SECTION 310000 - EARTHWORK

This Section includes earthwork operations, including site clearing, excavation, fill and backfill, subgrade preparation, compaction, riprap placement, and rough and final grading. For materials related to earthwork, refer to Section 310001 – Earthwork Materials.

Contract Limit Line (CLL) must be indicated on Contract Drawings of projects requiring earthwork.

State quantities for work, where relevant, on the Contract Drawings. Any variance in specified quantities will be negotiated by a field order or change order to the contract.

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section Includes:

Disconnecting, capping, sealing, and/or removing existing utilities.

Site Clearing:

Protecting existing vegetation to remain.

Removing existing vegetation.

Clearing and grubbing.

Stripping and stockpiling topsoil and rock.

Removing above- and below-grade improvements.

Disconnecting, capping or sealing, and removing or abandoning site utilities in place.

Retain subparagraph below if erosion and sedimentation control are not included in Section 015000 "Temporary Facilities and Controls."

Excavation:

Excavating for buildings and structures.

Excavating trenches for utilities and pits for buried utility structures.

Fill and Backfill:

Backfilling for building and site structures to subgrade elevations.

Backfilling for trenches.

Fill under slabs-on-grade.

Fill under pavements.

Fill for over-excavation.

Subsurface drainage backfill for walls and trenches.

Preparation of subgrades.

Compaction.

Riprap placement.

Rough and final grading.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 310001 – Earthwork Materials.

Section 312316.26 – Rock Removal.

Section 312319 – Dewatering.

Section 312323.33 – Flowable Fill

Section 312500 – Erosion and Sedimentation Controls.

Section 315000 – Excavation Support Protection.

Section 329200 – Turf and Grasses.

Section 329300 – Plants.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

LEED requires compliance with specific editions of referenced standards. Consider including publication dates for referenced standards in this Section to ensure that the correct standard is used for LEED compliance.

* + - * 1. ASTM International:

ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).

ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).

ASTM D2419 – Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).

ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

ASTM D2974 – Standard Test Methods for Determining the Water (moisture) Content, Ash Content, and Organic Material of Peat and Other Organic Soils.

ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

ASTM D4373 - Standard Test Method for Rapid Determination of Carbonate Content of Soils

ASTM D4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

* + - * 1. Related Requirements:

Local utility standards when working in close proximity to utility lines.

Occupational Safety and Health Administration: Comply with the applicable requirements of the Code of Federal Regulations Title 29 – Labor, Part 1926 Safety and Health Regulations for Construction (OSHA).

* + - * 1. New York State Department of Transportation (NYS DOT)

NYS DOT 620 - Bank and Channel Protection

NYS DOT 703 - Aggregates

NYS DOT 733 - Earthwork Materials

* + - 1. DEFINITIONS
				1. Surface Soil: Soil that is present at the top layer of the existing soil profile.
				2. Subsurface: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile.
				3. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsurface; reasonably free of subsurface soils, clay lumps, gravel, weeds, roots, toxic materials, or other non-soil materials.
				4. Borrow Soil: Approved soil imported from off-site for use as fill or backfill.
				5. Backfill: Soil material or controlled low-strength material used to fill an excavation.

Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

Final Backfill: Backfill placed over initial backfill to fill a trench.

* + - * 1. Fill: Soil materials used to raise existing grades.
				2. Suitable Material (Fill and Backfill for Landscaped Areas): Material generally consisting of mineral soil (inorganic), blasted or broken rock and similar materials of natural or man-made origin, including mixtures thereof. Maximum particle size will not exceed 2/3 of the specified layer thickness prior to compaction. Topsoil and organic silt may be used as suitable material in landscaped areas provided it is placed as the surface soil.
				3. Unsuitable Material: Material containing cinders, industrial waste, sludge, building/construction rubble, land fill, muck, and peat.
				4. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage material, or topsoil materials.
				5. Subbase Course: Aggregate layer placed between the subgrade and asphaltic or concrete pavement section or concrete structure.
				6. Bedding Course (Cushion Material): Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
				7. Drainage Material: Aggregate layer with minimal material passing the #200 sieve to promote downward water flow and minimizes upward capillary flow of pore water.

Retain one of the following. "Classified Earth Excavation” and “Rock” paragraphs if sound bedrock exists within the limits of excavation and it is known that the subsurface is free of cobbles, boulders, very dense soils, former foundations, etc. Use definition for “Unclassified Earth Excavation” when it’s known that the excavations will be very dense or if it is known that concrete foundations, boulders, cobbles, etc. exist beneath the limits of excavation.

