



**PROJECT SPECIAL PROVISIONS**  
**Utility Construction**

**I. DESCRIPTION**

The work covered by these provisions only applies to Charlotte-Mecklenburg Utilities facilities and consists of constructing various utilities as required by the plans and provisions herein or as directed by the Engineer. The Contractor shall furnish any and all materials, labor, equipment, and incidentals necessary to complete the proposed utility work.

Apply the applicable provisions of the Rules and Regulations of the North Carolina Department of Environment and Natural Resources, Division of Environmental Health to the construction of water lines. Apply the Rules and Regulations of the North Carolina Department of Environment and Natural Resources, Division of Environmental Management to the construction of sanitary sewer lines except as otherwise provided.

**II. GENERAL CONSTRUCTION REQUIREMENTS**

**Specifications:**

The proposed utility construction shall meet the applicable requirements of the NC Department of Transportation's "Standard Specifications for Roads and Structures" dated July 2006, all applicable permits, and Charlotte-Mecklenburg Utilities standard details as shown on the plans, as outlined in the following provisions, or as directed by the Engineer.

**Existing Utilities:**

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' ahead of construction or as noted in the Special Provision Section of this document.

All utility owners will be notified prior to excavation as required by the 1985 Underground Damage Prevention Act. Owners who are members of NC One-Call may be notified in accordance with current NC 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.

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.

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

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

**Utility Connections:**

Make connections between existing and proposed utilities at times most convenient to the public, without endangering the utility service, and in accordance with the owner's requirements. Make connections on weekends, at night, and on holidays if necessary.

Should the position of any pole, pipe, conduit, or other structure require removal or adjustment, the Engineer will coordinate the change with the owner of the obstructions or a representative of the owner.

**Excavation and Backfill for Utility Pipeline Construction:**

All excavations for pipe laying, manholes, piers, drainage ditches, grading and any other for the proper completion of this contract shall be included herein.

Excavation within street rights-of-way shall be backfilled when left unattended for more than 1 hour unless otherwise approved by the controlling agency. Excavations within sewer/water rights-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.

Trench Excavation: No more than 100' 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 ENGINEER. Ground conditions and/or location requirements shall govern the amount of trench open at any one time as determined by the ENGINEER. The maximum trench width shall be as indicated for each type of pipe specified. If the actual trench width exceeds the specified width, due to shoring methods, the contractor must obtain approval from the ENGINEER.

Trench Width for Water Line: Maximum trench width for pipe shall be equal to the outside diameter (as measured at the pipe barrel) of the pipe plus 16".

Trench width shall be measured between faces of cut at the top of the pipe bell. If the Contractor varies from this requirement without approval of the ENGINEER, he shall at his own expense install Type II or Type III bedding defined in this specification.

Trench Width for Sewer Line: The maximum trench width shall be measured between faces of cut at the top of the pipe bell.

The trench width for 8" – 30" pipe shall be limited to the nominal pipe size plus 36".

If the Contractor varies from this requirement without prior approval of the ENGINEER, or if specified trench widths cannot be maintained, improved bedding and/or improved pipe material shall be installed as directed by the ENGINEER.

Trench Bottom Conformation: The excavation shall be made to the elevations, grades, and lines shown on the Construction Plans. The trench bottom shall be excavated slightly above grade and cut down to the pipe grade by hand in the fine grading operation. The trench bottom shall be true and even with bell holes at each joint to provide the barrel of the pipe with soil or granular bedding 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 (at his own expense) fill it to grade with approved material thoroughly tamped, or with #67 bedding stone. Pipe depth and/or soil conditions may require Type II or Type III granular embedment. This bedding shall also be shaped to allow adequate support of the pipe.

If the trench passes either under or over another pipeline or previous excavation, the trench bottom in this area shall be tamped, if necessary, so the disturbed soil has approximately the same supportive strength as the native soil.

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 3' 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.

