PRELIMINARY GEOTECHNICAL SUMMARY
FOR
PROPOSED PARKING FACILITY
ORCHARD STREET LOT
DOVER, NH
CITY OF DOVER
OFFICE OF THE FINANCE DIRECTOR
288 CENTRAL AVENUE
DOVER, NH 03820-4169
ATTN: DANIEL BARUFALDI

JTC Project # 11-GEO-005



# **TABLE OF CONTENTS**

**Geotechnical Summary** 

Boring Location Plan & Boring Logs

Lab Results

**Site Photos** 

## JOHN TURNER CONSULTING, INC

19 DOVER STREET
DOVER, NEW HAMPSHIRE
603-749-1841 (p)/603-516-6851 (f)
NH-MA-ME-VT
consultJTC.com

## **MEMORANDUM**

TO:

City of Dover

Office of the Finance Director

288 Central Avenue Dover, NH 03820-4169

FROM:

Kyle Urso

Kevin Martin, P.E.

Field Engineer

Geotechnical Engineer

DATE:

February 24, 2011

RE:

PRELIMINARY GEOTECHNICAL SUMMARY

PROPOSED PARKING FACILITY

ORCHARD STREET LOT DOVER, NEW HAMPSHIRE

Project No. 11-GEO-005

This memorandum report presents the findings of a subsurface exploration program and a preliminary evaluation of the conditions encountered as they relate to the feasibility of a proposed parking facility. The contents of this report are subject to the attached *Limitations*.

#### BACKGROUND

The purpose of this preliminary geotechnical study is to review the subgrade conditions and feasibility for potential re-use of city owned lots. Future development is uncertain but may include a parking lot or parking garage. A parking garage may be up to 4-7 stories with considerable load. Based on a recent meeting, it is expected that the Orchard Street Lot may be the preferred candidate for a parking garage given the large footprint. It was further discussed that a basement level is being considered which would require a  $\approx 10$ -12 ft deep lower garage level. It is expected that the basement level of the garage will be accessed from Central Avenue Street to the east with first floor access along Chestnut Street to the west.

#### SITE & PROJECT DESCRIPTION

The project site is presently utilized as a parking lot. The Cocheco River is located to the immediate north of the site. The site is relatively level based on visual estimate. Recent survey of the test bores indicates grades to vary from elevation  $\approx 53$ -61 ft with an average grade near  $\approx 57$  ft. In general, the grades are shown to gradually slope downward to the east. A *Site Plan* is in the process of being complied for the project. An *Environmental Site Assessment* (ESA) is also being completed for the project. This *ESA* report was not completed at the time of this study. It is noted that the site was prior used as a tannery. Prior *Sanborn Fire Maps* show several dwellings throughout the property.

#### SUBSURFACE EXPLORATIONS & LABORATORY TESTING

#### **Test Borings**

The subgrade conditions were reviewed with the completion of six (6) test borings throughout the lot. The test borings (identified as B13 to B18) were advanced to refusal depths of about ≈38-47 ft utilizing either continuous flight solid stem augers, hollow stem augers and/or NW casing. Soil samples were typically retrieved at no greater than 5 ft intervals with a 2-inch diameter split-spoon sampler. Standard Penetration Tests (SPTs) were performed at the sampling intervals in general accordance with ASTM-D1586 (Standard Method for Penetration Test and Split-Barrel Sampling of Soils). Field descriptions and penetration resistance of the soils encountered, observed depth to groundwater, depth to apparent bedrock refusal and other pertinent data are contained on the attached Test Boring Logs. The test borings were located by survey as shown on the Test Boring Location Plan.

## **Laboratory Testing**

Three (3) selected split-spoon samples obtained from the test borings were submitted to our laboratory for sieve analyses or Atterberg Limits per ASTM Standards. The purpose of the testing was to assess engineering characteristics for design and to assess the suitability of the site soils for re-use as structural fill on the project. The test results are attached for review.

#### SUBGRADE CONDITIONS

The subgrade conditions were consistent across the site. The subgrade conditions, in general, consist of (1) shallow granular Fill underlain by (2) a clayey Silt, (3) very soft silty Clay then (4) Refusal. The clayey Silt and deeper silty Clay are unconsolidated alluvium deposits associated with the adjacent river. A *Subsurface Profile* depicting the subgrade conditions is attached for review.

A shallow, granular Fill was encountered throughout the site to depths of  $\approx 3-5$  ft. Other fill should be expected being associated with intersecting utilities and past construction. A relatively stable clayey Silt was identified to a depth of about  $\approx 13-14$  ft below grade. This deposit consists of a sandy Silt at shallow depths being more plastic (clayey) with depth. The clayey Silt is expected to be encountered throughout most of the basement level construction. The clayey Silt is moisture sensitive, poor-draining and frost susceptible. The predominate overburden consists of a grey, very soft, silty Clay. This deposit is very weak and unstable. The silty Clay will govern the foundation design for the parking garage.

Test boring refusal, presumably bedrock, was met in all the test borings at depths of  $\approx 38-43$  ft below grade. The relatively consistent depth to refusal further suggests bedrock. The USGS Bedrock Geologic Map of New Hampshire (1996) depicts bedrock in the area to include biotite granofels, mica schist, quartzite and/or phylitte. Such rock types are characteristically hard and of sound quality. The bedrock is expected to possess a gradual contour.

Groundwater was encountered in the test borings about  $\approx 9$  ft below grade. It should be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time of the measurements. The study was completed at a time of seasonally low groundwater. The groundwater is expected to be directly impacted by the Cocheco River to the north. Monitoring wells should be considered for better survey of the groundwater table especially for a basement level foundation.

