

# TECHNICAL SPECIFICATIONS

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## RIVERSIDE EXTENSION OCMULGEE HERITAGE TRAIL

NEWTOWN MACON, INC.  
MACON – BIBB COUNTY, GEORGIA

NOVEMBER 2019



HODGES, HARBIN,  
NEWBERRY & TRIBBLE, INC.

*Consulting Engineers*



## TABLE OF CONTENTS

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01010	General Requirements
01560	Erosion and Sediment Control
02110	Clearing and Grubbing
02210	Grading
02220	Trenching, Backfilling, and Compaction

## **01010 GENERAL REQUIREMENTS**

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### **1. SANITARY CONVENIENCES:**

The CONTRACTOR shall provide adequate sanitary conveniences for use of those employed on the work and their use shall be strictly enforced. Such conveniences shall be made available when the first employees arrive on the site and shall be removed after the departure of the last employees from the job.

### **2. UTILITY SERVICE:**

The CONTRACTOR will arrange for temporary electrical service through the local agency at his own expense if CONTRACTOR desires electrical power on-site.

### **3. ENVIRONMENTAL IMPACT:**

The CONTRACTOR shall conduct all operations so as to minimize, to the greatest extent possible, adverse environmental impact.

#### **A. Noise:**

All equipment and machinery shall be provided with exhaust mufflers maintained in good working order so as to reduce operating noise to minimum levels.

#### **B. Dust/Smoke:**

All equipment movements shall be accompanied by a minimum of dust. Traveled surfaces and earthwork shall be maintained in a moist condition to avoid the generation of dust or the airborne movement of particulate matter under all prevailing atmospheric conditions.

Burning operations will not be allowed.

#### **C. Traffic:**

Trucks shall be routed over roads which will result in the least effect on traffic and nuisance to the public. All material shall be loaded in a manner which will preclude the loss of any portion of the load in transit, including covering, if necessary.

#### **D. Sedimentation:**

All points of concentrated runoff from rainfall shall be visually monitored to determine that no eroded material from the construction site is being deposited off-site. Measures shall be taken to promptly eliminate such a deposition if occurring, including the installation of sedimentation basins.

E. Fuel and Lubricant Spills:

All spills shall be removed from the site immediately by the CONTRACTOR. No residue from the spill shall remain on site.

**4. UTILITIES:**

Utilities such as sewer, water, gas, and electric lines encountered in the work shall be protected from injury and maintained in service until moved or replaced as required under this Contract or by others as the case may be, or abandoned as may be necessary for the proper construction and use of the new work.

**5. MAINTENANCE DURING CONSTRUCTION:**

The CONTRACTOR shall maintain the Work from the beginning of construction operations until final acceptance. This maintenance shall constitute continuous and effective work prosecuted day by day with adequate equipment and forces to the end that the site and structures thereon are kept in satisfactory condition at all times.

**6. BARRICADES, DANGER, WARNING & DETOUR SIGNS:**

The CONTRACTOR shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights, danger signals, signs and other traffic control devices, and shall take all necessary precautions for the protection of the work and safety of the public. Suitable warning signs shall be provided to properly control and direct traffic.

The CONTRACTOR shall furnish, install, and maintain all necessary barricades, warning signs, and other protection devices in accordance with the State requirements in which the project is located. Temporary signs may be reused, provided they are in good condition and legible. All protective devices shall be kept in a good, legible condition while in use.

The cost of furnishing, erecting, maintaining, and removing protective devices will not be paid for as a separate Bid Item. Where the CONTRACTOR is required to perform any of these functions, the cost thereof shall be included in the overall Bid submitted. Ownership of the temporary warning devices shall remain with the CONTRACTOR.

Any work performed within the Georgia Department of Transportation's (GA DOT) right-of-way shall be in accordance with the "Manual on Uniform Traffic Control Devices".

**7. HIGH VOLTAGE ACT:**

The CONTRACTOR must follow all requirements of the High Voltage Act of the General Assembly of Georgia.



**8. ACCESS FOR INSPECTION:**

Access for inspection shall be provided for representatives of the Macon – Bibb County, GA DOT, and Georgia Department of Natural Resources, Environmental Protection Division.

**9. USE OF CHEMICALS:**

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in conformance with instructions.

**10. EROSION AND SEDIMENT CONTROL:**

Siltation and soil erosion must be minimized during construction.

**11. CLEANING UP:**

The CONTRACTOR shall remove from the OWNER's property and from all public and private property, at his own expense, all temporary structures, signs, rubbish, and waste material including excess excavated materials resulting from his operations.

**12. RESTORATION:**

The CONTRACTOR shall conduct his operations so that restoration of roadways, driveways, curb and gutter, ditches, and easements progresses along with the construction. If the ENGINEER determines that inadequate progress is being made with the restoration, he may shut down the CONTRACTOR's construction operation until the restoration is caught up with the progress of construction.

Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and the tree branches shall be temporary tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed to those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

**13. CONSTRUCTION WATER:**

Construction water is the CONTRACTOR's responsibility.

**14. KEEPING ROADWAYS OPEN FOR TRAFFIC:**

The work shall be scheduled and shall progress in a manner that allows continuous traffic operations.

-- END OF SECTION --



## **SECTION 01560                      EROSION AND SEDIMENT CONTROL**

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### **PART 1        GENERAL**

#### **1.1        DESCRIPTION OF WORK**

- A.    Work includes the installation of soil erosion and sediment control devices. The work specified in this section consists of providing and maintaining temporary and permanent erosion and sediment controls as shown on the Drawings and as specified in this section. This section also specifies the subsequent removal of temporary erosion and sedimentation control measures.
- B.    After installing the soil erosion and sediment control devices as called for on the Drawings, the Contractor shall assure himself that all reasonable measures are in place to prevent the siltation of nearby water courses. Temporary and permanent erosion and sedimentation controls include grassing and laying excelsior matting on disturbed areas and structural barriers at those locations that will ensure erosion during construction will be managed to within acceptable limits. Acceptable limits are as established by the Georgia Environmental Protection Division, and applicable codes, ordinances, rules, regulations, and laws of local and municipal authorities having jurisdiction.
- C.    Land disturbance activity shall not commence until all appropriate permits have been issued.
- D.    Land Disturbance Permit, if necessary, shall be obtained and paid for by the OWNER.

