SECTION 312000

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Furnishing all materials, labor, supervision, tools, equipment, tools, and performing all operations and incidentals necessary for earthwork.

2. Earthwork activities include but are not limited to subgrade preparation, excavating, backfilling, and compaction for structures and foundations, pavements, sidewalks, landscape areas, and utilities. The Contractor shall pay for and coordinate the services of a geotechnical engineer and testing agency to perform quality control of the earthworks.

B. Related Sections:

1. Section 311010 Site Preparation.

1.3 DEFINITIONS AND ABBREVIATIONS

A. Definitions

1. Backfill: Soil materials used to fill an excavation.

2. Structural fill: On-site soils should not be used as fill beneath foundations. Soils to be imported for use as structural or load-bearing fill should be granular material meeting the NJDOT 2A stone specification and should be compacted to a level equivalent to at least 95 percent of the maximum dry density as determined by the laboratory procedures set forth in ASTM D1557 (modified Proctor). This material should be placed in horizontal lifts of not more than 8 inches in loose thickness when compacted with heavy compaction equipment and not more than 6 inches in loose thickness when compacted with hand-operated equipment.

3. Base Course: Layer placed between the subgrade and paving.

4. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

5. Borrow: Approved soil materials imported from off-site for use as fill or backfill.

6. Classification: All material shall be classified as either Regular, Hard Material, or Rock.

7. Degree of Compaction: Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated hereinafter as percent laboratory maximum density. For granular material, relative density is determined in accordance with ASTM D 4254.

8. Excavation: Removal of material encountered down to subgrade elevations:

   a. Bulk Excavation: Excavation more than 10 feet in width.
   b. Overexcavation: Excavation of existing unsuitable material beyond limits shown on the Drawings for replacement with structural fill as directed by the Owner.
   c. Unauthorized Excavation: Excavation below subgrade elevations or beyond limits shown on the Drawings without direction by the Owner.

9. Hard Material: Weathered rock, dense consolidated deposits, or buried construction debris (i.e., demolished brick walls, concrete, etc.) which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

10. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cubic yard. for bulk excavation or 3/4 cubic yard. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment without systematic drilling, ram hammering, ripping, or blasting, when permitted

11. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base or topsoil materials.

12. Subbase: Material between the pavement base and subgrade.

13. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

B. Abbreviations

1. None.

1.4 REFERENCES

A. The most current version of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

   a. C 33 Concrete Aggregates

   b. D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method

   c. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3.))

   d. D 2167 Density and Unit Weight of Soil in Place by the Rubber Balloon Method

e. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, and Rock

f. D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)

g. D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

h. D 2937 Density of Soil in Place by the Drive-Cylinder Method ASTM D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

i. D 3740 Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

j. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

k. D 4254 Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

1.5 ACTION SUBMITTALS

A. General:

1. Make submittal in compliance with all provisions of Division 01 pertaining to submittals and quality assurance.

2. Render submittals and receive approval prior to delivery of installation.

3. Approval in writing by the Engineer of submitted products, samples, test reports, and certificates, does not constitute final acceptance.

B. Testing Agency Qualifications: Provide a statement of qualifications of the geotechnical engineer and testing agency that will perform the quality control tasks required.

1. The geotechnical engineer shall be an experienced inspector working under the direction of a professional engineer licensed to practice in the State of New York who is experienced in providing engineering services related to earthworks.

2. The testing agency shall be an independent laboratory having a minimum of 3 years of experience in conducting the testing indicated herein.

3. The testing laboratory shall meet the requirements of ASTM D 3740.

C. Material Test Reports: Shall be provided from the testing agency indicating and interpreting test results for compliance on the following:

1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.

2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill; provide for each material type and for every 5,000 cubic yards of each material.

3. Material Gradation Tests.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified contractor. Include list of similar projects completed by Contractor demonstrating Contractor's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of Owners' contact persons.

1.7 QUALITY ASSURANCE

A. The Contractor shall engage the services of a testing agency to perform quality control of the concrete.

1.8 DELIVERY, STORAGE AND HANDLING

A. None.

1.9 PROJECT CONDITIONS

A. Codes and Standards: Perform earthwork complying with federal, state, and local regulations including the Occupational Safety and Health Act of 1970 as amended.

B. All applicable regulations regarding notification of utility companies.

C. Any pumped water shall be discharged from the Site in accordance with federal, state and local codes and regulations. Comply with all local, county, and state permit requirements.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil or suitable backfill materials are not available from excavations.

B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SP, SM, SW, SC, GC, SC, ML and CL or a combination of these group symbols.

1. Low plasticity (plasticity index less than 10).
2. Less than 15 percent, by weight, of particles larger than 2 inches in greater dimension.
3. Less than 2 percent deviation from optimum moisture content.

