

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Complete Earthwork, as shown or specified, including but not limited to the following:
 - a. Clearing and grubbing.
 - b. Stripping topsoil.
 - c. Removing fences and similar aboveground elements; removing or breaking-up walks, pavements and other surfaces not part of building demolition.
 - d. Excavating
 - e. Disposing of waste material
 - f. Stockpiling reusable material
 - g. Dewatering
 - h. Excavation protection
 - i. Filling and backfilling
 - j. Grading
 - k. Stabilizing subgrade
 - l. Slope protection

B. Related Work Specified in Other Sections:

1. Geotechnical Data – Information for Bidders.
2. Soils and Aggregates - Division 2.
3. Underground Electrical Services - Division 16
4. Underground Utility Services - Division 2.

1.2 SUBMITTALS

- A. Furnish submittals for items that are identified in this Section by different typeface and bracketed code (e.g., *Item [L]*). Refer to Division 1, General Requirements for definition of codes for types of submittals and administrative requirements governing submittal procedure.
- B. *Contractor-furnished material [S]*: Submit to -Owner-retained Testing Agency for its analysis and report, in sufficient time so as not to delay progress of Work. Do not submit samples of concrete fill, riprap or lime.
- C. Quality Assurance/Control Submittals
 1. Confirm Topography: before topsoil stripping operations, confirm topography shown on Contract Documents and state in writing acceptance of topography as basis of conditions before this Contract.
 2. Contractor Acceptance of Previous Contract Work: Existing conditions and elevations shown on drawings show work under previous contract and are not considered “as built”

conditions or “as built” drawings. Contractor shall confirm conditions and elevations on Contract Documents and state in writing acceptance of conditions and elevations as basis of conditions before entering into this Contract.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements

1. For work done on public property, comply with requirements of governmental authorities having jurisdiction.

1.4 PROJECT CONDITIONS

A. Existing Conditions

1. Drawings show physical dimensions, existing levels and general topography of site, with subsurface obstructions, existing underground utilities and similar items being shown where known.
2. Locations of existing underground utilities and subsurface obstructions are shown using best information available but with no representation that shown locations are accurate or that lines other than shown may not be present. Refer to heading “Protection” for details of requirements of identification and locations of these utilities.
3. Information pertaining to existing conditions is offered to help in evaluation of Work, but with no specific representation, either expressed or implied, about completeness or accuracy. Contractor shall be responsible for deductions or conclusions made based on this information and that of any additional site inspections, if made.

B. Sequencing, Scheduling

1. Use of explosives is prohibited.
2. Take measures to prevent incorporation of excessive water into soil. Take appropriate measures to control dust and dirt, both windblown and from machine moving operations. Do not place fill over frozen subgrade or that covered with ice, snow or water.
3. If earthwork operations are stopped for winter or other extended period, slope surface to provide run-off and provide temporary ditches and other drainage facilities to prevent water ponding.
4. If any unidentified water conditions are encountered, or if conditions caused by rain, affect these operations or schedule of Work, notify Registered Design Professional. Registered Design Professional will give directions on procedure.

C. Cold Weather Operations

1. Schedule Work to avoid earthwork operations under cold weather conditions. Obtain written approval from Owner before conducting earthwork operations at temperatures below 32 degF. Do not use frozen fill material.
2. The following shall apply to approved earthwork operations between 15 degF and 32 degF:
 - a. Sequencing, scheduling:
 - 1) Schedule removal of snow, topsoil, so that subgrades do not freeze before starting filling operations.

