

SECTION 7
EFFLUENT REUSE SYSTEMS

7.1 GENERAL

This section sets forth the general requirements for design, installation and testing of effluent reuse distribution systems for irrigation service. Additional information can be found in Section 4 (General Conditions), Section 9 (Standard Drawings), and Section 10 (Standard Plan Notes). Utility shall not guarantee flow or system pressure.

7.2 SYSTEM DESIGN

The Engineer shall comply with the design and installation requirements as specified by the Department of Lee County Utilities and the Department of Environmental Regulation.

A. Flow Demands

Flow demands for design shall be calculated on the basis of full development as known or projected.

B. Valves and Valve Locations

Resilient wedge valves or resilient gate valves shall be utilized on effluent reuse mains, 61 cm (24") or less in diameter. For effluent reuse mains 61 cm (20") or larger, a 10 cm (4") valved bypass line shall be installed at all valves.

Valves shall be provided at branch locations, pipe terminations, and all other locations necessary to provide an operable, easily maintained and repaired effluent reuse distribution system. Maximum length of effluent reuse main that is to be shut down for repair work shall not exceed 460 meters (1,500 feet). All valves shall be tied by stationing for easy identification by field personnel.

C. Pipe Depth

The standard minimum cover for effluent reuse distribution systems shall be 76 cm (30") from the top of pipe to finished grade. Should this design not be possible, alternate methods must be submitted to and approved by the Department of Lee County Utilities. Where possible, maximum cover for effluent reuse mains shall not exceed 122 cm (48").

D. Corrosion Protection

Protection shall be provided for underground ductile iron pipe and fittings within areas of known

severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be those set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be protected for a distance of 6.1 meters (20 feet) to each side. If ductile iron pipe is to be installed parallel to and within 3 meters (10 feet) of cathodically protected pipe, then protection shall be provided for the entire length.

E. Air Venting

Where the effluent reuse main profile is such that air pockets or entrapment may occur which could result in flow blockage, methods for air release shall be provided. At critical points on major mains automatic air release assemblies shall be installed. All dead-end effluent reuse mains, whether temporary or permanent, shall be equipped with a manually operated blow-off at the terminal.

F. Joint Restraining

Pressure pipe fittings and other appurtenances requiring restraint shall utilize joint restraint devices, manufactured restrained joint pipe and fittings or, if approved by Lee County Utilities be braced with thrust blocks. Joint restraining systems shall be designed for the maximum pressure condition and the safe bearing load for horizontal and vertical thrust. At a minimum, the thrust restraining system shall have a working pressure equal to or greater than the pipe material maximum pressure rating. For PVC pipe and fittings, restraining devices shall meet the requirements of Uni-Bell Specifications, UNI-B-13m (recommended standard performance specifications for joint restraining devices for use with PVC pipe), and shall be UL and FM approved for 10 cm, (4"), through 30 cm, (12"), DR 18 PVC pipe. A reasonable safety factor shall be determined by the Design Engineer in specifying all restraining devices.

A joint restraining schedule shall be the responsibility of the Design Engineer and shall be included in the design package. The restraining schedule shall be an integral part of the package submitted for approval to the Department of Lee County Utilities and the permit agencies.

G. Electrolysis Prevention

All systems shall be designed to best avoid electrolytic action through the contact of dissimilar metals. Preventative action, if required, may consist of installing insulating or dielectric couplings between the two materials.

H. Identification

To preclude possible domestic water tapping, all underground PVC effluent reuse mains shall be color coded lavender in accordance with the Utility Location and Coordination Council Uniform Color Guide. All underground effluent piping shall be installed ~~and marked~~ with a continuous strip

of 7.6 cm (3") detectable marking tape for "effluent reuse" and placed a minimum of 45 cm (18") above the pipe and in accordance with the manufacturer's specification.

I. Backflow Prevention

Any property which is served by the Department of Lee County Utilities potable water which also utilizes reuse water shall provide for a backflow prevention device at the customer's water service connection in accordance with the Department of Lee County Utilities Cross Connection Control Policy. See Section 5.6 and Section 9 for details.

J. Effluent Reuse Storage

It is the intent of the Department of Lee County Utilities that all large use customers shall provide on-site storage in the form of tank (s) or pond (s), for the delivery of Effluent Reuse. Storage capacity of the on-site facility shall be reviewed and accepted by Lee County Utilities.

