This report documents the preliminary field investigation performed for the subject project and the information obtained. This report supersedes the original report, dated November 21, 2011.

Information used in the preparation of this report included the following:


1.0 Background Information – The project site is located within the White Mountain National Forest along U.S. Route 302 in Harts Location, approximately 4 miles north of the Bear Notch Road/Route 302 intersection. Sawyer River flows in an easterly direction across the site and crosses below Route 302 through an existing 95 foot long single span, concrete bridge structure. The 1989 design plans for the existing bridge indicate that a spread footing was supported by a naturally deposited, undisturbed fluvial deposit for the north and south abutment foundations.

The existing Route 302 Bridge over the Sawyer River was damaged during Tropical Storm Irene in August 2011. Traffic has been detoured on to a temporary bridge located just downstream, between the Route 302 Bridge and the railroad bridge.

The Sawyer River at this site is approximately 40 feet wide under normal flow conditions and was generally less than 3 feet deep during the fall 2011 exploration program. The river bed and exposed river bank are covered with numerous cobbles and boulders (Pictures 1 and 2).

The US Geological Survey Report on the Geohydrology and Water Quality of Stratified-drift Aquifers in the Saco and Ossipee River Basin states the valley of the Saco River consists of glacially derived deposits of very coarse material (largely gravel and sand including large boulders). Although the report lists no wells in the vicinity of the roadway bridge over the Sawyer River, interpreted seismic-refraction data collected by the US Geological Survey
indicates the depth to bedrock in the vicinity of the Route 302 Sawyer River bridge may be approximately 130± feet. This interpreted bedrock surface information has not been confirmed with test borings or drilled wells.

2.0 Scope of Exploration Program – Test borings (B01 through B04) were undertaken to determine the subsurface conditions at the proposed location for the new Route 302 bridge, north and south abutments. Test borings (B1 through B4) were conducted in 1989 for the existing bridge.

2.1 Test Borings for New Proposed Bridge – The exploration program conducted in October 2011 and November 2011 by NHDOT crews consisted of four test borings (B01 through B04) taken at the approximate locations of the four corners of the new proposed bridge abutments. The borings were located by the NHDOT Survey Section. The locations of the 2011 subsurface explorations are plotted on the 2011 Boring Location Plan (Figure 1). The test boring logs are provided in Appendix A. Elevations were measured by the Survey Section.

Standard Penetration Tests (SPT) were conducted in the test borings in general accordance with AASHTO T206 standards. The SPT consists of a 1-3/8 inch inside diameter sampler driven in 6-inch increments, using a 140-pound hammer dropped 30 inches. N-size (approximate 1-7/8 inch) rock cores were also obtained in selected test borings. Due to cobbles and boulders encountered during the drilling process, segments of the test borings were advanced with a spin shoe diamond, roller bit and/or NX core barrel. There was periodic loss of water during advancement of the test borings, plugging up of the spin shoe diamond and damage to the split spoon sampler. Therefore, samples were not recovered from portions of the test borings and in some cases observations were limited to the wash water and the rate of advancement.

2.2 Test Borings for Existing Bridge – The existing bridge test borings (B1 through B4) were completed in April 1989 by NHDOT drill crews. Standard Penetration Tests (SPT) were conducted in these test borings, and advancement was accomplished with NX and AX sized rock core tooling through cobbles and boulders. The 1989 test boring logs are provided in Appendix B and their locations are shown on the 1989 Boring Location Plan (Figure 2).

3.0 Data Presentation – This section summarizes our interpretation of the subsurface conditions and a general description of the soils encountered in the subsurface explorations.

3.1 Soil and Bedrock Conditions – Subsurface deposits include the following strata, proceeding downward from the ground surface. Any one or several units may be absent or in a different sequence at specific locations in the field. The exploration logs should be referenced for a more detailed description of subsurface conditions at their specific locations.

- **Asphalt Pavement** - A layer of asphalt pavement (0.4 feet thick) was encountered at the surface in two of the test borings (B03 and B04).

- **Miscellaneous Fill** - This deposit represents materials placed during previous site development work, which includes the existing roadway and bridge facilities, and underground utilities. When encountered, the miscellaneous fill in the test borings
generally consisted of gravelly coarse to fine sand and medium to coarse sand with lesser amounts of silt and gravel. The density ranged from loose to very dense. Cobbles and boulders were encountered within the fill. Test borings B03 and B04 encountered a concrete approach slab with reinforcing rebar at a depth of approximately 4 feet.

- **Glaciofluvial** – This deposit represents materials placed by streams flowing from glaciers. The deposit was typically described as coarse to fine sand, gravelly coarse to fine sand, coarse to fine sandy gravel and silty coarse to fine sand. Cobbles and boulders were encountered within the deposit. The density ranged from medium dense to very dense.

### 3.2 Summary of Test Boring Data

The 2011 test borings were advanced through the existing embankment fill into the underlying glaciofluvial deposit. These test borings encountered fill ranging in thickness from 16.0 to 23.0 feet. The two test borings (B03 and B04) taken for the southern abutment encountered asphalt pavement over fill with a concrete approach slab at a depth of approximately 4 feet. The extensive depth of the underlying glaciofluvial deposit resulted in all four borings being terminated before they encountered glacial till or bedrock. The underlying glaciofluvial deposit extends to at least a depth ranging from 100 to 121 feet with the total thickness of the deposit unknown. A summary of the materials encountered in the 2011 test borings are listed in the table below:

#### SUMMARY OF MATERIALS IN 2011 TEST BORINGS

<table>
<thead>
<tr>
<th>Test Boring</th>
<th>Depth of Asphalt (ft)</th>
<th>Depth of Fill (ft)</th>
<th>Depth of Glaciofluvial (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B01</td>
<td>N/A</td>
<td>0 – 17.0</td>
<td>17.0 – 100+</td>
</tr>
<tr>
<td>B02</td>
<td>N/A</td>
<td>0 – 16.0</td>
<td>16.0 – 100+</td>
</tr>
<tr>
<td>B03</td>
<td>0 – 0.4</td>
<td>0.4 – 23.0</td>
<td>23.0 – 121.0+</td>
</tr>
<tr>
<td>B04</td>
<td>0 – 0.4</td>
<td>0.4 – 23.0</td>
<td>23.0 – 105.0+</td>
</tr>
</tbody>
</table>

**Note:** Elevations stated on the boring logs are in feet.

The 1989 test borings encountered natural soil at the ground surface, which was in the approximate elevation range of 867 to 875 at the time. These test borings were terminated at depths ranging from 23.0 to 34.3 feet (El. 839.8 to El. 845) below the ground surface.

Cobbles and boulders were encountered throughout the glaciofluvial soil in both the 1989 and 2011 test borings, sometimes concentrated in pockets and layers within the deposit. The 1989 test borings (B1 through B4) encountered cobbles and boulders throughout their soil profile. Test borings B01 and B02, taken for the northern abutment, encountered fewer cobbles and boulders below elevations 810± and 805±, respectfully. Test borings B03 and B04, taken for the southern abutment, encountered fewer cobbles and boulders below elevation 825± (Figure 3 - Subsurface Fence Diagram). Test boring B03 encountered a zone of numerous cobbles at a depth of 110 to 115 feet (El. 770.3 to El. 765.3).

### 3.3 Laboratory Test Results

Representative soil samples were recovered from test borings taken for the proposed bridge abutments. Very fine soils were washed through a #200 sieve according to AASHTO T-11 standards to determine the percentage of silt
and clay sized particles. Granular soils were run through a series of different sized sieves according to AASHTO T-27 standards to develop grain size distribution curves.

Appendix C contains grain size distribution curves developed from the results of the AASHTO T-27 sieve analyses conducted on soil samples recovered from test borings B01 and B04.