- 2) Schedule continuous earthwork operations to prevent freezing.
 - 3) When earthwork operations are stopped at end of workday or are interrupted for any other reason for an extended period, place an insulating layer of soil over exposed subgrade. Remove insulating layer before resuming earthwork operations.
 - 4) Stockpile frozen reusable materials for reuse after thawing.
 - 5) If compaction operations are stopped because of changes in weather conditions, roll and slope surface to provide runoff. Do not operate equipment over these surfaces until they are dry enough to prevent rutting and remolding of top 8 inches.
- b. Frozen surfaces:
- 1) Do not place fill over frozen material.
 - 2) Remove frozen material and stockpile for future use after thawing.
- c. Materials:
- 1) Within limits of Structures. Type GM-2 per Division 2, Soils and Aggregates.
 - 2) Elsewhere. Per Division 2, Soils and Aggregates. If Type E is allowed but unfrozen material is not available, substitute Type GM-2 free of ice and frozen clods.
3. When temperature is less than 15 degF. Earthwork is not allowed.
 4. Protection of foundations and similar structures. Provide sufficient earth cover or heating to prevent heaving or freezing under or around bearing surfaces.
- D. Finishing of Spoils Area: Once spoils area is no longer required, area shall be compacted, graded and by other means as necessary in order to develop proper natural drainage of spoils area and adjacent areas. Miscellaneous construction debris shall be removed before grading and compacting sequences occur. Provide smooth transition from existing to new grades.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Concrete Fill. Normal weight concrete, of 2000 psi - 28-day strength, per ASTM C 94, "Standard Specification for Ready-Mixed Concrete".
- B. Earth. Refer to Division 2, Soils and Aggregates.
 1. Local pockets of material that are substantially different in character from surrounding soil may be unsatisfactory for use as earth fill under certain climatic conditions or geological formations. Do not use these materials without approval of Registered Design Professional.
- C. Aggregates: Refer to Division 2, Soils and Aggregates.
- D. Topsoil. Refer to Division 2, Soils and Aggregates.
- E. Unsuitable Material. Refer to Division 2, Soils and Aggregates.

- F. Riprap. Refer to Division 2, Soils and Aggregates.
- G. *Silt Fence [P]*: Prefabricated fabric panels (3' x 100') with 1 ¼" hardwood posts at 8' intervals.
 - 1. JDR Enterprises, Inc., "Silt Lok 36-300P"
 - 2. Mirafi, Inc., "Silt Fence with Pockets".
- H. Provide temporary seeding cover of topsoil, and fertilize seeded areas in accordance with requirements of State Highway Specifications. Place seed at earliest time possible to ensure proper germination and growth, and at rates previously specified. Apply seed using mechanical seeders, or by hydro-seeder spraying method. After seeding, mulch with hay or straw at rates of 2.5 to 3.0 tons per acre.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Confirm Topography: before topsoil stripping operations, confirm topography shown on Contract Documents and state in writing acceptance of topography as basis of conditions before this Contract.

3.2 PREPARATION

- A. Protection
 - 1. Maintain in service and protect from damage existing utilities that are to remain.
 - 2. Before commencing any site operations, contact municipal service departments, service companies and other utilities affected, and arrange to have lines that are within Work Area accurately located and identified with appropriate surface markers. Locate and identify lines adjacent to or extending across Work Area and mark on record document drawings.
 - 3. Conduct operations to insure safety of persons and to prevent damage to existing structures, pavements and utilities, trees and other vegetation to be left in place, construction in progress, and other property.
 - 4. Conduct operations and move materials to stockpile or disposal areas to ensure minimum interferences with operations of others, private and public.
 - 5. Do not close or obstruct streets, walks, and other facilities occupied and used by Owner or public, without prior written permission.
- B. Clearing And Grubbing
 - 1. Clear Site, within Work Area as shown for construction operations. Remove trees, shrubs and other vegetation, except individual items shown to remain.
 - 2. Cut off standing trees and other vegetation at ground surface. Remove downed timber, logs and other vegetation resting on or partially embedded in ground surface, brush, weeds, undergrowth, rubbish and other debris.
 - 3. Remove stumps. Remove roots of 1/4 inch diameter or larger, organic or metallic debris embedded in ground, to depth of not less than 8 inches below existing ground or finished

grade if grade change is shown. Do not use grubbing equipment within drip line of trees shown to remain.

