

GENERAL CONSTRUCTION

STANDARDS & SPECIFICATIONS MANUAL



MOORE COUNTY PUBLIC WORKS

ORIGINAL PUBLICATION: OCTOBER 2012

REVISED: JANUARY 2015

PREFACE

These standards are for design and construction of general construction activities related to water mains, wastewater mains, pump stations, force mains, and flow metering stations, which will come under the jurisdiction of Moore County Public Works (MCPW). **These standards alone do not constitute a complete set of construction documents. The owner's or developer's Professional Engineer is responsible for providing plans that encompass all the needs of the project and comply with the standards within this manual.**

The standards do not include a complete commentary on methods or installation and detailed information or quality of workmanship in place. The owner's or developer's Professional Engineer must include detailed information on methods of construction and should expand on the testing and any of the special requirements to the engineer's satisfaction, subject to the approval of MCPW.

From time to time, these standards will be amended and/or expanded at the pleasure of the MCPW Engineering Division. It will be the responsibility of the owner or developer to contact the MCPW to obtain updated standards.

There may be circumstances whereby the design engineer may wish to propose changes or modifications to these standards, when this occurs permission from the County Engineer shall be obtained prior to submission to NC DENR.

Disclaimer

To the best of their ability, the authors have insured that material presented in this manual is accurate and reliable. The design of engineered facilities, however, requires considerable judgment on the part of designer. It is the responsibility of the design professional to insure that techniques utilized are appropriate for a given situation. Therefore, neither Moore County Public Works, nor any author or other individual, group, etc., associated with production of this manual, accepts any responsibility for improper design, any loss, damage, or injury as a result of the use of this manual.

MANUAL 2: GENERAL CONSTRUCTION – DETAIL SPECIFICATIONS

Table of Contents

	Page
2.01 ARCHAEOLOGICAL.....	1
2.02 CONSTRUCTION LIMITS.....	1
2.03 DAMAGES AND COMPLAINTS	1-2
2.04 DUST CONTROL	2
2.05 PRELIMINARY WORK.....	2
A. Work Area	
B. Vegetation and Ornamental Items	
C. Clearing and Grubbing	
D. Disposal of Cleared and Grubbed Material	
2.06 TRAFFIC CONTROL & WORK ZONE SAFETY.....	3
A. Controlling Agencies	
B. Traffic Control Methods	
C. Lane Closures	
D. Dress Code	
E. Improper Control	
2.07 UNLOADING & STORAGE OF MATERIALS	3
2.08 TRENCH EXCAVATION & PREPARATION.....	4-7
A. Trench Dimensions	
B. Poor Soil conditions	
C. Trench Bottoms	
D. Unstable Material	
E. Disposal of Material	
F. Ground Water	
G. Utilities	
H. Rock Excavation	
I. Blasting Procedures	
J. Shoring	

2.09	ENCASEMENT INSTALLATION.....	7-9
	A. Boring and Jacking	
	B. Driving Encased Pipe	
	C. Pneumatic Drilling	
	D. Casing Pipe	
	E. Spider Support	
2.10	DIRECTIONAL DRILLING.....	9-13
	A. Scope	
	B. General Description of Method	
	C. Site Conditions	
	D. Drilling Fluid	
	E. Dewatering	
	F. Guided Boring Operations	
2.11	PAVEMENT REMOVAL AND REPLACEMENT.....	13-14
	A. Pavement Cut	
	B. Sub-base	
	C. Base	
	D. Surface	
	E. Maintenance	
2.12	SERVICE AND UTILITY: REPAIRS TO DAMAGES.....	14
2.13	SIDEWALK REMOVAL AND REPLACEMENT.....	15
	A. Removal	
	B. Replacement	
	C. Maintenance	
2.14	SEEDING/TURFING & EROSION CONTROL.....	15-21
	A. Seeding	
	B. Lime	
	C. Fertilizer	
	D. Establishing Turf	
	E. Mulching	
	F. Manicured Areas (Sod)	
	G. Permanent Erosion Control	
	H. Sedimentation and Erosion Control	
	I. Mowing	
2.15	FENCES AND GATES.....	21-22
2.16	CLEANUP.....	22
	A. Roadway Cleanup	22

2.17 DETAIL DRAWINGS

- GC-1 Roadway Pavement, Open Cut & Patch
- GC-2 Driveway Pavement, Open Cut & Patch
- GC-3 Standard Bore Encasement
- GC-4 Directional Drill, HDPE
- GC-5 HDPE/DIP Transition Assembly

MOORE COUNTY PUBLIC WORKS ENGINEERING DIVISION

Manual 2 – General Construction – Detail Specifications

2.01 ARCHAEOLOGICAL

If the Contractor, during the prosecution of work, encounters an unidentified archaeological or other cultural resource within the work area, the Contractor shall immediately stop work and notify the Engineer.

2.02 CONSTRUCTION LIMITS

All trash, forms, debris, and other foreign material shall be cleared from around all pipes and structures before backfilling.

Backfilling shall be kept up with the pipe laying to the satisfaction of the Engineer.

Backfilling around the pipe and to a depth of at least 12” above the top of pipe shall be in layers of not over 6”. Only select material containing no rocks or other objectionable material shall be used for this portion of the backfill. As soon as the material is placed, it shall be cut under the haunches of the pipe with a shovel and thoroughly compacted with mechanical tamps for the full width of the trench to provide support for the bottom and sides of the pipe. Back filling shall be carried up evenly on both sides.

Excess material shall be promptly removed from the site, and the pavement or road surface cleaned of objectionable material. The pavement and/or road surface shall be cleaned daily with a mechanical broom and/or washed, if required by the Engineer.