C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups MH, CH, OL, OH, and PT, or a combination of these group symbols, or materials not conforming to the requirements for satisfactory soils, including:

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2. Debris, waste, frozen materials, vegetation and other deleterious matter.
3. Otherwise not meeting the requirements for satisfactory soil materials.
4. Materials containing excessive amounts of deleterious materials including construction debris, wood, glass, ash, or organic material as determined by Owner.

D. Backfill and Fill Materials: Satisfactory soil materials.

1. Class B backfill shall be granular, well graded friable soil; free of rubbish, ice, snow, tree stumps, roots, clay and organic matter; with 30% or less passing the No. 200 sieve; no stone greater than two-third (2/3) loose lift thickness, or six inches, whichever is smaller.

2. Select backfill shall be granular, well graded friable soil, free of rubbish, ice snow, tree stumps, roots, clay and organic matter, and other deleterious or organic material; graded within the following limits:

Sieve Size	Percent Finer by Weight
3"	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

E. Imported topsoils, or manufactured soil blends designed to serve as topsoil, may not be mined from the following locations (unless these soils are a byproduct of a construction process):

1. Greenfield sites

2. Prime farmland, unique farmland, farmland of statewide importance, or farmland of local importance as defined by the U.S. Natural Resources Conservation Service (or local equivalent for projects outside the United States)

F. Structural Fill: Satisfactory soil materials.

G. Base Course: 2A coarse aggregate, Type C or better. Recycled crushed concrete will not be allowed.

1. Salvage and re-use existing onsite asphalt material or dense graded aggregate where indicated on the Drawings and as approved by the Licensed Site Remediation Professional.

H. Bedding: No. 8 (AASHTO) coarse aggregate or as specified herein.

I. Rip-Rap at flush curb areas in stormwater bumpouts: 3” to 6” river rock.

1. Braen Supply Haledon, New Jersey, or approved equal.

2. Smooth finish.

3. Color: Blend of grey, blue, brown, and earth tones.

2.2 ACCESSORIES

A. Detectable Warning Identification Tape: Acid-and-alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities. Warning tape shall be a minimum 6 inches wide, 6 mils thick, have a minimum tensile strength 7,500 lbs/in^2, continuously inscribed with a description of the utility in permanent printing with caution striping, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; APWA color-coded as follows:

1. Red: Electric
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing utilities, sidewalks, structures, pavements, and other facilities to remain free from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways in accordance with the Drawings.

3.2 DRAINAGE AND DEWATERING

A. Prevent surface water and subsurface or groundwater from entering or flowing into excavations, from ponding on prepared subgrades, and from flooding the project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

C. 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.

3.3 EXPLOSIVES

A. Explosives: The use of explosives are prohibited on this Project.

3.4 FROST PROTECTION AND SNOW REMOVAL

A. Keep earthwork operations clear and free of accumulations of snow as required to carry out the work.

B. Protect the subgrade beneath structures and pipes from frost penetration when freezing temperatures are expected.

3.5 GENERAL EXCAVATION

A. Excavate to depths and limits shown on the Drawings. Compact subgrade surface in accordance with Section 3.11.

B. In all excavation areas, strip the surficial topsoil layer and underlying subsoil layer separate from underlying soils. In paved areas, first cut pavement as specified in Section 3.6 A of this specification, strip pavement and pavement subbase separately from underlying soils.

C. All excavated materials shall be stockpiled separately from each other within the limits of work.

D. Any soft or unstable material as characterized in the geotechnical report or by visual inspection of the geotechnical engineer shall be overexcavated and replaced by the contractor with compacted load bearing fill. Any areas of instability shall be overexcavated to a depth of at least 2 feet and replaced with structural fill in accordance with Section 3.11.

E. Provide shoring and bracing as necessary.

F. All footing excavation surfaces should be protected until the concrete and backfill is placed. Footing bearing surfaces should be cleaned of all material loosened by the excavation process and be recompacted using hand-operated compaction equipment prior to concrete placement. Should loose or soft materials be encountered or if the bearing materials become disturbed or softened, the disturbed materials should be removed and the footing should be lowered to undisturbed bearing materials or the undercut zone should be filled with lean concrete or compacted structural fill.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Prior to excavation, trenches in pavement shall be the traveled way surface cut in a straight line by concrete saw or equivalent method, to the full depth of pavement. Excavation shall only be between these cuts. Excavation support shall be provided as required to avoid undermining of pavement. Cutting operations shall not be done by ripping equipment.

B. Perform all dewatering requirements specified in Section 3.2 before performing trench excavations.

C. Trenches shall be excavated to such depths as will permit pipe to be laid at the elevations, slopes, and depths of cover indicated on the Drawings. Trench widths shall be as shown on the drawings or as specified.

D. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

E. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed.

F. Clearance: 12 inches on each side of pipe or conduit or as indicated.

G. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Remove projecting stones and sharp objects along trench subgrade.

1. Provide bedding depth as indicated on the drawings.

2. Shape bedding to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

3. For pipes and conduit less than 6 inches in nominal diameter and flat-bottom, multiple-duct conduit units, hand-excavate trench bottom to accurate elevations and support pipe and conduit on an undisturbed subgrade.

4. For pipes and conduit 6 inches or larger in normal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with bedding material. At each pipe joint, dig bellholes to relieve pipe bell of loads and to ensure continuous bearing of pipe barrel on bearing surface.

3.7 EXCAVATION FOR FOUNDATIONS

A. Excavations shall not be wider than required to set, brace, and remove forms for concrete, or perform other necessary work.

B. After the excavation has been made, and before forms are set for footings, mats, slabs, or other structures, and before reinforcing is placed, all loose or disturbed material shall be removed from the subgrade. The bearing surface shall then be compacted to meet the requirements of this specification.

C. If, in the opinion of the Engineer, the existing material at subgrade elevation is unsuitable for structural support; excavate and dispose of the unsuitable material to the required width and depth as directed by the Engineer. If, in the opinion of the Engineer, filter fabric is required; place filter fabric as approved by the Engineer and per the manufacturer's recommendations. Structural fill shall then be placed in lifts and compacted to required densities. Backfill shall be placed to the bottom of the proposed excavation.

3.8 EXCAVATION NEAR EXISTING STRUCTURES

A. Attention is directed to the fact that there are pipes, manholes, drains, and other utilities in certain locations. An attempt has been made to locate all utilities on the drawings, but the completeness or accuracy of the given information is not guaranteed.

B. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and excavation shall be done by means of hand tools, as required. Such manual excavation, when incidental to normal excavation, shall be included in the work to be done under items involving normal excavation.

C. Where determination of the exact location of a pipe or other underground structure is necessary for properly performing the work, the Contractor shall excavate test pits to determine the locations.

3.9 UNAUTHORIZED EXCAVATION

A. Unauthorized excavations shall be filled with satisfactory fill materials and compacted in accordance with the relevant paragraphs of this Section.

B. The Contractor is responsible for furnishing all materials, labor, supervision, tools, and equipment associated with unauthorized excavations without additional compensation.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and excavated satisfactory materials sufficiently far away from the edge of excavations to preclude excavation instability. Stockpile soil materials without intermixing. Cover to prevent windblown dust.

B. Install erosion control measures around stockpiles as required to comply with The Standards for Soil Erosion and Sediment Control in New York.

3.11 GENERAL BACKFILL

A. Backfill shall not be placed on a subgrade which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all subgrade types, including the natural ground, all prepared subgrades (whether in an excavation or in a trench) and all layers of previously placed and compacted earth fill which become the subgrade for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Owner and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompacted to the specified criteria before additional material is placed. The geotechnical engineer will determine when placement of fill shall cease due to cold weather.

B. Prior to backfilling, compact the exposed natural subgrade to the densities as specified herein.

C. Place and compact backfill in excavations promptly, but not before completing the following:

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

2. Surveying locations of underground utilities for record documents.

3. Inspecting and testing underground utilities.

4. Removing concrete formwork.

5. Removing temporary shoring, bracing, and sheeting unless directed to remain.

6. Removing trash and debris.

7. Place and compact materials to the specified density in continuous horizontal layers. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557, Method C. The minimum degree of compaction for fill placed shall be as follows:

LOCATION	PERCENT OF MAXIMUM DENSITY
Below pipe centerline	95
Above pipe centerline	92
Below pavement (upper 3 ft.)	95
Embankments	95

Below pipe in embankments	95
Adjacent to structures	92
Below structures	95

D. The Engineer reserves the right to test backfill for conformance to the specification and the Contractor shall assist as required to obtain the information. Compaction testing will be performed by the Engineer or by an inspection laboratory designated or approved by the Engineer, engaged and paid for by the Contractor. If test results indicate work does not conform to specification requirements, the Contractor shall remove or correct the defective Work be recompacting where appropriate or replacing as necessary and approved by the Engineer, to bring the work into compliance, at no additional cost to the Owner. All backfilled materials under structures and buildings shall be field tested for compliance with the requirements of this specification.

E. Where horizontal layers meet a rising slope, the Contractor shall key each layer by benching into the slope.

F. If the material removed from the excavation is suitable for backfill with the exception that it contains stones larger than permitted, the Contractor has the option to remove the oversized stones and use the material for backfill or to provide replacement backfill at no additional cost to the Owner.

