SECTION 02315

EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.

B. Common Excavation, stockpile subsoil for later reuse. Remove excess from site.

C. Grade and rough contour site.

D. Prepare subsoil and borrow to receive subbase and base gravels and topsoil materials.

E. Fill materials

F. Aggregate base and subbase gravels for pavement areas

G. Preparation of foundation bearing surfaces.

H. Place, grade and compact subbase and base gravels to receive pavement.

I. Compaction requirements.

J. Dust Control.

K. The following soils report, boring logs, supplemental reports, letters, etc. are included and hereby made a part of these specifications. Construct project in accordance with the recommendations contained in these reports. All references in the construction documents to "Geotechnical Report" or "Soils Report" are to the following:

1. "Geotechnical Engineering Services, Proposed Housing, 84 Marginal Way, Portland, Maine, 05-1177.2" prepared by S.W. Cole Engineering, Inc. of Gray, Maine, dated September 7, 2006. Data on the indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. Additional test borings and other exploratory operations may be made by the Contractor for the purpose of preparing his bid but these will be at no cost to the Owner.

1.02 RELATED SECTIONS

A. Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 02250 - Dewatering.

C. Section 02317 - Trenching for Site Utilities.

D. Section 02320 - Slope Protection and Erosion Control.

E. Section 02741 - Bituminous Concrete Paving.

1.03 REFERENCES

A. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 1996a.

B. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 1991.

C. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 1991.

D. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System); 1998.

E. .ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 1996.

F. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 1996.

G. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 1998.

H. State of Maine Department of Transportation, Standard Specifications, latest edition (Maine DOT Specifications).

1.04 DEFINITIONS

A. Common Excavation: Excavated material meeting the description of Maine DOT Specifications Section 203.01, except common excavation shall include the removal and disposal of boulders, solid mortared stone masonry, and concrete masonry when each is less than 2 cubic yards in volume.

B. Earth excavation includes excavation of pavements and obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered.

1.05 SUBMITTALS

A. Samples: 75 pound sample of each type of fill and aggregate material; submit in air-tight containers to testing laboratory.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory gradation tests on proposed and actual materials used.

D. Moisture Density Test Reports: Results of ASTM D 1557 laboratory tests. Verify soil/fill-bearing capacity conforms to design requirements. Perform on test at each column pad and per each 50 linear feet of foundation.

E. Field density tests, Perform at least one test per each 2,500 sq. ft. per lift or fill

F. Trench Backfill: Perform at least one test per each 100 lineal feet of trench. Recompact and retest density and compaction of any trench installed after building pad testing has been performed.

G. Foundation wall backfill inside and outside shall have compaction tests made every 50 linear feet. Tests shall be performed on each 12 inch lift.

H. Perform one test per each type soil and each 1,000 cubic yards of material.

I. Final building pad verification letter, submitted by the Geotechnical Engineer at the completion of grading operations, summarizing satisfactory completion of all tests performed prior to slab placement.

1.06 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Protect plants, lawns, and other features to remain.

C. bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Protect above or below grade utilities which are to remain.

E. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

F. Notify Owner of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.

G. Protect excavations and soil adjacent to and beneath foundations from frost.

H. Grade excavation top perimeter to prevent surface water runoff into excavations.

I. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil from falling into excavation.

J. Maintenance of existing flows:
   1. Keep existing sewers and drains in operation.
   2. If existing sewers and drains are disturbed, provide for maintenance of such flows until work is completed.
   3. Do not allow raw sewage to flow on ground surface or stand in excavation.

K. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary. store materials on site in advance of need.

L. When fill materials need to be stored on site, locate stockpiles where indicated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.
   4. Limit stockpile heights so as to preclude ground failure.

M. The Contractor will be responsible for obtaining any necessary street opening permits from the City of Portland, and complying with the terms and conditions of said permit.

PART 2 PRODUCTS

2.01 MATERIALS

A. Subsoil: Reused, meeting the requirements of Granular Borrow or as Common Borrow, provided they comply with the specifications below.

B. Common Borrow: Maine DOT Section 703.18; Shall consist of inorganic mineral soil free of ice, loam, organic or other unsuitable material, with sufficient moisture content to provide the required compaction, moisture content shall not exceed 4 percent above optimum. Determine optimum moisture content in accordance with ASTM D 698 (Cohesive Soils) or D 1557 (Granular Soils).

C. Granular Borrow: Maine DOT 703.19; Mixture of sand, gravel and silt or reclaimed asphalt, concrete, brick, crushed rock that is crushed and blended with sand, free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that portion passing a 2 inch sieve shall meet the following requirements:
   1. No. 40 sieve: 0 to 70 percent passing by weight.
   2. No. 200 sieve: 0 to 20 percent passing by weight.
   3. Granular borrow shall contain no particles or fragments with a maximum dimension in excess of one-half of the compacted thickness of the layer being placed. Granular borrow shall not contain particles of rock which will not pass the 6 inch square mesh sieve.

D. Aggregate Base: Maine DOT Section 703.06 Type 'A' Crushed Gravel, of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 3 inch sieve shall meet the following requirements:
   1. 1/2 inch sieve: 45 to 70 percent passing by weight
   2. 1/4 inch sieve: 30 to 55 percent passing by weight
   3. No. 40 sieve: 0 to 20 percent passing by weight
   4. No. 200 sieve: 0 to 5 percent passing by weight
   5. Type A aggregate shall not contain particles of rock which will not pass the 2 inch square mesh sieve.

E. Aggregate Subbase: Maine DOT Section 703.06, Type 'D' Gravel, of hard durable particles free form vegetable matter, lumps or balls of clay and other deleterious substances. The gradation of that part that passes a 3 inch sieve shall meet the following requirements:
   1. 1/4 inch sieve: 25 to 70 percent passing by weight
   2. No. 40 sieve: 0 to 30 percent passing by weight
   3. No. 200 sieve: 0 to 7 percent passing by weight.
   4. Type D aggregate shall not contain particles of rock which will not pass the 6 inch square mesh sieve.

F. Structural Fill: Clean, non-frost susceptible, sand, screened or crushed gravel of hard durable particles free from vegetable matter, lumps or balls of clay and other deleterious substances. The gradation shall meet the following requirements:
   1. 4 inch sieve: 100 percent passing by weight.
   2. 3 inch sieve: 90 to 100 percent passing by weight.
   3. 1/4 inch sieve: 25 to 90 percent passing by weight.
   4. No. 40 sieve: 0 to 30 percent passing by weight.
   5. No. 200 sieve: 0 to 5 percent passing by weight.

G. Crushed Stone: Maine DOT Section 703.22 Underdrain backfill Type 'C' meeting the following requirements:
   1. 1 inch sieve: 100 percent passing by weight.
   2. 3/4 inch sieve: 90 to 100 percent passing by weight.
   3. 3/8 inch sieve: 0 to 75 percent passing by weight.
   4. No. 4 sieve: 0 to 25 percent passing by weight.
   5. No. 10 sieve: 0 to 5 percent passing by weight.

2.02 ACCESSORIES

A. Water for sprinkling: Fresh and free from oil, acid, and injurious alkali or vegetable matter.

B. Woven Geotextile Fabric: Non-Biodegradable, Mirafi 500x or approved equivalent.

C. Non-woven Geotextile Fabric: Non-Biodegradable, Mirafi 160N or approved equivalent.

D. Calcium chloride: ASTM D 98 commercial grade except as waived by Owner.

2.03 SOURCE QUALITY CONTROL

A. Where fill materials are specified by reference to a specific standard, test and analyses samples for compliance before delivery to site.

B. If tests indicate materials do not meet specified requirements, change material and retest. Materials failing to meet specified requirements, if used prior to acceptance, shall be removed and replaced at no cost to Owner.

C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Examine the areas and conditions under which excavating and filling is to be performed and notify Owner in writing of conditions detrimental to proper and timely completion of work.

C. Correct unsatisfactory conditions in a manner acceptable to owner prior to proceeding with work.

D. Maintain in operation condition existing utilities, active utilities and drainage systems encountered in utility installation. Repair any surface or subsurface improvements as shown on Drawings.

E. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

F. Verify structural ability of unsupported walls to support imposed loads by the fill.

G. Notify utility company to remove and relocate utilities.

3.02 INSPECTION

A. Verify stockpiled fill to be reused is approved.

B. Verify areas to be backfilled are free of organics, debris, snow, ice or water, and surfaces are not frozen.

3.03 PREPARATION

A. When necessary, compact subgrade surfaces to density requirements for aggregate base and aggregate subbase materials.

B. Identify known underground utilities. Stake and flag locations.

C. Identify and flag surface and aerial utilities.

D. Notify utility companies of work to be done.

E. Locate, identify, and protect utilities that remain and protect from damage.

F. Proofroll subgrade surface to identify soft spots.

G. Cut out soft areas of subgrade not capable of compaction in place. Backfill with select fill above the groundwater table or crushed stone below the groundwater table.

3.04 FOUNDATION PREPARATION

A. Topsoil and pavement shall be removed from proposed building area.

B. Overexcavate the pile cap and grade beam subgrades by 12 inches and replace with 12 inches of compacted crushed stone to provide a stable working mat and drainage media for dewatering.

