

# **APPENDIX 'A'**

# **GEOTECHNICAL REPORT**

November 25, 2022

KGS Group  
865 Waverley Street  
Winnipeg, Manitoba R3T 5P4

Attention: Mr. Craig Rowbotham, P.Eng.  
Municipal Assistant Department Head

**Re: 2023 City of Winnipeg Local Street Renewal Program  
Report of Geotechnical Investigation and Test Results**

Dear Mr. Rowbotham

This letter summarizes KGS Group’s geotechnical results for the 2023 City of Winnipeg (COW) Street Renewal Program in Winnipeg, Manitoba. KGS Group’s scope of services for this project was outlined in our proposal no. 22-000-1495 titled “2023 COW Local Street Renewal Program – Geotechnical Services” dated September 21, 2022.

KGS Group was retained to complete pavement and subsurface investigations for approximately 3.8 km of local streets across twelve sites included in the 2023 project scope. Of the twelve sites, 10 were identified as minor / major rehabilitation, one (1) as asphalt concrete rehabilitation, and one (1) as reconstruction. Pavement investigations were completed for all twelve sites, with additional subsurface drilling investigations completed for the site classified as reconstruction. This report details the results of the geotechnical investigation activities.

## **1.0 GEOTECHNICAL INVESTIGATIONS**

Coring and subsequent identification of subgrade materials was conducted at each of the twelve sites, with additional drilling and soil sampling completed at Manahan Avenue (Site 12) which is identified as reconstruction. The required scope of the investigation for each site, such as, the need for additional subsurface investigations, number of test holes, and test hole locations, were determined in accordance with the City of Winnipeg Appendix B – COW Site Investigation Requirements. Test hole locations for each site are shown in attached Figures 1 through 12, and Table 1 provides location descriptions and approximate coordinates.

## 1.1 Coring and Sampling

Pavement coring was completed at each of twelve sites using a surface mounted coring machine fitted with a 150 mm diameter core barrel. Upon completion of coring, KGS measured the base thickness via hand excavation / auguring and visually classified the material as granular or crushed limestone. Each test location was then backfilled to the base of pavement material with excavated fill and patched to surface with cold mix asphalt. Individual cores were placed in pre-labeled bags and were retained for photographs.

Table 2 attached summarizes coring results in detail. Individual core photos can be found in Appendix A.

## 1.2 Drilling and Sampling

Drilling and sampling were completed following coring activities along Manahan Avenue (Site 12) as it was classified as a reconstruction project as per the City of Winnipeg RFP 74-2022 Appendix B – Project Locations and Technical Scoping. Three (3) test holes were advanced using a 50 mm hand auger to a depth of 2.3 m (7.5 ft) below ground surface, with soil samples collected every 0.3 m (1 ft). A bulk composite soil sample composed of sandy clay and clay was also collected from the upper 1.5 m (5 ft) of each test hole for Proctor and California Bearing Ratio (CBR) testing. No water was observed during or after drilling activities, and all test holes remained open to the full depth of exploration. Test holes were then backfilled with auger cuttings to base of pavement and with cold mix asphalt to surface.

Test holes logs for Manahan Avenue (Site 12) are attached in Appendix B.

## 1.3 Laboratory Testing

Laboratory tests were completed on select soil samples from Manahan Avenue (Site 12). Testing was completed in a Winnipeg, Manitoba laboratory certified by the Canadian Council of Independent Laboratories (CCiL). Lab testing included 21 moisture contents, five (5) Atterberg Limits, five (5) particle size analysis, one (1) moisture-density relationship (standard Proctor) test, and one (1) California Bearing Ratio (CBR) test.

Laboratory test results are summarized in Appendix C.

# 2.0 INVESTIGATION RESULTS

## 2.1 Pavement Structure and Stratigraphy

Table 2 attached provides a summary of the coring and test hole results. Site specific summaries are presented in the following sections.

### **MONTROSE STREET (SITE 9)**

Four (4) cores were completed along Montrose Street; two (2) at joint locations (TH22-02 and TH22-04), and two (2) mid-slab (TH22-01 and TH22-03). The pavement surfacing consisted of concrete with a thickness of 159 to 203 mm (6.25 to 8 in.). Base material was only encountered in TH22-02 and consisted of 51 mm (2 in.) thick crushed limestone. Clay subgrade was encountered directly below pavement in the remaining test holes. Core hole locations are shown in Figure 1 attached.

### **SCOTLAND AVENUE (SITE 10)**

Five (5) cores were completed along Scotland Avenue; three (3) at joint locations (TH22-06, TH22-07 and TH22-09), and two (2) mid-slab (TH22-05 and TH22-08). Pavement surfacing consisted of concrete with a thickness of 171 to 222 mm (6.75 to 8.75 in.). Base material consisted of crushed limestone 25 mm (1 in.) thick in TH22-09, and granular 38 to 51 mm (1.5 to 2 in.) thick in TH22-07 and TH22-05. Clay subgrade was encountered directly below pavement in TH22-06 and TH22-08. Core hole locations are shown in Figure 2 attached.

### **RENFREW STREET (SITE 8)**

Four (4) cores were completed along Renfrew Street; two (2) at joint locations (TH22-11 and TH22-13), and two (2) mid-slab (TH22-10 and TH22-12). The pavement surfacing consisted of concrete ranging in thickness from 152 to 178 mm (6 to 7 in.). Base material consisted of crushed limestone 51 to 76 mm (2 to 3 in.) thick in TH22-10 and TH22-11, and granular 38 mm (1.5 in.) thick in TH22-13. Clay subgrade was encountered directly below pavement in TH22-12. Core hole locations are shown in Figure 3 attached.

### **LUMSDEN AVENUE (SITE 3)**

Four (4) cores were completed along Lumsden Avenue; two (2) at joint locations (TH22-15 and TH22-17), and two (2) mid-slab (TH22-14 and TH22-16). The pavement surfacing consisted of asphalt over concrete material. The asphalt and concrete were 38 to 48 mm (1.5 to 1.9 in.) and 184 to 222 mm (7.25 to 8.75 in.) in thickness respectively. Granular base material ranged in thickness from 38 to 137 mm (1.5 to 5.4 in.). Core locations are shown on Figure 4 attached.

### **FAIRLANE AVENUE (SITE 2)**

Three (3) cores were completed along Fairlane Avenue; two (2) at joint locations (TH22-18 and TH22-20), and one (1) mid-slab (TH22-19). The pavement surfacing consisted of concrete material ranging in thickness from 152 to 159 mm (6 to 6.75 in). Base material consisted of limestone crush over granular and varied in thickness from 159 to 216 mm (6.25 to 8.5 in). Core locations are shown on Figure 5 attached.

### **CARLYLE BAY (SITE 4)**

Four (4) cores were completed along Carlyle Bay; two (2) at joint locations (TH22-21 and TH22-23), and two (2) mid-slab (TH22-22 and TH22-24). The pavement surfacing consisted of concrete material with a thickness between 156 to 203 mm (6.13 to 8 in). Base material consisted of crushed limestone and ranged in thickness from 73 to 197 mm (2.9 to 7.75 in). Core locations are shown in Figure 6 attached.

### **COLLEGIATE STREET (SITE 5)**

Four (4) cores were completed along Collegiate Street; two (2) at joint locations (TH22-26 and TH22-28), and two (2) mid-slab (TH22-25 and TH22-27). The pavement surfacing consisted of concrete 143 to 159 mm (5.6 to 6.25 in) in thickness. Granular base material was encountered below pavement in TH22-25 and was 25 mm (1 in) thick. Clay subgrade was observed directly under pavement in TH22-26, TH22-27, and TH22-28. Core locations are shown in Figure 7 attached.

### **EXMOUTH BOULEVARD (SITE 7)**

Three (3) cores were completed along Exmouth Boulevard; two (2) at mid-slab locations (TH22-29 and TH22-31), and one (1) on-joint (TH22-30). The pavement surfacing consisted of 152 to 159 mm (6 to 6.25 in) of concrete underlain by 29 to 324 mm (1.13 to 12.75 in.) of granular base. Coring hole locations are shown in Figure 8 attached.

### **HOLDSWORTH AVENUE (SITE 6)**

Three (3) cores were completed along Holdsworth Avenue; two (2) at mid-slab locations (TH22-32 and TH22-34), and one (1) on-joint (TH22-33). Pavement surfacing consisted of 127 to 140 mm (5 to 5.5 in) thick concrete at TH22-33 and TH22-34, and asphalt 44 mm (1.75 in.) thick over 146 mm (5.75 in.) of concrete at TH22-32. Underlying base material consisted of crushed limestone with sand which ranged in thickness from 76 to 127 mm (3 to 5 in) in TH22-32 and TH22-34. Thickness of base material in TH22-33 could not be determined due to hand excavation refusal at 495 mm (19.5 in) on a suspected cobble. Core locations are shown in Figure 9 attached.

### **SINNOTT STREET (SITE 1)**

Three (3) cores were completed along Sinnott Street; two (2) at joint locations (TH22-35 and TH22-37), and one (1) mid-slab (TH22-36). The pavement surfacing consisted concrete with a thickness from 178 to 191 mm (7 to 7.5 in). Granular base material 76 mm (3 in) in thickness was encountered directly below pavement in TH22-35 and TH22-36. Clay subgrade was encountered immediately below pavement in TH22-37. Core locations are shown on the attached Figure 10.

### **BEAUMONT STREET (SITE 11)**

Three (3) cores were completed along Beaumont Street at mid-slab locations (TH22-38 to TH22-40). The pavement surfacing consisted of asphalt material 114 to 241 mm (4.5 to 9.5 in) thick, with two (2) distinct pavement layers encountered at TH22-38. Base material ranged in thickness from 254 to 343 mm (10 to 13.5 in.) and consisted of granular over sand in TH22-38 and TH22-39, and granular in TH22-40. Core locations are shown in Figure 11 attached.

### **MANAHAN AVENUE (SITE 12)**

Three (3) test holes were advance along Manahan Avenue to a depth of 2.3 m (7.5 ft) below pavement surface using a 50 mm hand auger. Two (2) test holes were completed at joint locations (TH22-41 and TH22-42), and one

(1) was completed mid-slab (TH22-43). The general stratigraphy encountered in the test holes was interpreted by KGS Group to consist of asphalt over granular base material, a sandy clay layer, and an underlying high plasticity clay containing an embedded silt layer. Further description of each layer is provided below and the test hole logs are provided in Appendix B. Test hole locations are shown in attached Figure 12.

**Asphalt** – Pavement surfacing consisted of asphalt material 89 to 128 mm (3.5 to 5 in) in thick, with two (2) distinct layers encountered at both TH22-41 and TH22-42. Individual asphalt layers at TH22-41 and TH22-42 were 38 and 51 mm (1.5 and 2 in), and 64 and 64 mm (2.5 and 2.5 in) thick respectively.

