

**PRELIMINARY GEOTECHNICAL SUMMARY  
FOR  
PROPOSED PARKING FACILITY  
FIRST 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**



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## Geotechnical Summary

**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  
                             FIRST STREET LOT  
                             DOVER, NEW HAMPSHIRE**

Project No. 11-GEO-005

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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.

**SITE & PROJECT DESCRIPTION**

The project site is presently utilized as a parking lot. The site is relatively level based on visual estimate. Survey of the test bores indicates grades to vary from elevation  $\approx$ 45-47 ft. The site is bordered by the Cocheco River to the immediate south. A *Site Plan* is in the process of being compiled 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 for residential development. Prior *Sanborn Fire Maps* show several dwellings throughout the property.

## SUBSURFACE EXPLORATIONS

### Test Borings

The subgrade conditions were reviewed with the completion of four (4) test borings throughout the lot. The test borings (identified as B9 to B12) were advanced to refusal depths of about  $\approx$ 10-35 ft utilizing 2¼ inch hollow stem augers. 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*.

### SUBGRADE CONDITIONS

The subgrade conditions, in general, consist of (1) undocumented Fill underlain by (2) unconsolidated alluvial deposits then (3) Hardpan or Refusal. Some buried organic soils were present below the fill towards the western portion of the site. A *Subsurface Profile* is attached for review.

Fill was encountered throughout the site to depths of  $\approx$ 9 ft. The Fill extends near or below the groundwater table suggesting a prior low area associated with the adjacent river. Some black organic Silt was encountered about  $\approx$ 9-10 ft below grade towards the west (B9 & B10). These organic laden soils may be prior river bed deposits. The fill generally consists of a dark brown, fine to medium Sand with gravel, little silt. There are trace amounts of brick, asphalt, rubble, ash, organics, cobbles and other matter embedded in the fill. The density of the fill varies from loose to medium dense suggesting inconsistent compaction.

The parent site soils include unconsolidated alluvium associated with the adjacent river. Specifically, the site soils include a Fine Sand with Silt which transitions into a silty Clay. Based on the *Profile*, the alluvium is thickest in the central portion of the site (B11). The alluvium soils are typically loose to very soft thereby rendered weak and unstable.

Test boring refusal, presumably bedrock, was met in all the test borings at varying depths of  $\approx$ 10-35 ft below grade. It is suspected that shallow ledge (10 ft) was met at B12 but it may also be a boulder obstruction. Nonetheless, the bedrock is expected to possess a variable and sloping contour. The *USGS Bedrock Geologic Map of New Hampshire (1996)* depicts bedrock in the area to include biotite granofels, mica schist, quartzite and/or phyllite. Such rock types are characteristically hard and of sound quality.

Groundwater was encountered in the test borings about  $\approx$ 8-9 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 should be directly impacted by the adjacent river.

## PRELIMINARY GEOTECHNICAL EVALUATION

The subgrade conditions warrant concern for support of a spread footing foundation. The undocumented fill, discontinuous organic layer and soft alluvium will impact both strength and compressibility for foundation support. The variable depth to bedrock will also impact differential movement throughout a parking structure. Given the high foundation loads associated with a parking garage, it is expected that end-bearing piles driven to bedrock would 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 multi-level parking garage.

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 (silt/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.

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.

