

REQUIREMENTS AND SPECIFICATIONS
FOR
WATER DISTRIBUTION CONSTRUCTION

REVISED 10-15-2002

THE INFORMATION PROVIDED IN THIS PACKET IS TO INFORM DEVELOPERS, ENGINEERS AND OTHER INTERESTED PARTIES OF THE SPECIFICATIONS AND STEPS NEEDED FOR WATER LINE INSTALLATION AND APPROVAL FOR SERVICE BY THE HARVEST-MONROVIA WATER AND FIRE PROTECTION AUTHORITY.

DEVELOPERS ASKING FOR WATER SERVICE ARE REQUIRED TO SUBMIT TO THE AUTHORITY A PLAN WITH ROAD AND LOT LAYOUT, THE WATER MAIN DISTRIBUTION SYSTEM, ELEVATION INFORMATION WITHIN THE DEVELOPMENT, A SECTION TIE, AND ANY OTHER INFORMATION THAT MAY PERTAIN TO THIS DEVELOPMENT. IF THE DEVELOPMENT IS MORE THAN ONE PHASE, YOU WILL NEED TO SUPPLY THE AUTHORITY WITH AN OVERALL MASTER PLAN TO MODEL AND REVIEW THE ENTIRE PROPOSED DEVELOPMENT.

DEVELOPMENTS ASKING FOR WATER SERVICE ARE REQUIRED TO HAVE A HYDRAULIC ANALYSIS AND A REVIEW OF THE PROPOSED DEVELOPMENT. THE DEVELOPMENT, WHEN MODELED, SHALL HAVE:

1. A FIRE FLOW OF 750 GALLONS PER MINUTE OR ABOVE FOR THE ENTIRE DEVELOPMENT.
2. A RESIDUAL PRESSURE OF 20 PSI OVER THE ENTIRE WATER SYSTEM AND THE DEVELOPMENT.
3. A MINIMUM OF 30 PSI AT EACH WATER SERVICE CONNECTION.
4. WATER MAIN IN THE DEVELOPMENTS SHALL BE 8" DIAMETER OR LARGER.
5. ALL WATER MAINS SHALL BE LOCATED ON COUNTY ROAD RIGHT OF WAYS.

THESE FIVE REQUIREMENTS SHALL BE MET BEFORE THE AUTHORITY WILL CONSIDER THE DEVELOPMENT FOR APPROVAL.

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THESE NOTES ARE TO BE ON ALL WATER DISTRIBUTION PLANS.

NOTES:

1. ALL WATER LINE WORK SHALL COMPLY WITH THE HARVEST-MONROVIA STANDARD SPECIFICATIONS AND DETAILS.
2. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING LOCATION OF EXISTING UTILITIES AND WATER CONNECTIONS PRIOR TO BID.
3. APPROVAL FOR THIS PLAN IS FOR _____ SUBDIVISION, PHASE _____ AND THE WATER LINE LAYOUT. ADDITIONAL LOTS WILL REQUIRE FURTHER REVIEW BY THE HARVEST-MONROVIA WATER AND FIRE PROTECTION AUTHORITY.
4. NO SERVICE CONNECTIONS ARE TO BE MADE BETWEEN FIRE HYDRANTS AND DEAD-ENDS.
5. DUCTILE IRON PIPE SHALL BE INSTALLED IN AREAS WHERE A MAIN SANITARY SEWER OR STORM SEWER PIPE IS TO BE LOCATED ABOVE OR BELOW THE PROPOSED WATER LINE AND SHALL EXTEND A MINIMUM OF 5' EITHER SIDE OF THE SEWER LINE OR STORM DRAIN. DUCTILE IRON PIPE MAY BE REQUIRED IN OTHER AREAS AS DETERMINED BY HARVEST-MONROVIA WATER AND FIRE PROTECTION AUTHORITY.
6. RETAINER GLANDS SHALL BE USED WITH ALL DUCTILE IRON PIPE INSTALLATIONS.
7. ANY WATER LINES THAT ARE TO BE RELOCATED AFTER FINAL ACCEPTANCE SHALL BE THE RESPONSIBILITY OF THE DEVELOPER.
8. PROPOSED WATER LINES LOCATED UNDER PAVEMENT SHALL BE DUCTILE IRON PIPE.
9. GRIPPER RINGS ARE REQUIRED ON ALL MECHANICAL JOINTS FOR PVC PIPE.
10. FIELD LOCK GASKETS SHALL BE USED FOR ALL DUCTILE IRON PIPE UNDER ROADWAYS, STREAM CROSSINGS, OR PIPE THAT IS ENCASED.