Dewatering: The Contractor shall at all times provide and maintain ample means and equipment with which to remove and properly dispose of water entering the excavation or other parts of the work and shall keep all excavations dry until such time as pipe laying and grading is completed.

Water shall not 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 minimize siltation and erosion on adjacent property or other construction.

OSHA – Trench/Excavation:

If, in the opinion of the ENGINEER, the trench/excavation is not in compliance with OSHA regulations, the Contractor may be directed to stop work. Continued unsafe conditions will be reported to the appropriate regulatory agency. The Contractor will be responsible for paying all fines resulting from safety violations.

**Pipe Laying:**

All bedding compaction shall be approx. 95% density in accordance with AASHTO T-99 as modified by NCDOT.

When granular material embedment is required, the Contractor will backfill above the granular bedding as specified for Type I bedding to an elevation one (1) foot above the top of the pipe bell.

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

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

Type II - Granular Material Embedment: For Type II bedding, the trench bottom shall be undercut a minimum of six (6) 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 for the pipe's entire length and the entire width of the ditch. Type II embedment shall be used as directed by the ENGINEER.

Type III - Granular Material Embedment: For Type III bedding, the trench bottom shall be undercut a minimum of six (6) 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 one-half the outside diameter of the pipe for the pipe's entire length and width of the ditch. Type III Granular material embedment shall be used as directed by the ENGINEER.

Depth of Pipe Installation: Unless otherwise indicated on Plans, or required by existing utility location, all pipe will be installed with the top of the pipe at least 3 feet below the edge of adjacent roadway pavement or 3 feet below the ground at the pipe, whichever is greatest. The

Contractor is instructed to check the construction plans and blow-up views for additional requirements.

Unless otherwise shown on the plans, the maximum depth of cover shall be as follows:

Type I Bedding	10 feet
Type II Bedding	15 feet
Type III Bedding	20 feet

The Contractor may be required to vary the depth of pipe to achieve minimum clearance from existing utilities while maintaining the minimum cover specified whether or not the existing pipelines, conduits, cables, mains, etc. are shown on the Plans.

#### **Sewer Line Clearance:**

Whenever a sewer main crosses under other utility lines (gas, telephone conduit, storm drain, etc.) there shall be 2' clearance between the top of the sewer and the bottom of the affected utility. Stone bedding shall be used from 6" below the sewer to 12" above the sewer from 1' outside the utility trench. If this clearance is not possible, the sewer line shall be Ductile Iron Pipe from 1' outside the utility trench with a minimum length of 10'.

#### **Concrete:**

Portland Cement Concrete: All concrete shall conform to the Standard Specifications for READY MIXED CONCRETE, ASTM C-94. An air-entraining admixture, conforming to ASTM C-260, shall be added to either Type I, Type II, or Type III Portland Cement. Fly Ash conforming to ASTM C-618 for Class C Fly Ash may be added to the concrete mix but shall not be considered as replacement for more than 10% of the cement therein (strengths shall not be less than hereinafter required).

Types I, IA, III and IIIA Portland Cement shall only be used for manhole inverts, concrete encasement, concrete blocking, and/or as directed by the ENGINEER, and shall conform to ASTM C-150.

Types II and IIA Portland Cement shall be used in precast manholes, cast in place manhole structures, reinforced concrete pipe, reinforced concrete piers and concrete or reinforced concrete rip-rap as directed by the ENGINEER, and shall conform to ASTM C-150 except that Tricalcium Aluminate ( $3\text{CaO}\cdot\text{Al}_2\text{O}_3$ ) content shall not exceed 8%.

Aggregates: All aggregates used for concreting shall conform to ASTM C-33 and shall be checked daily for any variances in moisture content. Said variances shall be corrected and/or taken into consideration for each batch.

Coarse Aggregates shall be uniformly and evenly graded for each application in accordance with A.C.I. Standard 318. Unless otherwise approved, aggregate shall be sound, crushed, angular granitic stone. Smooth or rounded stone (river rock) shall not be acceptable.