3.4 **Groundwater** - Groundwater levels and corresponding elevations generally refer to the recorded groundwater measured at the completion of the exploration, which may not represent stabilized groundwater conditions. Groundwater at the site is expected to vary seasonally and with changes in temperature, precipitation, runoff and modification of the existing topography.

Groundwater was encountered in the 2011 test borings at depths ranging from 16.7 to 20.6 feet (El. 858.0 to 861.7) below the ground surface. The groundwater in the 1989 test borings was encountered at depths ranging from 5.6 to 12.5 feet (El. 860.4 to 863.9) below the then existing ground surface.

Please contact us at 271-3151, if you have further questions or need additional information.

Sincerely,

*Richard M. Lane, PG, CPG*
*Engineering Geologist*

*Charles R. Dusseault, PE*
*Geotechnical Section Chief*

**enc:** Pictures (1 and 2)
Figure 1 - Test Boring Location Plan (2011)
Figure 2 – Test Boring Location Plan (1989)
Figure 3 – Subsurface Fence Diagram
Appendix A – 2011 Test Boring Logs (B01 through B04)
Appendix B – 1989 Test Boring Logs (B1 through B4)
Appendix C – Grain Size Distribution

**cc:** Theodore Kitsis, Bureau of Construction
Charles Dusseault, Bureau of Materials & Research (file copy)
Picture 1 - Sawyer River bed and exposed river bank are covered with numerous cobbles and boulders
Picture 2 - River bank of Sawyer River covered with cobbles and boulders
Figure 1 - 2011 Exploration Location Plan
Figure 2
Test Boring Location Plan (1989)
Appendix A
2011 Test Boring Logs
(B01 through B04)
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SAMPLE NUMBER</th>
<th>SAMPLER RECOVERY (%)</th>
<th>DEPTH RANGE (ft)</th>
<th>FIELD CLASSIFICATION AND REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>S1</td>
<td>1.0 [50]</td>
<td>0.0</td>
<td>Medium dense, dark greyish brown and dark yellowish brown, gravelly MEDIUM-FINE SAND, little coarse sand, little-trace silt</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>0.4 [20]</td>
<td>5.0</td>
<td>Dense, greyish brown, gravelly MEDIUM-FINE SAND, trace coarse sand, slight trace of silt</td>
</tr>
<tr>
<td></td>
<td>S3</td>
<td>1.2 [60]</td>
<td>10.0</td>
<td>Dense, dark greyish brown and dark yellowish brown, gravelly COARSE-FINE SAND, little silt</td>
</tr>
<tr>
<td></td>
<td>C1</td>
<td>0.4 [13]</td>
<td>15.0</td>
<td>Advanced hole to 15.0' utilizing Nx core barrel; recovered coarse-fine gravel-sized stones (discarded); damaged spin shank diamond while attempting to spin 3&quot; casing to desired depth; re-inserted 3&quot; casing with drive shoe then drove casing to 15.0'</td>
</tr>
<tr>
<td></td>
<td>S4</td>
<td>1.3 [65]</td>
<td>22.0</td>
<td>Dense, dark yellowish brown, MEDIUM-FINE SAND, little coarse sand, little silt, little to trace fine gravel</td>
</tr>
<tr>
<td></td>
<td>S5</td>
<td>1.2 [60]</td>
<td>25.0</td>
<td>Medium dense, greyish brown, MEDIUM-FINE SAND, little-trace coarse sand, trace gravel, trace silt</td>
</tr>
<tr>
<td></td>
<td>S6</td>
<td>1.0 [50]</td>
<td>30.0</td>
<td>Medium dense, greyish brown, FINE SAND</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Able to easily advance casing to 30.0' as no cobbles/boulders encountered</td>
</tr>
</tbody>
</table>

**Coarse-Fine Sand:**
- Medium dense, greyish brown, MEDIUM-FINE SAND, little coarse sand, little-trace silt
- Dense, greyish brown, gravelly MEDIUM-FINE SAND, trace coarse sand, slight trace of silt
- Dense, dark greyish brown and dark yellowish brown, gravelly COARSE-FINE SAND, little silt
- Medium dense, greyish brown, MEDIUM-FINE SAND, little-trace coarse sand, trace gravel, trace silt
- Medium dense, greyish brown, FINE SAND

**Fluvial Sediments:**
- MEDIUM-FINE SAND
- MEDIUM-FINE SAND, Boulde, Little, Trace
- MEDIUM-FINE SAND, Trace, Little, Trace

**Glacial Fluvial Sediments:**
- MEDIUM-FINE SAND
- MEDIUM-FINE SAND, Trace, Little, Trace
- MEDIUM-FINE SAND, Boulde, Little, Trace

**Cohesive Soils:**
- Hard
- Very Hard

**Non-Cohesive Soils:**
- Very Loose
- Loose
- Medium Dense
- Dense
- Very Dense

**Soil Descriptions:**

<table>
<thead>
<tr>
<th>Soil Name</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Soft</td>
<td>Very Loose</td>
</tr>
<tr>
<td>Soft</td>
<td>Loose</td>
</tr>
<tr>
<td>Medium Stiff</td>
<td>Medium Dense</td>
</tr>
<tr>
<td>Stiff</td>
<td>Dense</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>Very Dense</td>
</tr>
<tr>
<td>Hard</td>
<td>Very Hard</td>
</tr>
</tbody>
</table>

**CONSISTENCY:**
- Very Soft
- Soft
- Medium Stiff
- Stiff
- Very Stiff
- Hard
- Very Hard

**Blows/foot:**
- 0 - 1
- 2 - 4
- 5 - 8
- 9 - 15
- 16 - 30
- 31 - 60
- > 60

**Sample Identification:**
- S: Standard Split Spoon
- SL: Large Spoon (O.D. = 3 in)
- T: Thin Wall Tube
- U: Undisturbed Piston
- O: Open End Rod
- A: Auger Flight
- C: Core Barrel
- NR: Not Recorded