C. Excavation to subgrade shall be made with a smooth-edge bucket to lessen disturbance of subgrade soils.

D. Soil fill placed adjacent to foundations exposed to freezing temperatures and as backfill around features such as bollards and light pole bases shall be structural fill.

E. Soil fill placed adjacent to foundation not exposed to freezing temperatures shall be granular borrow.

F. Place all fill in horizontal lifts and compact such that the desired density is achieved throughout

the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thickness for soil fills shall not exceed 12 inches.

G. Sub-slab fill shall be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557

H. Exterior foundation backfill shall be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557 beneath paved areas, entrance slabs and adjacent to sidewalk areas. All other areas shall be compacted to at least 90 percent of its maximum of its maximum dry density as determined by ASTM D-1557.

I. Backfill for foundation walls acting as retaining walls shall be compacted to between 90 and 95 percent of ASTM D-1557 to avoid additional lateral stress on the walls associated with over-excavation.

J. Crushed stone shall be compacted to 100 percent of its dry rodded unit weight as determined by ASTM C-29

K. An exterior perimeter foundation drainage system using rigid 4" diameter SDR-35 pipe shall be provided with 6 inches of crushed stone wrapped in non-woven geotextile fabric. Set the foundation drain adjacent to the footing, above the 12 inch working mat.

L. Exterior foundation backfill shall be sealed with a surficial layer of clayey or loamy soil in areas that are not paved or occupied by entrance slabs.

3.05 EXCAVATING

A. Underpin adjacent structures which may be damaged by excavating work.

B. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Excavate materials encountered when establishing required subgrade elevations in accordance with Maine DOT Specification Sections 203.04 and 203.05.

D. Remove lumped subsoil, boulders, solid mortared stone masonry, concrete masonry and rock up to 2 cubic yards, measured by volume.

E. Conform to elevations, contours, dimensions, line and grade shown on the drawings.

F. When excavating through roots is necessary, perform work by hand and cut roots with a sharp axe.

G. Slope banks of excavations deeper then 4 feet to angle of repose or flatter until shored. All excavations shall be consistent with OSHA regulations.

H. Do not interfere with 45 degree bearing splay of foundations

I. Correct areas that are over-excavated and load-bearing surfaces that are disturbed at no cost to Owner

J. Grade top perimeter of excavation to prevent surface water from draining into excavation.

K. Remove excavated material that is unsuitable for re-use from the site.

L. Surplus Material:
   1. Make arrangements to provide suitable disposal areas off-site
   2. Deposit and grade material to the satisfaction of the owner of the property on which the material is deposited.
   3. Obtain any necessary permits for disposal.
   4. Provide suitable watertight vehicles to haul soft or wet materials over streets or pavements to prevent deposits on same.

5. Keep crosswalks, streets, and pavements clean and free of debris.
6. Clean up materials dropped from vehicles as often as directed by Owner.

M. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd (0.25 cu m) measured by volume.

3.06 FILLING AND SUBGRADE PREPARATION

A. Topsoil and pavement shall be removed from proposed fill and pavement areas.

B. Proofroll exterior pavement subgrades using a 10-ton vibratory roller-compactor, unless otherwise noted. Any areas that continue to yield after 3 to 5 passes of the compaction equipment shall be over-excavated and replaced with clean granular borrow in dry, non-freezing conditions, and select fill in other conditions.

C. Pavement subgrade in fill areas shall consist of Granular Borrow compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557.

D. Landscape subgrade shall consist of Common Borrow compacted to at least 90 percent of its maximum dry density as determined by ASTM D-1557

E. Place and compact fill materials in continuous layers not exceeding 12 inches loose depth upon compacted material.

F. Employ a placement method that does not disturb or damage other work.

G. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

H. Maintain optimum moisture content of fill materials to attain required compaction density.

I. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

J. Correct areas that are over-excavated:
   1. Load-bearing foundation surfaces: Fill with concrete.
   2. Pavement areas: Use granular borrow above the groundwater table in the event of dry, non-freezing conditions or select fill in other conditions and crushed stone below the groundwater table, flush to required elevation, compacted to 95 percent of maximum dry density.
   3. Other areas: Use Granular Borrow, flush to required subgrade elevations, compacted to minimum 95 percent o of maximum dry density. Use select fill or crushed stone as necessary to backfill wet areas of over excavation.

K. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At other locations: 90 percent of maximum dry density.

L. Leave stockpile areas completely free of excess fill materials

M. Reshape and re-compact fills subjected to vehicular traffic.

N. Frost:
   1. Do not excavate to full indicated depth when freezing temperatures may be expected unless fill material or structures can be constructed immediately after the excavation has been completed. Protect the excavation from frost if placing of fill or structure is delayed.
   2. Fill shall not be placed over frozen soil. Soil that is frozen shall be removed prior to placement of compacted fill. Remove all frozen uncompacted soil prior to placing additional fill for compaction.

O. Native soils can undergo substantial strength loss when subjected to construction traffic and excavation activities, particularly during periods of precipitation and shallow groundwater levels. Care must be exercised to minimize disturbance of the bearing soils. Should the subgrade become yielding or difficult to work, disturbed areas shall be excavated and backfilled in accordance with Section 3.06 L.

P. Clean granular soil meeting the structural fill gradation shall be provided to a depth of 4.5 feet below the top of entrance slabs and sidewalks in contact with the structure. The thickness of structural fill shall extend horizontally from the structure outward to a point at least one foot beyond the adjacent subbase at a 1V to 3H slope or flatter

3.07 CONSTRUCTION OF AGGREGATE BASE AND SUBBASE COURSE

A. Place and compact aggregate base and subbase course materials in continuous layers not exceeding 12 inches loose depth upon compacted material, unless noted otherwise.

B. Employ a placement method so not to disturb or damage structures and utilities.

C. Spread well-mixed materials having no pockets or either fine or coarse materials.

D. Do not segregate large or fine particles.

E. Compacted by mechanical means to obtain 95 percent of maximum dry density as determined in accordance with ASTM D 1557. Base course material shall be compacted with a minimum of two passes with self propelled vibratory compaction equipment.

F. Maintain surface, compaction and stability until placement course has been placed.

G. Conform to elevations, contours, dimensions, line and grade shown on the Drawings.

3.08 DUST CONTROL

A. Upon request of Owner, implement the following dust control measures:
   1. Apply water and calcium chloride as directed by Owner.
   2. Spread calcium chloride uniformly over designated area.
   3. Apply water with equipment having a tank with pressure pump and nozzle equipped spray bar acceptable to Owner.

3.09 TOLERANCES

A. Top surface of base and subbase course: Plus or minus 3/8 inch.

3.10 FIELD QUALITY CONTROL

A. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

B. Compaction density testing will be performed by the Owner of compacted fill in accordance with ASTM D 2922.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor") or ASTM D 1557 ("modified Proctor") as appropriate for soil type.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

E. Frequency of Tests:
   1. Building subgrade areas, including 10'-0" outside exterior building lines: In fill areas, not less than one compaction test on each lift for every 2,500 square feet. Proofroll cut areas.
   2. Areas of construction exclusive of building subgrade: In fill areas, not less than one compaction test on each lift for every 10,000 square feet. Proof roll cut areas.

3.11 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

C. Protect newly graded areas form traffic and erosion and keep free of trash and debris.

D. Repair and re-establish grades in settled, eroded and rutted areas within specified tolerances.

E. Slope fill surfaces to shed water.

3.12 ATTACHMENTS

A. "Geotechnical Engineering Services, Proposed Housing, 84 Marginal Way, Portland, Maine, 05-1177.2" prepared by S.W. Cole Engineering, Inc. of Gray, Maine, dated September 7, 2006.

END OF SECTION 02315

Attachment

Geotechnical Engineering Services, Proposed Housing
84 Marginal Way, Portland, Maine, 05-1177.2

By S.W. Cole Engineering, Inc. of Gray, Maine

Report dated September 7, 2006

GEOTECHNICAL ENGINEERING SERVICES
PROPOSED HOUSING
84 MARGINAL WAY
PORTLAND, MAINE

05-1177.2 **September 7, 2006**

PREPARED FOR:

Realty Resources Chartered
Attention: Ed Marsh, Jr.
28 Merchants Plaza
Bangor, Maine 04401

PREPARED BY:

S.W.COLE ENGINEERING, INC.

286 Portland Road
Gray, Maine 04039

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05-1177.2

September 7, 2006

Realty Resources Chartered
Attention: Ed Marsh, Jr.
28 Merchants Plaza
Bangor, Maine 04401

Subject: Geotechnical Engineering Services
Proposed Housing
84 Marginal Way
Portland, Maine

Dear Mr. Marsh:

In accordance with our Agreement, dated July 13, 2006, we have made a subsurface investigation for the Proposed Housing at 84 Marginal Way in Portland, Maine. This report presents our findings and recommendations and is subject to the limitations set forth in Attachment A.

1.0 INTRODUCTION

1.1 Scope of Work

The purpose of our work was to obtain additional subsurface information at the site in order to develop geotechnical recommendations relative to foundations and earthwork associated with the proposed construction. The investigation has included subsurface explorations, a geotechnical analysis of the subsurface findings, and preparation of this report.