Fine Aggregates shall consist of natural sand, manufactured sand or a combination thereof. Fine aggregates shall conform to the sieve analysis as specified in paragraph 4.1 of the standard except that the percent passing a No. 50 sieve shall not exceed 5% and the percent passing a No. 100 sieve shall be 0% as provided for in paragraph 4.2 of the standard.

Mix Design: Concrete shall be watertight, resistant to freeze-thaw cycles and moderate sulfate attack, abrasion resistant, workable, and/or finishable. These qualities may be met through the use of admixtures (if and only if approved in the mix design as hereinafter specified) conforming to the appropriate ASTM with the exception of the use of calcium chloride, which shall be

limited to no more than 1% by cement weight -thoroughly mixed to insure uniform distribution within the mix. If the concrete is used with reinforcing steel, no calcium chloride will be allowed.

The Contractor shall assume responsibility for concrete mixture. The concrete shall be proportioned to meet the following requirements: (Note: This mix does not apply "in total" to precast manhole or reinforced concrete pipe).

Compressive Strength	Minimum 3,600 PSI
Water-Cement Ratio by Weight	0.40-0.50 (as required by the application)
Slump	Min. 3" Max. 5"
Air Content (Entrained & Entrapped)	Min. 4% Max. 6%
Coarse Aggregate	.75" – 1.5" (as required by the application)

When required by the ENGINEER, and prior to beginning construction, the Contractor, at his expense, shall obtain from an approved commercial testing laboratory a design for a suitable concrete mix and submit same with his list of materials and material suppliers for approval.

Curing Compound: All concrete curing compounds shall conform to the standard specifications for LIQUID MEMBRANE - FORMING COMPOUNDS FOR CURING CONCRETE, ASTM C-309, Type 2.

Curing compounds shall be applied as forms are stripped.

Grouts: All grouts shall be of a non-shrink nature (as may be achieved through additives or proportioning) and depending upon application range from plastic to flowable cement water paste. Testing as specified above for concrete may be required for acceptance of grouts to include frequent checks for consistency by a time-of-flow measurement.

Acceptable range of testing requirements:

Compressive Strength	10,500 PSI to 12,500 PSI
Bond Strength	1,350 PSI to 1,700 PSI
% Expansion	+0.025% to +0.75%

Expansion grouts shall be used only as directed by the ENGINEER.

Grouts shall be mixed (if applicable) and placed in accordance with the manufacturer's current recommendations, for each specific application.

Mortar: Mortar used in sanitary sewer manholes shall be hydraulic cement mortar in accordance with ASTM C-398. Mortar used in water meter vaults and water valve vaults shall be Type M mortar in accordance with ASTM C-270.

#### **Stone and Brick:**

Granular Bedding Material: All bedding material shall be angular, clean washed crushed stone graded in accordance with Size #67 in ASTM D-448 for "Standard Sizes of Coarse Aggregate" (NCDOT Standard size #67).

Bedding material will be used only as instructed in the Specifications and/or as specifically directed by the ENGINEER.

Brick: All brick used to construct manhole inverts or adjust frames shall be made from clay or shale, shall be solid only and shall be of standard building size. All brick shall meet or exceed the compressive strength and water absorption properties specified in ASTM C-32 for Grade MS brick or in-ASTM C-216 and ASTM C-62 for Grade SW brick.

**Installing Valves and Fittings:**

Valves and fittings shall be installed in the manner specified for installation and assembly of pipe. Valves and hydrants shall be installed at locations shown on the plans and/or as directed by the Engineer.

Valve Boxes: A valve box conforming to the Standard Details shall be installed for every gate valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut, with the box cover flush with the surface of the pavement or other existing surface.

Where the box is not set in pavement, the top section shall be anchored by an 18" x 18" x 6" concrete pad, or an approved pre-cast concrete pad, set flush with the existing terrain. The top section will be grouted into the pre-cast concrete pad. The location of valves will be identified by the letter "V" imprinted into the curb adjacent to mainline or hydrant valve.