## 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

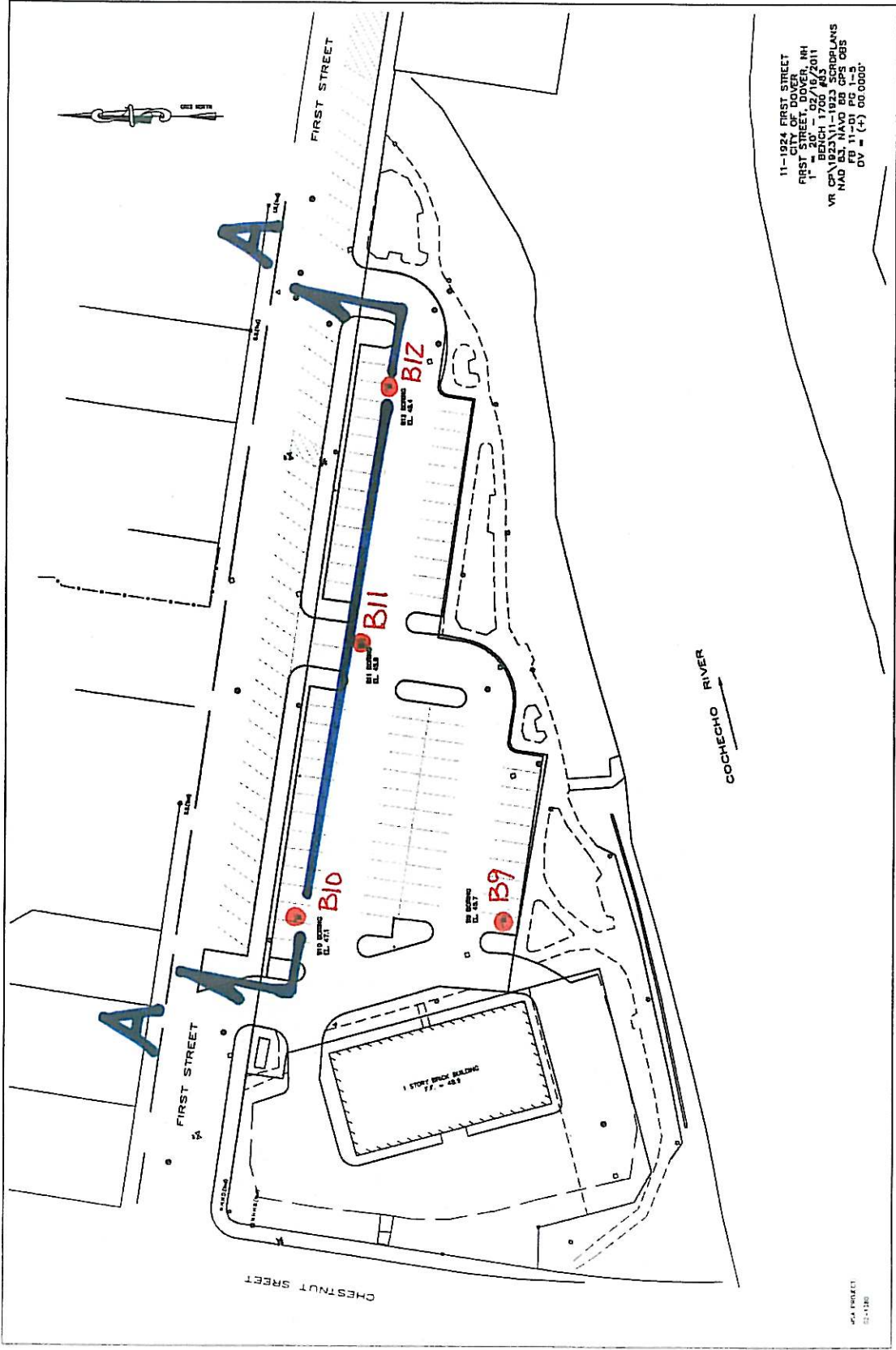
4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.
5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the 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