#### **1.2        RELATED WORK**

Section 02210 – Grading

Section 02220 – Trenching, Backfilling, and Compaction

#### **1.3        SUBMITTALS**

- A.    Submit product data in accordance with the requirements of this section.
- B.    Prior to any construction activity, the CONTRACTOR shall submit, for the ENGINEER's review, a schedule for the accomplishment of temporary and permanent erosion and sedimentation control work. No work shall be started until the erosion and sedimentation control schedule and methods of operation have been reviewed and noted as acceptable by the ENGINEER.
- C.    Product Data Submittals
  - 1.    Article 2.1 Silt Fence
  - 2.    Article 2.2 Temporary Grassing
  - 3.    Article 2.5 Rip Rap Outlet Protection
  - 4.    Other items as required by ENGINEER

## 1.4 QUALITY ASSURANCE

- A. The temporary and permanent erosion and sedimentation control measures shown on the Drawings are minimum requirements. Any additional erosion and sedimentation control measures required by the state or local jurisdictions will be installed by the CONTRACTOR. CONTRACTOR shall immediately notify ENGINEER and OWNER of any additional measures required prior to installation.
- B. Perform all work under this section in accordance with all applicable rules and regulations including, but not limited to, those stated in this section. Where provisions of rules and regulations conflict with these specifications, the more stringent provisions shall govern.
- C. Provide all materials and promptly take actions to achieve effective erosion and sedimentation control in accordance with the rules and regulations of Georgia Environmental Protection Division. Local ordinances, other permits, local enforcing agency guidelines and this section.

### Basic Principles:

- 1. Coordinate the land disturbance activities to fit the topography, soil types, and conditions
  - 2. Minimize the disturbed area and the duration of exposure to erosive elements
  - 3. Provide temporary or permanent stabilization to disturbed areas immediately after rough grading is complete
  - 4. Safely convey run-off from the site to a runoff stabilizing outlet to prevent flooding and damage to downstream facilities
  - 5. Retain sediment on-site that was generated on-site
  - 6. No encroachments allowed upon watercourses or buffers
  - 7. Maintain all erosion and sediment control measures
- D. Implementation
    - 1. The CONTRACTOR is solely responsible for the control of erosion within the project site and the prevention of sediment from leaving the project site or entering waterways.
    - 2. The CONTRACTOR shall install temporary and permanent erosion and sedimentation controls which will ensure that runoff from the disturbed area of the project site shall pass through a filter/control system before exiting the project site.

3. The CONTRACTOR shall provide temporary and permanent erosion and sedimentation control measures to prevent silt and sediment from entering the waterways. The CONTRACTOR shall maintain all required undisturbed vegetative stream buffers. The CONTRACTOR shall comply with all local (city and county) stream buffer ordinances and state codes and regulations concerning the width, care and protection of stream buffers. The CONTRACTOR shall limit land disturbance activity to those areas shown on the Drawings.
4. All fines imposed for improper erosion and sedimentation control shall be paid by the CONTRACTOR.

## 1.5 MAINTENANCE

- A. The CONTRACTOR shall maintain erosion and sedimentation control measures with disturbed areas on the entire site at no additional cost to the OWNER until the acceptance of the Project. Maintenance shall include re-seeding, clean out of sediment barriers and replacement of washed-out or undermined matting and erosion control materials, to the satisfaction of the ENGINEER.

## 1.6 RULES AND REGULATIONS

- A. The erosion and sediment controls shall conform with all rules and regulations established under the Georgia Erosion and Sedimentation Act of 1975, as amended, and the “Manual for Erosion and Sediment Control in Georgia”, current edition as of project date.

## PART 2 PRODUCTS

### GENERAL

Temporary and permanent erosion and sedimentation control devices shall be of the specified quality to prevent erosion and prevent sediment from exiting the site. If as determined by the ENGINEER, any of the devices should deteriorate or become ineffective prior to the end of the construction, the devices shall be replaced immediately at no additional cost to the OWNER.

### 2.1 SILT FENCE

- A. Posts

Silt fence posts shall be a minimum 1.3 lbs/ft steel post, a minimum of four (4) feet long and spaced a maximum of four (4) feet apart.

- B. Woven Wire Fence

Wire fence reinforcement shall be a minimum of 14-gauge, 4-inch x 4-inch hogwire.



C. Filter Fabric

Use only synthetic filter fabric that is approved by the Georgia Department of Transportation Qualified Products List #36 that matches the type shown in the Drawings. The Department of Transportation Qualified Products List #36 can be found on their website at <http://www.dot.state.ga.us>.

Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six (6) months of expected usable construction life at a temperature of 0° F to 120° F.

**2.2 TEMPORARY GRASSING**

Temporary seed shall be Brown Top Millet, Wheat, or Pearl Millet at the planting rates specified in Article 3.2. Other mixes may be approved.

A. Temporary Seed

1. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the U.S. Department of Agriculture Federal Seed Act.
2. All seed shall be from the last crop available at time of purchase and shall not be moldy, wet or otherwise damaged in transit or storage.
3. Seed shall bear the growers analysis testing to 98 percent for purity and 90 percent for germination. At the discretion of the ENGINEER, samples of seed may be taken for verifying the grower's analysis.

**2.3 RIP-RAP OUTLET PROTECTION**

A. Stone

Stone for rip-rap shall be durable, dense, specifically selected and graded quarried stone. The size shall meet the Georgia Department of Transportation class of stone called for on the Drawings.

**TABLE 1**  
**REQUIREMENTS FOR NONWOVEN GEOTEXTILE**

<b>PROPERTY</b>	<b>TEST METHOD</b>	<b>CLASS I</b>
Tensile strength (lbs) <sup>1</sup>	ASTM D 4632 Grab testing	180 minimum
Elongation at failure (%) <sup>1</sup>	ASTM D 4632	≥ 50
Puncture (pounds)	ASTM D 4833	80 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum
Apparent opening size (AOS)	ASTM D 4751	As specified max. no. 40 <sup>2</sup>
Permittivity sec <sup>-1</sup>	ASTM D 4491	0.70 minimum

1. Minimum average roll value
2. U.S. Standard Sieve Size

**B. Grout or Concrete Fill**

Grout or Concrete for rip-rap outlet protection or ditches shall be minimum 3,000 psi concrete.

**2.4 EXCELSIOR MATTING**

Excelsior matting for slopes shall be an erosion control blanket consisting of an excelsior mat with a synthetic netting on one side similar and equal to Curlex I as manufactured by American Excelsior Company. Excelsior matting used in ditches shall consist of an Excelsior Mat with a synthetic netting on both sides similar and equal to Curlex II as manufactured by American Excelsior Company.

**2.5 TURF REINFORCEMENT MAT (TRM)**

TRM shall be an erosion control mat comprised of a dense, three-dimensional web of polyolefin fibers oriented and mechanically bonded between nets and designed to be non-soil filled. The product shall be similar and equal to Landlok TRM 450 by Synthetic Industries.

**PART 3 EXECUTION**

**GENERAL**

Construct temporary and permanent erosion control measures as shown on the plans Drawings, as required by site conditions, regulatory agency or ENGINEER. All permanent erosion control work shall be incorporated into the project at the earliest practicable time. Temporary erosion control measures shall be coordinated with permanent erosion control measures and all other work on the project to

assure economical, effective, and continuous erosion control throughout the construction and post construction period and to minimize siltation of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property. If a disturbed area is left exposed and construction activity ceases for more than 7 days, it shall be seeded using the temporary seed type and planting rates specified herein.

