Water Standards
for
Design and Construction

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STANDARDS FOR DESIGN AND CONSTRUCTION OF WATER MAINS

Section 1.01 Purpose

This section of the Specifications describes materials to be incorporated into water lines and requirements for installation and use of these materials. The Contractor/Developer shall furnish all materials and perform all labor necessary to fulfill the requirements of these Specifications.

Compliance with these specifications by the Contractor/Developer is required to ensure a safe potable public drinking water system free from potential sources of contamination and constructed with materials approved by Columbus Water Works (CWW). Compliance with these specifications by the Contractor/Developer is a condition of acceptance of the water main into the maintenance program and creates no contractual relationship between CWW and the Contractor. CWW reserves the right to reject any installed items not in compliance with these specifications. *Columbus Water Works also reserves the right to accept exceptions to these standards if conditions warrant changes. Any proposed changes must be clearly indicated on drawings and addressed in a cover letter to CWW. Only changes approved by CWW Engineering will be acceptable.* Furthermore, latent indications of deficient installation of the water main and/or appurtenances will be the responsibility of the developer to rectify at his expense.

Section 1.02 General

(a) Applicable Standards:

Supply all materials and perform all work in accordance with Columbus Water Works standards, and American Water Works Association (AWWA) standards, latest edition, and standards referenced therein.

(b) Laws and Regulations:

The Contractor's/Developer's attention is directed to the fact that all applicable federal, state, county, and city law, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the project throughout. The Contractor shall keep fully informed of all laws, ordinances, and regulations of the federal, state, county, city and municipal governments or authorities in any manner affecting those engaged or employed in the work or the materials used in the work and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency should be discovered in these specifications herein referred to, in relation to any such law, ordinance regulation, order or decree, the Contractor shall herewith report the same, in writing, to the Columbus Water Works.

The Contractor shall at all times observe and comply with all such existing and future laws, ordinances, and regulations, and shall protect and indemnify the Columbus Water Works, and their agents against the violation of any such law, ordinance, regulation, order or decree, whether by the Contractor or by the contractor's employees.

The Contractor/Developer is responsible for enforcing safety in accordance with all OSHA and other regulations. CWW assumes no responsibility for the Contractor/Developer's job site safety program.

(c) Lands and Rights of Way:

In order for the water distribution to be accepted by Columbus Water Works, the Developer shall provide all necessary easements to insure full ingress and egress for the purpose of maintaining said system. Easements will be a minimum of 20' wide and in the name of Columbus Water Works.

Any easement which is intended to be dedicated to Columbus Water Works must be included on the as-built. The easement must be recorded at the county clerk's office by at least one of the two following ways:

(1) An easement agreement form and two drawings shall be recorded with the county clerk.

(2) The following verbiage can be included on the final recorded plat:

"Water and sanitary sewer easements are granted for the purpose of constructing and maintaining water mains and sanitary sewers and for no other purpose, and the duly authorized agents and employees of the Columbus Water Works shall have the right of access to the said strip of land for the purpose of constructing said water and sewer mains and for inspecting and maintaining the same in good serviceable condition, and for said purposes they shall have the right to cut and remove any trees or vegetation which may interfere with proper construction and maintenance; and during construction the Columbus Water Works may use any additional adjacent ground which may be necessary for temporary storage of excavated dirt of materials required for construction."

(d) Testing, Inspection and Rejection of Work:

(1) Testing of Materials: Unless otherwise specifically provided for in the Specifications, the inspection and testing of products to be incorporated in the work at the site shall be made by bureaus, laboratories, or agencies approved by the Columbus Water Works; the cost of such inspection and testing shall be paid by the Contractor.

The Contractor shall furnish evidence, satisfactory to the Owner, that the products have passed the required tests prior to their incorporation into the work. The Contractor shall promptly segregate and remove rejected products from the site of the work.

(2) Inspection: The Contractor/Developer shall furnish the Columbus Water Works with every reasonable facility for ascertaining whether or not the work performed and products used are in accordance with the requirements and intent of the Specifications. No work shall be done or products used without suitable inspection by the Columbus Water Works. Failure to reject any defective work or product shall not in any way prevent later rejection when such defects are discovered or obligate Columbus Water Works to final acceptance.

(3) Authority and Duties of the Columbus Water Works Inspector: The Inspector will be authorized to inspect all work done and all products furnished, including preparation, fabrication and manufacture of the products to be used. The Inspector may reject material and workmanship or suspend the work until any question at issue can be referred to and decided by the Columbus Water Works and/or the Developer/Contractor. The responsibility of the Contractor is not lessened by the presence of the Inspector.

(4) Rejection of Work and Materials: All products furnished and all work done that is not in accordance with the Approved Drawings or Specifications or that is defective will be rejected. All rejected products or work shall be removed immediately. If rejected products or work is not removed within forty-eight (48) hours, the Columbus Water Works will have the right and authority to stop the work immediately and will have the right to arrange for the removal of said rejected products or work at the cost and expense of the Contractor/Developer. All rejected products or work shall be replaced with other products or work, which conforms with the Approved Drawings and Specifications.

(5) Contractor's/Developer's Responsibilities: Inspection of the work will not relieve the Contractor/Developer of any obligations to meet the requirements of the Specifications and defective work shall be made good regardless of whether such work has been previously inspected and accepted. The failure of the Columbus Water Works to reject improper work shall not be considered a waiver of any defect, which may be discovered later, or for work actually defecti

Section 1.03: Sequence of Activities:

The following is the sequence of steps which will be required for preliminary activities as well as construction and final acceptance activities for successful acceptance of the water system by Columbus Water Works:

- Engineering submits 2 full sets of construction drawings for water and sewer review.
- CWW review of drawings.
- CWW returns marked up drawings back to engineer and keeps a file copy.
- Engineer's review (transpose CWW mark-ups onto construction drawings).
- Engineer returns 5 transposed drawings (2 full sets, plus 3 additional site plan sheets for approval.
- CWW reviews, stamps and sends back one approved set of drawings.
- At the pre-construction conference, the CWW Inspector will give the Contractor an approved set of plans and go over the CWW approved plans, discuss the dates of construction, agree on initial washout location and review anticipated procedures.
- One copy of the CWW stamped approved plans shall be maintained on site by the contractor at all times.
- Engineer can submit a material's take off with a request for quotation if it is desired to purchase materials through Columbus Water Works.
- Notify CWW Inspector 48 hours before pipe construction begins.
- CWW Inspector inspects and approves all stockpiled materials prior to construction.
- To coordinate to wash out a new line, call the CWW Inspector and give at least a 48 hours notice.
- 24 hours notice to the CWW Inspector to pressure test the system.
- CWW will disinfect the line and take water samples, lab results in 72 hours.
- Contractor/Developer submits as-built drawings to CWW for approval. (One disk copy and three hard copies 17" x 22").
- CWW final acceptance upon receipt of approved water sample and all as-built drawings.

