

**SECTION 02220**

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## SECTION 02220

### EXCAVATION, BACKFILL AND COMPACTION

#### **PART 1 - GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Excavate to line, grade and configuration as shown in the plans and specifications for proposed structures, utility pipelines, appurtenance structures, pavement sections, and miscellaneous site work.
- B. Backfilling trench with bedding materials as specified and indicated and finishing filling trench with suitable material to proposed subgrade.
- C. Fill to line, grade and configuration as shown in the plans and specifications for proposed structures, utility pipeline installations, and pavement sections.
- D. Borings and casings under roads.
- E. Compacting for materials in an acceptable manner as stated herein.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 02050 - Demolition
- B. Section 02180 - Subsurface Soil Investigation
- C. Section 02200 - Earthwork
- D. Section 02227 - Aggregate Material
- E. Section 02229 - Rock Excavation
- F. Section 02505 - Paving Base and Subbase Course
- G. Section 02511 - Asphaltic Concrete Paving
- H. Section 02525 - Curb and Sidewalks
- I. Section 02605 - Manhole and Catch Basin Structures
- J. Section 02660 - Water Distribution Systems
- K. Section 02720 - Storm Sewer Systems
- L. Section 02730 - Sanitary Sewer Systems
- M. Geotechnical Report for boring locations and findings of subsurface materials and conditions.
- N. Construction Drawings

### 1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

D422 Method for Particle and Size Analysis of Soils

D698 Test for Moisture-Density Relations of Soils Using 5.5 lb. (2.5 kg) Rammer and 12-inch (304.8 mm) Drop (**Standard Proctor**)

D1556 Test for Density of soil in Place by the Sand Cone Method

D1557 Test for Moisture-Density Relations of Soils using 10-lb (4.5 kg) Rammer and 18-inch (457 mm) Drop (**Modified Proctor**)

D1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

D2167 Test for Density of Soil in Place by the Rubber Balloon Method

D2216 Laboratory Determination of Moisture content of Soil

D2487 Classification of Soils for Engineering Purposes

D2922 Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D4318 Test for Plastic Limit, Liquid Limit, & Plasticity Index of Soils

C25 Chemical Analysis of Limestone, Quicklime and Hydrated Lime

C110 Physical Testing for Quicklime and Hydrated Lime, Wet Sieve Method

C618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

C977 Quicklime and Hydrated Lime for Soil Stabilization

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.

T88 Mechanical Analysis of Soils

### 1.04 QUALITY ASSURANCE

A. In general, projects occupying over 20 acres of land and those which have over three acres of non-revegetated surfaces (individually or cumulatively) since 1975 requires a Site Location of Development Permit and attendant drawings. The City of Saco has “delegated review authority” to review certain projects. The Site Location of Development Permit requires all construction to conform with approved drawings.

B. For certain projects where work effects or is within a specified distance of a regulated resource (wetland stream, pond, or shoreline) individually or in conjunction with the State of Maine Site Location of Development Permit, a Natural Resource Permit from the State of Maine is required. This permit also requires construction of the project to be in accordance with approved plans.

C. Land within 500 feet of the Saco River requires approval and a permit from the Saco River Corridor Commission.

- D. Project which increase the hardened surface a property may require a separate stormwater permit. This permit may require specific measures to control the release of stormwater and require water quality measures.
- E. The City of Saco requires Site Plan permits for projects involving more than 10,000 s.f. of disturbance and subdivision approval from the planning board.

#### **1.05 QUALITY ASSURANCE**

Independent testing laboratory selected and paid by Contractor shall be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 02200 and as stated herein. It shall be the responsibility of the Contractor to accurately establish locations for all utilities.

#### **1.06 SUBMITTALS**

- A. The Contractor shall contact all utility companies and determine if additional easements will be required to complete the project. Contractor shall provide written confirmation of the status of all easements to the Engineer at the time of the preconstruction conference or no later than 90 days prior to the project possession date.
- B. Submit a sample of each type of off-site fill material that is to be used in backfilling in an airtight, 10 lb. container for the testing laboratory or submit a gradation and certification of the aggregate material that is to be used to the testing laboratory for review.

#### **1.07 PROJECT RECORD DOCUMENTS**

Accurately record actual locations of all subsurface utilities, structures and obstructions encountered. Submit a copy of such records to the City of Saco Department of Public Works in the form at required by the Department (forms available upon request).

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Fill material from on-site as specified in Section 02200 and approved by the Engineer.
- B. Fill material from off-site as specified in Section 02200 and approved by the Engineer.
- C. Aggregate material as specified in Section 02227.
- D. Geotextile stabilization and filter/drainage fabrics as specified in Section 02200.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Identify all lines, elevations and grades necessary to construct building subgrades, utility pipeline installations, pavements, curb and gutter, bases, walkways and roadways as shown in the plans and specifications.
- B. Carefully protect bench marks, property corners, monuments or other reference points.
- C. Locate and identify all site utilities that have previously been installed and may be in danger of damage by grading operations.
- D. Locate and identify all existing utilities that are to remain and protect them from damage.

