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Preliminary Aggregate Resource Study

Bank Street
Ottawa, Ontario



Prepared For

Greely Sand and Gravel

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Report No. PH2552-REP.01
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1.0 INTRODUCTION

At the request of Mr. Brent Pyper of Greely Sand and Gravel, this firm was retained to conduct a preliminary assessment of the viability of the remaining lands adjacent to the current extraction area, and currently zoned as a Mineral Resource designation (ME2 Zone) in the City of Ottawa Official Plan. In particular, the lands under consideration consist of two parcels of land fronting near to Bank Street and having a municipal identification of 5310 Bank Street (north parcel) and 5362 Bank Street (south parcel), Ottawa, Ontario. The future development of these lands are currently being considered for a commercial subdivision.

This report has been prepared specifically and solely for the above noted project which is described herein. It contains all of our findings and results of the preliminary investigation at this site.

2.0 SITE INFORMATION

The subject lands consists of two properties located on the west side of Bank Street in the City of Ottawa. The properties abut each other and are located immediately east of the existing Greely Sand and Gravel Aggregate Extraction area, as shown on Figure 1. The northern parcel, which is known as the Moffatt Lands, is located on Part of Lot 28, Concession IV in the former Township of Gloucester and has a municipal address of 5310 Bank Street. The southern parcel, known as the Pyper Lands, consists of Part of Lot 27, Concession IV in the former Township of Gloucester and has a municipal address of 5362 Bank Street. The total study area is approximately 20.4 hectares in size with the north and south parcels being approximately 15.58 and 4.83 hectares in size, respectively.

The northern parcel currently has a ME2 zoning and the southern parcel has a RU zoning designation. The properties are sandwiched by an existing church and graveyard located at 5338 Bank Street (R15 Zoning). A large commercial property (Grandor Lumber) is located immediately north of the study area at 5224 Bank Street (RG1 Zoning). There is currently a licenced bedrock quarry, owned and operated by R.W. Tomlinson Limited on the east of Bank Street approximately 250 m east of the eastern limits of the study area. There is also a cellular telephone tower located near the centre of the study area.

Presently, the northern parcel is mostly heavily tree covered with the exception of a gravel access road and a cell tower located near the centre of this parcel. A number of buildings and a large gravel parking/storage area are located in the northwest quadrant of the south parcel. The south parcel is mostly tree covered to the east half of the property. Reference should be made to the appended Site Location Plan for an aerial view of the surrounding lands.

It should be noted that the south parcel, identified as 5362 Bank Street did have a prior Mineral Resource Designation that was subsequently changed to the RU Zoning.

3.0 SCOPE OF WORK

The scope of work for this Preliminary Aggregate Resource Study was as follows:

- Determine the suitability of the overburden aggregates (based on gradation) of the various materials recovered from the test pits.
- Provide an assessment of the viability of the suggested aggregate reserve within the ME2 Zone, for future extraction in the overburden materials.

4.0 METHODOLOGY

On May 27, 2014, a site meeting was held with Chris Bierman of the Ministry of Natural Resources and the current landowners. A walkabout of the site was conducted, and three (3) test pits were put down, on the north parcel, to provide verification of the aggregate quality. On August 5, 2014, two (2) additional test pits were put down on the south parcel. The approximate locations of the test holes are shown on Drawing No. PH2552-FIG.2, Test Pit Location Plan, included in Appendix 3.

The test pits were completed using a track mounted mechanical shovel supplied by the client. The test pit procedure consisted of excavating to the required depths at the selected locations and logging and sampling the overburden. The test pits were loosely backfilled upon completion.

Sampling and Identification

All soil samples were classified on site, placed in sealed plastic bags and transported to our laboratory. The depths at which the test pit samples were recovered from the test holes are shown as G samples on the Soil Profile and Test Data sheets in Appendix 1.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

At the time of the fieldwork program, groundwater was encountered at depths ranging from 1.7 m in TP 1 to 4.5 m in TP 4 and TP 5. Seasonal variations in the groundwater table are to be expected, with higher levels being encountered during prolonged wet periods (i.e. spring thaw).

Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. Samples of the various stratigraphic units were selected for grain size distribution analyses. The results are presented in Appendix 2.

5.0 OBSERVATIONS

5.1 Regional Geology

The dominant stratigraphic unit in the extraction area west of the subject property comprises fluvioglacial deposits that have resulted in the formation of an esker, that is quite extensive in the Greely area. This formation has been successfully mined in recent years, and has been known to produce good quality sand and gravel material. On the edges of the esker deposit, as is the case for the subject lands, poorly sorted glacial till materials exist. Regional mapping, which is duplicated on Drawing No. PH2552-FIG.3 in Appendix 3 provides confirmation of the in situ observations at the test pit locations.

5.2 Subsurface Profile

The soil profile underlying the north parcel (TP 1 to TP 3 inclusive) consists primarily of a topsoil layer overlying a thin layer of sand and gravel deposits containing silt and clay overlying poorly sorted glacial till deposits. The glacial till is underlain by dolomitic bedrock of the Oxford Formation at shallow depth. In the eastern face of the existing pit to the west, the glacial till unit was visible in the pit face, and basically defines the limit of usable quality aggregate in the current extraction area.

The soil profile underlying the south parcel, as encountered in TP 4 and TP 5, generally consists of fill materials (1.5 m to 2.3 m thick), underlain by a fine sand deposit (approximately 1.8 m thick), which in turn, is underlain by fine sand to sandy silt. Groundwater was encountered at approximately 4.5 m depth.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profiles encountered at each test hole location.

Any information pertaining to soils and all test hole logs are furnished as a matter of general information only, and test pit descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those described by the test pits themselves.

5.3 Laboratory Testing

Five samples representing the stratigraphic units in the test pits were submitted for grain size distribution analysis. The results are summarized in Table 1. The detailed results are presented on the Grain Size Distribution sheets in Appendix 2 of this report.

Table 1 - Result Summary of Grain Size Distribution Tests on Sand and Silty Sand / Sandy Silt Samples

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt and Clay Fines (%)
TP1-G1	0.5	15	60	25
TP1-G2	1.6	36	52	12
TP2-G3	2	8	68	24
TP2-G4	3.5	12	77	11
TP3-G5	0.6	48	35	17
TP4-G6	3.6	1	95	4
TP4-G7	4.3	0	90	10
TP5-G8	3.8	0	23	77

Based on the results of the eight (8) grain size distributions, none of the samples meet the Ontario Provincial Standard Specifications (OPSS) for a Granular B Type I material.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Viability of Future Extraction

Based on the results of this study, in conjunction with regional investigations and mapping, the primary extraction areas are in the esker deposit to the west of the subject lands, which is currently owned and operated by Greely Sand and Gravel.

Based on regional mapping, in conjunction with site specific observations, the eastern extremity of the current pit operations have reached the point where no quality aggregate remains in place, thus limiting the value of the remaining lands as an aggregate resource. The further complicating factor is that the remaining lands are landlocked on three sides, with existing commercial or institutional development on the north and south sides, and Bank Street to the east. The application of applicable setbacks would result in minimal lands being available for further mining operations, and from a strictly planning perspective, would not be considered to be viable, even if there were quality aggregates on the site.

In addition, the depth of overburden is quite limited, and none of the sand samples meet specifications OPSS Granular B Type 1 material, or for other select materials such as concrete sand, mortar sand, filter sand, playground sand and/or bedding sand.

6.2 Proposed Commercial Development

Based on the results of this investigation, it is our opinion that the geotechnical conditions underlying the site are suitable for commercial subdivision development. Although this study is not intended to be used in support of a subdivision development application, it is evident that this property would be well suited for commercial type development, given the current land uses on the surrounding lands.

7.0 SUMMARY

A geological assessment was conducted on the subject properties to determine the suitability of these lands for future aggregate extraction operations. Based on the results of this assessment, it is evident that the current operations to the west have reached their eastern limit of quality aggregate. Based on the results of the test pitting and laboratory testing, the material contained within the ME2 Zone does not meet specifications for select granular material, and as such, has no economic value in this regard. The existing lands to the north and south along Bank Street have been previously de-designated and developed, which would result in significant reductions in aggregate extraction, due the applicable setbacks that would be required for a mineral resource extraction operation. As such, it is our opinion that the de-designation of these lands complies with the intent of the Provincial Policy statements based on economic viability and potential environmental impacts.

Yours truly,

Paterson Group Inc.



Stephen J. Walker, P. Eng.

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- Greely Sand and Gravel (3 copies)
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APPENDIX 1

