11.03 CONSTRUCTION, INSTALLATION AND TESTING OF SANITARY SEWER MAINS

The Contractor shall furnish all materials, equipment and labor required to construct the project as outlined in these specifications and associated plans.

11.03.01 HANDLING AND STORAGE OF MATERIALS

1. The Contractor shall be responsible for the safe storage of materials furnished by or to him, and accepted by him and intended for the work, until they have been incorporated in the completed project. The interior of all pipe, manholes and other accessories shall be kept free from dirt and foreign materials at all times.

    a. Transportation of Materials and Equipment: The Contractor and/or his Suppliers are directed to contact the North Carolina Department of Transportation to verify axle load limits on State maintained roads (and bridges) which would be used for hauling of equipment and materials for this project. The Contractor and his Suppliers shall do all that is necessary to satisfy the North Carolina Department of Transportation requirements and will be responsible for any damage to said roads which may be attributed to this project.

        i. All materials furnished by the Contractor shall be delivered and distributed at the site by the Contractor or his material supplier.

    b. Loading and Unloading Materials: Ductile iron pipe and cast iron accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. DIP, PVC pipe, and precast manholes will be unloaded with hoists and/or as recommended by the respective manufacturers. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

    c. Responsibility for Materials on Site: In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pedestrian or vehicular traffic shall not be unduly inconvenienced in placing of material along the streets or right-of-way, as applicable.

        i. The Contractor will string in advance no more than the amount of pipe and material that can be installed within one (1) week or less as approved by the Water Resources Engineer. All the materials shall be placed in such a manner as not to hinder access, endanger or impede traffic, or create a public nuisance. Materials strung through residential areas (or any area with maintained lawns) shall

be placed in such a manner as not to restrict normal maintenance of established lawns, and must either be installed within one week or removed to an approved storage yard, as required by the Water Resources Engineer.

d. Material and Equipment Storage: The Contractor will be responsible for locating and providing storage areas for construction materials and equipment. Unless prior written consent from the owner of the proposed storage area is obtained by the Contractor with said written notice provided to the Water Resources Engineer, the Contractor will be required to store all equipment and materials within the limits of the sanitary sewer right-of-way and temporary construction easement provided. The materials and equipment storage shall comply with all local and state ordinances throughout the construction period. Material and equipment may only be stored within road right-of-way if approved by the controlling agency.

    i. The Contractor shall be responsible for the safeguarding of materials and equipment against fire, theft, and vandalism and shall not hold the City responsible in any way for the occurrence of the same.

e. Care of Coatings and Linings: Pre-cast manholes, pipe and fittings, including rings and covers, steps, straps, etc., shall be handled so that the coating or lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Water Resources Engineer. PVC pipe shall be stored on the job site in accordance with the manufacturer's recommendations. Any PVC pipe that has been subjected to excessive ultraviolet radiation from the sun shall not be used. Noticeably faded materials shall not be installed and shall be promptly removed from the site.

11.03.02 CONNECTION TO EXISTING SEWERS

Tie-ins to existing activated sewer lines will be allowed when proper precautions are taken to protect the existing main. Tie-ins to existing non-activated sewer lines not installed under the same contract will not be allowed without written approval from all parties involved (City of Monroe, contractors, contract holders, etc.). The Contractor will be required to install watertight plugs in the proposed pipeline at the existing manhole and at the first proposed manhole until all construction is completed and testing begun. If the proposed sewer does not begin at an existing manhole, a straddle type "Doghouse" manhole as shown on the **Standard Detail 12.04.00** of these Specifications will be constructed over (and around) the undisturbed existing pipeline and the proposed pipeline plugged as specified. The existing pipeline will not be broken-out and the new invert formed until all testing has been successfully completed. Any connection with 18-inch and smaller pipe at an existing pre-cast or cast-in-place manhole will require the

Contractor to core the necessary opening through the manhole wall. Connections to existing manholes with 21-inch and larger pipe may be cored or sawed as approved by the Water Resources Engineer.

1. Temporary Watertight Plugs: The Contractor shall install temporary watertight plugs in the proposed sewer line at any manhole that is incomplete, at the open end of the pipeline prior to leaving the job site daily and elsewhere as dictated by good engineering and construction practices. All installed pipe shall be backfilled or otherwise securely tied down to prevent flotation in the event water enters or rises in the trench.

    a. The plugs as installed shall prevent infiltration or the introduction of any foreign material into either the existing or proposed systems.

    b. The City will not accept any pipeline or manhole, which contains any silt, sedimentation or other foreign material, within. The Contractor shall at his own expense flush, or otherwise cause the line (and manholes) to be cleaned out without any discharge into the existing system.

    c. Upon completion of all construction, the Contractor will be responsible for the complete removal of all watertight plugs, in the sequence necessary to allow testing and subsequent activation, all under the direction of the Water Resources Engineer.

2. Scheduling: When the flow of an existing sewer must be interrupted and/or bypassed, the Contractor shall, before beginning any construction, submit a written work schedule which will minimize the interruption and/or bypassing of wastewater flow during construction. This schedule must be approved by the appropriate controlling agencies and Water Resources Engineer and may require night, holiday, and/or weekend work.

3. Bypass Pumping: If pumping is required, an identical standby pump shall be on site in the event of failure of the primary pump. If, at any time during construction, effluent from the existing sewer is not fully contained by the bypass system, gravity service will be restored by a temporary tie to the new construction and work shall be suspended until the problem is resolved to the satisfaction of the Water Resources Engineer. The Contractor shall be responsible for any fines or claims levied as a result of wastewater backup or spill. The Contractor will be required to verify his method of handling sewer flows during construction by pumping at peak flows for 1 hour as approved the Water Resources Engineer.

11.03.03 EXISTING UTILITIES

1. The Developer/Contractor shall be responsible for all costs associated with an adjustment, relocation or modification of existing city infrastructure that was the result of the construction of the proposed sewer mains or other improvements in the area.

2. The Contractor will be required to excavate to determine the precise location of utilities, or other underground obstructions, which are shown on the Construction Plans. Such location and excavation shall be at least 500 feet ahead of construction.

   a. All utility owners will be notified prior to excavation as required by the latest Underground Damage Prevention Act. Owners who are members of North Carolina One-Call may be notified in accordance with current North Carolina One-Call procedures. The Contractor will be fully responsible for damage to any utilities if the owners have not been properly notified as required by the Underground Damage Prevention Act.

   b. Utility owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the Contractor.

   c. Conflicts with underground utilities may necessitate changes in the alignment and/or grade of this construction. All changes will be approved by the Water Resources Engineer before the construction proceeds.

3. When underground obstructions not shown on the Construction Plans are encountered, the Contractor shall promptly report the conflict to the Water Resources Engineer and shall not proceed with construction until the conflict is resolved.

11.03.04 SEWER LINE / UTILITY CLEARANCE

1. See 11.01.04 for separation of main requirements

11.03.05 CLEARING

1. Unless otherwise specified, the entire permanent right-of-way shall be cleared and all stumps, limbs and trash removed and disposed of at an approved location. When the sewer line is installed in undeveloped/non-maintained areas (woods), stumps can be left flush with the ground if they are outside the trench excavation. Stumps must be removed from all maintained areas (yards, lawns, etc.).