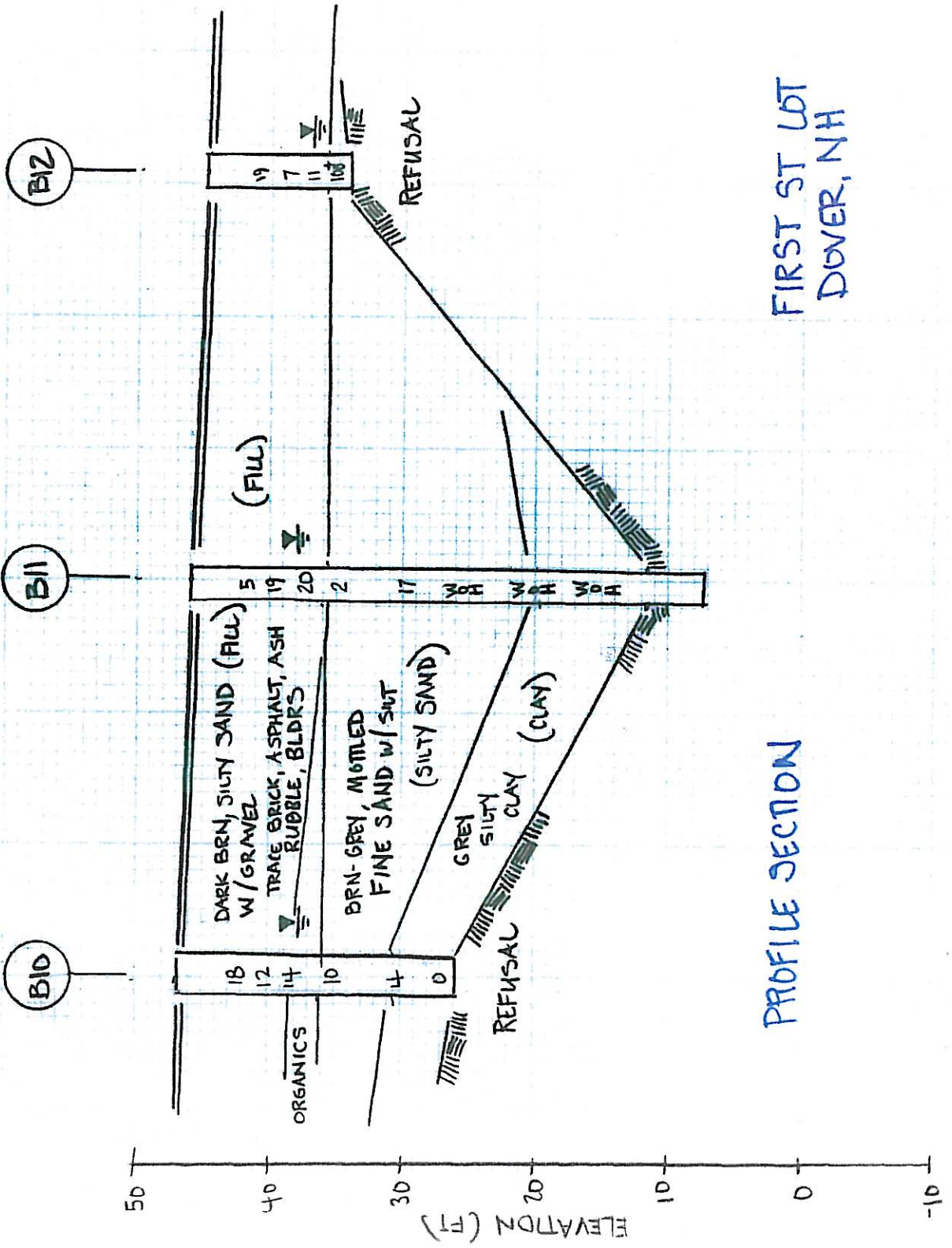
6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ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