* + - * 1. Classified Earth Excavation: Removal of all surface and subsurface material not classified as rock, to the lines and dimensions indicated.
				2. Rock: Limestone, sandstone, shale, granite and similar material in solid beds or masses in its original or stratified position which can be removed only by blasting operations, drilling, wedging, or use of pneumatic tools, and boulders with a volume greater than 1.0 cu yd. Concrete building foundations and concrete slabs, not indicated, with a volume greater than 1.0 cu yd shall be classified as rock.

Limestone, sandstone, shale, granite, and similar material in a broken or weathered condition which can be removed with an excavator or backhoe equipped with a bucket with ripping teeth or any other style bucket shall be classified as earth excavation.

Masonry building foundations, whether indicated or not, shall be classified as earth excavation.

* + - * 1. Unclassified Earth Excavation: Removal of all surface and subsurface material, of any description, necessary to perform the work of this contract. This will include:

All soil deposits of any description both above and below groundwater levels. These may be naturally deposited or placed by previous construction operations.

Ledge rock should not normally be defined under “Unclassified Earth Excavation” and should be deleted from this section. However, in some instances it may be required. Consult with the Geotechnical Engineer or Project Manager.

Ledge rock of all quality. (Limestone, Sandstone, Shale, Granite and similar materials in solid beds or masses in its original or stratified position which can only be removed by drilling, wedging, use of pneumatic tools or heavy ripping equipment). Blasting operations will not be permitted to loosen any ledge rock necessary to be removed in this contract.

Boulders of any size.

Any materials of man-made origin.

* + - * 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Director’s Representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for [**unit prices**] [**changes in the Work**].
				2. Bulk Excavation: Excavation more than [**10 feet**] in width and more than [**30 feet**] in length.
				3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Director’s Representative. Unauthorized excavation, as well as remedial work directed by Director’s Representative, shall be without additional compensation.
				4. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
				5. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

Retain "Plant-Protection Zone" paragraph below if applicable to the Project.

* + - * 1. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction.
				2. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.
				3. Landscaped Areas: Areas not covered by structures, walks, roads, paving, or parking.
				4. Grading Limit Line (Shown on Drawings): Limits of grading, excavations and filling required for the Work. Unless specifically noted otherwise, the Grading Limit Line and Contract Limit Line shall be considered the same.
			1. MATERIAL OWNERSHIP
				1. Except for materials indicated to be stockpiled or otherwise remain State’s property, cleared materials shall become Contractor’s property and shall be removed from Project site.
			2. SUBMITTALS
				1. Submittals for this Section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Existing Conditions: Submit documentation before earthwork activities begin of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by the Work of this Section.

Revise subparagraphs below and insert additional requirements to suit project.

Use sufficiently detailed photographs or video recordings.

Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

Coordinate "Qualification Data" paragraph below with "Quality Assurance" Article.

* + - * 1. Qualification Data: For qualified testing agency.
			1. QUALITY ASSURANCE

Retain "Geotechnical Testing Agency Qualifications" paragraph below if Contractor selects agency for rock-definition testing.

* + - * 1. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.
			1. FIELD CONDITIONS
				1. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Director’s Representative and authorities having jurisdiction.

Provide alternate routes around closed or obstructed traffic ways if required by Director’s Representative or authorities having jurisdiction.

Retain "Improvements on Adjoining Property" paragraph below to suit Project; coordinate with Director’s Representative.

* + - * 1. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining State's property will be obtained by Director’s Representative before award of Contract.

Do not proceed with work on adjoining property until directed by Director’s Representative.

Retain “Salvageable Improvements” paragraph below to suit Project. Indicate items to be salvaged on Drawings or in schedules.

* + - * 1. Salvageable Improvements: Carefully remove items indicated to be salvaged and store [**where indicated**].
				2. Utility Locator Service: Locate underground utilities, in accordance with Section 023313 – Underground Utility Locator Service, before beginning site clearing or earth-moving operations.
				3. Do not commence operations until temporary site fencing and erosion and sedimentation control measures are in place.

Retain first paragraph below if protection zones and protection-zone fencing are required.

* + - * 1. Do not commence earthwork operations until plant-protection measures specified herein are in place.

Retain three paragraphs below if plant-protection zones are required.

* + - * 1. The following practices are prohibited within protection zones:

Revise subparagraphs below to suit Project.

Storage of construction materials, debris, or excavated material.

Parking vehicles or equipment.

Foot traffic.

Erection of sheds or structures.

Impoundment of water.

Excavation or other digging unless otherwise indicated.

Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

* + - * 1. Do not direct vehicle or equipment exhaust towards protection zones.
				2. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
				3. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.
1. PRODUCTS
	* + 1. MATERIALS
				1. See Section 310001 - Earthwork Materials.
				2. Protection-Zone Fencing:

Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.