The CONTRACTOR shall be liable for all damages to public or private property and fines as may be placed on the project by the local regulatory agencies due to soil erosion from the project site. Clear only those areas required to install the soil erosion control devices, request an inspection by the local agency having jurisdiction.

All erosion control devices shall be inspected by the CONTRACTOR after each rainfall. Any required repairs shall be made immediately. Sediment deposits shall be removed when deposits reach approximately one-half of the capacity of the erosion control device.

The CONTRACTOR shall remove all sedimentation and erosion control devices upon the approval of permanent seeding and stabilization by the agency having jurisdiction of the area and by the ENGINEER. All sediment deposits remaining in place after the erosion control devices are removed shall be dressed to conform to the existing grade, prepared and seeded. The cost of removal and cleanup shall be included in the cost of the installation of the device or in the cost for maintenance.

### **3.1 SILT FENCE AND INLET PROTECTION**

- A. Silt fence shall be installed in accordance with the details in the Drawings.
- B. Should the filter fabric deteriorate or become ineffective prior to the end of the construction as determined by the ENGINEER, the fabric shall be replaced immediately at no additional cost to the OWNER.
- C. Silt fence shall be installed at the inlet of a stormwater drainage structure in accordance with the details in the Drawings.

### **3.2 TEMPORARY GRASSING**

Temporary grassing procedures will be implemented as required by permit, when directed by the ENGINEER or as required by the soil erosion (local) inspector and in portions of the site where construction activities have temporarily or permanently ceased but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.

Seeding for temporary grassing shall be applied to all shoulders, side ditches, cut slopes, fill slopes, and any other area disturbed by the CONTRACTOR and not designated for pavement or structures. Apply temporary seeding immediately following final land disturbing activities. Any unseeded area which erodes shall be repaired to the satisfaction of the ENGINEER at no additional cost to the OWNER. Temporary seeding shall be applied at the rates in the table that follows:

### Temporary Grassing Table

Temporary Seeding	*LBS/Acre	*LBS/Acre	Depth of Cover	Date of Planting	Comments**
	Alone	In Mixtures			
Browntop Millet	40	10	¼" – ½"	4/01 – 6/30	137,000 seed per pound
Pearl Millet	50	N/A	¼" – ½"	5/01 – 7/31	88,000 seed per pound
Wheat	180	30	¼" – ½"	9/15– 12/31	15,000 seed per pound
Annual Ryegrass	40	N/A	¼" – ½"	8/1 – 4/30	227,000 seed per pound
*Reduce seeding rates by 50% when drilling.					
**Seeding rates are 100% Pure Live Seed. Prorate seeding rates for less percentage of pure live seed.					
*** Additional species may be approved by ENGINEER if planting outside of dates listed above.					

### 3.3 RIP-RAP OUTLET PROTECTION

- A. Prepare subgrade to the required lines and grades as shown or indicated on the Drawings. Place any fill required in the subgrade to a density equal to that of the surrounding area. Place filter fabric on the finished subgrade.
- B. Place rip-rap by mechanical methods, augmented by hand placing where necessary to prevent damage to permanent works, provided that when the rip-rap is completed it forms a properly graded, dense, neat layer of stone. The completed rip-rap shall have a thickness as shown on the Drawings.
- C. If the plans specify using grouted or cement filled rip-rap, lay the stone as specified above. Fill the spaces between the stones with concrete. Use sufficient concrete to completely fill all voids, except leave the face surface of the stone exposed. Place grout from the bottom to the top and then sweep the surface with a stiff broom. After completing the grouting, cure the surface.

### 3.4 EXCELSIOR LINED DITCH OR SLOPE MATTING

- A. Grade slope in accordance with the Drawings.
- B. Apply lime, fertilizer, and seed in accordance with the grassing specifications.
- C. Place the excelsior mat in accordance with the detail, table in the erosion control plan, and the manufacturer's recommendation.
- D. Start laying the mat from the top of the slope or the upstream end of the channel and unroll it downgrade. Do not stretch netting.
- E. Bury the upslope end and staple the mat every 12 inches across the top end, every three (3) feet around the edges and across the mat so that it is held closely against the soil. However, do not stretch the mat when stapling.



- F. To join ends of strips, insert the new roll of mat in a trench as with upslope end and overlap it 18 inches with the previously laid upper roll. Turn under 6 inches of the 18 inches overlap and staple every 12 inches across the end.

### **3.5 TURF REINFORCEMENT MAT (TRM)**

The ditch or slope for all TRM shall be constructed to the configuration shown on the Drawings and the manufacturer's recommendations.

--- END OF SECTION ---

## **SECTION 02110 CLEARING AND GRUBBING**

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### **PART 1 GENERAL**

#### **1.1 DESCRIPTION OF WORK**

The extent of site clearing is shown on the Drawings. Clearing and grubbing includes, but is not limited to, removing trees, stumps, root, brush, and other vegetation, structures, abandoned utilities, trash and debris from the site. Clearing and grubbing includes materials found on or near the surface of the ground in the construction area that is understood by generally accepted engineering practice not to be suitable for the type of construction contemplated.

- A. Take precautionary measures that prevent damage to features that are to remain.
- B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.
- C. Clear only to the limits of construction shown on the Drawings.
- D. Clearing and grubbing includes stripping and stockpiling of topsoil unless the item is addressed in another section contained in these specifications.

#### **1.2 RELATED WORK**

Section 01560 – Erosion and Sediment Control  
Section 02210 – Grading

#### **1.3 SUBMITTALS**

N/A

#### **1.4 QUALITY ASSURANCE**

The CONTRACTOR shall comply will applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.

Open burning, if allowed, shall first be permitted by the local authority having jurisdiction. The CONTRACTOR shall notify the local fire department and abide by fire department restrictions.

- A. Obtain copy of Grading Permit and maintain at the site.
- B. Perform all work in accordance with requirements of OSHA and the Environmental Protection Agency in addition to State and local requirements.

## 1.5 JOB CONDITIONS

- A. Examine areas for conditions under which work is to be performed. Report to the ENGINEER all conditions contrary to those shown on the Drawings or specified herein and all other conditions that will affect satisfactory execution of the work. Do not proceed with work until unsatisfactory conditions have been corrected and authorization has been given by OWNER.
- B. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.
- C. Provide protection necessary to prevent damage to features and structures that are to remain in place on the OWNER's property and adjoining properties. Restore damaged improvements to their original condition without additional cost to the OWNER.
- D. Keep dirt, dust, noise, and other objectionable nuisances to a minimum. Use temporary enclosures, coverings, and sprinkling, or a combination, to limit dust to lowest practicable level. Do not over use water to the extent that it causes flooding, contaminated runoff, or icing.
- E. Protect trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, access foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.
  - 1. Water trees and other vegetation to remain within limits of the contract work as required to maintain their health during course of construction operations.
  - 2. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to the OWNER and without additional cost to the OWNER. Employ licensed arborist to repair damages to trees and shrubs.
  - 3. Replace trees which cannot be repaired and restored to full-growth status, as determined by arborist.
- F. Property corners, iron pipe and/or monuments, shall be located and protected before beginning clearing operations.