**Fill** – Granular base material was encountered directly below asphalt in all test holes and was between 152 and 191 mm (6 to 7.5 in.) thick. The fill material was grey to light brown in colour, damp, compact, frozen, and contained coarse gravel, fine to coarse sand, and some silt. The maximum aggregate size observed was between 30 and 40 mm.

**Sandy Clay (CL-CH)** – Sandy clay was observed directly below fill material in all test holes and ranged in thickness from 280 to 330 mm (11 to 13 in). The sandy clay was black to dark grey in colour, dry to damp, firm, and contained silt, fine to medium sand, and trace coarse gravel. Trace silt inclusions and trace organics were noted throughout the sandy clay.

Two (2) Atterberg limit tests were completed for clay samples collected at a depth of 0.3 m (1 ft) in TH22-41 and TH22-42. Results indicated a liquid limit of 60 and plasticity index of 28 in TH22-41, and a liquid limit of 48 and plasticity index of 19 in TH22-42, classifying the material as a high plasticity clay in TH22-41, and a low plasticity clay in TH22-42. Grain size analysis tests completed on the same samples indicated 0 % gravel, 31 to 32% sand, 45 to 47% silt, and 25 to 23% clay. Moisture contents ranged from 25 to 29%.

**Clay (CH)** - Clay was encountered below the sandy clay and extended the full exploration depth of 2.3 m (7.5 ft). The clay was generally dark grey to brown in colour, damp, and contained silt, trace fine to medium sand, and trace organics.

Undrained shear strengths for the clay were estimated during drilling using a handheld Torvane and ranged from 79 to > 100 kPa classifying the clay as stiff to very stiff in consistency. Two (2) Atterberg limit tests were completed on clay soil samples from depths of 0.6 and 0.9 m (2 and 3 ft) in TH22-41 and TH22-42. Results indicated liquid limit values of 80 and 83, and plasticity index value of 54 to 58, classifying the material as high plasticity clay. Grain size analysis tests completed on the same samples indicated 0 to 1% gravel, 2 to 3% sand, 28 to 29% silt, and 68 to 70% clay. Moisture contents ranged from 28 to 51% and generally increased with depth.

**Silt (MH)** - High plasticity silt was observed embedded within the clay layer at depths between 1.4 and 2 m (4.5 and 6.8 ft) below grade surface with a thickness of 100 to 457 mm (4 to 18 in). The silt layer was generally light grey to brown in colour, damp to moist, loose to compact, and contained clay.

**Additional Laboratory Testing** - A moisture-density relationship test (standard Proctor) and a California Bearing Ratio (CBR) test were completed on a composite sample consisting of sandy clay and clay collected from the upper 1.5 m (5 ft) below base of fill material in all test holes. Results indicated a maximum dry density of 1500 kg/m<sup>3</sup>, an optimum moisture content of 24.5%, and a CBR of 3.6 at 2.54 mm penetration. Atterberg limit and

grain size analysis testing completed on the same composite sample classified the material as a high plasticity clay with a liquid limit of 84 and plasticity index of 59 containing 0% gravel, 4% sand, 24% silt, and 72% clay. The laboratory Proctor and CBR-value test reports are attached in Appendix C.

### 3.0 CLOSURE

Should you have any questions regarding the enclosed information or require additional information, please contact the undersigned.

Prepared By:



Ian Deniset, M.Sc., P.Geo.  
Geoscientist

Approved By:



Trevor Schellenberg, P.Eng.  
Geotechnical Engineer

ID/TS/cs  
Attached

## STATEMENT OF LIMITATIONS AND CONDITIONS

### Limitations

This report has been prepared for KGS Group in accordance with the agreement between KGS Group's Geotechnical and Municipal departments (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 KGS Group. 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.