The following is a more in-depth explanation of the above steps and should be thoroughly studied:

(a) Construction Drawings:

(1) The Engineer will be required to furnish one full set of preliminary construction plans to Columbus Water Works Engineering Department for review and comment. The plan must include the Engineer's water system design. Additional copies needed by the contractor/Developer will be submitted as required. *The Engineer will need to show all proposed easements with widths on the first submittal. Typical easements are 20' side and should be dedicated easements. The first submittal should also include any phase lines for subdivisions.*

(2) The Columbus Water Works Engineering Department will review the submitted construction plans and make changes as necessary to indicate to the contractor/Developer any changes which need to be made prior to construction activity. *CWW will indicate the disinfection tap location on the submittal plans.* Columbus Water Works Engineering will review the plans, but the responsibility for the design will be with the Engineer. Any plans marked "amended and resubmit" or "rejected" will require a resubmittal prior to construction. Plans marked "no exceptions taken" or "Make corrections noted" may also be stamped approved for construction by Columbus Water Works Engineering. In this case, a Contractor/Developer is permitted to begin construction activities.

(3) All drawings submitted to Columbus Water Works Engineering shall be stamped by a Professional Engineer registered in the State of Georgia. The engineer is responsible for checking water pressure and basing his design accordingly. The drawings shall include the following basic information:

- Engineer's name, address, and phone number.

- Developer's name, address, and phone number.

- Subdivision identification or project identification, revision number of the plans, scale, date of latest drawing, north arrow, and sheet number.

(b) Submittals Required:

The Contractor/Developer shall furnish drawings and descriptive literature for all manufactured and fabricated products to the Columbus Water Works for review.

Additional information such as special drawings, schedules, calculations, system curves, etc., shall be provided as specifically requested by the Columbus Water Works.

(c) Site Plan Drawings:

The Contractor/Developer shall review and check drawings and submittals, and shall indicate approval by initials and date. Contractor/Developer shall furnish the Columbus Water Works two full sets and two site plans of construction drawings of all submittals. A transmittal form shall accompany each submittal or group of submittals.

(d) Columbus Water Works Review:

All submittals will be reviewed, stamped and dated by the Columbus Water Works before being returned to the Engineer with the following acceptance comments:

(1) No Exceptions Taken: Plans are approved without modification.

(2) Make Corrections Noted: Comply with comments marked on drawings by Columbus Water Works. Plans are approved.

(3) Amend and Resubmit: Comments are excessive; make necessary changes and resubmit.

(4) Rejected: Drawings are insubstantial and/or non-compliance with specifications; redesign and resubmit. No construction activity will be allowed until submittals have been properly processed. Allow thirty (30) days for review and/or approval of initial submittals. Allow fifteen (15) days for resubmmittals. Two stamped drawings will be returned to the Engineer. One stamped drawing must be kept on the job site at all times.

(e) Drawings for Construction:

Drawings or other submittals not bearing the Columbus Water Works stamp shall not be utilized for construction purposes. The Contractor/Developer shall maintain a complete set of construction drawings at the job site bearing the Columbus Water Works review stamp.

(f) Construction Notification:

If will be the responsibility of the Contractor/Developer to notify Columbus Water Works Engineering Department of the date of construction and name of the Contractor performing said construction, as well as his address and telephone number.

(g) Construction and Inspection Procedure:

Curb and Gutter should be in prior to the water main. Avoid valve boxes in the curb and gutter. Also, ensure that the meter boxes are installed in the correct horizontal location (5' off the back of the curb) and that water mains are installed at the correct depths according to the approved plans.

The Contractor/Developer will install the water main including all fittings, blockings, etc., along with all service lines, meter boxes or vaults, curb stops and corporation stops. Columbus Water Works will make the connection to the existing water system. Installation of water mains shall be in accordance with the following procedures:

(1) To receive a price quote for materials from Columbus Water Works, the Owner and/or Developer should have a representative submit a material's take-off to the Columbus Works Engineering Department. Pricing should be requested only once per project. Usually the Owner/Developer's Engineer would request this quotation. A priced copy of the material quotation will be returned by Columbus Water Works. Also allow at least 30 days for permits for Department of Transportation roads. Developers will incur any costs for permitting, such as application fees and insurance premiums, etc.

(2) If it is desired that Columbus Water Works purchase the materials, a check for the full amount, including shipping, should be made out to Columbus Water Works and accompany a request for purchase. A copy of the purchase order to the supplier will be provided by Columbus Water Works. The Contractor must arrange for delivery of pipe and fittings to the job site directly with the supplier. Corporation stops, curb stops, copper tubing and meter boxes will be provided by Columbus Water Works at no charge for systems that will be accepted by CWW for perpetual maintenance. Quantities will be coordinated with the Inspector. These items plus valves and fire hydrant assemblies must be picked up at CWW Service Center. Excess copper must be returned to the Service Center.