SOIL PROFILE & TEST DATA SHEETS

DATUM

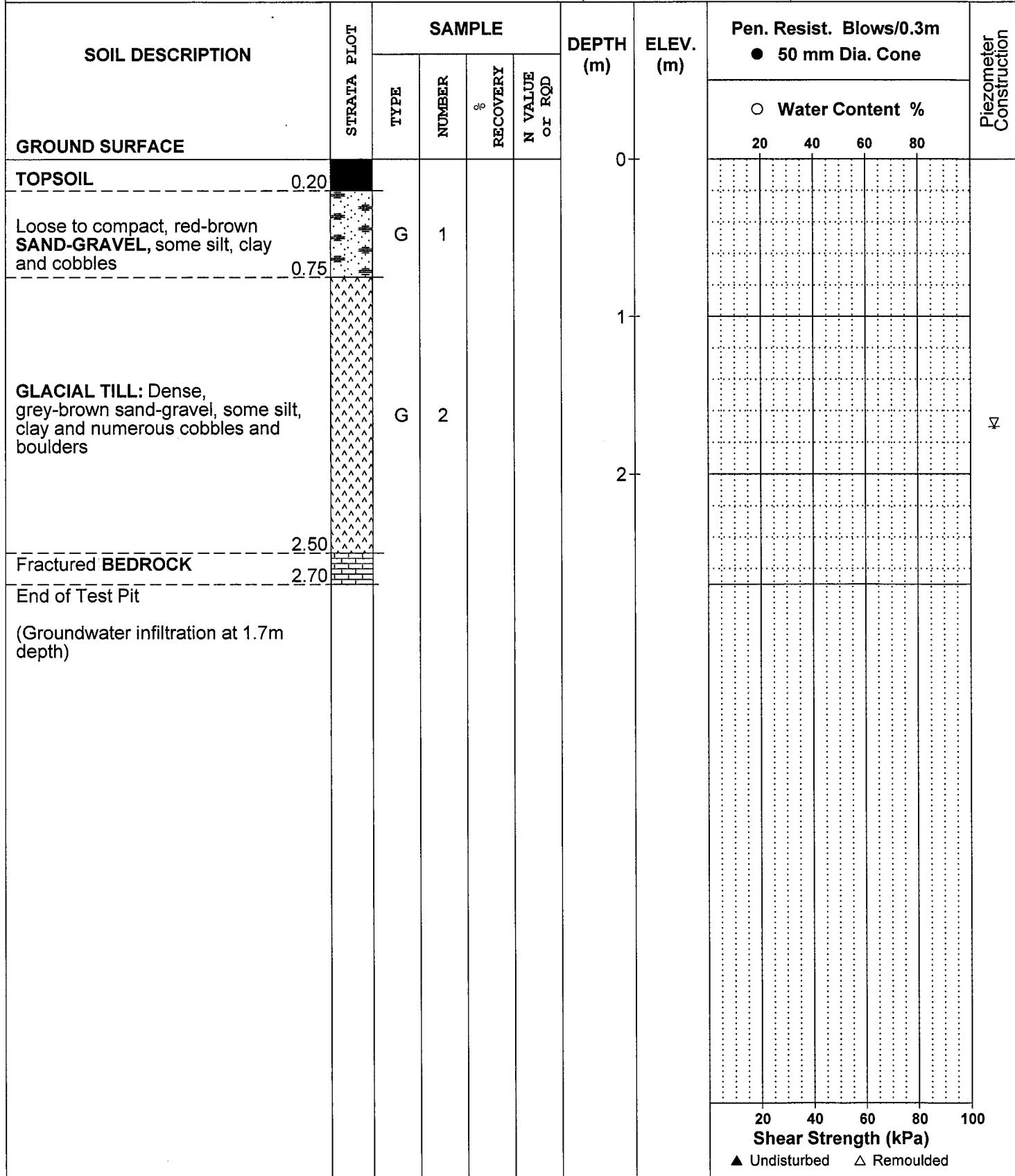
FILE NO.
PH2552

REMARKS

HOLE NO.
TP 1

BORINGS BY Backhoe

DATE May 27, 2014



DATUM

FILE NO. **PH2552**

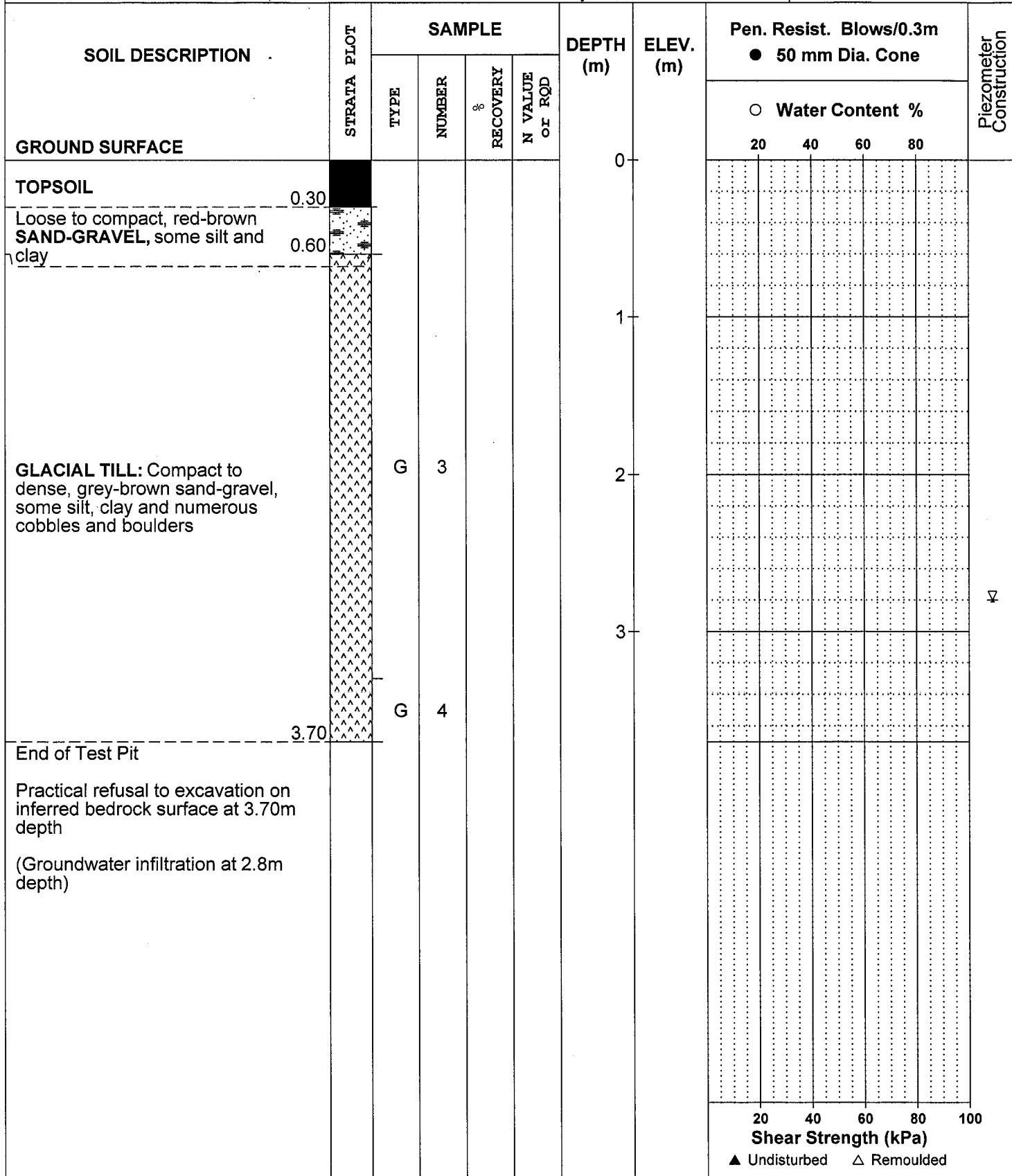
REMARKS

HOLE NO. **TB 2**

BORINGS BY Backhoe

DATE May 27, 2014

TP 2



DATUM

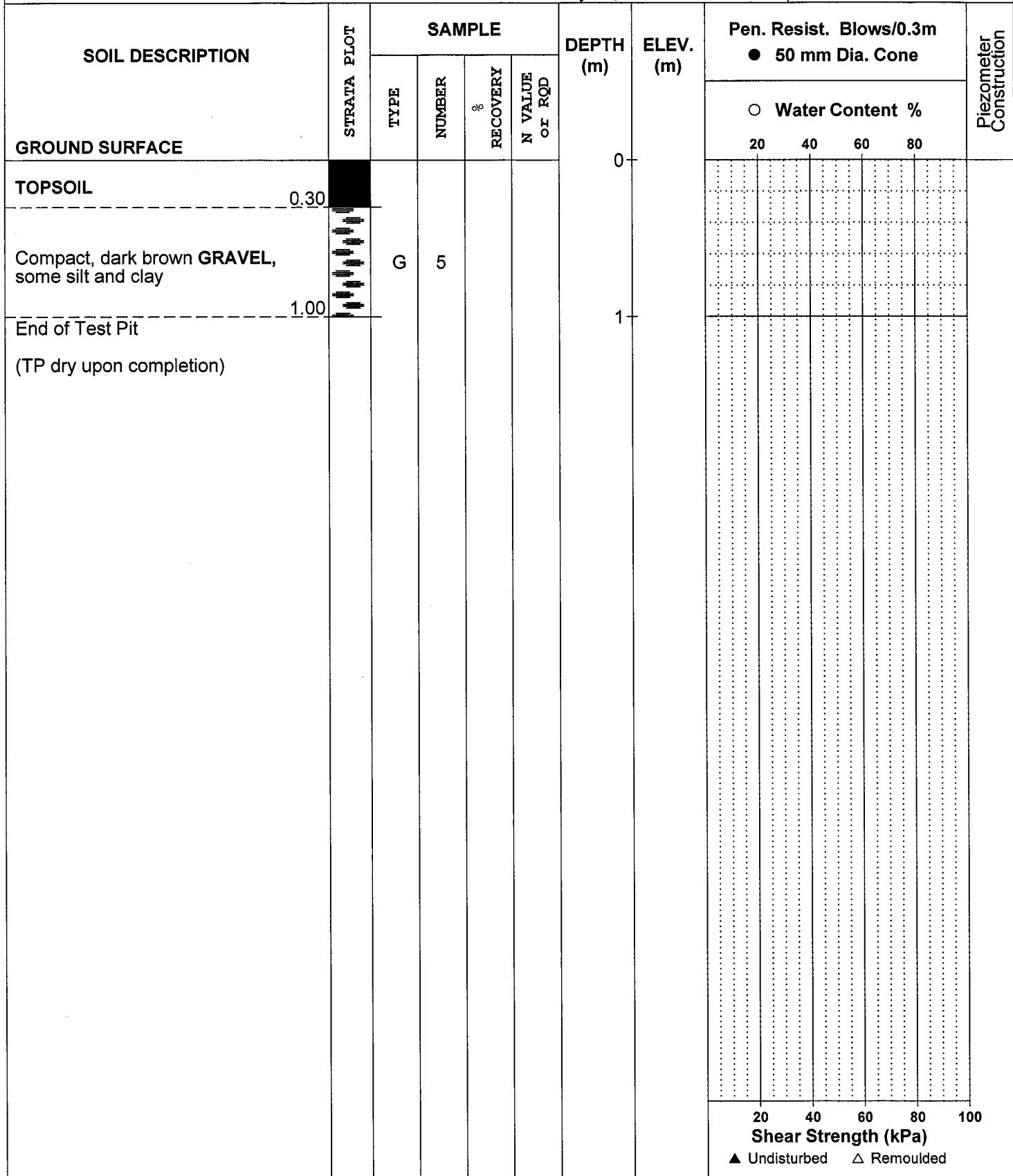
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REMARKS

HOLE NO. **TP 3**

BORINGS BY Backhoe

DATE May 27, 2014



DATUM

FILE NO.