**Cooperative Soils:**
- Very Loose
- Loose
- Medium Dense
- Dense
- Very Dense

**Capitilized Soil Name:**
- MAJOR COMPONENT
- LOWER CASE ADJECTIVE

**Proportion:**
- 35% - 50%
- 20% - 35%
- 10% - 20%
- 1% - 10%

**Weight of Rod:**
- WOR
- WOH

**Weight of Hammer:**
- WHW
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>STRATUM CHANGE (ft)</th>
<th>BLOWSPER0.5 ft</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH RANGE (ft)</th>
<th>FIELD CLASSIFICATION AND REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>6</td>
<td>30.0</td>
<td>S7</td>
<td>1.2 [60]</td>
<td>Medium dense, greyish brown w/ traces of dark yellowish brown, MEDIUM-FINE SAND, little-trace silt, trace fine gravel, trace coarse sand</td>
</tr>
<tr>
<td>35</td>
<td>7</td>
<td>30.0</td>
<td>S8</td>
<td>1.3 [65]</td>
<td>Medium dense, dark yellowish brown, MEDIUM-FINE SAND, little silt, little-trace fine gravel, trace coarse sand</td>
</tr>
<tr>
<td>40</td>
<td>7</td>
<td>40.2</td>
<td>S9</td>
<td>0.4 [67]</td>
<td>Dark yellowish brown and dark greyish brown, MEDIUM-FINE SAND, trace fine gravel, trace coarse sand</td>
</tr>
<tr>
<td>45</td>
<td>7</td>
<td>45.2</td>
<td>C2</td>
<td>2.4 [55]</td>
<td>Advanced hole through boulder (40.8'-41.8'), cobbles and gravelly sand with no water return; barrel plugged at 45.2' - further advanced w/ 3&quot; roller bit to 46.4' through gravelly sands</td>
</tr>
<tr>
<td>50</td>
<td>7</td>
<td>46.4</td>
<td>S10</td>
<td>1.2 [60]</td>
<td>Dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt to &quot;silty&quot;</td>
</tr>
<tr>
<td>55</td>
<td>7</td>
<td>53.5</td>
<td>S11</td>
<td>0.4 [60]</td>
<td>Dense, dark yellowish brown-light olive brown, gravelly COARSE-FINE SAND, some silt to &quot;silty&quot;</td>
</tr>
<tr>
<td>60</td>
<td>7</td>
<td>55.5</td>
<td>S12</td>
<td>0.6 [30]</td>
<td>Hole advanced through numerous small cobbles, coarse gravel to 58.5'</td>
</tr>
<tr>
<td>65</td>
<td>7</td>
<td>60.5</td>
<td>S13</td>
<td>0.4 [20]</td>
<td>Dense, similar to S12</td>
</tr>
<tr>
<td>65</td>
<td>7</td>
<td>65.5</td>
<td>S14</td>
<td>0.4 [20]</td>
<td>S14, 63.5' - 63.7', no recovery. Refusal on cobble (63.5'-63.9')</td>
</tr>
<tr>
<td>70</td>
<td>7</td>
<td>69.2</td>
<td>S15</td>
<td>0.4 [20]</td>
<td>Advanced hole to 69.2' w/ 3&quot; roller bit; spun casing to same w/ no water return and many cobbles encountered</td>
</tr>
<tr>
<td>75</td>
<td>7</td>
<td>70.5</td>
<td>S16</td>
<td>0.4 [20]</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>7</td>
<td>75.0</td>
<td>S17</td>
<td>0.4 [20]</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>7</td>
<td>80.0</td>
<td>S18</td>
<td>0.4 [20]</td>
<td></td>
</tr>
</tbody>
</table>
## FIELD CLASSIFICATION AND REMARKS

<table>
<thead>
<tr>
<th>STRATUM CHANGE (ft)</th>
<th>STRATUM SYMBOL</th>
<th>DEPTH RANGE (ft)</th>
<th>DEPTH (ft)</th>
<th>SAMPLE NUMBER</th>
<th>BLOWSPER0.5 ft</th>
<th>SAMPLER RECOVERY (ft) [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>S15</td>
<td>71.2</td>
<td>69.2</td>
<td>S15</td>
<td>0.8 [40]</td>
<td>69.2</td>
</tr>
<tr>
<td>22</td>
<td>S16</td>
<td>75.3</td>
<td>73.3</td>
<td>S16</td>
<td>0.7 [35]</td>
<td>73.3</td>
</tr>
<tr>
<td>27</td>
<td>S17</td>
<td>81.0</td>
<td>79.0</td>
<td>S17</td>
<td>0.8 [40]</td>
<td>79.0</td>
</tr>
<tr>
<td>35</td>
<td>S18</td>
<td>86.0</td>
<td>84.0</td>
<td>S18</td>
<td>0.8 [40]</td>
<td>84.0</td>
</tr>
<tr>
<td>28</td>
<td>S19</td>
<td>90.3</td>
<td>89.0</td>
<td>S19</td>
<td>0.8 [62]</td>
<td>89.0</td>
</tr>
<tr>
<td>31</td>
<td>S20</td>
<td>96.0</td>
<td>94.0</td>
<td>S20</td>
<td>1.5 [75]</td>
<td>94.0</td>
</tr>
</tbody>
</table>

**DESCRIPTION**

- **Dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt, isolated 1/2" layer of fine sand**
- **Very dense, dark yellowish brown and light olive brown, gravelly COARSE-FINE SAND, some silt to "silty", cobbles likely**
- **Noted cobble from approximately 78.2'-78.8'**
- **Dense, dark yellowish brown, COARSE-FINE SAND, some gravel, little silt**
- **Still no water return observed while advancing to 84.0'**
- **Very dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt to "silty", cobbles likely**

**-GLACIAL FLUVIAL-**

- **Dark yellowish brown, gravelly COARSE-FINE SAND, some-little silt, over grey-olive grey, sily FINE SAND, little gravel, trace coarse-medium sand**
- **Note: driller had difficult time attempting to spin casing due to spin shoe diamond repeatedly plugging up with sand; drill "bogging down" during this process; large amount of grey and dark grey medium and fine sands being brought to surface; material became coarser w/ occasional stones from approximately 93.5'**
- **Very dense, dark yellowish brown, silty COARSE-FINE SAND, little gravel**

**Advanced hole to 100.0' w/ 3" roller bit; occasional small cobble, gravelly sands encountered**

**Bottom of Exploration @ 100.0 ft (El. 779.6)**
## Test Boring Report

**Project Name:** HARTS LOCATION 16396A  
**Description:** Bridge Replacement - Rte 302 over Sawyer River

### Groundwater

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Depth (ft)</th>
<th>Elev. (ft)</th>
<th>Bottom of Casing</th>
<th>Bottom of Hole</th>
<th>Bottom of Hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/1/11</td>
<td>7:30 am</td>
<td>dry</td>
<td>14.0</td>
<td>13.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/2/11</td>
<td>7:30 am</td>
<td>5.2</td>
<td>16.6</td>
<td>16.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/3/11</td>
<td>7:30 am</td>
<td>6.2</td>
<td>16.7</td>
<td>16.7</td>
<td>858.0</td>
<td>858.0</td>
</tr>
</tbody>
</table>

### Equipment

<table>
<thead>
<tr>
<th>Type</th>
<th>Size D.I.D. (in)</th>
<th>Hammer WT. (lb)</th>
<th>Hammer Fall (in)</th>
<th>Hammer Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.375</td>
<td>140</td>
<td>30</td>
<td>Automatic</td>
</tr>
</tbody>
</table>

### Sampler

<table>
<thead>
<tr>
<th>Type</th>
<th>Recovery [%]</th>
<th>Depth Range (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Split Spoon</td>
<td>0.7 [35]</td>
<td>2.0</td>
</tr>
<tr>
<td>Large Spoon (O.D.= 3 in)</td>
<td>0.8 [89]</td>
<td>4.0</td>
</tr>
<tr>
<td>Thin Wall Tube</td>
<td>1.2 [86]</td>
<td>11.0</td>
</tr>
<tr>
<td>Open End Rod</td>
<td>0.7 [35]</td>
<td>14.0</td>
</tr>
<tr>
<td>Auger Flight</td>
<td>0.4 [20]</td>
<td>20.0</td>
</tr>
<tr>
<td>Core Barrel</td>
<td>0.4 [20]</td>
<td>24.0</td>
</tr>
<tr>
<td>Not Recorded</td>
<td>&gt; 60</td>
<td></td>
</tr>
</tbody>
</table>

### Field Classification and Remarks

- Loose, dark yellowish brown, MEDIUM-FINE SAND, some-little gravel, little coarse sand, little silt
  - Advanced hole to 4.0' utilizing 4" roller bit; spun 3" casing w/casing diamond to same; cobbles encountered throughout
  - Dark yellowish brown, MEDIUM-FINE SAND, little to trace coarse sand, little-trace silt, trace fine gravel
    - FILL-
  - Advanced hole to 9.0' w/ 3" roller bit; cut through boulder (4.9'-7.3') and an occasional cobble; spun 3" casing to same
  - Dark yellowish brown, gravelly COARSE-FINE SAND, little-trace silt
    - Advanced hole w/ Nx core barrel to 11.0'; cut boulder from 9.6'-10.8'
  - Dense, greyish brown and dark yellowish brown, gravelly COARSE-FINE SAND, little silt
    - Note: outside of spoon gouged during SPT; most likely driven between cobbles/small boulders
  - Advanced hole to 20.0' by spinning 3" casing; cut through boulder from approximately 18.9'-19.8'; damaged spin shoe diamond in process - replaced w/new and re-advanced hole to 20.0'
  - Dense, dark yellowish brown, gravelly COARSE-FINE SAND, trace silt
    - GLACIAL FLUVIAL-
  - Dense, similar to S5

