface and the remaining well casing backfilled in accordance with regulations.

As part of the abandonment process, in accordance with regulations of the Ontario Water Resources Act (O.Reg. 903), if the well has a well tag, it must be removed and returned to the MECP Director within 30 days after completion of abandonment and removing the tag. The well tag must be returned to Wells Help Desk, Environmental Monitoring and Reporting Branch Ministry of the Environment, Conservation and Parks, 125 Resources Road, Toronto, Ontario, M9P 3V6 (1-888-396-9355).

Licensed well contractors shall forward the water well record (abandonment report), with an accompanying transmittal letter to the Ministry of Environment, Conservation and Parks. A copy of the above record and letter shall be sent to the Contract Administrator. This shall be provided to the Contract Administrator before payment of the abandoned wells is approved.

The Contractor must obtain a blank well record form from the Ministry of the Environment, Conservation and Parks. On completion of the abandonment of a well, the Contractor must:

- Within 14 days after the date on which the well construction equipment is removed from the site, deliver a copy of the well record to the owner of the land on which the well is situated; and
- Within 30 days after the date on which the well construction equipment is removed from the site, forward a copy of the well record and any well tag that was removed from the well, to the Ministry of Environment, Conservation and Parks.

### **7.01 Removal and Disposal**

Any effluent pumped during well decommissioning shall be managed in accordance with the requirements of O.Reg 347. Further, all material resulting from the abandonment of the wells shall become property of the Contractor and shall be disposed of in accordance with OPSS 180.

## **8.0 QUALITY ASSURANCE - Not Used**

## **9.0 MEASUREMENT FOR PAYMENT**

Measurement for the above tender item shall be for each well decommissioned.

## **10.0 BASIS OF PAYMENT**

Payment at the contract price for the above tender item shall be full compensation for all labour, Equipment and Materials required to do the work.





**[golder.com](http://golder.com)**