SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Work included under this Section includes, but is not limited to, providing all labor, materials, equipment, and incidentals to conduct and complete the Work related to the planned building, utilities and site improvements as specified herein and shown on the Drawings.

1. Excavate all materials, including soil, boulders, abandoned utilities, existing and previous building foundations, railroad tracks, pavements, curbs, granite blocks, and all other materials as necessary to construct the building improvements shown on the Drawings.
2. The CONTRACTOR shall be solely responsible for impacts and damage to structures due to their work, and for corrective action or repairs needed to restore the structure(s) to its original condition at no additional cost to the OWNER. Where structures are adversely affected by construction operations, they shall be repaired, restored and replaced in accordance with the requirements outlined herein.
3. The CONTRACTOR shall note that some over-excavation and replacement of in-situ fill soils may be required to reach the bearing soils for parking garage and office building footings.
4. Handle, process, re-handle, segregate, and stockpile materials during the course of the Work. Existing on-site materials may require processing prior to reuse. Processing may include separating, crushing, blending, screening, and other measures to meet the requirements herein and as directed by the ENGINEER. Only those soils and other materials approved by the ENGINEER shall be reused on-site.
5. Prepare, grade, shape, compact and protect all subgrades, backfills, and ground surfaces shown on the Drawings.
6. Dewater as necessary to enable construction of site improvements, including backfilling, in-the-dry in accordance with section 02240. The CONTRACTOR shall be responsible for control, pumping, and legal disposal of groundwater, precipitation, or other water which enters or accumulates in excavations to maintain stable subgrades and allow all below-grade construction to be conducted in-the-dry.
7. Provide, place, moisture condition, compact, and grade fill, backfill and other materials to the horizontal and vertical limits to construct the proposed site improvements and achieve the lines and grades as shown on the Drawings.
8. Place plastic separators, vapor barriers, mudmats, and geotextiles as necessary and required.
9. Install underslab drainage system elements at the locations and elevations shown on the Drawings.
10. Preserve and protect existing structures and utilities and new site improvements during the course of the Work.
11. Manage and legally dispose off-site all excess excavated materials, including, but not limited to soil, rock, boulders, water, demolition waste, and debris that cannot be reused on-site.
12. Obtain, maintain and pay for all required permits, licenses, and approvals prior to commencing the Work of this and other related Sections.
13. Off-site disposal of contaminated material, if required, shall not be conducted without prior approval of the OWNER and ENGINEER. Disposal of contaminated material shall be done in accordance with Section 02110.
14. Provide and install erosion control during the Work as indicated on the Drawings, as required in the Specifications, and in accordance with applicable regulations and permits.
15. The CONTRACTOR shall be solely responsible for impacts and damage to any existing structures due to their Work, and for corrective action or repairs needed to restore the structure(s) to original condition at no additional cost to the OWNER.

B. Related Work Specified Elsewhere:

1. Existing Subsurface Conditions: Section 02010
2. Handling of Contaminated Soils: Section 02110
3. Site Preparation: Section 02200
4. Demolition: Section 02220
5. Dewatering: Section 02240
6. Lateral Earth Support: Section 02250
7. Erosion and Sedimentation Control: Section 02370

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, groundwater 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 the 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 the ENGINEER.

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 the ENGINEER and OWNER. Materials testing firm to be independent of CONTRACTOR.

B. The ENGINEER will observe the CONTRACTOR'S earthwork activities, including excavation, dewatering, subgrade preparation, backfilling and on-site reuse of excavated materials. The CONTRACTOR shall provide sufficient notice to the ENGINEER to allow the ENGINEER to be present to observe the Work.

C. The ENGINEER will conduct field and laboratory density testing of placed and compacted soils to confirm compliance with the requirements of this Section. Field and laboratory density testing will be conducted in general conformance with ASTM or other applicable reference standards. The CONTRACTOR shall cooperate with the ENGINEER in all respects to facilitate any testing or observations.