(3) Notify the Columbus Water Works Inspector 48 hours before any pipe is to be laid. Where the waterline is to be within a new road right-of-way, all curbing must be in place. The pipe, fittings, gaskets, etc., must be on the site and ready to be inspected. A pre-construction conference is required with the CWW Inspector on site. *The approved CWW stamped plans will be given to the Contractor at this meeting.*

(4) After materials on the site have been approved, installation can begin. Do not backfill over any locations where fittings have been used or thrust blocking is to be placed. The Inspector must approve all tees, bends, reducers, retainer glands, blow-offs, valves, hydrants, taps of any kind, etc., before backfilling. Service locations must be marked on curb or pavement edge with a blue "M".

(5) The Inspector will coordinate with the Contractor, which ends of the pipe to leave open for the initial washout. The Contractor will need to supply all materials deemed necessary by the Inspector to facilitate the washout. Forty-eight hours notice must be given to the Columbus Water works Inspector prior to the washout. Columbus Water Works will operate all existing valves. The Inspector must approve the initial washout, including service lines. Leave open corporation stops until tested.

(6) After all meter boxes are in their permanent locations at five feet off of the back of curb to include all short and long-side stub-outs, the pressure test will be performed by the Contractor. Twenty-four hours notice must be given to the Columbus Water Works Inspector prior to pressure testing the system. The Inspector will provide the pressure gauge and flow meter to be used in the test. If approved by the Inspector, a clean uniformly shaped container may be used to supply water for the test in lieu of a water meter. See Section 1.17 for test procedure and allowable leakage.

(7) Columbus Water Works will make all taps to the existing water system. Connection to dead end lines by contractor must be made in presence of Columbus Water Works Inspector. *CWW does not locate water lines in subdivisions that have not yet been accepted.*

(8) Upon successful completion of the pressure test, the Contract/Developer will disinfect the system and the CWW Inspector will sample the water for the CWW lab to test. Results from the lab test normally take 72 hours. After Laboratory approval, the water line may be put into service.

(9) After positive results from the water samples have been obtained, sewer availability fees have been received (if applicable), and as-built drawings have been accepted, the Owner/Developer will be notified that the line is accepted for maintenance by Columbus Water Works. *Note: The new water system must be put into use quickly, or stagnation will occur. In this event, Columbus Water Works may need to re-chlorinate/washout the system. Any measures necessary to disinfect systems after initial disinfection will be charged to the Owner/Developer. The cost for re-disinfection will be based upon time and materials.*

(10) Field changes may be worked out with an onsite review with the CWW Inspector, Contractor, Engineer, etc. Agree to changes will be noted on the Inspector's drawings, initialed by the parties in attendance, and verified on the as-built drawings.

(11) Numbers to Call:

- For inspection, testing, ordering materials, design questions and materials to be supplied by Columbus Water Works, call the Engineering Department at 649-3471 or 649-3472.

- For pipe and fittings delivery, call the appropriate supplier.

- For information regarding work provided by Columbus Water Works, call 649-3469.

(h) As-Built Drawings:

Four copies of the water line as-built drawings by the project engineer are to be submitted on sheet size of 17' x 22" and a scale no less than 1"=100' to the Columbus Water Works Engineering Department. An AutoCAD disk copy of the as-built information should also be provided. The as-built should include horizontal dimensioning to all valves, hydrants, fittings, etc., and be referenced from permanent monuments such as property corners, right-of-way markers, or other physical and permanent markers. As-builts should be prepared on a copy of a recorded plat or on an otherwise prepared drawing with a reference to a recorded plat book and folio number. In this instance, a copy of the recorded plat should be supplied with the as-built submittal.

(i) Final Acceptance:

Final Acceptance into the water system will take place upon receipt by Columbus Water Works of passing water samples and as-built drawings. Columbus Water Works must have a coy of the as-built drawing before water service will be provided. Once the as-built is provided, then the water service will be turned on. Columbus Water works will only accept the main line for maintenance when all other utilities are in, the meter box locations are properly set 5' from back of curb, and the as-built has been accepted by Columbus Water Works.

Section 1.04 – Materials:

Contractor/Developer will furnish all pipe, fittings, valves, hydrants, and other material required for completion of the work, except those items as listed in paragraph 1.03(g) #2. All material will be of United States manufacture. *Columbus Water Works does not provide material for commercial jobs.* Materials will be in accordance with the following:

(a) Ductile Iron Pipe (DIP):

Ductile iron pipe shall conform to AWWA C-151 and shall be Pressure Class 350. Sizes will be shown on the drawings. Minimum main line size shall typically be eight (8) inches. All pipe and fittings shall be of United States manufacture. Pipe and fittings shall be cement lined in accordance with AWWA C-104. Fittings shall be ductile iron conforming to AWWA C-110 with a minimum rated working pressure of 350 psi. Pipe and fittings shall be furnished with bituminous outside coatings. Pipe shall be American Fast Iron Pipe company or equal.

Joints shall be push-on type for pipe and standard mechanical joints for fittings. Joints shall conform to ASA 21.11. Restrained joint pipe shall be American C.I.P., Fast-Grip or equal. Leaded joint pipe or fittings will not be allowed.

Acceptance will be on the basis of the Columbus Water Works inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

The only currently approved methods of restraint are the American Fast-Grip gasket for restraining pipe and/or the Megalug restraint system for fittings.

(b) Gate Valves (GV):

Gate valves shall be resilient seat type conforming to the requirements of AWWA C-509 and shall be American-Darling or equal.

- Valve ends shall be mechanical joint type except where flanged ends are required.
- Valves shall open left, have a 2-inch square operating nut and have "O"-ring type stem seals.
- Buried valves shall be equipped with valve boxes. Provide extension stems where required.
- Valves, including geared valves, shall be non-rising stem type.

(c) Butterfly Valves (BV):

- Shall be used for all valves 12 inches in diameter and larger.
- Butterfly valves shall be resilient seat type conforming to the requirements of AWWA C-504 and shall be M & H, Muller, or approved equal. Valves 16 inches and larger shall be gear operated.

- Valve ends shall be mechanical joint type except where flanged ends are required.

- Valves shall open left, have 2 inch square operating nut and shall have vee ring stem seals.

- Buried valves shall be equipped with valve boxes. Provide extension stems where required.

