APPENDIX A

GEOTECHNICAL DATA REPORT



CentrePort South Regional Water & Wastewater Servicing Geotechnical Data Report

Revision: Final Rev 2

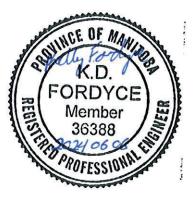
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STATEMENT OF LIMITATIONS AND CONDITIONS

Limitations

This report has been prepared for City of Winnipeg in accordance with the agreement between KGS Group and City of Winnipeg (the "Agreement"). This report represents KGS Group's professional judgment and exercising due care consistent with the preparation of similar reports. The information, data, recommendations and conclusions in this report are subject to the constraints and limitations in the Agreement and the qualifications in this report. This report must be read as a whole, and sections or parts should not be read out of context.

This report is based on information made available to KGS Group by City of Winnipeg. Unless stated otherwise, KGS Group has not verified the accuracy, completeness or validity of such information, makes no representation regarding its accuracy and hereby disclaims any liability in connection therewith. KGS Group shall not be responsible for conditions/issues it was not authorized or able to investigate or which were beyond the scope of its work. The information and conclusions provided in this report apply only as they existed at the time of KGS Group's work.

Third Party Use of Report

Any use a third party makes of this report or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

Geotechnical Investigation Statement of Limitations

The geotechnical investigation findings and recommendations of this report were prepared in accordance with generally accepted professional engineering principles and practice. The findings and recommendations are based on the results of field and laboratory investigations, combined with an interpolation of soil and groundwater conditions found at and within the depth of the test holes drilled by KGS Group at the site at the time of drilling. If conditions encountered during construction appear to be different from those shown by the test holes drilled by KGS Group or if the assumptions stated herein are not in keeping with the design, KGS Group should be notified in order that the recommendations can be reviewed and modified if necessary.



1.0 INTRODUCTION

1.1 General

KGS Group was retained by the City of Winnipeg Water and Waste Department to perform geotechnical investigations to facilitate the detailed design and construction of regional water and wastewater infrastructure to support future industrial and residential developments within CentrePort South.

CentrePort Canada is North America's largest tri-modal port shared between the City of Winnipeg and the RM of Rosser. The goal of this project is to bring regional water and wastewater infrastructure to the southern portions of Centreport Canada (CentrePort South) located within the City of Winnipeg. These lands will ultimately result in an additional 1,457 hectares of serviced lands planned for commercial and residential development. The Phase 1A plan addresses the limited water demand and wastewater generation during years 1 to 5. Phase 1A involves four separate contracts described in Table 1-1 in order of priority.

Priority	Phase 1A Contracts	Rationale
1	Interceptor & Intake Sewers (Contract 3)	Provides connection points for wastewater collection permitting development of commercial and industrial lands.
2	750 mm Feeder Main, Silver to Offtake Structure 3 (Contract 4A)	Provides central location to permit initial development of both residential and commercial lands. Feeder Main to be extended further north in future once development warrants it.
3	Force Main (Contract 2A)	Installation of a single force main to support initial development. Future force main to be designed and constructed when wastewater generation warrants it.
4	By-Pass Lift Station (Contract 1A)	Small station to support initial development until wastewater levels are actually generated. Infrastructure to be repurposed as part of future full build-out station.

TABLE 1-1: PHASE 1A CONTRACTS

The purpose of our investigation was to identify the subsurface soil, bedrock, and groundwater conditions along the alignments of the proposed works. This factual report contains a description of the geotechnical investigations program performed by KGS Group and our findings. This GDR should be read in conjunction with the Geotechnical Baseline Report(s) (GBR) prepared by KGS Group for the Project.



1.2 Purpose of Report

This report summarizes the geotechnical conditions observed along the alignments of the proposed pipeline infrastructure within the entire project area and provides geotechnical considerations that would form part of the basis of design for the Work. This report includes geotechnical data collected at the project site and summary of encountered subsurface conditions along the alignments.

1.3 Report Limitations

This report has been prepared for the exclusive use of the City of Winnipeg for the specific application to the proposed CentrePort South Regional Water and Wastewater Servicing project. It has been prepared in accordance with generally accepted geotechnical engineering practice. No other warranty, express or implied, is made.

The geotechnical data presented in this report are based on the observations and test results obtained from field investigation programs completed between 1988 and 2024. The information provided in this report and the contract documents indicate soil and bedrock conditions and water levels only at specific locations and times, and only to the depths penetrated. Subsurface conditions and water levels at other locations may differ from conditions occurring at these explored locations. Also, the passage of time may result in a change in conditions at these locations. KGS Group is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or for reuse of subsurface data, without KGS Group's express written authorization.



2.0 BACKGROUND INFORMATION

2.1 Previous Geotechnical Investigations

A review of available geotechnical information pertinent to the project was conducted and presented in this report, including the 1998 UMA Engineering Ltd. investigations, and investigation programs completed by KGS Group in 2009 and 2019. The boreholes from the previous investigations were considered and incorporated in the development of the site stratigraphy and the associated figures. The results of these geotechnical investigations are summarized below.

2.1.1 1988 GEOTECHNICAL INVESTIGATION

In 1988, UMA Engineering Ltd. completed a geotechnical investigation for Genstar Development Co. in the CentrePort South region. The geotechnical investigation was completed along two (2) proposed sewer alignments leading to and within the land parcel proposed for development. The investigation consisted of geotechnical drilling, piezometer installation, and single channel hammer seismic survey. A total of 74 boreholes were advanced to auger refusal along the proposed sewer alignments at approximately 200 m spacing. Additionally, approximately 200 hammer seismic spreads were laid out on a 200 m grid to estimate the depth to till and bedrock on the western portion of the site.

The boreholes in Table 2-1 were drilled along the proposed pipe alignments for the Centreport South project and were used to develop the soil profiles.

Borehole ID	Northing (m)	Easting (m)	Approx. Ground Surface Elevation (m)	Approx. Borehole Depth (m)	Approx. Bedrock Contact Elevation (m)
G-88-32	5532399	623852	239.44	6.10	
G-88-40	5530812	623754	236.94	9.91	
G-88-46			238.15	8.23	
G-88-50	5530581	623734	237.59	8.64	
G-88-62	5534084	624819	239.76	6.40	
G-88-68	5532561	623848	240.19	3.65	
G-88-71	5533141	623773	239.44	4.27	
G-88-P3	5529985	622588	238.55	23.77	222.09
G-88-P8	5534095	624858	239.56	18.29	231.06
G-88-P9	5534102	626431	240.45	18.29	225.97

TABLE 2-1: SELECT 1988 BOREHOLES IN PROJECT AREA



Borehole ID	Northing (m)	Easting (m)	Approx. Ground Surface Elevation (m)	Approx. Borehole Depth (m)	Approx. Bedrock Contact Elevation (m)
G-88-S1	5530166	623409	237.17	4.42	232.87
G-88-S3	5529509	623268	236.95	4.21	232.96
G-88-S7	5530174	622685	237.17	11.89	228.18
G-88-S13	5529776	622081	237.17	10.67	226.68

The 1988 borehole logs are included in the 2019 KGS Group Geotechnical Report in Appendix A. The location of the boreholes within the vicinity of the site are shown on Figure 1. Details of the geotechnical investigation are outlined in the report titled "Sewer Alignment Investigation and Property Investigation Lands North of Saskatchewan Ave", dated December 1988.

2.1.2 2009 GEOTECHNICAL INVESTIGATION

In 2009, KGS Group completed a geotechnical investigation for MMM Group Ltd. for the construction of CentrePort Canada Way (CCW). Boreholes were drilled at the CCW and Provincial Trunk Highway (PTH) 101 interchange and at the CCW crossing over the Canadian Pacific Kansas City (CPKC) mainline near Inkster Boulevard. The boreholes in Table 2-2 were drilled along the proposed pipe alignments for the CentrePort South project and were used to develop the soil profiles.

Borehole ID	Northing (m)	Easting (m)	Approx. Ground Surface Elevation (m)	Approx. Borehole Depth (m)	Approx. Bedrock Contact Elevation (m)
TH09-20	5533717	624309	238.46	9.14	232.98
TH09-21	5533684	624275	238.99	11.05	233.65
TH09-22	5533532	624113	239.28	6.55	
TH09-23	5533770	624364	237.34	7.62	232.77
TH09-24	5533797	624389	238.12	18.23	232.79
TH09-25	5533919	624517	238.02	6.55	

TABLE 2-2: SELECT 2009 BOREHOLES IN PROJECT AREA

The 2009 borehole logs are included in the 2019 KGS Group Geotechnical Report in Appendix A and the locations are shown on Figure 1. Details of the geotechnical investigation are outlined in the report titled "CentrePort Canada Way Geotechnical Investigation Phase 1 Report", dated July 2009.



A total of two (2) pneumatic and four (4) standpipes were installed in the clay, till, and bedrock units during the 2009 investigations for the boreholes located within the CentrePort South project area. Two (2) pneumatic piezometers were installed in the clay, two (2) standpipes installed in the till, and two (2) standpipes installed in the bedrock. The installation details of the piezometers are shown on the borehole logs in Appendix A. Groundwater monitoring data for the 2009 instrumentation is summarized in Table 2-3.

Borehole ID	TH09-20	TH09-20(2)	TH09-20(2)	TH09-23	TH09-23(2)	TH09-23(2)
Ground Elevation (m)	238.46	238.44	238.44	237.34	237.39	237.39
Piezometer No.	Standpipe 1	Standpipe 2	32314	Standpipe 1	Standpipe 2	32315
Tip Elevation (m)	229.36	233.44	234.44	229.74	232.79	234.39
Monitoring Zone	Bedrock	Till	Clay	Bedrock	Till	Clay

TABLE 2-3: 2009 GROUNDWATER MONITORING DATA

Groundwater Elevation Monitoring Data									
Date									
2009-05-08	236.67	237.18	235.71						
2009-05-25	236.65	237.60	239.22	236.77	237.77	235.51			
2009-05-29	236.64	237.68		236.75	237.81				
2009-06-09	236.58	237.77	239.29	236.77	237.89	237.90			

As part of the laboratory testing program for this project, a total of six (6) one-dimensional consolidation (oedometer) tests were performed on select samples of the clay overburden to determine representative deformation properties of the material for use in estimating the anticipated settlements under embankment loads. Testing results from the relevant boreholes within the CentrePort South project area are included in Appendix E.

2.1.3 2019 GEOTECHNICAL INVESTIGATION

In 2019, KGS Group completed a geotechnical investigation for the City of Winnipeg as part of the preliminary design phase for the CentrePort South region. Due to the variable soil conditions with till and bedrock observed outcrop at the surface in some locations, seismic refraction surveys were completed in addition to conventional borehole drilling. A total of 36 boreholes were advanced to bedrock between September 2019 and February 2020 to investigate the subsurface stratigraphic conditions. The drilling was completed using a track-mounted sonic drill rig to provide full drilling recovery of the clay and till. The locations of the boreholes are shown on Figure 1.



Clay samples were tested with a field Torvane to evaluate consistency and estimate the undrained shear strength of cohesive soils. Pocket penetrometers were used to evaluate the consistency of the till. A diagnostic laboratory program was not performed as part of this project.

The boreholes in Table 2-4 were drilled along the proposed pipe alignments for the Centreport South project and were used to develop the soil profiles.

Borehole ID	Northing (m)	Easting (m)	Approx. Ground Surface Elevation (m)	Approx. Borehole Depth (m)	Approx. Bedrock Contact Elevation (m)
TH19-01	5530427.04	623766.69	238.75	14.63	224.27
TH19-02	5530706.00	623776.19	238.19	13.72	226.00
TH19-03	5530934.92	623782.92	238.41	9.60	228.96
TH19-04	5531169.14	623790.12	238.39	10.67	228.63
TH19-05	5531557.79	623802.42	238.97	7.77	231.35
TH19-06	5531769.09	623809.13	239.37	10.67	229.62
TH19-07	5532001.74	623815.91	239.66	4.72	235.09
TH19-08	5532179.49	623820.81	240.03	4.57	235.52
TH19-09	5532489.28	623831.30	241.01	4.42	236.74
TH19-10	5532671.52	623801.35	241.24	7.92	233.47
TH19-14	5534076.22	624802.28	239.90	9.14	231.21
TH19-15	5534084.99	624968.52	239.66	11.89	228.08
TH19-16	5534089.93	625160.45	240.07	9.14	231.23
TH19-17	5534092.93	625284.88	240.18	7.92	232.41
TH19-18	5534128.16	625626.02	239.60	7.62	232.29
TH19-19	5534129.01	625786.32	239.46	4.57	235.04
TH19-20	5534113.91	625935.76	239.48	7.16	232.62
TH19-21	5534123.38	626090.00	239.63	11.43	228.51
TH19-22	5534126	626254	240.78	2.90	
TH19-23	5534133	626546	238.98	13.26	226.03

TABLE 2-4: 2019 BOREHOLES IN PROJECT AREA



Borehole ID	Northing (m)	Easting (m)	Approx. Ground Surface Elevation (m)	Approx. Borehole Depth (m)	Approx. Bedrock Contact Elevation (m)
TH19-24	5534137.26	626754.97	237.41	13.11	224.45
TH19-25	5534142.21	626886.53	236.66	9.60	227.21
TH20-01	5528369	624632	237.78	7.92	230.16
TH20-02	5528377	624389	238.62	7.77	231.15
TH20-03	5528389.90	624024.30	240.09	3.05	237.35
TH20-04	5528382.07	623724.35	239.95	5.79	234.46
TH20-05	5528600	623708	239.76	9.14	231.23
TH20-06	5528940.52	623733.94	239.98	9.14	231.14
TH20-07	5529234	623750	240.62	4.27	236.66
TH20-08	5529566.66	623701.15	240.58	6.40	234.33
TH20-09	5529742.84	623534.88	239.94	5.79	234.45
TH20-10	5529859.34	623401.36	239.80	5.49	234.47
TH20-11	5530037.66	623085.45	239.67	10.36	229.61
TH20-12	5530152.99	622811.01	239.70	12.50	228.12
TH20-13	5529862.39	622450.60	239.23	15.54	223.99
TH20-14	5530123.73	623582.28	239.37	9.30	230.38

The 2019 borehole logs are included in Appendix A. The location of the boreholes within the vicinity of the site are shown on Figure 1. Details of the geotechnical investigation are outlined in the KGS Group report titled "Airport Area West Regional Water and Wastewater Servicing Preliminary Engineering, 2019/2020 Preliminary Geotechnical Investigation Report", dated March 2020, included as Appendix A.

A total of five standpipes were installed along the proposed alignment during the 2019/2020 geotechnical investigation. Two standpipes were installed in the bedrock and three standpipes were installed in the till. The installation details of the piezometers are shown on the borehole logs in Appendix A. Groundwater monitoring data for the 2019/2020 instrumentation is summarized in Table 2-5.



TABLE 2-5: 2019/2020 GROUNDWATER MONITORING DATA

тн	19-04	TH19-18	TH20-12	
0+	+850	5+250	10+500	
23	8.39	239.60	239.7	
Standpipe 1	Standpipe 2	Standpipe 1	Standpipe 1	Standpipe 2
230.34	228.14	233.08	235.82	228.01
Till	Bedrock	Till	Till	Bedrock
Grou	ndwater Elevatior	n Monitoring Data	I	
236.44	236.33	238.42		
236.41 236.11		237.01	Dry	233.41
	0- 23 Standpipe 1 230.34 Till Grout 236.44	230.34 228.14 Till Bedrock Grouwater Elevation 236.44 236.33	0+350 5+250 230.34 Standpipe 2 Standpipe 1 230.34 228.14 233.08 Till Bedrock Till Cruetter Elevation 236.44 236.33 238.42	0 + 50 $5 + 250$ $10 + 10 + 10 + 100$ $2 - 30 + 50$ $2 - 30 + 50$ $2 - 30 + 50$ $1 - 30 + 50$ 1

Notes:

1) Stationing based on figures contained in the 2019 KGS Group Geotechnical Report (Appendix A)

2) The 2019/2020 instrumentation were unable to be located in 2023/2024 to obtain recent readings.

KGS Group retained the services of Frontier Geoscience Inc. to perform seismic refraction surveys along the proposed pipeline alignments. The primary objective of the geophysical survey was to obtain estimates of the depths to till and bedrock along the proposed alignment of the pipelines. The location of the seismic lines is shown on Figure 1. The results of the seismic refraction survey are included in the 2019 KGS Group Geotechnical Report in Appendix A.

Cobbles and Boulders

As part of the 2019/2020 drilling investigation, cobbles were encountered in the clay deposit near the till interface in some boreholes. Cobbles were observed within the silt till in a majority of the boreholes as indicated on the borehole logs. Based on previous works completed by the City of Winnipeg in the vicinity of this project, it is understood that installation of the new pipelines near the clay/till interface and within the till may encounter substantial quantities of cobbles and boulders. Zones with increased cobbles and boulders were identified as part of the geophysical investigation and were observed at Stations 3+140 to 3+250, 8+820 to 8+950, 9+000 to 9+030, 9+270 to 9+320, and 9+500 to 9+540 (refer to station ranges in Appendix A).

2.2 Regional Geologic Setting

The geology in Winnipeg generally consists of carbonate sedimentary bedrock overlaying Precambrian era granite and gneiss. The sedimentary rock consists of alternating layers of limestone, and dolomite and to a lesser extent shale. The proposed pipelines will encounter the Stony Mountain Formation. In the Stony Mountain Formation, the basal Gunn member consists of greyish-red to purplish- and reddish-grey, fossiliferous, calcareous shale with interbeds of relatively clean, fossiliferous limestone. It is overlain by yellowish- to reddish-grey fossiliferous, argillaceous dolomite of the Penitentiary member. These two units together compose the lower Stony Mountain Formation.



The surface of the bedrock is usually highly fractured and disturbed, often mixed with gravels and sands. Geological maps for Winnipeg indicate karst topography caused from dissolution of the soluble rock, and a heavily fractured upper bedrock layer. The karst topography is typically infilled with mixtures of silt, sand and gravel till soils.

During the last glacial advance and retreat, Winnipeg's glacial till was deposited by ice masses. Glaciolacustrine deposits suspended in glacial lakes confined by ice masses settled to overlie the tills. Additional information on the regional geology can be found in the Geological Engineering Report for Urban Development of Winnipeg, University of Manitoba (Reference 4).



3.0 SCOPE OF 2023/2024 INVESTIGATION PROGRAM

3.1 General

This section provides a summary of the 2023/2024 field investigation program, instrumentation installation and monitoring, and laboratory test results; as well as a description of the subsurface conditions encountered at the project site.

The 2023/2024 geotechnical and geophysical investigations were completed to determine the subsurface conditions along the proposed water and wastewater pipeline alignments, and within the footprint of the proposed lift station. The results of the investigation program are presented in this Geotechnical Data Report.

3.2 Borehole Drilling and Soil Sampling

The borehole drilling and sampling program was completed by KGS Group from September 25 to April 22, 2024 over multiple field work mobilizations. A total of twenty-two (22) boreholes were advanced to at least power auger refusal, with nine (9) of the boreholes being advanced into bedrock. The boreholes were completed to investigate the subsurface stratigraphic conditions within the project area and evaluate the suitability of the till and bedrock for trenchless construction methodologies that are anticipated to be utilized for the various construction contracts and at specific road/railway crossing locations. Two (2) pumping wells, PW23-01 and PW23-02, were advanced in the footprint of the future lift station. The locations of the 2023 boreholes are shown in plan on Figure 1 and a summary of the locations is presented in Table 3-1.

Maple Leaf Drilling of Winnipeg, Manitoba provided the drilling services using a track-mounted drill rig equipped with 125 mm solid stem augers, casing advancer, and HQ coring. The drilling was completed under the supervision and direction of KGS Group personnel. Soil samples were collected at intervals of 1.5 m (5 ft.) or at any changes in soil strata encountered during drilling. The soil samples were visually inspected for material type and classified according to the Modified Unified Soil Classification System (USCS).

Standard Penetration Tests (SPTs) were completed in the glacial till to evaluate the in-situ density. Clay samples were tested with a field Torvane to evaluate the consistency and estimate the undrained shear strengths of cohesive soils. Glacial till samples were tested with a Pocket Penetrometer to estimate the unconfined compressive strength of non-cohesive soils. Upon completion of drilling, the boreholes were examined for indications of sloughing and seepage and then backfilled. Borehole log records incorporating field observations, and field test results are provided in Appendix B. Photographs of the soil and bedrock samples are included in Appendix C.

A test pit excavation and sampling program was completed by KGS Group from February 21 to 22, 2024 and on April 15, 2024. A total of five (5) test pits were advanced to refusal on the bedrock surface. The test pits were completed to confirm the depth to bedrock and evaluate the composition of the glacial till on either side of the proposed trenchless crossings across Canadian Pacific Kansas City Railway (CPKC) right-of-ways (Glenboro and Carberry Subdivisions). One (1) test pit was located on the northeast side of the intersection of Sturgeon Road and Selkirk Avenue. Excavation services were provided by J Con Civil Ltd. of Winnipeg, Manitoba using a rubber-tire excavator. Soil samples were collected at changes in soil strata and were



visually classified according to the USCS. Upon completion of excavation, each test pit was examined for indications of sloughing and seepage and then backfilled.

TABLE 3-1:	SUMMARY	OF	2023	BOREHOLE	AND	2024	TEST	ΡΙΤ
			LOCA	TIONS				

Borehole ID	Northing (m)	Easting (m)	Approx. Ground Surface Elevation (m)	Approx. Borehole Depth (m)	Approx. Bedrock Contact Elevation (m)
TP24-01	5529179	623763	239.97	5.3	234.87
TP24-02	5529137	623772	240.64	4.6	236.04
TP24-03	5533683.99	624558.95	237.44	5.5	231.95
TP24-04	5533583.04	624491.12	238.36	5.2	233.18
TP24-05	5532450.43	623837.68	240.07	3.5	236.56
TH24-01	5533698.12	624479.21	237.70	19.51	231.60
TH24-02	5533655	624430	237.67	21.49	232.79
PW23-01	5530157	623136	238.91	22.30	
PW23-02	5530127	623154	238.77	22.30	
TH23-01	5530113	623145	240.20	22.50	229.08
TH23-03	5528181	623558	237.80	7.07	
TH23-04	5528361	623519	237.80	7.39	
TH23-05	5528557	623549	239.33	4.27	
TH23-06	5528836	623547	239.10	6.78	
TH23-07	5529083	623587	239.10	5.49	
TH23-08	5529096	623757	239.40	9.45	234.37
TH23-09	5529183	623764	240.00	9.75	233.52
TH23-11	5529997	623757	237.50	7.85	
TH23-12	5530219	623766	237.80	7.62	
TH23-17	5533655	624430	237.67	12.60	233.28
TH23-18	5533695	624469	238.01	12.62	233.16
TH23-19	5533941	624602	238.74	7.32	



Borehole ID	Northing (m)	Easting (m)	Approx. Ground Surface Elevation (m)	Approx. Borehole Depth (m)	Approx. Bedrock Contact Elevation (m)
TH23-20	5534056	624724	238.81	8.11	
TH23-21	5534214	624686	238.92	8.08	
TH23-22	5534319	625352	239.74	7.32	
TH23-23	5534208	625352	238.81	6.25	
TH23-24	5529982	622695	238.26	12.37	
TH23-25	5530062	622907	239.06	14.07	227.94
TH23-26	5529971	623340	239.09	15.62	232.69

Notes:

1) Ground surface elevations for boreholes were established from City of Winnipeg LiDAR data. Ground surface elevations for test pits were established using survey grade GPS.

2) Top of bedrock elevation is reported where bedrock was confirmed during drilling/test pitting.

3.3 Groundwater Monitoring

A total of three (3) vibrating wire piezometers and five (5) standpipes piezometers were installed at the project site. The standpipes were installed within the bedrock and the vibrating wire piezometers were installed in the overlying glacial till. Based on the results of the drilling, the standpipe in TH23-24 is likely installed within a zone of cobbles/boulders or highly weathered bedrock. Table 3-2 summarizes the installation details and the piezometer monitoring completed to date. The installation details of the piezometers are shown on the 2023 borehole log records provided in Appendix B.



TABLE 3-2: GROUNDWATER MONITORING DATA

Borehole ID	тн	19-04	TH19-18	TH	20-12	PW23-01	PW23-02	TH2	3-01	TH23-09	TH23-18	т	H23-24	TH2	3-25
Ground Elevation (m)	23	8.39	239.60	23	39.70	238.77	238.91	240).20	240.00	238.01		238.26	239	9.06
Piezometer No.	Standpipe 1	Standpipe 2	Standpipe 1	Standpipe 1	Standpipe 2	Pump Well	Pump Well	VW171370	Standpipe 1	Standpipe 1	Standpipe 1	VW164950	Standpipe 1	VW163297	Standpipe 1
Tip Elevation (m)	230.34	228.14	233.08	235.82	228.01	216.52	216.66	231.67	218.76	230.86	225.82	228.81	226.07	229.00	225.50
Monitoring Zone	Till	Bedrock	Till	Till	Bedrock	Bedrock	Bedrock	Till	Bedrock	Bedrock	Bedrock	Till	Cobbles/Boulders	Till	Bedrock
Groundwater Elevation Monitoring Data															
Date															
2019-10-28	236.44	235.33	238.42												
2020-02-28	236.41	236.11	237.01	Dry	233.41										
2023-11-14								233.21	233.21	232.60					
2023-11-20						230.28	233.42		233.18	232.60	237.06		236.33		233.63
2023-12-01								233.31	233.01		236.99	233.63	235.93	233.64	233.61
2023-12-13								233.32	233.09	232.60	237.16	233.63	235.71	233.64	233.51
2024-01-17								233.21	233.08	232.57	237.41	233.47	235.11	233.62	233.52
2024-04-01								233.08	232.97	232.46	frozen	233.37	233.72	233.43	233.36
2024-04-15								233.09	232.97	233.08	frozen	233.38	233.65	233.54	233.34
2024-05-01								233.24	233.27	232.53	237.63	233.64	233.60	233.95	233.68

Notes:

1) Instrumentation casings for the 2019/2020 instrumentation were unable to be located during instrumentation readings in 2023/2024.

2) Additional instrumentation readings are recommended to be collected during spring and summer conditions to determine seasonal fluctuations of groundwater.



3.4 Geophysical Seismic Refraction Survey

KGS Group retained the services of Frontier Geoscience Inc. to complete seismic refraction surveys along a portion of the preferred force main alignments for the interceptor sewer and feeder main contracts. The seismic refraction surveys were completed from October 31 to November 3, 2023. The objective of the geophysical survey was to obtain estimates of the depth to glacial till and bedrock along the preferred alignments as noted. The locations of the 2023 seismic lines are shown on Figure 1 and the results of the seismic refraction survey are included in the Seismic Refraction Survey Report included in Appendix F. The interpreted profiles of the glacial till and bedrock surfaces are also included on the respective Contract Drawings.

3.5 Laboratory Testing

Laboratory testing was performed on select soil and bedrock samples for use in the characterization of the subsurface.

Laboratory testing was completed on representative soil samples including:

- Moisture content;
- Particle size distribution; and
- Atterberg Limit.

Laboratory testing on the bedrock samples was completed to determine the following mechanical properties:

- Uniaxial Compressive Strength.
- CERCHAR Testing (rock abrasivity).

All laboratory testing was performed at a Canadian Council of Independent Laboratories (CCIL) certified laboratory in general accordance with ASTM International standards.

The 2023 laboratory test results are summarized in Section 4.0 and included in Appendix D.

3.6 Well Pump Testing

KGS Group completed drilling a 125 mm diameter PVC test well (PW23-02) on November 14, 2023. Drilling services were provided by licensed water well driller Maple Leaf Drilling Ltd., under KGS Group supervision. The borehole was completed using a Canterra CT 250 truck-mounted rig using mud rotary drilling techniques in the overburden and to set the PVC casing into the bedrock. Open hole rotary drilling was used to bore an open hole into the bedrock beneath the casing. The casing was grouted in place, as per the Provincial water well installation guidelines. The location of PW23-02 is shown on Figure 1 and a summary log is included in Appendix B. Pump test well PW23-01 was initially installed at the site, but due to low preliminary yield (<1 USgpm), a second pump test well (PW23-02) was installed to facilitate the pump test.

A pumping test of PW23-02 was conducted on November 20, 2023, to quantify the hydraulic characteristics of the carbonate bedrock aquifer at the test well site, and to monitor the aquifer response to pumping in the piezometers installed in borehole TH23-01 and in PW23-01. A 2-hour pumping test was conducted on



PW23-02 on November 20, 2023, starting a 15:00 and ending at 17:00. Recovery, following the cessation of pumping, was measured for an additional half hour, until 17:30.

The pump test memorandum is included as Appendix G.



4.0 SUBSURFACE CONDITIONS

The stratigraphy at the site is described in this section and is based on the exploratory boreholes, seismic refraction surveys, and our understanding of the site geology. Borehole logs from the 1988, 2009, and 2019/2020 geotechnical investigations along the proposed project alignments are provided in the 2019 KGS Group Geotechnical Report in Appendix A. The borehole and test pit logs from the 2023/2024 geotechnical investigations are provided in Appendix B.

In general, the stratigraphy consists of fill overlying clay, silt till, and bedrock. The following sections describe the soil and the bedrock encountered during the geotechnical drilling investigation. Fencelines showing soil profiles along the proposed alignment are shown on Figures 2 to 6. The approximate till surface is shown on the fenceline and is generally interpolated between boreholes. The seismic refraction survey results are overlain on the fencelines where survey data exists. The seismic refraction data indicates that there is variability in the till and bedrock elevations between the boreholes.

4.1 Overburden

The overburden deposits encountered at the project site generally consist of fill over glaciolacustrine clay, glacial silt till deposit, and underlain by the carbonate bedrock. Variable layers of fill and occasional silt were observed in the boreholes within the Upper Complex Zone.

The Upper Complex Zone in Winnipeg generally consists of stratified clays, and silts with variable amounts of organics, granular and fill material. This zone has high soil variability. The base of the Complex Zone is typically defined by the base of the silt layer. The silt interlayers in the Complex Zones can vary from 100 mm to up to 3 m in thickness and are typically approximately 1 m. Typically the silt is tan in colour, soft in consistency, of no to low plasticity and may have a perched groundwater table. The moisture content of the silt ranges from 20 to 35% and the unit weight is within the range of 18.8 to 20.4 kN/m³ (Reference 4).

4.1.1 FILL

In the project area, topsoil or fill was generally encountered above the glaciolacustrine clay deposit. For boreholes drilled on or adjacent to roadways, a layer of granular fill was observed.

The granular fill was fine to coarse grained gravel and was described as brown in colour, damp, loose to compact in density, contained some fine to coarse grained sand, and trace silt, and trace clay.

The clay fill was mottled brown to grey, damp, firm to stiff, low to high plasticity, contained trace to some fine to coarse grained gravel, trace to some fine to coarse grained sand, some organics, and trace rootlets.

The extent of the clay fill identified in the project area is outlined in Table 4-1 below.



TABLE 4-1 :	CLAY	FILL -	PROJECT	AREA
--------------------	------	--------	---------	------

Location	Profile	Clay Fill		
	Elevation at Top (m)	235.89 to 241.24		
Project Area	Thickness (m)	0.15 m to 2.44 m		

A summary of the laboratory material testing results on the clay fill from the KGS Group 2023/2024 geotechnical investigations and the background geotechnical investigations are summarized in Table 4-2.

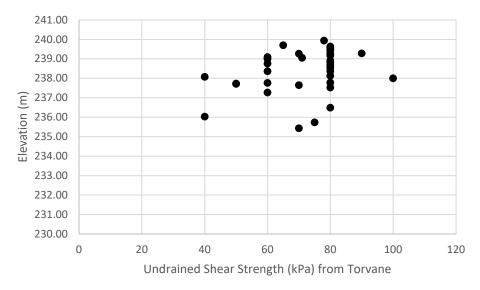
TABLE 4-2: SUMMARY OF LABORATORY AND FIELD TEST RESULTS FOR CLAY FILL

Laboratory Test	Clay Fill
Moisture Content (%)	42 to 43
Undrained Shear Strength (kPa) – Torvane	40 to 100
Unconfined Compressive Strength (kPa) – Pocket Penetrometer	350
Notes:	

1) Unconfined Compressive Strength is based on one pocket penetrometer test.

Values of undrained shear strength (Su) with elevation for the clay fill as estimated from a field Torvane during the KGS Group 2023 investigation and background geotechnical investigations throughout the project site are summarized in Figure 4-1.

FIGURE 4-1: UNDRAINED SHEAR STRENGTH WITH ELEVATION FOR CLAY FILL





4.1.2 GLACIOLACUSTRINE CLAY

The glaciolacustrine clay deposit in the Winnipeg region is typically 9 to 12 m thick. In decreasing occurrence, typically the predominant mineral composition of the lacustrine clay generally consists of montmorillonite (a member of the smectite family), illite, kaolinite and some mica (Graham and Shields 1985). The clay deposit changes from brown to grey (sometimes referred to as blue clay) at depths of approximately 4.6 to 7.6 m. Within this depth range, the brown and grey clays often appear mottled, making it sometimes difficult to observe a discrete contact between the two (2) colours. It is believed the colour change is due to the oxidation of the brown clay (Graham and Shields 1985).

The brown clay is typically stiff in consistency and of a high plasticity. The brown clay is highly fissured with the frequency of fissures decreasing with depth. White gypsum pockets and veins are typically observed within the brown clay, often filling in the fissures. The lower grey clay is firm to stiff in consistency and of intermediate to high plasticity. Fine to coarse grained gravel and boulders are found occasionally in the grey clay, near the till interface.

The glaciolacustrine clay typically contains trace to some silt nodules. These non-plastic, non-clay materials generally occur throughout the clay deposit as varves, veins, seams, inclusions or pockets that are typically less than a centimeter in diameter. The tendency for horizontal orientation of the varves, veins, and seams introduces a visible macrostructure to the clay and are a contributing cause for the observed anisotropy in horizontal permeability and strength of the deposit. Quigley (1968) offers the explanation that frozen silt lumps were rafted into glacial Lake Agassiz by icebergs and dropped into the clays as frozen lumps. Baracos (1977) provided a more likely explanation, considering the sharply defined boundaries of the inclusions, that they were deposited not frozen but as cemented or lithified material which subsequently disintegrated into silt.

Typical moisture content in the glaciolacustrine clay ranges from 40 to 60%. Atterberg Limit tests within the brown and grey clay has shown the brown clay is typically more plastic than the underlying grey clay. Liquid Limits in the brown clay typically range from 80 to 110% and the Plastic Index from 60 to 80%. Liquid Limits in the grey clay typically range from 65 to 95% and the Plastic Index ranges from 40 to 65%. Unconfined compressive strengths usually range from 70 to 100 kPa within the brown clay. Measured values within the upper brown clay are variable due to fissures. Typically, the unconfined compressive strengths generally yield a lower bound to undrained shear strengths (Reference 4).

Undrained shear strengths measured from unconfined compression tests are generally higher within the upper clay zone (~ top 2 to 3 m), typically in the order of 70 to 100 kPa. Below a depth of about 4 to 5 metres, strengths typically decrease approximately uniformly with increasing depth. As the underlying till layer is approached, strengths are typically in the order of 40 kPa but may be as low as 25 kPa. The higher undrained shear strengths with the upper brown clay and lower shear strengths at depth near the till is caused by weathering near the ground surface and decreasing over consolidation ratios to approximately normally consolidated conditions near the bottom of the deposit. They may also reflect artesian ground water conditions (and therefore low vertical effective stresses).

Effective shear strength parameters of the brown and grey clay obtained from consolidated undrained compression triaxial strength testing of a large number of relatively undisturbed samples yielded intact peak strength of c' = 19.6 kPa and ϕ' = 20.5° and c' = 29.8 kPa and ϕ' = 15.8°, respectively. While the effective large



strain shear strength parameter for the brown and grey clay were c' = 14.5 kPa and ϕ' = 13.3° and c' = 7.7 kPa and ϕ' = 15.7°, respectively (Reference 4). The effective shear strength parameters typically used by local geotechnical engineers in Winnipeg for slope stability analysis are c' = 5 kPa and ϕ' = 14° for both clays.

XRD analysis was not completed on the clay deposit as part of the 2023 geotechnical investigations. Testing results from another tunnelling site in Winnipeg indicated that the quartz content of the clay samples ranged from 16.1 to 20.2%, the clinochlore content ranged from 13.3 to 17.0%, the muscovite content ranged from 15.4 to 29.3%, the calcite content ranged from 0.6 to 4.5%, the dolomite content ranged from 4.2 to 9.7%, and the smecite content ranged from 28.6 to 37.1%.

In the project area, the thickness of the glaciolacustrine clay deposit is generally less than the majority of the Winnipeg region, with glacial till and bedrock outcrop observed at surface in some areas. The extent of the glaciolacustrine deposits identified in KGS Group's 2023/2024 geotechnical investigations and the background geotechnical investigations is outlined in Table 4-3 below.

TABLE 4-3: GLACIOLACUSTRINE DEPOSITS - PROJECT AREA

Location	Profile	Glaciolacustrine Clay		
Draiget Area	Elevation at Top (m)	235.13 to 240.45		
Project Area	Thickness (m)	0.30 to 7.01		

A summary of the laboratory material testing results on the glaciolacustrine clay from the KGS Group 2023 geotechnical investigations and the background geotechnical investigations are summarized in Table 4-4.

TABLE 4-4: SUMMARY OF LABORATORY AND FIELD TEST RESULTS FOR GLACIOLACUSTRINE CLAY

Laboratory Test	Glaciolacustrine Clay
Moisture Content (%)	18 to 57
Atterberg – Plastic Limit (%)	16 to 29
Atterberg – Liquid Limit (%)	49 to 95
Plasticity Index (%)	27 to 66
Grain Size – Gravel (%)	0
Grain Size – Sand (%)	1 to 13
Grain Size – Silt (%)	3 to 32
Grain Size - Clay (%)	53 to 97
Undrained Shear Strength (kPa) – Torvane	15 to 100
Unconfined Compressive Strength (kPa) – Pocket Penetrometer	75 to 450



Values of undrained shear strength (Su) with elevation for the glaciolacustrine clay as estimated from a field Torvane during the KGS Group 2023 investigation and background geotechnical investigations throughout the project site are summarized in Figure 4-2.

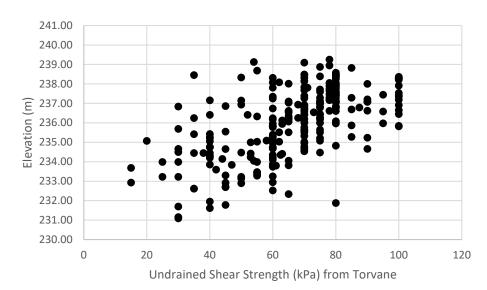


FIGURE 4-2: UNDRAINED SHEAR STRENGTH WITH ELEVATION FOR GLACIOLACUSTRINE CLAY

4.1.2.1 Swelling Potential of Clay Deposit

The swelling potential of a clay soil can be categorized based on the plasticity and percentage of clay sized particles (Figure 12.8, Canadian Foundation Engineering Manual, 5th Edition). The swelling potential of clay is highest when a sample has a high percentage of clay size particles and high plasticity index. Clay minerals accounts for between 67 and 81 % of the total composition of the Lake Agassiz clay in Winnipeg. The clays' size fractions typically consist of up to 75 % montmorillonite, 10 % illite, and 10 % kaolinite and approximately 5% quartz mineral. Over-consolidation ratio of the clay is generally less than 2.

The clay in the project area is classified to have a very high potential severity of an expansive soil based on the laboratory testing completed and is subject to considerable volume change with change in moisture content. Volumetric increases are usually in the 2% range with swelling pressure generally less than 75 kPa.

The variability of moisture content in the overburden with elevation in the project area is shown in Figure 4-3.



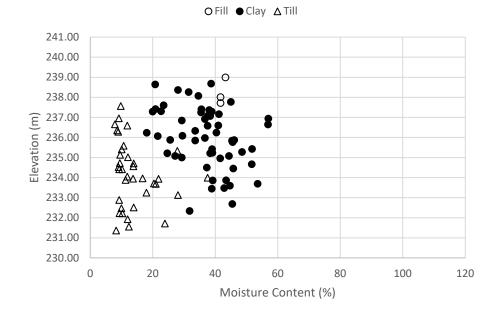


FIGURE 4-3: MOISTURE CONTENT OF OVERBURDEN WITH ELEVATION

4.1.2.2 Stickiness Potential and Clogging Risks

The clay and silt till deposit present at the site has a tendency to develop sticky behaviour (adhesion of cohesive material to each other or to a metal surface). This stickiness may result in the clogging and blockage of trenchless construction equipment including cutterhead, tooling, work chamber, screw conveyors, muck carts, conveyors, slurry lines, or prevent the shield advancement due to excessive friction.

The potential for clogging while tunnelling through the clay and glacial till formations was evaluated using the chart suggested by Hollmann and Thewes (2013). Atterberg Limits (Liquid limit, Plastic limit, and natural moisture content) of cohesive samples tested in the Laboratory and their Plasticity Indices were plotted on Figure 4-4 to determine the corresponding clogging potential of the clay and glacial till. It should be noted that the Hollman and Thewes chart was developed from data collected from fluid supported trenchless shield drives, but are assumed to be applicable to other tunnelling methods.



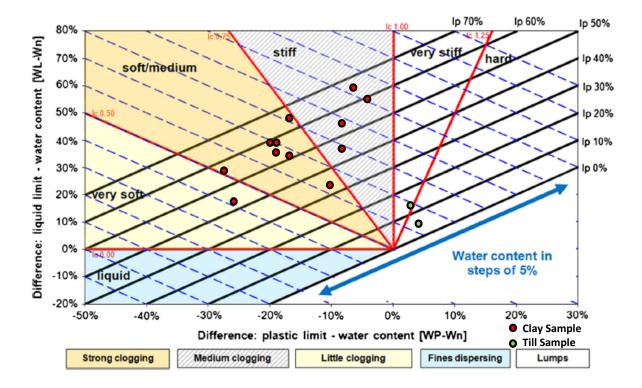


FIGURE 4-4: STICKINESS POTENTIAL OF COHESIVE SOIL

4.1.3 GLACIAL TILL DEPOSIT

The glaciolacustrine clays are underlain by glacial silty tills. Based on the borehole drilling and test pits, glacial silt till was encountered at elevations ranging from 230.7 to 239.5 m within the project area. The glacial till ranged in thickness from 0.4 to 13.6 m. The glacial till may include a transition zone of till lenses in clay and clay inclusions in the till. The composition of the till is variable. The till is of varying consistency with the dense to very dense portions of the deposits being a basal till (hardpan). The upper horizon of the till deposit may be frequently loose and considerably softer, and water bearing like an ablation till (putty till). The upper ablation till typically may have water contents ranging from 10 - 15% while the denser basal till will typically have water contents in the range of 7 - 10%. The upper tills contain more clay, and have a slightly higher plasticity than the lower tills with high silt contain. Unconfined compressive strengths ranging from 3.4 - 3.6 MPa have been reported for very dense tills with a moisture content of about 5% (Reference 4). Young's moduli typically range from 170 to 240 MPa (Reference 4). The tills are highly variable in terms of thickness, density and cobble/boulder content. Pockets of non-combustible gas, often under pressure are occasionally encountered in the till layer (Reference 3).

The uncorrected Standard Penetration Test blow counts ranged from 5 to greater than 50 blows/0.3 m, classifying the material as loose to very dense throughout the project area.

In KGS Group's experience and as observed during this program, zones of cobbles and/or boulders have been encountered within the till deposits such as those at this site. The composition of the boulders will contain granite with diameters up to 600 mm based on previous experience in Winnipeg. The percent volume of boulders per total volume of glacial till excavated is estimated to be up to 6%. The boulder frequency



observed during the 2024 test pitting investigation was roughly up to 4 boulders (greater than 300 mm diameter) per cubic meter of glacial till excavated. These zones can cause difficulties during construction and should be anticipated within the deposits in the project area. Photos of boulders encountered during the test pitting investigation are provided in Appendix C.

The extent of the glacial till deposit identified in KGS Group's 2023/2024 geotechnical investigations and the background geotechnical investigation is outlined in Table 4-5 below.

TABLE	4 - 5 :	GLACIAL	TILL	-	PROJECT	AREA
	1					

Location	Profile	Glacial Till		
Draiget Area	Elevation at Top (m)	230.16 to 239.54		
Project Area	Thickness (m)	0.40 to 13.56		

Notes:

1) Thickness is based only on boreholes where the bedrock elevation was confirmed.

A summary of the laboratory material testing results on the glacial till deposits from the KGS Group 2023 geotechnical investigations and the background geotechnical investigations are summarized in Table 4-6.

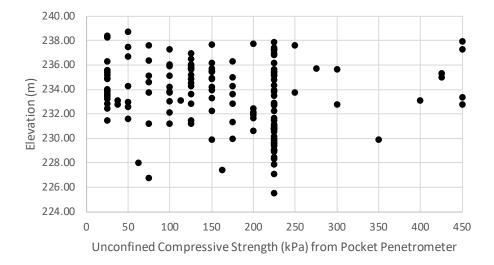
TABLE 4-6: SUMMARY OF LABORATORY TEST RESULTS FOR GLACIAL TILL

Laboratory Test	Glacial Till
Moisture Content (%)	8 to 28
Atterberg – Plastic Limit (%)	14 to 16
Atterberg – Liquid Limit (%)	21 to 27
Plasticity Index (%)	5 to 13
Grain Size – Gravel (%)	0 to 25
Grain Size – Sand (%)	1 to 37
Grain Size – Silt (%)	15 to 81
Grain Size - Clay (%)	10 to 84
Uncorrected Standard Penetration Test – Blow Count	5 to >100
Unconfined Compressive Strength (kPa) – Pocket Penetrometer	25 to 450

Values of unconfined compressive strength (Cu) with elevation for the glacial till deposit as estimated from a pocket penetrometer during the KGS Group 2023 investigation and background geotechnical investigations throughout the project site are summarized in Figure 4-5.

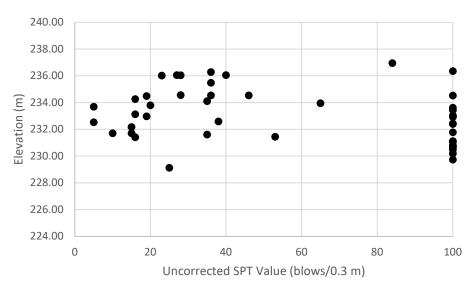


FIGURE 4-5: UNCONFINED COMPRESSIVE STRENGTH WITH ELEVATION FOR GLACIAL TILL



Uncorrected Standard Penetration Test (SPT) blow count values (blows/0.3 m) with elevation for the glacial till encountered during the KGS Group 2023 investigation and background geotechnical investigations throughout the project site are summarized in Figure 4-6.





Notes:

1) Values of 100 indicate early refusal of the split spoon during SPT.

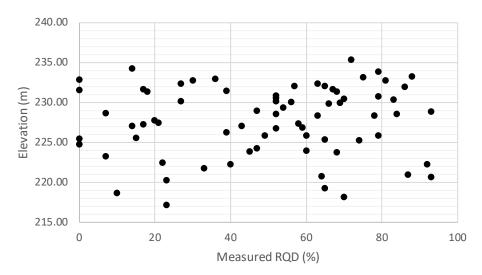


4.1.4 BEDROCK

The carbonate bedrock within the project area belongs to the Gunn and Penitentiary members of the Stony Mountain Formation. The Gunn and Penitentiary members typically include the lowest strength rock in the Winnipeg region with compressive strengths in the order of 25 to 30 MPa. The Young's modulus (E) generally ranges from 15 to 25 GPa for the stronger rocks in the Winnipeg area, and as low as 4 GPa for the weaker rocks (Reference 4).

Bedrock was cored in nine (9) boreholes during the 2023/2024 KGS Group investigations and within fortyseven (47) boreholes during previous geotechnical investigations. Based on the borehole drilling and test pitting, bedrock was encountered below the silt till at elevations ranging from 222.1 to 237.4 m. The estimated bedrock elevation from the 2019 seismic refraction survey ranged from approximate El. 223 m to 238.5 m along Sturgeon Road and ranged from approximate El. 225 m to 235 m along the northern portion of CentrePort Canada Way (CCW). The estimated bedrock elevation from the 2023 seismic refraction survey ranged from approximate El. 221 m to 231 m on the south side of Sturgeon Access and ranged from approximate El. 225.5 m to 232 m on the north side of Sturgeon Access. The seismic refraction survey results are generally consistent with observations from the drilling. The seismic refraction lines from the 2019 and 2023 surveys are shown on Figure 1.

The bedrock consists of argillaceous limestone to calcareous shale and occasionally overlain by argillaceous dolomite. The shale is typically interbedded with the limestone and was observed to be very weak to weak. In TH24-02, the shale exhibited qualitative characteristics similar to a mudstone. The dolomite was observed in boreholes/test pits TH23-08, TH23-09, TH23-26, TP24-01, TP24-02, TP24-03, and TP24-05. The measured RQD of the bedrock with elevation is shown in Figure 4-7 below, and a histogram with the RQD distribution is shown on Figure 4-8.







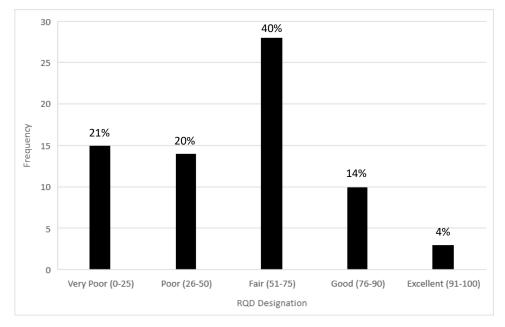
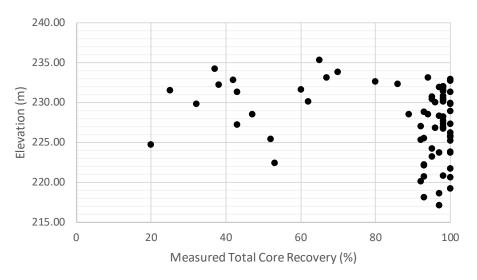


FIGURE 4-8: HISTOGRAM OF DISTRIBUTION OF RQD WITHIN BOREHOLES

Total Core Recovery (TCR) is the total length of the bedrock core recovered and is expressed as the percentage of actual length of the core run (typically 1.5 m). A summary of the TCR values is provided in Figure 4-9.





Uniaxial compressive strength testing was completed on bedrock samples from boreholes TH23-01, TH23-08, TH23-17, TH23-18, TH23-25, TH23-26, and TH24-01. The results for compressive strength testing are summarized in Figure 4-10.



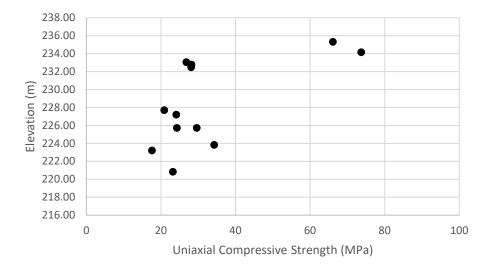


FIGURE 4-10: UCS OF BEDROCK WITH ELEVATION

CERCHAR laboratory testing was completed in accordance with ASTM D7625-22 to determine the CERCHAR Abrasiveness Index (CAI) of the bedrock in order to evaluate the wear on cutting tool components for common trenchless construction techniques (e.g. tunnel boring machine). The results of the CERCHAR testing are summarized in Table 4-7 and a detailed report is provided in Appendix D.

Borehole ID	Sample Depth (m)	Sample Elevation (m)	Description	CAI	ASTM Classification
TH23-17	5.18	232.49		0.301	< Very Low Abrasiveness
TH23-18	5.49	232.52	Argillaceous Limestone /	0.445	Very Low Abrasiveness
TH23-25	11.58	227.48	Calcareous Shale	0.525	Very Low Abrasiveness
TH23-26	10.97	228.12		0.278	< Very Low Abrasiveness

TABLE 4-7: CERCHAR ABRASIVENESS INDEX RESULTS

4.1.4.1 Excavatability/Rippability of Bedrock

Excavation of bedrock will be required at temporary shaft locations and open-cut trenching. Rippability of bedrock was assessed using the Kirsten method (Kirsten 1988; ASTM STP 984). Rippability indices for bedrock were estimated using the factors provided in Kirsten (1988) at the elevations where UCS data was collected for the bedrock. The Rippability index for bedrock within the CentrePort project area varied from 260 to 6500, indicating a hard to extremely hard ripping classification.



4.2 Well Pump Test Results

A summary of measured response to pumping during the 2-hour pumping test are shown in Table 4-8. The pumping test data was analyzed using the Cooper Jacob (1946) method (both time and distance drawdown) method and the hydraulic parameters inferred from the data are shown in Table 4-9.

Test Hole	Instrument Type	Tip Depth (m bgs)	Monitored Zone	Distance from Pumping Well (m)	Static Water Level (m below TOC)	GW Elevation (masl)	End of Test Drawdown (m)
PW23-02	Standpipe	11.73	Bedrock	-	6.07	233.42	5.57
TH23-01	Standpipe	21.40	Bedrock	~ 13	7.93	233.15	0.08
TH23-01	Vibrating wire	9.10	Silt Till	~ 13	7.84	233.28	None
PW23-01	Standpipe	12.95	Bedrock	~ 35	9.07	230.28	None

TABLE 4-8: PUMPING TEST DRAWDOWN RESULTS

TABLE 4-9: TRANSMISSIVITY AND STORATIVITY CALCULATIONS FROM PUMPING TEST

Data from the Well	Data Type	Method	Transmissivity (m²/day)	Storativity
PW23-02	Residual Drawdown vs Elapsed Time	Cooper-Jacob (1946)	1.47	-
PW23-02 and TH23-01	Distance-Drawdown	Cooper-Jacob (1946)	2.9	0.0032
Average Transmissivity (m ² /day)			2.18	

In general, the estimated transmissivity of the bedrock aquifer was 2.18 m²/day (<500 USgpd/ft), based on the results of the 2-hour, single pumping well test, and the data from the responding observation wells. The drawdown observations from the bedrock monitoring wells (TH23-01, PW23-01) did not indicate appreciable fracture connectivity to the pumping well. Drawdowns in the limestone aquifer were small but detectable in observation well TH23-01; however, no drawdown was observed in PW23-01. The estimated storativity was calculated to be 0.003. It was observed that PW23-02 recovered to the static groundwater level within the first 10 minutes of the recovery period following pump shutoff.

Radius of influence calculations were not performed; however, it was noted from the drawdown versus time data for TH23-01 that the maximum drawdown at this well location was 0.08 m. It is estimated that the radius of influence of pumping at 8 USgpm was approximately 13 m.



Details of the pump test assessment are included in Appendix G

4.3 Groundwater

Groundwater level monitoring data is presented in Table 3-2.

Potentially difficult groundwater inflows were noted in several boreholes from the 2023 geotechnical investigation and background geotechnical investigations. End of drilling observations are included on the borehole logs in Appendix A and B. After completion of drilling, at least 1.0 m of water was observed in the following boreholes within five minutes:

• G-88-32, G-88-33, G-88-34, G-88-37, G-88-38, TH23-01, TH23-21, TH23-22, TH23-23, TH23-24, TH23-25, TH24-01, and TH24-02.

Water seepage was observed in the following additional boreholes and test pits:

• G-88-40, G-88-50, G-88-55 to G-88-60, G-88-63, TH09-20, TH09-22, TH23-20, TP24-03, and TP24-04.

Groundwater levels observed in the 2019/2020 borehole immediately upon the completion of drilling included on the borehole logs may not be representative, as water was used during the sonic drilling program.

In KGS Group's experience, zones of cobbles, boulders, and/or granular layers are known to exist within till deposits. These zones should be expected to be water bearing.



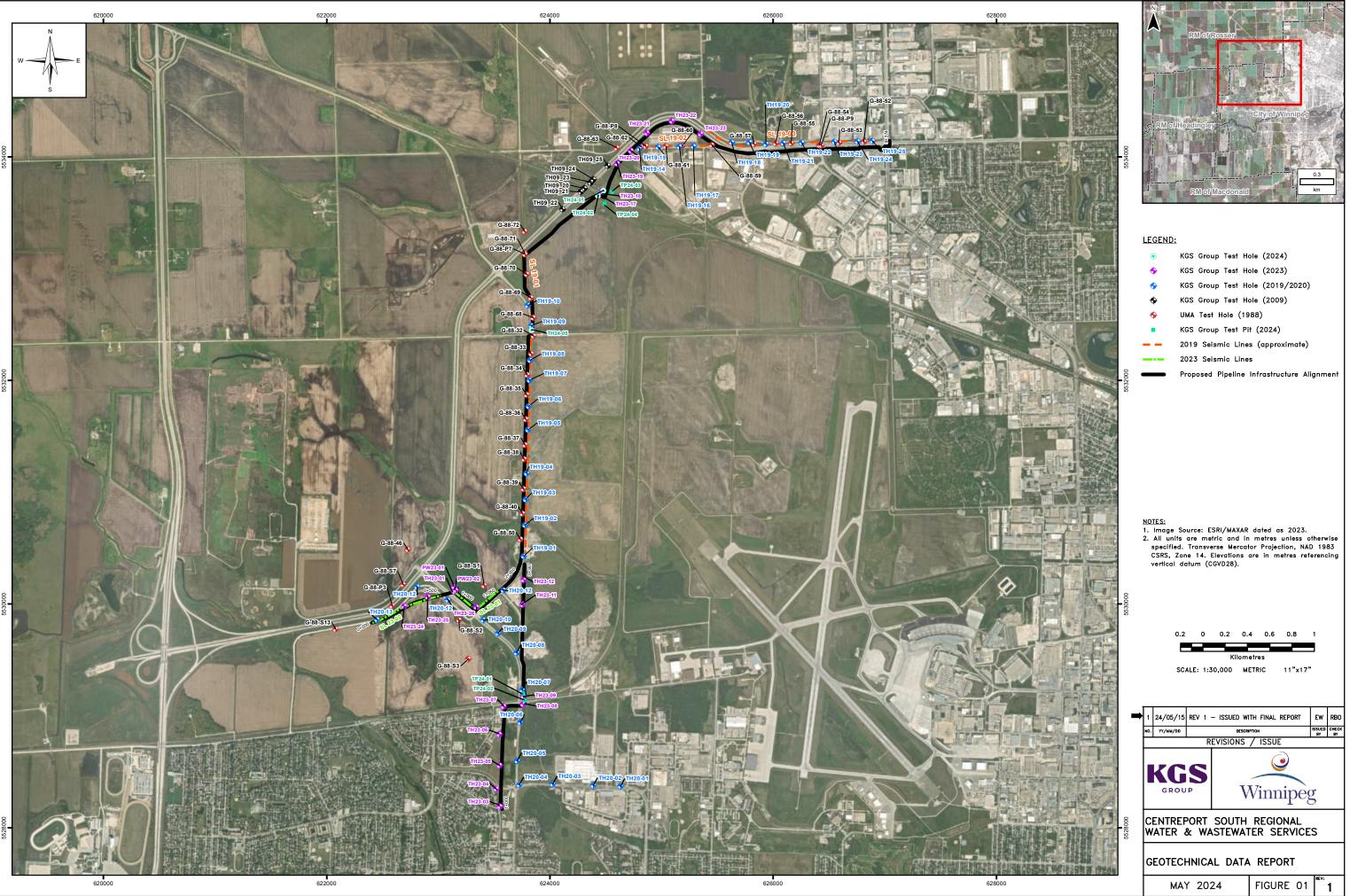
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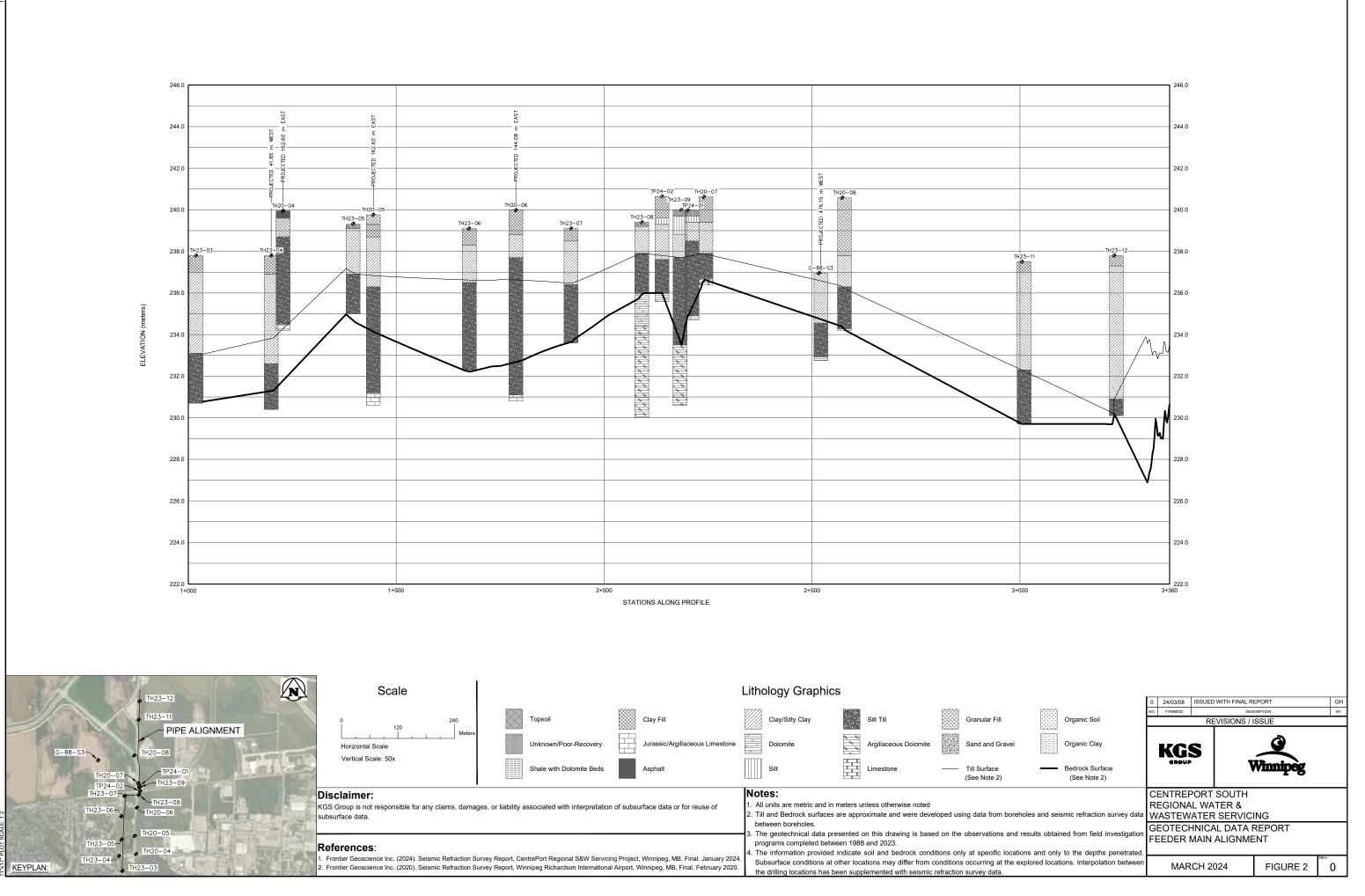


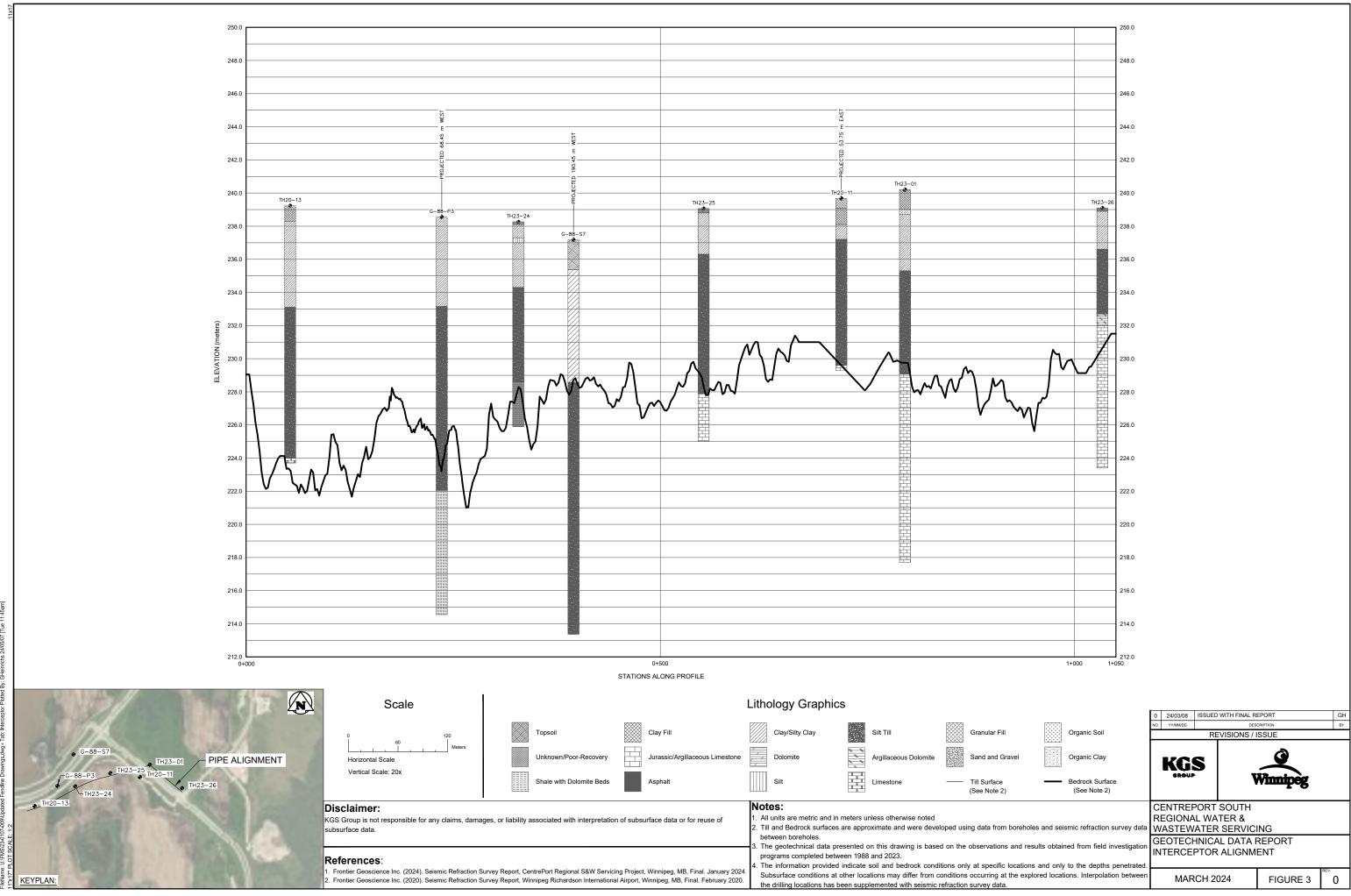
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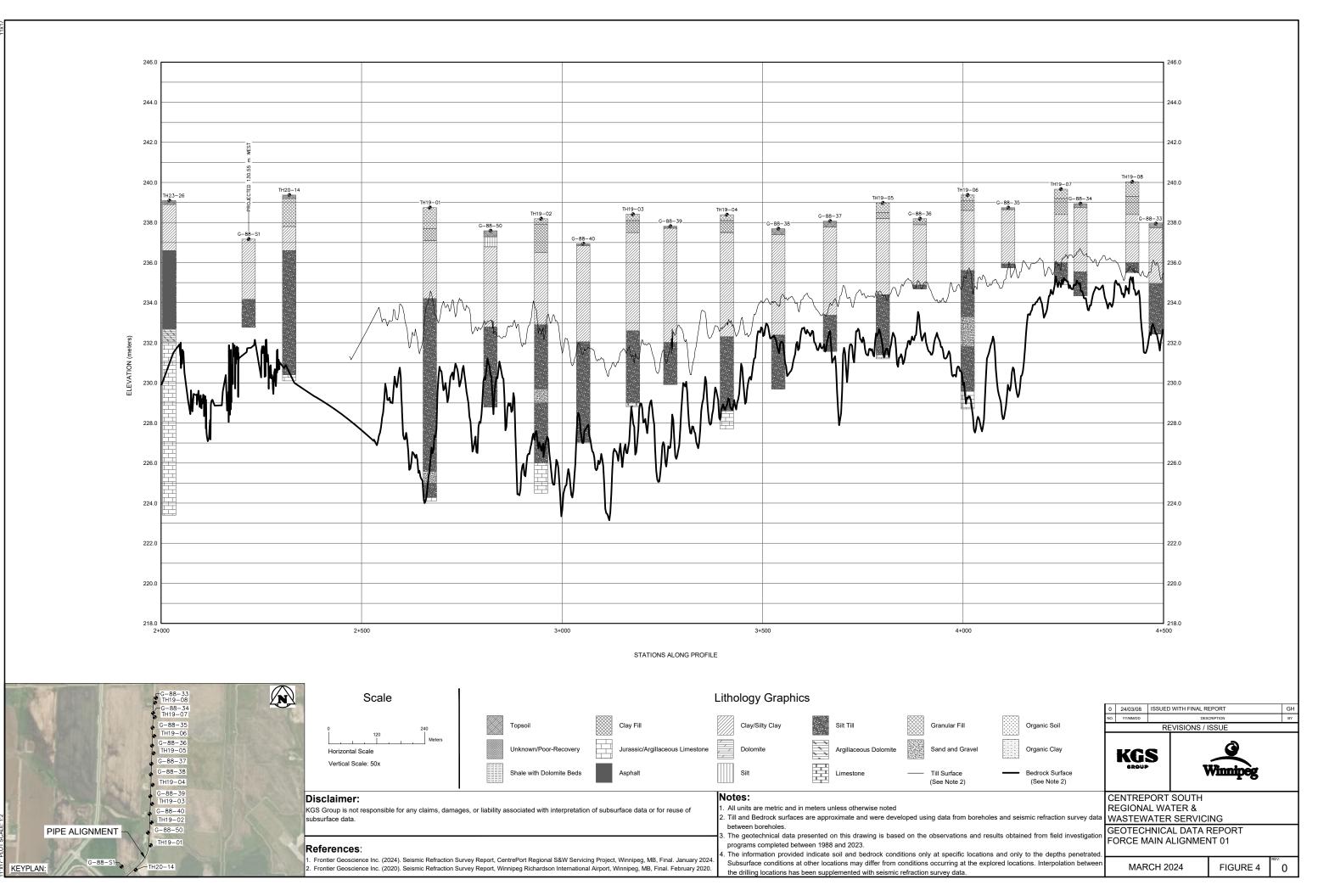
ort∖23-(M/SI9/B~d/60(ē FileName: R:\Projects\2023\23 11"x17' PLOT SCALE 1:1

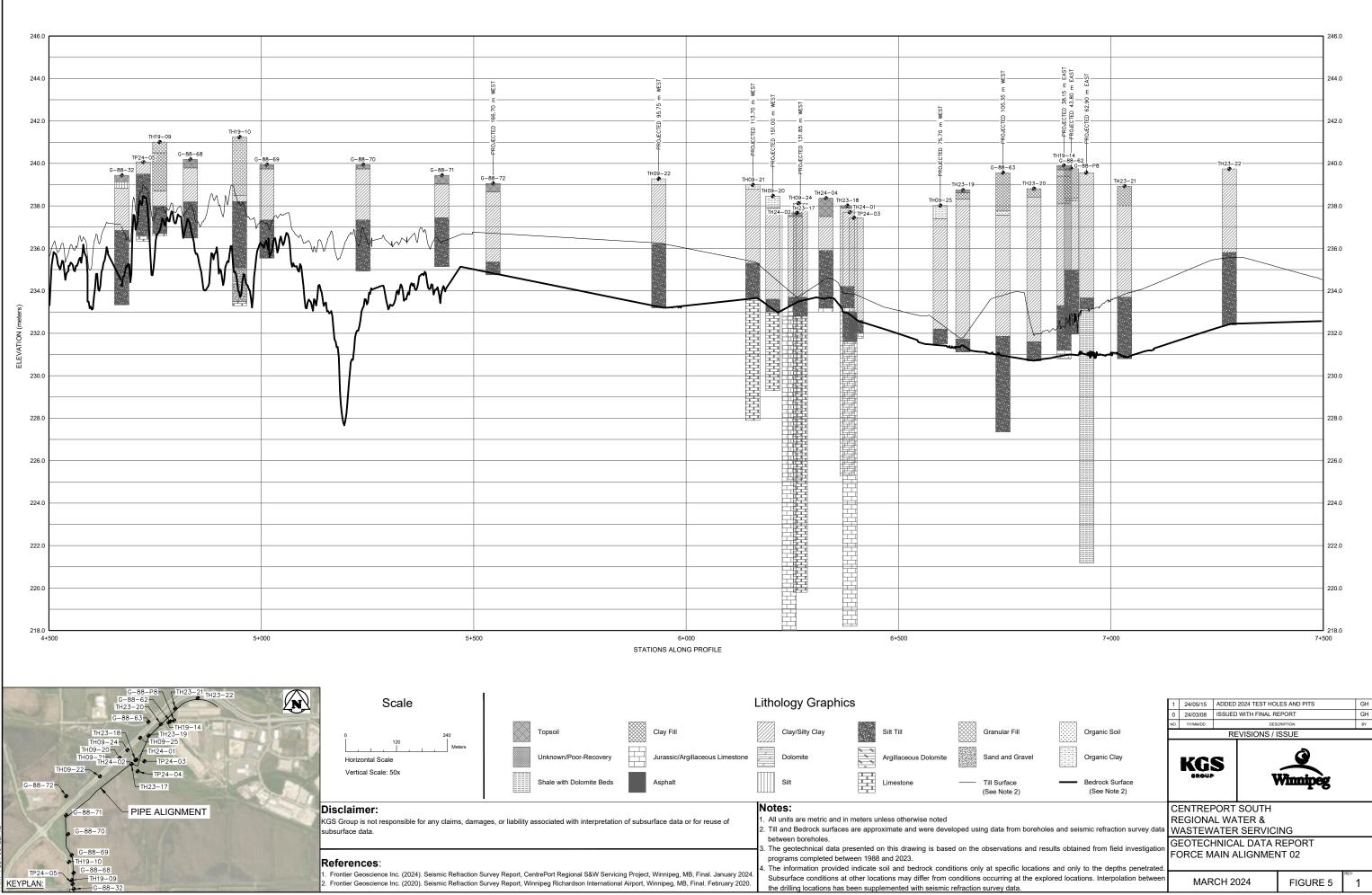


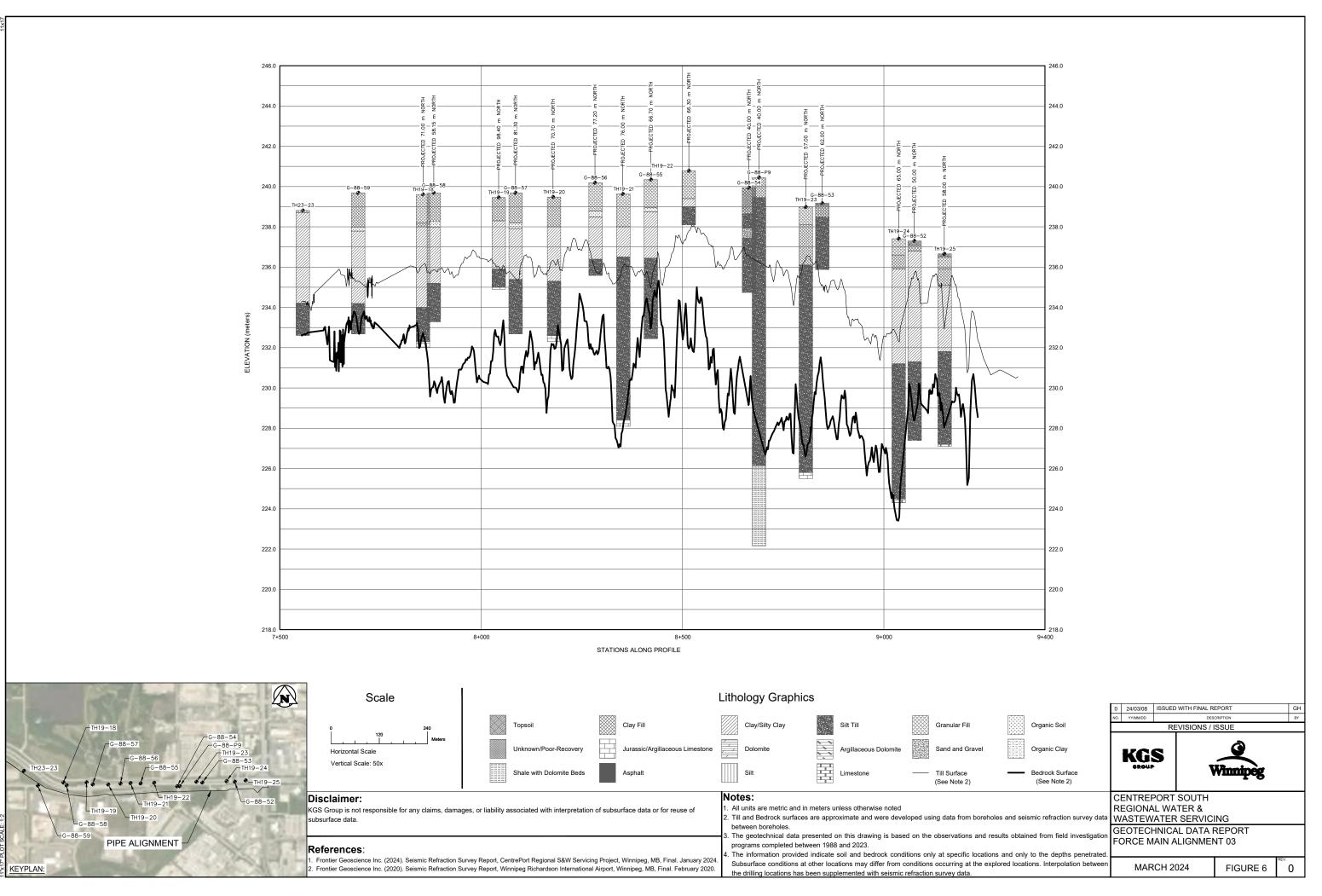
۲	KGS Group Test Hole (2024)
•	KGS Group Test Hole (2023)
+	KGS Group Test Hole (2019/2020)
\$	KGS Group Test Hole (2009)
•	UMA Test Hole (1988)
	KGS Group Test Pit (2024)
	2019 Seismic Lines (approximate)
	2023 Seismic Lines
_	Proposed Pipeline Infrastructure Alignment











APPENDIX A

2019/2020 KGS Group Preliminary Geotechnical Investigation Report



CITY OF WINNIPEG

Airport Area West Regional Water and Wastewater Servicing Preliminary Engineering 2019/2020 Preliminary Geotechnical Investigation Report

Final:

Version 02

City of Winnipeg RFP No.: 289-2019

KGS Group Project: **19-0107-009**

Date: March 27, 2020 Prepared by:

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Approved by:

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STATEMENT OF LIMITATIONS AND CONDITIONS

Limitations

This report has been prepared for City of Winnipeg in accordance with the agreement between KGS Group and City of Winnipeg (the "Agreement"). This report represents KGS Group's professional judgment and exercising due care consistent with the preparation of similar reports. The information, data, recommendations and conclusions in this report are subject to the constraints and limitations in the Agreement and the qualifications in this report. This report must be read as a whole and sections or parts should not be read out of context.

This report is based on information made available to KGS Group by City of Winnipeg and unless stated otherwise, KGS Group has not verified the accuracy, completeness or validity of such information, makes no representation regarding its accuracy and hereby disclaims any liability in connection therewith. KGS Group shall not be responsible for conditions/issues it was not authorized or able to investigate or which were beyond the scope of its work. The information and conclusions provided in this report apply only as they existed at the time of KGS Group's work.

Third Party Use of Report

Any use a third party makes of this report or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

Geotechnical Investigation Statement of Limitations

The geotechnical investigation findings and recommendations of this report were prepared in accordance with generally accepted professional engineering principles and practice. The findings and recommendations are based on the results of field and laboratory investigations, combined with an interpolation of soil and groundwater conditions found at and within the depth of the test holes drilled by KGS Group at the site at the time of drilling. If conditions encountered during construction appear to be different from those shown by the test holes drilled by KGS Group or if the assumptions stated herein are not in keeping with the design, KGS Group should be notified in order that the recommendations can be reviewed and modified if necessary.



1.0 INTRODUCTION

KGS Group was retained by the City of Winnipeg Water and Waste Department to complete a preliminary engineering assessment for the Airport Area West Regional Water and Wastewater Servicing. The overall goal of the project is to develop a Class 3 cost estimate to determine the extent of the regional infrastructure required to support the proposed industrial and residential developments within the approximately 1,460 Ha of unserviced City lands (located within the AAW site). As part of our scope of services, KGS Group completed geotechnical investigations to facilitate the preliminary design of the water and wastewater systems.

1.1 Investigation Objectives

The objectives of the investigations were to review and collect available geotechnical information for the site, and complete additional investigations to gain a better understanding of the soil along the proposed infrastructure route for the purpose of cost estimates, risk assessment and general groundwater conditions along the planned regional routes at a preliminary level.



2.0 PREVIOUS GEOTECHNICAL INVESTIGATIONS

A number of geotechnical investigations have been completed in the area, which include a geotechnical drilling and seismic survey investigation for Genstar Developments in 1988 and a geotechnical investigation completed by KGS Group in 2009 for the CentrePort Canada Way development. The test holes from the previous geotechnical investigations were considered and incorporated in the development of the site stratigraphy and the associated figures. The results of these geotechnical investigations are summarized below.

2.1 1988 Geotechnical Investigation

In 1988 UMA Engineering Ltd. completed a geotechnical investigation for Genstar Development Co. in the Airport Area West region. The geotechnical investigation was completed along two (2) proposed sewer alignments leading to and within the land parcel proposed for development. The investigation consisted of geotechnical drilling, piezometer installation and single channel hammer seismic survey. A total of 74 test holes were advanced to auger refusal along the proposed sewer alignments at approximately 200 m spacing. Additionally, approximately 200 hammer seismic spreads were laid out on a 200 m grid to estimate the depth to till and bedrock on the western portion of the site.

The following test holes were drilled along the proposed pipe alignment and were used to develop of the soil profiles: G-88-32 to G-88-40, G-88-46G-88-50, G-88-52 to G-88-62, G-88-68 to G-88-71, G-88-P3, G-88-P8, G-88-P9, G-88-S1 to G-88-S3, G-88-S7 and G-88-S13. These 1988 test hole logs are included in Appendix A. The location of the test holes within the vicinity of the site are shown on Figure 1. Details of the geotechnical investigations are outlined in the report titled "Sewer Alignment Investigation and Property Investigation Lands North of Saskatchewan Ave", dated December 1988.

2.2 2009 Geotechnical Investigation

In 2009 KGS Group completed a geotechnical investigation for MMM Group Ltd. for the construction of CentrePort Canada Way (CCW). Test holes were drilled at the CCW and PTH 101 interchange and at the CCW crossing over the CP mainline near Inkster Boulevard. The following test holes were drilled along the proposed pipe alignment and were used in the development of the soil profiles: TH09-20 to TH09-25. These test hole logs are included in Appendix B and the locations are shown on Figure 1. Details of the geotechnical investigation are outlined in the report titled "CentrePort Canada Way Geotechnical Investigation Phase 1 Report", dated July 2009.



3.0 REGIONAL GEOLOGICAL SETTING

Winnipeg geology consisted of carbonate sedimentary bedrock overlaying Precambrian era granite and gneiss. The sedimentary rock consists of limestone, dolomite and to a lesser extent shale. Local geological maps indicate karst topography caused from dissolution of the soluble rock, and a heavily fractured upper bedrock layer. The karst topography is typically infilled with mixtures of silt, sand and gravel till soils.

During the last glacial advance and retreat, Winnipeg's glacial till was deposited by ice masses. Glaciolacustrine deposits suspended in glacial lakes confined by ice masses settled to overlie the tills. Additional information on the regional geology can be found in the Geological Engineering Report for Urban Development of Winnipeg, University of Manitoba.