S. W. COLE ENGINEERING, INC. had previously completed preliminary geotechnical engineering services and presented a preliminary report dated March 7, 2006 (SWCE Project No. 05-1177).

1.2 Proposed Construction

Based on the information provided, the proposed construction consists of two, five-story student housing structures with at grade parking below the first floor. The structures will be about 50 by 350 feet in plan dimensions. The structures will be located on the easterly end of the approximately 3.1 acre parcel. It is understood the first level will be predominantly paved parking with a portion of the first level area in the southwest area being used for retail and mechanical spaces. It is understood the structures will be of modular wood construction and wood framed. Based on information provide by Becker Structural Engineers (project structural engineers), column loads on the order of 400 kips for interior columns and 200 kips for perimeter columns are anticipated for the structure. We understand that 70 ton working capacity piles are being considered for this project. Based on information provided by Mitchell & Associates (project site civil engineers), it is anticipated that finished grades and the finished floor elevation for the retail areas will be at about elevation 12.

2.0 EXPLORATION AND TESTING

2.1 Exploration

Three test borings (B-1, B-2, and B-3) were drilled during the preliminary subsurface investigation in January 2006. Three additional test borings (B-201, B-202, and B-203) were drilled recently at the project site during July 18 to July 20, 2006. The borings were made by Great Works Test Boring of Rollinsford, New Hampshire working under subcontract to S. W. COLE ENGINEERING, INC. The explorations were established in the field by S. W. COLE ENGINEERING, INC. based on measurements from existing site features. The approximate exploration locations are shown on the "Exploration Location Plan" attached as Sheet 1. Logs of the test borings are attached as Sheets 2 through 11. A key to the notes and symbols used on the logs is attached as Sheet 12.

A Phase I Environmental Site Assessment was conducted concurrent with the geotechnical exploration. Soil samples were collected from each boring. The soil samples were screened for petroleum and other volatile organic compounds (VOCs) with a photoionization detector (PID). Two soil samples containing ash were submitted to Katahdin Analytical Services in Westbrook, Maine for total RCRA 8 metals analyses. A separate letter report for this work has been provided to you (SWCE Project No. 05-1177.1 E).

2.2 Testing

Field tests included standard penetration resistance tests (SPT) performed with split-spoon samplers, pocket penetrometer tests, and field vane shear tests. Laboratory testing was performed on selected samples from the explorations. The results of field tests and laboratory moisture content tests are shown on the boring logs. Results of grain-size testing are attached as Sheets 13 and 14.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The site is generally bounded by Interstate 295 to the north, Marginal Way to the south, Preble Street to the west, and an existing bus shelter and skateboard park to the east. The site is currently a paved parking lot used by the city as a recycling center, with recycling dumpsters placed on the site. The site is relatively flat and the elevation is about 11 feet.

3.2 Subsurface Conditions

In general the borings encountered a soil profile consisting of fill overlying organic silt (bay mud) with shells overlying silty clay. The silty clay deposit is underlain by a layer of sand (glacial outwash) which is underlain by silty sand with gravel (glacial till). Apparent bedrock was encountered in four of the six test borings. The principal strata encountered at the borings are summarized below. Refer to the attached logs for more detailed descriptions of the subsurface findings at each of the test boring locations.

Fill: The fill generally consists of two units, an upper sand and gravel fill, and a lower silt, sand, and gravel fill. The sand and gravel is a base course / subbase fill, was found to be generally medium to very dense and extends to depths of 1.7 to 9 feet below the pavement at the borings. The lower fill is generally loose to medium dense and is composed of silts, sand, gravel, and some ash and brick. The lower fill was found to extend to about 15 feet below the pavement at the borings.

Glaciomarine Strata: The glaciomarine stratum generally consists of a soft relic bay-mud layer with organics and seashells overlying a stiff layer of brown silty clay overlying a medium to soft layer of gray silty clay. The stiff brown silty clay was not encountered in boring B-201. The relic bay-mud ranges in thickness from about 4 to 11 feet. The stiff brown clay ranges in thickness from about 6 to 8 feet, where encountered. The medium to

soft gray clay begins at depths ranging from about 15 to 36 feet below the ground surface and ranges in thickness from about 50 to 60 feet at the borings.

Glacial Outwash: The glacial outwash stratum found at borings B-201 and B-203, generally consists of medium dense silty fine to medium sand and a trace of gravel. The outwash sands were encountered at depths ranging from about 83 to 87 feet and are interpreted to be about 4 feet in thickness. The glacial outwash was not encountered at boring B-202.

Glacial Till: The glacial till stratum ranges from medium-dense to very dense gray silty sand with gravel. The glacial till stratum was generally encountered at depths ranging from about 78 to 91 feet at the explorations. Occasional cobbles and boulders were encountered in boring B-201 and the glacial till is generally dense to very dense below depths of ranging from about 90 to 100 feet. Glacial till typically contains cobble and boulders of various sizes.

3.3 Groundwater Conditions

Based on visual observations of soil samples, the soils appeared saturated below about 5 feet below the ground surface. Water level measurements were taken on July 19, 2006 at the piezometer installed in boring B-2 from the previous explorations at the site. The groundwater was measured to be about 5 feet below the existing pavement surface.

3.4 Seismic and Frost Conditions

According to the 2003 International Building Code, we interpret the subsurface conditions to correspond to a seismic soil Site Class E. The design freezing index for the Portland area is about 1,250-Fahrenheit-degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet.

4.0 EVALUATIONS AND RECOMMENDATIONS

4.1 General

Based on the subsurface findings and our understanding of the proposed project and structural loads, it is our opinion that the site soils are not suitable for support of the proposed structure on spread footings. Due to the presence of uncontrolled fills and thick deposits of glaciomarine clays at the site, the proposed structure will require a deep foundation system. Because the site is underlain by uncontrolled fills, we recommend that

any concrete floor slabs at ground level also be structurally supported. This includes the proposed retail / mechanical space or other concrete slab areas.

Considering the site has been utilized as a parking area for many years and the existing pavement is in good condition, it is our opinion that the asphalt pavement section proposed for the on-grade parking can be supported on the prepared existing soils.

Excavation work below a depth of about 5 to 6 feet will likely encounter groundwater seepage that will cause softening of subgrades and destabilize excavations. Controlling groundwater to a depth of at least 1 foot below subgrades will help to stabilize subgrades. Deeper excavations will need braced sheeting or trench boxes.

4.2 Pile Foundations

Based on the subsurface findings, it appears that driven steel H-piles or driven displacement piling such as concrete filed steel pipe piles or precast-prestressed concrete piles would be suitable for support of the structure and structural slabs. Piles will need to be driven to practical refusal in the dense glacial till or to bedrock. Based on our understanding of the proposed project, we offer the following table of sample pile sections and estimated allowable capacities.

Recommended Pile Capacities		
Pile Type	**Section**	**Estimated Allowable Axial Compressive Capacity (kips)**
Concrete filled Steel Pipe Pile, 0.3" min wall thickness, 1" flat plate at tip	10 ¾" diameter	80
	12 ¾" diameter	100
Precast-Prestressed, Solid Core, Reinforced Concrete Pile (f´c = 5000 psi)	10" square	80
	12" square	100
Steel H-Pile with cast driving tips, 50-ksi steel, driven to practical refusal		⅛" corrosion
	HP 12 x 53	100
	HP 12 x 74	200
	HP 14 x 89	250
	HP 14 x 117	380

NOTES:

1) A reduction in pile capacity will need to be considered, due to soil downdrag, if surficial loads, such as new fills or surface loads over 200 psf, are placed on the site.
2) The above capacities are estimates only. Actual capacities will need to be assessed by the pile contractor through a test pile and load testing program.
3) The estimated capacities shown above for concrete-filled steel pipe pile are based on capacities achieved at a nearby site driven into the glacial outwash sands or just into the glacial till. A pile capacity of at least 100 kips was required for that project. We would expect capacities of the pipe pile, solid core concrete piles, and ICP concrete piles to be similar, using similar dimensional piles. We expect, however, that higher capacities of pipe pile, solid core concrete piles, and ICP piles could be achieved by driving these piles deeper into the glacial till stratum.

Considering the depths to dense glacial till encountered at the test borings and a pile cap depth of at-least 4.5 feet below finished grade, we estimate pile lengths may range from 85 to 100 feet for steel pipe and prestressed concrete piles. H-piles should be driven into the very dense glacial till stratum, or to bedrock, or until a practical refusal surface is encountered, which may result in pile lengths generally ranging from about 100 to 120 feet. Because subsurface conditions vary across the site, the actual tip elevations and lengths of driven piling will also vary with location. Lengths of any pile type driven into the glacial till would be variable due the presence of cobbles and boulders within the glacial till that may result in practical pile refusal. For any pile option, it is likely that some piles may encounter cobbles and/or boulders at depth and could be damaged during driving, thus the project should account for a loss of piles and/or capacity reduction, due to damage. To assess the variability of depth to bearing strata and to better refine estimates for pile lengths, we recommend that the contractor coordinate several test piles to be driven at different locations at the site.