(d) Valve Boxes (VB):

All buried valves shall be equipped with valve boxes. Valve boxes shall be 8" PVC. A cast iron ring and cover manufactured to Columbus Water Works Standards shall be used. Valve boxes can be supplied by Columbus Water Works.

Manufactures valve boxes may be used. These valve boxes when under pavement shall be adjustable to 6 inches up or down from the nominal required cover over the pipe. Typical valve box details are included in Drawings A-7 and A-26.

(e) Tapping Sleeves and Valves (TS&V):

Tapping sleeves shall be of the split sleeve, mechanical joint type (see Detail A-7). Valves shall be tapping valves furnished in accordance with the specifications shown above, with flanged connections from the tapping sleeve and mechanical joint connection to the branch pipe. The necessary bolts, glands and gaskets shall be furnished, as manufactured by American-Darling.

(f) Tapping Saddles:

Tapping saddles shall be ductile iron body type with "O"-ring rubber gasket and alloy steel straps. connection shall be flanged or mechanical joint as required, as manufactured by American-Darling.

(g) Fire Hydrants:

All fire hydrants shall conform to the requirements of AWWA C-502 for 150 psi working pressure. Hydrants shall be the compression type and close with line pressure. The valve opening shall be a minimum 5 ¼ inches. Hydrants shall open right, have two 2 ½ inch nozzles and one 4 ½ inch steamer with N.T.S. threads and equipped with cap and chain. The operating nut shall be a 1 ½ inch Hex, and hydrants shall be painted yellow. (See Detail A-26).

In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.

Attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.

Hydrants shall be fully bronze-mounted with all working parts made of bronze. The valve seat ring shall be bronze and shall screw into a bronze retainer.

Two hose and one pumper connection shall be breech locked, pinned, or threaded and pinned. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.

Minimum depths of bury shall be three (3) feet. Provide extension section where necessary for vertical installation and in accordance with manufacturers' recommendations.

All outside surfaces of the barrel above grade shall be painted with Koppers Glamortex 501 enamel with yellow color. Hydrants shall be American-Darling B-84-B type. Typical spacing along water mains is 500 feet for residential development and 300 feet for commercial/residential development.

Use galvanized threaded rods to restrain fire hydrants.

(h) Couplings:

Couplings shall be Dresser Style 38 or equal. Couplings requiring thrust restraint shall be equipped with four steel tie-bolts extending from steel lugs welded on the pipe to lugs welded on the middle ring of the coupling. Lugs shall be shop welded and delivered to the job site ready for installation.

(i) Valve markers (VM):

Concrete valve markers shall be supplied when required by Columbus Water Works.

(j) Backflow Prevention Devices:

Backflow prevention is required on all new construction. The backflow preventer will be required on all meter installations. The potable water system shall be protected from actual or potential contamination by conforming to the Columbus Water Works Cross-Connection Control Program and the Georgia Safe Drinking Water Act.

All installations must conform to the guidelines set forth by the SBCCI, AWWA M-14, and EPA guidelines for cross-connection control. Inquiries related to cross-connection control should be directed to the Program Manager, phone 649-3490.

(k) Service Lines:

Service lines shall be type "k" soft copper and a minimum ¾" inside diameter with 0.0625" wall thickness. Unions shall not be used under pavement.

(l) Corporation Stops:

Corporation stops shall be copper, McDonalds No. 4701- (T, VT, VY) or equivalent.

(m) Curb Stops:

Curb stops shall be McDonalds No. 6102-T or equivalent.

(n) Meter Boxes:

All water meter boxes for 2" meters and smaller shall be Dexol or equivalent and shall be installed by the Developer and provided by CWW.

Contractor/Developer shall provide a vault for meter sizes 3 inch and above, as well as banks of meters. The vault design shall be as shown on drawing A-1 or A-2, or approved submittal.

(o) Thrust Restraint:

All thrust restraint systems must be approved by Columbus Water Works. The only currently approved methods of restraint are the American Fast-Grip gasket for restraining pipe, concrete blocking or the Megalug restraint system for restraining fittings. concrete blocking shall be 3000 psi and shall be placed against undisturbed earth. (See Detail Drawings A-13 thru A-22). *All pipes with the Fast-Grip joint will be painted with a yellow band around the pipe bell. Megalugs will be available from CWW at cost.*

Section 1.05 – Handling Materials:

Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

(a) Handling:

Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift or front loader. Do not use material damaged in handling.

(b) Distribution:

Distribute and place pipe and materials so as to not interfere with traffic. Do not string pipe more than 1,000 feet beyond the area where pipe is being laid. Do not obstruct drainage ditches or create a traffic hazard.

(c) Storage:

Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

Section 1.06 – Construction along Highways, Streets and Roadways:

Install pipe lines and accessories along highways, streets, and roadways in accordance with the applicable regulations of the Georgia Department of Transportation and Columbus Consolidated Government with reference to construction operations, safety, traffic control, road maintenance and repair. Refer to sections 1.14 and 1.15 for additional roadway requirements. Water mains will generally be located on the South and West sides of roads, unless otherwise approved by Columbus Water Works.

(a) Protection of Traffic:

Provide and maintain suitable signs, barricades and lights for protection of traffic. Removal of highway signs for construction shall be under permission of the Georgia Department of Transportation or the City of Columbus. Do not close or block any highway, street or roadway without first obtaining permission from the proper authorities. Traffic control shall conform to the Manual on Uniform Traffic Control Devices for Streets and Highways. Manuals may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington DC., 404 Publication Number FHWA-SA-89-006 (or latest revision).

(b) Construction Operations:

Perform all work along highways, streets and roadways to least interfere with traffic.

(1) Clearing and Grubbing:

Erosion control measures shall be installed prior to clearing and grubbing and shall be properly maintained during the life of the project.

(2) Trenching, Laying and Backfilling:

Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day maintaining positive drainage, which does not impact traffic.

(3) Shaping:

Reshape damaged slopes, side ditches and ditch lines immediately after completing backfill operations. Replace topsoil if necessary to re-establish sod and other landscaping removed from shoulders.