4.0 2019/2020 FIELD INVESTIGATION PROGRAM

The geotechnical field investigation program was developed to meet the objectives stated in Section 1.1 of this report. Based on projects previously completed in the region, variable soil conditions have been identified. Bedrock, till, sand, clay and silt are known to exist at differing elevations, with till and bedrock observed outcrop at the surface in some locations. Seismic refraction was selected in addition to conventional test hole drilling to provide a continuous profile and assist with identifying obstacles and anomalies along the proposed pipe alignment.

4.1 Test Hole Drilling and Soil Sampling

The test hole drilling and sampling programs were completed by KGS Group from September 23 to 28, 2019, and February 3 to 6, 20202. A total of 36 test holes were advanced to bedrock to investigate the subsurface stratigraphic conditions. The information obtained from the site investigations in conjunction with the previous completed investigations was used to developed profiles to facilitate the preliminary design of the water and wastewater lines for the Airport Area West region.

Paddock Drilling of Brandon, Manitoba provided the drilling services using a track mounted sonic drill rig. The sonic drilling approach allowed for full recovery of the clay and till, even through difficult drilling conditions. Soil samples were collected at intervals of 1.5 m (5 ft.) or at changes in soil strata encountered during drilling. The soil samples were visually inspected for material type and classified according to the Modified Unified Soil Classification System (USCS).

Test holes TH19-01 to TH19-10 were drilled on the east shoulder of Sturgeon Road. Test holes TH19-14 to TH19-17 were drilled on the north shoulder of the service road south of Inkster Boulevard (Red Fife Road). Test holes TH19-18 to TH19-22 were drilled on the south shoulder of the service road north of Inkster Boulevard (Park Royale Way) and test holes TH19-23 to TH19-25 were drilled on the north shoulder of Inkster Boulevard between Oak Point highway and Brookside Boulevard. Test holes TH20-01 to TH20-04 were drilled on Murray Park Road and test holes TH20-05 to TH20-10 and TH20-14 were drilled on the east shoulder of Sturgeon Road. Test holes TH20-11 to TH20-13 were drilled on the shoulder of Summit Road, the access road south of CentrePort Canada Way. Test holes were not drilled along the portion of the alignment on the previous Sturgeon Road alignment and along CentrePort Canada Way. Test holes are shown on Figure 1.

Clay samples were tested with a field Torvane to evaluate consistency and estimate undrained shear strengths of cohesive soils. Pocket penetrometers were used to evaluate the consistency of the till. Upon completion of drilling, the test holes were examined for indications of sloughing and seepage, and then backfilled. Detailed test hole log summary reports incorporating field observations, and field test results are provided in Appendix C. Photographs of the soil samples are included in Appendix C.



4.2 Groundwater Monitoring

A total of five standpipes were installed along the proposed alignment during the 2019/2020 geotechnical investigation. Two standpipes were installed in the bedrock and three standpipes were installed in the till. The installation details of the piezometers are shown on the test hole logs in Appendix C.

4.3 Geophysical Investigation

KGS Group retained the services of Frontier Geoscience Inc to perform seismic refraction surveys along the proposed pipeline alignment from October 1 to 10, 2019. The primary objective of the geophysical survey was to obtain estimates of the depths to till and bedrock along the proposed alignment of the water and wastewater pipelines. The locations of the seismic lines are shown on Figure 1. The results of the seismic refraction survey are included in the Survey Report included in Appendix D.



5.0 FIELD INVESTIGATION RESULTS

5.1 Subsurface Characterization

The stratigraphy at the site is described in this section is based on the exploratory test holes, seismic refraction survey and our understanding of the site geology. Test hole logs from the 1988, 2009, and 2019/2020 geotechnical investigations along the proposed alignment are provided in Appendices A, B and C, respectively.

The approximate stratigraphic boundaries shown on the test hole logs were inferred from soil sampled during the drilling. The engineering characteristics of the subsurface materials are descried in the following sub-sections. The soil classification is based on visual examination.

In general, the stratigraphy consists of granular fill overlying clay, silt till and bedrock. The following sections describe the soil and the bedrock encountered during the geotechnical drilling investigation. Fencelines showing soil profiles along the proposed alignment are shown on Figures 2 to 5. The approximate till surface is shown on the fenceline, interpolation between boreholes, however the seismic refraction survey results, included in Appendix D should be consulted for the till and bedrock surface in between boreholes. The seismic refraction survey shows there is variability in the till and bedrock elevations between the boreholes.

5.1.1 TOPSOIL

Topsoil was encountered from existing ground surface to depths of 0.1 to 0.2 m in test holes TH19-14, TH19-25 and TH20-14. The topsoil was black in colour and damp at the time of drilling.

5.1.2 PAVEMENT STRUCTURE

Test holes TH20-01 to TH20-04, TH20-09 and TH20-10 were drilled on the edge of the road surface, through the pavement structure. The asphalt was less than 0.3 m thick and was founded on granular base material.

5.1.3 FILL

A layer of granular fill was encountered in all of the 2019 and 2020 test holes with the exception of TH20-06 and TH20-07. The granular fill varies in thickness from 0.2 to 2.7 m. The granular fill was fine to coarse grained gravel and was described as brown in colour, damp, loose to compact in density, contained some fine to coarse grained sand, and trace silt and trace clay.

Clay fill was encountered below the granular fill in all 2019 and 2020 test holes with the exception of TH19-10, TH19-19, TH19-20, TH19-21, TH19-22, TH20-01, TH20-04, TH20-08, TH20-09, TH20-10, and TH20-14. The clay fill varied in thickness from 0.3 to 2.4 m. The clay fill was mottled brown to grey, damp, firm to stiff, low to high plasticity, contained trace to some fine to coarse grained gravel, trace to some fine to coarse grained sand, some organics and trace rootlets.

5.1.4 CLAY(CH)

High plasticity clay was encountered in all test holes with exception of TH19-23 at various depths ranging from 0.9 to 3 m below grade. The clay was typically mottled brown to grey in colour, damp to moist, stiff to



firm in consistency and of high plasticity. In general, the consistency of the clay decreased with depth. The material contained trace to some silt nodules. The thickness of the clay deposit ranged from XX to YY m. Fine to coarse grained gravel and boulders were encountered in the grey clay near the till interface. The undrained shear strength of the clay deposit, as determined using a field Torvane on disturbed samples, ranged from 30 to 80 kPa, generally decreasing with depth.

Trace to with silt till inclusions were noted in the clay, increasing in frequency with depth in 23 of the 29, 1988 test holes, or approximately 40% of the test holes for that investigation.

5.1.5 SILT TILL

Glacial silt till was encountered below the high plasticity clay at depths ranging from 0.9 to 9.1 m below existing ground surface. Shallow till was encountered at a depth of 2.0 m near Station 6+520, and at depths ranging from 0.9 to 2.0 m near Station 0+900 and from Stations 9+120 to 9+420. The silt till was tan in colour, damp to wet, loose to very dense and contained trace to some fine to coarse grained gravel and some fine to coarse grained sand, and trace cobbles. Boulders and cobbles are commonly found within till and should be anticipated within the deposits at the project site.

Cobbles and Boulders

As part of the 2019/2020 drilling investigation cobbles were encountered in the clay deposit near the till interface in some test holes. Cobbles were observed within the silt till in majority of the test holes as indicated on the test hole logs. Based on previous works completed by the City of Winnipeg in the vicinity of this project, it is understood that installation of the water and sewer pipes near the clay/till interface and within the till will encounter significant quantities of cobbles and boulders. Zones with increased cobbles and boulders were identified as part of the geophysical investigation and were observed at Stations 3+140 to 3+250, 8+820 to 8+950, 9+000 to 9+030, 9+270 to 9+320, and 9+500 to 9+540.

In KGS Group's experience and as observed during this drilling program, sporadic irregular zones or cobbles and/or boulders have been encountered within the till deposits such as those at this site. These zones can cause difficulties during construction.

5.1.6 BEDROCK

Bedrock was encountered below the silt till at depths ranging from 2.7 to 15.3 m below grade. The bedrock consisted of limestone, was pink to red in color in all test holes with exception of test holes TH19-03, TH19-07, TH19-09, TH19-10, TH19-19, TH19-22, TH19-23, TH19-25, TH20-03, TH20-06 to TH20-10 and TH20-13 where it was noted to be white to yellow, weak, and broken.

Shale bedrock was observed in test hole G-88-P8 and G-88-P9 from the 1988 investigation. The shale was observed at depths ranging from 8.5 to 14.5 m and was described as red to brown in colour, soft and contained dolomite layers.

5.2 Groundwater Monitoring

Five standpipe piezometers were installed as part of the 2019/2020 geotechnical investigation. The installation details for the standpipes are included on the test hole logs included in Appendix C. Since



installation, groundwater monitoring has been completed twice. Measured groundwater levels are listed below in Table 1.

TABLE 1: GROUNDWATER MONITORING RESULTS

Test Hole ID	TH19	9-04	TH19-18	TH	TH20-12				
Approx. Station (m)	0+8	50	5+250	10+500					
Ground Elevation (m)	238	.39	239.60	239.60 239.7					
Piezometer No.	Standpipe 1	Standpipe 2	Standpipe 1	Standpipe 1	Standpipe 2				
Tip Elevation (m)	230.34	0.00	230.34	235. 4	227.0				
Monitoring Zone	Till	Bedrock	Bedrock Till		Bedrock				
Date									
Oct-28-2019	236.44	236.33	236.44	-	-				
Feb-28-2020	235.25	236.57	237.09	Dry	233.56				



6.0 UNDERSTANDING OF THE PROPOSED WORK

The goal of this scope of services is to develop a Class 3 cost estimate to determine the extent of the regional infrastructure required to support the future industrial and residential developments within the approximately 1,460 Ha of unserviced City land. The key components of the regional infrastructure needed to support the future development include a sewage lift station to collect the gravity flows; feeder mains to meet the domestic and fire water demands; and sewage force mains to direct the effluent to the City's Inkster interceptor sewer.

At the time of this report, the proposed location of the lift station is at the intersection of CentrePort Canada Way and the Sturgeon Access road. The pipe sizes had been estimated and minimum grades had been applied to several of the longer branches within the network to determine the overall drop from the most extreme limits of the AAW lands to the proposed lift station location. Using this approach, it was determined that the required invert elevation at the station is approximately 226.50 m, or a depth of approximately 12.0 m below the existing ground surface. The total depth of excavation increases to approximately 15.4 m when considering the required station sump, slab thickness, and mud slab.

Wastewater flows from the AAW lands are to be directed from the wastewater lift station to the 1350mm diameter Inkster Interceptor at Inkster and Brookside Boulevard via force mains. The alignment of the force main extends from the location of the lift station (identified previously) and travels east and north along Sturgeon Road to the north limit of the AAW and City lands. The force main then continues north along the east side of Sturgeon Road within the RM of Rosser to the north terminus of Sturgeon Road at CentrePort Canada Way, where a future interchange is planned to be constructed by the Province of Manitoba. The force main then travels northeast along the south side Centerport Canada Way across both the Canadian Pacific rail line and Canadian National rail lines. Finally, the alignment extends due east through the historic Inkster Boulevard extension (within Rosser) towards CentrePort Canada Way, where it continues along CentrePort Canada Way until it terminates at the Inkster interceptor sewer. The alignment is assumed to be on the east side of the Sturgeon Road and the south side of CentrePort Canada Way to avoid the Cartier Water Supply line located on the west side of Sturgeon Road and north side of CentrePort Canada Way. The current design includes two (2) 500 mm force mains, with a burial depth of approximately 2.5 m. The proposed installation method for the pipes will be likely be open cut with minimal trenchless installation at select locations where open cut is not feasible, e.g. under the Canadian Pacific rail line and Canadian National rail lines.

Feeder mains are required to provide domestic and fire protection flows to the future development within the AAW project site. For the estimate, feeder mains are considered to be water pipes 600 mm in diameter or larger. The feeder mains for this project are located south of the geotechnical investigation and were not considered as part of the scope of this investigation.



7.0 CONSTRUCTION CONSIDERATIONS

7.1 Presence of Cobbles and Boulders

As discussed in Section 5.2.3 and confirmed through the seismic refraction survey, there are cobbles and boulders within the silt till and in the clay near the silt till interface. The till contains cobbles and boulders and underground utility installations extending to the clay/till interface, or within the till will encounter cobbles and boulders. Zones within the silt till with increased cobbles and boulders were noted in the seismic refraction survey and are marked on the profiles with a dashed purple line. These zones were noted from the seismic survey at approximate at Stations 3+140 to 3+250, 8+820 to 8+950, 9+000 to 9+030, 9+270 to 9+320, and 9+500 to 9+540. Construction methodologies selected for the work should give due consideration to presence of cobbles and boulders.

7.2 Groundwater

Potentially difficult groundwater inflows were noted in several of the test holes during drilling. After completion of drilling, 1.0 to 2.1 m of water was observed in the following five test holes within five minutes, G-88-32, G-88-33, G-88-34, G-88-37 and G-88-38, Stations 4+120 to 4+220 and 4+870 to 5+220. Water seepage was observed in eleven additional test holes from Stations 3+370 to 3+620, 6+520 to 7+170, and 7+720 to 7+920. (G-88-40, G-88-50, G-88-55 to G-88-60, G-88-63, TH09-20, and TH09-22).

Groundwater levels observed in the 2019/2020 test hole logs immediately upon the completion of drilling included on the test hole may not be representative, as water was used during the sonic drilling progress. As part of the geotechnical investigation, five standpipes were installed within the silt till and bedrock. The piezometers have been monitored twice since September and the measured groundwater levels are shown on Table 1.

In KGS Group's experience, zones of cobbles, boulders and/or granular layers are known to exist within till deposits. These zones should be expected to be water bearing, which may cause difficulties with open cut or trenchless pipe installation methods.

7.3 Potential Soft Ground Conditions

At the time of the geotechnical investigations, soft ground conditions were encountered from Station 5+500 to 6+000, along the old alignment of Sturgeon Road. Due to the soft ground conditions, geotechnical drilling could not be completed. Depending on the alignment of the pipelines, soft ground conditions should be expected during construction. Selected construction methodologies should consider potential soft ground conditions and the required mitigation measures.

7.4 Rail Crossing

The current alignment of the force mains crosses the both the Canadian Pacific rail line and Canadian National rail lines. As part of the CentrePort Canada Way development, KGS Group completed a geotechnical



investigation on either side of the rails. Trenchless installation methods will be required for the pipe installations at these crossings. Additional geotechnical investigations may be required by either Canadian Pacific rail line and Canadian National rail lines as part of the utility crossing permit application.

7.5 Variable Ground Conditions

Based on the geotechnical drilling investigation and seismic refraction survey, there is variability in the till and bedrock surface along the proposed pipe alignments. The invert of the proposed pipes will likely be designed through multiple soil strata including clay, till with cobbles and boulders and potentially bedrock. If the pipes are installed using trenchless technologies, the equipment will need to be designed to excavate different soil strata.



8.0 RECOMMENDATIONS

The preliminary geotechnical investigation completed for this project consisted of advancing 36 test holes using sonic drilling methods and seismic refraction along the majority of the proposed alignment. Geotechnical investigations were not completed along the portion of the alignment on CentrePort Canada Way. It is recommended additional geotechnical investigations be completed along this stretch of the route from Station 5+500 to 7+300 in next design phase.

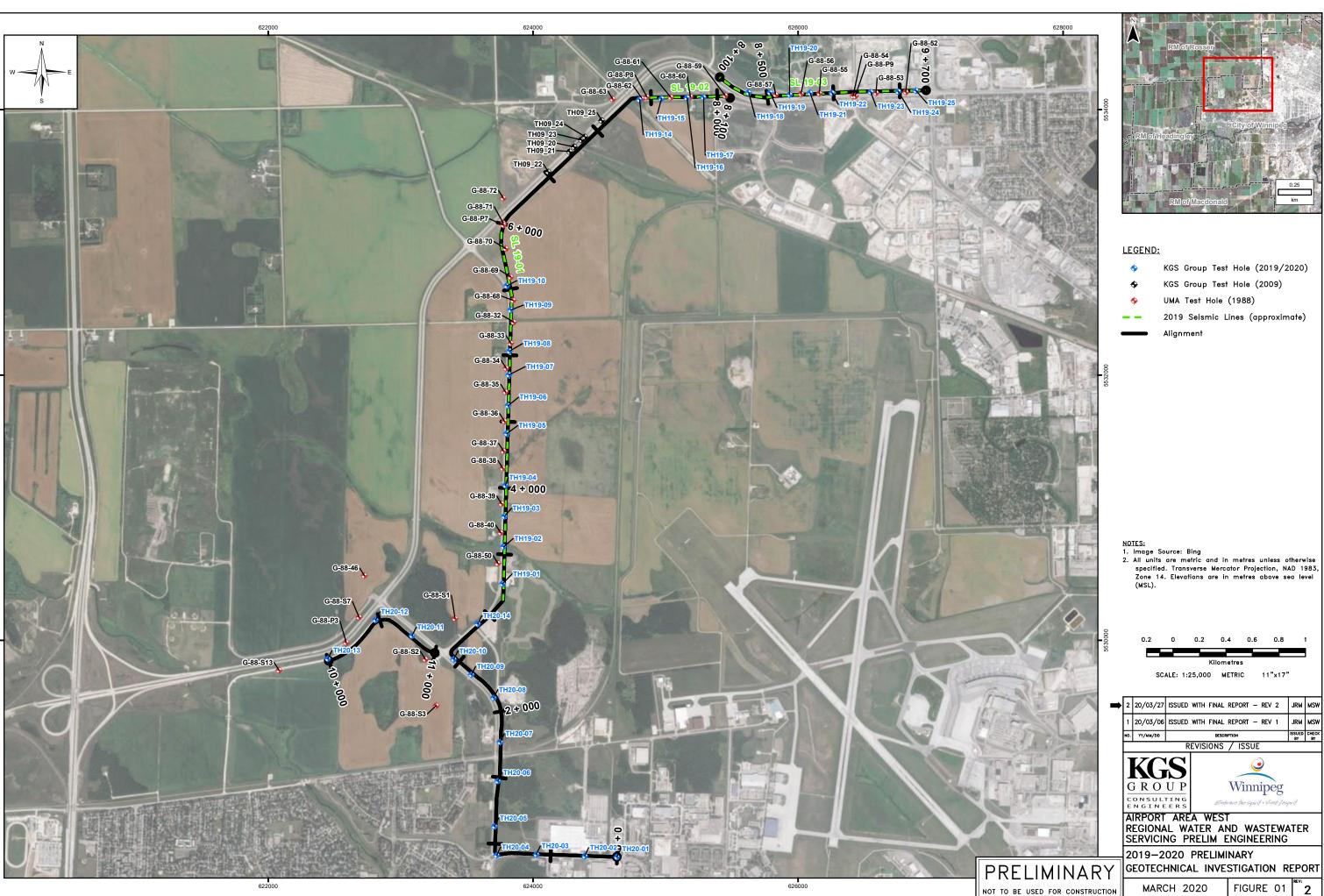


9.0 CLOSURE

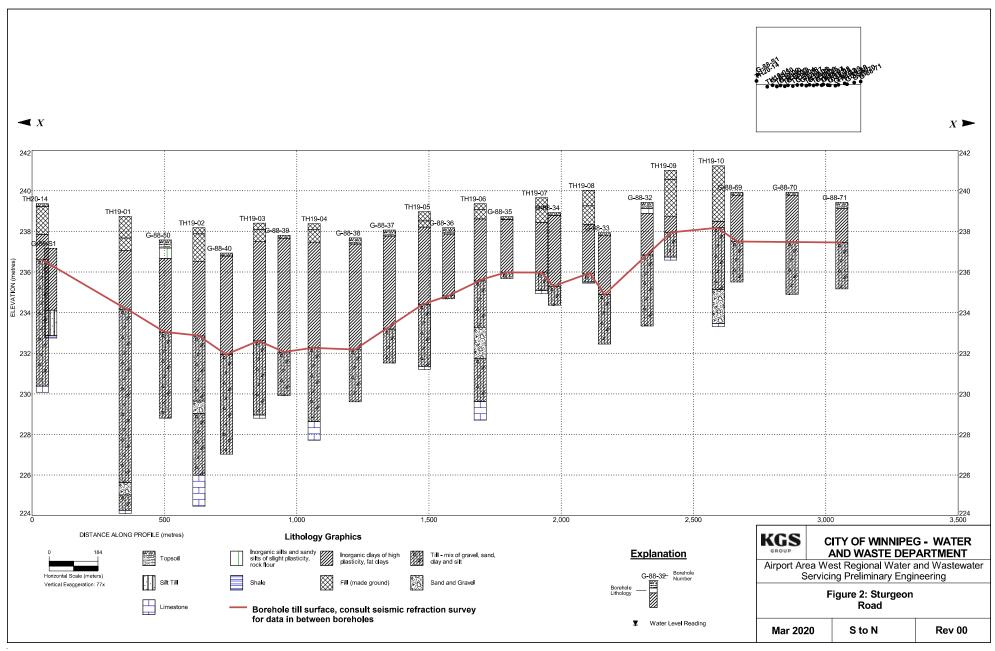
The geotechnical investigation conducted by KGS Group describes the overburden deposits and bedrock stratigraphy along the proposed alignment based on the information from the 1988, 2009 and 2019/2020 test hole data and seismic refraction survey. This report presented the geotechnical engineer's best judgement of the subsurface and ground conditions anticipated to be encountered across the project site. In order to develop the fencelines, it was necessary to interpolate between test holes. While the actual conditions encountered in the field are expected to be within the range of the conditions discussed in this document, the spatial variability of subsurface conditions that could be encountered may be more complex than the simplified interpretation presented in this report.

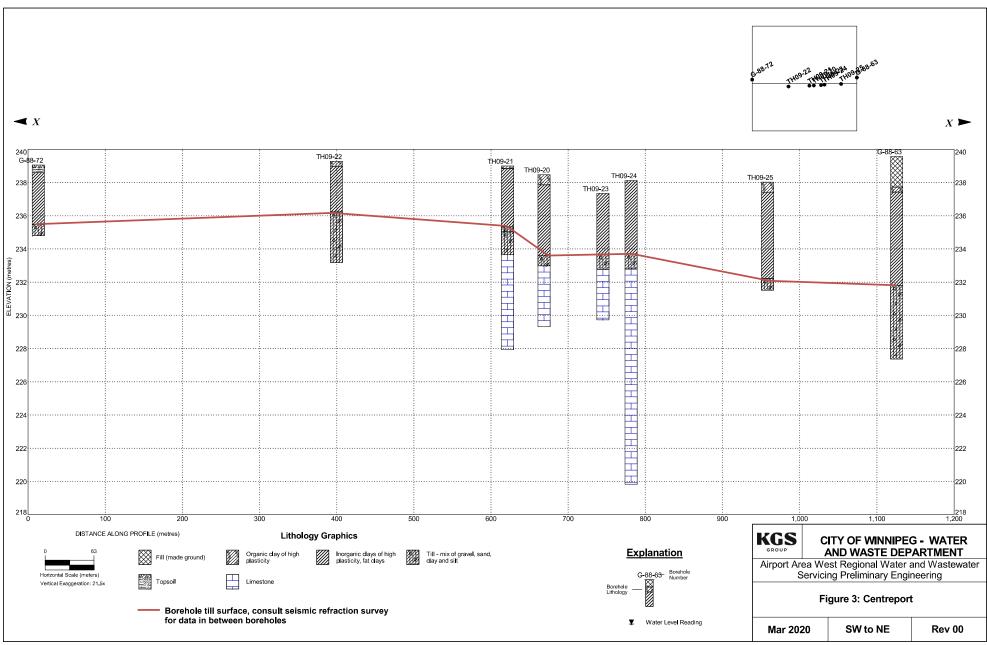


FIGURES

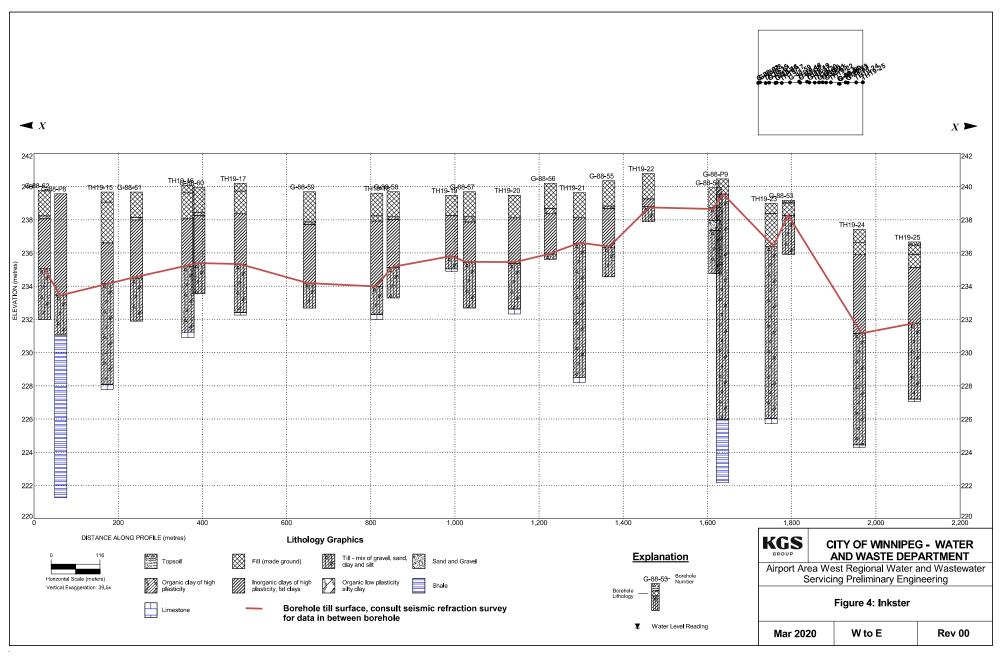


•	KGS Group Test Hole (2019/2020)
+	KGS Group Test Hole (2009)
•	UMA Test Hole (1988)
	2019 Seismic Lines (approximate)
_	Alignment

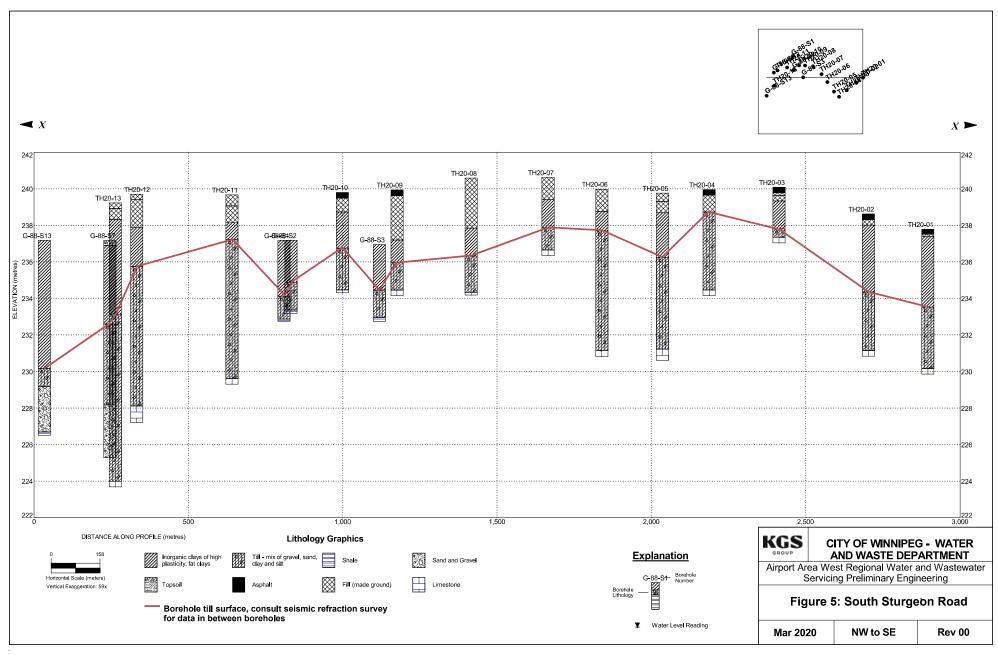




FENCE W/O WELL INSTALLATION UNEMS/19-0107-009/19-0107-009.GP.



FENCE W/O WELL INSTALLATION UNEMS/19-0107-009/19-0107-009.GPJ



APPENDIX A

1988 Test Hole Logs

	I OF SAS						SUBTERRANEAN LT	D,				BOREHOLE N	ic. G-88-	-32
	AR DEVEN			ар. 									08 -0898-26	
	LE TYPE			(P) #	7	-	TUEZ DISTURBED					ELEVATION 2		
	▲ BA	K DE 5117	(t/m				IT TUBE STORED	N	D RECOVERY	[Щc	ORE BARREN	मार्ट्स क्षेत्र	-1777
Ē	1.4	1.0 2 2. 5172.00 200 3	<u>2.2'</u> лн.7й	2.6		ł				ب <u>ہ</u> ا	0			
Ě	100	200 3	KK.	400	USC		50	IL		TYPE	N N N		ther	E
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-						h.	TOPSOIL		·					- [a
						7	SILT-DEY, TAN CLAY-SOME SILT			1				Ļ
-10				: :		$\langle \rangle$	-SOHE TILL INCLUSI	ons						F
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-3.0			····			ų.	TILL-SILT WITH GRANULA BOULDERS)	r (sand to						┢
						Я.	-WELLID PAT TEST							-10.
						X.	-WETTER WITH DEPT	н						Ľ
4,0					ł	χ.	-LITTLE CLAY -TAN							F
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60 .	····				F	ł	TOLEN SELFAGE							F
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ľ							NOTE: APPROX.1.6 D	F WATER IN	The Hole		Ì			F
7.0			••••	· • • • • • • • • • • • • • • • • • • •			IN 5 MIN. NO SLOUGHING		· · m					F
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¢0 L		: : : 113 <i>2</i> -				<u> </u>		- <u>.</u>						-45.0
		UMA	EI	ngine	erir	ıg	Ltd.	COMPLETIO	N DEPTH *.*	m		COMPL	SITE	
		Tin	mi	peg,	Man	ut	oba	LOGGED BY	TH		D	TG NO.	Page 1	

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	H OF SASE					SUBTERRANEAN LTD	r				BOREHOLE No. (<u>G-86-3</u>	33
	IAR DEVEL ICT ENGEN		LTD.			· · · · · · · · · · · · · · · · · · ·					Project No: 06 -0	0899-266-	
	LE TYPE					<u> </u>					ELEVATION 237.93		
OF BET I	45.0	ODATI (/m3) A		LEY TUR		NO REC	OVERY	_[D	ORE BAFEEL	WIPELINE-	TYPE
д (ш) н	1.4 15HEA 100	(DENSITY (1 1.5 2.2 R STRENGTH 200 300	2.6 (KPa) = 4(x)	USC		SO	L		H	E #O			(1)
DEPTH	PLASTIC					DESCRI	PTION		SAMPLE	SAMPLE	comme	nts	hermu (a)
0.0 		80 120	160		10005	XL		••••••					4
10					CLAY-	-Some Silt Some Till Inclusio (More with Depth Brown to Dark Br)						
20					-	STIFF							-5. -
3.0					TILL	NTH SILT							-10
4.0				*****		SOME GRANULAR (SJ GREY RED BROWN LIMEST((SAME RED BROWN DET ICAL)	wu tu boulde Xne (water bej Limestone to	LRS) Aring)					
50				2222 2222 2		REFUSAL)							-15 - -
50.					AUGER N	REFUSAL @ 5.54 DTE: WATER ROSE AF NO SLOUGHING	"Prox. 2.1 in (5 MIN					-20
7.0													-25
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2.0	······································												-40
3.0													- - -
40 L		TITE	Un -i-			3]				<u> </u>	-45
		UMA W:	Engin	eerm	ខ្លុ ដូរ	1.	COMPLETION D		<u> </u>		COMPLETE		
	·	11111	nipeg,	Man	itoda		LOGGED BY TH			1	DWG NO.	Pege 1 o	f 1

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	H OF SASI	_					SUBTERRAN	AN LTD.					BOREHOLE No.	G-88-3	34
	TAR DEVEL ECT ENGIN			<u>لا ایا</u>					· · · · · · · · · · · · · · · · · · ·				Project No: 08 -		
_	LE TYPE			1000 X	170		<u> </u>						ELEVATION 239.06		
CORIT.						ABY TUP		URBED	NO RECOV	VERY	Τ	Dc	OFT BAENEL	WREELDE-	TYPI
(E)	1.4	N DONES 1.0 P CTARS	2.2	2.6	4						ربا	~			1
۲ ۲	5HEA 100	200	300	400	USC	Ì		SOIL			Έ	ON 3	Othe	r	3
DEPTH	PLASTIC	3.LE		UCUD	UDC		DES	CRIPT	'ION	- - - -	SAMPLE TYFE	SAMPLE	comme	nts	DE 0114 (44)
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- [····			8									F.
-20						2									Ľ
_ [4 -	BROWN TO G	RAY							┝
						X I	SOME TILL IN LITTLE SILT	CLUSIONS		Ì					F
-3.0															-10
-					l b	<u>а</u> ти –	SILT WITH GR			{					Ľ
-4.ŭ					6	0	BOULDERST	ano <u>e</u> nii (8	WE IV		ł				F
					B	1	SOME CLAY (TAN				}				È
					ľ		REFUSAL @	4.57	<u> </u>	<u> </u>	Į				F15.
30		· · · · · ·				NC	TE: WATER SE	EPAGE FR	DM 4.26 TO 4	.57		İ			$\left \right $
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	H OF SASI						SUPTERFAN	EAN LTD.					BOREHOLE No.	<u>G-68-</u>	35
	TAR DEVEL ECT ENGIN			JID.									Project No: 06	-0899-286	
_	LE TYPE			ਮਾਸ ਦ			N 100						ELEVATION 235	.630 (m)	
Leana						UBY TUR		TURBLD		ELCOVERY		<u>∏</u>]o	OFZ BAFFFI	ADATTER	TYPE
<u>ن</u>	1.4 1.4 5HEA 100	1.00-57 1.0 P 5TPEN 200	2.2 KUTH (k 300	2.6 (Pa) 🖬 400				SOIL			TME	Ŷ	Oth	er	Ŧ
DEPTH	PLASTIC	N.C		LIQUED	USC		DE	SCRIP'			SAMPLE	SAMPLE	comm		DE PTH (H)
0.0	40	80	t20	160							5	0			2
						NIOPS:	HL SOME SILT			/	+				-+00
10						·	SOME TILL I BROWN	NCLUSIONS							F
							FIRM TO ST	न							F
20															-5.(-
		······.													F
3.0						11	SILT WITH GI BOULDERS	Yanular (s)	iand to						-10,
F.O.] -	SOME CLAY TAN DECLICAT OF		555°						F
						NO	: REFUSAL (TE: NO SLO NO WATE	UGHING	ROCA						+
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	H OF SASI				<u> </u>		SUPTERRANEAN LI	D.				BOREHOLE No.	G-88-	36
	ECT ENGIN											Project No: 0d	-0895-268	-01
	LE TYPE				77-							ELEVATION 235.		
<u>Osmr</u>		L GELL	SEEPL	2		LEY TURE		DN E	ELCOVERY		ШC	· · · · · · · · · · · · · · · · · · ·	WIFELDE	TYP
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-10				· · · · · · {		<u> </u>	MORE WITH DEPTI	IONS				ŧ		Ē
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4,0						<u>}</u>]	EOULDERS)	γ =₩ +₩	ļ ļ	ļ				┝
							REY REFUSAL @ 3,51		j					F
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	OF SASKATCHEWAN		SUBTERRANEAN LTD.				BOREHOLD No	<u> </u>	3-37
	ar developments ltd.						Project No: 0	6 -0899-2	
	CT ENGINEER: TW						ELEVATION 23		
SAMP	E TYPE GRAB SAMPLE	SHELFY TV	EE 🔀 DISTURBED	NO RECOVERY	Ţ	∏α	ORE BARREL	T ADZI	NE-TYPE
(m)	A BULH DOISTY (L/m3) A 1.4 1.8 2.2 2.6 SHEAR STRENGTH (LFO) II 100 200 300 400	1100	SOII		TME	E NO	01	her	(#)
DEPTH (m)	PLASTIC ILC LIQUID	USC	DESCRIF	TION	Sound	SAMPLE	com	ments	0EFTH (H)
0.0	40 80 120 160				Ť				
-10			sole Some Silt Uttle Till inclusioi Brown Stiff	S					-5.0 -10.0 -10.0
-4.0 			-SILT WITH GRANULAR	(SAND TO					-15.0
-60			POULDERS) LITTLE CLAY TAN/GREY WATER SEEPAGE						-20.0
-7.0 		AUG	ER REFUSAL & 6.55 NOTE: WATER APPROX. APPROX. 5 MIN. NO SLOUGHING	1 m in Hole in					-25.0
- - -									-30.0
-100									-35.0
-110									
-12.0									- 40 .0
-13.0									-
-140	UMA Engii	<u>L I</u>	[+a	COMPLETION DEPTH			COMP		
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L	Winnipeg	<u>, manito</u>	Da	LOGGED BY TH			DWG NO.		age 1 of 1

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	H OF 549					SUBTERRANEAN LTD	*			BOREHOLE No.	G-88-	38
	TAR DEVE		LTD.						_	Project No: 08 -		
	ect engin									ELEVATION 237.8		
SAMP	LE TIPE	GEAE :	SAMPLE		BT TUB	DISTURBED	NO EECOVERY				WEELDE	TYPE
\sim	. ▲ BLR. 1.4	A DENSITY (1 1.5 2.2	l/m3) ▲ 2.6								.J	<u> </u>
оертн (m)		A CENSITY (1 1.E 2.2 R STRENGTH 200 300		USC		SO	Ľ	E TIPE	on Ji	Othe	r	E
		¥.C				DESCRI	PTION	SOMPLE	SAMPLE	comme	nts	DEPTH (H)
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3.0												t.
												-10.0
					-1	IRANSITION TO GREY	' CLAY					-
4.0												┢
50												-15.0
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				R	TILL-S	ILT WITH GRANULAR	(SAND TO					┝
5 0		••••••		n A		BOULDERS) IET TO PAT TEST						
					-1	R CLAY						20.0
7.0				3	-5	SMALL WATER BEARIN	NG LAYER 🛛 5.50					-
												F
												L.
9 .0					¥	VATER SEEPAGE (FR VATER BEABING LAYE	Ом 7.0 10 7.9) ER (7.62 TO 7.93)					25.0
.					AUGER	REFUSAL @ 8.08		11	1			-
					N		PPROX.1.0 IN HOLE					┝
9.0	: : :					5 Min. No sloughing						t.
												-30.0
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	· · · ·	KATCHEWA				SUFTERRANEAN LTD.				BOREHOLE No. (<u>a</u>
	TAR DEVE ECT ENGIN	LOPMENTS	LTD.							Project No: 68 -6)8%- 266 -0	1
		CRAB S		1 1			······			ELEVATION 237.74	0 (m)	
CAURT.	Í ▲ B.≦	E DENSITY OF	(m3) 🛦		EY TUBI	E DISTURNED	NO R	LCOVERY	٦Ľ	COFE BARREL	WIFZILINZ-TY	TPE
Ĵ,	1.4 5HE	E DENSITY (1) 1.5 2.2 R STRENCTH 200 300	2.5 (KPa) =			SOI	т	ME	Ŷ	Other		- -
DEPTH	PLASTIC	N.C	LIQUO	USC		DESCRI		SMIPLE 1	SAMPLE			refin (h)
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-						410 F					}- ⊢	- -5.0
-20											ŀ	-
3.0			· · · · · · · · · · · · · · · · · · ·								- F	-
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7.0					-1	AN/GREY MATER SEEPAGE					L F	-
5.0											+ 	23.
					AUGER NOT	REFUSAL @ 7.93 E: TRACE OF WATER NO SLOUGHING	In hole				Ē	
9.0	·					NU SLOUGHING						30.
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	H OF SAT						SUPTERFANEAN LT	D.	<u> </u>	_	B	CREHOLE No	<u> </u>	40
	TAR DEVE			LTD,									. <u>0</u> 000 8 -0598-2 8 6	
	BCT ENCE					_						LEVATION 23		
SAMP	PLE TYPE						IT TUBE 🔀 DISTURBED	NO RECO	WERY			RE BAREFI	WIRELENE	-TYPE
Ē	1.4 100	1.8 1.8 200	मार (17) 222 अर्दाप्त (300	nis)▲ <u>25</u> \$P€)∎ 400	-		SO	II.		TYPE	£	01	her	
0EPTH (m)	PLASTIC	۶.			USC		DESCRI			SMPLE TYPE	SAMPLE		ments	0EPTH (H)
0.0	40	80	120	180						3	5			
- -10		-					CLAY-SOME SILT -BROWN -TR TILL INCLUSIONS	· · · · · · · · · · · · · · · · · · ·						0.0 -
-20							(More with Depti- -Stiff	4)						-5.0
-3.0							-transition to gre	Y CLAY						
4,0														
٤0							NUL-SILT WITH GRANULAI BOULDERS)	R (SAND TO						-15.
5 0							-TR GLAY -WET TO PAT TEST -TAN -DENSE							-20.
7.0			-											
ð,0						28-5-5-5-5-5- 5-5-5-5-5-5-5-5-5-5-5-5-5-5								- 25
9.0						11444								-30.4
100						۳)	-WATER SEEPAGE JUGER REFUSAL & 9.91 NOTE: TR WATER IN H NO SLOUGHING	0LE	{					-35.
110														
12.0	·····													- -+0.4
3.0														
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PROJEC SAMPL	AR DEVELOPMENTS LTD. CT ENGINEER: TN E TYPE GRAB SAMPLE A BAA DENSIT (L/m3) A 1.4 1.5 2.2 2.5 SHEAR STRENGTH (LPG) B 100 200 300 400 PLASTIC M.C LIGHT 40 80 120 160	USC	ET TUBE DIETUREED SOI DESCRIF		L.] ∞ ⊋	ject No: 08 -08 NATION 235.150		01
E HE 20	E TYPE S GRAB SAMPLE ▲ B.A.A. DENSIT (L/m3) ▲ 1.4 1.8 2.2 2.6 ■ SHEAR STRENGTH (BPa) ■ 101 200 300 400 PLASTIC M.C LIQUED		SOI	L	L.] <u>∞.≂</u> ⊊	BARREL III		ГУР1
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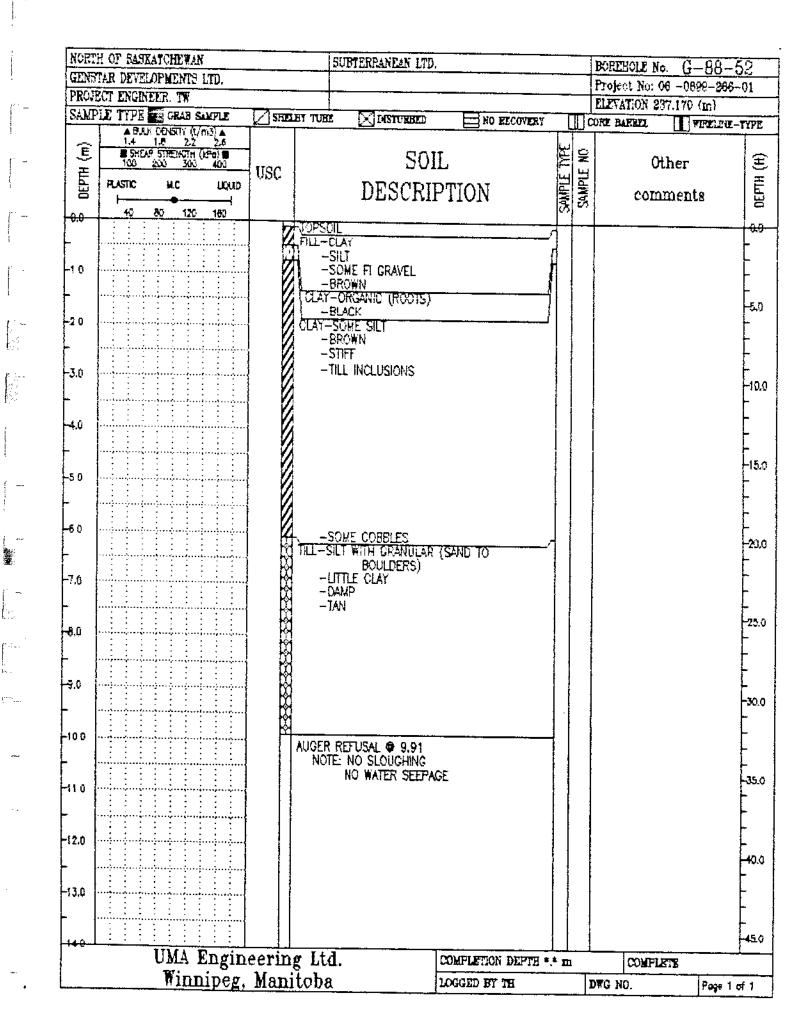
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	ect engi											ELEVATION 2	40.700 (m)	
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	TAR DEVE			LTD.								ect No: 66		
PROJE	ect enge	EF	TN				•				ELE	VATION 240	.650 (m)	
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	OF SASKATCHER			SUBTERRANEAN LTD.		-		BOREHOLE No. G.	-88-56	3
	AR DEVELOPMENT							Project No: 08 -08		
	CT ENGINEER: TW				• • • • • • • • • • • • • • • • • • • •			ELEVATION 240.100		-
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				LAYER BLACK OGANICS MI	(ED WITH CLAY	41			H	-5
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		SATCHERAN				SUBTERRANEAN LTD.			BOREHOLE No.	<u>G-88-57</u>
		LOPHENTS	LTD.						Project No: 08 -	
	CT ENGE	CRAE S	-	1				_	ELEVATION 239.7	
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	AR DEVEL		s ltd.					Project No: 08	-0698-266-01	
	CT ENGIN		A					ELEVATION 239.		_
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	AR DEVE			LTD,							_	Project No: 08 -08		
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L'IANG	A BA	K CONT	Y (1/n	113) 🛦	_ <u>[2]</u> 3m			NO NO	ELCOVERT		Πc	OPE BAREFI	FR.DE-TYP	25
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-20						VACEAY.	R BLACK ORGANIC (-WITH SILT -BROWN	LAY		1		- -		5.0
-3.0						1; -	-Stiff -Stiff -Till inclusions (More with D	ερτή					- - -1	10,
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-7.ċ						- الأ	-TR CLAY -TR WATER SEEPAGE -GREY						-2	20
						AUGE	-WATER SEEPAGE R REFUSAL & 7.01 NOTE: NO SLOUGHIN			1			2	25
-8.0							WATER SEEPAC	E TRUM LATE	.K 19 5.09				- -	
-9 ,0													- - -	5 0
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13.0													ب ب ا	
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	H 07 545					SUBTERPANEAN LTD.				BOREHOLE No. G-	-68-60
	TAR DEVE						•			Project No: 68 -069	6-266-01
	ICT ENGE									ELEVATION 240.000 ((IV)
SAMP.	LE TIPE		B SAMPLE		BY TUBE	DISTURBED	NO RECOVER	r [OFE BARKEL	PELDE-TYPE
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(n	# 5HE 100	r Sirenc 200 J	Tri (kPo) 🖬 👘			SOIL		<u>m</u>	₽	Other	E
DEPTH (m)	PLASTIC	M.C	LIQUID	USC		DESCRIP'		SAMPLE	SAMPLE	comment	8 (H) DEPTH (H)
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					ד 	UAY SOME GRANULAR		-			
-10					- 	BROWN					
-				4	1						-
					NLAYER A TAVE	BLACK CLAY MIXED W WITH SILT	ITH_ORGANICS	_			-5.4
-20						BROWN					[
-		···•				STIFF		ļ			F
-3.0] -	TILL INCLUSIONS (MORE WITH DEPTH)					-
5.0						Consider a contraction of the constant of the					-1G
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4.0					1						Ē
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					ΠЦ.–S						-15.
-50			<u>.</u>	·		SOME SILT IR WATER SEEPAGE					F
-		····;···;···			-	layered (sand and s	ILT)				Ľ
-50					[-]	IR CLAY	•				F
~~ I		: :				SOME GRANULAR AND D DENSER THAN ABOVE	COHBLES				-20.
-				·}	T\I	DENSER THAN ABOVE		_1			۱. ۲
-7.0				.	AUGER	REFUSAL & 6.40 DTE: NO SLOUGHING					E
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-110		····. : :		1						1	-
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12.0										{	Ľ
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		UMU	A Engil	ieerm	ig LU	u. [C	OMPLETION DEFTE	i *.* Σ	D.	COMPLETE	
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<u> </u>	H OF SASE					SUPTERRANEAN LTD			BOR	EHOLP No. G-	-98-61
	TAR DEVEL		LTD.							ect No: 08 -08	
	ect engin									ATION 239.700	
SAM	LE TYPE	GRAE S	SAMPLE		BY TUBY	MISTURBED	NO ELCO	ERT [CORE		PT.DE-TYPE
(m) H	5954	000011 (1 1.0 2.2 P STRENGTH 200 300	(kPa)	USC		S0.	IL	, <u> </u> − .	€	Other	
DEPTH	PLASTIC 40	NC 80 120		0.00		DESCRI	PTION	Sumple	SAMPLE	comment	DEPTH (#)
-0.0					FILL-C	CLAY AND SILT					
- -1 0					_: -!	SOME GRANULAR SROWN					
-20					-14CL#Y -1	<u>BLACK CLAY AND 1</u> WITH SILT BROWN	DRGANICS				-5.0 ~
3.0						STIFF					- -
4 .0					_1	RANSITION TO GRE					
50					-1	ILL INCLUSIONS (MORE WITH DEF					-15.
60				\$-\$-\$-	-5 -1	WNDY SILT SOME GRANULAR IR CLAY VATER SEEPAGE					-20,
-7.0											-
. .0						Xobbles and boul Refusal @ 7.77	DERS				-25.0
					N	OTE: HOLE STARTIN WATER IN HOL	g to slough E				-
9.0 -											- -30,0 -
100											
110											-35.0 -
12.0			-								- 40.0
13.0											
48.		11164	<u> </u>								-45.(
		UMA	Engin	eerin	g Lte	1.	COMPLETION DE	718 *.* m		COMPLETE	
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	H OF SAFE	_					SUBTERFANEAN LTD.				BOREHOLE No. G-	
	TAR DEVEL			LTD.							Project No: 66 -089	
	AT ENGIN					}					ELEVATION 239.890 (
DAMP.	LE TYPE	<u></u> . 106				ET TUEL	MSTURBED	NO RECOVER	<u> </u>	Шa	ORZ BARREL	RELING-TYPE
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{ m}}	■ 5HEA 100	20	300	400	UGA		SOI	4	Т	E NO	Other	
DÈPTH	PLASTIC	W.C	C	LIQUID	USC		DESCRIF	PTION	SAMPLE TYPE	SAMPLE	comment	оо ПЕШИ (4)
0.0	43	80	120	183	 				 			
-					I R		CLAY AND SILT SOME GRANULAR					
-			Ē				BROWN					┝
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.									-]	F.
							BLACK CLAY WITH O SOME SILT	RGANICS	_1			-5.1
-20						- 100	BROWN					
			:	· · · ·			STIFF					Ę
_						1 -	TILL INCLUSIONS					F
-3.0		:	:			1	(MORE WITH DEPTH)				}	-10
-				····		3					1.	F
-4.0		÷÷		:::		- 1	TILL POCKETS TO .3	DIA				F
4.4		: :	;									Ē
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			1		1 1		SANDY SILT SOME GRANULAR		}			-
•			÷	<u> Porter terre</u>	1 1) _'	WATER SEEPAGE IN T	HE SANDY TILL	{			-
-60			:	: : : 		d -	MORE WATER SEEPAG	e with depth				F
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7.0				<u>.</u>	1 12	1						-
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-						N	DTE: WATER IN HOLE NO SLOUGHING					F
							HA APPORTUND					Γ
-5.0		······ : :		÷								-3x
-	ļ		<u>.</u>	·····	4				ł	l	ļ	F
-100										l		F
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	I OF SASI						SUBTERPANEAN LTD.	······································			BOREHOLE No. G-	
	AR DEVE			JTD.			l				Project No: 06 -089	
	CT ENGIN						.			- 1 - 1 -	ELEVATION 239.620 (
SAMP.	LE TIPE					ET TUB	E MISTURELD	NO RECOVE	RT		CORE BAFEEL	FILED-TYPE
(m)	1.4 1.4 100	K DDNS).0 NR 51762 200	2.2 HGTH {I 320	2.5 400			SOII		<u>t</u>		Other	Ē
DEPTH	RASTIC	¥.			USC		DESCRIF	TION	State Free	SAMPLE	comment	8 19 19 19
9.0	40	80	120	150		FILL-	-CLAY AND SILT			, 		a .
-10						-	-SOME GRANULAR -BROWN					
												- -5.
-20					7	11 -	R OF BLACK ORGANIC -ROOTS	MATERIAL				-
-3.0			:			-	-SOWE SILT -BROWN -STIFF					-14
-4.0							-TILL INCLUSIONS					F
												-1
-S0 -							-TRANSITION TO GRAY -TILL INCLUSIONS	CLAY				
-60							- FIRM - FIRM					2
- 7.0						-	-Becoming Softer W	ith depth	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
- 8 ,0						<u>u</u>	-SILT WITH CLAY -SOME GRANULAR					-2
- - 3 .0							-TR COBBLES -GREY					- - -3
-					- B							ŀ
-10 0		<u>.</u>										
-110						· 8	-TAN/YELLOW LIMESTO	DNE				3 - -
-12.0							-GRANULAR CREENISH	I CÓLOR				- - -
-13.0						END	OF HOLE @ 12.20 IN NOTE: NO SLOUGHING TR WATER SEEP					
-												
		IJ	MA	Engi	neerii	ng L	.tđ.	COMPLETION DE	PTH *,*	E	COMFLETE	
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		ATCHEWAN OPMENTS				SUBTERRANEAN LTD.			_	BOREHOLE No. G- Project No: 66 -089	
	CT ENGIN						· · ·			ELEVATION 240.240 (
		GRAB SI	เมาวิโ 🖝	SHI	EY TUBE	DISTURBED	NO RECO				FELDOL-TYPE
SAMP:		<u></u>	MATLE .		Ter tobe	Mater		<u>ו האיי</u>	<u>Ľ`</u>		ACRICE-IIFE
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-						SOME SILT					Г
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-10]		: : :			STIFF					Ļ
-			.;;;			SMALL TILL INCLUSIO	VS				40
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-20	{·····				4	SILT WITH GRANULAR		i			Ļ
-))		SOME CLAY					-
				R	× -	SOME COBBLES AND	BOULDERS				┢
-3.0			1	1 13	- Ľ	WET TO PAT TEST					-10.0
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		UMA	Engi	neeri	ng L	td.	COMPLETION I	Depte *.*	m	COMPLETE	
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NORTH	H OF BAFKATCHEVAN			SUPTERPANEAN LTD.			I	BOREHOLE No. G-	<u>88-6</u>	<u>ģ</u>
	TAR DEVELOPMENTS LTD.			· · · · · · · · · · · · · · · · · · ·			Ì	Project No: 08 -069		
	ECT ENGINEER: TW							ELEVATION 240.050 (m)	
SAMP.	LE TIPE 🧱 GEAR SAMPLE	🗌 इसम	BY TUE	E XINSTURBLD	NO EECOVERY			OFE BARREL	PZ:DQ-T	YPE
DEFTH (m)	▲ BUL: DEVESTI (1/763) ▲ 1.4 1.8 2.2 2.6 ■ SHEAR STRENGTIR (1/763) ■ 100 200 300 400 PLASTIC M.C LIQUED 40 85 120 180	USC		SOIL DESCRIP			SAMPLE ND	Other comments	3	DEPTH (#)
0.0		7	TOPS			7				0.0
- -10 				-AND SILT SOME GRANULAR TILL INCLUSIONS DRY BROWN						
-20			1							-
-3.0 		14-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5		SILT WITH GRANULAR SOME COBBLES DENSE TAN LIMESTONE BECOMING	YELLOW					- - - -
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-50				R REFUSAL & 4.42 NOTE: NO SLOUGHING TR WATER ON AU	iger tip					-15.0 - -
-60		[
										-20.0
-7.0										-
-19 .0										-25.0
⊢ -\$.0 -										- -30.0
-100										
-110										-35.0
-12.8										-40.0
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	UMA Engi				COMPLETION DEPTH	I *.* I	n	COMPLETE	- , -	
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	AR DEVEL			<u>الا ا،</u>	<u>_</u>								Project No: 08		-01
	LE TYPE			PLF.	1 ene	LEY TUB	z 🕅 MSTU				1.1		ELEVATION 240		
	A E.t.	00507	10m	JL A	<u>[</u>] 3006			ROLD	NO RECOVE	TRY T	<u> </u>	ျက	FE BARREL	WIER LINE	-TYPE
Ê	E SHEA	e streniči	<u>n (e</u>	2.6 Pa) 🖬				CUIT			É	ᢓ			
Ξ	1.00	200 3	d3	400	usc	ł		SOIL					Oth	ner	13
DEPTH	PLASTIC	H.C					DES	CRIPT	ION			SAMPLE	comn	aents	nemu (4)
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10							dry Lt brown								┝
. [A CLAY-	-SOME SILT			1					-
20							Brown Stiff					Ì			15,(
						<u> </u>	STIFT TILL INCLUSIO	vs							┢
						2 { 11	SILT WITH GRA			{					+
3.0					Ŕ	ļ -	SOME CLAY								-10
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4.0					a di	! -	UNJAT								┢
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	OF BASE				50	BTERRANEAN LTD.				BOREHOLE N		
	AR DEVEL		LID.				;			Project No:		
	CT ENGINE									ELEVATION 2	239.530 (m)
SAMPI	E TYPE				et tube	DISTURBED	NO ELCOVERY		∏a	ORE BARREL	NET ALE	LINE-TYP
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0EPTH (m)		<u>20 90</u>	ALDU	USC				SAMPLE TYPE	SAMPLE	'		
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	AR DEVE			D.			ļ			- ·				Project No: 06		-01
	CT ENGI				T 3		<u> </u>			· · · · · ·				ELEVATION 239		
SAMPI	LE TIPE					LEY TUE		X DISTURBED		ש סא 🗮	ECOVERY	1	<u> </u> c	ORE BARREL	AIRTUNE-	TYPE
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	H OP SASKATCHEWAN		FRUISEN DRULLERS	MD.		BOREHOLE No. G-88-	- <u>P8</u>
	TAR DEVELOPMENTS LTD					Project No: 08 -0898-266	
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	TAR DEVELOPMENTS LTD.				- ·			et No: 06 -0		
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APPENDIX B

2009 Test Hole Logs

		5	REFERENCE NO.			DLE M H09		0	SHEET 1 of 2
SITE	JECT C	CENTF Propose	ANADA GROUP LIMITED RE PORT CANADA WAY PROJECT ed Interchange at Sturgeon Rd. and Inkster Blvd. n Rd. and Inkster Blvd.					JOB NO. GROUND ELEV. TOP OF PVC ELEV. WATER ELEV. DATE DRILLED	09-183-01 238.46 m /. 239.63 m 5/6/2009
DRII			ø Solid Stem Auger and HQ Core Barrel, Acker MP5-T					UTM (m)	N 5,533,717 E 624,309
ELEVATION (m)	(m) (ff)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	RECOVERY %		Cu POCKET PEN (kPa) \bigstar Cu TORVANE (kPa) \bigstar 20 40 60 80 PL MC LL $\%$ 20 40 60 80
- 238 237.9 _			<u>ORGANIC CLAY</u> (CI-CH) - Black, damp, firm, intermediate to high plasticity, trace rootlets, trace silt, trace fine to medium grained sand. <u>SILTY CLAY</u> (CH) - Brown, damp, stiff, high plasticity, trace silt seams (1 to 2 m thick), trace silt pockets (1 to 8 mm diameter), trace fine to medium grained sand.	-		₽ ^s			
- 236	2 2 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		- Mottled brown/grey, damp to moist, firm below 3.05 m.				⁵ 75		
- 234 233.6 _	4		<u>SILT TILL</u> - Reddish tan, wet, soft to firm, mixture of clay, silt, sands and gravel.	-		₽₹ s	57 58 100	····	
- 6665 - 6667 - 755 -	6 20 20		LIMESTONE - Limestone to argillaceous limestone, brown, heavily fossilized, nodular to very poorly laminated, moderately fractured, moderately indurated, some fractures have rust coloured clay fill up to 1.5 cm thick. Occasional thin layer (1 - 2 cm) of grey, unfossilized limestone rip up clasts, core has a red to purplish-brown hue. Many fractures are ground due to drilling action.	-			19 100 12 98		
	7		- 3 reddish clay filled fractures between 6.68 m and 7.39 m. - Friable, soft at 7.29 and 7.37 m.		8.2		13 98		
	9		- Hole terminated in a clay filled fracture with a small stone in the clay at 9.14 m. END OF HOLE ON LIMESTONE AT 9.14 m.		8.5 8.8 9.1		90		
SAM SAM CON CON E	PLE TYPE TRACTOR Paddock		Auger Grab Shelby Tube Core Barrel INSPECTOR Ling Ltd. B. P. ARPIN			.PPR MRJ	ÓVE		DATE 2/16/19

Ê								Cu POCKET PEN (kPa Cu TORVANE (kPa)
) NOI	DEPTH	GRAPHICS		PIEZ. LOG	(m) H	ү % Ү %	SPT (N) blows/0.15 m ▲	20 40 60 80
ELEVATION (m)		GRAP	DESCRIPTION AND CLASSIFICATION	PIEZ.	DEPTH (m)	SAMPLE TYPE NUMBER RECOVERY %	DYNAMIC CONE (N) blows/ft △	PL MC L
	(m) (ft)		Notes:		_	RE N S	20 40 60	20 40 60 80
228			 Solid stem auger refusal at 5.49 below grade. Water infiltration between 4.88 and 5.49 m. Switched to HQ core barrel at 5.49 m. Installed a 25 mm diameter standpipe with Casagrande tip to a depth of 9.14 m below grade, stickup = 1.17 m. 					
227								
	12 - 40							
226								
225								
224								
	15							
223								
222								
00.1								
221								
220								
219								
	20 - 65							
218								
217								

CLIE	ENT	-	ANADA GROUP LIMITED			JOB NO. GROUND ELEV.	09-183-01 238.99 m
PRO	JECT	CENTF	RE PORT CANADA WAY PROJECT			TOP OF PVC ELEV	
SITE		-	ed Interchange at Sturgeon Rd. and Inkster Blvd.			WATER ELEV.	
LOC	ATION	Sturgeo	n Rd. and Inkster Blvd.			DATE DRILLED UTM (m)	5/6/2009 N 5,533,684
DRII MET	LLING HOD	125 mm	ø Solid Stem Auger and HQ Core Barrel, Acker MP5-T				E 624,275
n)							Cu POCKET PEN (kP Cu TORVANE (kPa)
ELEVATION (m)	Ŧ	lics		H	%	SPT (N)	
ATIC	рертн	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	지		20 40 60 8
LEV		GR				(N) blows/ft \triangle	PL MC L
ш	(m) (ft)			RECOVERY	20 40 60	% 20 40 60 80
238.8 -	-		ORGANIC CLAY (CI-CH) - Black, damp, firm, intermediate to high plasticity, trace rootlets, trace silt inclusions, trace fine to medium grained sand.	Rs	51		•••••••••••••••••••••••••••••••••••••••
	-		SILTY CLAY (CH) - Brownish grey, damp, stiff, high plasticity, trace rootlets, trace	₽s	52		_
			fine to medium grained sand, trace silt, trace organic seams, trace fine grained gravel.				· · · · · · · · · · · · · · · · · · ·
238				₹¶ s	3		
	-5			s	54		··· ·· - ┃·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ··
			- Brown, trace silt pockets (2 to 10 mm diameter), trace silt lenses, trace silt seams (1	₽ R			······································
237	2		to 3 mm thick), trace medium to coarse grained sand below 1.83 m.	R	,5	······································	······
				सि s	6		
236				ł			
005.0				s	57		
235.3			SILTY CLAY TILL - Brown, damp, firm, mixture of clay, silt, sand and gravel.	₽ ₽ 8	88		••••••••••••••••
235.0 235 -	4		SILT TILL - Tan, dry to damp, compact to dense, mixture of silt, sand and gravel.				
				₽ ₽	9	······································	
			- Moist to wet below 4.57 m.	S	10	▲ 6	
234	5		- Reddish tan, dry below 5.03 m.	रिं	11	1 0	····
233.7 _		97/7/2/	LIMESTONE - Limestone to argillaceous limestone, grey to redish brown in color,	F			
			heavily fossilized, heavily fractured limestone, nodular to very poorly laminated, moderately indurated, very few vugs. Several fractures have rust coloured clay fill on				
233	6		them. Core breaks easily in several places into discs between 0.5 to 1 cm thick pieces. Bedrock contact is a 100 mm clay contact zone, red in colour.	R	1 100		
			- 7 cm thick clay seam at 5.72 m. - Friable at 5.72 m.				
			- 5 cm thick clay seam at 6.48 m. - Friable at 6.48 m.				
232	7-						······································
	- 25	;			2 98		
231	8-1						······
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230	9 <u>-</u> 30	,		R	³ 100	······································	•••••••••••••••••••••••
			- 3 cm thick clay seam at 9.53 m - Friable, soft at 9.53 m.				
229	L - H PLE TYP	'E [7]	Auger Grab Shelby Tube Split Spoon	H		arrel	<u></u>

4 (m)		ş			SPT (N)		KET PEN (VANE (kPa	
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER RECOVERY %	blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	20 PL	40 60 MC	80
	(m) (ft)			SAN NUI REC	20 40 60	20	% 40 60	80
			- 1.5 cm thick clay seam at 9.88 m. - Friable, soft at 9.88 m.	R4 ₉₄		 	······································	:: : :: : 1::1: 1::1:
22289			-Hole terminates in clay seam at least 7.5 cm thick at 11.0 m. \- Friable, soft at 10.97 m.		······································	 		
			END OF HOLE ON BEDROCK AT 11.05 m.					:: ::
227			Notes: 1. Switched to HQ core barrel at 5.30 m. 2. Backfilled test hole with cement grout to 5.30 m depth, remainder filled with bacteria.				······································	 :: <u> </u>
	40		bentonite.					
226	13 —						· · · · · · . · · . · . · . · . · . · . · . · . · .	:: ::
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224	15 -					 	<u> </u> 	
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219	20							
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218	21						······································	
SAM] PLE TYPE	सि	Auger Grab 🔲 Shelby Tube 🔀 Split Spoon	Core Ba	<u></u> rrel	1	<u></u>	1::1

SITE	JECT E	CENT Propos	CANADA GROUP LIMITED RE PORT CANADA WAY PROJECT red Interchange at Sturgeon Rd. and Inkster Blvd.				JOB GRC TOP WAT	oune of f Ter f	D EL PVC ELE	ELE V.	V.	09-1 239	0.28	m	
DRII	LLING THOD		on Rd. and Inkster Blvd. n ø Solid Stem Auger, Acker MP5-T				DAT UT№			ED				3,53	2
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	гүре		۲%	SPT blov	(N) vs/0.	15 n	n 🔺	Cu	TOR\		PEN (E (kPa 60	(kPa) a) ⁸⁰
ELEVA	(m) (ft	-		SAMPLE TYPE	NUMBER	RECOVER	DYN (N) k	olow	s/ft				M	.	
220.0			ORGANIC CLAY (CI-CH) - Black, moist, firm, high plasticity, trace rootlets, trace			Ľ	 :::::!			· · ·	::::	20 :::::::	40	60	80
22990 _			medium to coarse grained sand. <u>SILTY CLAY</u> (CH) - Brown, moist, stiff, high plasticity, trace silt nodules, trace coarse grained sand.		- S1										
238															
	-5		- Increased silt nodules/pockets (2 to 5 mm diameter) below 1.52 m.		S2									 	
	2-		- Grey below 1.80 m.		S3								<u></u>	:: :: .:	
237							····	· · · · · ·		 				· · · · · · · ·	
			- Firm, trace silt nodules (approx. 2 to 5 mm diameter) below 2.44 m.											 :: ::	1
236.2 _	3		SILT TILL - Beige, moist, firm, trace sand, trace fine grained gravel, trace clay.	+			<u></u>	····+		<u>-</u>		<u></u>	<u>- </u> 	• • • • • • • •	<u> </u>
236					S5										
			 - Moist to wet, soft, some fine to medium grained sand, trace coarse grained sand to fine grained gravel below 3.66 m. 												
235			- Wet from water infiltrating the hole.	R	S6									 	
		5						- -		/				 	
	5-		- Dense below 4.88 m.	Å	S7	100	ă:́5:			 		::::i:):: :: 	i::i:: 1.:1.:
234			- Some coarse grained gravel in split spoon.							 			· · · ·	 	
				X	S8	28		2			. .	ал: Ц.Ц			
233.2 _	6		AUGER REFUSAL ON SUSPECTED BEDROCK AT 6.10 m.	4				·····				· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · ·	
233			Notes:							; 					 <u></u>
			1. Encountered water at 3.35 m below grade at end of drilling. 2. Backfilled test hole with bentonite to 1.52 m depth, remainder filled with auger												
232			cuttings.				::::t								
		5						 		 					
	8-						t					: :: : +-+			1::1::
231										 				:: :: :: ::	
							t t	i i					-1-1 	<u></u> 	1 1
	9-	30					····· ····		 	<u></u>	- - - -		 	 	
230						::::t t			 		:1::1: :	:::: 	:: :: :: ::	:: :: :: ::	
							····· ·····	····· ·····		 		-11-	- 	 	
SAM	I 1 PLE TYF	'E [7]	Auger Grab Shelby Tube Split Spoon		1			<u>;.</u> 1	···;···	<u> </u>	<u> </u>	<u>т.т</u> .	<u> </u>		<u> </u>
	TRACTO		INSPECTOR	APP	RO	VEI)				DAT	Έ			

	GROU	-	5	SUMMARY LOG REFERENCE NO.			DLE N HO		3	SHEET 1 of 1
SITE	JECT E ATION	C P IS	ENTR ropose turgeo	ANADA GROUP LIMITED RE PORT CANADA WAY PROJECT ad Interchange at Sturgeon Rd. and Inkster Blvd. In Rd. and Inkster Blvd. Ø Solid Stem Auger and HQ Core Barrel, Acker MP5-T					JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED UTM (m)	09-183-01 237.34 m ∨. 238.38 m 5/7/2009 N 5,533,770 E 624,364
ELEVATION (m)) DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) \star Cu TORVANE (kPa) 20 40 60 80 PL MC LL % 20 40 60 80
- 237 - 236	1	5		SILTY CLAY (CH) - Black, moist, stiff, high plasticity, some organics, trace rootlets, trace medium grained sand. - Brown, trace silt nodules (approx. 1 to 2 mm diameter) below 1.07 m.			A N s	1		
- 235	2	-10		- Grey, firm, trace silt nodules/pockets (approx. 5 to 25 mm diameter), trace coarse grained sand to fine grained gravel below 2.13 m.			N N S S S S S S S S S S S S S S S S S S	4		
- 234 233.7 _ - 233 232.8 _	4	15		<u>SILT TILL</u> - Beige, moist, soft, trace medium to coarse grained sand, trace fine grained gravel, trace clay.	-		s N S S		▲6 Note 2	
- 232	5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	.20		heavily fossilized, mottled tan to redish brown, nodular to very poorly laminated, moderately fractured, a few narrow shale zones. - Friable, rubble core zone between 4.85 and 4.93 m. - Top 32 cm is heavily fractured.			R	1 98		
- 231 - 230 230 7	7 1 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	•		 Nearly all core fractures are 80° to 90° to core axis. Friable at 6.88, 7.14 and 7.16 m. Becomes grey, moderately fractured, several narrow shale zones (< 1 cm), core tends to break at shale layers. 		7.0 7.3 7.6	R	2 98		
229.7 _ - 229	888444444	25		END OF HOLE AT 7.62 m Notes: 1. Installed Casagrande standpipe to a depth of 7.62 m below grade, stickup = 1.04 m. 2. SPT bounced after 6 blows on suspected boulder or bedrock for S8. 3. Switched to HQ core barrel at 4.6 m.	<u>, , , , , , , , , , , , , , , , , , , </u>	. 1.0				
- 228		-30	ردتا ردتا							
CON	PLE TY TRACT	OR	<u>F</u> Drill	Auger Grab Shelby Tube Split Spoon INSPECTOR ing Ltd. C. FRIESEN			Co PPR MRJ	ore Ba	D	DATE 12/16/19

SITE LOC	JECT	г (F N 9 Э 1	CENTR Propose Sturgeo	ANADA GROUP LIMITED RE PORT CANADA WAY PROJECT ed Interchange at Sturgeon Rd. and Inkster Blvd. n Rd. and Inkster Blvd. ø Solid Stem Auger, HQ Core Barrel			JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED UTM (m)	2 :V. 5 N E	9-183- 238.12 5/7/200 5,533 624,3	m 9 3,797 389	
ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	COVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △			(kPa) 60 C	
000	(m)	(ft)		SILTY CLAY (CH) - Brown, moist, stiff, high plasticity, trace rootlets, trace sand,	r s	RE	20 40 60	20		60	80
238 237	+- +-+ 1-+-	- - -		trace fine grained gravel, trace organics upper 0.30 m.	₩ ^{S1}						
236	2 2 2	5 - -		- Trace oxidation, trace silt nodules (approx. 1 to 3 mm diameter) below 1.52 m.	S3 X S4 S5						
235	3 3 4 4	—10 - -		- Grey, moist, firm, trace silt nodules (approx. 3 to 10 mm diameter), trace silt till, trace coarse grained gravel below 3.05 m.	S6						
233.7 _	, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	- 15 -		<u>SILT TILL</u> - Beige, moist, firm, trace to some clay. - Moist to wet, soft, some sand, trace fine grained gravel below 4.57 m.	X S7						
232.8 _ 232	6 6	- - —20		LIMESTONE - Limestone to argillaceous limestone, grey/green to brown and rust red, fossiliferous, oxidized, moderately indurated, mottled to nodular structure, moderately fractured, heavily fossilized, sloughed till material at top 0.19 m. - Red-brown clay seam (< 50 mm thick), soft, friable, oxidized at 5.87 m.	S9 R1	39 80	17 Note:2				
231	-+	- - -		- Trace reddish clay lenses (approx. 25 mm thick), high plasticity.	R2	100					
230	8 8	- 25 - - -		- Red-brown clay seam (~ 75 mm thick), soft, friable, oxidation at 8.03 m. - Friable, soft, oxidation between 8.03 and 8.10 m.	R3	100					
229	9 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				 R4	98					

000 000000000000000000000000000000000		GROUP	ICS		щ Ш	%	SPT (N)	Cu TOR	KET PEN (VANE (kPa	
23	ELEVATIO	HLA BO (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	AMPLE TYI	ECOVERY 6	blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	PL	MC %	80
225 0 -	227	11		fossils, several clay/shale seams throughout, mottled to nodular structure. - 1 cm thick clay/shale seams at 10.39 m, 10.67 m, 10.72 m, 11.48 m, 12.07 m, 12.14 m, 12.17 m, 12.98 m, 13.18 m, 13.79 m, 13.92 m, 13.97 m, 14.0 m, 14.02 m, 14.33 m. - 5 cm thick clay/shale seam, soft, friable, oxidation at 11.23 m.						
221 14	225				R	³ 100				
²²³ ²²³ ²²⁴ ¹⁶ ¹⁶ ¹⁶ ¹⁶ ¹⁶ ¹⁶ ¹⁶ ¹⁶ ¹⁷ ¹⁶ ¹⁷ ¹⁶ ¹⁶ ¹⁷ ¹⁶ ¹⁷ ¹⁶ ¹⁷ ¹⁷ ¹⁸ ¹⁸ ²¹¹ ¹⁸ ¹⁸ ¹⁹ ¹⁸ ¹⁹ ¹⁸ ¹⁹ ¹⁹ ¹⁸ ¹⁹ ¹⁹ ¹⁰ ¹¹ ¹⁰ ¹¹	224			- Friable, soft, oxidation between 13.79 and 13.90 m.	R	7 100				
221 17 -55 17 -55 18 -60 18 -60 18 -60 18 -60 19 -60 10 -7 10 -7 10 -7 10 -7 11 -7 120 -7 13 -7 14 -7 15 -7 18 -7 19 -7 19 -7 19 -7 19 -7 19 -7 19 -7 19 -7 10 -7 218 -7 218 -65 218 -65 218 -7 219 -7 210 -7 211 -7 212 -7 213 -7 214 -7 215 -7				weak to moderate fracturing with occasional clay and shale seams, fossil content is similar to upper portion of hole, several clay and shale seams. - 1 cm thick clay/shale seams at 15.90 m, 16.03 m, 16.56 m, 18.14 m. Soft, friable.	 Rt	3 93				
220 18 60 END OF HOLE AT 18.29 m. 219 19 1. Lost circulation between 5.51 and 6.40 m. Possibly in clay layer or fracture in bedrock. 219 19 65 218.8 0. Switched to HQ core barrel at 5.30 m. 4. Backfilled test hole with concrete grout to 5.30 m depth, remainder filled with bentonite. 218 20 218 21 219 10 218 20 218 21 219 21 210 21 211 21 212 21	221	-			R	9 100				
219 19 1. Lost circulation between 5.51 and 6.40 m. Possibly in clay layer or fracture in bedrock. 2. Bouncing on suspected bedrock into second set of SPT for S9. 3. Switched to HQ core barrel at 5.30 m. 4. Backfilled test hole with concrete grout to 5.30 m depth, remainder filled with bentonite. 5. Testhole log is a combination of two testholes drilled 2 m apart. First testhole was drilled to 8.56 m and the second testhole was drilled to 18.29 m. 217 21 21	220 19.8 _									
218 20 - 5. Testhole log is a combination of two testholes drilled 2 m apart. First testhole was drilled to 18.29 m.	219			 Lost circulation between 5.51 and 6.40 m. Possibly in clay layer or fracture in bedrock. Bouncing on suspected bedrock into second set of SPT for S9. Switched to HQ core barrel at 5.30 m. Backfilled test hole with concrete grout to 5.30 m depth, remainder filled with 						
		20		5. Testhole log is a combination of two testholes drilled 2 m apart. First testhole was						

CLIEN PROJ SITE LOCA DRILI METH		F N S	CENTR Propose	ANADA GROUP LIMITED RE PORT CANADA WAY PROJECT ed Interchange at Sturgeon Rd. and Inkster Blvd. n Rd. and Inkster Blvd. ø Solid Stem Auger, Acker MP5-T	1		JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED UTM (m)	238.0 V. 5/8/2 N 5,5 E 62	2009 533,919 24,517	
ELEVATION (m)	(m) DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20, 40, 60	Cu TORVA 20 40 PL ∎	0 60 80	0 .L
	-			ORGANIC CLAY (CH) - Black, moist, stiff, high plasticity, trace medium to coarse grained sand, trace rootlets.	₽s	51			···	::
237.4 _	1 1 1 1 1			<u>SILTY CLAY</u> (CH) - Brown, moist, stiff, high plasticity, trace rootlets, trace sand, trace fine grained gravel, trace organics.		² 100				
236	2	- 5		 Brown, moist, stiff, high plasticity, trace silt nodules (approx. 1 mm diameter) below 1.22 m. Trace silt nodules (approx. 2 to 5 mm diameter) below 1.52 m. 	₩ ₽	3				
235	3 1 1 3	-10		- Firm below 2.44 m. - Grey below 2.59 m.		5 100				
234	4 1 1 4 1 1 1 1 1 1			 Silt pocket (approx. 25 mm diameter) at 3.99 m. Medium grained sand pockets (approx. 25 to 30 mm diameter) at 4.42 m. 						
233	5 	- 15		- Trace silt till below 5.18 m.	s	⁵⁸ 92				
232.2				- Trace silt nodules (approx. 1 to 3 mm diameter) below 5.38 m.		⁹ 100				 ::1
232 231.5 _	6	-20		<u>SILT TILL</u> - Beige, moist, loose, medium grained to coarse grained sand, trace fine grained gravel, trace to some clay.		11 78				
231		- 25		AUGER REFUSAL ON SUSPECTED BEDROCK AT 6.50 m. Notes: 1. SPT bounced on suspected bedrock for S11. 2. Backfilled test hole with bentonite to 1.52 m depth, remainder filled with auger cuttings to grade.						
230	8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1									
229	9 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-30								

APPENDIX C

2019/2020 Test Hole and Photograph Logs

		G		5		IOLE N		l	SHEET 1 of 2
PI		INT JEC1	· 4	Airport	F WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing Inary Engineering n Road			JOB NO. GROUND ELEV. TOP OF PVC ELEV WATER ELEV.	19-0107-009 238.75
LC	OC	ΑΤΙΟ	N 2	800 m \$	South of CentrePort Canada Way, East Shoulder of Sturgeon Road			DATE DRILLED UTM (m)	9/23/2019 N 5,530,427
		LINC	s s	ionic SI	DC 450, Track Drill Rig				E 623,767
ELEVATION (m)		(m)	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) \bigstar Cu TORVANE (kPa) \blacklozenge 20 40 60 80 PL MC LL \checkmark \checkmark \checkmark 20 40 60 80
					<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand.	s	1		
- 238					- Damp below 0.6 m.	S			
237.	.' -				CLAY FILL - Black, damp, low plasticity, stiff, some organics.	s	3		
237. - 237	.1 7 -	2	-5		<u>CLAY (CH)</u> - Mottled brown to grey, moist, stiff, high plasticity.	-			
- 236	6				- Trace silt nodules below 2.3 m.	∏ s.	4		
		3-1	-10		- Firm below 3.2 m.				
- 235	5								
234.	2				- Trace fine to coarse grained gravel below 3.9 m.	S	5		· · · · · · · · · · · · · · · · · · ·
- 234	-	5	- 15		SILT TILL (ML) - Tan, moist, compact, some fine to coarse grained sand, some fine to coarse grained gravel, trace cobbles.				
- 233		6 6	-20		- Cobbles encountered at 5.9 m. - Moist to wet, loose, some to with fine to coarse grained gravel below 6.0 m.	S	6		
- 231		7	- 25			s	7		
- 230	D	8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				S	8		
-0107-009.GPJ	9	9	-30		- Damp, dense below 9.0 m.	S	9		
10-0107-010-91 1 235	I		- 35		- Trace limestone fragments below 11.2 m.	S1	0		
GEOTECHNICAL-SOIL LOG U/FMS/19-0107-009.GPJ 72 - 527 - 520 - 527 -		12	-40		 - 150 mm sand seam observed at 11.4 m. - Cobbles encountered below 12.0 m. - Pink to red, moist below 12.2 m. 	I S1	1		
AS INCAL	۱ AM	PLE T	YPE		Sonic Barrel		1		
CC GEOTEC		TRAC addc				APPRO JRM	OVE		DATE 12/16/19

l (m)		ŝ					SPT	(NI)				POC TOR				νa)
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	LE TYPE	NUMBER	VERY %	DYN (N) b	/s/0. AMI	c co		-	20 PL	40 	60 //C		80
ELI	(m) (ft)	9		SAMP	NUME	RECO	. 20			60 .		20	40	● /6 60	. 8	30
225.6 225.0 225 -			SAND AND GRAVEL - Brown, moist, dense, some silt, some cobbles.							 ::::: 						
			<u>SILT TILL (ML)</u> - Red, moist, dense, some fine to coarse grained sand, some fine to coarse grained gravel.		S12											
^{224.3} – 224.1 – 224		Y X I XIIX / S	JURASSIC LIMESTONE - Pink to grey, weak.	┢┚	S13											
223			END OF TEST HOLE AT 14.4 m Notes: 1. Water observed at 6.5 m below grade after the completion of drilling. 2. TH19-01 open to 7.1 m below grade after the completion of drilling.						 							
			3. Backfilled with bentonite chips and auger cuttings.													
222	17									1						
221) 		: :: - :: : :: -		 		+
220	19 															
219	20											: :: : :: : ::				
218	21) 						
217	22 —								 							
216																
215									 							
214	24) 						
213	25 +								 			- - -				
212									 	 						
211	2790															
	28															İ

