APPENDIX A
GEOTECHNICAL REPORT

BROOKSIDE CEMETERY WATER MAIN
3001 NOTRE DAME AVENUE
WINNIPEG, MANITOBA

GEOTECHNICAL INVESTIGATION REPORT

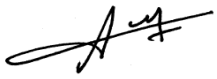
Prepared for:
The City of Winnipeg
Cemeteries Branch
3001 Notre Dame Avenue
Winnipeg, Manitoba
R3H 1B8

Prepared by:
Stantec Consulting Ltd.
905 Waverley Street
Winnipeg, Manitoba
R3T 5P4

April 25, 2014

Sign-off Sheet

This document entitled Brookside Cemetery Water Main, Winnipeg, Manitoba was prepared by Stantec Consulting Ltd. for the account of the City of Winnipeg. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Prepared by  _____
(signature)

Farouk Fourar Laidi, M.Sc., EIT
Geotechnical Engineering

Reviewed by  _____
(signature)

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

Table of Contents

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained to undertake a geotechnical investigation to evaluate the existing soil and groundwater conditions along the alignment for the proposed water main at the Brookside Cemetery in Winnipeg, Manitoba. Three testholes were drilled on the project site on April 16, 2014. The scope of work for this project was outlined in our proposal dated March 19, 2014. Jane Saxby from the City of Winnipeg provided authorization to proceed with the geotechnical investigation on March 24, 2014.

The work that has been performed as part of this geotechnical study included the following:

- A geotechnical drilling and soil sampling program at the project site to identify the existing soil conditions.
- Laboratory testing on select samples to determine the engineering properties for the soils encountered during the geotechnical investigation. The laboratory testing program included moisture contents on all samples and particle size analysis and Atterberg limits on selected soil samples.
- Preparation of this geotechnical report outlining the existing site conditions, a site plan with testhole locations, laboratory test results and testhole logs with information on soil and groundwater conditions.

2.0 PROJECT SITE AND PROPOSED CONSTRUCTION

The project site is located at the 3001 Notre Dame Avenue in Winnipeg, Manitoba. It is our understanding that a new water main will be installed at the Brookside Cemetery.

3.0 GEOTECHNICAL INVESTIGATION

3.1 TESTHOLE DRILLING AND SOIL SAMPLING

The subsurface drilling and sampling program was conducted on April 16, 2014. Drilling services were provided by Maple Leaf Enterprises Ltd. under the supervision of our geotechnical field personnel. Three testholes were drilled on the project site using a truck-mounted drill rig equipped with 125 mm solid stem augers. Testholes TH1 to TH3 were drilled to a depth of 6.1 m along the proposed alignment for the water main. The testhole locations are shown on the Testhole Location Plan provided in Appendix B.

Soil samples were obtained directly from the auger flights at depth intervals ranging from 0.3 to 1.5 m. The soil samples were visually classified in the field and returned to our soils laboratory for additional examination and testing. Upon completion of drilling, the testholes were examined for evidence of sloughing and groundwater seepage. The testholes were backfilled with auger cuttings with excess auger cuttings left at the testhole locations.

The detailed testhole logs are provided in Appendix C.

3.2 LABORATORY TESTING

A laboratory testing program was performed on select soil samples from the drilling program to determine the relevant engineering properties of the subsurface materials. Diagnostic testing included moisture contents (ASTM D2216) on all soil samples and particle size (ASTM D422) and Atterberg limits (ASTM D4318) on select soil samples. The results of the laboratory testing are shown on the testhole logs (Appendix C) and on the laboratory reports (Appendix D). The test data for particle size and Atterberg limits are summarized in the following table.

Table 1 - Particle Size and Atterberg Limits Test Data

Testhole no.	Sample Depth (m)	Soil Type	Particle-Size Analysis				Atterberg Limits		
			Gravel (%) 75 to 4.75 mm	Sand (%) <4.75 to 0.075 mm	Silt (%) <0.075 to 0.005 mm	Clay (%) <0.005 mm	Liquid Limit	Plastic Limit	Plasticity Index
TH2	0.8	silt	0.2	17.0	57.7	25.1	27	17	10
TH2	3.0	clay	1.3	1.1	6.7	90.9	107	28	79

4.0 INVESTIGATION RESULTS

4.1 SOIL PROFILE

The typical soil stratigraphy on the project site, as interpreted from the testhole logs, consists of topsoil, silt and clay overlying silt till to the depths explored in the testholes. A description of the soil stratigraphy is provided below.