(c) Excavated Materials:

Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered and excavated material off the pavement. Wash the street if necessary.

(d) Drainage Structures:

Keep all ditches, culverts, cross drains and other drainage structures clear of excavated material and free to drain at all times.

(e) Maintaining Highways, Streets, Roadways and Driveways:

Maintain streets, highways and roadways in suitable condition for movement of traffic until completion and final acceptance of the work. Use street running plate to maintain traffic until pavement replacement is completed.

(f) Piping Location:

Piping shall be installed at a minimum of five (5) feet behind the roadway curbing or pavement edge. Where possible, pipe will be located on the south or west side of roadways.

(g) Easements:

Contractor/Developer will be responsible for providing any necessary easement agreements. See Section 1.02 (c).

(h) Water Meter Locations Along Roadways:

Final meter locations will be within the right-of-way as indicated on Drawing A-32. No meter boxes will be located in driveways, sidewalks, pedestrian pathways or ditches. Corporation stops and curb stops shall not be installed under pavement unless allowed by the Inspector. The location of the water meter along the property frontage is up to the Developer, but it is recommended that meters be placed near the property corners. Meters that must be relocated by CWW after acceptance will be moved by CWW at the Owner/Developer's expense. Dual services are recommended at the property lines so that meters can be grouped together.

Section 1.07 – Existing Underground Utilities and Obstructions:

It is the responsibility of the Contractor/Developer to locate all existing utilities along the path of construction. Drawings shall indicate underground utilities or obstructions that are known to exist. Where these or unforeseen underground utilities are encountered, the location and alignment may be changed, upon written approval of the Columbus Water Works, to avoid interference. Such changes will be marked up on Contractor's/Developer's as-built plans.

Section 1.08 – Water and Sewer Separation:

Water mains shall maintain a minimum 10-foot edge to edge separation from sewer lines, whether the sewer operates by gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the 10-foot separation, the water main must be separated a minimum of 18 inches above the top of the sewer. If neither of these two separation criteria is possible, then the water main shall be installed below the sewer with a minimum vertical separation of 18 inches. Where the water main crosses a sewer line, an 18-inch vertical separation shall be maintained and a full joint of water pipe shall be centered over the sewer line.

No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

Section 1.09 – Connection to Existing Pipe Lines:

Columbus Water Works will make connections to existing pipe lines with tapping sleeves, valves, and other necessary materials. Columbus Water Works will operate all existing valves and new valves that directly connect a new system to the existing distribution system.

(a) Location:

Before laying pipe, locate the points of connection to existing pipe lines and uncover as necessary for the Columbus Water Works to confirm the nature of the connection to be made.

(b) Interruption of Services:

Columbus Water Works will make connections to existing pipe lines only when system operations permit. Operation of existing valves will be the sole responsibility of the Columbus Water Works. Tampering with valves is illegal according to city ordinances and fines may be levied.

Section 1.10 – Excavation:

Excavate all material encountered and dispose of excess excavated material not required for backfilling in accordance with applicable local, state and federal regulations.

(a) Depth of Trenches:

Excavate trenches to provide a minimum cover of three feet. Within the right-of-way of highways, streets, or roadways, excavate to place the top of the pipe at a minimum of four feet below the nearest pavement edge, and at least two feet below the bottom of the drainage ditch.

(b) Width of Trenches:

Excavate trenches wide enough to allow proper installation of pipe, fittings, and other materials, and not less than six (6) inches clear of the outside barrel of the pipe on any side at any point.

(c) Bell Holes:

At each joint, excavate bell holes of ample depth and width to permit the joint to be made properly and to relieve any pressure on the pipe bell.

(d) Earth Excavation:

Excavate and prepare the trench bottom to support the pipe uniformly throughout its length. For ductile iron pipe, the trench shall meet the requirements of Standard Laying Condition Type 2 in accordance with AWWA C-151. If the trench is excavated to excavated to excessive width or depth, provide sand or gravel to achieve Standard Laying Condition Type 4 in accordance with AWWA C-151. (See Detail A-33).

(e) Bracing and Sheeting:

When required by regulations or to prevent damage to adjoining structures, roadways, pavements, utilities, trees, or private property which are specifically required to remain, provide bracing and sheeting. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the Columbus Water Works it cannot be safely removed. Cut off sheeting left in place at least two (2) feet below the surface.

(1) Timber:

Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.

(2) Steel Sheet Piling:

Continuous lockjoint steel sheet piling may be substituted for timber sheeting when approved by Columbus Water Works. Steel piling may be removed, without cutting, provided the rate of removal is kept in pace with the tampering and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of the tamping and backfilling will not be permitted. Piling, where ordered to be left in place by the Columbus Water Works for reasons of safety, will be cut off where directed.

(f) De-Watering Trenches:

Keep pumping out water to continuously maintain a water level two feet below the bottom of the trench. Continue to de-water running sand by using well pointing. where soil conditions do not permit the use of well pointing, then construct trench drains of crushed stone or gravel to conduct water to sumps.

(g) Trench Stabilization:

Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, the Columbus Water Works will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and backfill with crushed stone bedding material. Place and compact this material to bring the trench to the required grade. No pipe shall be laid directly on excavated rock. Trench stabilization shall be in accordance with Details A-33.

Section 1.11 – Laying and Jointing Pipe and Fittings:

Lay all pipe and fittings to accurately conform to the lines and grades approved by the Columbus Water Works as follows:

(a) Handling:

Use suitable tools and equipment to handle and lay pipe. Prevent damage to the pipe and the cement lining. Examine all pipe carefully for cracks and other defects as it is laid. Do not use pipe or other materials which are known to be defective. Lower pipe, fittings, valves and accessories into the trench by suitable means. Do not drop or dump pipe or accessories into the trench. If any pipe or other material is discovered to be defective or damaged after being laid, remove and replace it. Clean pipe and fittings thoroughly before laying. Keep the pipe line clean until final acceptance.