PH2552

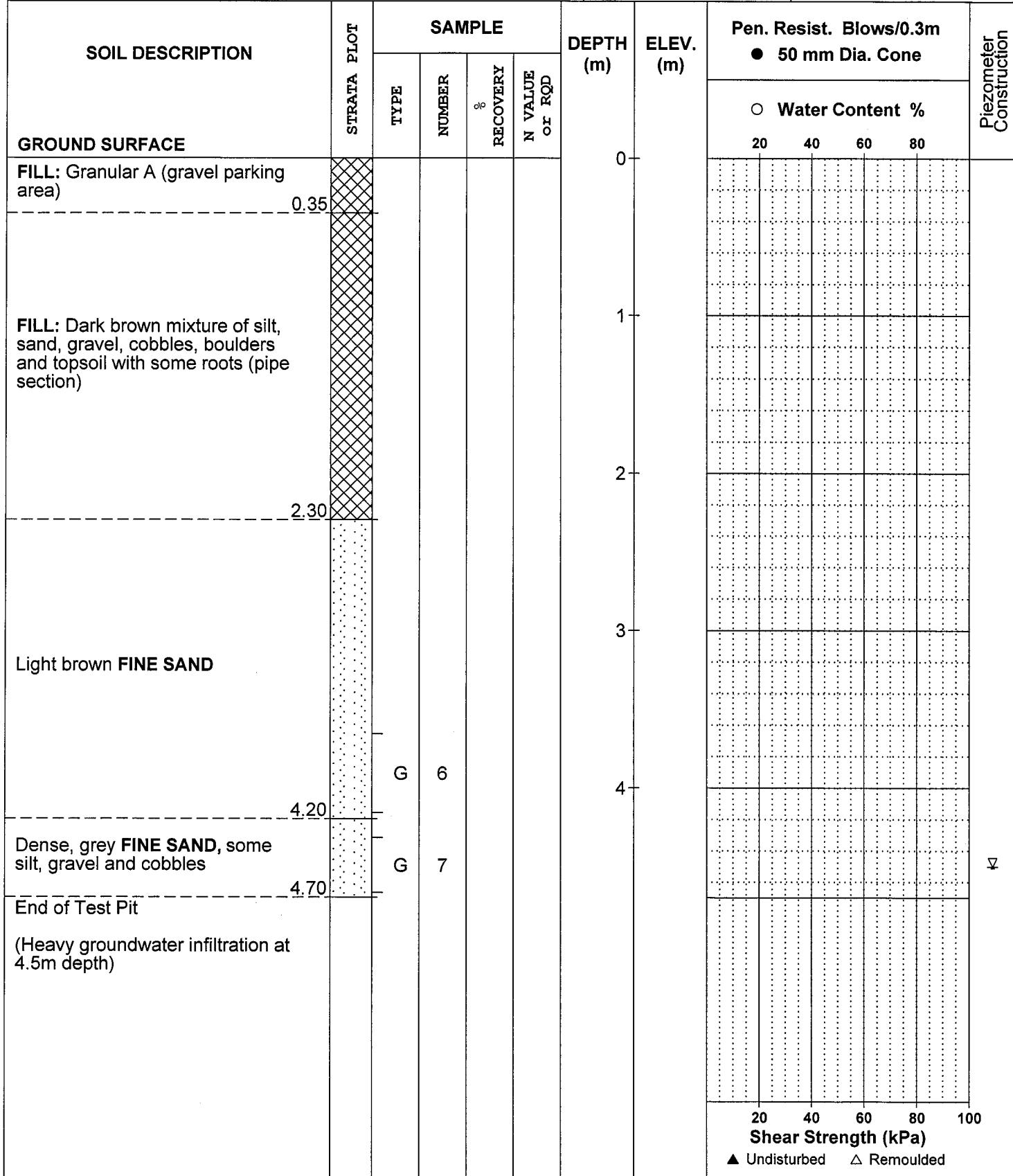
REMARKS

HOLE NO.

TP 4

BORINGS BY Backhoe

DATE August 5, 2014



DATUM

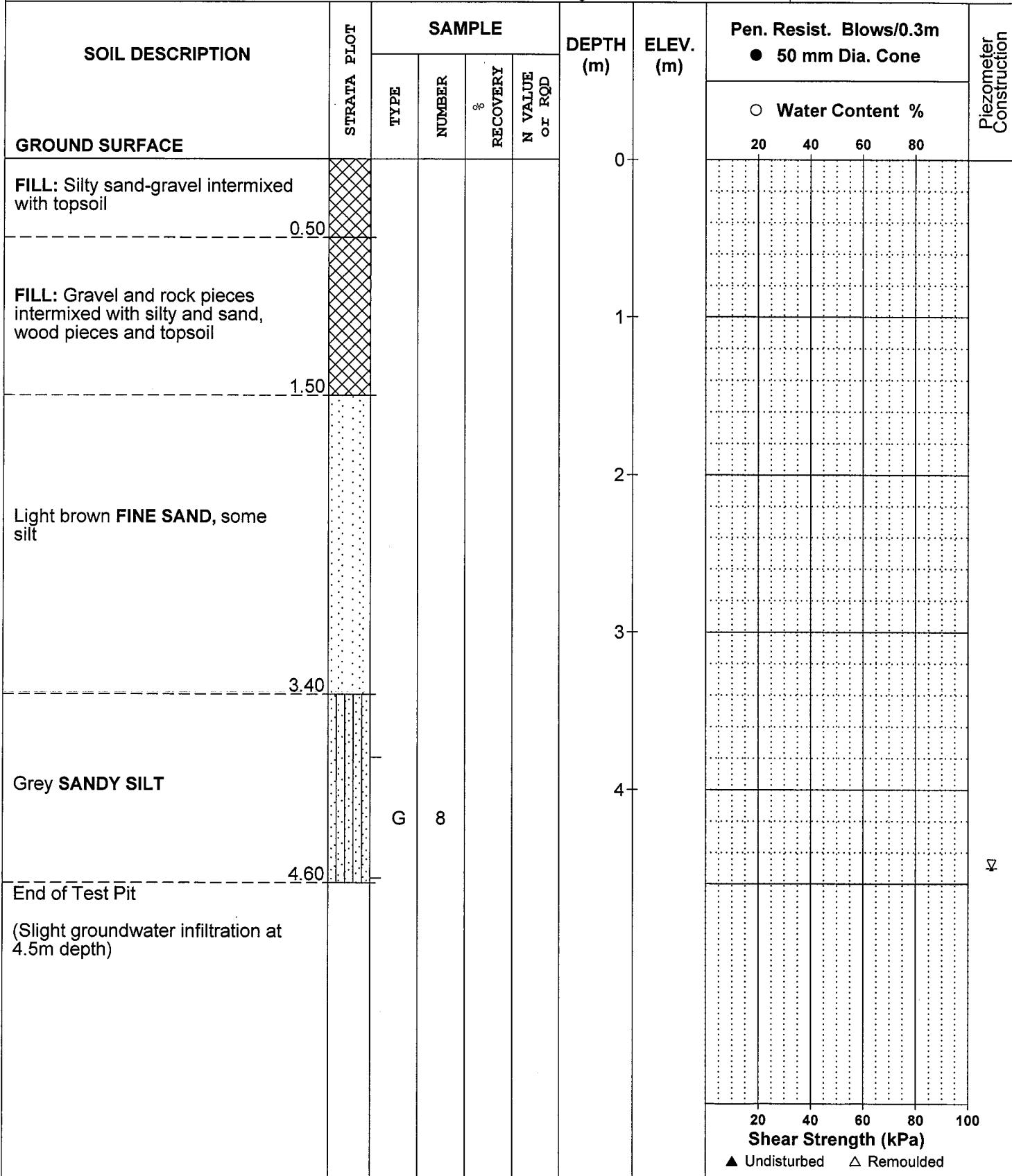
FILE NO. **PH2552**

REMARKS

HOLE NO. **TP 5**

BORINGS BY Backhoe

DATE August 5, 2014



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called "mechanical breaks") are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

- SS - Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
- TW - Thin wall tube or Shelby tube
- PS - Piston sample
- AU - Auger sample or bulk sample
- WS - Wash sample
- RC - Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
D _{xx}	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D ₁₀	-	Grain size at which 10% of the soil is finer (effective grain size)
D ₆₀	-	Grain size at which 60% of the soil is finer
C _c	-	Concavity coefficient = $(D_{30})^2 / (D_{10} \times D_{60})$
C _u	-	Uniformity coefficient = D_{60} / D_{10}

C_c and C_u are used to assess the grading of sands and gravels:

Well-graded gravels have: $1 < C_c < 3$ and $C_u > 4$

Well-graded sands have: $1 < C_c < 3$ and $C_u > 6$

Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.

C_c and C_u are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

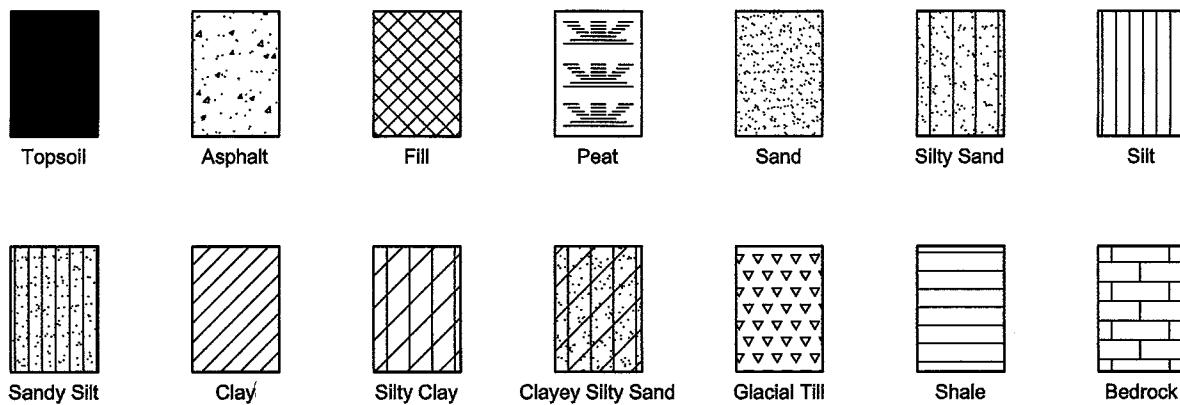
p'	-	Present effective overburden pressure at sample depth
p' _c	-	Preconsolidation pressure of (maximum past pressure on) sample
C _{cr}	-	Recompression index (in effect at pressures below p' _c)
C _c	-	Compression index (in effect at pressures above p' _c)
OC Ratio		Overconsolidation ratio = $p'c / p'$
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
W _o	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.
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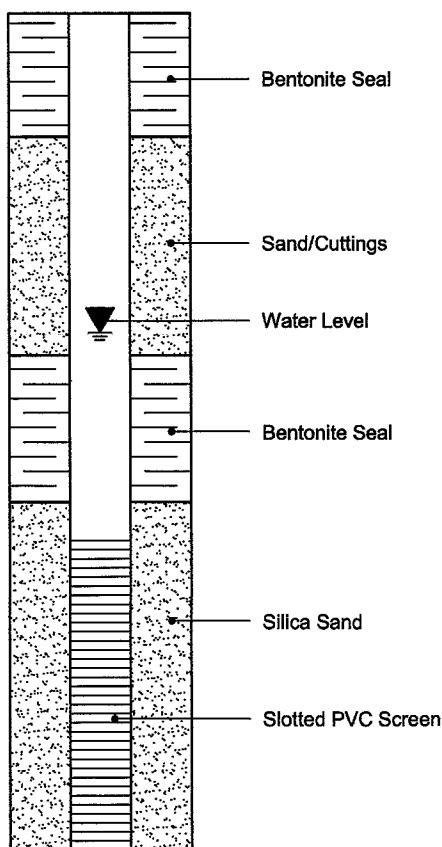
SYMBOLS AND TERMS (continued)

