Section 02300 - Earthwork

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Work included: All excavating, filling, backfilling, and removal of materials. Earthwork for utilities is included in this section.

B. Related Work Specified Elsewhere:

Existing Subsurface Conditions: Section 02010

Shoring and Bracing: Section 02250

Slope Protection and Temporary Erosion Control: Section 02370

Dewatering: Section 02240

1.02 PROTECTION:

A. Paved Surfaces: Do not operate equipment that will cause damage on paved surfaces. Any damage to existing roads or other paved surfaces caused by construction equipment shall be repaired at no additional cost to OWNER.

B. Maintain Excavations with approved barricades, lights, and signs to protect life and property until excavation is filled and graded to a condition acceptable to the ENGINEER.

C. Protect structures, utilities, monitoring wells, property monuments, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. The CONTRACTOR shall be responsible for actual cost of repair or replacement of any items damaged as a result of construction activities, including any professional services required for inspection of repairs and replacement.

1.03 QUALITY ASSURANCE:

A. Testing and Inspection: OWNER shall be responsible for all testing, unless otherwise noted. The cost for retesting due to failed tests shall be the responsibility of the CONTRACTOR.

The CONTRACTOR shall be responsible for coordinating with ENGINEER to allow for testing to be performed at the frequencies specified. A minimum of 48 hours notice for in-place testing shall be given to allow proper scheduling by ENGINEER.

B. Materials Testing Firm: Company specializing in in-situ testing of compacted fills with a minimum of five years documented experience. Company to be acceptable by ENGINEER and OWNER. Materials testing firm to be independent of CONTRACTOR.

1.04 JOB CONDITIONS:

A. Site Information: The CONTRACTOR may make his own borings, hand probes, explorations, and observations to determine soil, water levels, and other subsurface conditions at no additional cost to OWNER. Coordinate with OWNER prior to start of additional investigative work.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during

earthwork operations. Coordinate with utility companies for actual locations and shut-off services. If utilities are encountered that are not shown or that are shown incorrectly on the Drawings, notify ENGINEER immediately. Repair damaged utilities to satisfaction of ENGINEER and utility.

1.05 REFERENCES:

A. Manual of Accident Prevention in Construction - Associated General Contractors of America, Inc.

B. 29 CFR 1926/1910 - OSHA Safety and Health Standards for Construction Industry

C. Standard Specifications for Highways and Bridges - Maine Department of Transportation, current edition

1.06 SUBMITTALS: Submit results of all aggregate gradation, moisture density, and field compaction testing for all materials to ENGINEER. Submit minimum 50-lb bag samples of each on-site or off-site material proposed for use to the ENGINEER at least 2 weeks prior to use on site. Submit documentation summarizing the origin of off-site fill material.

PART 2 - MATERIALS

2.01 MATERIALS:

A. General: All materials utilized for this Project shall be obtained from a source that has been licensed or permitted for such use by local and state authorities. The CONTRACTOR shall be required to submit evidence of such if so requested.

1. Suitable materials: Suitable soil materials are defined as those complying with ASTM D2487 soil classification groups GW, SM, SW, and SP.

2. Unsuitable materials: Materials containing excessive amounts of water, clay, vegetation, organic matter, debris, pavement, stones or boulders over 6-inches in greatest dimension, frozen material, and material which, in the opinion of the ENGINEER, will not provide a suitable foundation or subgrade.

3. On-Site Material: Any suitable material from on-site excavation. In-situ fill soils may be suitable for reuse to raise site grades. In-situ fill soils shall not be used as base or subbase soils beneath roadways and sidewalks. If the in-situ fill soils are used, they shall be run through a mechanical screen to remove all oversize particles per the requirements of this section. Use of in-situ soils as on-site fill, including the requirement for screening the fill, shall be performed at the sole risk of the CONTRACTOR, at no additional expense to the OWNER.