D. The CONTRACTOR shall not place or compact any fill, backfill, prepare subgrades or place concrete on bearing surfaces unless the ENGINEER is present to observe the Work. Materials

placed and/or compacted which do not conform to project specifications for the area, shall be removed and replaced with appropriate, suitable material when directed by the OWNER or the ENGINEER at no additional cost to the OWNER. Costs related to testing or replacement of nonconforming Work or materials, and/or delays caused by nonconforming Work or materials, shall be paid for by the CONTRACTOR at no additional cost to the OWNER.

E. The presence of the ENGINEER shall not relieve the CONTRACTOR of their responsibility to perform the Work in accordance with the Contract Documents, nor shall it be construed to relieve the CONTRACTOR from full responsibility for the means and methods of construction, protection of site improvements against damage, and for safety on the construction site. The CONTRACTOR shall comply with all applicable laws, rules, ordinances and regulations of the Federal Government, the State of Maine, and the City of Portland, governing the transportation, storage, handling and use of explosives. All labor, materials, equipment and services necessary to make the blasting operations comply with such requirements shall be provided without additional cost to the OWNER.

F. The CONTRACTOR shall adhere to the applicable requirements of the specifications, OSHA Standards and to all other applicable ordinances, codes, statutory rules, and regulations of federal, state, and local authorities having jurisdiction over the Work of this Section.

G. The CONTRACTOR may conduct additional field and laboratory testing or screening tests for their own information at no additional cost to the OWNER.

H. In case of conflict between regulations or between regulations and Specifications, the CONTRACTOR shall comply with the strictest applicable codes, regulations, or Specifications.

1.04 JOB AND SUBSURFACE CONDITIONS:

A. Site Information: The CONTRACTOR may make their own borings, hand probes, explorations, and observations to determine soil, groundwater 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 the 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:

A. General

1. Unless otherwise noted, the CONTRACTOR shall forward submittals to the ENGINEER a minimum of two weeks prior to any planned work related to the CONTRACTOR'S submittals.
2. The time period(s) for submittals are the minimum required by the ENGINEER to review, comment, and respond to the CONTRACTOR. The ENGINEER may require resubmission(s) for various reasons. The CONTRACTOR is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the Work.
3. The CONTRACTOR'S submittals shall be reviewed and accepted by the ENGINEER prior to conducting any Work.
4. The CONTRACTOR'S submittals shall be prepared and stamped by a Professional Engineer registered in the State of Maine, retained by the CONTRACTOR as requested by the ENGINEER.
5. Acceptance of the CONTRACTOR'S submittals by the ENGINEER does not relieve the CONTRACTOR their responsibility for the adequacy, safety and performance of the Work.

B. Excavation and Backfilling

1. A narrative and drawings (plans and elevations at 1 in.= 40 ft scale) describing the schedule, construction sequence and procedures for excavation, subgrade preparation, foundation construction, cold weather subgrade protection, backfilling, dewatering, soil handling, stockpiling and other related activities. This includes soil management to eliminate cross-contamination of soils.

2. Details of proposed backfill materials and equipment.

3. Proposed types and sources of all off-site fill materials, including topsoil. For each type of soil to be utilized as fill or backfill, the CONTRACTOR shall submit results of all aggregate gradation, moisture density, and field compaction testing for all materials to the ENGINEER. Submit minimum 50-lb. bag samples of each on-site or off-site material proposed for use, from each borrow source or supplier to the ENGINEER'S laboratory for review and laboratory testing at least 2 weeks prior to use on site. Do not import any material to the site unless accepted by the ENGINEER. With each sample provide the following documentation:

   a. Location of the borrow source site.
   b. Present and past usage of the source site material.
   c. All previously existing report(s) associated with an assessment of the source site as related to the presence of oil or hazardous materials.

   If materials are suspected of containing oil and/or hazardous materials based on the ENGINEER'S review of the submitted data described above, the CONTRACTOR shall submit chemical test data on the material. The cost of any required testing shall be borne entirely by the CONTRACTOR. The ENGINEER will review the data and determine its acceptability for use on site.