2. Temporary construction easements will be selectively cleared with specimen trees left standing as stipulated in Special Provisions and/or right-of-way agreements.

No clearing or grubbing may be performed on right-of-way except under supervision of the Project Inspector.

3. Useable timber and/or firewood may be left on adjoining property, off the permanent right-of-way at the request of the property owner. Such requests must be in writing and must release the City from any claims for improper disposal of timber.

4. The Contractor shall abide by all special conditions contained in the right-of-way agreements for the project. When the right-of-way agreement specifies stacking timber or firewood adjacent to the right-of-way, a written release is not required. The Contractor shall verify cut lengths of timber/firewood for such placement and location with the property owner.

5. Fences removed during construction shall be replaced of the same material and to the same condition existing prior to the construction. Contractors shall be allowed to put in temporary fencing for the purpose of maintaining livestock or prohibit trespassing. Temporary fencing may remain in place to date of completion. Permanent fencing must be in place before final completion.

6. The Contractor shall confine all his operations to the bounds as set forth in all right-of-way unless prior written approval of the current property owner is obtained and submitted to the Water Resources Engineer for his approval.

11.03.06 EXCAVATION

1. Excavation within street right-of-way shall be backfilled when left unattended for more than 1 hour unless otherwise approved by the controlling agency. Excavations within sewer/water right-of-way shall be backfilled, fenced or otherwise protected when left unattended for more than 1 hour. Fencing or other protection methods shall be designed to reasonably prevent people and large animals from entering the excavation.

2. Trench Excavation: No more than (100 ± LF) of trench shall be opened in advance of the pipe laying than is necessary to expedite the work unless prior approval is given by the Water Resources Engineer. Ground conditions and/or location requirements shall govern the amount of trench open at any one time as determined by the Water Resources Engineer.

   a. Trench Width: The trench width shall be the installed pipe outside diameter plus 12” clearance on each side of the pipe to the trench wall to allow for compaction and fill material. If the actual trench width exceeds the specified width, due to shoring methods or in unsupported/unstable soils, the contractor must obtain approval from the Water Resources Engineer.

i. Trench width shall be measured between faces of cut at the top of the pipe bell. If the Contractor varies from this requirement without prior approval of the Water Resources Engineer, or if specified trench widths cannot be maintained, improved bedding and/or improved pipe material shall be installed as directed by the Water Resources Engineer.

b. Trench Bottom Conformation: The excavation shall be made to the elevations, grades, and lines shown on the Construction Plans unless otherwise approved by the Water Resources Engineer. For 8" – 18" sanitary sewer mains the trench bottom shall be 4-inches below the installed invert of the pipe. For sanitary sewer main larger than 18" the trench bottom shall be determined based upon the material specifications of the pipe used. The trench bottom shall be true and even with bell holes at each joint to provide the barrel of the pipe with soil and/or granular bedding (as applicable) support for its full length. This should prevent point loading at the bells. If the trench bottom is inadvertently cut below grade, the Contractor shall fill it to grade with NCDOT No. 67 stone.

i. Pipe depth and/or soil conditions may dictate a granular embedment as specified in Section **11.03.07** of these Specifications. Such bedding shall also be shaped to allow adequate support of the pipe along the full length of the barrel.

ii. If the trench passes either under or over another pipeline, both the new main and existing line shall be properly haunched and backfilled with NCDOT No. 67 stone.

3. Excavation for Structures: The excavation shall be made to the lines, grades and elevations shown on the Plans and Standard Details. The area excavated shall be limited to no more than is necessary to allow the proper installation of the structure as determined by the Water Resources Engineer. The excavation shall remain open no longer than is necessary to allow the proper and complete installation of the structure.

a. Structure Pit Bottom Conformation: The pit bottom shall be true and even, and capable of supporting the structure as determined by the Water Resources Engineer. If the pit bottom is inadvertently cut below grade, the Contractor shall fill it to the proper elevation with approved material capable of continually maintaining adequate supportive strength.

4. Excavation for Bore Pits: The excavation shall be controlled by the limits of the existing right-of-way and shall not exceed these without prior written approval of the current property owner. The excavation shall be made to the proper elevation,

line and grade as required to install the casing pipe as shown on the construction plans.

a. Bore Pit Conformation: The pit bottom shall be true and even with adequate stabilization to maintain proper elevation and grade on the boring rig for the duration of the bore.

5. Rock Excavation: Rock excavation shall be defined as boulders greater than one (1) cubic yard in volume and solid ledge rock, which in the opinion of the Water Resources Engineering Manager or his authorized representative, requires drilling and blasting, sledging, or barring for its removal. Soft or disintegrated rock that can be removed with a pick, or trenching machine (minimum of a Caterpillar Model 325) shall not be classified as solid rock. Loose, shaken or previously blasted rock; masses of broken stone in rock; and construction debris shall not be considered as rock excavation.

a. Rock shall be removed to a depth of six (6) inches below the pipe bell and to the trench widths specified for each size and type of pipe installed. Rock around structures shall be removed to the same twelve (12) inch minimum as measured between vertical planes around the structure, but only to a depth necessary to allow proper installation.

b. The trench width shall be kept to a minimum, allowing only the space necessary for pipe installation during the removal of rock. Accordingly, the minimum trench width is outside pipe diameter plus 24" (12" minimum on each side of pipe). For Contracts with the City, only this width will be considered for payment. Over excavation of rock due to removal methods, or for safety considerations, shall be the Contractor's responsibility at no additional cost to the City.

c. When rock removal is necessary for pipeline installation either Type II or Type III bedding shall be installed as specified and directed by the Water Resources Engineer. A minimum of 4-inches of pipe bedding material shall be carefully placed and tamped over the rock before the pipe is installed, then the balance of the backfill shall be placed

d. All blasting shall be conducted in a manner as specified elsewhere in these Specifications.

6. Piling Excavated Material: All excavated material shall be piled in a manner that will not endanger the work. Excavated material will be piled a safe distance away from the edge of the excavation allowing room for an adequate angle of repose and if shoring, sheeting, and bracing is used to protect the excavation, no material will be piled within three (3) feet of the nearest edge. Sidewalks, driveways, hydrants, valve pit covers, valve boxes, curb stop boxes, existing manholes, fire

and police call boxes, or other utility controls shall be unobstructed and accessible until the work is completed. Gutters, catch basins, and natural watercourses shall not be obstructed or silted.

a. When working in close proximity with a creek channel or natural watercourse the Contractor shall pile all excavated material on the side of his excavation away from the watercourse.

7. De-watering: The Contractor shall at all times provide and maintain ample means and equipment with which to remove and properly dispose of any and all water entering the excavation or other parts of the work and keep all excavations dry until such time as pipe laying and grading is completed and structures to be built therein are completed.

a. No water shall be allowed to rise around the pipe in unbackfilled trenches nor shall it be allowed to rise over masonry until the concrete or mortar has set (minimum 24 hours). All water pumped or drained from the work shall be disposed of in such a manner as to prevent siltation and erosion to adjacent property or other construction.