Topsoil – Topsoil was encountered at the surface of the testholes. The thickness of the topsoil was approximately 50 mm at the testhole locations.

Clay – Clay was encountered below the topsoil and extended to depths ranging from 5.5 m to 5.9 m in the testholes. The clay was brown to grey in color, soft to stiff in consistency, moist and of high plasticity. Water contents of the clay ranged from 28% to 61%.

Silt – Silt was encountered within the clay layer in Testholes TH2 and TH3. The silt layer was encountered at depths of 0.15 m and 0.6 m respectively in Testholes TH2 and TH3. The silt extended to a depth of 1.2 m in Testhole TH2 and to a depth of 1.1 m in Testhole TH3. The silt was tan in color, soft in consistency, moist, and of low plasticity. The silt was clayey with some sand. Water contents of the silt ranged from13% to 22%.

Silt Till – Silt till was encountered below the clay and extended to depths explored in the testholes. The silt till was tan in color, moist, compact and of medium plasticity. The silt till was clayey and contained varying amounts of gravel. Water contents of the silt till ranged from 12% to 26%.

4.2 GROUNDWATER AND SLOUGHING CONDITIONS

No groundwater seepage or soil sloughing was observed during or upon completion of drilling. It should be noted that only short-term seepage and sloughing conditions were observed and groundwater levels will normally fluctuate during the year and will be dependent on precipitation and surface drainage. Although groundwater seepage and soil sloughing were not observed during the field drilling program, groundwater seepage and soil sloughing should be expected from the silt layer during periods of heavy precipitation and snow melt.

5.0 Closure

This report has been prepared for the sole benefit of the City of Winnipeg and its agents, and may not be used by any third party without the express written consent of Stantec Consulting Ltd. Any use, which a third party makes of this report, is the responsibility of such third party. Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of the City of Winnipeg who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec Consulting Ltd. should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design or construction

We trust the above information meets with your present requirements. Should you have any questions or require further information, please contact us. This report has been prepared by Farouk Fourar Laidi, EIT and reviewed by Don Flatt, M.Eng., P.Eng.

Thank you for the opportunity to be of service to you.

Yours truly,

STANTEC CONSULTING LTD

Farouk Fourar Laidi, M.Sc., EIT
Geotechnical Engineering
Tel: (204) 928-8829
farouk.fourar@stantec.com

Don Flatt, M.Eng., P.Eng.
Senior Geotechnical Engineer
Tel: (204) 928-4001
don.flatt@stantec.com

APEGM
Certificate of Authorization
Stantec Consulting Ltd.
No. 1301

PROVINCE OF MANITOBA
D.G.
FLATT
Member
5062
REGISTERED PROFESSIONAL ENGINEER

APPENDIX A

Statement of General Conditions

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

APPENDIX B

Testhole Location Plan

Stantec	Project No. 123311133	Drawn by: FL	Figure: 1	**Testhole Location Plan** **Brookside Cemetery Water Main** **3001 Notre Dame Avenue** **Winnipeg, Manitoba**
	Date: April 23, 2014	Reviewed by: DF	Scale: NTS	