### Sampler Identification

- Standard Split Spoon: 0 - 1 Very Soft
- Large Spoon (O.D.= 3 in): 0 - 4 Very Soft
- Thin Wall Tube: 2 - 4 Soft
- Undisturbed Piston: 5 - 8 Medium Stiff
- Open End Rod: 9 - 15 Stiff
- Auger Flight: 16 - 30 Very Stiff
- Core Barrel: 31 - 60 Hard
- Not Recorded: > 60 Very Hard

### Soil Descriptions

- Non-Cohesive Soils
  - Blows/foot: 0 - 4 Very Loose
  - Blows/foot: 5 - 10 Loose
  - Blows/foot: 11 - 24 Medium Dense
  - Blows/foot: 25 - 50 Dense
  - > 50 Very Dense

- Cohesive Soils
  - Type: Capitalized Soil Name
  - Consistency: Lower Case Adjective
  - Proportion: Major Component

- Soil Descriptions
  - WOR - Weight of Rod
  - WOH - Weight of Hammer

### ENGLISH
### FIELD CLASSIFICATION AND REMARKS

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>STRATUM CHANGE (ft)</th>
<th>SAMPLE NUMBER</th>
<th>SAMPLE RECOVERY (ft) [%]</th>
<th>DEPTH RANGE (ft)</th>
<th>STRATUM SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>30</td>
<td>S7</td>
<td>0.6 [33]</td>
<td>31.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dense, dark greyish brown and dark yellowish brown, coarse-fine sandy GRAVEL, some silt, cobble at 31.1'</td>
</tr>
<tr>
<td>35</td>
<td>6</td>
<td>S8</td>
<td>0.9 [45]</td>
<td>34.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dense, dark yellowish brown and dark greyish brown, gravelly MEDIUM-FINE SAND, some coarse sand, some silt</td>
</tr>
<tr>
<td>40</td>
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<td>0.8 [40]</td>
<td>38.7</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt to &quot;silty&quot; over MEDIUM-FINE SAND, some silt, trace coarse sand</td>
</tr>
<tr>
<td>45</td>
<td>16</td>
<td>S10</td>
<td>1.2 [60]</td>
<td>43.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Medium dense, dark yellowish brown, MEDIUM-FINE SAND, little silt, little-trace fine gravel, trace coarse sand</td>
</tr>
<tr>
<td>60/0.3</td>
<td>60</td>
<td>S11</td>
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<td></td>
<td>49.2</td>
<td>GLACIAL FLUVIAL</td>
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<tr>
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<td>Dark yellowish brown, gravelly COARSE-FINE SAND, some silt</td>
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<tr>
<td>55</td>
<td>21</td>
<td>S12</td>
<td>0.6 [30]</td>
<td>54.0</td>
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<td></td>
<td></td>
<td></td>
<td>Dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt</td>
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<tr>
<td>60</td>
<td>21</td>
<td>S13</td>
<td>0.7 [35]</td>
<td>64.0</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very dense, dark yellowish brown and dark greyish brown, gravelly COARSE-FINE SAND, some-little silt</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note: outside of split spoon gouged and tip damaged; likely driven</td>
</tr>
</tbody>
</table>

**Advanced hole to 34.5’ w/ 3” roller bit; occasional cobble encountered**

**Hole advanced easily to 43.7” w/ no cobbles/boulders encountered**

**Advanced hole to 54.0’ w/ 3” roller bit; cut through cobble from 49.2’-49.6’ as well as occasionally others while advancing to 54.0’; damaged spin shoe diamond - replaced w/ new and re-advanced casing**

**Advanced hole to 64.0’; cut through boulder from approximately 58.7’ to 59.9’ as well as numerous small cobbles; noted that sand began to enter inside casing (2-3’) from 60.0’ preventing SPT at 60.0’; once again at 64.0’ (3-4’) where driller re-washed casing in order to sample (0.3’ remained inside casing after 2nd wash)**
**FIELD CLASSIFICATION AND REMARKS**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>STRATUM CHANGE (ft)</th>
<th>BLOWS PER 0.5 ft</th>
<th>SAMPLE NUMBER</th>
<th>SAMPLER RECOVERY (ft) [%]</th>
<th>DEPTH RANGE (ft)</th>
<th>STRATUM SYMBOL</th>
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</thead>
<tbody>
<tr>
<td>0.0</td>
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<td>S15</td>
<td>0.3 [15]</td>
<td>71.0</td>
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<td>0.8 [40]</td>
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<td></td>
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<td>S17</td>
<td>1.3 [65]</td>
<td>85.0</td>
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</tr>
</tbody>
</table>

**Description**

- Between cobbles/boulders
- Hole advanced through numerous cobbles to 69.0'
- Dense, dark greyish brown, gravelly COARSE-FINE SAND
  - Note: 2-3" of material inside casing prior to sampling
- Dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt to "silty"
- Dense, similar to S15, slightly less coarse
- Very dense, dark yellowish brown and dark greyish brown, gravelly COARSE-FINE SAND, some silt over greyish brown and yellowish brown, silty FINE SAND w/ 2" layer of coarse-medium sand (no silt)
- Further advanced hole to 100.0' w/ 3" roller bit; encountered only an isolated small cobble or two with most of the material being a gravelly sand to sand with little or no gravel; drill head advanced quite rapidly through last 5' of material (95-100') w/ no stones encountered

**Bottom of Exploration @ 100.0 ft (El. 774.7)**
<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Depth (ft)</th>
<th>STRATUM CHANGE (ft)</th>
<th>ELEVATION</th>
<th>STRATUM SYMBOL</th>
<th>DEPTH</th>
<th>BLOWSPER0.5 ft</th>
<th>DEPTH RANGE (ft)</th>
<th>SAMPLE NUMBER</th>
<th>SAMPLER RECOVERY (%)</th>
</tr>
</thead>
<tbody>
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<td>0.4</td>
<td>879.9</td>
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<td></td>
<td></td>
<td>10</td>
<td>1.0 [60]</td>
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<tr>
<td>11/2/11 7:30 am</td>
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<td>16</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11/3/11 7:30 am</td>
<td>10</td>
<td>31</td>
<td>10.0</td>
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<td></td>
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</tr>
<tr>
<td>11/30 11/3/11</td>
<td>15</td>
<td>55</td>
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<tr>
<td>11/4/11</td>
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<td>17.0</td>
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</tr>
<tr>
<td>11/1/11 7:30 am</td>
<td>25</td>
<td>13</td>
<td>26.0</td>
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<tr>
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<td>28.5</td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**FIELD CLASSIFICATION AND REMARKS**

- **ASPHALT PAVEMENT**
  - Advanced through "gravelly" material to 1.0' w/ 4" roller bit
  - Dense, dark yellowish brown, MEDIUM-FINE SAND, some gravel, little silt, trace to little coarse sand
  - Advanced hole to 5.0' w/ 3" spin shoe diamond; cored through concrete, rebar rods (approach slab) and small cobble; re-inserted casing and drove to same depth
  - Dense, dark yellowish brown and greyish brown, MEDIUM-FINE SAND, little silt, little-trace gravel, trace coarse sand