The Contractor shall be responsible for all final grade of all trenches and shall leave the same flush with the original ground after all settlement has taken place. Trenches must be protected against scour due to surface drainage. The Contractor shall correct any future settlement within the warranty period at his own expense.

2.03 DAMAGES AND COMPLAINTS

The Contractor shall provide protection which, in the opinion of the Engineer, will prevent damage to the property, such as lawns, roads, fences, buildings, drains, bridges

and pipelines by his equipment, and shall assume sole responsibility for damages thereby incurred and shall notify the Engineer immediately if and when damage occurs. The Engineer shall be promptly notified of all pipelines that are broken by the Contractor's operations and immediate arrangements made for repairs. Damage to property shall be repaired to a condition that is as good as, or better than original.

The Contractor shall promptly comply with all reasonable requests of the landowners and tenants relative to access to right-of-way and to general conduct of his work; however, he shall not enter into any agreements with property owners or tenants on other matters such as the saving of logs or firewood or the disposal of brush without prior approval of the Engineer. In cases of disagreement between any landowner or tenant and the Contractor, the Contractor shall notify the Engineer immediately and shall not perform any further operations against the objections of the property owner or tenant without prior approval of the Engineer.

2.04 DUST CONTROL

The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition endangering the value, or appearance of any property. The Contractor will provide dust control measures as directed by the Engineer.

2.05 PRELIMINARY WORK

- A. Work Area:** Adequate working space shall be cleared along the pipe lines and space shall be provided for control stakes and hubs. Trees and permanent structures not located within the right-of-way shall be removed only as directed by the Engineer.
- B. Vegetation and Ornamental Items:** The Contractor shall be fully responsible for protection of or removal and replacement of ornamental trees, shrubs and grasses, decorative items such as retaining walls and all other items with no additional payment or compensation.
- C. Clearing and Grubbing:** Clearing and grubbing shall be performed in areas indicated and where required for construction. It shall include the complete removal and disposal of all brush, weeds, timber, stumps, rubbish and all other obstructions. In clearing and grubbing areas where excavation is done, all timber, roots, or stumps removed that are exposed by said excavation shall be removed to a depth of one foot below the excavated surface.

- D. Disposal of Cleared and Grubbed Material:** All refuse from the clearing and grubbing operation shall be disposed of in compliance with Town, County and State regulations.

2.06 TRAFFIC CONTROL AND WORK ZONE SAFETY

A. Controlling Agencies

The Contractor shall maintain traffic during construction and provide, install, and maintain all traffic control devices in accordance with the project guidelines, the Project Special Provisions, North Carolina Department of Transportation “Standard Specifications for Roads and Structures”, the current edition of the “Manual of Uniform Traffic Control Devices” (MUTCD) and any special local laws or ordinances.

B. Traffic Control Methods

The Contractor shall utilize complete and proper traffic controls and traffic control devices during all operations. All traffic control and traffic control devices required for any operation shall be functional and in place prior to the commencement of that operation. Signs for temporary operations shall be removed during periods of inactivity. The Contractor is required to leave the project in a manner that will be safe to the traveling public and which will not impede motorists.

C. Lane Closures

Traffic movement through lane closures on roads with two way traffic shall be controlled by flaggers stationed at each end of the work zone. In situations where sight distance is limited, the Contractor shall provide additional means of controlling traffic, including, but not limited to, two-way radios, pilot vehicles, or additional flaggers. Flaggers shall be competent personnel, adequately trained in flagging procedures.

D. Dress Code

All personnel when working in traffic areas or areas in close proximity to traffic shall wear an approved safety vest, or shirt or jacket and hat or helmet which meets the color requirements of the “Manual of Uniform Traffic Control Devices” (MUTCD).

E. Regulations

Contractor shall comply with all applicable laws and regulations relating to the safety of persons or property.

F. Improper Control

Failure to comply with any of the requirements for safety and traffic control of these standards and specifications shall result in suspension of work.

2.07 UNLOADING & STORAGE OF MATERIALS

The unloading and loading of all pipe, fittings, and other accessories shall be in accordance with manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material. All such material shall not be stored directly on the ground, but shall be on pallets or other suitable supports so as to prevent the entry of mud and debris in pipe or other materials.

Once on the job site, all materials shall be stored in accordance with the manufacturer's recommended practices, and within the limits of the Project site.

2.08 TRENCH EXCAVATION & PREPARATION

A. Trench Dimensions

The pipeline trench shall be excavated to the line and gradient shown on the approved drawings. The minimum width of the trench as measured at the top of the pipe shall be the outside diameter of the pipe barrel, plus 8 inches on each side. The maximum trench width measured at the top of the pipe shall not exceed the outside diameter of the pipe barrel, plus 12 inches on each side. Where pavement is to be cut, it shall be cut in advance of trenching 12" wider than the specified width of the trench on each side. See STD. No. GC-1 & GC-2 for details.

The length of trench which may be open ahead of pipe laying operations shall be no more than 100 feet and no less than 20 feet unless warranted by special circumstances, and then only upon approval of the Engineer.

Depth of cover shall not be less than 3'-0" for pipe up to 8" in diameter and 3'-6" for pipe 10" and larger in diameter, measured to the top of pipe, unless shown differently on the profile plans or authorized by the Engineer.

B. Poor Soil Conditions

Where soil conditions prohibit vertical walls, the trench width at the bottom and at 1' above the top of the pipe shall be as specified above with the remainder being held to the least possible width greater than that specified. Where soil conditions prevent ditch excavation without excessive widths, or where directed by the Engineer, wood sheeting, as hereinafter specified, shall be driven to support the trench walls or a suitable reinforced steel trench box shall be employed.