4. For trees left standing, trim dead branches. Trim live branches to heights and shape to retain natural proportions. Cut trimmed branches close to tree trunks or main branch. Seal cut surfaces with emulsified asphalt coating specially formulated for horticultural use.
5. Protect trees left standing against damage, including unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering by stockpiling materials or parking of vehicles within drip line.
6. Coat cut or abraded surfaces of branches, trunk or roots with an emulsified asphalt coating specially formulated for horticultural use. Temporarily cover exposed roots with wet burlap to prevent drying out of roots and provide earth cover as soon as possible.
7. Repair or replace trees left standing that are damaged by Contract operations, at no additional cost to Owner. Only an established approved tree surgeon shall perform tree damage repair.

C. Stripping Topsoil

1. Strip surface grass and weeds vegetation, including roughly 1 inch of soil. Dispose of as waste material.
2. Strip topsoil, as defined "For Removal" in Division 2, Soils and Aggregates, in areas of earthwork operations. Strip to depths encountered. Strip in manner to prevent intermixing with, or removal of, underlying soil or objectionable materials.
3. In fill areas that are inside building wall lines (Interior Areas), strip topsoil to depths directed by Registered Design Professional. Stockpile or dispose of greater depth of topsoil at no additional cost to Owner and as designated for "Topsoil For Removal". Term "inside building wall lines" includes areas within graded area that are designated for present or future buildings.
4. In fill areas, topsoil layers of 2 inches or less depth, after surface vegetation is stripped, may be left in place if approved by Registered Design Professional.
5. Stripping of surface vegetation may be combined with stripping topsoil, except for stripping of "Project-usable" TOPSOIL as defined in Division 2, Soils and Aggregates.
6. The depth of removal is expected to be 4 inches on an average basis over entire area stripped. Additional removal, or directed by Registered Design Professional, will be paid for per unit price provisions of Contract Documents.

D. Method Of Measurement

1. The quantities of (additional) topsoil removal shall be number of cubic yards of material in original position, measured by method of average end areas.
2. Volumetric quantities of (additional) topsoil removal shall be computed from cross section measurements provided by professional agencies retained by Owner. Notify Registered Design Professional sufficiently before each operation so that cross section elevations and measurements of ground surface may be taken.

3.3 CONSTRUCTION

A. Excavating

1. The construction methods specified are not intended to be completely detailed. Perform Work and provide properly functioning systems per applicable codes, manufacturer's instructions and best-accepted safe work practices.
2. Remove, haul, and dispose of materials and obstructions encountered. Remove obstructions within lines of construction, or that would interfere with construction. Obstructions include metallic, concrete, wooden or masonry debris, boulders up to 1/2 cubic yard, tree roots and similar items.
3. Excavate to levels required for bottoms of footings, walls, subgrade, underfloor fills, slabs laid on ground, utilities, storage tanks, and similar items. Excavate to extent necessary to provide excavation protection as specified under heading "Excavation Protection". Provide space to permit form placing, inspection of work, support system, waterproofing, and other underground work adjacent to construction. Where permitted, excavate to footing lines; otherwise, allow for form placement and removal.
4. At load-bearing elevations or subgrade, remove unsuitable materials disclosed below these elevations as defined in Division 2, Soils and Aggregates. Under footings and foundations, fill resulting void with Concrete Fill; under slabs and paving, fill resulting void as specified in Division 2, Soils and Aggregates. Footings and foundations shall bear on firm soil capable of supporting loadings. If satisfactory bearing capacity is not found at bearing elevations shown, deepen, or enlarge excavations. Excavation, and fill, beyond limits shown, when authorized, will be considered as Changes In Work and will be paid for by Owner. However, if excavations are carried beyond limits shown, without authorization, or unsatisfactory conditions occur due to Contractor's operations, Contractor shall fill voids with one of materials specified above, at his own expense.
5. Protect active utilities within work areas. Immediately notify Registered Design Professional of any utilities encountered that are not shown.
6. Store on Project Site where shown or directed, excavated material suitable and approved for backfill, fill, and rough grading. Remove unsuitable material and excess suitable material from Project Site. Provide additional fill material, if required and if no Owner-furnished borrow area is indicated.
7. Trim, level and clean excavations just before placement of later work. If bottom of continuous footings are at different elevations, step excavation where soil permits, or slope if necessary. Later work shall not be performed until soil conditions have been approved.
8. Excavate for underground piping systems and utility lines, including civil/site, mechanical, and electrical systems. Excavate trench bottoms to 4" below bottom of pipe to allow for bedding material.
9. Saw cut at pavement removals.