We understand that prestressed ICP concrete piles are being considered for foundations support. We anticipate that ICP piles would have allowable axial compressive capacities similar to concrete filled steel pipe piles or precast-prestressed reinforced concrete piles. Since this pile type is new to the Portland area, we recommend that further evaluation of this pile type by the contractor to include a test pile and load test program to evaluate drivability and allowable capacities.

Uplift capacity of the piles will be affected by the pile spacing, pile type, splices and actual depths required to achieve capacity. S. W. COLE ENGINEERING, INC. can assist the

design team to help estimate uplift capacities of the piles after a proposed pile type has been selected and again after the test piles have been driven. Alternatively, an uplift test program can be implemented by the contractor to assess actual uplift capacities.

Grade beams, pile caps and foundations exposed to freezing temperatures should extend at least 4.5 feet from finished grade. Piles should be spaced a minimum center-to-center distance of at least 3 pile diameters, but no less than 30 inches. Piles in groups should be driven from the interior outward to help preclude excessively hard driving conditions of the interior piles due to soil densification.

We recommend that lateral loads be resisted by passive earth pressures acting on the grade beams and pile caps. Passive lateral resistance acting on grade beams and pile caps backfilled with compacted Structural Fill should consider a total unit weight of granular backfill (γ_t) of 125 pcf, an angle of internal friction of 30 degrees with an ultimate passive lateral earth pressure coefficient (K_p) of 3.0. Additional resistance to lateral loads can be mobilized along the pile shafts and by battered piles, if needed. S. W. COLE ENGINEERING, INC. can assist with lateral pile capacities, as deemed necessary by the structural engineer. Alternatively, a lateral load test program can be implemented by the contractor to assess actual lateral pile shaft capacities.

Pile load tests are required to be performed on projects having piles with design capacities over 40 tons (80 kips). We understand that a 70 ton pile capacity is being considered for this project. A test pile program including monitoring of several piles with a Pile Driving Analyzer (PDA) to determine pile and driving equipment compatibility as well as to define the “set” criteria and allowable capacity should be implemented. The test pile program should include PDA monitoring of the test piles during re-strikes in order to assess pile capacity and driving resistance after pore water pressures have relaxed. The pile driving contractor should submit a WEAP analysis and information relative to pile driving equipment prior to beginning driving. S. W. COLE ENGINEERING, INC. should be on-site during pile driving to document the pile driving

4.3 Subgrade Preparation

Site preparation should begin with construction of an erosion control system to protect drainage ways and areas outside the construction limits. The soils that will be exposed will

be subject to erosion. As much existing pavement and vegetation as possible should remain adjacent to the construction site to lessen the potential for erosion.

Based on the information obtained at the test borings, subgrades will likely consist of uncontrolled loose to dense generally granular fill. Ash fill should also be expected in this area of Portland. Groundwater will be encountered in excavations, such as for foundations, elevator pits or site utilities. We recommend that all foundations, including pile cap and grade beam subgrades be overexcavated by about 12 inches and replaced with a layer of compacted crushed stone. The crushed stone will help to provide a stable working mat and a drainage media for dewatering. Pipe trench bottoms should also be overexcavated at least 12 inches and replaced with at least 12 inches of compacted crushed stone overlying a non-woven geotextile fabric such as Mirafi 160N. Utility structures such as manholes, vaults and catch basins should be overexcavated at least 24 inches and replaced with at least 24 inches of compacted crushed stone overlying a non-woven geotextile fabric. We recommend that excavation to subgrades be completed with a smooth-edged bucket to lessen disturbance of subgrade soils.

4.4 Excavation

Excavation work will encounter uncontrolled miscellaneous fills. The on-site fill soils are not suitable for reuse below slabs or backfill against foundations, but it may be possible to reuse the sandy on-site upper fill for trench backfill below paved areas provided they are screened of miscellaneous debris and are at a moisture content which is consistent with the required compaction. Existing asphalt pavement should be removed prior to foundation construction. The pavement may be crushed and blended with sand to create material suitable for reuse as pavement subbase.

Groundwater and wet soil conditions will likely be encountered in the foundation excavations deeper than about 5 feet below existing grades. In our opinion, ditching with sump and pump dewatering techniques should be adequate to control groundwater in shallow foundation excavations. It should be anticipated, however, that heavy rains and/or higher than normal tides will affect groundwater levels and may require significant sumping and pumping or other means of dewatering. We recommend a 12-inch layer of crushed stone be placed over foundation subgrades to act as a drainage media from which to sump and pump. Deeper excavation, such as for utilities, will likely require trench box or braced sheetpile shoring for groundwater cutoff and excavation stability. In any case, excavations must be properly shored and/or sloped in accordance with OSHA trenching regulations to prevent sloughing and caving of the sidewalls during construction.

4.5 Concrete Slabs in Heated Areas

We recommend that concrete slab floors in the retail / mechanical area be structurally supported. These slabs should be underlain by at least 12 inches of compacted Structural Fill or crushed stone. We have assumed these slabs will be in heated areas. The Structural Fill or crushed stone below the slabs should be hydraulically connected to foundation underdrains.

We recommend that a vapor retarder be placed directly below concrete slabs in enclosed spaces. The vapor retarder should have a permeance that is less than the floor covering being applied on the slab and should be installed according to the manufacturer's recommended methods including taping all joints and wall connections. Flooring suppliers should be consulted relative to acceptable vapor retarder systems for use with their products. The vapor retarder must have sufficient durability to withstand direct contact with the subslab fill and construction activity.

4.6 Foundation Drainage

We recommend that a perimeter foundation drain system as well as several interior sub-slab drains be provided for the retail / mechanical areas and other enclosed first floor areas of the structure. An underdrain should also be provided for any elevator pit areas. The foundation drains should be placed at least 4.5 feet from freezing temperatures and should consist of 4-inch diameter rigid underdrain pipe having perforations of ¼ to ½ inches. We recommend that at least 6 inches of crushed stone bedding be provided around the foundation drains and that the stone be wrapped with a geotextile filter fabric having an apparent opening size of at least 70. The foundation drainage system must have a positive gravity outlet.

Exterior foundation backfill should be sealed with a surficial layer of clayey or loamy soil in areas that are not to be paved or occupied by entrance slabs to reduce direct surface water infiltration into the backfill. Roof drains should be routed in separate non-perforated pipes, also placed below the frost depth. Utilities in non-heated areas, extending through slabs or asphalt paving into underlying soils, should have a gasket at grade to prevent surface water from entering the underlying fills and to allow some differential movement.

4.7 Entrances, Sidewalks, and Exterior Slabs

Entrance approaches, sidewalks and exterior slabs should be designed to reduce the effects of differential frost action between doorways and entrances. We recommend that excavations beneath the entire width of entrances, sidewalks, and exterior slabs continue to at least 4.5 feet below finish grade. These areas should be backfilled with compacted non-frost susceptible granular fill meeting the Structural Fill gradation to limit abrupt heave or differential movement. We recommend the structural fill be underlain by non-woven geotextile fabric. The zone of non-frost susceptible material adjacent to exterior foundations and below entrance slabs and sidewalks should transition up to any adjacent pavement subbase or loam at a 3H:1V slope or flatter.

4.8 Backfill and Compaction

The on-site fills are not suitable for reuse below pavements, slabs or adjacent to foundations. The sandy portions of the on-site upper fills may be suitable for reuse as compacted trench backfill below paved areas. Compacted granular fill below entrances, sidewalks, on-grade slabs (parking areas) and as backfill against all foundations (interior and exterior) should be clean granular material meeting the gradation for Structural Fill:

Structural Fill	
Sieve Size	Percent Passing
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
No. 40	0 to 30
No. 200	0 to 5

Crushed stone for drainage and use below pile caps and grade beams should meet the gradation given below. A nominal size ¾ inch crushed stone usually meets these gradation requirements.

Crushed Stone	
Sieve Size	Percent Finer by Weight
1 inch	100
3/4 inch	90 to 100
3/8 inch	0 to 75
No. 4	0 to 25
No. 10	0 to 5

Fill should be placed in horizontal lifts and be compacted. Lift thickness should be such that desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Foundation backfill and fills placed beneath paved areas and walkways should be compacted to at least 95 percent of its maximum dry density as determined by the Modified Proctor (ASTM D1557). Backfill below pile-supported foundations should be compacted crushed stone. Because of the loose nature of the existing fills, it will be necessary to densify subgrades below grade beams and provide compacted structural fill or crushed stone bedding.

4.9 Asphalt Pavement

We have provided the following proposed pavement sections based on our experience with similar facilities and certain geotechnical assumptions. We offer the following new pavement sections for consideration:

Recommended Pavement Sections		
Pavement Layer	Thickness	
	Standard Duty (Parking)	Heavy Duty (Driveways)
MDOT 703.09 Type 9.5 mm Hot Mix Asphalt	1 ¼ inches	1 ¼ inches
MDOT 703.09 Type 19 mm Hot Mix Asphalt	1 ¾ inches	2 ¾ inches
MDOT 703.06 Type A Base Course Aggregate	6 inches	6 inches
MDOT 703.06 Type D Subbase Aggregate	12 inches	15 inches

All pavement sections need to be placed on properly prepared densified subgrades. All pavement subgrades should be densified by a vibratory roller compactor. Any areas that

are soft, wet and yielding should be assessed for the need for over-excavation and replacement with structural fill and/or underlain by woven geotextile filter fabric such as Mirafi 500X. Granular base and subbase material(s) should be compacted to at least 95 percent of their maximum dry densities as determined by ASTM D-1557 at a moisture content at or near optimum moisture. Bituminous pavement should be compacted to 92 to 97 percent of its theoretical maximum density (TMD) as determined by ASTM D-2041.

