

**SECTION 02225  
TRENCH EXCAVATION AND BACKFILL**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Drawings and as specified.
- B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.
- D. The trench is divided into five specific areas:
  - 1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
  - 2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
  - 3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
  - 4. Initial Backfill: The area above the haunching material and below a plane 18 inches above the top of the barrel of the pipe or the top of duct bank.
  - 5. Final Backfill: The area above a plane 18 inches above the top of the barrel of the pipe.
- E. The choice of method, means, techniques and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material proximity of man-made improvements to be protected, available easement or right-of-way and prevailing practice in the area.

**1.02      QUALITY ASSURANCE**

- A. Density: All references to "maximum dry density" shall mean the maximum dry density defined by the "Maximum Density-Optimum Moisture Test", ASTM D 698, except that for non-cohesive materials "maximum dry density" shall mean the maximum index density as determined by the "Maximum Index Density of Soils Using a Vibratory Table", ASTM D 4253. Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, "Density of Soil In Place by the Sand Cone Method", ASTM D 2937, "Density of Soil In Place by the Drive-Cylinder Method" or ASTM D 2922, "Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)".
- B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory. All imported fill materials shall meet the requirements of on-site fill materials.
- C. All costs associated with compaction testing ordered by the City shall be paid for by the Contractor. The extent of testing required shall be reasonable, but shall also be dependent upon soil conditions, Contractor's means and methods of operation, and regulatory requirements. As a minimum, compaction tests shall be performed in two foot lifts at a single location per each public right-of-way.

**1.03      SAFETY**

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in OSHA publication 2226. Particular attention is drawn to the requirement that the Contractor must have on site and individual with current competent person training certification.

**PART 2    PRODUCTS**

**2.01      TRENCH FOUNDATION MATERIALS**

Crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone sizes shall be between No. 57 and No. 4, inclusive.

**2.02 BEDDING AND HAUNCHING MATERIALS**

- A. Unless shown on the Drawings or specified otherwise, bedding and haunching materials shall be as follows:
  - 1. Gravity Sewers: Class IA, IB or II embedment material as specified below.
  - 2. Gravity Sewer Services: Earth materials as specified below.
  - 3. Force Mains: Earth materials as specified below.
  - 4. Water Mains: Earth materials as specified below.
  
- B. Bedding and haunching material under all pavement areas or where the trench is within three feet of the pavement edge shall be Class IA, IB or II embedment material.
  
- C. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, as determined by the City, provide select material conforming to the requirements of this Section at no additional cost to the City.
  
- D. Class IA, IB and II Embedment Materials
  - 1. Class IA, IB and II embedment materials shall meet the requirements of ASTM D 2321.
  - 2. Class IA embedment material is generally a manufactured aggregate, open-graded and clean; has a particle size distribution such that, when it is compacted, the voids between the aggregate particles, expressed as a percentage of the total space occupied by the material, is small. This material shall include angular, crushed stone or rock, crushed gravel, broken coral, crushed slag, cinders or shells.
  - 3. Class IB embedment material is generally manufactured or processed aggregate, dense-graded and clean; such as slag, that is a product or byproduct of a manufacturing process, or natural aggregates that are reduced to their final form by a manufacturing process such as crushing. This material includes Class IA materials and stone/sand mixtures with gradations selected to minimize migration of adjacent soils into this material.

4. Class II embedment material is generally coarse-grained soils which are clean. This material includes well-graded and poorly graded gravels and gravel-sand mixtures with little to no fines; well graded and poorly graded sands and gravelly sands, with little or no fines.

### **2.03 INITIAL BACKFILL**

- A. Unless shown on the Drawings or specified otherwise, initial backfill material shall be crushed stone, Class IA, IB or II embedment material, or earth materials as specified for bedding and haunching materials.
- B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2 inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, as determined by the City, provide select material conforming to the requirements of this Section.

### **2.04 FINAL BACKFILL**

Unless shown on the Drawings or specified otherwise, final backfill material shall be general excavated earth materials, shall not contain more than one-third broken rock, of which no stone or boulder shall weigh more than 50 pounds, cinders, stumps, limbs, man-made wastes and other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, as determined by the City, provide select material conforming to the requirements of this Section.

### **2.05 SELECT BACKFILL**

Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

### **2.06 CONCRETE**

Concrete for bedding, haunching, initial backfill or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5 inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

**PART 3 EXECUTION**

**3.01 TRENCH EXCAVATION**

- A. Topsoil and grass shall be stripped a minimum of 6 inches over the trench excavation site and stockpiled separately for replacement over the non-paved, finished grading areas.
- B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.
- C. Trench Width for Pipelines
  - 1. The sides of all trenches shall be as vertical as is practical to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.
  - 2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.
  - 3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 6 inches clearance between the rock and any part of the pipe or appurtenance.
  - 4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher Class or Type of bedding and haunching as shown on the Drawings for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the City.
- D. Depth
  - 1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the dimensions shown on the

Drawings or specified.