#### PRELIMINARY GEOTECHNICAL EVALUATION

The soft Silt & Clay will govern the foundation for the parking garage. The Silt & Clay is weak, compressible and unstable. Given the high foundation loads associated with a parking garage, the foundation will likely require deep pile support. More specifically, end-bearing piles driven to bedrock will likely be the most feasible means of foundation support. Driven piles may include steel (concrete filled pipe or H-sections) or precast concrete. Pile loads upwards of  $\approx 50-150$  tons should be feasible given the bedrock. Pile loads greater than  $\approx 100$  tons will likely be necessary for a multilevel parking garage. It is possible to support the ground level floor on a conventional slab-on-grade. The lighter floor loads and basement level excavation should be feasible for this approach.

The subsurface conditions were reviewed with respect to seismic criteria set forth in the *International Building Code (2009)*. Based on the fine-grained composition of the site soils (clay), the site is not susceptible to liquefaction (complete loss of shear resistance) in the event of an earthquake. Based on interpretation of the *Building Code* together with the project and site conditions, the *Site Classification* (Table 1613.5.2) is "E" (Soft Soil). This Classification will likely impact the structural design of the garage due to increased shear (lateral) loads.

Orchard Street Lot Dover, New Hampshire

February 24, 2011 Page 4 of 4

The groundwater table should also be considered with the final foundation design. A basement level foundation will require some means of groundwater control. The deeper the groundwater encroachment, the more difficulty with both short and long term water management. The flood elevation of the adjacent Cocheco River should also be considered in the final design.

We trust the contents of this memorandum report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.

kmm50/jtc11/DoverOrchardStreet.wpd

#### LIMITATIONS

#### **Explorations**

- 1. The analyses, recommendations and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.
- 2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.
- 3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

#### Review

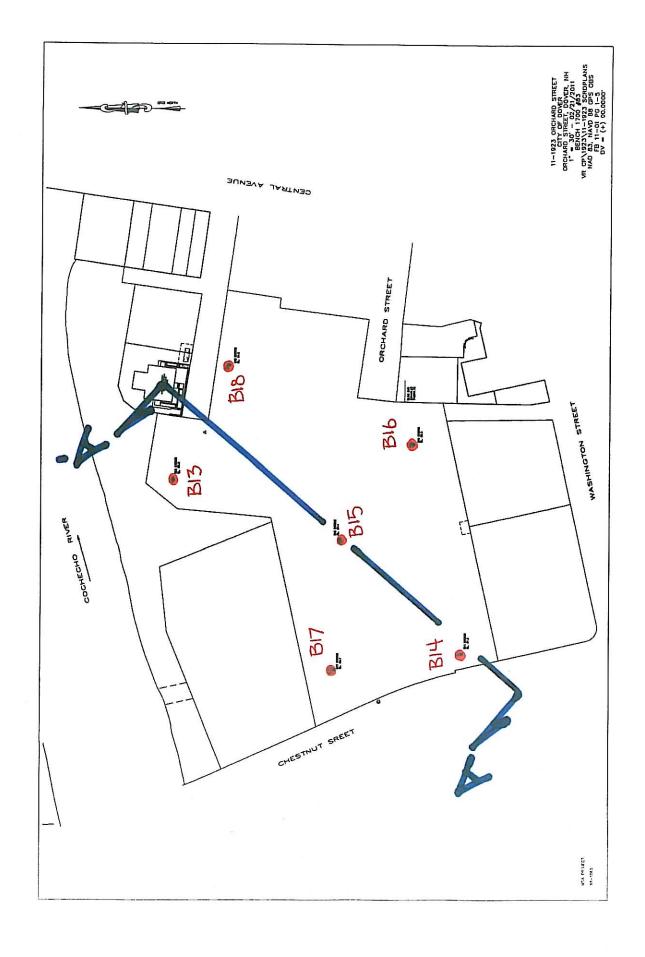
- 4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.
- 5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by John Turner Consulting, Inc.