ADDITIONAL NOTES TO BE ADDED TO WATER DISTRIBUTION PLANS IF SANITARY SEWER EXISTS OR WILL BE INSTALLED IN THE DEVELOPMENT:

1. WHERE POSSIBLE, INSTALL WATER LINE SUCH THAT THE TOP ELEVATION OF THE SEWER LINE IS A MINIMUM OF 18 INCHES BELOW THE BOTTOM ELEVATION OF THE WATER LINE. DUCTILE IRON PIPE SHALL BE USED IN AREAS WHERE MAIN SANITARY SEWER LINE CROSSES THE WATER LINE.
2. PROVIDE A MINIMUM HORIZONTAL SEPARATION OF (5) FIVE FEET BETWEEN WATER LINES AND SANITARY SEWER LINES. WHERE CROSSINGS ARE NECESSARY, AND THERE IS NOT AN 18" CLEARANCE BETWEEN THE TOP OF THE SEWER LINE AND THE BOTTOM OF THE WATER LINE, ENCASE THE SEWER LINE WITH A CONTINUOUS DUCTILE IRON PIPE OF SUFFICIENT LENGTH, LOCATED SUCH THAT A MINIMUM (5) FIVE FEET SEPARATION EXISTS BETWEEN EACH END OF THE CASING PIPE AND UNCASSED PIPE.
3. DO NOT INSTALL ANY WATER LINE SUCH THAT IT COMES IN CONTACT WITH ANY PART OF A SANITARY SEWER MAIN, SANITARY SEWER LATERAL, SANITARY SEWER MANHOLE OR ANY SEPTIC TANK FIELD LINES.

WATER DISTRIBUTION SYSTEM SPECIFICATIONS FOR WATER MAINS, SERVICES AND APPURTENANCES

DESCRIPTION: This item consists of furnishing and installing approved water pipe, services and fittings of the specified type and size, laid in a trench and backfilled as specified herein and conforming in all aspects to the lines and grades shown on the plans or as established by the Authority.

This item shall include excavation, trenching and backfilling; installing all trench sheeting and bracing; furnishing and installing pipes, fittings, valves, fire hydrants, curb stops, and corporation cocks, service connections and making up all joints and connections.

MATERIALS

(A) GENERAL. Materials shall conform to the following requirements:

(B) PIPE.

1. Ductile Iron Pipe: Ductile iron pipe shall be designed in accordance with the latest revision of ANSI/AWWA C150/A21.50 for a minimum 350 psi rated working pressure plus a 100 psi minimum surge allowance; a 2 to 1 factor of safety on the sum of working pressure plus surge pressure; Type 2 laying condition and a depth of cover of 3.0 feet.

Ductile iron pipe shall be manufactured in the U.S.A. in accordance with the latest revision of ANSI/AWWA C151/A21.51. Each pipe shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture.

Pipe shall have a standard asphaltic coating on the exterior. Pipe shall also have a cement mortar lining on the interior in accordance with ANSI/AWWA C 104/A21.4, of latest revision.

The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.

All pipe shall be furnished with Push-on Type Joints, such as "Tyton" or "Fastite". Joints shall be in accordance with ANSI/AWWA C111/A21.11, of latest revision, and be furnished complete with all necessary accessories.

All pipe 10 inches in diameter and larger shall be Ductile Iron.

Fittings shall be manufactured in the U.S.A., and be ductile iron. Ductile iron fittings shall conform to the latest revision of either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.

Fittings shall have a standard asphaltic coating on the exterior. Fittings shall also have a cement mortar lining on the interior in accordance with ANSI/AWWA C104/A21.4, of latest Revision, or Ductile Iron fittings shall be coated with a 6 – 8 mil nominal thickness fusion bonded epoxy conforming to the requirements of ANSI/AWWA C550/A21.16.

