

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 Description

A. Scope:

1. Under this Section, the Contractor shall make all necessary excavations for pits, piping and structures and for all required or ordered purposes incidental to the work; shall backfill such excavations to the extent necessary; shall dispose of all excess materials and shall do miscellaneous grading.
2. Earthwork required under other Contracts (if applicable), if any, shall be included under that Contract and shall conform to all applicable requirements of Section 02200.
3. All such work shall be done as indicated on the Drawings and as herein specified at no additional cost to the Owner; except as/if specifically covered in other sections.
4. Excavation shall include the removal, storage, segregation, handling, rehandling, refill and disposal of any and all materials of whatever nature encountered in the work and shall include all dewatering and sheeting and bracing.
5. Only the use of light excavating machinery will be permitted, except in places where operation of same will cause damage to adjacent property, utilities, structures or completed work, in which case hand methods shall be employed.
6. The program of excavation, sheeting and bracing shall be carried out in such a manner as to prevent undermining or disturbing the foundations of existing structures or of work previously completed under this contract.
7. All excavation shall be made in the dry.

1.2 Submittals

A. Disposal Sites:

1. List of disposal sites for unsuitable materials and all required permits for use of the sites.

B. Manufacturer's Data:

1. Submit for approval manufacturer's specifications, performance characteristics and operating instructions for the compaction equipment.

1.3 Accessibility

- ##### A. The Contractor shall maintain the site in such condition that all the employees of the Owner may conduct their work without interference.

1.4 Lines of Excavation

- ##### A. All excavations shall be made in such manner and to such widths as will give ample room for properly building and inspecting the structures and piping they are to contain, for such sheeting and bracing, as may be necessary, and for application of damp-proofing if required.
- ##### B. When excavating for structural work, special care shall be taken not to disturb the bottom of the excavation and the final removal of material to subgrade shall not be made until just before concrete is placed.

1.5 Quality Assurance

- ##### A. Permits and Regulations: Contractor shall perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- ##### B. Design Criteria:
1. All steel work for sheeting, shoring, bracing and other related Work shall be in accordance with the provisions of the AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", except that field welding will be permitted.
 2. Contractor shall be wholly responsible for installing and operating the system used to accomplish the sheeting and bracing if shown or otherwise required.
- ##### C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. ASTM A 328, Steel Sheet Piling.
 2. ASTM D 422, Particle-Size Analysis of Soils.
 3. ASTM D 698, Moisture-Density Relations of Soils, using 5.5 lb (2.5 kg) Rammer and 12-inch (304.8 mm) Drop.
 4. ASTM D 1556, Density of Soil in Place by the Sand-Cone Method.

1.6 Protection of Persons and Property

- ##### A. Barricade open excavations occurring as part of this Work and post with warning lights. Contractor shall provide "Jersey" type concrete barriers with reflective tape where shown on the contract drawings or required by OSHA, or the agency having jurisdiction. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
- ##### B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by contractor's operations.
- ##### C. Consult Engineer and obtain his approval before removing, trimming, or disturbing trees, shrubs, plants, fences, rails, walks, structures or other facilities that are encountered on the line of the excavation.
- ##### D. Structures, utilities, sidewalks, pavements and other facilities removed or disturbed shall be replaced to their original condition, unless otherwise shown, specified or directed.
- ##### E. Dust Control: Contractor shall conduct all of his operations and maintain the area of his activities, including sweeping and sprinkling of roadways, so as to minimize creation and dispersion of dust. In addition, Contractor shall be responsible for controlling dust caused by his operation of vehicles and equipment, clearing or for any reason whatever.
- ##### F. Odor Control: As an odor abatement measure, cover, at the end of each work day, all areas of organic or odorous material which were exposed during excavation with a minimum 6-in and a maximum 24-in deep of clean fill. Excavated organic or odorous material shall be immediately removed off-site and shall not be stockpiled on-site.
- ##### G. Roadways and Walks: Unless otherwise approved by Engineer, excavated material and materials of construction shall be so deposited, and the Work shall be so conducted, as to leave open and free for pedestrian traffic all cross-

walks, and for vehicular traffic a roadway not less than 10 feet in width. All hydrants, valves, and other facilities which may require access during construction shall be kept accessible for use. During the progress of the Work, Contractor shall maintain such crosswalks, sidewalks, and roadways in satisfactory condition and the Work shall at all times be so conducted as to cause a minimum of inconvenience. Temporary bituminous macadam (2-inch minimum) shall be installed at all disturbed sidewalk areas until such time as the final restoration is performed.