# FIGURES

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Test Hole Location Plans

**FIGURE 1: Test Hole Locations for Site 9 - Montrose Street**

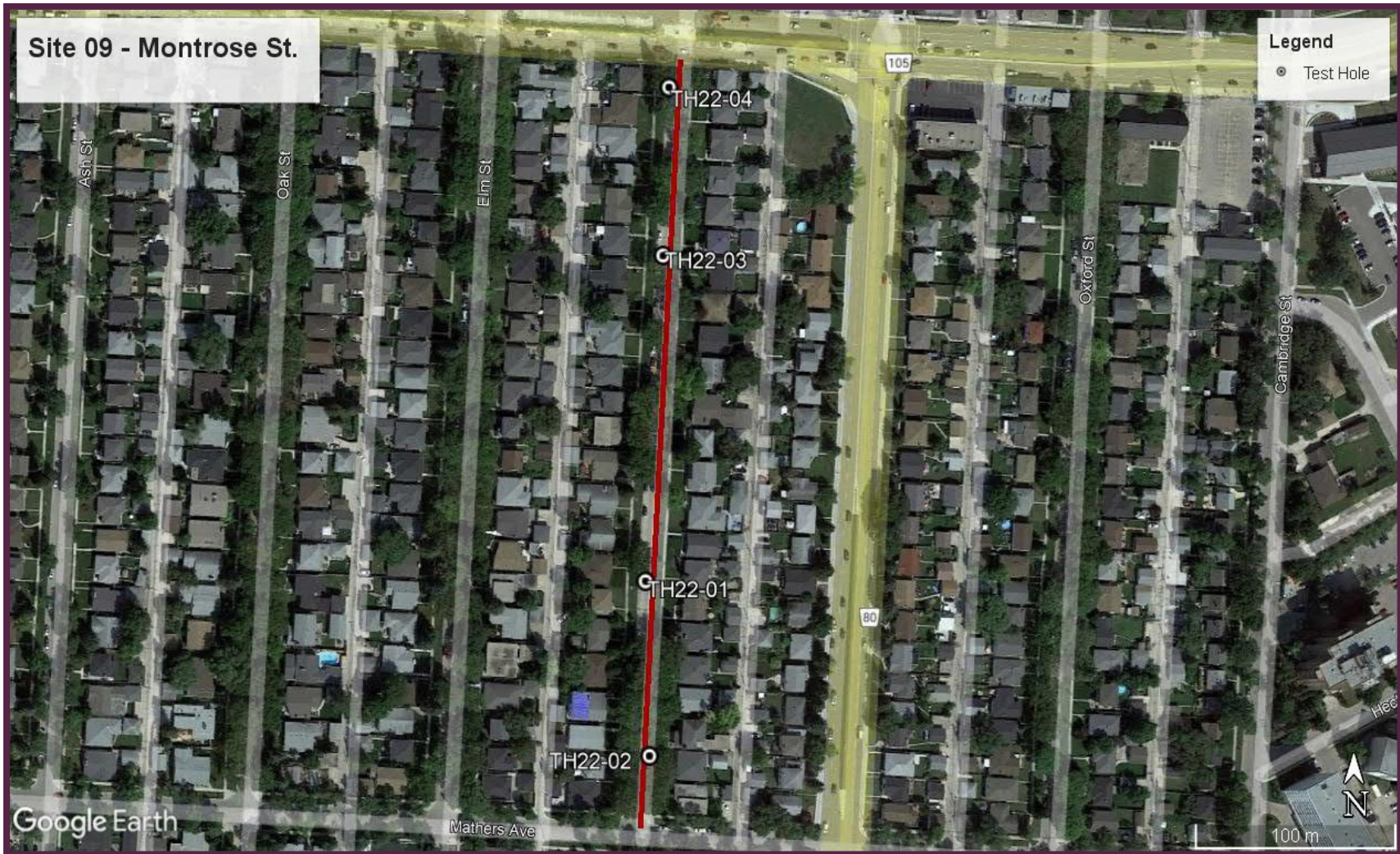


FIGURE 2: Test Hole Locations for Site 10 - Scotland Avenue

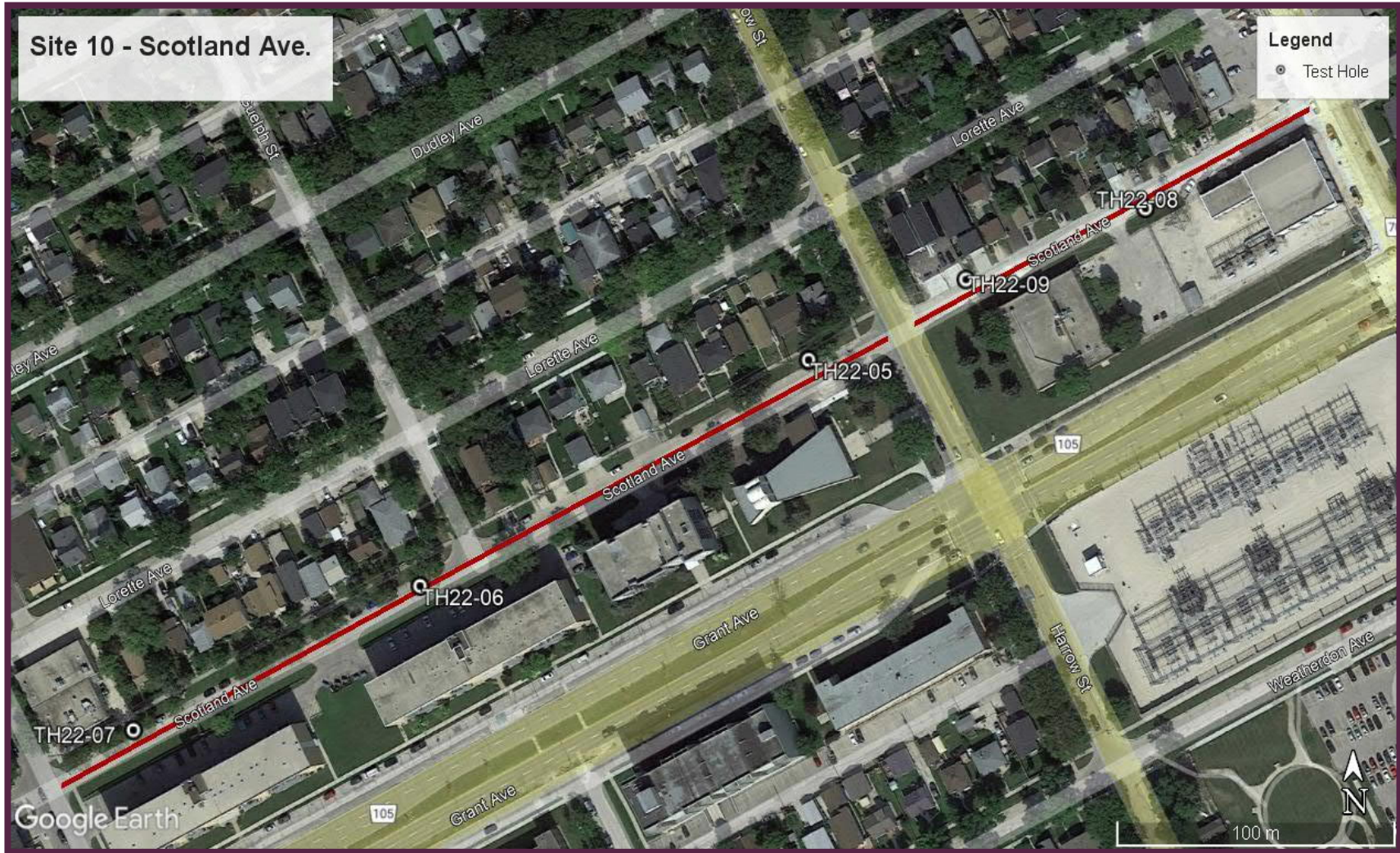


FIGURE 3: Test Hole Locations for Site 8 - Renfrew Street

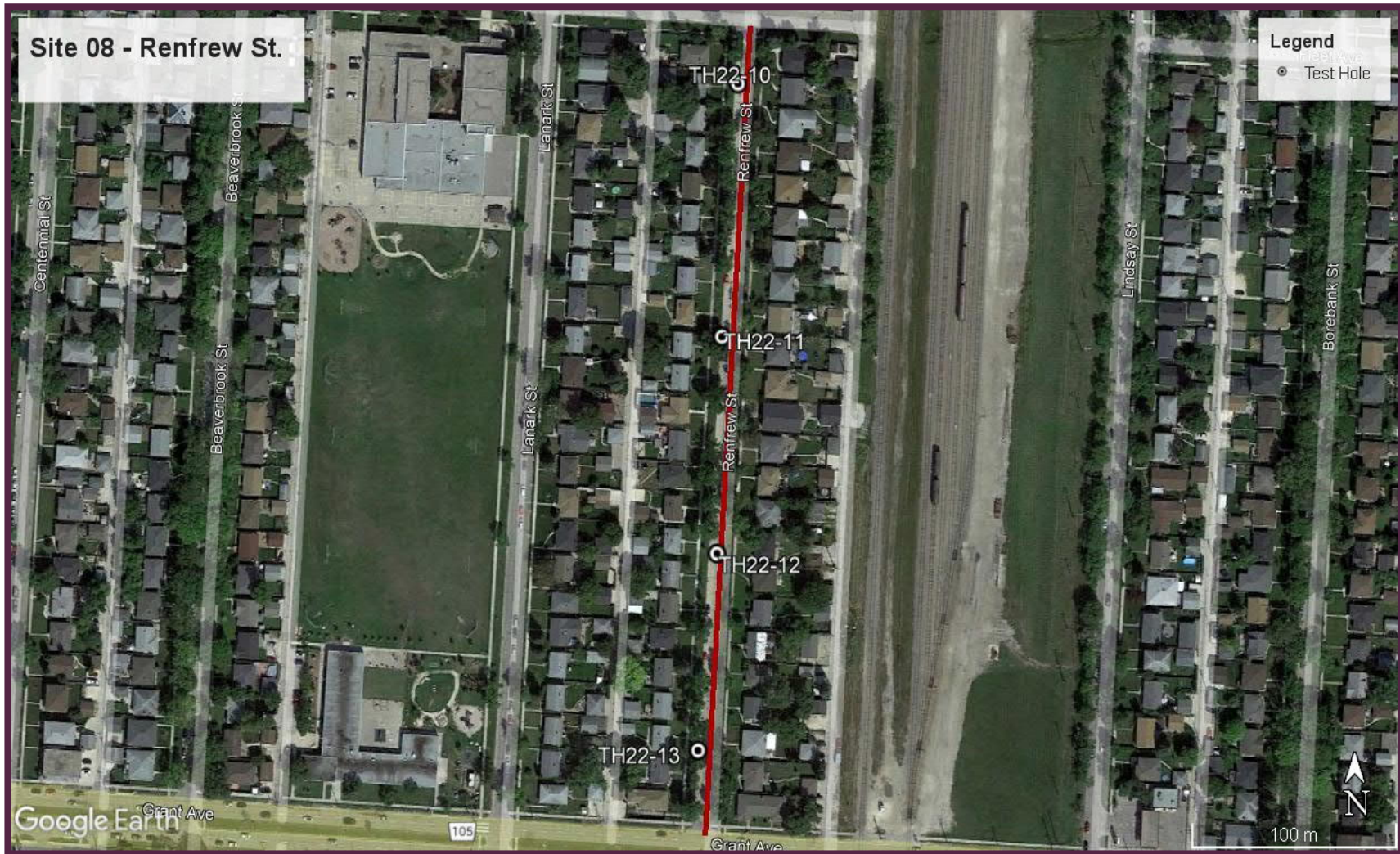