C. Trench Bottoms

Trench bottoms shall be hand graded to provide uniform and continuous bearing for the pipe along its entire length, with bell holes being dug for pipe bells. No ridges,

sags, or undercutting will be allowed. Excess excavation below grade shall be backfilled with suitable material which shall be thoroughly tamped.

If approved by the Engineer and subject to suitable soil conditions, the trench may be excavated a few inches below the established subgrade and backfilled with select material (from the excavation, if available) well compacted and so shaped as to give the pipes uniform bearing throughout their lengths at the established grade. Bell holes shall be dug to relieve the bells of load and to provide for completion of the joints.

D. Unstable Material

Where the material at grade is unstable, soft, and incapable of supporting the pipe, the trench shall be excavated below grade, as directed by the Engineer, and refilled to grade with stone or gravel to form a firm foundation for the pipe. Stone shall be compacted and graded to provide a stable foundation and a uniform bearing for pipe. Bell holes shall be provided as in other types of foundations.

E. Disposal of Material

When authorized by the Engineer, the contractor shall dispose of material excavated from the trench that is unsuitable for backfill material. The Contractor shall provide and place select borrow material to replace unsuitable material for backfilling the trench as directed.

F. Ground Water

Should ground water be encountered in the bottom of the trench, causing the trench bottom to be unstable, the material, as directed by the Engineer, shall be excavated below grade sufficiently, 8” minimum, to allow a bed of crushed rock or gravel to be placed in which to bed the pipe. The crusher-run stone or gravel shall be placed up to the spring line of the pipe. The work shall be done as for unstable foundations. The depth of cut below grade shall be only the minimum amount to accomplish the purpose, and shall be as directed by the Engineer.

The Contractor shall furnish all machinery for pumping, bailing, and/or well pointing and shall pump, bail, or otherwise remove any water which may be found or shall accumulate in the trenches. The disposal of water after removal shall be satisfactory to the Engineer.

G. Utilities

All existing water, sewer, and gas lines, buried electrical and telephone cable, and other known utilities intersecting the lines of construction, if requested by the Engineer, shall be uncovered by the Contractor at his expense and exposed to the Engineer at least 100’ ahead of pipe laying operations to insure the correctness of grades.

The Contractor shall at all times take necessary precautions in preventing gutters, catch basins, ditches and other drainage facilities from being clogged that might cause flooding conditions and damage to public or private properties.

H. Rock Excavation

In the event rock is encountered, the trench shall be excavated to a depth of not less than 6 inches beneath the bottom of the pipe and then refilled with No. 67 stone. For ductile iron pipe, or cast iron pipe, the bedding may be other native granular soil as may be approved by the Engineer. The trench width in rock excavation shall be as previously specified.

I. Blasting Procedures

Blasting for trench rock may be initiated only after the permitting requirements are met by the local governing body.

Blasting Procedures shall conform to all applicable local, State, and Federal laws and ordinances. The Contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. The Contractor shall keep explosive materials which are needed on the job site in specially constructed boxes provided with locks. These boxes shall be painted red and plainly identified as to their contents. After working hours, the boxes containing explosive material shall be removed from the job site.

Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within 500 feet of a utility, structure, or property which could be damaged by vibration, concussion, or falling rock, the Contractor shall be required to keep a blasting log containing the following information for each and every shot:

1. Date of shot
2. Time of shot
3. Explosive Specialist's name
4. Number and depth of holes
5. Approximate depth of overburden
6. Amount and type of explosive used in each hole
7. Type of caps used (instant or delay)
8. The weather

This blasting log shall be made available to the Engineer upon request and shall be kept in an orderly manner. Compliance by the Contractor with these specifications does in no way relieve him of legal liabilities relative to blasting operations.

The Engineer reserves the right to require removal of rock by means other than blasting where any utility, residence, structure, etc. is either too close to, or so situated with respect to the blasting hazardous.

J. Shoring

Shoring will be provided by the Contractor when the excavation will endanger existing structures, utilities, pavements and banks, and workmen. The shoring shall be constructed of adequate size members and the arrangement of members shall be suitable to withstand the earth pressure expected. Shoring, sheeting, and bracing that are utilized above the invert of the pipe shall be removed carefully during the backfilling process in order to prevent caving that might displace the pipe from the correct line and grade. When and where directed by the Engineer, sheeting may be left in place in the backfill with adequate braces to provide lateral support. Shoring shall be in accordance with OSHA regulation

2.09 ENCASEMENT INSTALLATION

A. Boring and Jacking

Boring and Jacking is performed with dry bores slightly larger than the pipe bored progressively ahead of the leading edge of the advancing pipe as spoil is mucked by the auger back through the pipe. As the dry boring operation progresses, each new section of encasement pipe shall be butt-welded to the section previously jacked into place.

If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe at 10-foot centers and the voids filled with 1:3 Portland cement grout at sufficient pressure to prevent settlement within a traffic bearing area. In the event an obstruction is encountered during the boring and jacking operation, the auger is to be withdrawn and the excess pipe is to be cut off, capped, and filled with 1:3 Portland cement grout as sufficient pressure to fill all voids before moving to another boring site. See Std. No. GC-3 for detail.

Upon insertion of the pipeline through the casing pipe, the ends of the encasing pipe shall be sealed with brick and mortar; adjustable stainless steel band or rubber casing seal. All seals shall be such as to withstand hydrostatic pressure from ground water, backfill loads and provide means to prevent water lines from flooding within the easement pipe. Grouting procedure will not be allowed.

B. Driving: A metal pipe, normally no larger than 8-inches in diameter with or without a pilot shoe can be driven through compressible soils by a steady thrust or hammering. The pipe, after penetration, is pulled out and a same size pipe or encasement pipe is installed.