4. For use of filter fabrics, underslab drain piping, prefabricated vertical drainage board, and underslab drain cleanouts submit manufacturer's literature for approval by the ENGINEER.

5. Submit details regarding proposed dewatering procedures including general approach to dewatering; equipment; pumping locations; discharge locations; means for preventing the pumping of fines from subgrade soils; means for controlling suspended solids in effluent.

1.07 LINES, GRADES AND TOLERANCES:

A. The CONTRACTOR shall be responsible for establishing all lines, grades and other survey control to complete the Work as shown on the Drawings.

B. Maintain the moisture content of backfill materials as necessary to allow for the material to be readily placed to the degree of compaction specified herein.

C. Construct finished soil and backfill surfaces to the elevations indicated on the Drawings.

D. Compact backfill materials to the specified degree of compaction.

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.

4. Material for embankments and general site fills may contain pieces of excavated ledge having a greatest dimension of up to 6-inches, unless otherwise approved by the 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 MaineDOT 703.06, 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 MaineDOT 703.06 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 MaineDOT 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. Granular Fill: Granular Fill shall consist of clean, aggregate sand and gravel mineral soil free of organic material, loam, trash, snow, ice, frozen soil or other compressible material well graded within the following limits:

Sieve Size	% Passing by Weight
3”	100
No. 4	30 – 90
No. 40	10 – 50
No. 200	0 – 5

Granular Fill shall be used below slabs within 5 feet in plan of pile caps and grade beams, sidewalks, exterior slabs, and at other locations shown on the Drawings. Processed concrete/building debris is not acceptable for use as Granular Fill.

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

I. 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.

J. Fabric Protection Layer: As specified on the Contract Plans.

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

L. 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.

M. Underslab Drain Piping: 4-in. diameter perforated and solid PVC or HDPE pipe, or approved equivalent, shall be used for the underslab drainage system at the location shown on the Drawings. Perforations shall be compatible with the crushed stone.

N. Drainage Board: Drainage Board shall consist of a High Density Polyethylene (HDPE) drainage net with a non-woven, synthetic, chemically resistant non-biodegradable fabric attached to both sides of the drainage net. The drainage board shall have a minimum transmissivity of 0.0024-gal/min/ft, and shall be installed against the outside face of the finished foundation wall as shown on the Drawings.

O. Geotextile: Geotextile shall consist of a non-woven, synthetic, chemically resistant non-biodegradable fabric. Geotextile shall be used to prevent fine-grained soils from migrating into coarse grain materials as judged necessary by the ENGINEER, and at the locations shown on the Drawings. Mirafi 160N, or approved equivalent shall be used as Geotextile.

PART 3 - EXECUTION

3.01 EXCAVATION:

A. General: Excavation shall include the removal of all encountered materials, including but not limited to, soil, boulders, asphalt pavement, concrete (reinforced and unreinforced), miscellaneous debris, buried and abandoned foundations and utilities, railroad tracks, site improvements, incidental structures and all other materials encountered to the limits shown on the Drawings, or designated in the Specifications. Where excavations are required to be made into the Zone of Influence (ZOI) below an existing or new foundation, utility or other structure, the CONTRACTOR shall design excavation and bracing system, underpinning, or other system approved by the ENGINEER to: 1) provide support to protect the soil within the ZOI from loosening and becoming disturbed, and 2) protect the structure from movement. The ZOI beneath a structure or utility is defined by imaginary lines extending outward 2 ft laterally beyond the bottom edge of a footing or from the springline of a utility and down on a one horizontal to one vertical (1H:1V) slope to the top of the natural inorganic bearing soils. Soils located within the zone of influence provide foundation support. Excavation and backfilling shall be performed in the same day.

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 the 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, railroad tracks, 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.

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 the final 1.0 feet to foundation subgrade level using methods and equipment designed to prevent disturbance to the bearing soils (by hand or by smooth bucket excavator).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 as required by OSHA standards.