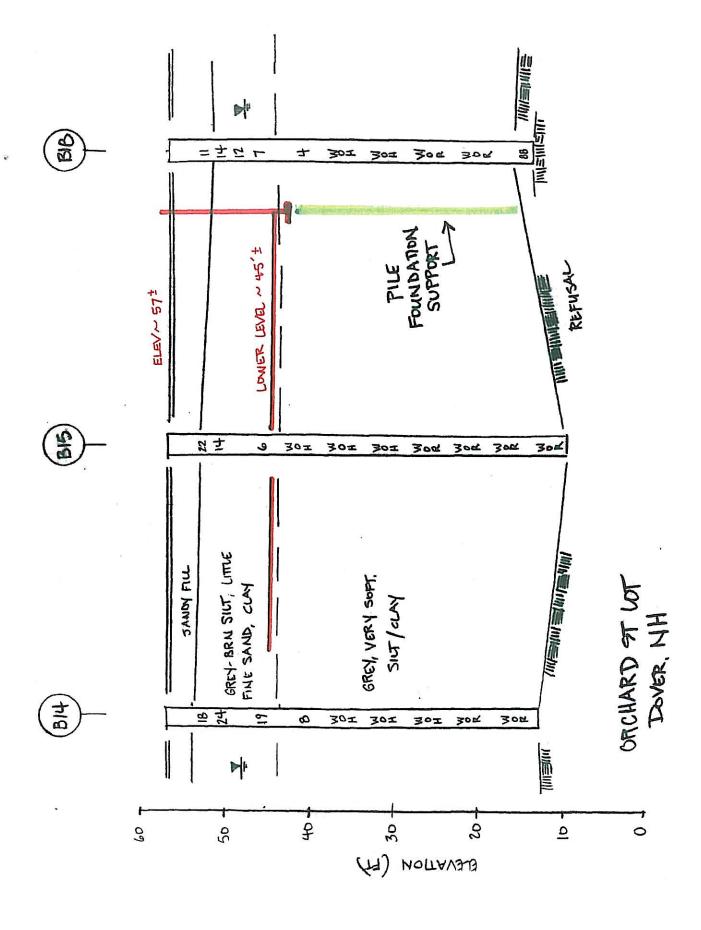
#### Construction

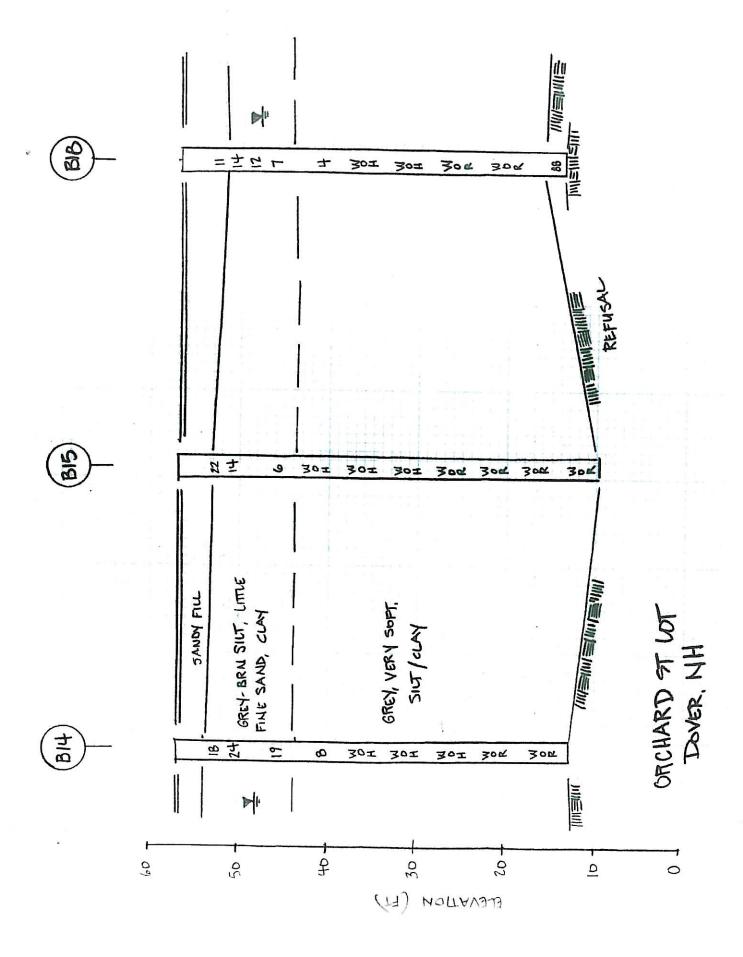
6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

#### Use of Report

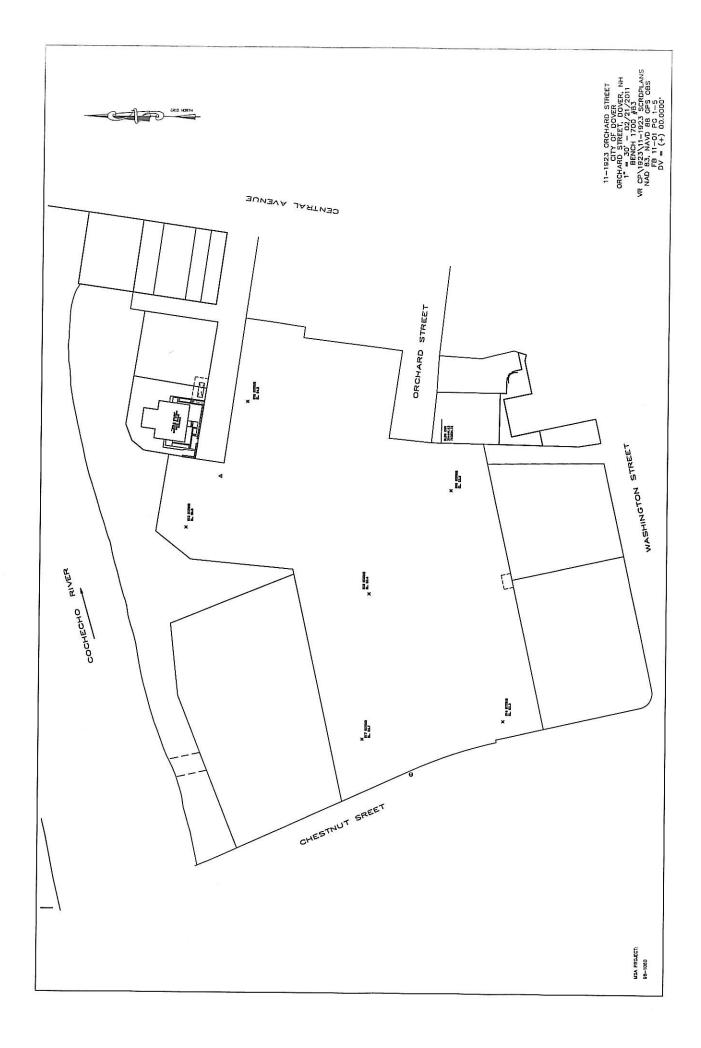
- 7. This report has been prepared for the exclusive use of the City of Dover in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.
- 8. This report has been prepared for this project by John Turner Consulting, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to geotechnical design considerations.







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				BOR	ING LOG				
JOHN	TURNI	ER CONSU	JLTING	, INC.		PHONE:	603-749-18	341	
19 DO	VER ST	REET				FAX:	603-516-68	351	
DOVE	R, NH	03820				* * * * * * * * * * * * * * * * * * *			
CLIEN	Г:	City of Do	over		BORING #:		B13		
PROJE	CT:	Geo-Anal	lysis: 4 C	City Parking Lots	LOCATION:		See Plan		
		Orchard 9	-		SURFACE ELEVA	TION:	56.5		
PROJE	CT NO:	11-GEO-0	005		DATE:		04-Feb-11		
TYPE C	F BORI	NG:	2.25" H.	S.A.		GROUNDWATER	OBSERVATIONS		Carl Carl
DRILLI	ING CO:		Great W	orks Test Boring	DATE:	DEPTH:		TIME:	200
DRILLI	ER:		Jeff Lee		04-Feb-11	12.5		Upon Completion	
JTC RE	P.:		Kyle Urs	SO .					
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FT	NO.	SAMPLE	REC.	SOIL & RO	CK CLASSIFICATION	N-DESCRIPTION	STRATUM	BLOWS	PEN
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WOH/24