All butterfly valves shall be installed with operating nuts plumb and centered beneath a manhole frame and cover, valve box top section and riser pipe as shown in the standard details. Extension stems as shown on the standard detail will be required on valves where the operating nut is more than 4' below the top of the frame and cover.

Valve Blocking: All end of line valves 12" and smaller installed on PVC or DIP water mains and all 12" valves installed along PVC water mains shall be securely wedge blocked with concrete bearing against, and cut into the excavated sides of the trench. Care shall be taken in forming and pouring the "wedge" blocking so the fitting joints will be accessible for repair and/or valve extraction.

Blocking Fittings: All plugs, caps, tees, and bends deflecting 11-1/4 degree or more on pressure mains 6" in diameter or larger shall be provided with thrust blocking, placed as shown on the Plans and/or directed by the Engineer, and consisting of ready mix concrete having compressive strength of not less than 3,600 PSI at 28 days.

Bagged mix concrete may be used for blocking, anchorage, concrete valve pads, etc. on water mains and valves 12" or smaller, when less than 1/2 yard is required.

Blocking shall be placed between solid ground and the fittings to be anchored. The area of bearing on the pipe and on the ground in each instance shall be that shown or directed by the Engineer. The blocking shall be so placed that the pipe and fittings will be accessible for repair.

Restrained joints shall be installed where shown on the plans, standard details or when approved by the Engineer, and may be installed in lieu of blocking. Installation shall be per manufacturer's recommendations, as shown on the plans, special provisions, and/or as directed by the Engineer. Restrained joints will not be allowed on PVC pipe.

**Utility Relocations:**Water:

Install existing water meters and meter boxes that are to be relocated adjacent to the right of way, as shown on the utility plans, or as directed.

Relocation of water meters consists of the removal and installation at the appropriate location of the water meter, meter yoke, meter valve, and meter box. This work also includes all pipe, corporation stops and tapping saddles necessary for this relocation. Perform all work in

accordance with the applicable plumbing codes, as shown on the plans, and as directed. Place relocated meter boxes with the top of the meter box flush with finish grade of the project. All pipe, fittings, tapping saddles, corporation stops, meter yokes, meter valves, meter boxes, and appurtenances associated with the relocation of water meters shall be considered incidental.

Locate and install fire hydrants as shown on the utility plans.

Relocate all existing fire hydrants in the road construction area, and others that will be a hazard to the motorist, adjacent to the right of way, as shown on the plans, and/or as directed.

Separate existing fire hydrants to be relocated at the hydrant base from the existing pipe and place in the new location. Where necessary, remove the hydrant shoe and replace with the appropriate type to connect the relocated hydrant to the new pipe. Furnish, install or remove hydrant extension pieces to provide the proper bury of the pipe and hydrant. Provide all necessary pipe, valves, and fittings necessary for this relocation. Handle pipe and appurtenances in such a manner as to ensure delivery to the site and installation in a sound, undamaged condition. Store plastic pipe out of direct sunlight until placement. All plastic pipes showing discoloration, or deterioration will be rejected for use and replaced with suitable pipe, at no additional cost. Carefully examine all pipe, fittings, and appurtenances for defects before placing, rejecting any found defective. If, at any time before completion of the contract, any broken pipe or any defects are found in the lines or in any of their fittings or appurtenances, replace them.

All pipe, fittings, valves, extension pieces, and appurtenances associated with the relocation of fire hydrants shall be considered incidental.

On tie-in sections, the Contractor may be required to anchor pipe bends, tees, etc. with precast concrete blocking, timbers, rodding, or other approved method to allow the water line to be placed back into service as soon as possible. Make final connections to existing mains where indicated on the drawings, as required to fit the actual conditions, or as directed. Order materials, install the new line, provide thrust restraint, and perform sterilization and pressure tests on the new line prior to installation and tie-in of the new line into service to the satisfaction of the Engineer. Notify owners in advance of any interruptions of water service with ample time to make arrangements. Limit interruption of water service on main lines to a maximum of 8 hours unless otherwise approved.