## PART 2 PRODUCTS

N/A



## **PART 3 EXECUTION**

### **3.1 CLEARING**

- A. Clearing shall consist of the cutting, removing, and satisfactory disposing of all trees and shrubs within the clearing limits as designated on the Drawings.
- B. Clear only those areas required to install the soil erosion control devices as shown on the Drawings and as outlined in Section 01560-Erosion and Sediment Control of these specifications prior to starting clearing operations.
- C. Repair and maintain erosion control devices during construction in order to always assure their efficiency.
- D. Trees to remain shall be trimmed of branches which will obstruct the new construction or as directed by the ENGINEER. Branches to be trimmed shall be neatly cut close to the bole of the tree or main branch. Cuts more than 1/2 inches in diameter shall be painted with tree wound paint formulated for use on damaged plant tissues.

### **3.2 GRUBBING**

- A. Grubbing shall consist of the removal and disposal of stumps, roots larger than three (3) inches in diameter and matted roots from the designated clearing limits to a depth of 18 inches below the original surface level of the ground.
- B. For trees to remain, provide protection for roots over 1/2 inches in diameter which are cut during grubbing. Coat cut faces with a tree wound paint formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out, cover with earth as soon as possible.
- C. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground, unless further excavation is indicated.
- D. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.

### **3.3 DISPOSAL OF MATERIAL**

- A. All vegetation and debris within the areas to be cleared shall become the property of the CONTRACTOR upon the start of work and shall be removed from the site and properly disposed.
- B. Burning of combustible materials removed by clearing and grubbing operations will not be allowed.

--END OF SECTION--





## **SECTION 02210 GRADING**

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### **PART 1 GENERAL**

#### **1.1 DESCRIPTION OF WORK**

Work covered under this section, includes but is not limited to; excavating and hauling soil type materials anywhere within the property lines; removing unsuitable material, placing soil for embankment, disposing of unstable materials, stockpiling materials, forming and compacting embankments, sediment ponds and on-site structural fill.

Work shall include, but not be limited to:

- A. Excavating, removing unsuitable and unstable materials, borrowing soil, filling, building embankments and stockpiling selected soils as defined in 1.5 DEFINITIONS.
- B. All excavation shall be as shown on the Drawings or established by the ENGINEER and shall conform to the lines and grades as shown on the Drawings.

#### **1.2 RELATED WORK**

Section 01560 – Erosion & Sediment Control  
Section 02220 – Trenching, Backfilling and Compaction

#### **1.3 SUBMITTALS**

- A. Test reports for the following items shall be provided to the ENGINEER by a third-party testing service employed by the OWNER:
  - 1. One (1) optimum moisture-density curve for each type of soil encountered, Article 3.2, C, 1.
  - 2. Field Density and Moisture Content Test Reports, Article 3.2, C, 2.

#### **1.4 QUALITY ASSURANCE**

- A. Perform excavation work in compliance with applicable requirements of the governing authorities having jurisdiction, where the Work is located.
- B. OWNER will engage soil sampling, testing and inspection services for quality control testing during grading operations.

#### **1.5 DEFINITIONS**

- A. Excavation (Unclassified)

1. Excavation (unclassified herein) shall consist of all the excavated material down to subgrades of structures. Excavation shall further include the fine grading and placement of all removed material whether placed into temporary soil compaction berms, structural fill in embankments, disposed, or stockpiled in designated areas, regardless of the nature or manner in which it is removed and placed.
2. Only suitable and designated unclassified excavation materials will be used for temporary soil compaction berms embankment fills, roadways, sediment pond embankments, and other structural applications on the job site. Excavation shall include rough and fine grading.

**B. Unsuitable Material**

Unsuitable soil materials include the following:

1. Materials that are classified as MH, PT, OH and OL according to ASTM D 2487.
2. Dispersive, collapsible or expansive silts and clays.
3. Materials that contain debris, roots, wood, scrap material, vegetation, refuse, soft particles, frozen, and other non-soil materials.
4. Materials that are contaminated with hydrocarbons or other chemical constituents.

Materials that are not listed above but cannot be compacted to the density required due to high moisture content are not unsuitable materials unless the CONTRACTOR demonstrates, at his own cost, that the soil cannot achieve the strength, density, or permeability requirements when the material is dried within the moisture content range specified in the contract documents.

**C. Structural Fill (Borrow Material)**

Structural fill (Borrow Material) shall consist of off-site material placed and compacted for construction of embankment and subgrade.

**D. Embankment**

Embankment is a raised structure or berm, typically made of earth that is used primarily to hold back water or support a roadway.

**E. Unstable Material**

The ENGINEER will define whether a material is unstable for the formation of embankments and subgrades. Unstable material may also be referred to as unsuitable. Moisture content of material alone may not render material unstable or unsuitable.

## 1.6 APPLICABLE STANDARDS

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

American Society for Testing and Materials (ASTM) Publications (Latest Edition):

D 422	Method of Particle-Size Analysis of Soils
D 698	Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 5.5 lb. Hammer/12-inch drop
D 1557	Moisture Density Relations of Soils and Soil Aggregate
D 2922	Density of Soil in Place by the Nuclear Gage
D 2937	Density of Soil in Place by the Drive-Cylinder Method
D 4318	Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
D6938	Standard Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Method.

## PART 2 PRODUCTS

### 2.1 SUITABLE MATERIAL

- A. Shall be free from construction material, debris, frozen material, organic matter, or unsuitable and unstable material.
- B. Shall be suitable for the formation of temporary soil compaction berms, embankments, subgrades, backfill, shoulders, and other places requiring structural fill as may be indicated on the Drawings or directed by the ENGINEER.

## PART 3 EXECUTION

### 3.1 PREPARATION FOR FILL

Before embankment construction begins, all vegetation and rubbish shall be cleared and removed from the area within the limits of the embankment and roadway.

Following clearing and removal, those areas at grade or designated to receive fill or subsequent materials placement shall be PROOF-ROLLED in the presence of the ENGINEER with a loaded dump truck or similar piece of heavy equipment to identify those areas needing repair due to pumping or yielding. Any area which runs or pumps excessively in the opinion of the ENGINEER shall be undercut to stable soil and backfilled with properly compacted soil fill.



Topsoil shall be stockpiled and utilized in areas to be seeded after completion of grading. Excess topsoil shall be hauled to areas designated by the ENGINEER.