FIGURE 4: Test Hole Locations for Site 3 - Lumsden Avenue

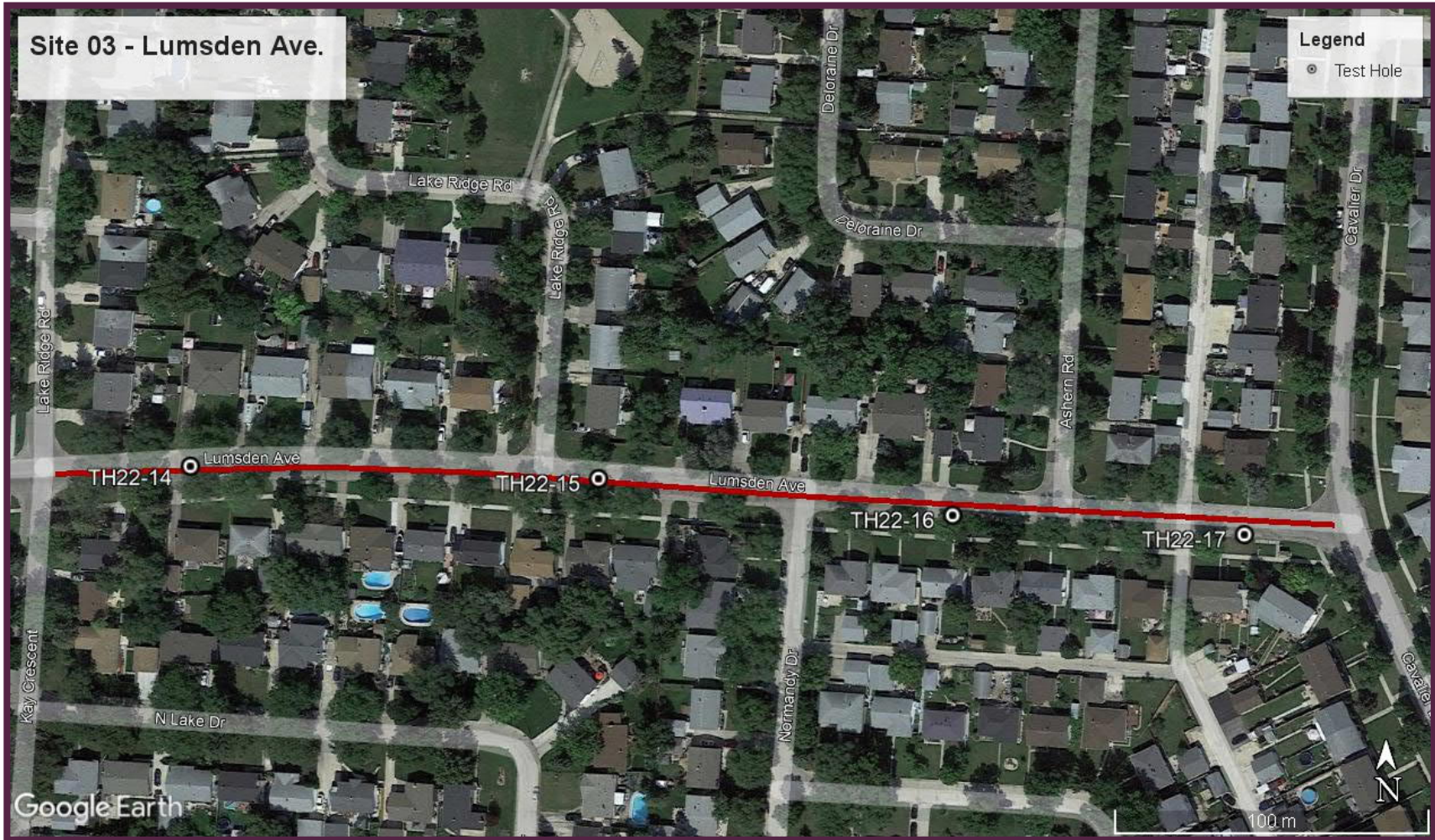


FIGURE 5: Test Hole Locations for Site 2 - Fairlane Avenue

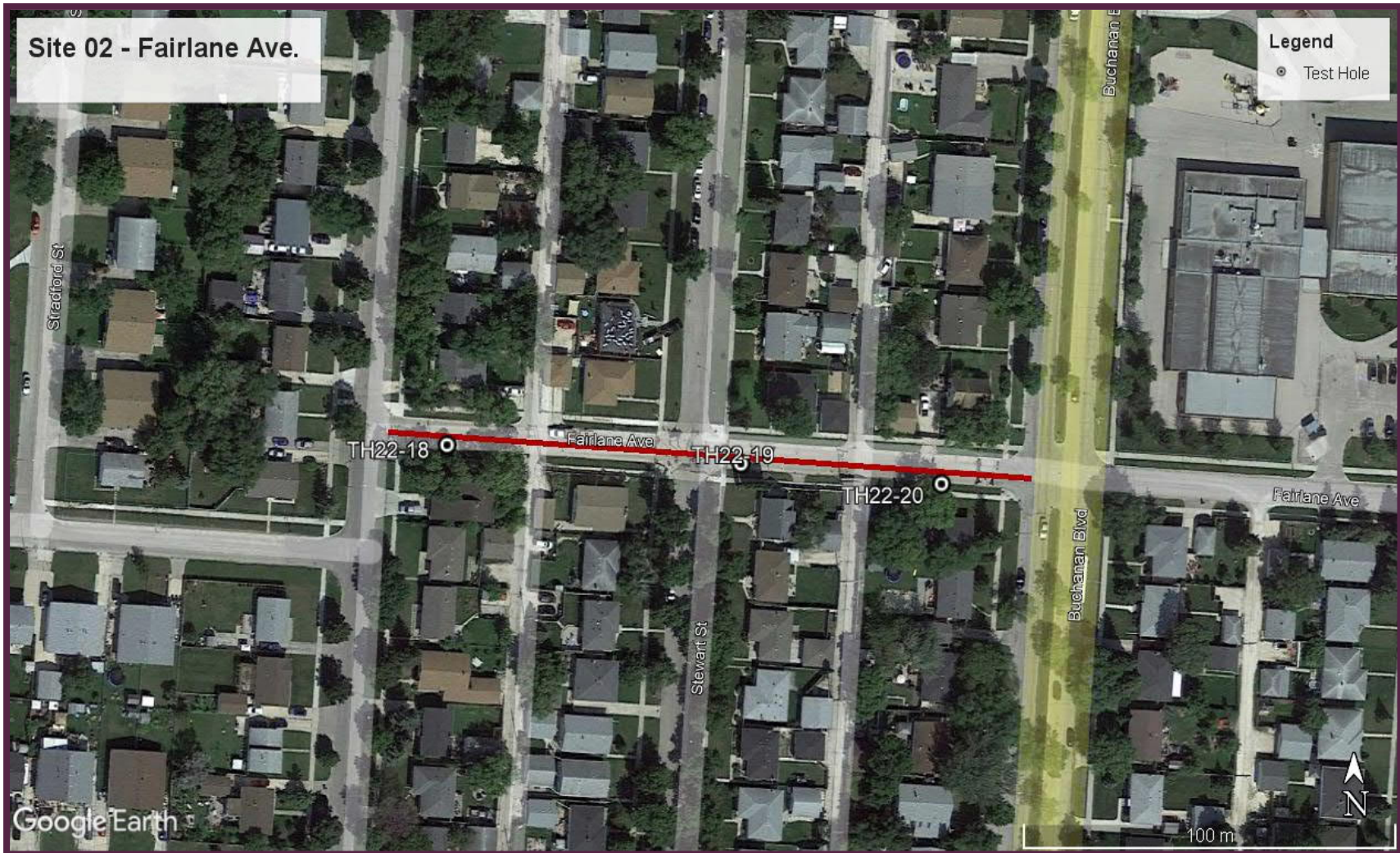


FIGURE 6: Test Hole Locations for Site 4 - Carlyle Bay

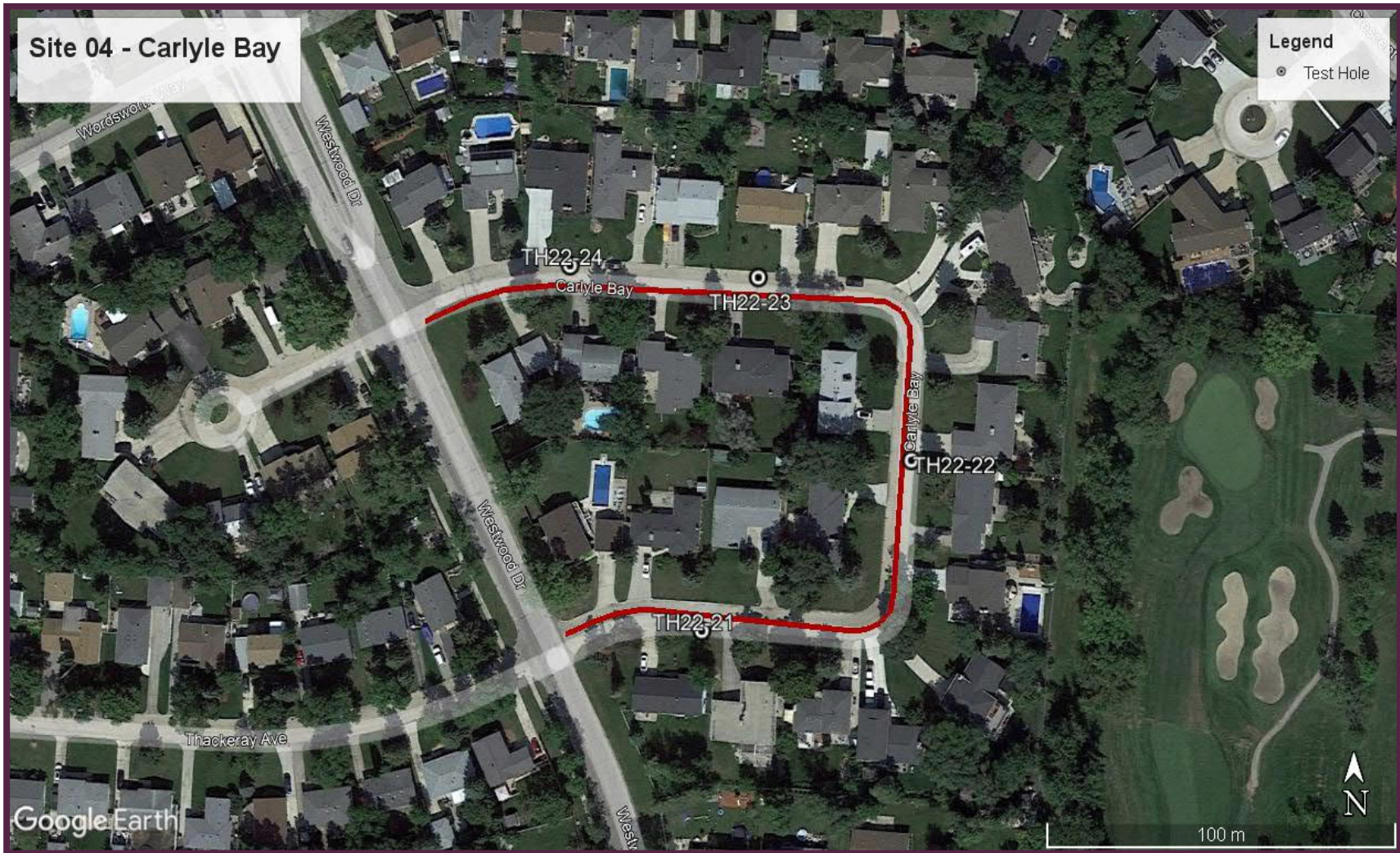


FIGURE 7: Test Hole Locations for Site 5 - Collegiate Street