	GROU	-			HOLE N		2	SH	EET 1	of 2
SITE	JECT E	A P S	irport relimi turgeo	DF WINNIPEG - WATER AND WASTE DEPARTMENT t Area West Regional Water and Wastewater Servicing inary Engineering n Road South of CentrePort Canada Way, East Shoulder of Sturgeon Road			JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED	23 V.	-0107-0 8.19 23/2019	
DRIL	LLING HOD			DC 450, Track Drill Rig			UTM (m)	Ν	5,530,7 623,776	06
ELEVATION (m)	() DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60		CKET PEN RVANE (kl 40 60 MC % 40 60	Pa) ♦
- 28789	1		*****	GRANULAR FILL - Brown, damp, compact, fine to coarse grained sand.		+		::1::1::		:1::1::1:
- 237 236.5 _	++++++++++++++++++++++++++++++++++++++	5		CLAY FILL - Grey, damp, firm, intermediate plasticity, trace fine to coarse grained gravel. - Black, low plasticity, some organics, trace silt nodules below 0.7 m. CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules.					- - -	
- 236	2				∏ s	3				
- 235	3	10		- Trace fine grained gravel below 3.0 m.						
- 234		15		- Cobbles encountered below 4.2 m.						
- 2 32 39 _	6	20		SILT TILL (ML) - Tan, damp, dense, some fine to coarse grained sand, some fine to coarse grained gravel.	s	4		*		
- 232 - 231	7			- 150 mm sand seam observed at 6.2 m. - Damp to moist below 6.7 m .	S	5				
- 230	8 1 1 1 1 1 1 1 1	25		- 300 mm sand seam observed at 7.6 m. - With fine to coarse grained gravel below 7.9 m.	S	6				
229.7 _ _ 229.0 _ _ 229 _	9	·30		<u>GRAVEL</u> - Brown, moist, compact, some fine to coarse grained sand, some silt. <u>SILT TILL (ML)</u> - Tan, moist, compact, some fine to coarse grained sand, some fine	s S	7				
	10 10 11 10			to coarse grained gravel.						
1/600-7010-61/		35		- Damp, dense below 10.3 m. - Very dense below 10.6 m.	S	3				
CODICCHNICAL-SOIL LOG UNEWSY19-0107-009:09-000-000:09-000-000-00-000-00-000-0		40		JURRASIC LIMESTONE - Pink to grey, weak.	S1	0				
SAL-S									<u> </u> :	<u>: :: : :</u>
SAM	PLE TY	ΈE		Sonic Barrel						
CON P	TRACT Paddoo			INSPECTOR Ling Ltd. M. SAALY	APPRO JRM	OVE		DATE 12/16/1	9	

	GROUP	cs		۶ PE		SPT (N)	1			POC TOR				
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER RECOVERY %		blows/Ó DYNAM (N) blov				20 PL	40 	60 IC ●		80
ш	(m) (ft)			SAN NUN REC		. 20 . 4	40 (60		20	% 40)	80
225							 							
24.5 _	45 14		END OF TEST HOLE AT 13.7 m			;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;)						
224			Notes:		:	:):: ::): <u>-:</u>	#	1		:1::1				
	15		 Water observed at 6.4 m below grade after the completion of drilling. TH19-02 open to 6.9 m below grade after the completion of drilling. Backfilled with bentonite chips and auger cuttings. 		:			:::: ::::		: :: : ::			:: : :: :	
223	-50		5. Dacklined with bencome chips and adger cultings.		:									
					:									
222	16				•									
221	17				:									
)						
220							#	1 1		. . : :		1 ::	. . :: :	+
							 							-
219	19 - 1									<u></u>				
							<u></u> 	<u> </u>						
218	20				: :									
							 	1					-1 -	
217	21 -				:									-
					: :									
216	22						<u> </u> :-::-	<u> </u> :-:	- :: :	<u>- </u> : ::	<u> </u> 	11	<u> -</u> :: :	
					:									
215	23 - 75				:	::::t:::: ::::::::::::::::::::::::::::]::::: 		::::I ::::I	· · · · · · · · · · · · · · · · · · ·	1::1 	::1: 	::
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214	24				:	·····	<u>.</u>						<u></u>	
					:		<u> </u> 	j <u></u>				<u> </u>		
213	25					::::p:::: :::::	 	1 		::::i ::::i	:: :: :: ::	:: 	:: : :: :	
					-		:::::: :::::::::::::::::::::::::::::::	1:::: 1::::		::::i		1::1 1 - 1	::i: :	i
010	26 - 85				:)::::: 		<u>- </u>	<u></u>	:: 		
212					: .	;;:: ::}: -; ;- }-		1:::: 		::::I -		ו::ו -:	:: : 	
	27				: .	<u></u>	1::::: 1::::::::::::::::::::::::::::::	1:::::: 1:::::::::::::::::::::::::::::		:::: -	<u></u>	:: 	:: : : :	
211	90					<u></u>		 						
	28 –							1		::::: ::::: :::::	·····	 :: 	.:1: ::1: 	
210					ŀ			<u> </u>	:: : 	<u>: :: </u>	<u></u>	<u> :: </u>	<u>:: :</u>	
	IPLE TYPE		Sonic Barrel INSPECTOR	APPROVE					DAT					•

the second second	GROU			REFERENCE NO.	HOLE N TH19		3	SHI	EET 1	of 1
SITE	JECT E ATION _LING	A P S N 2:	irport relimi turgeo 330 m \$	F WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing nary Engineering n Road South of CentrePort Canada Way, East Shoulder of Sturgeon Road DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED UTM (m)	ROUND ELEV.238.41OP OF PVC ELEV.ATER ELEV.ATER DRILLED9/24/2019		
ELEVATION (m)	(B) DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NIIMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60		KET PEN VANE (kP 40 60 MC % 40 60	
238.1 _ - 238	Li I I			<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, with fine to coarse grained sand.						
237.5 _ - 237 - 236	1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5		 CLAY FILL - Mottled black to grey, damp, stiff, intermediate plasticity, some fine to coarse grained sand, some fine to coarse grained gravel, some organics. CLAY (CH) - Brown, damp, stiff, high plasticity. Mottled brown to grey, trace silt nodules below 1.6 m. 	s					
- 235	3 3 4 4	-10		- Firm below 3.6 m. - Grey, moist, some silt nodules below 4.2 m.						
- 234 - 233 232.6 _		-15		SILT TILL (ML) - Tan, moist, loose, some fine to coarse grained sand, some fine to coarse grained gravel.	S4	4				
- 232 - 231	+ ₁ -+ ₁ -+ ₁ + ₁ + ₁ + ₁ + ₁ + ₁ + ₁ + ₁ + ₁ + ₁	25		- Damp, dense to very dense below 7.6 m.	S	5				1
- 230 - 2229 -	8 9 9	-30		∖ <u>LIMESTONE</u> - White, weak.	Se St	7				1
228.8 – – 228	10 10 11 11 11 11 11 11	35		END OF TEST HOLE AT 9.6 m Notes: 1. Water observed at 5.6 m below grade after the completion of drilling. 2. TH19-03 open to 5.8 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.						
- 2299 _ 228.8 - 228 - 228 - 227 - 226 SAM: CON'	12	-40								
SAM	PLE TY			Sonic Barrel			D			
CON"	TRACT addo		Drill	INSPECTOR Ling Ltd. M. SAALY	APPRO JRM	JVE	D	DATE 12/16/19)	

KGS	5	SUMMARY LOG REFERENCE NO.			DLE 1 H1	NO. 9-0 4	ŀ	SH	EET 1 of 1
PROJECT A P SITE S LOCATION 2'	Airport Prelimi Sturgeo 100 m S	F WINNIPEG - WATER AND WASTE DEPARTMEN Area West Regional Water and Wastewater Serv nary Engineering n Road South of CentrePort Canada Way, East Shoulder of Sturge DC 450, Track Drill Rig	vicing	ad			JOB NO. GROUND ELEV. TOP OF PVC ELE ^V WATER ELEV. DATE DRILLED UTM (m)	23 V. 9/2 N	-0107-009 8.39 24/2019 5,531,169 623,790
ELEVATION (m) (m) DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBEK RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60		KET PEN (kPa) X 40 60 80 MC LL % 40 60 80
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		GRANULAR FILL - Brown, damp, loose, fine to coarse grained gravel, with fine to coarse grained sand. ////////////////////////////////////		5.9 6.7 7.0 7.4 7.7 9.4 10.1 10.7		31 32 33 33 34 35 56 56 39 10			
SAMPLE TYPE CONTRACTOR Paddock		Sonic Barrel INSPECTOR .ing Ltd. M. SAALY			APPR RM	OVE		DATE 12/16/19	9

	G			HOLE NO		5	SHEET 1 of 1
SITE	JECT	Airport Prelim Sturgeo	DF WINNIPEG - WATER AND WASTE DEPARTMENT t Area West Regional Water and Wastewater Servicing inary Engineering on Road South of CentrePort Canada Way, East Shoulder of Sturgeon Road			JOB NO. GROUND ELEV. TOP OF PVC ELE ^V WATER ELEV. DATE DRILLED	9/24/2019
	LLING HOD	Sonic S	DC 450, Track Drill Rig			UTM (m)	N 5,531,558 E 623,802
ELEVATION (m)	(m) DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) \clubsuit 20 40 60 80 PL MC LL % 20 40 60 80
220.5	1		GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, with fine to coarse grained sand.				
238.5 238.2			CLAY FILL - Mottled black to grey, damp, stiff, low plasticity, some organics.				
- 238			CLAY (CH) - Brown, damp, stiff, high plasticity. - Mottled brown to grey, damp to moist, trace silt nodules below 1.2 m.	S1			
- 237 - 236				S2			
- 235			- Grey, trace fine grained gravel below 3.0 m.	S3			
^{234.4} _		5	<u>SILT TILL (ML)</u> - Tan, damp, loose to compact, some fine to coarse grained gravel, some fine to coarse grained sand.				
- 233				S4			
- 232				S5			
231.4							
231.2 – – 231	8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		JURASSIC LIMESTONE - Red, weak. END OF TEST HOLE AT 7.7 m Notes: 1. TH19-05 open to 7.4 m below grade after the completion of drilling.	S6			
– 230 Гd9:600-	9-1-3	D	 Water encountered at 4.7 m below grade after the completion of drilling. Backfilled with bentonite chips and auger cuttings. 				
-7009/19-010/-		5					
:\FMS\19-0107 1 872 872							
GEOTECHNICAL-SOIL LOG UNEWSY19-0107-009(19-0107-0000) Reveree Rev		D					
₹ 226 Z SAM	PLE TYF	ΡΕ	Sonic Barrel	_ I	1		
	TRACTC	DR		APPRO JRM	VEI		DATE 12/16/19

the second second second second second second second second second second second second second second second se	GROU		5		HOLE NO. TH19-0	6	SHEET 1 of 1	1
SITI LOC DRII	JECT E	F S N 1	Airport Prelimi Sturgeo 480 m S	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing Inary Engineering In Road South of CentrePort Canada Way, East Shoulder of Sturgeon Road DC 450, Track Drill Rig		JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED UTM (m)	19-0107-009 239.37 V. 9/24/2019 N 5,531,769 E 623,809	
	DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) Cu TORVANE (kPa) 20 40 60 80 PL MC LL % 20 40 60 80	•
239.1	1		\times	GRANULAR FILL - Grey, damp, compact, fine to coarse grained gravel, with fine to				1::
- 239 -	-[coarse grained sand. CLAY FILL - Mottled black to grey, damp, stiff, low plasticity, some organics.				
238.6 -	▎▁▋			<u>CLAY (CH)</u> - Motified brown to grey, damp, stiff, high plasticity.				
	']				S2			
- 238	-	- 5		- Trace silt nodules, trace fine grained gravel below 1.5 m.				1:
- 237					S3			İ.
- 231					55			
	3	10						:::
- 236	ľ	-10		- Moist below 3.0 m.				
								1
235.6 -				SILT TILL (ML) - Tan, moist, loose, some fine to coarse grained sand, some fine to			···· \star ··· ·· ·· ·· ·· ··	
- 235] ‡			coarse grained gravel, trace cobbles.				
- 235	-	- 15						
	5							
- 234	ĬŤ							
- 234	-				S4			
233.3	6							1::
- 233	Ĭ	-20		SAND AND GRAVEL - No recovery in sonic barrel from 6.1 m to 7.6 m.				
200			0.00					1.
	7		, a .O					
- 232	1		000		S5			i::
231.8		- 25	00 WNN	SILT TILL (ML) - Tan, moist to wet, loose to compact, some fine to coarse grained	_			
	8-			sand, some fine to coarse grained gravel, trace cobbles.				
- 231								
	1		Yo X	- Yellow, moist, dense below 8.5 m.	S6			1::
	9-	~~						1
a 230	1	-30		- With fine to coarse grained gravel below 9.1 m.	S7			1.
0 229.6			XXXX					
107-(10 –			JURASSIC LIMESTONE - Red to purple, broken.	S8			1.
6 6 – 229	‡			- 300 mm clay seam observed at 10.3 m.				
228.7]	- 35		- 300 mm clay seam observed at 10.3 m. END OF TEST HOLE AT 10.6 m				1::
0107.	11 -							
0 6 - 228				Notes: 1. TH19-06 open to 8.5 m below grade after the completion of drilling.				1::
EMS.				2. Water encountered at 5.5 m below grade after the completion of drilling.				
 5	12 -	40		3. Backfilled with bentonite chips and auger cuttings.				
0 - 227		-40						
065 - 229.6 - 229.6 - 229.6 - 229.7 - 000:029.10-000:029.10 - 229.7 -]							1.
CAL			┏┳			<u>1</u>	<u> ·· ·· ·· ·· ·· ·· ·· ··</u>	1
Z SAM	PLE T			Sonic Barrel				
E CON	TRAC			INSPECTOR	APPROVE		DATE	
Ü E	addo	CK	Urill	Ling Ltd. M. SAALY	JRM		12/16/19	

	GROU	1.00	5		HOLE I		7	SHEET 1 of 1
SITI)JECT E	A F S N 1	Airport Prelimi Sturgeo 250 m S	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing inary Engineering n Road South of CentrePort Canada Way, East Shoulder of Sturgeon Road			JOB NO. GROUND ELEV. TOP OF PVC ELE ¹ WATER ELEV. DATE DRILLED UTM (m)	9/24/2019 N 5,532,002
	HOD	' S	ionic SI	DC 450, Track Drill Rig			-	E 623,816
ELEVATION (m)	(m) DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) \blacklozenge $20 \ 40 \ 60 \ 80$ PL MC LL \clubsuit $20 \ 40 \ 60 \ 80$ $20 \ 40 \ 60 \ 80$
239.2				<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand.				
- 239				- 30 mm organic clay observed at 0.3 m.		51		
238.4	1 - 1			CLAY FILL - Mottled black to grey, damp, stiff, high plasticity, some organics.			······································	
- 238		- 5		<u>CLAY (CH)</u> - Brown, damp, stiff, high plasticity. - Mottled brown to grey, damp to moist, trace silt nodules below 1.5 m.				
200	2							
					۲ ۲	52		
- 237								
		-10		- Grey, moist, trace fine to coarse grained gravel below 3.0 m.				
- ^{236,0} -	-[53		
	4			SILT TILL (ML) - Tan, damp, dense, some fine to coarse grained sand, some fine to coarse grained gravel, some cobbles.				
235.1		45				54		
- 233.59 -		- 15		LIMESTONE - White, weathered, soft. END OF TEST HOLE AT 4.7 m		55		
- 234				Notes: 1. TH19-07 open to 4.5 m below grade after the completion of drilling.				
	6-	-20		 Water encountered at 3.8 m below grade after the completion of drilling. Backfilled with bentonite chips and auger cuttings. 				······································
- 233								
	1							
- 232		- 25						
	8-1							
- 231								
- 231	9-1							
		-30						
230								
229		- 35						
229 - 229 - 229 - 227 - 227 - 227 - 227 - 227 - 227 - 227 - 227 - 227 - 227 - 227 - 227 - 227 - 229	11 -							
D-8110								
- 228								
		-40						
227	=							
								<u> </u>
SAM	IPLE T			Sonic Barrel	ADDE		D	
	TRAC			INSPECTOR Ling Ltd. M. SAALY	APPR JRM	OVE		DATE 12/16/19
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CLIEN PROJ SITE LOCA	ECT	Airport Prelimi Sturgeo	DF WINNIPEG - WATER AND WASTE DEPARTMENT A Area West Regional Water and Wastewater Servicing inary Engineering n Road South of CentrePort Canada Way, East Shoulder of Sturgeon Road		JOB NO. GROUND ELEV. TOP OF PVC ELE ¹ WATER ELEV. DATE DRILLED	9/25/2019
DRILL METH		Sonic SI	DC 450, Track Drill Rig		UTM (m)	N 5,532,179 E 623,821
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) \bigstar Cu TORVANE (kPa) \bigstar 20 40 60 80 PL MC LL % 20 40 60 80
- 237 - 2369 235.5 = - 236 - 237 - 236 - 234 - 233 - 231 - 232 - 231 - 231 - 232 - 231 - 232 - 231 - 232 - 231 - 232 - 231 - 232 - 231 - 232 - 231 - 232 - 231 - 232 - 231 - 232 - 232 - 231 - 232 - 231 - 232 - 232 - 231 - 232 - 232 - 231 - 232 - 232 - 231 - 232 - 232 - 232 - 231 - 232 - 231 - 231 - 232 - 3 - 232 - 3 - 232 - 3 - 232 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3	$\begin{array}{c} & & & \\ 1 & & & \\ 2 & & & \\ 2 & & & \\ 3 & & & \\ 4 & & & \\ 5 & & & \\ 5 & & & \\ 6 & & & \\ 7 & & & \\ 6 & & \\ 7 & & & \\ 8 & & \\ 1 &$		GRANULAR FILL Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. CLAY FILL - Mottled black to grey, damp, stiff, intermediate plasticity, some organics. - Trace coarse grained gravel below 0.9 m. CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules. SILT TILL (ML) - Tan, moist, dense. JURASSIC LIMESTONE - Red, weak. END OF TEST HOLE AT 4.5 m Notes: 1. TH19-08 open to 4.5 m below grade after the completion of drilling. 2. Water observed at 1.8 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.			
IICAL-SO			Sonia Dowal			
	LE TYP RACTO ddock	R		APPROVE JRM		DATE 12/16/19

	GROU	-	5		HOLE I		9	SHEET 1 of 1
SITI LOC DRII	DJECT E Ation Lling	A F S	Airport Prelimi Sturgeo 60 m S	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing Inary Engineering In Road Outh of CentrePort Canada Way, East Shoulder of Sturgeon Road DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELEV WATER ELEV. DATE DRILLED UTM (m)	19-0107-009 241.01 /. 9/25/2019 N 5,532,489 E 623,831
	DEPTH (m)	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION		NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) \star Cu TORVANE (kPa) 20 40 60 80 PL MC LL % 20 40 60 80
240.5				GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand.	s	61		· · · · · · · · · · · · · · · · · · ·
- 240 - 239		5		CLAY FILL - Mottled black to grey, damp, stiff, intermediate plasticity, some organics, trace coarse grained gravel.		52		
238.7				- 150 mm silt seam observed at 2.1 m.	_{			
- 2 <u>3</u> 80 _		-10		CLAY (CH) - Brown, damp, stiff, high plasticity, trace silt nodules. SILT TILL (ML) - Tan, damp, dense, some fine to coarse grained sand, some fine to coarse grained gravel. - Some cobbles below 3.3 m. - Moist below 3.9 m.		63 64 65		
236.7 _ 236.6 -			///////////////////////////////////////	LIMESTONE - Orange to white.		56		
CONECHNICAL-SOIL LOG U;FMS(19-0107-009(19-0107-009(19-0107-009(19-0107-009(19-0107-009(19-0107-009(19-0107-0107-0107-0107-0107-0107-0107-01		-20 -25 -30 -40		END OF TEST HOLE AT 4.4 m Notes: 1. TH19-09 open to 4.4 m below grade after the completion of drilling. 2. Water observed at 3.6 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.				
SAM	IPLE TY	γPE		Sonic Barrel			· · · · · · · · · ·	
CON	TRACT			INSPECTOR Ling Ltd. M. SAALY	APPR JRM	OVE		DATE 12/16/19

	GS	5		HOLE I)	SHEET 1 of 1
CLIEN PROJI SITE LOCAT DRILL	ECT	Airport Prelimi Sturgeo 570 m S	DF WINNIPEG - WATER AND WASTE DEPARTMENT A Area West Regional Water and Wastewater Servicing inary Engineering on Road Fouth of CentrePort Canada Way, East Shoulder of Sturgeon Road DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELEV WATER ELEV. DATE DRILLED UTM (m)	19-0107-009 241.24 /. 9/25/2019 N 5,532,672 E 623,801
ELEVATION (m)	m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) ✓ Cu TORVANE (kPa) ▲ 20 40 60 80 PL MC LL % 20 40 60 80
- 241 - 240 - 239	1 1 2 1 1		<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand.				
236.5 _ 238.2 _ 3 - 238 4 - 237 4 - 237 5 - 236			CLAY (CH) - Brown, damp, stiff, high plasticity, trace silt nodules. SILT TILL (ML) - Tan, damp, compact, some fine to coarse grained sand, some fine to coarse grained gravel, trace cobbles. - Yellow to brown, moist, some cobbles below 4.5 m.	; [] [] [] [] []	52 53 54 55		
235.1 6 - 235 7 - 234 7 - 234 233.5 2 233.3 6	7 - 25		SAND AND GRAVEL - Brown, damp, compact, fine to coarse grained gravel, some silt, some fine to coarse grained sand.		66 67		
- 233 Fd97600-2010-0100-0100-0100-0100-0100-0100-0			Notes: 1. TH19-09 open to 4.4 m below grade after the completion of drilling. 2. Water observed at 4.4 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.				
SAMPL	RACTOR	λ	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPR JRM	OVE		DATE 2/16/19

	G	5	REFERENCE NO.	HOLE NO TH19-		ļ	SH	EET 1	of 1
CLIE PROJ SITE	NT JECT ATION	Airport Prelimi Red Fife 1635 m	DF WINNIPEG - WATER AND WASTE DEPARTMENT A Area West Regional Water and Wastewater Servicing inary Engineering Road West of Oak Point Hwy, North shoulder of Red Fife Road DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELE ⁴ WATER ELEV. DATE DRILLED UTM (m)	D ELEV. 239.90 PVC ELEV. ELEV. RILLED 9/25/2019		76
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20, 40, 60		AVANE (kr 40 60 MC • % 40 60	Pa) ♦
239.7 - 239.4 - - 239	1 1 1 5		TOP SOIL - Black, damp, stiff, low plasticity, with organics, trace rootlets. GRANULAR FILL -Brown, damp, compact, fine to coarse grained gravel, trace fine to coarse grained sand. CLAY FILL - Mottled black to grey, damp, stiff, intermediate plasticity, some organics, trace silt nodules. - Black, damp to moist, trace rootlets below 0.7 m.	S1 S2 S3					
_ 238.1 _ _ 238 _ _ 237	2		CLAY (CH) - Mottled brown to grey, damp to moist, stiff, high plasticity, trace silt nodules, trace rootlets. - Brown, no rootlets below 3.0 m.	S4					
– 236 – 235	4		- Trace coarse grained gravel below 4.5 m.	\$5					
- 234 233.3 _	6 		- 150 mm silt seam observed at 5.8 m. - 300 mm silt seam observed at 6.0 m. <u>SILT TILL (ML)</u> - Tan, moist, loose, some fine to coarse grained sand, some fine to coarse grained gravel, trace cobbles.						
- 232 231.2	7		- Broken fragments of Jurassic bedrock below 8.2 m.	S6					
- 231 230.8	9 <u>1</u> 9 <u>1</u> 		JURASSIC LIMESTONE - Red, weak. END OF TEST HOLE AT 9.1 m Notes: 1. TH19-14 open to 8.8 m below grade after the completion of drilling. 2. Water observed at 3.3 m below grade after the completion of drilling.	S7					
228			3. Backfilled with bentonite chips and auger cuttings.						
227 SAMP	12	E	Sonic Barrel						
CONT	TRACTO addock		INSPECTOR Ling Ltd. M. SAALY	APPRO JRM	VEI		DATE 12/16/19	9	

	GROL	1.00	5		HOLE I TH1		5	SHI	EET 1	of 2
SITI LOC DRI)JECT E	• 4 F F N 1	Airport Prelimi Red Fife 470 m	DF WINNIPEG - WATER AND WASTE DEPARTMENT A Area West Regional Water and Wastewater Servicing Inary Engineering Road West of Oak Point Hwy, North shoulder of Red Fife Road DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELE ^T WATER ELEV. DATE DRILLED UTM (m)	D ELEV. 239.66 PVC ELEV. ELEV. RILLED 9/26/2019))85
ELEVATION (m)	DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20, 40, 60	Cu POC Cu TOR 20 PL 20 20		0 80 LL
_ 239.0 _ 239 _				GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. CLAY FILL -Black, damp, stiff, low plasticity, some organics, trace coarse grained					: : : : : : : : : :	
	1-			gravel, trace rootlets, trace cobbles.				::::::::::::::::::::::::::::::::::::::	:: :: :: :.	:: :: :: ::
- 238		- 5		- Mottled black to grey, intermediate plasticity, no rootlets below 1.5 m.	S	51				
- 237								<u></u>		
236.6	3-	-10		CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules,	s	52				•
- 236				trace coarse grained gravel.	s	3				
	4-							······································		······································
- 235		- 15								
	5-1			- Firm to stiff below 5.1 m.				······································	······	······································
^{234.2} _				SILT TILL (ML) - Tan, moist, loose, trace fine grained sand.	-					
	6-	-20		- Some fine to coarse grained sand, some fine to coarse grained gravel below 6.0 m		54				
- 233						55		::!::!::! :-!:-!:-!	:: :: :: :- :- :-	
	7							*	· · · · · · · · · · · · · · · · · · ·	·····
000		- 25		- Cobbles encountered below 7.1 m.	s	6				
- 232	8-	20								125
				- Damp, compact below 8.0 m.					·····	
- 231					s	9				
25		-30		- Dense below 9.1 m.						
230				- Brown below 9.4 m.			······································			······································
010-81				- Grey to red below 10.0 m.						
229		- 35			S	10				
010-81										
228.1 - 228 - 227.8 -			<u> / X/X/X/</u>	JURASSIC LIMESTONE - Red, weak.	S	11				
	12-	-40		END OF TEST HOLE AT 11.8 m						· · · · · · · · · · · · · · · · · · ·
228.1 227.8 200 200 200 200 200 200 200 200 200 20				Notes: 1. Water observed at 5.5 m below grade after the completion of drilling.						
SAM	I – IPLE T	YPE	Π	Sonic Barrel		1	<u> </u>	········	<u>·······</u>	<u>···········</u>
CON	TRAC	TOR		INSPECTOR	APPR	OVE		DATE		
j I	addo	ck	Drill	Ling Ltd. M. SAALY	JRM			12/16/19)	

	GROUP	ŝ			SPT (N)			(et pen 'Ane (kf	
VIIO	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	TYPE RY %	blows/0.15 m 🔺		20	40 60	80
ELEVATION (m)		GRA		SAMPLE TYPE NUMBER RECOVERY %	DYNAMIC CONE (N) blows/ft \triangle	P	י∟ 	MC	
ш	(m) (ft)			SANNUN	20 40 60		20	% 40 60	80
			2. Test hole sloughing condition could not be measured due to the drillers broken rod which fell in the test hole after the completion of drilling.					. . : : . : 	
226	45		3. Backfilled with bentonite chips and auger cuttings.						
						:::::			:1::1
225									
	15							· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·
224						╏┄╏╌		╡╌╡╌╡╴	
	16 –								
223									
	17 <u>-</u> 55								<u>: :: </u>
								: :: :: : 	::::
222	18								
	60								::::: ::::::
221									
220									
	20								
219							1-1-	-111 - : : : : : :	++ ::
	21								
218							- :: :		
	22							<u> - - -</u> - - -	<u> </u>
217									
	23 - 75					:: :: 	1::1: 11:	: :: :: : - -	: :: -
216									
216	24 –						1::1:	: :: :: : - - -	:1::1
	80							: :: :: : : :: :: :	
215	25							: :: :: : : :: :: :	:::: : ::
214									
213					┝╼╸ ┊╼╸┝╼╸┊╼╸ │╼╼┊╼╼┥╺╼╡╺╼ ╴╴╴╴┝╴╴┊╸╴┝╴╴╴╸┥╴╴╸ ╴╴╴				
	27 –								
212	90 								<u> </u>
	28 –								
SAM	I I I I I I I I I I I I I I I I I I I	П	Sonic Barrel	.		11	11.		<u>-11</u>

		S		HOLE 1 TH1		6	SHI	CET 1 c	of 1
SITE	JECT	Airport Prelimi Red Fife 1278 m ¹	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing Inary Engineering Road West of Oak Point Hwy, North shoulder of Red Fife Road DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED UTM (m)	240 V. 9/2 N \$	0107-009 0.07 6/2019 5,534,090 525,160	
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60		KET PEN (1 VANE (kPa 40 60 MC % 40 60	
- 240 239.6 _ - 239	1 1 5		<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. <u>CLAY FILL</u> - Mottled black to grey, damp, stiff, intermediate plasticity, some organics, trace coarse grained gravel, trace rootlets.		51				•
238.1 _ - 238 - - 237	2		CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules, trace coarse grained gravel.		52				
- 236 235.2 _ - 235	4		<u>SILT TILL (ML)</u> - Tan, moist, loose, trace fine grained sand, trace fine grained gravel.		33				
- 234 - 233	6 <u>-</u> 20 7 <u>-</u>		- Trace cobbles below 6.0 m.	E s	64				
– 232 231.2 _ – 2 20 9			- Moist to wet below 7.6 m. - Pink below 8.2 m. JURASSIC LIMESTONE - Red, weak.	s	\$5				
	10		END OF TEST HOLE AT 9.1 m Notes: 1. TH19-16 open to 6.4 m below grade after the completion of drilling. 2. Water observed at 3.3 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cutting						
GEOTECHNICAL-SOIL LOG U/FMS/19-0107-009/19-0107-009.GPJ BAN VOD 827 657 657 757 657 757 657 757 757 757 75	11								
SAM CON CON P	PLE TYPI TRACTOI Paddock	<u></u>	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPR JRM	OVE		DATE 12/16/19		

1000	GROU		5		HOLE N TH19		7	SHEET 1 of 1
PRC SIT LOC	ATION	A P R	Airport Prelimi Red Fife 155 m V	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing Inary Engineering Road West of Oak Point Hwy, North shoulder of Red Fife Road			JOB NO. GROUND ELEV. TOP OF PVC ELEV WATER ELEV. DATE DRILLED UTM (m)	19-0107-009 240.18 /. 9/26/2019 N 5,534,093
	LLING THOD	S	onic SI	DC 450, Track Drill Rig				E 625,285
ELEVATION (m)	(m) DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) ▲ Cu TORVANE (kPa) ▲ 20 40 60 80 PL MC LL % 20 40 60 80
- 240			****	GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine				
239.7 <u>-</u> - 239 238.4		5		to coarse grained sand. CLAY FILL - Mottled black to grey, damp, stiff, intermediate plasticity, some organics, some fine grained gravel, trace silt nodules, trace rootlets.	s S			
- 238				CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules.	s:			
- 237		-10		- Damp to moist below 3.3 m. - 30 mm silt seam observed at 3.8 m.				
- 236 235.3		15		- 30 mm silt seam observed at 4.1 m. - 40 mm silt seam observed at 4.5 m.				
- 235				SILT TILL (ML) - Tan, moist, compact, some fine to coarse grained sand, some fine to coarse grained gravel, trace cobbles.	s	5		
- 234		-20		- With fine to coarse grained sand, with fine to coarse grained gravel below 6.4 m.				
- 233 232.4		25		- Cobbles encountered below 7.0 m.	S	6		
232.3 - - 232				<u>JURASSIC LIMESTONE</u> - Red, weak. END OF TEST HOLE AT 7.9 m Notes:				
– 231 GD:600	9	-30		 TH19-17 open to 7.3 m below grade after the completion of drilling. Water observed at 5.2 m below grade after the completion of drilling. Backfilled with bentonite chips and auger cuttings. 				
-230		35						
-7010-0107- 1 555								
GEOTECHNICAL-SOIL LOG U:/FMS/19-0107-009/19-0107-009.GFJ 877 677 WPS 100 677 100 677		-40						
SAN	PLE TY	/PE		Sonic Barrel				
CON GEOTEC	TRACI Paddo			INSPECTOR Ling Ltd. M. SAALY	APPRO JRM	OVE		DATE 12/16/19

	G	S	REFERENCE NO.			DLE NO H19-		SHEET 1 of 1
SITE LOC DRII	JECT E ATION	Airport Prelim Park Ro 810 m V	DF WINNIPEG - WATER AND WASTE DEPARTME t Area West Regional Water and Wastewater Servinary Engineering yale Way Vest of Roy Roche Dr, South Shoulder of Park Royale Way DC 450, Track Drill Rig	/icing			JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED UTM (m)	19-0107-009 239.60 EV. 9/26/2019 N 5,534,128 E 625,626
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE NUMBER	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) 20 40 60 80 PL MC LL % 20 40 60 80
- 239 - 238.2 - - 237 - 237 - 236 - 236 - 237 - 236 - 236 - 237 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 239 - 231 - 237 - 239 - 237 - 238 - 237 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 237 - 238 - 237 - 237 - 238 - 237 - 238 - 237 - 237 - 238 - 237 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 238 - 237 - 237 - 237 - 238 - 237	$\begin{array}{cccccccccccccccccccccccccccccccccccc$)	GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, with fine to coarse grained sand. CLAY FILL - Mottled black to grey, damp, stiff, low plasticity, some organics. CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules. SILT TILL (ML) - Tan, damp, loose, some fine to coarse grained sand, some fine to coarse grained gravel. - Trace cobbles below 6.4 m. JURASSIC LIMESTONE - Red, weak. END OF TEST HOLE AT 7.6 m Notes: 1. Installed a 25.4 mm diameter PVC standpipes with 0.3 m casagrande tip to 7.0 m below grade. 2. Test hole sloughing condition and water level could not be measured due to the installation of standpipe. 3. Backfilled with bentonite chips and auger cuttings.		5.5 6.2	S1		
SAM CON CON P	PLE TYP TRACTO Paddock	R	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY			APPROV RM		DATE 12/16/19

KGS		HOLE NO. TH19-1 9)	SHEET 1 of 1
PROJECT Airport Prelim SITE Park Ro LOCATION 650 m V	DF WINNIPEG - WATER AND WASTE DEPARTMENT t Area West Regional Water and Wastewater Servicing inary Engineering byale Way Vest of Roy Roche Dr, South Shoulder of Park Royale Way DC 450, Track Drill Rig		JOB NO. GROUND ELEV. TOP OF PVC ELE ^T WATER ELEV. DATE DRILLED UTM (m)	19-0107-009 239.46 V. 9/26/2019 N 5,534,129 E 625,786
ELEVATION (m) (m) (m) (m) (m) (m) (m) (m)	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ♦ 20 40 60 80 PL MC LL % 20 40 60 80
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. CLAY (CH) - Mottled brown to grey, moist, stiff, high plasticity. SILT TILL (ML) - Tan, moist, loose, some fine to coarse grained sand, some fine to coarse grained gravel. LIMESTONE - White to yellow. END OF TEST HOLE AT 4.5 m Notes: 1. TH19 open to 1.8 m below grade after the completion of drilling. 2. Water suspects to be deeper than 1.8 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.			
SAMPLE TYPE CONTRACTOR Paddock Dril:	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPROVE		:: :: :: :: :: :: :: :: :: :: :: :: ::

		S		HOLE FH1)	SHEE	T 1 of 1
SITE	JECT	Airport Prelimi Park Ro 500 m W	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing inary Engineering yale Way West of Roy Roche Dr, South Shoulder of Park Royale Way DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELE ^T WATER ELEV. DATE DRILLED UTM (m)	239.4 V. 9/27/2	2019 534,114
ELEVATION (m)	(f) (f) (f)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20, 40, 60	Cu POCKE Cu TORVA 20 40 PL 20 40) 60 80 MC LL ♥ ∎
- 239	1		<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. - Trace cobbles below 0.7 m.					
- 238.0 - 238 - - 237	2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		<u>CLAY (CH)</u> - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules, trace coarse grained gravel.		S1			
- 236 235.3 _ - 235			SILT TILL (ML) - Tan, moist, loose, some fine to coarse grained sand, some fine to coarse grained gravel.	_				
- 234	5 5 6		- Compact below 5.3 m. - Trace cobbles below 5.5 m.		52			
- 233 232.6 _ 232.3 _ - 232			- With fine to coarse grained gravel below 6.0 m. <u>JURASSIC LIMESTONE</u> - Red, weak. END OF TEST HOLE AT 7.1 m		S3 S4			
- 231	8		Notes: 1. TH19-20 open to 3.6 m below grade after the completion of drilling. 2. Water suspects to be deeper than 0.6 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.					
C - 230 - 230 - 229 - 229	9							
GEOTECHNICAL-SOIL LOG U:FMS/19-0107-009/19-0107-009.GPJ M V S 82 657 052 M V S 82 657 052 052 052 052 052 052 052 052 052 052	11							
	12		Sonic Barrel					
	TRACTO	λ	INSPECTOR Ling Ltd. M. SAALY	APPR JRM	OVE		DATE 12/16/19	

	G	S	REFERENCE NO.	HOLE N TH19		1	SHEET 1 of 1
SITE	JECT E ATION	Airport Prelimi Park Ro 345 m V	DF WINNIPEG - WATER AND WASTE DEPARTMENT A Area West Regional Water and Wastewater Servicing inary Engineering yale Way Vest of Roy Roche Dr, South Shoulder of Park Royale Way			JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED UTM (m)	9/27/2019 N 5,534,123
MET			DC 450, Track Drill Rig			1	E 626,090
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) \star Cu TORVANE (kPa) \bullet 20 40 60 80 PL MC LL * 20 40 60 80 20 40 60 80
- 239			<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand.				
_ 238.0 _ 238 − _ 237	2 +		CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules, trace coarse grained gravel.	S1	1		
236.5 _ - 236	3-1-10 		SILT TILL (ML) - Tan, moist, loose, some fine to coarse grained sand, some fine to coarse grained gravel. - Moist to wet, trace cobbles below 3.6 m. - Compact at 4.0 m.	\$2 \$3 \$3	3		
- 235 - 234	-+ -+ -+ 5 + 5 + -+						
- 233	6 <u>1</u> 20		- Cobbles observed at 5.9 m. - Damp below 6.2 m.	\$5 \$6 \$7	5 7		
- 232	8		- Red, dense below 7.0 m. - Very dense below 7.6 m.	S	3		
- 231	9 30 9 3 3			S	9		
228.4 -	10						
228.4 – 229 228.4 – 228 228.1 – 228 228.1 – 228 228.1 – 228 228.1 – 228 228.1 – 228 228.1 – 228 228.1 – 228	12		JURASSIC LIMESTONE - Red. END OF TEST HOLE AT 11.4 m Notes: 1. TH19-21 open to 3.3 m below grade after the completion of drilling. 2. Water observed at 0.6 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.	S1	0		
SAM	PLE TYP TRACTO	R	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPRC JRM	DVE		DATE 12/16/19

		5	REFERENCE NO.	HOLE NC TH19-		2	SH	EET 1 o	of 1
PRO	E	Airport Prelimi Park Ro	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing Inary Engineering Hyale Way West of Roy Roche Dr			JOB NO. GROUND ELEV. TOP OF PVC ELEV. WATER ELEV. DATE DRILLED	240 /. 9/2	-0107-009 0.96 27/2019	
	LLING THOD	Sonic S	DC 450, Track Drill Rig			UTM (m)		5,534,126 626,254)
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION		RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60		MC • %	
- 240 239.4			<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, with fine to coarse grained sand.						
- ² 289 -			CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules, trace coarse grained gravel.						•
238.1			SILT TILL (ML) - Tan, damp, loose, some fine to coarse grained sand, some fine to coarse grained gravel, trace cobbles.				· · · · · · · · · · · · · · · · · · ·		
- 238)	END OF TEST HOLE AT 2.9 m						
- 237		5	 TH19-22 open to 2.7 m below grade after the completion of drilling. Water observed at 0.9 m below grade after the completion of drilling. Backfilled with bentonite chips and auger cuttings. 						
- 236									
- 235	6- <u>1</u> -20)							
- 234									
- 233		,							
- 232 Gg	9)							
.600-231									
1600-2010-61		5							
COTECHNICAL-SOIL LOG U:FMS/19-0107-009.6PJ 662 - 572 662 - 572 672 672 709.19-0107-009.6PJ 672 709.19-0107-009.6PJ 709.201 709.701 709.701 709.702 7009.702 700.702 70000000000)							
T-SOIL L									
SAN	IPLE TYP		Sonic Barrel						
EOT CON	NTRACTO Paddock		INSPECTOR Ling Ltd. M. SAALY	APPROV JRM	VEI		DATE 12/16/19)	

		5		HOLE I TH1		3	SHEET 1 o	of 2
SITE	JECT	Airport Prelimi nkster I 105 m E	DF WINNIPEG - WATER AND WASTE DEPARTMENT A Area West Regional Water and Wastewater Servicing Inary Engineering Boulevard Fast of Roy Roche Dr, South Shoulder of Park Royale Way DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELE [®] WATER ELEV. DATE DRILLED UTM (m)	19-0107-00 238.73 V. 9/27/2019 N 5,534,13 E 626,546	
ELEVATION (m)	HOD THOD DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (Cu TORVANE (kPa 20 40 60 PL MC % 20 40 60	
238.1 238 237	1 1 1 2 1 1		GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. CLAY FILL - Mottled black to grey, damp, firm, intermediate plasticity, some organics, some fine to coarse grained sand, some fine to coarse grained gravel.	_	51			
236.1 _ - 236 - 235	3 		<u>SILT TILL (ML)</u> - Tan, damp, compact, some fine to coarse grained sand, some fine to coarse grained gravel.		52 53			 178
- 234 - 233	6 - - - - - - - - - - - - -		- 100 mm sand seam observed at 4.7 m. - Dense below 5.2 m.	E S	54			~~~
- 232 - 231 - 230	7		- Very dense below 8.5 m.		55			
Cd5)600-701-0-61/600-70	9				56			
GEOTECHNICAL-SOIL LOG U/FMS/19-0107-009/19-0107-009.GPJ 822								
SAM CON CON E	PLE TYPE TRACTOF Paddock	ξ	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPR JRM	OVE		DATE 12/16/19	

E B ST (N) S	(m)		Ņ				SPT (N)					KET F /ANE		-	a)
m m 55 2 2 20 40 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00 200 400 00	TION	PTH	рніс	DESCRIPTION AND CLASSIFICATION	TYPE	۲۶ %	blows/0	.15 n			20	40	60	80	0
Image: Problem in the second of the	-EVA	DE	GRA		PLE.		DYNAM (N) blow	IC CC /s/ft		P	<u>ال</u>	M	c	L	L
23 Image: Control in the control in	Ξ	(m) (ft)			N UM N UM	REC	20	40 6	50		• 20			80	•)
22 Notes: 1 </td <td>225.5 _</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1::1:</td> <td>:1::1</td> <td></td> <td></td> <td></td>	225.5 _										1::1:	:1::1			
14 1 1.1.1.2.3 open to 1.1.2. m below grade after the completion of diffing. 24 1.5 -00 3. Backfilled with bentonite chips and auger cuttings. 26 1.5 -00 1.5 1	225	45				Ī			; ;						
22 3. Backfilled with bencome chips and auger cuttings. Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. 22 Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. 23 Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. 24 Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. 24 Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. 24 Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. 24 Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. 24 Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. 24 Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. Image: Control of the chips and auger cuttings. <		14		1. TH19-23 open to 11.2 m below grade after the completion of drilling.		ł					1::1:	:1::1		1::1	
16	224			 Backfilled with bentonite chips and auger cuttings. 		ł									
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	SAM	IPLE TYPE		Sonic Barrel	P					<u> </u>				<u></u>	

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SITE	JECT	Airport Prelimi Inkster I	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing Inary Engineering Boulevard ast of Roy Roche Dr, South Shoulder of Park Royale Way		JOB NO. GROUND ELEV. TOP OF PVC ELEV WATER ELEV. DATE DRILLED	19-0107-009 237.41 /. 9/28/2019
DRII			DC 450, Track Drill Rig		UTM (m)	N 5,534,137 E 626,755
ELEVATION (m)	(a) (a) (a) (a)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER RECOVERY %		Cu POCKET PEN (kPa) \star Cu TORVANE (kPa) \bullet 20 40 60 80 PL MC LL % 20 40 60 80
- 237 236.6 _	т. 		GRANULAR FILL -Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. CLAY FILL -Grey, moist, stiff, high plasticity, trace rootlets.	S1		
- 2 33 99 _	2 2 1 1 1 1 1 1 1 1		<u>CLAY (CH)</u> - Mottled brown to grey, moist, stiff, high plasticity, trace silt nodules, trace coarse grained sand, trace fine grained gravel.	S2 S3 S3		
- 234	3 10 		- Trace silt nodules below 3.0 m.			
- 233	4 		- Cobbles encountered at 4.2 m.	S5		
- 232 231.2 _ - 231	6 20		- Firm below 5.8 m. - Cobbles encountered at 6.0 m. <u>SILT TILL (ML)</u> - Tan, moist, dense to very dense, some to with coarse grained gravel, trace to some fine grained gravel, some fine to coarse grained sand, trace	S6		
- 230	7		clay.	S8		225
- 229	9 1 1 1 1 1 1 1 1 30		- Moist to wet below 9.1 m.	S9		
			- Cobbles encountered at 9.7 m. - 600 mm layer of sand till at 9.7 m. - Red to brown below 10.3 m.	S10 S11 S12		
C10-000-000-000-000-000-000-000-000-000-	11			S13 S14 S15		
SAM	PLE TYP		Sonic Barrel			
	TRACTO addock		INSPECTOR Ling Ltd. M. Alfaro	APPROVEI JRM		DATE 2/16/19

	GROUP										(ET P		
ELEVATION (m)	F	GRAPHICS		ΥΡΕ < %		SPT (N) blows/0.	.15 m					60	80
EVAT	DEPTH	ŝRAP	DESCRIPTION AND CLASSIFICATION	LE T BER VER		DYNAMI (N) blow	C CO	NE △	P	1	MC		
EL	(m) (ft)	0		SAMPLE TYPE NUMBER RECOVERY %		20 4			2	20 4	% 40	60	80
224.3			LIMESTONE Red, weak. END OF TEST HOLE AT 13.2 m		-						 . : :: :		
224	45		Notes:										
000			 TH19-24 open to 10.9 m below grade after the completion of drilling. Water observed at 8.2 m below grade after the completion of drilling. 								:1::1:	::::	
223			3. Backfilled with bentonite chips and auger cuttings.										
	15												
222					ŀ					- -	++- :::::		
	16												
221											 : :: :		: [::
	17 -										<u> -</u> : :: :	<u>- </u>	
220											,		
										.: ::: ::	 . 		
219													
	19				-						<u> </u> 	<u></u>	
218													
	20 - 65				-	::::::::::::::::::::::::::::::::::::::	::::: : ::::::::::::::::::::::::::::::		:: :: :. .:	:: :: 	: :: : : :: :	::::	:: :
217											: :: : - -		
	21							•••••	••••	i··i··		••i••i	i • • i ·
216										1::1::			
	22											<u></u>	
215					-								
	23 - 75								· · · · ·	:: :: .	: :: : . .	::::: -:: :	:: :
214													
	24 –										<u> </u> 	:: : 	
213													
	25					· · · · · · · · · · · · · · · · · · ·						·····	
212										:: :: .		::::: 	
	26 - 85										<u> :: :</u> -		
211										:: :: -	1:1:	:::: 	::::
	27												
210	90												
	28					::::::::::::::::::::::::::::::::::::::				:: :: :: ::	::::: :::::::	:1::1	
											: . : :: :		
	IPLE TYPE		Sonic Barrel INSPECTOR	APPROVI	ED			1	DATI	F			
		Dril	ling Ltd. M. Alfaro	JRM					12/16				

	GROL	1.00	5	REFERENCE NO.	HOLE TH1		25			SHE	ET :	1 of 1
SITE	JECT : ATIO .LING	· A P Ir N 4	Airport Prelimi hkster I 45 m E	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing Inary Engineering Boulevard ast of Roy Roche Dr, South Shoulder of Park Royale Way DC 450, Track Drill Rig			G TC W D,	DB NO. ROUND ELEV. DP OF PVC ELE /ATER ELEV. ATE DRILLED TM (m)		236 9/28 N 5)107- .66 8/201 ,534, 26,88	9 142
ELEVATION (m)	(m) DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER RECOVERY %		PT (N) lows/0.15 m ▲ YNAMIC CONE I) blows/ft △ 20 40 60	Cu	20 	ANE (40 0 MC %	60 80
236.5 - - 2 38 9 - - 235.1 - - 235	1 1 2 1	- 5		TOP SOIL - Black, damp, compact. GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. CLAY FILL - Mottled grey to black, moist, firm to stiff, intermediate plasticity, trace coarse grained gravel, some to with fine to coarse grained gravel. - High plasticity, no gravel below 1.2 m. CLAY (CH) - Mottled brown to grey, moist, stiff, high plasticity, some to with silt nodules, trace oxidation, trace coarse grained sand, trace fine grained gravel.		S1 S2 S3 S4						
- 234 - 233 - 232				- Firm below 3.3 m.		S5						
231.8 _ - 231 - 230	5 6 6	-20		SILT TILL (ML) - Tan, moist, compact, trace fine grained gravel, trace coarse grained sand, trace to some fine grained sand.		S6 S7					:1::1::	<pre></pre>
- 229	7	- 25		- Trace to some fine grained gravel, no cobbles below 7.3 m. - Damp to dry, very dense below 8.0 m.		S8						225 1 223 1 223 1 225 1 225
227.2 _ _ 2 <u>37</u> 1 -	9	30		- Cobbles encountered at 9.1 m. LIMESTONE White, weak. END OF TEST HOLE AT 9.6 m Notes:		S9 S10	,					
- 225	11	- 35		 TH19-25 open to 8.8 m below grade after the completion of drilling. Water observed at 8.7 m below grade after the completion of drilling. Backfilled with bentonite chips and auger cutting 								
CON	T PLE T TRAC addc	TOR		Sonic Barrel INSPECTOR Ling Ltd. M. Alfaro	APPI JRM		ED		DA7 12/1	TE 6/19		<u> :: :: :: ::</u>

the second second second second second second second second second second second second second second second se		S	REFERENCE NO.	HOLE NO. TH20-0 1	1	SHEET 1 of 1
SITE		Airport Prelimi Murray 235 m V	DF WINNIPEG - WATER AND WASTE DEPARTMENT t Area West Regional Water and Wastewater Servicing inary Engineering Park Road Vest of Moray Street, North Shoulder of Murray Park Road DC 450, Track Drill Rig		JOB NO. GROUND ELEV. TOP OF PVC ELE ^T WATER ELEV. DATE DRILLED UTM (m)	19-0107-009 237.78 m V. 2/3/2020 N 5,528,369 E 624,632
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) 20 40 60 80 PL MC LL % 20 40 60 80
237.5 _ 237.4 = _ 237			ASPHALT GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, with fine to coarse grained sand. CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity.	S1		
- 236 - 235	2		- Trace silt nodules below 1.5 m. - Trace coarse grained gravel, some silt pockets below 3.0 m. - 200 mm silt seam observed at 3.3 m.	S 3		
- 234 233.5 _ - 233	4		<u>SILT TILL (ML)</u> - Tan, damp, compact, trace fine to coarse grained gravel, trace coarse grained sand. - Trace cobbles below 4.5 m.	S4		
- 232 - 231	6 - <u>1</u> - 20		- With coarse grained gravel below 6.0 m.	5 6		
230.2 _ - 2 2 9.9 _	8 - 25		JURASSIC LIMESTONE - Red, weak. END OF TEST HOLE AT 7.9 m	S7		
- 229 G. 5. 60. - 228	9 1 1 30		Notes: 1. TH20-01 open to 7.1 m below grade after the completion of drilling. 2. Water observed at 4.2 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.			
GEOTECHNICAL-SOIL LOG UVFMS/19-0107-009/19-0107-009.GPJ BAV 252	10					
- 226 - 226 - 225 - 225 - 225	12					
SAM CON CON E	PLE TYP TRACTO Paddock	R	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPROVE JRM		DATE 3/9/20

the second second second second second second second second second second second second second second second se		S	REFERENCE NO.	HOLE TH2		2	SH	EET 1 O	f 1
SITE LOC DRII	JECT	Airport Prelimi Murray 500 m V	OF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing nary Engineering Park Road Vest of Moray Street, North Shoulder of Murray Park Road DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELE [®] WATER ELEV. DATE DRILLED UTM (m)	238 V. 2/3 N 4	.0107-009 3.62 m //2020 5,528,377 624,389	
ELEVATION (m)	(ft) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60		MC %	
238.3 _ _ 2398 _ _ 237 _ 237 _ 236 _ 235 _ 234.4 _	1 1 1 2 3 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		ASPHALT CLAY FILL - Mottled black to grey, damp, stiff, low plasticity, trace fine to coarse grained gravel, some organics. CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity. - Trace coarse grained gravel below 0.7 m. - Trace silt nodules below 1.5 m. - Some silt nodules below 2.1 m.		S1 S2 S3				
- 234 - 233 - 232 231.2 - 2 30 .8			SILT TILL (ML) - Tan, damp, dense, trace fine to coarse grained sand, with fine to coarse grained gravel Very dense below 6.4 m. JURASSIC LIMESTONE - Red, weak.		S4 S5 S6				
GEOTECHNICAL-SOIL LOG U:FMS/19-0107-009/19-0107-009/GPJ 622 622 622 622 622 622 622 622 622 62	8 9 10 12 12 14 14 14 14 14 14 14 14 14 14		END OF TEST HOLE AT 7.7 m Notes: 1. TH20-02 open to 7.7 m below grade after the completion of drilling. 2. Water observed at 6.4 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.						
SAM SAM CON CON P	PLE TYPI TRACTOI Paddock	<u></u>	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPF JRM	ROVE		DATE 3/9/20		<u></u>

		S	REFERENCE NO.	HOLE NO. TH20-0	3	SHEET 1 of 1
SITE LOC DRII	JECT E ATION	Airport Prelimi Murray 320 m E	DF WINNIPEG - WATER AND WASTE DEPARTMENT t Area West Regional Water and Wastewater Servicing inary Engineering Park Road tast of Sturgeon Road, North Shoulder of Murray Park Road DC 450, Track Drill Rig		JOB NO. GROUND ELEV. TOP OF PVC ELEV WATER ELEV. DATE DRILLED UTM (m)	2/3/2020 N 5,528,390
ELEVATION (m)	HOD DEPTH (m) (tt)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER RECOVERY %		E 624,024 Cu POCKET PEN (kPa) \star Cu TORVANE (kPa) \bullet 20 40 60 80 PL MC LL \star 20 40 60 80 0
- 240 239.8 _ 239.6 - 239.3 _ - 239 - 239	1 2		ASPHALT GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. CLAY FILL - Mottled black to grey, damp, stiff, low plasticity, with organics, trace rootlets. CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules.	S1 S2 S3 S3		
237.8 _ 237.3 _ _ 237.0 _ _ 237 _	3 + 10		SILT TILL (ML) - Tan, damp, dense, trace fine to coarse grained sand, with fine to coarse grained gravel, trace cobbles. LIMESTONE - White, weak. END OF TEST HOLE AT 3.0 m	S4		
- 236 - 235	4		Notes: 1. TH20-03 open and dry after the completion of drilling. 2. Backfilled with bentonite chips and auger cuttings.			
- 234	6 					
- 233 - 232	8 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1	;				
- 231 - 230	9 + 30 9 + 30 10 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 +					
- 229	11					
- 229 - 229 - 228 SAM CON	PLE TYP		Sonic Barrel			
CON	TRACTO addock		INSPECTOR Ling Ltd. M. SAALY	APPROVE JRM		DATE 5/9/20

		5	REFERENCE NO.	HOLI TH			4			SH	EET	1	of 1
SITE LOC DRII	DJECT A F E N ATION 4	Airport Prelimi Aurray 0 m Ea	DF WINNIPEG - WATER AND WASTE DEPARTMENT A Area West Regional Water and Wastewater Servicing Inary Engineering Park Road Ist of Sturgeon Road, North Shoulder of Murray Park Road DC 450, Track Drill Rig				top (Wate	JND E DF PV ER ELI DRIL	C EL EV.	23 2/. N	9-010 99.95 3/20 5,52 623	5 m 20 28,38	
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (blows DYNA (N) bl	s/0.15 MIC C ows/fi	ONE	u PO u TOF 20 PL ∎ 20	RVAN 40	E (kP 60 //C	(kPa) ★ a) ♦ 80 LL 80 80
239.6 _ - 239 238.7 _ - 238	1 1 2		ASPHALT GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. SILT TILL (ML) - Tan, damp, dense, some fine to coarse grained gravel. - Boulder encountered at 1.5 m.										
- 237 - 236	2 		- Very dense below 2.4 m. - Boulder was observed at 3.2 m. - Trace cobbles below 3.2 m.		S3 S4								
- 235 234.5 _ 234.2 _ - 234	5 		- Some cobbles below 4.1 m. JURASSIC LIMESTONE - Red, weak. END OF TEST HOLE AT 5.8 m		S6								
- 233	6 <u>-</u> 20 7 <u>-</u> 7 <u>-</u> - 25		Notes: 1. TH20-04 open to 5.8 m below grade after the completion of drilling. 2. Water observed at 3.6 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.										
- 232 - 231	8 												
- 230 - 229	10												
- 229 - 228 - 227 - SAM - CON	12 – 40 – 40 – – 40 – – – – – – – – – – – – – – – – – – –		Sonic Barrel										
	TRACTOR Paddock		INSPECTOR Ling Ltd. M. SAALY	APF JRM		VE	D			ATE 9/20			

		S	REFERENCE NO.	HOLE I TH2		5	SH	EET 1 of	£ 1
SITE	JECT	Airport Prelimi Sturgeo 220 m N	DF WINNIPEG - WATER AND WASTE DEPARTMENT t Area West Regional Water and Wastewater Servicing inary Engineering In Road lorth of Murray Park Road, East Shoulder of Sturgeon Road DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELEV WATER ELEV. DATE DRILLED UTM (m)	23 /. 2/4 N	-0107-009 9.76 m 4/2020 5,528,600 623,708	
	HOD HLA30 (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION <u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, some fin	SAMPLE TYPE	NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu PO	CKET PEN (kl RVANE (kPa) 40 60 MC %	Pa) ★ 80 LL - ■ 80
239.3 _ 238.7 _ 238.7 _ 238.7 _ 238.3 _ 236.3 _ 236.3 _ 236.4 _ 237 _ 236.3 _ 236.4 _ 237 _ 236 _ 237 _ 236 _ 237 _ 236 _ 237 _ 238	$\begin{array}{c} & 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1$		to coarse grained sand. CLAY FILL - Mottled black to grey, damp, stiff, low plasticity, trace fine to coarse grained gravel, with organics. CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity. - Trace silt nodules below 1.5 m. - Some silt nodules below 3.0 m. SILT TILL (ML) - Tan, damp, dense, with fine to coarse grained gravel, trace cobbles, trace fine to coarse grained sand. - Very dense below 4.4 m. - Pink below 4.5 m. - Red below 7.3 m. JURASSIC LIMESTONE - Red, weak. END OF TEST HOLE AT 9.1 m Notes: 1. TH20-05 open to 8.0 m below grade after the completion of drilling.		51 52 53 55 55 56 57 58				- 150 - 150
CON	10	<u></u>	In 120-05 open to 8.0 m below grade after the completion of drilling. Water observed at 5.1 m below grade after the completion of drilling. Backfilled with bentonite chips and auger cuttings. Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPR JRM	OVE		DATE 8/9/20		

	G		REFERENCE NO.	HOLE N TH20		5	SH	EET 1	of 1
CLIE PRO SITE LOC	INT JECT ATION	CITY Airpo Preli Sturg 170 m	OF WINNIPEG - WATER AND WASTE DEPARTMENT ort Area West Regional Water and Wastewater Servicing minary Engineering eon Road South of Saskatchewan Avenue Avenue, East Shoulder of Sturger SDC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELEV WATER ELEV. DATE DRILLED UTM (m)	23 /. 2/4 N	-0107-00 9.98 m 4/2020 5,528,94 623,734	
ELEVATION (m)	(m) (f)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu PO	Aug CKET PEN (RVANE (kPa 40 60 MC • • % 40 60	
- 239 238.8 _		5	CLAY FILL - Mottled black to grey, damp, stiff, low plasticity, trace coarse grained gravel, some organics, trace rootlets. CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules, trace fine grained gravel.	d			::::::		i::i::i::
- 238 237.7 _ - 237	2 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10	SILT TILL (ML) - Tan, damp, compact to dense, some fine to coarse grained grai	52					
- 236 - 235	4 1 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	15	- Dense below 4.0 m.	S3	5				
- 234 - 233	6 1 7 1 7 1	20		S4					
- 232 231.1 _ - 233.8	0 8 0	25	- Red below 7.3 m. - Very dense below 7.6 m. LIMESTONE - White, weak.	S5					220
		30	END OF TEST HOLE AT 9.1 m Notes: 1. TH20-06 open to 9.1 m below grade after the completion of drilling. 2. Water observed at 7.0 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.						
229 - 229 - 228 - 227 - 228 - 227 - 228 - 227 - 228 - 227 - 228 - 227 - 228 - 227 - 228 - 227 - 228 - 229 -	11	40							
SAM	PLE TY TRACTO	OR	Sonic Barrel INSPECTOR 11ing Ltd. M. SAALY	APPRO	 DVEI		DATE 3/9/20	<u> </u>	:: :: ::

	G	5	REFERENCE NO.	HOLI TH			7			SHI	ZET	1	of 1
CLIE PRO SITE LOC	ENT JECT E ATION	Airport Prelimi Sturgeo	F WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing Inary Engineering In Road North of Saskatchewan Avenue Avenue, East Shoulder of Sturgeon	Road	I		TOP O	ND ELEV F PVC EL R ELEV. DRILLED		24(2/4	-010' 0.62 4/202 5,529	т 20	
	LLING HOD	Sonic SI	DC 450, Track Drill Rig				0 (.	,			623,		•
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPI F TYPF	NUMBER	RECOVERY %		/0.15 m MIC CONI	Cu		KET I VANE 40 	60 60 C	(kPa) ★ a) ◆ <u>80</u> LL 80
- 240	++++++++++++++++++++++++++++++++++++		<u>CLAY FILL</u> - Mottled black to grey, damp, stiff, low plasticity, some organics, trace rootlets.										1:1:1:
239.4 _ - 239	2 2 1 2		CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules.		S1								• • • • • •
- 28789 _	3 - 1 1 3 - 1 1 1 1 1		SILT TILL (ML) - Tan, damp, dense, some fine to coarse grained gravel, trace cobbles.		S3 S4								
- 237 236.7 _ 236.4 _	4		LIMESTONE - White, weak. END OF TEST HOLE AT 4.2 m		S5								
- 236 - 235	5		Notes: 1. TH20-07 open to 4.2 m below grade after the completion of drilling. 2. Water observed at 2.7 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cutting										
- 234	6 <u>-</u> 20												
- 233	8												
- 232	9 1 1 3 1 1 30												
- 231 - 231 - 231 - 230							Lietei						
10-7010-61/SML	11												
-010201 - 228 													
CON	PLE TYPI TRACTOI Paddock	R	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	API JRM		VE	D		DA 3/9/2				

		5	REFERENCE NO.	HOLE N TH2(8	SI	HEET 1	of 1
SITE	JECT / F ATION 4	Airport Prelimi Sturgeo 130 m N	DF WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing inary Engineering n Road lorth of Saskatchewan Avenue, East Shoulder of Sturgeon Road DC 450, Track Drill Rig			JOB NO. GROUND ELEV. TOP OF PVC ELE WATER ELEV. DATE DRILLED UTM (m)	24 EV. 2/ N	9-0107-4 40.58 m 5/2020 5,529,5 623,70	567
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu TO	CKET PE RVANE (H 40 6 MC % 40 6	0 80 LL
- 240 - 239 - 2 37 8	1-1-5 2-1-5		<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand.						
- 237.8 _ - 237 236.3 _ - 236	3 <u>10</u> 4 <u>1</u> 4 <u>1</u> 15		 <u>CLAY (CH)</u> - Brown, damp, stiff, high plasticity, trace silt nodules. Some silt nodules below 3.0 m. <u>SILT TILL (ML)</u> - Tan, damp, dense, some fine to coarse grained gravel, trace cobbles. 	s:					• - - - - - - - - - - - - - - - - - - -
- 235 234.3 _ 234.2 - - 234	5		- Boulder encountered at 4.8 m. <u>LIMESTONE</u> - White, weak. END OF TEST HOLE AT 6.4 m	□ s □ s s	5				
- 233	7		Notes: 1. TH20-08 open to 5.8 m below grade after the completion of drilling. 2. Water observed at 3.9 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.						
	9 								
2 – 229 5 0 0									
SAMI	PLE TYPE		Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPRO		D	DATE 3/9/20		

		S	REFERENCE NO.	HOLE N TH2(9	ŝ	SHEET 1	. of 1
SITE	DJECT A F E S ATION 2	Airport Prelimi Sturgeo 240 m S	DF WINNIPEG - WATER AND WASTE DEPARTMENT t Area West Regional Water and Wastewater Servicing inary Engineering on Road Southeast of Summit Road, East Shoulder of Sturgeon Road			JOB NO. GROUND ELEV TOP OF PVC EL WATER ELEV. DATE DRILLED UTM (m)	.EV.	19-0107- 239.94 m 2/5/2020	743
	HOD		DC 450, Track Drill Rig					E 623,53	
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	TYPE	к Y %	SPT (N) blows/0.15 m	Cu T	ORVANE (I	
ELEV	(m) (ft)	GRI		SAMPLE TYPE	RECOVE	DYNAMIC CON (N) blows/ft	≏ ∎	%	LL 60 80
239.6 _ - 239			ASPHALT GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, with crushed limestone.	s S	1				
- 238 237.2 _ - 237			<u>CLAY (CH)</u> - Brown, damp, stiff, high plasticity, trace silt nodules.						
- ² 3980 -	4		<u>SILT TILL (ML)</u> - Tan, damp, dense, some fine to coarse grained gravel, trace cobbles.	S					
- 235 234.5 _ 234.1 _ - 234			LIMESTONE - White, weak. END OF TEST HOLE AT 5.8 m	s	5		:: :: ::		
- 233	7		Notes: 1. TH20-09 open to 5.8 m below grade after the completion of drilling. 2. Water observed at 3.9 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.						
- 232	8								
- 231 - 230	9								
- 229									
- 229 - 229 - 228 - 228 - 228 - 227 - SAM - CON	12								
SAM	PLE TYPE		Sonic Barrel INSPECTOR	APPRO		D	DATI	7	
	TRACTOR Paddock		Ling Ltd. M. SAALY	JRM	JVE.	U	3/9/2		

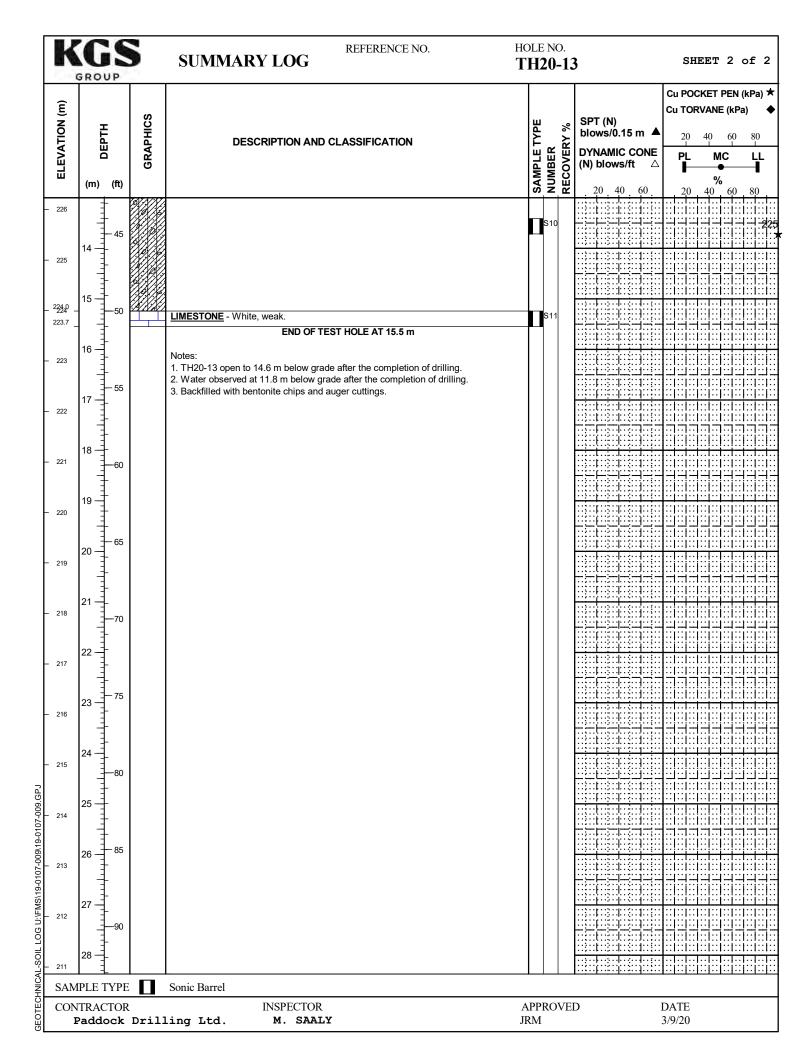
		5	REFERENCE NO.	HOLE I TH2		0			S	HEI	ET I	1 0	f 1
SITE	JECT	Airport Prelim Sturgeo	DF WINNIPEG - WATER AND WASTE DEPARTMENT t Area West Regional Water and Wastewater Servicing inary Engineering on Road putheast of Summit Road, East Shoulder of Sturgeon Road			top (Wate	UND E DF PV ER ELE E DRILI	C ELE ^V EV.	2 V.	239.8 2/6/2	107. 80 n 2020 529,)	
	LLING (HOD	Sonic S	DC 450, Track Drill Rig			01101	(111)		E	E 62	23,40	01	
ELEVATION (m)	DЕРТН	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ТҮРЕ	RY %	SPT (blows	s/0.15		Cu P Cu T 2(ORV	ANE ((kPa)	(Pa) ★
ELEVA	四 (m) (ft)	GRA		SAMPLE	NUMBER RECOVERY %	DYNA (N) bl	AMIC C lows/ft 40		Pl		MC		
239.5 _ - 239			ASPHALT GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand.	_	2 1 2					::1::	1::1::		80
238.7 _ - 238			CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules.		62								★
- 237 236.8 _	² ¹ ¹ ¹ ¹ ¹ ¹ ¹ ¹ ¹ ¹												• • • • • • • • • • • • • • • • • • •
- 236			<u>SILT TILL (ML)</u> - Tan, damp, dense, with fine to coarse grained gravel, trace fine to coarse grained sand, trace cobbles.		53								1.12
- 235 234.5	5 5 5 5			2	64								-11
234.3 — 234	6 <u>1</u> 6 <u>1</u> 20		LIMESTONE - White, weak. END OF TEST HOLE AT 5.4 m Notes:										
- 233	7 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 +		 TH20-10 open to 3.9 m below grade after the completion of drilling. Water observed at 3.3 m below grade after the completion of drilling. Backfilled with bentonite chips and auger cuttings. 										-11
- 232	8					::::::::::::::::::::::::::::::::::::::		- <u>1</u>					
- 231	9 1 1 3 1 1 30							- j	::i::i				
- 230													
– 229 – 228	11										. . 11.		
- 227													
CON	PLE TYPI TRACTOI Paddock	<u></u>	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APPR JRM	.OVE	D			DATE 3/9/2(

the second second second	GS	5		hole TH2		1			SH	EET	1 of 1
SITE LOC	JECT A F ATION 3	Airport Prelimi Summit 350 m S	DF WINNIPEG - WATER AND WASTE DEPARTMENT A Area West Regional Water and Wastewater Servicing inary Engineering Road southeast of Centreport Canada Way, East Shoulder of Summit Road DC 450, Track Drill Rig	ł		top C Wate	JND ELE DF PVC ER ELEV DRILLE	ELEV. ′.	23 2/: N	-0107 9.67 1 5/2020 5,530 623,0	m 0 ,038
ELEVATION (m)	HLA BO (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER RECOVERY %	SPT (blows DYNA (N) blows 20	s/0.15 m MIC CO ows/ft	NE ∆	Cu PO	2KET P RVANE 40 1 MC %	PEN (kPa) ★ (kPa) ◀ 60 80
_ 239.1 _ _ 239 _	+-+ +-++ 1-+		<u>GRANULAR FILL</u> - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand. <u>CLAY FILL</u> - Mottled black to grey, damp, stiff, low plasticity, trace rootlets, some organics.	_					:1::1::		:1::1::1::1:
238.1 _ - 238 237.2 _ - 237	2		CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity. SILT TILL (ML) - Tan, damp, dense, with fine to coarse grained gravel, trace fine to coarse grained sand.		S1						
- 236	3 <u></u> 10 4 <u></u>				S2						
- 235 - 234	- - - - - - - - - - - - - - - - - - -				S3						
- 233	6 <u>-</u> 20		- Trace cobbles below 6.0 m. - Boulder encountered at 6.7 m.		S4 S5						
– 232 – 231	8 - - - - - - - -				S6						20 .20 .20
_ 230 229.6 _	9 		JURASSIC LIMESTONE - Red, weak.		S7 S8						
- 230 229.6 _ 229.3 _ - 229 - 228 - 227 SAM CON	11		BIND OF TEST HOLE AT 10.3 m Notes: 1. TH20-11 open to 10.3 m below grade after the completion of drilling. 2. Water observed at 4.8 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.								
- 227 SAM	PLE TYPE		Sonic Barrel				·				
P	TRACTOR addock		INSPECTOR Ling Ltd. M. SAALY	APPF JRM		U.			ATE 9/20		

	GROU	1.1	5	REFERENCE NO.			DLE N H2(2	SH	EET 1 of 2
CLIE PRO SITE LOC	ENT DJECT E Atio	• 4 F S N 5	Airport Prelimi Summit 0 m So	F WINNIPEG - WATER AND WASTE DEPARTME Area West Regional Water and Wastewater Ser inary Engineering Road outheast of Cebtreport Canada Way, North Shoulder of Su	vicing	bad			JOB NO. GROUND ELEV. TOP OF PVC ELE ^M WATER ELEV. DATE DRILLED UTM (m)	23 V. 2/4	-0107-009 9.70 m 6/2020 5,530,153
	LLING HOD	S	ionic Sl	DC 450, Track Drill Rig	_				- ()	E	622,811
ELEVATION (m)	a) DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE NIIMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60		CKET PEN (kPa) ✓ RVANE (kPa) ▲ 40 60 80 40 60 80 MC LL % 40 60 80
239.4				GRANULAR FILL - Brown, damp, compact, fine to coarse grained \gravel, trace fine to coarse grained sand.	7					:::::::	.
- 239 - 2 33 89		- 5		<u>CLAY FILL</u> - Mottled black to brown, damp, stiff, low plasticity, trace fine grained gravel, some organics.]		S.	1			
- 237		-10		CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, some silt nodules.		3.5	S2	2			
- 236 235.7 _ - 235	4 4 5	- 15		<u>SILT TILL (ML)</u> - Tan, damp, dense, some fine to coarse grained gravel, trace cobbles, trace fine to coarse grained sand.		4.0 4.1 4.3 4.6	S ²				
- 234 - 233	6 6 7 7	-20					S				
- 232 - 231	9 9	-30		- 500 mm moist sand seam observed at 7.6 m.			S				20
229 229 229 228.1 228 228.1 228 228 227 227 227 227 227 227	10 10	- 35		- Very dense below 9.7 m.		11.1	S S				
228.1 _ 228 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		-40		JURASSIC LIMESTONE - Red, weak. END OF TEST HOLE AT 12.5 m		11.7 11.9 12.3 12.5					
SAM	PLE T	YPE		Sonic Barrel	•		•				
	TRAC addo			INSPECTOR Ling Ltd. M. SAALY			APPRO RM	OVE		DATE 3/9/20	

	GROUP			_						Cu PO Cu TO				Pa)
NOI	1 1	HICS		LOG	E T	YPE	SPT (N) blows/0	.15 m		20	40	60) 5	80
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	LE T ER /ER)	DYNAM			PL		мс		
ELE	(m) (ft)	Ū		<u>م</u>		SAMPLE TYPE NUMBER RECOVERY %	(N) blow	/s/ft 4060		⊢	(• %		-
			Notes:						<u>.</u>	20	40 .11. :1::1:	60 	, e	80 .1. :1:
226	45		1. TH20-12 open to 12.5 m below grade after the completion of drilling. 2. Water observed at 2.9 m below grade after the completion of drilling.											
	14		3. Installed two 25.4 mm diameter PVC standpipes with 0.3 m casagrande tip installed 4.3 m and 11.8 m below grade.				···;··;··;··;·			<u> -</u> :1::1:	<u>. </u>	<u></u> 	<u></u>	<u>1</u>
							<u> </u>							ļ
225	15											: <u> ::</u> 	<u></u>	:i
	50													
224	16											: ::		
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23	- 55													
	17										<u>;;;;;</u>		<u></u>	
22														
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21														H
	19 -						···········		<u>;</u>	<u> -</u>	· · · · · · · ·	<u></u>	<u></u>	1
220	20 - 65								:			: ::		
219	21													
	70													
218														
											:::::			
217														1
	23 - 75											· · · · · · · · · · · · · · · · · · ·	· · · ·	
216											<u> -</u> -			-
	24											<u>-11</u>		4
	80													
215	25									<u></u>	<u></u>			
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214	26 - 85													ļ
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213														
	27							::::1:: ::::::						
212	90 													
	28							 						Ť
SAM	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		Sonic Barrel		·	• • •								1
	NTRACTOR Paddock		INSPECTOR Ling Ltd. M. SAALY			APPROVEI RM)			ATE 9/20				

	GROU	1	5	REFERENCE NO.	HOLE NO. TH20-1	3	SHEET 1 of 2
SITE	JECT E	N 6	Airport Prelimi Summit 00 m So	F WINNIPEG - WATER AND WASTE DEPARTMENT Area West Regional Water and Wastewater Servicing nary Engineering Road outhwest of Sturgeon Road, North Shoulder of Summit Road DC 450, Track Drill Rig		JOB NO. GROUND ELEV. TOP OF PVC ELE ^V WATER ELEV. DATE DRILLED UTM (m)	19-0107-009 239.23 m /. 2/5/2020 N 5,529,862 E 622,451
ELEVATION (m)	DEPTH	(ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △ 20 40 60	Cu POCKET PEN (kPa) \star Cu TORVANE (kPa) 20 40 60 80 PL MC LL % 20 40 60 80
- 22899				GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand.	e		
				<u>CLAY FILL</u> - Mottled black to brown, damp, stiff, low plasticity, some organics.	/ S1		
238.3	1-1			CLAY (CH) - Brown, damp, stiff, high plasticity, trace silt nodules.			
- 238 - 237	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	- 5 -			S 2		
- 236	3	- 10 -		- Some silt nodules below 3.0 m.	S 3		
- 235	4 4 5	- 15 -		- 300 mm silt seam at 5.2 m.	S4		
233.1 _ - 233	6 6	- 20 -		SILT TILL (ML) - Tan, damp, dense, some fine to coarse grained gravel, trace fine to coarse grained sand, trace cobbles.			
- 232	7	- - - 25			S6		2000
- 231	8 9 1 1 1 1 1 1 8			- Very dense below 8.2 m.	S7		
- 230) ++++++++++++++++++++++++++++++++++++	30 - -					
230 229 229 229 229 229 229 228 228	+	- 35 -			5 8		
	12	- 40 -	0.0		5 9		222
	L – PLE T	VDF	▞▞ᡘ᠕	Sonic Barrel		1	·····················
CON	TRAC	TOR		INSPECTOR ing Ltd. M. SAALY	APPROVE JRM		DATE 3/9/20



		5		HOLE TH			1				SF	IEE'	т 1	of	1
SITE LOC DRII		Airport Prelim Sturgeo 250 m N	DF WINNIPEG - WATER AND WASTE DEPARTMENT t Area West Regional Water and Wastewater Servicing inary Engineering on Road lortheast of Sturgeon Access, South Shoulder of Sturgeon Road DC 450, Track Drill Rig				JOB N GROU TOP C WATE DATE UTM	JND I DF P\ ER EL DRIL	/C EL _EV.	.EV.	23 2/ N	39.3 6/20 5,5	07-0 7 m 020 330,1 3,582	24	
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (blows DYNA (N) bl	s/0.18 MIC ows/1	CON	c ▲	Cu PO Cu TO 20 PL 20 20	40	NE (kl 60 MC %	Pa) 80 L) L
239.2 - - 239 - 238 - 2338			TOPSOIL GRANULAR FILL - Brown, damp, compact, fine to coarse grained gravel, some fine to coarse grained sand.	_/	S1							:1::1:	::1::1	:::::	
- 237 236.6 _			CLAY (CH) - Mottled brown to grey, damp, stiff, high plasticity, trace silt nodules. <u>SILT TILL (ML)</u> - Tan, damp, dense, trace fine to coarse grained gravel, trace fine to coarse grained sand.	2	S2										
- 236 - 235	4		- Trace cobbles below 3.3 m.		S3										
- 234 - 233	5 				S4							· · ·		· · ·	125
- 232	7 7 1 1 1 1 1 1 25 8 1				S5										
- 231 230.4 _ $-$ 230.1 _	9		JURRASIC LIMESTONE - Red, weak. END OF TEST HOLE AT 9.3 m		S6 S7										
- 229	10		Notes: 1. TH20-14 open to 8.8 m below grade after the completion of drilling. 2. Water observed at 6.0 m below grade after the completion of drilling. 3. Backfilled with bentonite chips and auger cuttings.												
- 229 - 229 - 228 - 227 SAM CON															
SAM CON	PLE TYP TRACTO	R	Sonic Barrel INSPECTOR Ling Ltd. M. SAALY	APP JRM		/EI	D	<u>.</u>	····		ATE 9/20	<u>;;:;</u> ;		<u></u>	

TH19-01



TH.01 0-2.5'









5-10









FH.01. 10-201









TH01 20-25-











T H.01 25'-30'





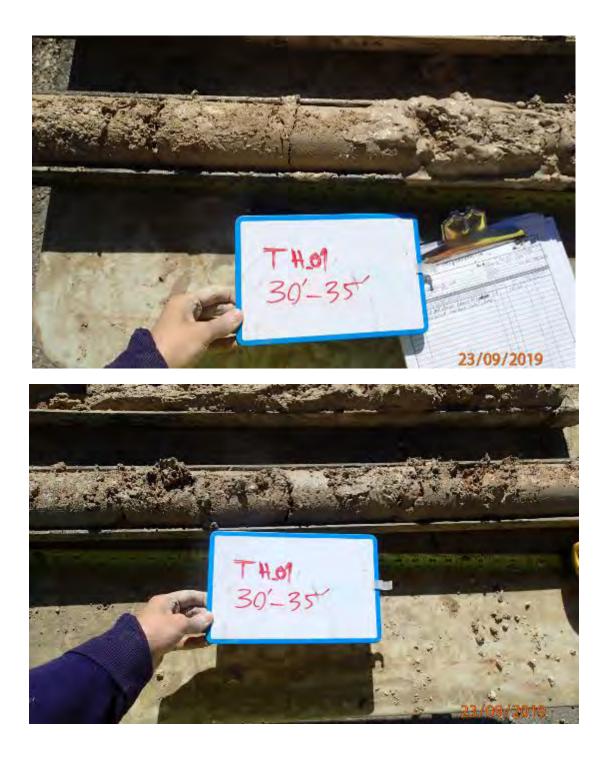




TH.01 30'-35









T H 61 35'-37'







TH-01 37-40





TH-01 40-45





TH-01 45'-48'





TH-01 45'-48'







TH19-02



TH-02 0-2.5'





2.515





TH-02 5-10



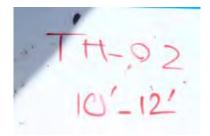


TH-92 5-10



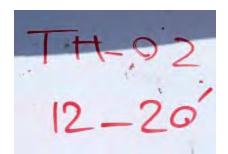








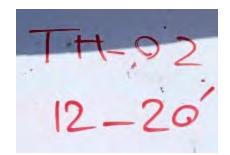
















25-27







28-30





TH-02 30'-33'





