

**MTO AGREEMENT NO. 5007-E-0052
FOUNDATION INVESTIGATION
AND DESIGN REPORT 42C-21
PROPOSED GARAGE FACILITY
WHITE RIVER PATROL YARD
HIGHWAY 17, WHITE RIVER, ONTARIO**

*Prepared for
MTO Northeastern Region*

February, 2009

File 03080770.07

Distribution:

4 c Client

1 c File



**JAGGER HIMS
LIMITED**
Environmental Consulting Engineers

294 Rink Street, Suite 103
Peterborough, Ontario
Canada, K9J 2K2
Tel 705 743-6850
866 818-8366
Fax 705 743-6854

February 4, 2009

Ontario Ministry of Transportation
Pavements and Foundations Section, Foundations Group
Room 223, Central Building
1201 Wilson Avenue
Downsview, Ontario,
M3M 1J8

Attention: Mr. Ken Ahmad, P. Eng.

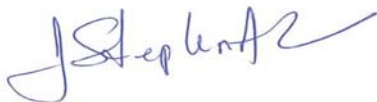
Dear Sirs:

Re: Assignment No. 5007E-0052
Foundation Investigation and Design Report
Proposed Garage Facility, White River Patrol Yard
File 03080770.07

We are pleased to submit our Foundation Investigation and Design Report for the proposed construction of a new garage facility at the MTO White River patrol yard. The report is based on a borehole investigation and laboratory testing program, and addresses the Terms of Reference requirements for the assignment.

Please contact us if you have any questions about the report.

Yours truly,
JAGGER HIMS LIMITED



J. Stephen Ash, B.Sc., P. Eng.
Project Engineer – Branch Manager





TABLE OF CONTENTS

	PAGE
<i>Letter of Transmittal</i>	
1.0 INTRODUCTION.....	1
2.0 SITE DESCRIPTION	1
3.0 INVESTIGATION PROCEDURES	3
3.1 SUBSURFACE INVESTIGATION.....	3
3.2 LABORATORY TESTING.....	5
4.0 SUBSURFACE CONDITIONS	6
4.1 SOIL PROFILE SUMMARY	6
4.1.1 Sand to Sand and Gravel	6
4.1.2 Silty Sand to Sand and Silt.....	7
4.1.3 Cobbles, Gravelly Sand.....	8
4.1.4 Bedrock.....	8
4.1.5 Groundwater.....	8
5.0 MISCELLANEOUS INFORMATION.....	9
5.1 BURIED UTILITY LOCATOR	9
5.2 DRILLING COMPANY IDENTIFICATION.....	9
5.3 LABORATORY IDENTIFICATION	9
5.4 SITE INVESTIGATORS	9
6.0 STRUCTURE FOUNDATION DESIGN	10
6.1 TYPE AND DEPTH OF FOUNDATION	10
6.2 BEARING RESISTANCE	10
6.2.1 Geotechnical Resistance at ULS.....	10
6.2.2 Geotechnical Reaction at SLS.....	11
6.3 LATERAL RESISTANCE	11
7.0 EARTH PRESSURE DESIGN	11
8.0 SEISMIC DESIGN	12



TABLE OF CONTENTS (Continued)

	PAGE
9.0 UNWATERING AND SUBDRAINAGE	12
10.0 FROST PENETRATION.....	12
11.0 BEDROCK EXCAVATION	13
12.0 CONSTRUCTION CONCERNS	13
12.1 SITE PREPARATION	13
12.2 FOUNDATION BACKFILL	13
12.3 PAVEMENT DESIGN.....	14
12.4 SPECIAL REQUIREMENTS.....	14
13.0 CLOSURE.....	14

APPENDIX

BOREHOLE LOGS
GRAIN SIZE ANALYSES

FIGURES

FIGURE 1	SITE PLAN	2
FIGURE 2	PEDOLOGICAL SKETCH	4

1.0 INTRODUCTION

This report contains the results of a foundation investigation carried out for a proposed maintenance garage structure at the White River Patrol Yard. The work was conducted under MTO Agreement Number 5007-E-0052, and included drilling and sampling of five (5) boreholes at the proposed structure location. Site details, procedures and our findings are discussed in subsequent report sections.

2.0 SITE DESCRIPTION

The White River patrol yard (site) is located on the north side of Highway 17, at the intersection with Highway 631, in the Town of White River. A site location map is included on Figure 1.

The site is currently occupied by two sand storage domes, a salt shed, a 5-bay maintenance garage/office, and a storage shed. Floor grade elevations of existing buildings are in the order of 381.2 m above sea level. The site area around the existing buildings is asphalt paved; other areas are gravel surfaced. The patrol yard also contains two propane tanks and an in-ground oil/water separator, and the site has municipal sewer and water services. A site plan is included on Figure 1.

The site is situated at the edge of a hill that slopes away from the site on the north, east and south sides. Onsite grades are generally flat, with a slight overall slope towards the south. No drainage ditches or bedrock outcrops were observed and existing vegetation includes perimeter trees with some grass covered areas. The proposed building location is currently a gravel covered area. Adjacent land use to the north, west and south of the site is residential.

The proposed location for the new garage facility is immediately south of an existing salt storage dome and east of an existing 5-bay garage, as indicated on Figure 1.

Insert Figure 1

It is understood that the dimensions of the new structure will be approximately 22 m by 25 m, and that the building will have a concrete floor slab at grade. It is expected that the building would be heated most of the time. The exterior perimeter apron within 10 m of the structure will be asphalt paved. The new pavement will abut existing pavement around the existing site structures. A field pedological sketch indicating features in the immediate area around the proposed structure location is included as Figure 2.

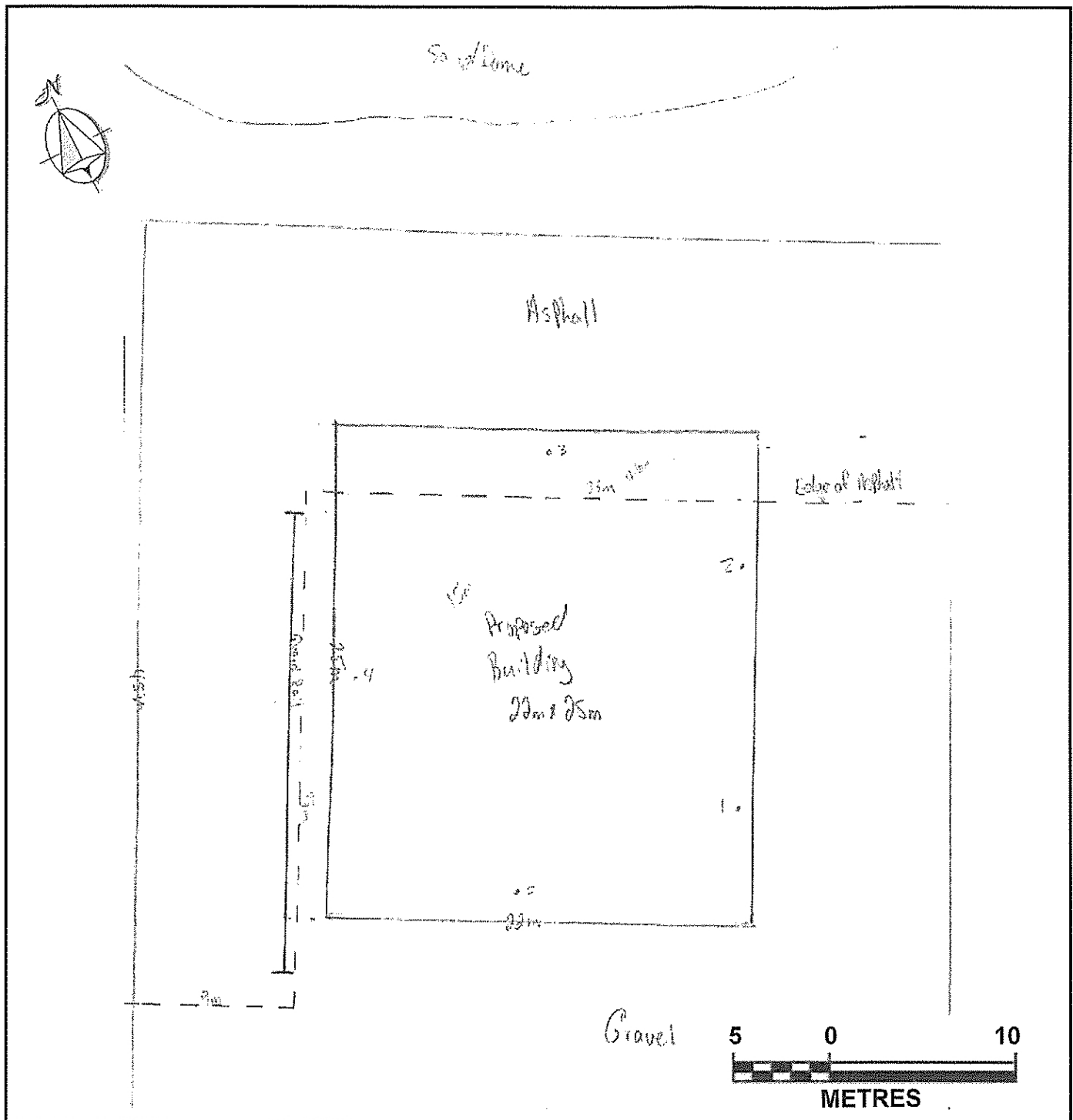
3.0 INVESTIGATION PROCEDURES

3.1 SUBSURFACE INVESTIGATION

Subsurface conditions at the proposed structure location were investigated between May 11 and May 13, 2008. Five (5) boreholes, designated as BH1 through BH5, were drilled with a truck-mounted rig equipped with hollow-stem augers and split-spoon samplers, and various other soil testing/sampling apparatus including field vane, dynamic cone penetrometer, and thin wall tube samplers. The rig also had capability for NQ size (48 mm diameter) rock coring, if necessary. All drilling and sampling was conducted under the supervision of a soils technologist. Borehole locations within the proposed building area are plotted on Figure 1.

The boreholes were located using a hand held GPS unit with MTO's WGS 84 coordinates, and the borehole elevations were surveyed to a site benchmark; the southeast corner of the existing salt shed floor has a reported elevation of 381.18 m above sea level. Borehole coordinates and elevations are indicated on the borehole logs.

Prior to undertaking the borehole investigation, existing buried utilities on the site were cleared with a private locator and Ontario One-Call services. MTO site supervisors accompanied field staff on the initial site inspection to stake out borehole locations and clear buried service conflicts.



LEGEND

PEDOLOGICAL FIELD SKETCH

GEOTECHNICAL INVESTIGATION
WHITE RIVER PATROL YARD
White River, Ontario
For: Ministry of Transportation

DATE: DECEMBER, 2008

SCALE: 1:300

PROJECT: 03080770.07

REF. NO.: 0308077007F5

**JAGGER HIMS
LIMITED**

Environmental Consulting Engineers

FIGURE

2

MTO's minimum requirements for the borehole investigation included the following.