- **FILL**
  - Very dense, dark yellowish brown and dark greyish brown, gravelly COARSE-FINE SAND, some silt, cobble(s) likely
  - Note: occasional cobble encountered while advancing to 15.0'
  - Very dense, yellowish brown and dark yellowish brown, MEDIUM-FINE SAND, some gravel, little-trace silt, trace coarse sand, isolated weathered cobble from approximately 15.5-15.8'
  - Advanced hole to 20.0' w/ 3" roller bit; no cobbles or boulders encountered; able to drive casing to same depth
  - Medium dense, dark greyish brown, COARSE-FINE SAND, little gravel, isolated wood fragment
  - Dense, recovered 3 fine gravel-sized rock fragments in end of spoon tip, most likely pushing larger stone

- **GLACIAL FLUVIAL**

**SOIL DESCRIPTIONS**

**COHESIVE SOILS**

- S Standard Split Spoon
  - Blows/foot
    - 0 - 1 Very Soft
    - 2 - 4 Soft
    - 5 - 8 Medium Stiff
    - 9 - 15 Stiff
    - 16 - 30 Very Stiff
  - Consistency
    - 0 - 1 Very Soft
    - 2 - 6 Soft
    - 8 - 13 Medium Stiff
    - 14 - 30 Stiff
    - 31 - 60 Very Stiff

**NON-COHESIVE SOILS**

- Blows/foot
  - 0 - 4 Very Loose
  - 5 - 10 Loose
  - 11 - 24 Medium Dense
  - 25 - 50 Dense
  - > 50 Very Dense
- Density
  - 0 - 0.4 WOR = Weight of Rod
  - 0.5 - 1.0 WOH = Weight of Hammer

**SOIL DESCRIPTORS**

- Capitalized Soil Name
- Major Component
- Lower Case Adjective
- Proportion

- **ENGLISH**
- **Capitalized Soil Name**: Very Soft
- **Major Component**: Very Loose
- **Lower Case Adjective**: 35% - 50%
- **Proportion**: 10% - 20%
# Test Boring Report

**State of New Hampshire Department of Transportation**

**Materials & Research Bureau - Geotechnical Section**

**Project Name**: HARTS LOCATION 16396A  
**Bridge No.**: 235/059  
**Description**: Bridge Replacement - Rte 302 over Sawyer River

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Stratum Change (ft)</th>
<th>Bore Hole 0.5 ft</th>
<th>Sample Number</th>
<th>Sampler Recovery (ft) [%]</th>
<th>Field Classification and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>S7</td>
<td>0.7 [35]</td>
<td>30.5</td>
<td>Very dense, dark yellowish brown, MEDIUM-FINE SAND, trace gravel, trace coarse sand, trace silt, cobbles likely beyond 29.5'; outside of split spoon gouged</td>
<td></td>
</tr>
</tbody>
</table>
| 35        | S8                  | 1.1 [55]         | 37.0          | Very dense, greyish brown, MEDIUM-FINE SAND, little gravel over dark yellowish brown, coarse-fine sandy GRAVEL, some silt to "silty"  
|           |                     |                  |               | Note: encountered numerous cobbles while advancing hole to 39.0' |
| 40        | S9                  | 0.7 [35]         | 41.0          | Very dense, dark yellowish brown, coarse-fine sandy GRAVEL, some silt to "silty"  
|           |                     |                  |               | -GLACIAL FLUVIAL- |
| 45        | S10                 | 0.8 [40]         | 46.4          | Dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt to "silty"  
| 50        | S11                 | 0.5 [63]         | 50.3          | Dark greyish brown and dark yellowish brown, coarse-fine sandy GRAVEL, some silt to "silty"  
| 55        | S12                 | 0.9 [45]         | 57.5          | Advanced hole to 55.5' through occasional cobbles, boulder (54.0'-55.4'); replaced worn roller bit following advancement  
| 60        | S13                 | 0.7 [35]         | 61.0          | Very dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt to "silty"  
|           |                     |                  |               | Dense, dark yellowish brown, COARSE-FINE SAND, some silt, little fine gravel  

**Elevation (ft)**: 880.3
### FIELD CLASSIFICATION AND REMARKS

- **Note:** hole advanced through much less coarse material

- **Dense, dark greyish brown, gravelly COARSE-FINE SAND, slight trace of silt**
  
  - Note: driller had great difficulty advancing casing to 74.0' due to high pressure build-up caused by the spin bit becoming plugged; no water return for most of the hole

- **Dense, dark greyish brown, COARSE-FINE SAND, some gravel**
  
  - Note: prior to sample, 3-4' of material entered up inside casing; driller re-washed casing prior to performing SPT; 3' of material still remained inside casing

- Driller unable to advance hole utilizing "spin" method to advance casing; drill rig losing power and stalling while attempting to advance; inserted Nx wireline in an attempt to advance hole but casing was bent at around 40.0', preventing core barrel any penetration beyond that point

- **Advanced hole by "probing" w/ 3" roller bit; water return was evident beyond 79.0'; encountered mainly sands with varying amounts of gravel and an occasional cobble**

---

**Note:** Sudden, total water loss from approximately 102.5' to 106.0' and from approximately 109.0' to 111.0'.

---

**-GLACIAL FLUVIAL-**
Continued advancement of borehole by "probing" w/ 3" roller bit to 121.0'; mainly encountered sands w/ varying amounts of gravel and an occasional cobble

-GLACIAL FLUVIAL-

Zone of numerous small cobbles and excessive drill-chatter noted from 110.0' to 115.0'

Bottom of Exploration @ 121.0 ft (El. 759.3)
### Groundwater Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Depth (ft)</th>
<th>Elevation</th>
<th>Bottom of Casing</th>
<th>Bottom of Hole</th>
<th>Type</th>
<th>Size I.D. (in)</th>
<th>Hammer WT. (lb)</th>
<th>Hammer Fall (in)</th>
<th>Recovery (%)</th>
<th>Sample Number</th>
<th>Depth Range (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/20/11</td>
<td>7:00 am</td>
<td>19.4</td>
<td>861.2</td>
<td>40</td>
<td>43.3</td>
<td>HAMMER</td>
<td>1.375</td>
<td>140</td>
<td>30</td>
<td>50</td>
<td>S1</td>
<td>1.1 [55]</td>
</tr>
<tr>
<td>10/21/11</td>
<td>7:30 am</td>
<td>19.5</td>
<td>861.1</td>
<td>51.8</td>
<td>52.2</td>
<td>HAMMER</td>
<td>3</td>
<td>1.875</td>
<td></td>
<td>30</td>
<td>S2</td>
<td>1.3 [65]</td>
</tr>
<tr>
<td>10/24/11</td>
<td>8:30 am</td>
<td>19.9</td>
<td>860.7</td>
<td>58.5</td>
<td>59.9</td>
<td>HAMMER</td>
<td>Automatic</td>
<td></td>
<td></td>
<td>50</td>
<td>S6</td>
<td>0.7 [35]</td>
</tr>
</tbody>
</table>

### Field Classification and Remarks

- **Asphalt Pavement**
  - Dense, greyish brown and dark yellowish brown, gravelly
  - COARSE-FINE SAND, trace silt
  - Advanced hole w/ 4" roller bit to 4.5'; cutting numerous cobbles, small boulder(s); inserted 3" casing w/ diamond spin shoe to further advance to 5.1'; encountered concrete with rebar re-enclosure (approach slab) and damaged spin shoe - replaced w/ new following advancement

- **Fill**
  - Dense, yellowish brown w/ traces of greyish brown, MEDIUM-FINE SAND, little silt, little-trace gravel, trace coarse sand
  - Greyish brown to dark greyish brown and dark yellowish brown, MEDIUM-FINE SAND, some silt to "silty", some gravel, trace coarse sand, cobbles likely
  - Note: outside of spoon damaged (deeply gouged)
  - Advanced through numerous cobbles to next sampling depth