8. Shoring and Shielding: The Contractor shall comply with the latest OSHA trenching and excavation regulations.. Shoring and/or shielding systems shall be used as specified by OSHA to prevent caving of trench banks and to provide a safe excavation.

a. The Contractor will be responsible for excavation safety and shall designate his "competent person" as defined by OSHA for the determination of proper shielding/shoring systems.

b. If, in the opinion of the Water Resources Engineering Manager or their authorized representative, the trench/excavation is not in compliance with OSHA regulations, the Contractor may be informed that all work will not be accepted until corrective measures are taken. Continued unsafe conditions may be reported to the appropriate regulatory agency. The Contractor shall be responsible for paying all fines resulting from safety violations.

11.03.07 PIPE LAYING

In all instances pipe shall be laid in a workmanlike manner, true to line and grade, with bell ends facing upgrade in the typical direction of laying. The various pipes referred to herein shall be handled, belled up and laid in accordance with the manufacturer's requirements and good engineering practices as defined in the various publications referenced in this document. The following requirements and/or standards of the City of Monroe shall govern this construction unless exceeded by other regulatory bodies.

1. Pipe Bedding: Unless otherwise specified or noted on the Plans the following bedding classes are required by this Department in accordance with ASTM Standards. Refer to the City's **Sewer Pipe Bedding Detail 12.09.00**.

   When granular material embedment is required, the Contractor will follow the layered procedure specified in Type I for soil placement, above the granular bedding, to an elevation one (1) foot above the top of the pipe bell.

   a. Type I - Shaped Bottom Bedding: The trench bottom shall be shaped so the pipe bears uniformly upon undisturbed native earth. Soil shall then be placed by hand around the pipe and completely under the pipe haunches in uniform layers not exceeding six (6) inches in depth up to an elevation one (1) foot above the top of the pipe bell.

      Each layer shall be placed and then carefully and uniformly tamped, so that the pipe is not damaged nor the alignment disturbed.

   b. Type II - Granular Material Embedment: The trench bottom shall be undercut a minimum of four (4) inches below the pipe barrel grade and filled with an approved stone to an elevation such that the pipe will be completely and uniformly bedded to a vertical height of one-third the outside diameter of the pipe bell for the pipe's entire length and for the entire width of the ditch. Depending upon soil and ground water conditions, greater depths (undercut) may be required to create a stable condition. Type II granular material embedment shall be used as directed by the Water Resources Engineer.

   c. Type III - Granular Material Embedment: The trench bottom shall be undercut a minimum of four (4) inches below the pipe barrel grade and filled with an approved stone to an elevation such that the pipe will be completely and uniformly bedded to vertical height of (2) inches above the top of the pipe for the pipe's entire length and for the entire width of the ditch. Depending upon soil and ground water conditions, greater depths (undercut) may be required to create a stable condition. Type III granular material embedment (#67 crushed stone) shall be used on all PVC SDR-35 sanitary sewer mains and as directed by the Water Resources Engineer.

   d. Stone Stabilization: When the bottom of the trench is not sufficiently stable to prevent vertical or lateral displacement of the pipe after installation with Type II or Type III bedding, stone stabilization will be required to develop a non-yielding foundation for the bedding and pipe. When such conditions are encountered, the trench will be excavated to a depth determined by the Water Resources Engineer, and #67 crushed stone will be placed to an elevation six-inches below the bottom of the pipe. The

pipe will then be laid with Type II or Type III bedding as directed by the Water Resources Engineer.

e. Concrete Encasement and Cradles: Shall be as designed for each individual case and will be noted on the Plans and in the Special Provisions when applicable.

2. Installation Depth Limitations: The following are limitations and bedding requirements for supportive strength and shall be adhered to at all times. Granular material embedment may still be required for lesser depths of cover should groundwater and/or soil conditions warrant its use, as determined by the Water Resources Engineer.

a. All pipes regardless of bedding or pipe type shall require adequate tamping of backfill as specified for Type I, Shaped Bottom Bedding.

b. When the cover is less than 3.0 feet or greater than the depths shown for Type III Bedding, Ductile Iron Pipe must be used.

c. Sewer Rated Ductile Iron Pipe: Installation of DIP shall be installed subject to the bedding limitations specified below. Greater depths of cover may be achieved by using a higher pressure classification and/or using pipe with a flexible lining. DIP, Class 350 or Class 250 may be used with Type I Shaped Bottom Bedding at depths up to 20 feet to invert grade unless otherwise required. Depths between 20 to 30 feet to invert grade require at least Type II Granular Embedment Material, and depths greater than 30 feet require Type III Granular Embedment Material.

b. Poly VinyI Chloride (PVC) Pipe: PVC SDR-35 pipe shall be installed with a minimum of 3.0 feet of cover and a maximum of 12 feet of cover. When the cover is less than 3.0 feet or more than 12 feet, sewer rated DIP must be used subject to the specified bedding limits. PVC pipe shall be installed in accordance with ASTM Standards with the following modifications:

i. All PVC-SDR 35 pipe shall be installed using Type III Granular Embedment. The bedding shall extend from the pipe to the trench wall or to two and one half pipe diameters (OD) on each side of the pipe, whichever is less.

e. Poly VinyI Chloride (PVC C900) Pipe: PVC DR-25 pipe shall be installed with a minimum of 3.0 feet of cover and a maximum of 20 feet of cover. When the cover is less than 3.0 feet or more than 20 feet, sewer rated DIP must be used subject to the specified bedding limits. PVC pipe shall be installed in accordance with ASTM Standards with the following modifications:

i. All PVC C900 DR-25 pipe shall be installed using Type II Granular Embedment. The bedding shall extend from the pipe to the trench wall or to two and one half pipe diameters (OD) on each side of the pipe, whichever is less.

3. Grade and Line for Pipe: As a minimum, centerline hubs will be set at each manhole and offset stakes set at each manhole, and if required at 100 foot intervals between manholes. Cut sheets will show the vertical distance from the offset stakes to the inlet and outlet pipe invert at each manhole and to the pipe invert at each offset stake.

a. Laser beams shall be used to set line and grade. The grade shall be checked at each manhole and at benchmarks every 500 feet. The Contractor shall keep close check of his laser for variations in line and grade. No variations between manholes shall be corrected without relaying that portion of line, which has deviated from line or grade unless otherwise approved by the Water Resources Engineer.

b. The Contractor shall keep accurate field notes to verify the correct grade has been installed for each pipe length between manholes with the use of a level and benchmark. A copy of the field notes shall be made readily available to the City of Monroe Water Resources Department Inspector or representative upon request at all times during construction.