- Five boreholes in the area of the structure, unless justification for additional boreholes was authorized by the MTO Project Manager.
- Boreholes advanced to a minimum of 3 m below refusal depth, as defined by material for which Standard Penetration Test (SPT) N values exceed 100 blows per 0.3 m.
- A maximum drilling depth of 15 m, unless refusal was encountered at shallower depth or justification for deeper drilling was authorized by the MTO Project Manager.
- When bedrock exists in foundation element locations, obtain a minimum 3 m core sample from below the bedrock surface. Determine the bedrock/soil interface by geological definition.
- Semi-continuous soil sampling at 0.75 m intervals within critical foundation zones and a maximum sampling interval of 1.5 m within the investigated depth.
- Backfilling of boreholes with bentonite sealant, and repair of holes in asphalt in accordance with abandonment procedures and regulations. Artesian groundwater pressure, if encountered, to be sealed at the source.

Soil samples were taken mainly using split spoon/standard penetration test (SPT) procedures (ASTM D1586). Soil samples collected during drilling operations were inspected and logged, and then placed in labeled bags for transport and storage. Jars with tight-sealing Teflon-lined lids were used for laboratory moisture content specimens.

3.2 LABORATORY TESTING

Soil samples from the borehole investigation were reviewed by the project geotechnical engineer, to confirm field descriptions and assess laboratory testing requirements.

The following routine laboratory testing was conducted on selected soil samples:

- Natural Moisture Content (LS-701): 21
- Particle Size Distribution Analysis (LS-602, LS-702): 14

No complex level soil or rock testing was completed for this site.

4.0 SUBSURFACE CONDITIONS

4.1 SOIL PROFILE SUMMARY

The subsurface profile in the investigated area generally consists of a sand and gravel to sand layer overlying deposits of silty sand to silt and sand, which in turn overly dense cobbly to gravelly deposits at depth. The boreholes were terminated in dense materials at depths of 11.3 m to 15.8 m below ground level. The boreholes were drilled beyond the limits of existing pavement at the site (no asphalt materials were penetrated) and none of the boreholes encountered bedrock. Saturated soils and groundwater were encountered at four of the five borehole locations, at depths ranging from 6.2 m to 8.7 m. Individual soil units and details are described in the following subsections, and the subsurface profile is shown on Figure 1.

4.1.1 Sand to Sand and Gravel

Brown sand with a trace of gravel and silt to sand and gravel, was encountered from surface to depths ranging up to 12.8 m at the borehole locations. Sampled material was generally moist at the time of the investigation, becoming saturated below the groundwater table. Based on SPT N values (uncorrected for depth) ranging from 2 to 29 blows per 305 mm, the sand to sand and gravel unit has very loose to compact (mainly compact) relative density.

Laboratory tests indicate that the natural moisture content of samples taken from the unsaturated zone range from approximately 2 % to 9 %. The saturated material has moisture content in the 10 % to 20 % range. Results of laboratory particle size distribution analyses for samples taken from the unit are included in the Appendix and indicate the following distribution (10 samples):

- 0 % to 53 % gravel (>4.75 mm),
- 43 % to 96 % sand (0.075 mm to 4.75 mm),
- 2 % to 11 % silt (0.002 mm to 0.075 mm), and
- 0 % to 1 % clay (<0.002 mm).

4.1.2 Silty Sand to Sand and Silt

Boreholes BH2, BH3 and BH4 penetrated deposits of silty sand to sand and silt below the sand unit, at respective depths of 7.3 m, 6.1 m and 5.6 m. The silty sand to sand and silt is brown to grey in colour, and is moist, becoming saturated below the groundwater table. Laboratory tests indicate that the natural moisture content of samples taken from this unit range from approximately 10 % to 20 %. The material is loose to dense (generally compact) based on uncorrected SPT N values ranging from 9 to 39 blows per 305 mm, and results of laboratory particle size distribution analyses of selected samples indicate the following distribution (3 samples):

- 0 % gravel (>4.75 mm)
- 36 % to 77 % sand (0.075 mm to 4.75 mm),
- 23 % to 63 % silt (0.002 mm to 0.075 mm), and
- 0 % to 1 % clay (<0.002 mm).

4.1.3 Cobbles, Gravelly Sand

Boreholes BH1 through BH3, and BH5 penetrated into, and were terminated in, a relatively dense deposit of very cobbly (possibly bouldery) material. Sample recovery from this layer was very limited using the SPT drilling methods. At BH4 the deposit was a relatively fine grained gravelly sand material, and sample recovery was improved. It is inferred that the cobble layer is saturated, being below the inferred groundwater table for the site. The gravelly sand material sampled at BH4 has the following particle size distribution based on laboratory tests (1 sample):

- 24 % gravel (>4.75 mm),
- 63 % sand (0.075 mm to 4.75 mm),
- 13 % silt (0.002 mm to 0.075 mm), and
- 0 % clay (<0.002 mm).

The cobble deposit is very dense with uncorrected SPT resistance values typically over 100 blows per 305 mm. The gravelly sand material at BH4 is dense based on uncorrected SPT N values of 30 to 38.

4.1.4 Bedrock

None of the boreholes encountered bedrock.

4.1.5 Groundwater

Wet to saturated soils and groundwater seepage was encountered in boreholes BH1 through BH4, at depths ranging from 6.2 m to 8.7 m. Soils penetrated at BH5 caved upon auger removal and a groundwater level could not be measured in that borehole. No artesian groundwater pressures were encountered.

5.0 MISCELLANEOUS INFORMATION

5.1 BURIED UTILITY LOCATOR

Buried utility clearances were performed by Cable Master of Newmarket, Ontario (ph: 905-715-7305).

5.2 DRILLING COMPANY IDENTIFICATION

The drilling company used on the assignment was Abraflex of Lively, Ontario (ph: 705-222-2272).

5.3 LABORATORY IDENTIFICATION

Medium complexity laboratory tests were conducted by Golder Associates of Mississauga, Ontario (ph: 905-567-4444), under a subcontract with Jagger Hims Limited.

5.4 SITE INVESTIGATORS

Mr. David Lembke of Jagger Hims Limited supervised the field drilling program. Mr. Stephen Ash, P. Eng. and Mr. Ben McWade, EIT, of Jagger Hims Limited, completed the geotechnical assessments and prepared the reports. Mr. Ash was the project manager and lead contact for the assignment.

6.0 STRUCTURE FOUNDATION DESIGN

5.5 TYPE AND DEPTH OF FOUNDATION

Based on the subsurface soil profile determined by the borehole investigation, the site location is suitable for a shallow foundation design, and it is recommended that the subject storage structure be supported on reinforced concrete strip footings.

Based on the analyses and discussion in the following Section 6.2, it is recommended that the strip footing be at least 0.6 m wide, and that it be placed at a minimum depth of 0.6 m below final exterior grade.

6.2 BEARING RESISTANCE

In accordance with the MTO Terms of Reference, foundation design for the proposed garage structure is based on the procedure stated in Section 6 of the Canadian Highway Bridge Design Code (CHBDC), as published by the Canadian Standards Association (CSA/CAN-S6-00). It is understood that shallow depth foundations are preferred, if possible, to minimize the amount of excavation disturbance, should shallower subgrade soils be appropriate for structural loadings.

6.2.1 Geotechnical Resistance at ULS

The unfactored bearing resistance at Ultimate Limit State (ULS) for a 0.6 m wide by 22 m long strip footing constructed in the compact sand unit, at a depth of 0.6 m below final grade as recommended (approximate elevation 380.6 m above sea level), is 578 kPa. Based on Table 6.6.2.1 of the CHBDC, the factored bearing resistance is 289 kPa.

6.2.2 Geotechnical Reaction at SLS

The geotechnical reaction at Serviceability Limit State (SLS) considers factors outlined in Section 6.6.3 of the CHBDC. Floor loadings within the proposed garage building are expected to be negligible with respect to foundation stress and settlement, and the structure is not expected to affect existing subsurface drainage and groundwater levels to a significant degree.

Estimated settlement of the foundation subgrade soils at the factored ULS loading of 289 kPa will be 25 mm or less, provided that construction disturbance of the subgrade soil is minimized. It is recommended that the SLS design loading be limited to 193 kPa (one third of the ultimate geotechnical resistance, q_u) to account for potential variability and to limit differential settlement potential, if any. Combinations of dead loadings and short-term live loadings (e.g. from equipment traffic, wind) up to the factored ULS bearing resistance could be considered, as permitted by the applicable building codes.

6.3 LATERAL RESISTANCE

The factored geotechnical horizontal soil resistance of a 0.6 m wide by 22 m long strip footing constructed at the recommended design depth is calculated as 1317 kN. Passive soil resistance is not included in this value.

7.0 EARTH PRESSURE DESIGN

No shoring or earth retaining systems are anticipated for this project, so lateral earth pressure design requirements are minimal.

The following active (K_a) and passive (K_p) earth pressure coefficients are recommended, using a resistance factor of 0.5 applied to the estimated 35° internal friction angle for the foundation soil:

- $K_a = 0.5$
- $K_p = 1.9$

8.0 SEISMIC DESIGN

Seismic surveys were beyond the scope of the assignment. However, based on Table 4.1.8.4.A of the Ontario Building Code and the inferred compact to very dense soil conditions encountered during the investigation, we recommend that Site Class C be used for seismic design (if required). Acceleration and velocity based site coefficients can be obtained from Tables 4.1.8.4.B and 4.1.8.4.C.

9.0 UNWATERING AND SUBDRAINAGE

The ground water table was encountered at 6.2 m to 8.7 m (elevations from 372.5 m to 375.7 m above sea level). With the exception of removing accumulated precipitation and runoff from the foundation excavation, no groundwater unwatering is required for the garage construction.

The foundation grade as detailed in this report is above the groundwater table, so no subdrains are recommended.

10.0 FROST PENETRATION

Based on the MTC report RR225 “Aspects of Prolonged Exposure of Pavements to Sub-Zero Temperatures,” the depth of frost penetration for the White River Patrol Yard is 2.4 m. Based on sample inspections and laboratory tests, materials at the site within that depth consist mainly of sand to sand and gravel, with traces (less than 10 percent) of silt. Therefore, the material has low frost heaving susceptibility. The site soils are well drained, and groundwater is not a factor within the frost penetration depth. Also, it is expected that the garage building will be heated, which will reduce frost penetration depth below the

foundation. Therefore, uninsulated footings constructed at depths of at least 0.6 m below final grades are considered appropriate for the site.

11.0 BEDROCK EXCAVATION

No bedrock excavation is required for shallow foundation construction at this site.

12.0 CONSTRUCTION CONCERNS

12.1 SITE PREPARATION

Trenching will be required for the foundation excavation, and should be conducted in accordance with OPSS 206 and the Occupational Health and Safety Act (OHSA). Type 3 cohesionless material is expected and trenches must be sloped at 1:1, maximum. It is recommended that excavation procedures be used to limit soil disturbance, and that loosened materials beneath the footing area be recompact with several passes of a heavy plate compactor, generally in accordance with OPSS 501.