Height: [**36 inches**] [**48 inches**] <**Insert dimension**>.

Color: High-visibility orange, nonfading.

Chain-Link Protection-Zone Fencing: As specified in Section 015000 - Construction Facilities and Temporary Controls.

* + - * 1. Protection-Zone Gates: [**Single-**] [**Double-**] swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width [**24 inches**] [**36 inches**] [**As indicated**] <**Insert width**>.
				2. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

Size and Text: [**As shown on Drawings**] <**Insert requirement**>.

Lettering: [**3-inch-**] <**Insert dimension**> high minimum, [**white**] [**black**] <**Insert color**> characters on [**white**] [**red**] <**Insert color**> background.

1. EXECUTION
	* + 1. PREPARATION
				1. Protect and maintain benchmarks and survey control points from disturbance during construction.
				2. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed as required.
				3. Protect existing site features, to remain, from damage during construction. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

Restore damaged improvements to their original condition, as acceptable to the Director’s Representative.

* + - * 1. Protect and maintain erosion and sedimentation controls during earth-moving operations.
				2. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
			1. TEMPORARY EROSION AND SEDIMENTATION CONTROL

Coordinate with Section 312500 Erosion and Sedimentation Controls. If the Section is not included in the Project Manual, revise to suit Project.

* + - * 1. Provide and maintain temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, in accordance with [**Section 312500 Erosion & Sedimentation Controls,**] the Contract Drawings, and requirements of authorities having jurisdiction. If the erosion and sedimentation controls specified by the authorities having jurisdiction are more stringent than those specified in the Contract Documents, contact the Director’s Representative.

Retain first paragraph below if plant-protection zones are required.

Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

Inspect, maintain, and repair erosion and sedimentation control measures during construction until permanent vegetation has been established.

Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

* + - 1. PLANT PROTECTION

Retain this article if required. If retaining, Drawings should show plant-protection zones and protection-zone fencing.

* + - * 1. Locate and clearly identify trees, shrubs, and other vegetation to remain and be protected. [**Flag**] [**Tie a 1-inch blue vinyl tape around**] <**Insert requirement**> each tree trunk at 54 inches above the ground.
				2. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
				3. Trunk Protection: Protect the trunk of each tree to remain as follows:

Install [**2-by-4-inch**] [**2-by-6-inch**] wood planks around trunk at maximum 3 inches apart. Minimum three planks per tree. Band together with no less than three steel bands stapled to the planks to hold them securely in place. [**Wrap orange plastic construction fencing to a minimum of three layers outside slats. Fasten wrap with wire.**]

Height: [**48 inches**] <**Insert dimension**>.

* + - * 1. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones[**before materials or equipment are brought on the site and construction operations begin**] <**Insert requirement**> in a manner that will prevent people[**and animals**] from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation. Install access gates where indicated.
				2. Install protection-zone signage in visibly prominent locations in a manner approved by Director’s Representative. Install one sign spaced approximately every [**20 feet**] [**35 feet**] [**50 feet**] <**Insert dimension**> on protection-zone fencing, but no fewer than [**four**] <**Insert number**> signs with each facing a different direction.
				3. Maintain protection zones free of weeds and trash.
				4. Maintain protection-zone fencing and signage in good condition as acceptable to Director’s Representative and remove when construction operations are complete and equipment has been removed from the site.

Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.

Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

* + - * 1. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

Retain one or both of "Small Trees" and "Large Trees" subparagraphs below; revise to suit Project.

Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures [**6 inches**] [**4 inches**] <**Insert dimension**> or smaller in caliper size.

Revise first subparagraph below to suit Project. Replacing larger than 6-inch caliper-size trees with trees of equal size is difficult and not always successful; some jurisdictions have established formulas for large-tree replacements.

Large Trees: Provide [**one**] [**two**] <**Insert number**> new tree(s) of [**6-inch**] [**4-inch**] <**Insert dimension**> caliper size for each tree being replaced that measures more than [**6 inches**] [**4 inches**] in caliper size.

Species: to match existing, unless otherwise directed by Director’s Representative.

Plant and maintain new trees as specified in Section 329300 - Plants.

* + - 1. EXISTING UTILITIES
				1. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

Arrange with utility companies to shut off indicated utilities as necessary

* + - * 1. Interrupting Existing Utilities: Do not interrupt utilities serving occupied facilities unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

Notify Director’s Representative not less than [**seven days**] in advance of proposed utility interruptions.

Do not proceed with utility interruptions without the Director’s Representative’s written permission.