C. Pneumatic Drilling: A pit is dug at the entrance where a support frame is installed to hold the encasement pipe and provide the proper slope. A Pneumatic Vibrator is then fastened to the outside end of the pipe and with a continuous thrusting action drives the pipe near flush with the pipe wall. The vibrator is then removed and a second encasement pipe is welded to the existing pipe. The vibrator is fastened to the outside end of the second pipe and vibration continues until this pipe is flush with the pit wall.

After all needed pipe has been installed, a rag is placed within the pipe opening and a flat piece of metal, that is larger than the pipe opening, and has a small hole in the middle is spot welded to the pipe end section. Air is then forced into the pipe line through the small plate opening which blows the material within the pipe line out the other end where it is contained within a small pit that was constructed earlier.

D. Casing Pipe

Size: See Below

<u>Carrier Pipe</u>	<u>Casing Pipe Minimum</u>
4"	10"
6"	12"
8"	16"
10"	18"
12"	20"
14"	22"
16"	24"
18"	26"
24"	32"
30"	38"

Thickness and Strength: Steel pipe for casings shall be manufactured from steel having a minimum yield strength of 35,000 psi, per ASTM A36/A36M, with the minimum wall thickness as shown below:

Pipe Sizes	Wall Thickness inches	
	Roadway	Railroad
4" – 10"	.188"	.188"
12" - 14"	.188"	.250"
16"	.250"	.218"
18"	.250"	.312"
20"	.250"	.344"
24"	.250"	.375"

30"	.312"	.469"
36"	.375"	.532"
48"	.500"	.688"

Casing under railroads: Railroad Crossing casing pipe to be 5 ft. 6 in. minimum from top of rail to top of Casing Pipe.

E. Spider Support: The carrier pipe shall be supported inside the casing pipe by metal Spiders. The Spiders shall be Epoxy Coated or Stainless Steel with polyethylene runners. There shall be a minimum of two Spiders per individual pipe length, one at each end of the pipe. The number can be increased as directed by the Engineer. See STD. No. GC-3 for detail.

2.10 DIRECTIONAL DRILLING

A. Scope: This section includes the installation of a water main or wastewater main by guided boring. The Contractor will furnish all labor, components, materials, tools and appurtenances necessary or proper for the performance and completion of the contract.

B. General Description of Method: Guided boring is a method of trenchless construction using a surface launched steerable drilling tool controlled from a mobile drilling frame, and includes a field power unit, mud mixing system and mobile spoils extraction system. The drilling frame is sited and aligned to bore a pilot borehole that conforms to the planned installation of the main. The drilling frame is set back from an access pit that has been dug (typically at the location of the proposed main or other appurtenance) and a high-pressure fluid jet toolhead that uses a mixture of bentonite clay and water is launched. Pits are normally dug at the start point and endpoint of the proposed pipe installation and are used to align the toolhead, attach other equipment, and to collect and remove excess spoils. Using an electronic guidance system, the toolhead is guided through the soil to create a pilot borehole. Upon reaching the endpoint joint, the toolhead is removed and a reamer with the product pipe attached is joined to the drill string and pulled back through the borehole. In large diameter installations, pre-reaming of the borehole will usually be done prior to attaching the product pipe for the final pullback. A vacuum spoils extraction system removes any excess spoils generated during the installation. The connections, manholes or other appurtenances are then completed at both the start point and endpoint locations and the surface restored to its original condition. See Std. No. GC-4 for detail.

C. Site Conditions

1. Drilling operations must not interfere with, interrupt or endanger surface, and activity upon the surface.

2. Contractor must comply with all applicable jurisdictional codes and OSHA requirements.
3. The Contractor shall conduct pre-bid and pre-drill investigations of each individual site. When rock stratum, boulders, underground obstructions, or other soil conditions that impede the progress of drilling operations are encountered, the Contractor shall change from a conventional drilling bit to one suitable for drilling in rock formations. This change in equipment shall be at no additional cost to the owner.

D. Drilling fluid

1. Drilling fluid will be a mixture of water and bentonite clay. The fluid will be inert. The fluid should remain in the tunnel to ensure the stability of the tunnel, reduce drag on the pulled pipe, and provide backfill with the annulus of the pipe and tunnel.
2. Disposal of excess drilling fluid and spoils will be the responsibility of the Contractor who must comply with all relevant regulations, right-of-way, work space and permit agreements. Excess drilling fluid and spoils will be disposed at an approved location.
3. The Contractor is responsible for transporting all excess fluid and spoils to the disposal site and paying any disposal costs. Excess drilling fluid and spoils will be transported in a manner that prevents accidental spillage onto roadways. Excess drilling fluid and spoils will not be discharged into sanitary or storm drain systems, ditches or waterways.
4. Fluid returns (caused by fracturing or formations) at locations other than the entry and exit points will be minimized. The Contractor will immediately clean up any drilling fluid that may surface through fracturing.
5. Mobil spoils removal equipment capable of quickly removing spoils from entry or exit pits and areas with returns caused by fracturing will be present during drilling operations to fulfill the requirements of paragraphs 2 and 3 above.
6. The Contractor will be responsible for making provisions for a clean water supply for the mixing of drilling fluid.

E. Dewatering

1. The Engineer shall be notified immediately if any obstruction is encountered that stops the forward progress of drilling operations.
2. Dewatering of pits and excavations must meet the general provisions and specifications for new water main construction as defined by MCPW. The type of dewatering method will be at the option of the Contractor. When water is encountered, the Contractor must provide a dewatering system of sufficient capacity to remove water, keeping any excavations free of water until the backfill operation is in progress. Dewatering shall be performed in a manner so that removal of soil particles is held to a minimum.