Site preparation will involve leveling and grading of the structure area to the design elevations. A finished floor/exterior grade elevation of 381.2 m above sea level has been assumed, which is consistent with the existing onsite structures. Grading may involve stripping loose surficial material and placement of granular engineered fill to the design elevations. Fill should consist of Granular B (Type I or II), per SP 110S13 amending OPSS 1010.

12.2 FOUNDATION BACKFILL

Foundation backfill must be free-draining, non-frost susceptible granular material such as Granular B (Type I or II), or approved equivalent in accordance with SP 110S13 amending OPSS 1010.

12.3 PAVEMENT DESIGN

Based on the thickness design, the following pavement structure has been recommended for the 10 m apron surrounding the structure.

Material	GBE Factor	GBE (mm)
40 mm Superpave 12.5 surface course	2.0	80
50 mm Superpave 12.5 binder course	2.0	100
150 mm Granular A base	1.0	150
Total = 240 mm		Total GBE= 330 mm

Pavement design details are provided in our memorandum dated December 15, 2008.

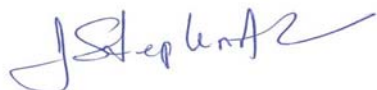
12.4 SPECIAL REQUIREMENTS

Should perched water lenses be encountered during the excavation process, precautions must be taken during construction to limit subgrade soil disturbance, and maintain dry and stable soil conditions.

13.0 CLOSURE

This concludes the foundation investigation and design report for the proposed structure. Please direct any questions to the undersigned.

JAGGER HIMS LIMITED



J. Stephen Ash, P. Eng.
Branch Manager



Andrew G. Hims, P. Eng.
Consulting Engineer

APPENDIX

BOREHOLE LOGS GRAIN SIZE ANALYSES

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. WHITE RIVER PATROL YARD LOCATION NORTHEASTERN REGION ORIGINATED BY DCL
DIST ALGOMA HWY 17 BOREHOLE TYPE I.D HSA / 51 mm O.D SPLIT SPOON COMPILED BY BPM
DATUM GEODETIC / m BELOW GROUND DATE 2008 05 11 - 2008 05 11 CHECKED BY JSA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
381.2	NO ASPHALT						20	40	60	80	100					
0.0	GRAVELLY SAND: BROWN GRAVELLY SAND, MOIST, COMPACT		1	SS	14											
380.4																
0.8	SAND: BROWN SAND, TRACE TO SOME GRAVEL, TRACE SILT, MOIST, COMPACT TO VERY LOOSE		2	SS	5											8 86 6
			3	SS	11											
			4	SS	4											
			5	SS	3											22 76 2
377.1																
4.1	SAND: BROWN FINE TO MEDIUM SAND, TRACE SILT, MOIST TO SATURATED, VERY LOOSE TO LOOSE		6	SS	2											
			7	SS	7											96 4
			8	SS	7											
	- SATURATED															
			9	SS	7											
371.0																
10.2	SAND: BROWN SAND TRACE GRAVEL TO SAND AND GRAVEL, SATURATED, COMPACT		10	SS	11											
368.4			11	SS	100/ 50 mm											
12.8	COBBLES: NO SIGNIFICANT SAMPLE RECOVERY, DIFFICULT AUGERING THROUGH COARSE MATERIALS, VERY DENSE															
366.1																
15.1	BOREHOLE TERMINATED AT 15.1 m DEPTH IN COBBLES															

ONTARIO MOT MTO 3080770.07.GPJ ONTARIO MOT.GDT 2/2/09

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. WHITE RIVER PATROL YARD LOCATION NORTHEASTERN REGION ORIGINATED BY DCL
 DIST ALGOMA HWY 17 BOREHOLE TYPE 1.D HSA / 51 mm O.D SPLIT SPOON COMPILED BY BPM
 DATUM GEODETIC / m BELOW GROUND DATE 2008 05 12 - 2008 05 12 CHECKED BY JSA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
381.3	NO ASPHALT															
0.0	SAND: BROWN SAND, SOME TO TRACE GRAVEL, SOME TO TRACE SILT, MOIST, COMPACT TO DENSE	1	SS	11		381										
		2	SS	16		380						o				18 70 11 1
		3	SS	19		379										
		4	SS	11		378						o				
		5	SS	27		377										
377.2						376										
4.1	SAND: BROWN TO GREY FINE TO MEDIUM SAND, TRACE SILT, MOIST TO SATURATED, LOOSE TO COMPACT	6	SS	9		375						o				95 5
		7	SS	25		374										
374.0						373										
7.3	SILTY SAND: GREY SILTY SAND, SATURATED, COMPACT TO DENSE, DILATANT	8	SS	21		372										
		9	SS	18		371						o				77 23
		10	SS	33		370										
370.0						369										
11.3	COBBLES: GREY GRANITE COBBLES, SOME GRAVEL, SOME SAND, VERY DENSE	11	SS	100/ 100 mm		368										
						367										
						366										
365.5																
15.8	BOREHOLE TERMINATED AT 15.8 m DEPTH IN COBBLES															

ONTARIO MOT. MTO 3080770.07.GPJ ONTARIO MOT.GDT 2/2/09

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

W.P. WHITE RIVER PATROL YARD LOCATION NORTHEASTERN REGION ORIGINATED BY DCL
 DIST ALGOMA HWY 17 BOREHOLE TYPE I.D HSA / 51 mm O.D SPLIT SPOON COMPILED BY BPM
 DATUM GEODETIC / m BELOW GROUND DATE 2008 05 12 - 2008 05 12 CHECKED BY JSA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20 40 60 80 100	20 40 60 80 100	W _p	W		
381.2	NO ASPHALT												
0.0	GRAVEL AND SAND: BROWN SAND SOME GRAVEL TO GRAVEL AND SAND, TRACE SILT, OCCASIONAL COBBLES FROM 3 m TO 5 m DEPTH, MOIST, COMPACT		1	SS	11								
			2	SS	15								
			3	SS	26								
			4	SS	22								
			5	SS	23								
			6	SS	29								
375.1	SILTY SAND: BROWN TO GREY SAND TO SILTY SAND, TRACE GRAVEL, MOIST TO SATURATED, COMPACT		7	SS	19								
6.1			8	SS	19								
	- SATURATED		9	SS	14								
370.0	COBBLES: GREY COBBLES, SOME GRAVEL, TRACE SAND, VERY DENSE		10	SS	19								
11.3			11	SS	100/ 0 mm								
366.2	BOREHOLE TERMINATED AT 15.0 m DEPTH IN COBBLES												
15.0													






ONTARIO MOT MTO 3080770.07.GPJ ONTARIO MOT.GDT 2/2/09

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

W.P. WHITE RIVER PATROL YARD LOCATION NORTHEASTERN REGION ORIGINATED BY DCL
 DIST ALGOMA HWY 17 BOREHOLE TYPE I.D HSA / 51 mm O.D SPLIT SPOON COMPILED BY BPM
 DATUM GEODETIC / m BELOW GROUND DATE 2008 05 12 - 2008 05 12 CHECKED BY JSA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
381.9	NO ASPHALT						20	40	60	80	100									
0.0	SAND AND GRAVEL: BROWN SAND AND GRAVEL, MOIST, VERY LOOSE		1	SS	3															
381.2			2	SS	16															
0.7	SAND: BROWN FINE SAND, TRACE GRAVEL, TRACE SILT, MOIST TO SATURATED, COMPACT TO LOOSE		3	SS	15															
			4	SS	6															
			5	SS	9															
			6	SS	26															
376.3																				
5.6	SILT AND SAND: GREY SILT AND SAND, MOIST, SATURATED BELOW 6.3 m DEPTH, COMPACT TO LOOSE, DILATANT		7	SS	12															
			8	SS	39															
			9	SS	9															
371.7																				
10.2	GRAVELLY SAND: GREY GRAVELLY SAND, SOME SILT, SATURATED, DENSE		10	SS	38															
			11	SS	30															
			12	SS	100/ 0 mm															
366.9																				
15.0	BOREHOLE TERMINATED AT 15.0 m DEPTH IN GRAVELLY SAND																			