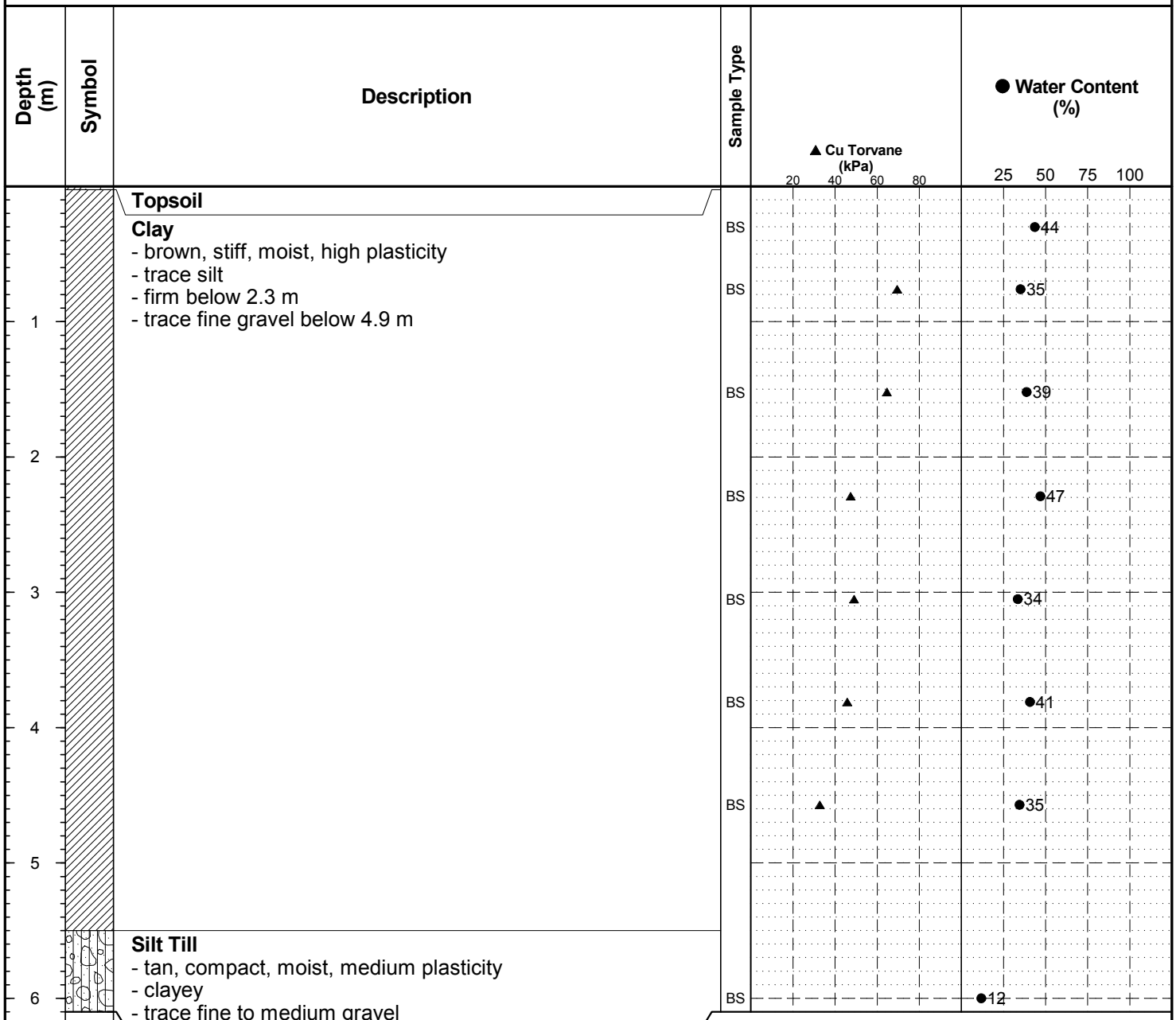
APPENDIX C

Testhole Logs

TESTHOLE TH1

Project Name: Brookside Cemetery Water Main
Project Location: 3001 Notre Dame Avenue,Winnipeg, Manitoba
Client: City of Winnipeg
Drilling Contractor: Maple Leaf Enterprises Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 627856.0 m E, 5530931.0 m N

Date Drilled: April 16, 2014
Depth of Testhole: 6.1 m
Logged by: Farouk Fourar Laidi
Reviewed by: German Leal