Since the native soils are frost susceptible, some frost heaving and distress of pavements must be anticipated unless all frost susceptible soils are removed to a depth of at least 4.5 feet below the pavement surface and backfilled with non-frost susceptible Structural Fill.

4.10 Weather Considerations

Subgrades, foundations and floor slabs must be protected from freezing conditions. Fill soils and concrete must not be placed on frozen soil and once placed, the soil beneath the structure must be protected from freezing. Further, the existing uncontrolled fill is moisture sensitive and as such subgrades will be susceptible to disturbance during wet conditions. Consequently, site work and construction activities should take appropriate measures to protect exposed subgrades, particularly when wet. This may require the use of temporary haul roads and staging areas to preclude subgrade damage due to construction traffic. Geotextile fabric may also be needed below haul roads and/or proposed slabs to help stabilize subgrades.

4.11 Construction Observation and Testing

S. W. COLE ENGINEERING, INC. should be retained to provide consultation and testing services for the piling, excavation and foundation phases of construction. This is to observe compliance with the design recommendations, drawings and specifications and to allow design changes in the event that subsurface conditions are found to differ from those anticipated prior to the start of construction. S. W. COLE ENGINEERING, INC. is available to provide vibration monitoring, pile installation monitoring, and testing of soils, concrete, steel, masonry, fireproofing and asphalt.

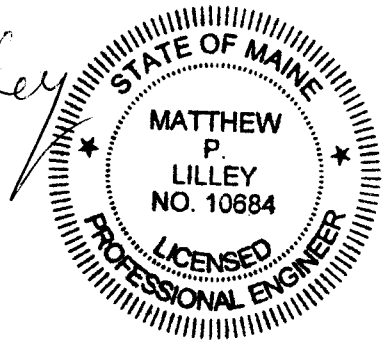
5.0 CLOSURE

S. W. COLE ENGINEERING, INC. should be retained to review the sitework and foundation design drawings to confirm that our recommendations have been appropriately interpreted and implemented. It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you as the design progresses and during the construction phase.

Sincerely,

S. W. COLE ENGINEERING, INC.

Matthew P. Lilley



Matthew P. Lilley, P. E.
Geotechnical Engineer

MPL:mpl/pfb

P:\2005\05-1177.2 S - Realty Resourses Chartered - Portland - Housing - 84 Marginal Way - SSI - PFK\Reports and Letters\05-1177.2 Report.doc

Attachment A - Limitations

This report has been prepared for the exclusive use of Realty Resources Chartered for specific application to the proposed Proposed Housing located at 84 Marginal Way in Portland, Maine. S. W. COLE ENGINEERING, INC. has endeavored to conduct the work in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S. W. COLE ENGINEERING, INC.'s scope of work has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S. W. COLE ENGINEERING, INC. should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S. W. COLE ENGINEERING, INC.

NOTES :

1.) Base plan provided by Mitchell & Associates.

2.) Test Borings B-1, B-2 and B-3 were drilled in January 2006.

3.) Test Borings B-201, B-202 and B-203 were drilled in July 2006.

S.W.COLE ENGINEERING, INC.

REALTY RESOURCES CHARTERED

EXPLORATION LOCATION PLAN

Proposed Housing
84 Marginal Way
Portland, Maine

Job No. 05-1177.2 S
Date : 08/01/06

Scale 1" = 50'
Sheet 1

LEGEND

Approximate Test Boring Location

INTERSTATE 295 - NORTHBOUND
OVERPASS
MAINE
PREBLE STREET EXT.
MARGINAL WAY
CONCRETE ISLAND
SHRUBS
CHAIN LINK FENCE
GUARDRAIL
SIGN
LIMIT OF WORK
R 11569.16'
L 227.68'
R 11569.16'
L 84.31'
HELD N39°13'17"E 34.26'
40 SPACES
31 SPACES
13 SPACES
24 SPACES
CAPITAL, LLC
1.37 ACRES
TOTAL SITE AREA
(BOTH PARCELS)
117,464 S.F.
2.7 Ac.
SOUTHERN MAINE STUDENT HOUSING, LLC
1.33 ACRES
N/F STATE OF MAINE
CLUMP
REMOVE AND STOCKPILE GRANITE CURBING TO LIMIT OF WORK LINES
CITY TO REMOVE JERSEY BARRIERS
TEMPORARILY REMOVE CHAIN LINK FENCE TO LIMIT OF WORK LINES. FENCE TO BE RESET ALONG PROPERTY LINE
REMOVE ALL GRAY TREES ON PROPERTY AND IN R.O.W. BETWEEN LIMIT OF WORK LINES, TYPICAL
REMOVE LIGHT POLE, TYPICAL
N60°49'24"E 165.85'
S63°58'52"W 46.13'
N63°44'28"E 75.51
R 3040.37'
L 22.37'
SAWCUT LINE
JERSEY BARRIERS
B-1
B-2
B-201
B-202
B-203
B-3
REMOVE VEGETATION
REMOVE BITUMINOUS PAVEMENT
REMOVE AND STOCKPILE GRANITE CURBING FOR REUSE
REMOVE EMERGENCY BOX - COORDINATE WITH CMP
S40°58'47"E 194.69'
PORCH
BUILDING
CITY TO REMOVE BUILDING
STEP
REMOVE AND STOCKPILE GRANITE CURBING FOR REUSE TO LIMIT OF WORK LINES
REMOVE CATCHBASIN
REMOVE LIGHT POLE, TYPICAL
REMOVE EXISTING, TYPICAL
342.24'
S49°01'08"W
LP (NO LITE)
ELEC. METER
REMOVE POST
CMP TO REMOVE UTILITY POLE
#12S
TBM PK NAIL IN UP #12 EL=10.62
REMOVE CATCHBASIN
REMOVE PIPE
EXISTING TREES TO BE SAVED, IF POSSIBLE
REMOVE ALL GRAY TREES ON PROPERTY AND IN R.O.W. BETWEEN LIMIT OF WORK LINES, TYPICAL
HELD
S49°01'08"W 474.82'
S52°26'29"W 59.30'
S52°26'29"W 41.21'
PAVED WALK
PROPERTY TO BE RETAINED BY THE CITY OF PORTLAND
1949 square feet = 0.05 acres, +/-.
R 49.00'
L 63.88'
R 1372.39'
L 202.94'
SIGNAL POST
TBM
#9
#110
#12
#125

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-201
SHEET: 1 OF 4
PROJECT NO.: 05-1177.2
DATE START: 7/19/2006
DATE FINISH: 7/20/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										3 1/2"± ASPHALT PAVEMENT
	1D	24"	16"	2.6'	18	42	13	20		TAN SILTY SAND AND GRAVEL (FILL)
	2D	24"	15"	4.6'	24	35	34	32		
	3D	24"	20"	7.0'	45	29	14	11	9.0'	
	4D	24"	4"	12.0'	4	10	7	5	14.0'	BLACK ASH, SAND (FILL)
									15.0'	BLACK ORGANIC SILT, PIECES OF WOOD
	5D	24"	24"	17.0'	4	7	10	11		GRAY CLAYEY SILT OR SILTY CLAY WITH SHELLS w = 31.6%
	6D	24"	15"	22.0'	3	3	3	2		~MEDIUM~ w = 53.7%
	7D	24"	24"	27.0'	WOH	3	10	11	26.0'	w = 30.0% GRAY SILTY CLAY
	8D	24"	24"	32.0'	WOH/18"			5		~SOFT~ w = 42.7%

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-201

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-201
SHEET: 2 OF 4
PROJECT NO.: 05-1177.2
DATE START: 7/19/2006
DATE FINISH: 7/20/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING
DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
	1V	3.5 X 7 VANE		40.6'						S_V = 0.27 / 0.04 ksf ~SOFT~
	1V	3.5 X 7 VANE		41.8'						S_V = 0.44 / 0.11 ksf GRAY SILTY CLAY CONTINUED
	2V	3.5 X 7 VANE		50.6'						S_V = 0.30 / 0.07 ksf
	2V	3.5 X 7 VANE		51.8'						S_V = 0.62 / 0.13 ksf
	3V	3.5 X 7 VANE		60.6'						S_V = 0.41 / 0.03 ksf ~MEDIUM~
	3V	3.5 X 7 VANE		61.8'						S_V = 0.83 / 0.08 ksf
	4V	3.5 X 7 VANE		70.6'						S_V = 0.52 / 0.16 ksf ~MEDIUM~
	4V	3.5 X 7 VANE		71.8'						S_V = 0.59 / 0.20 ksf