ONTARIO MOT MTO 3080770.07.GPJ ONTARIO MOT.GDT 2/2/09

RECORD OF BOREHOLE No 5

1 OF 1

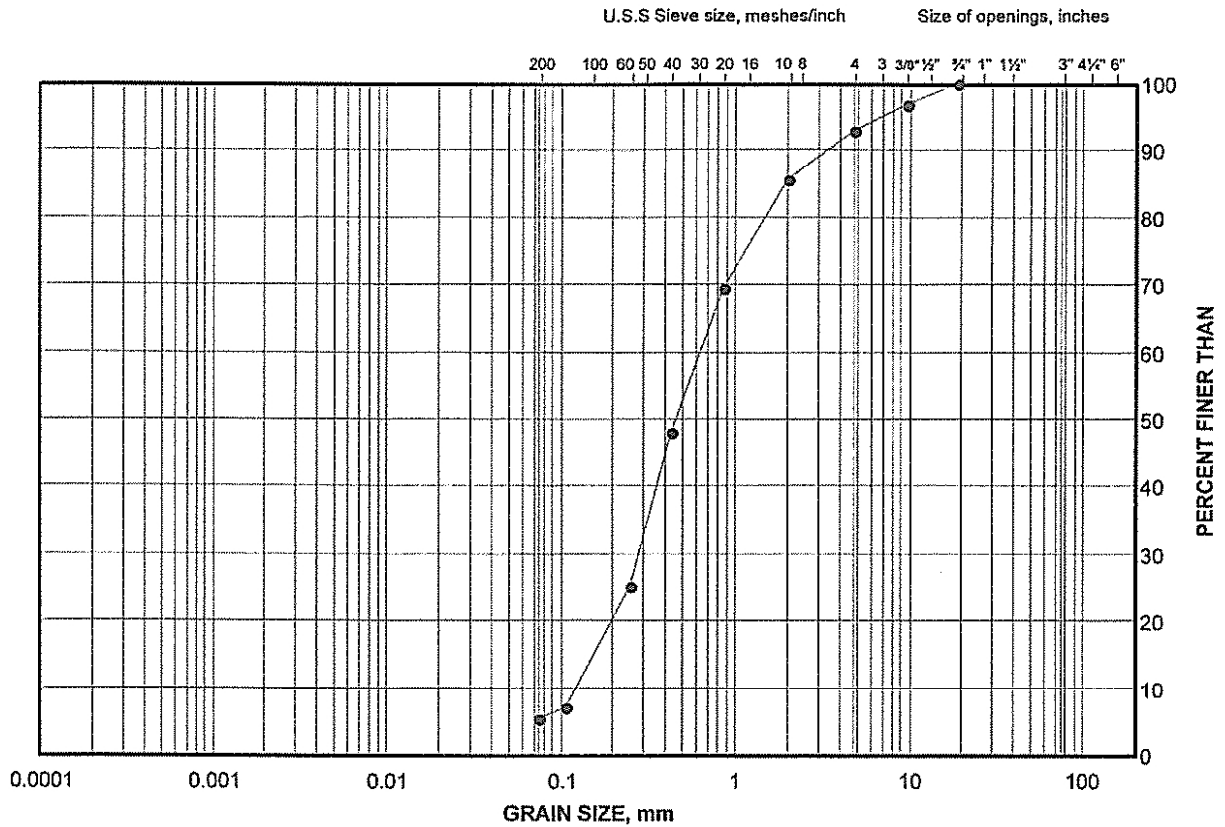
METRIC

W.P. WHITE RIVER PATROL YARD LOCATION NORTHEASTERN REGION ORIGINATED BY DCL
 DIST ALGOMA HWY 17 BOREHOLE TYPE I.D HSA / 51 mm O.D SPLIT SPOON COMPILED BY BPM
 DATUM GEODETIC / m BELOW GROUND DATE 2008 05 13 - 2008 05 13 CHECKED BY JSA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
381.1	NO ASPHALT															
0.0	SAND, BROWN TO GREY SAND, TRACE GRAVEL, TRACE TO SOME SILT, MOIST, LOOSE TO COMPACT	1	SS	12		380										
		2	SS	10												
		3	SS	6		379										
		4	SS	7		378										1 95 4
		5	SS	13												
						377										
		6	SS	15		376										92 8
						375										
		7	SS	44												
373.9						374										
7.2	COBBLES, NO SIGNIFICANT SAMPLE RECOVERY, DIFFICULT AUGERING THROUGH COARSE MATERIALS, VERY DENSE	8	SS	100/ 25 mm		373										BOREHOLE UNSTABLE, NO GROUNDWATER MEASUREMENT
		9	SS	100/ 10 mm		372										
						371										
		10	SS	100/ 10 mm		370										
369.8																
11.3	BOREHOLE TERMINATED AT 11.3 m DEPTH IN COBBLES															