Fittings and accessories shall be furnished with Mechanical joints in accordance with ANSI/AWWA C111/A21.11, of latest revision.

All pipe, fittings, and accessories shall be installed and tested in accordance with the latest revision of AWWA Standard C600. Newly installed ductile iron water mains shall be disinfected in accordance with the latest revision of AWWA Standard C651 prior to placing in service.

2. Polyvinyl Chloride Pipe - When indicated in the Proposal or on the plans, polyvinyl chloride (PVC) pressure pipe may be used for water lines except for fire hydrant branch line, runs less than 30' in length, for creek crossings, and 50 feet adjacent to dead ends of lines or other similar locations designated by the Authority in the field. It is the intent that PVC water pipe is to be used in long runs between fittings and/or valves only. PVC pipe can be used for 8 inch pipe only.

The PVC pipe shall be manufactured of Type 1, Grade 1, 2000 PSI design stress compound and shall conform to ASTM Specifications D 2241 and bear the National Sanitation Foundation (NSF) seal of approval. Pipe having a maximum hydrostatic working pressure of 200 PSI (SDR-21) shall be used as shown in the proposal form. The compound used to produce the pipe and fittings shall conform to ASTM Specification D 1784. All pipe shall have a factory molded belled end.

PVC pipe shall be joined by means of a rubber ring slip joint. The bell joint shall be an integral and homogeneous part of the pipe and shall have the maximum ratio of O.D. to wall thickness as the pipe specified in the bell and ring groove, as well as the barrel of the pipe, to provide the same minimum pressure rating throughout the pipe and joint. Non integral bells will be acceptable provided same are factory welded and that pipe and bell are by the same manufacturer.

Marking PVC pipe: All PVC pipe shall be marked using a metallic tape buried not more than 6 inches above the top of the pipe. Tape shall be Terra Tape, 3" wide minimum, as manufactured by Friffolyn Company, Inc. or an approved equal. The pipe trench shall be backfilled to a depth 6" above the top of the pipe and metallic tape shall be placed flat on the backfill. Backfill shall be carefully placed to a depth of 3 inches by hand to assure that the tape is secured in place over the pipe. It is the intent of this paragraph to provide a means to locate PVC pipe using standard pipe location equipment.

3. Polyethylene Service Pipe - Service pipe shall be Polyethylene service tubing and shall conform to the proposed standards of the Plastic Pipe Institute and shall carry the NSF seal of approval. The material shall meet the requirements, as described in Standard Specification for Polyethylene Plastic Pipe, ASTM Designation D-1248. Tubing shall be standard 3/4 inch or 1

inch size and rated for (CTS-OD) 200 PSI working pressure, ASTM D- 2737.

4. Copper Tube and Fittings - Copper tubing for underground service shall be Type K, soft annealed, in accordance with A.S.T.M. Specification No. B88-55. Fittings shall be flare tube fittings, in accordance with A.S.A. Standard A40.2.

5. Steel Encasement Pipe

The steel encasement pipe shall comply with the appropriate requirements for the size shown in the following table:

Pipe Diameter Inches	Minimum Wall Thickness Inches	Pipe Requirements
<4	Sch. 40	ASTM A 120, Sch. 40
4 – 6	.083	ASTM A 139, Grade B
8 – 12	.104	ASTM A 139, Grade B
14 – 20	.134	ASTM A 139, Grade B
22 – 24	.164	ASTM A 139, Grade B
26 – 36	.164	ASTM A 139, Grade B
38 – 42	.188	ASTM A 139, Grade B
44 – 48	.219	ASTM A 283, Grade B
50 – 60	.250	ASTM A 283, Grade B

All pipe shall be coated inside and out with at least one shop coat of an approved primer paint. In addition, the external surface shall be treated with one (1) coat of asphaltum paint. Other approved protection material may be used if approved by the Authority.