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-201

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-201
SHEET: 3 OF 4
PROJECT NO.: 05-1177.2
DATE START: 7/19/2006
DATE FINISH: 7/20/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING
DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
	9D	24"	24"	82.0'	WOR / 24"					~SOFT~ GRAY SILTY CLAY CONTINUED
									87.0'	
										GRAY SILTY SAND, TRACE FINE GRAVEL
	10D	24"		92.0'	19	12	15	18	91.0'	~DENSE~ GRAY SILTY SAND WITH GRAVEL, OCCASIONAL COBBLES (GLACIAL TILL)
	11D	5"	4"	100.4'	50/5"					~VERY DENSE~
									115.8'	ROLLER CONE 115.8' TO 120.0' PROBABLE BEDROCK
										BOTTOM OF EXPLORATION @ 120.0'

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST-

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-202
SHEET: 1 OF 3
PROJECT NO.: 05-1177.2
DATE START: 7/20/2006
DATE FINISH: 7/20/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING
DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										3 1/2"± ASPHALT PAVEMENT
									1.7'	TAN SAND AND GRAVEL (FILL)
	1D	24"	16"	2.5'	13	22	16	20		
	2D	24"	18"	4.5'	26	30	25	13	5.0'	GRAY SILTY SAND WITH GRAVEL (FILL)
	3D	24"	24"	7.0'	6	6	6	5	9.0'	GRAY SILT (FILL)
	4D	24"	10"	12.0'	4	12	15	15	14.8'	GRAY SILTY SAND AND GRAVEL (FILL)
	5D	24"	24"	17.0'	4	5	5	8	19.0'	GRAY ORGANIC SILT, SHELLS
	6D	24"	20"	22.0'	13	13	15	13		OLIVE BROWN SILTY CLAY ~STIFF TRANSITIONING TO MEDIUM~ w = 28.2%
	7D	24"	19"	27.0'	5	5	6	6		GRAY SILTY CLAY w = 36.9%
	8D	24"	24"	32.0'	WOR/12"		WOH/12"			~SOFT~

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-202

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-202
SHEET: 2 OF 3
PROJECT NO.: 05-1177.2
DATE START: 7/20/2006
DATE FINISH: 7/20/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING
DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										~SOFT~ GRAY SILTY CLAY CONTINUED
									78.0'	GRAY SILTY SAND WITH GRAVEL, OCCASIONAL COBBLES (GLACIAL TILL)

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-202

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-202
SHEET: 3 OF 3
PROJECT NO.: 05-1177.2
DATE START: 7/20/2006
DATE FINISH: 7/20/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING
DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
	9D	24"	17"	82.0'	10	13	20	27		GRAY SILTY SAND WITH GRAVEL, OCCASIONAL COBBLES CONTINUED ~MEDIUM DENSE~ (GLACIAL TILL)
	10D	24"	21"	92.0'	48	44	39	55		~VERY DENSE~
									106.4'	ROLLER CONE 106.4' TO 110.5' PROBABLE BEDROCK
									110.5'	BOTTOM OF EXPLORATION @ 110.5'

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[X] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-202

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-203
SHEET: 1 OF 4
PROJECT NO.: 05-1177.2
DATE START: 7/18/2006
DATE FINISH: 7/18/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING
DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										3 1/2"± ASPHALT PAVEMENT
	1D	24"	12"	2.5'	13	23	14	13	3.0'	BROWN SAND AND GRAVEL (FILL)
	2D	24"	22"	4.5'	2	20	46	34		~MEDIUM DENSE TO DENSE~
	3D	24"	18"	6.5'	7	24	16	21		BROWN TO BLACK SILTY SAND, ASH, BRICK (FILL)
	4D	24"	15"	12.0'	14	21	25	21	14.5'	
	5D	24"	24"	17.0'	2	2	3	2	19.0'	GRAY ORGANIC SILT, SHELLS ~SOFT~
	6D	24"	24"	22.0'	WOH	2	2	2	22.0'	GRAY SILTY CLAY ~SOFT~
	7D	24"	24"	27.0'	12	13	17	19		OLIVE BROWN SILTY CLAY
	8D	24"	24"	32.0'	WOH/18"			3		q_p = 3.0 tsf ~VERY STIFF TRANSITIONING TO MEDIUM~
	1V	2 X 4 VANE		35.5'						GRAY SILTY CLAY ~SOFT~
	1V	2 X 4 VANE		36.0'						S_V = 0.45 / 0.11 ksf
										S_V = 0.50 / 0.17 ksf

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-203

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-203
SHEET: 2 OF 4
PROJECT NO.: 05-1177.2
DATE START: 7/18/2006
DATE FINISH: 7/18/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING
DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										GRAY SILTY CLAY CONTINUED
	2V	3.5 X 7 VANE		45.8'						S_V = 0.62 / 0.13 ksf ~MEDIUM~
	2V	3.5 X 7 VANE		46.6'						S_V = 0.63 / 0.12 ksf
	3V	3.5 X 7 VANE		55.8'						S_V = 0.73 / 0.06 ksf ~MEDIUM~
	3V	3.5 X 7 VANE		56.6'						S_V = 0.75 / 0.05 ksf
	4V	3.5 X 7 VANE		65.8'						S_V = 0.57 / 0.03 ksf ~MEDIUM~
	4V	3.5 X 7 VANE		66.6'						S_V = 0.65 / 0.03 ksf

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-203

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-203
SHEET: 3 OF 4
PROJECT NO.: 05-1177.2
DATE START: 7/18/2006
DATE FINISH: 7/18/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING
DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									83.0'	GRAY SILTY CLAY CONTINUED
	9D	24"	19"	87.0'	15	15	15	22	87.0'	GRAY SILTY SAND
	10D	24"	17"	92.0'	30	34	29	23		GRAY SILTY SAND WITH GRAVEL, OCCASIONAL COBBLES (GLACIAL TILL) ~VERY DENSE~
	11D	11"	7"	95.9'	40	50/5"				
	12D	21"	16"	106.7'	38	47	43	50/3"		
	13D	3"	3"	115.3'	50/3"				118.5'	PROBABLE BEDROCK

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-203

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-203
SHEET: 4 OF 4
PROJECT NO.: 05-1177.2
DATE START: 7/18/2006
DATE FINISH: 7/18/2006
ELEVATION: 11' ±
SWC REP.: MPL

PROJECT / CLIENT: PROPOSED HOUSING / REALTY RESOURCES CHARTERED
LOCATION: PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING
DRILLER: WAYNE MCPHERSON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	CASED	4"		
SAMPLER:	SS	1 3/8"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEAR SATURATED @ ABOUT 5'

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										PROBABLE BEDROCK CONTINUED ROLLER CONE FROM 118.5' TO 122.5'
									122.5'	BOTTOM OF EXPLORATION @ 122.5'

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-203

KEY TO THE NOTES & SYMBOLS
Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - based on laboratory unconfined compressive test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. based on pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass. RQD is computed from recovered core samples.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

0 to 5% TRACE
5 to 12% SOME
12 to 35% "Y"
35+% AND

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

S.W.COLE ENGINEERING, INC.

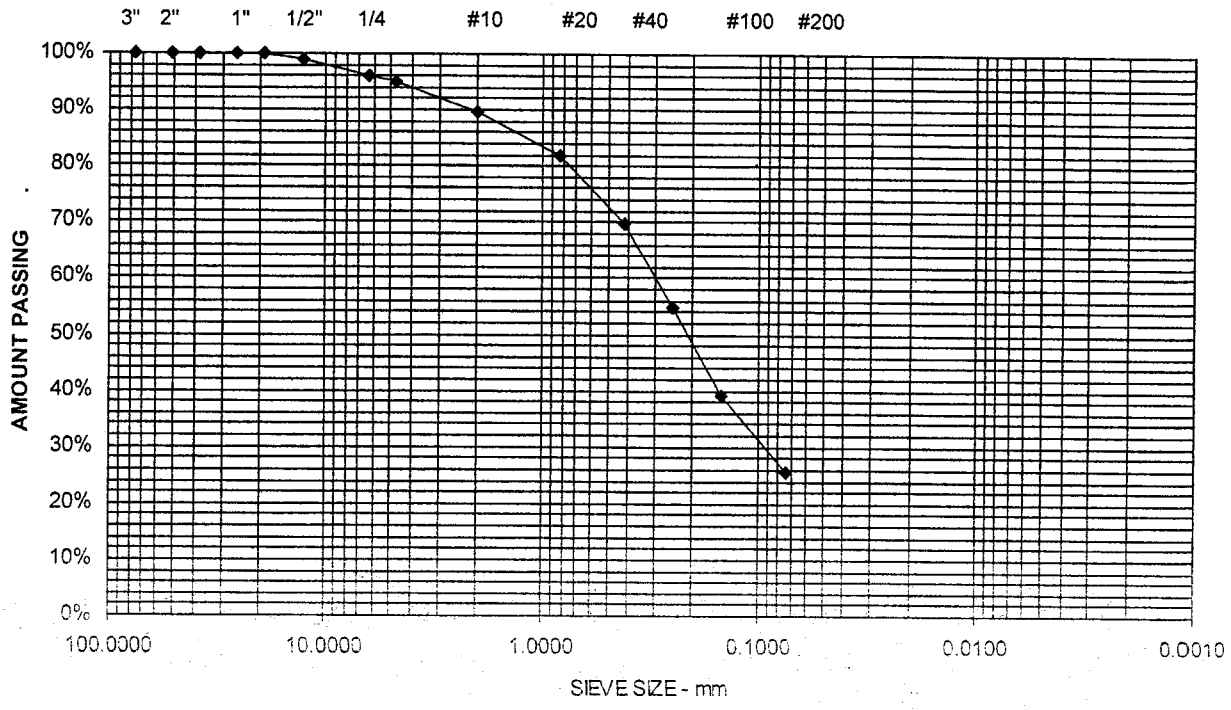
Report of Gradation

ASTM C-117 & C-136

Project Name: PORTLAND - 84 MARGINAL WAY HOUSING - GEOTECHNICAL ENGINEERING SERVICES
Client: REALTY RESOURCES CHARTERED
Material Source: **B-201 2D 2.6-4.6**