(b) Alignment and Gradient:

Lay pipe straight in alignment and gradient or follow true curves as nearly as practical. Do not deflect any joint more than 2/3 the maximum deflection recommended by the manufacturer. Maintain a transit and accessories along with complete personnel on the job to lay out angles and ensure that deflection allowances are not exceeded.

(c) Expediting Work:

Do all of the following promptly: excavate the trench, call for inspection, install the pipe, fittings and hydrants, and backfill as soon as possible. Notify Columbus Water Works Engineering Department twenty-four (24) hours before backfilling is to commence. All thrust restraint must be in place at time of inspection. The contractor must receive permission to backfill by the Inspector. Any deficiencies noted by the Inspector must be brought into compliance and a second inspection must be scheduled, as directed by Columbus Water Works.

Do not leave un-jointed pipe in the trench. Backfill and compact as soon as possible after laying and jointing is completed. Plug the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe, close the end with an approved plug.

(d) Laying Pipe in Trenches:

Lay the pipe with solid bearing throughout its length. Pipe bedding as specified in AWWA C-151 or last revision. Refer to typical Detail A-33.

(1) Earth Trenches:

Grade the bottom of the trench to a true line. Lay the pipe in clean bedding material, free of rock, organics and other unsuitable materials.

(2) Wet Trenches:

Do not lay pipe in water. Provide de-watering equipment to maintain a ground water level two feet below the bottom of the pipe while the pipe is being laid.

(3) Blasted Rock Trenches:

Do not lay pipe directly on to blasted rock. Keep a minimum 6" layer of crushed stone underneath the pipe at the highest peak of the blasted rock as in Detail A-33.

(e) Joints

(1) Push-On Type Joints:

Push-on type joints shall be made in accordance with the manufacturer's recommendations.

(2) Mechanical Joints:

Make mechanical joints in accordance with the manufacturer's recommendations.

(3) Flange Joints:

Provide gaskets for flange joints made of 1/8 – inch thick rubber. Gaskets may be ring type or full-face type. Provide bolts for flange connections.

Bolts shall be steel with American regular unfinished square or hexagon heads. Nuts shall be steel with American Standard Regular hexagon dimensions, all as specified in ANSI B-17.2. All bolts and all nuts shall be threaded in accordance with ANSI B-1.1, Coarse Thread Series, Class 2A and 2B fit.

(f) Cutting:

Cut ductile iron pipe using an abrasive wheel saw. Remove all burrs and smooth the end before jointing.

Section 1.12 – Thrust Restraint

Provide restraint at all points where hydraulic thrust may develop. See Details A-13 thru A-25.

(a) Couplings:

The restraint system to be used for joining pipes to mechanical joint fittings shall be the Megalug restraint system or approved equal. The approved restraint system for restraining a pipe to pie (bell and spigot) connection shall be the American Pipe Fast-Grip gasket system or approved equal. *Any pipes with the Fast-Grip joint should be painted yellow around the bell of the pipe. CWW can provide Megalus to the contractor at cost.*

(b) Harnessing:

Install harness rods with eyebolts only where specifically directed by the Columbus Water Works. Harness rods shall be manufactured in accordance with ASTM A-36 or A-307, and shall have an allowable tensile stress not less than 22,000 psi. Harness rods shall be stainless steel, hot dip galvanized or field coated with bitumastic before backfilling.

(c) Concrete Blocking:

Provide concrete blocking for all other bends, tees and other points where thrust may develop.

Concrete shall be Georgia D.O.T. Class A and have a compressive strength of not less than 3000 psi. Ready mixed concrete shall be mixed and transported in accordance with ASTM C-94. Form and pour concrete blocking at fittings as directed by the Columbus Water Works. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation. See Thrust Restraint Details A-13 to A-25 for specific blocking requirements.

Section 1.13 – Backfilling:

Backfill trench and compact to prevent settlement and displacement of the pipe.

(a) Material:

Backfill trenches with earth only. Do not use rock or organic material excavated from trenches in the backfill. If necessary, furnish suitable earth material to backfill the trench. Use select material for initial backfill.

(b) Compaction:

Consolidate backfill material in the bottom of the trench and up to two (2) feet above the pipe in six (6) inch layers.

(c) Initial Backfill:

(1) Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.

(2) Place initial backfill material carefully around the pipe in uniform layers to a depth of at least eighteen (18) inches above the pipe barrel. Layer depths shall be a maximum of six (6) inches for pipe eighteen (18) inches in diameter and smaller, and a maximum of twelve (12) inches for pipe larger than eighteen (18) inches in diameter.

(3) Backfill and compact on both sides of the pipe simultaneously to prevent side pressures.

(4) Compact each layer thoroughly with suitable hand tools or tamping equipment.

(5) Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density based on standard proctor unless shown or specified otherwise. The Contractor will provide the service on an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

(d) Final Backfill:

(1) Backfill carefully to restore the ground surface to its original condition. Remove all excavated rock from the ground surface and restore the area to a mowable condition, free from rock and deleterious materials.

(2) The top six (6) inches shall be topsoil when directed by Columbus Water Works.

(3) Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of. The site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.

(4) After initial backfill material has been placed and compacted, backfill with final backfill material. Final backfill shall not contain more than one-third broken rock, of which no stone or boulder will be six (6) inches in diameter or weigh more than fifty (50) pounds. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

- In six (6) inch layers, if using light power tamping equipment such as a "jumping jack."
- In one (1) foot layers, if using heavy tamping equipment, use a hammer with tamping feet.

(5) Settlement: If the trench settles, refill and grade the surface to conform to the adjacent surfaces. The Contractor will provide the service or an independent testing lab to verify compaction results as directed by the CWW Inspector in cases where compaction results are in question.

Section 1.14 – Removing and Replacing Pavement:

(a) Removing Pavement:

Remove existing pavement as necessary for installing the pipeline and appurtenances. When pipeline crosses pavement at an angle other than perpendicular, then the pavement shall be overlaid at ninety (90) degrees to the pavement edge and replaced to the ends of the excavation. Saw cut pavement parallel to pipe as per Details A-4, A-4A and A-4B.