(C) GATE VALVES AND BOXES

1. Valves 4” through 24” shall be resilient wedge type in compliance with AWWA C509, latest revision, with ductile iron wall thicknesses that meet or exceed AWWA C153 ductile iron fittings. Gate valve shall be rated for 250 psi cold water working pressure and hydrostatically tested at 500 psi. Valve body, bonnet, wedge and operating nut shall be constructed of ductile iron. The exterior of the wedge shall be 100% rubber encapsulated. The wedge shall be symmetrical and seal equally well with flow in either direction.

2. Operating nut shall be constructed of ductile iron and shall have four flats at stem connection to assure even input torque to the stem. All gaskets shall be pressure energized O-rings. Bolts shall follow ANSI A16.1. Metric bolting shall not be allowed. Stem shall be sealed with O-rings. The top two O-rings shall be replaceable with valve fully opened and while subject to fully rated working pressure. O-rings set in cartridge shall not be allowed. Valve shall have thrust washers located with one above and one low below the thrust collar to assure trouble free operation of valve. All internal and external surfaces of the valve body and bonnet shall have a fusion bonded epoxy coating complying with ANSI/AWWA C550, applied hydrostatically prior to assembly. The epoxy coating shall be a color other than blue. Valves shall be ductile iron resilient seated gate valve.

3. Valve boxes shall be manufactured in the U.S.A. of cast-iron, complete with cover. Cast-iron boxes shall be the extension type with screw or slide type adjustment and flared base. The minimum thickness of metal shall be 3/16 inch. The word "WATER" shall be cast in the cover. Boxes shall be installed over each gate valve unless otherwise shown on the plans. The boxes shall be of such lengths as will be adapted, without full extension, to the depth of cover required over the pipe at the valve location.

(D) TAPPING SLEEVES AND VALVES

1. Tapping sleeves shall be stainless steel sleeves; outlet flange is AWWA C207, Class D ANSI 150 lb. Drilling, Style Fast Ford Meter Box Co., Inc.

2. Tapping valves shall be ductile iron mechanical joint, inlet flange is class 125, ANSI B16.1, 200 PSI working pressure.

(E) FIRE HYDRANTS

1. Fire hydrants shall be of compression type, conforming to AWWA Specifications C502, having six-inch inlet connection of the mechanical joint type with harnessing lugs, unless otherwise specified. Valve opening shall not be less than 5-1/4" in size for six-inch hydrants. Hydrants shall have two 2 1/2" hose nozzles and one pumper nozzle. Hose and pumper nozzle threads shall conform to A.S.A. Specification B 26. Hydrants shall be yellow in color.

2. Hydrants shall open by turning to the left, and shall have drain openings and nozzle cap gaskets. Each hydrant shall be installed with a 6 inch gate valve and box between the hydrant and the main. 6 inch Ductile Iron pipe shall be used with retainer glands to connect gate valve and fire hydrant. Nozzles shall be set at a minimum of 20" above ground level.

3. Valve box tops shall be set flush with surrounding ground.

4. Fire hydrant shall be installed at the end of each cul-de-sac.

5. Fire hydrant shall be placed every 500 ft. apart.

(F) AIR-RELEASE VALVES

1. Air-release valves shall be similar and equal to Crispin combination air-release valve manufactured by Crispin Valve Multiplex Manufacturing Corporation. Valves shall be tapped into the top of the water main with a two-inch threaded inlet and in operation shall automatically release air from the line while filling or when full and under pressure. The air-release valve shall be furnished with an auxiliary cock or gate valve made of brass and shall be installed between the two-inch pipe and the base of the air-release valve.

2. The Contractor shall furnish and install air-release valves at high points on the water mains at the locations shown on the plans or as directed by the Authority.

3. Air-release valve assembly shall be housed in a reinforced concrete box with manhole ring and cover.

(G) SERVICE METERS, BOXES, AND CONNECTIONS

1. General - Service meters and boxes are to be placed at the inside edge of the road right-of-way. The lines are to have a minimum cover of 24 inches. In order that the minimum cover can be attained, it may be necessary to vary the connection at the main from that shown on the plans.