11.03.08 LATERAL INSTALLATION

1. 4-Inch Laterals: Four inch laterals shall be connected to the main with tees as previously specified if the lateral is installed during the construction of the main. 4-inch laterals shall be connected to existing mains with saddles placed in holes cored by an approved coring machine. Saddles and tees shall be as previously specified and as shown on the Standard Details. The lateral shall be laid with a minimum slope of 1/4-inch per foot (2 %) unless approved by Water Resources Engineer.

a. Laterals shall be completed to the property line using 22-1/2 ° bends at the tee or saddle and pipe as previously specified and as shown in the **Standard Detail 12.13.00** of these Specifications. The lateral shall be laid with a minimum slope of 1/8-inch per foot or 1% slope. The end of the lateral will be plugged water/air tight. All tees saddles and bends shall be completely encased in #67 crushed stone. An "X" shall be cut in the curb at the location where lateral crosses under curb. In subdivisions constructed without curb, the Contractor will paint an "X" on the edge of pavement at the location where the lateral crosses under the edge of pavement. Markings will be made using green paint.

b. All laterals except those serving lots adjacent to in line manholes or upstream from dead-end manholes in cul-de-sacs shall be connected to the sewer main. Laterals connected to manholes shall be laid on a line from the center of the lot to the center of the manhole and shall extend not more than six inches inside the manhole wall. Manholes in cul-de-sacs shall have a maximum of four (4) laterals. Any in line manhole shall have a maximum of two (2) laterals. The lateral elevation entering the manhole shall match crown to crown with the main entering the manhole and a trough shall be formed for the lateral invert. Laterals that are connected to outfall lines shall enter the manhole at the shelf and an invert shall be formed to carry the lateral flow to the main invert.

c. The laterals shall be installed with a minimum of four (4) feet of cover or at gravity sewer main grade at the property line, unless otherwise approved by City of Monroe. The depth of the lateral at the property line shall not be greater than five (5) feet unless greater depth is required to serve the building. The Contractor will not backfill any portion of the lateral until the installation is approved by a City of Monroe Inspector.

2. Measurements: The Contractor shall be responsible for measuring the distance to the tee or tap from the down-stream manhole to obtain the information required for the "As-Built" records.

3. 6-lnch and Larger Laterals: 6-inch and larger diameter laterals shall connect to manholes, unless otherwise approved by Water Resources Director, with the lateral invert above the manhole shelf in accordance with the specifications and standard details for mainline construction. When the lateral is the same diameter as the main line pipe, a drop of 0.2 feet will be provided in the manhole between the invert of the lateral and the invert of the main line pipe. The lateral shall be laid with a minimum slope of1/8-inch per foot (1 %).

4. All sewer laterals for individual house pumps shall be connected to a manhole.

11.03.09 BACKFILL

1. All backfill shall be of a non-plastic nature soil, free from roots, vegetative matter, waste, construction material, or other objectionable material, including but not limited to rock larger than 6-inch in diameter. Rock shall not exceed 10% of the fill material, and shall not be placed within 2-feet of finished grade. Backfill material shall be capable of being tamped by mechanical tamps using relatively low velocity and heavy blows. The material shall have no tendency to flow or behave in a plastic manner under the tamping blows. Material deemed by the Water Resources Engineering Manager or authorized their representative as

unsuitable for backfill shall be removed from the job site before backfilling operations begin.

2. Subgrade soils that become soft, loose, "quick," or otherwise unsatisfactory for support of the pipe or structures as a result of inadequate excavation, dewatering, or other construction methods shall be removed and replaced at the direction of the Water Resources Engineering Manager.

3. For excavations under NCDOT or City owned roads or traveled areas, NCDOT ABC stone shall be used as backfill.

4. Backfill shall be accomplished immediately after the pipe is laid. Backfill around pipe and to an elevation of one (1) foot above the pipe bell shall be done only by hand and in layers not exceeding six (6) inches with each and every layer thoroughly tamped. The first three (3) feet of fill shall be completely free of rocks. Successive layers of backfill shall be compacted in place as specified below.

5. Under no circumstances shall water be permitted to rise in unbackfilled trenches after the pipe has been placed. Should water rise in an unbackfilled ditch after the pipe has been placed, the Water Resources Engineer may require the Contractor to remove the pipe, muck the trench and follow the procedure for either Type II or Type III Granular Embedment when relaying the pipe.

   a. Backfill of trenches within sewer main right-of-way: Trenches excavated outside existing roadway and railway right-of-way may be backfilled, above the initial one (1) foot, by mechanical means in layers up to twelve (12) inches thick unless otherwise directed by the Water Resources Engineer.

   b. Backfill of trenches within road and railway right-of-way: Trenches excavated within existing road and railway right-of-way shall be backfilled in layers not to exceed six (6) inches and each successive layer shall be thoroughly tamped, as specified.

11.03.10 COMPACTION REQUIREMENTS

1. All materials shall be properly placed and compacted to correct any deficiencies resulting from insufficient or improper compaction of such materials. The Developer/Contractor shall determine the type, size, and weight of compaction best suited to the work at hand, select and control the lift thickness, exert proper control over the moisture content of the material, and other details necessary to obtain satisfactory results. The selection of compaction equipment is the Developer/Contractor's responsibility but shall be subject to the approval of the Water Resources Engineering Manager.

2. Moisture content and density testing of backfill shall be performed by a duly appointed agency of the City of Monroe. The Contractor will cooperate fully with the soils technicians in providing access to backfill at any requested depth for the purpose of performing moisture content/density testing. When requested, the Contractor shall excavate a backfilled ditch to any specified depth for a compaction test and shall insure that the ditch meets all OSHA safety standards before the technician enters to perform the test.

3. Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship determined in accordance with ASTM Standards:
    1. Under lawn or paved areas: All material shall have a minimum in-place density of 95% maximum density.
    2. Under slabs, structures, pavement, shoulders, and curb: All material from the bottom of the trench to six (6) inches of the subgrade shall have an in place density of 95% of the maximum dry density. All material within six (6) of subgrade level shall have in an in-place density of 100% of the maximum dry density.

11.03.11 MANHOLE CONSTRUCTION

1. All manholes outside street right-of-way or landscaped areas shall be constructed to a height of two (2) feet above the adjacent finished ground elevation unless otherwise indicated on the Plans. Manholes within street right-of-way or landscaped areas shall have finished rim elevations flush with the pavement or 0.1 feet above final grade in right-of-ways outside of the pavement.

2. Precast Reinforced Concrete Structures: All precast manhole sections shall conform to the Material Specifications and Standard Details.

    a. Precast manholes shall be treated similar to reinforced concrete pipe for installation. When ground water and/or soil conditions require stabilization for reinforced concrete pipe installation comparable measures will be required for precast manhole installation. Under no circumstances will a precast base section be placed on unstable soil as solely determined by the Water Resources Engineer.

    b. Jointing of precast sections will be done in accordance with the manufactures' recommendation, with special attention called to the amount of force used.

    c. All backfill around structures shall be thoroughly tamped in layers as specified for placing backfill.

d. Regardless of the type manhole construction used, the Contractor shall use all means and methods required to stabilize the soil intended to support the structure. A stable condition shall only be so adjudged by the Water Resources Engineer or his authorized representative. Any cost incurred by the Contractor in stabilizing the area to support a manhole shall be considered incidental to the manhole construction.

4. Outside Drops: When design considerations dictate a large elevation change across a manhole, an outside drop shall be constructed in accordance with the City of Monroe **Standard Detail 12.03.00** of these Specifications. When there is not sufficient elevation difference to permit construction of an outside drop, the grade of the influent pipe shall be lowered such that the vertical separation of the influent and effluent pipes is 0.2 feet, as measured at the center of the manhole when the grades of both pipes are projected to that point. Outside drops shall not enter the cone section of precast manholes.

5. Inside Drops: When connecting a proposed sewer main to an existing manhole at an elevation significantly higher than the existing invert elevation, and where safety considerations or working space limitations preclude building an outside drop, the connection may be made with an inside drop constructed in conformance with the Standard Details. Inside drops will be used only where shown on the plans or specifically approved by the Water Resources Engineer. They may not be used in lieu of outside drops shown on the plans. Inside drops shall not enter the manhole in the cone section. Inside drops are not allowed on four (4) feet diameter manholes.