### 3.2 SOIL TESTING

#### A. Testing Protocol

Field density testing under this Specification Section will be paid for by the OWNER. The OWNER will select a laboratory for testing. Laboratory testing will be performed by an approved commercial testing laboratory approved by the OWNER. Laboratory tests for developing moisture-density relations shall be performed in accordance with ASTM D698. Field tests for density and moisture content shall be performed in accordance with ASTM D1556 or ASTM D2937.

#### B. Classification Tests

Soil shall be classified according to the Unified Soil Classification System (USCS) according to ASTM D2487, latest edition.

Liquid Limit, Plastic Limit, and Plasticity Index will be determined in accordance with ASTM D4318, latest edition. Sieve Analysis will be made as specified in ASTM D422.

These tests shall be used to classify each type of soil.

#### C. Soil Tests

The following tests will be performed by the CQA Engineer and are considered to be the minimum number of tests. Additional tests may be required contingent upon weather and/or soil conditions.

1. One (1) laboratory moisture-density relation test and companion classification test for each type of soil encountered including liquid limit, plastic limit, plasticity index (ASTM D4318) and sieve analysis (ASTM D422).
2. A minimum of one (1) field density test and moisture content test shall be performed for each 1,000 c.y. of subgrade fill or embankment fill.

#### D. Testing Responsibilities

Exact locations of tests shall be as directed by the Engineer. The CONTRACTOR shall be responsible for maintaining a copy of all test results on file at the jobsite.

The CONTRACTOR shall be responsible for:

1. Coordinating and scheduling the sampling and laboratory field testing
2. Providing representative fill soil samples when requested by the Engineer
3. Documenting the location of samples pulled for testing

### 3.3 GENERAL COMPACTION REQUIREMENTS

Excavation, fill, and compaction requirements for the Project vary as to the respective subgrade being constructed. Any subgrade not specifically detailed or any subgrade requirements that reference this Specification Section shall meet the requirements of this Section.

- A. When tested, fill material shall be compacted to not less than the percent compaction shown in the table that follows. The percent compactions are based on the appropriate Modified or Standard Proctor of the maximum dry density. All subgrades will be proof-rolled in the presence of the ENGINEER. Proof-rolling will be in accordance with procedures in Article 3.1 of this Specification Section.

<u>DESCRIPTION</u>	<u>GENERAL</u>			
	<u>COMPACTION</u>		<u>TOP 12"</u>	
	Standard	Modified	Standard	Modified
Paved Roadways	95%	92%	98%	95%
Shoulders and Embankments	95%	92%	95%	92%
Other Areas	95%	92%	95%	92%

- B. Soils that are classified as sands using the Unified Soil Classification System (USCS) according to ASTM D2487 shall be compacted to the above limits using the Modified Proctor (ASTM D1557) method or Standard Proctor (ASTM D698) for determining maximum dry density and soil compaction of sampled and tested soil materials. Standard Proctor (ASTM D698) methods will be used for all others including clayey soils with greater than 30% passing a US Sieve No. 200.
- C. If, in the opinion of the ENGINEER, subgrade or fills have been placed and compacted below specified density, the CONTRACTOR shall provide additional compaction or repairs at no additional cost to OWNER. Retests may be charged to the CONTRACTOR as determined by the ENGINEER.
- D. Subgrade materials shall be compacted at moisture content within plus or minus three (3) percent of optimum. The CONTRACTOR shall dry or add moisture to the subgrade material to provide a uniformly compacted subgrade.

### 3.4 DRAINAGE

The Contractor shall protect all work including excavations and trenches from rainfall, surface runoff and back up of water from drains and sewers. Furnish all labor, pumps, shoring, enclosures, and equipment to protect and keep the Work free of water.

Ditches and drains shall be provided and maintained to satisfactorily drain the subgrade. Where previously approved subgrade is damaged by natural causes, by hauling equipment or by other traffic, the CONTRACTOR shall restore the subgrade to the required lines, grades, and typical sections and to the required density at no additional cost to the OWNER.

### 3.5 EMBANKMENT

#### A. Embankment Formation

1. Areas to receive embankment formations or fill shall be cleared and grubbed.
2. Soil fill used to construct the embankment shall be deposited and spread in successive, uniform, loose horizontal layers of not more than eight (8) inches in depth, for the full width of the cross section, and shall be kept level by the use of effective spreading equipment. Each layer of the embankment shall be satisfactorily compacted as specified.
3. The weight of hauling equipment shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form during the construction of the embankment. The embankment shall be properly drained at all times.
4. Where embankments are to be constructed across ground that will not support the weight of trucks or other equipment, the first layer of the embankment may be constructed by dumping successive truck or other equipment loads in uniform layers to support trucks or hauling equipment.
5. If allowed by the ENGINEER a limited amount of end or side dumping will be permitted in valleys, ravines, and toe of slopes. Soils will be used to form a satisfactory base for the embankment. Soils shall be constructed in layers parallel with finished grades.
6. Embankment shall be graded to a tolerance of 1 inch (+/-) of the grades indicated on the Drawings.

#### B. EMBANKMENT COMPACTION

1. All embankment material shall be compacted to 95% Standard Proctor compaction unless otherwise or directed by the ENGINEER. Compaction equipment used by the CONTRACTOR shall be adequate to produce the required compaction and produce a uniformly constructed embankment with all layers uniformly bound to all preceding layers.
2. Embankment materials shall be compacted at moisture content within plus or minus three (3) percent of optimum. The CONTRACTOR shall dry or add moisture to the embankment material when required to provide a uniformly compacted and stable embankment.

### 3.6 STOCKPILE AREAS

Surplus and unsuitable materials shall be hauled, placed, and sloped to drain for each material classification.

Material stockpile areas will be designated by the OWNER. All excavation material shall be placed or stockpiled by one of the types listed below. All material types and classifications shall be subject to the interpretation of the ENGINEER and shall be stockpiled or used for fill as directed by the ENGINEER.

- Used for structural fill
- Stockpiled as topsoil
- Stockpiled at designated off-site location

Silt fences shall be installed around stockpiles in accordance with Section 01560 - Erosion and Sediment Control.

### 3.7 MOISTURE CONTROL

#### A. Low Moisture Content

Where subgrade or layer of soil material must be wetted before compaction, apply water to surface of subgrade or layer of soil material. Apply water uniformly and without excess in order to prevent water from accumulating on surface during or subsequent to compaction operations.

The CONTRACTOR shall furnish equipment to adjust the moisture content of the fill material. Water shall be distributed evenly and in a controlled manner over the fill. Equipment for adding water must be approved by the ENGINEER before using on fill material.

During placement operations, CONTRACTOR shall keep surfaces from drying by addition of water or placement of additional materials.

#### B. High Moisture Content

Fill material may be aerated to reduce water content. Aeration equipment must be approved by the ENGINEER before using on fill material.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Reducing moisture content may be accomplished by harrowing or pulverizing fill material for drying.