* + - * 1. Excavate for and remove underground utilities indicated to be removed.
			1. CLEARING AND GRUBBING
				1. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

Do not remove trees, shrubs, and other vegetation indicated to remain.

Grind down stumps and remove roots, obstructions, and debris to a depth of [**18 inches below exposed subgrade**] [**to lines and grades as shown on the Construction Drawings**].

Use only hand methods or air spade for grubbing within protection zones.

Chip removed tree branches and [**stockpile in areas approved by the Director’s Representative**] [**dispose of off-site**].

* + - * 1. Fill depressions caused by clearing and grubbing operations with suitable material unless further excavation or earthwork is indicated.

Place fill material in horizontal layers not exceeding a loose depth of [**8 inches**], and compact each layer to specified density.

* + - 1. TOPSOIL STRIPPING
				1. Remove sod and grass before stripping topsoil.

Select option for topsoil depth in first paragraph below.

* + - * 1. Strip topsoil to depth [**indicated on Drawings**] [**of 4 inches**] in a manner to prevent intermingling with underlying soil or other waste materials.

Remove subsurface soil and non-soil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

Revise paragraph below if topsoil is to be removed from site. Insert here or indicate on Drawings the quantity of topsoil to be stockpiled or reused, if known.

* + - * 1. Stockpile topsoil away from edge of excavations without intermixing with subsurface soil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

Limit height of topsoil stockpiles to [**120 inches**].

Do not stockpile topsoil within protection zones.

Retain one of two subparagraphs below to suit Project.

Stockpile surplus topsoil to allow for respreading deeper topsoil.

Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

* + - 1. STORAGE OF SOIL MATERIALS
				1. Stockpile borrow soil materials and excavated suitable materials away from the edge of excavations and without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

Limit height of soil stockpiles to [**180 inches**].

Do not stockpile soil material within protection zones.

Dispose of surplus soils. Surplus soil is that which exceeds quantity indicated to be stockpiled or reused.

* + - 1. STOCKPILING ROCK

Revise this article according to the rock types, source locations, and sizes required to be stockpiled.

* + - * 1. Remove from [**area indicated on Drawings**] [**construction area**] naturally formed boulders that measure more than **[1 foot]** across in least dimension. Do not include excavated or crushed rock.

Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than [**2 inches**] in diameter; trash, debris, weeds, roots, and other waste materials.

Insert here or indicate on Drawings the quantity of rocks to be stockpiled or reused, if known.

* + - * 1. Stockpile rock [**where indicated on Drawings**] [**away from edge of excavations**] without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

Limit height of rock stockpiles to [**240 inches**].

Do not stockpile rock within protection zones.

Retain one of two subparagraphs below to suit Project.

Stockpile surplus rock to allow for later use.

Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.

* + - 1. DEWATERING
				1. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades. Refer to Section 312319 – Dewatering.
				2. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
				3. Protect subgrades from rain or water accumulation that can cause softening, undermining/undercutting, washout, damage, and other soil changes that would be detrimental to the stability of subgrades.

Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

* + - * 1. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

Retain section below if required. If required the soil parameters required for design must be provided on the contract drawings (Geotechnical notes) and specified herein. Consult the Geotechnical Engineer for these parameters.

* + - 1. SHEETING, SHORING, AND BRACING
				1. Temporary Sheeting: Install temporary sheeting, shoring and bracing as required to create a safe working environment and prevent settlement or other damage to adjacent grounds and structures resulting from excavation operations. Shore and brace sheeting in a manner which will not interfere with progress of other Work or related contracts (if any) on this project. Check shoring and bracing for settlement and adjust for settlement. Promptly remove temporary sheeting, shoring, and bracing when no longer required.

Retain subparagraph below to suit project. Review with Geotechnical Engineer and edit as necessary.

* + - * 1. Permanent Sheeting: Install permanent steel sheetpiling where shown. [**Cut off top of permanent sheeting 12 inches below finish grade**] **<Insert requirement>**.
			1. EXCAVATION, GENERAL

Retain one of "Unclassified Earth Excavation" or "Classified Earth Excavation" paragraph below. Retain first paragraph if excavation is unclassified and no changes in the Contract Sum or the Contract Time will be authorized for rock excavation. Retain second paragraph if excavation is classified, and adjustments in the Contract Sum and, if applicable, the Contract Time will be authorized for rock excavation.

* + - * 1. Unclassified Earth Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

If excavated materials intended for fill and backfill include unsuitable materials and rock, replace with suitable materials.

* + - * 1. Classified Earth Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned. The Contract Sum will be adjusted for rock excavation according to Contract provisions for [**unit prices**] [**changes in the Work**]. Changes in the Contract Time may be authorized for rock excavation.