4. Material for embankments and general site fills may contain pieces having a maximum dimension of 6-inches, unless otherwise approved by ENGINEER.

5. Inspection: The ENGINEER may inspect off-site sources of materials and order tests of these materials to verify compliance with these Specifications.

6. Sieve Analysis: Submit sieve analysis in accordance with ASTM D422 for all materials prior to start of construction.

B. Gravel/Aggregate Base: Hard, durable gravel contained only particles passing the 2-inch sieve. Equal to MDOT 703.06a, Type A material. Sieve analysis by weight:

Sieve Size	% Passing by Weight
2"	100
1/2"	45 - 70
1/4"	30 - 55
No. 40	0 - 20
No. 200	0 – 5

C. Aggregate Subbase: Sand or gravel of hard, durable particles; equal to MDOT 703.06b Type D material. Aggregate subbase shall not contain particles that will not pass the 6-inch sieve. The part that passes the 3-inch sieve shall meet the following gradation requirements:

Sieve Size	% Passing by Weight
1/4"	25 - 70
No. 40	0 - 30
No. 200	0 - 7

D. Subbase Fill: Sand or gravel of hard, durable particles; equal to MDOT 703.06 Type F material. Subbase fill shall not contain particles that will not pass the 6-inch sieve. The part that passes the 3-inch sieve shall meet the following gradation requirements:

Sieve Size	% Passing by Weight
1/4"	60 - 100
No. 40	0 - 50
No. 200	0 - 7

E. 3/4" Crushed Stone: Durable, clean angular rock fragments obtained by breaking and crushing rock material.

Sieve Size	% Passing by Weight
1"	100
3/4"	90 - 100
3/8"	20 - 55
No. 4	0 - 10
No. 200	0 - 1.5

F. Sand: Sand shall be well-graded coarse sand without excessive fines and free from loam, clay, and organic matter. Beach sand shall not be used. The grading requirements are as follows:

Sieve Size	% Passing by Weight
3/8"	100
No. 4	95 - 100
No. 16	50 - 85
No. 50	10 - 30
No. 100	2 - 10

G. Riprap: In accordance with MDOT 703.26 – Plain and Hand Laid Riprap, or as otherwise noted.

H. Refill Material: Use 3/4" crushed stone for refilling excavation below normal grade, rock excavation or refilling excavations of unsuitable material, unless otherwise directed by ENGINEER.

I. Fabric Protection Layer: As specified in Section 02210.

J. Select Backfill: Use gravel/aggregate base material as directed by ENGINEER.

K. Common Borrow: Earth suitable for embankment and general site fills construction free from frozen material, perishable rubble, peat and other unsuitable material. Moisture content shall be sufficient to provide required compaction and stable embankment, but shall not exceed 4% above optimum.

L. Compacted Granular Fill: Mineral, bank-run sand and gravel, free of organic material, snow, ice, or other unsuitable materials conforming to the following grading requirements:

Sieve Size	% Passing by Weight
6"	100
No. 4	30 - 80
No. 40	10 - 50
No. 200	0 - 8

PART 3 - EXECUTION

3.01 EXCAVATION:

A. General: Remove all materials encountered to the limits shown on the Drawings, or designated in the Specifications.

B. Classifications: The following classifications of excavation will be made which will be paid for on a unit cost basis:

Rock Excavation
Excavation below Normal Grade

C. Rock Excavation includes removal and disposal of materials and obstructions encountered that cannot be excavated with modern, track-mounted, heavy-duty excavating equipment without drilling, blasting, or ripping; includes boulders larger than 2 cubic yards each.

Do not perform rock excavation or excavation of unsuitable materials until material to be excavated has been cross-sectioned and classified by ENGINEER. Pre-drilling and blasting of bedrock through overburden may be allowed. However, if this method is used, the rock excavation quantities will be adjusted downward in proportion to the ground swell from this blasting method.

D. Earth Excavation: Remove and dispose of obstructions visible on ground surface, underground structures, utilities, and items indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation.