FIGURE 8: Test Hole Locations for Site 7 - Exmouth Boulevard

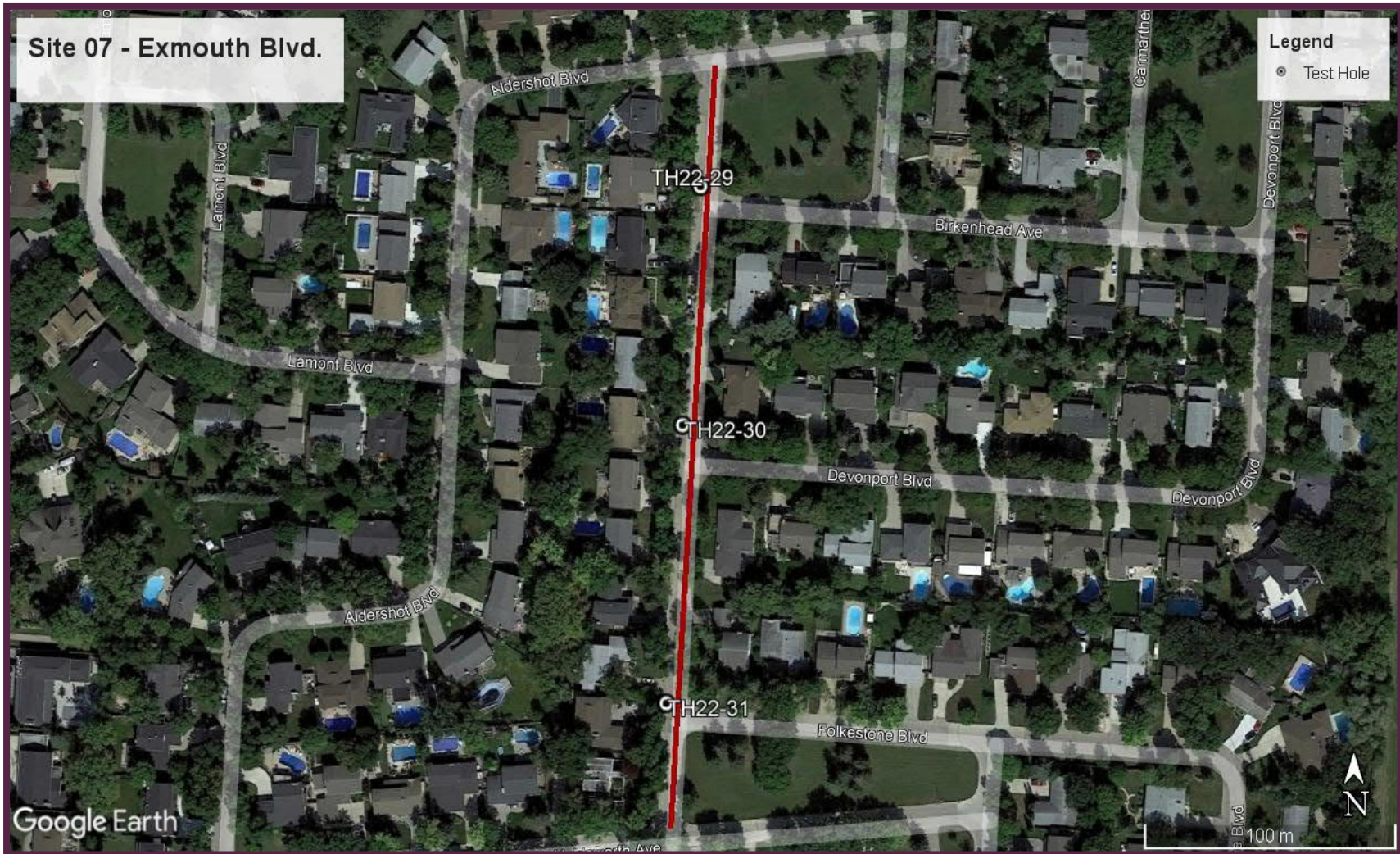


FIGURE 9: Test Hole Locations for Site 6 - Holdsworth Avenue



FIGURE 10: Test Hole Locations for Site 1 - Sinnott Street

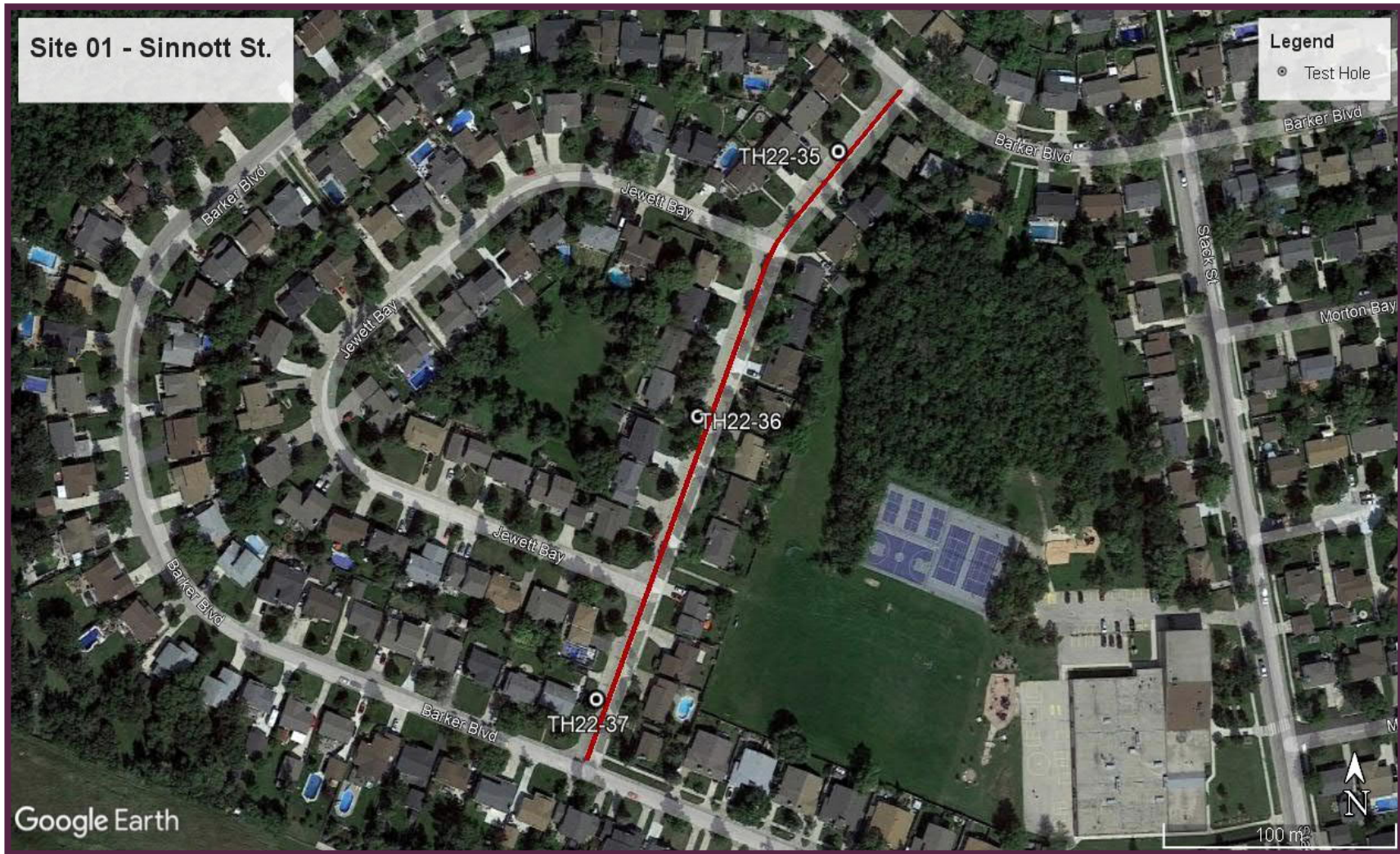


FIGURE 11: Test Hole Locations for Site 11 - Beaumont Street

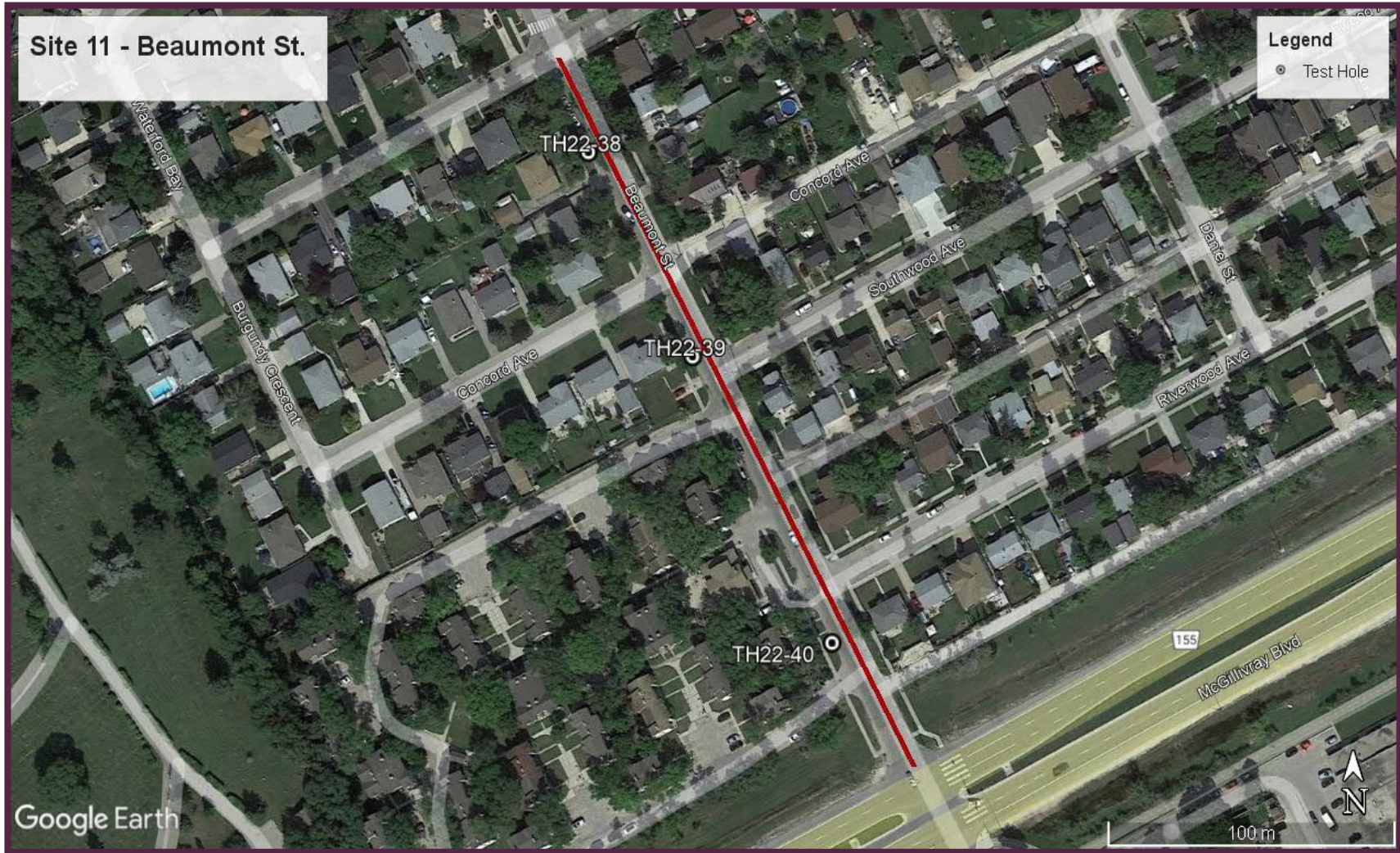
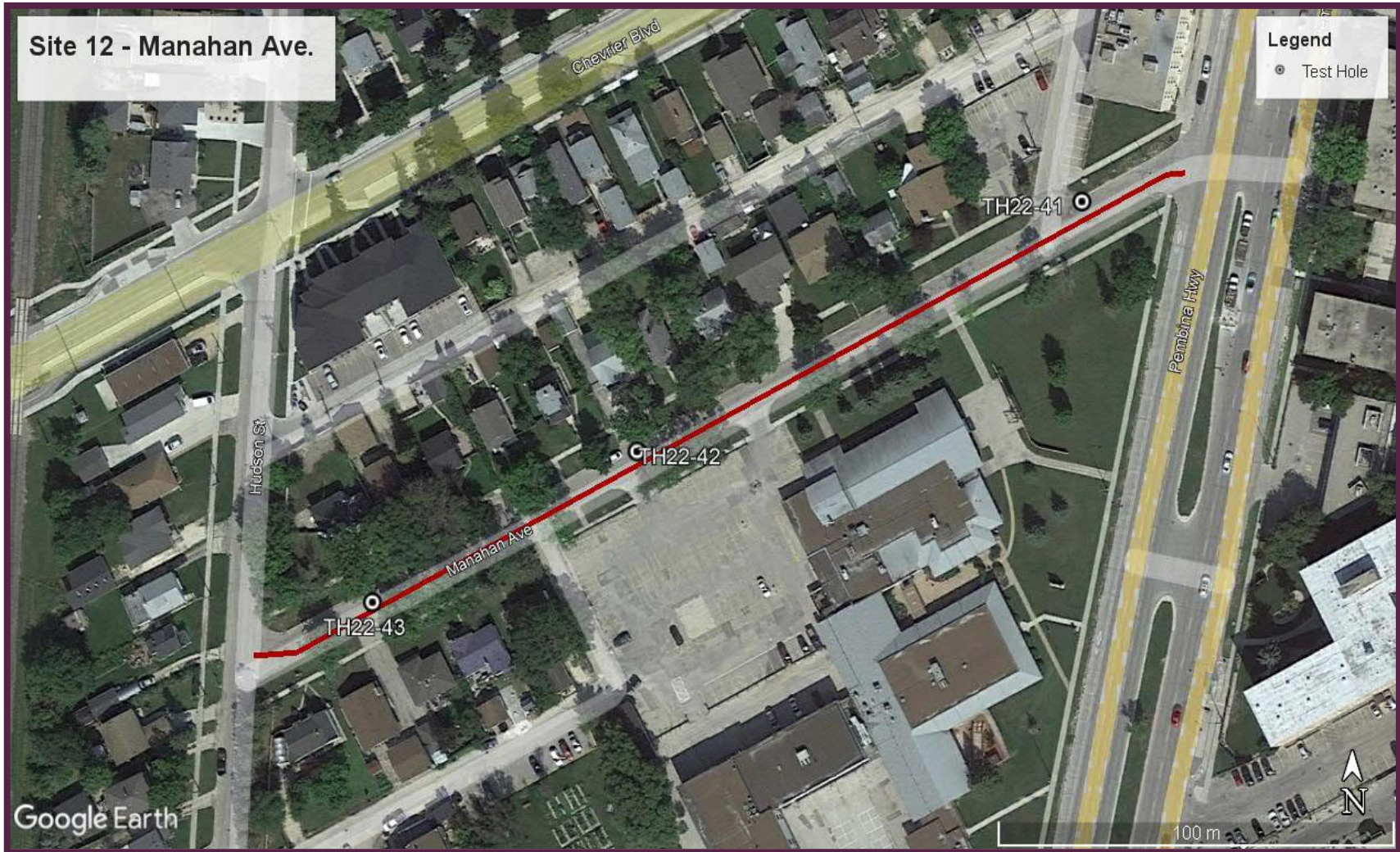