Revise description in first subparagraph below if removal of surface features and underground utility structures is specified in Section 024116 - Structure Demolition.

Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

* + - 1. EXCAVATION

Revise tolerances in this article to suit office practice if applicable.

* + - * 1. Excavation for Structures: Excavate to indicated elevations and dimensions within a tolerance of plus or minus [**1 inch**]. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

Revise "Excavations for Footings and Foundations" paragraph below if footings and foundations are placed on borrow fill.

* + - * 1. Excavations for Footings and Foundations:

Do not disturb bottom of excavation when concrete is to bear on undisturbed soil. Excavate by hand to final foundation bearing grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

Where concrete is to bear entirely on existing rock, remove loose soil and loose rock and place concrete to required lines and grades.

Where concrete is to bear partially on rock and partially on soil, immediately notify the Director’s Representative before any backfilling or concrete placement occurs; the Director’s Representative will determine the correct foundation treatment for the Work.

Retain "Pile Foundations" subparagraph below if required.

Pile Foundations: Stop excavations **[6 to 12]** inches above bottom of pile cap before piles are placed. After piles have been installed, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

* + - * 1. Excavation for Underground Tanks, Basins, and Mechanical or Electrical utility structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus **[1 inch]**. Do not disturb bottom of excavations intended as bearing surfaces.
				2. Excavation for Slabs and Floors: Excavate to the following depths below bottom of concrete for addition of **[Select Granular Material]**:

Interior Floors: **[6 inches]**, unless otherwise indicated.

Exterior Slabs and Steps: **[12 inches]**, unless otherwise indicated.

Retain "Excavations at Edges of Plant-Protection Zones" paragraph below if required.

* + - * 1. Excavations at Edges of Plant-Protection Zones:

Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

Retain first paragraph below to limit damage to roots of valuable trees or delete if not required. Procedure is expensive.

Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

* + - * 1. Excavation for Walks and Pavements: Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
				2. Excavation for Open Ditches: Cut ditches to cross sections and grades indicated.

Coordinate this article with utility Sections in other Divisions.

* + - * 1. Excavation for Utility Trenches: Excavate trenches to indicated gradients, lines, depths, and elevations.

Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line, unless noted otherwise in contract plans.

Trench Width: Excavate trenches to uniform widths to provide 12 inches of clearance on each side of pipe or conduit.

Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells and coupling joints of pipe.

* + - * 1. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
			1. UNAUTHORIZED EXCAVATION

Revise this article to suit Project.

* + - * 1. Fill unauthorized excavation under foundations, wall footings, and retaining walls with [**Select Granular Material**][**concrete fill**]<**Insert Material**>, without altering top elevation of footing, foundation, or wall.

Unauthorized excavations under structural work shall be reported to the Director’s Representative immediately before any backfilling or concrete work commences.

* + - * 1. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavation of the same classification, unless otherwise directed by the Director’s Representative.
			1. SUBGRADE INSPECTION

Retain paragraph below if necessary. Revise locations for proof-rolling in first paragraph below if required; revise type of vehicle and minimum weight to suit Project. Proof-rolling can be used for wide areas, not trenches.

* + - * 1. Notify Director’s Representative when excavations have reached required subgrade and are ready for inspection.
				2. Proof-roll subgrade [**below the building slabs and pavements**] <**Insert locations**> with a pneumatic-tired [**and loaded 10-wheel, tandem-axle]** dump truck[**weighing not less than 15 tons**] <**Insert requirement**> to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

Completely proof-roll subgrade in one direction[**, repeating proof-rolling in direction perpendicular to first direction**]. Limit vehicle speed to [**3 mph**].

* + - * 1. If Director’s Representative determines that unsuitable material is present or that there are soft spots or areas of excessive pumping or rutting, excavate and replace with compacted backfill or fill material as directed.

Have cross section taken, under the supervision of an independent land surveyor, to determine volume of additional excavations.

* + - * 1. Authorized additional excavation and replacement material will be paid for according to Contract provisions for [**unit prices**] [**changes in the Work**].
				2. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Director’s Representative, without additional compensation.
			1. BACKFILL & SOIL FILL
				1. Place and compact backfill in excavations promptly, but not before completing the following:

Revise subparagraphs below to suit Project.

Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.

Surveying locations of underground utilities for Record Documents.

Testing and inspecting underground utilities.

Removing concrete formwork.

Removing trash and debris.

Removing temporary shoring, bracing, and sheeting.

Cutting off top of permanent sheeting or sheetpiling.

Installing permanent or temporary horizontal bracing on horizontally supported walls.

Acceptance by the Director’s Representative of construction below finish grade.