E. Excavation in Paved Areas: Cut pavement prior to excavation to provide a clean, uniform edge. Minimize disturbance of remaining pavement. Cut and remove the minimum amount of

pavement required to do the Work. Use shoring and bracing where sides of excavation will not stand without undermining pavement. Remove all topsoil, organic matter and fill materials containing debris within limits of paved areas.

F. Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete formwork and reinforcement is installed. Trim bottoms to required lines and grades to leave solid base to receive other Work. When excavating in clay material, use a smooth-edged bucket to avoid disturbance of the bottom of the excavation. Use shoring and bracing where sides of excavation will not support itself.

G. Excavation for Utility Trenches: Excavate to widths shown on the Drawings and depths indicated or required to establish indicated slope and invert elevations.

Produce an evenly graded, flat trench bottom at the subgrade elevation required for installation of pipe and bedding material. Place backfill material directly into trench or excavation. Do not stockpile material to be used as backfill along edges of trenches. Load excavated material directly into trucks, unless otherwise permitted by the ENGINEER.

H. Unauthorized Excavation: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of ENGINEER. Unauthorized excavation, as well as remedial work directed by ENGINEER, including refilling, shall be at CONTRACTOR's expense.

I. Refilling Unauthorized Excavation: For trenches, use 3/4-inch crushed stone. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by ENGINEER.

J. Excavation of Unsuitable Materials: When excavation has reached required subgrade elevations, notify ENGINEER who will make an inspection of conditions. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper as directed by ENGINEER and replace excavated material as specified. Removal of unsuitable material and its replacement as directed by ENGINEER will be paid for as Excavation Below Normal Grade unless material has been made unsuitable by CONTRACTOR’s operations. In this instance, removal and replacement will be performed at CONTRACTOR’s expense.

K. Material Storage: Stockpile and maintain suitable surplus excavated materials for re-use as backfill within the Project limits, as directed by ENGINEER. Place, grade and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations.

3.02 BLASTING

A. General: Obtain approval of OWNER and ENGINEER before blasting. All blasting for utilities shall be paid as Utility Trench Blasting. All blasting related to footings, foundations and other site elements NOT related to utilities shall be paid as Open Blasting.

B. Pre-blast Survey shall be the responsibility of the CONTRACTOR. Provide pre-blast survey prior to any blasting or blasting related operations. A written report of the preblast survey will be provided to the OWNER by the CONTRACTOR and will be available for review by the City of Portland. A copy of the blasting plan will be submitted to the City of Portland and OWNER for review and approval prior to the initiation of the site preparation work.

All owners of buildings, dwellings or residences located within 500-feet of the blasting location shall be notified, in writing, by the CONTRACTOR a minimum of 30 days prior to the scheduled blasting date about the proposed blasting and how to request a pre-blast survey. Upon request, the CONTRACTOR shall determine the pre-blasting condition of any structure located within this area and prepare a written report. The pre-blast survey shall be limited to the surface conditions of the structures but shall comply in all respects with 30 CFR, Chapter VII, Section 816.62.

1. Pre-blast Survey shall include, but not be limited to:
    a. Video tape of each structure within 500-feet of the blasting location to show pre-blast conditions. Highlight existing defects in structures and pavements. Provide some means of establishing scale of existing defects (i.e., include tape measure or folding ruler at defect during video taping).
    b. Video taping shall be done with commercial grade equipment to allow equipment still viewing without distortion of the viewed area.
    c. Still photos and videotapes shall be retained by the pre-blast surveyor and shall be available for viewing by the OWNER and ENGINEER within 24 hours upon request.
2. A blasting plan shall be prepared which addresses:
    a. Airblast Limits
    b. Ground Vibrations
    c. Maximum Peak Particle Velocity
3. The blasting plan shall meet criteria established in Chapter 3 (Control of Adverse Effects) in the Blasting Guidance Manual of the United States Department of the Interior Office of Surface Mining Reclamation and Enforcement.
4. Provisions and measures to monitor and assure compliance with the blasting plan.
5. The blasting plan and preblast survey shall conform to all recommendations of the project geotechnical report and supplemental geotechnical evaluations included in these Specifications.