PART 2 - PRODUCTS

2.1 Segregation of Excavated Materials

A. General:

1. All materials removed by excavation shall be stockpiled and tested for gradation and compaction (relative density), by the Contractor for the presence of any unsuitable materials (e.g., organics, silts or clays) or unsuitable materials (e.g., debris from prior construction).
2. Locations of these stockpiles shall be subject to the approval of the Engineer. The stockpiles shall be segregated by approved use (i.e., Topsoil, Select Fill, General Fill), and shaped to drain.
3. Unsuitable material shall be immediately removed from the Owner's property and the project site and disposed of by the Contractor in an acceptable disposal site. Contractor shall furnish appropriate manifests for disposal, to the Engineer.
4. Selection of material for each classification shall be at the direction of the Engineer.
5. Surplus excavated material, either unsatisfactory for or over and above that required for backfilling or regrading shall be disposed of by the Contractor, at his own expense, off the site of the work.
6. All materials removed by excavation (excluding paving, concrete, etc.) shall be reused as General or Select Fill, unless found to be unsuitable or unusable.
7. Local, deeper excavations should be made, as required for construction.
8. Local dewatering should be made, as required for construction.
9. Compaction criteria for stockpiled material reused in construction shall be based upon tests made on materials taken from stockpile.
10. Compaction criteria shall be the highest dry unit weight and corresponding moisture content, as determined by the following tests:

Location	ASTM-D1557	or	ASTM-D4253/4
Below structures and pipe	98%		85%
All other areas	95%		80%

B. Select Fill:

1. Where quantity of on-site fill material is not sufficient, additional select fill shall be provided by the Contractor as ordered by the Engineer and shall meet the following requirements:

Sieve Size	Percent Passing
1"	100
#4	60-95
#20	35-85
#60	10-30
#100	5-15
#200	less than 4

2. Materials for select fill shall consist of well drained on-site or off-site material, free of clay, mud, frost, organic matter or construction debris.
3. Select Fill shall be used to backfill around pipe (except as otherwise specified) and under structures, and as shown on the Plans or directed by the Engineer.
4. Unless otherwise specified, directed by the Engineer or shown on the Plans, Select Fill shall be placed in compacted lifts of 6" maximum thickness and compacted by means of a mechanical tamper to at least 98% dry density (ASTM-D1557) or 85% (ASTM-D4253/4).
5. All controlled backfilling shall be performed with Select Fill obtained either from excavated material or from outside sources.
6. Payment for Select Fill from Outside Sources to be used in backfilling shall be included in the Contractor's unit price bid for "Select Fill from Outside Sources."

C. General Fill:

1. Material for General Fill shall be acceptable for backfill in areas other than under structures and piping as shown or directed.
2. The selection of material for General Fill and the location for its use shall be as shown on the plans and as directed by the Engineer.
3. It shall consist of clean, compactible sound granular material free from rubbish or other unsuitable material.
4. Unless otherwise specified, directed by the Engineer or shown on the plans, general fill shall be placed in compacted lifts of 12" maximum thickness and compacted by means of a mechanical tamper to at least 95% dry density (ASTM-D1557) or 80% (ASTM-D4253/4).

D. Unsuitable Material:

1. Material unsuitable for use in backfilling are clay, boulders, peat, construction debris, organics and any other material so designated by the Engineer.
2. Stockpiling of Unsuitable Material shall not be permitted.
3. Unsuitable Material must be promptly removed from the site and disposed of by the Contractor, at his own expense, off the site of the work.

E. Excess Material:

1. Any excavated material not required for use in the project shall become the property of the Contractor and shall be removed by him from the site.

F. Crushed Stone: Crushed rock conforming to the following gradation:

Sieve Size	Percent Passing
2"	
1 1/2"	0-10
1"	30-65
3/4"	85-100
3/8"	95-100

2.2 Sheeting and Bracing

- A. The Contractor shall be required to use sheeting and bracing (temporary support system) on this project, where conditions or laws require it. All costs for sheeting shall be included in the lump sum price bid. The temporary support system shall be designed by a licensed professional engineer (NYS) engaged by the Contractor.
- B. The Contractor shall furnish, put in place, and maintain such sheeting, bracing, etc., as may be necessary to prevent groundwater from penetrating into the excavation and to support the sides of the excavation to prevent any movement of earth which could in any way diminish the width of the excavation to less than that necessary for proper construction, or could otherwise injure or delay the work, or endanger adjacent structures, or embankments. All sheeting shall be adequate and conform to the provisions of the current New York State Industrial Code Rule 23 as established by the New York State Department of Labor, Board of Standards and Appeals, as well as all appropriate State and Federal regulations including OSHA.
- C. The Contractor shall leave in place any sheeting, bracing, etc., which the Engineer may direct him in writing to leave in place, at any time during the progress of the work, for the purpose of preventing injury to structures or property. Payment for timber sheeting left in place shall be included in the lump sum price bid. Where steel sheet piling is utilized as specified in Section 02350, and the sheeting is ordered left in place by the Engineer, it shall be paid for under the unit price bid for "Sheeting Ordered Left in Place."
- D. The Engineer may direct that timber used for sheeting and bracing be cut off at any specified elevation.
- E. All sheeting and bracing not to be left in place shall be carefully removed in such manner as not to endanger the construction or other structures. All voids left or caused by the withdrawal of sheeting shall be backfilled immediately with select fill and compacted by ramming with tools especially adapted to the purpose, by watering, or by other means as may be directed.
- F. Vibrating type hammers shall not be permitted. Any material which stops the installation of sheeting shall be removed by the Contractor.
- G. Wood Sheeting: New or used timber meeting the requirements for Douglas Fir Dense Construction grade or Southern Pine No. 2 Dense S3.
- H. Steel Sheeting: Steel conforming to ASTM A328. Steel for soldier piles, wales and braces may be new or used and shall conform to ASTM A36.
- I. Safe and satisfactory installation of the sheeting shall be the entire responsibility of the Contractor.