TH-02 33-35





TH-02 35'-36'





TH-02 36'-38'





1 H-02 38'-45'









TH19-03



TH 03 0-4'





TH:03 4-10





TH 03 10-20





TH 03 10-20





1H 03 20-30





TH 03 20-30











TH-03 39-31.5'







TH19-04

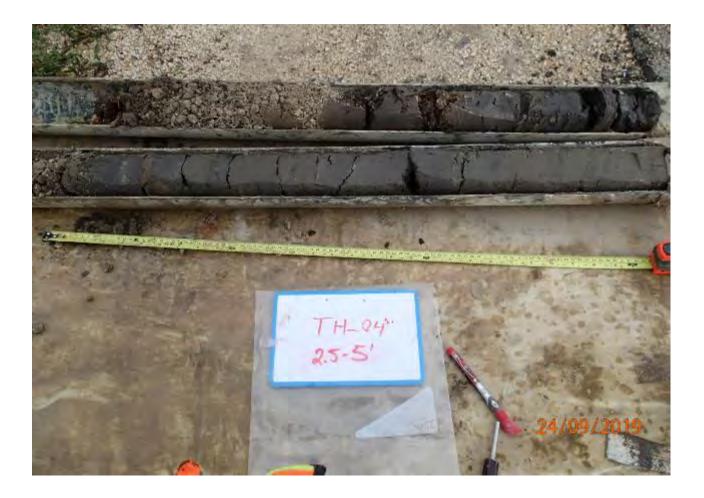


TH-04 0-2.5





TH-04" 2.5-5'









TH-04' 5-10'



















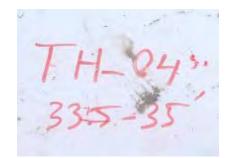






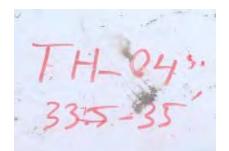




















TH-05 0-2.5





TH-05 2.55-10'





TH-05 10-20'













TH-05 20-25.5







TH-05 20-25.5







TH-06 0-2.5'





TH-06 25-5'





TH-06 5-10'





TH-06 5-10'





TH-06 10-20













TH-06 20-30'











TH-06 30-35











TH-06 30-35









TH-07 0-5'





TH-07 5-14.5





TH-07 10-14.5









TH-07 14.5-15:5'









TH-08 0-2.5'





TH-08 25-5'





TH-08 5-10'





TH-08 10-15'



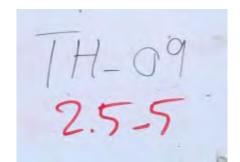




TH-09 0-2.5'











1H-09 5-10









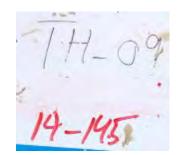


TH-09 12-14















TH19-10



TH-10 0-2.5'





TH-10 2.5.5





TH-10 5-10





TH-10 10-15





TH-10 10-15











TH-10 15-20'













TH-10 20-25





TH-10 75-26





TH19-14



TH-14 0-2.5





TH-14 2.5-5





TH-14 5-10





TH-14 10_20





TH-14 20-28





TH-14 20-28







TH-14 20-28





TH-14 28-30











TH19-15



TH-1415 2.5-5'







TH-1415 5-10

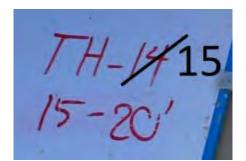




TH-1415













TH-1415







TH-1415 20-23.5'





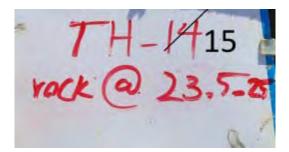


TH-1415 20-23.5'













TH-1415 25-28 04



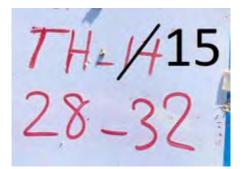


TH-1/415 25-28



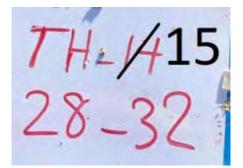








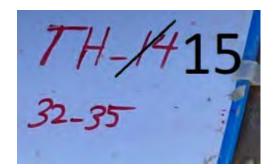
















TH-1415 32-35











TH-1415 35-37.5





Pictures previous. 19Cr TH-1415 35-37.5







TH-1415 37.5-39





TH19-16



TH-16, 0-2.5





TH-16 2.5-5'











TH-16 10-20'











TH-16 20-25











TH-16 25-29















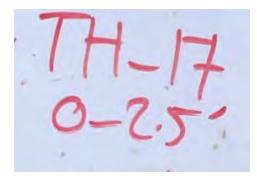
TH-16 29-30





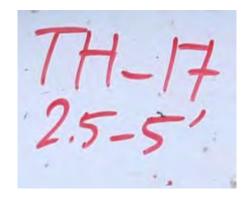
TH19-17















TH-17 5-10'





TH-17 10-15





TH-17 16-20

























TH-17 23-25













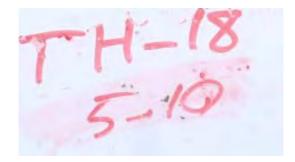
TH19-18



TH-18 0-5











TH-18 10-29













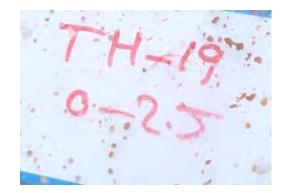
TH-18 24-25





TH19-19





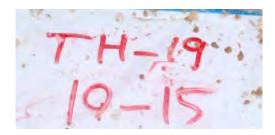






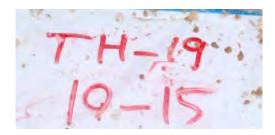


















TH19-20



TH-20 0-2.5





TH-20 2.5-5





TH-20 7.5-10





TH-20 10-18





TH-20 10-18

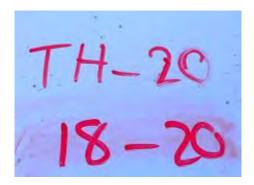




TH-20 10-18

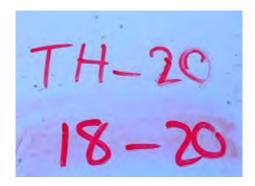






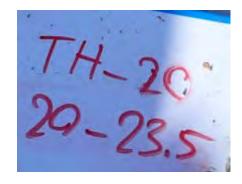










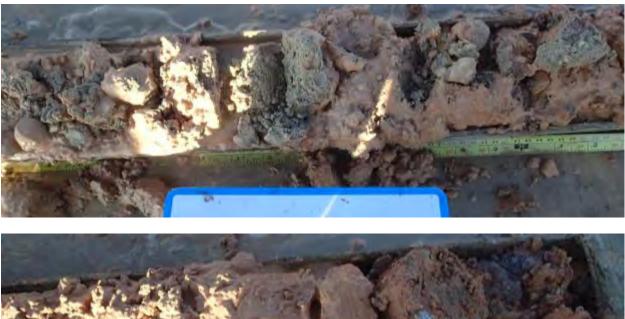








TH-20° 29-23.5











TH19-21



TH-21 0-25





TH-21 2.5-5'





TH-21 10-14'





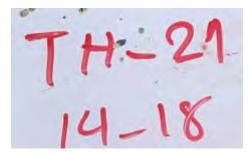
TH-21-10-14'















TH-21-18-18.5

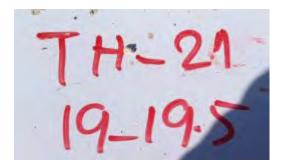




TH-21 185-19

















TH-21 20-21.5









TH-21 21.5-25





TH-21 21.5-25





TH-21 21.5-25









TH-21 25-30





TH-21 25-30





TH-21 25-30







TH-21 30-35





TH-21 30-35







TH-21 35-37.5





TH19-22



TH-22 0-2.5





TH-22 5-9

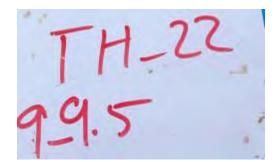










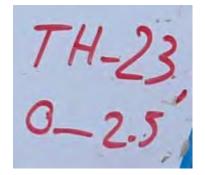






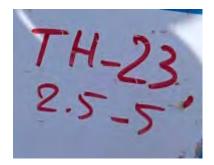
TH19-23













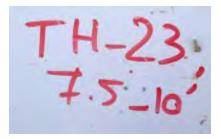




H-23 5-7.5













TH-23, 10-14.5





TH-23, 10-14.5





TH-23, 10-14.5





TH-23, 14.5-16.5





TH-23, 14.5-16.5





TH-23, 14.5-16.5







TH-23. 14.5-16.5





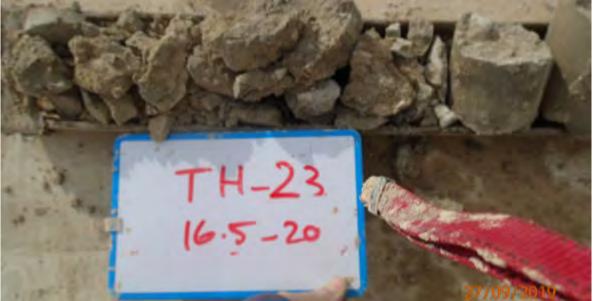
TH-23 16.5-20





TH-23 16.5-20



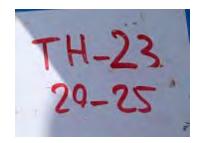




TH-23 16.5-20























TH-23 25-27







TH-23 27-30





TH-23 27-30







TH-23 27-30





TH-23 30-335





TH-23 30-335







TH-23 30-335





TH-23 33.5-39





TH-





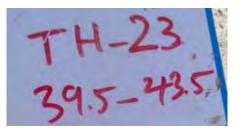


TH-23



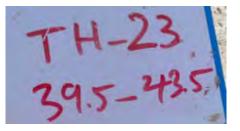


















TH-23. 39.5-43.5





TH19-24



19-0107-009 SEPT.28,2019 TH-24 DEPTH: 0-2.5







19-0107-009 SEPT. 28, 2019 TH-24 DEPTH 2.5-5'





19-0107-009 SEPT.28,209 TH-24 DEPTH 5'-10'





19-0107-009 SEPT. 28, 209 TH-24 DEPTH 10-16'





19-0107-009 SEFT. 28, 209 TH-24 DEPTH 10-16





19-0107-009 SEPT.28,209 TH-24 DEPTH KO-20'









19-0107-009 SEPT. 28, 209 TH-24 DEPTH 20-26





19-0107-009 SEPT. 28, 209 TH-24 DEPTH 20-26







19-0107-009 SEPT. 28, 209 TH-24 DEPTH 20-26







19-0107-009 SEPT. 28, 209 TH-24 DEPTH 20-26

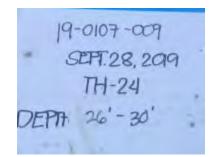


















19-0107-009 SEFT. 28, 2019 TH-24 DEPT 26'-30'





19-0107-009 SEPT. 28, 2019 TH-24 -36 30 FPA







19-0107-009 SEPT.28,209 TH-24 TH-24



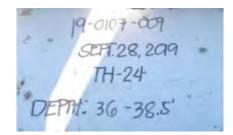




19-0107-009 SEPT.28,209 TH-24 TH-24 TH-30'-36' EPA





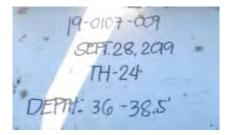












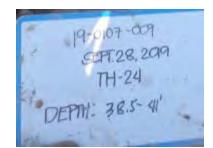
























19-0107.009 SEPT. 28, 209 24 EPTH. 41.5-43 (BR@42.5)





TH19-25



19-0107-009 9/28/2019 TH 25 0-2.5





19-0107 : 39 91/28/2017 TH 25 2.5'-5.0'





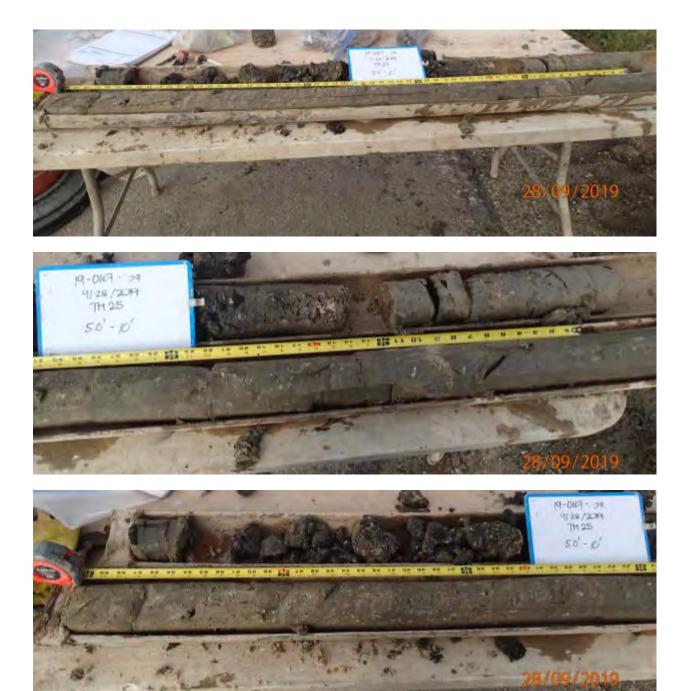
19-0107 : 39 91/28/2017 TH 25 2.5' -5.0'







19-0107 - 29 9/28/2019 TH 25 5.0' - 10'











19-0107 : 39 91/28/2019 711 25 20









19-0107 : 29 9128/2019 TH 25 20'-24'









19-0107 - 29 9/28/2019 TH 25 24-27.5'











17.-0107 - 29 91.28/2019 TH 25 27.5-31.5'







KGS: 19-0107-009 | March 2020









CH 20-07 0-6"





TH 20-07





TH 20-07





H 20-01





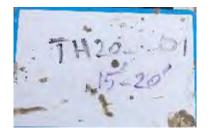
































TH20-02







TH20-02 2.5-10





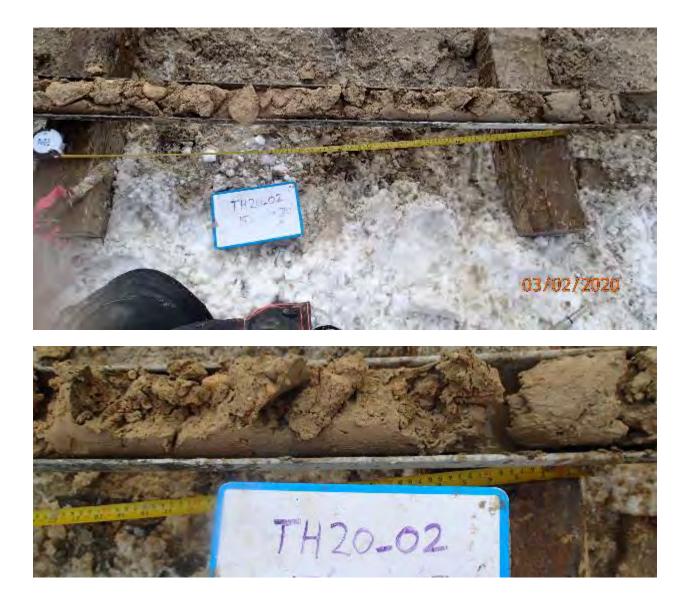


TH20-02





TH20-02







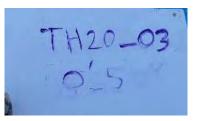


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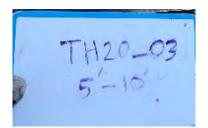


















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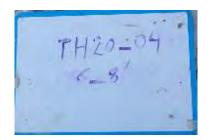




TH20-04 4-6

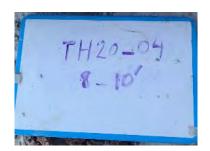






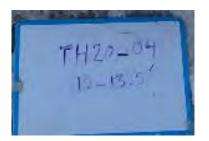
















TH20-04 13.5'-19











TH20-05 0-5'



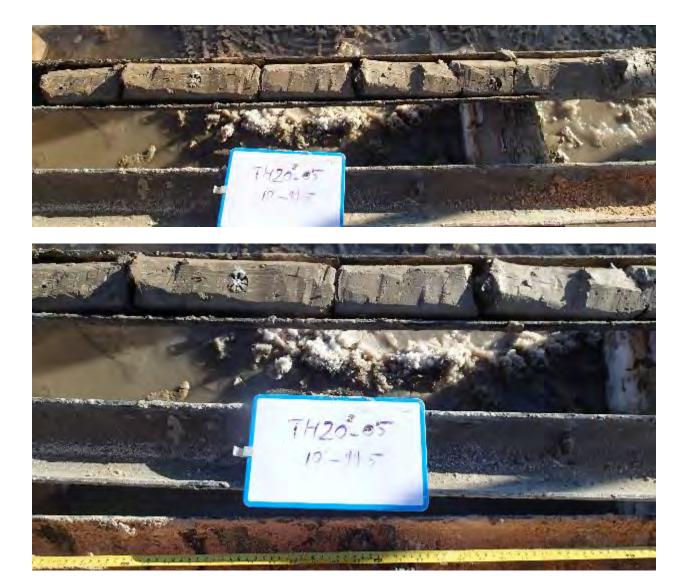


TH20-05





TH20-05 10-11-





H20-05





TH20-05 15-20













TH20-05 25-30







H 20-0





TH 20-06

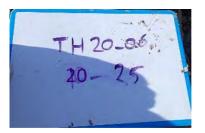




120-06















TH 20-06 25-28





TH 20-06 28-30'



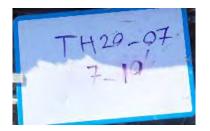




ALC: NO. Q7









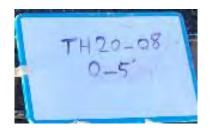


TH20-07



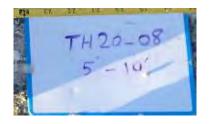
















TH 20-08





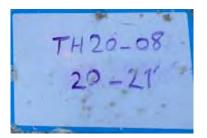




TH 20-08













TH20-09 0-10'





TH20-09 10-19"







120-10

















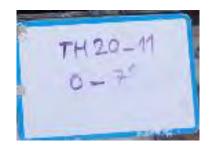






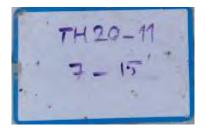
TH20-11



















TH 20-11





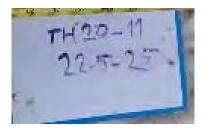
















TH 20-11 25-2













TH 20-11 30-34.5





TH20-12



TH20-12 0-2.5



20-12

06/02/20





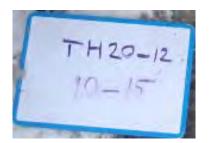


TH20-12









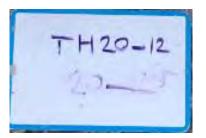












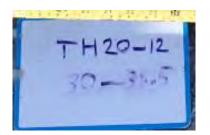




TH20-12 25-30

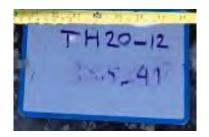
















TH20-13



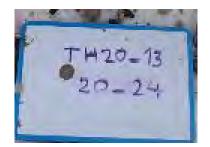




TH20-13 5-29











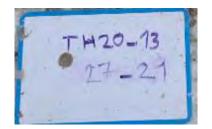




TH20-13







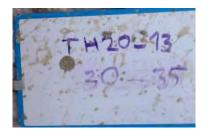




































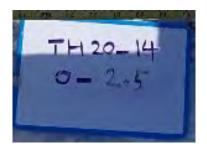






TH20-14









TH 20-14 2.5 = 5







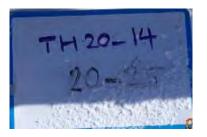








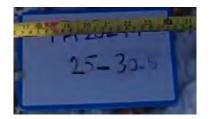




















APPENDIX D

Seismic Refraction Survey Report

SEISMIC REFRACTION SURVEY REPORT WINNIPEG RICHARDSON INTERNATIONAL AIRPORT WINNIPEG, MB

Submitted to: KGS Group February 10, 2020

Authors: Orgil Bayarsaikhan, B.Sc. Caitlin Gugins, P.Geo

Project: FGI-1644

237 St. Georges Ave. North Vancouver, B.C. V7L 4T4

604 987 3037

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2.3 Seismic Refraction Interpretive Method	3
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Figure 25	Interpreted Depth Section SL19-03D
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Figure 29	Interpreted Depth Section SL19-03H

Location Appendix

1. Introduction

During the period of October 1 to 10, 2019, Frontier Geosciences Inc. carried out a seismic refraction investigation for KGS Group near the Winnipeg James Armstrong Richardson International Airport, in Winnipeg, Manitoba. The survey area is located to the northwest of the airport, along Klimpke Road and Inkster Boulevard. A Survey Location Plan of the area, is shown at a scale of 1:50,000 in Figure 1.

The purpose of the geophysical survey was to determine depth to bedrock and overburden layering classification to aid in defining depth to a till layer, as well as characterizing materiel types and densities. In all three separate seismic refraction traverses were surveyed for a total of approximately 5 kilometres of detailed seismic refraction surveying. Two site plans illustrating the locations of the seismic lines are presented at a scale of 1:10,000 in Figures 2 and 17, in the Appendix.



Instrumentation Setup

2. Seismic Refraction Survey

2.1 Survey Equipment

The seismic refraction investigation was carried out using two Geometric Geode, 24 channel, signal enhancement seismographs and Oyo Geospace 10 Hz geophones. Geophone intervals along the multicored seismic cable were maintained at 1.5 or 2.5, metres in order to ensure high resolution data on subsurface layering. Seismic energy was provided from a shotgun seismic source firing blank, 8 gauge shotgun shells into hand-excavated shotholes and a sledgehammer striking a steel plate. Shot initiation or zero time was established by metal to metal contact of a striking hammer contacting the firing pin of the shotgun, or the hammer striking the plate.

2.2 Survey Procedure

Field procedure entailed setting out two 24 channel geophone cable in a straight line and implanting the geophones. The spread was traversed with the seismic source, moving progressively down the array of geophones, with up to 9 individual shotpoints on each spread: one at either end of the spread, five at intermediate locations along the seismic cable, and one off each end of the spread to ensure adequate coverage of the basal layer. The shots were triggered individually and arrival times for each geophone were recorded digitally in the seismograph. For quality assurance, field inspection of raw data after each shot was carried out, with additional shots recorded if first arrivals were unclear. Data recorded during field surveying operations was generally of good to excellent quality.

Throughout the survey, notes were recorded regarding seismic line positions in relation to topographic and geological features. Relative elevations along the seismic lines were recorded by chain and inclinometer.

2.3 Seismic Refraction Interpretive Method

The final interpretation of the seismic data was arrived at using the method of differences technique. This method utilizes the time taken to travel to a geophone from shotpoints located to either side of the geophone. Velocities are calculated as the slope of first break pick times and geophone distances. When there is a significant change in slope a new velocity is calculated and assigned to the new layer. Basal velocities are calculated by the arrivals of off-end shots, where picked arrivals are refracted from the basal layer. Each geophone is assigned a velocity and time for each layer. Using the total time, a small vertical time is computed which represents the time taken to travel from the refractor up to the ground surface. This time is then multiplied by the velocity of each overburden layer to obtain the thickness of each layer at that point. The thicknesses are splined along the seismic line to create a continuous boundary between layers.



Example of Survey Procedure

3. Geophysical Results

3.1 General

The seismic refraction survey area is presented in two site areas, with the interpreted results of the seismic refraction data illustrated at a 1:250 scale in each corresponding figure. The Klimpke Road Site Plan, Figure 2, shows line SL-1, with results presented in Figures 3 to 16, in the Appendix. Lines SL-2, and SL-3 are displayed in the Inkster Boulevard Site Plan, Figure 17, with corresponding results presented in Figures 18 to 29. The seismic velocity layer interfaces are marked on the seismic profile in blue, green, purple, and red. The interface line colours are not a specific velocity contour, but rather the interpreted discrete boundary above which velocities are defined within a certain range and below which velocities are within a significantly increased velocity range.

3.2 Discussion

The results of the seismic refraction survey indicate the area is underlain by up to five distinct velocity layers. The surficial layer, displaying compressional wave velocities varying from 340 m/s to 450 m/s, averages approximately 1.5 metres in thickness, reaching a maximum thickness of 4 metres at station 378E on line SL19-02. This velocity layer corresponds to testhole intersections of granular and clay fill.

Underlying the fill layer is an intermediate velocity layer with an interpreted velocity range of 800 m/s to 1330 m/s. These velocities are consistent with testhole intersections of firm to stiff, clays, with trace sands and gravels. Averaging approximately 3 m in thickness, this layer thins to half a metre around station 2360N on line SL19-01 and near near station 900E on line SL19-03 and displays a maximum thickness of 5.5 metres at the end of line SL19-03.

A deeper intermediate layer was identified with compressional wave velocities ranging from 1600 m/s to 2250 m/s. This layer thins to less than 0.5 metre along the end of line SL19-01, while reaching a maximum thickness of almost 10 metres at station 1397E on line SL19-03. This velocity range is consistent with loose to compact silt till, as well as compact sand and gravel encountered in the testholes, indicating this layer correlates with silt till in the area. Faster velocities in this range likely correspond to zones of higher compaction or density.

A third intermediate layer was also identified, with a velocity range from 2500 to 2600 m/s, is interpreted to be a denser zone within the silt till layer with possible increased cobbles and boulders. This layer is illustrated as a dashed purple line in the data, as due to the relatively high velocity and minimal thickness of this layer, it was not accurately resolvable in the data processing, described as a 'hidden' layer. In most areas where this layer is shown, testhole logs indicated presence of this layer, although it may exist in other sections of the survey area.

Underlying the intermediate layers is the interpreted basal layer with compressional wave velocities of 2500 m/s to 4500 m/s. Lower velocities in this range are most likely indicative of weathering and/or fracturing within the bedrock. The lower end of interpreted velocities most likely represents a higher level of fracturing and/or weathered bedrock, while the higher end is indicative of more competent bedrock. The basal layer closely corresponds with limestone bedrock encountered within the testholes in proximity to the seismic lines. This interpreted bedrock surface exhibits an average depth of approximately 8 metres and reaches a maximum depth of almost 16 metres at station 575N along line SL19-01, while rising to a minimum depth of 2.6 metres, at station 2155N on line SL19-01.

In general, seismic refraction results matched well with the nearby provided testholes logs in the area. Additionally, in some areas, updated testholes results may indicate a deeper bedrock layer than illustrated in the profiles, due to the presence of the denser 'hidden' layer described above.

4. Limitations

The depths to subsurface boundaries derived from seismic refraction surveys are generally accepted as accurate to within ten percent of the true depths to the boundaries, below 10 metres. Above 10 metres, the accuracy of seismic refraction data is approximately +/- 1.0 metres due mainly to the greater statistical error in determining the upper velocity layers from fewer data points. In some cases, unusual geological conditions may produce false or misleading data points with the result that computed depths to subsurface boundaries may be less accurate. In seismic refraction surveying difficulties with a 'hidden layer' or a velocity inversion may produce erroneous depths. The first condition is caused by the inability to detect the existence of a layer because of insufficient velocity contrasts or layer thicknesses. A velocity inversion exists when an underlying layer has a lower velocity than the layer directly above it. The interpreted depths shown on drawings are to the closest interface location, which may not be vertically below the measurement point if the refractor dip direction departs significantly from the survey line location. Structural discontinuities occurring on a scale less than the geophone spacing or isolated boulders would go undetected in the interpretation of the data. The seismic refraction method may not detect a narrow canyon-like feature incised into bedrock, if the canyon width is narrow relative to the depth of burial of the feature. Contour plan gridded data is only valid directly beneath seismic lines and testholes used in the gridding process, and is interpolated elsewhere. Additionally, small errors may also occur in data gridding.

The information in this report is based upon geophysical measurements and field procedures and our interpretation of the data. The results are interpretive in nature and are considered to be a reasonably accurate representation of existing subsurface conditions within the limitations of the seismic refraction method.

For: Frontier Geosciences Inc.

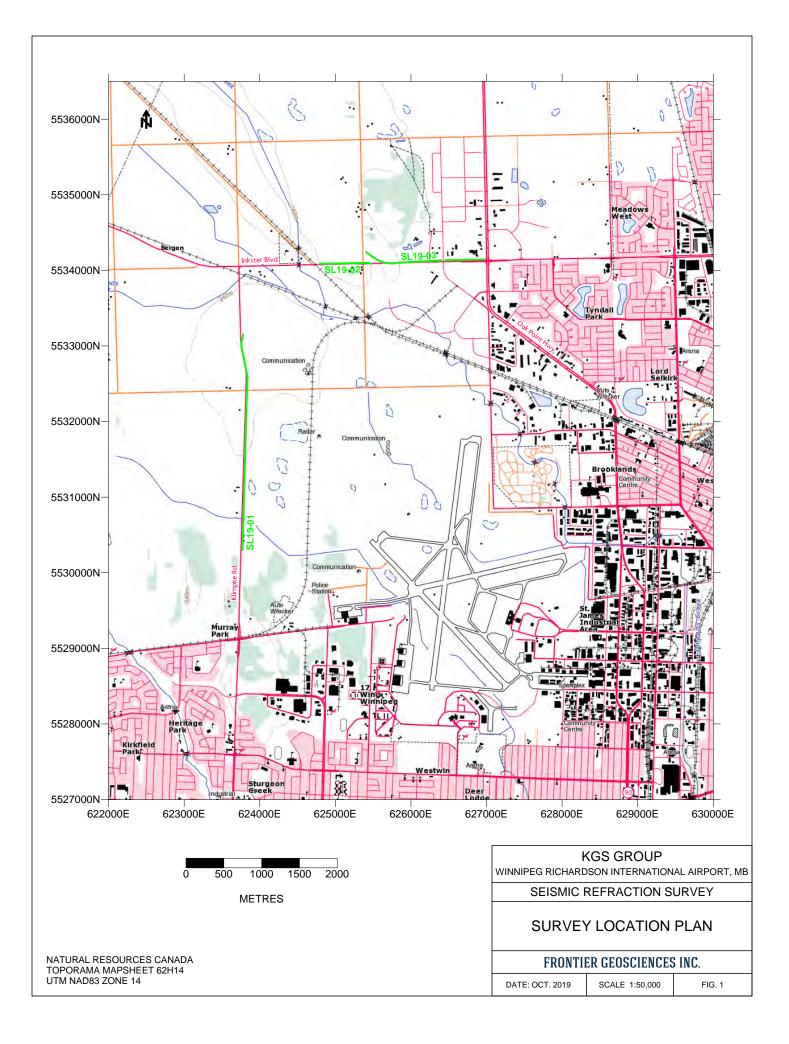
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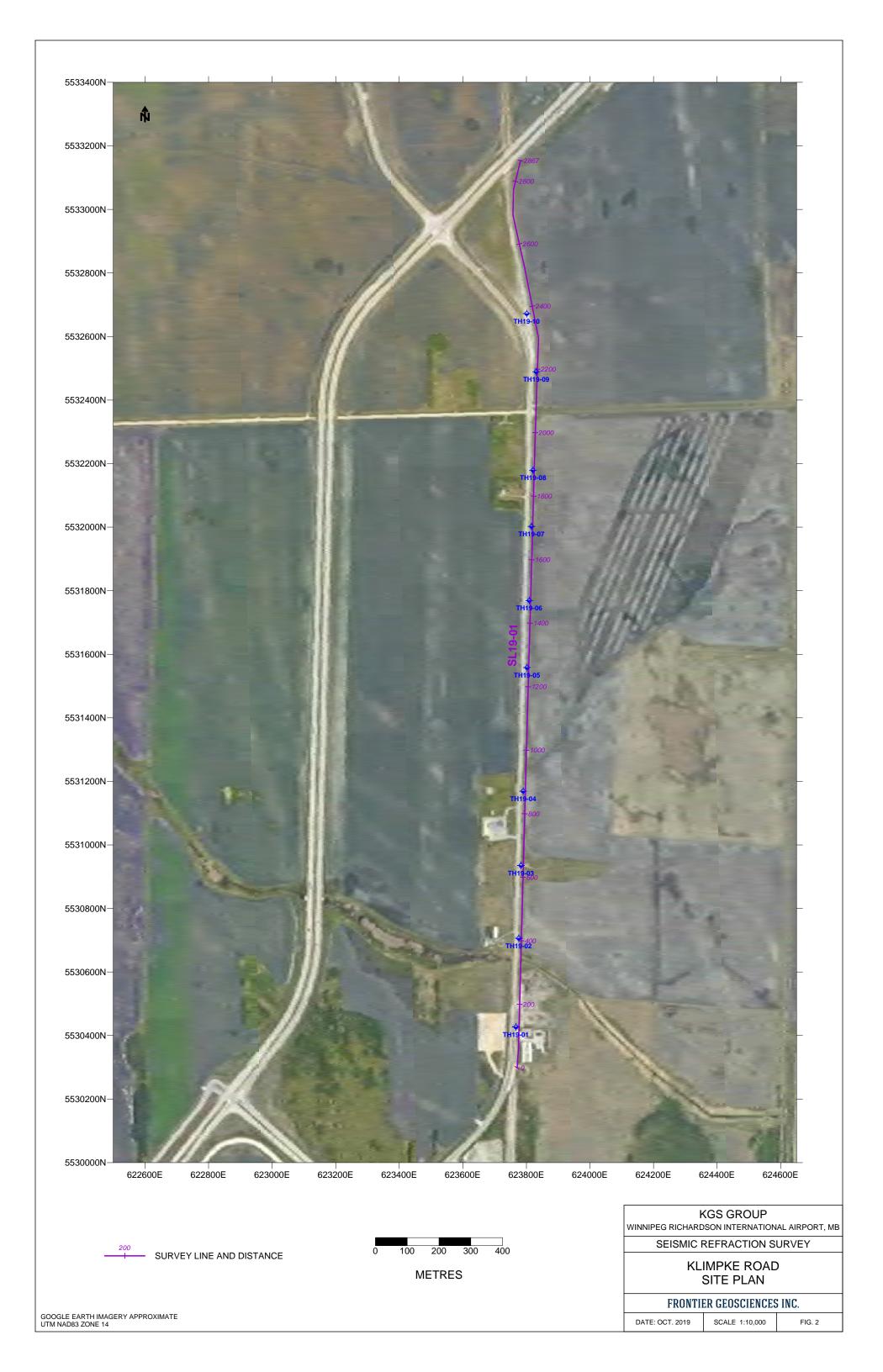
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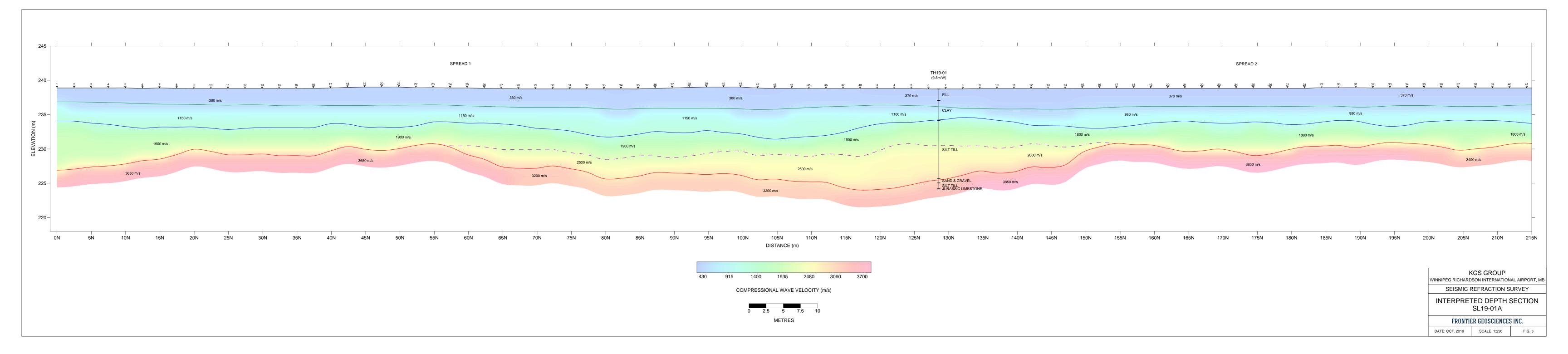
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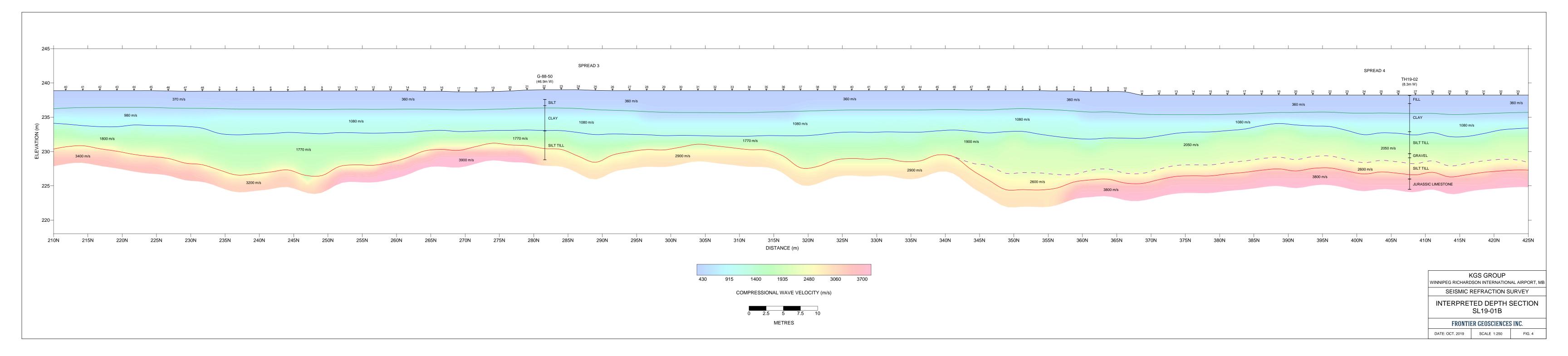
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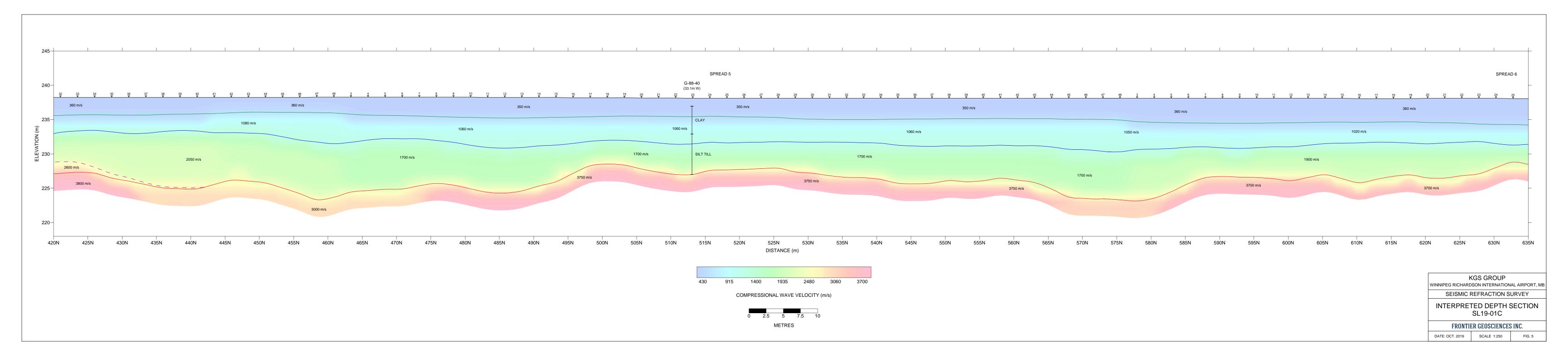
APPENDIX

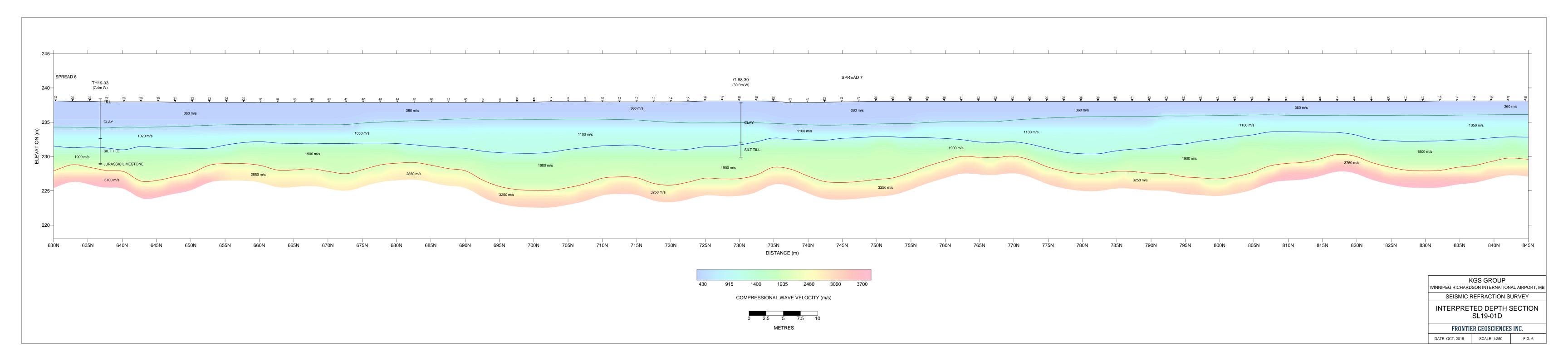




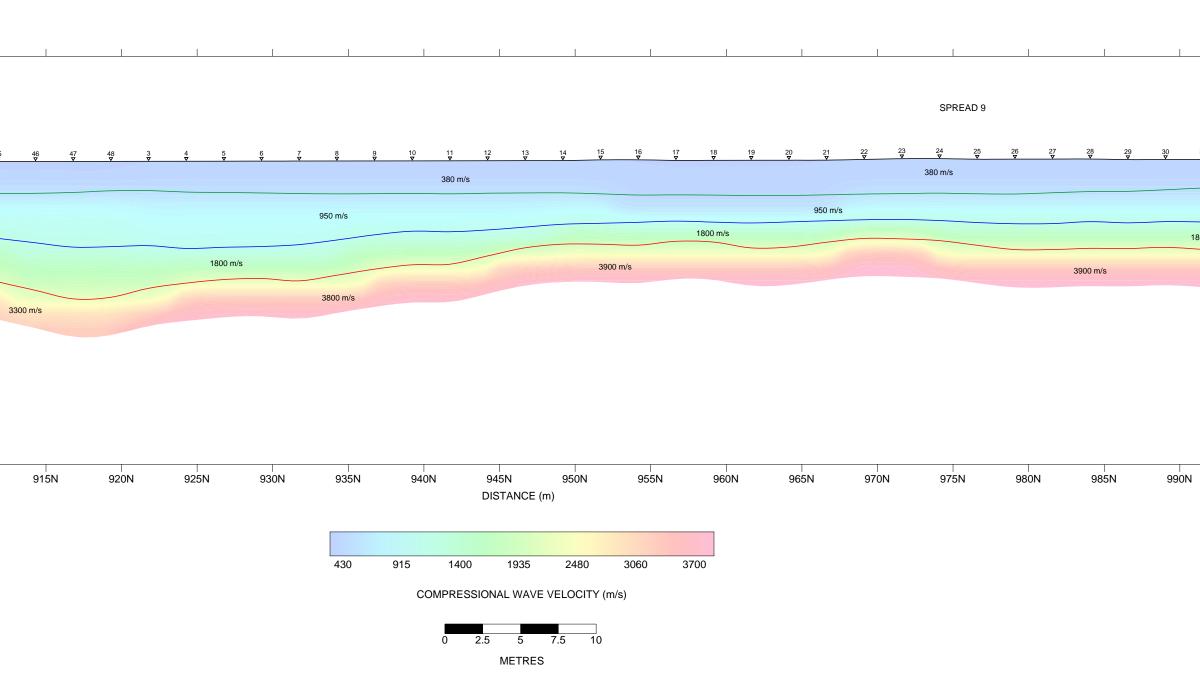




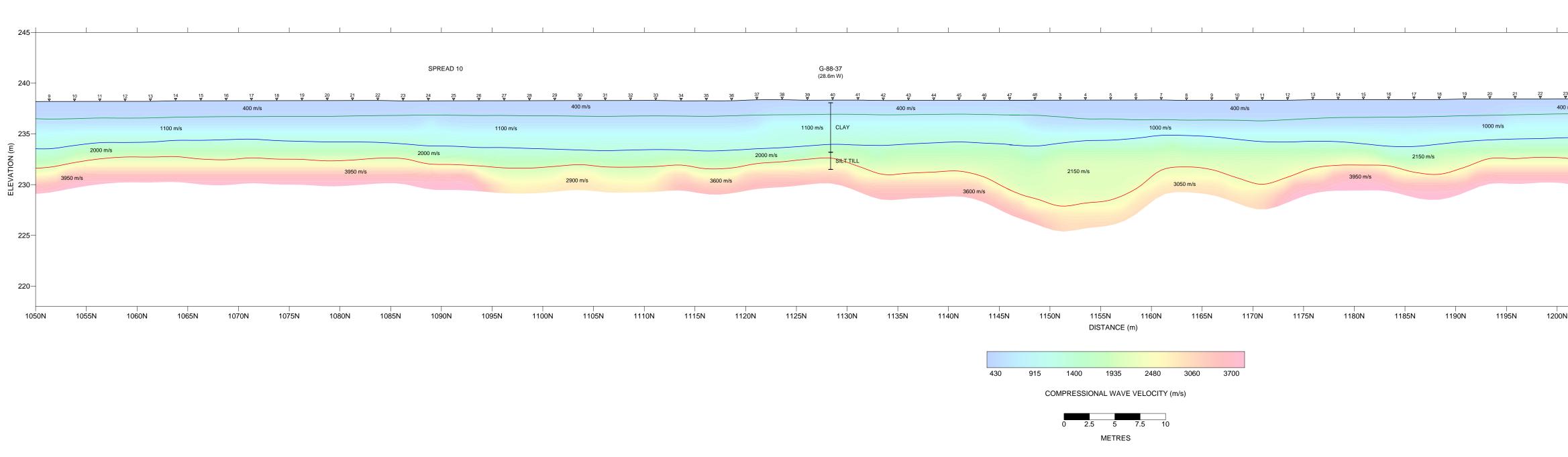




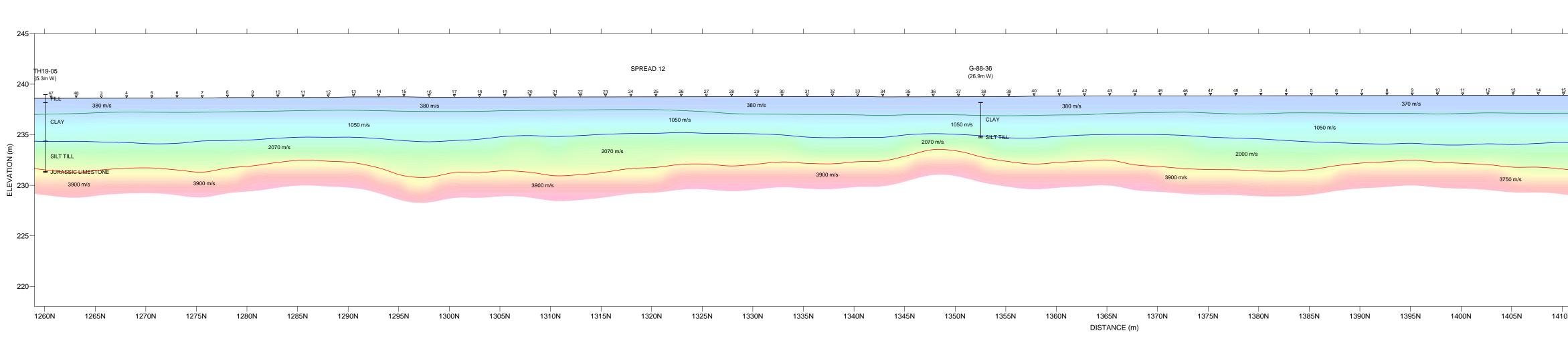
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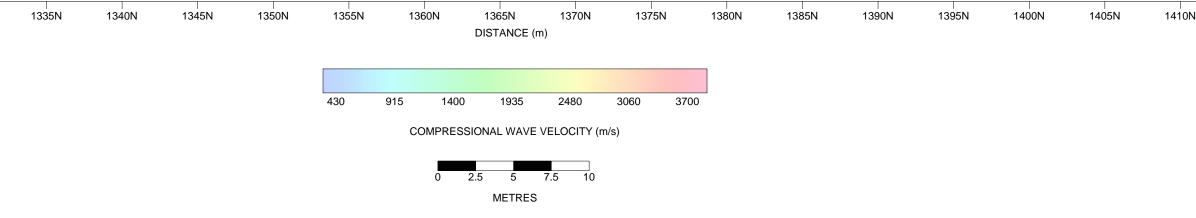


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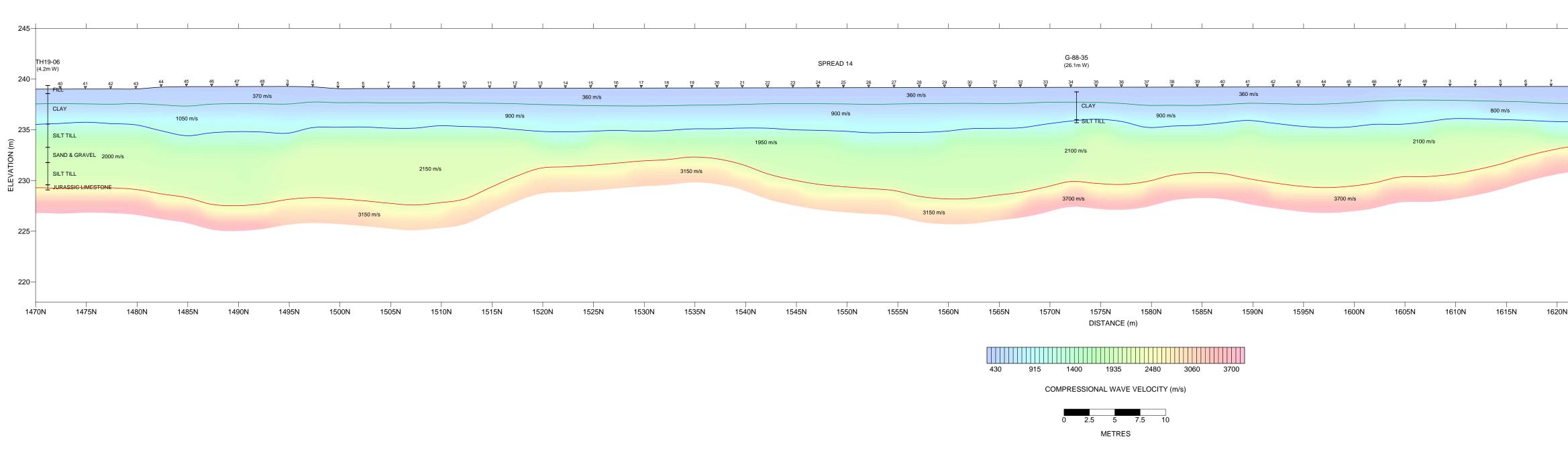


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DON	1205N	1210N	121	1 15N	122	20N	122	1 25N	1230	ON	123	5N	124	ON	124	45N	125	WINN	IIPEG RIC	KC CHARDS MIC RE	GS GR SON INTER EFRAC	OUP RNATION TION S	NAL AIRPO
ION	 1205N	1210N	121	1 15N	122	20N	122	1 25N	1230	DN	123	5N	124	0N	124	45N	12	WINN	IIPEG RIC	KC CHARDSO MIC RE PRETE	GS GR SON INTER EFRAC	OUP RNATION TION S PTH 3	NAL AIRPO
0N	1205N	1210N	121	1 15N	122	20N	122	25N	1230	DN	123	5N	124	ON	124	45N	125	WINN	IIPEG RIC SEISI	KC CHARDS MIC RE PRETE	GS GR SON INTER EFRAC ED DE	OUP RNATION TION S PTH 3	NAL AIRPO SURVEY SECTIO

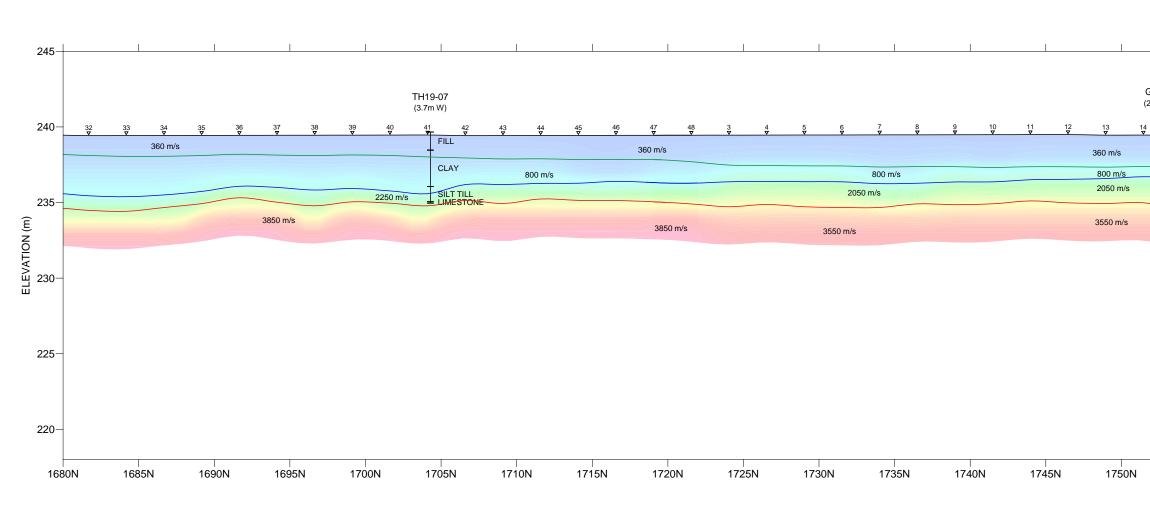




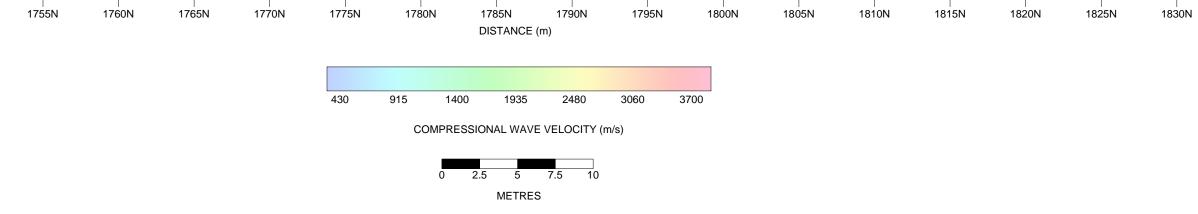
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15 10	5 17	18 19	20 21	22 23	SPREAD 13	26 27	28 29	30 31	32	13 34	35	36 37		19-06 (m W)
V	▼	▼ ▼	20 21 V V 370 n	<u> </u>	<u> </u>	<u>v</u> <u>v</u>	28 29 V V	<u>▼</u> ▼	32 3 V	33 34 ▼ ▼	370 m/s	<u> </u>	38 39 ▼ ¥ILL	
		1050 m/s							1050 m/s				CLAY SILT TILL	_
2000	m/s						2000 m/s						SAND & GRAVEL	+
													SILT TILL	-
						3750 m/s							3750 m/s	-
1 410N	1415N	1420N	1425N	1430N	1435N	1440N	1445N	1450N	I 14	55N	1460N	14651	N 1470N	- - 1475N
											WIN	NIPEG RICHAR	KGS GROUF	ONAL AIRPORT,
													REFRACTION TED DEPTI SL19-01G	H SECTION
											1			
												FRONT	IER GEOSCIEN	



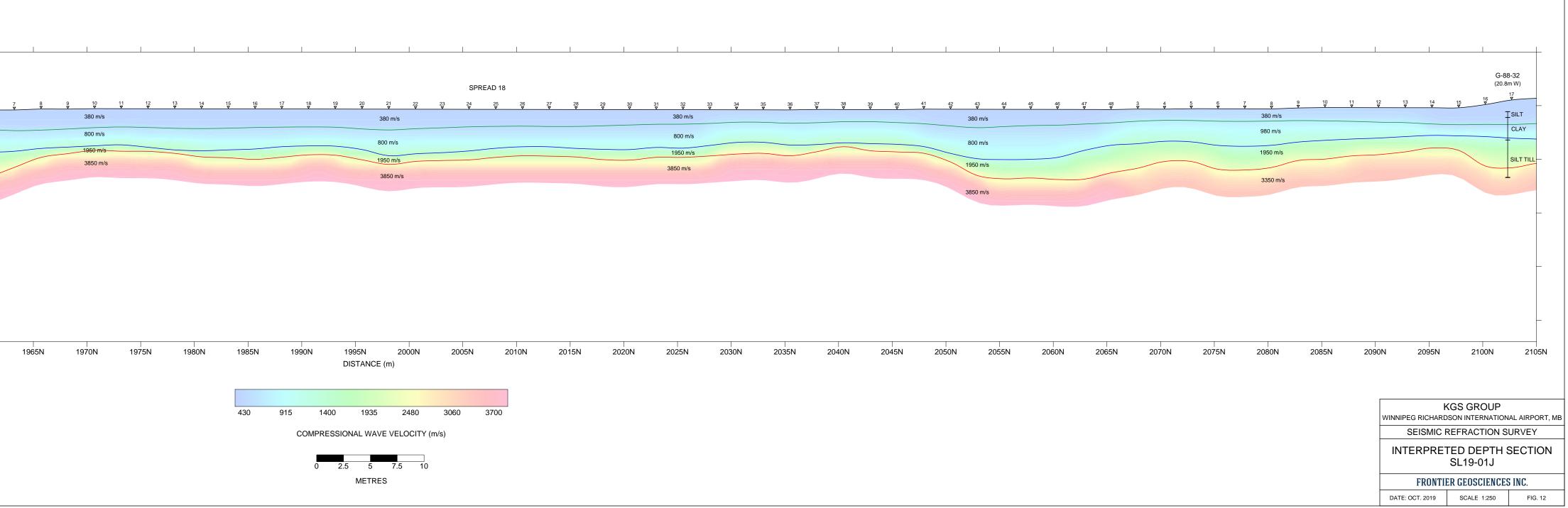
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8	9 V	10 ▼	11 12 V V	13 V	14 15 V V	16 ▼	17 ▼	18 1 V	9 20 7 7	21 文	22 ▼	23 V	24 ▼	25 2 V	6 27	28 マ	29 V	30 ▼	31 文	32 ▼	33 —
360 m/s										360 m/s									000 /		
							800) m/s											800 m/s		
					2100 m/s											2100 m/s					_
			3550 m/s										3	850 m/s							
					1											Γ					_
ON	1625N	N	1630N	1635N	164	ON	1645N	1	650N	1655	N	1660N	I	1665N	167	70N	1675	1	1680N		1685N
																WINNIP	EG RICHA		GROU		AIRPORT,
																	SEISMI				
																INT	ERPR		DEPT 19-01H		CTION
																	FRON		EOSCIEN		VC.
																DATE	OCT. 2019	s	CALE 1:250		FIG. 10

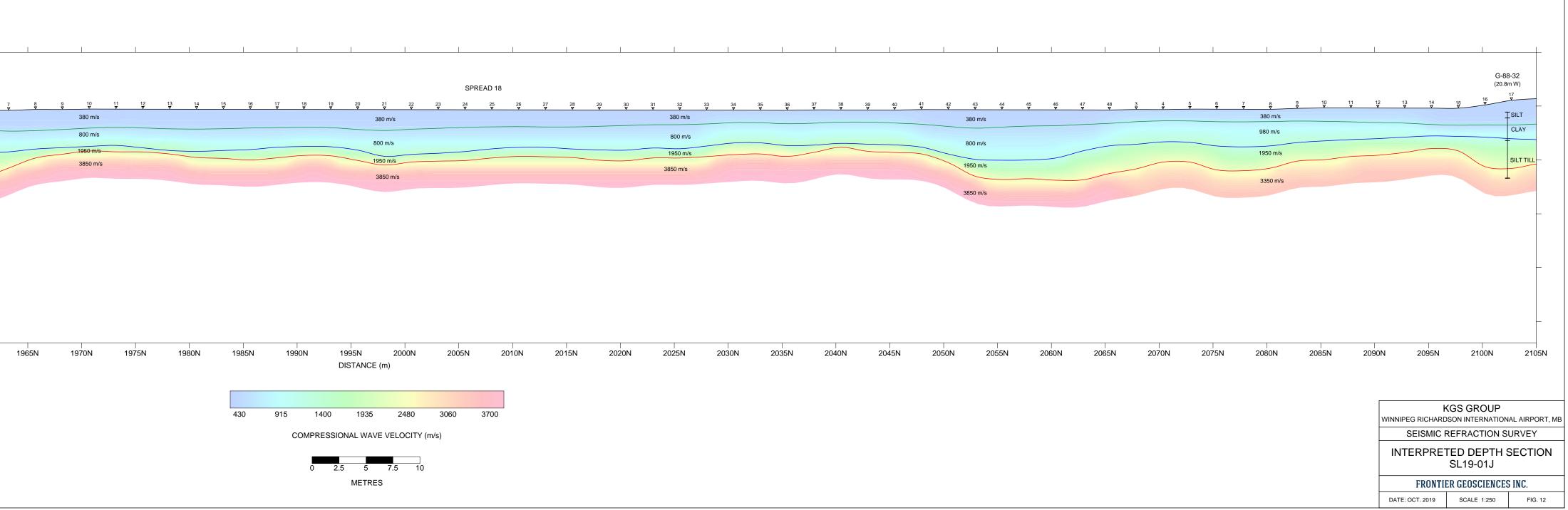


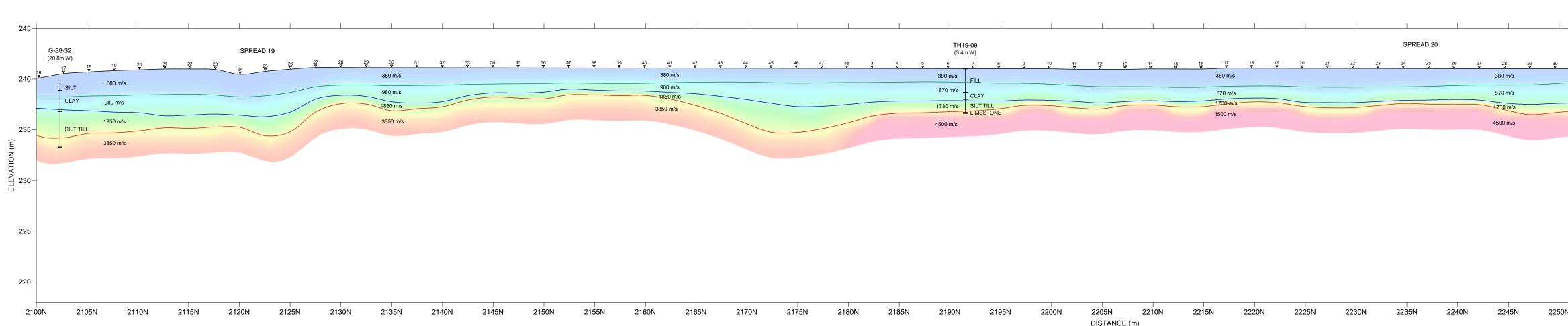
				1 1 1 1	
G-88-34 (25.1m W)	SPREAD 16				TH19-08 (3.7m W) SPREAD 17
14 15 16 17 V V V V		31 32 33 34 35 36 37 38 39 40 41 V V V V V V V V	42 43 44 45 46 47 48 3 4 5 v v v v v v v v v v		18 19 20 21 22 23 24 25 FILL 250 m/c
	360 m/s	360 m/s	360 m/s	350 m/s	
CLAY	800 m/s	800 m/s	800 m/s	800 m/s	CLAY 800 m/s
SILT TILL	2050 m/s	2050 m/s	2050 m/s	2050 m/s	LIMESTONE 2050 m/s
	3550 m/s	3550 m/s	3550 m/s	3850 m/s	3850 m/s
N 1755N 1760P	N 1765N 1770N 1775N 1780N 1785N 1790N	1795N 1800N 1805N 1810N 1815N 182	0N 1825N 1830N 1835N 1840N 1845		-
	DISTANCE (m)	3060 3700			KGS GROUP WINNIPEG RICHARDSON INTERNATIONAL AIRPORT, MB SEISMIC REFRACTION SURVEY INTERPRETED DEPTH SECTION SL19-011

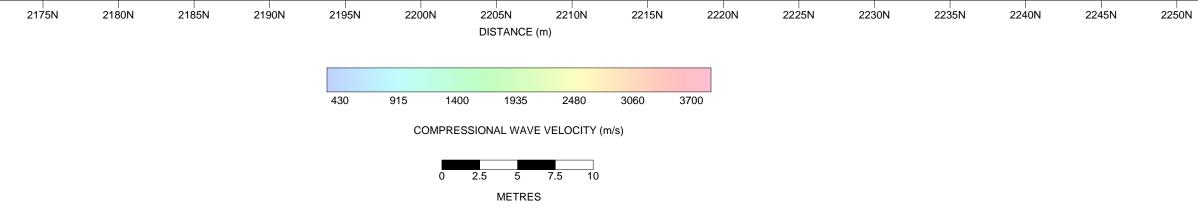


SPREAD 17 G-88-33 (5.7mW) 240 - ²⁴ 350 m/s 350 m/s 850 m/s 800 m/s CLAY 235 2050 m/s 2050 m/s SILT TILL 2800 m/s 2800 m/s <u></u> 230-225-220-1905N 1910N 1890N 1895N 1900N 1915N 1920N 1925N 030N 1935N

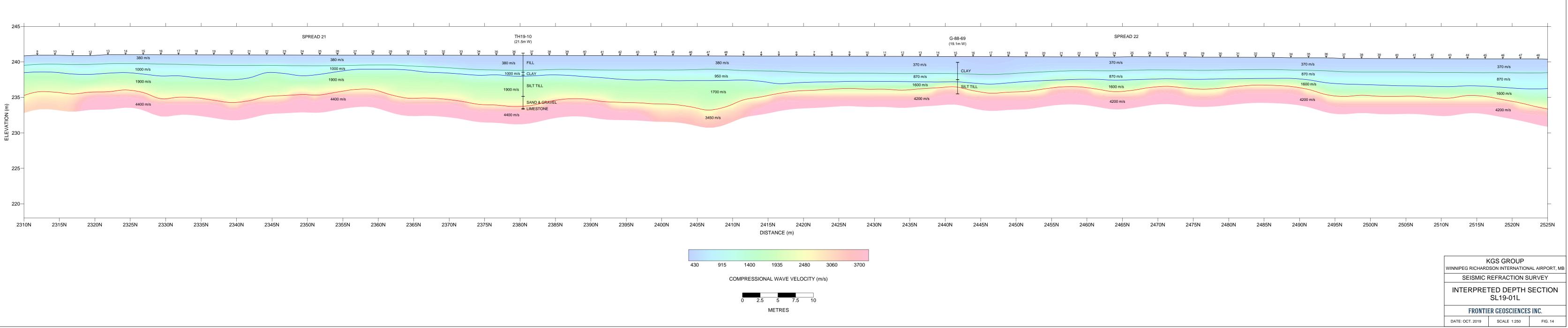


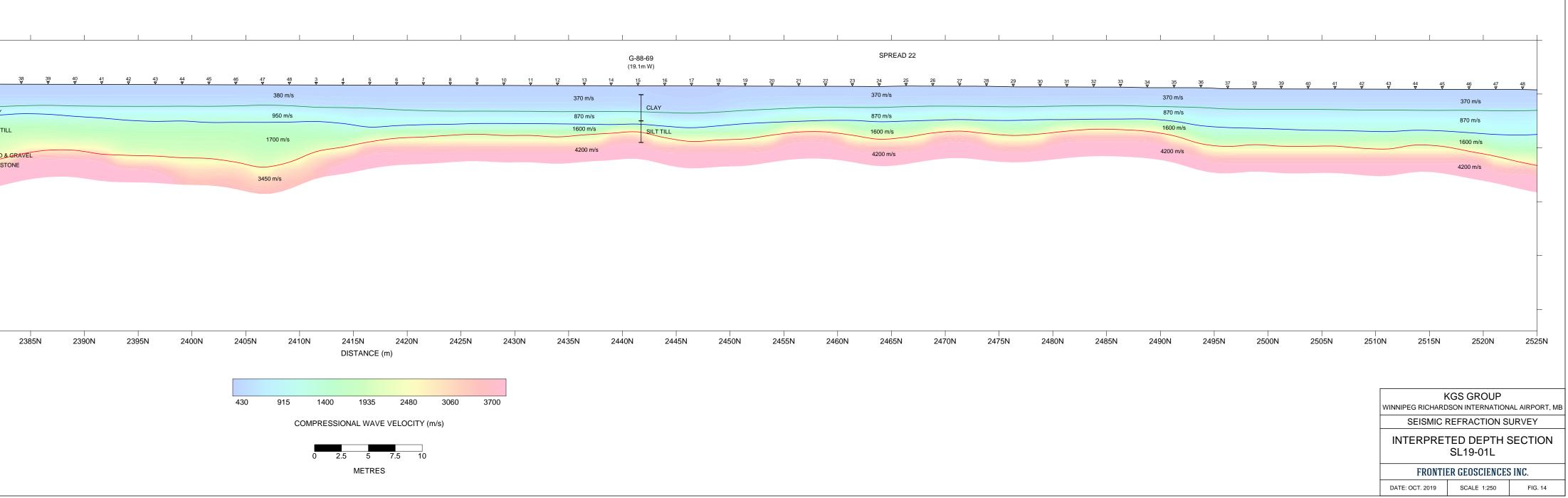


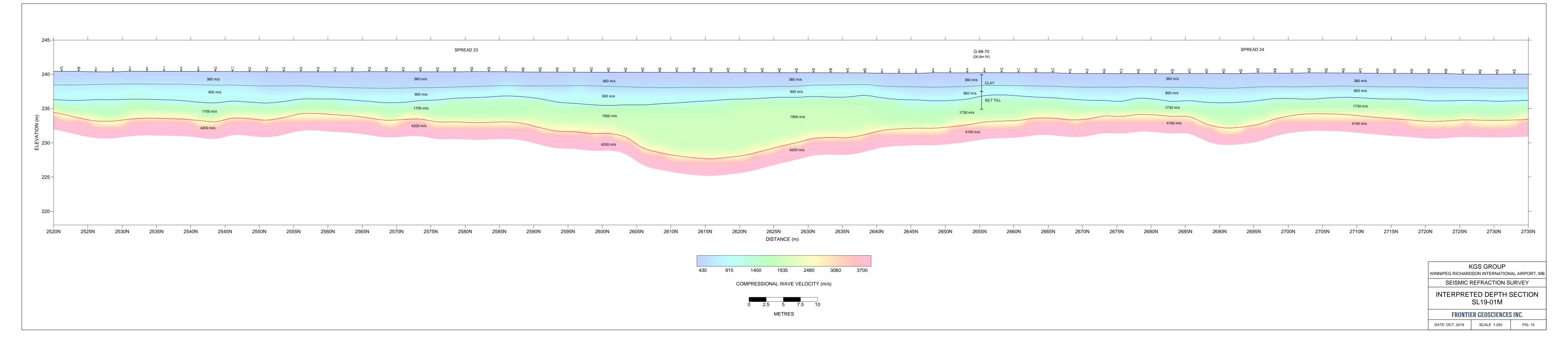


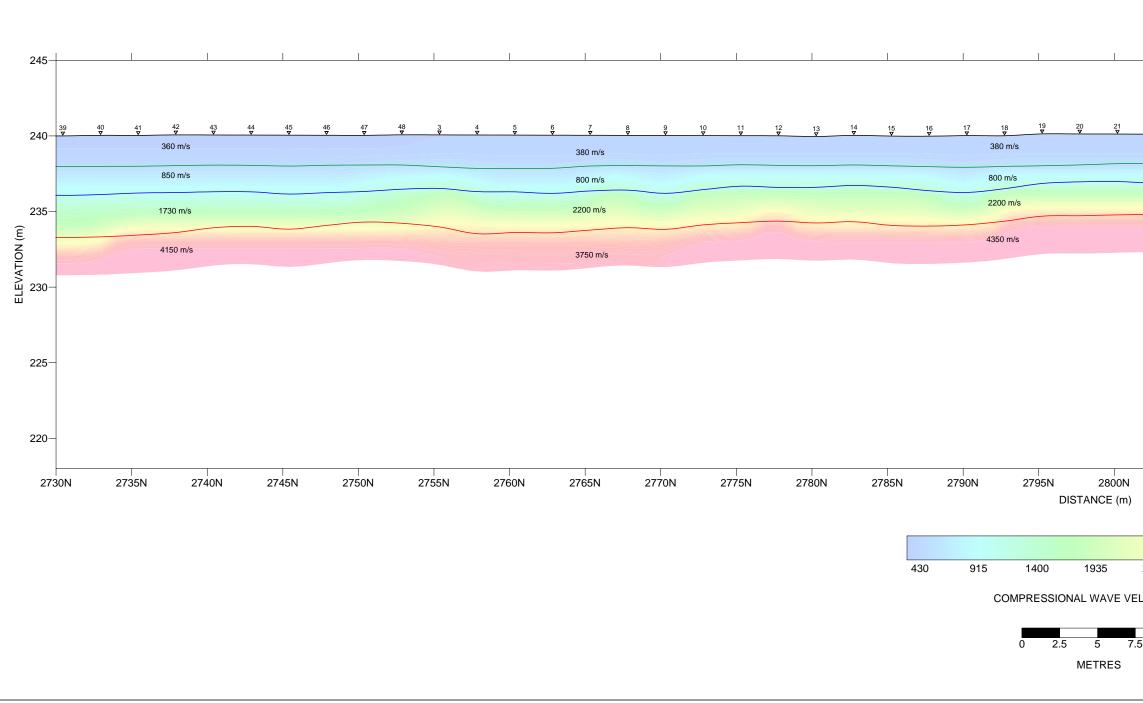


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					G- (10	-88-68).9m W)																		
)	31 ▼	32 ▼	33 V	34 ▼	35 V	3 <u>6</u> ⊤	37 文	38 3 V 380	v	0 41 7 7	42 ▼	43 ▼	44 ⊽	45 ▼	46 4 V V	7 48 7 7	3 7	4 ▼ 380 m/s	5 V	6 7	7 7	8	9 10 • •	
						CLAY		870	m/s									1000 m/s						
						SILT	TILL	210) m/s									1000 m/s						
								4500	m/s									1900 m/s	j					-
																		3150 m/s						
																								-
																								L
																								-
50N		2255N		2260N		2265N	1	2270N	2	275N	2280	N	2285	N	2290N	2295	5N	23001	N	2305N		2310N	231	5N
																		Г			KGS	GROUP		
																		,			RDSON	INTERNATIO	ONAL AIRPO	
																		+						
																			IINTE	-KPRI		DEPTH 19-01K	I SECT	UN
																				FRONT	FIER GI	EOSCIENC	ES INC.	
																			DATE: O	CT. 2019	S	CALE 1:250	FIG	G. 13

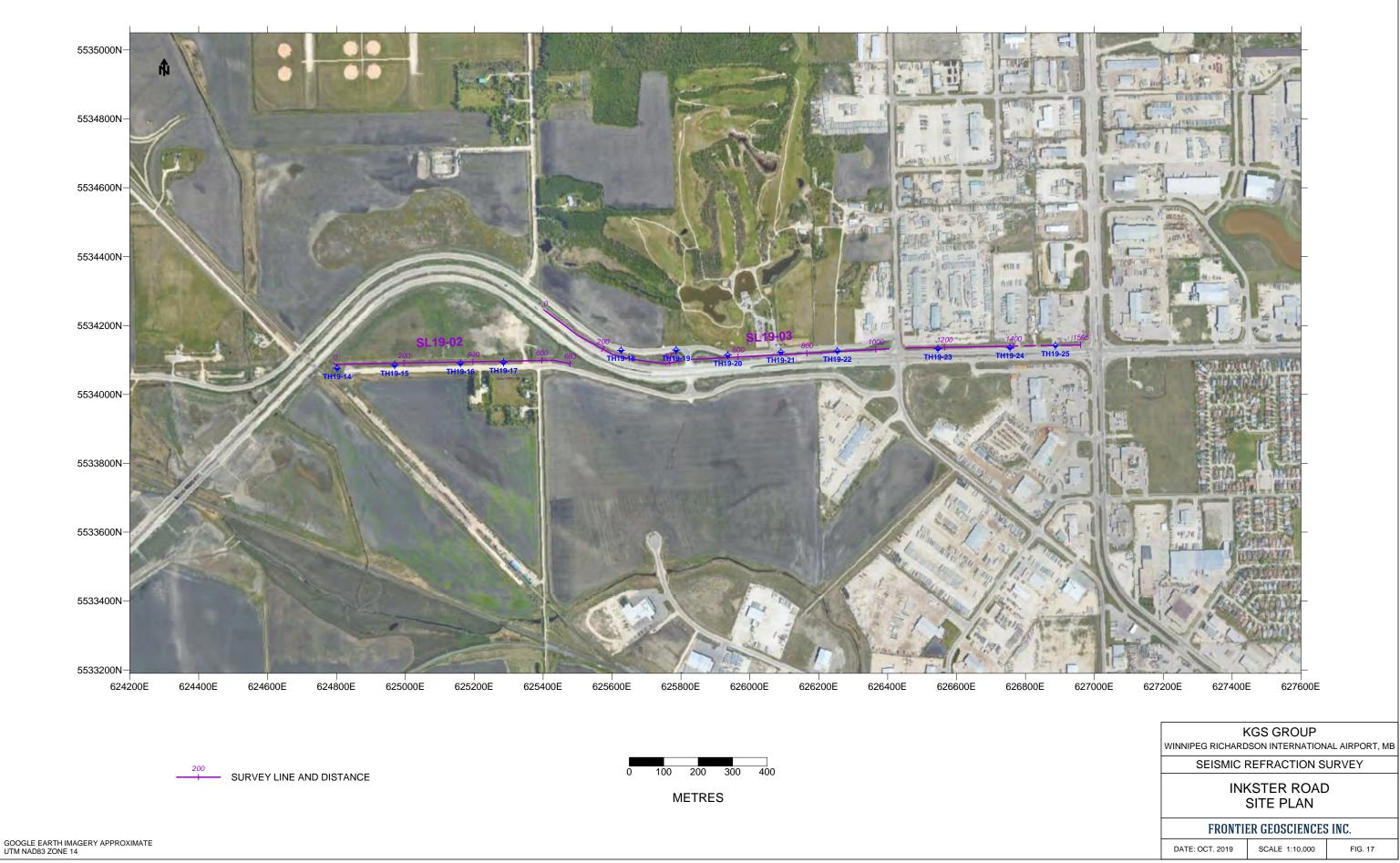


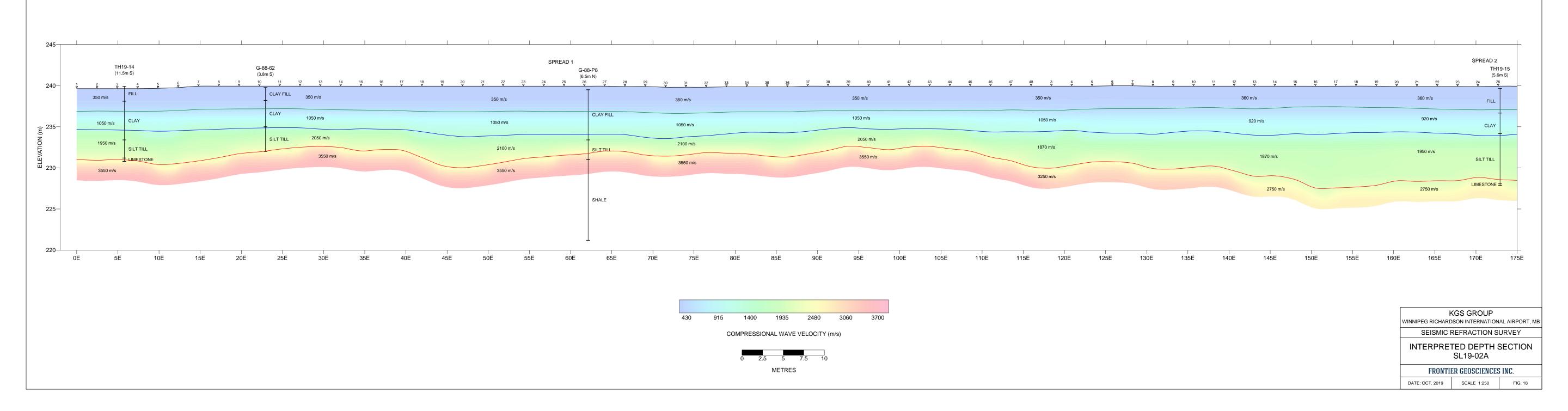


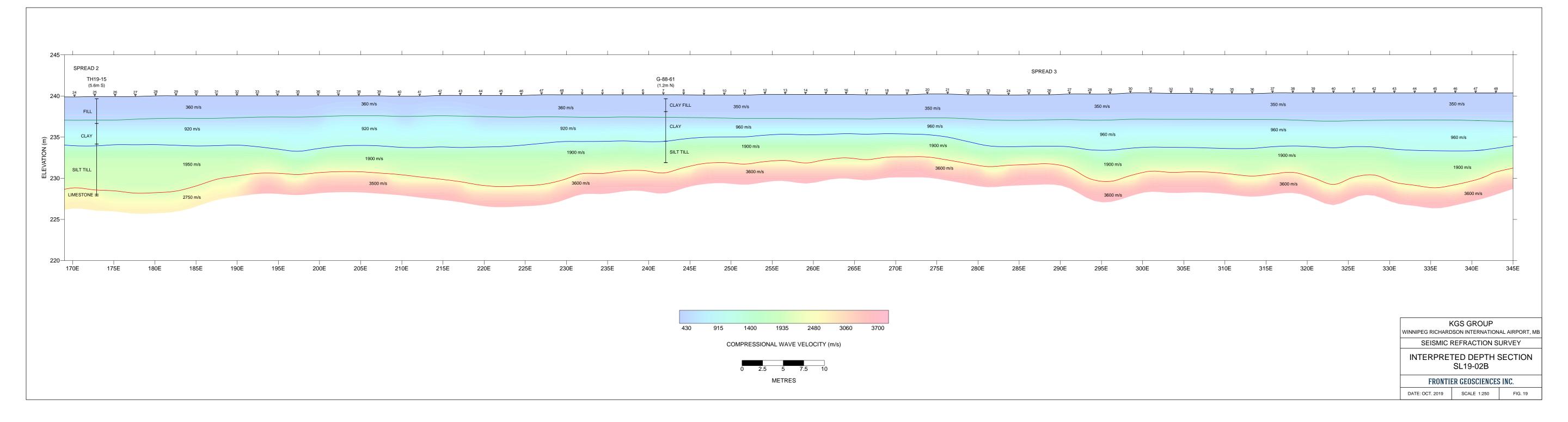


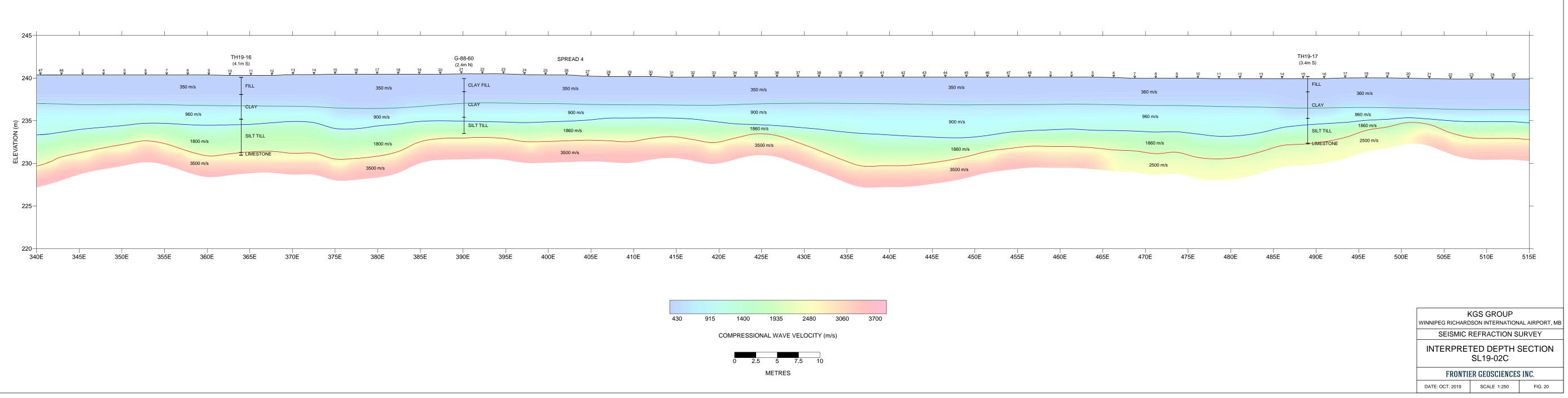


		SPREAD 2	25											G-88-71 (5.2m W)				
22 ▼	23 ▼	24 25 V V	26 マ	27 V	28 29 V V	30 31 V V	32 33 V V	3 34 ▼	35 ▼	36 37 V V	38 ▼	39 40 ▼ ▼	41 V	42 4 V	13 44 ▼ ▼	45 X	46 47 V V	48 v
					350 m/s							350 n	n/s					
					700 m/s							700 n	n/s					
					2100 m/s							2100	m/s	SILT	FILL		(mail	
					2100 11/3													
					4350 m/s							4350	m/s					
																		_
					1							1						_
I)	2805N	2810	DN	2815N	2820N	2825N	l 283	DN	2835N	28401	I 28	∣ 45N	2850N	285	55N	2860N	 2865N	28701
1) 2480				2815N	2820N	2825N	 283	N	2835N	28401	I 28	 45N	2850N	[K	3S GROUP	
	3060			2815N	2820N	 2825N	1 283	DN	2835N	28401	I 28	 45N	2850N	[WINNIPEG	K(G RICHARDS	GS GROUP	DNAL AIRPORT,
	3060 ГҮ (m/s)			2815N	2820N	2825N	1 283	DN	2835N	28401	I 28	 45N	2850N	[WINNIPEG	KO GRICHARDS EISMIC RI ERPRETI	GS GROUP ON INTERNATION	DNAL AIRPORT,
/ELOCIT	3060 ГҮ (m/s)			2815N	2820N	2825N	1 283	ON	 2835N	28401	I 28	 45N	2850N	[K(S RICHARDS EISMIC RI RPRETI	GS GROUP ON INTERNATION EFRACTION ED DEPTH	DNAL AIRPORT, SURVEY I SECTION