F. Guided Boring Operations

1. Equipment:

- a. The drilling equipment must be capable of placing the pipe within the limits indicated on the contract plans.
- b. Guided boring equipment shall consist of a surface launched steerable drilling tool controlled from a mobile drilling frame, and include a field power unit, mud mixing system and mobile spoils extraction system.
- c. The number of access pits shall be kept to a minimum and the equipment must be capable of boring the following lengths in a single bore. The guided boring system will have the capability of boring and installing a continuous run without intermediate pits of a minimum distance for the following pipe diameters:

<u>Product Pipe Size</u>	<u>Minimum Boring Distance</u>
1 – 1 ½ inches	500 feet
2 – 4 inches	450 feet
6 inches	400 feet
8 inches	350 feet
19 – 16 inches	300 feet

- d. The guidance system shall have the capability of measuring vertical (depth) position, horizontal position and roll. The guidance system must meet the following specifications in soft homogenous soils:

Accuracy

11 of 22

Vertical position:	1 inch at	18-96 inches of depth
	2 inches at	97-144 inches of depth
	4 inches at	145-180 inches of depth
	6 inches at	181-300 inches of depth
	10 inches at	301-480 inches of depth

Horizontal position:	2 inches at	18-96 inches of depth
	4 inches at	97-180 inches of depth
	6 inches at	145-180 inches of depth
	12 inches at	181-300 inches of depth
	24 inches at	301-480 inches of depth

e. Equipment set-up requirements shall be prepared by the Contractor and submitted to the Engineer per the requirements as stated under “Submittals”.

f. Required Safety Equipment:

During drilling operations all equipment shall be effectively grounded and incorporate a system that protects operating personnel from electrical hazards. The system shall be equipped with an audible alarm that can sense if contact is made with an energized electric cable. Proper operation of the alarm system will be confirmed prior to the drilling of each tunnel. All equipment will be connected to ground with a copper conductor capable of handling the maximum anticipated fault current. Crew members operating drilling equipment and handling rods will do so while standing on grounded wire mesh mats, ensuring that all equipment is grounded, and wearing hot boots, hot gloves, safety glassed and hard hats. Crew members operating handheld locating equipment will wear hot boots.

g. Equipment set-up requirements and locations shall be determined by the Contractor and submitted to the Engineer per the requirements as stated under “Submittals”.

2. Pilot Hole Boring:

a. The entry angle of the pilot hole and the boring process will maintain a curvature that does not exceed the allowable bending radii of the product pipe.

b. The Contractor shall follow the pipeline alignment as shown on the Drawings, within the specifications stated. If adjustments are required, the Contractor shall notify the Engineer for approval prior to making the adjustments.

3. Installing Product Pipe:

- a. Water mains crossing streams shall be of HDPE, DR-9, 250 psi. The pipe shall be directional drilled at sufficient depth to provide a minimum of 5 foot of cover between the top of pipe and stream bed. There should be a minimum of two feet (2') clearance between any utility crossing and a minimum of three feet (3') of cover from any surface area.
 - b. HDPE and Mechanical Joint Pull Assembly shall be as shown in Std. No. GC-4. HDPE and DIP Transition Assembly shall be as shown in Std. No. GC-5.
 - c. Reaming diameter will not exceed 1.5 times the diameter of the product pipe being installed.
 - d. The HDPE pipe being pulled into the tunnel will be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.
 - e. Pullback forces will not exceed the allowable pulling forces for the product pipe.
 - f. The Contractor shall allow sufficient lengths of product pipe to extend past the termination point to allow connections to the diffuser assembly. Pulled pipe will be allowed 24 hours of stabilization prior to making tie-ins. The length of extra product pipe will be at the Contractor's discretion.
 - g. Valves shall be provided at or near both ends of the HDPE water crossings so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding.
1. After installation:
 - a. A plan and profile shall be provided from entry to exit for each directional bore.
 - b. All bore sections shall be hydrostatically tested per specification standards upon completion of installation and prior to placing the water main on-line.
 - c. This standard is also applicable to wetlands or any applications where directional bore with polyethylene pipe is needed.

5. Clean-up

The Contractor shall maintain the work site in a neat and orderly condition throughout the period of work and after completing the work at each site, remove

debris, surplus material and temporary structures erected by the Contractor. The site shall be restored to a condition equal to the existing condition prior to being disturbed.

2.11 PAVEMENT REMOVAL AND REPLACEMENT

A. Pavement Cut

All pavements shall be neatly cut to a straight edge in advance of trenching with the method of cutting being subject to approval of the Engineer. Pavement shall be cut 12" wider than the excavated area on each side. Ragged or irregular edges will not be allowed and work completed with barred edges shall be redone. Concrete pavement shall be sawed with suitable concrete saw cutting equipment. See Std. No. GC-1 and GC-2.

B. Sub base

Trench backfilling shall be done in layers not over 6" thick and thoroughly compacted to within 8" of pavement surface. Compaction shall be such as to prevent future settlement and shall be done by acceptable means, approved by the Engineer. Rolling with rubber tired vehicles or track-type equipment will not be allowed. Compaction shall be at least 95% of minimum compaction.

C. Base

The base shall be filled with 8" crusher run stone (ABC) for the length of the pavement, plus 8" beyond the existing pavement on each end. This stone shall be compacted to 100% minimum compaction, for Secondary Highways, City Streets and Driveways.

Primary Highways require 6 inches of Asphalt Concrete Base Course or as directed by N.C. Department of Transportation or Town.