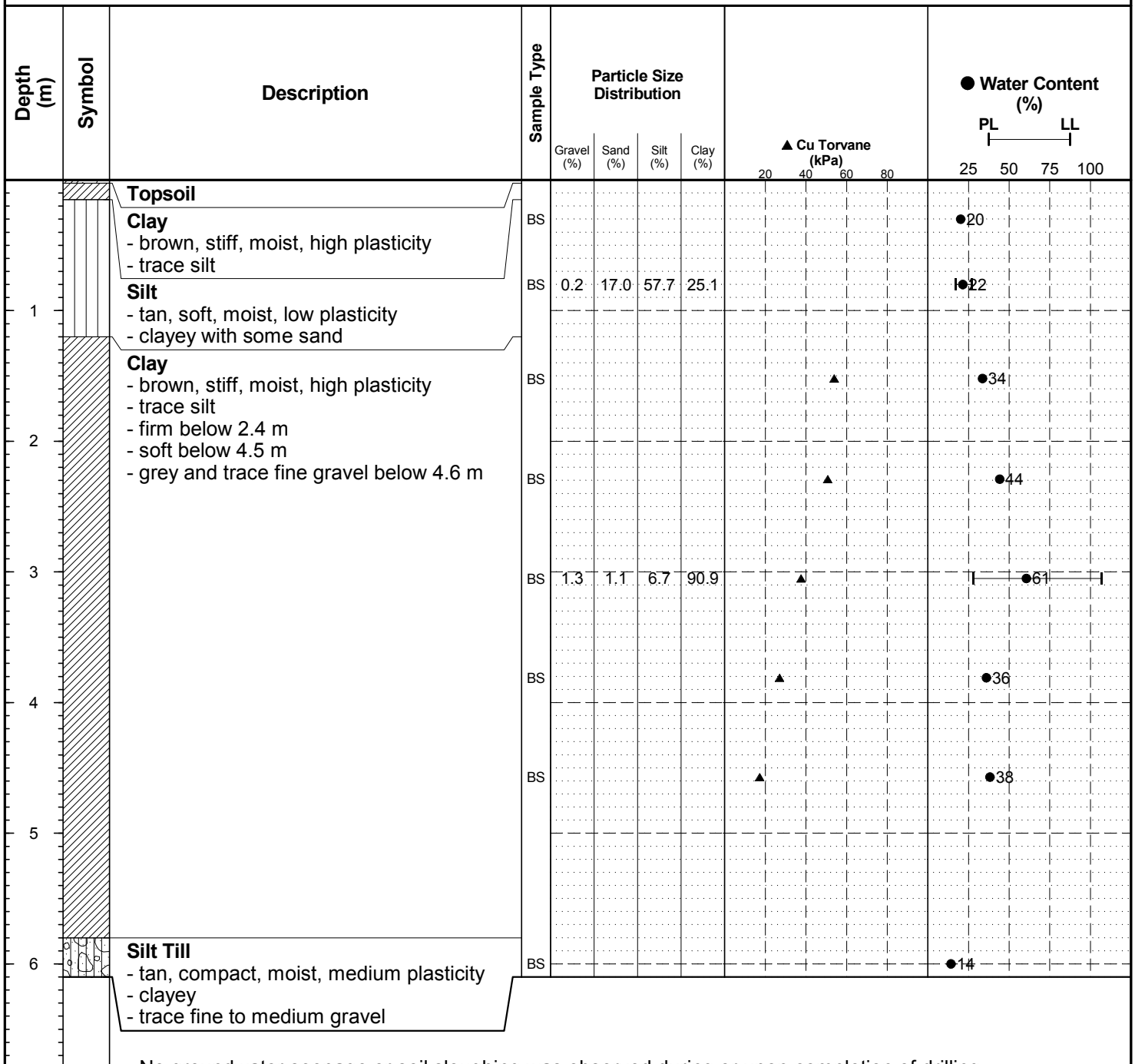


• No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
• Testhole terminated at a depth of 6.1 m.

TESTHOLE TH2

Project Name: Brookside Cemetery Water Main
Project Location: 3001 Notre Dame Avenue,Winnipeg, Manitoba
Client: City of Winnipeg
Drilling Contractor: Maple Leaf Enterprises Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 627829.0 m E, 5531089.0 m N

Date Drilled: April 16, 2014
Depth of Testhole: 6.1 m
Logged by: Farouk Fourar Laidi
Reviewed by: German Leal



- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- Testhole terminated at a depth of 6.1 m.

TESTHOLE TH3

Project Name: Brookside Cemetery Water Main
Project Location: 3001 Notre Dame Avenue,Winnipeg, Manitoba
Client: City of Winnipeg
Drilling Contractor: Maple Leaf Enterprises Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 627781.0 m E, 5531149.0 m N

Date Drilled: April 16, 2014
Depth of Testhole: 6.1 m
Logged by: Farouk Fourar Laidi
Reviewed by: German Leal

Depth (m)	Symbol	Description	Sample Type	▲ Cu Torvane (kPa) 20 40 60 80	● Water Content (%) 25 50 75 100
		Topsoil			
		Clay - black, firm, moist, high plasticity - trace to some organic materials - trace silt	BS		●53
1			BS		●13
		Silt - tan, soft, moist, low plasticity - clayey with some sand	BS	▲	●28
		Clay - brown, stiff, moist, high plasticity - trace silt - firm below 3.0 m - trace fine gravel below 4.6 m	BS	▲	●46
3			BS	▲	●49
			BS	▲	●38
4			BS	▲	●29
5					
6		**Silt Till** - tan, compact, moist, medium plasticity - clayey - trace fine to medium gravel	BS		●26
7					

• No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
• Testhole terminated at a depth of 6.1 m.