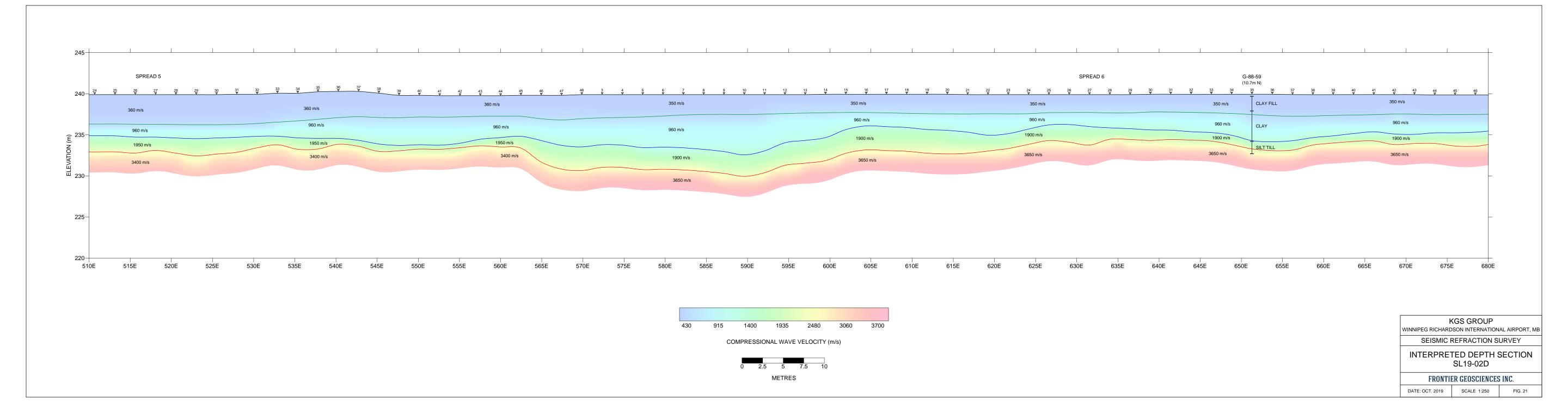


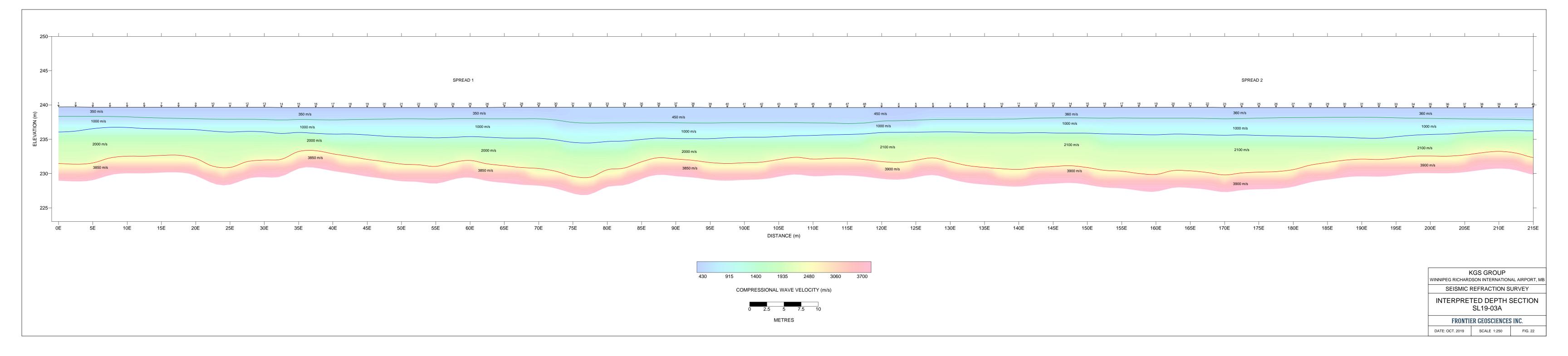


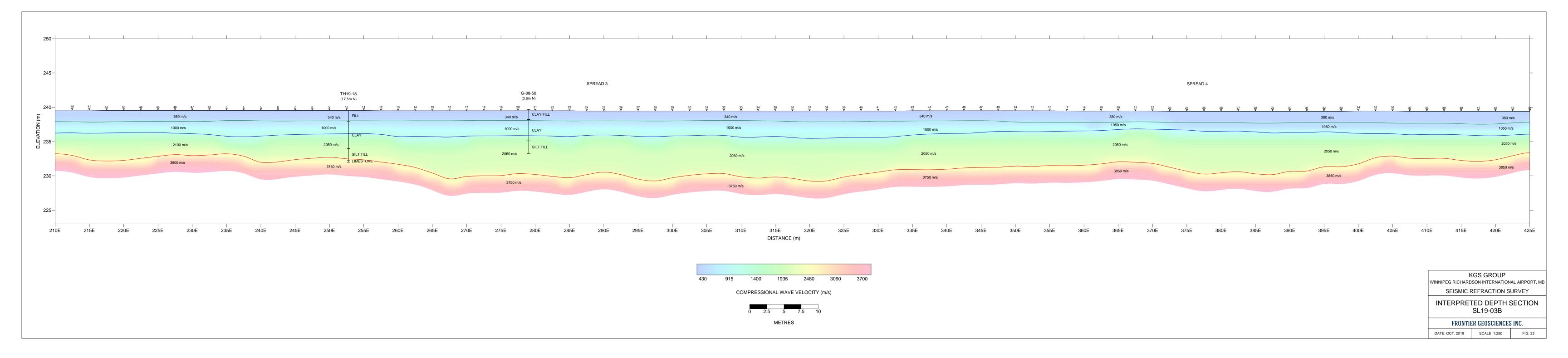


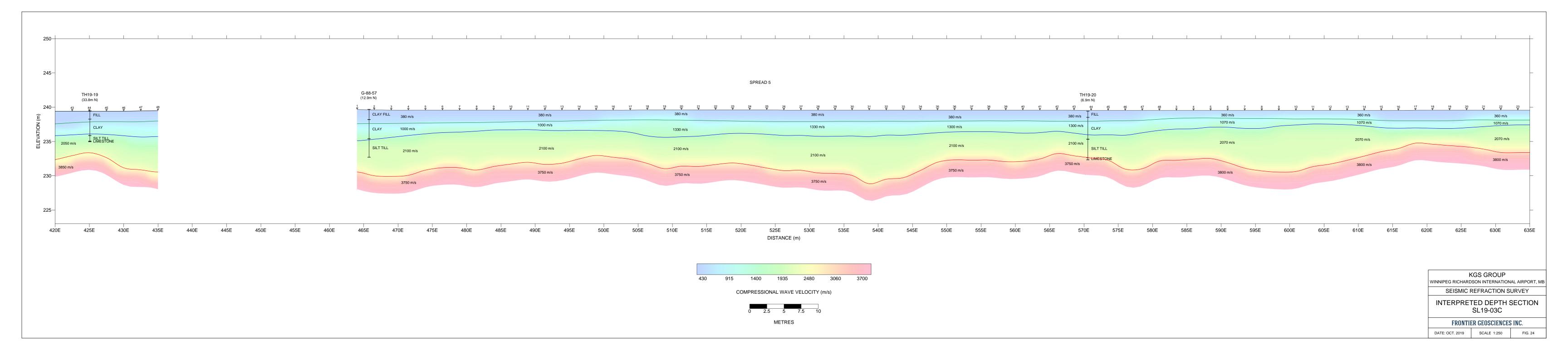


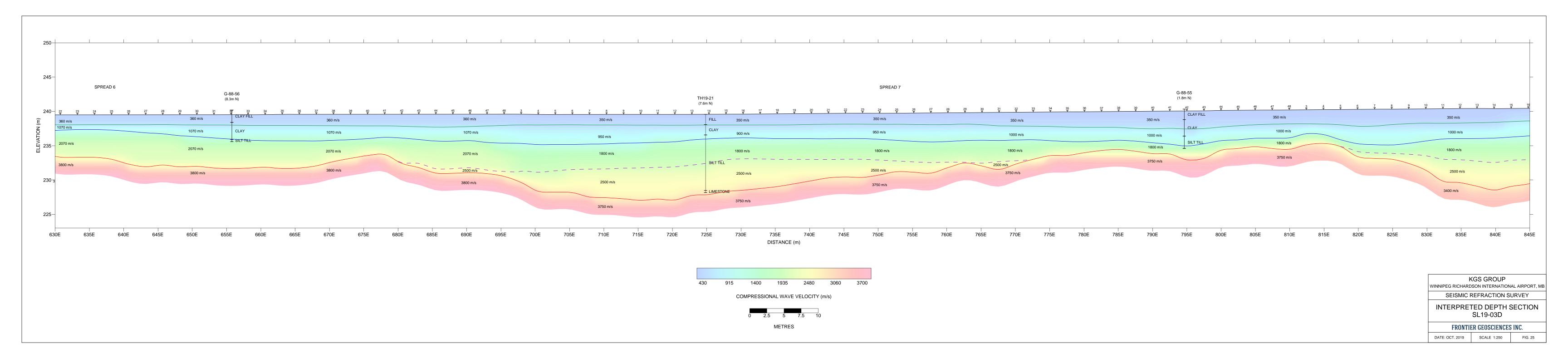


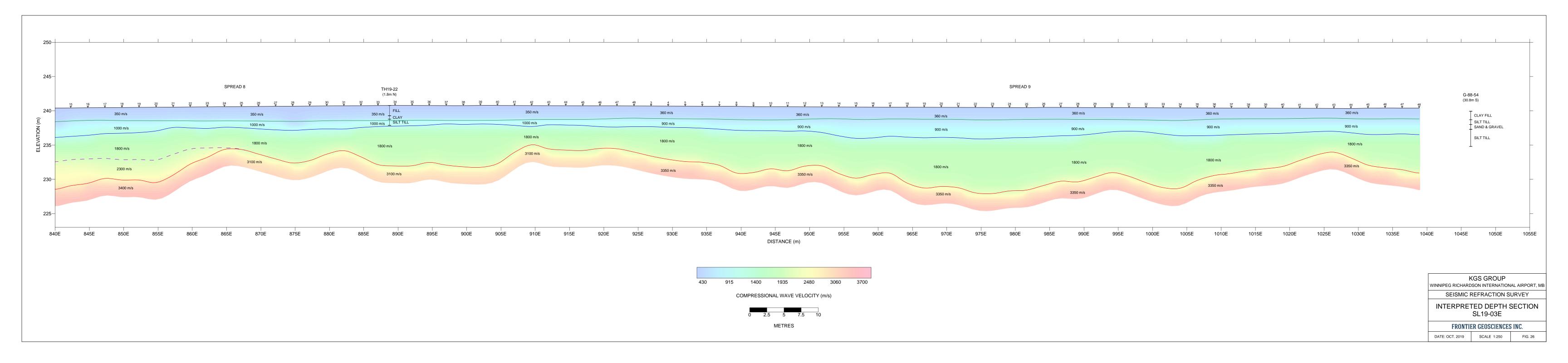


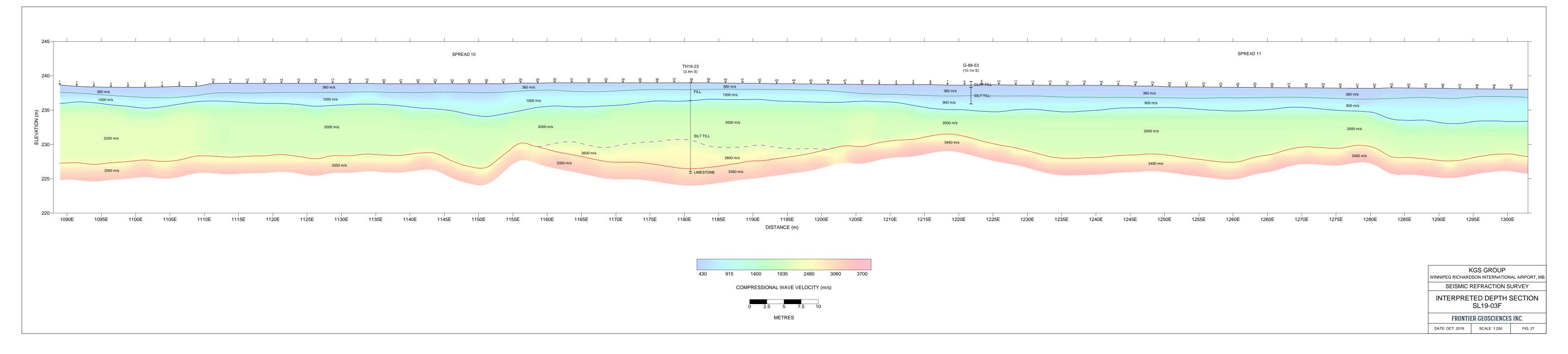


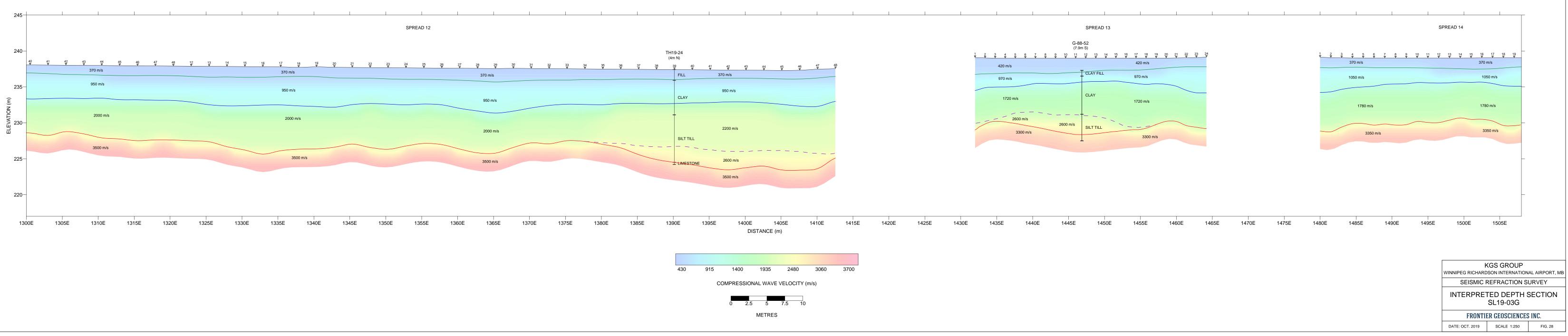


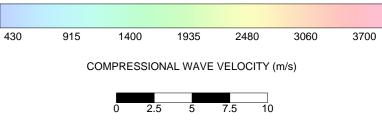


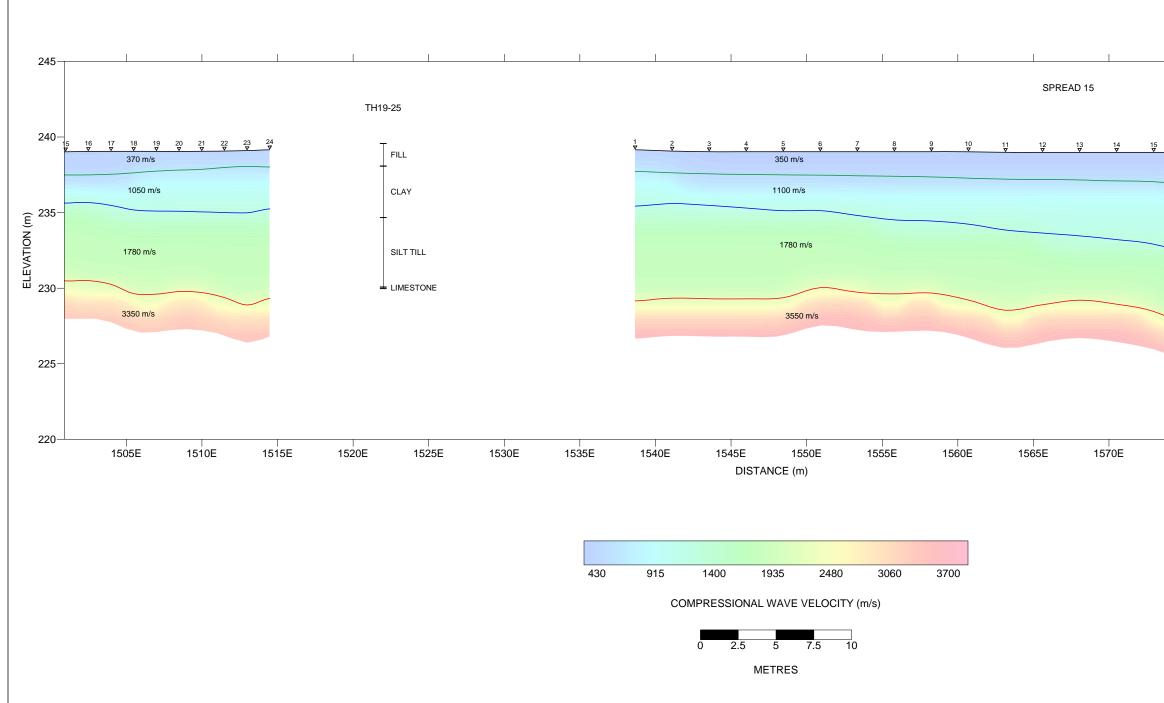












		_							\top
16 ▼	17 ▼	18 ▼	19 V	20 マ	21 ▼	22 V	23 V	24 V	_
	350 m/s								
		_							
	1100 m/s								_
	1700 m/s		/						_
	1780 m/s								
	3550 m/s	s							
1575E	1	580E		1585E		1590E		1595E	
					k	GS GR	OUP		
					ARD	SON INTER	RNATION		
						REFRAC			
			INT 	ERPR	RE	FED DE SL19-0		SECTI	ON
				FROM	ITI	ER GEOSC		S INC.	
			DATE:	OCT. 2019)	SCALE	1:250	FIG	. 29



Experience in Action

APPENDIX B

2023/2024 KGS Group Borehole/Test Pit Logs

		5	TEST HOLE LOG					le n 123	0. -01						SHEET	1 of 2
LOC DES DRII	NT DJECT ATION CRIPTION LL RIG / HA THOD(S)	AMMEF	CITY OF WINNIPEG - WATER AND WASTE DEPAR CentrePort Regional S&W Servicing Winnipeg, Manitoba Southwest corner of lift station GeoProbe 3230 Track Mounted Drill Rig with Auto 0.0 m to 9.1 m: 125 mm Ø SSA 9.1 m to 22.5 m: Water Rotary HQ Core - switcher	o-H	amn	ner	SUI TO ST/ UT	RFAC C STI ART I M (m	DATE 1)	ev. IP / E	2 LEV. () 9 N E)-28-2 N 5,53 E 623,) m n / 24: 023 0,113 145	1.12 m	ı (Standp e 14	ipe)
1 (m)		cs		VEL		DG OF STALLS	YPE	RUN	۲ %	/RUN)	l5 m	ш		PL	MC L	L
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	WATER LEVEL	DIAGRAM	DEPTH (m)	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE			/ANE (kPa T PEN (kF	-
	(m) (ft)		ELEV (m)					z		ß	-		SPT 2	(N) BL	ows/0.3) m ▲ 80
240			<u>CLAY FILL</u> - 1219 mm, Grey and black, dry to damp, very stiff, trace to some organics.				₿ }	S1								350
239			ORGANIC SOIL - 305 mm, Black, dry to damp, loose, trace wood, organics. 238.7 CLAY (CH) - Black, damp to moist, very stiff, high					S2 S3							•	300
238	2.0		plasticity, trace organics. - Brown to grey, trace to some gypsum and silt pockets below 2.0 m.				₹]	S4								275
239 238 238 238 237 237 237	3.010						Ы									250 250 250
236	4.0		- Stiff below 4.1 m. - LL=66, PL=21, PI=45 at 4.3 m.				₹1	S5						•		•
11111111111111111111111111111111111111	5.0		235.3 <u>SILT TILL (ML)</u> - Light grey, dry to damp, dense, with coarse grained sand, trace gravel, some clay.													225
67.01.97 11.11.1234	6.020		- PSA: 7% gravel, 34% sand, 45% silt, 14% clay at 5.8 m. - Light brown to grey below 6.1 m.		Vibra Vibra Vivv17		₿ }	S6 S7	100		9 14 21	35	•			
	7.0			Ţ			स	58								
	8.0							S9	100		14 19 19	38				
232 232 1111111111231 231 231 231	9.0		- Very dense below 9.1 m.		VIDI a Wi VW17	8.53 8.53 9.40	₹ <u>1</u>	S10 S11	55		49 50/ 100mm	+100	•			>>
	10.0		 Hard drilling/grinding below 10.0 m. Grey and black boulders and cobbles, trace to some weathered limestone in sampler from 10.1 m to 11.1 m. 			10.46		R1	32							
			229.1 ARGILLACEOUS LIMESTONE/CALCAREOUS SHALE - Reddish-gray to purplish-gray, fine grained, thinly bedded, fossiliferous, fissile, moderately strong.					R2	97	78						
		ing Dril on Com	ling/Diggingon 9-28-2023 None Encounteredpletion6.71 m on 9-29-2023			CONTR Mar	-	-	Drillir	ng Ltd		IN	ISPEC M.R	TOR ODRIC	GUEZ	
	14					APPRO	VE					D	ATE	2-2024		

	GROUP	5	TEST HOLE LOG						le n 123	0. 5 -01					S	HEET 2	! of
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION		WATER LEVEL	LOG OIAGRAM		SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE			E (kPa)) ♦
<u></u> ∎	(m) (ft)		515	V (m)	1	/IQ	DEI	S	ž	-	RQI	B		SPT (N	I) BLOW 40	s/0.30	m
228	-40		- Good quality from 11.2 m to 12.6 m.	• (11)	╞			t 🔳			(10)			20	40	<u> </u>	
	=		 ~30 mm soft shale/clay seam at 12.1 m. Fair quality from 12.6 m to 15.7 m. 					-									
2227 2226 2225 2224 2223 2222 2221	13.0		- UCS: 24.1 MPa at 12.9 m. - Increased shale content, weak, several ~20 mm joints with soft shale/clay infill from 13.0 m to		· · · · · · · · · · ·				R3	96	59 (14)						+
	14.0		13.1 m. - Decreased shale/clay content from 13.1 m to 14.3 m.						113	50	(14)						
226			- Broken/Fractured core zone infilled with soft reddish-purple shale/clay at 13.9 m. - ~125 mm Fractured zone infilled with soft		· · · · · · · · · · · · · · · · · · ·												
225	15.0		 Shale/clay, very weak at 14.3 m. Moderate strength below 15.2 m. 		· · · · · · · · · · · · · · · · · · ·		15.34		R4	92	65 (15)						+
			- Poor quality from 15.7 m to 20.3 m.														
224			- 50 - 100 mm thick shale interbeds spaced 150 - 300 mm apart from 16.0 m to 18.0 m.		· · ·				R5	97	45 (23)						
23	17.0—		- UCS: 17.6 MPa at 16.9 m.								. ,						_
-											40						
222	18.060								R6	93	40 (18)						+
221	19.0				· · ·												_
	65								R7	93	64 (16)						
220	20.0		- Fair quality below 20.3 m.					-									
219	21.0		- Two ~75 mm thick shale/clay interbeds from 20.9 m to 21.5 m.						R8	100	65 (14)						+
			- Decreasing shale/clay content, increasing strength below 21.2 m.				21.44										
18			Notes:	217.7			22.50		R9	93	70 (3)						
218 217 217 216	23.0 75		 End of test hole at 22.5 m. Refusal encountered on suspected boulder at a depth of 9.1 m. 														
	24.0		 Protective well cover installed at surface. 50.8 mm or two (2) inches diameter standpipe installed. 														
216			 Vibrating wire piezometer (VW171370) installed at 8.53 m below grade. 														
215	25.0																
	26.0																
	 ER		Iling/Digging on 9-28-2023 None Encounte	ered		СС	DNTF						I IN			7	
	.S 및 Upo	n com	pletion 6.71 m on 9-29-2023				PRC			זוווייט	ng Ltd	•		<u>м. ко</u> Ате	DRIGUE	2	

	GROUP	5	TEST HOLE LOG			23-						SHEET	1 of 1
LOC DES DRI	DJECT ATION CRIPTION	AMMER	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba ~180 m south of Silver Ave, ~125 m west of Sturgeon Rd GeoProbe 3230 Track Mounted Drill Rig with Auto-Hamm 0.0 m to 7.0 m: 125 mm Ø SSA	SI ST U	URF TAR	ECT ACE T D/ (m)	ELE Ate	EV.	2	23-010 237.80 9-27-2 N 5,52 E 623,5	023 8,181	one 14	
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)		SA	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE	qu POC	MC • RVANE (kP KET PEN (k BLOWS/0.3 40 60	Pa) 🛨
			CLAY FILL - 762 mm, Grey and black, dry, grass surface.	237.0		ł	S1						400
237	1.0		<u>CLAY (CH)</u> - Grey, dry to damp, high plasticity, very stiff to hard.			<u>₹</u>	S2						275
236	2.0		 Trace to some silt inclusions below 1.8 m. Damp to moist, stiff below 2.3 m. 										•
	3.0		- Firm below 3.0 m.			£	S3					•	
234	4.0			233.1		£	S4				•		
-233	5.0		SILT TILL (ML) - Light grey, moist, compact, some to with fine to coarse grained sand, trace gravel. - With red discoloration/alteration below 5.3 m.			<u>1</u>	S5						
	6.0-20		- Compact, some limestone fragments in sampler at 6.1 m.			4	S6	56	4 5 5	10			
231	7.0		Notes: 1. End of test hole at 7.1 m. 2. Refusal encountered on suspected bedrock at a depth of 7.0 m. 3. Test hole backfilled with auger cuttings and bentonite chips.	230.7			S7	17	40/ 60mm	+100			
229	8.0												
228													
227	35												
226													
WAT LEVE	ER		ling/Diggingon 9-27-2023 None Encounteredpletionon 9-27-2023 None Encountered	CONTRA Maple			rillin	g Ltd		IN	ISPECTOR M. RODR		
	• -			APPROV K. FO	ED			-		D	ATE 1-22-202	24	

	GRO		TEST HOLE LOG TH23						Ļ				Sł	IEET 1	of 1
LOC DES DRII	JECT ATIOI CRIPT	ION i / HA	MME	 CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba ~15 m south of Silver Ave, ~175 m west of Sturgeon Rd R GeoProbe 3230 Track Mounted Drill Rig with Auto-Hamm 0.0 m to 7.3 m: 125 mm Ø SSA 	S S U	URF		T NO E ELI DATE I)	EV.		23-010 237.80 9-27-2 N 5,52 E 623,5	m 023 8,361	Zone 14	4	
ELEVATION (m)	3 DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m	WATER LEVEL	SAMPLE TYPE	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE	qu PC		E (kPa) · EN (kPa))*
		-		CLAY FILL - 914 mm, Grey and black, dry, grass surface.			Ĭ	S1							
-237		- - 5 -		<u>CLAY (CH)</u> - Grey, damp to moist, hard, high plasticity, some silt pockets. - Very stiff below 1.5 m.	236.9		ß	52							450 ★ 300 ★
237 236 235 235 234	3.0	_ _ 10 _		 Stiff, increasing silt pockets below 2.3 m. Firm below 3.0 m. 			8	S3					•	•	
	4.0	- - 15			222.6		招	S 4				•			
ЕРТ 26 ТО 29, 2023. ПТТТТТТТТТТТТТТТ 757	6.0	- - 20		SILT TILL (ML) - Light grey, moist, compact, some to with fine to coarse grained sand, trace fine grained gravel. - With red discoloration/alteration below 5.6 m. - Compact below 6.1 m.	232.6		н Д	S5 S6 S7	72	5 7 8	15		•		
09 CENTREPORT S 77111111111111	7.0	_ _ 25		Notes: 1. End of test hole at 7.4 m.	230.4	4		58	17	40/ 80mm	+100				
	8.0 1 9.0 1 1	_ _ 30 		 Refusal encountered on suspected bedrock at a depth of 7.3 m. Test hole backfilled with auger cuttings and bentonite chips. 											
		- 35 													
				Iling/Digging on 9-27-2023 None Encountered on 9-27-2023 None Encountered	CONTRA Maple APPROV K. FO	e Le 'ED	af [ng Lto	l.		SPECTO M. ROE ATE 1-22-2	DRIGUE	z	

	-			5		TEST HO	LE LOG				E NC 23). - 05						SHEET	1 of 1
P L C	OC/ DES(DRIL	JECT ATIOI CRIPT	ION i / HA	MME	CentrePort Re Winnipeg, Ma ~180 m north R GeoProbe 323	egional S&W Ser anitoba of Silver Ave, ~1	50 m west of Sturg d Drill Rig with Aut	geon Rd	SI ST U	URF Far	AC	r no e ele ate)		:	23-010 239.33 11-15- N 5,52 E 623,5	m 2023 8,557		e 14	
		a) DEPTH		GRAPHICS		DESCRIPTI CLASSIFIC	ATION		ELEV (m)		SAMPLE TYPE	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE	Cu qu l	TORV	MC L ANE (kPa T PEN (kP DWS/0.30) ◆ a) ★
2	39		-				n organics, with rootl nigh plasticity, trace f		239.2										
E			-		coarse grained sa	nd.					ਸ	S1							
Ē		1.0	-		- Stiff, trace fine	grained gravel below	w 0.8 m.												┥┥
=_2	38		- 5				-l				ਸ	S2							
E		2.0	-		- Mottled brown	to grey, trace slit in	clusions below 1.5 m				ਸ	S3					•		•
2	37	2.0	-			aht grev moist der	nse, with fine to coars	so grained	237.0										
E			_		sand, trace fine to	o coarse grained gra	ivel, some clay.	se granieu											
Ē		3.0	-10		- PSA: 8% gravel,	27% sand, 46% silt,	19% clay at 2.7 m.				R	S4		9		•			
	36		-	· [] .[.	- No clay below 3	8.4 m.						S5	56	9 15 21	36				275
E			-								Ы	S6				•			×
	25	4.0			Notes:				235.1										
I SEPT 26 10 29, 2023.GPJ ТПТПППППППППППППП А	34	5.0			 End of test hol Refusal encou 	ntered on suspecte	d bedrock at a depth ttings and bentonite												
5 E		7.0	_																
	32		-																
			-25																
10/-0		8.0	_																
-7010-23-010/-	31		-																
		9.0	-																
	30		30																
P/FMS/23-010/-			_																
		10.0	-																
	29		-																
		,, [–]	35																
	28	11.0	_																
			-																
		= = = R □ ▽	- Duri	ng Dri	lling/Digging	on 11-15-2022	None Encountere	h l											
	VEL				pletion		None Encountere		CONTRA Maple			rillin	g Ltd	•		ISPECT S. GA			
202								Γ	APPROV	ED					D	ATE	2024		
<u>د</u>									K. FO	κDΥ	rUE					1-22	-2024		

K	GROUP	S	TEST HOLE LOG		OLE N		5			SHEET 1 of 1
LOC DES DRI	ENT DJECT EATION ECRIPTION LL RIG / H THOD(S)		 CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba ~260 m south of Saskatchewan Ave, ~160 m west of Stur R GeoProbe 3230 Track Mounted Drill Rig with Auto-Hamn 0.0 m to 6.7 m: 125 mm Ø SSA 	SI ST geon Rd U	ROJEC URFA TART TM (r	ce el Date	EV.	2	23-010 239.10 9-27-20 N 5,528 E 623,5	0 023 8,836
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)			RECOVERY %	BLOWS/0.15 m	N-VALUE	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80
239			<u>CLAY FILL</u> - 762 mm, Grey and black, dry, grass surface. <u>CLAY (CH)</u> - Grey, dry to damp, hard, high plasticity.	238.3						42
237	2.0		 Stiff below 2.1 m. <u>SILT TILL (ML)</u> - Light brown to grey, damp to moist, compact, with fine to coarse grained sand, trace fine grained gravel. Compact below 3.0 m. 	236.5	, LI	7	100	8 11	27	15
235	4.0		- Dense, with red discoloration/alteration below 4.6 m.			S4	100	11 16 13 24 22	27 46	
	5.0 6.0 20		- Very dense below 6.1 m.	222.2	Εų.	57	100	33 50/ 110mm 40/	+100	>>
	7.0		Notes: 1. End of test hole at 6.8 m. 2. Refusal encountered on suspected bedrock at a depth of 6.7 m. 3. Test hole backfilled with auger cuttings and bentonite chips.	232.3		58	17	80mm	+100	
23600-7010-523SW45	9.0 30									
	10.0									
			lling/Diggingon 9-27-2023 None Encounteredpletionon 9-27-2023 None Encountered	CONTRA Maple			ng Lto	 I.	IN	ISPECTOR M. RODRIGUEZ
			-	APPROV K. FO	ED		-		D	ATE 1-22-2024

				TEST HOLE LOG		-	E NO 23	э. -07				SHEET 1 of 1
	CLIE PRO LOCA DESO DRIL		MME	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba ~15 m south of Saskatchewan Ave, ~130 m west of Sturge GeoProbe 3230 Track Mounted Drill Rig with Auto-Hamm 0.0 m to 5.5 m: 125 mm Ø SSA	S S eon Rd U	URI TAF	FAC RT D	T NO E ELI DATE	EV.		23-010 239.10 9-27-20 N 5,529 E 623,5	m 023 9,083
	ELEVATION (m)	(t) (t) (t)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m	WATER LEVEL	SAMPLE TYPE	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80
	-239			CLAY FILL - 610 mm, Grey and black, dry, grass surface.	220 Г		Ł	S1				
F	238	1.0 		CLAY (CH) - Grey, damp, hard, high plasticity, some silt pockets.	238.5	<u>,</u>	ł	52				400 350 400 400
	236	3.0 1 10 1 1 10 1 1 10 1 1 10 1 1 10 1 1 10		<u>SILT TILL (ML)</u> - Light grey, dry to damp, dense, some fine to coarse grained sand, trace fine grained gravel. - Dense below 3.0 m.	236.4	Ł	ł	S3 S4	56	14 20 20	40	
7 Z3, ZUZ3.GL J	235	5.0		Notes:	233.6	5	R	S5 S6 S7	100 6	7 7 29 40/ 30mm	36 +100	
	-233	6.0 ² 20 7.0 ²		 End of test hole at 5.5 m. Refusal encountered on suspected bedrock at a depth of 5.5 m. Test hole backfilled with auger cuttings and bentonite chips. 								
	231	8.0 										
		9.0										
		11.0 11.0										
	- I Wate Level			Iling/Diggingon 9-27-2023 None Encounteredpletionon 9-27-2023 None Encountered	CONTRA Maple)rilli-	لم ا+ما	I	IN	SPECTOR M. RODRIGUEZ
		∓ oho			APPROV K. FO	ΈD			יק בנט	•	D	ATE 1-22-2024

K	GRO		5	TEST HOLE LOG				le N 123	0. - 08						SHEE	ET 1 o	/f 1
LOC DES DRI	DJECT ATIOI CRIPT	'ION i / HA	MMEF	CITY OF WINNIPEG - WATER AND WASTE DEPARTMEN CentrePort Regional S&W Servicing Winnipeg, Manitoba South side Saskatchewan Ave Rail Crossing GeoProbe 3230 Track Mounted Drill Rig with Auto-Ham 0.0 m to 3.0 m: 125 mm ø SSA 3.0 m to 9.4 m: Water Rotary HQ Core - switched due t	nmer		SUI STA UTI	RFAC ART [M (m	-	EV.	2 9 1 1	23-010 239.40 9-26-2 N 5,52 E 623,7) m 023 9,096	5	ne 14		
ELEVATION (m)	B) BEPTH		GRAPHICS		ELEV (m)	WATER LEVEL	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE	qu	POCK	MC VANE (k ET PEN (LOWS/0 0 60	(kPa) -	*
				 TOPSOIL/ORGANICS - 152 mm, Grey and black, dry, trace to some organics. CLAY (CH) - Grey, dry, hard, high plasticity, trace silt and gypsum pockets, trace fine gravel. SILT TILL (ML) - Light grey, dry to damp, dense, with fine to coarse grained sand, with fine grained gravel, trace to some clay. PSA: 25% gravel, 30% sand, 35% silt, 10% clay at 2.7 m. Very dense below 3.0 m. DOLOMITE - Mottled yellow-white, fine grained, massive, trace vugs, very strong. Fair quality from 3.4 m to 4.9 m. UCS: 66.1 MPa at 4.0 m. No water return at 4.3 m. Good quality from 4.9 m to 6.4 m. Highly fractured and broken lost core zone from 4.9 m to 5.0 m. ARGILLACEOUS DOLOMITE - Mottled reddish-gray to green, fine grained, fossiliferous, moderately strong. UCS: 73.7 MPa at 5.1 m. Lost core zone from 6.4 m to 7.5 m. Poor quality from 6.4 m to 7.5 m. Poor quality from 6.4 m to 7.5 m. Good quality below 7.9 m. ~ 30 mm thick soft shale seam at 8.0 m. Decreased shale content, increased porosity, very strong below 8.5 m. Increased joint frequency below 8.5 m. Notes: End of test hole at 9.4 m. Refusal encountered on suspected bedrock at a depth of 3.0 m. Test hole backfilled with auger cuttings and bentonite chips. 	_239.2 _237.9 _236.0 _236.0 _230.0			S1 S2 S3 R1 R2 R3	67 65 70 38 95	72 (8) 79 (2) 27 (3) 79 (12)	8 50/ 80mm	+100					450 7 450 7 >>
				ling/Diggingon 9-27-2023 None Encounteredpletionon 9-27-2023 None Encountered	APP	Ma PRC	ple I VE	.eaf I	Drillin	ng Ltd			ATE	TOR ODRI 2-2024			

K	GROUP		TEST HOLE LOG					le N 123	o. -09)				s	HEET 1	of 1
LOC DES DRI	INT DJECT ATION CRIPTION LL RIG / H THOD(S)		CITY OF WINNIPEG - WATER AND WASTE DEP CentrePort Regional S&W Servicing Winnipeg, Manitoba North side Saskatchewan Ave Rail Crossing R GeoProbe 3230 Track Mounted Drill Rig with A 0.0 m to 5.3 m: 125 mm ø SSA 5.3 m to 9.8 m: Water Rotary HQ Core - switch	uto-H	lamme	r	SUI TOO STA UTI	RFAC C STI ART I M (m	DATE າ)	EV. IP / E	LEV.	23-010 240.00 0.91 m 9-25-20 N 5,529 E 623,7	m / 240. 023 9,183	.91 m (S Zone 1	Standpip 14)e)
(m) NO	ΤΗ	HICS	DESCRIPTION AND	LEVEL		ALLS	Е ТҮРЕ	RUN	ERY %	ITS/RUN)	0.15 m	TUE			C LL	•
ELEVATION (m)	(m) (ft)	GRAPHICS	CLASSIFICATION	E WATER LEVEL	DIAGRAM	DEPTH (m)	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE			PEN (kPa) V S/0.30 r 60 80	
	1.0		TOPSOIL/ORGANICS - 305 mm, Black, damp, with organics and roots.	<u>9.7</u>			£	S1					•			
239	2.0		23 <u>CLAY (CH)</u> - Dark brown, moist, stiff, high plasticity, some silt pockets, trace fine to coarse grained gravel. - Hard drilling below 2.0 m.				ਸ਼	52								•
237	3.010		SILT TILL (CL) - Light brown, moist, dense, low plasticity, with fine to coarse grained sand, some fine grained gravel, some clay.	/./			招	S3 S4	77		19 34 50/	+100	•			250 ★ >>
236	4.0							5-			50/ 130mm					300
29, 2023.GPJ 111111111111111111111111111111111111	5.0		 LL=27, PL=14, PI=13 at 4.4 m. PSA: 17% gravel, 26% sand, 42% silt, 15% clay at 4.4 m. Some coarse grained gravel, trace cobbles below 4.9 m. 				ਸ ਸ						•			425 * 425
SEPT 26 TO 29, 7111111111111111111111111111111111111	6.020		- Loss of return water, 15 cm granite boulder in sampler at 5.3 m. 23 ARGILLACEOUS DOLOMITE - Mottled green-red,	3.5		5.79 6.10		R1	37	14 (10)						
	7.0		Find the grained, fossiliferous, strong. - Very poor quality from 6.5 m to 9.4 m. - Increased shale content on joint faces below 6.5 m. - Highly fractured and broken lost core zones					R2	42	0 (10)						
000-23-0107-000 0101-0101-000 0101-0101-000-000-000	8.0		below 6.6 m. - No water return during run at 7.9 m.					R3	43	18 (2)						
VFMS/23-0107-0	9.0		 Reddish-purple, increased fossils, strong below 23 9.1 m. Notes: 	<u>).6</u>		9.14 9.45				(2)						
	10.0		 End of test hole at 9.8 m. Refusal encountered on boulder or bedrock at a depth of 5.3 m. Protective well cover installed at surface. 25.4 mm or one (1) inch diameter standpipe installed. 													
			illing/Digging on 9-27-2023 None Encounter npletion on 9-27-2023 None Encounter				ple L	.eaf I	Drillir	ng Ltd	 I.		SPECT G. GIT			
2						APPRC K. F) DYCE				D	ATE 1-22-	2024		

KCS	5	TEST HOLE LOG		ioli [H]		0. -11					SH	IEET 1 o	of 1
CLIENT PROJECT LOCATION DESCRIPTION DRILL RIG / HAI METHOD(S)	MMER	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba ~60 m northest of Tonka Pt, ~220 m east of Sturgeon Rd GeoProbe 3230 Track Mounted Drill Rig with Auto-Hamme 0.0 m to 7.8 m: 125 mm Ø SSA	s s l	URI	FAC RT D	T NO E ELI DATE I)	EV.		23-010 237.50 9-26-2 N 5,52 E 623,7) m 023 9,997	one 14	Ļ	
ELEVATION (m) (tt) (tt)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m		SAMPLE TYPE	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE		KET PE	LL E (kPa) ◀ N (kPa) 5/0.30 m 50 80	*
237 1.0 236 2.0 2.0 235 3.0 -10 4.0 -10 -15 -15 -10		<u>CLAY FILL</u> - 457 mm, Grey and black, dry, some organics, some fine to coarse grained gravel. <u>CLAY (CH)</u> - Light brown to grey, dry to damp, very stiff, high plasticity. - Trace to some silt and gypsum pockets below 1.8 m.	237.(R	\$1 \$2							350 350 250
		 Damp to moist, stiff below 2.3 m. Firm below 3.0 m. Soft below 3.8 m. 			ß	S3				•	•	•	175 7
		 LL=83, PL=26, PI=57 at 4.3 m. <u>SILT TILL (ML)</u> - Light brownish grey, moist, compact, low plasticity, with fine to coarse grained sand, trace fine grained gravel, with clay. 	232.3		ß	S4				◆ F-	•		•
		- PSA: 4% gravel, 28% sand, 39% silt, 29% clay at 5.8 m. - Compact below 6.1 m.			R R	S5 S6 S7	44	2 4 12	16				
6.0 2231 7.0 230 2230 225 8.0 229 9.0 30 229 10.0 30 227 35 11.0 227 35 11.0 4 4 4 5 4 5 5 5 5 5 5 5 5 5 5 5 5 5		Notes: 1. End of test hole at 7.8 m. 2. Refusal encountered on suspected bedrock at a depth of 7.8 m. 3. Test hole backfilled with auger cuttings and bentonite chips. 4. Caving encountered at 7.0 m.	229.	7		57	17	50/ 80mm	+100				
WATER			CONTRA Mapl APPRO\ K. FC	e Le /ED	af C		ng Ltd	I.		ISPECTOF M. ROD ATE 1-22-20	RIGUEZ	2	

		5	TEST HOLE LOG			E NO 23	o. -12	1				SHEET	1 of 1
LOC DES DRII	DJECT ATION CRIPTION	AMME	 CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba ~220 m northeast of Tonka Pt, ~75 m east of Sturgeon Ro R GeoProbe 3230 Track Mounted Drill Rig with Auto-Hamm 0.0 m to 7.6 m: 125 mm Ø SSA 	SI S' ad U	URI TAF	FAC	T NO E ELI DATE I)	EV.	:	23-010 237.80 9-27-20 N 5,530 E 623,7	m 023 0,219	one 14	
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)	WATER LEVEL	SAMPLE TYPE	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE	qu POC	MC PRVANE (kP CKET PEN (k BLOWS/0.3 40 60	Pa) 🛨
 237	1.0		 <u>CLAY FILL</u> - 457 mm, Grey and black, dry to damp, some organics, some fine to coarse grained gravel. <u>CLAY (CH)</u> - Light brown to grey, damp to moist, stiff, high plasticity 	237.3	_	1	S1					•	150
236	2.0		- Mottled brown/ grey, moist, trace to some gypsum & silt pockets below 2.0 m.			£	S2					•	◆ 150150150
235	3.0 - 10					₹ <u>1</u>	S3					•	125
234	4.0					₹ 1	S4					•	
232	6.0 20		 Firm below 5.2 m. Increasing silt inclusions below 5.8 m. 			₽ ₽	S5						
231	7.0		SILT TILL (ML) - Light brownish grey, moist, compact, some to with fine to coarse grained sand, trace to some fine grained gravel.	230.9)						•		
230	8.0		 With red discoloration/alteration at 7.6 m. Notes: End of test hole at 7.6 m. Refusal encountered on suspected bedrock at a depth of 7.6 m. Test hole backfilled with auger cuttings and bentonite chips. Caving encountered at 6.4 m. 			1	S6 S7	11	20/ 30mm	+100			
228	9.0												
2227	11.0												
WAT LEVE			Iling/Digging on 9-27-2023 None Encountered opletion on 9-27-2023 None Encountered	CONTRA Maple APPROV K. FO	e Le ED	af [ng Ltd	 I.		SPECTOF <u>M. ROD</u> I ATE 1-22-20	RIGUEZ	

	GRO		5	TEST HOLE LOG	HOLE NO. TH23-1	.7						5	SHEET 1	of 2
LOC DES DRII)ject Atioi Cript	ION / HA	MME	 CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba ~30 m south of CPKC Rail Line, ~125 m east of CCW R GeoProbe 3230 Track Mounted Drill Rig with Auto-Hammer 0.0 m to 4.3 m: 125 mm ø SSA 4.3 m to 12.6 m: Water Rotary HQ Core - switched due to encour 	PROJECT N SURFACE I START DA UTM (m) ntering den	ele Te	v.		23 11 N	37.67 1-17-	2023 3 <i>,</i> 655	Zone	14	
ELEVATION (m)	a) (j) (j) (j)		GRAPHICS		ELEV (m)	WATER LEVEL	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	qu PC	ORVA	C LL NE (kPa) PEN (kPa 00 50)♦ a)★
		_		TOPSOIL - 203 mm, Black, moist, with organics, some rootlets. CLAY (CH) - Dark brown, moist, stiff, high plasticity, trace fine to coarse	237.5									
237	1.0	_		grained sand, some silt inclusions.			R	S1				-	• •	•
236		—5 —		- Brown, very stiff, trace fine grained gravel, trace silt inclusions below 1.5	m.									
	2.0	-		- LL=80, PL=25, PI=55 at 2.0 m.			<u>}</u>	S2			F	•	<u> </u>	
		-		- Stiff below 2.4 m.									•	•
236 	3.0	10 		 Brown silt till pocket, moist, compact, some clay, trace fine to coarse grain sand, trace fine grained gravel from 3.0 m to 3.4 m. Predominantly clay below 3.4 m. 	ned									150
	4.0	_		SILT TILL (CL) - Brown, moist, compact, low plasticity, and clay, some fine to	233.7		ਸ ਸ	53 54			•	•	_	250
		- 15		coarse grained sand, trace fine grained gravel. - PSA: 4% gravel, 21% sand, 35% silt, 40% clay at 4.0 m.	233.3		T	R1	94	75 (2)				
	5.0	-		ARGILLACEOUS LIMESTONE/CALCAREOUS SHALE - Reddish-gray to purplish-gray, fine grained, thinly bedded, fossiliferous, fissile, moderately strong. - Strong below at 4.6 m.						(2)				
	6.0	_ 20		 40 mm horizontal joint infilled with shale at 4.7 m. UCS: 28.2 MPa at 4.9 m. UCS: 28.1 MPa at 5.2 m. 				R2	97	65 (12)				
	7.0	-		- 75 mm horizontal joint infilled with shale at 6.6 m.				R3	95	70				
	8.0	-25		- Increased shale content, weak from 8.0 m to 8.1 m.						(10)				
	9.0	- - 30		- Three closely spaced joints partially infilled with shale from 8.6 m to 8.8 n	n.			R4	100	47 (17)				
	10.0	-		 Increased shale content / shale interbeds from 9.4 m to 11.6 m. Very weak with significant shale content from 9.5 m to 10.1 m. 										
	11.0	- 35 -		- Three 25 - 75 mm shale beds spaced 0.3 to 0.4 m apart from 10.6 m to 11	.4 m.			R5	98	21 (23)				
226		-												
	L ∃ ER ▼	- Uno	n Corr	pletion on 11-17-2023 None Encountered CONT	RACTOR			R6	100	60 IN	ISPECTO			
	LS	- 40		Ma	ple Leaf Dri	llinį	g Lto	d.			S. GAR			
				APPR J. 1	OVED MACLENNAI	N				D.	ATE 1-10-2	024		

K	GROUP	5	TEST HOLE LOG	HOLE NO. TH23-1	7						SHE	ET 2 of 2
ELEVATION (m)	DEPTH (m) (tt)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)	WATER LEVEL	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	qu POC		LL (kPa) ✦ (kPa) ★ 0.30 m ▲) 80
2225 2224 2223 2224 2224 2223 2223 2223 2224 2224 2224 2223 2224 2224 2224 2224 2224 2224 2224 2225 2226 2226 2227 2226 2227 2217			 Decreasing shale content, increasing limestone from 12.2 m to 12. Increasing shale content, fissile from 12.4 m to 12.6 m. Notes: Refusal encountered in silt till at a depth of 4.3 m. Test hole backfilled with auger cuttings and bentonite chips. 									
	26.0 ER ⊻ Upo LS	n Com	pletion on 11-17-2023 None Encountered	CONTRACTOR Maple Leaf Dril APPROVED J. MACLENNAN		; Lto	d			SPECTOR S. GARG ATE 1-10-202	24	

K	GROUP	5	TEST HOLE LOO	G					le n 123	o. -18					SH	IEET 1	of 2
LOC DES DRI	INT DJECT ATION CRIPTION LL RIG / HA FHOD(S)	MME	CITY OF WINNIPEG - WATER AND WAS CentrePort Regional S&W Servicing Winnipeg, Manitoba ~15 m north of CPKC Rail Line, ~125 m e GeoProbe 3230 Track Mounted Drill Rig 0.0 m to 4.7 m: 125 mm ø SSA 4.7 m to 12.6 m: Water Rotary HQ Core	east of CC g with Aut	W o-H	ammer		SUI TO STA UT	RFAC C STI ART I M (n	DATE n)	EV. IP / E	EEV. (11-16-2 N 5,533 E 624,4	m / 238.9 2023 3,695 169	92 m (St Zone 14		ce)
ON (m)	ТН	GRAPHICS	DESCRIPTION AND		: LEVEL	LOG INSTA	ALLS	E TYPE	R / RUN	RECOVERY %	ITS/RUN)	'0.15 m	LUE	PI ∎ Cu⊺	- MC	LL I E (kPa)	•
ELEVATION (m)	(m) (ft)	GRAP	CLASSIFICATION	ELEV (m	WATER LEVEL	DIAGRAM	DEPTH (m)	SAMPLE	NUMBER / RUN	RECOV	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE		OCKET PE		m▲
			TOPSOIL - 152 mm, Black, moist, with organics, with rootlets.	, 237.9													
237	1.0		<u>CLAY (CH)</u> - Dark brown, moist, stiff, high plasticity, trace fine grained sand. - Brown below 0.5 m.					R	S1								> > >
236																•	
236	2.0		- Light brown, moist, with silt, trace fine to coa					R									
-235	3.0-10		grained sand, trace coarse grained gravel below 2.3 m. - Trace fine grained gravel below 2.4 m.	N				₹ ፤	S3							•	
			- LL=49, PL=16, PI=33 at 2.4 m. - Grey clay, trace silt below 3.0 m.												•		
234	4.0		 Brown to light brown, moist, intermediate plasticity, with silt, trace fine to coarse grained gravel below 3.4 m. 	234.2	2			R	S4					• •	•		
	15		<u>SILT TILL (CL-ML)</u> - Light brown, moist, dense, low plasticity, with fine to coarse grained sand,						S5	100		30/ 100mm	+100				>>
2023.GPJ	5.0		some clay, trace fine grained gravel. - LL=21, PL=16, PI=5 at 4.0 m. - PSA: 2% gravel, 33% sand, 47% silt, 18% clay a	233.2	2				R1	67	88	10011111					
^{29,}			4.0 m. ARGILLACEOUS LIMESTONE/CALCAREOUS SHA						R2	86	63 (7)						
SEPT 26 TO	6.020		 Reddish-gray to purplish-gray, fine grained, thinly bedded, fossiliferous, fissile, moderately 								(7)						
ORT SE			strong. - UCS: 26.8 MPa at 5.0 m. - Highly fractured, broken core zone, two verti	cal													
	7.0		joints from 5.3 m to 5.7 m. - 25 mm shale bed at 5.8 m. - Increased shale content, very weak / fissile fr						R3	98	52 (15)						
	8.0-25		 - Increased shale content, very weak / instite in 7.1 m to 7.2 m. - 25 mm shale bed at 7.3 m. 	om													
07-009/23-0107-009_CENTREPORT_SEPT			 - 15 mm shale bed at 7.7 m. - 15 mm shale bed at 7.9 m. - Several shale beds 25 - 50 mm thick, very we 	alı													
600-201 229	9.0		from 8.5 m to 9.0 m.	ак					R4	102	54 (15)						
MS\23-0			- Four 12 mm thick shale beds, very weak from	ı													
			9.5 m to 9.8 m. - Seven 25 - 40 mm thick shale beds spaced						R5	0.9	20						
			approximatley 150 mm from 10.1 m to 11.3 m.				10.52		СЛ	98	20 (25)						
	11.0						. 11.28										
C:UUSERSIKFORDYCEIUESKTOPYFMSU23-0107-009227-009223-0107-009227-009223-0107-009227-00922-0092-0092-0002-0002-0002-0022-0002-0002-0002-0002-0002-0002-0002-00			- Increased shale content, fissile, weak from 11 m to 12.0 m.	1.6					R6	100	39 (14)						
	ER	ng Dri	ling/Digging on 11-16-2023 None or	n Auger		C	ONTF Maj			Drillir		l .	IN	SPECTO S. GAR			
KGS_L						A	PPRC J. N		D LENN	NAN			D	ATE 1-10-2	2024		

K		5	TEST HOLE LOG					le N 123	0. - 18	}			SHEET 2 of 2
(m)	Ŧ	cs		EVEL	LOG INSTA		гүре	' RUN	۲Y %	S/RUN)	15 m	JE	PL MC LL
ELEVATION (m)	HLLADO (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	WATER LEVEL	DIAGRAM	DEPTH (m)	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE	Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★
CENTREPORT SEPT 2522 2523 2529 2527 25			<text><text><section-header><section-header><list-item><list-item><list-item></list-item></list-item></list-item></section-header></section-header></text></text>			LA3O 12.19 12.62					BLO		up occcer per (N) BLOWS/0.30 m ▲ 20 40 60 80
		ng Dri	Iling/Digging on 11-16-2023 None on Auger			ONTF Mar PPRO	ole I	Leaf I	Drillir	ng Ltd			ISPECTOR S. GARG ATE 1-10-2024

		5	TEST HOLE LOG			E NC 23-). - 19)			SHEET 1 of 1
LOC DES DRII	JECT ATION CRIPTION	AMMER	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba South side of Colony Creek, ~30 m east of CCW GeoProbe 3230 Track Mounted Drill Rig with Auto-Hamm 0.0 m to 7.3 m: 125 mm Ø SSA	S S U	URI TAF	FAC	r no e eli Ate)	EV.	:	23-010 238.74 11-15-2 N 5,533 E 624,6	m 2023 3,941
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)	SAMPLE TYPE	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80
238	1.0		<u>TOPSOIL</u> - 152 mm, Black, damp, trace organics, trace rootlets. <u>CLAY FILL</u> - 305 mm, Dark greyish brown, moist, very stiff, high plasticity. <u>CLAY (CH)</u> - Mottled grey/brown, moist, very stiff, high plasticity, trace silt inclusions.	238.6		ਸ	S1				
-238 -237 -236 -235 -235 -234 -233 -232 -231 -231 -231 -232 -232 -232	3.0 1 10 4.0 1		- Stiff below 2.7 m. - Trace oxidation staining below 3.0 m.			ੲ	S2 S3				
234 234 233	5.0 6.0 20		 No oxidation staining below 4.6 m. LL=79, PL=24, PI=55 at 5.2 m. Grey, increased silt inclusions below 5.3 m. 			ਸ	S4				
232 	7.0		<u>SILT TILL (ML)</u> - Brown, moist, compact, low plasticity, trace coarse grained sand, trace fine grained gravel, trace clay. Notes: 1. End of test hole at 7.6 m. 2. Refusal encountered on suspected bedrock at a depth of 7.6 m. 3. Test hole backfilled with auger cuttings and bentonite chips.	231.7 231.1		R R	S5 S6 S7	0	50/ 30mm	+100	• •
230 	9.0 30										
228 227 227 WATE	===35 11.0 === == == S Upo	n Comp	letion on 11-15-2023 None Encountered	CONTRA						IN	SPECTOR
LCVEL	-3			Maple APPROV J. MA	ΈD			ng Ltd	l.	DA	S. GARG ATE 1-10-2024

		5	TEST HOLE LOG		ole H2		o. -20)				SH	EET 1	of 1
LOC DES DRII	DJECT ATION CRIPTION	MMER	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba 15m west of CN Rail Line on Road 64N Mobile B37X Track Mounted Drill Rig with Auto-Hammer 0.0 m to 8.1 m: 125 mm Ø SSA	SI S	JRF	AC	T NO E ELI DATE I)	EV.	:	23-010 238.81 10-5-2 N 5,53 E 624,7	023 4,056	ne 14		
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)		SAMPLE TYPE	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE	PL Cu TOF qu POCH SPT (N) B 20	(ET PEN	N (kPa	◆) ★
	1.0		CLAY FILL - 457 mm, Black, damp, firm, intermediate plasticity, trace rootlets and grass. CLAY (CH) - Light brown to grey, damp, stiff, high plasticity, with silt, trace coarse sand, trace rootlets and organics.	238.4		R	S1							
 237 	2.0		 No organics below 1.7 m. Decreased silt content below 2.1 m. 			ਸ							•	22
236 2	3.0		- Light grey, some silt inclusions from 3.0 m to 5.8 m.			ਸ							•	
235 234	4.0		- LL=85, PL=26, PI=59 at 3.8 m.			ਸ ਸ					•	•		-8
	5.0 6.0 20		- Firm below 6.1 m.			ਸ ਸ						•		
-232	7.0		<u>SILT TILL (ML)</u> - Light brown, damp, loose, non-plastic, some to with fine to coarse sand, trace fine grained gravel.	231.6		ਸ਼						•		
-231	9.0 25 		 Wet below 7.6 m. - Red/Purple limestone fragments in split spoon at 8.1 m. Notes: End of test hole at 8.1 m. Refusal encountered on suspected bedrock at a depth of 8.1 m. Test hole backfilled with auger cuttings and bentonite chips. Caving Encountered at 7.7 m. 			R	S10 S11	6	50/ 20mm	+100		•		
UNCERT CONTRACTOR CONT			ing/Digging on 10-5-2023 None Encountered letion 7.62 m on 10-5-2023	CONTRA Maple APPROV J. MA	e Le ED	af D		ng Lto	 I		ISPECTOR L. PROVE ATE 1-10-202			

	GROUP	5	TEST HOLE LOG		-	E NC 23). • 21				SHEET 1 of
LOC DES DRII	NT DJECT ATION CRIPTION LL RIG / HA THOD(S)	MMER	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba Ditch, offset ~12 m south of CCW, north Red Fife Rd. Mobile B37X Track Mounted Drill Rig with Auto-Hammer 0.0 m to 8.1 m: 125 mm Ø SSA	SI S'	URF TAF	FAC	NO E ELI ATE	EV.		23-010 238.92 11-22- N 5,53 E 624,8	2 m 2023 4,214
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)		SAMPLE TYPE	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m 4 20 40 60 80
-237 -237 -236 -235	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0		<u>CLAY FILL</u> - 914 mm, Dark brown, moist, very stiff, high plasticity, trace fine grained gravel, trace organics. <u>CLAY (CH)</u> - Brown, moist, stiff, high plasticity, trace coarse grained sand. - Trace silt inclusions below 1.2 m.	238.0			S1 S2				
	3.0 10 4.0 10		 - Grey below 2.7 m. - LL=80, PL=29, PI=51 at 3.7 m. - Some silt inclusions below 4.0 m. - Silt till pocket at 4.1 m. 		¥	ß	S3 S3				
-234 -233 -232	5.0 6.0 20 7.0		SILT TILL (ML) - Light brown, damp, compact, low plasticity, silt, trace fine grained sand, some clay. - PSA: 0% gravel, 2% sand, 81% silt, 17% clay at 5.5 m. - Free water in split spoon at 5.8 m. - Moist to wet, some fine to coarse sand, trace fine grained gravel below 5.8 m. - Moist, dense, some fine grained gravel below 6.4 m.	233.7			S5 S6 S7	89	6 5 11	16	
-232 - -231 - -230	9.0 30		 Yellow sandy silt till below 7.6 m. Notes: 1. End of test hole at 8.1 m. 2. Refusal encountered on suspected bedrock at a depth of 8.1 m. 3. Test hole backfilled with auger cuttings and bentonite chips. 4. Caving encountered at 6.2 m. 	230.8		R	S8 S9	100	10 13 22	35	
-227 VATI EVEI	ER 및 Upo LS	n Compl	letion 4.27 m on 11-22-2023	CONTRA Maple APPROV J. MA	e Le ED	af D		ng Ltd	•		I ISPECTOR K. FORDYCE ATE 1-10-2024

KCS	TEST HOLE LOG	HOLE NO. TH23-22	SHEET 1 of 1
CLIENT PROJECT LOCATION DESCRIPTION DRILL RIG / HAMME METHOD(S)	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba Ditch, offset ~12 m south of CCW, north Red Fife Rd. R Mobile B37X Track Mounted Drill Rig with Auto-Hammer 0.0 m to 7.3 m: 125 mm Ø SSA	PROJECT NO. SURFACE ELEV. START DATE UTM (m)	23-0107-009 239.74 m 11-22-2023 N 5,534,319 E 625,091 Zone 14
ELEVATION (m) (m) (t) GRAPHICS	DESCRIPTION AND CLASSIFICATION	(a) Aarra (a) Aa	PL MC LL Cu TORVANE (kPa) \blacklozenge qu POCKET PEN (kPa) \star SPT (N) BLOWS/0.30 m 20 40 60 80
	 CLAY (CH) - Greyish brown, moist, very stiff, high plasticity, trace silt inclusions, trace coarse grained sand, trace organics. Some silt inclusions, trace fine grained gravel below 1.2 m. Stiff below 1.5 m. 		
-237 $3.0 - 10$ -10 -236 $4.0 - 15$ -15 $5.0 - 15$ $5.0 - 15$ -235 $5.0 - 15$ -234 $6.0 - 20$ -20	 Moist to wet below 3.7 m. SILT TILL (ML) - Light brown, damp, dense, non-plastic, silt, trace fine grained sand. Light grey silt and fine grained sand pocket from 4.3 m to 4.4 m. Some clay below 4.6 m. PSA: 0% gravel, 6% sand, 77% silt, 17% clay at 4.7 m. Moist, trace fine to coarse grained sand, trace fine grained gravel below 5.2 m. Coarse grained gravel (granite) in tip of split spoon at 5.8 m. Trace to some sand and gravel below 5.8 m. 	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Notes: 1. End of test hole at 7.3 m. 2. Refusal encountered on suspected bedrock at a depth of 7.3 m. 3. Test hole backfilled with auger cuttings and bentonite chips. 4. Caving encountered at 5.8 m.	232.4 S10 100 50	0 +100
229 10.0 -35 11.0 -228 VATER ¥ Upon Con EVELS	·	CONTRACTOR Maple Leaf Drilling Ltd. APPROVED	INSPECTOR K. FORDYCE DATE

	_	GRO		5	TEST HOLE LOG			e no 23-						SHE	ET 1 of 1	
	LOC DES DRI)ject Atioi Cript	'ION i / HA	MME	 CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba Ditch, offset ~12 m south of CCW, north Red Fife Rd. R Mobile B37X Track Mounted Drill Rig with Auto-Hammer 0.0 m to 6.2 m: 125 mm Ø SSA 	SI ST	URI FAF	JECT FACE RT D/ I (m)	ELE Ate			23-010 238.81 11-22- N 5,53 E 625,3	2023 4,208	ne 14		_
	ELEVATION (m)	a) DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)		SAMPLE TYPE	NUMBER	RECOVERY %	BLOWS/0.15 m	N-VALUE	PL Cu TOR qu POCK SPT (N) B 20 4	ET PEN	(kPa) ★	
E	-		_		TOPSOIL - 152 mm, Black, moist, organic clay.	238.7										
	-238 -237	1.0	_ _ 5 _		CLAY (CH) - Brown, moist, stiff, high plasticity, trace organics. - Mottled brown, trace silt inclusions, trace oxide nodules below 1.2 m.		¥	FI FI	S1 S2						•	
E	-236 	3.0	10 10 		 Trace light brown silt till pockets, no oxide nodules below 2.7 m. LL=56, PL=29, PI=27 at 3.7 m. 				S3 S3 S4				• 1		◆	
E	-234	4.0 1 1 5.0	 15 		 Grey below 4.0 m. <u>SILT TILL (ML)</u> - Light brown, moist, dense, silt, trace clay. Wet, trace fine grained sand below 4.9 m. 	234.2		<u>}</u>	S5				•	•		-
NTREPORT SEPT 26 TO 2	-233 -232	6.0	20 		 Sloughed material in top 125 mm of split spoon at 5.8 m. Damp to moist, dense, non-plastic, some fine to coarse grained sand, trace fine grained gravel below 5.9 m. Notes: End of test hole at 6.2 m. Refusal encountered in silt till at a depth of 6.2 m. Test hole backfilled with auger cuttings and bentonite chips. 			Ы	S6 S7	100	14 50	+100				90
3/23-0107-009_CEI	-231 -230	8.0	25 													
E\DESKT	-229	10.0	—30 — — — —35													
\USERS\KFORE	-228 -227	11.0	- - -	n Com	pletion 1.83 m on 11-22-2023											
g	EVE	LS ¥	oho	ii com		CONTRA Maple			rillin	g Ltd.		IN	ISPECTOR K. FORDY	CE		
KGS_L(T T	APPROV	ED					D	ATE			1
×						J. MA	ULÉ	INN/	AIN				1-10-202	4		

K		5	TEST HOLE LOG				HOLI TH							S	HEET 1	of 2
LOC DES DRII	NT DJECT ATION CRIPTION LL RIG / HA FHOD(S)	MME	CITY OF WINNIPEG - WATER AND WASTE DEPAR CentrePort Regional S&W Servicing Winnipeg, Manitoba Farm field, ~75 m east of CCW, ~320 m south of S R GeoProbe 3230 Track Mounted Drill Rig with Aut 0.0 m to 10.1 m: 125 mm ø SSA 10.1 m to 12.4 m: Water Rotary HQ Core - switch	Sturge o-Han	eon nme	Access er	STAF UTM	FACI STIC RT D I (m	E ELI CK-U ATE)	ev. IP / Ei	LEV.	23-010 238.26 1.00 m 11-13- N 5,52 E 622,6	m / 239.2 2023 9,982	26 m (S [.] Zone 1		pe)
(m) N	т	ICS			EVEL	LOG (INSTA		гүре	/ RUN	۲۶ %	.15 m	UE	PL ₽	•		
ELEVATION (m)	(E) DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION		WATER LEVEL	DIAGRAM	DEPTH (m)	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	BLOWS/0.15 m	N-VALUE	qu PC	ORVAN	EN (kPa	a) ★
_	(m) (ft)		ELI	EV (m)		۵	□		2		-		SPT (N 20) BLOW 40	S/0.30	m ▲ 30
238	$\frac{1}{1}$		TOPSOIL 152 mm, Black, moist, soft, with organics, with rootlets. CLAY (CH) - Mottled grey/brown, moist, very stiff, high	238.1				ਸ	S 1							
237				<u>237.3</u> 237.0				ਸ	S2							•
236	2.0		<u>CLAY (CH)</u> - Light brown, moist, firm, high plasticity, trace clay, trace fine grained gravel.													•
			- Stiff below 2.3 m.		¥			ਸ਼	S3						•	
235	3.010		- Firm below 2.7 m.											—		
235 			- Grey, no oxidized nodules below 3.0 m.											•		
				234.3				ष्य	S4					•		
	4.0		<u>SILT TILL (ML)</u> - Light brown, moist, loose, low plasticity, some clay, trace fine to coarse grained gravel					R	S5							
	15		(putty till). - With fine to coarse grained sand, trace fine grained					E T			1		•			
234	5.0		gravel, trace to some clay below 4.6 m.						S6	81	1 3 2	5				
			- Compact below 5.5 m.					ਸ਼	S7							
232	6.020								S8	39	4 7	15				
										39	8	15				
	7.0							P	S9				•	*		
231					,											
	25		- Very dense below 7.6 m.						S10	63	10 50	+100				>>
230	8.0															350
			- PSA: 10% gravel, 37% sand, 42% silt, 11% clay at 8.4 m.					ਸ਼	S11				•			*
	9.0															
229			- Compact at 9.1 m.			Vibrating Wire VW164950	9.45		S12	64	18 21 4	25				
			POOR RECOVERY - Only fragmented rock pieces	228.6		VVV104930	9.91	F			-					
228	10.0		recovered. Unable to distinguish if the recovered material is glacial till or top of bedrock. Granite and													
232	 35		limestone fragments recovered. Limestone is very strong				10.36 10.67		R1	20						
	11.0															
2227																
									R2	0						
WAT	ER ⊻ Upo	n Com	pletion 2.54 m on 11-14-2023				RACT	OR		Ľ		IN	SPECTO			<u> </u>
LEVE	13				\vdash			eaf D	rillin	ng Ltd.			G. GITZ	EL		
						APPRO K. F	ORD	YCE				ים	ATE 1-22-2	024		

		5	TEST HOLE LOG				HOLI TH		0. - 24				SHEET 2 of 2
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)	WATER LEVEL	LOG (INSTA WY BIAGRAM		SAMPLE TYPE	NUMBER / RUN	RECOVERY %	BLOWS/0.15 m	N-VALUE	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80
1 2225 2224 1 2224 1 2223 1 2223 1 2223 1 2223 1 2223 1 2223 1 2223 1 2223 1 2223 1 2223 1 2223 1 2223 1 2224 1 2223 21 221 21 21 21 21 21 21 21 2	$\begin{array}{c} & & & \\ & & & & \\ & & & \\ & & & \\ & & & & \\ & & & \\ & & & &$		Notes: 1. End of test hole at 12.4 m. 2. Refusal encountered on suspected bedrock at a depth of 10.1 m. 3. Test hole backfilled with grout. 4. Protective well cover installed at surface. 5. 25.4 mm or one (1) inches diameter standpipe installed. 6. Vibrating wire piezometer (VW164950) installed at 9.45 m below grade. 3. 45 m below grade. 3. 50 m or 0.10	225.9			12.19						
	⊣ R ⊻ Upo S	n Corr	pletion 2.54 m on 11-14-2023			APPRO	ole Le	eaf I		ng Ltd			I ISPECTOR G. GITZEL ATE 1-22-2024

K		5	TEST HOLE LOG	5					le n 123	o. - 25					SH	EET 1 of 2
LOC DES DRI	INT DJECT ATION CRIPTION LL RIG / HA THOD(S)	MME	CITY OF WINNIPEG - WATER AND WAS CentrePort Regional S&W Servicing Winnipeg, Manitoba Farm field, ~180 m east of CCW, ~125 m GeoProbe 3230 Track Mounted Drill Rig 0.0 m to 8.2 m: 125 mm ø SSA 8.2 m to 14.1 m: Water Rotary HQ Core	south of with Auto	Stu o-Ha	igeo amn	n Access ner	SUI TO STA UTI	RFAC C STI ART I M (n	DATE 1)	ev. IP / EI	LEV.	23-010 239.06 0.79 m 11-14- N 5,53 E 622,9	m / 239.8 2023 0,062	5 m (Sta Zone 14	indpipe)
(m) NC	ΓH	HICS			LEVEL	IN	DG OF STALLS	ТҮРЕ	/ RUN	RY %	rs/run)).15 m	UE	PL ┣ Cu T		LL ■ (kPa) ●
ELEVATION (m)	(ft) (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION		WATER LEVEL	DIAGRAM	DEPTH (m)	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE	qu PC	OCKET PE	(KPa) ★ N (kPa) ★ /0.30 m ▲
239			TOPSOIL - 305 mm, Dark brown, damp, with	ELEV (m)		•••					"			20	40 6	0 80
 	1.0		organics, with rootlets. <u>CLAY (CH)</u> - Dark brown, damp, very stiff, high plasticity, trace medium grained sand. - Brown, moist below 0.8 m.					ਸ	S1							
 	2.0		- Mottled grey to brown, trace silt inclusions, trace oxide nodules below 1.5 m.													•
				236.3				ष्ट	S2						• •	
236	3.010		SILT TILL (ML) - Light brown, moist, compact, low plasticity, with fine to coarse grained sand, trace					8 7	S3	70		5 10	22			
E			fine grained gravel, some clay. - Trace coarse grained gravel below 3.0 m.					ਸ ਸ	S4 S5	72		10	23			22
235	4.0							Ē	55							
									S6	81		5 6	19			
234	5.0							ਸ	50 S7	01		13	19			22
²						• • •										
233	6.0 20		- Wet below 6.1 m.		Ţ				S8	44		10 10	19			
			- PSA: 8% gravel, 34% sand, 45% silt, 13% clay a	t				Ы	S9	44		9	19			
232	7.0		6.6 m.												\setminus	
	25		- Very dense below 7.6 m.						S10	53		12 26	53			
231	8.0								510			27	55			
230	9.0								R1	22						
233						Vibra Wi VW16	ting re 3297		R2	21						
							10.82									
228			ARGILLACEOUS LIMESTONE/CALCAREOUS SHA	<u>227.9</u> LE												
			thinly bedded, fossiliferous, fissile, moderately strong.				11.58		R3	43	17					
	ER ⊻ Upo LS	n Com	pletion 6.22 m on 11-14-2023				CONTR Map			Drillir	ng Ltd		IN	ISPECTO G. GITZ		
							APPRO K. F		D DYCE	-			D	ATE 1-22-2	024	

End End <th></th> <th>GROUP</th> <th></th> <th>TEST HOLE LOG</th> <th></th> <th></th> <th></th> <th></th> <th>le N 123</th> <th>o. -25</th> <th>, ,</th> <th></th> <th></th> <th>SHEET 2 of 2</th>		GROUP		TEST HOLE LOG					le N 123	o. - 25	, ,			SHEET 2 of 2
ELEV (m)	(m)	-	S		EVEL	LOG INSTA		'YPE	RUN	۲%	s/RUN)	15 m	Γ	
226 130	ELEVATIO		-	CLASSIFICATION	-	DIAGRAM	DEPTH (m)	SAMPLE 1	NUMBER /	RECOVER	RQD (JOINTS	BLOWS/0.	N-VALL	qu POCKET PEN (kPa) ★
LEVELS Maple Leaf Drilling Ltd. G. GITZEL APPROVED DATE		13.0 14.0 14.0 14.0 15.0 16.0 17.0 18.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0 10.0 19.0 10.0		m to 11.3 m. - UCS: 20.9 MPa at 11.4 m. - Broken lost core zone from 11.7 m to 12.5 m. - UCS: 24.3 MPa at 13.3 m. - 50 mm joint infilled with shale at 13.5 m. - Increased shale content below 13.9 m. 225.0 Notes: 1. End of test hole at 14.1 m. 2. Refusal encountered on suspected bedrock at a depth of 8.2 m. 3. Test hole backfilled with grout. 4. Protective well cover installed at surface. 5. 25.4 mm or one (1) inches diameter standpipe installed. 6. Vibrating wire piezometer (VW163297) installed at 10.06 m below grade.			13.56			100	79 (8)			ISPECTOR
K. FORDYCE 1-22-2024		LS					Maj PPRC	ole I VEC	L <mark>eaf</mark> I D		ng Ltd			G. GITZEL ATE

K	GRO		5	TEST HOLE LOG			DLE N H23)				SHEET 1 of 2
LOC DES DRI	DJECT CATIOI SCRIPT	ION i / HA	MME	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba Field, ~35 m west of Stugeon Rd, ~40 m north of Sturgeon GeoProbe 3230 Track Mounted Drill Rig with Auto-Hamm	n Acces	รเ รา	Roje(JRFA) ART TM (r	CE EL DATE	EV.		23-010 239.09 11-14- N 5,52 E 623,3	m 2023 9,971	one 14
ELEVATION (m)	(m) DEPTH		GRAPHICS		EV (m)	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE	qu POCI	MC LL ● I RVANE (kPa) ◆ KET PEN (kPa) ★ BLOWS/0.30 m ▲ 40 60 80
239 		_]		<u>TOPSOIL</u> - 152 mm, Black, moist, with organics, with rootlets. CLAY (CH) - Brown, moist, very stiff, high plasticity, trace	, 238.9			_					
238	1.0	-		<u>CLAY</u> (CH) - Brown, moist, very stirt, high plasticity, trace medium to coarse grained sand, trace rootlets.		Ł	5 51						
237	2.0			 Grey, trace silt inclusions, trace fine grained gravel, no rootlets below 1.5 m. <u>SILT TILL (ML)</u> - Light brown, damp, compact, low plasticity, 	236.6	Ł	5 S2					•	•
236	3.0			trace fine to coarse grained sand, trace fine grained gravel, some clay.		Ł	53 S3	78		14 16 12	28	•	225
235	4.0	_		- With fine to coarse grained sand below 4.0 m.		Ł	S 5					•	
11111234	5.0	—15 — —		- Very dense below 4.6 m. - PSA: 10% gravel, 31% sand, 45% silt, 14% clay at 4.6 m.			S6	96		43 50	+100	•	>>
SEPT 26 TO 29	6.0	 20		ARGILLACEOUS DOLOMITE - Mottled yellow-green, fine	<u>232.7</u>	-	R1	41					
009 CENTREPORT	7.0	_ _ 25		- 50 mm horizontal joint infilled with shale at 6.8 m. ARGILLACEOUS LIMESTONE/CALCAREOUS SHALE - Reddish-gray to purplish-gray, fine grained, thinly bedded, fossiliferous, fissile, moderately strong.	232.0		R2	98	86 (7)				
0-2010-2010-2010-2010-2010-2010-2010-20	9.0	 30		 25 mm horizontal joint infilled with red shale at 7.3 m. 12 mm horizontal joint infilled with red shale at 7.7 m. Broken core zone with significant shale infill from 8.1 m to 8.3 m. 75 mm horizontal joint infilled with red shale at 8.5 m. Increasing green shale interbeds; decreased red shale from 8.8 			R3	98	83				
DESKTOP/FMS/23		- - -		m to 9.8 m.			R4	93	93 (6)				
		35 		 7 mm horizontal joint infilled with red shale at 11.0 m. 25 - 65 mm thick shale interbeds spaced at 0.3 - 0.45 m extending to the full exploration depth. UCS: 29.6 MPa at 11.4 m. 			R5	100	58 (12)				
	⊑ ⊐ ER ⊻	Duri	ng Dri	lling/Digging on 11-14-2023 None on Auger	CONT		CTOR	1			I	SPECTOR	
	VELS							Drillir	ng Ltd	•	-	G. GITZEL	
KGS					APPR K.		ED RDYCI	Ξ			D,	ATE 1-22-202	4

	GROUP	5	TEST HOLE LOG				NO. 2 3-2	6			SHEET 2 of 2
ELEVATION (m)	(t) (t) (t)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	EV (m)	WATER LEVEL	SAMPLE I YPE		RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80
2226 2225 2224 2224 2222 2222			 Three 100 - 125 mm thick limstone interbeds spaced at 0.3 m from 13.5 m to 13.6 m. Decreasing shale, increasing limestone from 14.9 m to 15.0 m. Broken core zone, open joint with shale at 15.2 m. Notes: End of test hole at 15.6 m. Refusal encountered on suspected bedrock at a depth of 5.0 m. Test hole backfilled with auger cuttings and bentonite chips. 	223.4	-	-	.6 10 .7 9	(10)	_		
2023.GPJ	17.0										
C.UJUSERSIKFORDYCE/DESKTOPLENSI23-0107-00923-0107-009 CENTREPORT SEPT 26 T0 29. C.UJUSERSIKFORDYCE/DESKTOPLENSI23-0107-00923-0107-009 CENTREPORT SEPT 26 T0 29. PTC 111111111111111111111111111111111111	21.0 										
KGS_LOG_C:UUSERSIKFORDYCEIDESK	25.0	ing Dri	Iling/Digging on 11-14-2023 None on Auger	APP	∕lapi RO\	e Lea	af Dril	ling Lt	d.		ISPECTOR G. GITZEL ATE 1-22-2024