6. Installation of Ring and Covers: The ring shall be installed on the manhole with a ½" diameter kwik bolt stud anchor system. 8-inch tall or 4-inch tall frames may be used for manholes with bolt down frames. These frames shall have four (4) holes in the support flange to permit installation on the cone with anchor bolts. Holes shall be equally spaced in the flange. The Contractor shall seal the frame to the manhole by installing a length of butyl rubber joint sealant to form a gasket between frame and manhole. The butyl rubber joint sealant shall have a one inch cross section, and shall make two full circles when placed on the cone section, and shall be compressed by the frame with the anchor bolts. Cement mortar grouting of the frame shall be required on the inside of the manhole. Brick may not be used on any manholes to adjust rim elevations.

a. 8-inch tall frames are required for all manholes that are flush with pavement or finished grade unless otherwise approved. Concrete grade rings may be used to adjust the finished rim elevation of such manholes. This adjustment may not exceed 21-inches in height including the 8-inch ring. Anchor bolt system shall be extended through the cast iron frame and the concrete grade rings and anchored into the cone section of the manhole. Butyl rubber joint sealant shall be used between each section of

concrete grade ring installed. Refer to **Standard Details 12.01.00 through 12.05.00**.

7. Steel Vent Pipes: Steel vent pipes will be installed in accordance with the **Standard Detail 12.08.00** of these Specifications. Shop drawings of strap on vents, mounting straps, and anchor bolts will be subject to approval of the Water Resources Engineer. Material shall be as specified in the Materials Specification Section.

11.03.12 REMOVAL AND RESTORATION OF PAVEMENT AND ROAD SURFACES

City of Monroe Roads

1. As a minimum, asphalt repair on priority streets shall be either (1) a minimum of 6 inches in thickness, 4 inches of asphalt base and 2 inches top surfacing course; or (2) equal to the existing asphalt thickness plus half of the existing stone thickness, whichever is greater, not to exceed a total of 10 inches. Cuts that cannot be repaired the same day on priority streets shall be covered with steel plates. All commercial and industrial streets shall meet the pavement structural requirements for priority streets.

2. Asphalt repair on minor residential streets shall be either (1) a 2 inch minimum asphalt top surfacing course; or (2) equal to the existing asphalt thickness, whichever is greater. Base material shall be 8-inches of aggregate base course (ABC). Asphalt base may be substituted for ABC. Maximum asphalt thickness should not exceed 8-inches.

3. The current pavement condition rating (PCR) can be obtained by contacting the Engineering Department at (704) 282-4667.

4. For minor residential streets included on the 3 year reclamation list, updated annually by the Engineering Department, an l-inch top surfacing course with 6-inches of ABC base course shall be provided. Trenches or tap repairs that cannot be repaired same day shall be backfilled with a minimum of 7-inches of ABC stone to allow for 1-inch asphalt cap at a later date. Note, Compaction of 95 percent is acceptable in these instances because the reclamation process wi11 involve re-compacting the entire street to achieve a final compaction of 100 percent prior to resurfacing.

5. When cuts are to be made in street rights-of-way under maintenance by the City of Monroe, the Contractor shall contact the Superintendent of Streets or his designated representative before each separate pavement cut is made and secure a permit. Cuts and replacement shall meet or exceed City requirements as stipulated in the permit or required by Superintendent of Streets or his designated representative.

NCDOT Roads

1. All construction and materials shall conform to the Standard Specifications and Details of the North Carolina Department of Transpiration, Office of Engineering and all conditional requirements set forth in the Encroachment Agreement issued by such agency.

Installation of Asphalt Pavement

1. Bituminous pavement shall be cut in a smooth and straight line. The Contractor shall contact the Superintendent of Streets and/or NCDOT District Engineer for a determination of the limits of concrete replacement and location of cuts. As a minimum, the width of pavement left between the edge of the ditch and the existing edge of the pavement or the front line of the gutter, shall be at least 2 feet. Residual strips of pavement less than 2 feet in width must be removed and replaced. The edge of existing pavement shall be cut a minimum of one foot beyond the excavation or disturbed base.

2. The Contractor shall remove and replace pavement which, in the opinion of the Water Resources Engineering Manager, has been cracked or displaced by the operation of the Contractor.

3. All material above the sub-base level shall be hot-mix bituminous asphalt conforming to North Carolina Department of Transportation standard specifications for roads and structures for both mix design and placement. The asphalt pavement as placed shall be as described above. The asphalt shall be placed in lifts not greater than 4 inches and shall be hot mix bituminous asphalt binder I-19.0A. The last two (2) inches in either instance shall be S-9.5A “Super Pave” suitable to the appropriate controlling agency. S-9.5A “Super Pave” asphalt pavement resurfacing will be placed with paving machines and/or rollers of a size and type currently approved by the North Carolina Department of Transportation for use on resurfacing contracts.

4. If a bituminous surfacing overlays a concrete base, the Contractor, at the option of the Water Resources Engineering Manager, shall replace the concrete to its original thickness, or to a level 2 inches below the finished surface. The Water Resources Engineering Manager may direct the Contractor to omit all concrete and to replace the pavement with bituminous materials.

5. Tack coats shall be employed with each lift. Tack coats shall be placed on both horizontal and vertical surfaces (pavement cuts or face of concrete gutters) in accordance with the manufacturer’s application rates.

6. Under normal conditions, asphalt binder will be placed in pavement cuts at the end of each work day. S-9.5A shall be replaced weekly or within five days following completion of pipeline construction along a continuous section of pavement. During inclement weather, the Water Resources Engineering Manager or their representative may permit the use of temporary asphalt (cold mix) to seal the trench until permanent asphalt can be placed.

7. Prior to placing permanent pavement, all castings within the area shall be adjusted to established grade and cross section.

11.03.13 CONCRETE CONSTRUCTION

1. Acceptance of Concrete: The Inspector will accept no ready mix concrete without the plant dispatch ticket.

   a. The Water Resources Engineering Manager or their authorized representative shall make or require any tests to be performed by an independent testing laboratory at the Contractor's expensethat they deems necessary to insure that the concrete meets specifications.

   b. Compressive strength in accordance with ASTM C-31 and ASTM C-39. Test cylinders which are formed in the field will be left in the field until compression testing (7 day, 14 day, 28 day) is completed thereby more closely approximating the curing conditions of the field placed concrete.

   c. Slump test in accordance with ASTM C-143

   d. Air Content Test in accordance with either ASTM C-173 or ASTM C-231.

2. Placement: Concrete will not be accepted if it cannot be placed within ninety (90) minutes of the dispatch time. Time requirements may fluctuate marginally due to temperature. Concrete shall be deposited in such a manner so as to prevent contamination by foreign material and segregation due to rehandling or flowing.

3. Joints: Expansion and contraction joints shall be placed as directed by the Water Resources Engineering Manager. At locations where replacing section of existing concrete driveway or walkway, sawcut existing concrete to provide a clean edge at the nearest adjacent construction joint, provided that the joint is beyond one foot from the edge of the trench or excavation or to a point to create control joints equidistant from one another.