7.3 MATERIALS

A. Pipe

1. Ductile Iron Pipe

Ductile Iron Pipe shall conform to the requirements of ANSI Standard A21.51. The pipe wall thickness shall not be less than that required by a working pressure of 1,034 kPa (150 psi) in laying condition Type 4 "B" with 1.5 meters (5 foot) cover in conformance with ANSI Standard A21.50. Ductile Iron Pipe shall be a minimum of Class 50 or pressure class 250 and will be accepted in any diameter for use within the distribution system.

All Ductile Iron Pipe and fittings shall be lined with Protecto 401 lining system to prevent corrosion.

Gaskets shall be a vulcanized crude rubber or polyvinyl chloride plastisol. Gaskets shall have clean tips unless otherwise specified. Elastomeric gaskets conforming to ASTM F-477 shall also be acceptable.

2. Polyvinyl Chloride Pipe (PVC)

Unless otherwise specified and approved by the Department of Lee County Utilities, all 10 cm (4") and larger diameter PVC shall be rated per AWWA, C900, DR18, Class 150.

All 5 cm (2") diameter PVC shall be rated Schedule 80. For 10 cm (4") through 30.5 cm (12") PVC pipe installed under roadway pavement by direct burial, shall conform to AWWA C900, DR14.

PVC pipe, 10 cm (4") in diameter or larger, shall have provisions for expansion and contraction provided in the joints. All joints except threaded or solvent welded joints shall be designed for push-on make-up connections. Push-on joint may be a coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross section, similar

and equal to John's Mannville ring-type and Ethyl Bell Ring or may be made with a separate twin gasketed coupling similar and equal to Certainteed Fluid-Type.

3. Polytubing

Polyethylene Tubing will be acceptable in sizes 1.9 cm (3/4") to 5 cm (2") in diameter. Tubing for service lines shall be of a type approved by the National Sanitation Foundation for use in transmitting fluids for human consumption. The tubing shall be designed for a minimum burst pressure of 4,344 kPa (630 psi) for water at 23BC and shall be manufactured in accordance with the requirements of ASTM D2737.

B. Fittings

All underground fittings shall be Ductile Iron push-on joint, Ductile Iron mechanical-joint type, Ductile Iron manufactured restrained joint, or AWWA C900 or C905 PVC push joint, with the minimum pressure rating of 1,724 kPa (250 psi).

All above-ground fittings shall be ductile iron flange-joint type with the minimum pressure rating of 1,724 kPa (250 psi) and shall conform to the requirements of ANSI Standard A21.10 and shall be painted blue.

Ductile Iron Fittings shall be cement lined, seal coated and outside coated as specified above.

Mechanical joints consisting of bell, socket, gland, gasket, bolts and nuts shall conform to ANSI Standard A21.11 or for PVC. Bolts and nuts shall be Ductile Iron, THead Type having hexagonal nuts. Bolts and nuts shall be machined through and nuts shall be tapped at right angles to a smooth bearing surface. Single sealed gasket push-on type joints shall conform to the requirements of ANSI A21.11.

PVC pipe fittings for 5 cm (2") and smaller diameter pipe shall be threaded or glued and shall be Schedule 80 and conform to the requirements of ASTM D-2464. Threaded joints shall be used only with Schedule 80 pipe or stronger. At threaded joints between PVC and metal pipes, the metal shall contain a threaded socket end and the PVC threaded spigot end. A metal spigot shall not, under any circumstances, be screwed into a PVC socket. PVC fittings 10 cm, (4"), and larger shall be a fitting manufactured entirely from PVC, shall be formed by a thermal-form process, and shall be of one piece construction. Fittings shall not use fiberglass over wraps and shall be compatible with joint restraining system.

C. Resilient Wedge or Gate Valves

Valves for pipe less than 5 cm (2") in diameter shall conform to the requirements of AWWA C509 (latest revision) and shall be cast iron, single wedge, non-rising stem, screwed bonnet, 56.7 kg (125 pound) S.P., 90.7 kg (200 pound) W.O.G with stuffing box repack-able under pressure and all parts renewable. Ends shall be as shown or indicated on the drawings.