ARGINATE OUS LIMPERON LAREOUS SHALE - Reddish.gray, fine grained, thinly bedded, fossiliferous, fissile, moderately strong. R2 96 56 - Three closely spaced shale beds ~7 - 13 mm thick from 7.1 m to 7.6 m. - Three closely spaced shale beds ~7 - 13 mm thick from 7.1 m to 7.6 m. R2 96 56 - Increasing joint frequency: spaced ~ 12 mm apart from 8.1 m to 8.5 m. - Increasing shale content, weak below 8.5 m. - - 100 mm thick shale bed at 8.8 m. - - 100 mm thick shale bed at 8.8 m. - 228 - Increasing fissility from 9.3 m to 11.4 m. - - Multiple shale interbeds ~12 - 50 mm thick from 9.6 m to 9.8 m. - R4 98 43 (13) - Decreasing shale content, moderately strong from 9.8 m to 10.0 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. R5 52 0 - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. INSPECTOR Maple Leaf Drilling Ltd. INSPECTOR M. RODRIGUEZ	K	GROUP	S	TEST HOLE LOG	HOLE NO. TH24-01							SHE	ET 1 of 2
DBILLOUT - Overburden drilled out. ELEV (m) Image: Construction of the construction of th	PRC LOC DES DRI	DJECT ATION CRIPTION LL RIG / HA	MME	CentrePort Regional S&W Servicing Winnipeg, Manitoba ~3 m north of TH23-18 R Mobile B37X Track Mounted Drill Rig with Auto-Hammer	SURFACE ELEV START DATE UTM (m)	•		237 4-1 N 5	7.70 0-20 5,533	m 024 3,698	.12	Zone	14
237 1.0 1.0 1.0 1.0 1.0 238 2.0 1.0 1.0 1.0 1.0 1.0 238 2.0 1.0 1.0 1.0 1.0 1.0 1.0 239 3.0 1.0 1.0 1.0 1.0 1.0 1.0 239 2.0 ABGILACEOUS LIMESTONE FRAGMENTS - Raddish-gray to purplish-gray, tome silt till. 231.0 1.0 <t< th=""><th>ELEVATION (m)</th><th></th><th>GRAPHICS</th><th>CLASSIFICATION ELEV (m)</th><th>DRILLING/ H DIGGING H REMARKS G</th><th>SAIMPLE I YPE</th><th>NUMBER / RUN</th><th>RECOVERY %</th><th>RQD (JOINTS/RUN)</th><th>Cı qu</th><th>I TOR POCK</th><th>• VANE (ET PEN</th><th>—∎ kPa) ◆ (kPa) ★</th></t<>	ELEVATION (m)		GRAPHICS	CLASSIFICATION ELEV (m)	DRILLING/ H DIGGING H REMARKS G	SAIMPLE I YPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	Cı qu	I TOR POCK	• VANE (ET PEN	—∎ kPa) ◆ (kPa) ★
10 10 <td< td=""><td></td><td></td><td></td><td>DRILL OUT - Overburden drilled out.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>				DRILL OUT - Overburden drilled out.									
233 20	237 237												
20- 233 20- 30- 10 233.0 233.0 233.0 233.0 233 5.0 10 233.0 233.0 233.0 233 5.0 10 233.0 233.0 233.0 233 5.0 10 233.0 233.0 233.0 233 5.0 10 10.0 233.0 233.0 233 5.0 10.0 10.0 10.0 10.0 233 5.0 10.0 10.0 10.0 10.0 233 5.0 10.0 10.0 10.0 10.0 10.0 233 5.0 10.0 10.0 10.0 10.0 10.0 10.0 224 4.0 10.0 10.0 10.0 10.0 10.0 10.0 225 10.0 - 10.0 10.0 10.0 10.0 10.0 226 10.0 - - 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 <td< td=""><td></td><td>1.0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>		1.0											
233 3.0 10 23.0 233 5.0 10 23.0 233 5.0 10 10 233 5.0 10 10 233 5.0 10 10 233 5.0 10 10 233 5.0 10 10 233 5.0 10 10 233 5.0 10 10 233 6.0 23.0 23.0 233 7.0 - 10.0 - Three dosely spaced shale beds ~7 - 13 mm thick from 7.1 7.0 - - 10.0 - - - - 230 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -	 236	5											
30 -10 -10 -10 -10 -10 -10 233 -15 COBBLES AND LIMESTONE FRAGMENTS - Reddish-gray 233.0 -11		2.0											
2234 4.0 -15 233.0 2233 5.0 COBBLES AND LIMESTONE FRAGMENTS - Reddish-gray to purplish-gray, some silt till. 231.0 2232 6.0 -20 ARCILLACEOUS UMESTONE (FRAGMENTS - Reddish-gray to purplish-gray, some silt till. 2231 -20 ARCILLACEOUS UMESTONE (FRAGMENTS - Reddish-gray to purplish-gray, fine grained, thinly bedded, fossiliferous, fissile, moderately strong. 2231 -7.0 - Three closely spaced shale beds ~7 - 13 mm thick from 7.1 m to 7.6 m. 2230 - Increasing shale content, weak below 8.5 m. - Increasing shale content, weak below 8.5 m. - Increasing shale content, weak below 8.5 m. - Increasing shale content, weak below 8.5 m. - Increasing shale content, weak below 8.5 m. - Increasing shale content, weak below 8.5 m. - Increasing shale content, weak below 8.5 m. - Increasing shale content, weak below 8.5 m. - Increasing shale content, weak below 8.5 m. - Increasing shale content, weak from 9.6 m - S.8 - Increasing shale content, moderately strong from 9.8 - Increasing shale content, moderately strong from 9.8 - Increasing shale content, moderately strong from 9.8 - Increasing shale content, moderately strong from 9.8 <	235 235												
4.0 -15 233.0 -233 5.0 -15 -232 6.0 -20 -233 -23.1.6 -231 -23.1.6 -231 -7.0 -231 -7.0 -231 -7.0 -231 -7.0 -231 -7.0 -231 -7.0 -231 -7.0 -231 -7.0 -232 -7.0 -233 -7.0 -234 -7.0 -235 -7.1 m to 7.6 m. -1 nreeasing joint frequency; spaced ~12 mm apart from 8.1 m to 8.5 m. -100 mm thick shale beds *7 - 13 mm thick from 9.5 m. -100 mm thick shale bed at 8.8 m. -100 mm thick shale bed at 8.8 m. -100 mm thick shale beds *12 - 50 mm thick from 9.6 m. -228 -0.0 -30 -1 ncreasing fissility from 9.3 m to 11.4 m. -100 mm thick shale beds spaced ~150 mm apart, weak from 10.2 m to 10.5 m. -227 -10 -35 -1 no 10.5 m. -226 -227 -30 -1 no 10.5 m. -226		3.010											
233 5.0 COBBLES AND LIMESTONE FRAGMENTS - Reddish-gray 233 5.0 COBBLES AND LIMESTONE FRAGMENTS - Reddish-gray 234 6.0 20 235 6.0 20 236 7.0 231.6 237 7.0 7.0 238 7.0 7.0 239 7.0 7.0 230 - Three closely spaced shale beds ~7 - 13 mm thick from 7.1 m to 7.6 m. 230 - Increasing joint frequency; spaced ~ 12 mm apart from 8.1 m to 8.5 m. - 100 mm thick shale bed at 8.8 m. - 100 mm thick shale bed at 8.8 m. - 100 mm thick shale bed at 8.8 m. - 227 10.0 - 100 mm thick shale bed spaced ~ 150 mm apart, weak from 9.6 m to 9.8 m to 10.0 m. - 100 mm thick shale bed spaced ~ 150 mm apart, weak from 10.2 m to 10.5 m. - 227 - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. WATER CONTRACTOR Matter Contractore 2000; Suppected due to drilling issues / action from 11.4 m to 12.3 m. CONTRACTOR INSPECTOR Maper Leaf Drilling Ltd. M. RODRIGUEZ													
233 5.0 COBBLES AND LIMESTONE FRAGMENTS - Reddish-gray 233 5.0 To purplish-gray, some silt till. 232 6.0 20 231 6.0 20 ARGILLACEOUS LIMESTONE/CALCAREOUS SHALE - Reddish-gray to purplish-gray, fine grained, thinly bedded, fossiliferous, fissile, moderately strong. R1 231 7.0 - -231 - Three closely spaced shale beds "7 - 13 mm thick from 7.1 m to 7.6 m. -230 8.0 - -231 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - - -230 - -		4.0											
232 60 20 231.6 232 60 20 ARGILLACEOUS LIMESTONE/CALCAREOUS SHALE - Reddish-gray to purplish-gray, fine grained, thinly bedded, fossiliferous, fissile, moderately strong. R1 25 0 230 - - - - - - 231 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -	233	15 15	\sim										
232 6.0 20 ARGULACEOUS LIMESTONE/CALCAREOUS SHALE - Reddish-gray to purplish-gray, fine grained, thinly bedded, fossiliferous, fissile, moderately strong. 1 <t< td=""><td></td><td>5.0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>		5.0											
- Three closely spaced shale beds ~7 - 13 mm thick from 7.1 m to 7.6 m Increasing joint frequency; spaced ~ 12 mm apart from 8.1 m to 8.5 m Increasing shale content, weak below 8.5 m 100 mm thick shale bed at 8.8 m Increasing fissility from 9.3 m to 11.4 m Multiple shale interbeds ~12 - 50 mm thick from 9.6 m to 9.8 m Decreasing shale content, moderately strong from 9.8 m to 10.0 m Thow ~ 60 mm thick shale beds spaced ~ 150 mm apart, weak from 10.2 m to 10.5 m Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. CONTRACTOR Maple Leaf Drilling Ltd. INSPECTOR MATER	232						R1	25	0				
- Three closely spaced shale beds ~7 - 13 mm thick from 7.1 m to 7.6 m Increasing joint frequency; spaced ~ 12 mm apart from 8.1 m to 8.5 m Increasing shale content, weak below 8.5 m 100 mm thick shale bed at 8.8 m Increasing fissility from 9.3 m to 11.4 m Multiple shale interbeds ~12 - 50 mm thick from 9.6 m to 9.8 m Decreasing shale content, moderately strong from 9.8 m to 10.0 m Thow ~ 60 mm thick shale beds spaced ~ 150 mm apart, weak from 10.2 m to 10.5 m Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. CONTRACTOR Maple Leaf Drilling Ltd. INSPECTOR MATER		6.0			-	_							
- Three closely spaced shale beds ~7 - 13 mm thick from 7.1 m to 7.6 m Increasing joint frequency; spaced ~ 12 mm apart from 8.1 m to 8.5 m Increasing shale content, weak below 8.5 m 100 mm thick shale bed at 8.8 m Increasing fissility from 9.3 m to 11.4 m Multiple shale interbeds ~12 - 50 mm thick from 9.6 m to 9.8 m Decreasing shale content, moderately strong from 9.8 m to 10.0 m Thow ~ 60 mm thick shale beds spaced ~ 150 mm apart, weak from 10.2 m to 10.5 m Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. CONTRACTOR Maple Leaf Drilling Ltd. INSPECTOR MATER	231			Reddish-gray to purplish-gray, fine grained, thinly bedded,									
 Increasing joint frequency; spaced ~ 12 mm apart from 8.1 m to 8.5 m. Increasing shale content, weak below 8.5 m. Increasing fissility from 9.3 m to 11.4 m. Increasing fissility from 9.3 m to 11.4 m. Increasing shale content, moderately strong from 9.8 m. Decreasing shale content, moderately strong from 9.8 m. Decreasing shale content, moderately strong from 9.8 m. Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. WATER CONTRACTOR Maple Leaf Drilling Ltd. M. RODRIGUEZ 		7.0		- Three closely snared shale hads ~7 - 12 mm thick from			R2	96	56 (14)				
 Increasing joint frequency; spaced ~ 12 mm apart from 8.1 m to 8.5 m. Increasing shale content, weak below 8.5 m. Increasing fissility from 9.3 m to 11.4 m. Increasing fissility from 9.3 m to 11.4 m. Increasing shale content, moderately strong from 9.8 m. Decreasing shale content, moderately strong from 9.8 m. Decreasing shale content, moderately strong from 9.8 m. Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. WATER CONTRACTOR Maple Leaf Drilling Ltd. M. RODRIGUEZ 		25											
10.0 - Decreasing shale content, moderately strong from 9.8 m to 10.0 m. - Decreasing shale content, moderately strong from 9.8 m to 10.0 m. - R4 98 43 (13) - Two ~ 60 mm thick shale beds spaced ~ 150 mm apart, weak from 10.2 m to 10.5 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. R5 52 0 (9) 0 (9) WATER LEVELS CONTRACTOR Maple Leaf Drilling Ltd. INSPECTOR M. RODRIGUEZ APPROVED DATE		8.0		- Increasing joint frequency: spaced ~ 12 mm apart from									
10.0 - Decreasing shale content, moderately strong from 9.8 m to 10.0 m. - Decreasing shale content, moderately strong from 9.8 m to 10.0 m. - R4 98 43 (13) - Two ~ 60 mm thick shale beds spaced ~ 150 mm apart, weak from 10.2 m to 10.5 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. R5 52 0 (9) 0 (9) WATER LEVELS CONTRACTOR Maple Leaf Drilling Ltd. INSPECTOR M. RODRIGUEZ APPROVED DATE				8.1 m to 8.5 m.			R3	89	52 (15)				
10.0 - Decreasing shale content, moderately strong from 9.8 m to 10.0 m. - Decreasing shale content, moderately strong from 9.8 m to 10.0 m. - R4 98 43 (13) - Two ~ 60 mm thick shale beds spaced ~ 150 mm apart, weak from 10.2 m to 10.5 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. R5 52 0 (9) 0 (9) WATER LEVELS CONTRACTOR Maple Leaf Drilling Ltd. INSPECTOR M. RODRIGUEZ APPROVED DATE		9.0		•									
10.0 - Decreasing shale content, moderately strong from 9.8 m to 10.0 m. - Decreasing shale content, moderately strong from 9.8 m to 10.0 m. - R4 98 43 (13) - Two ~ 60 mm thick shale beds spaced ~ 150 mm apart, weak from 10.2 m to 10.5 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. - Broken lost core zone; suspected due to drilling issues / action from 11.4 m to 12.3 m. R5 52 0 (9) 0 (9) WATER LEVELS CONTRACTOR Maple Leaf Drilling Ltd. INSPECTOR M. RODRIGUEZ APPROVED DATE					-								
Image: Second second	228	10.0		to 9.8 m.			R4	98	43				
Image: Second second				m to 10.0 m.									
Image: Second second	227	-			-			┢					
226 action from 11.4 m to 12.3 m. WATER LEVELS CONTRACTOR Maple Leaf Drilling Ltd. M. RODRIGUEZ APPROVED DATE				- Broken lost core zone; suspected due to drilling issues /				_					
LEVELS Maple Leaf Drilling Ltd. M. RODRIGUEZ APPROVED DATE	<u> </u>						CJ	52					
APPROVED DATE		ER LS				Ltd.			IN			GUEZ	
K. FORDYCE 5-3-2024						DATE							

	GRO		5	TEST HOLE LOG	HOLE NO. TH24-01					SHEET 2 of 2
ELEVATION (m)	EPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION ELEV (m	DRILLING/ DIGGING REMARKS	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80
 224	13.0	40 45 		 Decreasing shale content, moderately strong below 12.4 m. Four 12 - 25 mm thick shale beds evenly spaced from 12.7 m to 13.0 m. 25 mm thick shale bed at 13.4 m. UCS: 34.3 MPa at 13.6 m. 65 mm thick shale bed at 13.7 m. Increasing shale content, increasing joint frequency, three ~ 7 - 25 mm thick shale beds from 13.8 m to 14.3 m. Broken lost core zone from 14.4 m to 15.1 m. 			R6	100	60 (10)	
223	15.0			 Broken lost core zone from 14.4 m to 15.1 m. Decreasing shale content, decreasing fissility, strong below 15.1 m. UCS: 23.2 MPa at 15.5 m. 	- Sample from R9		R7 	98	22 (10) 87 (6)	
	18.0	 60 		- Limited to no recovery below 17.1 m.	became stuck in core sampler and had to be removed forcefully - Approx 0.3 m of rock and poor recovery due to drilling issues. Coring		R9 R10	0	0	
ENTREPORT SEPT 26 TO 29, 2023 111111111111111111111111111111111111	20.0	65 		218.2 Notes: 1. End of test hole at 19.5 m. 2. Test hole backfilled with grout.	hole					
C:UUSERSIKFORDYCE/DESKTOPYEMS23-0107-009/23-0107-009 CENTREPORT SEPT 26 T0 29 111111111111111111111111111111111111	22.0	_ _ 75 _ _								
	25.0 26.0 ER	80 85			CONTRACTOR Maple Leaf Drilling	g Lt	d.			ISPECTOR M. RODRIGUEZ
KGS					APPROVED K. FORDYCE				D	ATE 5-3-2024

k	GROUP	5	TEST HOLE LOG	HOLE NO. TH24-02							SHE	ET 1 of 2
LOC DES DRI	ENT DJECT CATION SCRIPTION LL RIG / HA THOD(S)	MME	~3 m south of TH23-17	PROJECT NO. SURFACE ELE START DATE UTM (m)	v.		23 4- N	37.67 22-20)24 3,653		e 14	
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	Cu qu l	POCKE	T PEN	LL kPa) ◆ (kPa) ★ 0.30 m ▲ 80
-237			DRILL OUT - Overburden drilled out.									
	5.0 6.0 20		 Limestone and boulders, trace fine grained gravel, some silt till in sampler R1 ARGILLACEOUS LIMESTONE/CALCAREOUS SHALE - Reddish-gray to purplish fine grained, thinly bedded, fossiliferous, fissile, moderately strong. Poor core condition, unable to determine depths and zones of broken lost from 4.9 m to 9.1 m. Moderately weak, increasing shale content towards end of Run 1. 	- <u>232.8</u> -gray,	-	R1	60	17				
231	7.0		- Moderately weak, three soft shale beds 51 - 76 mm thick observed in reco core for Run 2.	vered		R2	62	27				
	8.0		- Moderately weak, increased shale interbedding observed in recovered cor Run 3.	e for		R3	47	7				
			 Very weak to weak, increasing shale content, increasing shale interbeds, increasing fissility below 9.1 m. Soft shale bed from 9.4 m to 9.4 m. Eleven soft shale beds 25 - 50 mm thick spaced 50 - 150 mm apart from 9.1 10.6 m. 	5 m to		R4	92	14 (24)				
			- Two 100 - 150 mm thick soft shale beds from 10.7 m to 11.0 m. - Increased shale content, very weak from 11.4 m to 12.0 m.			R5	93	15 (26)				
				RACTOR ple Leaf Drilling	; Lto	ł.		IN	SPECT M.R	TOR ODRIG	GUEZ	
22			APPRC K. F	OVED ORDYCE				DA	ATE 5-3-2	2024		

	GROUP	5		le no. 124-02						SH	EET 2	of 2
ELEVATION (m)	(ft) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	PL Cu TO qu POC SPT (N) I 20		N (kPa))*
225	40		 Decreased shale content from 12.0 m to 12.2 m. Broken lost core zone, significant soft shale observed in recovered portion of F from 12.2 m to 13.0 m. 	Run	-	R6	20	0				
224	13.0		 Decreasing shale content, moderately strong from 13.0 m to 13.4 m. Four 50 - 100 mm thick shale beds spaced 125 - 150 mm apart, moderately we to weak from 13.4 m to 14.4 m. 	ak		R7	95	7 (21)				
223	15.0		- Increased shale content, increased fissility, very weak from 14.4 m to 15.0 m. - Weak from 15.0 m to 15.7 m.		_	R8	100	33 (9)				
			 Increased fissility from 15.7 m to 16.1 m. Decreased shale content, moderately strong from 16.1 m to 16.4 m. Very weak / soft thinly bedded clacareous shale to mudstone with occassional 		-							
221			limestone beds of moderate strength from 16.4 m to 21.0 m. - Decreased shale / mud content from 17.5 m to 17.9 m.			R9	92	23 (14)				
219	18.0		- Decreased shale / mud content from 18.0 m to 18.3 m.			R10	97	10 (25)				
8 TO 29, 2023.GP. 11 11 11 11 11 11 11 1 81	20.0		 Decreased shale / mud content from 19.1 m to 19.6 m. Decreased shale / mud content from 20.0 m to 20.4 m. 			R11	97	23 (25)				
REPORT SEPT 26 TO 29.1	21.0		- Three 25 -75 mm thick limestone beds from 20.6 m to 21.0 m. - Decreasing shale / mud content, weak, no longer soft below 21.0 m.	216.2	_	R12	60	28				
0107-009 CENT	22.0		Notes: 1. End of test hole at 21.5 m. 2. Test hole backfilled with grout.						I	1		
215 211 211 211 214 214 214	23.0											
CE/DESKTOP/FM: 71171717171717171717171717171717171717	24.0											
C:UUSERSIKFORDYCEIDESKTOP/FMS/23-0107-009/23-0107-009/26-011	25.0											
WATI LEVEI			CONTRAC Maple APPROVE K. FOR	L eaf Drillin g D	g Lto	d.			SPECTOR M. RODF ATE 5-3-2024	IGUEZ		

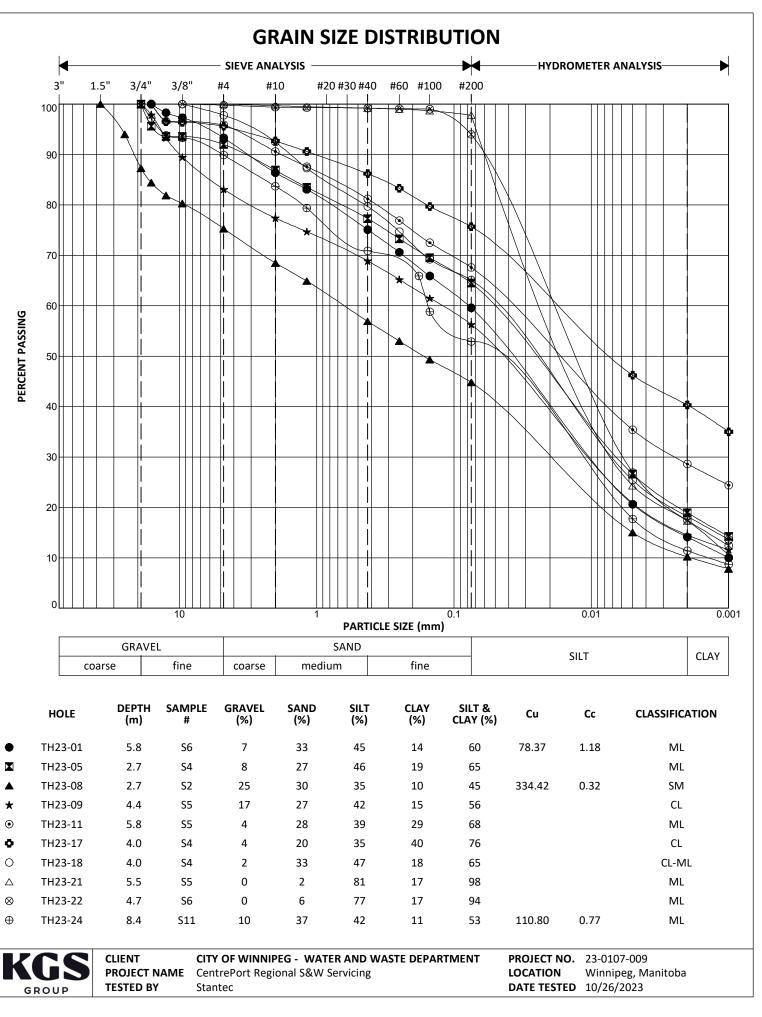
	GROU		5	TEST PIT LOG	HOLE NO. TP24-01						SHE	ET 1 of 1
LOC DES EXC	ENT DJECT CATION SCRIPTIC CAVATO THOD(S	ON DR		CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba Approx 15 m North of TH23-09 CAT 320 Excavator	PROJECT NO. SURFACE ELE START DATE UTM (m)			239 2-21 N 5,	.97 i L-20 529		Zone 2	14
ELEVATION (m)	a) DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	E	LEV (m)	WATER LEVEL	SAMPLE TYPE	NUMBER	qu POC	MC RVANE (1 KET PEN BLOWS/(40 60	-
		341.1/1		TOPSOIL - Black, frozen, with grass and rootlets. SILT - Light brown, non-plastic, frozen. CLAY - Brown, damp, stiff, low plasticity, some silt.		239.7 239.4		•	51			
239 	1.0	ł				220 5		•	52			
238	2.0	-5 .		SILT TILL - Light brownish grey, dry, dense, low plasticity, some gravel clay, trace cobbles/boulders. - Increased gravel, cobbles/boulders. Average boulder size of 380 mr of 560 mm below 2.0 m.		238.5		•	53			
 	3.0	-10						•	54			
236	4.0	-15							55			
235	5.0			- Silt till mixed with weathered bedrock at 4.9 m.		234.9	•	•	56			
		-20 -25 -30		BEDROCK - Reddish brown, argillaceous, brittle. Notes: 1. End of test pit at 5.3 m. 2. Refusal encountered on boulder or bedrock at a depth of 5.1 m. 3. Test pit backfilled with excavated material.		234.7						
WAT	ER ⊻ l LS	Upon	n Com		CONTRACTOR J CON Civil					SPECTOR L. PROVE		
202				· · · · · · · · · · · · · · · · · · ·	APPROVED K. FORDYCE				DA	TE 2-29-202	24	

K		5	TEST PIT LOG	HOLE NO. TP24-02			SHEET 1 of 1
LOC DES EXC			CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba North Shoulder of Saskatchewan Ave outside CPKC ROW CAT 320 Excavator	PROJECT NO. SURFACE ELEV. START DATE UTM (m)	2 2 N	40.64 -22-2 1 5,52	
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)	WATER LEVEL SAMPLE TYPE	NUMBER	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80
-239 -238 -237 -236 -236 -236 -237 -236 -237 -236 -237 -236 -237 -236 -237 -236 -237 -238	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0		CLAY FILL - Black, topsoil at ground surface, frozen, trace rootlets. SILT - Light brown, dry, low plasticity, some clay. CLAY - Brown, damp, hard, low plasticity, with silt. SILT TILL - Light grey, damp, dense, low plasticity, and clay, some gratrace cobbles/boulders. - Trace clay. Sedimentary/Igneous boulders (maximum size of 600 r below 3.5 m. BEDROCK - Mottled yellow grey dolomite, hard, strong. Notes: 1. End of test pit at 5.0 m. 2. Refusal encountered on boulder or bedrock at a depth of 4.6 m. 3. Test pit backfilled with excavated material.		Ĭ	 S1 S2 S3 S4 S5 	
	9.0 	n Corr	pletion 4.60 m Dry	CONTRACTOR J CON Civil APPROVED K. FORDYCE			ISPECTOR L. PROVEN ATE 2-29-2024

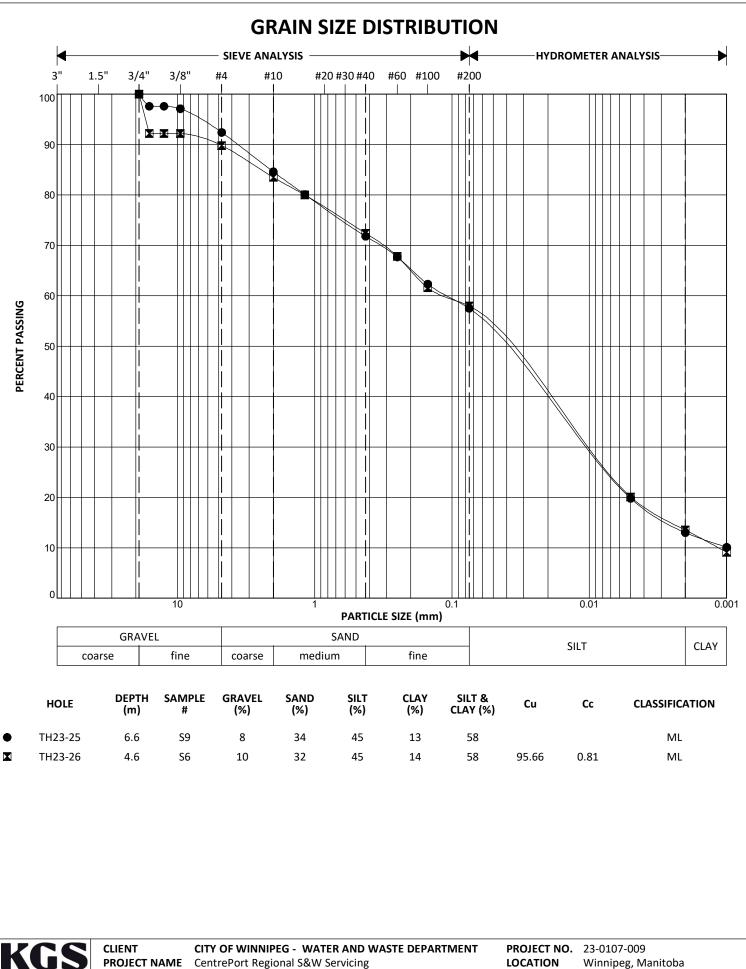
K	GROUP	5	TEST PIT LOG	HOLE NO. TP24-03				SHEET 1 of 1
LOC DES EXC	ENT DJECT CATION SCRIPTION CAVATOR THOD(S)		CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba North of CPKC ROW and East of TH23-18 CAT 320 Excavator	PROJECT NO SURFACE ELE START DATE UTM (m)		2	237.44 4-15-2 N 5,53	
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION		ELEV (m)	WATER LEVEL	NUMBER	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80
	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0		 CLAY - Brown, moist, firm, intermediate to high plasticity, some silt, Stiff, high plasticity, trace silt below 0.9 m. Large silt till inclusion (~300 mm diameter) around 3.1 m. Grey below 3.7 m. SILT TILL - Light brown, dry to damp, dense, some gravel, some sand cobbles, trace boulders (up to 300 mm diameter). Trace water encountered at 5.3 m. BEDROCK - mottled yellow grey dolomite, hard, strong. Notes: End of test pit at 5.5 m. Refusal encountered on suspected bedrock at a depth of 5.5 m. Test pit backfilled with excavated material. 	trace silt nodules.	 		 \$1 \$2 	
	 ER ⊈ Upo LS	n Com	pletion 5.46 m	CONTRACTOR J CON Civil				ISPECTOR C. FRIESEN
N Y C Y				APPROVED K. FORDYCE			D	ATE 5-3-2024

K	GROUP	5	TEST PIT LOG	HOLE NO. TP24-04			SHEET 1 of 1	1
CLIENT PROJECT LOCATION DESCRIPTION EXCAVATOR METHOD(S)			CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba South of CPKC ROW and East of TH23-17 CAT 320 Excavator	PROJECT NO. SURFACE ELEV. START DATE UTM (m)	23-0107-009 238.36 m 4-15-2024 N 5,533,583.04 E 624,491.12 Zone 14			
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m	WATER LEVEL	SAMPLE TYPE	PL MC LL Cu TORVANE (kPa) \blacklozenge qu POCKET PEN (kPa) \star SPT (N) BLOWS/0.30 m $\overset{1}{}$ 20 40 60 80	
238			ORGANIC SOIL FILL - 910 mm, Black, damp to moist, stiff, intermedia with clay, some sand.	ate to high plasticity,				
237			<u>CLAY</u> - Brown, moist, stiff, high plasticity.	237.5	5			
236 236 	2.0 1.1 2.0 1.1 1.1 1.1 1.1 1.1 1.1 1.1 1		SILT TILL - Light brown, damp, compact, some gravel, some sand, so cobbles, trace boulders (up to 300 mm diameter).	235.s me clay, some)			
 234	4.0		- Dry, very dense below 4.0 m.				S1	
	5.0 5.0 6.0 7.0 7.0 8.0 9.0 9.0 30		 Increased sand/gravel and cobble content below 5.1 m. Trace water encountered at 5.2 m. <u>BEDROCK</u> - Reddish brown, fairly hard but fractured slightly with bu Notes: End of test pit at 5.2 m. Refusal encountered on suspected bedrock at a depth of 5.2 m. Test pit backfilled with excavated material. 	233.2 233.0 cket.			52 52	
229								
	ER ¥ Upo	n Corr	pletion 5.18 m	CONTRACTOR				
	LS ± Opo		-	CONTRACTOR J CON Civil			INSPECTOR C. FRIESEN	
				APPROVED K. FORDYCE			DATE 5-3-2024	

KCS		5	TEST PIT LOG	HOLE NO. SHEE			SHEET 1 of 1
CLIENT PROJECT LOCATION DESCRIPTION EXCAVATOR METHOD(S)			CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba East of Sturgeon Road and North of Selkirk Avenue CAT 320 Excavator	PROJECT NO. SURFACE ELEV. START DATE UTM (m)	23-0107-009 240.07 m 4-15-2024 N 5,532,450.43 E 623,837.68 Zone 14		7 m 2024 32,450.43
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m	WATER LEVEL	SAMPLE TYPE NUMBER	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80
240 	1.0		<u>CLAY</u> - Grey and black, moist, firm, intermediate to high plasticity, so <u>SILT TILL</u> - Light brown, damp, compact, some gravel, some sand, so cobbles. - Dry to damp, some boulders (up to 400 mm diameter) below 1.5 m	me topsoil/organics. 239.5 ne clay, some			
238	2.0		 Very dense, with cobbles below 2.1 m. <u>BEDROCK</u> - Mottled yellow grey dolomite, hard, strong. Notes: 	Ţ	S 1		
235	4.0 		 End of test pit at 3.5 m. Refusal encountered on suspected bedrock at a depth of 3.5 m. Test pit backfilled with excavated material. 				
233	6.0						
232	8.0 						
	_{10.0}	n Con		CONTRACTOR J CON Civil			I NSPECTOR C. FRIESEN
				APPROVED K. FORDYCE		l	DATE 5-3-2024



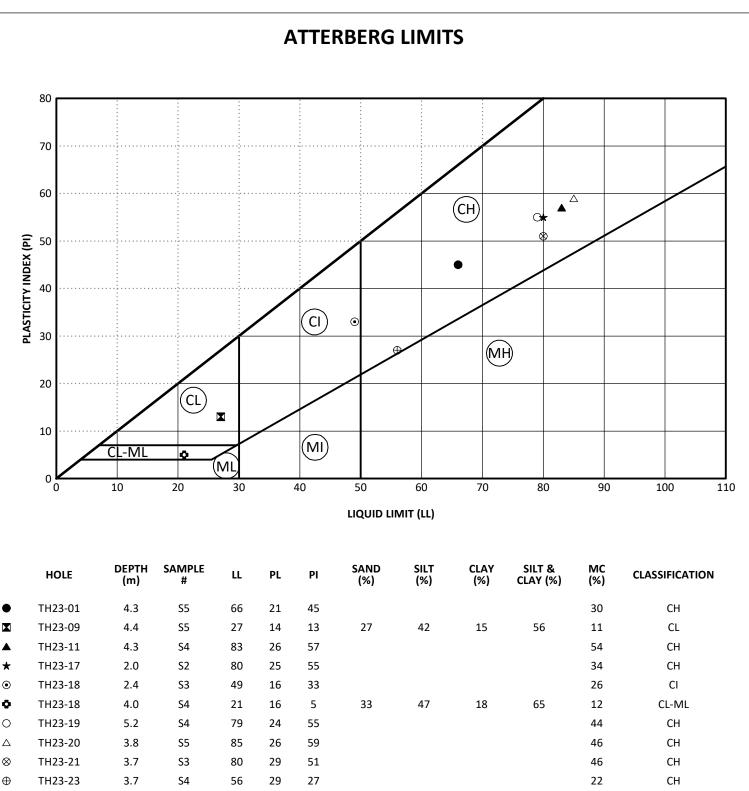
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DATE TESTED 10/26/2023

TESTED BY GROUP

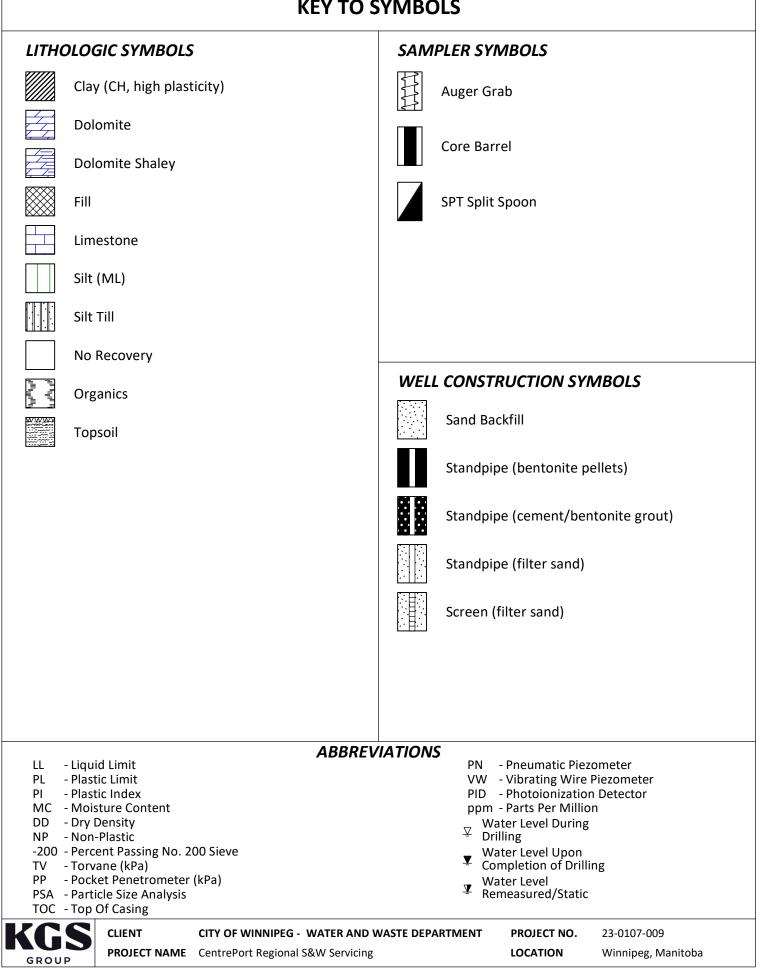
Stantec



A-L



KEY TO SYMBOLS



APPENDIX C

2023/2024 Select Drilling Photos



TH23-01 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-01 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-01 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)



TH23-01 Photo 4: 4.5 m to 6.0 m (15 ft to 20 ft)





TH23-01 Photo 5: 6.0 m to 7.5 m (20 ft to 25 ft)



TH23-01 Photo 6: 7.5 m to 9.0 m (25 ft to 30 ft)





TH23-01 Photo 7: Bedrock Core, 9.45 m to 22.2 m (31.5 ft to 74 ft)





TH23-03 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-03 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-03 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)



TH23-03 Photo 4: 4.5 m to 6.0 m (15 ft to 20 ft)





TH23-03 Photo 5: 6.0 m to 7.0 m (20 ft to 23 ft)





TH23-04 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-04 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-04 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)



TH23-04 Photo 4: 4.5 m to 6.0 m (15 ft to 20 ft)





TH23-04 Photo 5: 6.0 m to 7.3 m (20 ft to 24 ft)





TH23-05 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-05 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-05 Photo 3: 3.0 m to 4.2 m (10 ft to 14 ft)





TH23-06 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-06 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-06 Photo 3: 3.0 m to 4.2 m (10 ft to 14 ft)



TH23-06 Photo 4: 3.0 m to 4.5 m (15 ft to 20 ft)





TH23-07 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-07 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-07 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)



TH23-07 Photo 4: 4.5 m to 5.4 m (15 ft to 18 ft)





TH23-08 Photo 1: Bedrock core, 3.3 m to 9.3 m (11 ft to 31 ft)





TH23-09 Photo 1: 0.0 m to 1.5 m (0 ft to 5 ft)



TH23-09 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-09 Photo 3: SPT from 3.0 m to 3.3 m (10 ft to 11 ft)



TH23-09 Photo 4: 3.0 m to 4.5 m (10 ft to 15 ft)





TH23-09 Photo 5: 4.5m to 5.2m (15 ft to 17 ft-3 in)





TH23-09 Photo 6: 5.2 m to 9.3m (17 ft-3in to 31ft)





TH23-11 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-11 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-11 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)



TH23-11 Photo 4: 4.5 m to 6.0 m (15 ft to 20 ft)





TH23-12 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-12 Photo 2: 3.0 m to 4.5 m (10 ft to 15 ft)





TH23-12 Photo 3: 4.5 m to 6.0 m (15 ft to 20 ft)



TH23-12 Photo 4: 6.0 m to 7.5 m (20 ft to 25 ft)





TH23-17 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-17 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-17 Photo 3: 3.0 m to 4.2 m (10 ft to 14 ft)





TH23-17 Photo 4: Bedrock core from 4.2 m to 12.4 m (14 ft to 41 ft - 4in)





TH23-18 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-18 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-18 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)





TH23-18 Photo 4: Bedrock core from 4.6 m to 12.4 m (15 ft - 5 in to 41 ft - 5 in)





TH23-19 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-19 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-19 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)



TH23-19 Photo 4: 4.5 m to 6.0 m (15 ft to 20 ft)





TH23-19 Photo 5: 6.0 m to 7.2 m (20 ft to 24 ft)





TH23-20 Photo 1: 0.0 m to 1.5 m (0 ft to 5 ft)



TH23-20 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-20 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)



TH23-20 Photo 4: 4.5 m to 6.0 m (10 ft to 15 ft)





TH23-20 Photo 5: 6.0 m to 7.5 m (20 ft to 25 ft)



TH23-20 Photo 6: 7.5 m to 8.1 m (25 ft to 27ft)





TH23-20 Photo 7: Bedrock recovered from SPT at 8.1m (27ft)





TH23-21 Photo 1: 0 to 1.2 m (0 to 4 ft)



TH23-21 Photo 2: 1.2 m to 2.7 m (4 ft to 9 ft)





TH23-21 Photo 3: 2.7 m to 4.2 m (9 ft to 14 ft)



TH23-21 Photo 4: 4.2 m to 5.7 m (14 ft to 19 ft)





TH23-21 Photo 5: SPT at 5.7m (19 ft)



TH23-21 Photo 6: 5.7m to 7.2 m (19 ft to 24 ft)





TH23-21 Photo 7: SPT at 7.2m (24 ft)



TH23-21 Photo 8: 7.2m to 7.8 m (24 ft to 26 ft)





TH23-22 Photo 1: 0 to 1.2 m (0 to 4 ft)



TH23-22 Photo 2: 1.2 m to 2.7 m (4 ft to 9 ft)





TH23-22 Photo 3: 2.7 m to 4.2 m (9 ft to 14 ft)



TH23-22 Photo 4: SPT at 4.2m (14 ft)





TH23-22 Photo 5: 4.2 m to 5.7 m (14 ft to 19 ft)



TH23-22 Photo 6: SPT at 5.7m (19 ft)





TH23-22 Photo 7: 5.7 m to 7.2 m (19 ft to 24 ft)



TH23-22 Photo 8: SPT at 7.2m (24 ft)





TH23-23 Photo 1: 0 to 1.2 m (0 to 4 ft)



TH23-23 Photo 2: 1.2 m to 2.7 m (4 ft to 9 ft)





TH23-23 Photo 3: 2.7 m to 4.2 m (9 ft to 14 ft)



TH23-23 Photo 4: 4.2 m to 5.7 m (14 ft to 19 ft)





TH23-23 Photo 5: SPT at 5.7m (19 ft)



TH23-23 Photo 6: 5.7 m to 6.2 m (19 ft to 20.5 ft)





TH23-24 Photo 1: 0 to 1.5 m (0 to 5 ft)



TH23-24 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-24 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)



TH23-24 Photo 4: 4.5 m to 6.0 m (15 ft to 20 ft)





TH23-24 Photo 5: 7.5 m to 9.0 m (25 ft to 30 ft)

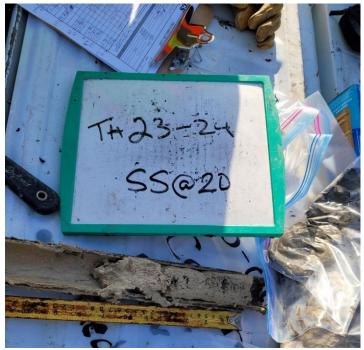


TH23-24 Photo 6: 9.0 m to 9.9 m (30 ft to 33 ft)





TH23-24 Photo 7: SPT at 4.5 m (15ft)



TH23-24 Photo 8: SPT at 6.0 m (20ft)





TH23-24 Photo 9: SPT at 7.5 m (25ft)



TH23-24 Photo 10: SPT at 9.0 m (30ft)





TH23-24 Photo 11: Bedrock core from 9.0 m to 11.2 m (30 ft to 37 ft – 3 in)





TH23-25 Photo 1: 0.0 m to 1.5 m (0 ft to 5 ft)



TH23-25 Photo 2: 1.5 m to 3.0 m (5 ft to 10 ft)





TH23-25 Photo 3: 3.0 m to 4.5 m (10 ft to 15 ft)

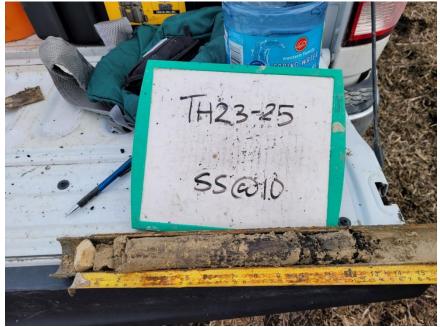


TH23-25 Photo 4: 4.5 m to 6.0 m (15 ft to 20 ft)





TH23-25 Photo 5: 6.0 m to 7.5 m (20 ft to 25 ft)



TH23-25 Photo 6: SPT at 3.0m (10 ft)





TH23-25 Photo 7: SPT at 4.5m (15 ft)



TH23-25 Photo 8: SPT at 6.0m (20 ft)





TH23-25 Photo 9: SPT at 7.5m (25 ft)





TH23-25 Photo 10: Bedrock core from 8.5 m to 13.9 m (28 ft - 2 in to 46 ft - 2 in)





TH23-26 Photo 1: Bedrock core from 5.5 m to 15.4 m (18 ft – 4 in to 51 ft – 4 in)





TH24-01 Photo 1: Bedrock core from 5.9 m to 19.5 m (19 ft – 6 in to 64 ft – 0 in)





TH24-02 Photo 1: Bedrock core from 4.9 m to 21.5 m (16 ft to 70 ft – 6 in)





TP24-01 Photo 1: Completed test pit to 5.1 m



TP24-01 Photo 2: Clay -rich Silt Till





TP24-01 Photo 3: Silt Till with Higher Gravel Content



TP24-01 Photo 4: Boulders from Silt Till





TP24-01 Photo 5: Sedimentary Boulder (22 inches)



TP24-01 Photo 6: Igneous Boulder (22 inches)





TP24-01 Photo 7: Sedimentary Boulder



TP24-01 Photo 8: Reddish Brown Argillaceous Bedrock at 5.1 m.





TP24-02 Photo 1: Top of bedrock encountered at 4.6 m



TP24-02 Photo 2: Cobbles and Boulders from silt till





TP24-02 Photo 3: Boulder from silt till (22 inches)



TP24-02 Photo 4: Boulders from silt till (16 inches)





TP24-02 Photo 5: Boulder from silt till (24 inches)



TP24-02 Photo 6: Igneous boulder in silt till





TP24-03 Photo 1: Top of bedrock encountered at 4.6 m



TP24-03 Photo 2: Cobbles encountered in silt till





TP24-04 Photo 1: Top of bedrock encountered at 5.2 m



TP24-04 Photo 2: Gravel and cobbles encountered in silt till





TP24-05 Photo 1: Top of bedrock encountered at 3.5 m



TP24-05 Photo 2: Cobbles and trace boulders in silt till





TP24-05 Photo 3: Cobbles and boulders in silt till



TP24-05 Photo 4: Igneous boulder in silt till



APPENDIX D

2023/2024 Laboratory Testing Results



ASTM D2216 - LABORATORY DETERMINATION OF WATER (MOISTURE) CONTENT OF SOIL AND ROCK BY MASS

то	KGS Group 3rd Floor - 8 Winnipeg, N	365 Waverley Street	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
	R3T 5P4		PROJECT NO	123316822
	ATTN:	Grace Gitzel	REPORT NO.	1
		2022 Son 25		

DATE SAMPLED: 2023.Sep.25DATE RECEIVED: 2023.Oct.20DATE TESTED: 2023.Oct.20SAMPLED BY:KGS Group Inc.SUBMITTED BY:KGS Group Inc.TESTED BY:Larry Presado

TESTHOLE	SAMPLE	MC %
	S3	45.5
	S5	29.5
TH23-01	S6	9.3
ſ	S8	9.3
	S10	8.3
TH23-08	S1	20.8
1 1123-00	S2	7.9
	S1	11.9
TH23-09	S3	9.8
1123-09	S4	9.2
ſ	S5	10.7
	S3	20.0
TH23-20	S5	45.6
11123-20	S6	29.3
	S8	42.9

REPORT DATE 2023.Oct.27

REVIEWED BY

fuce Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided on written request. The data presented is for sole use of client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.

PAGE 1 OF 1



ASTM D2216 - LABORATORY DETERMINATION OF WATER (MOISTURE) CONTENT OF SOIL AND ROCK BY MASS

то	KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba		PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
	R3T 5P4		PROJECT NO.	123316822
	ATTN:	Grace Gitzel	REPORT NO.	2

DATE SAMPLED: 2023.Nov.15 DATE RECEIVED: 2023.Nov.27 SAMPLED BY: KGS Group Inc.

SUBMITTED BY: KGS Group Inc.

DATE TESTED: 2023.Nov.28 TESTED BY: Carson Cockwell

TESTHOLE	SAMPLE	MC %
	S3	31.5
TH23-05	S4	11.9
	S6	9.0
	S3	38.4
TH23-11	S4	53.6
	S5	23.9
	S1	38.4
TH23-17	S2	33.6
1 1 23-17	S3	27.2
	S4	20.4
TH23-18	S3	25.6
1H23-18	S4	11.9
	S2	36.7
TH23-19	S3	39.1
1 1 23-19	S4	43.5
	S5	31.8
	S3	46.1
TH23-21	S4	41.6
	S7	10.3
	S3	22.7
TH23-22	S4	18.1
	S7	13.8
	S2	38.9
TH23-23	S4	21.6
	S5	21.9

TESTHOLE	SAMPLE	MC %
	S3	37.6
	S5	37.6
TH23-24	S7	10.0
	S9	12.4
	S11	9.5
	S2	37.7
TH23-25	S5	10.1
11123-25	S7	11.3
	S9	13.9
	S2	20.9
TH23-26	S3	8.6
1 1123-20	S5	9.6
	S6	9.1

office

Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services

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REPORT DATE

2023.Nov.29

PAGE 1 OF 1





TO KGS Group Inc. 3rd Floor - 865 Waverley Street	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
Winnipeg, Manitoba R3T 5P4	PROJECT NO.	123316822
ATTN: Grace Gitzel	REPORT NO.	1
DATE SAMPLED: 2023.Sep.28 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Oct.20 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Oct.26 TESTED BY: Larry Presado
SAMPLE ID: TH23-01, S5, 14'-15'		
LIQUID LIMIT TRIAL 1 2 3 BLOWS 30 25 17 MC (%) 64 67 69	PLASTIC LIMIT TRIAL 1 2 MC (%) 21 21	LIQUID LIMIT, LL66PLASTIC LIMIT, PL21PLASTICITY INDEX, PI45AS REC'D MC (%)29.5
$ \begin{array}{c} 70\\ 69\\ 68\\ 67\\ 66\\ 65\\ 64\\ 15\\ 20\\ 25\\ 30\\ 35\\ \end{array} $	$\begin{array}{c} 60\\ 50\\ 40\\ 30\\ 30\\ 10\\ 0\\ 0\\ 10\\ 20\\ 30\\ 40 \end{array}$	OUT LIPE CH NH 0 50 60 70 80 90 100 Liquid Limit 0 0 0 0 0
COMMENTS:		
REPORT DATE 2023.Oct.27		Betwee laume Beauce, P.Eng. technical Engineer - Materials Testing Services
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TO KGS Group Inc. 3rd Floor - 865 Waverley Street	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
Winnipeg, Manitoba R3T 5P4	PROJECT NO.	123316822
ATTN: Grace Gitzel	REPORT NO.	2
DATE SAMPLED: 2023.Sep.25 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Oct.20 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Oct.26 TESTED BY: Larry Presado
SAMPLE ID: TH23-09, S5, 14.5'-15'		
LIQUID LIMIT TRIAL 1 2 3 BLOWS 32 24 19 MC (%) 25 27 28	PLASTIC LIMIT TRIAL 1 2 MC (%) 14 14	LIQUID LIMIT, LL 27 PLASTIC LIMIT, PL 14 PLASTICITY INDEX, PI 13 AS REC'D MC (%) 10.7
$\begin{array}{c} 29\\ 28\\ 28\\ 26\\ 25\\ 15\\ 20\\ 25\\ 15\\ 20\\ 25\\ 30\\ 35\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\ 8\\$	60 50 40 30 20 10 0 0 10 20 30 CL MI 0 0 0 0 0 0 0 0	NH MH 50 60 70 80 90 100
COMMENTS:		
REPORT DATE 2023.Oct.27	Geo	Betwee laume Beauce, P.Eng. technical Engineer - Materials Testing Services
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TO KGS Group Inc. 3rd Floor - 865 Waverley Street	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
Winnipeg, Manitoba R3T 5P4	PROJECT NO.	123316822
ATTN: Grace Gitzel	REPORT NO.	3
DATE SAMPLED: 2023.Sep.25 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Oct.20 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Oct.26 TESTED BY: Larry Presado
SAMPLE ID: TH23-20, S5, 12.5'-13' LIQUID LIMIT TRIAL 1 2 3	PLASTIC LIMIT	LIQUID LIMIT, LL 85 PLASTIC LIMIT, PL 26
BLOWS 33 25 18	MC (%) 26 26	PLASTICITY INDEX, PI 59
MC (%) 82 84 88		AS REC'D MC (%) 45.6
$ \begin{array}{c} 88\\ 87\\ (\%) 86\\ 83\\ 82\\ 81\\ 15\\ 20\\ 25\\ 30\\ 35\\ Blows \end{array} $	$\begin{array}{c} 60\\ 50\\ 40\\ 30\\ 20\\ 10\\ 0\\ 0\\ 10\\ 20\\ 30\\ 10\\ 0\\ 10\\ 20\\ 30\\ 40\\ 0\\ 10\\ 20\\ 30\\ 40\\ 0\\ 10\\ 20\\ 30\\ 40\\ 0\\ 10\\ 20\\ 30\\ 40\\ 0\\ 10\\ 20\\ 30\\ 40\\ 0\\ 10\\ 10\\ 20\\ 30\\ 40\\ 0\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10$	NUT LINE CH NAT LINE NAT LINE NAT LINE NAT LINE 50 60 70 80 90 100 Liquid Limit NAT NAT NAT NAT
COMMENTS:		
REPORT DATE 2023.Oct.27 Reporting of these test results constitutes a testing service only. Engineering in responsible, nor can be held liable, for the use of this report by any other party,	Geot terpretation or evaluation of the test results is provided on written reques	Betwee aume Beauce, P.Eng. echnical Engineer - Materials Testing Services st. The data presented is for sole use of client stipulated above. Stantec is no
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TO KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
R3T 5P4	PROJECT NO.	123316822
ATTN: Grace Gitzel	REPORT NO.	4
DATE SAMPLED: 2023.Nov.15 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Nov.27 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Dec.06 TESTED BY: Blair Dawson
SAMPLE ID: TH23-11, S4		
LIQUID LIMIT TRIAL 1 2 3 BLOWS 30 26 22 MC (%) 79 82 85	PLASTIC LIMIT TRIAL 1 2 MC (%) 26 26	LIQUID LIMIT, LL83PLASTIC LIMIT, PL26PLASTICITY INDEX, PI57AS REC'D MC (%)11.9
$ \begin{array}{c} & 86 \\ & 85 \\ & 84 \\ & 83 \\ & 82 \\ & 84 \\ & 83 \\ & 82 \\ & 84 \\ & 9 \\ & 70 \\ & 70 \\$	$\begin{array}{c} 60\\ 50\\ 40\\ 30\\ 30\\ 20\\ 10\\ 0\\ 0\\ 10\\ 20\\ 30\\ 40 \end{array}$	NU: LINE CH NI: LINE NI: LINE NI: LINE NI: LINE S0 60 70 80 90 100 Liquid Limit S0 100 S0 100
COMMENTS:	(Return
REPORT DATE 2023.Dec.08		Betwee aume Beauce, P.Eng. aechnical Engineer - Materials Testing Services
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TO KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)			
R3T 5P4	PROJECT NO.	123316822			
ATTN: Grace Gitzel	REPORT NO.	5			
DATE SAMPLED: 2023.Nov.15 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Nov.27 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Dec.06 TESTED BY: Carson Cockwell			
SAMPLE ID: TH23-17, S2					
LIQUID LIMIT TRIAL 1 2 3 BLOWS 35 25 19 MC (%) 78 79 80	PLASTIC LIMIT TRIAL 1 2 MC (%) 25 25	LIQUID LIMIT, LL80PLASTIC LIMIT, PL25PLASTICITY INDEX, PI55AS REC'D MC (%)33.6			
$ \begin{array}{c} 81 \\ 81 \\ $	$\begin{array}{c} 60\\ 50\\ 40\\ 30\\ 20\\ 10\\ 0\\ 0\\ 10\\ 20\\ 30\\ 40 \end{array}$	Image: CH Image: CH Image: CH Image: CH			
COMMENTS:					
REPORT DATE 2023.Dec.11	REVIEWED BY Guilla	Betuce aume Beauce, P.Eng. echnical Engineer - Materials Testing Services			
	Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided on written request. The data presented is for sole use of client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.				
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TO KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
R3T 5P4	PROJECT NO	. 123316822
ATTN: Grace Gitzel	REPORT NO.	6
DATE SAMPLED: 2023.Nov.15 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Nov.27 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Dec.06 TESTED BY: Carson Cockwell
SAMPLE ID: TH23-18, S3		
LIQUID LIMIT TRIAL BLOWS MC (%) 30 22 15 MC (%) 48 49 50 50 50 50 50 48 49 50	0	LIQUID LIMIT, LL PLASTIC LIMIT, PL PLASTICITY INDEX, PI AS REC'D MC (%)
COMMENTS:		
REPORT DATE 2023.Dec.08		Betwee uillaume Beauce, P.Eng. eotechnical Engineer - Materials Testing Services
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TO KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
R3T 5P4	PROJECT	NO. 123316822
ATTN: Grace Gitzel	REPORT N	0. 7
DATE SAMPLED: 2023.Nov.15 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Nov.27 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Dec.06 TESTED BY: Carson Cockwell
SAMPLE ID: TH23-18, S4		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c} PLASTIC LIMIT \\ TRIAL 1 2 \\ MC (\%) 16 16 \\ \hline 60 \\ 50 \\ 40 \\ \end{array}$	LIQUID LIMIT, LL PLASTIC LIMIT, PL PLASTICITY INDEX, PI AS REC'D MC (%) 25.4 10 10 10 10 10 10 10 10 10 10
$ \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \end{array} & \begin{array}{c} & \begin{array}{c} & \end{array} & \begin{array}{c} & \end{array} & \begin{array}{c} & \begin{array}{c} & \end{array} & \begin{array}{c} & \end{array} & \begin{array}{c} & \end{array} & \begin{array}{c} & \end{array} & \begin{array}{c} & \end{array} & \begin{array}{c} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \end{array} & \end{array} & \begin{array}{c} & \end{array} & \end{array} & \end{array} & \end{array} & \begin{array}{c} & \begin{array}{c} & \end{array} & \end{array} & \end{array} & \end{array} & \end{array} & \end{array} & \end{array} & $	x 40 30 10 0 10 20 30 10 20 30	
COMMENTS:		
REPORT DATE 2023.Dec.08	REVIEWED BY	Betwee Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services
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TO KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
R3T 5P4	PROJECT NO.	123316822
ATTN: Grace Gitzel	REPORT NO.	8
DATE SAMPLED: 2023.Nov.15 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Nov.27 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Dec.06 TESTED BY: Carson Cockwell
SAMPLE ID: TH23-19, S4		
LIQUID LIMIT TRIAL 1 2 3 BLOWS 32 24 17 MC (%) 75 79 83	PLASTIC LIMITTRIAL12MC (%)2424	LIQUID LIMIT, LL79PLASTIC LIMIT, PL24PLASTICITY INDEX, PI55AS REC'D MC (%)43.5
$ \begin{array}{c} $	$\begin{array}{c} 60\\ 50\\ 40\\ 30\\ 20\\ 10\\ 0\\ 0\\ 10\\ 20\\ 30\\ 40 \end{array}$	NH MH 50 60 70 80 90 100 Liquid Limit 100 100 100 100
COMMENTS:		Bennce
REPORT DATE 2023.Dec.08		Deuwe aume Beauce, P.Eng. technical Engineer - Materials Testing Services
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TO KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
R3T 5P4	PROJECT NO.	123316822
ATTN: Grace Gitzel	REPORT NO.	9
DATE SAMPLED: 2023.Nov.15 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Nov.27 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Dec.06 TESTED BY: Carson Cockwell
SAMPLE ID: TH23-21, S3		
LIQUID LIMIT TRIAL 1 2 3 BLOWS 33 25 17 MC (%) 77 80 83	PLASTIC LIMIT TRIAL 1 2 MC (%) 29 29	LIQUID LIMIT, LL80PLASTIC LIMIT, PL29PLASTICITY INDEX, PI51AS REC'D MC (%)46.1
$ \begin{array}{c} 84 \\ 83 \\ 84 \\ 84 \\ 84 \\ 84 \\ 84 \\ 84 \\ 84 \\ 84$	$\begin{array}{c} 60\\ 50\\ 40\\ 30\\ 30\\ 20\\ 10\\ 0\\ 0\\ 10\\ 20\\ 30\\ 40 \end{array}$	NU LINE CH MH 50 60 70 80 90 100 Liquid Limit 100 100 100 100
COMMENTS:		
REPORT DATE 2023.Dec.08		Betuce aume Beauce, P.Eng. rechnical Engineer - Materials Testing Services
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TO KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba	PROJECT	CentrePort AAW Regional S&W Servicing (23-0107-009)
R3T 5P4	PROJECT NO.	123316822
ATTN: Grace Gitzel	REPORT NO.	10
DATE SAMPLED: 2023.Nov.15 SAMPLED BY: KGS Group Inc.	DATE RECEIVED: 2023.Nov.27 SUBMITTED BY: KGS Group Inc.	DATE TESTED: 2023.Dec.06 TESTED BY: Carson Cockwell
SAMPLE ID: TH23-23, S4		
LIQUID LIMIT TRIAL 1 2 3 BLOWS 33 24 16 MC (%) 54 56 58	PLASTIC LIMIT TRIAL 1 2 MC (%) 29 29	LIQUID LIMIT, LL56PLASTIC LIMIT, PL29PLASTICITY INDEX, PI27AS REC'D MC (%)21.6
58 58 57 57 56 55 55 55 54 55 54 55 54 55 54 55 54 55 55	$\begin{array}{c} 60\\ 50\\ 40\\ 30\\ 0\\ 0\\ 10\\ 0\\ 0\\ 10\\ 20\\ 30\\ 40 \end{array}$	MH MH 50 60 70 80 90 100
COMMENTS:		
REPORT DATE 2023.Dec.08		Betwee laume Beauce, P.Eng. technical Engineer - Materials Testing Services
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AASHTO T88 (ASTM D422) - PARTICLE-SIZE ANALYSIS OF SOILS

то	3rd Fl	Group oor - 8	65 V		rley S	tree	t							PR	OJECT			ePort AAW Regiona cing (23-0107-009)	I S&W
	R3T 5	peg, N 5P4	anno	JDa										PR	OJECT NO	D. 12	331	6822	
	ATTN	: (Grac	e Git	zel									REI	PORT NO	. 1			
	SAMP			-	.28 Jp Inc						EIV D B		2023 KGS		20 up Inc.			DATE TESTED: TESTED BY:	2023.Oct.24 Larry Presado
		100 -																SIEVE SIZE (mm)	% PASSING
		90 -										+					Ī	37.5	100.0
		80 -								-		+						25.0	100.0
	(%)	70 -																19.0	100.0
	Percent Passing (%)	60 -																16.0	100.0
	assi	50 -															Ì	12.5	98.3
	E B	40 -															Ì	9.5	97.3
	rcer																Ì	4.75	93.3
	Pe	30 -															Ì	2.00	86.4
		20 -							\vdash			+						1.18	83.1

10						
	100 10		1	0.1	0.01	0.001
			ize (mm)			
Gravel		Sand	-	Silt	Clay	Colloids
	Coarse	Medium	Fine	Oilt	Ciay	0010103

15.5

45.5

25.0	100.0
19.0	100.0
16.0	100.0
12.5	98.3
9.5	97.3
4.75	93.3
2.00	86.4
1.18	83.1
0.425	75.1
0.250	70.6
0.150	65.9
0.075	59.6
0.005	20.6
0.002	14.1
0.001	10.0

COMMENTS:

6.7

Material tested was identified as TH23-01, S6, 19'-20'.

6.9

11.3

REPORT DATE 2023.Oct.27

14.1

10.0

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ТО		oor -	865 Wa	-	Stree	et						PROJ	ECT			ort AAW Regiona g (23-0107-009)	I S&W	
	R3T 5	-	Manitob	a								PROJ	ECT NO.	1233	168	322		
	ATTN:	:	Grace	Gitzel								REPC	ORT NO.	2				
	SAMPI		2023.S KGS G	-	IC.				CEI\ Ed e			Oct.20 Group				DATE TESTED: TESTED BY:	2023.Oct.2 Larry Presa	
		100													s	IEVE SIZE (mm)	% PASSING	
		90														37.5	100.0	
		80	++++++										+			25.0	94.0	
	(%)	70						_			_		++			19.0	87.3	
) gu	60							_							16.0	84.8	
	assi	50														12.5	81.9	
	E D	40														9.5	80.3	
	Percent Passing (%)															4.75	75.3	
	Ре	30									\mathbf{N}					2.00	68.5	

Oracial		Sand		0:14	Olau	0-11-1-1-
Gravel	Coarse	Medium	Fine	Silt	Clay	Colloids
24.7	6.8	11.6	12.1	34.6	10.2	7.8

Particle Size (mm)

1

0.1

37.5	100.0
25.0	94.0
19.0	87.3
16.0	84.8
12.5	81.9
9.5	80.3
4.75	75.3
2.00	68.5
1.18	64.9
0.425	56.9
0.250	53.0
0.150	49.3
0.075	44.8
0.005	15.0
0.002	10.2
0.001	7.8

COMMENTS:

Material tested was identified as TH23-08, S2, 10'-11'.

10

REPORT DATE 2023.Oct.27

0.01

0.001

REVIEWED BY Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services





то	KGS (3rd Flo Winnip	oor -	865	Wave	erley	Stre	et					F	PRO	JECT			Port AAW Regiona ng (23-0107-009)	I S&W	
	R3T 5	-	Mari	lioba								F	PRO	JECT NO.	1233	16	5822		
	ATTN:	:	Gra	ice G	itzel							F	REPO	ORT NO.	3				
	E SAMPI PLED B`			3.Se S Gro		nc.				CEI ED			Oct.2 Group	0 o Inc.			DATE TESTED: TESTED BY:	2023.Oct.24 Larry Presa	
		100														Γ	SIEVE SIZE (mm)	% PASSING	
		90															37.5	100.0	
		80												++			25.0	100.0	
	(%)	70			_									+			19.0	100.0	
	bu	60															16.0	97.9	
	assi	50															12.5	93.3	
	E E	40															9.5	89.5	
	Percent Passing (%)																4.75	83.1	
	Ре	30															2.00	77.4	

	0						
	1	00	10	1	0.1	0.01	0.001
				Particle S	Size (mm)		
Cri	avel		Sand		Silt	Clay	Colloids
	avei	Coarse	Medium	Fine	Siit	Clay	Colloids
16	6.9	5.7	8.5	12.6	41.8	14.5	11.6

PASSING
100.0
100.0
100.0
97.9
93.3
89.5
83.1
77.4
74.7
68.9
65.2
61.5
56.3
20.8
14.5
11.6

COMMENTS:

Material tested was identified as TH23-09, S5, 14.5'-15'.

REPORT DATE 2023.Oct.27

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то	KGS Grou 3rd Floor - Winnipeg,	865 Waverley Street		PROJECT	CentrePort AAW Regiona Servicing (23-0107-009)	II S&W
	R3T 5P4	Mantoba		PROJECT NO.	123316822	
	ATTN:	Kelly Fordyce		REPORT NO.	4	
	E SAMPLED PLED BY:	: 2023.Nov.15 KGS Group Inc.	DATE RECEIVED: SUBMITTED BY:	2023.Nov.27 KGS Group Inc.	DATE TESTED: TESTED BY:	2023.Dec.04 Larry Presado
	100				SIEVE SIZE (mm)	% PASSING
	90				37.5	100.0
	80				25.0	100.0
	8 70				19.0	100.0
					16.0	95.6
	Dercent Passing (%)				12.5	93.6
	L 40				9.5	93.6
					4.75	92.0
					2.00	86.9
	20				1.18	83.5
	10				0.425	77.3
	0				0.250	73.3

Gravel		Sand		Silt	Clay	Colloids
Glaver	Coarse	Medium	Fine	511	Clay	Colloius
8.0	5.1	9.6	12.8	45.6	18.9	14.2

Particle Size (mm)

1

0.1

9.5	93.6
4.75	92.0
2.00	86.9
1.18	83.5
0.425	77.3
0.250	73.3
0.150	69.5
0.075	64.5
0.005	26.6
0.002	18.9
0.001	14.2

COMMENTS:

Material tested was identified as TH23-05, S4.

100

10

REPORT DATE 2023.Dec.07

0.01

0.001

REVIEWED BY Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services





-	ТО	KGS (3rd Fle Winnij	oor -	865	Wav		y Str	eet						PRC	JECT				ort AAW Regiona g (23-0107-009)	I S&W	
		R3T 5	-	viai	nobe	a								PRC	JECT	NO.	1233 ⁻	168	322		
		ATTN	:	Ke	lly Fc	ordyc	е							REF	PORT	NO.	5				
		SAMPI LED B`			23.No S Gr						ECE TEE		2023. (GS		.27 ıp Inc.				DATE TESTED: TESTED BY:	2023.Dec.0 Larry Presa	
			100	T	_													s	IEVE SIZE (mm)	% PASSING	
			90													-			37.5	100.0	1
			80		+++-							+				_			25.0	100.0	1
		(%)	70									+				_			19.0	100.0	1
		ing	60		+++-											_			16.0	100.0	1
		assi	50																12.5	96.6	1
		Ĕ	40																9.5	96.6	1
		Percent Passing (%)																	4.75	95.9]
		Ъе	30																2.00	90.6]
			20			+		+++	+	 +++			 		+++				4.40	07.0	1

20 10 0						
-	100	10	1	0.1	0.01	0.001
			Particle S	Size (mm)		
Gravel		Sand	I	Silt	Clay	Colloids

Fine

13.6

39.0

37.5	100.0
25.0	100.0
19.0	100.0
16.0	100.0
12.5	96.6
9.5	96.6
4.75	95.9
2.00	90.6
1.18	87.6
0.425	81.2
0.250	76.9
0.150	72.5
0.075	67.6
0.005	35.4
0.002	28.6
0.001	24.4

COMMENTS:

4.1

Material tested was identified as TH23-11, S5.

Coarse

5.3

Medium

9.4

REPORT DATE 2023.Dec.07

REVIEWED BY Guillaume Beauce, P.Eng.

28.6

24.4

Geotechnical Engineer - Materials Testing Services





то		oor -	865 Wa	verley Street			F	PROJECT		ePort AAW Regiona cing (23-0107-009)	I S&W	
	R3T 5		Manitob	a			F	PROJECT NO.	1233	16822		
	ATTN	:	Kelly F	ordyce			F	REPORT NO.	6			
	E SAMP PLED B		2023.N KGS G	lov.15 roup Inc.		ECEIVED: TED BY:		lov.27 iroup Inc.		DATE TESTED: TESTED BY:	2023.Dec.04 Larry Presa	
		100								SIEVE SIZE (mm)	% PASSING	
		90								37.5	100.0	
		80	++++++							25.0	100.0	
	(%)	70								19.0	100.0	
) Bu	60								16.0	100.0	
	assi	50								12.5	96.4	
	L P	40								9.5	96.4	
	Percent Passing (%)	-								4.75	95.6	
	Ре	30								2.00	92.7	
		20	+++++++							1.18	90.6	
		10								0.425	86.2	
		0	$\frac{1}{1}$							0.250	83.3	
			100	10	1	0.1	0.0	1 0.001		0.150	79.7	

	Gravel		Sand		Silt	Clay	Colloids	
Ľ	Glavei	Coarse	Medium	Fine	Sill	Clay	Colloids	
	4.4	2.9	6.5	10.5	35.4	40.3	35.0	

Particle Size (mm)

0.0	
4.75	95.6
2.00	92.7
1.18	90.6
0.425	86.2
0.250	83.3
0.150	79.7
0.075	75.7
0.005	46.2
0.002	40.3
0.001	35.0

COMMENTS:

Material tested was identified as TH23-17, S4.

REPORT DATE 2023.Dec.07

REVIEWED BY Guillaume Beauce, P.Eng.

Geotechnical Engineer - Materials Testing Services





то		oor - 8	365 Wave	rley Street			PROJE	СТ		ePort AAW Regiona cing (23-0107-009)	I S&W	
	R3T 5		<i>l</i> anitoba				PROJE	CT NO.	1233	16822		
	ATTN	:	Kelly Ford	łyce			REPOR	RT NO.	7			
	E SAMP PLED B		2023.Nov KGS Grou			RECEIVED: ITTED BY:	2023.Nov.27 KGS Group I	nc.		DATE TESTED: TESTED BY:	2023.Dec.04 Larry Presad	
		100								SIEVE SIZE (mm)	% PASSING	
		90								37.5	100.0	
		80		+ +++++++++++++++++++++++++++++++++++++						25.0	100.0	
	(%	70		<u> </u>						19.0	100.0	
	Percent Passing (%)	60								16.0	100.0	
	assi	50								12.5	100.0	
	E E	40								9.5	100.0	
	rcer									4.75	97.8	
	Ре	30								2.00	92.5	
		20	1111111							1.18	87.3	
		10	+++++++++++++++++++++++++++++++++++++++							0.425	79.7	
		0	<u> </u>							0.250	74.7	
		1	00	10	1	0.1	0.01	0.001		0.150	69.2	

Gravel		Sand		Silt	Clay	Colloids	
Glaver	Coarse	Medium	Fine	511	Ciay	Colloius	
2.2	5.3	12.8	14.6	46.9	18.2	13.6	

Particle Size (mm)

2.00	92.
1.18	87.
0.425	79.
0.250	74.
0.150	69.
0.075	65.
0.005	25.
0.002	18.
0.001	13.

.2 .1

.4 .2 .6

COMMENTS:

Material tested was identified as TH23-18, S4.

REPORT DATE 2023.Dec.07

REVIEWED BY Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services





то	KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba												Ρ	RO	JEC	т	CentrePort AAW Regional S&W Servicing (23-0107-009)				
	R3T 5	-	lanito	ра									Ρ	RO	JEC	T NO.	1233	168	22		
	ATTN:		Kelly I	Ford	yce								R	EP	ORT	NO.	8				
	SAMPL PLED BY		2023. KGS (REC					27 5 Inc) .			DATE TESTED: ESTED BY:	2023.Dec.0 Larry Presa	
		100						•-•		•-•								S	EVE SIZE (mm)	% PASSING	
		90								-	X								37.5	100.0	1
		80								+									25.0	100.0	1
	(%)	70								_									19.0	100.0	1
	Percent Passing (%)	60								_									16.0	100.0	1
	assi	50																	12.5	100.0	1
	L P	40											VI						9.5	100.0	1
	rcer																		4.75	100.0	1
	Pe	30												X					2.00	99.7	1

10 0 100 10 1 0.1 0.01 0.001 Particle Size (mm) Sand Silt Colloids Gravel Clay Coarse Medium Fine 0.0 0.3 0.5 1.4 80.5 17.3 10.5

SIEVE SIZE (mm)	% PASSING
	FASSING
37.5	100.0
25.0	100.0
19.0	100.0
16.0	100.0
12.5	100.0
9.5	100.0
4.75	100.0
2.00	99.7
1.18	99.5
0.425	99.2
0.250	99.0
0.150	98.7
0.075	97.8
0.005	24.3
0.002	17.3
0.001	10.5

COMMENTS:

Material tested was identified as TH23-21, S5.

fuce

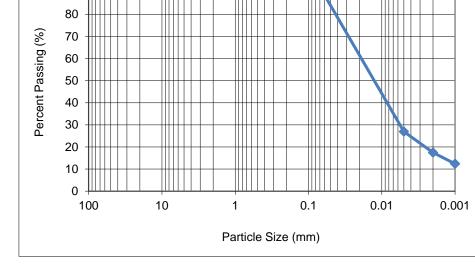
REPORT DATE 2023.Dec.07

REVIEWED BY Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services





то		865 Waverley Street		PROJECT		ePort AAW Regional cing (23-0107-009)	S&W	
	Winnipeg, R3T 5P4	Manitoba		PROJECT NO.	1233	16822		
	ATTN:	Kelly Fordyce		REPORT NO.	9			
	SAMPLED: PLED BY:	: 2023.Nov.15 KGS Group Inc.	DATE RECEIVED: SUBMITTED BY:	3.Nov.27 Group Inc.		DATE TESTED: TESTED BY:	2023.Dec.0 Larry Presa	
	100					SIEVE SIZE (mm)	% PASSING	
	90					37.5	100.0	
	80					25.0	100.0	



37.5	100.0
25.0	100.0
19.0	100.0
16.0	100.0
12.5	100.0
9.5	100.0
4.75	99.8
2.00	99.4
1.18	99.3
0.425	99.2
0.250	99.1
0.150	99.0
0.075	94.0
0.005	26.9
0.002	17.4
0.001	12.4

Gravel		Sand		Silt	Clay	Colloids	
Glaver	Coarse	Medium	Fine	Sill	Ciay	Conolas	
0.2	0.4	0.2	5.2	76.6	17.4	12.4	

COMMENTS:

Material tested was identified as TH23-22, S6.

REPORT DATE 2023.Dec.07

REVIEWED BY Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services





	TO KGS Group Inc. 3rd Floor - 865 Waverley Street Winnipeg, Manitoba											PROJ	ECT			Port AAW Regional ng (23-0107-009)	I S&W		
		R3T 5		vianiiu	ba								PROJ	ECT NO.	1233	16	822		
		ATTN	:	Kelly	Ford	lyce							REPC	ORT NO.	10				
ĺ		SAMP		2023 KGS			-		DA ⁻ SUE				Nov.2 Group				DATE TESTED: TESTED BY:	2023.Dec.0 Larry Presa	
			100		*											:	SIEVE SIZE (mm)	% PASSING	
			90	+++++	++-							+					37.5	100.0	
			80		++-									+			25.0	100.0	
		(%)	70		++		$\left \right \left \right $					_		+			19.0	100.0	
		Percent Passing (%)	60														16.0	97.2	
		ass	50		Ш.												12.5	93.8	
		L P	40														9.5	93.3	
		rcer															4.75	89.9	
		Ре	30														2.00	83.7	
			20		++												1.18	79.4	
			10		++					-							0.425	70.0	

10						
-	100	10	1	0.1	0.01	0.001
Particle Size (mm)						
Gravel		Silt	Clay	Colloids		
Giavei	Coarse	Medium	Fine	Sill	Cidy	Conolas
10.1	6.2	12.8	18.0	41.5	11.4	8.7

37.5	100.0
25.0	100.0
19.0	100.0
16.0	97.2
12.5	93.8
9.5	93.3
4.75	89.9
2.00	83.7
1.18	79.4
0.425	70.9
0.250	65.9
0.150	58.8
0.075	52.9
0.005	17.7
0.002	11.4
0.001	8.7

COMMENTS:

Material tested was identified as TH23-24, S11.

REPORT DATE 2023.Dec.11

REVIEWED BY Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services





то		865 Waverley Street	PROJECT	CentrePort AAW Regiona Servicing (23-0107-009)	I S&W
	Winnipeg, R3T 5P4	Manitoba	PROJECT NO.	123316822	
	ATTN:	Kelly Fordyce	REPORT NO.	11	
	SAMPLED: PLED BY:	2023.Nov.15 KGS Group Inc.	 3.Nov.27 Group Inc.	DATE TESTED: TESTED BY:	2023.Dec.04 Larry Presado
	100			SIEVE SIZE (mm)	% PASSING
	90			37.5	100.0
	80			25.0	100.0
	8 70			19.0	100.0
	ຍີ່ 60			16.0	97.6
	assing 60			12.5	97.6
	L			0.5	07.1

Crovel	Sand			Silt	Clay	Colloids
Gravel	Coarse	Medium	Fine	Sill	Clay	Colloius
7.6	7.8	12.8	14.3	44.5	13.0	10.1

Particle Size (mm)

1

0.1

37.5	100.0
25.0	100.0
19.0	100.0
16.0	97.6
12.5	97.6
9.5	97.1
4.75	92.4
2.00	84.6
1.18	80.1
0.425	71.8
0.250	67.7
0.150	62.3
0.075	57.5
0.005	19.8
0.002	13.0
0.001	10.1

COMMENTS:

Percent |

Material tested was identified as TH23-25, S9.

10

REPORT DATE 2023.Dec.07

0.01

0.001

REVIEWED BY Guillaume Beauce, P.Eng. Geotechnical Engineer - Materials Testing Services





то		- 865 Waverley Street		PROJECT	CentrePort AAW Regiona Servicing (23-0107-009)	I S&W
	R3T 5P4	ı, Manitoba		PROJECT NO.	123316822	
	ATTN:	Kelly Fordyce		REPORT NO.	12	
	SAMPLEE PLED BY:): 2023.Nov.15 KGS Group Inc.	DATE RECEIVED: 202 SUBMITTED BY: KG	23.Nov.27 S Group Inc.	DATE TESTED: TESTED BY:	2023.Dec.04 Larry Presado
	10	0			SIEVE SIZE (mm)	% PASSING
	9	0			37.5	100.0
	8	0			25.0	100.0
	8 7	0			19.0	100.0
	bu 6	o			16.0	92.2
	assi	o			12.5	92.2
	J L A	0			9.5	92.2
	1 8				4.75	89.8
	e 3	0			2.00	83.5

Gravel		Sand		Silt	Silt Clay C		Colloids
Glavei	Coarse	Medium	Fine	511	Ciay	Colloids	
10.2	6.3	11.1	14.4	44.5	13.5	9.1	

Particle Size (mm)

1

0.1

0110	100.0
25.0	100.0
19.0	100.0
16.0	92.2
12.5	92.2
9.5	92.2
4.75	89.8
2.00	83.5
1.18	80.0
0.425	72.4
0.250	67.8
0.150	61.6
0.075	58.0
0.005	20.1
0.002	13.5
0.001	9.1

COMMENTS:

Material tested was identified as TH23-26, S6.

10

Betuce

REPORT DATE 2023.Dec.07

REVIEWED BY Guillaume Beauce, P.Eng.