STRATA PLOT

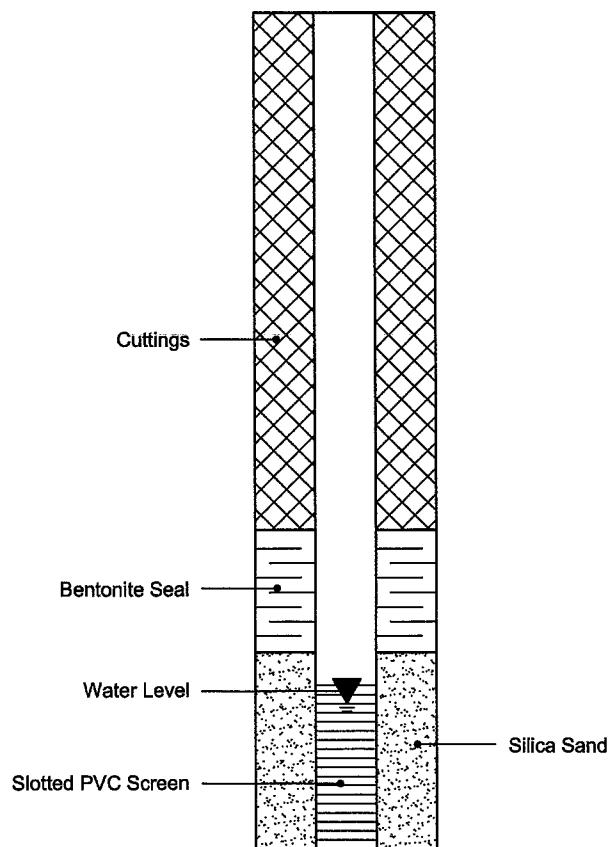


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION

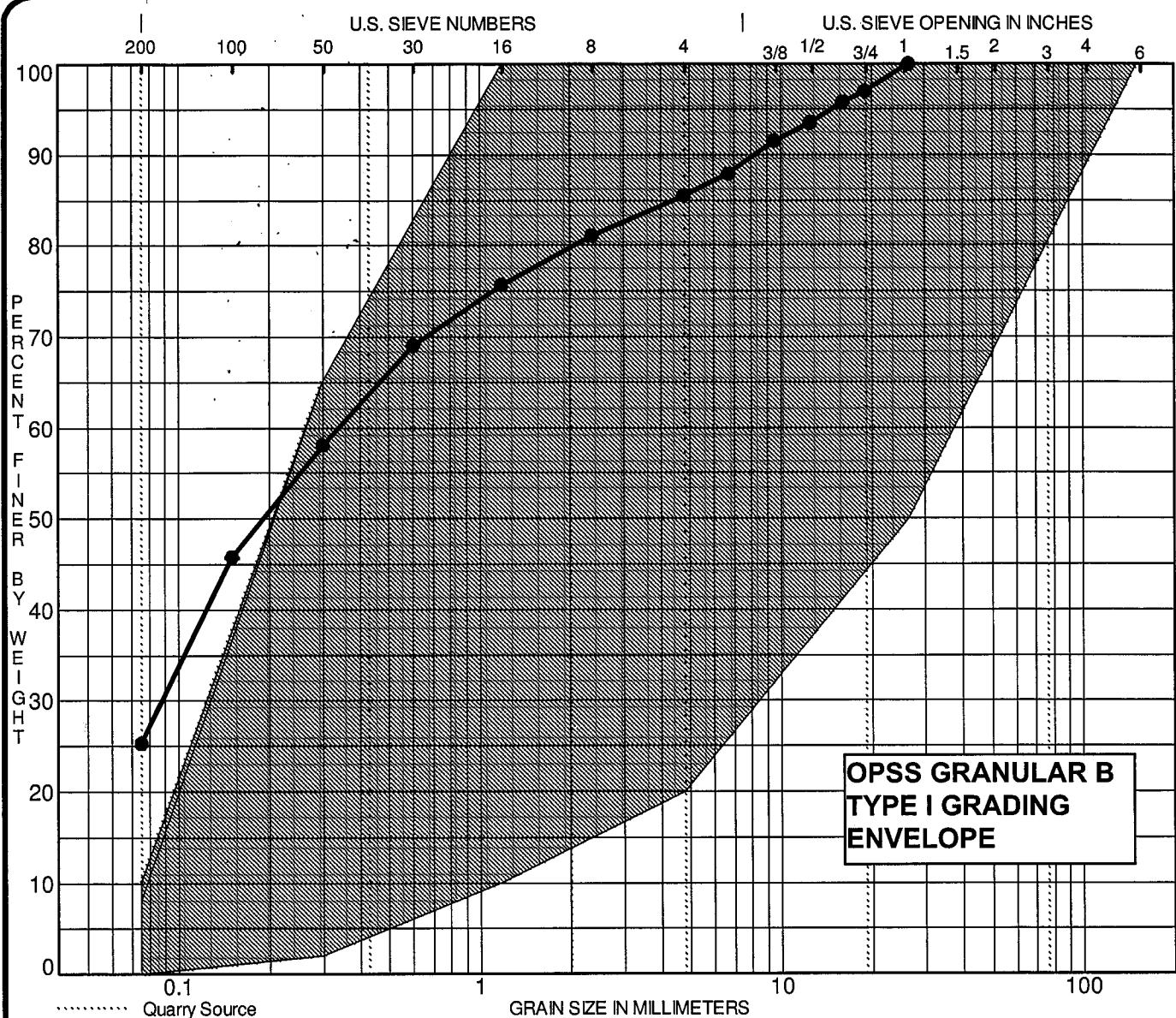


PIEZOMETER CONSTRUCTION



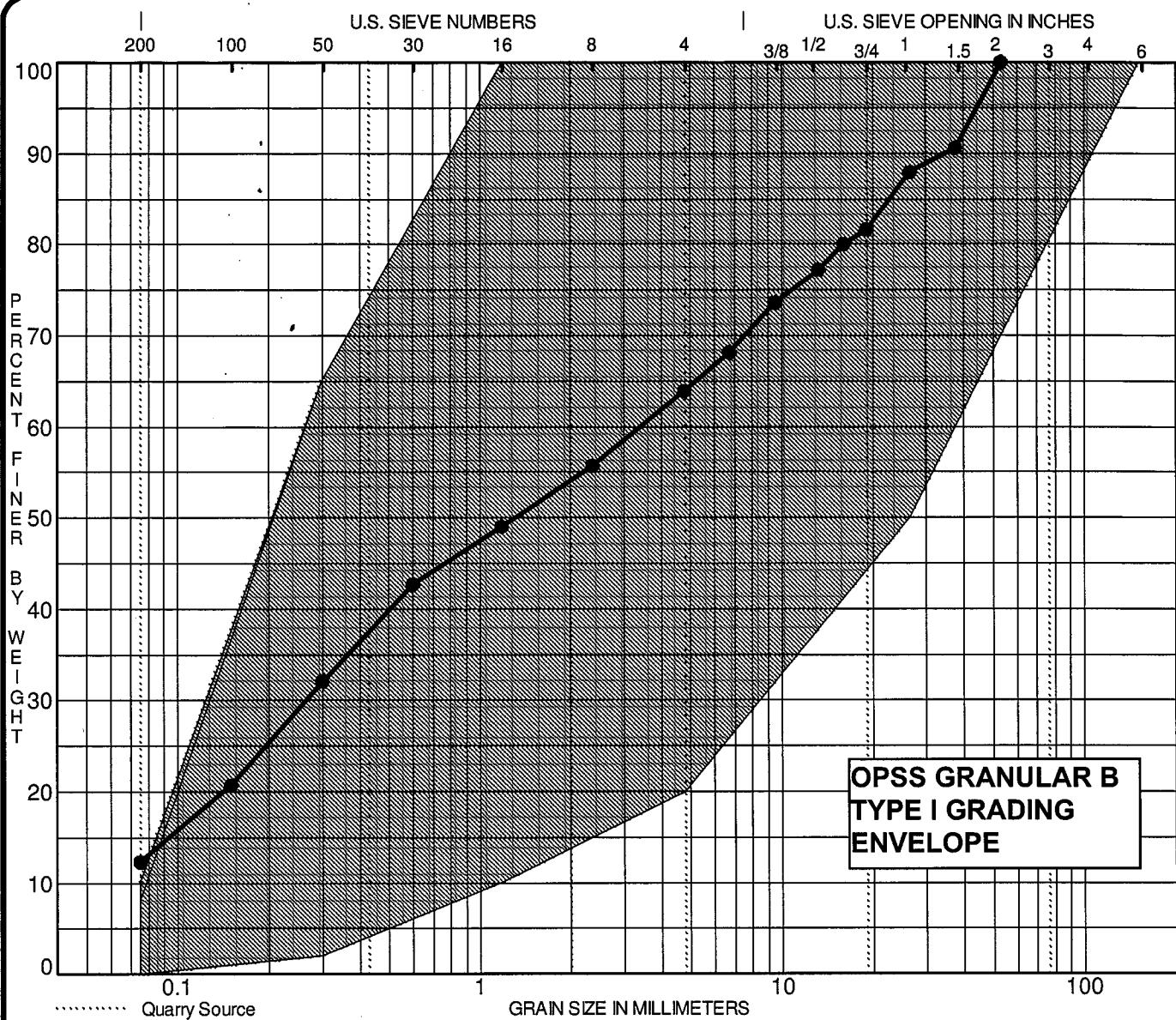
APPENDIX 2

GRAIN SIZE DISTRIBUTION TEST RESULT SHEETS



SILT	SAND			GRAVEL		COBBLES	
	fine	medium	coarse	fine	coarse		
Specimen Identification	Classification				MC%	LL	PL
● TP 1 G 1	SAND-GRAVEL, some silt and clay				PI	Cc	Cu
■							
▲							
★							
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt
● TP 1 G 1	26.50	0.34	0.088		14.5	60.2	25.3
■							
▲							
★							