APPENDIX D

Laboratory Test Reports

LABORATORY
199 Henlow Bay
Winnipeg MB, R3Y 1G4
Tel: (204) 488-6999

PARTICLE SIZE ANALYSIS
ASTM D422

City of Winnipeg
Cemeteries Branch
3001 Notre Dame Avenue
Winnipeg, MB, R3H 1B8

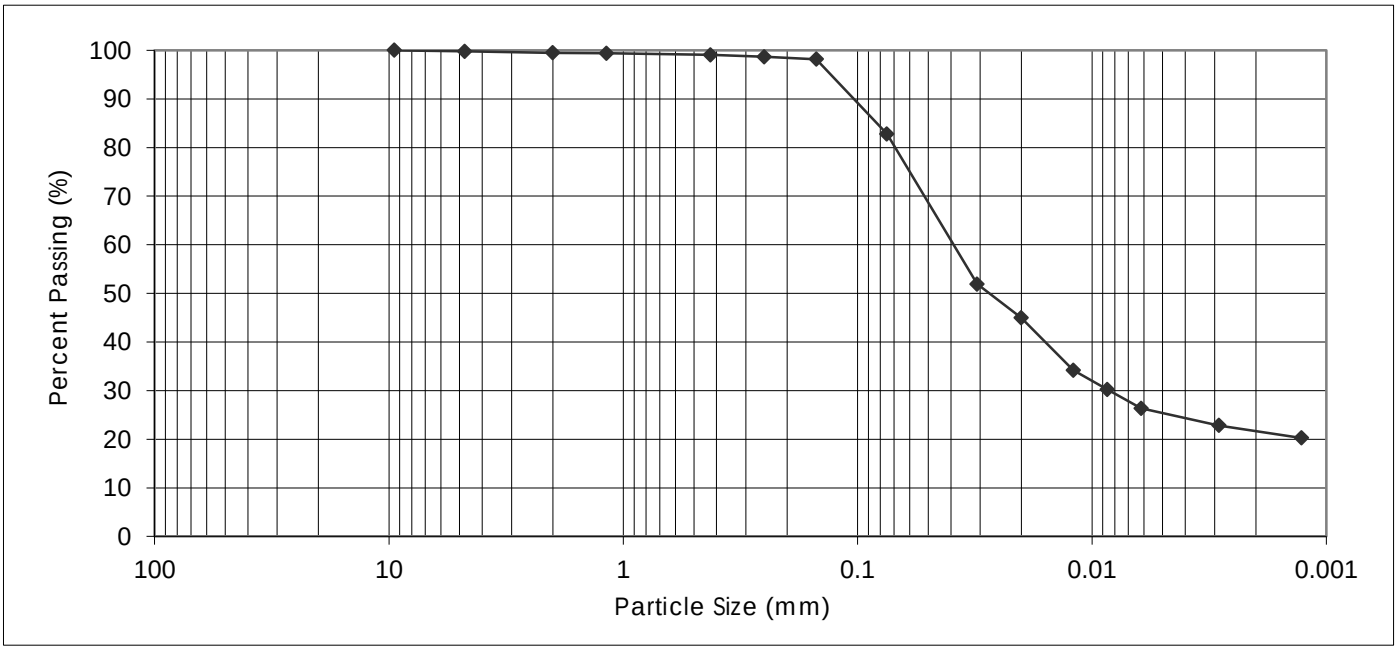
PROJECT: Brookside Cemetery
Water Main

Attention: Jane Saxby

PROJECT NO.: 123311133

SAMPLED BY: Farouk Fourar Laidi
SAMPLE ID: TH2 at 0.8 m

DATE RECEIVED: April 16, 2014
TESTED BY: Nestor Abarca



PARTICLE SIZE	PERCENT PASSING
37.50 mm	100.0
25.00 mm	100.0
19.00 mm	100.0
16.00 mm	100.0
12.50 mm	100.0
9.50 mm	100.0
4.75 mm	99.8
2.00 mm	99.5

PARTICLE SIZE	PERCENT PASSING
1.18 mm	99.4
0.425 mm	99.1
0.250 mm	98.7
0.150 mm	98.2
0.075 mm	82.8
0.005 mm	25.1
0.002 mm	21.4
0.001 mm	NT*

Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.005 mm	Clay, % <0.005 mm	Colloids, % < 0.001 mm
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm			
0.2	0.3	0.4	16.3	57.7	25.1	NT*