4. Forms: Forms exposed to concrete surfaces shall be plywood, metal, metal frames, plastic-faced, or any other materials acceptable to the Water Resources

Engineering Manager to provide continuous straight, smooth exposed surfaces. Forms shall be of sufficient thickness to withstand pressure of newly placed concrete without bow or deflection. Forms will normally be left for the entire (7) day period. Exposed surfaces not covered by forms will be kept moist continuously for the entire seven day period or will be cured through use of an approved curing compound which will be applied after all surface water has disappeared.

a. Mechanical vibrators, of an approved type, and continuous spading and/or rodding of concrete shall be used to produce proper contact of concrete with forms and reinforcing steel in piers and with forms and pipe in monolithic inverts insuring a compact, dense and impervious artificial stone of uniform texture.

5. Wire Fabric Reinforcement: Wire fabric shall be placed at the mid-point of slabs supported and lapped as required as directed by the Water Resources Engineering Manager.

6. Finishing: The surfaces shall be finished with a float and troweled by skilled workmen. After the surface has been leveled and finished and before the concrete takes its final set, the surface shall be textured to a uniform finish as approved by the Water Resources Engineering Manager.

7. Curing: All concrete will be cured for a seven (7) day period after placement according to the following procedure.

11.03.14 BORING AND JACKING STEEL ENCASEMENT

1. Installation: Smooth wall or spiral weld steel pipe may be jacked through dry bores 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. Continuous checks shall be made as to the elevation, grade and alignment of each successive section of encasement as well as the tracks (rails) upon which the boring rig travels.

a. If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe at ten (10) foot centers and the voids filled with 1:3 Portland Cement grout at sufficient pressure to prevent settlement in the roadway/railway.

b. Boring operations shall be continuous to their completion, and unnecessary or prolonged stoppages shall not be allowed.

c. In the event an obstruction is encountered during the boring and jacking operations, the auger is to be withdrawn and the excess pipe is to be cut off, capped, and filled with 1:3 Portland Cement Grout at sufficient pressure to fill all voids before reapplying to the Controlling Agency for permission to open cut, bore at an alternate location, or install a tunnel.

d. Installation shall be to the limits specified by the Controlling Agency and/or as delineated in their encroachment issued to the City of Monroe. (Copy of the encroachment agreement must be kept at the site throughout boring operations).

e. The completed casing installation shall be such as to prevent the formation of a waterway under the road or railbed.

f. The Controlling Agency shall have full authority to require remedial measures and/or to stop all work if, in its opinion, said work will cause any damage to the roadway/railway section or endanger traffic. In all instances the Controlling Agencies reserve the right to sample, test, and approve all materials and methods used.

g. The Contractor shall notify the Controlling Agency through the Water Resources Engineer and acknowledgment shall be received a minimum of five (5) working days prior to beginning any work within roadway or railway right-of-way. If required, 24-hours notice will be given prior to completion.

h. Flexible restrained joint sewer rated ductile iron pipe shall be used as a carrier pipe in all steel casing.

11.03.15 BLASTING

1. Prior to commencing any blasting operations the Contractor shall obtain a permit through the City of Monroe Public Safety Department and obtain written permission from the Water Resources Engineering Manager.

2. All blasting operations shall be conducted in strict accordance with any and all decrees, rules, regulations, ordinances, and laws as may be imposed by any regulatory body and/or agency having jurisdiction over the work relative to handling, transporting, use and storage of explosives. Blasting shall be performed only by competent and experienced personnel and monitored by an experienced seismologist. . Satisfactory information must be provided to the Engineer that the blaster satisfies the requirements of OSHA.

3. All rock dirt and debris from blasting shall be contained within the excavation by use of weighted mats or undisturbed overburden. The Contractor's blaster shall

be fully responsible for determining the method of containment and the weight, size and placement of material required to contain the charge he is using.

4. Charges shall be sized such that no damage to houses, structures, utilities, roadways etc. outside the limits of excavation will occur. Where there is a possibility of such damage, the charge will initially be set at very low level and increased in small increments until the proper charge is determined. The Contractor shall be held responsible for any and all injury to persons or damage to public or private property.

5. The Contractor shall not be allowed to blast within any rights-of-way maintained by any agency (NCDOT, Railroad, etc. other than the City without specific approval of the controlling agency and only in accordance with their respective requirements.

6. If blasting is conducted within 300 feet of any structure, the Contractor shall employ specialists to conduct pre-blasting surveys of structures and water wells in the vicinity of the work and to monitor the effects of blasting by obtaining and interpreting seismic records.

11.03.16 PHYSICAL INSPECTION AND TESTING

The Contractor shall provide proper ventilation of sewer lines and manholes during any test or inspection procedure. The Contractor shall be responsible for providing all equipment and personnel necessary to comply with OSHA confined spaces regulations.

1. Physical Inspection: All work shall be physically inspected by the Engineer to confirm that all sewer lines have been constructed between manholes without defects in condition, grade, or alignment. Physical inspection may be by lamping at manholes, by video camera designed for use in sewer pipe, or both, at the discretion of the Engineer. All observed defects shall be corrected by the Contractor at no additional expense to Owner.

2. Deflection Testing of all PVC Pipe: Not less than 30 days following completion of backfill, the pipe shall be tested for deflection with a 5 degree mandrel sized as defined in ASTM Standards. Mandrels shall be furnished by the Contractor. The mandrel shall be pulled through each section of pipe from manhole to manhole. The mandrel must slide freely through the pipe with only a nominal hand force applied. No mechanical device shall be used in pulling the mandrel. Any pipe which refuses the mandrel shall be removed and replaced or re-rounded and the bedding shall be properly constructed as specified to prevent excessive deflection. Such sections shall be re-tested for deflection after completion of backfill.

3. Pipe Leakage Test: All completed sewer mains shall be tested between manholes for compliance with an exfiltration and infiltration standard of less than or equal to 100 gallons/mile/inch dia./day. For all sanitary sewer mains 24-inch and small in diameter, a low pressure air test shall be required. For all sanitary sewer mains 24-inch and larger in diameter, the contractor must use weirs to determine infiltration.

   a. Low-Pressure Air Test: The test pressure shall be a minimum of 3.5 psi. Testing time in minutes shall be according to the schedule shown in Table SP-1.

   b. Infiltration: Weirs are to be furnished and installed by the Contractor. The infiltration shall not exceed 100 gallons/mile/inch diameter/day as measured for a reach of pipe the same diameter up to one mile long. However, when excessive infiltration can be isolated to a particular section (manhole-manhole) the limit will be applied to that section. There shall be no visible points of infiltration. Any section (manhole-manhole) must be isolated and tested separately if so directed by the Water Resources Engineer.

   c. Final Air Test: Final air test of public and private sewer mains and service laterals along with final certification will not be accepted until all utilities are installed. The developer has the option to expedite the acceptance process prior to the installation of all utilities by agreeing to perform closed circuit television (CCTV) inspection at the conclusion of construction and to repair problems identified by the CCTV to the sewer mains and service laterals. Acceptance of the sewer certification will enable the City of Monroe to accept final certification of water, streets, and storm drainage. All testing, air test or CCTV shall be performed to the requirements as set forth by the Water Resources Department.