2. Force Mains

- a. Excavate trenches to provide a minimum cover of 36 inches. Within the right-of-way of highways, streets or roadways, also excavate to place the top of the pipe a minimum of 36 inches below the nearest pavement edge or drainage ditch.
- b. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.

3. Water Mains

- a. Excavate trenches to provide a minimum cover of 36 inches. Within the right-of-way of highways, streets or roadways, also excavate to place the top of the pipe a minimum of 36 inches below the nearest pavement edge or drainage ditch.
  - b. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.
4. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.
5. Where rock is encountered in trenches for pipelines, excavate to the minimum depth which will provide clearance below the pipe barrel of 8 inches for pipe 21 inches in diameter and smaller and 12 inches for larger pipe, valves and manholes. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe, manhole or accessory.

E. Excavated Materials

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Top soil shall be carefully separated and lastly placed in its original location.
2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

**3.02 SHEETING, BRACING AND SHORING**

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## City of Thomasville Water, Sewer & Natural Gas Specifications

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- A. Sheeting, bracing and shoring shall be performed in the following instances:
  - 1. Where sloping of the trench walls does not adequately protect persons within the trench from slides or cave-ins.
  - 2. In caving ground.
  - 3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced and shored.
  - 4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.
  - 5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.
- B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.
- C. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.
- D. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities.
- E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe or utility.
- F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the City it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet below the surface.
- G. Sheet piling within three feet of an existing structure or pipeline shall remain in place,

unless otherwise directed by the City.

### **3.03 ROCK EXCAVATION**

- A. Definition of Rock: Any material which cannot be excavated with conventional excavating equipment, and is removed by drilling and blasting, or mechanically fracturing by means other than a trench excavator, and occupies an original volume of at least one-half cubic yard.
- B. Blasting: Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the City may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
- C. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.
- D. The Contractor shall notify the City prior to any blasting. Additionally, the Contractor shall notify the City and local fire department before any charge is set.
- E. The Contractor shall conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.

### **3.04 DEWATERING EXCAVATIONS**

- A. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.
- B. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.
- C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.
- D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.
- E. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at



least two feet below the bottom of the trench, Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.

- F. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

**3.05 TRENCH FOUNDATION AND STABILIZATION**

- A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
- B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the City shall then authorize payment for trench stabilization.
- C. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the City, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone or surge stone as directed by the City.
- D. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

**3.06 BEDDING AND HAUNCHING**

- A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.
- B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper

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## City of Thomasville Water, Sewer & Natural Gas Specifications

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elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.

- C. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.
- D. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.
- E. Gravity Sewers and Accessories: Lay PVC pipe with minimum Class "B" bedding. Lay all other pipe with Class "C" bedding, unless shown or specified otherwise.
  - 1. Class "A" (Bedding Factor - 2.8): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Lay pipe to line and grade on concrete block. Place concrete to the full width of the trench and to a height of one-fourth of the outside diameter of the pipe above the invert.
  - 2. Class "B" (Bedding Factor - 1.9): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.
  - 3. Class "C" (Bedding Factor - 1.5): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel.
  - 4. Type 5: Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade before installing pipe. After the pipe has been brought to the proper grade, haunching material shall be carefully placed by hand and compacted to the top of the pipe.
- F. Manholes: Excavate to a minimum of 12 inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding or Class IA, IB or II embedment material to the required grade before constructing the manhole.

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## City of Thomasville Water, Sewer & Natural Gas Specifications

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### G. Force Mains

#### 1. Ductile Iron Pipe

- a. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching.
- b. Unless specified or shown otherwise, bedding shall meet the requirements for Type 2 Pipe Bedding. Unless specified or shown otherwise for restrained joint pipe and fittings, bedding shall meet the requirements for Type 3 Pipe Bedding.
- c. Where the depth of cover over the piping exceeds 15 feet, the pipe bedding shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds 28 feet, the pipe bedding shall meet the requirements of Type 5 Pipe Bedding.
- d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the City, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing sand, gravel or crushed stone as bedding and haunching material.

#### 2. Polyvinyl Chloride Pipe

- a. Unless shown otherwise on the Drawings, utilize earth materials for bedding and haunching.
- b. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Drawings.
- c. Where the depth of cover over the piping exceeds 15 feet, the pipe bedding shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds 28 feet, the pipe bedding shall meet the requirements of Type 5 Pipe Bedding.
- d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the City, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing sand, gravel or crushed stone as bedding and haunching material.