NT* Sample not tested for colloids

April 24, 2014

REVIEWED BY: Farouk Fourar Laidi, M.Sc., EIT

LABORATORY
199 Henlow Bay
Winnipeg MB, R3Y 1G4
Tel: (204) 488-6999

PARTICLE SIZE ANALYSIS
ASTM D422

City of Winnipeg
Cemeteries Branch
3001 Notre Dame Avenue
Winnipeg, MB, R3H 1B8

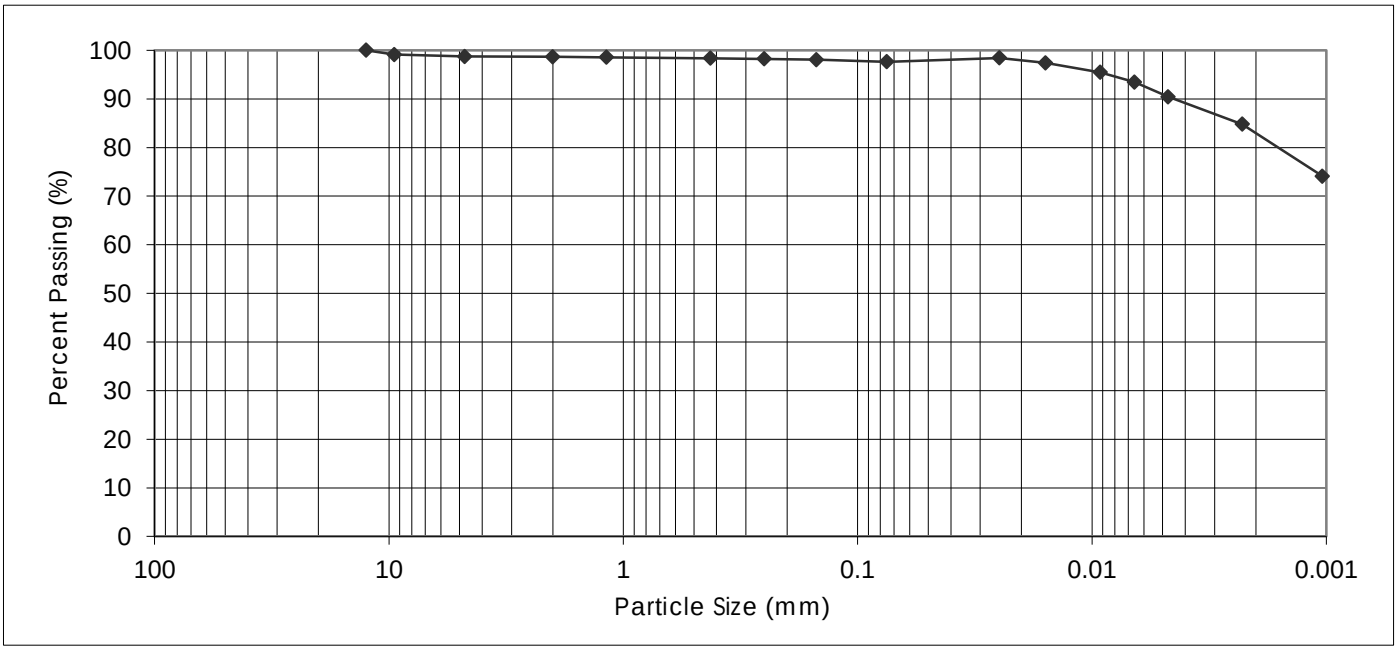
PROJECT: Brookside Cemetery
Water Main

Attention: Jane Saxby

PROJECT NO.: 123311133

SAMPLED BY: Farouk Fourar Laidi
SAMPLE ID: TH2 at 3.0 m

DATE RECEIVED: April 16, 2014
TESTED BY: Nestor Abarca



PARTICLE SIZE	PERCENT PASSING
37.50 mm	100.0
25.00 mm	100.0
19.00 mm	100.0
16.00 mm	100.0
12.50 mm	100.0
9.50 mm	99.1
4.75 mm	98.7
2.00 mm	98.6

PARTICLE SIZE	PERCENT PASSING
1.18 mm	98.6
0.425 mm	98.4
0.250 mm	98.2
0.150 mm	98.1
0.075 mm	97.6
0.005 mm	90.9
0.002 mm	82.3
0.001 mm	NT*

Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.005 mm	Clay, % <0.005 mm	Colloids, % < 0.001 mm
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm			
1.3	0.1	0.2	0.8	6.7	90.9	NT*

NT* Sample not tested for colloids

April 24, 2014

REVIEWED BY: Farouk Fourar Laidi, M.Sc., EIT