D. Surface

1. Asphalt Replacement: The edges of the asphalt shall be trimmed to a new face and mopped with asphalt cement. The asphalt surface shall be placed and thoroughly rolled to a smooth, dense surface true to adjacent areas of the street. The asphalt surface course shall consist of 2" min. Type SF-9.5A bituminous concrete surface course in accordance with N.C. Department of Transportation Specifications.

2. Concrete Replacement (Roadways): Concrete replacement shall be performed in accordance with N.C. Department of Transportation “Standard Specifications for Roads and Structures”.

E. Maintenance:

Cut areas shall be maintained by the Contractor in a safe, passable condition until paved. Should the area create a dusty condition, the Contractor shall remedy this condition by the use of water or calcium chloride. Special care shall be given to the areas cut in traffic lanes and intersections by placing crushed stone and maintaining in a smooth condition at the Contractor’s expense.

2.12 SERVICES AND UTILITIES, REPAIRS TO DAMAGES

Repairs to damaged services and utilities shall be promptly made at the Contractor’s expense. The contractor shall use every effort to avoid damaging or breaking water, sewer, gas, power, telephone, or other utility service. Utility lines shall be properly supported across the pipe trench until backfilling is completed. Should damage occur, immediate action shall be initiated to effect satisfactory repairs. All repair work shall be satisfactory to the Owner of the damaged utility.

2.13 SIDEWALK REMOVAL AND REPLACEMENT

A. Removal

Where pipe is to be placed under existing concrete sidewalk, the concrete shall be removed in construction units unless their length is more than 10’, in which case the concrete shall be cut. The backfill shall be thoroughly compacted for the entire depth of the trench.

B. Replacement

The sidewalk shall be replaced with 3000 psi. concrete, 4” thick, except for driveways where it shall be 6” thick. The concrete shall be placed monolithic and dressed off with a wooden float, brush and edging tool. Where pipe is to be placed under concrete walk, the Contractor may, with the permission of the Engineer, install the pipe by tunneling instead of removing and replacing the walk or driveways. If pipe is to be placed under curb and gutter, it shall be done by tunneling, unless other methods are approved by the Engineer.

C. Maintenance

The Contractor shall be responsible for removing and replacing items such as mail boxes, fences, shrubbery, walls, steps, and any other private ornamental items that are in direct conflict with the construction.

2.14 SEEDING/TURFING and EROSION CONTROL

- A. **Seeding:** Seed shall be furnished and sowed as follows, all mixtures and ratios are based on a per acre application rate:

YEARROUND Mix – Sandy Soils

Kentucky 31 Tall Fescue or Alta Tall Fescue	50 lbs.
Pensacola Bahia grass	50 lbs.
Centipede	5 lbs.
Fertilizer (10-20-20 analysis)	500 lbs.
Limestone	4,000 lbs.

YEARROUND MIX Clay Soils

Kentucky 31 Tall Fescue or Alta Tall Fescue	100 lbs.
Kenblue Bluegrass	15 lbs.
Fertilizer (10-20-20 analysis)	500 lbs.
Limestone	4,000 lbs.

Add 10 pounds of Kobe or Korean Lespedeza and 10 pounds of Millet to the above mixture from May 1 – August 31.

On cut and fill slope 2:1 or steeper, add 30lbs. Sericea Lespedeza from January 1 – December 31.

Fertilizer shall be 10-20-20- analysis. Upon written approval from the NCDOT – District Engineer, a different analysis may be used provided the 1-2-2 ratio is maintained and the rate of application is adjusted to provide the same amount of plant food as a 10-20-20- analysis.

Quantities stated are in terms of total seed of the specified quantity.

The three types of seed shall be mixed thoroughly prior to sowing.

All sowing of seed shall be completed within the time limit of the contract, or unless otherwise authorized by the Engineer. All seed shall be covered to an average depth of one-fourth (1/4) inch.

- B. **Lime:** The quantity of lime and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Lime Law and regulations adopted by the North Carolina Board of Agriculture.

During the handling and storing, the lime shall be cared for in such a manner that it will be protected against hardening and caking. Any hardened or caked lime shall be pulverized to its original condition before being used.

Lime shall be applied at the rate of 4,000 lbs. per acre and mixed thoroughly with the topsoil, as the seedbed is prepared.

- C. **Fertilizer:** Applying Fertilizer – Fertilizer shall be distributed at the rate to provide 500 pounds per acre (Complete mix fertilizer – 10 parts nitrogen 20 parts phosphoric acid and 20 parts potash), after topsoil is returned to the area and thoroughly mixed with the topsoil immediately before planting.
- D. **Establishing Turf:** The establishment period shall continue for six (6) months from the date of seeding. The Contractor shall be responsible for maintenance, protection, repairing and resulting re-seeding and re-fertilization for six (6) months after initial seeding. No direct payment will be made for this work.
- E. **Mulching:** Where indicated on the plans or as described in encroachment agreements, mulch shall be applied as described herein.

1. Materials:

- a. **Mulch Material:** Acceptable mulch shall be the materials listed below or any approved locally available material that is similar to those specified. Low grade, musty, spoiled, partially rotted hay, straw, or other materials unfit for animal consumption will be acceptable. Mulch materials, which contain matured seed of species that would volunteer and be detrimental to the proposed overseeding or to surrounding farmland, will not be acceptable. Straw or other mulch material which is fresh and/or excessively brittle, or which is in such an advance stage of decomposition as to smother or retard the planted grass, will not be acceptable.
- b. **Straw:** Straw shall be the threshed plant residue of oats, wheat, barley, rye, or rice from which grain has been removed as approved by the Engineer.
- c. **Asphalt Binder:** Asphalt binder material shall conform to the requirements of AASHTO M140. Type SS-1. or RS-1 as appropriate.