FIGURE 12: Test Hole Locations for Site 12 - Manahan Avenue



# **TABLES**

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Location Descriptions and Coordinates  
Summary of Core Results

Table 01: Test Hole Locations

Site Number	Location	Test Hole ID	Location Description	UTM Coordinates	
				Northing [m]	Easting [m]
9	Montrose Street	TH22-01	805 Montrose St.; 120 meters N of Mathers Ave.	5523972	630822
		TH22-02	825 Montrose St.; 37 meters N of Mathers Ave.	5523889	630826
		TH22-03	749 Montrose St.; 100 meters S of Grant Ave.	5524127	630827
		TH22-04	729 Montrose St.; 21 meters S of Grant Ave.	5524207	630828
10	Scotland Avenue	TH22-05	959 Scotland Ave.; 32 meters W of Harrow St.	5524902	632263
		TH22-06	1007 Scotland Ave.; 22 meters W of Guelph St.	5524821	632125
		TH22-07	1045 Scotland Ave.; 32 meters E of Wilton St.	5524769	632023
		TH22-08	926 Scotland Ave.; 68 meters W of Stafford St.	5524957	632383
		TH22-09	944 Scotland Ave.; 28 meters E of Harrow St.	5524931	632319
8	Renfrew Street	TH22-10	619 Renfrew St.; 30 meters S of John Brebeuf Pl.	5524636	629591
		TH22-11	647 Renfrew St.; 150 meters S of John Brebeuf Pl.	5524518	629586
		TH22-12	675 Renfrew St.; 143 meters N of Grant Ave.	5524417	629586
		TH22-13	699 Renfrew St.; 40 meters N of Grante Ave.	5524325	629579
3	Lumsden Avenue	TH22-14	94 Lumsden Ave.; 46 meters E of Kay Crs.	5528440	621506
		TH22-15	58 Lumsden Ave.; 17 meters E of Lake Ridge Rd.	5528439	621636
		TH22-16	32 Lumsden Ave.; 35 meters W of Ashern Rd.	5528430	621749
		TH22-17	10 Lumsden Ave.; 32 meters W of Cavalier Dr.	5528426	621842
2	Fairlane Avenue	TH22-18	Fairlane Ave.; 18 meters W of Isbister St.	5527407	620785
		TH22-19	Fairlane Ave.; 8 meters W of Stewart St.	5527404	620864
		TH22-20	Fairlane Ave.; 23 meters E of Buchanan Blvd.	5527400	620918
4	Carlyle Bay	TH22-21	43 Carlyle Bay; 40 meters W of Westwood Dr.	5525609	622804
		TH22-22	31 Carlyle Bay; 140 meters W of Westwood Dr.	5525657	622863
		TH22-23	19 Carlyle Bay; 102 meters W of Westwood Dr.	5525706	622818
		TH22-24	13 Carlyle Bay; 46 meters W of Westwood Dr.	5525708	622764
5	Collegiate Street	TH22-25	528 Collegiate St.; 42 meters S of St. Matthews Ave.	5527993	628093
		TH22-26	504 Collegiate St.; 120 meters S of St. Matthews Ave.	5527913	628090
		TH22-27	478 Collegiate St.; 117 meters N of Silver Ave.	5527818	628086
		TH22-28	456 Collegiate St.; 23 meters N of Silver Ave.	5527725	628084
7	Exmouth Boulevard	TH22-29	6 Exmouth Blvd.; 9 meters N of Birkenhead Ave.	5524903	628234
		TH22-30	18 Exmouth Blvd.; 15 meters N of Devonport Blvd.	5524812	628229
		TH22-31	38 Exmouth Blvd.; 7 meters N of Folkestone Blvd.	5524706	628225
6	Holdsworth Avenue	TH22-32	4 Holdsworth Ave.; 39 meters W of Glastonbury Blvd.	5524658	628313
		TH22-33	22 Holdsworth Ave.; 9 meters E of Exmouth Blvd.	5524649	628219
		TH22-34	38 Holdsworth Ave.; 54 meters E of Aldershot Blvd.	5524637	628105
1	Sinnott Street	TH22-35	54 Sinnott St.; 36 meters S of Barker Blvd.	5525309	620786
		TH22-36	30 Sinnott St.; 73 meters N of Jewett Bay	5525198	620728
		TH22-37	3 Sinnott St.; 31 meters N of Barker Blvd.	5525081	620687
11	Beaumont Street	TH22-38	1293 Beaumont St.; 33 meters S of Waterford Bay	5522720	632341
		TH22-39	Beaumont St.; 10 meters N of Southwood Ave.	5522653	632379
		TH22-40	72 Beaumont St.; 18 meters S of Riverwood Ave.	5522559	632430
12	Manahan Avenue	TH22-41	Manahan Ave.; 34 meters W of Pembina Hwy.	5521461	632907
		TH22-42	1029 Manahan Ave.; 110 meters E of Hudson St.	5521398	632796
		TH22-43	1050 Manahan Ave.; 31 meters E of Hudson St.	5521360	632730

Table 02: Core Information

Site Number	Location	Test Hole ID	Pavement Type	Location	Core Thickness [mm]	Base Material	Base Thickness [mm]	Depth to Sub-Grade [mm]
9	Montrose Street	TH22-01	Concrete	Mid-slab	159	Clay	0	159
		TH22-02	Concrete	Joint	178	Crushed limestone	51	229
		TH22-03	Concrete	Mid-slab	178	Clay	0	178
		TH22-04	Concrete	Joint	203	Clay	0	203
10	Scotland Avenue	TH22-05	Concrete	Mid-slab	171	Granular	51	222
		TH22-06	Concrete	Joint	191	Clay	0	191
		TH22-07	Concrete	Joint	222	Granular	38	260
		TH22-08	Concrete	Mid-slab	203	Clay	0	203
		TH22-09	Concrete	Joint	203	Crushed limestone	25	229
8	Renfrew Street	TH22-10	Concrete	Mid-slab	178	Crushed limestone	51	229
		TH22-11	Concrete	Joint	152	Crushed limestone	76	229
		TH22-12	Concrete	Mid-slab	152	Clay	0	152
		TH22-13	Concrete	Joint	178	Granular	38	216
3	Lumsden Avenue	TH22-14	Asphalt/Concrete	Mid-slab	44/184	Granular	51	279
		TH22-15	Asphalt/Concrete	Joint	38/190	Granular	64	292
		TH22-16	Asphalt/Concrete	Mid-slab	48/203	Granular	137	387
		TH22-17	Asphalt/Concrete	Joint	44/222	Granular	38	305
2	Fairlane Avenue	TH22-18	Concrete	Joint	159	Granular	216	375
		TH22-19	Concrete	Mid-slab	152	Granular	191	343
		TH22-20	Concrete	Joint	171	Granular	159	330
4	Carlyle Bay	TH22-21	Concrete	Joint	203	Crushed limestone	197	400
		TH22-22	Concrete	Mid-slab	156	Crushed limestone	73	229
		TH22-23	Concrete	Joint	156	Crushed limestone	92	248
		TH22-24	Concrete	Mid-slab	159	Crushed limestone	83	241
5	Collegiate Street	TH22-25	Concrete	Mid-slab	159	Granular	25	184
		TH22-26	Concrete	Joint	143	Clay	0	143
		TH22-27	Concrete	Mid-slab	156	Clay	0	156
		TH22-28	Concrete	Joint	146	Clay	10	156
7	Exmouth Boulevard	TH22-29	Concrete	Mid-slab	159	Granular	121	279
		TH22-30	Concrete	Joint	152	Granular	29	181
		TH22-31	Concrete	Mid-slab	159	Granular	324	483
6	Holdsworth Avenue	TH22-32	Asphalt/Concrete	Mid-slab	44/146	Crushed limestone	76	267
		TH22-33	Concrete	Joint	127	Crushed limestone	368	495
		TH22-34	Concrete	Mid-slab	140	Crushed limestone	127	267
1	Sinnott Street	TH22-35	Concrete	Joint	178	Granular	76	254
		TH22-36	Concrete	Mid-slab	178	Granular	76	254
		TH22-37	Concrete	Joint	191	Clay	0	191
11	Beaumont Street	TH22-38	Asphalt/Asphalt	Mid-slab	25/89	Granular/Sand	254/89	457
		TH22-39	Asphalt	Mid-slab	241	Granular/Sand	203/51	495
		TH22-40	Asphalt	Mid-slab	152	Granular	267	419
12	Manahan Avenue	TH22-41	Asphalt/Asphalt	Joint	38/51	Granular	191	279
		TH22-42	Asphalt/Asphalt	Joint	64/64	Granular	152	279
		TH22-43	Asphalt	Mid-slab	127	Granular	152	279



# APPENDIX A

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Core Photo Log

## MONTROSE STREET



Photo 1: TH22-01



Photo 2: TH22-02



Photo 3: TH22-03



Photo 4: TH22-04

## SCOTLAND AVENUE



Photo 05: TH22-05



Photo 06: TH22-06



Photo 07: TH22-07



Photo 08: TH22-08



Photo 09: TH22-09

## RENFREW STREET



Photo 10: TH22-10



Photo 11: TH22-11



Photo 12: TH22-12



Photo 13: TH22-13



## LUMSDEN AVENUE



Photo 14: TH22-14



Photo 15: TH22-15



Photo 16: TH22-16



Photo 17: TH22-17

## FAIRLANE AVENUE



Photo 18: TH22-18



Photo 19: TH22-19



Photo 20: TH22-20

## CARLYLE BAY



Photo 20: TH22-21



Photo 22: TH22-22



Photo 23: TH22-23



Photo 24: TH22-24

## COLLEGIATE STREET



Photo 25: TH22-25



Photo 26: TH22-26



Photo 27: TH22-27



Photo 28: TH22-28



## EXMOUTH BOULEVARD



Photo 29: TH22-29



Photo 30: TH22-30



Photo 31: TH22-31

## HOLDSWORTH AVENUE



Photo 32: TH22-32



Photo 33: TH22-33



Photo 34: TH22-34

## SINNOTT STREET



Photo 35: TH22-35



Photo 36: TH22-36



Photo 37: TH22-37

## BEAUMONT STREET



Photo 38: TH22-38



Photo 39: TH22-39



Photo 40: TH22-40



## MANAHAN AVENUE



Photo 41: TH22-41



Photo 42: TH22-42



Photo 43: TH22-43

# APPENDIX B

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Test Hole Logs

<b>CLIENT</b>	<b>CITY OF WINNIPEG - PUBLIC WORKS</b>	<b>PROJECT NO.</b>	22-0535-035
<b>PROJECT</b>	<b>2023 Local Street Renewal Program</b>	<b>START DATE</b>	10/14/2022
<b>LOCATION</b>	Winnipeg, MB	<b>UTM (m)</b>	N 5,521,461.08 E 632,907.28 Zone 14
<b>DESCRIPTION</b>	Manahan Ave.; 34 m W of Pembina Hwy.		
<b>DRILL RIG / HAMMER</b>	Hand Auger		
<b>METHOD(S)</b>	0.0 m to 2.3 m: 50 mm ø Hand Auger		

DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	WATER LEVEL	SAMPLE TYPE	NUMBER / RUN	PL MC LL		
						Cu TORVANE (kPa) ◆	qu POCKET PEN (kPa) ★	SPT (N) BLOWS/0.30 m ▲
		ASPHALT - 38 mm.			S0			
		ASPHALT - 51 mm.						
		FILL - 191 mm, Light grey, damp, compact, coarse gravel with fine to coarse sand, some silt, maximum aggregate size of 30 mm.						
		SANDY CLAY (CH) - Dark grey, dry, firm, high plasticity, silty, with fine to medium sand, trace coarse gravel. - LL=60, PL=28, PI=32 at 0.3 m. - PSA: 0% gravel, 31% sand, 47% silt, 22% clay at 0.3 m.			S1			
		CLAY (CH) - Dark greyish brown, damp, stiff, high plasticity, with silt, trace silt inclusions, trace fine sand, trace organics. - No organics below 0.6 m. - Dry, very stiff below 0.8 m.			S2			
1		- LL=80, PL=26, PI=54 at 0.9 m. - PSA: 0% gravel, 3% sand, 29% silt, 68% clay at 0.9 m. - With grey silt inclusions, trace coarse gravel below 0.9 m.			S3			
					S4			
5		- Moist, no sand, no gravel, no silt inclusions below 1.5 m.			S5			
					S6			
		SILT (MH) - Light brown, damp, loose, high plasticity, with clay.						
		CLAY (CH) - Dark grey, damp, stiff, high plasticity, trace silt inclusions.			S7			
		Notes: 1. End of test hole at 2.3 m. 2. Test hole remained open to 2.3 m upon completion of drilling/digging. 3. Test hole backfilled with auger cuttings. 4. Test hole located 5 feet from west-bound curb 5. Core taken mid-slab 6. Test hole location patched with cold mix asphalt						

<b>WATER LEVELS</b>	▽ During Drilling/Digging	None Encountered	<b>CONTRACTOR</b>	<b>INSPECTOR</b>
	▼ Upon Completion	Dry	KGS Group	I. DENISET
			<b>APPROVED</b>	<b>DATE</b>
			T. SCHELLENBERG	11/25/2022

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<b>CLIENT</b>	<b>CITY OF WINNIPEG - PUBLIC WORKS</b>	<b>PROJECT NO.</b>	22-0535-035
<b>PROJECT</b>	<b>2023 Local Street Renewal Program</b>	<b>START DATE</b>	10/14/2022
<b>LOCATION</b>	Winnipeg, MB	<b>UTM (m)</b>	N 5,521,398.5 E 632,796.09 Zone 14
<b>DESCRIPTION</b>	1029 Manahan Ave.; 110 m E of Hudson St.		
<b>DRILL RIG / HAMMER</b>	Hand Auger		
<b>METHOD(S)</b>	0.0 m to 2.3 m: 50 mm ø Hand Auger		

DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	WATER LEVEL	SAMPLE TYPE	NUMBER / RUN	PL MC LL			Cu TORVANE (kPa) ◆	qu POCKET PEN (kPa) ★	SPT (N) BLOWS/0.30 m ▲
						20	40	60	80		
		ASPHALT - 63 mm.			S0						
		ASPHALT - 63 mm.									
		FILL - 152 mm, Light grey, damp, compact, coarse gravel with fine to coarse sand, trace silt, maximum aggregate size of 30 mm.									
		SANDY CLAY (CL) - Black, damp, firm, low to intermediate plasticity, silty, with fine to medium sand, trace fine gravel, trace organics, trace red silt inclusions. - LL=48, PL=19, PI=29 at 0.3 m. - PSA: 0% gravel, 32% sand, 45% silt, 23% clay at 0.3 m. - Trace coarse gravel below 0.5 m.			S1						
		CLAY (CH) - Dark grey, damp, very stiff, high plasticity, with silt, trace fine sand, trace organics, trace fine gravel. - LL=83, PL=25, PI=58 at 0.6 m. - PSA: 0% gravel, 2% sand, 28% silt, 70% clay at 0.6 m.			S2						
1		- Increasing silt content below 1.1 m.			S3						
					S4						
		SILT (MH) - Light grey, damp, compact, high plasticity, with clay. - Decreasing clay content to 1.4 m.			S5						
5					S6						
		CLAY (CH) - Dark brown, damp, very stiff, high plasticity, some silt.			S7						
		Notes: 1. End of test hole at 2.3 m. 2. Test hole remained open to 2.3 m upon completion of drilling/digging. 3. Test hole backfilled with auger cuttings. 4. Test hole located 5 feet from west-bound curb 5. Core taken on joint 6. Test hole location patched with cold mix asphalt									

<b>WATER LEVELS</b>	▽ During Drilling/Digging	None Encountered	<b>CONTRACTOR</b>	<b>INSPECTOR</b>
	▼ Upon Completion	Dry	<b>KGS Group</b>	<b>I. DENISET</b>
			<b>APPROVED</b>	<b>DATE</b>
			<b>T. SCHELLENBERG</b>	<b>11/25/2022</b>

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<b>CLIENT</b>	<b>CITY OF WINNIPEG - PUBLIC WORKS</b>	<b>PROJECT NO.</b>	22-0535-035
<b>PROJECT</b>	<b>2023 Local Street Renewal Program</b>	<b>START DATE</b>	10/14/2022
<b>LOCATION</b>	Winnipeg, MB	<b>UTM (m)</b>	N 5,521,360.43 E 632,730.76 Zone 14
<b>DESCRIPTION</b>	1050 Manahan Ave.; 31 m E of Hudson St.		
<b>DRILL RIG / HAMMER</b>	Hand Auger		
<b>METHOD(S)</b>	0.0 m to 2.3 m: 50 mm ø Hand Auger		

DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	WATER LEVEL	SAMPLE TYPE	NUMBER / RUN	 Cu TORVANE (kPa) ◆ qu POCKET PEN (kPa) ★ SPT (N) BLOWS/0.30 m ▲ 20 40 60 80		
						PL	MC	LL
		ASPHALT - 63 mm.			S0			
		ASPHALT - 63 mm.						
		FILL - 152 mm, Light brown, damp, compact, medium to coarse sand, some coarse gravel, maximum aggregate size of 40 mm.						
		SANDY CLAY (CL) - Black, damp, very loose, low to intermediate plasticity, silty, with fine to medium sand, trace coarse gravel, trace silt inclusions.			S1			
		CLAY (CH) - Grey and black, damp, very stiff, high plasticity, with silt, trace fine sand. - Increased silt content around 0.7 m.			S2			
1		CLAY (CH) - Grey and black, damp, very stiff, high plasticity, with silt, trace fine sand. - Brown below 1.2 m.			S3			
		CLAY (CH) - Grey and black, damp, very stiff, high plasticity, with silt, trace fine sand. - Brown below 1.2 m.			S4			
5		CLAY (CH) - Grey and black, damp, very stiff, high plasticity, with silt, trace fine sand. - Brown below 1.2 m.			S5			
		SILT (MH) - Light brownish grey, damp to moist, compact, high plasticity, with clay.			S6			
2		CLAY (CH) - Brown, damp to moist, stiff, high plasticity, trace silt inclusions, trace fine sand.			S7			
		Notes: 1. End of test hole at 2.3 m. 2. Test hole remained open to 2.3 m upon completion of drilling/digging. 3. Test hole backfilled with auger cuttings. 4. Test hole located 5 feet from west-bound curb 5. Core taken mid-slab 6. Test hole location patched with cold mix asphalt						

<b>WATER LEVELS</b>	∇ During Drilling/Digging	None Encountered	<b>CONTRACTOR</b>	<b>INSPECTOR</b>
	∇ Upon Completion	Dry	<b>KGS Group</b>	<b>I. DENISET</b>
			<b>APPROVED</b>	<b>DATE</b>
			<b>T. SCHELLENBERG</b>	<b>11/25/2022</b>

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# APPENDIX C

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Laboratory Testing





# SUMMARY OF INDEX TESTS

Test Hole ID	Smpl No.	Depth From (m)	Depth To (m)	Classification	Gravel (%)	Sand (%)	Silt/Clay (%)	LL	PL	PI	MC (%)	Dry Dens (kN/m <sup>3</sup> )	Spec Gvty	Saturation (%)	Proctor Max DD (kg/m <sup>3</sup> )	Proct Opt MC (%)	CBR Initial DD (kg/m <sup>3</sup> )	CBR Initial MC (%)	CBR % of Max DD	CBR % of Opt MC	CBR @2.54 mm	CBR % Swell	
Composite	S1	0.0	1.5	CH	0	4	96	84	25	59	34				1500	24.5	1425	24.6	95.0	0.1	3.6	7.0	
TH22-41	S1	0.3	0.4	CH	0	31	69	60	28	32	25												
TH22-41	S2	0.6	0.7	CH							43												
TH22-41	S3	0.9	1.0	CH	0	3	97	80	26	54	31												
TH22-41	S4	1.2	1.3	CH							33												
TH22-41	S5	1.5	1.7	CH							42												
TH22-41	S6	1.8	2.0	CH							47												
TH22-41	S7	2.2	2.3	CH							51												
TH22-42	S1	0.3	0.4	CL	0	32	68	48	19	29	28												
TH22-42	S2	0.6	0.7	CH	0	2	98	83	25	58	30												
TH22-42	S3	0.9	1.0	CH							35												
TH22-42	S4	1.2	1.3	CH							29												
TH22-42	S5	1.5	1.7	MH							22												
TH22-42	S6	1.8	2.0	MH							31												
TH22-42	S7	2.1	2.3	CH							35												
TH22-43	S1	0.3	0.4	CL							29												
TH22-43	S2	0.6	0.8	CH							25												
TH22-43	S3	0.9	1.0	CH							30												
TH22-43	S4	1.2	1.3	CH							39												
TH22-43	S5	1.5	1.7	CH							43												
TH22-43	S6	1.8	2.0	MH							43												
TH22-43	S7	2.1	2.3	CH							50												

\* Moisture conditioned and remolded sample.  
 \*\* Assumed specific gravity.