- **Glacial Fluvial**
  - Medium dense, greyish brown and dark yellowish brown, gravelly
  - COARSE-FINE SAND, little to trace silt
  - Note: removed 3" casing (damaged spin shoe diamond) and advanced hole w/ 4" roller bit to 20.4'; re-advanced casing w/ new spin shoe
  - Dense, dark yellowish brown, COARSE-FINE SAND, some gravel, some-little silt
  - Note: cobbled encountered from 24.3'-24.8'
  - Dense, dark yellowish brown, COARSE-FINE SAND, some silt, little gravel

### Soil Descriptions

- **Cohesive Soils**
  - Major Component: 35% - 50%
  - Proportion: Lower Case Adjective
  - Capitalized Soil Name
  - Major Component: 20% - 35%
  - Proportion: Some
  - Capitalized Soil Name
  - Major Component: 10% - 20%
  - Proportion: Little
  - Capitalized Soil Name
  - Major Component: 1% - 10%
  - Proportion: Trace
  - Capitalized Soil Name

- **Non-Cohesive Soils**
  - Major Component: Very Loose
  - Proportion: 0 - 4
  - Capitalized Soil Name
  - Major Component: Loose
  - Proportion: 5 - 10
  - Capitalized Soil Name
  - Major Component: Medium Dense
  - Proportion: 11 - 24
  - Capitalized Soil Name
  - Major Component: Very Dense
  - Proportion: > 50
  - Capitalized Soil Name

- **CME 45-C Trlr**
  - Weight of Rod: 880.2
  - Weight of Hammer: 857.6
### FIELD CLASSIFICATION AND REMARKS

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>STRATUM CHANGE (ft)</th>
<th>ELEVATION</th>
<th>STRATUM SYMBOLO</th>
<th>DEPTH RANGE (ft)</th>
<th>BLOWSPER 0.5 ft</th>
<th>SAMPLE NUMBER</th>
<th>SAMPLER RECOVERY (ft) [%]</th>
<th>DEPTH (ft)</th>
<th>SAMPLE NUMBER</th>
<th>SAMPLER RECOVERY (ft) [%]</th>
<th>DEPTH RANGE (ft)</th>
<th>BLOWSPER 0.5 ft</th>
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<th>DEPTH (ft)</th>
<th>SAMPLE NUMBER</th>
<th>SAMPLER RECOVERY (ft) [%]</th>
<th>DEPTH RANGE (ft)</th>
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<td></td>
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<td>S7</td>
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<td>C1</td>
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<td>61.5</td>
<td>C2</td>
<td>0.7 [14]</td>
<td>65.5</td>
<td>68.5</td>
<td>C2</td>
</tr>
<tr>
<td>60</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S12</td>
<td>0.8 [40]</td>
<td>58.5</td>
<td>61.5</td>
<td>S12</td>
<td>0.8 [40]</td>
<td>58.5</td>
<td>61.5</td>
<td>C2</td>
<td>0.7 [14]</td>
<td>65.5</td>
<td>68.5</td>
<td>C2</td>
</tr>
<tr>
<td>65</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S12</td>
<td>0.8 [40]</td>
<td>58.5</td>
<td>61.5</td>
<td>S12</td>
<td>0.8 [40]</td>
<td>58.5</td>
<td>61.5</td>
<td>C2</td>
<td>0.7 [14]</td>
<td>65.5</td>
<td>68.5</td>
<td>C2</td>
</tr>
</tbody>
</table>

- **Medium dense, dark yellowish brown and dark greyish brown, gravelly COARSE-FINE SAND, some-little silt**

  Note: able to easily advance hole to 35.0' w/ 3" roller bit; spin shoe diamond burnt - drove casing to 35.0'

- **Medium dense, dark greyish brown, COARSE-FINE SAND, some gravel**

  Advanced easily into sands to 40.0'; no cobbles or boulders encountered

- **Dense, dark yellowish brown, gravelly COARSE-FINE SAND, some silt to "silty"**

  Note: split spoon badly damaged during SPT, cobble(s) likely

- **Dense, greyish brown, MEDIUM-FINE SAND, little gravel, some-little silt, little coarse sand**

  Note: split spoon bent during SPT

---

**-GLACIAL FLUVIAL-**

- **Very dense, light olive brown and dark yellowish brown, MEDIUM-FINE SAND, some gravel to "gravelly", some silt to "silty", little coarse sand, cobble(s) likely, split spoon gouged on outside during SPT**

  Advanced hole to 55.6' w/ 3" roller bit; cutting boulder from 55.0'

- **Continued to cut through boulder (55.0'-56.0') and coarse gravel; damaged inner barrel catcher - replaced w/ new**

  Drove casing w/ damaged spin shoe to 58.5'

- **Dense, light olive brown and dark yellowish brown, silty COARSE-MEDIUM SAND, some gravel to "gravelly", little fine sand**

  Advanced hole w/ Nx core barrel; recovered cobble and coarse-fine gravel-sized rock fragments; sample discarded
Advanced hole w/ Nx core barrel; recovery similar to C2; material being washed out of core barrel is mainly sand w/ varying amount of fine gravel; periodic water loss occurring during advancement; sample discarded

Similar to C3, sample discarded

Similar to C3; sample discarded

Note: from start of run, drill rig was "bogging down", trying to stall, barely could spin the core barrel; diamond kept plugging

Advanced core barrel through sand (no stones encountered) w/ great difficulty; prior to starting C6, approximately 4.0’ of sand entered core barrel; once again, drill rig trying to stall and was bogging down with attempted advancement

Further advanced hole utilizing 3” roller bit as a probe; noted increase in stones to include cobbles from beyond 83.5’; material became coarser w/ depth; no water return during any advancement of bit

Advanced hole further w/ 3” roller bit to 105.0’; bit attempting to plug at approximately 100.0’; occasional cobble encountered; mainly sands with varying amounts of gravel
### Field Classification and Remarks

- **GLACIAL FLUVIAL**

Bottom of Exploration @ 105.0 ft (El. 775.6)
Appendix B
1989 Test Boring Logs
(B1 through B4)
# TEST BORING REPORT

**STATE OF NEW HAMPSHIRE DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS**

**MATERIALS AND RESEARCH DIVISION - SOILS SECTION**

**PROJECT: HARTFORD - location**

**PROJECT NO.: P-4268**

**BRIDGE NO.: 235/1059**

**HOLE NO.: B1**

**SHEET NO.: 1 OF 1**

**STA 5705 + 00 OFFSET 8722**

**BASELINE 2303 SURVEY**

**ELEVATION: 775.1**

**DATE START: 4/13/89**

**DATE FINISH: 4/20/89**

**DRILLER: J. Greenwood**

**INSPECTOR: S. Miers**

**CLASSIFIED BY: F. Ayers**

## Groundwater and Depth to Materials

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Water</th>
<th>Bottom of Casing</th>
<th>Bottom of Hole</th>
<th>Type</th>
<th>Size</th>
<th>I.D.</th>
<th>Hammer WT</th>
<th>Hammer Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/10/89</td>
<td>7:20 AM</td>
<td>11.2</td>
<td>18.75</td>
<td>300</td>
<td>BVI</td>
<td>2.5%</td>
<td>3/4</td>
<td>15 lb</td>
<td>20</td>
</tr>
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</table>

## Depth, Strata Change, Casing Blows, Sampler Blows, Sample Number, Sample Depth Range, Recovery Field Classification and Remarks