* + - * 1. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
				2. Place fill and backfill on subgrades free of mud, frost, snow, or ice.
				3. Place fill and backfill materials in layers not more than eight inches thick in loose depth, unless otherwise specified. Before compaction, moisten or aerate each layer as necessary to facilitate compaction to the specified density.

Place fill and backfill against foundation walls and in confined areas such as trenches not easily accessible by larger compaction equipment in maximum 6-inch-thick loose depth layers.

For large fill and backfill areas, the layer thickness may be modified by the Director’s Representative, at the Contractor’s written request, if in the Director’s Representative’s judgment, the equipment used is capable of compacting the fill material in a greater layer thickness. This request will include the type and specifications of compaction equipment intended for use.

Delete item below if open graded stone is not included/specified.

For Open Graded Stone/Clean Stone (Item B-12, No. 1 crushed stone, No. 2 crushed stone, etc.) in excess of six inches: Material must be wrapped in separation fabric.

* + - * 1. Concrete Walls

Do not place fill or backfill against concrete walls until the walls have attained 70 percent of their design strength. Place backfill against walls of structures containing basements or crawl spaces only after the first floor structural members are in place and any concrete components of the first floor structural system have attained 70 percent of their concrete design strength.

Prevent wedging action of backfill against structures backfilled on both sides, by placing backfill uniformly around structure so that the elevation on each side never differs by more than 24 inches.

* + - * 1. Foundation Drains

Line pipe trench loosely with drainage geotextile. Lap successive sheets 18 inches.

Place drainage/cushion material a minimum of [**4 inches**] deep under pipe and [**6 inches**] on both sides and over top of pipe.

Completely wrap drainage/cushion material with drainage geotextile.

* + - * 1. Perimeter Insulation: Before the insulation is installed, place and tamp specified backfill to a smooth plane even with the required elevation of the lower surface of the insulation.
				2. Under Exterior Concrete Slabs and Steps:

Up to Subgrade Surface Elevation: Place Selected Fill when fill or backfill is required.

Subbase Material: Place [**12 inches**] of [**Select Granular Material**] <**Insert Material**> over subgrade surface.

* + - * 1. Under Interior Concrete Slabs:

Up to Subgrade Surface Elevation: Place Selected Fill when fill or backfill is required.

Subbase Material: Place [**6 inches**] of [**Select Granular Material**] <**Insert Material**> over subgrade surface.

* + - * 1. Under Pavements and Walks:

Up to Subgrade Surface Elevation: Place Selected Fill when fill or backfill is required.

Subbase Material: Place as indicated.

* + - * 1. Landscaped Areas: Place Suitable Material when required to complete fill or backfill areas up to subgrade surface elevation. Do not use material containing particles over four inches in diameter within the top 12 inches of suitable material.
				2. Utility Trench Backfill

Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

Backfill voids with suitable material while removing shoring and bracing.

Initial Backfill:

Update to suit project conditions.

Soil Backfill: Place and compact initial backfill of Cushion Material to a minimum depth of [**4 inches**] below the bottom, [**12 inches**] to the sides, and to a height of [**12 inches**] over the pipe or conduit.

Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit.

Flowable Fill: Place initial backfill of flowable fill (controlled low strength material) to a height of [12 inches] over the pipe or conduit.

Coordinate backfilling with utilities testing.

Final Backfill:

Soil Backfill: Place and compact final backfill of [**Selected Fill**] soil to final subgrade elevation.

* + - * 1. Backfilling Excavation Resulting From Removal of Unsuitable Material:

Up to Subgrade Surface Elevation: Place Select Granular Material when backfill is needed unless otherwise specified by the Directors Representative.

* + - 1. GEOFOAM FILL

Retain this article only if geofoam is required.

* + - * 1. Place a leveling course of sand, [**2 inches**] <**Insert dimension**> thick, over subgrade. Finish leveling course to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

Place leveling course on subgrades free of mud, frost, snow, or ice.

* + - * 1. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.
				2. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.

Retain paragraph below if a geotextile cover is required for soil separation or to distribute uplift buoyancy.