B. Disposing Of Waste Material

1. Haul, and dispose of, waste material, debris, rubble, and excess excavated material, other than that defined as Earth and Topsoil in Division 2, Soils and Aggregates, to designated spoils area on Owner's property.
2. Divert construction and demolition debris from disposal in land fills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect

reusable materials to appropriate sites. Construction Waste Management shall comply with LEED version 2.2, MR Credit 2.1

C. Project-Usable Material

1. Stockpile Project-usable Topsoil in designated area clear of new construction operations, separate from other stockpiled soils to prevent intermixing. Shape pile so that surface water drains freely and to minimize wind erosion.
2. Haul and stockpile excess excavated material defined as Earth and Project-usable Topsoil, to stockpile areas on Owner's property as designated. Segregate stockpiles of Earth and Project-usable Topsoil to prevent intermixing and contamination.
3. Provide temporary seeding cover of topsoil, and fertilize seeded areas in accordance to requirements of State Highway Specifications. Place seed at earliest time possible to ensure proper germination and growth, and at rates previously specified. Apply seed using mechanical seeders, or by hydro-seeder spraying method. After seeding, mulch with hay or straw at rates of 2.5 to 3.0 tons per acre.

D. Dewatering

1. Maintain positive, free-draining drainage within Work area. Arrange site excavation and fill work to avoid obstructing natural flow of water away from areas of work. If necessary, provide temporary drainage ditches or temporary pumping to existing drainage facilities on or off site. Fill temporary drainage ditches as necessity is reduced.
2. Provide temporary drainage to keep excavations free from water until permanent construction is in place, backfilling is completed, and building drains are operating and capable of maintaining drainage. Submit proposed method of dewatering that includes points of discharge to Registered Design Professional and Owner's Representative for approval before implementation. Provide systems required by site conditions. Operate pumps and other water moving systems to accomplish above 24-hours per day.

3.4 PROTECTION

- A. Provide excavation protection to support earth banks for excavations, including trenches, and to protect existing structures, services and utilities.
- B. Excavation protection shall include angle of repose of soil or shall include support systems, based on site conditions and the following factors:
 1. Depth of cut and type of soil.
 2. Water table and variations in its extent while excavation is open.
 3. Anticipated changes in material attributable to exposure to air, sun, water or freezing.
 4. Load imposed by structures, equipment, overlying or stored material or adjacent traffic.
 5. Vibration from traffic, equipment, demolition or construction operations.
 6. Space allowed for excavations.
- C. Design and provide support systems of required strength, rigidity and spacing to suit site conditions, and in quantities to maintain project schedules.
- D. Support system may include, but not be limited to:
 1. Bracing

2. Cribbing
3. Sheet piling
4. Shoring
5. Stringers
6. Tie rods or tie backs
7. Tight sheeting
8. Trench jack
9. Trench shield
10. Underpinning
11. Uprights

- E. Maintain support systems in place until immediately before filling or backfilling operations. Remove support system in stages as filling or backfilling progresses. Parts of support system may be left in place up to 2 feet below finished grades where shown on contract drawings or approved in writing by Registered Design Professional.

3.5 QUALITY CONTROL - PROOFROLLING

- A. Proof roll areas to be paved or surfaced, and areas within building footprint to 10 ft. outside of building wall lines.
- B. Remove soft or unstable areas disclosed by proof rolling and fill as specified in Division 2, Soils and Aggregates. Material removed may be reused if it meets requirements of Division 2, Soils and Aggregates and other applicable requirements.
- C. Proof roll with at least one pass of equipment, with perpendicular passes for thorough coverage. Use (fully loaded single axle dump truck) (smooth steel drum vibratory compactor with minimum static weight of 3,000 lbs. and minimum dynamic force of 10,000 lbs.) (50-ton rubber tired roller). Arrange observation of proof rolling by Testing Agency.
- D. Where basements and voids remain because of demolition operations, fill these areas per Division 2, Soils and Aggregates. Grade fill surface to blend in with adjacent grades and to provide surface water drainage.