2. Meters - Service meters shall be 5/8" x 3/4", 3/4" x 1", or 2". The size service to be provided at each location shall be as directed by the Authority. Meter shall be approved by the Authority. Meters shall be of the nutating disc type with magnetic drive and shall be approved by the Authority prior to installation. At the Contractor's request, the Authority will examine and approve the proposed meter. All meters shall read in gallons and all meters less the 2" shall have frost proof bottoms.

3. Backflow Preventers - Backflow Preventers shall be installed at each water meter to prevent the introduction of contaminates into the Public Water System from the customer side. Backflow Preventers shall be installed on the customer side of the Water Meter. Backflow Preventers shall meet or exceed ANSI/ASSE Standard 1024. The size of the device shall be appropriate to the individual connection and shall be approved by the Authority.

4. Meter Boxes - Meter boxes shall be concrete boxes as manufactured by Concrete Products Company, or approved equal. Oversize meter boxes shall be provided at locations where pressure regulating and relief valves are required.

5. Service Connections - All service connections shall be either 1 inch or 3/4 inch in size and shall consist of tapping the main, installing a corporation stop, Ford Type Flood with insert stiffeners, installation of appropriate lengths of service tubing, curb stop, and meter box. Service pipe shall be laid with a minimum of 24" cover. Service pipe which crosses any road or street shall be encased in PVC encasement pipe, 1 1/2" minimum I.D. Each service pipe shall be encased in separate encasement pipes. The connections shall be extended from the main to the property line. Curb stops shall be Ford No. B43 - 232WR.

6. Taps are to be made in accordance with pipe manufacturer's recommended procedures and/or as approved by the Authority.

RESPONSIBILITY FOR MATERIALS

The Contractor shall be responsible for all materials furnished to him and shall replace at his own expense all such material damaged in handling after delivery to the site. This shall include the furnishing of all material and labor required for the replacement of installed material discovered damaged prior to the final acceptance of the work.

The Contractor shall be responsible for the safe storage of material furnished by him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe fittings, castings and accessories shall be kept free from dirt and deleterious matter at all times.

HANDLING OF MATERIAL

All materials furnished to the Contractor shall be delivered and distributed at the site by the Contractor. Pipe and fittings shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

CONSTRUCTION DETAILS

1. Equipment - All equipment necessary and required for proper construction of water mains and appurtenances shall be on the project in first class working condition and shall have been approved by the Authority before construction is permitted to begin.

The Contractor shall provide the necessary hoist equipment or any other devices required for unloading and placing the water pipe in its final position without damage to the pipe. The Contractor shall provide hand tampers or pneumatic tampers or both, and any other equipment necessary for the proper compaction of the backfill in the trenches as specified in these specifications or as directed by the Authority.

2. Excavation - The Contractor shall perform all excavation of every description and or whatever substances encountered to the depth specified in the plans or as directed by the Authority. The bottom of all trenches shall be carefully graded and shaped, and aligned in accordance with the instructions of the Authority and to its complete satisfaction before any pipe is placed. Care shall be taken not to excavate below the depth specified: however, in the event that this should occur, the bottom of the trench shall be filled back to the grade with approved material and thoroughly compacted in a manner satisfactory to the Authority.

All excavated material which is unsuitable or not needed for backfill shall be wasted or disposed of to the satisfaction of the Authority. Surfaces shall be cleaned up, all hummocks and piles smoothed down and the surface left neat and workmanlike. Where existing drainage ditches are disturbed or obstructed with excavated material, such material shall be entirely removed and the ditch left true to original line and grade. Street shoulders, if disturbed, shall be regraded and compacted to their original contours.

Bell holes of ample size shall be cut under and around all joints to provide adequate room for working and to assure that the body of the pipe shall rest uniformly and in continuous contact with the supporting ground for its entire length.

Water will not be permitted in the trenches while the pipe is being laid. The Contractor shall not open up more trenches than the available pumping facilities are able to de-water to the satisfaction of the Authority.

All pipe shall be carefully lowered into the trench by rope slings or by other approved means in such a manner as to prevent damage to the pipe or the pipe coating. The work shall be installed with the bell ends pointing in the direction that the work is to proceed. In soft ground, the Authority may require each piece of pipe to be supported by three pieces of heart timber which shall be 2" x 8', evenly spaced and long enough to span the bottom of the trench.