17

12

2

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REMARKS: Acker Drill Rig, 2.25" Internal Diameter Hollow Stem Auger

24

24

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)

Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" l.D. split spoon sampler unless otherwise noted

Wet, Gray, CLAY, some Silt

Wet, Gray, CLAY, some Silt

Wet, Gray, CLAY, some Silt

S =split-spoon sample; C =rock core sample; U =undisturbed

15

20

25

S-4

S-5

15-17

20-22

25-27

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made. Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)

Moist, Grayish Brown, Silty Clay, little fine Sand

	BORING LOG									
				BORII	NG LOG					
JOHN	TURNE	ER CONSU	ILTING,	INC.		PHONE:	603-749-1	841		
19 DO	VER ST	REET				FAX:	603-516-6	851		
DOVE	R, NH (	03820								
CLIENT	Γ:	City of Do	ver		BORING #:		B13	Page 2 of 2		
PROJE	CT:	Geo-Anal	ysis: 4 C	ity Parking Lots	LOCATION:		See Plan			
		Orchard S	Street Pa	rking Lot	SURFACE ELEVAT	ON:	56.5			
PROJE	CT NO:	11-GEO-0	005	-	DATE:		04-Feb-11			
TYPE O	F BORI	NG:	2.25" H.S	S.A.		GROUNDWATER (	OBSERVATIONS			
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tandard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)										
Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted = split-spoon sample; C = rock core sample; U = undisturbed										
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JOHN	TURN	ER CONSU	LTING,	INC.		PHONE:	603-749-18	41	
19 DO'	VER ST	REET				FAX:	603-516-68	51	
DOVER	JECT: Geo-Analysis: 4 City Parking Lots Orchard Street Parking Lot					*noutry/statetern			
CLIENT	Γ:	City of Do	ver		BORING #:		B14	Page 1 of 2	
PROJE	ROJECT: Geo-Analysis: 4 City Parking Lots				LOCATION:		See Plan	in .	
	Orchard Street Parking Lot				SURFACE ELEVA	TION:	57.3		
PROJE	Orchard Street Parking Lot ROJECT NO: 11-GEO-005			***	DATE:		08-Feb-11		
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JTC RE	P.:		Kyle Urs	D					
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				Moist, Brown, Medium-Fine Sand, Some Gravel, little Silt (FILL)			
	S-1	3-5	17	Moist, Brown, Medium-Fine Sand, Some Gravel, little Silt (FILL)	4	6-7-11-14	18
				Moist, Grayish Brown, SILT, little fine Sand			
5	S-2	5-7	22	Moist, Grayish Brown, SILT, little fine Sand		5-10-14-17	24
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10	S-3	10-12	24	Moist, Grayish Brown, Silty Clay, trace fine Sand		5-9-10-11	19
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					13		
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15	S-4	15-17	24	Moist, Gray, Silty Clay	-	2445	
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		- 1			<b></b>		
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25	S-6	25-27	24	We, Gray, Silty Clay		WOH/24	0
							***
						7747	
30	S-7	30-32	24	Wet, Gray, Silty Clay		WOR/24	0

REMARKS: Steel Track Drill Rig, 2.25" Internal Diameter Hollow Stem Auger, Automatic Hammer

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)

Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted

S =split-spoon sample; C =rock core sample; U =undisturbed

2				BORII	NG LOG			30		
JOHN	TURNE	R CONSU	LTING,			PHONE:	603-749-18	341		
19 DO	/ER ST	REET				FAX:	603-516-68	351		
DOVER	R, NH C	3820								
CLIENT	:	City of Do	ver		BORING #:		B14	Page 2 of 2		
PROJEC	CT:	Geo-Anal	ysis: 4 Ci	ty Parking Lots	LOCATION:			SST-		
		Orchard S		rking Lot	SURFACE ELEVATI	ON:	57.3			
PROJEC		11-GEO-0			DATE:		08-Feb-11			
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CLIENT	î:	City of Do			BORING #:		B15	Page 1 of 2	
PROJEC	CT:			City Parking Lots	LOCATION:		See Plan		
		Orchard S		rking Lot	SURFACE ELEVA	TION:	57.4		
PROJEC		11-GEO-0			DATE:		08-Feb-11		
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5	S-2	5-7	24	Moist, Grayish Brown, S	st, Grayish Brown, SILT, little fine Sand			4-6-8-10	14
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10	S-3	10-12	24	Wet, Grayish Brown, Sil	ity Clay, trace fine Sar	ıd		2-3-3-4	6
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REMARI	KS:	Steel Track D	Orill Rig, 2.	.25" Internal Diameter Ho	ollow Stem Auger, Au	tomatic Hammer			-

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)

Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted

S =split-spoon sample; C =rock core sample; U =undisturbed

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19 DO						FAX:	603-516-68	351		
DOVER	NH C	3820								
CLIENT	<b>':</b>	City of Do	ver		BORING #:		B15	Page 2 of 2		
PROJE	CT:	Geo-Anal	ysis: 4 C	ity Parking Lots	LOCATION:		See Plan			
		Orchard S		rking Lot	SURFACE ELEVATI	ON:	57.4			
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40	S-9	40-42	24	Wet, Gray, Silty Clay				WOR/24	0	
								1: 1:3		
45				-			<u></u>			
			-	T-1 C D-III	Dt. D-C1 C 48 01	Day to the transport	47			
		-		Tri-Cone Drill	Bit Refusal @ 47.0' on BEDROCK	Probable intact	<del></del>			
				ł	BEDRUCK		<del></del>			
50							H +			
			-							
				1						
-				1						
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	-									
		-								
DENG	VC.	01.77 1	D.III D' -	0681-1-1-1-1-1	11 6.	STATE OF THE STATE				
REMAR	v2:	Steel Track I	onii Rig, 2.	.25" Internal Diameter Ho	ollow Stem Auger, Autor	natic Hammer				
Standard	Donatra	tion Tests (	CDT) = 14	O# hammer falling 30'	(ACTM D1596)					

Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted

S =split-spoon sample; C =rock core sample; U =undisturbed

				BORI	NG LOG		1.5		
JOHN	TURNE	ER CONSU	JLTING,			PHONE:	603-749-18	341	
Department of the second	VER ST		•			FAX:	603-516-68		
	R, NH (					• 5555			
CLIEN'	Г:	City of Do	over	- 10	BORING #:		B16	Page 1 of 2	
PROJE	CT:	Geo-Anal	lysis: 4 C	ity Parking Lots	LOCATION:		See Plan		
		Orchard S		rking Lot	SURFACE ELEVA	ΓΙΟN:	53.2		
		11-GEO-0			DATE:		18-Feb-11		
	F BORI	NG:		S.A./Casing @ 5.0'		GROUNDWATER (	OBSERVATIONS		
	NG CO:			orks Test Boring	DATE:	DEPTH:		TIME:	
DRILL			Jeff Lee						
JTC RE	P.:		Kyle Urs	0					
		ATURNAS D							
FT	NO.	SAMPLE	REC.	2000000	K CLASSIFICATION		STRATUM	BLOWS	PEN
	l	DEPTH	(IN.)	CONTRACTOR OF THE PROPERTY OF	RMEISTER SYSTEM		CHANGE	PER	(N)
	<u> </u>	(FT.)			OF ENGINEERS SY	STEM (ROCK)	(FT.)	6 INCHES	
0	-			Asphalt			0.21		
				Moist, Light Brown, M	edium-Fine Sand, Some	Gravel, little Silt			
	0.1	2.5	10	(Fill)	CIT TO 1		2.75		
	S-1	3-5	18	Moist, Grayish Brown,	SILT, little fine Sand			6-9-15-17	24
				1					<del> </del>
- 5	S-2	5-7	24	Moist, Grayish Brown,	SII T little fine Sand			6-10-12-17	22
	5-2	J-,	27	inoisi, Giayish Blown,	oner, muc mic oniu			0-10-12-17	22
				i					1900
				1					
				]					
10	S-3	10-12	24	Wet, Grayish Brown, S	ilty Clay, trace fine San	d		4-6-8-10	14
				1					
							13		
15									
15	S-4	15-17	24	Wet, Gray, Silty Clay				WOH/24	0
				ł					
				1					-
				1					
20				Wet, Gray, Silty Clay					
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				1					
				]					
				1				1	

WOR/6-WOH/18

0

Wet, Gray, Silty Clay REMARKS: Steel Track Drill Rig, 2.25" Internal Diameter Hollow Stem Auger, Automatic Hammer

Wet, Gray, Silty Clay

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)

Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted

S = split-spoon sample; C = rock core sample; U = undisturbed

24

25

30

S-5

25-27

			_	BORI	NG LOG						
JOHN	TURNE	ER CONSU	JLTING,			PHONE:	603-749-18	341			
	VER ST		32 02	10 de 96		FAX:	603-516-68				
DOVE	R, NH (	J3820				Company attraction for	200				
CLIENT	Г:	City of Do			BORING #:		B16	Page 2 of 2			
PROJEC	CT:			City Parking Lots	LOCATION:		See Plan				
		Orchard S		rking Lot	SURFACE ELEVATI	ION:	53.2				
	CT NO:	11-GEO-0			DATE:	- Targe	18-Feb-11				
	DF BORI			S.A./Casing @ 5.0'			ROBSERVATIONS	A pull mining			
DRILLE	ING CO:		Jeff Lee	orks Test Boring	DATE:	DEPTH:		TIME:			
JTC RE			Kyle Urs	20	<del> </del>						
JIC K	READING.	KINS I	Kyle Ols		THE RESERVE OF THE PARTY.	STATE STATE STATE OF THE STATE			WINDSHEEP BRIDE		
FT	NO.	SAMPLE	REC.	SOIL & ROC	K CLASSIFICATION-I	DESCRIPTION	STRATUM	BLOWS	PEN		
1186 94	278recons	DEPTH	(IN.)		BURMEISTER SYSTEM (SOIL)			PER	(N)		
		(FT.)			U.S. CORPS OF ENGINEERS SYSTEM (ROCK)			6 INCHES	V. 7		
35	S-6	35-37	24	Wet, Gray, Silty Clay	Wet, Gray, Silty Clay			WOR/24	0		
				20 65 20				11775-2	†		
'							39				
		<u> </u>	<u> </u>	Tri-Cone Drill	Bit Refusal @ 39.0' on	Probable intact					
BI					BEDROCK						
	-	<del>                                     </del>		4							
	<b>—</b>		<u> </u>	4			<b> </b>				
<b></b>		$\vdash$		4			<del>  </del>				
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<b></b>											
<del> </del>			$\longrightarrow$	(4)							
DEMAR	MARKS: Steel Track Drill Rig, 2.25" Internal Diameter Hollow Stem Auger, Automatic Hammer										
REMARI	KS:	Steel Track L	Jrill Rig, 2.	25" Internal Diameter Ho	sllow Stem Auger, Auton	natic Hammer					
Standard	l Danetro	tion Tests (S	PT) - 14	0# hammer falling 30"	1 ( A CTM D1 506)			W.			
				by 2" O.D. by 1 3/8" I		- unless otherwise	s = otad				
S = split	-spoon se	imple; $C = r$	ock core s	sample; $U = undisturbe$	D. эриг эроон эамрас эл	a unicss oniciwisc	: noteu				