TABLE SP-1
SANITARY SEWER MAIN AIR TEST FOR EXFILTRATION
MINIMUM TIME REQUIRED FOR A 0.5 PSIG AIR PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED

Specification Time in min:sec

PIPE DIA. (IN)	Length of Pipe Section							
	100 FT.	150 FT.	200 FT.	250 FT.	300 FT.	350 FT.	400 FT.	450 FT.
4	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12

8	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	5:40	5:42	7:05	8:33	9:58	11:24	12:50
15	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	17:46	26:43	35:37	44:31	53:25	62:19	71:13	80:07

a. A segment of pipe 450 feet or less in length will be considered to pass if the air pressure drop does not exceed 0.5 psi at the end of the testing time. For lengths of pipe greater than 450 feet, the following formula shall be used for determining testing time:

$T = 0.000198\ D^2\ L$

Where: T = Minimum testing time, minutes
D = Nominal inside pipe diameter, inches
L = Length of pipe tested, feet

4. Manhole Vacuum Test: Each manhole shall be vacuum tested after completing pipe connections and sealing but before completing backfill around manhole and after placement of ring and cover. It shall be required that 10% of all manholes shall be vacuum tested at the factory prior to shipping to the site. The Contractor shall submit to the Owner written certification from the manufacturer that 10% of the manholes have passed a factory vacuum test. Field vacuum testing shall be performed as follows:

a. Plug all pipe entrances with suitably sized and rated pneumatic or mechanical plug inserted 6” into the pipe and properly braced to achieve seal without leakage.

b. Position vacuum tester head assembly to seal against the interior surface of the top of the manhole ring and inflate per manufacturer instructions.

c. Draw a vacuum of 10” of mercury, close the valve on the vacuum line, and shut off vacuum pump.

d. Measure the time for the vacuum to drop to 9” of mercury. The manhole has passed a leakage test if the time exceeds the following:

Manhole Internal Diameter (ft)	4	5	6	7
Time (sec)	60	75	90	105

b. If the Engineer permits the manhole to be tested by hydrostatic testing in lieu of vacuum testing, the pipe entrances shall be plugged similar to the vacuum test and the manhole filled with water to within 3" of the top of the cone. Following maximum absorption of water by the concrete and piping (and water is added to restore the level within 3" of top of cone), a test for four hours should show no measureable change in water level.

11.03.17 REPAIRS AND MODIFICATIONS

All leaks shall be repaired by identifying and exposing the defective section of pipe and completing repairs as follows:

1. Existing Utilities: The developer or contractor shall be responsible for all costs necessary for the replacement, addition, or modification of existing water and sewer utilities that are a result of proposed construction. Costs shall be consider incidental to the work performed and be included in the unit prices.

2. PVC, Ductile Iron Pipe: Defective or damaged pipe including leaking joints shall be removed and replaced with sound new pipe. The pipe shall be re-connected with approved couplings as specified in the Materials Section of these specifications.

3. Manholes: Any damage to the interior wall of the manhole resulting from penetration of the lift holes shall be repaired with non-shrink cement grout.

   a. Leaks through manhole joints or walls or around pipe collars may be repaired from inside the manhole with non-shrink cement grout. If the size of the leak, or the external water pressure, prevents such repairs, the manhole shall be excavated and repaired from outside.

   b. Leaks around boots or gaskets used to join pipe to manholes shall be repaired by external concrete collars or as approved by the Water Resources Engineer.

11.03.18 ABANDONMENT

The following requirements shall apply for proposed abandonment of existing facilities unless otherwise shown on the plans or approved by the Water Resources Engineer. All areas disturbed by abandonment will be restored.

1. Abandonment of Existing Manholes: Influent and effluent mains shall be bulkheaded at the manhole wall. Mains under a City of Monroe of NCDOT road

may be required to be filled with flowable fill or a fine aggregate concrete slurry, depending on the size. The manhole will then be filled with non-compressible material (NCDOT No. 67 stone or as approved), to a point three feet (3'-0") below the finish grade. The remainder of the manhole shall be broken down and removed. Then the excavation shall be filled to finish grade with suitable excavated material or NCDOT ABC stone. Ring and covers shall be salvaged and delivered to the City of Monroe Operations Center.

2. Abandonment of Mains At Manholes Which Remain in Service: Abandoned mains at active manholes shall be completely disconnected from the manhole by cutting the pipe outside the manhole, plugging the abandoned main with sandbags, mechanical plug, or concrete cap, then sealing the manhole wall with an approved watertight non-shrink grout. The bench shall be modified to establish a smooth transition of flow.

3. Abandonment of Exposed Pipe: Exposed sections of abandoned mains shall be removed to a point not less than 5 feet into the adjacent banks. The remaining ends of the pipe shall be plugged with bricks and mortar or approved bulkhead. Concrete piers or collars in the creek channel shall be removed completely. Concrete piers or collars not located in the creek channel shall be removed to a point three feet (3'-0") below the existing grade. Steel piers shall be cut off three feet (3'-0") below existing grade.

11.03.19 LANDSCAPE RESTORATION

1. Topsoil
   A. Topsoil shall consist of friable, natural earth of loamy character, without admixture of subsoil, uniform in quality, and free of refuse of any nature, hard clods, stiff clay sods, hard pan, pebbles larger than 3/4 inch in diameter, coarse sand, noxious weeds, sticks, brush and other rubbish. The pH shall range between 6.0 and 7.0 and shall contain not less than 5 percent and no more than 8 percent organic matter.

2. Fertilizer
   A. Fertilizer shall be commercial mixed free flowing granules or pelleted fertilizer, 11-8-4 grade for lawn and naturalized areas. Fertilizer shall be applied at a rate of 20 lbs/1,000 sq ft or as determined by the soil test.

3. Lime
   A. Lime shall be ground limestone containing not less than 85 percent calcium and magnesium carbonates and be ground to such fineness that at least 50 percent shall pass a 100-mesh sieve and at least 90

percent shall pass a 20 percent sieve. Lime shall be applied at a rate of 150 lbs/1,000 sq ft or as determined by the soil test to bring topsoil pH to a range of 6.0 to 7.0.

4. Seed
   A. Seed shall be furnished in sealed bags or containers bearing the date of the last germination and free from noxious weeds. Seed mixtures shall consists of see proportioned by weight as follows:
      a. Kentucky 31 Fescue 40 percent
      b. Palmer Perennial Ryegrass 30 percent
      c. Birds Foot Trefoil 15 percent
      d. Red Clover 5 percent
      e. White Clover 5 percent
      f. Redtop 5 percent
   B. Seed shall be applied at a rate of 5 lbs/1,000 sq ft.

5. Erosion Control Blankets/Jute Matting
   A. The area to be covered shall be properly prepared, fertilized, and seeded before the blanket is applied. The blankets shall be applied in the direction of water flow, butted at the ends and side and stapled.

6. Gravel Areas
   A. All areas (shoulders, side streets, drive, parking areas, etc.) which exhibit a gravel surface at the time of construction will be re-graveled with a minimum depth of six (6) inches of CABC stone compacted in place for the width and length of the disturbed area and then feathered gradually into the existing cross section. When a driveway is finished with other than ABC stone, a one-inch finish coating to match existing gravel gradation and appearance shall be placed.