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-1	2	0.80 - 1.40

REMARKS
3080770.07

Project Number: 08-1116-0014

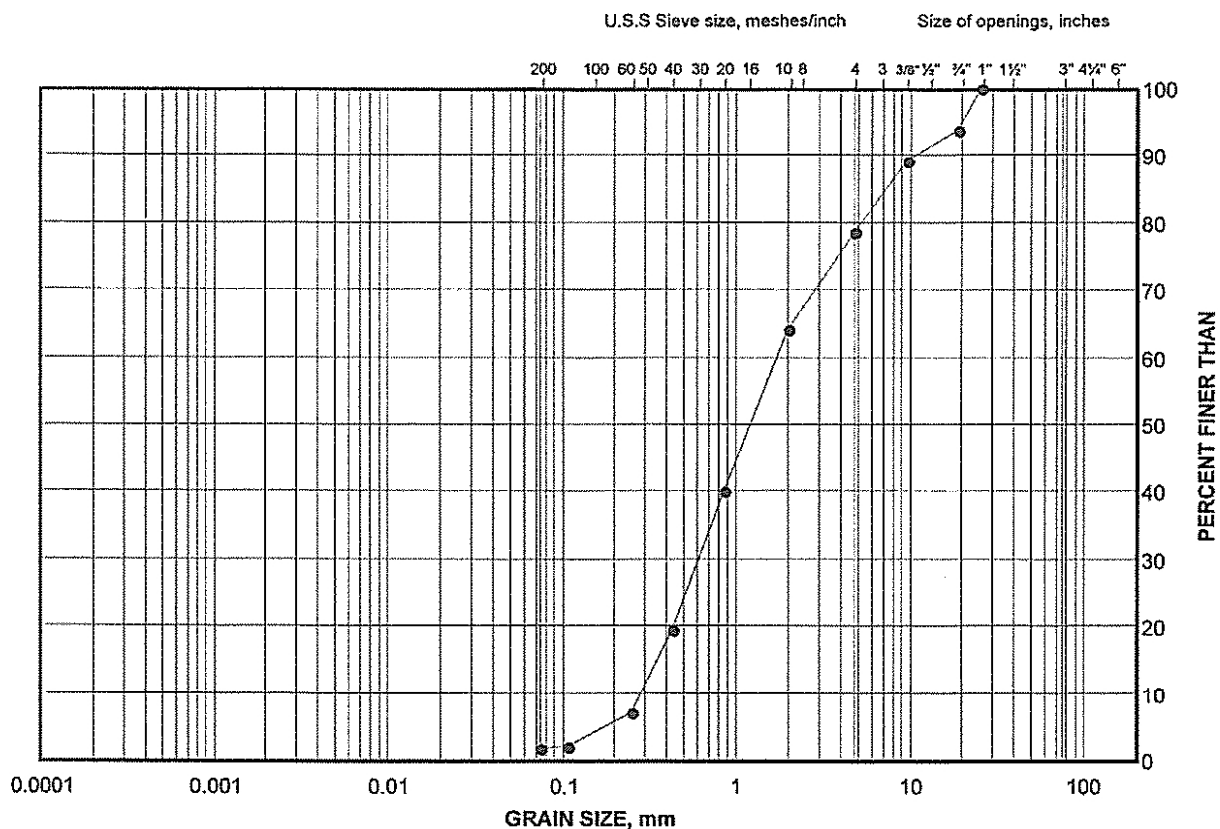
Checked By: *[Signature]*

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-1	5	3.10 - 3.70

REMARKS
3080770.07

Project Number: 08-1116-0014

Checked By: _____

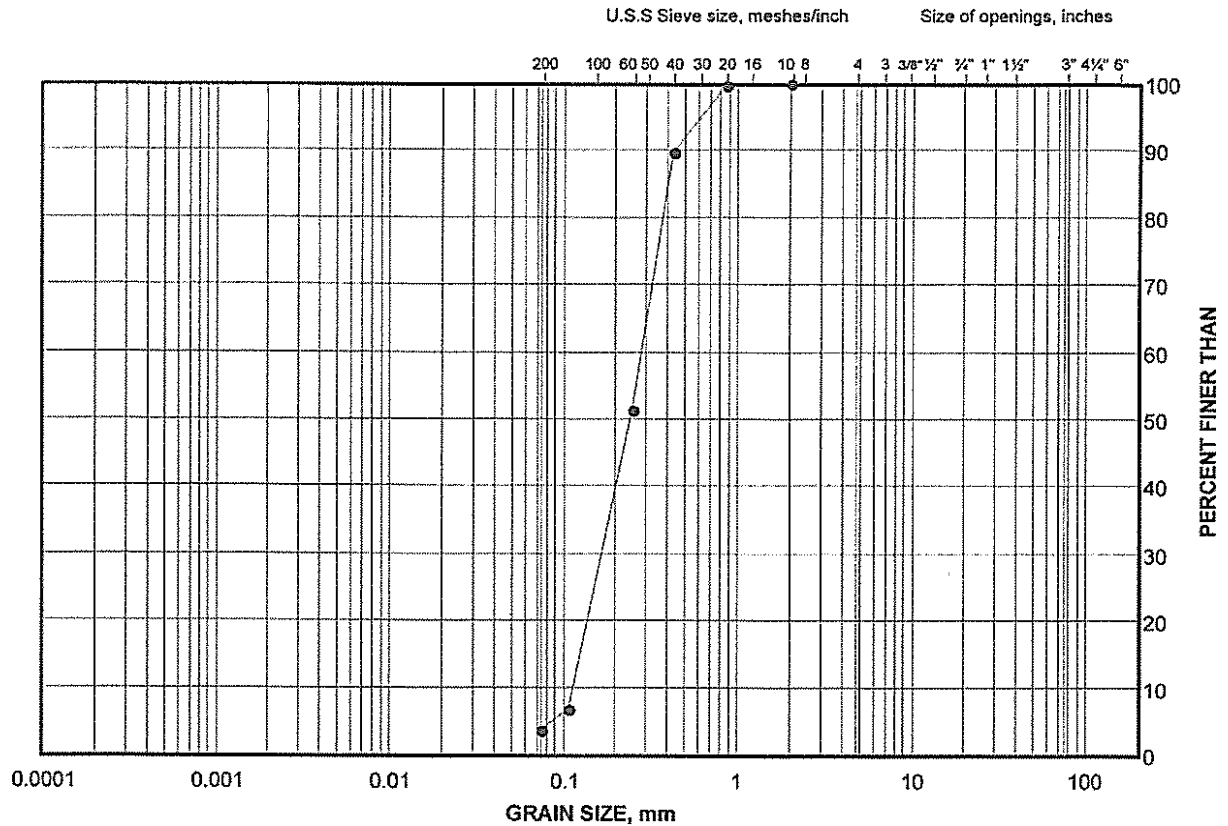
bl

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-1	7	6.10 - 6.70

REMARKS
3080770.07

Project Number: 08-1116-0014

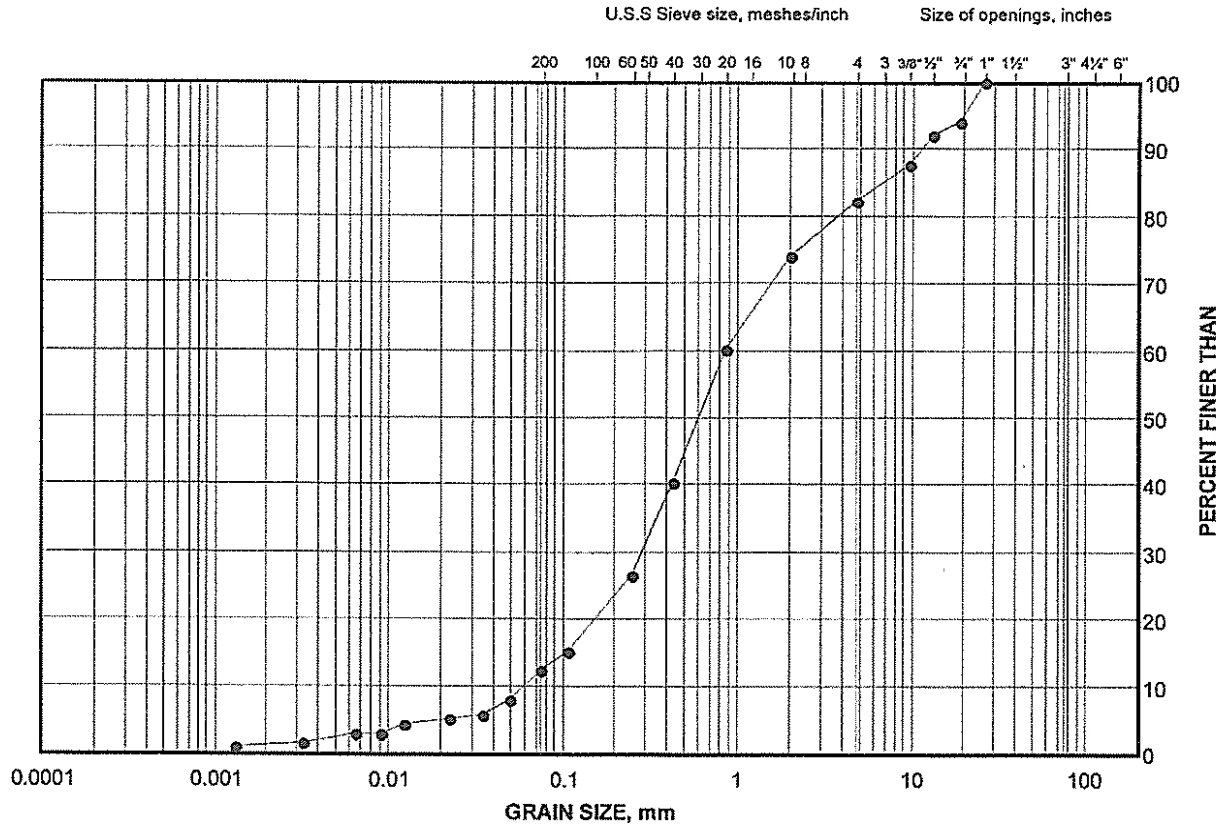
Checked By: *lab*

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-2	2	0.80 - 1.40

REMARKS
3080770.07

Project Number: 08-1116-0014

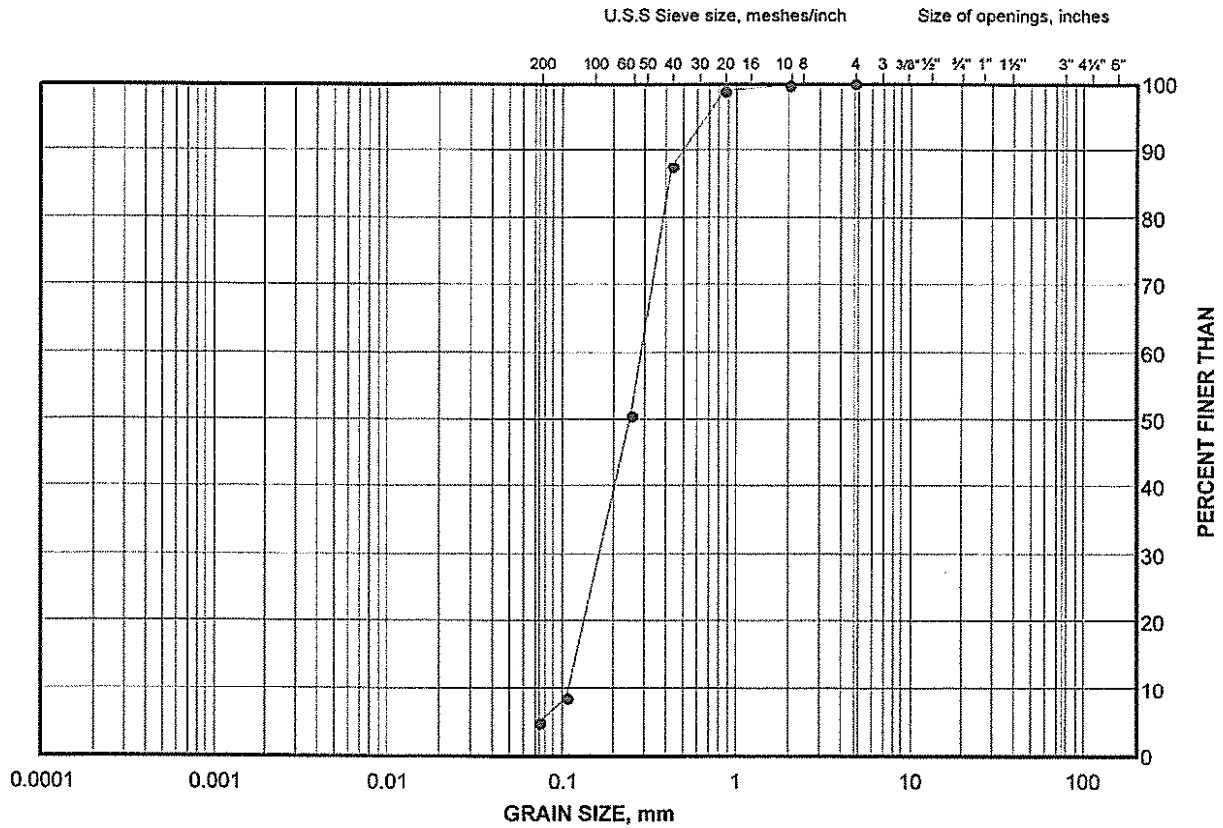
Checked By: *[Signature]*

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-2	6	4.60 - 5.20

REMARKS
3080770.07

Project Number: 08-1116-0014

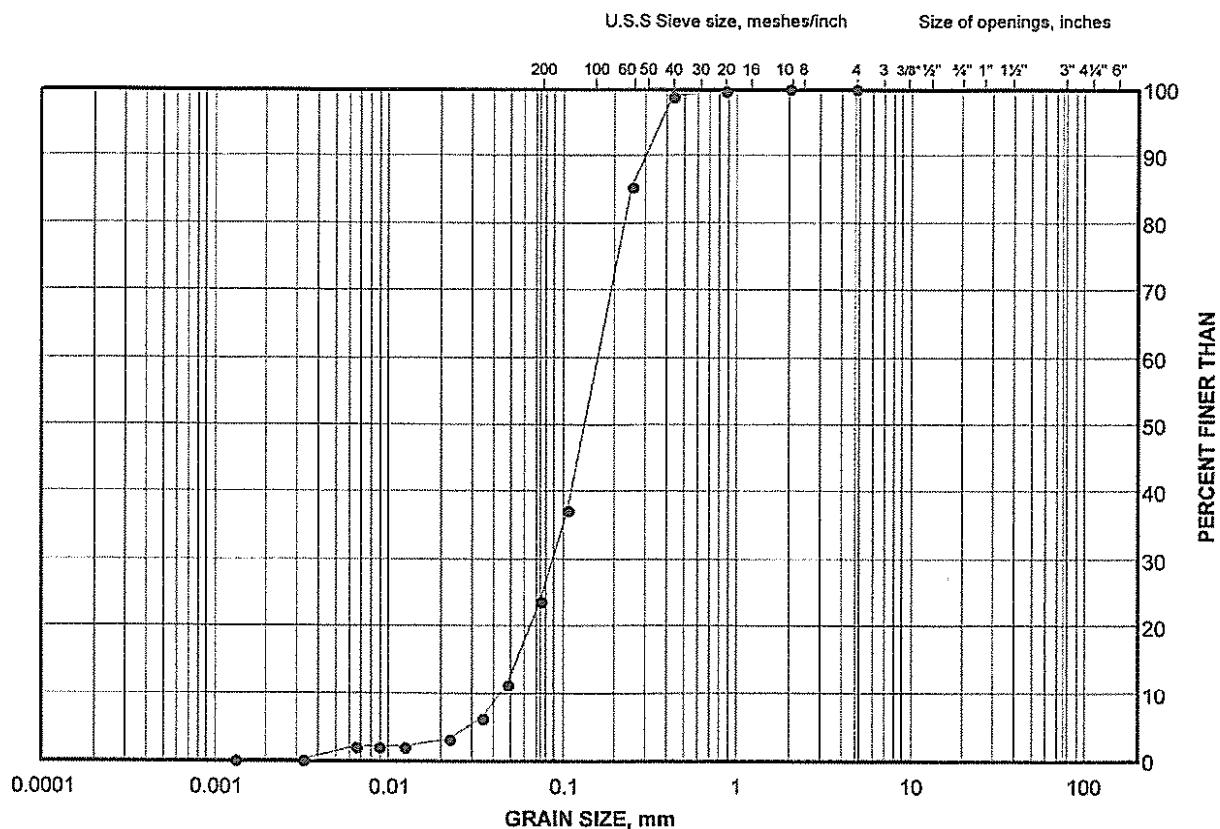
Checked By:

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-2	9	9.10 - 9.80

REMARKS
3080770.07

Project Number: 08-1116-0014

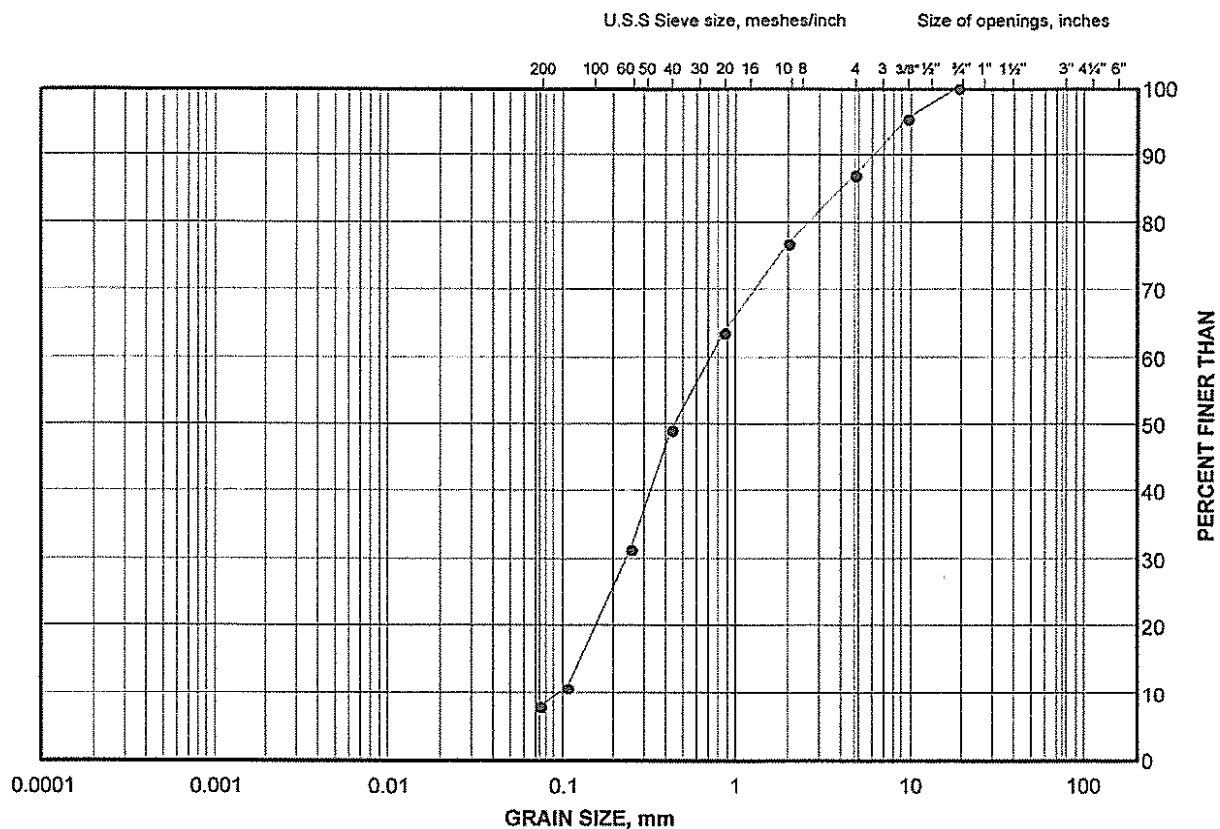
Checked By: _____

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-3	2	0.80 - 1.40

REMARKS
3080770.07

Project Number: 08-1116-0014

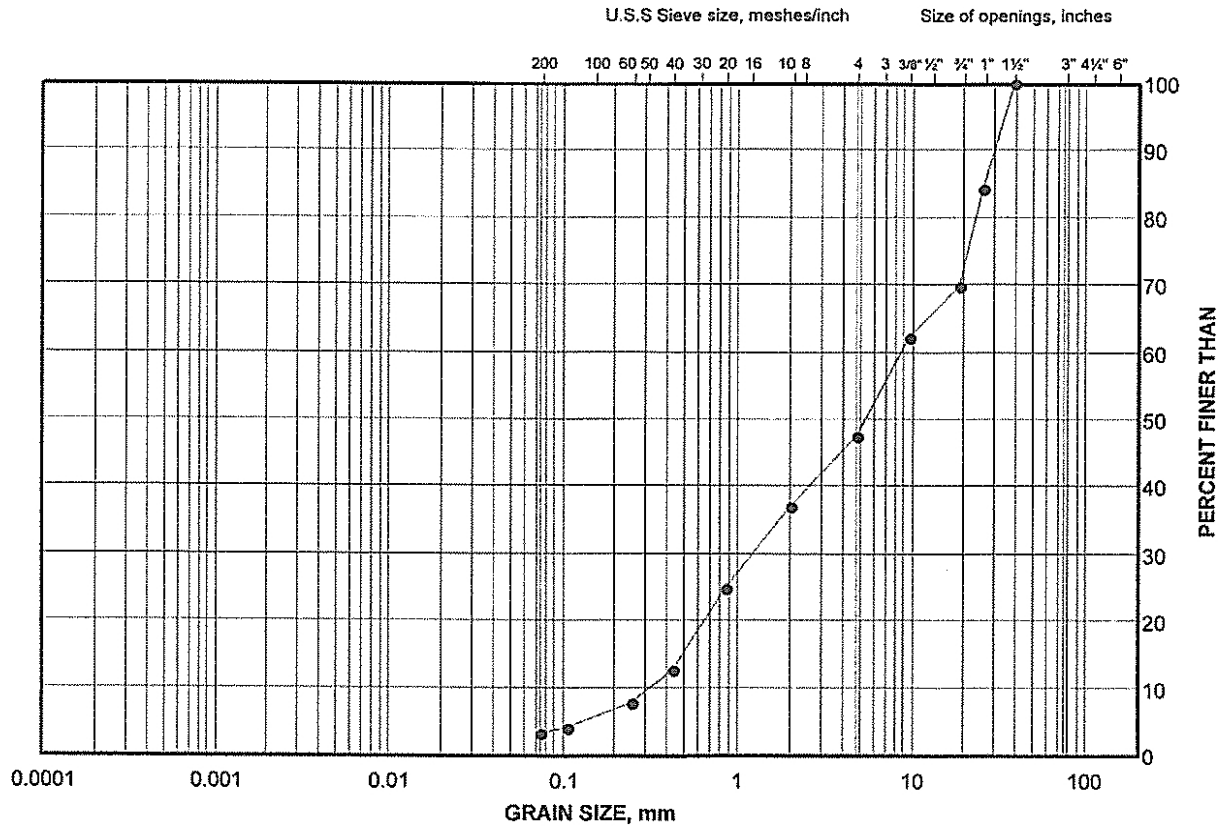
Checked By: _____

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-3	5	3.10 - 3.70

REMARKS
3080770.07

Project Number: 08-1116-0014

Checked By: _____

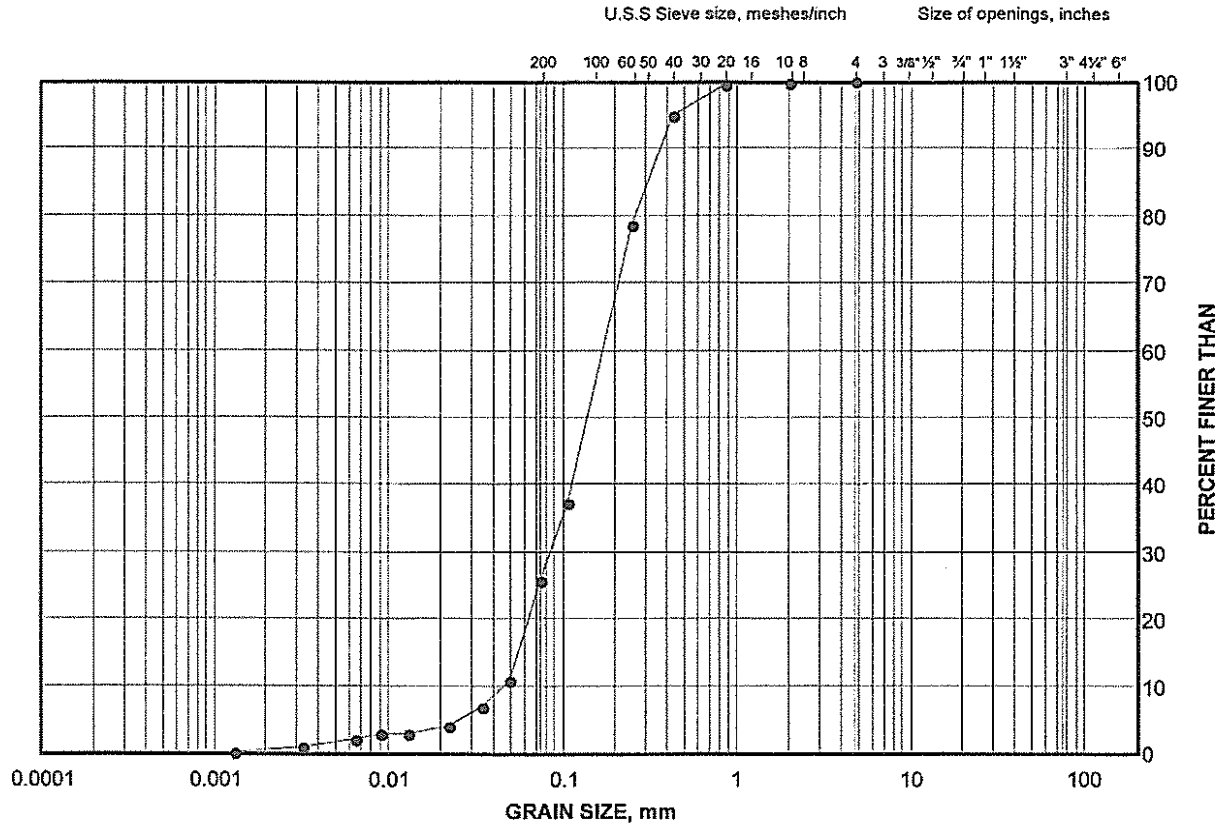
Handwritten signature

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-3	8	7.60 - 8.20

REMARKS
3080770.07

Project Number: 08-1116-0014

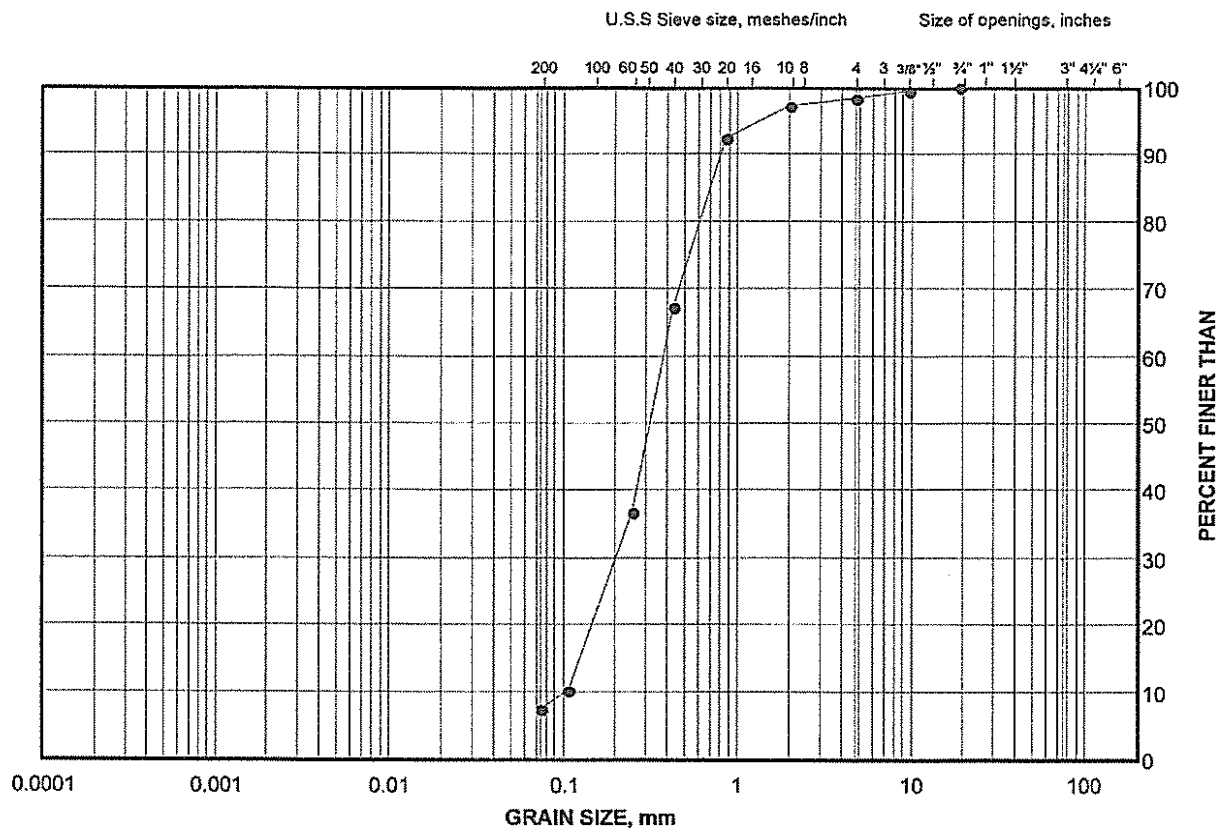
Checked By: *[Signature]*

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-4	2 & 3	0.80 - 2.10

REMARKS
3080770.07

Project Number: 08-1116-0014

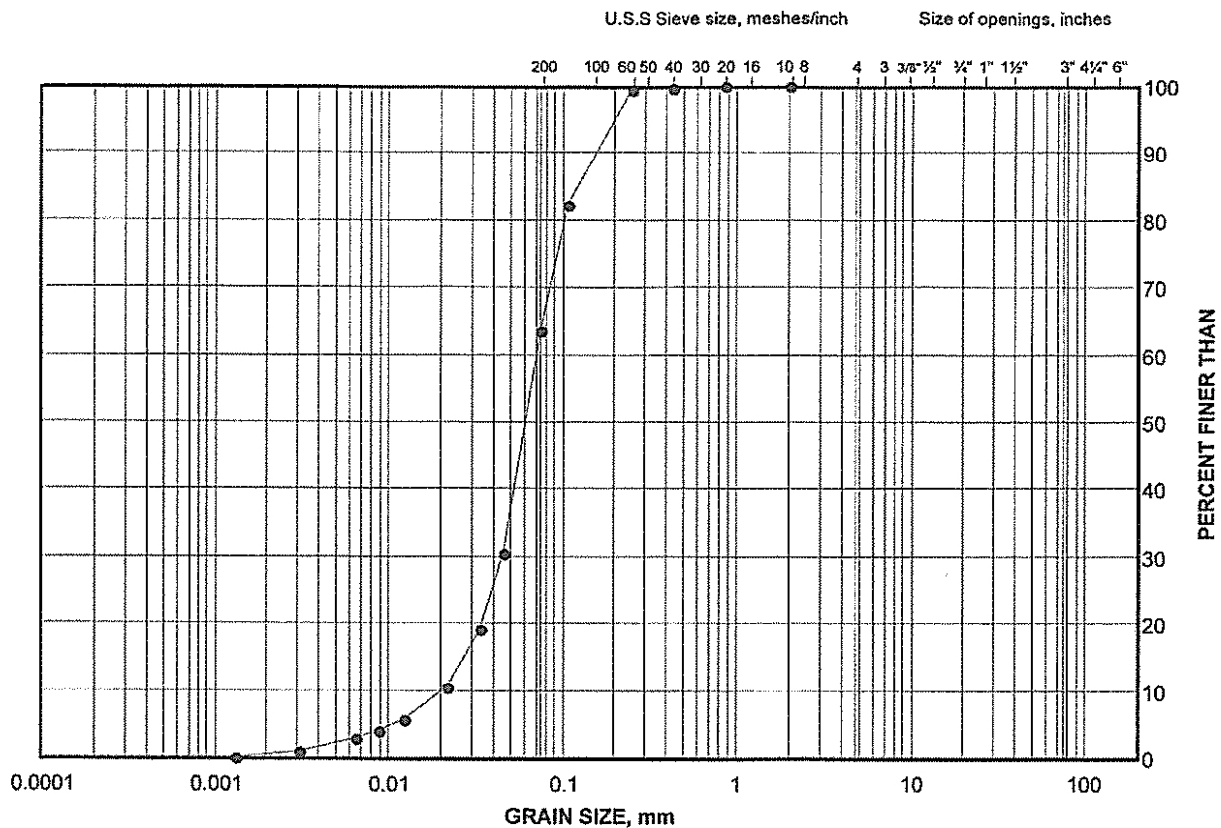
Checked By: *[Signature]*

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-4	7	6.10 - 6.70

REMARKS
3080770.07

Project Number: 08-1116-0014

