

SECTION 02200

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SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Protection, modification and/or installation of utilities as the project progresses paying particular attention to grade changes, any necessary staging of work, and compliance with permits, ordinances, and safety regulations.
- B. Cutting, filling, and grading to required lines, dimensions, contours and proposed elevations for proposed improvements.
- C. Scarifying, compaction, drying, and removal of unsuitable material to ensure proper preparation of areas for fills or proposed improvements.

1.02 RELATED REQUIREMENTS

- A. Section 02050 – Demolition
- B. Section 02180 - Subsurface Soil Investigation
- C. Section 02100 - Site Preparation
- D. Section 02220 - Excavation, Backfill, and Compaction
- E. Section 02227 - Aggregate Materials
- F. Section 02229 – Rock Excavation
- G. Section 02270 - Slope Protection and Erosion Control
- H. Construction Drawings

NOTE TO USERS: A copy of the Geotechnical Investigation Report and Erosion and Sedimentation Control Report should be appended to Specification Sections 02180 and 02270, respectively, for large projects, and shall be considered part of the Contract Document.

1.03 REFERENCE STANDARDS

American Society for Testing and Materials (ASTM), Latest Edition:

- D422 Method for Particle 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
- American Association of State Highway and Transportation Officials (AASHTO), Latest Edition:
- T88 Mechanical Analysis of Soils

1.04 ENVIRONMENTAL REQUIREMENTS

Construct temporary erosion control systems as shown on the plans or as directed by the engineer to protect adjacent properties and water resources for erosion and sediment damages.

1.05 QUALITY ASSURANCE

- A. Independent Testing Laboratory selected and paid by Contractor, shall be retained to perform construction testing on site based on the following:

In general, cut areas, not less than one compaction test for every 10,000 square feet. In fill areas, same rate of testing for each 8-inch lift (measured loose). For building areas, the frequency shall be twice this rate.
- B. 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.
- C. The following tests shall be performed on each type of on-site or imported soil material used as compacted fill as part of construction testing requirements:
 - 1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557
 - 2. Mechanical Analysis: AASHTO T-88
 - 3. Plasticity Index: ASTM D 4318
- D. Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements:
 - 1. Sand-Cone Method: ASTM D 1556
 - 2. Balloon Method: ASTM D 2167
 - 3. Nuclear Method: ASTM D 2922 (Method B- Direct Transmission)
- E. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, Engineer, Contractor and the City of Saco Department of Public Works shall be provided with copies of reports within 96 hours of time test was performed. In the event that any test performance fails to meet these Specifications, the Owner and Contractor shall be notified immediately by Independent Testing Laboratory.

All costs related to retesting due to failures shall be paid for by the Contractor at no additional expense to the Owner (**SPECIFIER TO VERIFY**). The Owner or the City of Saco reserves the right to employ a second Independent Testing Laboratory and to direct any testing that is deemed necessary beyond that which is required within this contract. Contractor shall provide free access to site for testing activities.

1.06 SUBMITTALS

- A. Submit a sample of each type of off-site fill materials that is to be used at the site in an air tight, 10 lb container for the testing laboratory.
- B. Submit the name of each material supplier and specific type and source of each material. Any change in source throughout the job requires approval of the Owner and engineer.
- C. For use of fabrics or geogrids, an Owner approved design shall be submitted.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Excavated and re-used materials for subsoil fill as specified herein.
- B. Aggregate fill as specified in Section 02227.
- C. Imported subsoil material approved by the owner and specified herein.
- D. Topsoil fill as specified in Section 02100.
- E. Acceptable stabilization fabrics as Geogrids:
 - 1. Mirafi 500X or 600X
 - 2. Phillips 66 Supac 6WS
 - 3. Dupont Typar 3401 and 3601
 - 4. Trevira S1114 and S1120
 - 5. Tensar SS-1 and SS-2
 - 6. Exxon GTF-200 or 350
- F. Filter/Drainage Fabrics
 - 1. Mirafi 140N
 - 2. Phillips 66 Supac 4NP
 - 3. Dupont Typar 3341

PART 3 - EXECUTION

3.01 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Locate and identify existing utilities that are to remain and protect them from damage.
- C. Notify utility companies to remove and/or relocate any utilities that are in conflict with the proposed improvements.
- D. Protect plant life, lawns, fences, existing structures, sidewalks, paving and curbs from excavation equipment and vehicular traffic. Protect any trees not authorized by the City Tree Warden.

- E. Protect benchmarks, property corners and all other survey monuments from damage or displacement. If a marker needs to be removed, it shall be referenced by a licensed land surveyor and replaced, as necessary, by the same.
- F. Remove from site material encountered in grading operations that, in opinion of Owner or Owner's representative, is unsuitable or undesirable for backfilling, subgrade, or foundation purposes. Dispose of in a manner satisfactory to Owner and in accordance with the applicable State, Local, and Federal Regulations, appended to Section 02050 of these specifications.
- G. Prior to those placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:
 - 1. Confirm State and Federal permitting is in place and review the conditions of these permits.
 - 2. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain same results. (Confirm this does not conflict with erosion/sediment control report.)
 - 3. After drainage of low area is complete, remove muck, mud, debris, and other unsuitable material by using acceptable equipment and methods that will keep natural soils underlying low areas dry and undisturbed.
 - 4. If proposed for fill, all muck, mud, and other materials removed from above low areas shall be dried on-site by spreading in thin layers for observation by the Owner's representative. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under or within 10'-0" of perimeter of building pad or paving subgrade. If, after observation by the Owner's representative, material is found to be unsuitable, all unsuitable material shall be removed from site.
 - 5. **NOTE TO SPECIFIER: BASED ON NATURAL RESOURCE PERMITS, YOU OR YOUR OWNER MAY BE REQUIRED TO SALVAGE adequate material from the wetland impact areas shall be retained for use in the wetland creation/enhancement area preparation. Recheck applicable permit.**