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 the ENGINEER. Unauthorized excavation, as well as remedial work directed by the ENGINEER, including refilling, shall be at the 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 the ENGINEER.

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

All owners of 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 the 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 requirements.

3.04 DEWATERING:

A. General: Refer to Section 02240 for dewatering requirements

3.05 SUBGRADE PREPARATION:

A. General

1. Care shall be taken to avoid disturbance to subgrades. Prepare subgrades no steeper than one vertical to ten horizontal unless otherwise approved by the ENGINEER.
2. Provide a firm, smooth, stable, undisturbed subgrade as judged by the ENGINEER. Loose, disturbed soil shall be removed by hand shovel.
3. Subgrades consisting of cohesive soils shall not be “backbladed” or compacted to prepare a smooth surface.
4. Subgrades consisting of granular soils shall be recompacted until firm.
5. Movement of construction equipment directly over exposed final subgrades, except for compaction equipment, shall not be permitted.
6. The exposed subgrade will be examined in the field by the ENGINEER to observe the strength and bearing capacity of the soils. Disturbed or soft or unstable soils, as judged by the ENGINEER, shall be excavated and replaced with lean concrete, granular fill, or other acceptable materials at no additional cost to the OWNER. Concrete shall not be placed prior to inspection of soil subgrade by ENGINEER
7. Prevent soil subgrades from freezing and frost. Soil subgrades that freeze prior to concrete or backfill placement shall be thawed and recompacted, or removed and replaced with non-frozen backfill, lean concrete or other acceptable material as directed by the ENGINEER.
8. Group 2 soils suitable for reuse beneath the Garage ramp and within the footprint of the Office and Garage shall be granular in nature and must be able to be placed in lifts and compacted in accordance with the requirements outlined herein. Suitable Group 2 soils

shall not contain appreciable amounts of topsoil, organic matter or miscellaneous debris. Group 2 soils shall not be placed in these areas without the prior approval of the ENGINEER.

9. Group 1 soils suitable for reuse beneath the Garage ramp and within the footprint of the Office and Garage shall be granular in nature and must be able to be placed in lifts and compacted in accordance with the requirements outlined herein. Suitable Group 1 soils shall not contain appreciable amounts of topsoil, organic matter or miscellaneous debris. Group 1 soils shall not be placed in these areas without the prior approval of the ENGINEER.

B. Office Building Footings

1. For all footings remove all in-situ fill soil, organic material, debris, disturbed soil and other compressible materials from within the Zone of Influence (ZOI) of footings to a minimum depth of 1 foot below the footing bearing level.
2. Proof-compact the acceptable subgrade (if bearing soils are granular in nature) to achieve a firm subgrade. Do not proof compact cohesive soil subgrades.
3. Place and compact Granular Fill, 1-1/2 inch crushed stone material, or other approved material in engineered lifts from the prepared subgrade elevation to the design footing bearing elevation to the limits shown on the Drawings.
4. Footing subgrade shall be approved by ENGINEER and footings shall bear on:
    a. 12 inch minimum thickness of 1-1/2 inch crushed stone placed following over-excavation of fill soil as described above.
    b. 12 inch minimum thickness of granular fill placed following over-excavation of fill soils as described above.

C. Building Slabs-on-Grade

1. Over-excavate all fill, topsoil, disturbed soil and any materials to a depth of at least 12 in. below the slab-on-grade bearing elevation, unless otherwise noted on the Drawings. Any utility abandoned in-place below the slab-on-grade shall be entirely backfilled with lean concrete or other grout material approved by the ENGINEER.
2. Proof-compact granular subgrade soils if required to achieve a firm subgrade. Do not proof compact cohesive soil subgrades.
3. Place and compact granular fill within 12 in. of the slab, unless otherwise noted on the Drawings.

3.06 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.

C. Placement: Place backfill and fill materials in layers not more than 12-inches in loose depth for material compacted by heavy compaction equipment, and not more than 9-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.

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.