#### Sewer:

Make final connections of the proposed sewer work to the existing system where indicated on the drawings, as required to fit the actual conditions, or as directed. Notify the owner at least 24 hours in advance of all arrangements for temporary service and for agreement with the owner as to the time that service may be interrupted.

Do everything necessary, including temporary pumping, in order to keep all existing sewers active for either the duration of this contract or until the Engineer authorizes connections.

#### **Testing and Inspection for Water Lines:**

Required testing of pipelines and valves shall be done under the direct supervision of the Project Inspector. Field testing shall not negate the requirements for material certifications as contained in the material specification section of this contract. Unless otherwise directed by the ENGINEER, all testing and disinfecting will be completed prior to connection to any existing line. The Contractor shall provide open ventilation of confined spaces. The Contractor shall be responsible for providing all equipment and personnel necessary to comply with OSHA confined spaces regulations.

Hydrostatic and Leakage Tests: On completion of the line or sections of the lines, connections and appurtenances, the line shall be filled and hydrostatically tested. The water for this purpose can be taken from existing lines under the supervision of the ENGINEER's Inspector and leakage

will be measured by the Inspector with a meter furnished by Charlotte-Mecklenburg Utilities. All leaks and any defective material shall be repaired or replaced to the satisfaction of the ENGINEER and the tests repeated until the requirements of this specification are met. Any special equipment, pumps, etc. required to make the test shall be furnished and operated by the contractor as directed by the Inspector.

The Contractor shall use great care to be sure that all air is expelled from each section under test. If fire hydrants or other openings are not available for the purpose of expelling air, the Contractor shall provide air releases of sufficient size (as determined by the ENGINEER) in accordance with City Standard Drawings, at his expense. Specific procedures for testing mains are as follows:

Test pressure will be 200 PSI at the low point of the section under test. When testing against butterfly valves, the differential pressure at the valve must not exceed 150 PSI for valves rated at 150 PSI. If the test cannot be made with differential pressure of 150 PSI, 250 PSI valves will be specified. Differential pressures across gate valves may be up to 200 PSI.

Allowable leakage for 16" nominal diameter pipe will be 1.7 gal/hour per Table 6, AWWA C-600.

Pressure and leakage tests will be run concurrently and for a duration of four hours except as modified below.

The Contractor will pressurize the line and verify that it is within allowable leakage before the official test is started.

The Inspector will begin the test and remain at the job for the first hour, making sure that the test pressure is maintained within  $\pm 5$  PSI. The Contractor is to maintain the pressure within  $\pm 5$  PSI for the duration of the test period. At the end of the first hour, with the line pumped to full test pressure, he will read the meter and record the first hour leakage. If the first hour leakage is within allowable, he will return at the end of the fourth hour and again read the meter. If the total leakage for the four hour period does not exceed four times the first hour leakage, the test will be terminated. If the total leakage exceeds four times the first hour leakage, but is still within allowable, the test will be held an additional hour. If the fifth hour leakage does not exceed the average hourly leakage for the first four hours, the test will be terminated at the end of the fifth hour. Otherwise, the test will be held until the leakage is non-increasing and within allowable for two consecutive hours.

If leakage exceeds allowable for the four hour test, the test will be terminated and re-scheduled after the Contractor has verified that actual leakage is within the allowable leakage, but no earlier than the next work day. If the first hour leakage does not exceed 10% of the allowable, or if the allowable leakage rate does not exceed 0.4 gal/hour, the test may be terminated at the end of two hours provided the second hour leakage does not exceed the first hour leakage. If the second hour leakage exceeds the first hour leakage, the test will be held for an additional period as described in the paragraph above.

The maximum length of pipe tested in one test shall be 5,000' or as close to 5,000' as possible depending on valve spacing.