### **3.8 PROTECTION OF SUBGRADES AND FILL SURFACES**

Newly graded areas shall be protected from traffic, erosion, settlement, and other causes, prior to being tested by the ENGINEER. Graded areas shall be repaired and grades re-established to the required elevations and slopes. Embankments and excavations shall be kept in good shape and drained. Ditches and drains along subgrade shall be maintained in such a manner as to drain effectively at all times.

The finished subgrade shall not be disturbed by traffic or other activities and shall be protected and maintained by the CONTRACTOR in a satisfactory condition until the road base materials are placed. The storage or stockpiling of materials on the finished subgrade will not be permitted.

-- END OF SECTION --



## **SECTION 02220 TRENCHING, BACKFILLING, AND COMPACTION**

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### **PART 1 GENERAL**

#### **1.1 DESCRIPTION**

- A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation, backfill and compaction required to install the site utilities, including all pipelines, drains, sewers, electrical conduits and duct banks as shown on the Drawings and as specified.
- B. Excavations shall include, but not be limited to the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, and/or which may obstruct the work. Excavation shall also include the digging up and removal (clean up) of all earth, rock or other materials to install the utility and appurtenances in conformance with the lines and grades as shown on the Drawings and as specified.
- C. Backfill shall include the refilling and compacting of the fill in the trenches and excavations up to the surrounding ground surface or grade as shown on the Drawings and as specified.

#### **1.2 RELATED WORK**

Section 01560 – Erosion and Sediment Control  
Section 02210 – Grading

#### **1.3 SUBMITTALS**

N/A

#### **1.4 DEFINITIONS**

- A. Bedding: Backfill material between a pipe and the foundation on which it is supported.
- B. Embankment: Fill material placed above original ground surface to provide cover over a conduit which is fully or partially exposed.
- C. Embedment and Backfill:
  - 1. Embedment is composed of foundation, bedding, and initial backfill.
  - 2. Generally the backfilled depth down to the stable soils and up to bedding.
- D. Final Backfill: Backfill placed from a distance of twelve (12) inches above the top of the pipe to the finished grade.

- E. Foundation:
  - 1. The load bearing portion of the embedment which underlines the bedding.
  - 2. Normally the excavated trench bottom except where unstable conditions exist and then alternate methods of foundation stabilization are required.
- F. Initial Backfill: Backfill placed from the top of the bedding and along the sides of the pipe to a distance of twelve (12) inches above the top of the pipe.
- G. Rock: "Rock" is used as the name of an excavated material, and means a boulder or piece of rock, concrete or masonry measuring one (1) cubic yard or more, hard shale or solid edge rock and masonry which, in the opinion of the ENGINEER, requires the use of heavy equipment, drilling or blasting for removal.

## **PART 2**    **PRODUCTS**

### **2.1**    **BACKFILL MATERIAL**

- A. The requirements of Trenching, Backfilling, and Compaction shall apply to all backfill materials unless otherwise specified in the Drawings.
- B. All material shall be suitable and free from roots, wood, scrap material, and other vegetative matter and refuse.
- C. Acceptable material shall generally be a natural or artificial mixture of soil types normally found in natural deposits in the project vicinity or material obtained from the CONTRACTOR's excavations.
- D. All material shall be sufficiently dry for compaction and shall not contain excessive amounts of soft or highly plastic clays. Materials that are OH, OL, or PT according to Unified Soil Classification System are not suitable materials and may only be used where shown on the Drawing or only where as directed by the ENGINEER.
- E. Maximum size of stone shall not exceed four (4) inches.

### **2.2**    **BEDDING MATERIAL**

- A. Fine Granular Bedding:
  - 1. Materials for fine granular bedding material shall consist of well graded fine to coarse sands or gravel meeting the gradation requirements of ASTM C 33 for fine aggregates.
  - 2. Natural materials or artificial mixtures, consisting largely of a mixture of sand and gravel, found in natural deposits in the project vicinity may be utilized as long as the material meets the proper proportions and gradation requirements.
  - 3. The material shall generally pass a 3/8-inch sieve with no more than 10% passing a No. 100 sieve, and shall be non-plastic.

- B. Gravel Bedding:
  - 1. Materials used for gravel bedding material shall consist of natural rounded or angular, graded stone or crushed rock, with little or no fines and shall be of a non-carbonaceous material such as granite.
  - 2. Generally, the aggregate size shall range from 1 ½ to ¾ inches.
  - 3. ASTM classification shall be No. 57 stone.

### 2.3 UNSUITABLE MATERIALS

- A. General: Any material that in the opinion of the ENGINEER, contains vegetable matter, muck, roots and rubbish shall be considered unsuitable.
- B. The following, as defined in the Unified Soils Classification System, shall be considered the basis for classifying unsuitable material unless specifically noted in other sections of the specifications:
  - 1. Highly plastic clay soils of the CH and MH descriptions.
  - 2. Border line soils of the SC-CH description.
  - 3. Organic soils of the OL and OH description.
  - 4. Highly organic soils of the PT description.

## PART 3 EXECUTION

### 3.1 SITE PREPARATION

- A. Clearing and Care of Surface Materials:
  - 1. In areas where pipelines are constructed through established lawns and other improved grass areas, the sod shall be carefully removed, kept alive and replaced after backfilling is finished.
  - 2. Any topsoil that is removed shall be stockpiled at an acceptable location for later use.
- B. Trees, plants, structures and utilities shall be protected with appropriate barriers prior to construction.

### 3.2 TRENCH EXCAVATION

- A. The requirements of this Section shall apply to all trench excavation unless otherwise specified in the Drawings.
- B. Trench excavation shall be of a depth to enable proper installation of bedding materials that will result in construction of the pipeline to the alignment and grade, and depth of cover, as shown on the Drawings.
  - 1. The CONTRACTOR shall over-excavate and replace materials with material where required by the ENGINEER.

2. If during the course of construction, the trench is inadvertently over-excavated, that area shall be backfilled with fine granular bedding material, unless gravel bedding material is specified where unsuitable materials are encountered in the subgrade or where gravel bedding material is required by the ENGINEER.
- C. All such related structures and appurtenances shall be constructed to the alignment, grade, and position as shown on the Drawings.
- D. In all cases where materials are deposited along open excavation they shall be placed so that in the event of rain, no damage will result to the work or adjacent property.
- E. Unstable trench bottom:
1. Where an unstable trench bottom condition is encountered due to the presence of muck, quicksand, or other unsuitable materials, the unstable soil material shall be removed to a depth which is sufficient to produce a firm foundation, as described in Article 3.6, C.
  2. The unstable soil material shall then be replaced with gravel bedding material for the full depth of unstable material excavation.
  3. The depth of unstable soil excavation foundation and bedding replacement will be dependent upon the severity of the trench bottom soil conditions.
  4. Depths of foundation and bedding shall be no less than the depths specified for Class B Foundation and Bedding, contained in Article 3.6, C. of this Section.
  5. Alternate foundations shall be used where required as specified in Article 3.7 of this Specification Section.
- F. Regardless of the type of foundation and bedding material used, all bell holes for bell and spigot pipe shall be excavated at proper intervals so that the barrel of the pipe will be support for its entire length by the bottom of the trench and the foundation and bedding material.
- G. All bedding materials shall be compacted to achieve the required densities by tamping with suitable tools and be shaped to receive the pipe, the pipe shall be supported and set at the exact elevation and line as shown on the Drawings.
- H. Wet excavation:
1. Where walls and slopes fail in the excavation area, the CONTRACTOR use methods to shore up and protect the work, provided the proposed method and equipment received prior approval from the ENGINEER.
  2. While using the selected method of construction, the excavation area shall be protected from damage until all construction work has been completed to the satisfaction of the ENGINEER.
  3. The cost of all temporary construction work, whether necessary or incidental, including the cost of installing and removing sand bags, coffer dams, sheet piling, excavating and backfilling, pumping and dewatering, shall be considered an integral part of the cost of trenching, backfilling and compaction.