3.07 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%
Within 5 feet laterally from edges of pile caps/ grade beams	95%
Below top 3 feet under pavement	92%
Structural fills	95%
Pipe Bedding	95%
Adjacent to structure foundation walls, retaining walls, and tank walls	95%
Trenches through Gravel areas	95%
Trenches through other non-paved areas	90%
Embankments	90%

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

C. Testing: In-situ density testing of placed/compacted lifts of soil will be performed by a material testing firm hired by the OWNER. The ENGINEER will provide part-time oversight of these activities. Perform additional work to obtain proper compaction if in-place densities do not meet specified densities at no additional cast to the OWNER.

D. Protection of Fill

1. The CONTRACTOR shall take the necessary steps to avoid disturbance of subgrade and underlying soils during excavation and backfilling operations. Procedures for excavating and backfilling shall be revised as necessary to avoid disturbance of subgrade and underlying soils, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering, and other acceptable control measures. Disturbance shall include the deterioration of backfill (after placement and satisfactory compaction) due to the Contractor's operations, such as moving equipment, hauling trucks, etc. All excavated or backfilled areas or subgrades that become disturbed during construction shall be removed and replaced with acceptable materials.

2. During earthwork operations, protect geofoam fill from damage. Damaged geofoam will be replaced per direction of the ENGINEER at no additional cost to the OWNER.

3. Prevent materials below constructed foundations from freezing. Materials that become frozen shall be removed and replaced, including foundations, at no additional cost to the OWNER.

4. At the completion of Work, all ground surfaces shall be left in a firm, stable, unyielding, reasonably uniform condition, free of ruts and surface irregularities, in accordance with grading requirements shown on the Drawings.

3.08 Reuse of In-Situ Soils

A. Group 2 Fill Soils

1. The CONTRACTOR shall, to the extent possible, reuse all Group 2 soils on site in areas acceptable to the ENGINEER and OWNER. Acceptable areas include the landscape berm along the north side of the Garage, beneath the Garage ramp, and within the office and garage footprints (except within 12 inches of slabs-on-grade, as base/subbase or roadway and within 5 feet in plan of grade beams, pile caps and footings).

2. The CONTRACTOR shall not remove any Group 2 soils from the site without notifying the ENGINEER and obtaining written approval from the OWNER.

A. Group 1 Fill Soils

1. The CONTRACTOR shall, to the extent possible, reuse all Group 1 soils on site in the “acceptable” areas outlined above. Group 2 soils shall be reused prior to reuse of Group 1 soils.

2. The CONTRACTOR shall not remove any Group 1 soils from the site without notifying the ENGINEER and obtaining written approval from the OWNER.

3.09 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.

3.10 FOUNDATION DRAINAGE

A. Install perimeter and underslab drainage system at locations shown on the Drawings. Pipe shall be laid flat with the invert positioned above the bottom of footing bearing level and at least 12 in. below the adjacent lowest level floor slab surface.

B. Perimeter drainage pipe shall be completely wrapped in a minimum of 6-inches of 3/4-in. crushed stone and geotextile. Pipe shall be placed with joints tightly closed in accordance with

manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down.

C. Underslab drainage pipe shall be installed at the locations and elevations shown on the plans.

D. Provide wall through penetrations at locations shown on the Drawings to allow connection of the perimeter and underslab drain piping. Perimeter and underslab drain pipes shall be installed at the same invert elevation.

E. At locations where perimeter drainage is installed, a prefabricated geocomposite drainage board shall be installed along the backfilled side of foundation walls. The drainage board shall be applied from the top of the footing up to within 1 ft below proposed finished grade.

F. Any sections of piping that are not true to lines and grades, or that show any undue settlement after being laid, or are damaged shall be removed and re-laid or replaced at no additional cost to the Owner.

G. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

H. Provide cleanouts for drainage piping at changes of direction, bend of lines, and wherever indicated on the Drawings, and necessary to enable system to be cleaned out. Extend cleanouts to finished grade or top of slab and provide surface protection. Coordinate cleanout locations with structural and architectural improvements.

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

3.12 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.

3.12 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