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Strata Change</th>
<th>Casing Blows Per Foot</th>
<th>Sampler Blows Per 6 Inches</th>
<th>Sample Number</th>
<th>Sample Depth Range</th>
<th>Recovery</th>
<th>Field Classification and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>S1</td>
<td>0.0</td>
<td>1.4</td>
<td>Med Dense (Frozen) Bk, Bk, Blm, Bk, Blm, ORGANIC litter, Roots. Natural.</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>S2</td>
<td>0.4</td>
<td>1.1</td>
<td>Dense Yellow Blm, Gs-Fn Sand + gravel</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td>S3</td>
<td>0.0</td>
<td>1.0</td>
<td>Very Dense Brown - Ditto.</td>
</tr>
</tbody>
</table>

**ADVANCE w/Bu + Ax Diamonds through Excessive Boulders in Soil**

| 20            |               |                       |                             | S5             | 14.5                | 0.9      | Very Dense Tan: Silty Fine Sand, little gravel (Bbl, Muffles) (Same Ward Strata) |
| 25            |               |                       |                             | S6             | 18.3                | 0.6      | Very Dense Olive Tan: Silty Fine Sand, little gravel, Fm, Gs - Ditto. |

**ADVANCED w/Ax Diamond through Boulder**

| 30            |               |                       |                             | O8             | 21.5                | 0.8      | Dense Tan: Med Sand, little gravel, Fm, Gs - Ditto. Silt, Fm - Ditto. |

**ADVANCED w/Ax Diamond through Stones**

| 35            |               |                       |                             | O9             | 28.5                | 0.5      | Very Dense Olive Tan: Silty Fine Sand, little gravel, Fm, Gs - Ditto. |

**ADVANCED w/Ax through Many Boulders and Smaller Stones in Soil**

---

## Soil Descriptions

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Cohesive Soils</th>
<th>Non-Cohesive Soils</th>
<th>Soil Descriptions</th>
<th>Proportion</th>
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<tr>
<td>Split Spoon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thin Wall Tube</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undisturbed Piston</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open End Rod</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wash Sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auger Flight Sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rock Core</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Blows/ft.**

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Blows/ft.</th>
<th>Consistency</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split Spoon</td>
<td>0 - 1</td>
<td>Very Soft</td>
<td></td>
</tr>
<tr>
<td>Thin Wall Tube</td>
<td>2 - 4</td>
<td>Soft</td>
<td></td>
</tr>
<tr>
<td>Undisturbed Piston</td>
<td>5 - 8</td>
<td>Medium Stiff</td>
<td></td>
</tr>
<tr>
<td>Open End Rod</td>
<td>9 - 15</td>
<td>Stiff</td>
<td></td>
</tr>
<tr>
<td>Wash Sample</td>
<td>16 - 30</td>
<td>Very Stiff</td>
<td></td>
</tr>
<tr>
<td>Auger Flight Sample</td>
<td>31 - 60</td>
<td>Hard</td>
<td></td>
</tr>
<tr>
<td>Rock Core</td>
<td>60+</td>
<td>Very Hard</td>
<td></td>
</tr>
</tbody>
</table>

---

**Capillarized Laminated Major Component**

**Lower Case Adjective**

**Little**

**Trace**

**Less than 10%**

**Note: Dote indicates some textural Descriptions as completing Sample**.
<table>
<thead>
<tr>
<th>DEPTH IN FEET</th>
<th>STRATA CHARGE</th>
<th>CASING BLOWS PER FOOT</th>
<th>Sampler Blows per inch</th>
<th>SAMPLE NUMBER</th>
<th>SAMPLE DEPTH RANGE</th>
<th>RECOVERY</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>S1</td>
<td>0.0</td>
<td>-</td>
<td>1/8</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>S2</td>
<td>4.5</td>
<td>-</td>
<td>4/8</td>
<td>Very Dense</td>
<td>Very Dense - Boulder</td>
</tr>
<tr>
<td>10</td>
<td>S3</td>
<td>10.0</td>
<td>-</td>
<td>12/8</td>
<td>S3</td>
<td>1.2</td>
</tr>
<tr>
<td>12</td>
<td>S4</td>
<td>12.0</td>
<td>-</td>
<td>14/8</td>
<td>Very Dense</td>
<td>Very Dense - Boulder</td>
</tr>
<tr>
<td>15</td>
<td>S5</td>
<td>12.0</td>
<td>-</td>
<td>14/8</td>
<td>Dense TAN-Stratified Fine Sand 5-1/2 Fine Sand</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>S7</td>
<td>18.0</td>
<td>-</td>
<td>20/8</td>
<td>Very Dense</td>
<td>Very Dense - Boulder</td>
</tr>
<tr>
<td></td>
<td>S8</td>
<td>20.0</td>
<td>-</td>
<td>22/8</td>
<td>Medium Dense TAN Fine Sand, Tr. Med. Sand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S9</td>
<td>22.0</td>
<td>-</td>
<td>24/8</td>
<td>Med. Dense</td>
<td>-</td>
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<tr>
<td></td>
<td>S10</td>
<td>24.0</td>
<td>-</td>
<td>26/8</td>
<td>Med. Dense TAN-Stratified Fine Sand 5-1/2 Fine Sand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S11</td>
<td>26.0</td>
<td>-</td>
<td>28/8</td>
<td>Med. Dense</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>S12</td>
<td>28.0</td>
<td>-</td>
<td>30/8</td>
<td>Dense TAN-Stratified Fine Sand</td>
<td></td>
</tr>
</tbody>
</table>

**FIELD CLASSIFICATION AND REMARKS**

- 1.0 Loose Yellow Brown Clay - Fine Sand + Gravel (with 5% Asphalt Particles, Near Surface)
- 1.2 Very Dense Dark Grey Very Siltily, Cs. Fine Sand, Little Silt (Tan-Tone Likely)
- 1.0 Dense TAN-Stratified Fine Sand 5-1/2 Fine Sand
- 1.1 Dense TAN-Work Strata - Cs. Fine Sand (Near) Abl. Silt, Fin. Sand 5-1/2 Fine Sand, Tr. Silt
- 1.1 Med. Dense TAN-Work Strata - Fine Sands, Acc. Tr. Silt
- 1.1 Med. Dense TAN-Work Strata - Fine Sands, Acc. Tr. Silt
- 1.1 Med. Dense TAN-Work Strata - Fine Sands, Acc. Tr. Silt
- 1.1 Med. Dense TAN-Work Strata - Fine Sands, Acc. Tr. Silt
- 1.1 Med. Dense TAN-Work Strata - Fine Sands, Acc. Tr. Silt
- 1.1 Med. Dense TAN-Work Strata - Fine Sands, Acc. Tr. Silt
- 1.1 Med. Dense TAN-Work Strata - Fine Sands, Acc. Tr. Silt
- 1.1 Med. Dense TAN-Work Strata - Fine Sands, Acc. Tr. Silt
- 1.1 Med. Dense TAN-Work Strata - Fine Sands, Acc. Tr. Silt

**SOIL DESCRIPTIONS**

- *Capillary* (saturated) with Major Component
- *Lower Case Adjective* 20% - 50%
- *Little* 10% - 20%
- *Trace* Less than 10%

**TEXTUAL DESCRIPTION AS OVERLAIN SAMPLE**
# Test Boring Report

**State of New Hampshire Department of Public Works and Highways**  
**Materials and Research Division - Soils Section**  
**Project No.: P-4366**  
**Bridge No.: 235/1059**  
**Hole No.: P2**  
**Sheet No.: 2 of 2**  
**STA 5100, OFFSET A + 374**  
**Baseline RT0 302 Survey**  
**Elevation 278.8**  
**Date Start: 7/12/79**  
**Date Finish: 7/13/79**  
**Driller: T. Greenwood**  
**Inspector: S. Myers**  
**Classified By: S. Myers**

## Groundwater

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Water Level</th>
<th>Bottom of Casing</th>
<th>Bottom of Hole</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Strata Change</th>
<th>Casing Blows/Per Foot</th>
<th>Sampler Blows/Per 6 Inches</th>
<th>Sample Number</th>
<th>Sample Depth Range</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td>S13</td>
<td>30.0</td>
<td>0.6</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td>S14</td>
<td>32.0</td>
<td>1.2</td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>34.0</td>
<td></td>
</tr>
<tr>
<td>34.3</td>
<td></td>
<td></td>
<td>34.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Field Classification and Remarks**

- **S13**: Medium Dense, Tan, Fine Sand, Tr. C6, Sand, Tr. Fine Gravel
- **S14**: Medium Dense, Tan, Fine Sand, Tr. Med. Sand
- **34.3**: Medium Dense, Frost Action, Tan, Fine Sand, Will Screen at 34.3 ft.