I. Disposal of materials:

1. Disposal of excess materials and smoothing of disturbed material during trenching operations shall be performed as the pipe is laid and shall not be allowed to lag more than 500 feet behind the pipe laying operations.
2. All Materials removed by excavation and that meet the requirements of these Contract Documents for a prescribed application may be used for backfilling pipe trenches, foundations and footings, and for such other purposes where shown on the Drawings and where allowed by the ENGINEER.
3. All Materials not used for backfilling, foundations, or footings shall be considered as excess materials and disposed of by the CONTRACTOR in an approved manner and at his own expense.
4. Excess materials may be deposited in stockpiles at locations where shown on the Drawings and approved by the ENGINEER.
5. If no disposal areas are shown on the Drawings, the CONTRACTOR shall provide, at his own expense, disposal areas satisfactory to the ENGINEER.
6. Excess materials shall not be left in unsightly piles. Materials may be spread in uniform layers and neatly leveled and shaped if approved by the ENGINEER.
7. Spoil banks shall be provided with adequate channeling of water to permit surface drainage of adjacent lands.
8. On completion of any part of the work proper disposal all surplus or unused materials left within the construction limits of such work shall be removed and disposed. After material is removed, the surface of the work shall be left in a neat and workmanlike condition.

### 3.3 DEWATERING

- A. Trenches shall be reasonably free of water while pipes are being laid.
  1. The CONTRACTOR shall remove and dispose of any water, stormwater, sewage, or any other liquid which is found or accumulates in the excavations.
  2. Removal may be accomplished by pumping as a part of a well point system, or other dewatering systems as approved by the ENGINEER.
- B. The CONTRACTOR shall examine the site after excavating, and before proceeding with the work he shall notify the ENGINEER of any evidence of water rising in the excavation areas.
- C. Static water levels shall be drawn down below the bottom of the excavation sufficiently to allow the placement of a foundation, bedding and backfill.
- D. Under certain conditions, the ENGINEER may permit the CONTRACTOR to remove the water using trench-side pumps.
- E. The CONTRACTOR shall not open up more trench than the pumps can dewater.

- F. The CONTRACTOR shall be responsible for disposing of all water, shall not damage natural drainage patterns in the area, and shall adhere to applicable erosion and sedimentation control standards.
- G. In no case will the pipe lines be used as drains for water. The ends of the pipe shall be kept blocked and sealed during construction using approved pipe caps or stoppers.
- H. All precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matters into the pipe lines. Any materials that have entered the pipe lines must be cleaned out, leaving the entire system clean and unobstructed.
- I. Release of groundwater to its static level shall be performed in a manner as to maintain an undisturbed state of natural foundation soils, to prevent disturbance of compacted backfill, foundation or bedding, and to prevent flotation of pipelines.
- J. The CONTRACTOR shall have appropriate, functional, pumping equipment and machinery at the project site for use during all onsite emergencies, with competent operators for operating of equipment. Machinery, equipment and operators shall be available at all times.
- K. Dewatering systems shall be designed and operated to prevent removal of natural soils and to prevent excessive reductions in the groundwater outside the excavation to the extent that damage or danger to adjacent structures or property would occur.

### **3.4 TRENCH SIZE**

- A. As soil conditions permit, the sides of trenches shall be cut in vertical, parallel planes from the bottom of the trench to the top of the pipe and have maximum width of two (2) feet plus the outside diameter of the pipe where shown on the Drawings.
- B. The width of the remaining depth of the trench may be as wide as necessary unless the excavation is restricted by limits of right-of-way, structures or improvements that are to be protected. The sides, however, shall be as nearly vertical as practicable or allowable.
- C. If the trench width from the bottom of the trench to the top of the pipe is over-excavated, pipes shall be laid on a gravel bedding at no extra cost to the OWNER.

### **3.5 EXCAVATION FOR APPURTENANCES AND STRUCTURES**

- A. Excavation for appurtenances shall be made to a size that will allow at least twelve (12) inches between the outer surfaces of the appurtenance and the excavation wall or shoring.
- B. Excavation for precast manholes and other precast structures shall be undercut six (6) inches below the bottom of the precast structure and shall be backfilled with gravel foundation and bedding material as specified under the Article 2. 2 Bedding Material in this Specification Section.
- C. Undercutting and providing foundation and bedding for structures shall be considered a part of the work under Trenching, Backfilling and Compaction.



### 3.6 EMBEDMENT OF PIPE

- A. Pipeline embedment shall consist of all foundation and bedding materials, including concrete, foundation and bedding, and initial backfill where shown on the Drawings.
- B. Class A Foundation and Bedding:
  - 1. Concrete Cradle: The pipe shall be placed in a monolithic cradle of plain or reinforced concrete.
    - a. The cradle shall have the greater thickness of one-fourth (1/4) the inside pipe diameter or four (4) inches under the barrel. The cradle shall extend up the sides for a height equal to one-fourth (1/4) the outside diameter.
    - b. The cradle shall have a width at least equal to the outside diameter of the pipe barrel plus eight (8) inches or poured to the full width of the trench.
  - 2. Concrete Arch: The pipe shall be embedded in carefully compacted gravel bedding material with a monolithic plain or reinforced concrete arch.
    - a. The gravel bedding material shall have a thickness of one-fourth (1/4) the outside pipe diameter or three (3) inch minimum between the barrel and bottom of trench excavation extending to the springline of the pipe.
    - b. The concrete arch shall have a minimum thickness of one-fourth (1/4) the inside diameter at the crown and have a minimum width equal to the outside pipe diameter plus eight (8) inches or poured to the full width of the trench.
- C. Class B Foundation and Bedding:
  - 1. Class B foundation and bedding shall be used where an unstable trench bottom condition is encountered as defined by these Contract Documents, or as determined by the ENGINEER or where shown on the Drawings.
  - 2. The pipe shall be laid on gravel placed on a flat trench.
  - 3. The gravel foundation and bedding shall have the greater thickness of one-fourth (1/4) the outside pipe diameter or three (3) inch minimum between the barrel and bottom of trench excavation extending to the spring line of the pipe.
  - 4. The gravel foundation and bedding shall extend to the springline of the pipe barrel, or one-half (1/2) the outside diameter of the pipe.
- D. Class C Foundation and Bedding:
  - 1. Class C foundation and bedding shall be used as the foundation and bedding for this project and shall be used unless unstable trench conditions, in the opinion of the ENGINEER, are present or where otherwise shown on the Drawings.