(1) Marking:

Before removing any pavement, mark the pavement neatly paralleling pipe. Space the marks to the width of the trench.

(2) Breaking:

Break asphalt pavement along the marks using jack hammers or other suitable tools as directed by Columbus Water Works. Cut Portland cement concrete pavement along the marks by use of pavement saws.

(3) Machine Pulling:

Do not pull pavement with machines until completely broken and separated from pavement to remain.

(4) Damage to Adjacent Pavement:

Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.

(5) Sidewalk:

Remove and replace sidewalks for their full width, without installing additional joints.

(6) Curbs:

Remove and replace or tunnel under any curb encountered. All pavement and/or curbing repairs or replacement will require City of Columbus Engineering Department's approval as a condition of acceptance.

(b) Replacing Pavement:

During backfilling, arrange to have the compaction tested by an approved independent testing laboratory if required by the Columbus Water Works or the city of Columbus Engineering Department. After the compaction testing has been satisfactorily completed, then replace all pavements, sidewalks and curbs in accordance with Georgia Department of Transportation and/or City of Columbus standard details as required. Payment for all costs incurred for testing shall be the Contractor's/Developer/s responsibility.

Section 1.15 – Roadway Crossing:

Furnish and install pipe casing and install the pipeline therein in accordance with the drawings and in accordance with Georgia Department of Transportation and City of Columbus specifications.

(a) General:

Operate well points or drainage systems in the vicinity of the casing construction to prevent the accumulation of water in the casing and to maintain the ground water table below the casing invert.

(b) Pipe Casing:

Furnish all material and equipment and perform all labor required to install steel pipe casing as required by the Columbus Water Works. Casings need to be placed at all roadway and driveway crossings by Contractor/Developer for future service connections. All casings shall terminate at a three (3) foot minimum for in-line fitting or connection.

(1) Boring:

The steel casing pipe shall be a minimum of Schedule 30 steel pipe manufactured from steel conforming to ASTM A-139, Grade B. Size and minimum wall thickness shall be as follows:

UNDER HIGHWAYS

Pipe Diameter Inches	Casing Diameter Inches	Wall Thickness Minimum Inches
6	12	0.250
8	16	0.250
10	16	0.250
12	18	0.250
14	22	0.250
16	24	0.250
18	30	0.312
20	30	0.312
24	36	0.375
30	42	0.375

UNDER RAILROADS

Pipe Diameter Inches	Casing Diameter Inches	Wall Thickness Minimum Inches
6	14	0.250
8	18	0.250
10	20	0.281
12	22	0.312
14	24	0.344
16	30	0.406
18	30	0.406
20	32	0.469
24	36	0.469
30	42	0.500

The outside of the casing pipe shall be primed and coated with a hot coal tar enamel a minimum of 3/32 inches thick. Only new primed and coated pipe shall be used.

When casing depth exceeds fifteen (15) feet, it is the responsibility of the Developer's Engineer to calculate the required casing wall thickness.

Install the steel pipe casing by the dry boring method. Bore the hole and install the casing through the soil simultaneously by using a cutting head on a continuous auger mounted inside the casing pipe. Lengths of casing pipe shall be fully welded to the preceding section in accordance with AWS recommended procedures. After the boring and installation of the casing is complete, install a cleaning plug on the rig and clean the casing.

(c) Installation of Pipe:

After installation of the casing is complete, install the pipelines using skids as shown on Detail Drawing A-18. Close the ends of the casing with four (4) inch brick walls sealed with Portland cement mortar. Leave a 4" x 8" opening at the bottom of the lowest closure for drainage.

(d) Safety:

Provide all necessary bracing bulkheads and shields to ensure complete safety to all traffic at times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.

Section 1.16 – Stream and Ditch Crossing:

At all points where banks of streams or drainage ditches are disturbed by excavation or where natural vegetation is removed, carefully compact the backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction alongside a stream or drainage ditch as well as crossing stream or drainage ditch. Place rip rap to protect the disturbed stream channel at a minimum of ten (10) feet each direction from centerline of the pipe. Extend rip rap from one (1) foot below the lowest point in the streambed to top of the bank. Place to conform with the natural slope of the stream bank. Accepted methods are listed below, or as approved by CWW Inspector.

(a) Stone Rip Rap:

Use sound, tough, durable stones resistant to the action of air and water. Slab-like or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or higher.

Minimum weight of individual stones shall be fifty (50) pounds. The maximum allowable dimension for an individual stone is twenty-four (24) inches. The minimum allowable dimension for an individual stone is six (6) inches.

At least fifty (50) percent of the stones shall have a minimum dimension of twelve (12) inches.

Embed stone rip rap by hand so as to form a compact layer at least twelve (12) inches thick. Place rip rap in such a way that the smaller stones are not segregated, but evenly distributed. Place chinking stones in the crevices between the larger stones so that a dense, well-graded mass is produced. Place filter fabric under stone as directed by CWW Inspector. Sand may be required as a bed for rip rap.

(b) Sand-Cement Bag Rip Rap:

Use cement sacks or burlap bags having a capacity of from one (1) to two (2) cubic feet. Do not use bags previously used for sugar or chemicals. Fill bags with mixture of one (1) part Portland cement to five (5) parts sand. Embed bags by hand to form a compact layer at least twelve (12) inches thick. Place with overlapping joints. The finished surface shall not deviate from that specified by more than three (3) inches at any point.

Section 1.17 - Testing

When a length of pipe approved by the Columbus Water Works is ready for testing, then fill the line with water, bleed out all air and conduct a leakage test. CWW will operate all valves.

(a) Preparation:

Provide a test pump and all other accessories required to make the test. Provide a corporation stop at each high point on the pipe to bleed off air. Provide and remove all temporary bulkheads, plugs and flanges required to perform the pressure test.

(b) Test Pressure and Leakage:

Test the pipeline at 200 psi measured at the lowest point for at least two (2) hours. Maintain the test pressure within 5 psi of the specified test pressure for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. An accurate pressure gauge with graduations not greater than 5 psi will be required. This pressure gauge will be supplied by Columbus Water Works.

Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section to maintain pressure within 5 psi of the specified test pressure for the test duration, plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter or out of an approved container with a known volume. (See Construction & Inspection Procedures in Section 1.03).

(c) Allowable Leak in Total Gallons during Water Pressure Test:

$$\frac{ND\sqrt{P}}{7400} = \text{\# of gallons leaked}$$

N = No. of Joints
D = Nominal diameter (inches)
P = Average Test Pressure (psi)

(d) Existing Valves:

All existing valves will be operated by Columbus Water Works personnel or as directed and supervised by the CWW Inspector. Provide adequate notice for operation.

Section 1.18 – Disinfecting Pipe Lines:

(a) Applicable Standard:

All water mains which are to be connected to the Columbus Water Works water distribution system shall be disinfected according to Sections 1 through 7 of AWWA C-651, the AWWA Standard for Disinfecting Water Mains.

(b) Form of Chlorine Used:

Acceptable forms of chlorine that may be used in the disinfecting operations are granular calcium hypochlorite and liquid sodium hypochlorite. Either material should be stored in a cool, dry and dark environment to minimize deterioration.

(c) Method of Chlorination:

The only method approved for general use is the continuous Feed Method as described in the following paragraphs. The tablet method and the slug method are not acceptable alternatives. Please note that the option of placing calcium hypochlorite granules in the pipe during construction is not required.

(1) It is of utmost importance that all precautions be taken during the construction phase to insure that the new water mains are kept clean and dry. The entry of dirt and other contaminants shall be kept to a minimum. Pipe stored at the construction site must be stored with the ends elevated to ensure against entry of mud and dirt. No greater quantity of pipe shall be strung beside or in the trench than can be installed during the current shift. At the close of each day's work, open pipe ends shall be sealed with water-tight and rodent proof plugs.

(2) Before being chlorinated, the main shall be flushed to remove particulates. This flushing shall be accomplished at flow rates sufficient to produce a minimum velocity of 2.5 feet per second in the main.

(3) The chlorination shall be done in accordance with paragraph 5/2/3 of AWWA C-651 Standard for Disinfecting Water Mains. The major points of this standard are summarized below.

Water shall be introduced into the new main from the existing distribution system at a constant, measured rate (or approximated by one of the listed means).

A chlorine solution shall be fed into the new main within ten (10) feet of the beginning of the new main. The concentration of the solution and the feed rate shall be adjusted so that the water in the main will have not less than 25 mg/L of free chlorine.

Once the application of chlorine has begun, it shall not stop until the entire main is filled with heavily chlorinated water. The chlorinated water shall remain in the main for a minimum of 24 hours. At the end of the 24 hours, the chlorinated water must retain a residual of not less than 10 mg/L of free chlorine. Extreme care must be taken during the chlorine application and the following retention period that none of the highly chlorinated water is allowed to migrate into the existing distribution system. Valves at all fire hydrants shall be operated to insure that every fire hydrant is disinfected.

The chlorinated water shall be flushed from the main as soon as practicable after the 24-hour retention period to reduce possible corrosion damage to the pipes. All heavily chlorinated water must be dechlorinated prior to discharge to the environment. Acceptable reducing agents for neutralizing the chlorine residual include sulfur dioxide, sodium bisulfate, sodium sulfite and sodium thiosulfate. Recommended application rates very with the chlorine residual and the chosen reducing agent, but are summarized in Appendix B of AWWA C-651. A copy may be obtained from the Water Works Inspector. The Water Works Inspector, who will verify the neutralization of the chlorine residual in all discharged water, shall witness all dechlorination activities.

(d) Sampling and Testing:

The Columbus Water Works Laboratory shall be responsible for testing of the completed water mains. The Water Works Inspector shall assist the lab personnel in determining the number and location of sample points and obtaining the transporting samples to the lab. Typically, there will be one sample point at the end of each main line branch. If the samples fail bacteriological tests, the main may be reflushed and resampled. If the resultant tests fail, the main shall be rechlorinated until satisfactory results are obtained.

(e) Division of Responsibility:

A summary of the steps to follow and the responsible parties follows:

Steps to follow	Responsible party
1. Initial Washout	Contractor/CWW
2. Pressure Test	Contractor/CWW
3. Disinfect	Contractor/CWW
4. Flush-out and dechlorinate	Contractor/CWW
5. Water Samples	CWW

Section 1.19 – Protection and Restoration of Work Area:

(a) General:

Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

(b) Man-Made Improvements:

Protect, or remove and replace, with the Columbus Water Works approval, all fences, piers, docks, walkways, mail boxes, pipelines, drain culverts, power, gas, telephone and television lines and cables and other improvements that may be encountered in the work.

(c) Cultivated Growth:

Do not disturb cultivated trees or shrubbery unless approved by the Columbus Water Works. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction on an experienced nursery person.

(d) Cutting of Trees:

Do not cut trees for the performance of the work unless specifically approved by the Columbus Water Works and the City of Columbus. Removal and/or replacement of plantings on the city right-of-way must be approved by the City Arborist. Protect trees that remain in the vicinity of the work from damage by equipment. Do not store spoil from excavation against the trunks. Remove excavated material, stored over the root system of trees, within thirty (30) days to allow proper natural watering of the root system.

Repair any damaged tree more than three (3) inches in diameter, not to be removed, under the direction of an experienced nursery person. All trees and brush that required removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, woodpiles, or trash piles will be permitted on the work site.

(e) Grassing:

Replant grass removed or damaged in residential areas using the same variety of grass and at the first appropriate season. Outside of residential areas, plant the entire area disturbed by the work in Fescue, Bermuda, Clover, St. Augustine or mixtures of these or other suitable groundcover upon completion of work in any area. In all areas, promptly establish successful stands of grass. During non-seasonal months for establishment of permanent grassing, temporary grassing is required such as winter rye.

(f) Erosion Control:

Plan excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. Erosion control activities must comply with City of Columbus requirements. Erosion control permitting is the responsibility of the Developer.

(g) Disposal of Rubbish:

Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, City, State and Federal.