G. The Contractor shall remove loam and topsoil, loose vegetation, stumps, large roots, etc., from areas upon which embankments will be built or areas where material will be placed for grading. The subgrade shall be shaped as indicated on the Drawings and shall be prepared by forking, furrowing, or plowing so that the first layer of the fill material placed on the subgrade will be well bonded to the subgrade.

3.12 UTILITY TRENCH BACKFILL

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

B. Place and compact bedding material by hand shovel in 6-inch lifts to a height of 12 inches above and below the top of utility pipe or conduit. This area of backfill is considered the zone around the pipe and shall be thoroughly compacted before the remainder of the trench is backfilled.

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

2. Place and compact materials to the specified density in continuous horizontal layers. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557, Method C.

C. Coordinate backfilling with utilities testing.

D. Fill voids with approved backfill or satisfactory soil materials as shoring, sheeting and bracing is removed. Place and compact final backfill of satisfactory soil material to final subgrade.

E. Install warning and identification tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 BACKFILLING ADJACENT TO STRUCTURES

A. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads to which they will be subjected. Excavated material approved by the Engineer may be used in backfilling around structures. Backfill material shall be thoroughly compacted to meet the requirements of this specification.

B. Contractor shall use extra care when compacting adjacent to pipes and drainage structures. Backfill and compaction shall proceed along sides of drainage structures so that the difference in top of fill level on any side of the structure shall not exceed two feet (2') at any stage of construction.

C. Where backfill is to be placed on only one side of a structural wall, only hand-operated roller or plate compactors shall be used within a lateral distance of five feet (5') of the wall for walls less than fifteen feet (15') high and within ten feet (10') of the wall for walls more than fifteen feet (15') high.

3.14 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry satisfactory soil material that exceed optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3. Construction during wet weather may also create unnecessary delays and undercutting of subgrades due to disturbance by construction traffic.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

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

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

B. Site Grading: Slope grades to direct water away from buildings and prevent ponding. Where paved, finish grades shall slope away from the building by a minimum 1/4” per foot for a distance of 8 feet unless otherwise indicated. In unpaved areas, finish grades shall slope away from the building by a minimum ½” per foot for a distance of 10 feet, unless otherwise indicated.

C. Finish subgrades to required elevations within the following tolerances:

1. Lawn or unpaved areas: Plus or minus 1 inch.

2. Pavements: Plus or minus ½ inch.

3.16 SUBBASE AND BASE COURSES

A. Under pavements and walks outside the right-of-way, place base course on prepared subgrade and as follows:

1. Place base course material over prepared subgrade.

2. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit density according to ASTM D 1557, as applicable.

3. Shape base to required crown elevations and cross slope grades.

4. When thickness of compacted base course is 6 inches or less, place materials in a single layer.

5. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

6. Place geogrid, geomembranes, and geotextiles where indicated on the Contract Drawings and per Section 310519 Geosynthetics for Earthwork.

3.17 FIELD QUALITY CONTROL

A. The contractor shall coordinate all earthwork with the testing agency and geotechnical engineer to allow for inspection and testing. The geotechnical engineer shall provide full-time observation and testing of the compaction operations and provide documentation to the Owner.

B. Allow geotechnical engineer to inspect and test each subgrade and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. The geotechnical engineer shall test compaction of soils in place according to ASTM D 1556, ASTM D 1557, ASTM D 2167, ASTM D 2922, ASTM D 2937, and ASTM D 4254 as applicable. Tests shall be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2200 sq. ft. or less of paved areas or building slab, but in no case fewer than three tests.

2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench, but no fewer than two tests.

3. Structural Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench, but no fewer than two tests.

D. When the geotechnical engineer reports that subgrades, fills or backfills have not achieved degree of compaction specified, recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish 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.

1. Scarify or remove and replace soil material to depth as directed by the Owner or the geotechnical engineer; reshape and recompact to the required density, at no additional cost to the Owner.

C. Where settling occurs before the project correction period elapses, remove finished surfacing, backfill with additional approved material, compact, and reconstruct.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible at no additional cost to the Owner.

D. Provide temporary underpinning, bracing, sheeting, and/or shoring as required to maintain the conditions of existing utilities or structures adjacent to excavation work. Prepare shop drawings of design details sealed by a professional engineer.

E. Provide fencing, barricades, and/or protective barriers for all excavation.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off site to a regulated and permitted facility. Provide two copies of load manifest and permit from owner of the property where material is deposited.

3.20 EARTHWORK COMPUTATIONS AND VOLUMES

A. All Earthwork shall be measured for payment via Surveyor methods which will obtain XYZ Data to be plotted by discipline. Also, where allowable, the Length, Width and Depth may be used in segments such as trenches, sub-bases and foundations while maintaining approximate site locations and project elevations.

END OF SECTION