Project Number: 05-1177.2
Lab ID: 5477G
Date Received: 7/24/2006
Date Complete: 7/25/2006
Tested By: JUSTIN BISSON

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	6"	100	
125 mm	5"	100	
100 mm	4"	100	
75 mm	3"	100	
50 mm	2"	100	
38.1 mm	1-1/2"	100	
25.0 mm	1"	100	
19.0 mm	3/4"	100	
12.5 mm	1/2"	99	
6.3 mm	1/4"	96	
4.75 mm	No. 4	95	5.1% Gravel
2.00 mm	No. 10	90	
850 um	No. 20	82	
425 um	No. 40	70	69.3% Sand
250 um	No. 60	55	
150 um	No. 100	39	
75 um	No. 200	25.6	25.6% Fines



Comments:

S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

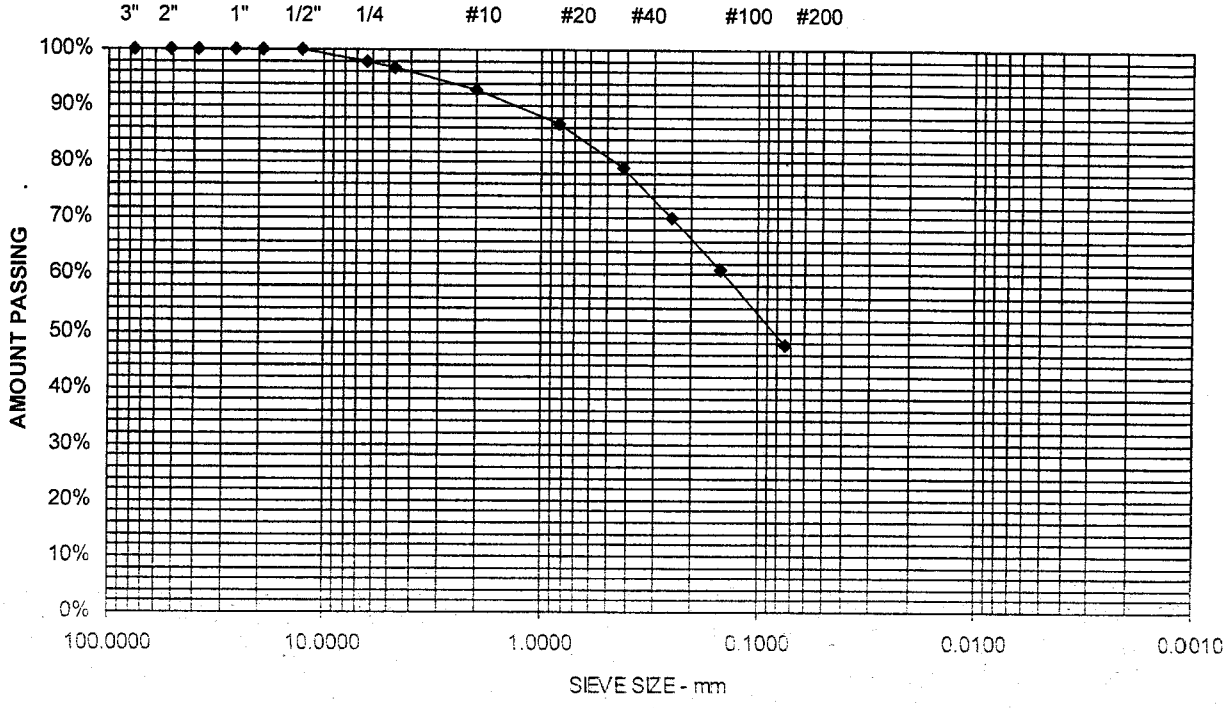
Project Name PORTLAND - 84 MARGINAL WAY HOUSING - GEOTECHNICAL ENGINEERING SERVICES

Client REALTY RESOURCES CHARTERED

Material Source **B-203 10D 90-92**

Project Number 05-1177.2
Lab ID 5478G
Date Received 7/24/2006
Date Complete 7/25/2006
Tested By JUSTIN BISSON

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	6"	100	
125 mm	5"	100	
100 mm	4"	100	
75 mm	3"	100	
50 mm	2"	100	
38.1 mm	1-1/2"	100	
25.0 mm	1"	100	
19.0 mm	3/4"	100	
12.5 mm	1/2"	100	
6.3 mm	1/4"	98	
4.75 mm	No. 4	97	3.2% Gravel
2.00 mm	No. 10	93	
850 um	No. 20	87	
425 um	No. 40	79	49.2% Sand
250 um	No. 60	70	
150 um	No. 100	61	
75 um	No. 200	47.6	47.6% Fines



Comments:

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-1**
SHEET: 1 OF 3
PROJECT NO.: 05-1177
DATE START: 1/26/2006
DATE FINISH: 1/26/2006
ELEVATION: 8' +/-
SWC REP.: ARS

PROJECT: PROPOSED STUDENT HOUSING
CLIENT : REALTY RESOURCES CHARTERED
LOCATION: 84 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JOHN DIBENEDETTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN.	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
FREE WATER AT 4'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									4"	ASPHALT
	1D	23"	15"	2.0'	16	13	31	50/5"	1.5'	BROWN GRAVELLY SAND, SOME SILT ~ DENSE ~
									4.0'	GRAY SILTY GRAVELLY SAND (TILL FILL) ~ MEDIUM DENSE ~
	2D	24"	10"	7.0'	5	25	10	8		BLACK GRAVELLY SILTY SAND WITH BRICKS AND GLASS AND WOOD w = 14.6%
	3D	24"	20"	9.0'	16	13	13	10		~ MEDIUM DENSE ~
	4D	24"	12"	12.0'	12	34	15	15		SHEEN OBSERVED IN WASH WATER AT 12' (POSSIBLE CONTAMINATION)
									13.0'	
									15.0'	DARK GRAY SILT, SOME FINE SAND WITH ORGANICS (NATIVE) ~ LOOSE ~
	6D	24"	8"	17.0'	3	2	2	4		MOTTLED BROWN-GRAY SILTY CLAY WITH SEA SHELLS w = 47.9%
	7D	24"	1"	22.0'	3	1	2	2		~ MEDIUM STIFF ~
	8D	24"	20"	27.0'	8	10	15	17		qp = 5 KSF w = 31.1%
									29.0'	
	1U	24"	24"	32.0'	PISTON					GRAY SILTY CLAY qu = 0.4 KSF w = 39.8% WL = WP =
	3.5" X 7" VANE			35.8'			21/3			Sv = 0.22/0.03 KSF ~ SOFT ~
	3.5" X 7" VANE			36.6'			35/6			Sv = 0.37/0.06 KSF

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-1**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-1**
SHEET: 2 OF 3
PROJECT NO.: 05-1177
DATE START: 1/26/2006
DATE FINISH: 1/26/2006
ELEVATION: 8' +/-
SWC REP.: ARS

PROJECT: PROPOSED STUDENT HOUSING
CLIENT : REALTY RESOURCES CHARTERED
LOCATION: 84 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JOHN DIBENEDETTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN.	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
FREE WATER AT 4'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
	3.5" X 7" VANE			40.8'			16/3			Sv = 0.17/0.03 KSF
	3.5" X 7" VANE			41.6'			45/9			Sv = 0.47/0.09 KSF
										GRAY SILTY CLAY
	2U	24"	24"	47.0'	PISTON					~ SOFT ~
	3.5" X 7" VANE			60.8'			55/2			Sv = 0.57/0.02 KSF
	3.5" X 7" VANE			61.6'			79/5			Sv = 0.82/0.05 KSF
										w = 38.7%
										GRAY SILTY CLAY
										~ MEDIUM STIFF ~
	10D	24"	0"	77.0'	WOR					

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-1**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-1**
SHEET: 2 OF 3
PROJECT NO.: 05-1177
DATE START: 1/26/2006
DATE FINISH: 1/26/2006
ELEVATION: 8' +/-
SWC REP.: ARS

PROJECT: PROPOSED STUDENT HOUSING
CLIENT : REALTY RESOURCES CHARTERED
LOCATION: 84 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JOHN DIBENEDETTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN.	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
FREE WATER AT 4'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										GRAY SILTY CLAY
									85.0'	~ MEDUIM STIFF ~
										GRAY GRAVELLY SILT AND SAND SOME COBBLES
	11D	17"	8"	92.0'	6	33	50/5"			~ MEDIUM DENSE ~
										w = 8.9%
	12D	24"	10"	102.0'	6	6	12	12		w = 11.9%
										PROBABLE DENSE AT 105'
									112.0'	
										BOTTOM OF EXPLORATION AT 112.0' - NOT REFUSAL (OUT OF ROD)