2. Mulching:

Before spreading mulch, all large clogs, stumps, stones, brush, roots, and other foreign material shall be removed from the area to be mulched. Mulch shall be applied immediately after seeding. The spreading of the mulch shall be by hand methods, blower, or other mechanical methods, provided a uniform covering is obtained.

Mulch material shall be furnished, hauled and evenly applied on the area shown on the plans or designated by the Engineer. Straw shall be spread over the surface to a uniform thickness at the rate of three (3) tons per acre to provide a sole depth of not less than 1-1/2 inches nor more than three (3) inches. Mulch may be blown on the slopes and the use of cutters in the equipment for this purpose will be permitted to the extent that at least 95% of the mulch in place on the slope shall be 6 inches or more in length. When mulches applied by the blowing method are cut, the loose depth in place shall be not less than one (1) inch or more than two (2) inches.

3. Securing Mulch:

The mulch shall be placed by asphalt binder on all slopes greater than 3 to 1 or as directed by the Engineer. Where mulches have been secured by either of the asphalt binder methods, it will not be permissible to walk on the slopes after the binder has been applied.

4. Care and Repair:

- a. The Contractor shall care for the mulched area until final acceptance of the project.
- b. The Contractor shall be required to, at his expense, repair or replace any mulching that is defective or becomes damaged until the project is finally accepted.
- c. If the "Asphalt Spray" method is used, all mulched surfaces shall be sprayed with asphalt binder material so that the surface has a uniform appearance. The binder shall be uniformly applied to the mulch at the rate of approximately 8.0 gallons per 1,000 square feet, or as directed by the Engineer, with a minimum of 6.0 gallons and a maximum of 10 gallons per 1,000 square feet, depending on the type of mulch and the effectiveness of the binder securing it. Bituminous binder material may be sprayed on the mulched slope areas from either the top or the bottom of the slope. An approved spray nozzle shall be used. The nozzle shall be operated at a distance of not less than four (4) feet from the surface of the mulch and uniform distribution of the bituminous material shall be required. A pump or an air compressor of adequate capacity shall be used to ensure uniform distribution of the bituminous material.

F. Manicured Areas (Sod)

1. Scope: The goal of sodding, where specified, is to return disturbed manicured lawns to their original vegetative condition, and to return the area to an aesthetically pleasing environment.

Vegetative restoration (sodding or seeding) shall be done as the work progresses.

All existing ornamental grass stands (commercial or private lawns) may be carefully taken up, protected and replaced to their original condition or the Contractor may elect to install new sod or the same type. In most instances the areas requiring sod restoration should be readily determinable by the Contractor based on preconstruction conditions. Questionable areas shall be restored in the manner (sodded or seeded) determined by the Engineer to be appropriate.

Any area disturbed without Owner authorization will be restored by the Contractor at his own expense. In all cases the Contractor will guarantee a stand of grass over the entire area.

The work to be done to acquire the necessary vegetative cover shall include but is not specifically restricted to appropriate tilling of the area, the application of fertilizer and lime for area to be seeded, placement of sod, or sowing of seed and placing of straw mulch to hold the seed and soil in place until germination and growth occur.

After bringing the area to be sodded or seeded to proper grade, the entire area shall be tilled to a minimum depth of four (4") inches by disking, harrowing or other approved means.

Following tilling, all large debris and stones shall be removed to the satisfaction of the Engineer and the surface leveled.

The Contractor shall provide general care for the restored areas as soon as the sod has been laid (or seeded and mulched), and such care shall continue until final inspection and acceptance of the work. All restored areas shall be protected against traffic or other use by warning signs or barricades approved by the Engineer.

2. Sodding: Sod furnished by the Contractor shall have good cover of living or growing grass. This shall be interpreted to include grass that is seasonally dormant during the cold or dry seasons and capable of renewing growth after the dormant period. All sod shall be obtained from areas where the soil is reasonably fertile and contains a turf relatively free of weeds or other undesirable foreign plants, large stones, roots, or other materials that might be detrimental to the development of the sod or to future maintenance. At least 70 percent of the plants in the cut sod shall be composed of the existing lawn species, and any vegetation more than six (6") inches in height shall be mowed to a height of (3") inches or less before sod is lifted. Sod, including the soil containing the roots and the plant growth showing above, shall be cut uniformly to a thickness not more than two (2") inches.

The sod shall be cut with approved sod cutters to such a thickness that after it has been transported and placed on the prepared bed, but before it has been compacted, it shall have a uniform thickness of not less than two (2") inches. Sod sections or strips shall be cut in uniform widths, not less than ten (10") inches and in lengths of not less than eighteen (18") inches are required, the sod must be rolled without damage with the grass folded inside. The Contractor may be required to mow high grass before cutting sod.

The sod shall be transplanted within 24 hours from the time it is stripped, unless circumstances beyond the Contractor's control make storing necessary. In such cases, sod shall be stored in an unrolled condition, irrigated, and protected from exposure to air drafts and sun and shall be kept from freezing. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. Where the soil is too dry, permission to cut sod may be granted only after it has been watered sufficiently to moisten the soil to the depth the sod is to be cut.

Sodding shall be performed only during the seasons when satisfactory results can be expected. Frozen sod shall not be used and sod shall not be placed upon frozen soil. Sod may be transplanted during periods of drought with the approval of the Engineer, provided the sod bed is watered to moisten the soil to a depth of at least four (4") inches immediately prior to laying the sod.