Resilient wedge or gate valves 5 cm (2") in diameter and larger shall be iron body, non-rising stem, bronze mounted gate valves, mechanical joint conforming to requirements of the AWWA Standard C509 and shall be provided with a 5 cm (2") square operating nut. Valves shall be resilient, wedge, or gate type and shall turn to the left (counter clockwise) to open. The wedge

or gate shall be cast iron or ductile iron per ASTM A536, minimum 4,570 kg/cm² (65,000 psi) strength, completely encapsulated with urethane rubber, permanently bonded to the wedge or gate to meet ASTM test for rubber metal bond, ASTM D429. The valve stems for non-rising stem assemblies shall be cast bronze with integral collars in full compliance with AWWA. The NRS stem stuffing box shall be the O-ring seal type with two rings located above thrust collar; the two rings shall be replaceable with valve fully open and subjected to full rated working pressure.

There shall be two (2) low torque thrust bearings located above and below the stem collar. The stem nut shall be independent of wedge and shall be made of solid bronze. There shall be a smooth unobstructed waterway free of all pockets, cavities and depressions in the seat area. The body and bonnet shall be coated with fusion bonded epoxy both interior and exterior. Valves 51 cm (20") in diameter or larger shall have a fully restrained 10 cm (4") bypass line with a 10 cm (4") resilient wedge valve, as shown in details in Section 9.

D. Check Valves

Check valves smaller than 10 cm (4") shall have a bronze body with a bronze disk. Check valves shall absolutely prevent the return of water back through the valve when the inlet pressure decreases below the delivery pressure.

The valve must be full opening, tight seating and its seat ring shall be renewable and must be securely held in place by a threaded joint; the valve disc shall be and shall be suspended from a non-corrosive shaft which will pass through a stuffing box.

The check valve 10 cm, (4"), and larger shall be a rubber flapper type swing check valve and the body and cover shall be cast iron construction meeting ASTM A126 Class B or Ductile Iron construction. The flapper shall be Buna-N having an O-ring seating edge and be internally reinforced with steel.

Flapper to be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position during flow through the valve. Flapper shall be easily removed without need to remove valve from line. Check Valves to have full pipe size flow area.

Seating surface to be on a 45° angle requiring the flapper to travel only 35% from closed to full open position, for minimum head loss and non-slam closure.

Non-slam closing characteristic shall be provided through a short 35% disc stroke and a memory flex disc return action.

When essential to create backflow thru the check valve, i.e.; to prime or backflush a clogged pump, an external backflow device shall be included.

Valve exterior to be painted Phenolic Primer Red Oxide for high resistance to corrosion.

Materials of construction shall be certified in writing to conform to A.S.T.M. specified above.

Valve shall be APCO Series 100 Rubber Flapper Swing Check Valve, as manufactured by Valve & Primer Corporation, Schaumburg, Illinois, U.S.A or Series 500 swing flex valve as manufactured by Val-Matic Valve and Manufacturing Corporation or approved equal.

E. Tapping Sleeves

Tapping sleeves used to make "wet" taps into existing effluent reuse mains shall be provided and installed at locations as shown on the drawings. Tapping sleeves shall be rated for 1,034 kPa (150 psi) working pressure and shall be constructed entirely of stainless steel; steel units shall be furnished with vinyl coating and stainless steel bolts. The Contractor shall determine the outside diameter and type of the existing main before ordering the sleeve.

F. Meters

Meters shall be Magnetic Drive Turbine Meters with internal strainer. For anticipated flows of 22 l/s (350 g.p.m.) or less, a Sensus Model W-350-DRS, 7.6 cm (3") Flanged Turbo-Meter, or approved equal, shall be used. For anticipated flows less than 9.5 l/s (150 g.p.m.), a Sensus Model W-160-DRS 5 cm (2") flanged Turbo-Meter, or approved equal, may be used in lieu of the above meter. All meters shall register usage in gallons. Meters shall be installed as shown on the details in Section 9. For flows in excess of 22 l/s (350 g.p.m.), meters shall be installed above ground on a meter pad with digital batching unit with display, and control functions to electrically operate control valve. The meter and meter pad design shall be approved by the Department of Lee County Utilities prior to installation or construction.

G. Meter Vaults

Meter vaults shall be of composite concrete type and shall conform to the applicable requirements of Section 8.5C. The cover for the non-traffic bearing vault shall be constructed of 4.76 mm (3/16") aluminum floor plate with reinforcement. Recessed locks and other vandalism-proof lids, such as Bilco "K" or "KD" will be required on vault covers 61 cm x 61 cm (2" x 2") or larger.