CLIENT	Greely Sand and Gravel	FILE NO.	PH2552
PROJECT	Mineral Aggregate Assessment - Bank Street,	DATE	27 May 14
	Ottawa (Greely), Ontario		
petersongroup		Consulting Engineers	GRAIN SIZE DISTRIBUTION
154 Colonnade Road South, Ottawa, Ontario K2E 7J5			



SILT	SAND			GRAVEL		COBBLES	
	fine	medium	coarse	fine	coarse		
Specimen Identification	Classification				MC%	LL	PL
● TP 1 G 2 GLACIAL TILL: Sand-gravel, some silt and clay							0.33 54.9
■							
▲							
★							
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt %Clay
● TP 1 G 2	53.00	3.41	0.264		36.1	51.6	12.3
■							
▲							
★							

CLIENT Greely Sand and Gravel
 PROJECT Mineral Aggregate Assessment - Bank Street,
 Ottawa (Greely), Ontario

petersongroup

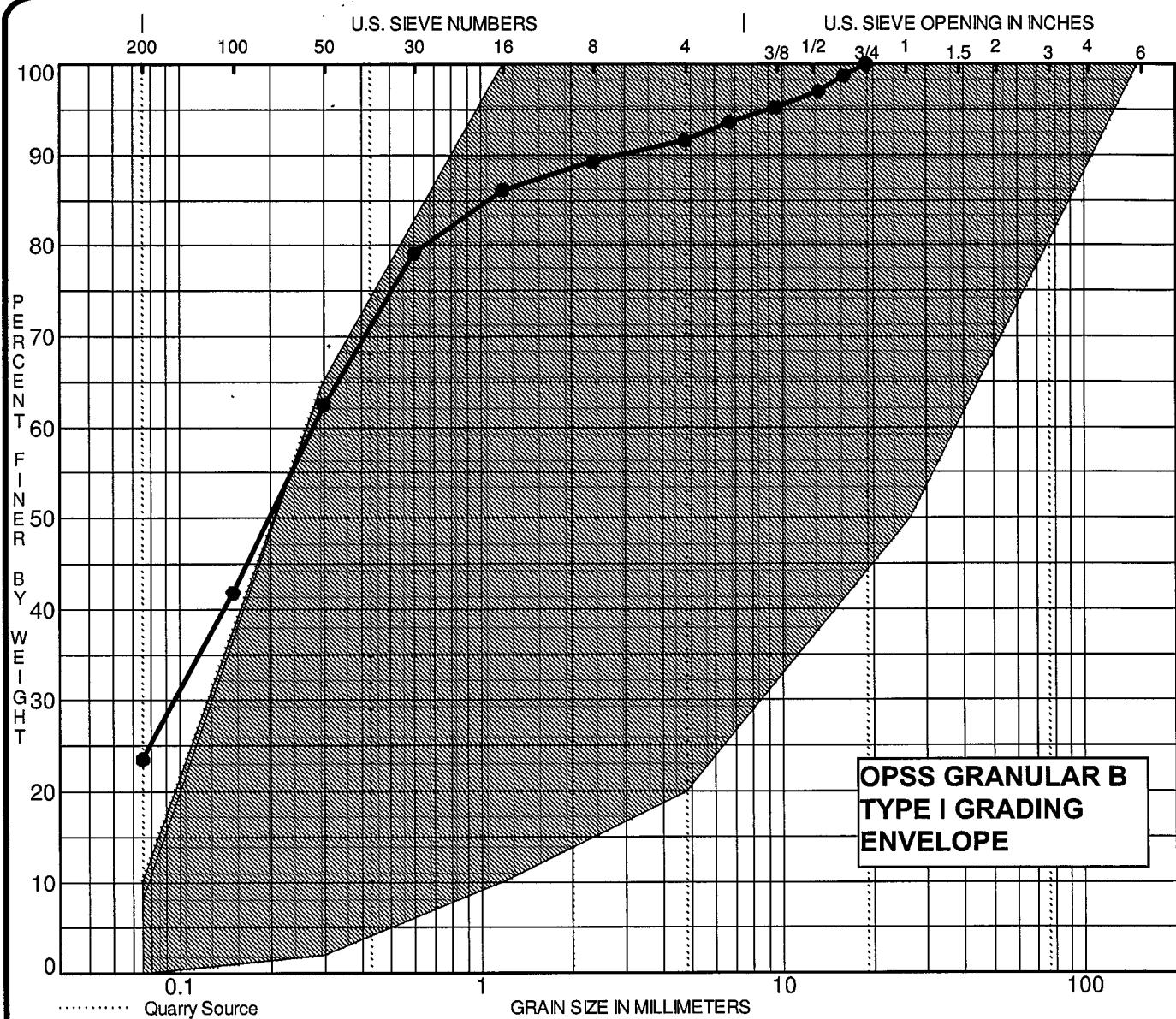
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

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**GRAIN SIZE
DISTRIBUTION**

FILE NO. PH2552

DATE 27 May 14



SILT	SAND			GRAVEL		COBBLES		
	fine	medium	coarse	fine	coarse			
Specimen Identification	Classification				MC%	LL	PL	PI
● TP 2 G 3	SAND-GRAVEL, some silt and clay							
☒								
▲								
★								
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● TP 2 G 3	19.00	0.28	0.096		8.4	68.1	23.5	
☒								
▲								
★								

CLIENT Greely Sand and Gravel FILE NO. PH2552

PROJECT Mineral Aggregate Assessment - Bank Street, DATE 27 May 14

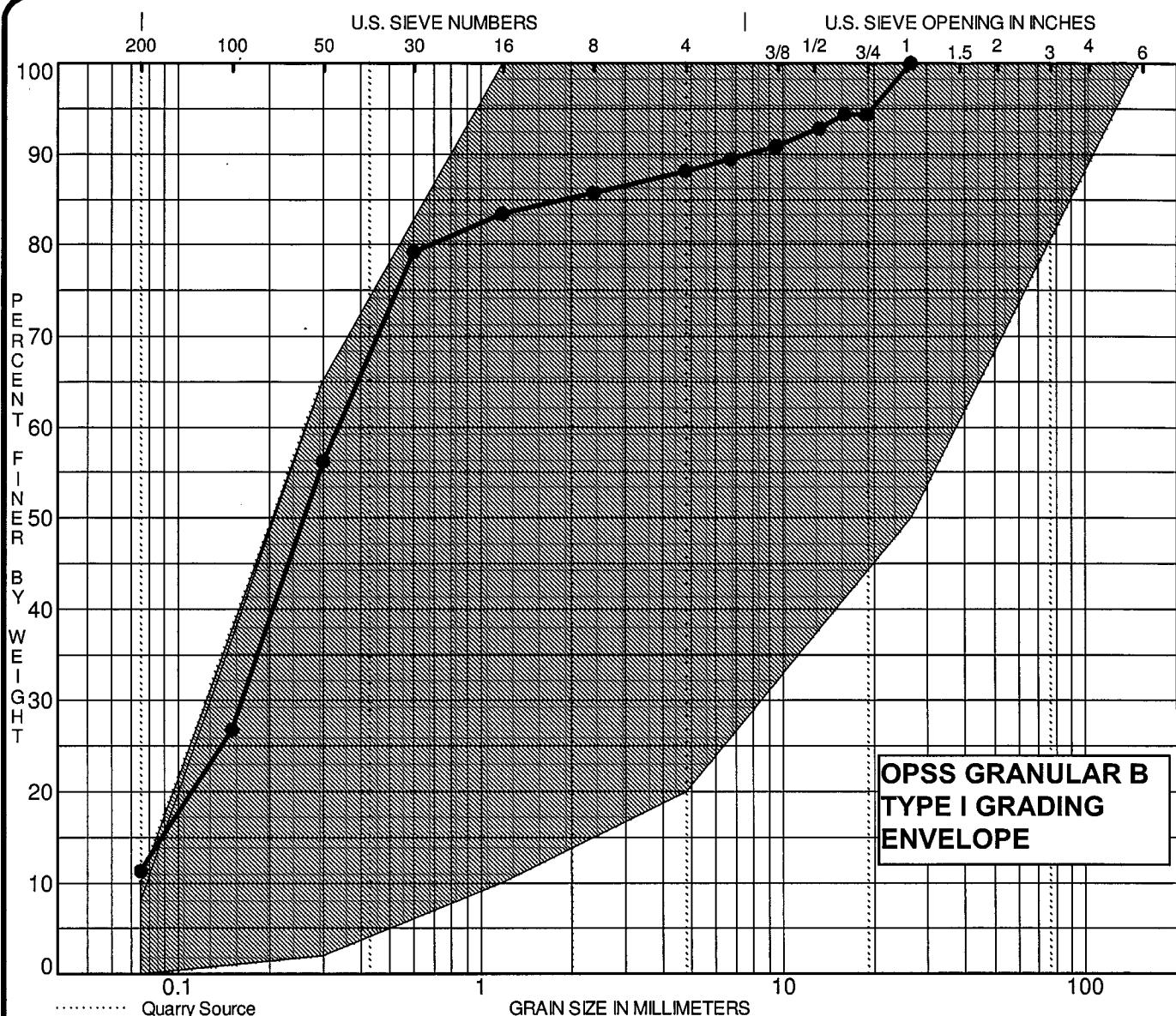
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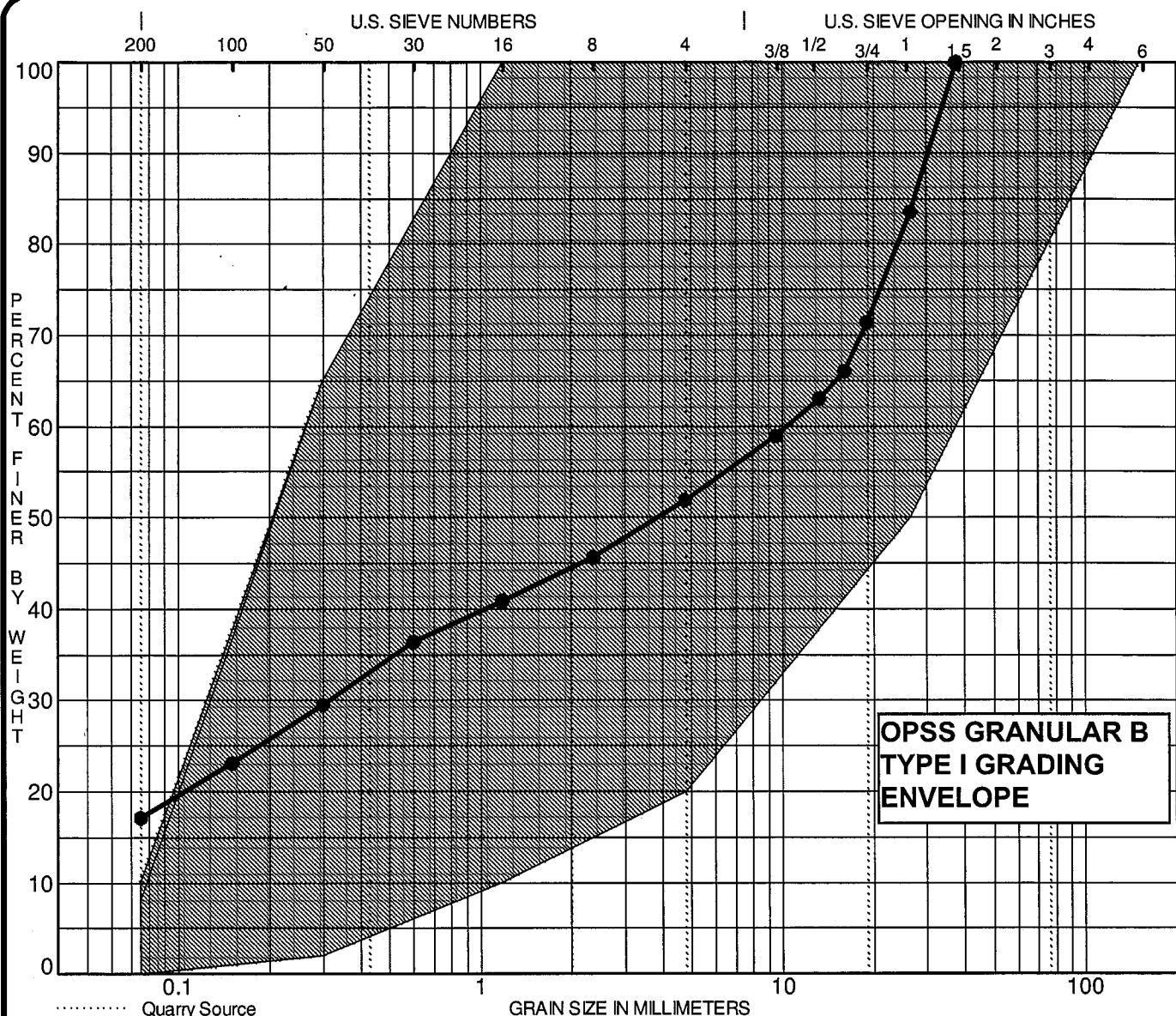
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**GRAIN SIZE
DISTRIBUTION**