0.01

0.001

Geotechnical Engineer - Materials Testing Services



Compressive Strength & Elastic Moduli of Intact Rock Core Speciments under Varying States of Stress and Temperatures Method C

ASTM	D7012	& D4543
------	-------	---------

Client:	KGS Group Inc.	Project No.:	123316822
Project:	CentrePort AAW Regional S&W Servicing		
Material Type:	Rock Core	Date Received:	October 26, 2023
Date Sampled:	October 25, 2023	Tested By:	Sagar Khatri
Sampled By:	Stantec	Date Tested:	November 6, 2023

Sample Information						
Borehole Location	TH23-01	TH23-01	TH23-08	TH23-08		
Sample Number	2697	2698	2699	2700		
Sample Depth	42'4"-42'11"	55'6"-56'0"	13'0"-13'9"	16'8"-17'9"		
	Compressive St	rength Test Data				
Physical Description	As per Geotechnical Report	As per Geotechnical Report	As per Geotechnical Report	As per Geotechnical Report		
Average Diameter (mm) (≥63.0)	60.63	60.71	60.65	60.63		
Average Sample Length (mm)	144.07	127.32	149.05	150.93		
Density (kg/m ³)	2500.81	2428.47	2484.85	2558.87		
Unit Weight (kN/m ³)	24.53	23.82	24.38	25.10		
L/D Ratio (2.0-2.5)	2.38	2.10	2.46	2.49		
Failure Load (lbs)	15610	11430	42960	47810		
Compressive Strength (MPa)	24.1	17.6	66.1	73.7		
Straightness by Procedure S1 (≤0.02inch)	<0.02	<0.02	<0.02	<0.02		
Flatness by Procedure FP2 (≤0.001inch)	<0.001	<0.001	<0.001	<0.001		
Parallelism by Procedure FP2 (≤0.25°)	-0.073	0.037	0.011	0.036		
Perpendicularity by Procedure P2 (≤0.0043)	<0.0043	<0.0043	<0.0043	<0.0043		
Moisture Condition	As-Received	As-Received	As-Received	As-Received		
Description of Break D7012/11.1.13	Diagonal cracking from one end.	Diagonal fracture with cracking through ends.	Reasonbly well formed cones on both ends.	Reasonbly well formed cones on both ends.		
Note						

Remarks:

Reviewed by: Brian Preven

Date: November 7, 2023

V:\01216\active\laboratory_standing_offers\2023-Lab	oratory Standing Offers\123370015-W	/innipeg lab\2023\Rock Cores\Oct 25, 2023	. Project # 123316822\ASTM D7012 Intact R	ock Core(63mm) May2014.xlsx



Compressive Strength & Elastic Moduli of Intact Rock Core Speciments under Varying States of Stress and Temperatures Method C ASTM D7012 & D4543

Client:	KGS Group Inc.	Project No.:	123316822
Project:	CentrePort AAW Regional S&W Servicing		
Material Type:	Rock Core; Diameter ≥ 63.0 mm	Date Received:	November 30, 2023
Date Sampled	November 29, 2023	Tested By:	Sagar Kharti
Sampled By:	Stantec	Date Tested:	December 4, 2023

Sample Information										
Borehole Location	TH23-17	TH23-17	TH23-18	TH23-25						
Sample Number	2816	2817	2818	2819						
Sample Depth	15'6"-16'4"	17'2"-17'11"	15'11"-16'6"	37'0"-37'5"						
	Compressive Str	rength Test Data	-							
Physical Description	As per Geotechnical Report	As per Geotechnical Report	As per Geotechnical Report	As per Geotechnical Report						
Average Diameter (mm) (≥63.0)	60.79	61.08	60.73	60.64						
Average Sample Length (mm)	145.77	150.82	144.05	122.57						
Density (kg/m ³)	2588.59	2512.24	2588.72	2584.92						
Unit Weight (kN/m ³)	25.39	24.65	25.40	25.36						
L/D Ratio (2.0-2.5)	2.40	2.47	2.37	2.02						
Failure Load (lbs)	18390	18480	17430	13590						
Compressive Strength (MPa)	28.2	28.1	26.8	20.9						
Straightness by Procedure S1 (≤0.02inch)	<0.02	<0.02	<0.02	<0.02						
Flatness by Procedure FP2 (≤0.001inch)	<0.001	<0.001	<0.001	<0.001						
Parallelism by Procedure FP2 (≤0.25°)	0.025	-0.043	-0.023	-0.060						
Perpendicularity by Procedure P2 (≤0.0043)	<0.0043	<0.0043	<0.0043	<0.0043						
Moisture Condition	As-Received	As-Received	As-Received	As-Received						
Description of Break D7012/11.1.13	Reasonably well formed cone on both ends	Reasonably well formed cone on both ends	Reasonably well formed cone on both ends	Reasonably well formed cone on both ends						
Note										

Remarks:

Reviewed by: Bricen Preven

Date: December 11, 2023

V:01216\active\laboratory_standing_offers\2023-Laboratory Standing Offers\123370015-Winnipeg lab\2023\Rock Cores\Nov 29, 2023. Job # 123316822, KGS Group Inc\Samples # 2816, 2817, 2818 & 2819 ASTM D7012 Intact Rc



Compressive Strength & Elastic Moduli of Intact Rock Core Speciments under Varying States of Stress and Temperatures Method C ASTM D7012 & D4543

Client:	KGS Group Inc.	Project No.:	123316822
Project:	CentrePort AAW Regional S&W Servicing		
Material Type:	Rock Core; Diameter ≥ 63.0 mm	Date Received:	November 30, 2023
Date Sampled	: November 29, 2023	Tested By:	Sagar Kharti
Sampled By:	Stantec	Date Tested:	December 4, 2023

Sample Information										
Borehole Location	TH23-25	TH23-26	TH23-26							
Sample Number	2820	2821	2822							
Sample Depth	43'5"-44'3"	37'0"-37'6"	43'6"-44'0"							
	Compressive Str	rength Test Data								
Physical Description	As per Geotechnical Report	As per Geotechnical Report	As per Geotechnical Report							
Average Diameter (mm) (≥63.0)	60.72	60.94								
Average Sample Length (mm)	113.62	151.95								
Density (kg/m ³)	2583.94	2538.38								
Unit Weight (kN/m ³)	25.35	24.90	#VALUE!							
L/D Ratio (2.0-2.5)	1.87	2.49	#VALUE!							
Failure Load (lbs)	15830	19440	0							
Compressive Strength (MPa)	24.3	29.6	#VALUE!							
Straightness by Procedure S1 (≤0.02inch)	<0.02	<0.02	<0.02							
Flatness by Procedure FP2 (≤0.001inch)	<0.001	<0.001	<0.001							
Parallelism by Procedure FP2 (≤0.25°)	0.062	-0.078	#N/A							
Perpendicularity by Procedure P2 (≤0.0043)	<0.0043	<0.0043	<0.0043							
Moisture Condition	As-Received	As-Received	As-Received							
Description of Break D7012/11.1.13	Reasonably well formed cone on both ends	Reasonably well formed cone on both ends	0							
Note			Sample broke while preparation							

Remarks:

Reviewed by: Brican Preven

Date: December 11, 2023

V:\01216\active\laboratory_standing_offers\2023-Laboratory Standing Offers\123370015-Winnipeg lab\2023\Rock Cores\Nov 29, 2023. Job # 123316822, KGS Group Inc\Samples 2820, & 2821ASTM D7012 Intact Rock Core(63m	V:\01216\active\laboratory_standing	_offers\2023-Laboratory S	Standing Offers\123370015-V	Vinnipeg lab\2023\Rock Core	s\Nov 29, 2023. Job # 123316822	, KGS Group Inc\Samples 2820,	& 2821ASTM D7012 Intact Ro	ock Core(63m
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Compressive Strength & Elastic Moduli of Intact Rock Core Speciments under Varying States of Stress and Temperatures Method C

ASTM D7012 & D4543

Client:	KGS Group Inc.	Project No.:	123370015
Project:	CentrePort AAW Regional S&W Servicing		
Material Type:	Rock Core; Diameter ≥ 47.0 mm	Date Received:	April 17, 2024
Sampled By:	NA	Tested By:	Sagar Khatri
Date Sampled	NA	Date Tested:	April 22, 2024
1			, , ,

Sample Information										
Borehole Location	TH24-01	TH24-01								
Sample Number	4194	4195								
Sample Depth	44'2" - 45'0"	50'7" - 51'7"								
	Compressive Str	ength Test Data	-							
Physical Description	As per Geotechnical Report	As per Geotechnical Report								
Average Sample Diameter (mm) (≥47.0)	61	61								
Average Sample Length (mm)	149	148								
Density (kg/m ³)	2598	2531								
Unit Weight (kN/m ³)	25.5	24.8								
L/D Ratio (2.0-2.5)	2.45	2.44								
Failure Load (lbs)	22390	15140								
Compressive Strength (MPa)	34.3	23.2								
Straightness by Procedure S1 (≤0.02inch)	<0.02	<0.02								
Flatness by Procedure FP2 (≤0.001inch)	<0.001	<0.001								
Parallelism by Procedure FP2 (≤0.25°)	0.136	-0.005								
Perpendicularity by Procedure P2 (≤0.0043)	<0.0043	<0.0043								
Moisture Condition	As-Received	As-Received								
Description of Break D7012/11.1.13	Well tormed cone on one end. Vertical cracks running through caps_no	Diagonal fracture.								
Note										

Remarks:

Reviewed by: Brican Prevent

May 2, 2024



December 20, 2023

Jacqueline MacLennan KGS Group 3rd Floor - 865 Waverley St Winnipeg, MB R3T 5P4

Re: CERCHAR Abrasivity Testing (KGS Project No. 23-0107-009)

Dear Jacqueline:

On November 29th, 2023, a series of four (4) HQ-sized core samples were received by Geomechanica Inc. via courier service. These samples were identified as being from KGS project 23-0107-009. From these samples, four (4) CERCHAR Abrasivity tests were completed.

Details regarding the steps of specimen preparation and testing along with the test results are presented in the accompanying laboratory report and summary spreadsheet.

Sincerely,

Bryan Tatone Ph.D., P. Eng.

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



Rock Laboratory Testing Results

A report submitted to:

Jacqueline MacLennan KGS Group 3rd Floor - 865 Waverley St Winnipeg, MB Canada, R3T 5P4

Prepared by:

Bryan Tatone, PhD, PEng

Omid Mahabadi, PhD, PEng Geomechanica Inc. #14-1240 Speers Rd. Oakville ON L6L 2X4 Canada Tel: +1-647-478-9767 lab@geomechanica.com

December 20, 2023 Project number: 23-0107-009

Abstract

This document summarizes the results of rock laboratory testing, including 2 CERCHAR Abrasivity tests. The CERCHAR Abrasivity Index (CAI) values are presented herein.

In this document:

1 CERCHAR Abrasivity Tests

1

Disclaimer:This report was prepared by Geomechanica Inc. for KGS Group. The material herein reflects Geomechanica Inc.'s best judgment given the information available at the time of preparation. Any use which a third party makes of this report, any reliance on or decision to be made based on it, are the responsibility of such third parties. Geomechanica Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

1 CERCHAR Abrasivity Tests

1.1 Overview

This section summarizes the results of CERCHAR abrasivity testing. Testing was performed using a Type-2 CERCHAR apparatus as shown in Figure 1a. The tips of the styluses were sharpened to a conical angle of 90° using the setup shown in Figure 1b. The styluses used to perform the tests are shown in Figure 1c-d (Rockwell hardness 55 ± 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 are as follows:

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

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 2b-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. The above testing procedure followed ASTM D7625.

1.2 Results

The results of CERCHAR abrasivity testing are provided in Table 1. Please note that additional specimen and testing details are available in the summary spreadsheet that accompanies this report.

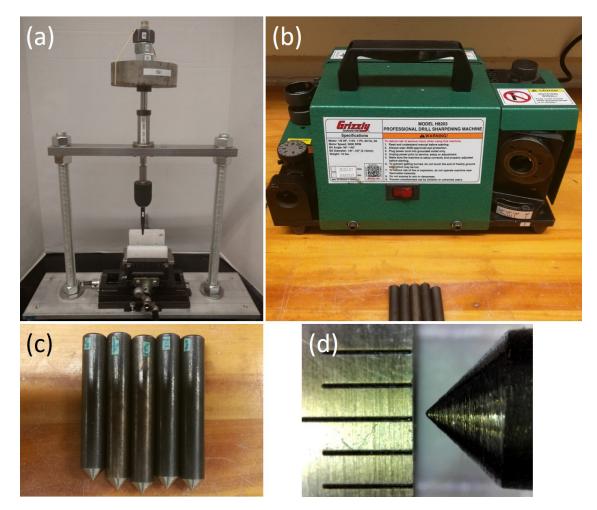


Figure 1: Photos showing (a) the CERCHAR apparatus, (b) tip sharpening setup, (c) the five styluses used to perform the test and (d) a microscope image of one of the stylus tips.

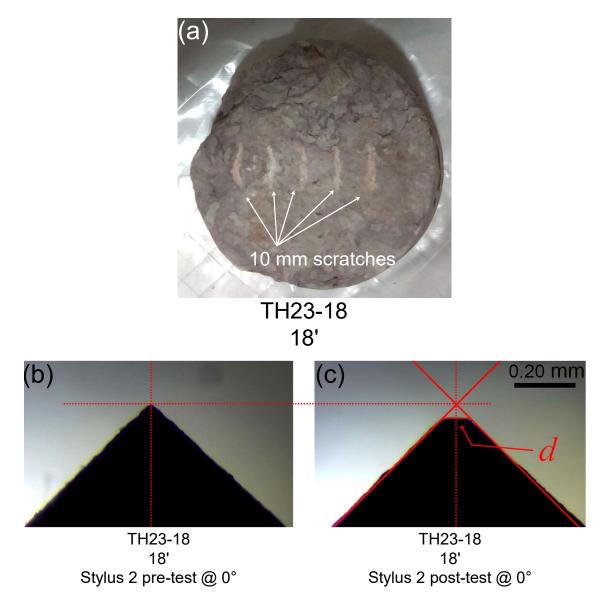


Figure 2: (a) Photograph showing an example of the five 10 mm scratches on a test specimen; (b) microscope image of select stylus prior to testing at the noted position; and (c) microscope image of the same stylus at the same position following testing with the wear flat, d, denoted.

Sample	Depth (ft)	Test 1 Mean (mm)	Test 2 Mean (mm)	Test 3 Mean (mm)	Test 4 Mean (mm)	Test 5 Mean (mm)	Mean Wear (mm)	CAI	Description	ASTM Classification
TH23-18	18'	0.045	0.094	0.029	0.030	0.025	0.045	0.445	Bedrock	Very Low
TH23-17	17'	0.021	0.022	0.037	0.032	0.038	0.030	0.301	Bedrock	< Very Low
TH23-26	36'	0.030	0.023	0.025	0.025	0.037	0.028	0.278	Bedrock	< Very Low
TH23-25	38'	0.024	0.061	0.060	0.082	0.036	0.053	0.525	Bedrock	Very Low

Table 1: Summary of CERCHAR abrasivity test results.

APPENDIX E

2009 Consolidation Testing Results



199 Henlow Bay Winnipeg, MB R3Y 1G4 Phone (204) 488-6999 Fax (204) 488-6947 Email info@nationaltestlabs.com www.nationaltestlabs.com

KGS Group Inc. 3rd Floor - 865 Waverley St. Winnipeg, Manitoba R3T 5P4

Attention: David Anderson

July 28, 2009

Project: Centre Port

Soil samples were submitted to our testing laboratory on May 19, 2009. The samples were tested for one-dimensional consolidation properties in accordance with ASTM D2435 (Method A). Additional loadings were applied at the beginning of each test to prevent swelling of the test specimens. The load and unload increments in kPa for the test specimens are summarized in the following table:

TH09-21F S4	TH09-25A S5	TH09-25A S8
23, 36, 41, 46, 51	26, 36	26, 36, 41
	51	51
100	100	100
200	200	200
399	399	399
200	200	200
100	100	100
200	200	200
449	399	399
798	797	798
1196	1195	1196
1594	1594	1595
399	399	399
100	100	100
26	26	26

The test data for the soil samples are summarized in the attached table and graphs.

We appreciate the opportunity to assist you in this project. Please call me if you have any questions regarding this report.

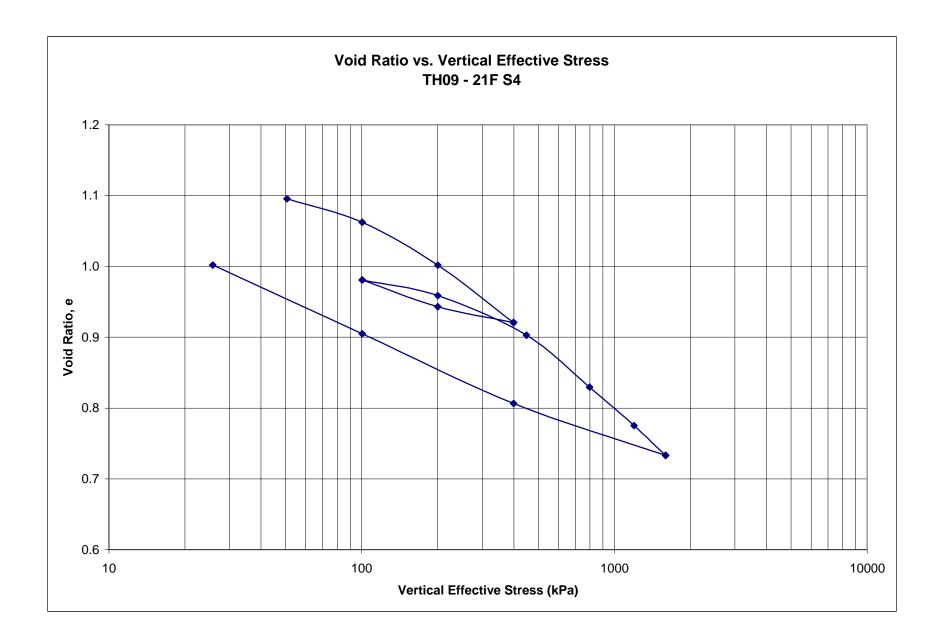
Don Flatt, M.Eng., P.Eng. Senior Geotechnical Engineer

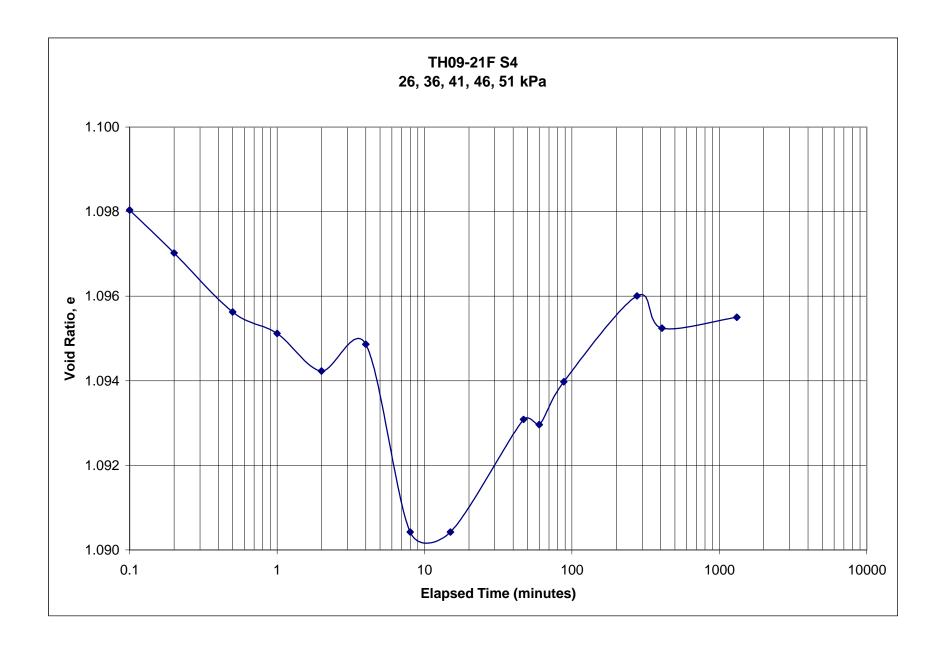
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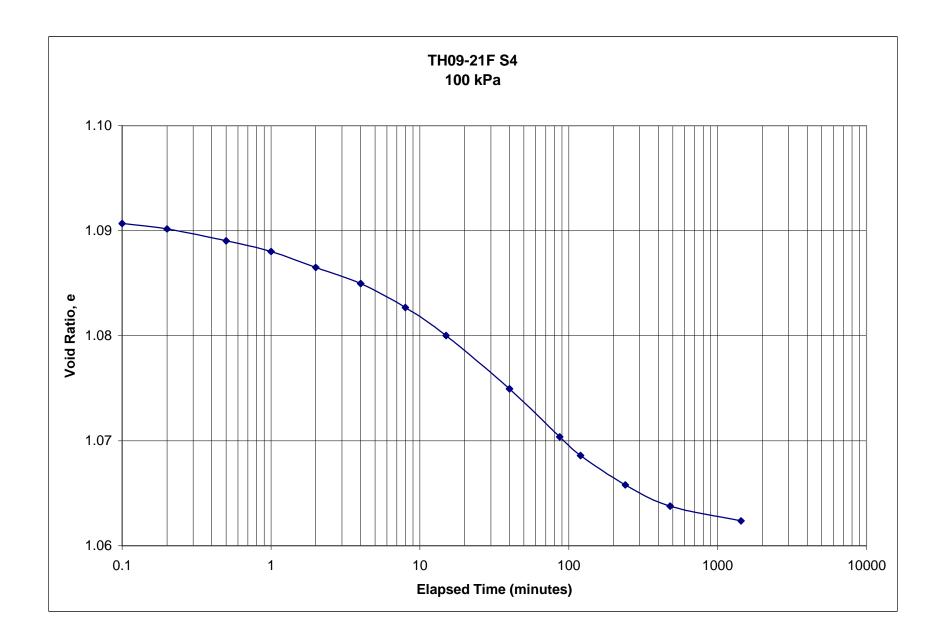


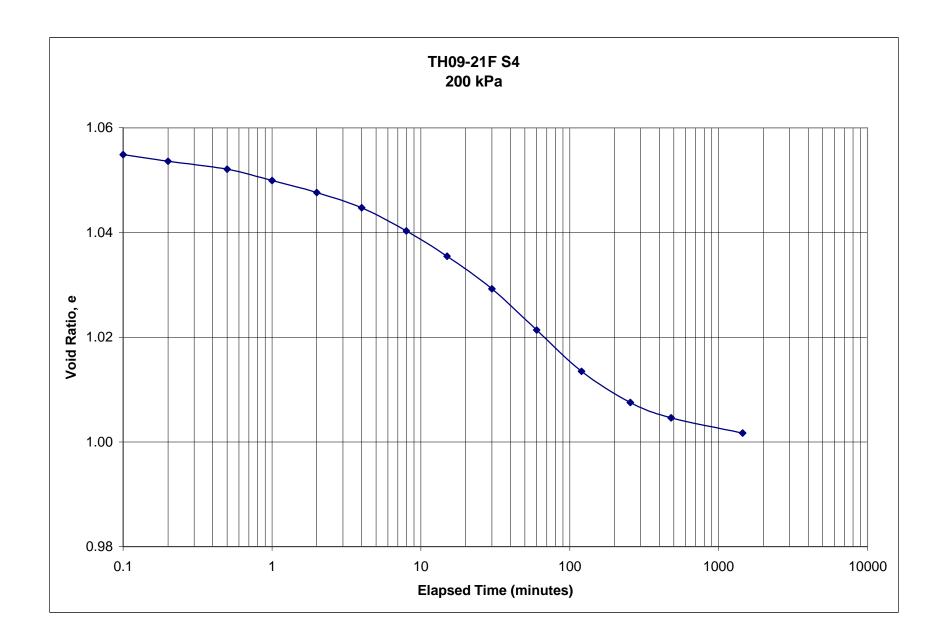
CONSOLIDATION TEST DATA CENTRE PORT

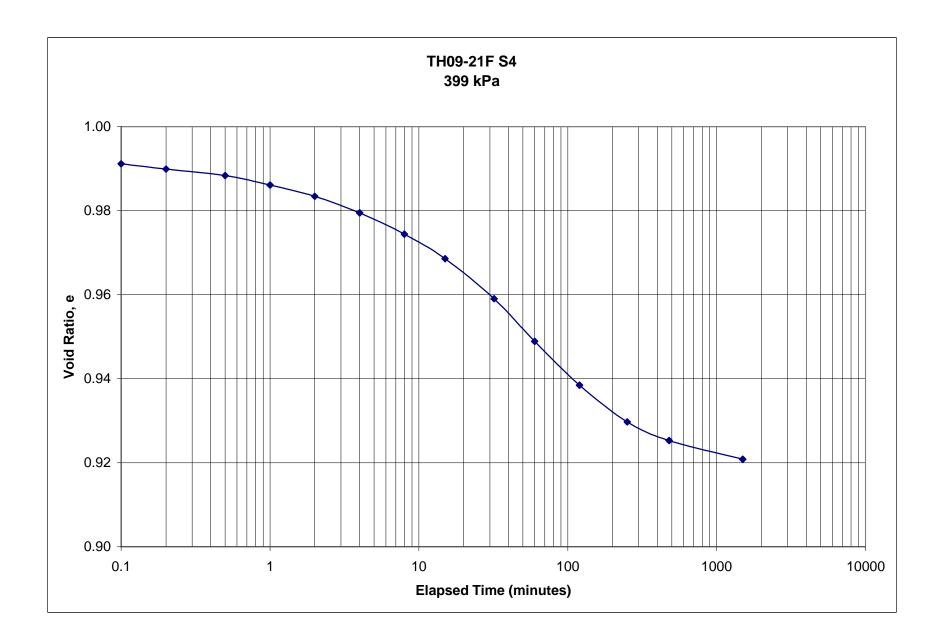
Testhole no. Sample		Cc	Cc	Cc	Cr	Moisture (Content (%)	Saturat	ion (%)	Void	Ratio	Wet Dens	ity (kg/m³)	Dry Densi	ity (kg/m³)
ID	UL	G	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final			
TH09-21F	S4	0.32	0.10	35.3	37.5	84.2	101.0	1.15	1.00	1728	1872	1277	1362		
TH09-25A	S5	0.55	0.13	51.3	47.7	83.1	102.1	1.70	1.25	1542	1778	1020	1203		
TH09-25A	S8	0.53	0.15	50.1	47.3	94.7	104.2	1.46	1.27	1682	1801	1120	1222		