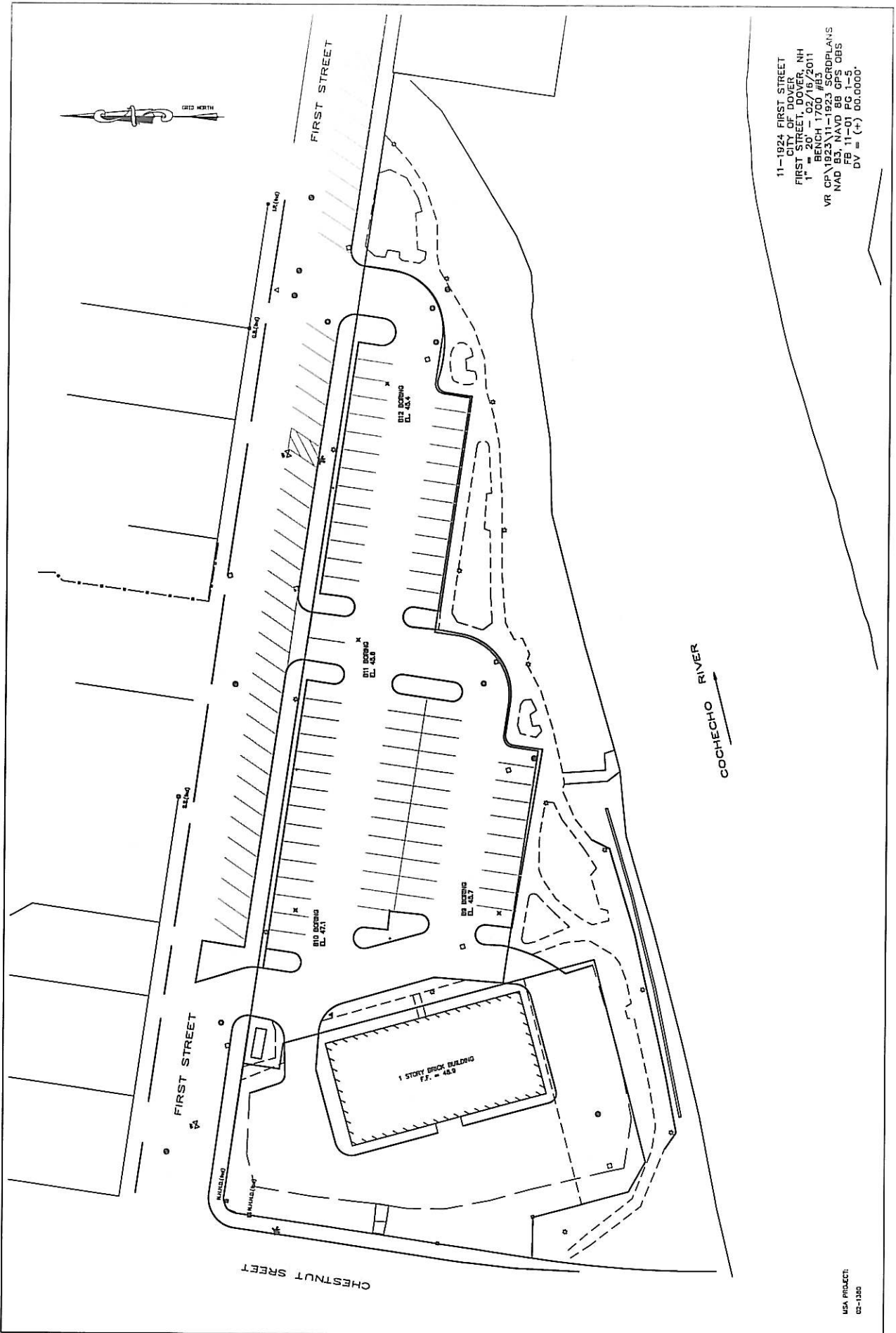




FIRST ST LOT  
DOVER, NH

PROFILE SECTION

## **Boring Location Plan & Boring Logs**



11-1924 FIRST STREET  
 CITY OF DOVER  
 FIRST STREET, DOVER, NH  
 1" = 20' - 02/16/2011  
 BENCH 1700 #B3  
 VR CP\1923\11-1923 SCROPLANS  
 NAD 83, NAVD 88 GFS OBS  
 DATE 11-01-01  
 DWG # (+) 80.0000

USA PROJECT  
 02-1320



## BORING LOG

JOHN TURNER CONSULTING, INC.  
19 DOVER STREET  
DOVER, NH 03820

PHONE: 603-749-1841  
FAX: 603-516-6851

CLIENT: City of Dover	BORING #: B10
PROJECT: Geo-Analysis: 4 City Parking Lots First Street Parking Lot	LOCATION: See Plan
PROJECT NO: 11-GEO-005	SURFACE ELEVATION: 47.1
	DATE: 07-Feb-11

TYPE OF BORING: 2.25" H.S.A.	GROUNDWATER OBSERVATIONS		
DRILLING CO: Great Works Test Boring	DATE: 7-Feb-11	DEPTH: 9.0'	TIME: During Drilling
DRILLER: Jeff Lee			
JTC REP.: Kyle Urso			

FT	NO.	SAMPLE DEPTH (FT.)	REC. (IN.)	SOIL & ROCK CLASSIFICATION-DESCRIPTION BURMEISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)	STRATUM CHANGE (FT.)	BLOWS PER 6 INCHES	PEN (N)
0				Asphalt	0.21		
				Moist, Dark Brown, Medium-Fine Sand, Some Gravel, little Silt (FILL)			
	S-1	3-5	14	Moist, Dark Brown, Medium-Fine Sand, Some Gravel, little Silt Brick remnants in sample (FILL)		2-4-14-22	18
5	S-2	5-7	11	Moist, Dark Brown, Medium-Fine Sand, Some Gravel, little Silt Brick and mortar remnants in sample (FILL)		5-7-5-26	12
				0.5" Buried Asphalt @ 6.5			
	S-3	7-9	12	Moist, Dark Brown, Medium-Fine Sand, Some Gravel, little Silt Brick, Ash in sample (FILL)	8	17-10-4-4	14
	S-3b			Moist, Black, SILT, little Medium-Fine SAND, trace Gravel Minor Organics (ORGANICS)	10		
10	S-4	10-12	20	Moist, Grayish Brown, Mottled, Fine SAND, some Silt, trace Gravel		6-6-4-5	10
15	S-5	15-17	16	Moist, Grayish Brown, Mottled, Fine SAND, some Silt, trace Gravel	15.5	1-2-2-2	4
				Wet, Gray, SILT/CLAY, trace Fine Sand			
20	S-6	20-21.8	20	Wet, Gray, SILT/CLAY, trace Fine Sand Weathered Rock in shoe		WOH/22	0
				Spoon Refusal @ 21.8' in Probable Intact Bedrock			