3.6 FILLING AND BACKFILLING

A. General

1. Schedule filling and backfilling operations to expedite construction progress and to maintain positive site drainage. Backfill adjacent to walls only after walls have attained minimum strength equal to 80% of design strength and no earlier than seven days after placing of concrete. Backfill after work has been inspected and approved by Registered Design Professional. Backfill both sides of retaining and grade walls at same time. Backfill at building walls after first floor slabs are in place, or if walls are properly braced, when there is a basement. Backfill in manner to prevent excessive pressure against or damage, including hydraulic, to adjacent work. Any resultant damage shall be corrected at Contractor's expense.
 - a. Fill required in areas scheduled to receive piles or machine-drilled piers shall be placed and compacted before installation of piles or machine-drilled piers.
 - b. In areas designed to have utilities, including sewers, where fill is also required, place and compact fill before placement of utilities or sewers.
2. Spread fill and backfill in uniform horizontal layers, filling holes and low areas first. Thickness of layers shall be as specified in Division 2, Soils and Aggregates.
3. Plow, step, bench, or break up sloped surfaces steeper than 4 horizontal to 1 vertical so that fill can bond with existing material.
4. Except as indicated, provide minimum 6-inch aggregate base under concrete slabs on grade.
 - a. Place vapor barrier at bottom of aggregate base. Lap joints of underlayment sheets 6 inches minimum, and 9 inches onto adjacent vertical surfaces, and seal vapor-tight. Seal underlayment around penetrations, and at damaged areas to maintain vapor-tight seal. Do not puncture underlayment during construction operations.
5. Compact each layer before placing succeeding layers. Provide compaction equipment of type best suited to achieve compaction specified for type of soil used. Use particular care to prevent "bulking" of fine granular fill. Terminate fills in true planes at correct elevations.

B. Materials And Compaction

1. The materials to be used and required compaction for each type of construction shall be as defined and specified in Division 2, Soils and Aggregates.

3.7 GRADING

- A. Grade areas to receive fill and backfills to levels indicated, as specified in Division 2, Soils and Aggregates.
- B. Remove unsuitable material, vegetation, rubbish and debris from areas to be filled.
- C. Rough grade landscaped areas, place TOPSOIL as specified in Division 2, Soils and Aggregates and smooth-finish grade to required elevations. Finish-grade other areas to finish grades, lines and elevations indicated. Finish-grade areas used for temporary construction facilities when use is terminated.

- D. Slope earth away from building walls. Finish grades not otherwise shown shall be uniform levels or slopes between given points or between given points and existing grades. Provide rounding at top and bottom of banks and at other breaks in grades. Rough grade to within 0.1 foot; finish grade to within 0.05 foot, of required slopes, grades and elevations.

3.8 SLOPE PROTECTION

- A. Lay riprap to extent shown, starting at low points and working up slopes. Place riprap individually, firmly embedding each piece into substrate and against adjacent pieces. Use small pieces to fill in voids between larger pieces. Finished surface shall not deviate from elevations or slopes shown, in any direction, within tolerances of plus or minus 1 inch when measured with 10-foot straightedge. Grout joints with mixture of 1 part portland cement and 3 parts sand, using clean water.
- B. Place 2500 psi concrete paving to extent shown, per Division 3, Cast-in-Place Concrete. Install Joints in paving at 10 feet on center unless otherwise shown.

3.9 AGGREGATE SURFACE

- A. Install as indicated. Compact per Division 2, Soils and Aggregates.

3.10 AGGREGATE SHOULDERS

- A. Install as indicated. Compact per Division 2, Soils and Aggregates.

END OF SECTION

| Revision History | |
|------------------|----------|
| Date | Rev. No. |
| A | 0 |
| B | 0 |
| C | 0 |
| D | 0 |
| E | 0 |
| F | 0 |
| 02-19-09 | 0 |
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