7. Execution
   A. Topsoil shall be placed, spread and finish graded within the job limits in order to provide a smooth surface without depressions or ridges and properly graded for drainage. Topsoil shall be placed to a depth of 4" (as measured after rolling and compaction). After placing the topsoil, the area shall be raked and all stones, rocks and weeds removed.
   B. Fertilizing and seeding installation shall be accomplished within the recommended seasons per the USDA.
   C. In order to prevent unnecessary erosion of newly topsoiled and graded areas, place and secure mulch or jute matting immediately after seeding.

D. Seeding and mulching may be applied hydraulically and sprayed over the area according to the manufacturers recommended proportions and application rates.

E. The Contractor shall maintain the seeded areas until there is a uniform growth three (3) inches high. Maintenance shall consist of watering, weed and pest control within established lawns, fertilization, erosion repair, reseeding and all else necessary to establish a vigorous healthy and uniform strand of grass. All areas and spots, which do not show a uniform strand of grass, for any reason, shall be treated repeatedly until a uniform strand is attained.

11.03.20 WORK WITHIN CITY RIGHTS-OF WAY, DEDICATED DEVELOPER-FUNDED/PUBLIC IMPROVEMENT PROJECTS

1. It shall be understood that the quality of workmanship and material entering into the work shall conform to the pertinent sections within these Specifications and the accepted industry standard of quality (i.e. AWWA, ACI, PPI, DIPRA, etc.).

2. The Contractor shall plan and conduct his/her operations such that any interruption(s) of service are discussed with, and approved by, the Water Resources Engineering Manager.

3. The Contractor shall maintain emergency vehicle access throughout the project site at all times. The Contractor shall also provide access for local traffic, the normal collection of garbage, commercial deliveries, and school bus traffic.

4. The hours of work shall be limited to the hours between 8:00 A.M. to 5:00 P.M., Monday through Friday, unless otherwise approved in writing by the Water Resources Engineering Manager. Written request to deviate from the aforementioned hours shall be submitted a minimum of three (3) working days in advance.

11.03.21 WORK WITHIN NCDOT RIGHT-OF-WAY

1. The Contractor will be required to participate in a 3-party encroachment agreement to perform any work within the NCDOT right-of-way in the City of Monroe limits. The Contractor shall abide by all additional requirements set forth in the Agreement not mentioned herein.

2. Traffic control shall be in accordance with the NCDOT Standard Specifications and the Manual of Uniform Traffic Control Devices, latest revision. All traffic control plans shall be submitted for review and approval of the NCDOT Division Engineer and Water Resources Engineering Manager.

3. No storage of material or equipment will be permitted within the right-of-way without approval of the NCDOT Division Engineer.

4. Excavations with the exception of boring pits must be backfilled during non-working hours. Boring pits must be fenced at all times.

5. When cutting of pavement is permitted, only one half of the road width shall be opened at any time. Full traffic flow is to be maintained between dusk and dawn and at other peak hours of traffic.

6. The Contractor is informed to contact NCDOT to verify axle load limits on State maintained roads and bridges, which will be used for hauling equipment or materials to the project site. The Contractor shall do all that is necessary to satisfy NCDOT's requirements and will be responsible for any damage to roads and bridges resulting from project construction.

7. All disturbed areas shall be restored in accordance with NCDOT Standard Specifications and meet the approval of the NCDOT Division Engineer.

8. A representative from the NCDOT shall be invited to final inspections of all work within the NCDOT right-of-way along with the Water Resources Engineering Manager or their authorized representative. The Contractor will be responsible for providing an acceptance letter from the NCDOT prior to dedication of the water main to the City. The Contractor shall then end the encroachment agreement as stipulated within.

11.03.22 CITY OF MONROE JOB CLOSE-OUT

The City of Monroe Water Resources Department requires the following procedures be completed before the activation of sanitary sewer main extension.

1. Final Inspection: Contractor shall contact the Water Resources Department Inspector or Representative to conduct an on-site final inspection of the installed infrastructure. **See following page for Final Sewer Inspection List.** All uncompleted work, defective materials and site restoration matters shall be listed on a punch list for the Contractor to complete before final acceptance. Upon completion of the punch list items, a follow up inspection will be completed by the Water Resources Inspector. All sewer main installation work in subdivisions shall be covered by the warranty conditions established by the City of Monroe Engineering Department and shall adhere to all conditions listed by the Engineering Department. Final air test of public and private sewer mains and service laterals along with final certification will not be accepted until all utilities are installed. The developer has the option to expedite the acceptance process prior to the installation of all utilities by agreeing to perform closed circuit television

(CCTV) inspection at the conclusion of construction and to repair problems identified by the CCTV to the sewer mains and service laterals. Acceptance of the sewer certification will enable the City of Monroe to accept final certification of water, streets, and storm drainage. All testing, air test or CCTV, shall be performed to the requirements as set forth by the Water Resources Department.

2. As-Builts and Engineering Certification: The activation of the sewer main shall not take place until the Project Engineer has furnished the Water Resources Department with an Engineering Certification of the Project and the As-Built drawing have been submitted, reviewed and approved by the Water Resources Department and/or the Division of Water Quality as applicable.

Final Sewer Inspection Checklist

1. Manholes:

- ☐ All concrete work in manhole is to be completed.
- ☐ Inverts and shelves are to be smooth with no paper hangers.
- ☐ No water ponding in invert.
- ☐ No gravel or asphalt in manhole.
- ☐ Steps in proper location and vertical.
- ☐ Check Distance from top of cone to top of ring. Max distance 21 1/2 inches.
- ☐ Manhole cover is to be clean. No asphalt on cover.
- ☐ Manhole set at proper grade. Flush with street, 1 inch above grade in grass areas and 24" for cross-country
- ☐ Remove plugs after testing.

2. Sewer Taps:

- ☐ Check riser to see that it is not broken.
- ☐ Riser should be at least 2 feet above ground elevation.
- ☐ Cleanouts not installed in low lying areas.
- ☐ Brass caps are installed on risers.
- ☐ 4 X 4 post in place and shall be a minimum of 4-feet above grade
- ☐ Riser should be marked on curb with " X ".

3. Sewer Mains:

- ☐ Lines are flushed and checked at the time they are tested. Lines are to be straight and on grade.
- ☐ No ponding in lines.
- ☐ No dirt or gravel in lines.

4. Sewer Outfalls:

- ☐ R/W clean of all rocks over 2 inches in diameter.
- ☐ All manholes at 2' +/- above grade.
- ☐ No ponding around manholes.
- ☐ All areas must have positive drainage across R/W.
- ☐ Vent pipes are to be vertical and painted sewer green.
- ☐ R/W is to be seeded and mulched. Grass should be up.
- ☐ All silt fence should be removed as soon as erosion control measures are released by controlling entity.

Note: Water and Sewer construction final is conducted for the convenience of the developer so that water and sewer main can be activated after receiving engineering certifications. No water meter will be set until certification and as-builts are received. During the overall final inspection for subdivision, all water and sewer facilities will be reinspected. Warranty on water and sewer will not begin until the subdivision final inspection is complete and warranty letter as shown in 07.16 of the Standard Specifications and Details Manual is issued