2.3 Removal of Water

- A. The Contractor's attention is directed to the fact that some of the work may be below groundwater, perched water, etc. Therefore, the need for an adequate and well planned dewatering system may be necessary to allow excavation and construction to be performed in a dry suitable environment.
- B. The Contractor, at all times during construction, shall provide and maintain ample means and suitable equipment, consistent with conditions encountered, with which to promptly remove and properly dispose of all water entering excavations or other parts of the work. All excavations

shall be kept dry at all times until the structures to be built or pipelines to be installed therein are completed and backfilled to approximate final grades except where otherwise approved by the Engineer in writing. Concrete for structures, pipe and sanitary structures shall be placed on subgrades which are dry. Water shall be disposed of in a suitable manner so as to avoid damage to adjacent property, existing structures and all work under construction. It shall be the Contractor's responsibility to prevent flotation of any structures during construction.

- C. Systems used to lower the groundwater level shall be maintained in operation continuously, 24 hours a day, 7 days a week, until the structures are completed adequately to prevent flotation. Termination of the dewatering operation shall receive approval of the Engineer.
- D. No additional compensation will be given to the Contractor because of damage from flooding caused by groundwater or surface waters rising above ground elevations.
- E. The Contractor shall be responsible for obtaining and adhering to all provisions of necessary dewatering permits at no additional costs to the Owner. Groundwater shall not be permitted to be discharged into storm drains or surface waters without proper approval from regulatory agencies.
- F. Dewatering system shall be installed as required to lower the groundwater level in general excavation at least 2 feet below final subgrade.
- G. Prior to installing and operating any dewatering system, the Contractor shall install a series of observation wells and monitor same for a minimum period of two working days in order to determine the groundwater level at the time of construction. The observation wells shall be located both within and adjacent to the proposed construction site. Observation wells located within the limits of the proposed construction site shall be situated outside of the physical limits of the structures and protected from damage. Any damaged observation wells shall be replaced or repaired. During construction, the water level in the observation wells shall be measured and recorded periodically. During start-up, the water levels shall be read a minimum of once each day and reported to the Engineer. After start-up, the water levels shall be read a minimum of once each week.

2.4 Unauthorized Excavation

- A. Whenever the excavation is carried beyond or below the lines and grades shown on the plans, or given by the Engineer, the Contractor shall at his own expense, refill such excavated space with select fill as directed by the Engineer.

PART 3 - EXECUTION

3.1 Protection of Existing Facilities

- A. The Contractor shall protect all existing facilities, utilities, etc. which are to remain in service from damage due to his operations throughout the duration of the work. Facilities which are to be replaced during the course of the Contract shall be protected until the Engineer gives notice that they are no longer required to be in service.
- B. Facilities which must be protected include but are not limited to utilities, adjacent structures/houses, building, tanks, piping, manholes, valves, etc. Prior to execution of the

work, the Contractor shall check and verify governing dimensions and elevations. The Contractor and Engineer shall jointly survey the condition of adjoining structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims.

- C. The Contractor shall not use machinery which threatens the integrity of existing facilities or facilities under construction. When the machinery in use threatens the integrity of such facilities, the Contractor shall use other machinery or do the work by hand. Any damage resulting from improper equipment use shall be repaired at the expense of the Contractor.
- D. The Contractor shall immediately repair or replace any facilities which are damaged by his operations. Repairs or replacement, etc. shall be made to current standards of the Owner.
- E. All existing electric conduits, lighting poles, telephone lines, chains, fences or other structures especially including underground process piping which are encountered or uncovered by the excavation and which do not, in the opinion of the Engineer, require to be changed in location, shall be carefully supported and protected from injury by the Contractor and if damaged or removed, they shall be restored by the Contractor, without compensation, to at least as good condition as that in which they were found immediately before work was begun.