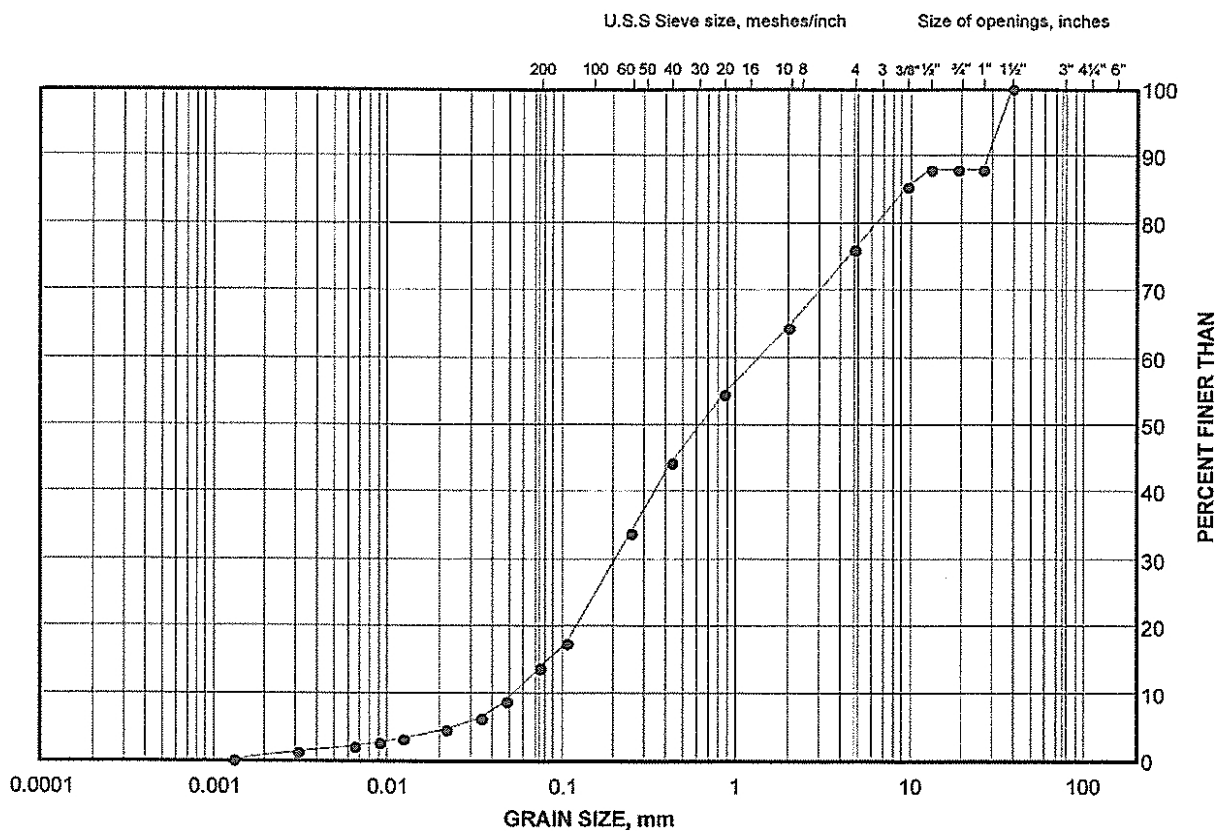
Checked By: *[Signature]*

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-4	10 & 11	10.70 - 12.80

REMARKS
3080770.07

Project Number: 08-1116-0014

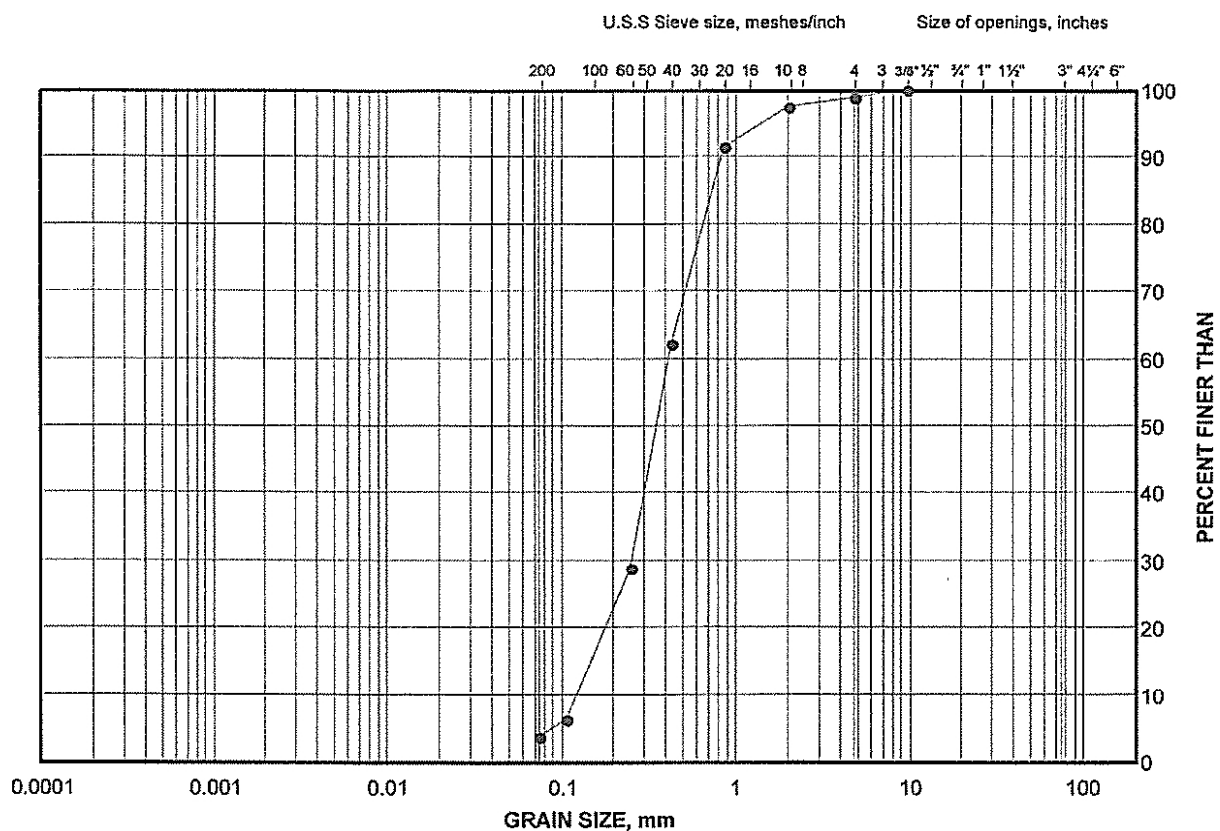
Checked By: _____

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-5	4	2.30 - 2.90

REMARKS
3080770.07

Project Number: 08-1116-0014

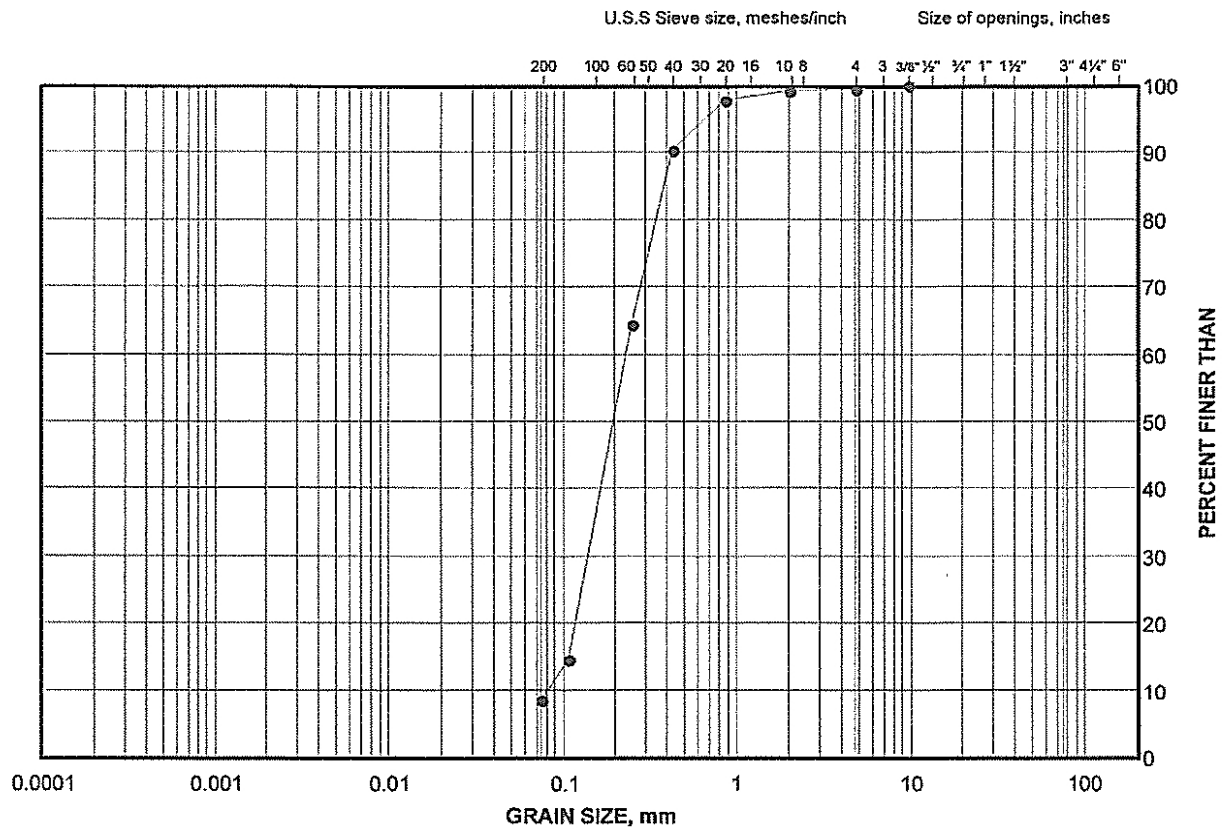
Checked By: *[Signature]*

Golder Associates

Date: 18-Jul-08

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	08-5	6	4.60 - 5.20

REMARKS
3080770.07

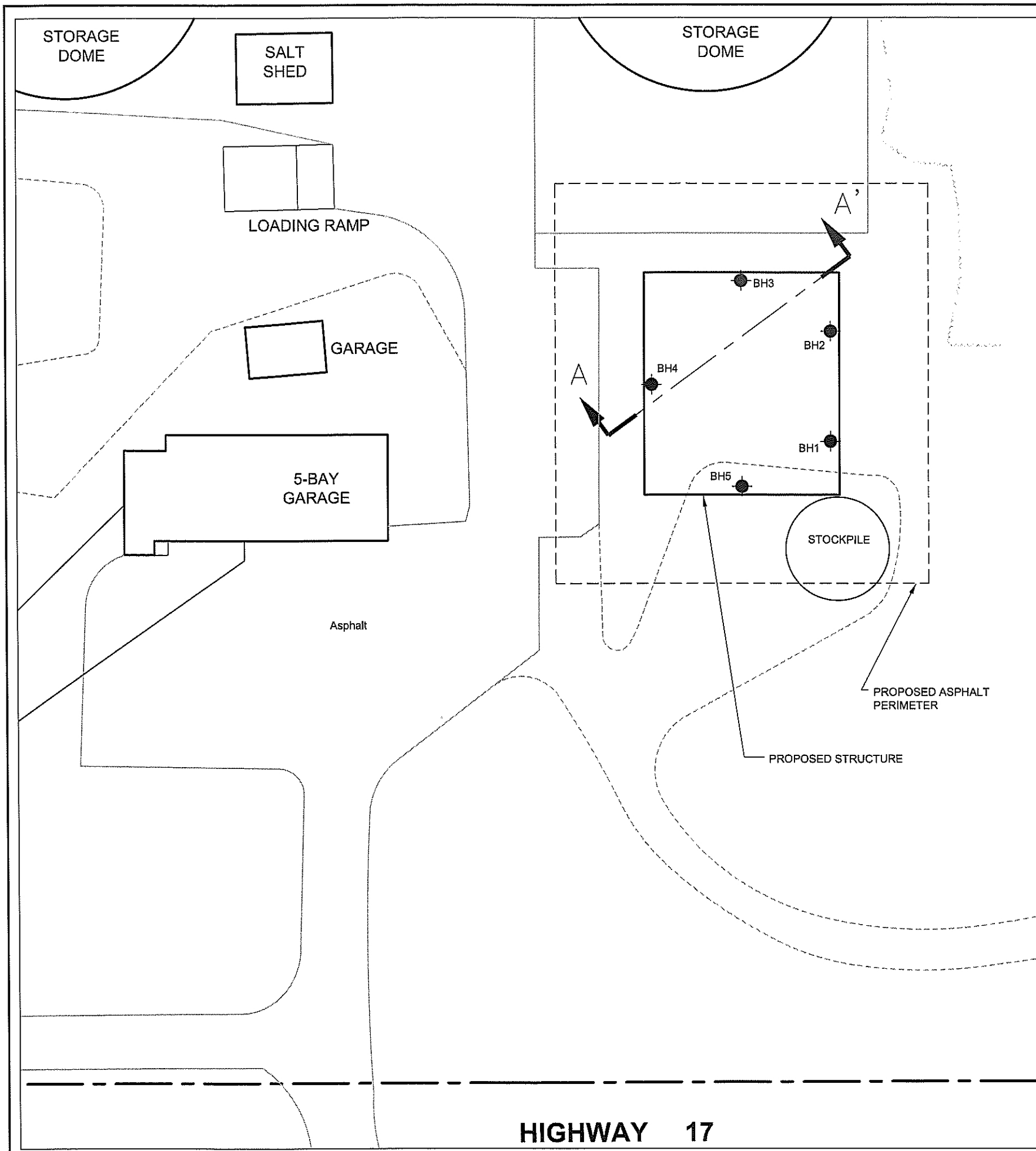
Project Number: 08-1116-0014

Checked By: _____

[Signature]

Golder Associates

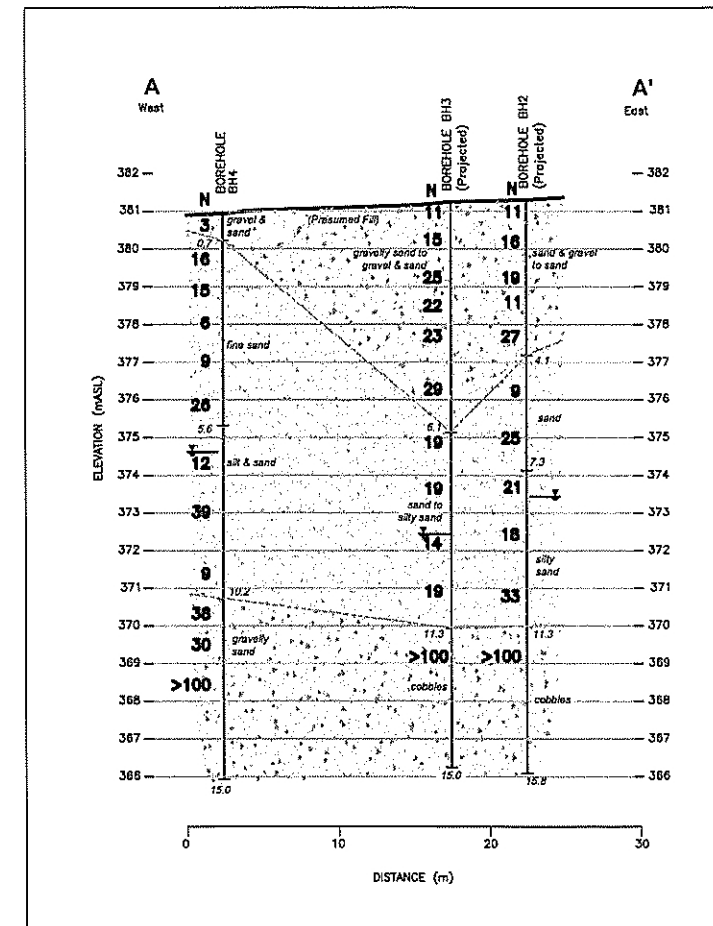
Date: 18-Jul-08



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

NOTES:

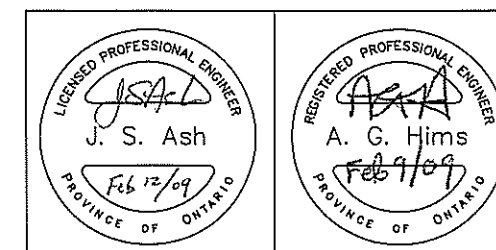
1. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
2. COORDINATES AT BOREHOLE LOCATIONS WERE BY HANDHELD GPS.
3. BOREHOLE ELEVATIONS WERE SURVEYED RELATIVE TO THE SOUTHEAST CORNER OF THE EXISTING SALT SHED (EL. 381.180 m).



CROSS SECTION A-A'