- E. Maintain in operating condition existing utilities, active utilities, and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.
- F. Verify location, size, elevation, and other pertinent data required to make connections to existing utilities and drainage systems as indicated on Drawings. Contractor shall comply with local codes and regulations.
- G. Over excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas are to be stabilized by using acceptable backfill material placed and compacted as specified, filter fabrics and/or additional bedding material.
- H. Install dewatering systems that will be required to construct the proposed utilities in a manner that is described herein.

### **3.02 EXCAVATION FOR FILLING AND GRADING ASSOCIATED WITH BUILDINGS**

*(Specifier to provide information based upon geotechnical reports and foundation design criteria.)*

### **3.03 FILLING AND SUBGRADE PREPARATION ASSOCIATED WITH BUILDINGS**

*(Specifier to provide information based upon geotechnical reports and foundation design criteria.)*

### **3.04 EXCAVATION FOR UTILITY INSTALLATIONS**

- A. The local utility companies shall be contacted before excavation shall begin. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks as nearly vertical as practical and remove stones as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding.
- B. All trench excavation side walls greater than 5 feet in depth shall be sloped, shored, sheeted, braced or otherwise supported by means of the sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to an exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.
- C. Perform excavation as indicated for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.
- D. Remove excavated materials not required or not suitable for backfill or embankments and waste as specified. Any structures discovered during excavation(s) shall be disposed of as specified.
- E. Utility trenches excavated into blast rock fill and/or choke stone shall be lined with a double layer of Mirafi 600X geotextile fabric, or equivalent, prior to placing the pipe bedding and trench backfill materials. Where voids are observed within the blast rock fill or choke stone, the voids shall be chinked with choke stone and select fill prior to placing the geotextile fabric.
- F. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.
- G. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.

- H. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.
- I. Trench width requirements below the top of the pipe shall not be less than 12" nor more than 18" wider than outside surface of any pipe or conduit that is to be installed to designated elevations and grades. All other trench width requirements for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.
- J. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances unless otherwise shown on the Drawings:
  - 1. Water Mains: 60" to top of pipe barrel or 6" below the frost line (established by the local building official), whichever is deeper.
  - 2. Sanitary Sewer: Depths, elevations, and grades as indicated on Drawings.
  - 3. Storm Sewer: Depths, elevations, and grades as shown on Drawings.
  - 4. Electrical Conduits: 29" minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or the local utility company requirements, whichever is deeper.
  - 5. TV Conduits: 29" minimum to top of conduit or as required by the local utility company, whichever is deeper.
  - 6. Telephone Conduits: 29" minimum to top of conduit, or as required by the local utility company, whichever is deeper.
  - 7. Gas Mains and Service: 30" minimum to top of pipe, or as required by the local utility company, whichever is deeper.
  - 8. Fire Alarm Conduit: 29" minimum to top of conduit, or as required by the local Fire Department, whichever is deeper.
- K. Provide sheeting and bracing, when necessary, in trenches and other excavations where protection of workmen is required. Sheeting may be removed after sufficient backfilling to protect against damaging or injurious caving.

### **3.05 UTILITY PIPE BEDDING**

- A. Accurately cut trenches for pipe or conduit that is installed to designated elevations and grades to line and grade from 6" below bottom of pipe and to width as specified. Place 6" of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel. After pipe installation, place select backfill and compact in maximum 6" layers measured loose to the top of the trench.
- B. Place geotextile fabrics as specified on the plans and specifications.

### **3.06 BACKFILLING FOR UTILITY TRENCHES**

- A. Criteria: Trenches shall not be backfilled until required tests are performed and the utility systems comply with and are accepted by applicable governing authorities. Backfill trenches as specified. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as specified, to properly correct condition in an acceptable manner.
- B. Backfilling: After pipe or conduit has been installed, bedded, and tested as specified, backfill trench or structure excavation with specified material placed in 8" maximum loose lifts.
- C. Backfill trenches to the contours and elevations shown on the plans with unfrozen materials.

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

### **3.07 EXCAVATION FOR PAVEMENT SECTIONS**

- A. Excavate roadway and pavement areas to line and grade as shown in the plans and specifications.
- B. Engage all suitable materials into the project fill areas as specified in Section 02200.
- C. Unsuitable excavated material is to be disposed of in a manner and location that is acceptable to the owner and the local governing agencies.
- D. Perform excavation using capable, well maintained equipment and methods acceptable to the owner and the project document requirements.