2. The pipe shall be placed on fine granular bedding material that is supported by the trench bottom. The pipe shall be level in cross-section except that a continuous bedding trough shall be shaped to conform to the pipe barrel with reasonable closeness.
  3. The foundation and bedding shall have the greater thickness of six (6) inches beneath the pipe or one-eighth (1/8) of the outside diameter of the pipe.
  4. The foundation and bedding shall extend up the sides of the pipe one-sixth (1/6) of the outside diameter of the pipe.
- E. Initial backfill material, which is from the top of bedding to one foot above the pipe:
1. Shall be carefully deposited in successive horizontal layers of not more than twelve (12) inches in loose depth on each side of the pipe.
  2. Shall be thoroughly and carefully tamped or rammed around the pipe with approved tools until reaching a minimum cover of not less than one foot over the top of the pipe.

### 3.7 ALTERNATE FOUNDATIONS

- A. Where, in the opinion of the ENGINEER, the bottom of the trench consists of unstable material and that the material cannot be removed and replaced with an adequate bedding material, alternative foundations methods may be required.
- B. The ENGINEER may require special foundations such as piling, concrete mats (or a combination thereof), sheeting with keyed-in plank foundation, or other means of soil stabilization.
- C. The type of alternative foundation methods shall be constructed in accordance with the Drawings or as approved by the ENGINEER.
- D. Instructions and drawings will be furnished, if in the opinion of the ENGINEER, they are needed.

### 3.8 BACKFILLING

- A. The backfilling of pipe line trenches shall start immediately after the pipe work and embedment preparation have been observed by the ENGINEER.
- B. Final backfill material, which is from a height of one foot above the pipeline upward:
  1. Shall be backfilled in well compacted layers.
  2. Shall be backfilled in the manner specified for initial backfill where indicated on the Drawings.



If the trench extends along or across streets, roadways, useable alleys, or sidewalks or any areas to be paved, the remainder of the trench shall be backfilled and tamped to its full depth in the manner specified for initial backfill.

- C. Placement of backfill material in layers greater than twelve (12) inches of loose fill must be approved by the ENGINEER.
- D. All backfilling shall be performed in such manner that will not disturb or injure the pipe or structure over or against which it is being placed. No pipe or structure will be damaged while backfilling.
- E. Any pipe or structure that is damaged or moved during backfilling operations shall be exposed and repaired before backfilling is complete.
- F. Where excavation has been made, the top one foot of backfill material shall consist of fine, loose earth; free of large clods, organic material, debris, stone, or other objectionable materials.
- G. Temporary surfaces:
  - 1. Where pipe trenches are cut across or along pavement, the CONTRACTOR shall construct a temporary surface over the cut by filling and tamping the upper six (6) inches of the cut with selected gravel or crushed stone which will not spread or settle under traffic. The temporary surface shall be maintained in good condition until permanent pavement is installed.

### **3.9 COMPACTION AND TESTING**

- A. Compaction and testing for quality control shall be in conformance with the specific requirements of this Section.
- B. Minimum tests required on all materials to prove compliance with the specifications shall be as follows:
  - 1. A determination of soil classification, sieve analysis, maximum dry density as per ASTM D-698 and optimum moisture content shall be made from each material source.
  - 2. In-place density compaction and moisture content testing shall be made on all materials in trenches, and under roadways, streets, useable alleys, or other areas as required by this specification or the ENGINEER.
- C. Compaction requirements:
  - 1. Unless otherwise specifically noted elsewhere in these Specifications or on the Drawings, material shall meet the following compaction requirements.
    - a. Foundation, bedding and initial backfill material shall be well compacted. Foundation and bedding under pipe and manholes shall be compacted to a

minimum of 95 percent of the maximum dry density as determined by the Standard Proctor Compaction Test, ASTM D 698.

- b. Initial backfill shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise. Backfill on both sides of the pipe simultaneously to prevent side pressures.
- c. Final backfill and embankments shall be compacted to a density equal to or greater than the surrounding undisturbed soil. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise. If trench settles, refill and grade the surface to conform to adjacent surfaces.
- d. Moisture shall be within +/- 3 percent of optimum moisture content for maximum density. (ASTM D 698)

D. Additional Material

Utilize excess suitable material excavated from the trench, if additional material is needed. Additional materials are not available from trench excavation, obtain suitable on-site material where approved by the ENGINEER.

E. Backfill Under Roads

Compact backfill underlying pavement and sidewalks and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density up to twelve (12) inches under pavement or gravel road surface. Compact the remaining twelve (12) inches of backfill to a minimum of 98 percent of the maximum dry density.

F. Backfill Along Restrained Joint Pipe

Backfill along restrained joint pipe shall be compacted to a minimum 95 percent of the maximum dry density.

G. Detection Tape

Detection tape shall be buried 4 to 10-inches beneath the ground surface directly over the top of the utility. Should detection tape need to be installed deeper, the CONTRACTOR shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finished grade surface.

### 3.10 SURFACE RESTORATION AND CLEAN-UP

- A. CONTRACTOR shall properly restore to the satisfaction of the ENGINEER all surfaces, structures, pavements and drives, sidewalks and curbs that were to remain but were removed or disturbed by the Contract through the execution of the Work.

B. Surface Restoration:

1. Once backfilling has been completed and all objectionable material has been removed, surface restoration shall be conducted.
2. The CONTRACTOR shall bring all surfaces to finish grade and fine grade all disturbed areas within the construction limits unless otherwise directed by the ENGINEER.
3. Upon completion of finish grading, the CONTRACTOR shall seed all disturbed areas, unless otherwise shown on the Drawings in accordance with the Landscape Plans.
4. Shrubbery or trees shall be replaced or properly heeled-in and replanted.

C. Clean-up and Maintenance:

1. The CONTRACTOR shall maintain excavated areas, backfills, embankments, trenches and access road grading and ditches until final acceptance by the OWNER.
2. Any settlement or washing that may occur prior to acceptance of the work, shall be repaired and grades re-established to the required elevations and slopes.
3. All debris and construction material and equipment shall be removed from the job site when the work is completed. Material and equipment that is no longer needed may be removed before the work is completed.
4. All rights-of-way shall be left in a clean, neat and serviceable condition during and after construction.

-- END OF SECTION --