3. Cutting Pipe - Where pipe must be cut in order to bring valves, hydrants, or other connections to the required location, this work shall be done in a manner satisfactory to the Authority.

4. Mechanical Joints - Where mechanical joint pipe is used, the following methods of installation shall be followed: the surfaces which come in contact with the gasket shall be brushed thoroughly with a wire brush just prior to assembly. The gasket should be brushed with soapy water prior to installation to remove loose dirt and to lubricate the gasket as it is forced into its retaining space.

When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly. The bolts should be partially tightened, the bottom bolt first, then the top, next the bolts on either side and finally the remaining bolts. Over-stressing of the bolts to compensate for poor workmanship will not be permitted.

5. Slip on Joints - When slip on pipe is used, the pipe must be cleaned with a wire brush and the spigot end of the pipe lubricated with a thin film of lubricant. The gasket shall be inserted into the bell socket recess and the spigot end of the pipe pushed home. The joint shall be installed in accordance with the manufacturer's instructions. All joints, of whatever type, shall be completely water tight after being subjected to the required tests.

6. Restrained Joints - 12" and less diameter pipe fittings shall have mechanical joint retainer glands.

12" and greater diameter pipe fittings shall have megalugs or approved equal.

8" diameter pvc pipe installed with mechanical fittings and transitions between ductile iron and pvc pipe shall have Romac Industries, Inc. gripper rings.

All ductile iron pipe for road crossings, stream crossings or encasement pipe shall have field lock gaskets.

7. Setting Fittings, Valves, Hydrants, Etc. - All fittings, valves, valve boxes, hydrants, and other appurtenances shall be set at the location indicated on the plans or as directed by the Authority. Omission of any of these items shall be corrected by the Contractor without extra cost to the Authority.

Fire hydrants shall be set backfilled with washed limestone rock. Hydrants shall be erect and shall stand to the proper height above the ground. Approximately one fourth of a cubic yard of washed gravel shall be installed around hydrant in order to provide for drain water absorption.

The ground shall be securely tamped to the surface around each hydrant as specified for trenching.

Fittings such as bends, tees, plugs, and caps shall be securely braced by concrete thrust blocks supported against the undisturbed trench bank to prevent the possibility of blowing off under pressure. All fittings and hydrants shall be secured with a locking tee and retainer glands.

Where indicated on the plans or directed by the Authority, the Contractor shall install plugs or fittings for anticipated expansion by placing a branch fitting (tee or cross) in the line and plugging the unused branch or branches. Where dead end lines are installed, Ductile Iron pipe shall be used. Blow off valves shall be placed on the end of the pipe.

8. Maintenance of Backfill - Backfill of trenches located in areas subject to traffic shall be sprinkled and kept wetted down by the Contractor to hasten settlement and to abate any dust nuisance. All pavement areas adjacent to trench cuts shall be kept clean of any dirt or gravel spilled thereon during the construction operations.

9. Pipe laying – Ductile iron pipe, specials, and fittings shall be carefully laid to the line and grade established or as directed by the Authority. The bed of each piece of pipe is to be shaped either by trimming the bottom of the trench or by placing excavated earth therein and tamped so that each piece of pipe shall have a uniform bearing. The trench shall be further excavated around each bell or hub so that it will be entirely clear of the ground and leave ample room for caulking or tightening the bolts.

The inside of the bell and the outside of the spigot shall be thoroughly cleaned before they are placed, and the inside of the pipe shall be kept clean and free of all obstructions and deleterious matter until the work is completed and accepted. Wherever pipe laying is stopped at the end of the day, or for any other cause, the end of the pipe shall be securely closed in order to prevent the entrance of water, mud, or any other objectional matter.

A tolerance of six (6) inches from the established grade may be permitted, if approved by the Authority, in order to prevent excessive breaks in alignment at the joints to such an extent that the joints cannot be uniformly and properly completed. It is the intent of this section to provide that the pipe shall be laid in such manner as not to create unwarranted strain or deflection in the completed pipe joints.