**Bottom of Exploration at 34.3 ft.**

---

## Soil Descriptions

- **Cohesive Soils**
  - **Blows/ft.**
    - Split Spoon: 0 - 1 (Very Soft), 2 - 4 (Soft), 5 - 8 (Medium Stiff), 9 - 15 (Stiff), 16 - 30 (Very Stiff), 31 - 60 (Hard), 60+ (Very Hard)
  - **Non-Cohesive Soils**
    - **Blows/ft.**
      - 0 - 4 (Very Loose), 5 - 10 (Loose), 11 - 24 (Medium Dense), 25 - 50 (Dense), 50+ (Very Dense)
    - **Density**
      - Capitalized Letters: Major Component
      - Lower Case Adjective: 20% - 50%
      - Little: 10% - 20%
      - Trace: Less than 10%

---

**Soil Descriptions**

- **Capitalized Letters**: Major Component
- **Lower Case Adjective**: 20% - 50%
- **Little**: 10% - 20%
- **Trace**: Less than 10%
# Test Boring Report

State of New Hampshire Department of Public Works and Highways
Materials and Research Division - Soils Section

**Project:** HARTS Location  
**Project No.:** 0-4266  
**Bridge No.:** 235/1059

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Water</th>
<th>Bottom of Casing</th>
<th>Bottom of Hole</th>
<th>Type</th>
<th>Size I.D.</th>
<th>Mixer</th>
<th>Hammer Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/13</td>
<td>AM</td>
<td>5.0</td>
<td>0.0</td>
<td>9.1</td>
<td>PW</td>
<td>2 1/4</td>
<td>1 / 2</td>
<td>50</td>
</tr>
</tbody>
</table>

**Hole No.: R3**

**Sheet No.: 1 of 1**

**STA:** 501 + 90  
**Offset:** R+4.56  
**Baseline:** R+302 Survey

**Elevation:** R+66.9

**Date Start:** 4/11/89  
**Date Finish:** 4/12/89

**Driller:** K. Dana

**Inspector:** S. Myers

**Classified by:** S. Myers

<table>
<thead>
<tr>
<th>Depth in Feet</th>
<th>Strata Chance</th>
<th>Casing Blows per Foot</th>
<th>Sampler Blows per Inch</th>
<th>Sample Number</th>
<th>Sample Depth Range</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1/8</td>
<td>7.1</td>
<td>0.8</td>
<td>S1</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>5</td>
<td>5.0</td>
<td>4.9</td>
<td>0.9</td>
<td>S2</td>
<td>1.7</td>
<td>1.7</td>
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<tr>
<td>10</td>
<td>11.0</td>
<td>11.0</td>
<td>1.0</td>
<td>S3</td>
<td>1.9</td>
<td>1.9</td>
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<tr>
<td>15</td>
<td>14.0</td>
<td>14.0</td>
<td>1.0</td>
<td>S4</td>
<td>0.0</td>
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<td>17.0</td>
<td>17.0</td>
<td>1.5</td>
<td>S5</td>
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</tr>
<tr>
<td>25</td>
<td>23.0</td>
<td>23.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Field Classification and Remarks:**

- Looser Surface Organic/Sandy Topsoil - Natural
- Very Dense Yellow Mirc-Fine Sandy Gravel (Larger Stones evident)
- Very Dense-Ditto

Cored through boulders and cobbles with soil filling.

Bottom of exploration at 23.0 ft.

<table>
<thead>
<tr>
<th>Sample Identification</th>
<th>Cohesive Soils</th>
<th>Non-Cohesive Soils</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Blows/FT.</td>
<td>Consistency</td>
</tr>
<tr>
<td>Split Spoon Thin Wall Tube</td>
<td>0 - 1</td>
<td>Very Soft</td>
</tr>
<tr>
<td>Undisturbed Piston Open End Rod Wash Sample Auger Flight Sample Rock Core</td>
<td>2 - 4 Soft</td>
<td>Medium Stiff</td>
</tr>
<tr>
<td></td>
<td>5 - 8</td>
<td>Medium Stiff</td>
</tr>
<tr>
<td></td>
<td>9 - 15</td>
<td>Stiff</td>
</tr>
<tr>
<td></td>
<td>16 - 30</td>
<td>Very Stiff</td>
</tr>
<tr>
<td></td>
<td>31 - 60</td>
<td>Hard</td>
</tr>
<tr>
<td></td>
<td>60+</td>
<td>Very Hard</td>
</tr>
</tbody>
</table>

**Soil Descriptions**

- Capitalized Letters: Major Component
- Lower Case Adjective: 20% - 50%
- Little: 10% - 20%
- Trace: Less than 10%

**Note:** Diffa indicates same textural description as overlying sample.
### Field Classification and Remarks

Continuous advancing w/wireline runs through soil containing very high percentage of boulders and smaller stones.

ADVANCED through boulder boulders and into soil last foot of run using NK wireline.

Bottom of Exploration AT 25.0 FT.
Appendix C
Grain Size Distribution Curves
**USCS Classification**

<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>USCS Classification</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>Cc</th>
<th>Cu</th>
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<tbody>
<tr>
<td>● B01, 26.0</td>
<td>POORLY GRADED SAND with SILT (SP-SM)</td>
<td>0.91</td>
<td>2.90</td>
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<tr>
<td>▲ B01, 95.0</td>
<td>WELL-GRADED SAND (SW)</td>
<td>1.40</td>
<td>6.04</td>
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<tr>
<td>▲ B04, 48.0</td>
<td>POORLY GRADED SAND with GRAVEL (SP)</td>
<td>0.99</td>
<td>9.21</td>
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</tr>
</tbody>
</table>

**Specimen Identification**

<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>D100</th>
<th>D60</th>
<th>D30</th>
<th>D10</th>
<th>%Gravel</th>
<th>%Sand</th>
<th>%Silt</th>
<th>%Clay</th>
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<tbody>
<tr>
<td>● B01, 26.0</td>
<td>4.75</td>
<td>0.217</td>
<td>0.121</td>
<td>0.0</td>
<td>89.9</td>
<td>10.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▲ B01, 95.0</td>
<td>12.5</td>
<td>1.832</td>
<td>0.88</td>
<td>0.303</td>
<td>10.8</td>
<td>85.1</td>
<td>3.9</td>
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</tr>
<tr>
<td>▲ B04, 48.0</td>
<td>25</td>
<td>1.685</td>
<td>0.554</td>
<td>0.183</td>
<td>15.7</td>
<td>70.7</td>
<td>4.5</td>
<td></td>
</tr>
</tbody>
</table>

**GRAIN SIZE DISTRIBUTION**

AASHTO T27/T11 - Sieve Analysis of Fine and Coarse Aggregates/Materials Finer Than No. 200 Sieve in Mineral Aggregates by Washing