During the last stages of the test and without any reduction in pressure, first the hydrant guard valves will be closed, then progressing in an orderly manner from the end opposite the test pump, each main line valve will be closed and pressure released to determine if it is holding pressure (minimum 10 minutes per valve closing).

#### **Sewer Manhole Construction:**

All manholes outside street rights-of-way or landscaped areas shall be constructed to a height of two (2') feet above the adjacent ground unless otherwise indicated on the Plans or by the



Special Provisions. Manholes within street rights-of-way or landscaped areas shall have finished rim elevations flush with the pavement or adjacent finished grade. After final inspection is complete and all deficiencies have been corrected, the Contractor shall seal all manholes (rings to covers) with penetration type asphaltic cement No. AC-20.

All sewer manholes shall be constructed of precast concrete sections only in conformance with the following specifications and Charlotte-Mecklenburg Utility Department Standard Detail Drawings. Special cast in place manhole structures shall be as shown on the plans and shall comply with the various other applicable sections in these specifications.

Manholes will be furnished with the following clear inside diameters according to the sewer main diameter unless amended by the Plans or Special Provisions:

8" to 18" pipe	4' Manhole (precast)
21" to 36" pipe	5' Manhole (precast)
39" to 54" pipe	6' Manhole (precast)
54" and larger	8' Manhole (precast)

The manhole diameter for a given pipe size may be increased from that shown above for applications where the angle between the influent and effluent pipes installation of the pipe connections in the standard size manhole. Manholes shall be furnished with precast bottom slabs and flexible watertight boots for 15-inch and smaller pipe. The boots shall be cast in as integral parts of the base or installed in cored openings with stainless steel compression bands, and shall conform to ASTM C-923. Manholes for 18-inch and larger pipe may be furnished with precast bottom slabs and flexible boots, flexible seals, or concrete collars. Flexible connectors shall conform to ASTM C-923. The concrete collars shall be according to the applicable Standard Detail. Manholes to be placed over existing pipelines shall be furnished with "doghouse" openings cast in the bottom section allowing it to be set over the existing pipe. A concrete base and invert shall be poured around the bottom section and the pipe according to the applicable Standard Detail.

Catalog cuts and/or shop drawings, which show dimensions, openings for pipe, reinforcing steel dimensions and layout and other essential details shall be submitted for approval.

Precast Reinforced Concrete Manhole Sections: All precast reinforced concrete manholes shall conform to CMUD Standard Detail drawings and to ASTM C-478. The following minimum standards shall also apply:

Wall thickness shall be  $1/12^{\text{th}}$  of the inside diameter with a minimum thickness of five (5") inches.

Base sections shall be cast monolithically or have a water stop cast in the cold joint between the walls and the base slab.

Cone sections shall normally be eccentric with the inside face of one side vertical and flush with the inside face of the barrel section. Eccentric cones with bolt down frame and cover shall have a minimum vertical height, as measured from the top of the cone to the bottom of the bell, of 32-inches. Eccentric cones without bolt down frame and cover to be installed flush to finish grade may have a minimum vertical height of 24-inches. Concentric cones with a vertical height of 20-inches may be used on manholes less than five (5') feet deep (4' diameter manhole only). Transition cone sections may be provided for an eccentric transition from a 60-inch riser to a 48-inch cone section to be placed directly beneath the 48-inch cone.

Transition slabs may be placed a minimum of five (5') feet above the invert shelf for six (6') feet and larger diameter manholes where the slab will be buried. Flat top slabs may be used for six (6') feet and larger diameter manholes, unless the manhole is located within pavement or maintained lawns.

Joints between sections shall be manufactured in accordance with ASTM C-443. Joints may be sealed with rubber gaskets in accordance with ASTM C-443 or with butyl rubber sealant conforming to Federal Specification SS-S-210A and AASHTO M-198, Type B.

All markings required by ASTM C-478 shall be clearly stamped on the inside of each section.

Aggregate shall be sound, crushed, angular granitic stone only, substantially in accordance with ASTM C-33, except that the requirement for gradation in that standard shall not apply. Smooth or rounded stone (river rock) shall not be acceptable.