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

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

**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%)

# BORING LOG

JOHN TURNER CONSULTING, INC.  
19 DOVER STREET  
DOVER, NH 03820

PHONE: 603-749-1841  
FAX: 603-516-6851

CLIENT: City of Dover	BORING #: B11	Page 1 of 2
PROJECT: Geo-Analysis: 4 City Parking Lots First Street Parking Lot	LOCATION: See Plan	
PROJECT NO: 11-GEO-005	SURFACE ELEVATION: 45.6	
	DATE: 08-Feb-11	

TYPE OF BORING: 2.25" H.S.A.	GROUNDWATER OBSERVATIONS		
DRILLING CO: Great Works Test Boring	DATE: 08-Feb-11	DEPTH: 9.0	TIME: During Drilling
DRILLER: Jeff Lee			
JTC REP.: Kyle Urso			

FT	NO.	SAMPLE DEPTH (FT.)	REC. (IN.)	SOIL & ROCK CLASSIFICATION-DESCRIPTION BURMEISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)	STRATUM CHANGE (FT.)	BLOWS PER 6 INCHES	PEN (N)
0				Asphalt	0.21		
				Moist, Dark Brown, Medium-Fine Sand, Some Gravel, little Silt (FILL)			
	S-1	3-5	14	Moist, Dark Brown, Medium-Fine Sand, Some Gravel, little Silt Brick remnants in sample (FILL)		3-3-2-5	5
5	S-2	5-7	11	Moist, Dark Brown, Medium-Fine Sand, Some Gravel, little Silt Brick remnants in sample (FILL)		7-9-10-17	19
	S-3	7-9	8	Fractured Rock in sample, Possible Boulder (FILL)		43-8-12-10	20
					9.5		
10	S-4	10-12	20	Moist, Light and Rust Brown, Mottled, Fine SAND, some Silt, trace Gravel		1-1-1-1	2
15	S-5	15-17	16	Moist, Light and Rust Brown, Mottled, Fine SAND, some Silt, trace Gravel		4-8-9-11	17
20	S-6	20-22	20	Wet, Dark and Rust Brown, Mottled, Fine SAND, some Silt, trace Gravel		WOH/24	0
25	S-7	25-27	24	Wet, Dark and Rust Brown, Mottled, Fine SAND, some Silt, trace Gravel	26	WOH/24	0
				Wet, Gray, SILT/CLAY, trace Fine Sand			
30		30-32		Wet, Gray, SILT/CLAY, trace Fine Sand		WHO/24	0

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

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  
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*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%)*



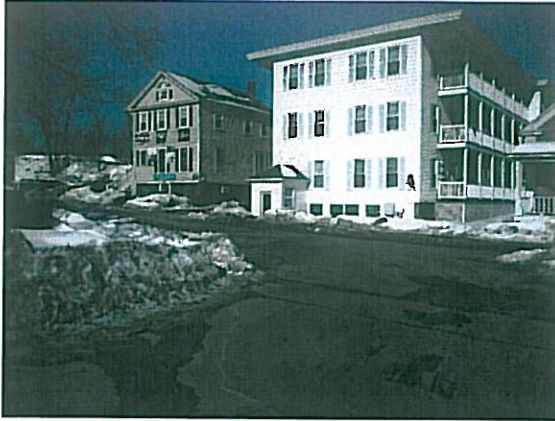




**Site Photos**

**City of Dover  
First Street  
Dover, NH 03820**

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**Northwest Entrance of Property Looking Northwest Across 1<sup>st</sup> Street**



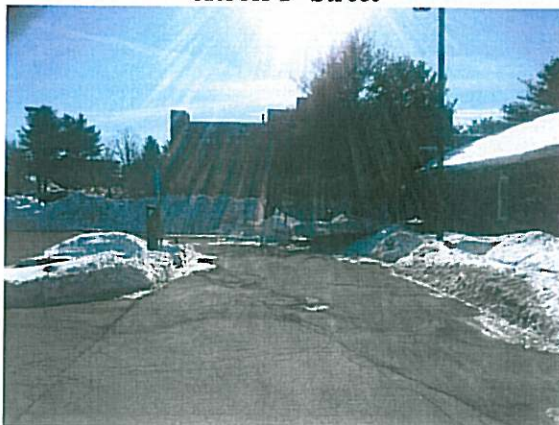
**Northwest Entrance of Property Looking North Across 1<sup>st</sup> Street**



**Northwest Entrance of Property Looking East Across 1<sup>st</sup> Street**



**Northwest Corner of Property Looking East**



**Northwest Corner of Property Looking South**



**Southeast Corner of Property Looking East**