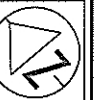


JAGGER HIMS LIMITED
Environmental Consulting Engineers



REF. NO.:
JAGGER HIMS LIMITED DRAWING: 3-08077007F1-SP White River.dwg.
DATED DECEMBER, 2008.

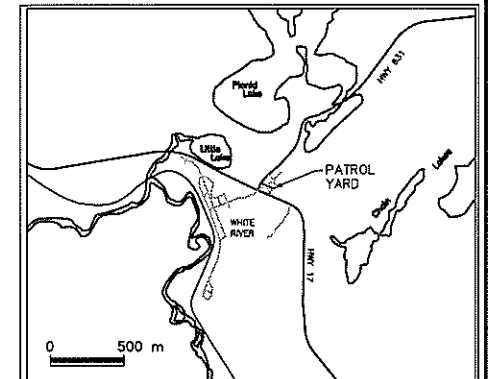
Agreement No.: 5007-E-0052



PATROL FACILITY SITE PLAN
WHITE RIVER PATROL YARD
KING'S HIGHWAY 17

FIGURE

1



KEY PLAN
SCALE = 1:50000

LEGEND

- Borehole
- N Blows/0.3m (Std. Pen Test, 475 J / blow)
- Water Level At Time Of Investigation

BH No	ELEVATION (mASL)	COORDINATES (WGS84)	
		LATITUDE	LONGITUDE
1	381.228	48° 35' 33.7"	85° 16' 12.0"
2	381.287	48° 35' 33.9"	85° 16' 11.7"
3	381.240	48° 35' 34.1"	85° 16' 12.2"
4	380.922	48° 35' 34.0"	85° 16' 12.6"
5	381.092	48° 35' 33.5"	85° 16' 12.3"

NOTE:
THE ACTUAL SOIL STRATIFICATION HAS BEEN VERIFIED FROM DATA OBTAINED AT THE BOREHOLE LOCATIONS ONLY. THE INFERRED CONTACTS SHOWN ARE BASED ON GEOLOGICAL EVIDENCE AND THESE MAY VARY FROM THOSE SHOWN BETWEEN BORINGS.

REVISIONS	DATE	BY	DESCRIPTION

APP'D: JSH	CHECKED: JSH	DATE: DEC 2008	QIST
DRAWN: PLB	CHECKED: ---	APPROVED: ---	DWG: ---