If a W-160-DRS meter is being used, it shall be installed in a Quazite PG1730BB12 box, with Quazite PG1730WAP1 cover, or CDR WB-1730-12 box with CDR WC00-1730-2C cover. If a W-350-DRS meter is being used, it shall be installed in an Olsen pre-cast (or approved equal) 61 cm (24") deep x 152 cm (60") long x 61 cm (24") wide pre-cast concrete vault with 10 cm (4") thick walls and locking aluminum hatch.

All meter box taps shall be colored or painted lavender.

H. Castings

The manhole frame and cover shall conform to the ASTM Designation A48, Class 25. Casting shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength or otherwise make them unfit for the service intended.

The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the drawings. The words REUSE shall be cast in the manhole cover. The manhole frame and cover shall be traffic bearing.

I. Valve Boxes

Cast iron valve boxes shall be provided for all valves installed underground which do not have extended operators such as is required by the plug valves. The valve boxes shall be adjustable to fit the designated depth of each cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. Valve boxes shall have an interior diameter of not less than 12.7 cm (5"). The valve boxes shall be provided with covers marked with the words, "REUSE." The covers shall be so constructed as to prevent tipping or rattling.

Valve boxes shall be of the heavy duty, traffic bearing cast iron, adjustable screw type with a drop cover. The valve box assembly shall consist of a bottom section, top section and cover which is cast from gray iron, formulated to ASTM specification A-48 latest revision, class 30 minimum and shall be free from blowholes, shrinkage or other imperfections not true to pattern. The shaft size shall be 13.34 cm (5 1/4") and the adjustable length shall be from 45 cm (18") to 61 cm (24").

The wall thickness shall be 4.76 mm (3/16") \pm 1.6 mm (1/16"). The weight of the assembly shall be 27.7 kg (61 pounds) \pm 0.9 kg (2 pounds), with the cover weight being a minimum of 5.44 kg (12 pounds).

The name of the manufacturer and foundry of origin shall be cast into each of the components of the assembly in legible form. The assembly shall be suitable for highway traffic wheel loads of 7,257 kg (16,000 pounds) and shall withstand a proof load test of 11,340 kg (25,000 pounds) without failure or permanent deflection, as per Federal Specification RR-F-621-C, latest revision.

The valve box shall be cast, machined, assembled, and packaged within the United States and shall fully comply with the Buy American provisions of Public Law 102-240, enacted 12/18/91.

Valve boxes shall be manufactured by OPELIKA FOUNDRY COMPANY, Opelika, Alabama or TYLER PIPE DIVISION, Tyler, Texas or approved equal.

J. Air Release Valves

Air release valves shall be of the short body, automatic type as shown in Section 9. The valve body shall be cast iron construction, ASTM A126, Class B, and all internal working parts shall be 300 Series stainless steel, and BUNA-N orifice button. The venting orifice shall be 4.76 mm (3/16") in diameter. The inlet opening shall be 2.54 cm (1") NPT screwed connection.

K. Concrete

Concrete shall conform to the requirements of Section 8.5C.

L. Sand

Sand for pipe encasement shall be sand or rock particles which pass a #4 sieve and are retained on the #200 sieve.

M. Batching Unit

Meter installation 10 cm (4") and larger shall have Digital Batching Units installed to totals and control flow. Batching unit shall operate on 110 VAC, have illuminated digital display readout of flow, preset quantity selector, "Start" push button and output contact to operate control valve.

N. Pressure Reducing, Pressure Sustaining, and Check Valve

This valve shall maintain a constant downstream pressure regardless of fluctuations in demand.

When the upstream pressure becomes equal to the spring setting of the pressure sustaining control, the valve throttles to maintain a constant inlet pressure. If the downstream pressure is greater than the upstream pressure, the valve closes automatically to prevent return flow. Solenoid control shall intercept pressure reducing control to close/open main valve. This valve shall be hydraulically operated.

The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally closed diaphragm valve which closes when downstream pressure exceeds the spring setting.

The pressure sustaining pilot control shall be a direct-acting adjustable, spring-loaded, normally closed diaphragm valve which opens when upstream pressure exceeds the spring setting. The control system shall include a strainer orifice assembly, and an adjustable opening speed control.