	OJECT:   Geo-Analysis: 4 City Parking Lots   LOCATION:   See Plan   Orchard Street Parking Lot   SURFACE ELEVATION:   60.7   60.7   OJECT NO:   11-GEO-005   DATE:   18-Feb-11   18-Feb-11   18-Feb-11   I8-Feb-11   I8-Feb-								
JOHN	TURN	ER CONSU	ILTING,			PHONE:	603-749-1	841	
COST WILLIAM			•						
1790 MM - 1980 M - 1980						• • • • • • • • • • • • • • • • • • •			
CLIENT	Γ:	City of Do	ver		BORING #:		B17	Page 1 of 1	
PROJE	CT:	Geo-Anal	ysis: 4 C	ity Parking Lots	LOCATION:		See Plan		
		Orchard S	Street Pa	rking Lot	SURFACE ELEVA	TION:	60.7		
PROJE	PROJECT NO: 11-GEO-005			62/900	DATE:		18-Feb-11		
TYPE C	F BORI	NG:	S.S.A			GROUNDWATER C	BSERVATIONS		WELLIE
DRILLI					DATE:	DEPTH:		TIME:	
					18-Feb-11	14.5'		Upon Completion	
JTC RE	P.:		Kyle Urs	io					
			STATE OF THE PARTY OF				A printed by	O THE SECTION	THE REAL PROPERTY.
FT	NO.		TO SECTION OF THE	SAME NATIONAL ACTION AND SECOND SECOND				BLOWS	PEN
			(IN.)			to a construction of the c	579079035555571100395855		(N)
		(FT.)			'S OF ENGINEERS SY	STEM (ROCK)	(FT.)	6 INCHES	
0				-			0.1		
					Medium-Fine Sand, Some	Gravel, little Silt			
				<del></del>			3	_	15.0
	S-1	3-5	21	Moist, Grayish Brown	, SILT, little fine Sand			4-4-7-9	11
_		-		4					
-5	82	5.7	24	Moist Gravish Brown	SILT little Geo Cand				
	3-2	3-7	24	Wolsi, Grayish Brown	i, Sill, inde line Sand			3-6-8-11	14
				1					
				1					
				1					
10	S-3	10-12	24	Moist, Grayish Brown	, Silty Clay, trace fine Sa	nd		2-3-4-5	7
				9893					
				L			13		

WOH/6-2-2-2

WOH/24

0

0

REMARKS: Steel Track Drill Rig, Solid Stem Auger, Automatic Hammer

24

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)

Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted

S =split-spoon sample; C =rock core sample; U =undisturbed

S-4

S-5

20

25

15-17

25-27

24

Wet, Gray, Silty Clay

Wet, Gray, Silty Clay

Wet, Gray, Silty Clay

Wet, Gray, Silty Clay

					NG LOG				
Marian and American		ER CONSU	ILTING,	INC.		PHONE:	603-749-1	841	
19 DO	/ER ST	REET				FAX:	603-516-6	851	
DOVER	R, NH (	3820							
CLIENT	<b>`:</b>	City of Do			BORING #:		B17	Page 2 of 2	
PROJEC	CT:			ity Parking Lots	LOCATION:		See Plan		
		Orchard S		rking Lot	SURFACE ELEVATI	ON:	60.7		
PROJEC		11-GEO-0			DATE:	CD CVIVIO	18-Feb-11		
DRILLI	F BORIN	and the same of th	S.S.A	orks Test Boring	GROUNDWATER OBSERVATIONS  DATE: DEPTH: TIME:				
DRILLE			Jeff Lee	orks Test Borning	18-Feb-11	DEPTH: 14.5'		TIME:	
JTC RE			Kyle Urs	0	18-FED-11	14.5		Upon Completion	
ore rec	Establication Ryle Class				A STATE OF THE PARTY OF		Of the Other to Market	AND REPORT OF THE PARTY.	Day of the last of
FT	NO.	SAMPLE	REC.	SOIL & ROCI	CLASSIFICATION-I	ESCRIPTION	STRATUM	BLOWS	PEN
580-9001	SURGERSON	DEPTH	(IN.)	E CONTROL OF THE PROPERTY OF T	MEISTER SYSTEM (S		CHANGE	PER	(N)
		(FT.)			OF ENGINEERS SYST		(FT.)	6 INCHES	(.,)
35	S-6	35-37	24	Wet, Gray, Silty Clay				WOR/24	0
				]					
								ii 3	
				2					
40							41		
	S-7	41-43	0	Weathered Rock				46-50/6"	50+
			-	nt. n.	51 (C) 42 (F) P11	1.1.1.1			-
				Probe Re	fusal @ 43.5' on Probal BEDROCK	ole intact	-		
45				-	BEDROCK			2020	
1 1									
	j.								_
				ŀ					
REMARI	KS:	Steel Track D	Drill Rig, So	oli Stem Auger, Automati	c Hammer				
	103					(4)	-2500	- CASINE IN CASE	
				0# hammer falling 30"				3500700	
				by 2" O.D. by 1 3/8" I		r unless otherwise no	ited		
	-	THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN CO		ample; U = undisturbe					
REMARK	S: The s	tratification I	ines renres	out the approximate how	dary between soil types	and the transition man	he anadual Water		

## **BORING LOG**

JOHN TURNER CONSULTING, INC.

19 DOVER STREET

PHONE:

603-749-1841

Page 1 of 2

FAX:

603-516-6851

DOVER, NH 03820

CLIENT: PROJECT: City of Dover

Geo-Analysis: 4 City Parking Lots

BORING #: LOCATION: B18

See Plan

Orchard Street Parking Lot

54.2

PROJECT NO: 11-GEO-005

DATE:

18-Feb-11

TYPE OF BORING:	S.S.A		GROUNDWATER OBSERV	ATIONS
DRILLING CO:	Great Works Test Boring	DATE:	DEPTH:	TIME:
DRILLER:	Jeff Lee	18-Feb-11	7.5	During Drilling
JTC REP.:	Kyle Urso			

SURFACE ELEVATION:

FT	NO.	SAMPLE	REC.	SOIL & ROCK CLASSIFICATION-DESCRIPTION	STRATUM	BLOWS	PEN
		DEPTH	(IN.)	BURMEISTER SYSTEM (SOIL)	CHANGE	PER	(N)
		(FT.)		U.S. CORPS OF ENGINEERS SYSTEM (ROCK)	(FT.)	6 INCHES	
0				Asphalt	0.13		
				Moist, Light Brown, Medium-Fine Sand, Some Gravel, little Silt			
				(FILL)			
	S-1	3-5	21	Moist, Grayish Brown, SILT, some, Gravel, little fine Sand		8-5-6-11	11
				(FILL)			
					5		
5	S-2	5-7	24	Moist, Grayish Brown, SILT, little fine Sand	6.5	5-6-8-11	14
				Wet, Light Brown Medium-Fine SAND, little Silt, trace Gravel			
				Seam @ 6.5'	7.5		
	S-3	7-9	24	Moist, Grayish Brown, SILT, little fine Sand		4-6-6-6	12
10	S-3	10-12	24	Moist, Grayish Brown, SILT/CLAY, trace fine Sand	11	2-3-4-6	7
				Wet, Light Brown Medium-Fine SAND, little Silt, trace Gravel			
				Seam @ 11'	11.5		
15	S-4	15-17	24	Wet, Gray, Silty Clay		2-2-2-2	4
20		20-22		West Course Cities Class			
20		20-22		Wet, Gray, Silty Clay			
				-			
25	S-5	25-27	24	Wet, Gray, Silty Clay		WOH/24	0
							100-
30		30-32					

REMARKS: Steel Track Drill Rig, Solid Stem Auger, Automatic Hammer

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)

Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted

S =split-spoon sample; C =rock core sample; U =undisturbed

7 1				BORI	NG LOG				
JOHN TURNER CONSULTING, INC. PHONE:						603-749-18	RA1		
	VER ST		LITINO,	INC.		FAX:	603-749-16		
	R, NH (					1700	000 010 00	)51	
CLIENT		City of Do	ver		BORING #:		B18	Page 2 of 2	
PROJEC		indiana managara		ity Parking Lots	LOCATION:		See Plan	1 450 2 01 2	
		Orchard S			SURFACE ELEVAT	ION:	54.2		
PROJEC	CT NO:	11-GEO-0			DATE:		18-Feb-11		
TYPE O			S.S.A			GROUNDWATER			
DRILLI			Great Wo	orks Test Boring	DATE:	DEPTH:		TIME:	
DRILLE			Jeff Lee		18-Feb-11	7.5		During Drilling	
JTC RE	P.:		Kyle Urse	.0					
	De la la	WHITE REAL	A STATE OF THE PARTY OF THE PAR	<b>则是是</b> 多层的			ANTEN BEREIT		
FT	NO.	SAMPLE	REC.	SOIL & ROC	K CLASSIFICATION	-DESCRIPTION	STRATUM	BLOWS	PEN
1		DEPTH	(IN.)		RMEISTER SYSTEM		CHANGE	PER	(N)
		(FT.)		1	OF ENGINEERS SYS	STEM (ROCK)	(FT.)	6 INCHES	
35	S-6	35-37	24	Wet, Gray, CLAY/SILT	į.			WOR/24	0
				1					
<b></b>		<b>  </b>	<u> </u>	4					
<b></b>			<u> </u>	4					
10		<del>                                     </del>		4			<u> </u>		-
40	6.7	41.42		Wdd Dle			41	20.50/68	
<b></b>	S-7	41-43	0	Weathered Rock				38-50/6"	
$\vdash$		<del>                                     </del>		Drobe Defue	al @ 43.8' on Probable	!-tast Badwaalt	-		1
		$\vdash$		From Reidsa	II (II) 43.8 UII I I UUADIC	Intact Beurock			
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		-		1			-		
				1					-
				1			1		
				1					
				1					
REMAR	KS:	Steel Track I	Orill Rig, S	Soli Stem Auger, Automat	tic Hammer				
				10# hammer falling 30'					
Blows a	re per 6 i	nches with a	1 24" long	g by 2" O.D. by 1 3/8"	I.D. split spoon samr	oler unless otherwise	noted		



## REPORT OF ATTERBERG LIMITS TEST RESULTS

CLIENT:

City of Dover

Dover, NH 03820

PROJECT:

**Orchard Street Parking Lot** 

DATE:

February 21, 2010

REPORT #:

11-GEO-005-006

**Sampled Source:** 

B14-S6 (25.0-27.0 ft)

Soil Type:

Clay (Lean)

Soil ID#:

11-588-008

**Intended Use:** 

**GEO** 

Date Received:

02/11/11

Sampled By:

Kyle Urso

Tested By:

**Kyle Urso** 

## ATTERBERG LIMITS TEST RESULTS

**Plastic Limit:** 

24

**Liquid Limit:** 

45

Plasticity Index:

21

Remarks:

In-Situ Moisture: 44.0%

**USCS-Lean Clay** 

NH ME MA

CONSULTJTC.COM

JOHN TURNER CONSULTING, INC.

19 DOVER STREET DOVER NH 03820 T 603.749.1841 F 603.516.6851 6 CLINTON AVENUE WESTFIELD MA 01085 T 413.642.0138 F 413.642.0164

15 HOLLY STREET, UNIT 109 SCARBOROUGH ME 04074 T 207.883.7878



### REPORT OF ATTERBERG LIMITS TEST RESULTS

CLIENT:

City of Dover

Dover, NH 03820

PROJECT:

**Orchard Street Parking Lot** 

DATE:

February 21, 2010

REPORT #:

11-GEO-005-007

Sampled Source:

B13-S14 (15.0-17.0 ft)

Soil Type:

Clay (Heavy)

Soil ID#:

11-588-003

**Intended Use:** 

**GEO** 

Date Received:

02/11/11

Sampled By:

**Kyle Urso** 

Tested By:

**Kyle Urso** 

#### ATTERBERG LIMITS TEST RESULTS

Plastic Limit:

26

**Liquid Limit:** 

52

Plasticity Index:

26

Remarks:

In-Situ Moisture: 36.3%

**USCS-Fat Clay** 

NH ME MA

CONSULTITC.COM

JOHN TURNER CONSULTING, INC.