The cement shall be Type II with a maximum tricalcium aluminate ( $3CaO \cdot Al_2O_3$ ) content 8%.

In lieu of Type II cement and granitic aggregate, precast manhole sections may be furnished of Type III cement with calcareous (limestone) aggregate. The manufacturer will submit lab tests certifying the amount of Alkalinity (minimum 78 %) present in the complete mix.

Manhole riser sections, transition slabs, flat top slabs, and cone sections shall be designed for H-20 loading.

The manufacturer shall furnish the ENGINEER with test results on compression and absorption for one section in every twenty-five sections poured, and certification from cement manufacturer and aggregate supplier certifying chemical content. The ENGINEER reserves the right to pick random sections for the required testing.

Installation Of Frames And Covers: The frame shall be installed on the manhole with anchor bolts on all manholes that are not flush with the ground. 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. Complete anchor bolt assemblies shall be zinc plated steel and shall consist of a drive in type anchor sleeve, a threaded stud and two nuts. Anchors shall be installed in field drilled holes in the cone. Minimum diameter of the threaded stud shall be 1/2 inch. 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. Brick may not be used to adjust rim elevations of above grade manholes.

Manholes that are installed flush with pavement or grade shall have frames attached to the manhole with a bed of cement mortar grout. 8-inch tall frames are required for all manholes that are flush with pavement or finished grade unless otherwise approved. Standard size brick or reinforced concrete grade rings may be used to adjust the finished rim elevation of such manholes. This adjustment may not exceed 21-inches in height.

Steps: Manhole steps will be furnished in accordance with Standard Detail Drawings ASTM C-478 and current OSHA regulations. In addition to the testing requirements of ASTM C-478 each step installed in pre-cast manholes will be tested to resist a 1000 lb. pullout. The manhole manufacturer will furnish certification of each test with each shipment showing manhole location, date of test, and results.

Manhole Step Testing: The Contractor will furnish a hydraulic driven system consisting of cylinder, connecting hose and above ground pump with gauge to test manhole steps to exceed 1000 lbs of resistance of pullout. All field installed steps will be tested in lieu of field testing steps installed at the plant, certified shop reports by the manufacturer showing that each step passed the required 1000 lb. pullout will be accepted. The certificates will be furnished to the Inspector prior to field installation.

Unless the Contractor can furnish the manufacturer's certification on step tests, the Contractor will be required to test 10% of the plant installed steps. An additional 10% will be tested for each failure.

**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 unactivated sewer lines not installed under the same contract will not be allowed without written approval from all parties involved (CMU, contractors, contract holders, etc.). The Contractor will be required to install watertight masonry plugs in the proposed pipeline at the existing manhole and at the first proposed manhole until all construction is complete and testing begun. If the proposed sewer does not begin at an existing manhole, a straddle type manhole as shown on the Standard Details 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 precast 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 Engineer.

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.

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

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.

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 Engineer.

Scheduling: When the flow of an existing sewer must be interrupted and/or bypassed, the Contractor shall, before beginning any construction, submit a 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 Engineer and may require night, holiday, and/or weekend work.

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 full 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 Engineer. The Contractor shall be responsible for any fines levied as a result of effluent reaching the creek. *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 by the Engineer.*

**Testing and Internal Inspection for Sewer Lines:**

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.

Gravity Sewer Pipe Leakage Testing: No sooner than 10 days following completion of backfill, the Contractor along with the project inspector will be required to determine the level of the ground water table. If the level of ground water table is above the top of the pipe, the sewer line shall be tested for infiltration. If there is no ground water above the top of the pipe the sewer line shall be low pressure air tested. Each test shall be performed as follows:

Infiltration: Weirs are to be furnished by CMU and installed by the Contractor. The infiltration shall not exceed 100 gallons per day per inch diameter per mile 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 ENGINEER. The Charlotte Mecklenburg Utilities reserves the right to TV any sewer line to detect sources of infiltration.