10. Sheeting and Bracing - The Contractor shall furnish and place to the satisfaction of the Authority, such sheeting and bracing as may be required to support the sides of the trench and to protect the workmen and the pipe or adjacent structures from injury by sloughing off or caving in of the trenches. This sheeting and bracing may be removed as the trench is backfilled, or may be left in place where necessary to prevent damage. In the event the sheeting or bracing is left in place, it shall not extend nearer than one foot to the surface of the ground. In no case will extra compensation be allowed for furnishing, placing, or removing any sheeting and bracing, but the cost of this work shall be included in the unit price bid for installing the pipe.

11. Pressure Testing - All new pipelines should be hydrostatically tested before backfilling is complete. This may be impractical in city streets with heavy traffic and complete backfilling may be necessary after a few lengths of pipe have been laid. The test pressure is 200 psi for a duration of at least 2 (two) hours for uncovered pipe and 6 (six) hours for covered pipe. The test cannot lose more than 6 psi for the duration of the test. A chart recorder will be used to record the pressure test. Harvest-Monrovia Water Authority will furnish the recorder and oversee the test.

The pipeline should be filled slowly and care should be exercised to vent all high points and expel all air. Vents should remain open until water flows from them at a steady flow. In addition, it is important that fittings and hydrants are properly anchored and that all valves to the existing system are completely closed before applying the pressure test. All valves in the newly installed pipeline shall be open. All corporation stops, service lines and curb stops shall be installed before the pressure test. Corporation stops shall be on for duration of pressure test.

12. Sterilization - Before each section of work is placed in service it shall be thoroughly flushed out to remove any dirt or other deleterious matter from inside the line, and the lines shall be sterilized to meet the requirements of the Alabama State Board of Health, namely a minimum of one sample per mile of pipe and a sample from each dead end line be collected upon completion of sterilization procedures. Disinfecting water mains shall be done in accordance with AWWA Standard C651. Samples are to be taken by Harvest-Monrovia Water Authority.

13. Backfilling Trenches - Backfilling the trenches shall be accomplished by either of the following methods which the Authority decides to be the most appropriate for the type soil encountered at the time the pipe is being laid.

Method A (For clay soil): Backfilling shall be carefully performed and the original surface restored, to the full satisfaction of the Authority. The trenches shall be backfilled with fine, loose earth, free from large clods or stone, carefully deposited on both sides of the pipe and thoroughly and carefully rammed until enough has been placed to provide a cover of not less than one foot above the pipe. The remainder of the backfill material may be then thrown in and tamped. Whenever the trenches have not been properly filled, or if settlement occurs, they shall be refilled, smoothed off, and finally made to conform to the surface of the ground. Backfill in open trenches, across sidewalks, and street traffic areas shall be made as specified above except that the fill above the pipe shall be made in six inch lifts and thoroughly compacted to a density of 95% (AASHTO Method T 99), so that when backfilling is completed the street paving and sidewalk can be immediately replaced. Surplus materials shall be disposed of as directed by the Authority.

Method B (for loamy soils): As soon as the Authority has inspected the pipe and given approval, the Contractor may proceed with the backfilling by placing loose earth, free from clods or stones, carefully on each side of the pipe and to a point approximately one foot above the pipe. This material shall be hand tamped to the satisfaction of the Authority; after the backfilling has progressed to this point, the trench shall be thoroughly flooded until the soil is completely embedded around the pipe. Additional backfill material shall then be deposited in lifts not to exceed three feet, each lift being thoroughly saturated with water, except the last two feet of trench shall not be wetted. This section shall be compacted by vibratory rollers or other approved

mechanical compacting devices until the top six inches attains a density of 95 % of the theoretical density when tested as above specified.

Method C: The Authority may require either one or both of the above methods of backfilling depending upon the type of soil, or it may require the Contractor to backfill the trenches in six inch lifts and tamped with a sufficient number or approved pneumatic tampers or mechanical compactors until the backfill has attained the proper density, as specified above.

Method D: The option to use dense graded base material on streets kept open during construction.