19 DOVER STREET DOVER NH 03820 T 603.749.1841 F 603.516.6851 6 CLINTON AVENUE WESTFIELD MA 01085 T 413.642.0138 F 413.642.0164 15 HOLLY STREET, UNIT 109 SCARBOROUGH ME 04074 T 207.883.7878



#### REPORT OF ATTERBERG LIMITS TEST RESULTS

CLIENT:

City of Dover

Dover, NH 03820

PROJECT:

**Orchard Street Parking Lot** 

DATE:

February 21, 2010

REPORT #:

11-GEO-005-008

Sampled Source:

B6-S16 (90.0-92.0 ft)

Soil Type:

Clay (Lean)

Soil ID#:

11-588-005

**Intended Use:** 

**GEO** 

Date Received:

02/11/11

Sampled By:

**Kyle Urso** 

Tested By:

Kyle Urso

ATTERBERG LIMITS TEST RESULTS

**Plastic Limit:** 

22

Liquid Limit:

36

Plasticity Index:

14

Remarks:

In-Situ Moisture: 32.2%

**USCS-Lean Clay** 

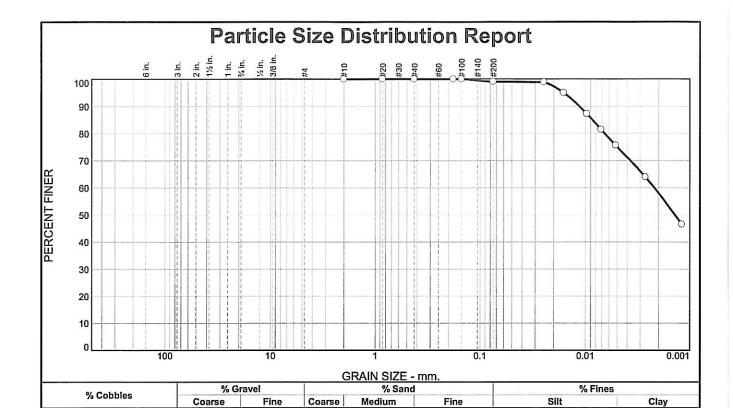
NH ME MA

CONSULTITC.COM

JOHN TURNER CONSULTING, INC.

19 DOVER STREET **DOVER NH 03820** T 603.749.1841 F 603.516.6851 6 CLINTON AVENUE WESTFIELD MA 01085 T 413.642.0138 F 413.642.0164

15 HOLLY STREET, UNIT 109 SCARBOROUGH ME 04074 T 207.883.7878



Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)	CLAY, some si
#10 #20 #40 #80 #100 #200 0.0248 mm. 0.0161 mm. 0.0097 mm. 0.0071 mm. 0.0052 mm. 0.0027 mm.	100.0 100.0 100.0 100.0 100.0 99.0 98.9 95.0 87.2 81.4 75.6 63.9	(i crociny	(certain)	PL= USCS (D 2487)  D90= 0.0114 D50= 0.0014 D10=
0.0012 mm.	46.5			Date Received Tested By Checked By

0.0

0.0

0.0

0.0

1.0

	<b>Material De</b>	escription	
CLAY, some silt			
Att	erbera Limits	(ASTM D 431	8)
PL=	LL=	PI=	
USCS (D 2487)=	<u>Classifi</u> A	<u>cation</u> ASHTO (M 145)	=
D <sub>90</sub> = 0.0114 D <sub>50</sub> = 0.0014 D <sub>10</sub> =	Coeffic D <sub>85</sub> = 0.008 D <sub>30</sub> = C <sub>u</sub> =		= 0.0022 =
	Rema	arks	
Date Received:	02.11.11	Date Tested:	02 19 11
Tested By:	ANT NIBA	Date Tested:	02-10-11
1500 to 1000s			
Checked By:	Kyle Urso		
Title:	Staff Engineer		

24.0

(no specification provided)

Location: B13 S3 (Orchard Street) Sample Number: 11-588-002

0.0

JOHN **TURNER** Dover, NH Depth: 10.0 - 12.0 ft

Client: City of Dover

Project: City Parking Lots

Project No: 11-GEO-005

Date Sampled: 02-04-11 --

75.0

Report #

002



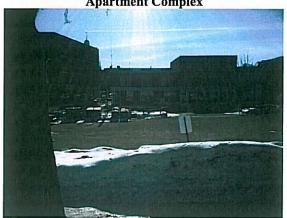
## City of Dover Orchard Street Dover, NH 03820



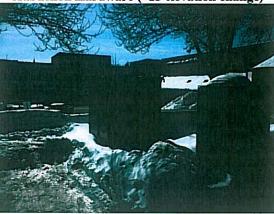
South End of Property Looking North to Apartment Complex



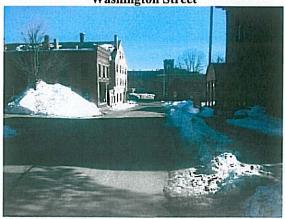
South End of Property Looking Southwest to Aubuchon Hardware (~15 elevation change)



South End of Property looking South to Washington Street



South End of Property Looking at 1 of 4 Transformers located on Property



Southeast End of Property Looking East down Orchard St



Southeast End of Property Looking North

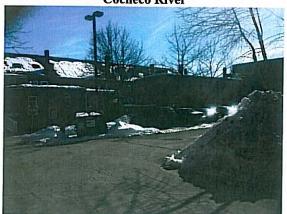




North End of Property Looking North to Cocheco River



North End of Property Looking SouthEast



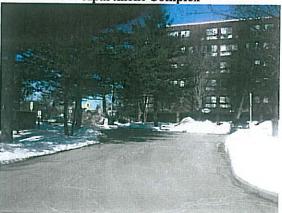
**East End of Property** 



Center of Property Looking North toward Apartment Complex



West End of Parking Lot Looking East



West end of Parking Lot Looking North toward Apartment Complex