**CLIENT** CITY OF WINNIPEG - PUBLIC WORKS  
**PROJECT NAME** 2023 Local Street Renewal Program  
**TESTED BY** Stantec

**PROJECT NO.** 22-0535-035  
**LOCATION** Winnipeg, MB  
**DATE TESTED** 2022/10/21

# PROCTOR TEST REPORT

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

CLIENT KGS Group Inc.  
C.C.

ATTN: Ian Deniset

PROJECT 2023 Local Street Renewals Program  
22-0535-035

PROJECT NO. 123316255

PROCTOR NO. 1

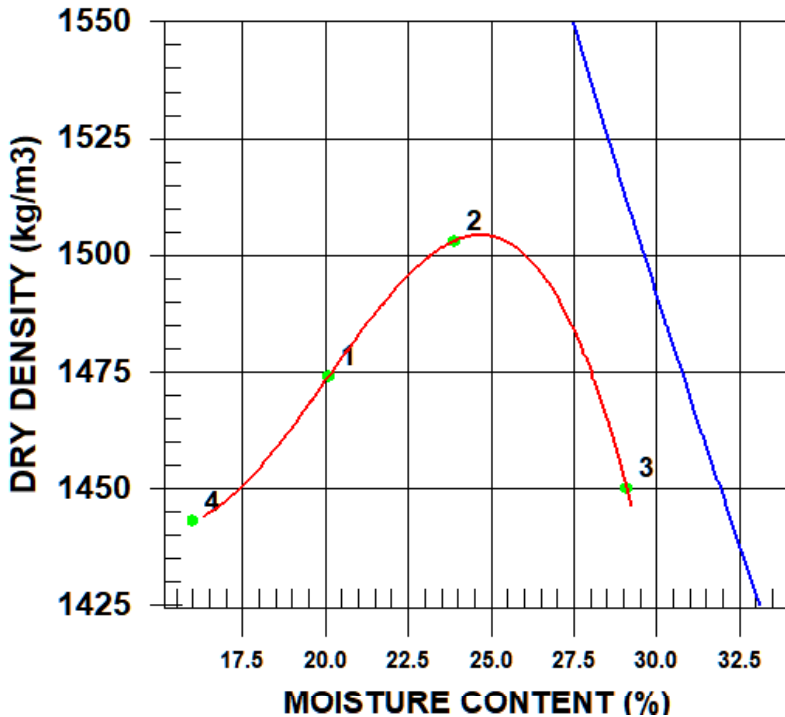
DATE SAMPLED 2022.Oct.14

DATE RECEIVED 2022.Oct.18

DATE TESTED 2022.Oct.21

INSITU MOISTURE 34.4 %  
TESTED BY Donald Eliazar  
MATERIAL IDENTIFICATION  
MATERIAL USE Subgrade  
MAX. NOMINAL SIZE  
MATERIAL TYPE Clay  
SUPPLIER In-situ  
SOURCE TH22-41 & TH22-43

COMPACTION STANDARD Standard Proctor, ASTM D698  
COMPACTION PROCEDURE A: 101.6mm Mold, Passing 4.75mm  
RAMMER TYPE Manual  
PREPARATION Moist  
OVERSIZE CORRECTION METHOD None  
RETAINED 4.75mm SCREEN



TRIAL NUMBER	WET DENSITY (kg/m <sup>3</sup> )	DRY DENSITY (kg/m <sup>3</sup> )	MOISTURE CONTENT (%)
1	1770	1474	20.1
2	1862	1503	23.9
3	1872	1450	29.1
4	1674	1443	16.0

	MAXIMUM DRY DENSITY (kg/m <sup>3</sup> )	OPTIMUM MOISTURE CONTENT (%)
CALCULATED	1500	24.5
OVERSIZE CORRECTED		

COMMENTS

REVIEWED BY  Jason Thompson, C.E.T.



## ASTM D1883 - CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

TO KGS Group  
 865 Waverley St.  
 Winnipeg, MB  
 R3T 5P4

PROJECT 2023 Local Street Renewal Program  
 (22-0535-035)

PROJECT NO. 123316255

ATTN: Ian Deniset

REPORT NO. 1 (Data page - see Page 2 for Chart)

DATE SAMPLED: Not Provided

DATE RECEIVED: 2022.Oct.14

DATE TESTED: 2022.Oct.26

SAMPLED BY: Ian Deniset

SUBMITTED BY: Ian Deniset

TESTED BY: Donald Eliazar

**MATERIAL IDENTIFICATION**

MATERIAL USE	Subgrade	SUPPLIER	Existing Material
MAX. NOMINAL SIZE	< 4.75 mm	SOURCE	In Situ
MATERIAL TYPE	Clay	SAMPLE LOCATION	Compostie
SPECIFICATION	Not Applicable	STANTEC SAMPLE NO.	4682

IMMERSION PERIOD	96 ± 2 hr	TARGET MAX. DRY DENSITY	1500 kg/m <sup>3</sup>
CONDITION OF SAMPLE	Soaked	TARGET OPTIMUM MOISTURE	24.5 %
SURCHARGE MASS	4.54 kg	AS-COMPACTED MAX. DRY DENSITY	1425 kg/m <sup>3</sup>
SWELL OF SAMPLE	7.0%	AS-COMPACTED MOISTURE CONTENT	24.6 %
		POST-TEST MOISTURE CONTENT (TOP 25 mm)	37.6 %

<b>CBR VALUE AT 2.54 mm PENETRATION</b>	<b>3.6</b>
<b>CBR VALUE AT 5.08 mm PENETRATION</b>	<b>2.9</b>

**COMMENTS:**

Sample prepared to 95% of the maximum dry density at the optimum moisture content as determined from ASTM D698.  
 We appreciate the opportunity to assist you on this project. Please contact the undersigned if you have any questions regarding this report.

REPORT DATE 2022.Oct.31

  
 REVIEWED BY Jason Thompson, C.E.T.  
 Principal - Manager of 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.

## ASTM D1883 - CALIFORNIA BEARING RATIO (CBR) OF LABORATORY-COMPACTED SOILS

TO KGS Group  
 865 Waverley St.  
 Winnipeg, MB  
 R3T 5P4

PROJECT 2023 Local Street Renewal Program  
 (22-0535-035)

PROJECT NO. 123316255

ATTN: Ian Deniset

REPORT NO. 1 (Chart page - See Page 1 for Data)

DATE SAMPLED: Not Provided

DATE RECEIVED: 2022.Oct.14

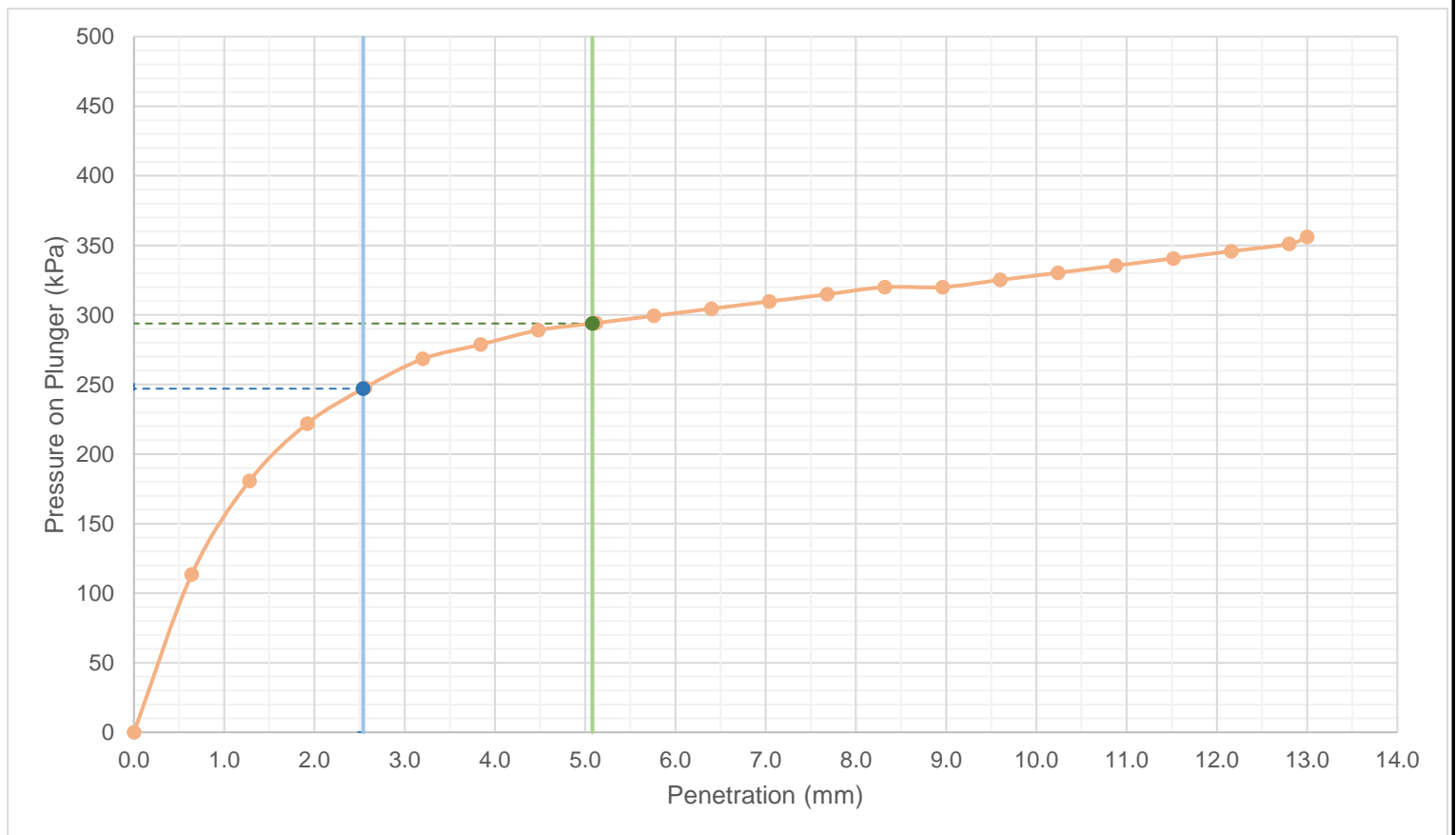
DATE TESTED: 2022.Oct.26

SAMPLED BY: Ian Deniset

SUBMITTED BY: Ian Deniset

TESTED BY: Donald Eliazar

**LOAD PENETRATION CURVE**



REPORT DATE 2022.Oct.31

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