C. Particle Velocities: Maximum allowable peak particle velocity shall be limited to 1.25 inches per second within 300 feet of the blast site. Monitor at location designated by ENGINEER.

D. Documentation: Submit an accurate record of the blasting operation to the ENGINEER. A copy should be retained by the blasting firm for at least 3 years. This record shall consist of the following information as listed in 30 CFR, Chapter VII, Section 816.68.

1. Name of the firm conducting the blast.
2. Location, date, and time of the blast.
3. Name, signature, and certification number of the blaster conducting the blast.
4. Identification, direction, and distance, in feet, from the nearest blast hole to the nearest dwelling, public building, school, church, community or institutional building outside the project area.
5. Weather conditions, including those that may cause possible adverse blasting effects.
6. Type of material blasted.
7. Sketches of the blast pattern including number of holes, burden, spacing, decks, and delay pattern.
8. Diameter and depth of holes.

9. Types and total weight of explosives used.

10. Mats or other protections used.

11. Seismographic and airblast records, which shall include: type of instrument, sensitivity, and calibration signal or certification of annual calibration; exact location of instrument and the date, time, and distance from the blast; and the vibration and/or airblast level recorded.

E. All blasting shall be performed in accordance with all pertinent provisions of the "Manual of Accident Prevention in Construction", issued by the Associated General Contractors of America, Inc., of the "Construction Safety Rules and Regulations", as adopted by the State Board of Construction Safety, Augusta, Maine, and the Maine Department of Transportation "Standard Specifications" Section 105.2.6, Use of Explosives. Blasting through the overburden will not be allowed.

F. Drilling Equipment will be equipped with suitable dust control apparatus that must be kept in repair and used during all drilling operations.

G. Open Blasting shall pertain to all blasting required for the placement of foundations, footings, and other project elements not specifically identified in paragraph H, Utility Trench Blasting. Vertical pay limits for all Open Blasting shall be one (1) foot below the base of structural elements to be placed. Horizontal pay limits for all Open Blasting shall be two (2) feet beyond each outside edge of structural elements to be placed. Blasting for placement of underdrain piping and associated appurtenances depicted along building footings will be considered Open Blasting.

H. Utility Trench Blasting shall pertain to all blasting required for the placement of any pipe, utility structure, or associated appurtenances. Utilities associated with the site shall include water distribution and service, sanitary sewer collection and service, storm sewer collection, underground electrical service, telecommunications, data, and geothermal related elements, as indicated on the drawings. All blasting required for the placement of utilities outside the horizontal and vertical pay limits defined by Open Blasting described in paragraph G, shall be paid as Utility Trench Blasting. Pay limits for piping and utility structures shall be as depicted on the contract drawings.

3.03 STABILITY OF EXCAVATIONS:

A. General: Slope sides of excavations to comply with OSHA Regulations and Local Codes. Shore and brace where sloping is not possible due to space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

B. Refer to Section 02250 for shoring and bracing requirements.

3.04 DEWATERING:

A. Refer to Section 02240 for dewatering requirements

3.05 BACKFILL AND FILL:

A. General: Place suitable soil material in layers to required elevations as shown on the Drawings. Fill, backfill, and compact to produce minimum subsequent settlement of the material and provide adequate support for the surface treatment or structure to be placed on the material. Place material in approximately horizontal layers of beginning at lowest area to be filled. Do not impair drainage.

B. Ground Surface Preparation: Remove vegetation, debris, unsuitable soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Remove

material to the full extent of root penetration. Scarify surfaces so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under Paragraph 3.06, Compaction, for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum dry density.