3.02 EXCAVATION FOR FILLING AND GRADING

- A. Classification of Excavation: Contractor by submitting bid acknowledges that he has investigated site to determine type, quantity, quality, and character of excavation work to be performed. All excavation shall be considered unclassified excavation.
- B. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and governing agencies.
- C. When performing grading operations during periods of wet weather, provide adequate drainage and ground water management to control moisture of soils.
- D. Shore, brace, and drain excavations as necessary to maintain safe, secure, and free of water at all times.
- E. Excavated material containing rock or stone exceeding 6" size limitation is unacceptable as fill within the proposed paving area unless stipulated otherwise in a geotechnical report accepted by the City of Saco.
- F. Rock or stone meeting the requirements contained in the geotechnical report is acceptable as fill when used as outlined in a geotechnical report accepted by the City of Saco.

- G. Excavation shall consist of the removal of all materials encountered in grading the project and disposal where necessary.
- H. Excavation shall be accomplished in a manner which complies with the erosion control measures for this site, meets all OSHA and related requirements, and maintains positive drainage of the subgrade throughout construction.

3.03 EXCAVATION AND EMBANKMENT

- A. Excavation shall consist of the removal, haul, disposal, and compaction if required of all material encountered in grading the project within the limits of construction. It 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 and all soft and disintegrated rock which can be removed with ordinary excavating machinery. It shall include grubbing which consists of the removal and disposal of all stumps, roots, bushes, grass, turf, and other objectionable material.

It shall include muck excavation which shall consist of the removal and disposal of saturated or unsaturated mixtures of soils and organic matter not suitable for embankment foundation material regardless of moisture content.

Suitable material taken from excavation shall be used in the formation of embankment, subgrade, for backfilling or offsite disposal.

- B. Borrow material shall consist of approved material required for the construction of embankment or subgrade. Material that cannot be obtained on site from excavation must consist of earth, suitable for embankment construction in accordance with MDOT 703.18. It shall be free from frozen material, perishable rubbish, peat, and other unsuitable material.

The moisture content shall be sufficient to provide the required compaction and stable embankment. In no case shall the moisture content exceed 4 percent above optimum.

The optimum moisture content shall be determined in accordance with AASHTO T180, Method C or D.

3.04 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 to depth necessary and replace in a manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.
- D. Grading of building and paving areas shall be checked by string line from grade stakes (blue tops) set at not more than 50' centers. Tolerance of + 0.10 feet will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations.
- E. Maintain subgrade for area to be paved and building pad subgrade, whether previously graded by others and accepted by contractor or constructed by contractor. Make adjustments that may be required in accordance with Specifications at no additional expense to Owner.

The Contractor shall protect all soils, compacted gravel, sand, and drainage fill material under poured slabs and in areas where slabs will be poured within the building; from frost, freezing temperatures, and excessive moisture. Any upper soils which freeze shall be scarified and recompacted prior to placement of pavement or slabs. All expenses associated with protective measures, temporary heating, and recompaction shall be at the expense of the Contractor.

3.05 RIPRAP

- A. Place riprap in all areas where indicated on the Drawings. The stone for riprap shall be washed and consist of field stone or rough unhewn quarry stone as nearly uniform, in section as is practical.

The stones shall be dense, resistant to the action of air and water, and suitable in all aspects for the purpose intended. The riprap shall be composed of a well-graded mixture down to the one-inch size particle such that 50 percent of the mixture by weight shall be larger than the D50 size as determined from the design procedure.

A well-graded mixture is defined as a mixture composed primarily of the larger stone size but with a sufficient mixture of other sizes to fill the progressively smaller voids between the stones. The diameter of the largest stone size in such a mixture shall be 1.5 times the D50 size. When subjected to the magnesium sulfate soundness test (ASTM C-88), the percent weight loss shall be less than 15%. When tested according to ASTM C-131, the crushed stone shall have a maximum loss of 45% at 5,000 revolution.

- B. Slopes and other areas to be protected shall be dressed to the line and grade shown on the plans prior to the placing of riprap. Contractor shall then undercut the areas to receive riprap to an elevation equal to the final elevation less the specified thickness of riprap as shown on the drawings.
- C. Filter fabric and bedding material shall be installed prior to the placement of the riprap if so indicated on the drawings. The bedding material shall be in accordance with Section 02227 and shall be 6" in depth. Filter fabric shall be as specified herein and as detailed on the plans.
- D. Stones shall be placed so that the greater portion of their weight is carried by the earth and not by the adjacent stones. These stones shall be placed uniformly with close joints. The upright areas of the stone shall make an angle of approximately 90 degree with the embankment slope. The courses shall be placed from the bottom of the embankment upward, the larger stones being placed in the lower courses. Open joints shall be filled with spalls. Stones shall be embedded in the embankment as necessary to present a uniform top surface such that the variation between tops of adjacent stones shall not exceed 3".

3.06 FINISH GRADING

- A. Grade all areas where finish grade elevations or contours are indicated on Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free of rock, debris, or irregular surface changes. Finished subgrade surface shall not be more than 0.10 feet above or below established finished subgrade elevation, and all ground surfaces shall vary uniformly between indicated elevations. Finish ditches shall be graded to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil application, refer to Section 02900.
- B. Correct all settlement and eroded areas within one year after date of completion at no additional expense to owner. Bring grades to proper elevation. Replant or replace any grass, shrubs, bushes, or other vegetation disturbed by construction using corrective measures. Refer to Section 02270 for slope protection and erosion control.

3.07 ROCK EXCAVATION (Refer to Section 02229)

3.08 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 of 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.

---END OF SECTION 02200---