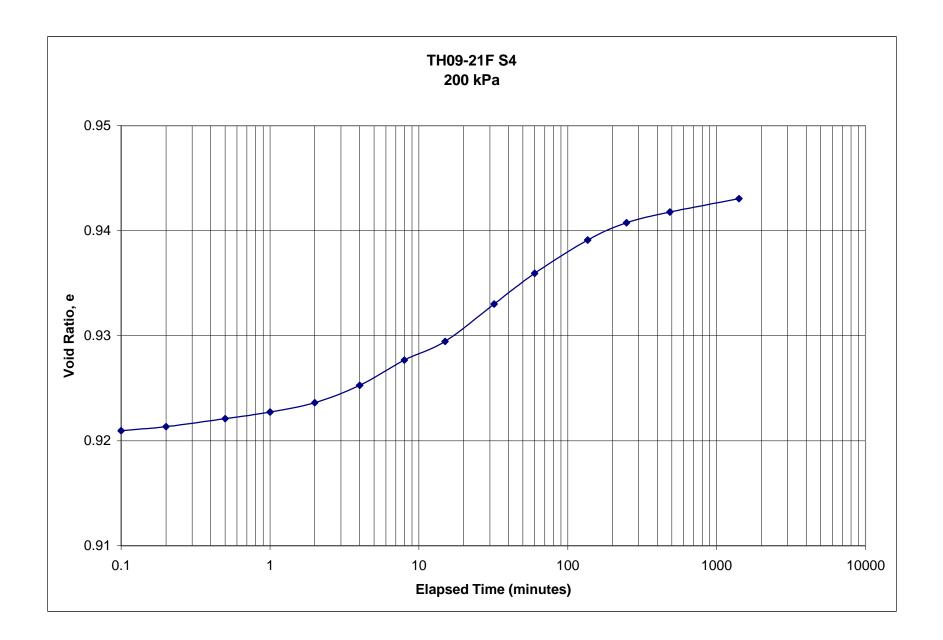


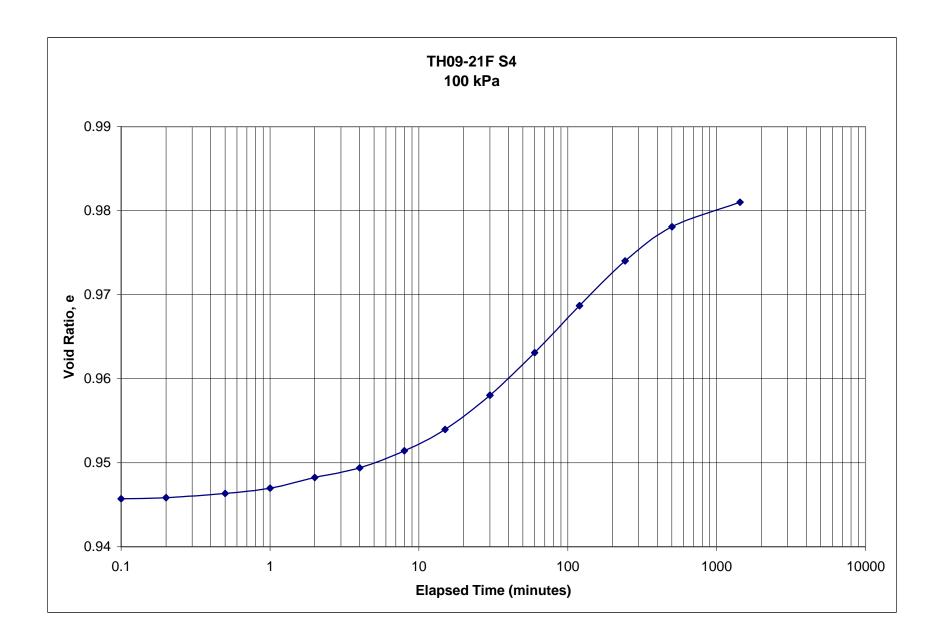


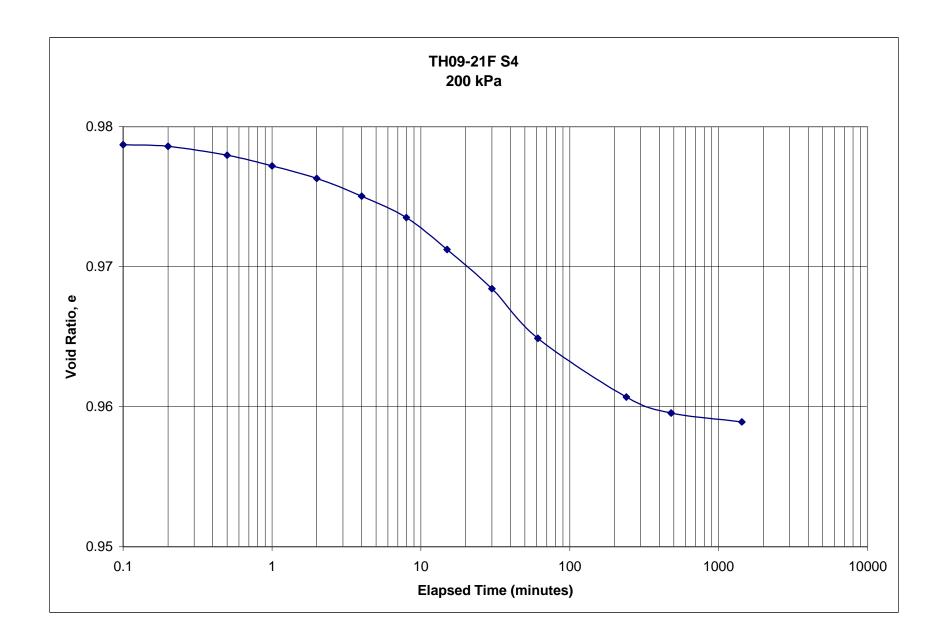


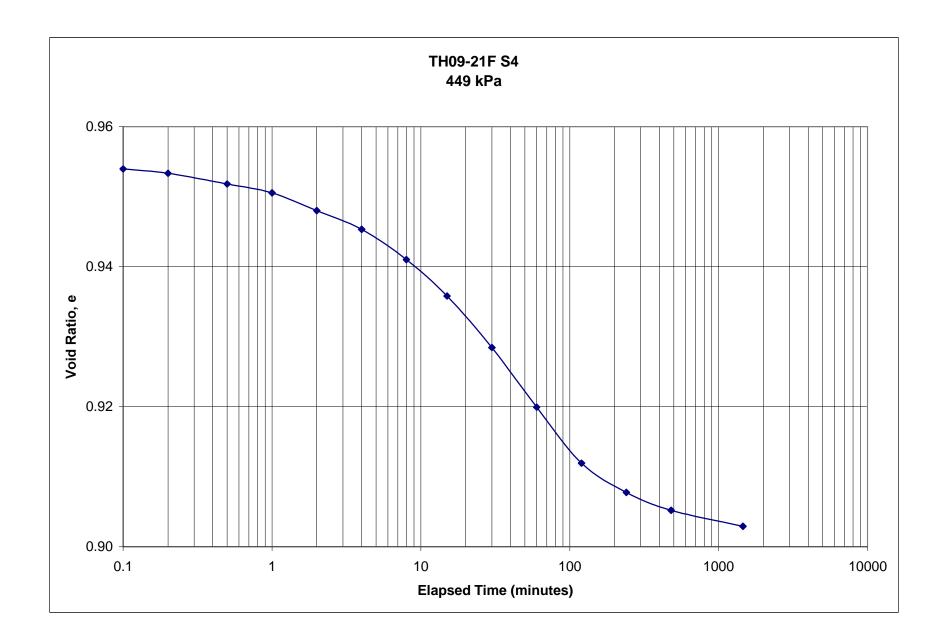


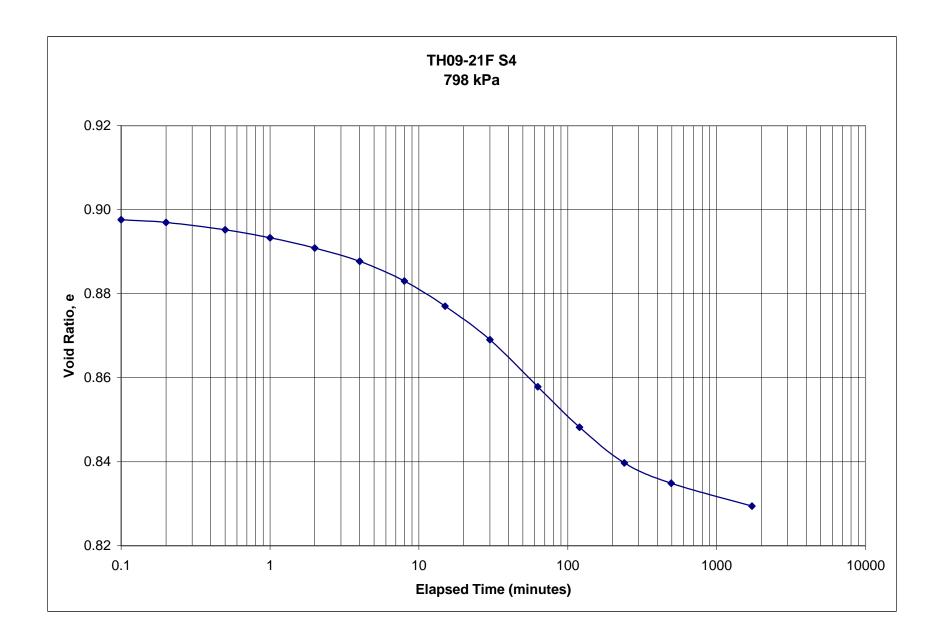


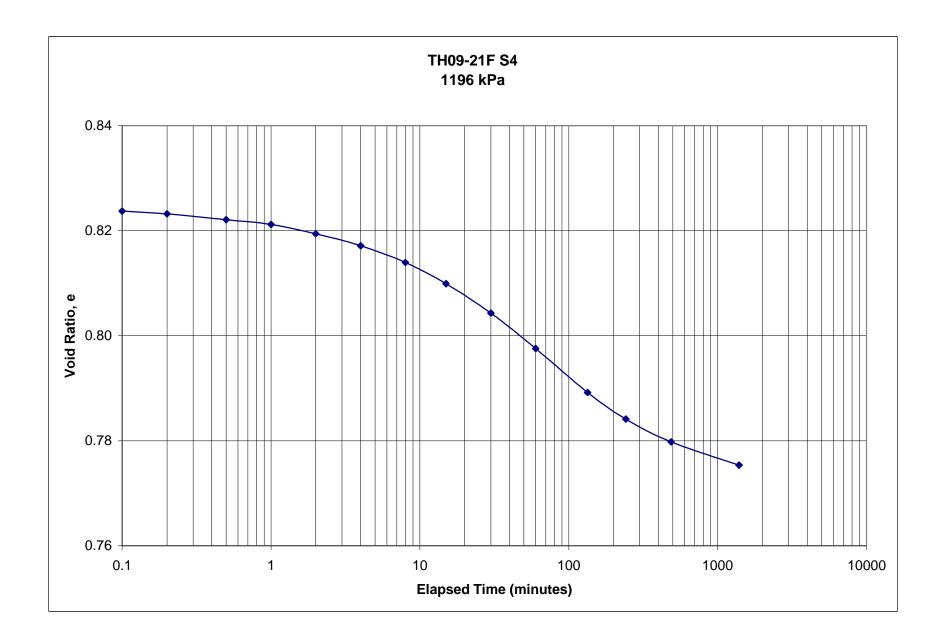


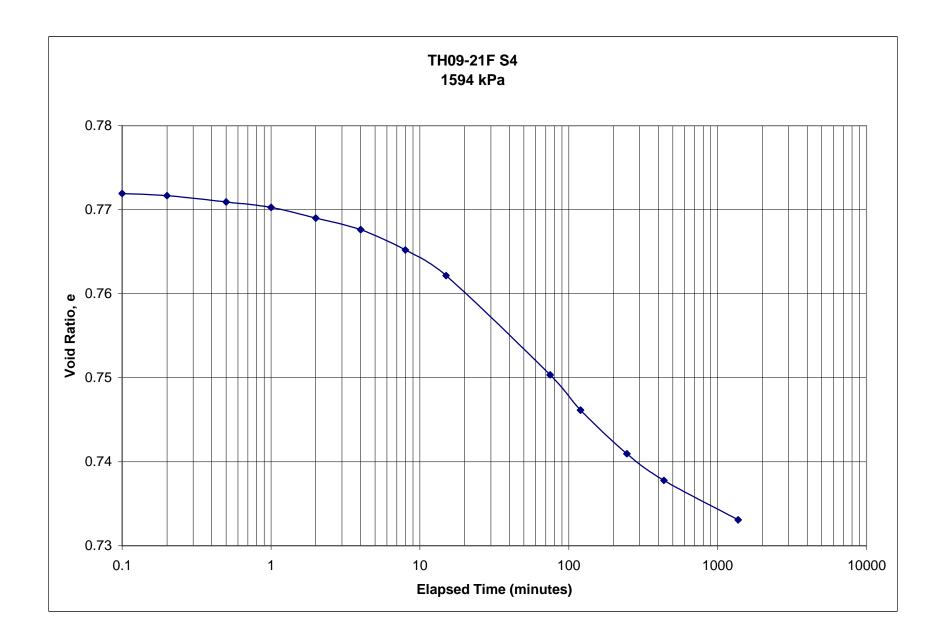


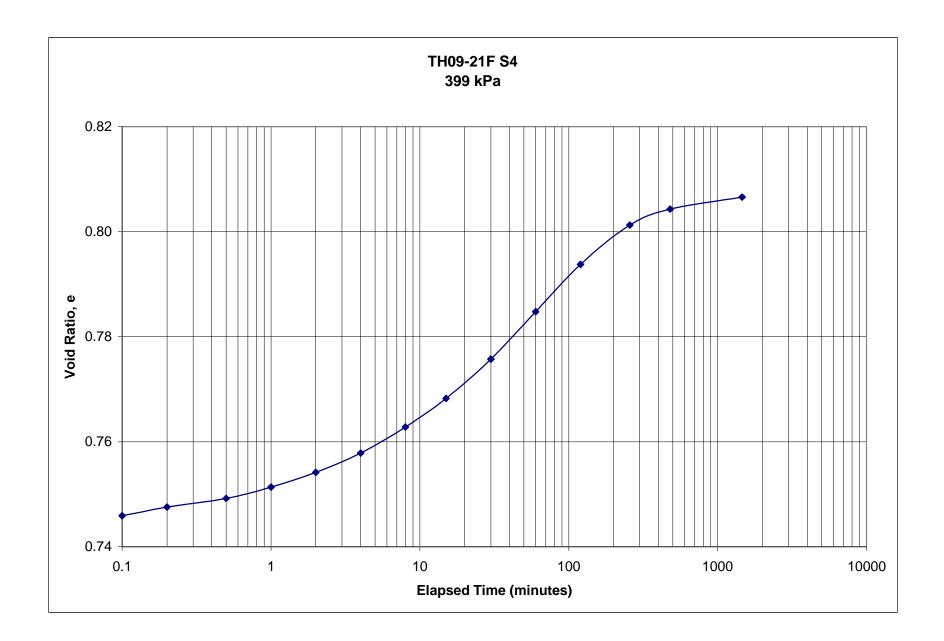


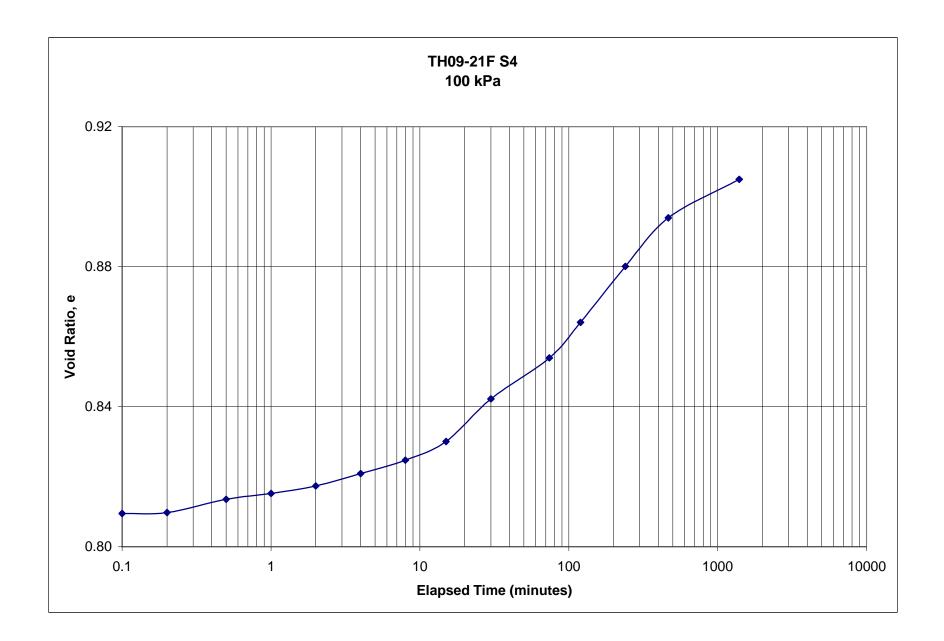


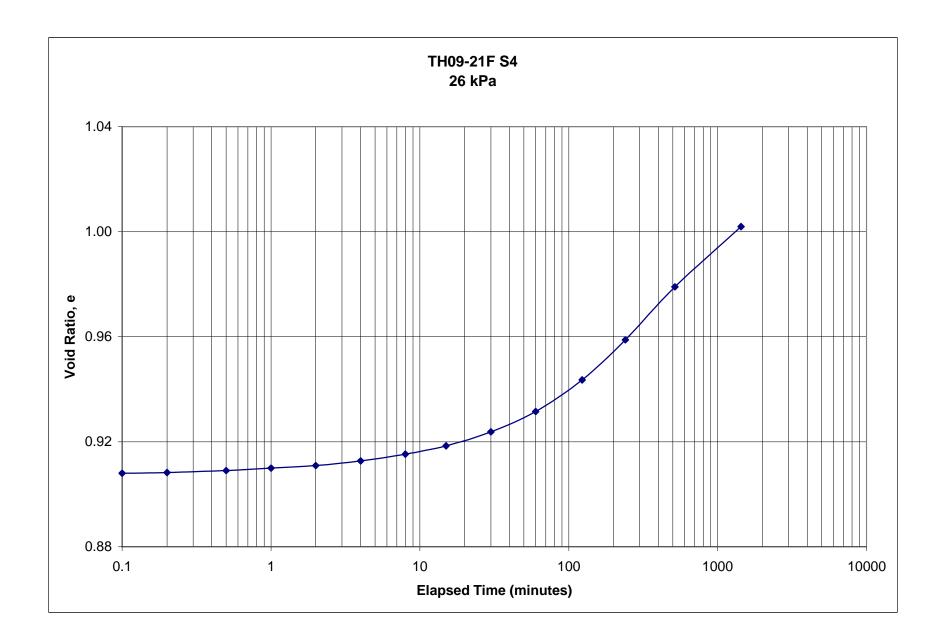


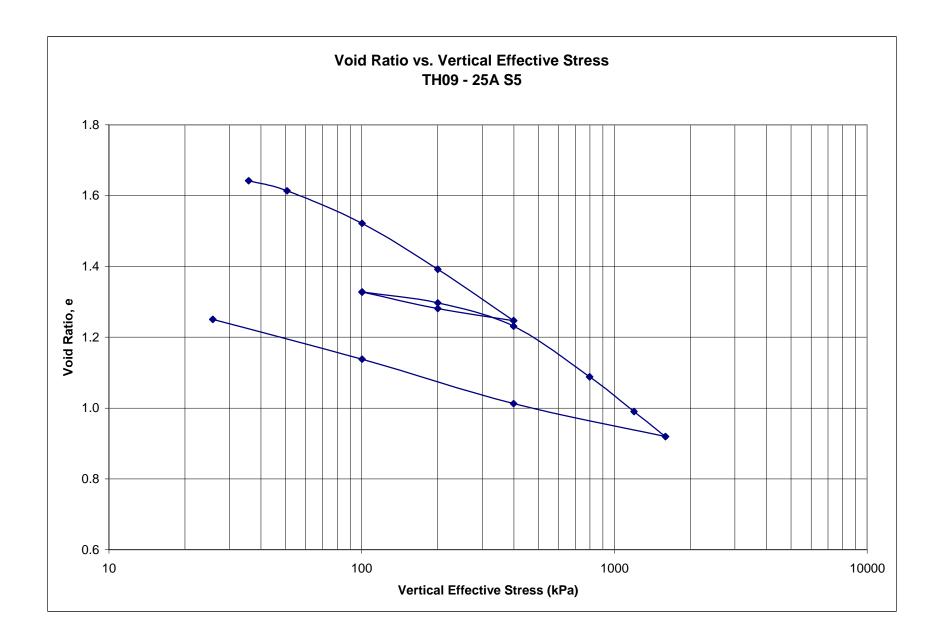


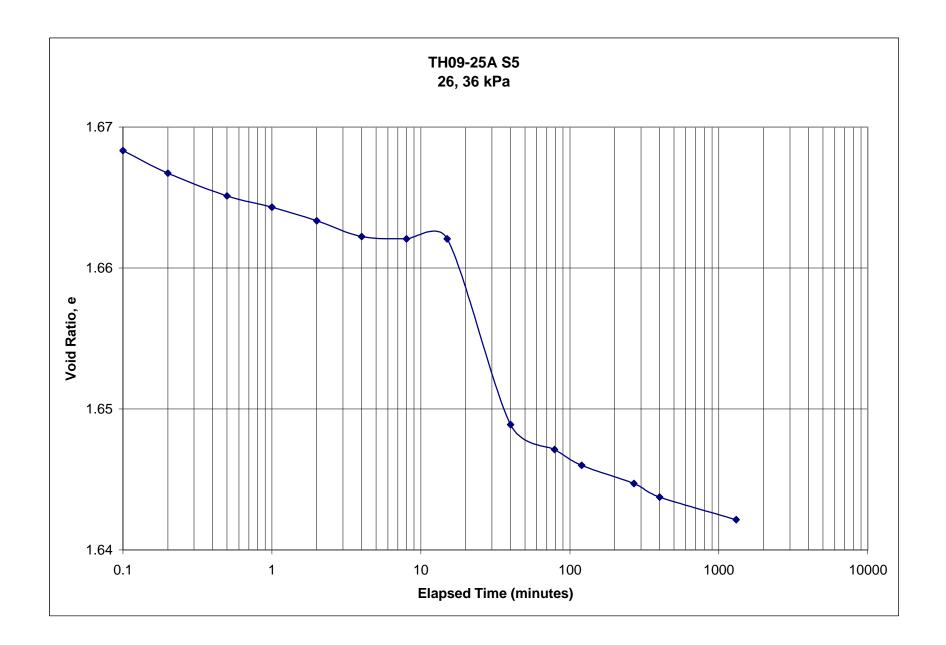


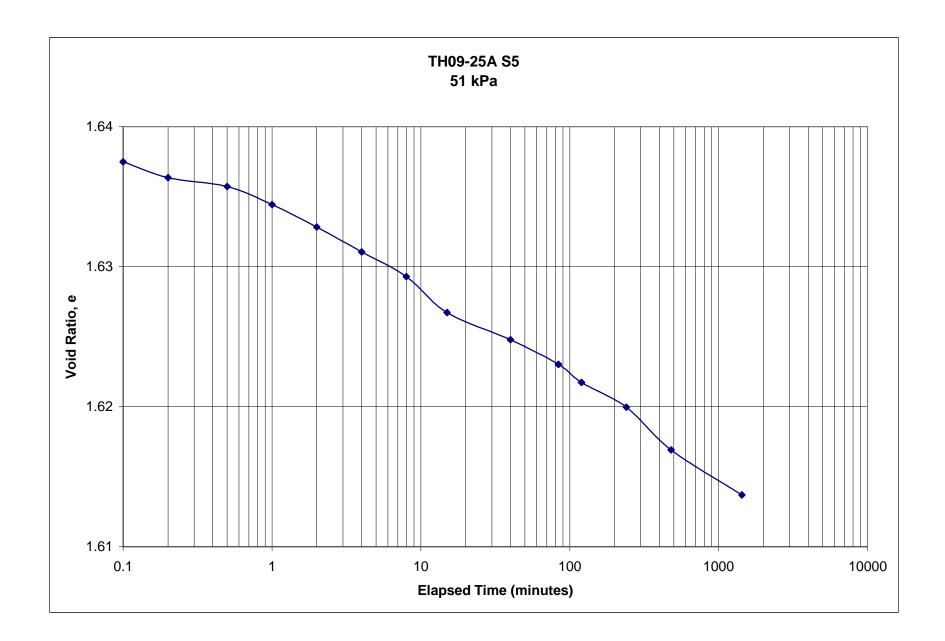


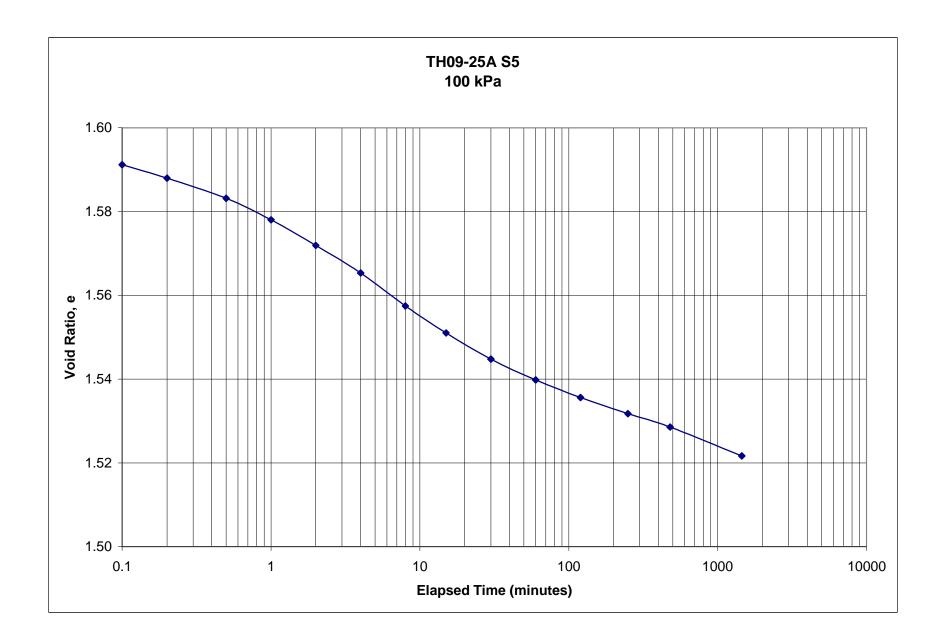


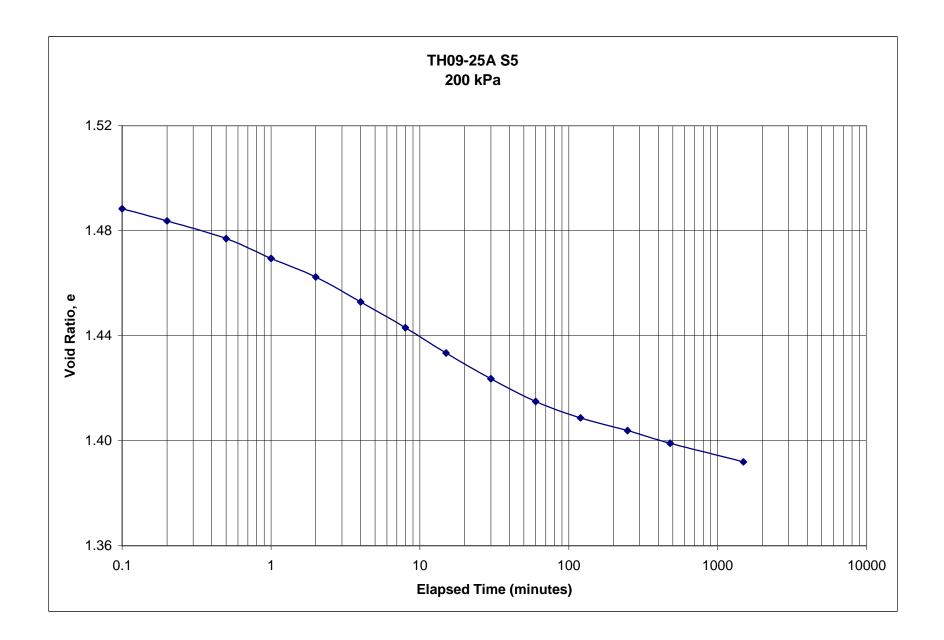


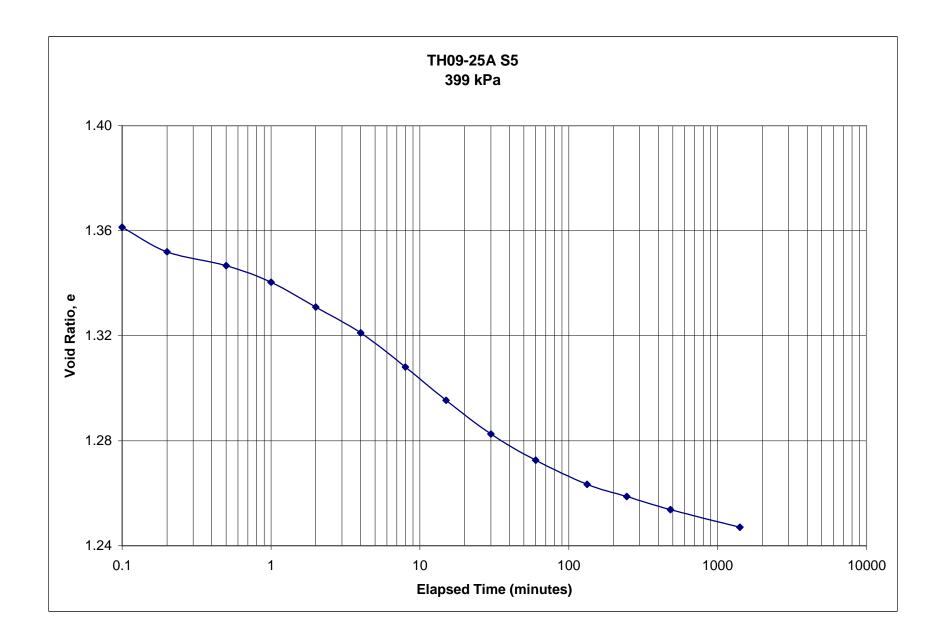


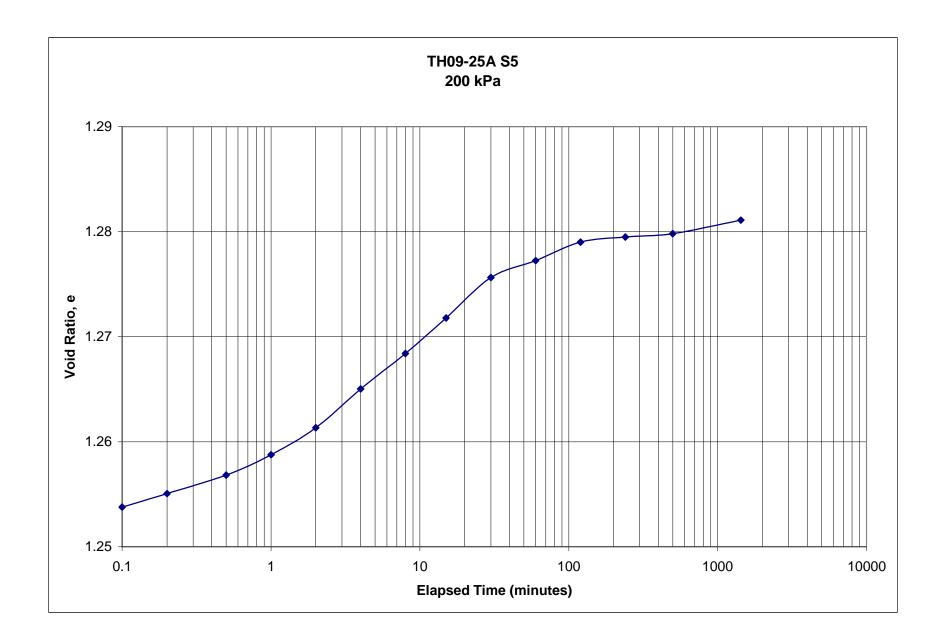


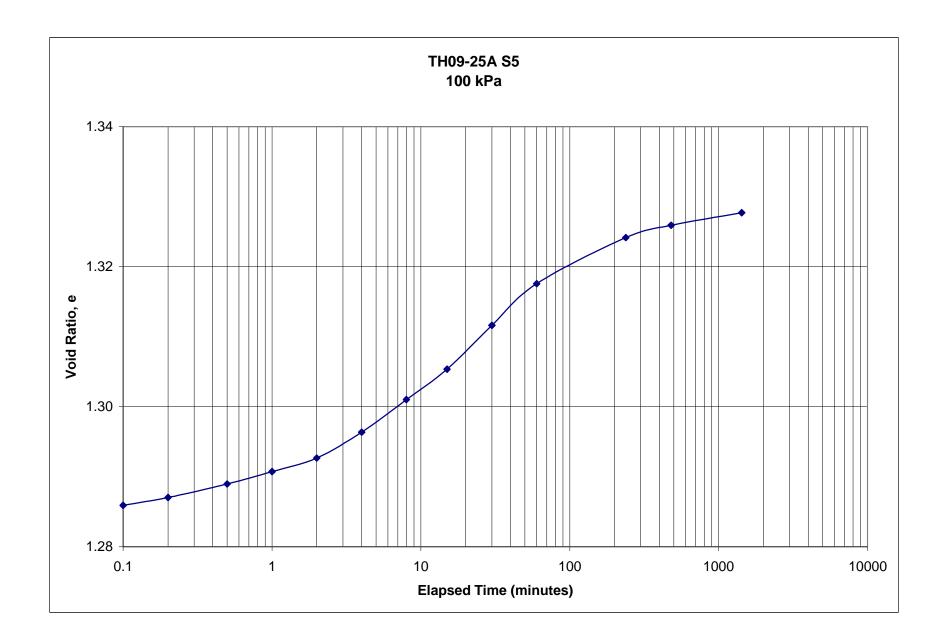


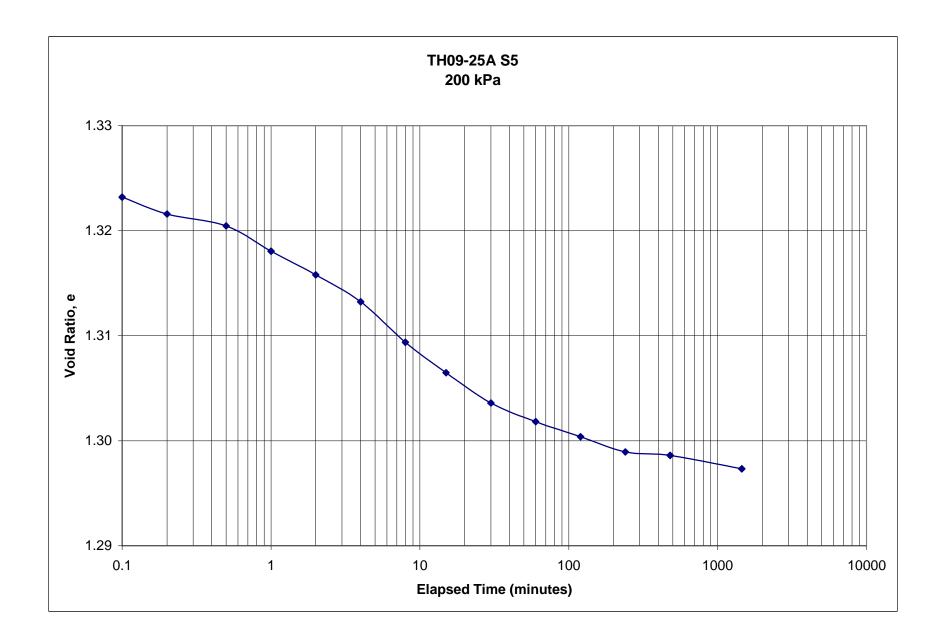


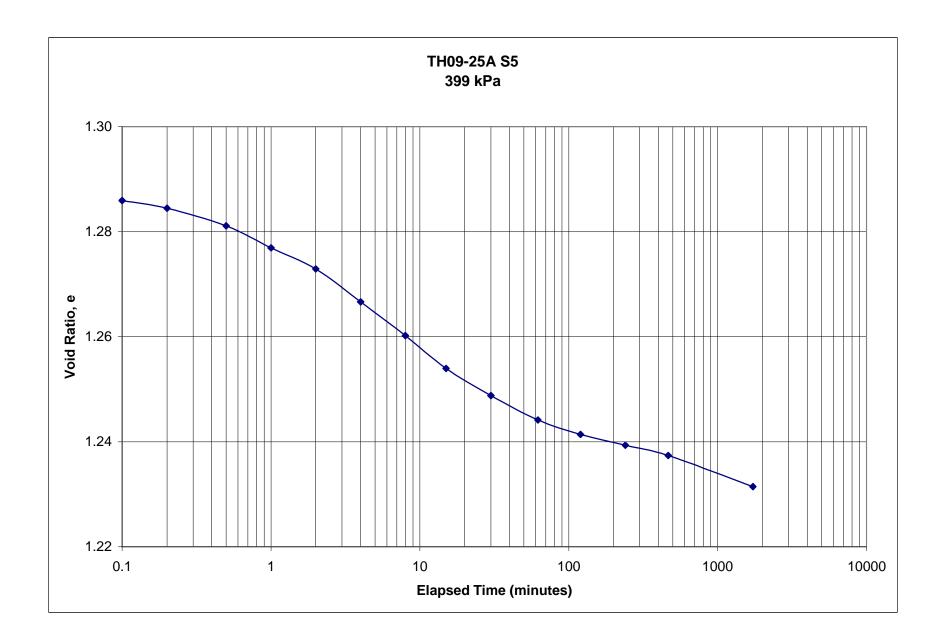


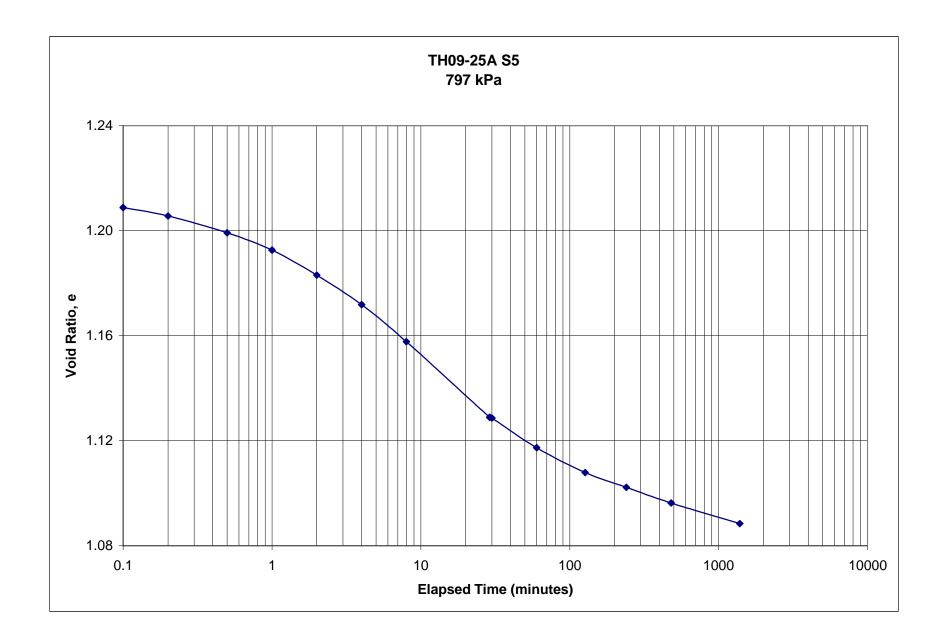


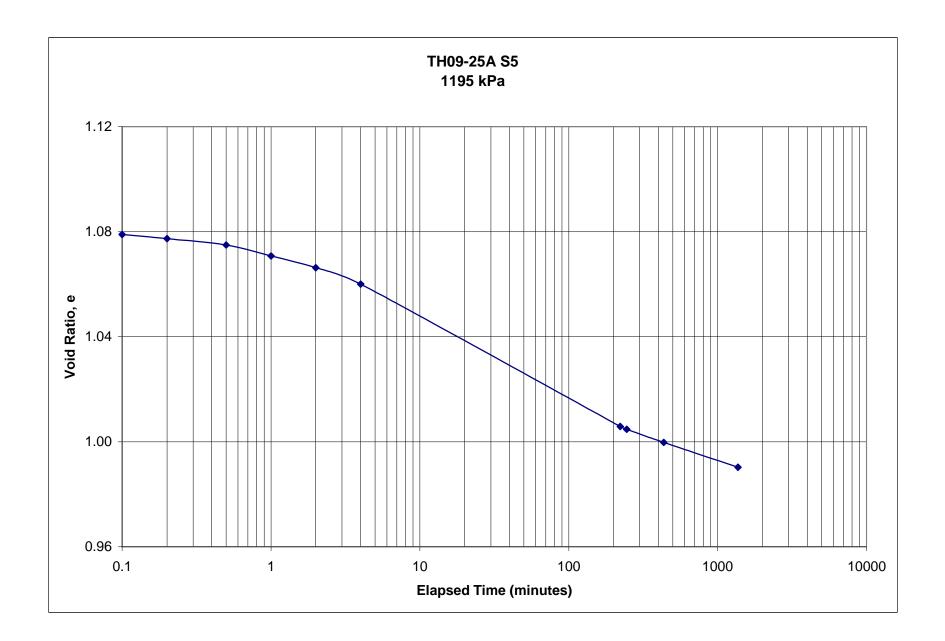


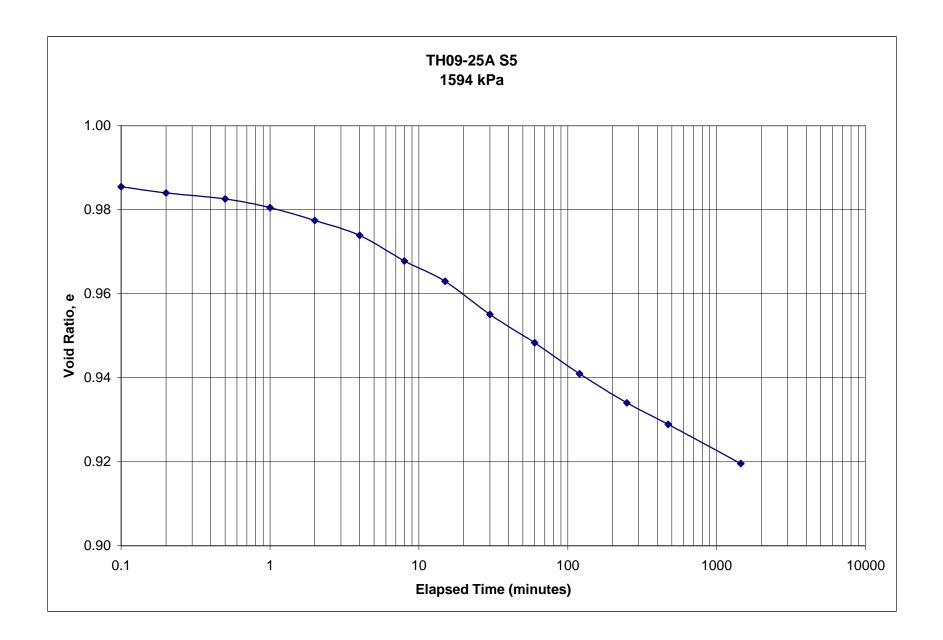


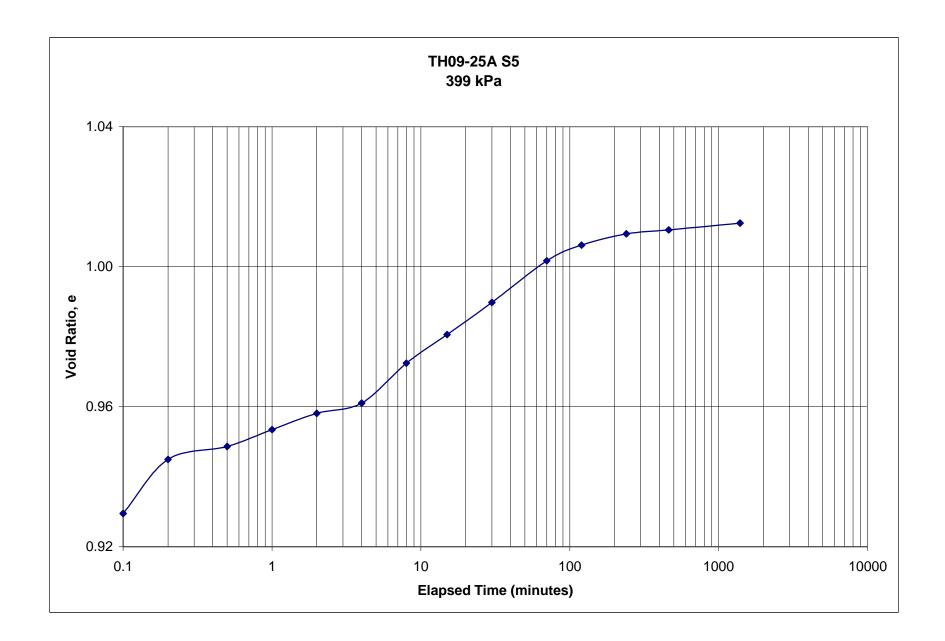


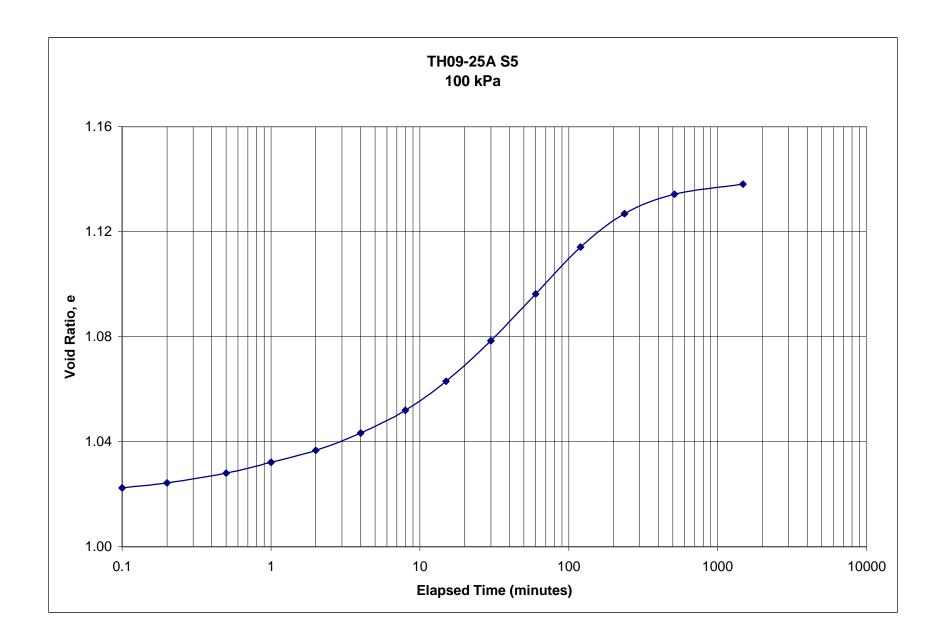


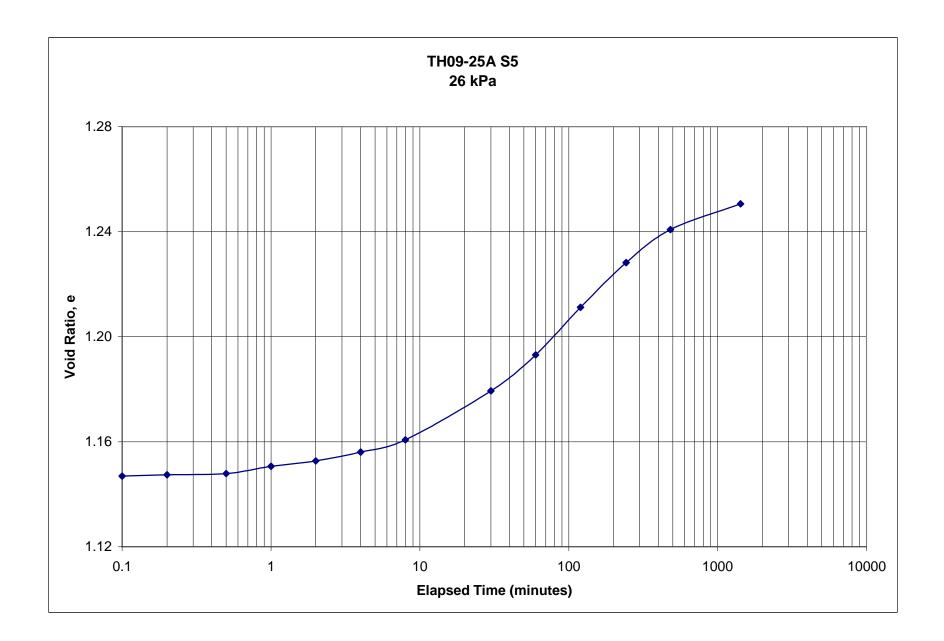




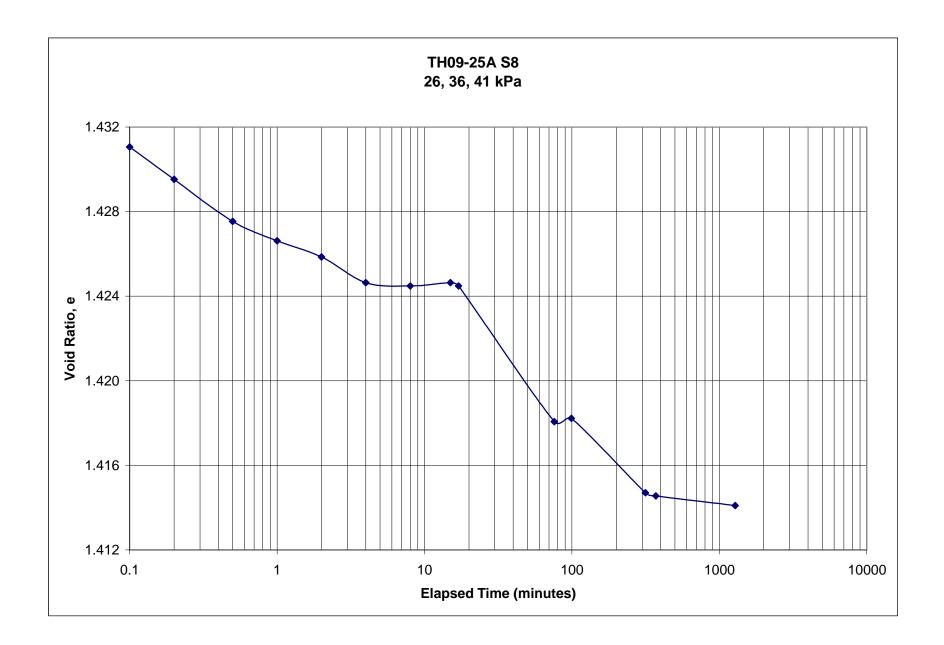


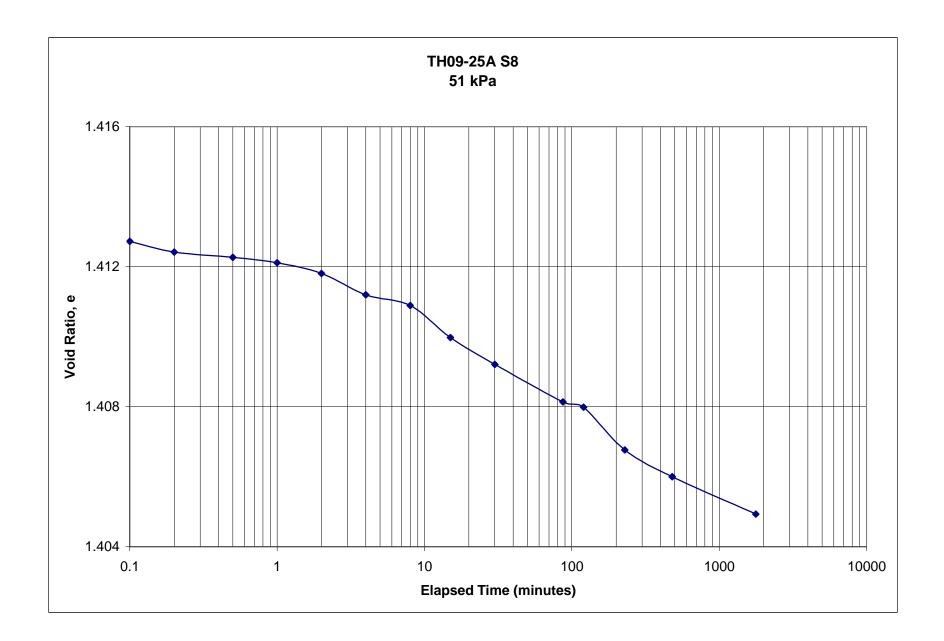


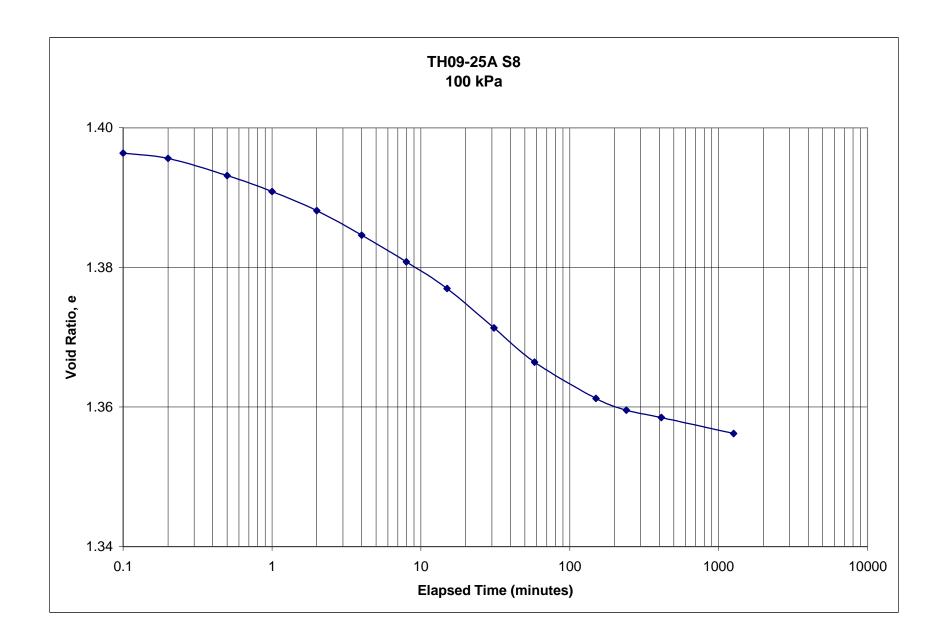


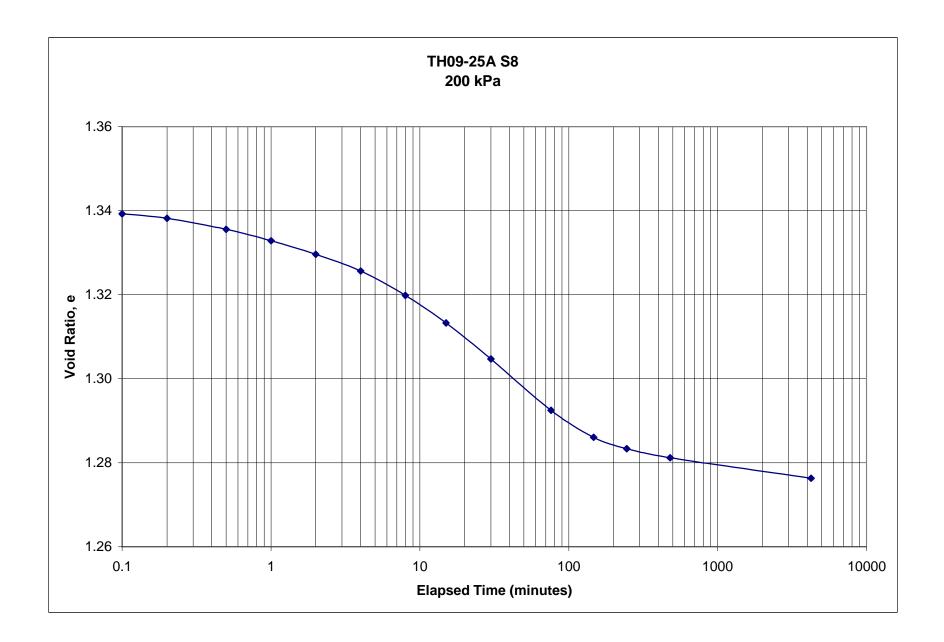


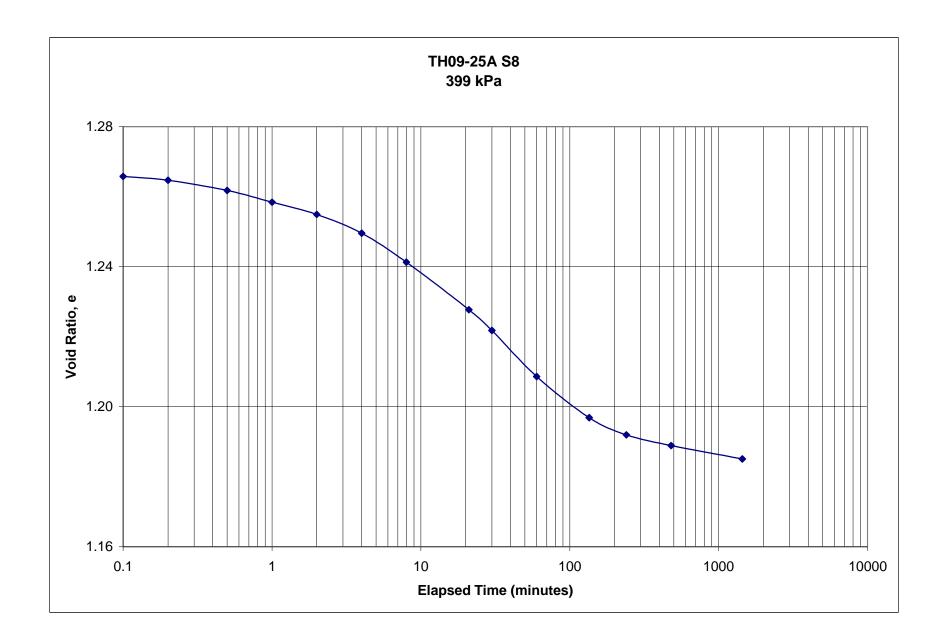


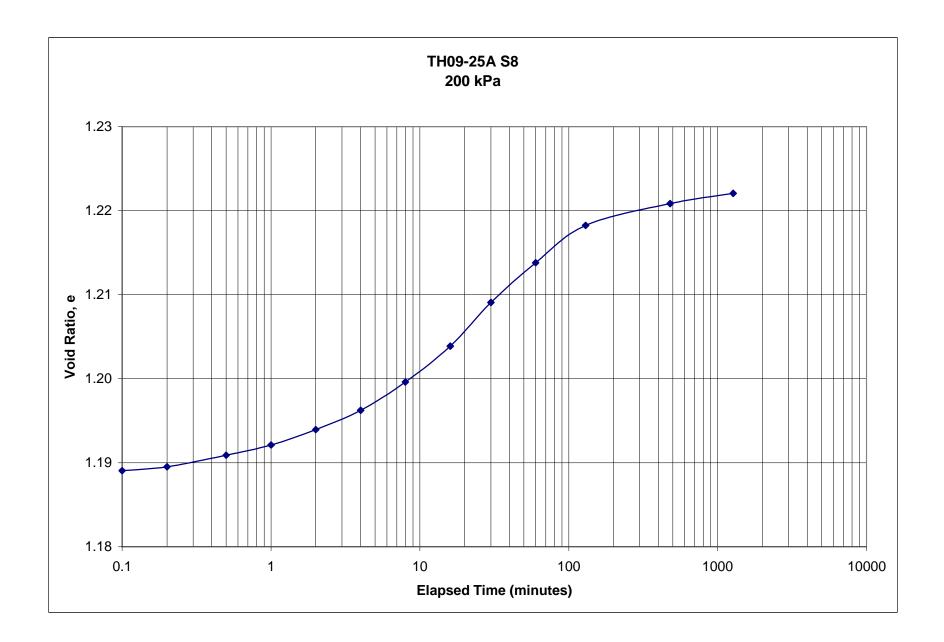


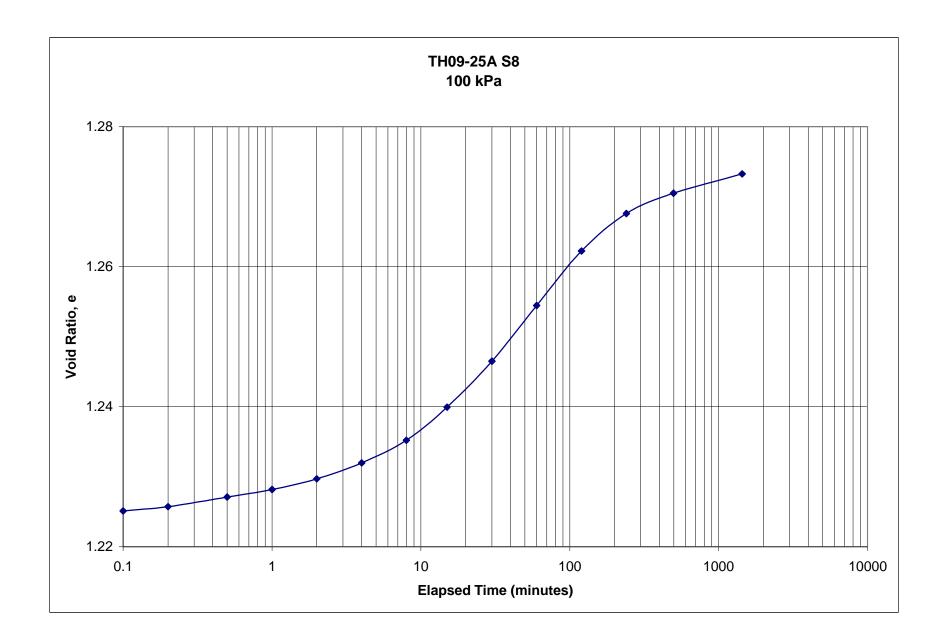


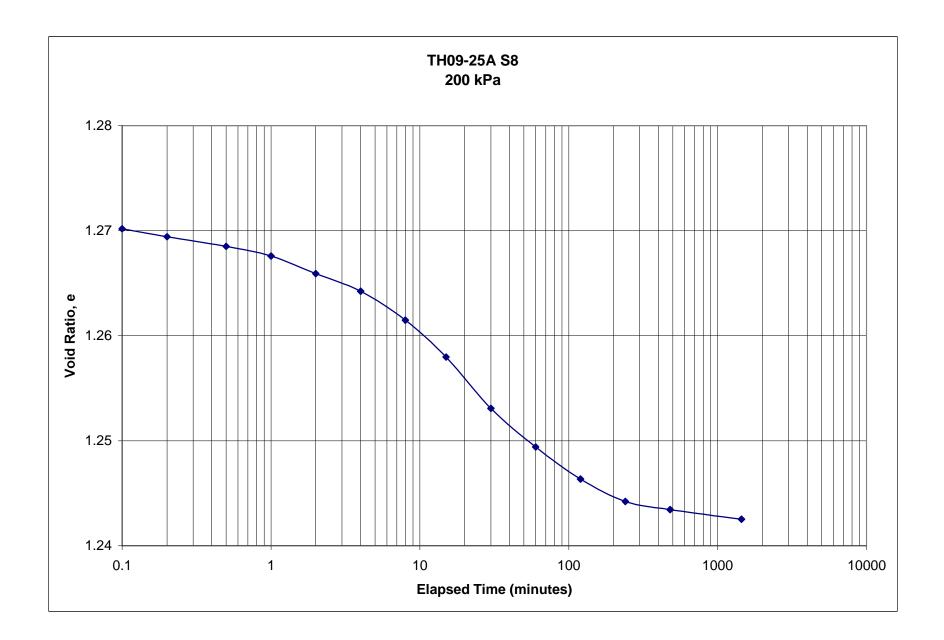


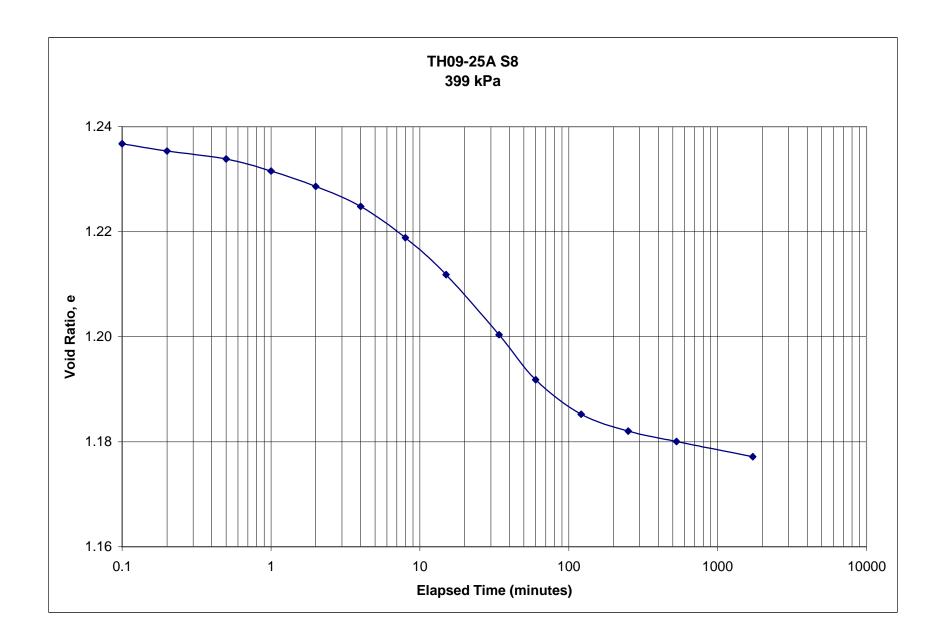


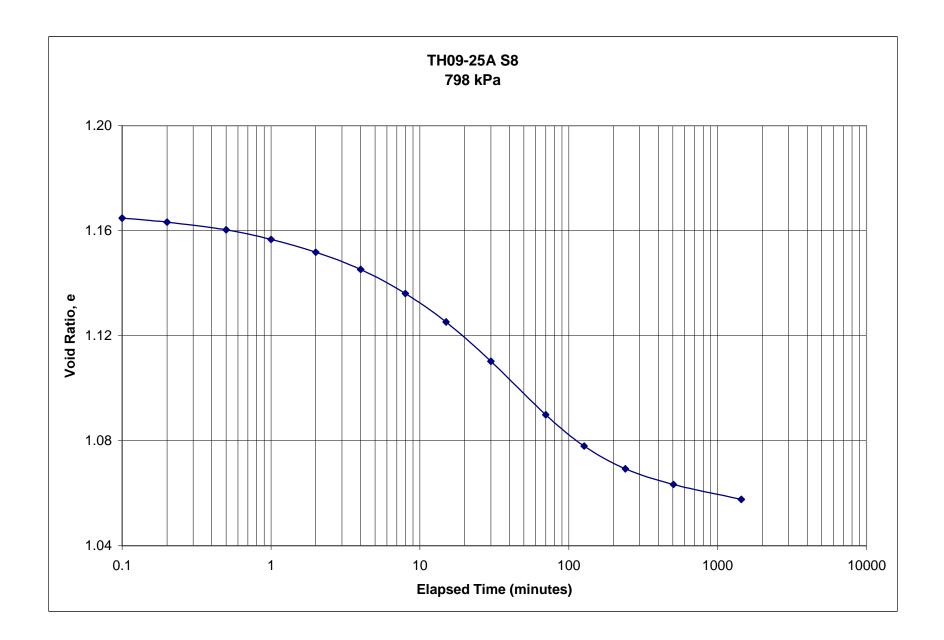


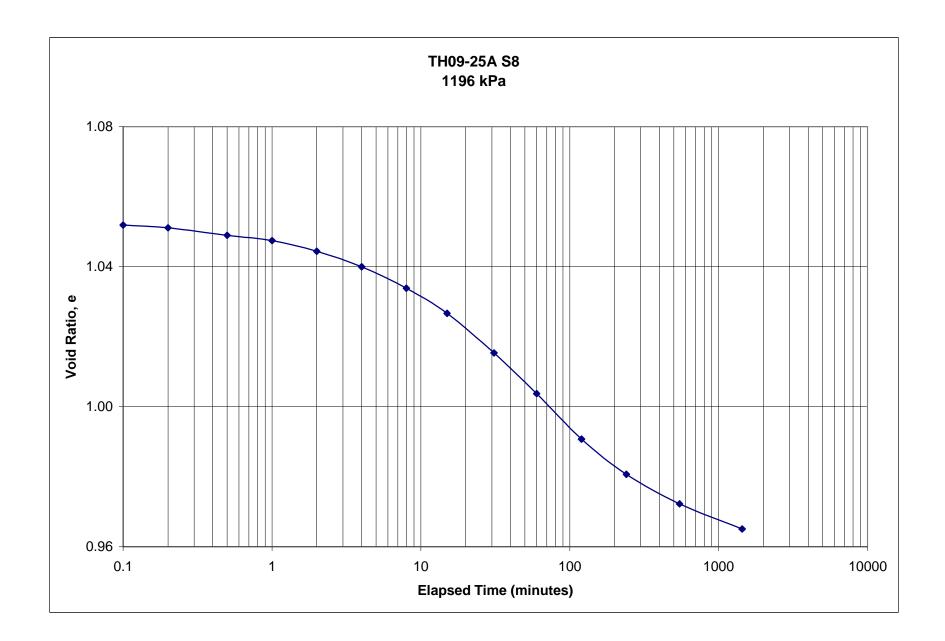


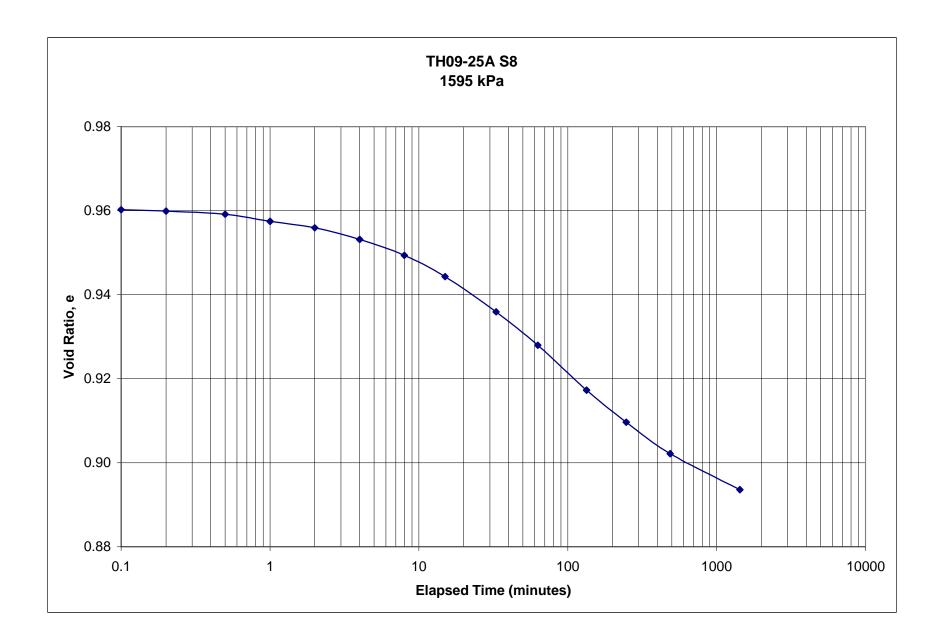


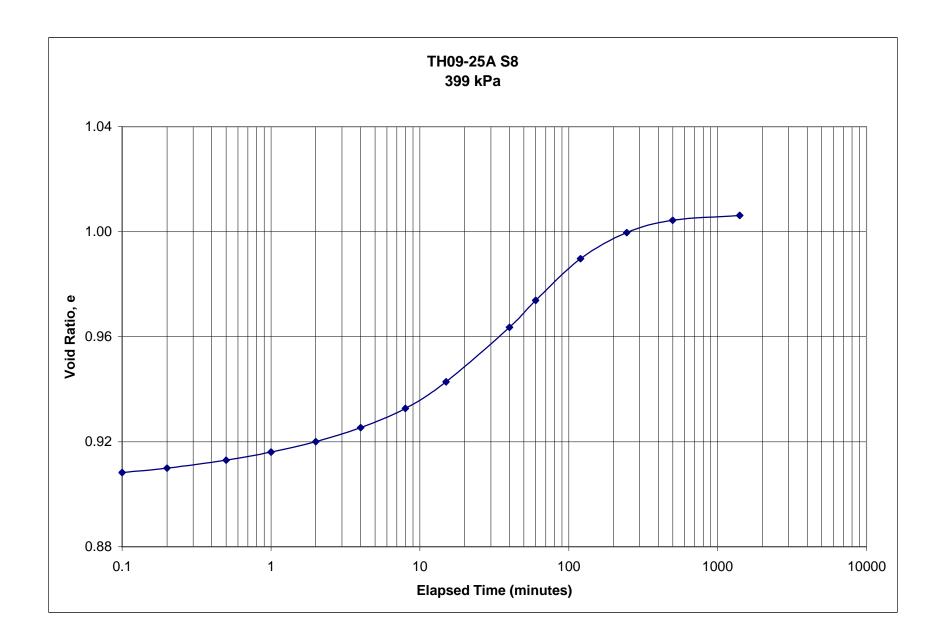


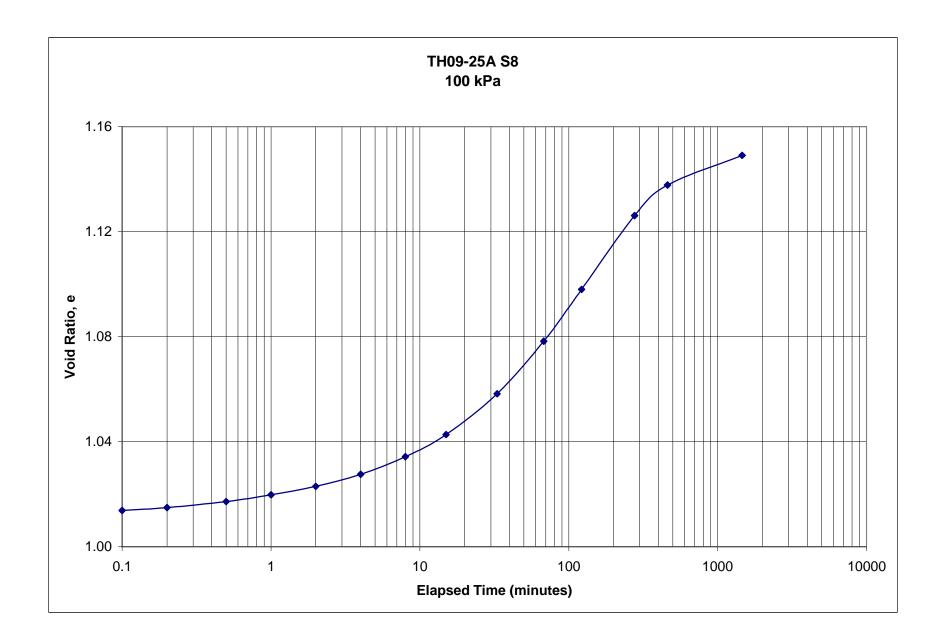


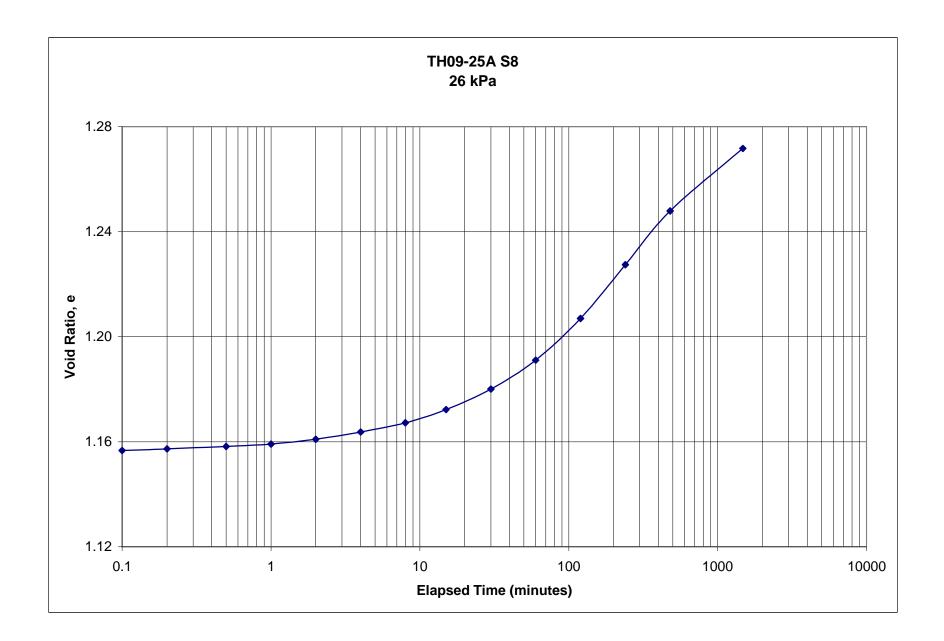












APPENDIX F

2023 Frontier Geoscience Seismic Refraction Survey Report

SEISMIC REFRACTION SURVEY REPORT CENTREPORT REGIONAL S&W SERVICING PROJECT WINNIPEG, MB

Submitted to:

KGS Group January 25, 2024

Authors: Laysa Vieira, M.Sc. Caitlin Gugins, P.Geo.

Project: FGI-1852

237 St. Georges Ave. North Vancouver, B.C. V7L 4T4

604 987 3037

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Figure 4	Interpreted Seismic Refraction Depth Section SL23-01B	Appendix
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Figure 6	Interpreted Seismic Refraction Depth Section SL23-01D	Appendix
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1. Introduction

During the period October 31 to November 3, 2023, Frontier Geosciences Inc. carried out a seismic refraction investigation for KGS Group in support of the Centreport Regional S&W Servicing Project, in Winnipeg, Manitoba. The survey area is located adjacent to Summit Road and Sturgeon Road, and to the west of the Winnipeg Richardson International Airport. A Survey Location Plan of the area is shown at a scale of 1:50,000 in Figure 1, in the Appendix.

The purpose of the geophysical survey was to determine depth to bedrock and overburden layering classification to aid in defining depth to a till layer, as well as characterizing material types and densities. Approximately 1150 metres of detailed seismic refraction data were collected along three separate seismic traverses. A Site Plan showing the line locations is presented at a scale of 1:5,000 in Figure 2, of the Appendix. This project is an augmentation of a previous geophysical investigation carried out by Frontier Geosciences Inc. in October, 2019.



Line SL23-03 Looking Northwest

2. Seismic Refraction Survey

2.1 Survey Equipment

The seismic refraction investigation was carried out using two Geometric Geode, 24 channel, signal enhancement seismographs and Oyo Geospace 10 Hz geophones. Geophone intervals along the multicored seismic cable were maintained at 2.5 metres in order to ensure high resolution data on subsurface layering. Seismic energy was provided from a percussive firing rod (PFR) discharging 8 gauge, blank, black powder shells into hand-excavated shotholes. Shot initiation or zero time was established by metal to metal contact of a hammer contacting the firing pin.



Example of Instrumentation Setup

2.2 Survey Procedure

Field procedure entailed setting out two 24 channel geophone cables in a straight line and implanting the geophones. The spread was traversed with the seismic sources, moving progressively down the array of geophones, with up to 9 individual shotpoints on each spread: one at either end of the spread, up to 5 at intermediate locations along the seismic cable, and one off each end of the spread, where possible, to ensure adequate coverage of the subsurface. The shots were triggered individually and arrival times for each geophone were acquired in the seismographs and recorded in the field laptop. For quality assurance, field inspection of raw data after each shot was carried out, with additional shots recorded if first arrivals were unclear.

Throughout the survey, notes were recorded regarding seismic line positions in relation to topographic and geological features. Relative elevations along the seismic lines were recorded by chain and inclinometer, with absolute elevations taken from the City of Winnipeg 2020 WWD Lidar.

2.3 Interpretive Method

The final interpretation of the seismic data was arrived at using the method of differences technique. This method utilises the time taken to travel to a geophone from shotpoints located to either side of the geophone. Velocities are calculated as the slope of first break pick times and geophone distances. When there is a significant change in slope a new velocity is calculated and assigned to the new layer. Basal velocities are calculated by the arrivals of off-end shots where picked arrivals are refracted from the basal layer. Each geophone is assigned a velocity and time for each layer. Using the total time, a small vertical time is computed which represents the time taken to travel from the refractor up to the ground surface. This time is then multiplied by the velocity of each overburden layer to obtain the thickness of each layer at that point. The thicknesses are splined along the seismic line to create a continuous boundary between layers.

3. Geophysical Results

3.1 General

The interpreted results of the seismic refraction lines are illustrated at a scale of 1:250, in profile in Figures 3 to 10 in the Appendix. The seismic velocity layer interfaces are marked on the seismic profiles in green, blue and red. The interface line colours are not a specific velocity contour, but rather the interpreted discrete boundary above which velocities are defined within a certain range, and below which velocities are within a significantly increased velocity range.



Line SL23-01 Looking Northeast

3.2 Discussion

The interpreted results of the seismic refraction survey indicate the area is underlain by four distinct velocity layers. The surficial layer with compressional velocities ranging from 360 m/s to 440 m/s, is consistent with a surficial sediment layer, such as clays, silts and fills. This layer averages approximately 2.7 metres in thickness, reaching a maximum thickness of 5.6 metres near station 125SE on line SL23-03 and a minimum of 1.5 metres at station 157NE on line SL23-02.

Below the surficial layer is an upper intermediate layer with an interpreted velocity range of 820 m/s to 1150 m/s. Averaging 3.3 metres, this layer reaches a maximum thickness of 5.3 m at the southeastern end of line SL23-03, while thinning to approximately one metre at station 30SE on SL23-03. These velocities are consistent with testhole intersections of firm to very stiff, clays and silts, or in some locations, a loose to compact, unsaturated silt till material.

The base of this upper intermediate layer is illustrated by a blue line, and in places may represent the transition from unsaturated to saturated in the compact to dense silt till present in the area; however, the thickness of the saturated zone is not large enough to significantly increase the compressional wave velocity to delineate it as a discrete velocity layer.

Bounded on the surface by this blue line, is a deeper intermediate layer, ranging in compressional wave velocity from 1800 m/s to 2250 m/s. This velocity range is consistent with dense to very dense silt till encountered in the testholes, indicating this layer correlates with, likely saturated, silt till in the area. The interpreted thickness of this layer varies significantly, from a minimum thickness of 1.1 metres near the end of line SL23-03, to a maximum of over 11 metres in more than one location along the first half of line SL23-01, with an average thickness of 5.5 metres.

Underlying the intermediate layers is the interpreted basal layer with compressional wave velocities of 3650 m/s to 4050 m/s. These velocities are consistent with testhole intersections of a limestone or shale bedrock, and is the interpreted bedrock surface. Lower velocities in this range most likely represents an increased level of fracturing and/or weathered bedrock, while the higher end is indicative of more competent bedrock. This interpreted bedrock surface exhibits an average depth of approximately 11.5 metres and reaches a maximum depth of almost 18 metres near station 265NE along line SL23-01, while rising to a minimum depth of 6.6 metres, at station 70NE on line SL23-02.

4. Limitations

The depths to subsurface boundaries derived from seismic refraction surveys are generally accepted as accurate to within ten percent of the true depths to the boundaries, below 10 metres. Above 10 metres, the accuracy of seismic refraction data is approximately +/- 1.0 metres due mainly to the greater statistical error in determining the upper velocity layers from fewer data points. In some cases, unusual geological conditions may produce false or misleading data points with the result that computed depths to subsurface boundaries may be less accurate. In seismic refraction surveying difficulties with a 'hidden layer' or a velocity inversion may produce erroneous depths. The first condition is caused by the inability to detect the existence of a layer because of insufficient velocity contrasts or layer thicknesses. A velocity inversion exists when an underlying layer has a lower velocity than the layer directly above it. The interpreted depths shown on drawings are to the closest interface location, which may not be vertically below the measurement point if the refractor dip direction departs significantly from the survey line location. Structural discontinuities occurring on a scale less than the geophone spacing or isolated boulders would go undetected in the interpretation of the data. The seismic refraction method may not detect a narrow canyon-like feature incised into bedrock, if the canyon width is narrow relative to the depth of burial of the feature.

The information in this report is based upon geophysical measurements and field procedures and our interpretation of the data. The results are interpretive in nature and are considered to be a reasonably accurate representation of existing subsurface conditions within the limitations of the methods used.

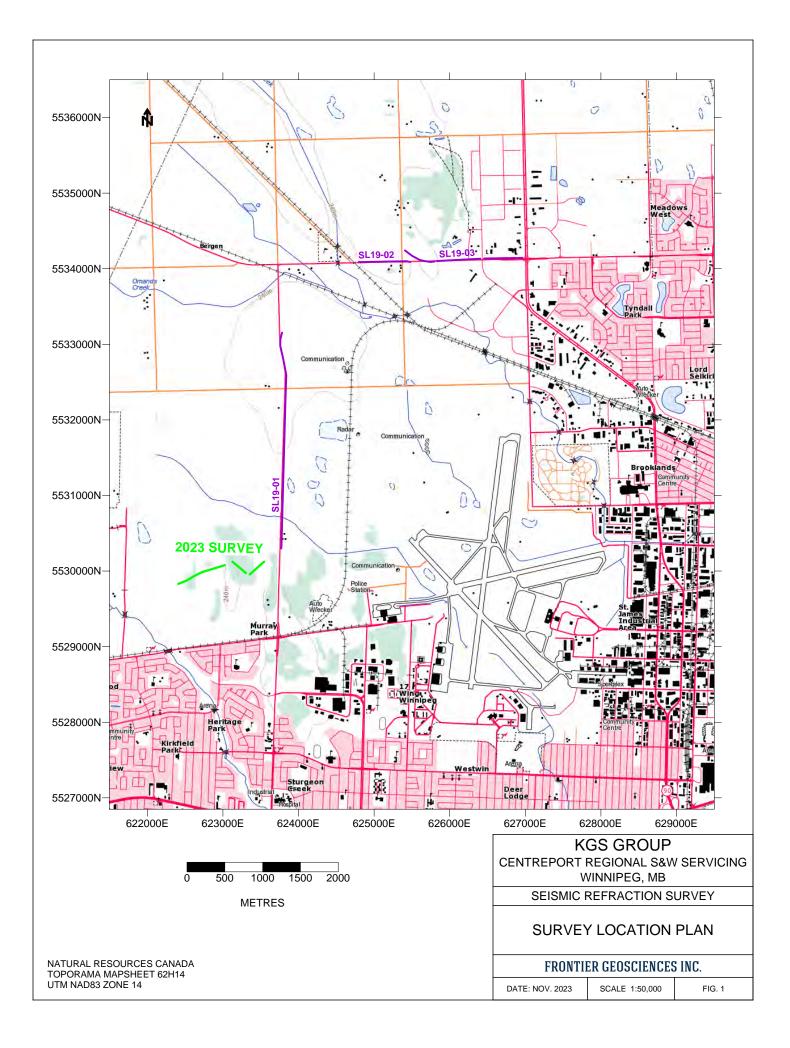
For: Frontier Geosciences Inc.

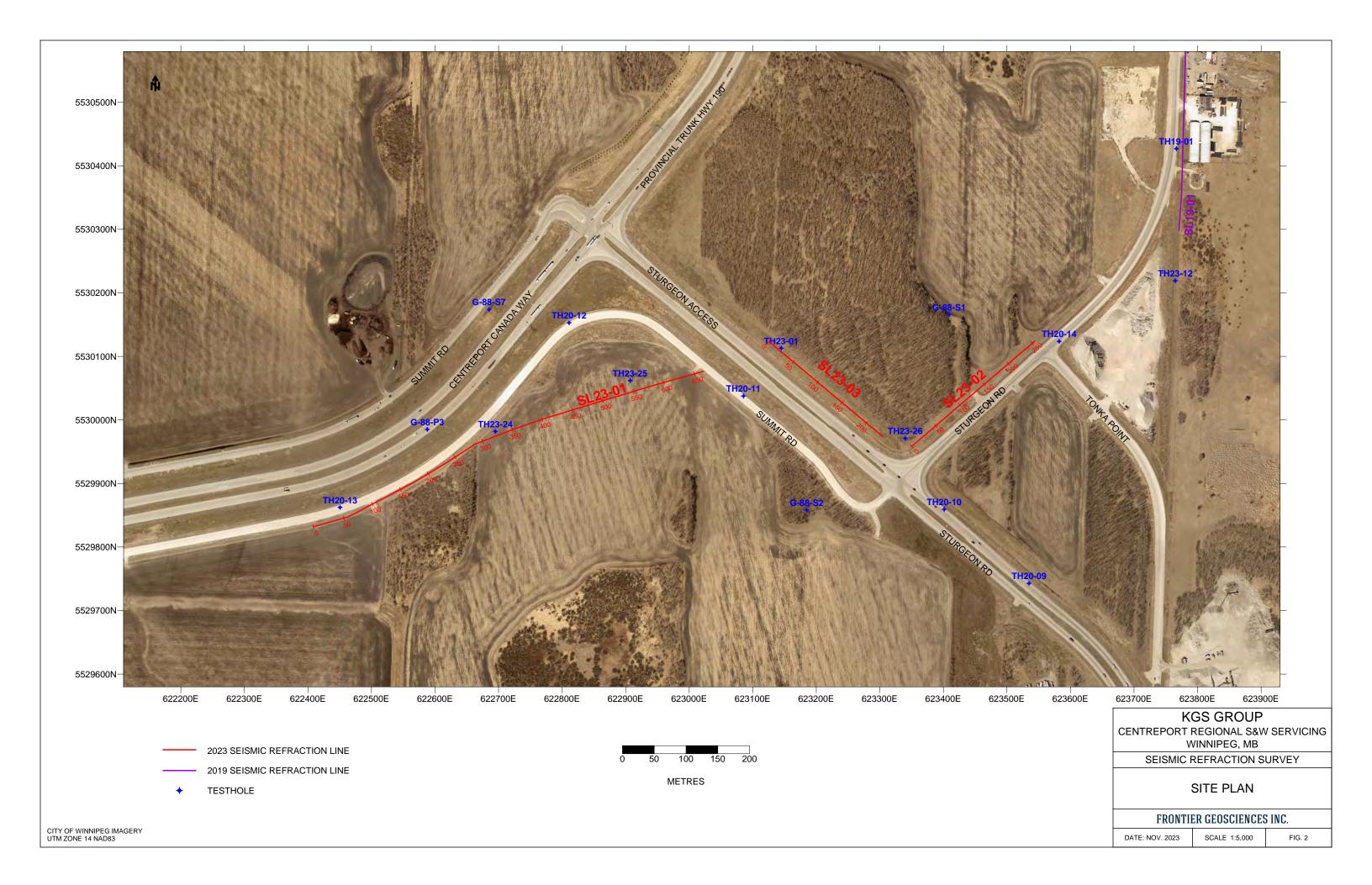
Laysa Vieira, M.Sc.

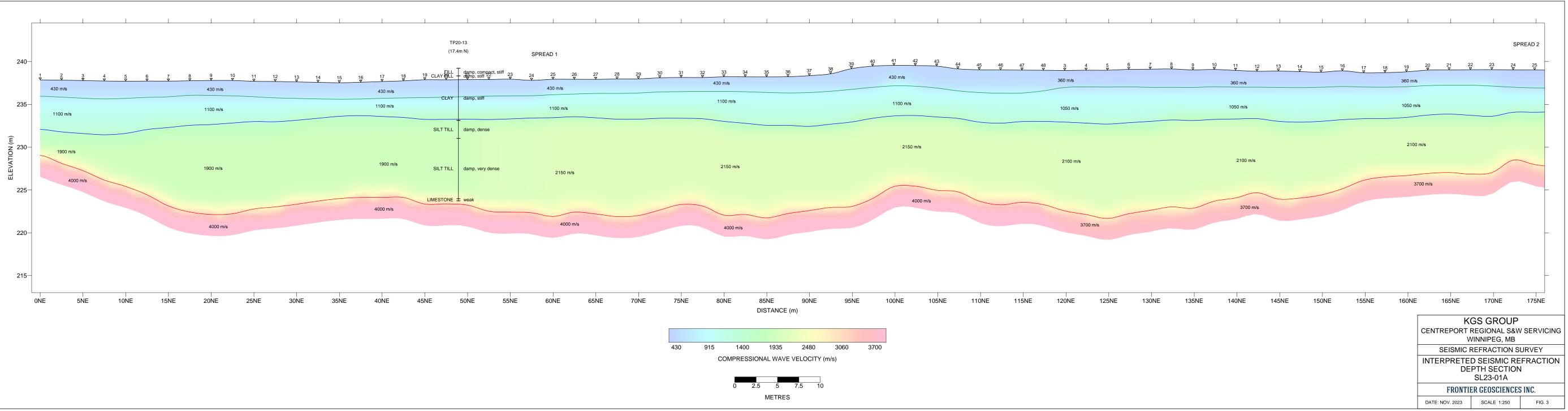
Caitlin Gugins, P.Geo. Engineers and Geoscientists of Manitoba Certificate of Authorization #7657

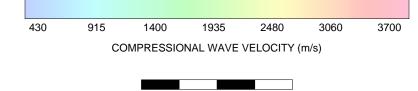
5. References

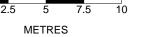
1. *Seismic Refraction Survey Report,* Winnipeg Richardson International Airport, Winnipeg, MB; Submitted to KGS Group; Frontier Geosciences Inc.; Project No. FGI-1644; October, 2019 **APPENDIX**

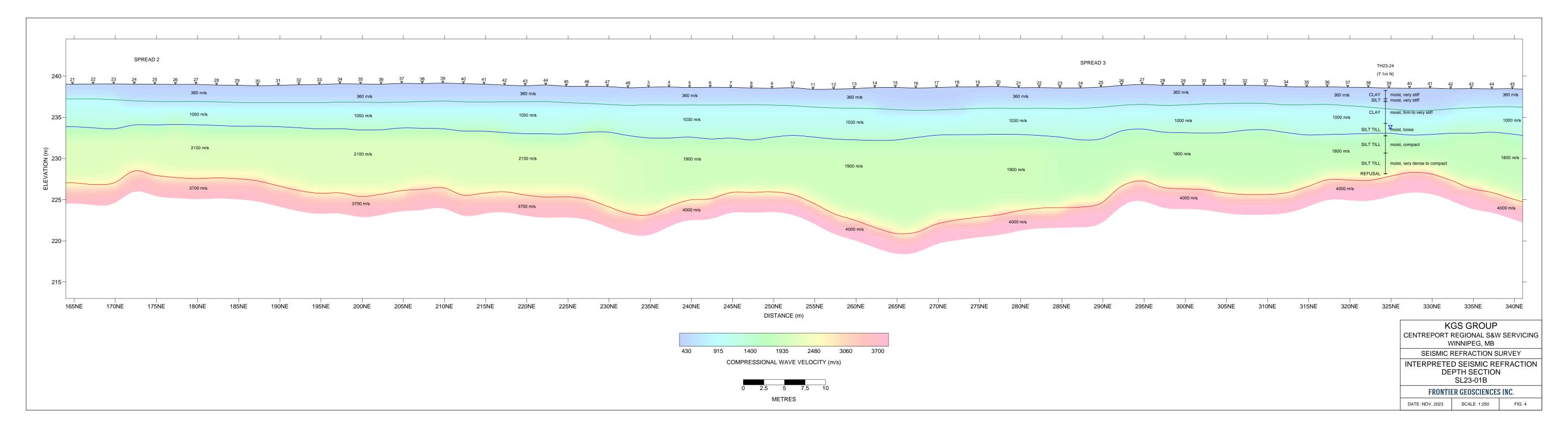


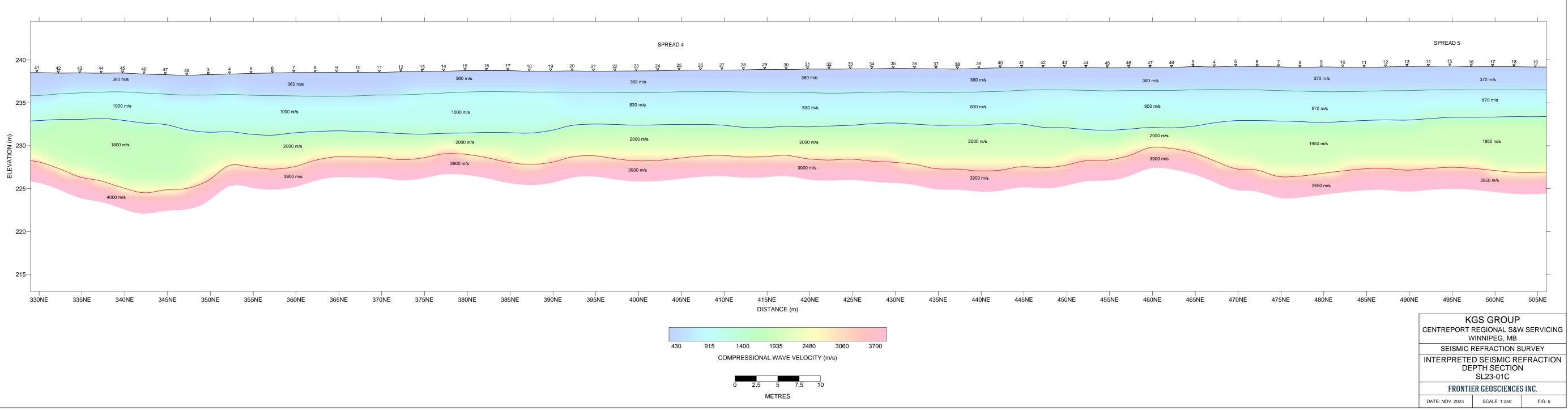


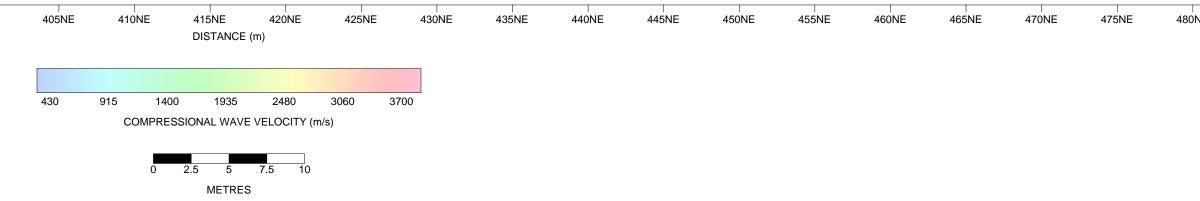


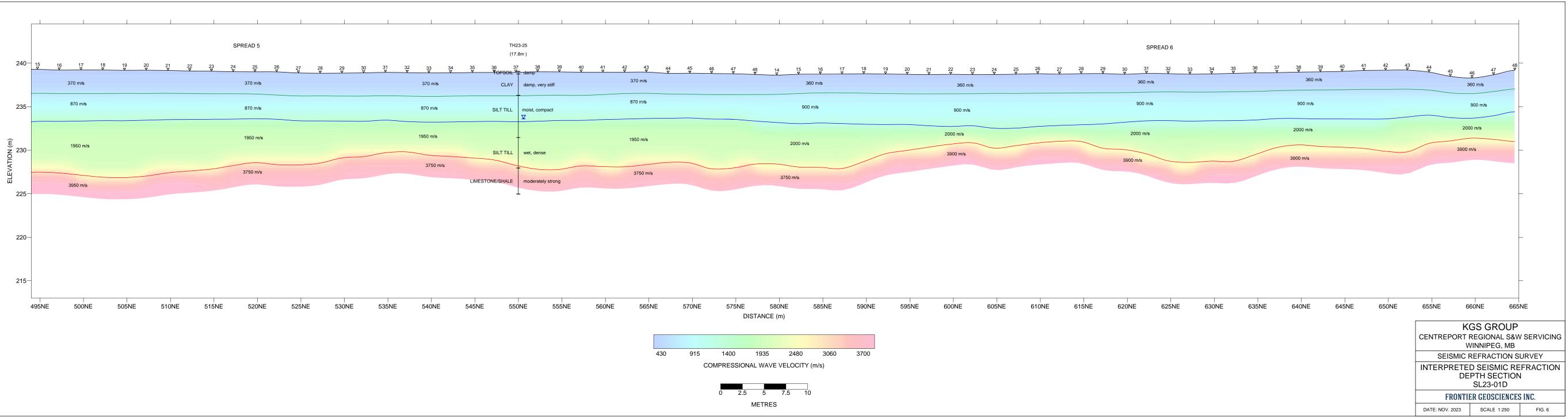


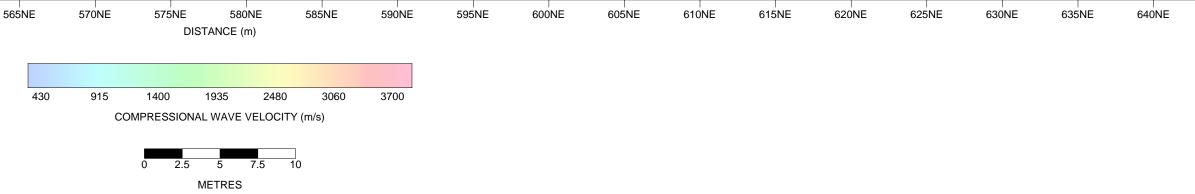


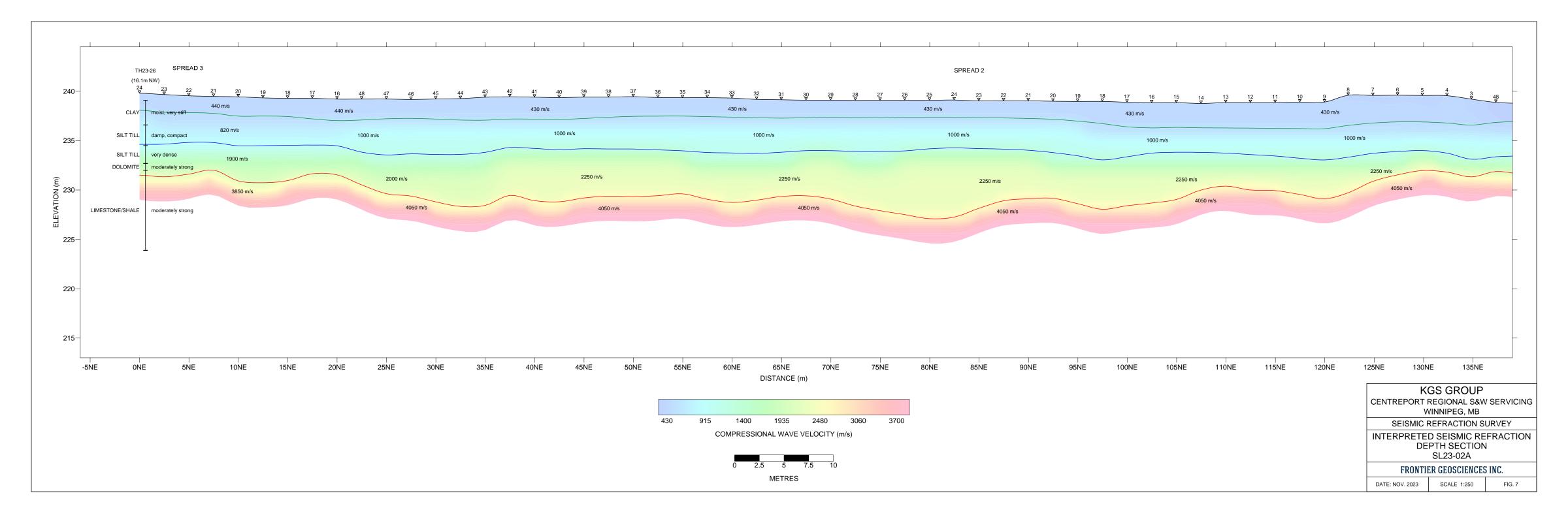


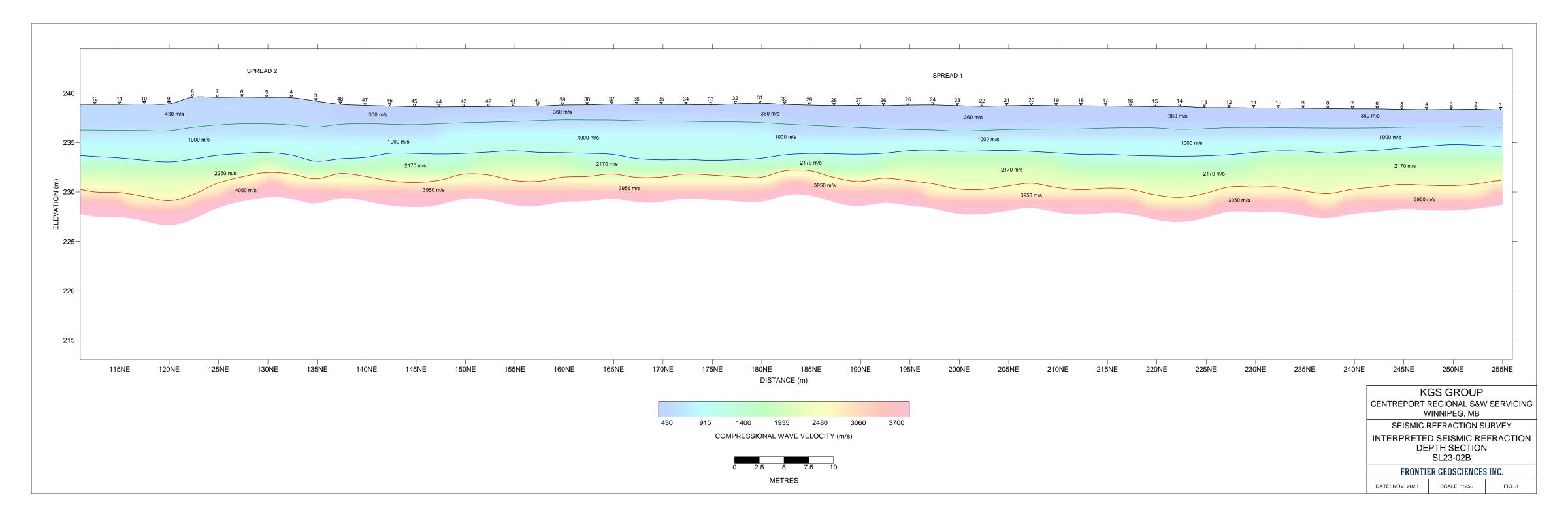


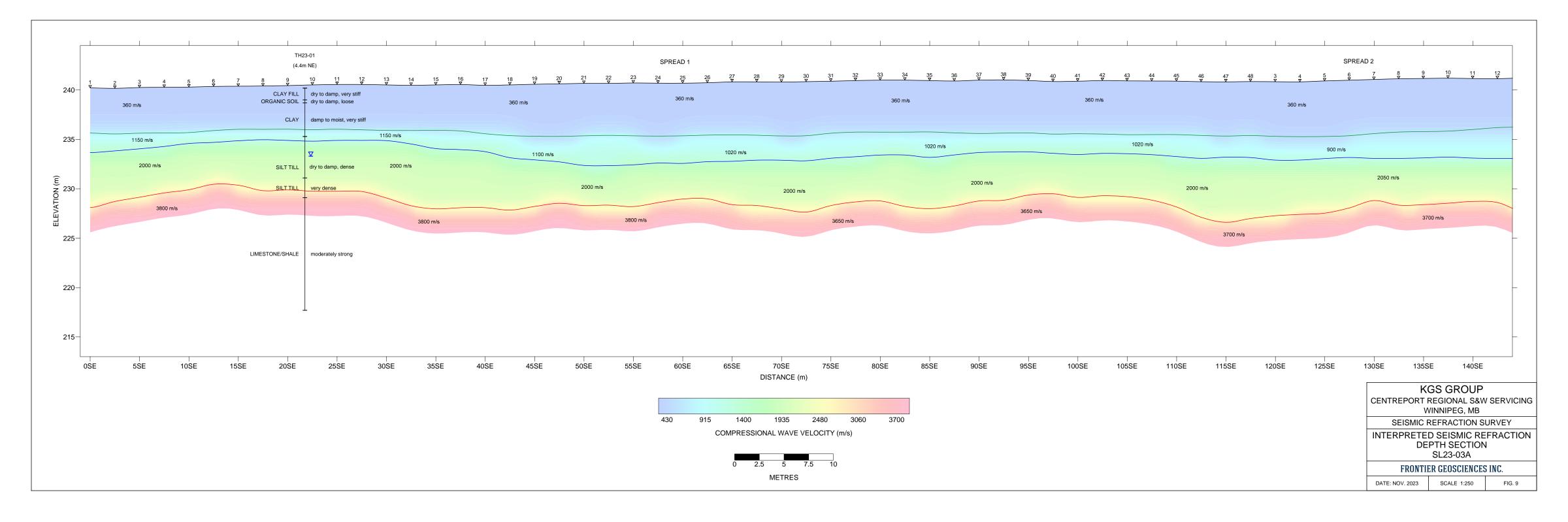


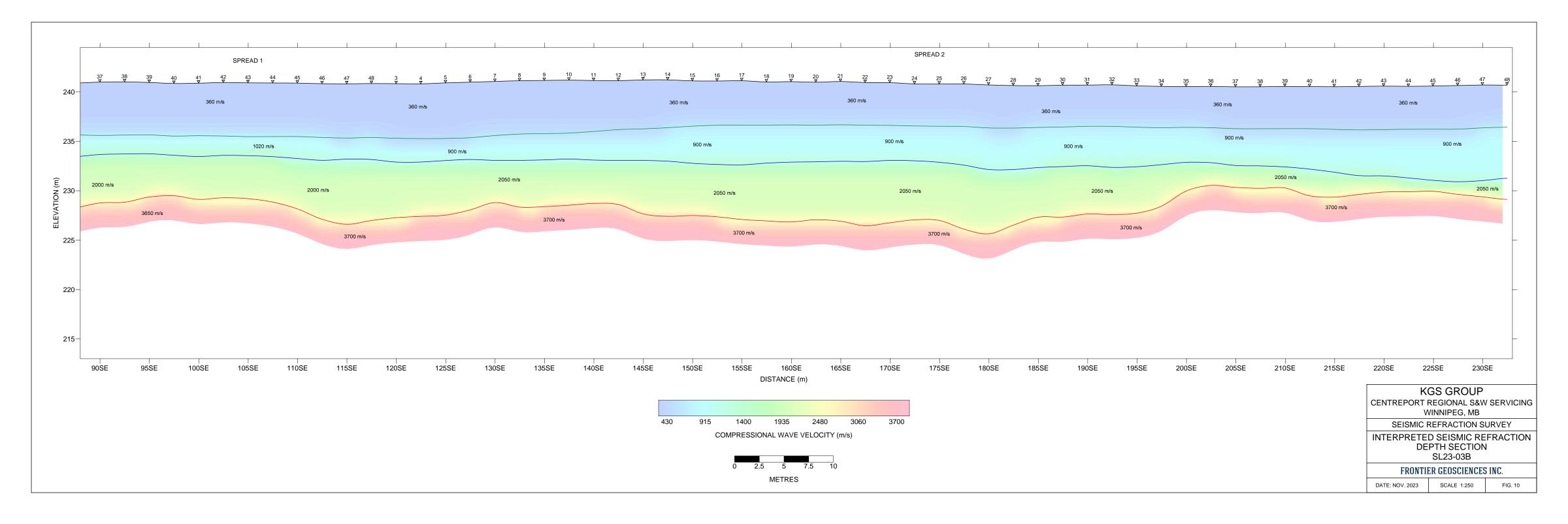












APPENDIX G

2023 KGS Group Hydrogeological Assessment Memo



Memorandum

То:	Ray Offman Municipal Department Head	Date:	June 5, 2024
	KGS Group	Project	23-0107-009
		No.:	
From:	Paul Lindell, B.Sc., P.Eng.	Cc:	Dami Adedapo, Ph.D., P.Eng.
	KGS Group		Principal & Geotechnical Department Head
	Simratpal Singh, M.Sc. EIT		Kelly Fordyce, B.Sc., P.Eng.
	KGS Group		Geotechnical Engineer, KGS Group
			Jason Mann, M.Sc., P.Geo., FGC
			Principal, KGS Group

4.2. PUMPING TEST DESIGN AND ANALYSIS

4.2.1. Pumping Test Design

A pumping test was completed within the footprint of the future CentrePort South lift station site (the "Site") on November 20, 2023, to understand the bedrock aquifer conditions for the deep shaft excavations that will be required for construction. The drilling contractor used for this pumping test was Maple Leaf Drilling Ltd., of Winnipeg, Manitoba.

An observation well designated TH23-01 was installed at the Site on September 28, 2023, to a total depth of 22.5 m below ground surface (bgs) using a GeoProbe 3230 track mounted drill rig. At this location, a 0.05 m (2-inch) standpipe piezometer was installed within the bedrock, and a vibrating wire piezometer (SN# VW171370) was installed at an elevation of 231.7 m above sea level (asl) within the silt till.

A 0.13 m (5-inch) diameter pumping well, PW23-01, was subsequently installed at the Site on November 14, 2023, using a Canterra CT 250 truck-mounted mud rotary drill rig. The PVC well casing was installed through the overburden soil into a competent underlying bedrock unit. The bottom of PVC casing was installed at 12.5 m bgs with an open hole drilled in the limestone bedrock from 12.5 m to 22.3 m bgs. The preliminary yield testing on this well resulted in a calculated specific capacity of less than 1 US gallons per minute (USgpm), which was low, and therefore a second pumping well (PW23-02) was installed closer to TH23-01 on November 17, 2023. Pumping Well, PW23-01 was used as an additional observation well during the pumping test at PW23-02.

PW23-02 was installed approximately 35 m southwest of PW23-01, and with similar depth specifications and well makeup as PW23-01. The specific capacity of this well was calculated at 5 USgpm.

The geographical location of each of these wells is shown in Figure 4.2.1. Coordinates of the wells were collected using a handheld GPS and are accurate to +/- 4m. The details on borehole drilling and well construction for the test wells are included in Table 4.2.1, and the borehole logs are included in Appendix A.

Test Hole ID	Casing Type and Diameter	Casing Depth (m bgs)	Total Depth (m bgs)	Easting (UTM)	Northing (UTM)
PW23-01	5-inch φ PVC	12.9	22.3	623136	5530157
PW23-02	5-inch φ PVC	11.7	22.3	623154	5530127
TH23-01	2-inch φ PVC	21.4	22.5	623145	5530113

TABLE 4.2.1: BOREHOLE INSTALLATION DETAILS

4.2.2. Aquifer Monitoring and Aquifer Testing

A 2-hour pumping test was conducted at PW23-02 on November 20, 2023, starting at 15:00 and ending at 17:00. Initially, an 8-hour pumping test was planned, but the approach was amended to compensate for the additional time required to drill the second pumping well, PW23-02.

To facilitate the test, a generator powered submersible pump with a diameter of 0.08 m (3-inch) was installed in PW23-02 at a depth of 10.9 m bgs. The pumping test was started with a flow rate of 5 USgpm, which achieved a stable drawdown of 1.7 m in PW23-02 after 26 minutes. The pumping rate was then increased to 10 USgpm to test and monitor the well response. This increased pumping rate lowered the groundwater elevation close to the submersible pump elevation within approximately 10 minutes, so the pumping rate was then reduced to 8 USgpm and a stabilized drawdown of 5.3 m was achieved for the remaining duration of the pumping test.

Water levels in TH23-01 and PW23-01 were monitored during the pumping test using Heron DipperLog nonvented M30/F100 and M10/F30 automatic data logging pressure transducers, respectively, to record how the aquifer responds to pumping. Additionally, the vibrating wire installed in the silt layer at TH23-01 was manually monitored intermittently throughout the pumping test. The water level in the pumping well, PW23-02, was monitored using a manual water level meter. Once pumping ceased, the pumping well and observation wells were monitored until groundwater recovered to at least 90% of the measured static water level.

A barometric pressure logger (Heron BarLog) was deployed onsite for use in barometric compensation of non-vented transducers. The transducers and the barologger were installed in the respective wells at least one hour prior to the start of pumping to collect the static water level and barometric pressure data. The transducer plots and drawdown measured in each observation well are shown in Figure 4.2.2.

The pumping test discharge was piped to a ditch south of the site, and approximately 30 m west of the pumping well. The water discharged from the pumping test was not expected to recirculate back into the bedrock aquifer during the 2-hour test.



4.2.3. Pumping Test Data Analysis

Field observations indicated that 2 hours of pumping established a drawdown around the pumping well, PW23-02, and allowed the cone of depression to expand to observation well TH23-01. The drawdown observations indicated there is not appreciable fracture connectivity in the bedrock between the pumping well and surrounding observation wells. Drawdown in the limestone aquifer was small but detectable in observation well, TH23-01; however, no drawdown was observed in PW23-01. A summary of measured responses during the 2-hour pumping test are shown in Table 4.2.2.

Test Hole ID	Instrument Type	Tip Depth (m bgs)	Monitored Zone	Distance from Pumping Well (m)	Static Water Level (m below TOC)	GW Elevation (m asl)	End of Test Drawdown (m)
PW23-02	Standpipe	11.73	Bedrock	-	6.07	233.42	5.57
TH23-01	Standpipe	21.40	Bedrock	~ 13	7.93	233.15	0.08
TH23-01	Vibrating wire	9.10	Silt Till	~ 13	7.84	233.28	None
PW23-01	Standpipe	12.95	Bedrock	~ 35	9.07	230.28	None

TABLE 4.2.2: PUMPING TEST DRAWDOWN RESULTS

Note: The GW Elevations were calculated using the ground elevations from the Lidar elevation data presented in figure 4.2.1.

KGS Group utilized The Cooper-Jacob (1946) method ⁽¹⁾, a semi-log approximation of the Theis (1935) method ⁽²⁾, to analyze the results of the pumping test at PW23-02 and estimate both the Transmissivity and Storativity of the aquifer. Notably, the aquifer does not appear to meet the isotropic hydraulic conductivity condition that this method is based on. The yielding capacity of both pumping wells (PW23-01 and PW23-02) appear to be distinct since the number of water-producing fractures likely vary at both locations; however, the limestone aquifer does appear to satisfy the confined aquifer conditions as an impermeable layer of clay, silt till, and a calcareous shale were observed above the limestone. No change in pressure readings were observed from the vibrating wire installed in the silt till zone. Since pumping was being carried out in the limestone bedrock, this suggests that a hydraulic disconnect exists between the silt till and the deeper bedrock aquifer making limestone bedrock a confined aquifer. In consideration of the observations made during the pumping test, KGS Group has assessed that the Cooper-Jacob method remains valid for this assessment.

The results of the analysis using the Cooper-Jacob (1946) method, considering both time and distance drawdown, are shown in Table 4.2.3.



Data from the Well	Data Type	Method	Transmissivity (m²/day)	Storativity
PW23-02	Residual Drawdown vs Elapsed Time	Cooper-Jacob (1946)	1.47	-
PW23-02 and TH23-01	Distance-Drawdown	Cooper-Jacob (1946)	2.90	0.0032
A	verage Transmissivity (m ²	2.18		

TABLE 4.2.3: TRANSMISSIVITY AND STORATIVITY CALCULATIONS FROM PUMPING TEST

Considering the results of the 2-hour pumping test at PW23-02, as measured at the pumping well location and surrounding monitoring well, the calculated aquifer transmissivity is 2.18 m²/day (<500 USgpd/ft). The storativity was calculated to be approximately 0.003.

The drawdown versus time plot for the pumping well PW23-02 is shown as Figure 4.2.3. This data was not considered in the analysis as the drawdown was stabilized initially at 5 USgpm for the first 26 minutes; however, on increasing the pumping rate to 10 USgpm, the groundwater level rapidly drew down to the elevation where the pump was sitting in the well. The pumping rate was then reduced to 8 USgpm resulting in a stabilized drawdown of 5.3 m for the remaining duration of the test. The residual drawdown verses time plot for the pumping well is shown in figure 4.2.4. It was observed that PW23-02 recovered to the static groundwater level within first 10 minutes of recovery period after pump shutoff.

A radius of influence calculation was not performed; however, it can be noted from the drawdown versus time data for TH23-01 (Figure 4.2.5) that the maximum drawdown at this well location was 0.08 m. Therefore, it can be estimated that the radius of influence of pumping at 8 USgpm was approximately 13 m.

REFERENCES

1. Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well field history, Am. Geophys. Union Trans., vol. 27, pp. 526-534.

2. Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol. 16, pp. 519-524.



STATEMENT OF LIMITATIONS AND CONDITIONS

Limitations

This memorandum has been prepared for City of Winnipeg in accordance with the agreement between KGS Group and City of Winnipeg (the "Agreement"). This memorandum represents KGS Group's professional judgment and exercising due care consistent with the preparation of similar documents. The information, data, recommendations, and conclusions in this memorandum are subject to the constraints and limitations in the Agreement and the qualifications in this memorandum. This memorandum must be read as a whole, and sections or parts should not be read out of context.

This memorandum is based on information made available to KGS Group by City of Winnipeg. Unless stated otherwise, KGS Group has not verified the accuracy, completeness, or validity of such information, makes no representation regarding its accuracy and hereby disclaims any liability in connection therewith. KGS Group shall not be responsible for conditions/issues it was not authorized or able to investigate or which were beyond the scope of its work. The information and conclusions provided in this memorandum apply only as they existed at the time of KGS Group's work.

Third Party Use of Memorandum

Any use a third party makes of this memorandum or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this memorandum.

Geo-Environmental Statement of Limitations

KGS Group prepared the geo-environmental conclusions and recommendations for this memorandum in a professional manner using the degree of skill and care exercised for similar projects under similar conditions by reputable and competent environmental consultants. The information contained in this memorandum is based on the information that was made available to KGS Group during the investigation and upon the services described, which were performed within the time and budgetary requirements of City of Winnipeg. As this memorandum is based on the available information, some of its conclusions could be different if the information upon which it is based is determined to be false, inaccurate, or contradicted by additional information. KGS Group makes no representation concerning the legal significance of its findings or the value of the property investigated.

Geotechnical Investigation Statement of Limitations

The geotechnical investigation findings and recommendations of this memorandum were prepared in accordance with generally accepted professional engineering principles and practice. The findings and recommendations are based on the results of field and laboratory investigations, combined with an interpolation of soil and groundwater conditions found at and within the depth of the test holes drilled by KGS Group at the site at the time of drilling. If conditions encountered during construction appear to be



different from those shown by the test holes drilled by KGS Group or if the assumptions stated herein are not in keeping with the design, KGS Group should be notified in order that the recommendations can be reviewed and modified if necessary.

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Reviewed By:

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Paul Lindell, P.Eng. Environmental Engineer

Approved By:

Jaron Mr

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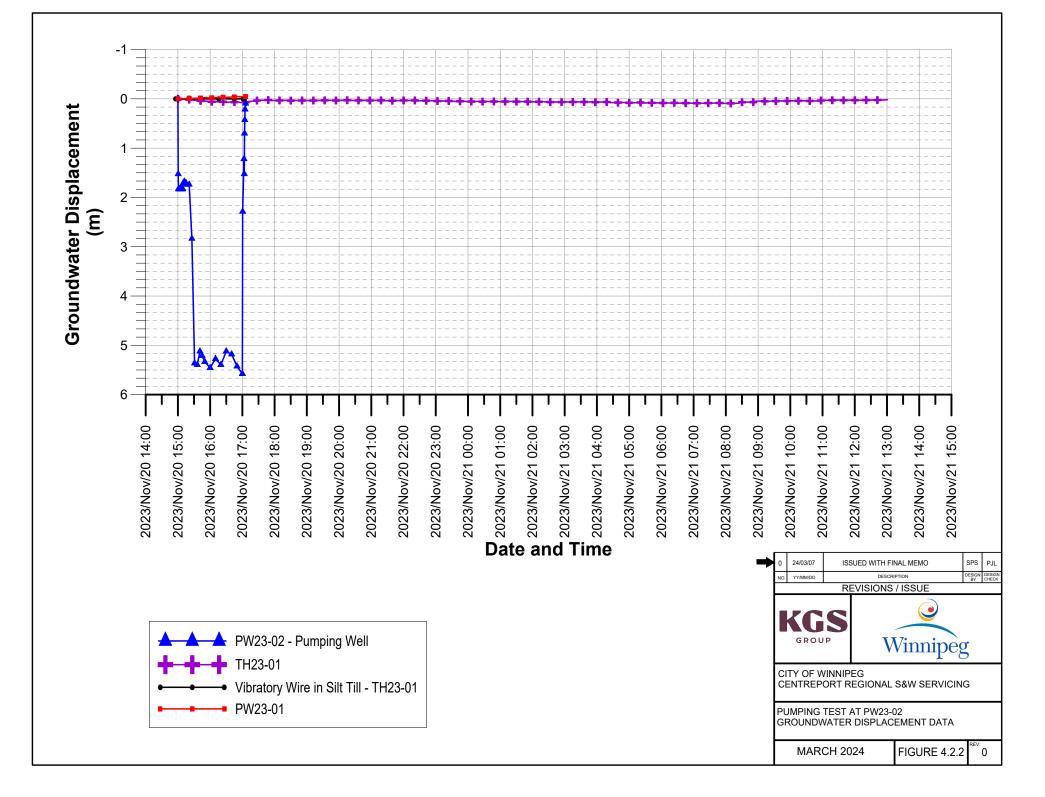
SPS/PJL/jdm/jr Attachments

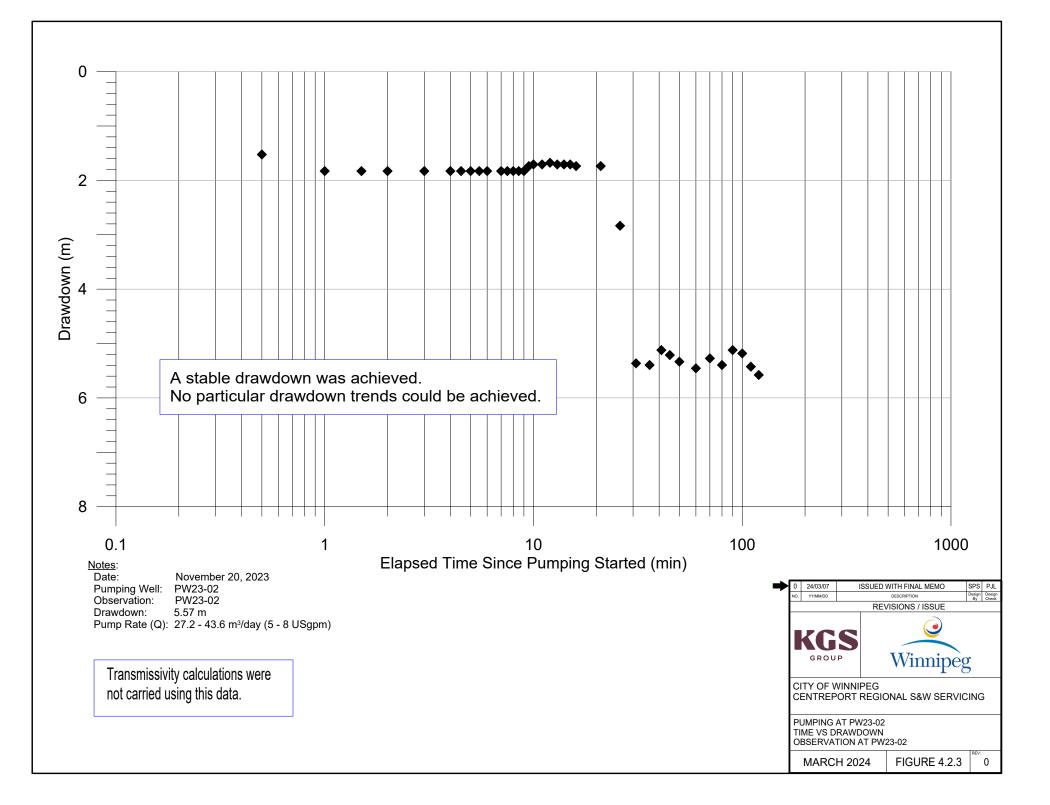


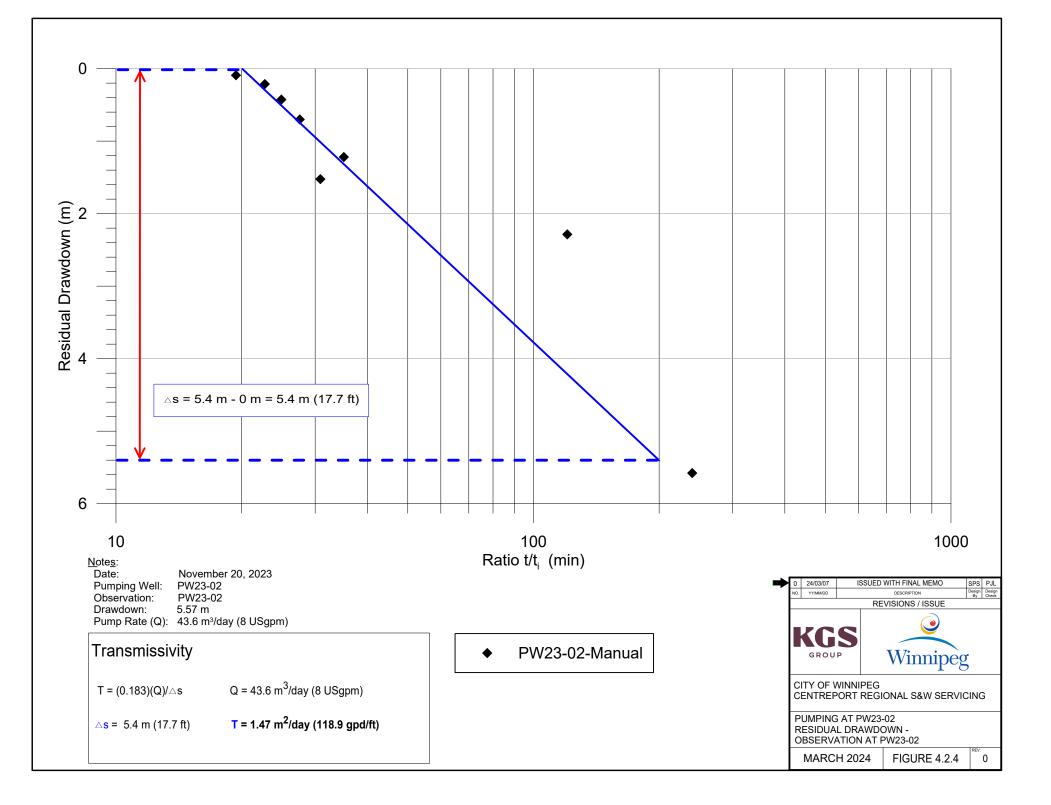
FIGURES

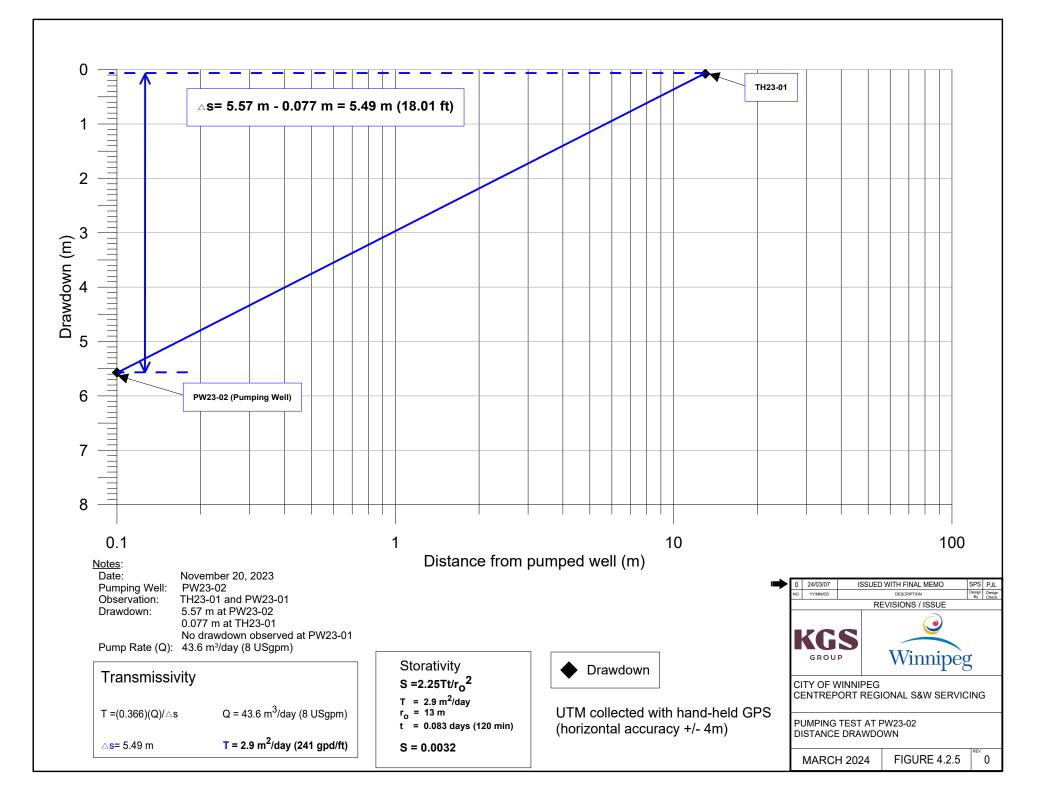












APPENDIX A

Borehole Logs



K	GROUP	5	TEST HOLE LOG					IE N	o. - 01						SHEET	1 of 2
LOC DES DRI	ENT DJECT CATION GCRIPTION LL RIG / HA THOD(S)		CITY OF WINNIPEG - WATER AND WASTE DEPAR CentrePort Regional S&W Servicing Winnipeg, Manitoba Southwest corner of lift station GeoProbe 3230 Track Mounted Drill Rig with Auto 0.0 m to 9.1 m: 125 mm Ø SSA 9.1 m to 22.5 m: Water Rotary HQ Core - switched	o-Ha	amm	ier	SUI TO ST/ UT	RFAC C STI ART I M (n	DATE ו)	EV. IP / E	2 E LEV. () 9 N E	9-28-2023 N 5,530,113 E 623,145 Zone 14				oipe)
(m)		S		VEL		OG OF STALLS	ΥΡΕ	RUN	۲ %	/RUN)	L5 m	ш		PL ∎	MC I	L
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	WATER LEVEL	DIAGRAM	DEPTH (m)	SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE			/ANE (kPa T PEN (kF	
	(m) (ft)		ELEV (m)			ä		2		å			SPT 2	(N) BL 0 40	OWS/0.3	0 m ▲ 80
240			CLAY FILL - 1219 mm, Grey and black, dry to damp, very stiff, trace to some organics.				₿	S1								350
239 238 238 237 237			239.0 ORGANIC SOIL - 305 mm, Black, dry to damp, loose, trace wood, organics. CLAY (CH) - Black, damp to moist, very stiff, high				2222	S2 S3							•	300
238	2.0		plasticity, trace organics. - Brown to grey, trace to some gypsum and silt pockets below 2.0 m.				₽ ₽	S4								275
237	3.010						Ы	0.								250 7 250 7
236	4.0		- Stiff below 4.1 m. - LL=66, PL=21, PI=45 at 4.3 m.) D (0 0 (0 0 (0 0 (0 0 (0 0 (0 0 (0 0 (₽ ₽	S5						•	I	•
C49:8235	5.0		235.3 <u>SILT TILL (ML)</u> - Light grey, dry to damp, dense, with coarse grained sand, trace gravel, some clay.													225
	6.0 20		- PSA: 7% gravel, 34% sand, 45% silt, 14% clay at 5.8 m. - Light brown to grey below 6.1 m.		· · · · · · · · · · · · · · · · · · ·		Ł	S6 S7	100		9 14 21	35	•	•		
	7.0			Ţ			स	60								
	8.0						Ъ Ч	58 59	100		14 19 19	38				
	9.0		- Very dense below 9.1 m.			ting e 1370 8.53	招	S10 S11	55		49 50/	+100	•			>>
			 Hard drilling/grinding below 10.0 m. Grey and black boulders and cobbles, trace to some weathered limestone in sampler from 10.1 m to 11.1 m. 			10.46		R1	32		100mm					
			229.1 ARGILLACEOUS LIMESTONE/CALCAREOUS SHALE - Reddish-gray to purplish-gray, fine grained, thinly bedded, fossiliferous, fissile, moderately strong.					R2	97	78						
		ing Dril	ling/Digging on 9-28-2023 None Encountered		• · ·		-	TOR		ng Ltd	I.	IN	ISPEC	TOR	GUE7	1
עפא	÷ obr					APPRO	VE			-0 -10		D	ATE	2-2024		

	GROUP	5	TEST HOLE LOG						le n 123	o. - 01					SH	EET 2	of
ELEVATION (m)	(m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION		WATER LEVEL	LOG OIAGRAM		SAMPLE TYPE	NUMBER / RUN	RECOVERY %	RQD (JOINTS/RUN)	BLOWS/0.15 m	N-VALUE	qu PO(N (kPa) 1
			- Good quality from 11.2 m to 12.6 m.	V (m)	+	-					2 (10)			SPT (N) 20	40 6	50 8	0
-2228 	13.0 		 ~30 mm soft shale/clay seam at 12.1 m. Fair quality from 12.6 m to 15.7 m. UCS: 24.1 MPa at 12.9 m. Increased shale content, weak, several ~20 mm joints with soft shale/clay infill from 13.0 m to 13.1 m. Decreased shale/clay content from 13.1 m to 14.3 m. 		•				R3	96	59 (14)						
226 225	15.0 		 Broken/Fractured core zone infilled with soft reddish-purple shale/clay at 13.9 m. ~125 mm Fractured zone infilled with soft shale/clay, very weak at 14.3 m. Moderate strength below 15.2 m. 		•		15.34		R4	92	65 (15)						
224	16.0 		 Poor quality from 15.7 m to 20.3 m. 50 - 100 mm thick shale interbeds spaced 150 - 300 mm apart from 16.0 m to 18.0 m. UCS: 17.6 MPa at 16.9 m. 						R5	97	45 (23)						
222	18.0				•				R6	93	40 (18)						
	19.0 65		- Fair quality below 20.3 m.		•				R7	93	64 (16)						
219	21.070		 Two ~75 mm thick shale/clay interbeds from 20.9 m to 21.5 m. Decreasing shale/clay content, increasing strength below 21.2 m. 		•		21.44		R8	100	65 (14)						
218	22.0		Notes: 1. End of test hole at 22.5 m. 2. Refusal encountered on suspected boulder at a	217.7			22.50		R9	93	70 (3)						
217 217 216 215	24.0		 Kerdsa encountered on suspected bounder at a depth of 9.1 m. Protective well cover installed at surface. 50.8 mm or two (2) inches diameter standpipe installed. Vibrating wire piezometer (VW171370) installed at 8.53 m below grade. 														
ATE VEL			Iling/Digging on 9-28-2023 None Encount pletion 6.71 m on 9-29-2023	ered			PRC	ple VE	Leaf		ng Ltd			ISPECTOR M. ROD ATE 1-22-20	RIGUEZ	2	

K		5	TEST HOLE LOG	HOLE NO		1				SHEET 1 of	f 1	
LOC DES DRI		AMME	 CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba W side of lift station; 40m NNW of TH23-01 R Canterra CT 250 Truck Mounted Drill Rig 0.0 m to 13.0 m: Mud Rotary/Air Hammer 13.0 m to 13.6 m: Mud Rotary, 150 mm Ø Tricone Bit - sw 13.6 m to 22.3 m: Mud Rotary, 125 mm Ø Tricone Bit 	SURFACI TOC STIC START D UTM (m)	e el CK-l DATI)	.EV. JP / E E		11-14-2023 N 5,530,157 E 623,136 Zone 14				
(m) ELEVATION (m)	HLLGO DEbLH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	ELEV (m)	WATER LEVEL			SAMPLE TYPE	NUMBER	PL MC LL Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m 20 40 60 80	*	
	11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 18.0 60		SILT TILL - Greyish brown. - Limestone boulder from 4.8 m to 5.6 m. WELL GRADED GRAVEL WITH SAND (GW). CALCAREOUS SHALE - Red. LIMESTONE.	237.1 232.2 				5				
	23.075 ER ¥ Ren		Notes: 1. End of test hole at 22.3 m. 2. Protective well cover installed at surface. 3. 127 mm or five (5) inch pump well installed. ed/Static 9.07 m on 11-20-2023 Monitoring Well									
	LS ¥ Ken	icasur		CONTRACTOR Maple Leaf D APPROVED K. FORDYCE	Drilli	ng Ltd	•			ISPECTOR L. MCALLISTER ATE 3-4-2024		

K	GROUP	5	TEST HOLE LOG)2				S	HEET 1 of 1			
LOC DES DRI	ENT DJECT CATION SCRIPTION LL RIG / HA THOD(S)	AMME	 CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT CentrePort Regional S&W Servicing Winnipeg, Manitoba S side of lift station; 16m NE of TH23-01 R Canterra CT 250 Truck Mounted Drill Rig 0.0 m to 11.7 m: Mud Rotary/Air Hammer 11.7 m to 12.3 m: Mud Rotary, 150 mm Ø Tricone Bit - sv 12.3 m to 22.3 m: Mud Rotary, 125 mm Ø Tricone Bit 	SURFAC TOC STI START E UTM (m	LEV. UP / EI E		11-17-2023 N 5,530,127 E 623,154 Zone 14					
ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION		WATER LEVEL			SAMPLE TYPE	NUMBER	PL MC LL ■ ■ ■ Cu TORVANE (kPa) ◆		
ELEVA	 (m) (ft)	GR		ELEV (m)	WAT	DIAGRAM	DEPTH (m)	SAM	N	qu POCKET P SPT (N) BLOW 20 40		
240	1.0		<u>CLAY</u> - Grey and black, damp, stiff.									
238	2.0 3.0 3.0 10		SILT TILL - Greyish brown, with boulders.	238.0								
237	4.0		- Limestone and granite boulders from 4.0 m to 4.7 m.									
235	5.0 6.0 20				Ţ							
233	8.0			231.3								
231	9.0 30		CALCAREOUS SHALE - Red.									
229			 - Broken Purple Limestone below 11.4 m. <u>LIMESTONE</u>. 			1 1	11.73 12.34					
	13.0 45 14.0											
	15.0 15.0 16.0											
	17.0 55											
221	19.0											
	21.0 21.0 22.0			217.9								
	23.0 75		Notes: 1. End of test hole at 22.3 m. 2. Protective well cover installed at surface. 3. 127 mm or five (5) inch pump well installed.	217.3		<u>, r</u>	22.25				_ I	
	ER ¥ Rem LS	neasur	ed/Static 6.10 m on 11-20-2023 Monitoring Well	CONTRACTOR Maple Leaf D APPROVED K. FORDYCE		ing Ltd.				ISPECTOR S. SINGH ATE 3-4-2024		



Experience in Action