#### 3. High Density Polyethylene Pipe: Per manufactures Specifications.

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## City of Thomasville Water, Sewer & Natural Gas Specifications

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### H. Water Mains

#### 1. Ductile Iron Pipe

- a. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching. Type 2, 3, 4 and 5 bedding shall be as detailed on the Drawings.
- b. Unless specified or shown otherwise, bedding shall meet the requirements for Type 2 Pipe Bedding. Unless specified or shown otherwise for restrained joint pipe and fittings, bedding shall meet the requirements for Type 3 Pipe Bedding.
- c. Where the depth of cover over the piping exceeds 15 feet, the pipe bedding shall meet the requirements of Type 4 Pipe Bedding. Where the depth of cover over the piping exceeds 28 feet, the pipe bedding shall meet the requirements of Type 5 Pipe Bedding.
- d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the City, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing sand, gravel, or crushed stone bedding and haunching material.

#### 2. Polyvinyl Chloride Pipe

- a. Unless shown otherwise on the Drawings, utilize earth materials for bedding and haunching.
- b. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Drawings.

#### 3. High Density Polyethylene Pipe: Per manufactures Specifications.

### I. Excessive Width and Depth

1. Gravity Sewers: If the trench is excavated to excess width, provide the bedding class with the next higher bedding factor. Crushed stone haunching and initial backfill may be used in lieu of Class "A" bedding, where Class "A" bedding is necessitated by excessive trench width.
2. Pressure Mains: If the trench is excavated to excess width, provide the next higher type or class of pipe bedding, but a minimum of Type 4, as detailed on the Drawings.
3. If the trench is excavated to excessive depth, provide crushed stone or Class IA,

IB or II embedment material to place the bedding at the proper elevation or grade for wastewater items only. For water mains, provide sand, gravel, or crushed stone to place the bedding at the proper elevation or grade.

- J. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

**3.07 INITIAL BACKFILL**

- A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
- B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18 inches above the pipe barrel. Layer depths shall be a maximum of 6 inches.
- C. Backfill on both sides of the pipe simultaneously to prevent side pressures.
- D. Compact each layer thoroughly with suitable hand tools or tamping equipment.
- E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.
- F. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

**3.08 CONCRETE ENCASEMENT FOR PIPELINES**

Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6 inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

**3.09 FINAL BACKFILL**

- A. Backfill carefully to restore the ground surface to its original condition.
- B. Except under paved areas, the top 6 inches shall be topsoil obtained as specified in "Trench Excavation" of this Section.
- C. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of, at no additional cost to the City, in a manner approved by the City. Surplus soil may be neatly distributed and spread over the site, if approved by the City.

If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.

- D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- E. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
  - 1. In 6 inch layers, if using light power tamping equipment, such as a "jumping jack"
  - 2. In 12 inch layers, if using heavy tamping equipment, such as hammer with tamping feet
  - 3. In 24 inch layers, if using a hydra-hammer
- F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- G. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

### **3.10 ADDITIONAL MATERIAL**

Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings. Utilize excess material excavated from the trench, if the material is suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide additional suitable fill material.

### **3.11 BACKFILL UNDER ROADS**

Compact backfill underlying pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 98 percent of the maximum dry density. The top 12 inches shall be compacted to a minimum of 98 percent of the maximum dry density.

### **3.12 BACKFILL WITHIN GEORGIA DOT RIGHT-OF-WAY**

Backfill within the Georgia DOT right-of-way shall meet the requirements stipulated in the "Utility Accommodation Policy and Standards", published by the Georgia Department of Transportation.

### **3.13 BACKFILL ALONG RESTRAINED JOINT PIPE**

Backfill along restrained joint pipe shall be compacted to a minimum 90 percent of the maximum dry density.

**3.14 TESTING AND INSPECTION**

- A. The soils testing laboratory is responsible for the following:
  - 1. Compaction tests in accordance with Article 1.02 of this Section.
  - 2. Field density tests as ordered by the City.
  - 3. Inspecting and testing stripped site, subgrades and proposed fill materials.
- B. The Contractor's duties relative to testing include:
  - 1. Notifying laboratory of conditions requiring testing.
  - 2. Coordinating with laboratory for field testing.
  - 3. Paying costs for all testing performed at the request of the City beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.
  - 4. Providing excavation as necessary for laboratory personnel to conduct tests.
- C. Inspection
  - 1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the City.
  - 2. Where required by the City, foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer, who shall verify suitable bearing and construction.
- D. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.
- E. City shall have the right to select the location of compaction tests, no more than one per 1,000 feet of pipeline, and shall be notified by Contractor 24-hours in advance for the City to be present.

**END OF SECTION**