Low Pressure Air Test: Tests shall be performed in accordance with ASTM C-828 and C-924 on sewer lines 42-inches in diameter and smaller. Test pressure will be measured by gauges furnished by CMU and installed by the Contractor above ground at the manhole opposite the air supply. The Contractor shall furnish all other test equipment required including connecting hoses at the CMU supplied gauge.

Sewer lines larger than 42-inches in diameter shall be tested for infiltration as specified above and each joint shall be visually inspected by a CMU representative.

Manhole Leakage Testing: Manholes shall be tested by plugging the inlet and outlet pipes with airtight plugs and using one of the following procedures:

Exfiltration: Fill the manhole to the rim with water and allow the level to equalize due to saturation. Refill the manhole and mark the level to begin the test. The test shall last at least 2 hours and allowable leakage shall be 3 gallons per hour. The ENGINEER will select 25% of the manholes on the project to be tested. If any manhole fails, an additional manhole will be tested. Manholes that fail the test shall be repaired as specified and retested until they pass.

Vacuum Air: Manhole vacuum air testing shall be performed in accordance with ASTM C-1244. The ENGINEER will select 25% of the manholes on the project to be tested. Manholes that fail the test shall be repaired as specified and retested until they pass. Manholes that show leaks and are repaired prior to testing shall be tested as specified.

**Repairs (Sanitary Sewer):**

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

PVC, VC or 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 MS Section of this document.

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.

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.

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

**Adjust, Abandon, or Remove Utilities:**

Adjust, abandon, or remove utility facilities. Provide all material, labor, equipment, pumping flowable fill or placing grout, removal and disposal of pipe, plugging pipe openings, breaking down manhole, rebuilding new manhole, paving, steps, excavation, backfill, and incidentals necessary to complete the proposed utility work unless indicated otherwise in the proposal.

Pipe: Fill abandoned pipe, designated on the plans or by the Engineer, with flowable fill or remove, at the discretion of the Contractor. Excavate, remove, and dispose of properly any abandoned pipe to be removed. Backfill the resulting trench and properly compact using local excavated material or select backfill as required. Fill all abandoned utility pipe located in the roadway, which is twelve inches in diameter and larger and has a cover of less than twenty feet below finished grade with flowable fill or remove pipe to the satisfaction of the Engineer. Remove any abandoned utility pipe exposed by grading operations to a minimum depth of twelve inches below subgrade elevation of the proposed roadbed or completed grading template. Plug all abandoned utility pipes. Use portland cement grout to plug all abandoned sewer pipes at the entrance to all manholes whether the manhole is to be abandoned or not. Use portland cement grout to plug all abandoned water mains after new mains are placed in service.

Manholes: For all utility manholes in the construction area that will be abandoned, plug all connecting utility pipes. Remove the top of the manhole to an elevation of two (2) feet below subgrade or below the spring line, and fill the manhole barrel with select earth material properly tamped. For any abandoned manhole that will have the connecting pipes filled with flowable fill, fill the manhole with cement grout to the top of main pipe. Plug connecting utility pipes that do not require filling with cement grout in an acceptable manner before the manhole is filled with earth material. Remove the frame and cover, manhole taper, wall, and base on all manholes that are required to be removed. Maintain ownership and properly dispose of the frame and cover. Remove the frame, cover, the manhole taper, and necessary manhole wall on manholes, which require rebuilding. Include in reconstruction of the manhole, the rebuilding of the manhole wall, manhole taper, steps, and replacing the frame and cover. Bring all adjusted utility manhole covers to an elevation slightly higher than the surrounding terrain so that surface water will not enter the manhole after the adjustment. Construct manholes located in paved areas flush with the surrounding pavement.

**IV. COMPENSATION**

No direct payment will be made for utility construction work required by the preceding provisions, which are general requirements applying to utility construction, and all of the requirements stated will be considered incidental work, paid for at the contract unit prices of the various utility items included in the contract.