This valve shall be a Bermad 700 Series combination pressure reducing, pressure sustaining solenoid shutoff check valve with opening and closing speed controls as manufactured by Bermad Control Valves of Anaheim, California or approved equal.

O. Restraining Devices

Joint restraining devices for Ductile Iron mechanical joint pipe and fitting shall be EBAA Iron Inc., Series 1100, or approved equal.

Joint restraining devices for push joint Ductile Iron pipe and fitting shall be EBAA Iron Inc., Series 1700, or approved equal. Joint restraining devices for push joint PVC pipe and M.J. Ductile Iron fitting shall be ERAA Iron, Inc., Series 2000 PU, Uniflange Series 1300 or approved

Joint restraining devices for push joint PVC pipe and PVC or Ductile Iron push joint fitting shall be EBAA Iron Inc, Series 1600, or 2800, Uniflange Series 1300, 1360, or 1390, or ROMAC Series 600 or approved equal.

Bolts and nuts shall be Ductile Iron or 300 Series Stainless Steel, T-Head type with hexagonal nuts. Bolts and nuts shall be machined through and nuts shall be tapped at right angles to a smooth bearing surface.

7.4 EXCAVATION, TRENCHING, BACKFILLING, AND RESTORATION

A. General

The provisions set forth in this Section shall be applicable to all underground effluent reuse piping installations regardless of location. Special design considerations shall require approval from the Department of Lee County Utilities.

B. Materials

1. Sheeting and Bracing

In order to prevent damage to property, injury to persons, erosion, cave-in or excessive trench width, adequate sheeting and bracing shall be provided per regulations of the Federal Occupational Safety and Health Administration and/or as directed by the Owner or Engineer. This work shall be performed in accordance with accepted standard practice when design consideration warrants due to adverse soil condition, proximity of existing utilities, maintenance and protection of traffic.

Sheeting shall be removed when the trench has been backfilled to at least one-half its depth or when removal would not endanger the construction of adjacent structures. When required to eliminate excessive trench width or other damage, shoring or bracing shall be left in place and the top cut off at an elevation 0.8 meters (2.5 feet) below finished grade, unless otherwise directed.

All sheeting and bracing shall be the responsibility of the Contractor to retain qualified design services for these systems, and to be completed with strict adherence to OSHA Regulations.

2. Concrete

Concrete shall comply with provisions detailed in Section 8.5C and shall have a minimum compressive strength of 175.75 kg/cm² (2,500 pounds per square inch).

C. Workmanship

1. Trench Dimensions

The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 20 cm (8") for unsheeted trench or 30 cm (12") for sheeted trench.

The maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus 61 cm (2 feet), unless otherwise shown on the drawing details or approved by the County. Trench walls shall be maintained vertical from the bottom of the trench to a line measured one foot above the top of the pipe. From one foot above the top of the pipe to the surface, the trench walls shall be approximately vertical or, as specified,

to conform with OSHA Regulations.

2. Trench Grade

Standard trench grade shall be defined as the bottom surface of the utility to be constructed or placed within the trench. Trench grade for utilities in rock or other non-cushioning material shall be defined as 15.25 cm (6") below the outside of the bottom of the utility of which 15.25 cm (6") shall be backfilled with extra utility bedding material. Excavation below trench grade that is done in error shall be backfilled to trench grade and compacted.

3. Utility Bedding

- a. Class B (minimum utility bedding). The bottom of the trench shall be shaped to provide a firm bedding for the utility pipe. The utility shall be firmly bedded in undisturbed firm soil or hand shaped unyielding material. The bedding shall be shaped so that the pipe will be in continuous contact therewith for its full length and shall provide a minimum bottom segment support for the pipe equal to 0.3 times the outside diameter of the barrel.
- b. Class A (special utility bedding). Should special bedding be required due to depth of cover, impact loadings or other conditions, Class A bedding shall be installed, as shown in Section 9.