* + - * 1. Cover geofoam with [**subdrainage**] [**separation**] geotextile before placing overlying soil materials.
			1. SOIL MOISTURE CONTROL
				1. Where fill or backfill must be moisture conditioned before compaction, uniformly apply water to the surface and to each layer of fill or backfill to within [**2 percent**] of optimum moisture content.
				2. Prevent ponding or other free water on surface during and after compaction operations.
				3. Remove and replace, or scarify and air dry, soil that is too wet to permit compaction to specified density. Soil that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to a value which will permit compaction to the percentage of maximum density specified.
				4. When the existing ground surface to be compacted has a density less than that specified for the particular area classification, break up and pulverize, and moisture condition to facilitate compaction to the required percentage of maximum density.
			2. COMPACTION OF SOIL BACKFILLS AND FILLS

Retain one option in paragraph below based on ASTM laboratory-test method required. Replace the term "unit weight" with "density" if preferred. ASTM D698 should be used for projects involving the backfilling of utility lines or the constructing of pavement sections. If the project involves the placement of a significant amount of fill to establish subgrade elevations or the construction of a new building, building addition or retaining wall use ASTM D1557. Note: only chose one.

* + - * 1. Compact soil materials to not less than the following percentages of maximum density according to [**ASTM D698**] [**ASTM D1557**] for the following:

Retain applicable subparagraphs below. Percentages of maximum dry unit weight are examples only; revise to suit Project. Delete scarifying and recompacting existing subgrade when proof-rolling will suffice.

Under structures, including area within 10-ft outside perimeter:[**95**] percent.

Under concrete slabs, steps, and pavements: [**95**] percent.

Under walkways: [**95]** percent.

Under landscaped areas, turf, or unpaved areas: [**90**] percent.

Pipe bedding: [**95**] percent.

Behind retaining walls: [**92 percent**][**As specified on the design drawings**]

* + - 1. RIPRAP PLACEMENT

Delete subparagraph below if separation fabric is not required.

* + - * 1. Do not place riprap over frozen or spongy subgrade surfaces.
				2. Install separation geotextile over properly prepared subgrade.
				3. Spread layer of bedding course prior to placing riprap at depth indicated on Drawings. Prevent mixing of bedding course with subgrade.
				4. Place riprap into position at thickness as indicated on Drawings.
				5. End Dumped: End dump riprap to conform to the lines, grades and thicknesses indicated. End dumped riprap shall be a well graded mass of variable size stones with no areas of uniform size material. Rearrange individual stones, if necessary, by hand or with mechanical equipment to obtain the specified results.
				6. Hand Placed: Hand place riprap with the largest stones placed at the bottom of slope. Align stones to obtain a close fit and to minimize voids. Fill spaces between stones with spalls of suitable size.
			1. GRADING
				1. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

Provide a smooth transition between adjacent existing grades and new grades.

Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

* + - * 1. Rough Grading:

 Interior Grading: Trim unexcavated spaces within the building to levels indicated.

Delete subparagraph below if not required.

Subgrade for Interior Slabs: Compact as specified to receive fill material. Finish subgrade surface within [**1 inch**] above or below level specified for fill required.

Drawings must indicate grading limit line (GLL) if grading is required as work of this contract.

Exterior Grading: Trim and grade area within the Grading Limit Line and excavations outside the limit line, required by this Contract, to a level of [**4 inches**] below the finish grades indicated unless otherwise specified herein or where greater depths are indicated. Provide smooth uniform transition to adjacent areas.

Delete subparagraph below if none.

Slope cut and fill in transition areas, outside of the grading limit line, to meet corresponding levels of existing grades at a slope of 1 vertical to 2 horizontal unless otherwise indicated.

Include subparagraph below for areas to be landscaped as work of this contract.

Landscaped Areas: Provide uniform subgrade surface within [**1 inch**] of required level to receive topsoil thickness specified. Compact fill as specified to within [**3 inches**] of subgrade surface. Remove objectionable material detrimental to proper compaction or to placing full depth of topsoil. If the top [**3 inches**] of subgrade has become compacted before placement of topsoil, harrow or otherwise loosen rough graded surface to receive topsoil to a depth of three inches immediately prior to placing topsoil.

* + - * 1. Subgrade Surface for Walks and Pavement

Shape and grade subgrade surface as follows:

Walks: Shape the surface of areas under walks to required line, grade and cross section, with the finish surface not more than [**1 inch**] above or below the required subgrade surface elevation.

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

Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

Thoroughly compact subgrade surface for walks and pavement by mechanical rolling, tamping, or with vibratory equipment as approved to the density specified.

Delete paragraph below if none.

Shoulders: Place shoulders along edges of filled subgrades to prevent lateral movement. Construct shoulders of [**Selected Fill**] material, placed in such quantity to compact to thickness of each subgrade course layer. Compact and roll at least a 2-foot wide additional layer of each subgrade course.

* + - * 1. Finish Grading:

Edit paragraph below if grading is minimal.

Uniformly grade rough graded areas within limits of the Grading Limit Line to finish grade elevations indicated.

Grade and compact to smooth finished surface within tolerances specified, and to uniform levels or slopes between points where finish elevations are indicated or between such points and existing finished grade.