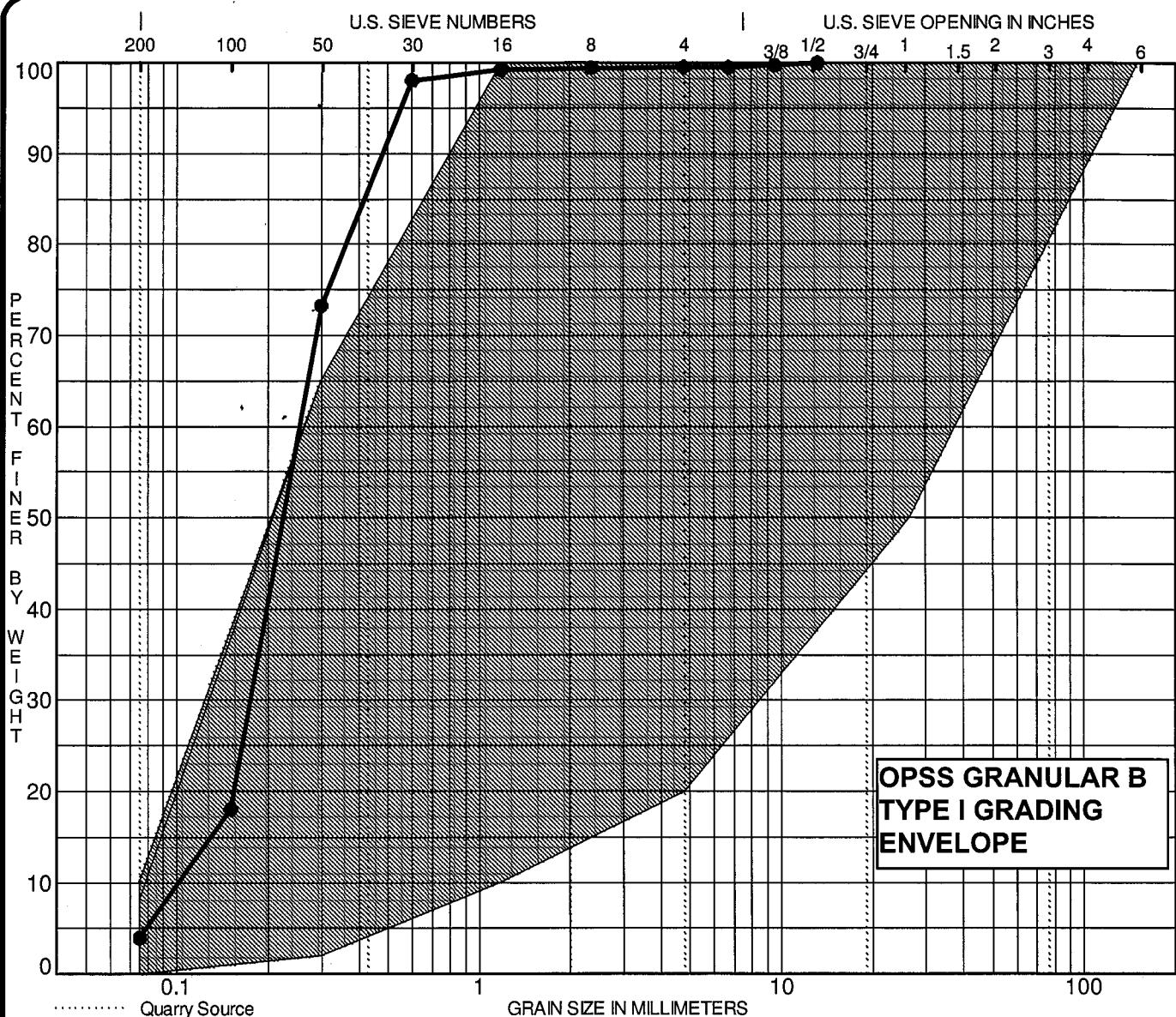
SILT	SAND			GRAVEL			COBBLES	
	fine	medium	coarse	fine	coarse			
Specimen Identification	Classification				MC%	LL	PL	PI
● TP 2 G 4 GLACIAL TILL: Sand-gravel, some silt and clay								1.10 4.8
■								
▲								
★								
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● TP 2 G 4 26.50	0.34	0.162			11.9	76.8	11.3	
■								
▲								
★								

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petersongroup Consulting Engineers		GRAIN SIZE DISTRIBUTION	
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SILT	SAND			GRAVEL		COBBLES	
	fine	medium	coarse	fine	coarse		
Specimen Identification	Classification				MC%	LL	PL
● TP 3 G 5	GRAVEL, some silt and clay				PI	Cc	Cu
■							
▲							
★							
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt
● TP 3 G 5	37.50	10.38	0.315		48.1	34.8	17.1
■							
▲							
★							

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5			



SILT	SAND			GRAVEL			COBBLES	
	fine	medium	coarse	fine	coarse			
Specimen Identification	Classification			MC%	LL	PL	PI	Cc Cu
● TP 4 G 6	FINE SAND							1.18 2.5
✗								
▲								
★								
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● TP 4 G 6	13.20	0.25	0.174	0.1011	0.5	95.6	3.9	
✗								
▲								
★								

CLIENT

Greely Sand and Gravel

FILE NO.