Method E (for Rock Trenches): The pipe shall be bedded in borrow material (clean sandy clay material) to the center line of the pipe. Select sandy/clay or sandy loam material free from rocks or stones larger than 1 1/2" diameter shall be installed in the remainder of the trench to the original ground surface. The intent of this procedure is to protect the pipe from point pressure caused by sharp stone edges.

14. Encasement Pipe - The location of encasement pipe is shown on the Plans.

Installation of casing and carrier pipe under railroads and highways shall conform to the requirements of the responsible railroad or highway agencies.

Casing shall be installed by jacking and boring or by tunneling to such minimum limits as may be allowable by railway or highway authorities; casing extending beyond such minimum limits may be placed in the open trench method. Any excavations necessary for approach trench shall be sheeted and otherwise adequately braced to withstand all possible loads, including traffic loads.

Tunneling operations and installation of liner plates shall be in accordance with the recommendations of the liner manufacturer. Care shall be exercised to install the liner to the proper line and grade. Care shall be taken to avoid loss of ground beyond the tunnel lining and to insure bearing against the ground all around the tunnel. Any space outside the liner plates shall be filled by pneumatically placed pea gravel, by grouting, or by other suitable backfill material as may be approved by the railroad or highway authority and the Authority.

Only personnel thoroughly experienced in performing tunneling operations shall be employed for this work.

Construction operations must not interrupt or interfere with highway or railway traffic. Roadways shall be kept clear at all times.

15. Trenching - Excavation of trenches for laying the pipe lines specified herein or shown on the Plans shall follow the lines and grades shown on the Plans or as directed by the Authority. Trenches shall be excavated in open cut and to such depths and widths as will give ample space for placing and jointing the pipe, for drainage, and for proper blocking and backfilling under the pipe. Minimum pipe cover shall be 36 inches or as shown on the Plans.

If rock is encountered in the bottom of the pipe trench, it shall be under cut to clear all portions of the pipe and fittings at least six (6) inches. This undercut shall be filled to center line of pipe with sand.

RESTORATION OF GROUND

1. As the work progresses and whenever so directed, the Contractor shall remove all surplus material and completely restore to the same good condition as when the work began, such unpaved roadway, curb gutter, sidewalk, parkway, railroad or other right of way, bridge, drain, grass plot, or other public or private property, not included in the hereafter specified, street pavement which has been disturbed, injured, destroyed, or removed by the Contractor, or by the traffic on account of this construction, and shall maintain the same in this condition for 12 months after the date of the final inspection.
2. At the completion of the work, all ground is to be gone over and all surplus material, refuse, or debris removed and the ground left in an entirely satisfactory condition.
3. The Contractor is entirely responsible for satisfying the restoration requirements of the State Transportation Department or Railroad with respect to restoration of work areas that are in their respective right-of-ways.

RESTORATION OF STREET PAVING

1. General - All roadway pavement and all hard surfaced roadways, including the street railway area (if any), where disturbed, injured, destroyed or removed by the Contractor or his agent, or by the street traffic or otherwise on account of the construction of this work, directly or indirectly, are to be completely restored to the same good condition as originally found at the commencement of work, and shall be maintained in this condition during the period of guaranty.
2. Paving Over Trenches - Upon approval of the Authority for the application of plant mix, 2 1/2 inches of the dense graded base will be removed, the edges of the ditch trued to as straight a line as possible, and retamping accomplished if necessary. The excavated section will be swept clean with particular attention given to the edges and this section will then be primed.

After the prime is allowed to penetrate and dry, a tack coat will be applied and 2 1/2 inches of plant mix base material will be placed therein, rolled and tamped to the level surface of the existing paving. The surface will then be maintained for a one year duration of time and any failures which may occur corrected as they appear.

WATER QUALITY

Water Samples - After completion of all work on any section of pipe and after having been sterilized as described, at least two samples shall be taken from remote parts of the system by the Harvest-Monrovia Water Authority for examination to determine if the system is free from organism of the Coli-Aerogenous group. If the samples submitted do not show negative for organism of the Coli-Aerogenous group, the system shall be disinfected and re-disinfected in a

manner meeting the requirements of the Alabama State Board of Health until the system is free from contamination. Samples will be taken by the Harvest Monrovia Water Authority.