C. Placement: Place backfill and fill materials in layers not more than 9-inches in loose depth for material compacted by heavy compaction equipment, and not more than 6-inches in loose depth for material compacted by hand-operated tampers. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

Do not allow heavy machinery within 5 feet of structure during backfilling and compacting.

D. Backfill excavations as promptly as work permits, but not until completion of the following:

Acceptance of construction below finish grade including dampproofing, and/or waterproofing.

Inspection, approval and recording locations of underground utilities.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids with suitable materials.

Removal of trash and debris from excavation.

Permanent or temporary horizontal bracing is in place on horizontally supported walls.

Backfill cast-in-place concrete structures when the concrete has developed adequate strength.

Use care in backfilling to avoid damage or displacement of underground structures and pipe.

E. Backfilling Trenches: See Trench Detail on the Drawings.

Bed pipe in 3/4-inch crushed stone, unless otherwise indicated. Limits of bedding and requirements for remaining trench backfill shown on Drawings.

F. Replacement of Unsuitable Materials:

Below normal grade: See paragraph 3.01J.

Above normal grade: Replace unsuitable material with suitable material from on-site. All excess suitable material must be used before additional material from off-site is used.

G. Compacted Granular Fill shall be placed within 6 ft (in plan) of the exterior face of below-grade foundation walls and within 12. in. of the bottom of soil-supported, concrete slabs.

3.06 COMPACTION:

A. Methods: Use methods which produce the required degree of compaction throughout the entire depth of material placed without damage to new or existing facilities and which are approved by the ENGINEER. Adjust moisture content of soil as required. Remove and replace material that is too wet to compact to required density. Compact each horizontal layer of fill and slope as Work progresses.

B. Degree of Compaction: Compact to the following minimum densities:

FILL AND BACKFILL LOCATION	DENSITY
Under structure foundations and slab on grade	95% of max.
Top 3 feet under pavement	95%
Below top 3 feet under pavement	92%
Structural fills	95%
Pipe Bedding	95%
Adjacent to structure foundation walls, retaining walls, and tank walls	92% - 95%
Trenches through Gravel areas	95%
Trenches through other non-paved areas	90%
Embankments/Landscaped Areas	90%

Maximum density: ASTM D1557.
Field density tests: ASTM D1556 (sand cone) or ASTM D2167 (rubber balloon), or ASTM D2922 (nuclear methods).

C. Testing: Determine actual in-place densities using field tests as directed by the ENGINEER. Tests will be made by an independent laboratory. Costs for initial tests will be paid by OWNER. Perform additional work to obtain proper compaction if in-place densities do not meet specified densities. Costs of re-testing shall be borne by CONTRACTOR.

D. Minimum Number of Tests: For areas to be paved and building subgrade, a minimum of one (1) test per 2,000 square feet (sf) per lift of material, but in no case less than three (3) tests. For trenches, a minimum of one (1) test per 100 lineal feet (lf) per lift of material. Other areas shall be tested at a minimum frequency of one (1) field test per 10,000 sf per lift of material, unless otherwise directed by ENGINEER.

3.07 GRADING:

A. Grading: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish surface within specified tolerances and compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Structure Lines: Grade areas adjacent to structure to drain away from structures and to prevent ponding.

C. Finish surfaces free from irregular surface changes and as follows:

Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.

Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

Fill Under Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.

D. Compaction: After grading, compact subgrade surfaces as required.

3.08 EROSION CONTROL: Provide erosion control measures as specified in Section 02370 and as shown on Drawings.

3.09 MAINTENANCE:

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during warranty period; remove surface, add backfill material, compact, and replace surface. Restore appearance, quality, and condition of surface to match adjacent work, and eliminate evidence of restoration work to greatest extent possible.

3.10 DISPOSAL OF EXCESS MATERIALS: Remove excess excavated material and dispose of it off-site in a lawful manner, unless otherwise directed by ENGINEER.

End of Section