Delete paragraph below if none.

Grade areas adjacent to building lines so as to drain away from structures and to prevent ponding.

Finish surfaces free from irregular surface changes, and as follows:

Delete or revise subparagraphs below to suit project.

Walks: Place and compact subbase material as specified. Shape surface of areas under walks to required line, grade and cross section, with the finish surface not more than [**1/4 inch**] above or below the required subbase elevation.

Pavements: Place and compact subbase material as specified. Shape surface of areas under pavement to required line, grade and cross section, with the finish surface not more than [**1/4 inch**] above or below the required subbase elevation.

Building Slabs: Grade subbase material smooth and even, free of voids, compacted as specified, and to required subbase elevation. Finish final grades within a tolerance of [**1/4 inch**] when tested with a ten-foot straightedge.

Surfaces To Receive Vapor Barrier: Provide smooth surfaces graded, tamped and/or rolled, entirely free of obstructions or protruding objects.

Spread topsoil directly upon prepared subgrade surface to a depth measuring [**4 inches**] after natural settlement of the topsoil has occurred in areas to be seeded or to receive sod. Perform topsoil spreading operations only during dry weather. Place to greater depth when necessary to adjust grades to required elevations.

Approved existing topsoil within the Grading Limit Line may be used. Provide additional topsoil from outside sources as required.

Finish topsoil surface free of depressions that would trap water, free of stones over 1 inch in any dimension, and free of debris or other objectionable material. Finished surfaces shall conform to the contour lines and elevations indicated on the drawings or as directed by the Director’s Representative.

* + - 1. FIELD QUALITY CONTROL

Retain "Special Inspections" paragraph below if special inspections are required by code. Special inspection may not be necessary for fill less than 12 inches deep or outside of foundation or pavement limits; verify with building code and authorities having jurisdiction.

* + - * 1. Special Inspections: Director’s Representative will engage a qualified Special Inspector to perform the following special inspections:

Determine prior to placement of fill that site has been prepared in compliance with requirements.

Determine that fill material classification and maximum lift thickness comply with requirements.

Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

<**Insert special inspections**>.

* + - * 1. Testing Agency: Director’s Representative will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

Requirements in remaining paragraphs below, if retained, may actually exceed code-required special inspections. Retain first paragraph below if applicable; revise to suit Project.

* + - * 1. Coordinate with and allow testing agency to inspect and test subgrades and each fill or backfill layer; provide testing agency minimum three working days advanced notice prior to all phases of filling and backfilling operations. Proceed with subsequent earthwork activities only after test results for previously completed work comply with requirements.

Retain "Footing Subgrade" paragraph below if applicable; revise to suit Project. If retaining, add other field tests, such as California bearing ratio of subgrades, subbases, and bases for paving, if required.

* + - * 1. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Director’s Representative.

Revise first paragraph below to suit Project.

* + - * 1. Testing agency will test compaction of soils in place according to ASTM D698 or ASTM D1557, as applicable. Tests will be performed at the following locations and frequencies:

Frequencies of testing in "Paved and Building Slab Areas," "Foundation Wall Backfill," and "Trench Backfill" subparagraphs below are examples only; revise to suit Project.

Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every [**2000 sq. ft.**] <**Insert area**> or less of paved area or building slab but in no case fewer than three tests.

Foundation Wall Backfill: At each compacted backfill layer, at least one test for every [**100 feet**] <**Insert dimension**> or less of wall length but no fewer than two tests.

Trench Backfill: At each compacted initial and final backfill layer, at least one test for every [**150 feet**] <**Insert dimension**> or less of trench length but no fewer than two tests.

* + - * 1. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.
			1. PROTECTION
				1. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
				2. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

Scarify or remove and replace soil material to depth as directed by Director’s Representative; reshape and recompact.

* + - * 1. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

* + - 1. DISPOSAL OF SURPLUS AND WASTE MATERIALS

Retain one of two paragraphs below.

* + - * 1. Remove from State property and dispose of excess and unsuitable materials, including materials resulting from clearing, grubbing and removal of existing improvements; soil; trash; and debris.
				2. Transport excess and unsuitable materials, including materials resulting from clearing and grubbing and removal of existing improvements, to spoil areas on State property designated by the Director’s Representative, and dispose of such materials as directed.

Delete paragraph below if removal of topsoil article is not used.

* + - * 1. Transport excess topsoil to areas on State property designated by the Director’s Representative. Smooth grade deposited topsoil.

Retain paragraph below where recycling programs exist, and recycling facilities can accept materials such as concrete or asphalt paving. Coordinate with Section 017419 - Construction Waste Management.

* + - * 1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 310000