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-1**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-2**
SHEET: 1 OF 2
PROJECT NO.: 05-1177
DATE START: 1/25/2006
DATE FINISH: 1/25/2006
ELEVATION: 8' +/-
SWC REP.: ARS

PROJECT: PROPOSED STUDENT HOUSING
CLIENT : REALTY RESOURCES CHARTERED
LOCATION: 84 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JOHN DIBENEDETTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN.	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
FREE WATER MEASURED @ 5.2 FEET
BELOW GROUND ON 3/01/06

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									4"	ASPHALT
									1.0'	BROWN GRAVEL AND SAND, SOME SILT ~ DENSE ~
	1D	24"	15"	2.5'	9	22	11	13	3.0'	BROWN GRAVELLY SILTY SAND ~ MEDIUM DENSE ~
	2D	24"	18"	4.5'	13	17	15	15		w = 18.0% GRAY SILT AND FINE SAND
									6.0'	~ MEDIUM DENSE ~
	3D	24"	18"	7.0'	7	10	14	10		GRAY GRAVELLY SILTY SAND (TILL FILL)
	4D	24"	5"	9.0'	9	9	20	11	9.0'	~ MEDIUM DENSE ~
	5D	24"	6"	12.0'	7	6	4	5		BLACK WOOD AND SILT, SOME SAND w = 33.9%
	6D	24"	12"	14.0'	3	3	3	3	13.5'	~ LOOSE ~
									14.5'	BLACK ORGANIC SILT ~ LOOSE ~
									16.0'	GRAY SILTY CLAY WITH SEASHELLS qp = 5 KSF
	7D	24"	15"	17.0'	6	5	4	3		w = 39.2%
										MOTTLED BROWN-GRAY SILTY CLAY
	8D	24"	24"	22.0'	7	9	10	12		~ STIFF ~ qp = 5 KSF w = 29.9%
	2" X 4" VANE			25.6'			40/11			Sv = 2.23/0.66 KSF
	2" X 4" VANE			26.0'			38/10			Sv = 2.11/0.56 KSF
									28.0'	
	9D	24"	24"	32.0'	WOH					GRAY SILTY CLAY w = 43.8% ~ SOFT ~
	3.5" X 7" VANE			35.8'			31/2			Sv = 0.33/0.02 KSF
	3.5" X 7" VANE			36.6'			42/9			Sv = 0.44/0.09 KSF

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-2**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-2**
SHEET: 2 OF 2
PROJECT NO.: 05-1177
DATE START: 1/25/2006
DATE FINISH: 1/25/2006
ELEVATION: 8' +/-
SWC REP.: ARS

PROJECT: PROPOSED STUDENT HOUSING
CLIENT : REALTY RESOURCES CHARTERED
LOCATION: 84 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JOHN DIBENEDETTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN.	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
FREE WATER MEASURED @ 5.2 FEET
BELOW GROUND ON 3/01/06

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
	10D	24"	10"	42.0'	WOR					w = 41.9% GRAY SILTY CLAY ~ SOFT ~
										ROD PROBE 42' TO 77'
										DEPTH: BLOWS:
										42.0'-45.0' WOM
										45.0'-46.0' 7
										46.0'-47.0' 7
										47.0'-48.0' 7
										48.0'-49.0' 7
										49.0'-50.0' 9
										50.0'-51.0' 9
										51.0'-52.0' 10
										52.0'-53.0' 9
										53.0'-54.0' 12
										54.0'-55.0' 12 INSTALLED WELL
										55.0'-56.0' 13
										56.0'-57.0' 13 SCREEN 15.0'-10.0'
										57.0'-58.0' 14 RISER TO SURFACE
										58.0'-59.0' 14 SAND 40.0' TO 8.0'
										59.0'-60.0' 13 BENTONITE 8.0'-6.0'
										60.0'-61.0' 13 SAND 6.0' TO SURFACE
										61.0'-62.0' 16
										62.0'-63.0' 15
										63.0'-64.0' 16
										64.0'-65.0' 17 PROBABLE TRANSITIONS FROM
										65.0'-66.0' 19 SOFT TO MEDIUM
										66.0'-67.0' 18 GRAY SILTY CLAY
										67.0'-68.0' 20
										68.0'-69.0' 19
										69.0'-70.0' 20
										70.0'-71.0' 21
										71.0'-72.0' 22
										72.0'-73.0' 21
										73.0'-74.0' 22
										74.0'-75.0' 37 POSSIBLE GLACIAL TILL
										75.0'-76.0' 50
									77.0'	76.0'-77.0' 51
										BOTTOM OF EXPLORATION AT 77.0' (NOT REFUSAL)

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-2**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-3**
SHEET: 1 OF 3
PROJECT NO.: 05-1177
DATE START: 1/24/2006
DATE FINISH: 1/24/2006
ELEVATION: 8' +/-
SWC REP.: ARS

PROJECT: PROPOSED STUDENT HOUSING
CLIENT : REALTY RESOURCES CHARTERED
LOCATION: 84 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JOHN DIBENEDETTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN.	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
SATURATED AT 7'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									4"	ASPHALT
									1.0'	BROWN GRAVELLY SAND, SOME SILT ~ DENSE ~
	1D	24"	15"	2.5'	14	16	24	30	3.0'	BROWN GRAVELLY SILTY SAND ~ DENSE ~
	2D	24"	18"	4.5'	29	28	20	20		w = 8.0% GRAY SILT AND SAND SOME GRAVAL SOME COBBLES (TILL FILL) ~ DENSE ~
	3D	24"	20"	7.0'	12	12	10	10	6.5'	
	4D	24"	1"	9.0'	22	17	12	13		BLACK CLAYEY SILTY GRAVELLY SAND WITH BRICKS, COBBLES, WOOD AND GLASS (MISCELLANEOUS FILL) ~ MEDIUM DENSE ~
	5D	16"	16"	11.3'	16	33	50/4"		13.0'	
	6D	24"	15"	14.0'	17	12	7	7		DARK GRAY SILT SOME FINE SAND WITH TRACE SHELLS (NATIVE) w = 35.9% ~ LOOSE ~
	7D	24"	24"	17.0'	WOH	2	3	4	20.0'	
	1U	24"	19"	22.0'	PISTON					qu = 1.3 KSF GRAY SILTY CLAY WITH SHELLS w = 48.5% WL = WP = ~ MEDIUM TO STIFF ~
	3.5" X 7" VANE			25.8'			70/3			Sv = 0.73/0.03 KSF
	3.5" X 7" VANE			26.6'			93/22			Sv = 0.96/0.24 KSF
									28.0'	
	2U	24"	24"	32.0'	PISTON					GRAY SILTY CLAY ~ SOFT ~
	3.5" X 7" VANE			35.8'			34/1			Sv = 0.36/0.01 KSF
	3.5" X 7" VANE			36.6'			41/9			Sv = 0.43/0.09 KSF

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-3**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-3**
SHEET: 2 OF 3
PROJECT NO.: 05-1177
DATE START: 1/24/2006
DATE FINISH: 1/24/2006
ELEVATION: 8' +/-
SWC REP.: ARS

PROJECT: PROPOSED STUDENT HOUSING
CLIENT : REALTY RESOURCES CHARTERED
LOCATION: 84 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JOHN DIBENEDETTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN.	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
SATURATED AT 7'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
										GRAY SILTY CLAY
										~ MEDIUM ~
										w = 32.7%
	3U	24"	24"	47.0'	PISTON					qu = 1.4 KSF WL = WP =
	3.5" X 7" VANE			50.8'			35/1			Sv = 0.37/0.01 KSF
	3.5" X 7" VANE			51.6'			47/9			Sv = 0.49/0.09 KSF
	3.5" X 7" VANE			61.5'			74/14			Sv = 0.77/0.16 KSF ~ MEDIUM ~
	3.5" X 7" VANE			62.3'			61/14			Sv = 0.64/0.16 KSF
										GRAY SILTY CLAY
									74.0'	
	8D	22"	15"	77.0'	18	25	29	50/4"		GRAY GRAVELLY SILTY SAND (TILL) w = 10.0% ~ DENSE ~

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-3**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-3**
SHEET: 3 OF 3
PROJECT NO.: 05-1177
DATE START: 1/24/2006
DATE FINISH: 1/24/2006
ELEVATION: 8' +/-
SWC REP.: ARS

PROJECT: PROPOSED STUDENT HOUSING
CLIENT : REALTY RESOURCES CHARTERED
LOCATION: 84 MARGINAL WAY, PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS, INC. DRILLER: JOHN DIBENEDETTO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0 IN	140 LB.	30 IN.
SAMPLER:	SS	1 3/8 IN.	140 LB.	30 IN.
CORE BARREL:				

WATER LEVEL INFORMATION
SATURATED AT 7'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									84.5'	GRAY GRAVELLY SILTY SAND (TILL)
	9D	1"	1"	85.1'	50/1"				87.0'	ROLLERCONE 84.5' TO 87' PROBABLE BEDROCK
										BOTTOM OF EXPLORATION AT 87.0'

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-3**