The sod shall be moist and shall be placed on a moist earth bed. Pitchforks shall not be used to handle sod, and dumping from vehicles shall not be permitted. The sod shall be carefully placed by hand, edge to edge and with staggered joints, in rows at right angles to the slopes, Commencing at the base of the area to be sodded and working upward. The sod shall immediately be pressed firmly into contact with the sod bed by tamping or rolling with approved equipment to provide a true and even surface, and insure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Where the sod may be displaced during sodding operations, the workmen when replacing it shall work from ladders or treated planks to prevent further displacement. Screened soil of good quality shall be used to fill all cracks between sod sections. The quantity of the fill soil shall not cause smothering of the grass. Where the grades are such that the flow of water will be from paved surfaces across sodded areas, the surface of the soil after compaction shall be set approximately one (1") inch below the pavement edge. Where the flow will be over the sodded areas and onto the paved surfaces around the manholes and inlets, the surface of the soil in the sod after compaction shall be placed flush with pavement edges.

On sloped steeper than 1 vertical to 2 ½ horizontal and in v-shaped or flat-bottom ditches or gutters, the sod shall be pegged with wooden pegs not less than twelve

(12") inches in length and have a cross-sectional area of not less than $\frac{3}{4}$ square inch. The pegs shall be driven flush with the surface of the sod.

Adequate water and watering equipment must be on hand before sodding begins, and sod shall be kept moist until it has become established and its continued growth assured. In all cases, watering shall be done in a manner that will avoid erosion from the application of excessive quantities and will avoid damage to the finished surface.

G. Permanent Erosion Control:

1. All disturbed areas shall be dressed to typical sections and plowed to a depth of 5 inches. The top 2 inches shall be pulverized to provide a uniform seedbed. NOTE: Lime should be applied before plowing operations.
2. Lime, seed, and fertilizer shall be applied with necessary equipment to give uniform distribution of these materials. Following are rates and kinds of these materials to be applied per acre.
3. Seeding area shall be cultipacked to firm seedbed and cover seed.
4. Grain straw shall be applied over seeded areas as a mulch base. Ground shall not be visible when riding by a mulched area if proper application is achieved. Thick clumps of straw are not permissible if a uniform coverage is expected.
5. Mulched area shall be tacked with asphalt when required to hold straw in place.
6. Ditch treatment shall be used in areas where steep grades could cause ditch erosion. Use of jute mash, excelsior matting, or fiberglass roving is acceptable. Ditch treatment should be installed before mulching operation.
7. The use of temporary erosion control measures shall be included to prevent siltation of waterways and adjacent property. The use of silt basins, brush barriers, and temporary seeding, and mulching, as needed is recommended.

H. Sedimentation and Erosion Control: The Contractor is instructed to control sedimentation runoff by methods approved by the Engineer during the course of construction of the project. The Contractor is reminded that all work shall meet all applicable requirements of the rules and regulations of erosion and sediment control as published by the Department of Natural Resources and Community Development, North Carolina Sedimentation Control Commission. The payment for construction of all erosion control measures as shown on the plans shall not be paid directly but shall be included in the cost per linear foot for the installation of water mains as noted in the Schedule of Bid Items. The construction sequence for sedimentation and erosion control is as follows:

1. Begin pipe laying activity.
2. Disturbed areas shall be seeded and mulched as per the specifications within 15 working days of pipe installation on all portions of the project. Approval of final grade for disturbed areas must be received from Engineer prior to seeding and mulching.
3. Install erosion control device(s) as detailed in project plans and as directed by the Engineer.
4. When construction is complete and all areas are stabilized, call for inspection by the Engineer.
5. When the site is approved, remove temporary erosion control measures and seed and mulch resulting disturbed areas.
6. When vegetation is established call for final site inspection.

I. **Mowing**: No mowing will be required, unless directed by the Engineer.

2.15 FENCES AND GATES

The Contractor shall not cut temporary openings or take down fences until he has contacted the property owner, tenant or occupant and arranged the ingress and egress to the right-of-way. All fences and gates removed for construction shall be replaced in like kind by the Contractor. Payment for fence and gate removal and replacement shall be by the Contractor.

In each case where the fence is opened, braced posts shall be installed capable of holding the tension in the fence wires so that the adjacent fence spans will not become slack. Where temporary openings are immediately adjacent to the corner post, the fence shall be firmly attached to the brace post, and the fence wire shall be removed or cut at the corner post. At other locations the fence openings shall be made by cutting the wires near one of the brace fence posts. In both the above cases, a gate shall be installed by the Contractor.

The Contractor shall be held responsible for damages to crops, livestock, or other property caused by his failure to keep fences, gates, and gaps in proper condition. Damage claims resulting from the Contractor's negligence with respect to construction and maintenance and use of these gates, fences and gaps shall be the Contractor's full responsibility.

The continuity of electric fences shall be maintained at all times.

2.16 CLEANUP

All pipeline work areas and other work areas shall be cleaned up, restored and left in satisfactory condition.

A. Roadway Cleanup:

Cleanup of work along highways or roads shall be made immediately upon completion of the backfill operation. Ditching and pipe laying shall be stopped at any time that cleanup work lags and shall not be resumed until cleanup progress is satisfactory to the Engineer. Final cleanup and condition of the work area shall be subject to the approval of the N.C. Department of Transportation, and the Engineer.

B. Cross-Country Cleanup:

Cleanup of work for cross-country locations shall follow immediately upon the completion of any major part of the work or upon instructions of the Engineer. Topsoil shall be replaced on all areas disturbed by the pipeline work throughout the length of the water or sewer main, and to the full satisfaction of the property owner. Topsoil may be removed from the line of work and stockpiled for future use. It shall be carefully removed, stockpiled, protected, spread, dressed up, and the entire right-of-way left in a condition acceptable to the Engineer and property owner. If topsoil is not stockpiled and protected, suitable, approved material from other sources shall be provided. Where the line is located on pasture land, grassed areas, or roadway shoulders, grass shall be replaced.