PH2552

PROJECT

Mineral Aggregate Assessment - Bank Street,

DATE

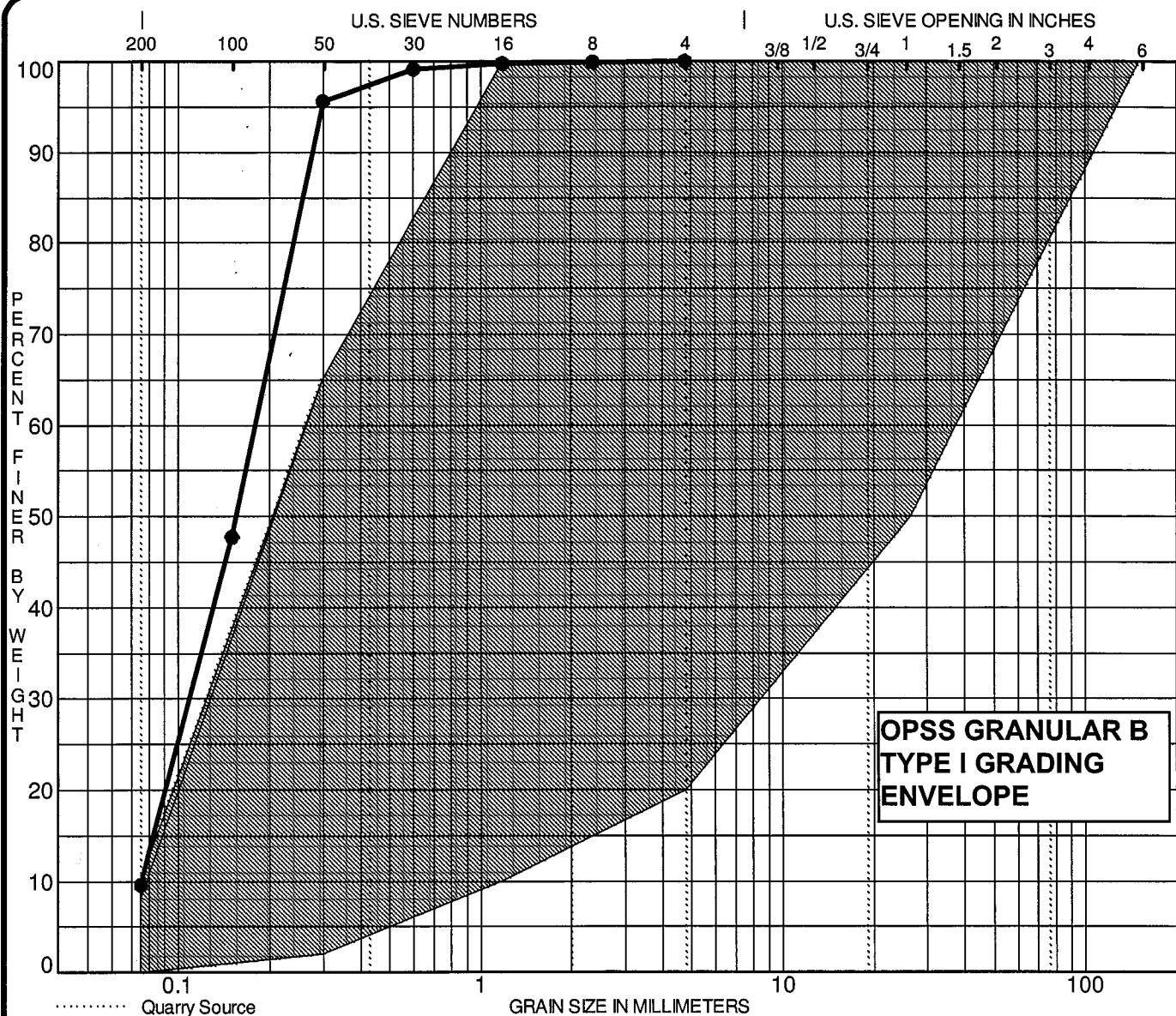
6 Aug 14

Ottawa (Greely), Ontario

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Consulting
Engineers**GRAIN SIZE
DISTRIBUTION**



SILT	SAND			GRAVEL		COBBLES	
	fine	medium	coarse	fine	coarse		
Specimen Identification	Classification				MC%	LL	PL
● TP 4 G 7	FINE SAND, trace silt						0.87
☒							
▲							
★							
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt
● TP 4 G 7	4.75	0.18	0.109	0.0756	0.0	90.4	9.6
☒							
▲							
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Greely Sand and Gravel

FILE NO.

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PROJECT

Mineral Aggregate Assessment - Bank Street,

DATE

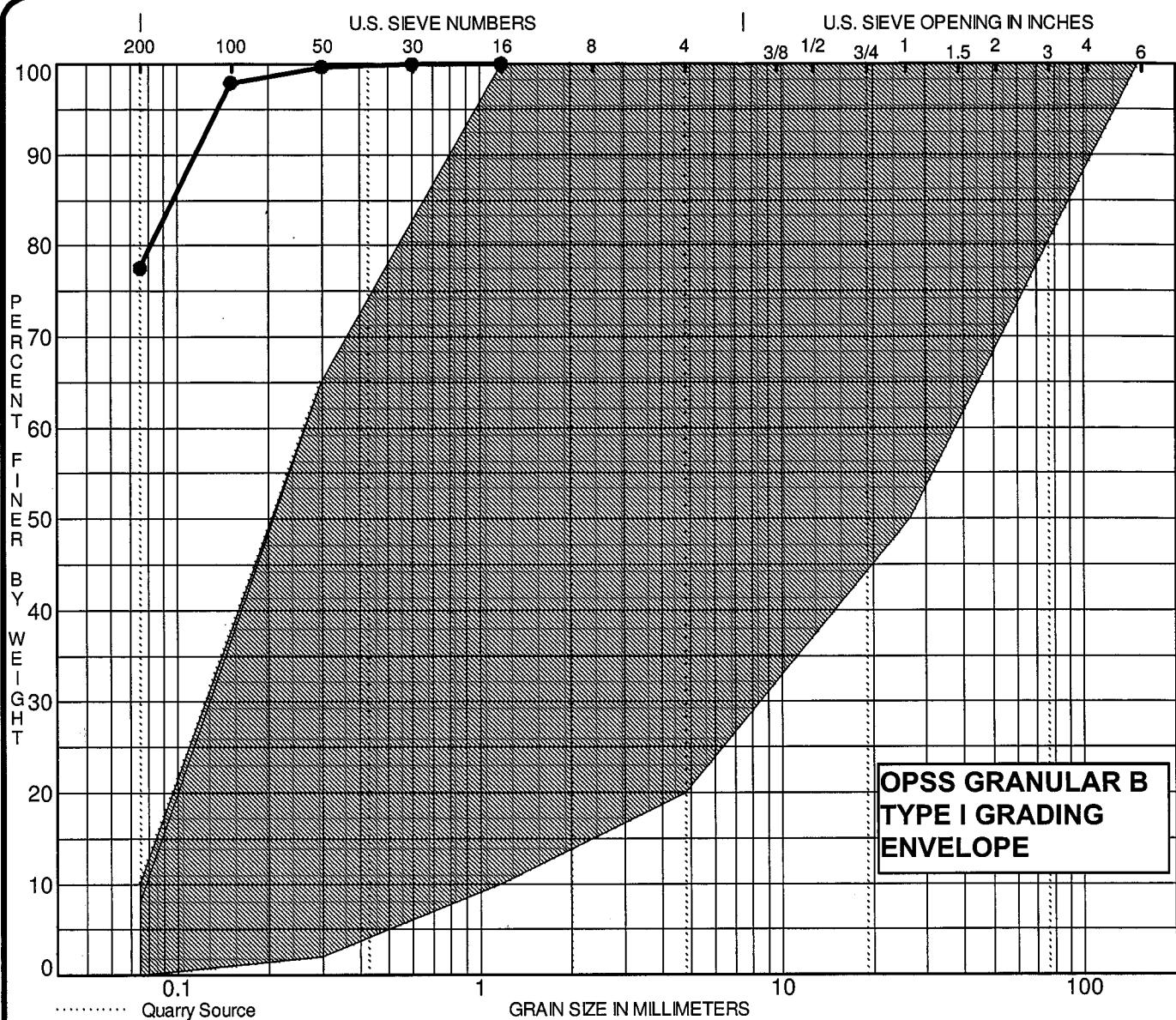
6 Aug 14

Ottawa (Greely), Ontario

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Consulting
Engineers**GRAIN SIZE
DISTRIBUTION**



SILT	SAND			GRAVEL		COBBLES	
	fine	medium	coarse	fine	coarse		
Specimen Identification	Classification				MC%	LL	PL
● TP 5 G 8	SANDY SILT				PI	Cc	Cu
■							
▲							
★							
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt %Clay
● TP 5 G 8	1.18				0.0	22.5	77.5
■							
▲							
★							

CLIENT Greely Sand and Gravel

FILE NO.

PH2552

PROJECT Mineral Aggregate Assessment - Bank Street,

DATE

6 Aug 14

Ottawa (Greely), Ontario

petersongroup

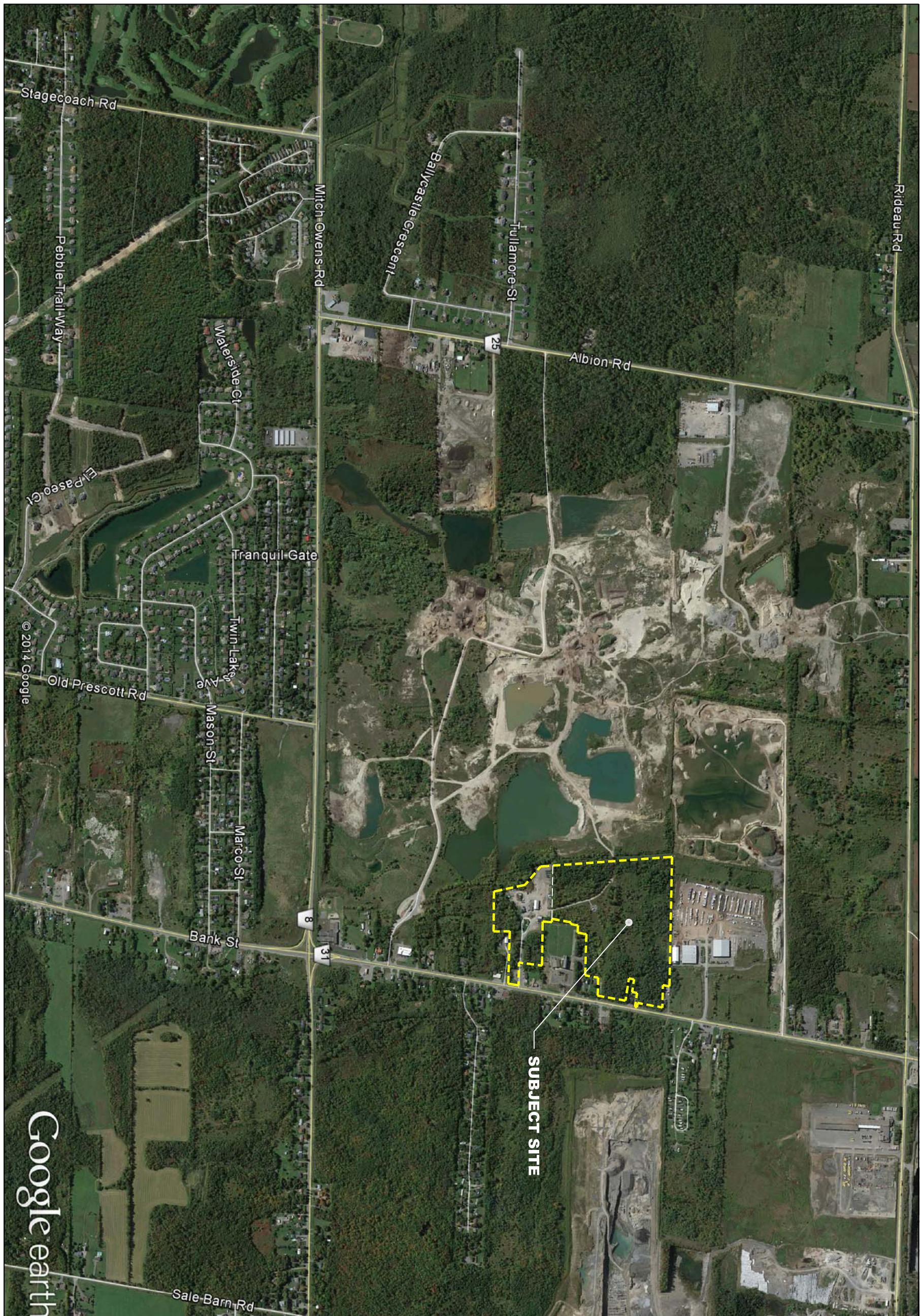
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Consulting
Engineers