### **3.08 FILLING FOR PAVEMENT SECTIONS**

- A. Stumps shall be removed in all parking lot areas and in fill areas and in fill areas where the stumps are located within 3 feet of final grade. Topsoil, organic soils, and other unsuitable materials shall be stripped within three feet of proposed final grade in all pavement areas.
- B. Unless specifically stated otherwise on the Drawings, areas exposed by excavation or stripping and on which the subgrade preparations are to be performed shall be scarified to minimum depth of 8" and compacted with a minimum of ten passes of a vibratory drum roller having a drum weight of at least 10,000 pounds and a dynamic force of at least 20,000 pounds. These areas shall then be proofrolled to detect any areas of insufficient compaction. Proof rolling shall be accomplished by making a minimum of two (2) complete passes with a with a fully loaded tandem axle dump truck or approval equivalent, in each of the two perpendicular directions under the supervision and direction of a field geotechnical engineer. Areas of failure shall be excavated and recompacted as stated above.
- C. Unless specifically stated otherwise on the Drawings, fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed 8" loose measure and compacted to a minimum density of 92% of maximum dry density, in accordance with ASTM D-1557 at a moisture content of not less than 1% below and not more than 3% above the optimum moisture content.
- D. Where excavations encounter wet natural soils, the work shall proceed carefully in a manner that avoids subgrade disturbance including using smooth-edged cutting buckets when making excavation within one foot of the final subgrade elevation, and placement of the subbase course (pavement areas) as soon as practicable to protect the subgrade from disturbance. In fill areas, the initial lift of fill on wet, natural subgrades should consist of 12 inches of select fill.

Fill materials and/or subgrade materials that become contaminated with fines during construction shall be replaced with the appropriate clean materials immediately prior to placing overlaying materials.

- E. To aid in maintaining stable cut and fill slope conditions, surface water runoff shall be diverted away from the top of slopes.
- F. Any fill materials that become wet or disturbed before the overlaying lift of fill can be placed (e.g. due to a rainstorm during the workday, overnight or over a weekend) shall be proof rolled, recompacted and/or excavated and replaced with drier fill material.

### **3.09 COMPACTION**

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

- B. All material shall be tested in accordance with Section 02200.
- C. An Independent Testing Laboratory selected and paid by the Contractor, shall be retained to perform testing on site.
- D. Compaction tests will be as specified in Section 02200 together with the following:
  - 1. For utility trench areas:

Perform field density tests at intervals not exceeding 200'-0" of trench for the first and every other eight-inch (8") lift of compacted trench backfill and furnish copies of test results as specified. Compact to minimum density of 95% of maximum dry density as determined by ASTM D 1557.
  - 2. For pavement areas:
    - a. In cut areas not less than one compaction test for every 10,000 square feet.
    - b. In fill areas, same rate of testing for each 8" lift (measured loose).
- E. If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to the Owner.
- F. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

### **3.10 MAINTENANCE OF SUBGRADE**

- A. Finished subgrades shall be verified to ensure proper elevation and conditions for construction above subgrade.
- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks and dump trucks.
- C. Remove areas of finished subgrade found to have insufficient compaction density of depth necessary and replace in a manner that will comply with compaction requirements by use of materials equal to or better than best subgrade materials on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable and true to grade and cross-section.

### **3.11 FINISH GRADING**

- A. Finish grading shall be in accordance with Section 02200 and as more specifically stated herein.
- B. Grading of building areas shall be checked by string line from grade stakes (blue tops) set at not more than 50' centers. Tolerance of 0.10 feet, more or less, will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, and elevations.
- C. Grading of paving areas shall be checked by string line from grade stakes (blue tops) set at not more than 50' centers. Tolerances of 0.10 feet, more or less, will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations.

### **3.12 ROCK EXCAVATION (Refer to Section 02229)**

### **3.13 SURPLUS MATERIAL**

All excavated material not incorporated into the finished work shall be the property of the Contractor unless the Public Works Director request the material be delivered and stockpiled at the Public Works Facility on North Street. Unacceptable material and material not requested by

the Public Works Director shall be removed from the project site and disposed of by the Contractor. When it is necessary to haul soft or wet materials over streets or pavements, the Contractor shall provide suitable watertight vehicles to prevent deposits on the streets or pavements. In all cases, materials dropped from vehicles shall be cleaned up as often as necessary or whenever directed by the Engineer, and crosswalks, streets, and pavements be kept clean and free of debris.

The Contractor shall be responsible for disposal of excavated materials in areas which are not classified as wetlands using the multi-parameter method of the Dept. of the Army Corps of Engineers. The Contractor shall also be responsible for erosion control measures, grading, seeding, and mulching of any disposal areas.

### **3.14 TEST PIT EXCAVATION**

Where designated on the Plans and where further directed by the Engineer, the Contractor shall make test pit excavations to expose existing facilities to allow the Engineer to obtain measurements or elevations. Extreme care must be taken to protect any existing utilities or structures so uncovered. All safety requirements under Paragraph 3.04 shall apply to test pit excavation. Upon completion of necessary measurements, the test pit shall be backfilled in accordance with the provision of Paragraph 3.06 and 3.08. In paved areas, the Contractor shall place and compact temporary bituminous cold mix paving over the test pit area.

**---END OF SECTION 02220---**