3.2 Excavation

A. Pipeline Excavation:

- 1. Pipe trenches shall be excavated below the pipe bottom by an amount sufficient for placement of the pipe bedding shown on the drawings and as specified.
- 2. Trench width shall be minimized to greatest extent practical but shall conform to the following:
 - a. Sufficient to provide room for installing, jointing and inspecting piping, but in no case wider at top of pipe than pipe barrel outside diameter plus 2 feet (5 foot wide maximum).
 - b. Enlargements at pipe joints may be made if required and approved by Engineer.
 - c. Sufficient for sheeting, bracing and sloping.
 - d. Sufficient to allow thorough compacting of granular embedment adjacent to bottom half of pipe.
 - e. Do not use excavating equipment which requires the trench to be excavated to excessive width.
- 3. At road crossings, trenching width shall be minimized by the use of sheeting, trench boxes or similar protection methods.

B. Structure Excavation:

- 1. Excavation shall be made to the grades shown on the Contract Drawings and to such widths as will give suitable room for construction of the structures/manholes, for bracing and supporting, pumping and draining. The bottom of the excavations shall be rendered firm and dry and in all respects acceptable to the Owner.
- 2. Excavation shall be accomplished by methods which preserve the undisturbed state of subgrade soils. For structures having multiple bearing levels or adjacent structures at different levels, excavation and foundation construction shall first be accomplished at the lowest levels to prevent undermining foundations and disturbing adjacent bearing soils at higher levels.

- 3. Excavation equipment shall be satisfactory for carrying out the work in accordance with the Specifications. Earth shall not be plowed, scraped, or dug with machines so near to the finished subgrade as to result in excavation of, or disturbance of material below grade.
- 4. When excavation for foundations has reached final depths, the Engineer shall be notified and will inspect conditions. If materials and conditions are not satisfactory to the Engineer, the Engineer will issue instructions as to the procedures for correction of the unsatisfactory condition.
- 5. During final excavation to subgrade level, take precautions required to prevent disturbance of material. Hand excavate the final 6-in as necessary to obtain a satisfactory undisturbed bottom.

3.3 Preparation of Subgrades

A. Subgrade for Reinforced Concrete Structures:

- 1. Provide a minimum of 12 inches of crushed stone below the bottom slab of structures and manholes.

B. Subgrade for Pipe:

- 1. Undisturbed subgrade and 6 inches of crushed stone acceptable to the Engineer.

C. Unsuitable Subgrade:

- 1. When clay or other material incapable of supporting the loads to be imposed is encountered at or near the subgrade elevation of any pipe or structure, the Contractor shall remove such material and replace it with Select Fill unless otherwise directed.

3.4 Controlled Backfilling

- A. Backfill under structures, pipes, sidewalks and roads shall be performed with Select Fill either from stockpiled material or from outside sources.
- B. Should the excavated material not be suitable or if more select fill is required than excavated, select fill shall be brought in from outside sources. Payment shall be included in the lump sum price as bid.
- C. Filling against the walls of structures shall be done as ordered and particular care shall be taken to prevent damage to green masonry by falling, rolling or sliding material.
- D. Fill shall not be placed against walls until they have attained sufficient strength to safely resist the thrust of the material.
- E. Backfill shall be placed in horizontal layers and compacted as indicated elsewhere in this specification.
- F. Backfilling shall not be made during freezing weather. It shall not be made with frozen material or when materials already placed are frozen.
- G. If any of the backfilling shall settle so as to be below the required levels for the proposed finished surface at any place before the final acceptance of the work to be done under this Contract, the Contractor shall, bearing expense and cost, supply additional materials and build up the low places as directed.
- H. A testing laboratory approved by the Engineer, shall be employed by the Contractor to perform all density tests and sieve analysis to certify the specified compaction and quality of material. Costs of tests shall be borne by the Contractor. If the tests indicate unsatisfactory compaction, the Contractor shall provide the additional compaction necessary to obtain the specified degree of compaction. All

additional compaction work shall be performed by the Contractor at no additional cost to the Owner until the specified compaction is obtained. This work shall include complete removal of unacceptable fill areas and replacement and recompaction until acceptable fill is provided, as determined by the Engineer.

3.5 Grading

- A. Areas to be graded shall be constructed true to grade, shall be shaped to drain, and shall be maintained free from extraneous accumulations until final inspection has been completed and the work has been accepted.
- B. Finished grade elevations shall be as shown on the Contract Drawings and as directed by the Engineer.
- C. Pavement, gutters, curbs, walks, driveways and roadways disturbed or damaged by the Contractor's operation shall be restored or replaced by him as specified or as shown on the contract drawings or to original or better condition.