**GRAIN SIZE
DISTRIBUTION**

APPENDIX 3

- DRAWING NO. PH2552-FIG.1: SITE LOCATION PLAN**
- DRAWING NO. PH2552-FIG.2: TEST PIT LOCATION PLAN**
- DRAWING NO. PH2552-FIG.3: SURFICIAL SOIL DELINEATION MAPPING**



LEGEND:
--- LIMIT OF STUDY AREA

Client:

GREELY SAND & GRAVEL

Consultant:
paterson consulting engineers

Project:

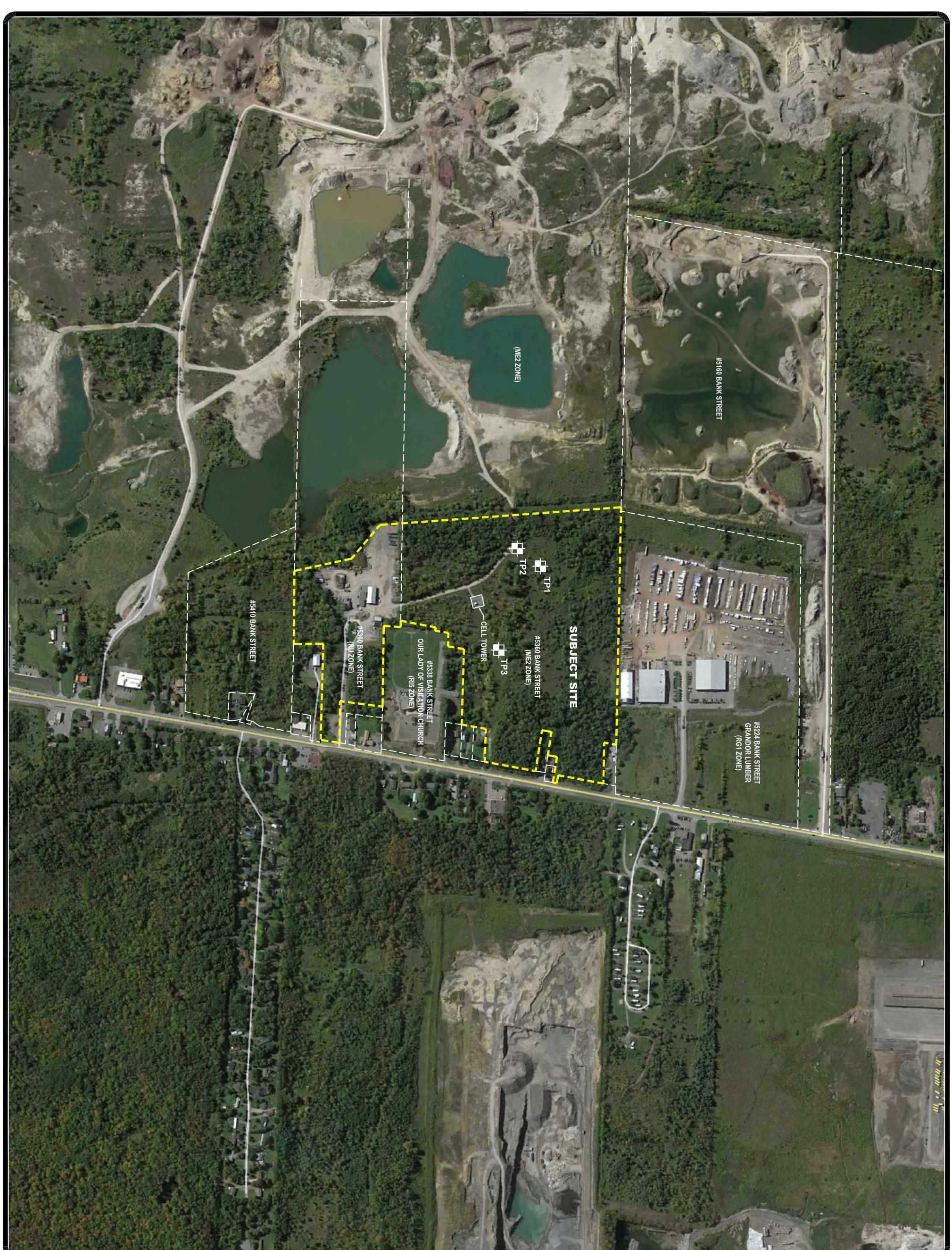
MINERAL AGGREGATE ASSESSMENT

5480 BANK STREET
OTTAWA (GRELLEY), ONTARIO

Drawing:

SITE LOCATION PLAN

Scale:	N.T.S.	Seal:
Date:	06/2014	
Drawn by:	BA	
Checked by:	AVS	
File:	PH2552	
Drawing No.:	PH2552-FIG.1	



Client:

GREELY SAND & GRAVEL

Consultant:

paterson consulting engineers

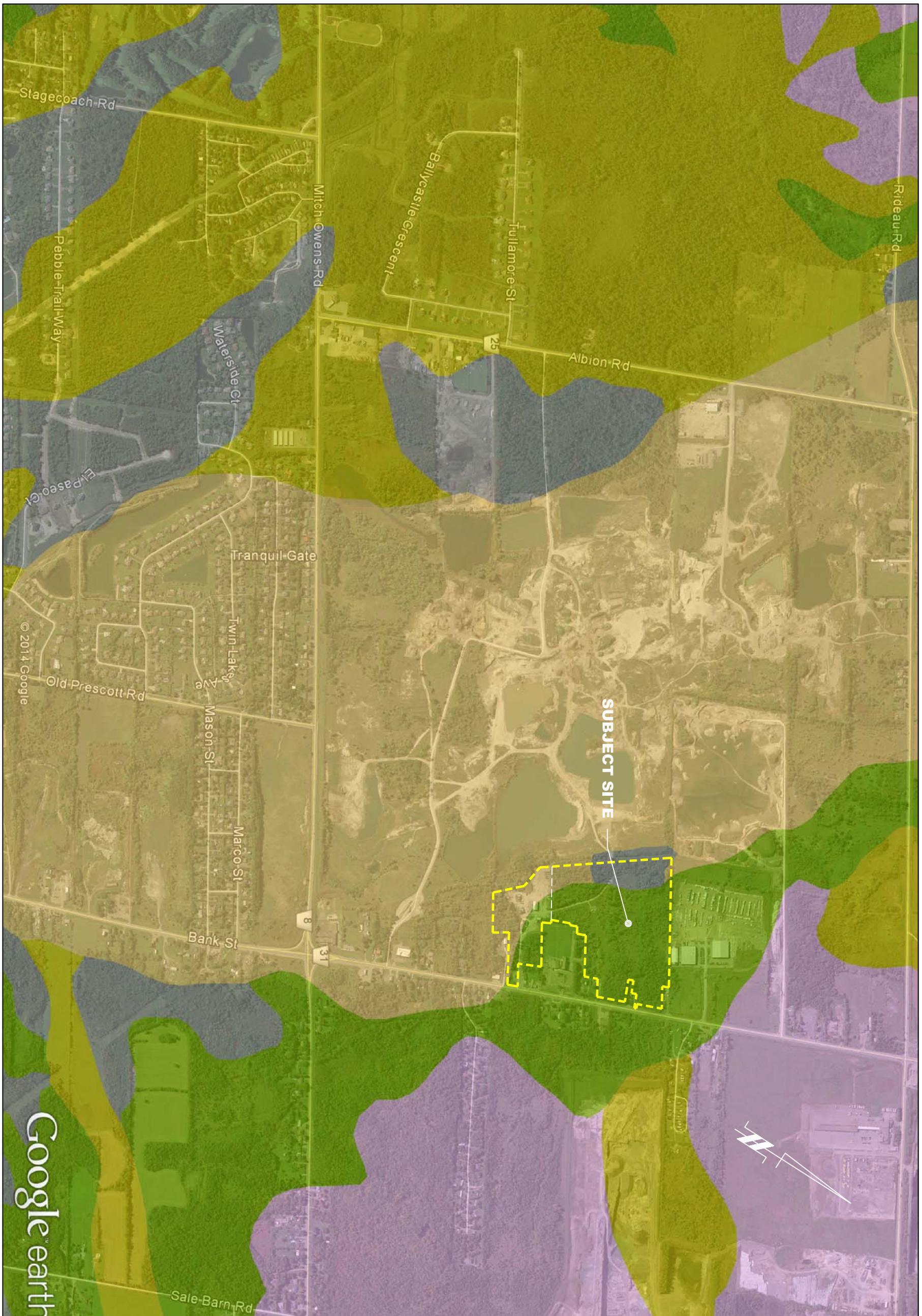
Project:

MINERAL AGGREGATE ASSESSMENT
5480 BANK STREET
OTTAWA (GEELEY), ONTARIO

Drawing:

TEST PIT LOCATION PLAN

Scale:	N.T.S.	Seal:
Date:	06/2014	
Drawn by:	BA	
Checked by:	AVS	
File:	PH2552	
Drawing No.:	PH2552-FIG.2	



MINERAL AGGREGATE ASSESSMENT		PALEOZOIC BEDROCK			
5480 BANK STREET OTTAWA (GEELEY), ONTARIO		TILL			
Drawing:		GLACIOFLUVIAL DEPOSITS			
SURFICIAL SOIL DELINEATION MAPPING		ORGANIC DEPOSITS			
Scale: N.T.S.	Seal:	COARSE-TEXTURED GLACIOMARINE DEPOSITS			
Date: 06/2014		LIMIT OF STUDY AREA			
Drawn by: BA					
Checked by: AVS					
File: PH2552					
Drawing No.:					
PH2552-FIG.3					
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