4. Unsuitable Material Below Trench Grade

Soil unsuitable for a proper foundation encountered at or below trench grade, such as muck or other deleterious material, shall be removed for the full width of the trench and to the depth required to reach suitable foundation material, unless special design considerations receive prior approval from the Department of Lee County Utilities. Backfilling below trench grade shall be in compliance with the applicable provisions of Section 7.4.C.12. Unless otherwise specified or directed, backfill layers shall not exceed 15.25 cm (6") in thickness for the full trench width and compaction shall equal 95% of maximum density or 98% if under paved area of roadway, as determined by AASHTO Specification T-180. Compaction density tests shall be made at all such backfill areas with spacing not to exceed 30.5 meters (100 feet) apart and on each 15.25 cm (6") compacted layer.

5. Extra Utility Bedding Material

When rock or other non-cushioning material is encountered at trench grade, excavation shall be extended to 15.25 cm (6") below the outside of the bottom of the utility and a cushion of sand or suitable crushed rock shall be provided. Utility bedding material shall be as specified under Section 7.4.

6. Excavated Material

Excavated material to be used for backfill shall be neatly deposited at the sides of the

trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall be responsible for obtaining the sites to be used and shall maintain his operations to provide for natural drainage and not present an unsightly appearance.

7. Material Disposal

Excess, unsuitable, or cleared and grubbed material resulting from utility installation shall be immediately removed from the work site and disposed of at a location secured by the Contractor. Disposal of cleared and grubbed material shall comply with Section 8.1.

8. Borrow

Should there be insufficient material from the excavations to meet the requirements for fill material, borrow shall be obtained from pits secured and tested by the Contractor and approved by the County. Copies of all test results shall be submitted to the Department of Lee County Utilities.

9. Rock Excavation

Rock excavation shall be defined as excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.

10. Dewatering

Water shall not be allowed in the trenching while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Engineer. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case shall the pipelines being installed be used as drains for such water and the ends of the pipe shall be kept properly and adequately blocked during construction by the use of approved stoppers and not be improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other foreign matter into the pipelines. If on completion of the work any such material has entered the pipelines, it must be cleaned so that the entire system will be left clean and unobstructed.

11. Obstructions

It shall be the Contractor's responsibility to acquaint himself with all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. Where actual conflicts are unavoidable, work shall be coordinated with the facility owner and performed so as to cause as little interference as possible with the service rendered by the facility disturbed. Facilities or structures damaged in the

prosecution of the work shall be repaired and/or replaced immediately, in conformance with current standard practices of the industry, or according to the direction of the owner of such facility, at the Contractor's expense.

12. Backfill

- a. General. Backfill material shall be clean earth fill composed of sand, clay and sand, sand and rock, crushed rock, or an approved combination thereof. Backfilling shall be accomplished under two specified requirements: First Lift, from trench grade to a point 30.5 cm (12") above the top of the utility; and, Second Lift, from the top of the First Lift to the ground surface. Where thrust blocks, encasements, or other below grade concrete work have been installed, backfilling shall not proceed until the concrete has obtained sufficient strength to support the backfill load.
- b. First Lift. Fine material shall be carefully placed and tamped around the lower half of the utility. Backfilling shall be carefully continued in compacted and tested layers not exceeding 15.25 cm (6") in thickness for the full trench width, until the fill is 30.5 cm (12") above the top of the utility, using the best available material from the excavation, if approved. The material for these first layers of backfill shall be lowered to within 61 cm (2 feet) above the top of pipes before it is allowed to fall, unless the material is placed with approved devices that protect the pipes from impact. The "First Lift" shall be thoroughly compacted and tested before the "Second Lift" is placed. Unless otherwise specified, compaction shall equal 98% of maximum density, as determined by AASHTO Specification T-180. The "First Lift" backfill shall exclude stones or rock fragments larger than the following:

<u>Pipe Type</u>	(Greatest Dimension-Inches)	
	<u>Fragment Size - Inches</u>	
	<u>cm</u>	<u>Inches</u>
Steel	5	2
Concrete	5	2
Ductile Iron	5	2
Plastic	2.5	1

- c. Second Lift. The remainder of the trench, above the "First Lift", shall be backfilled and tested in layers not exceeding 15.25 cm (6"). The maximum dimension of a stone, rock, or pavement fragment shall be 15.25 cm (6"). When trenches are cut in pavements or areas to be paved, compaction, as determined by ASSHTO Specification T-180, shall be equal to 98% of maximum density. Compaction in other areas not less than 90% of maximum density or 95% of maximum density in unpaved portions of Rights-of-Way.

As an alternative, or if required under roadways, ?Flowable Fill may be substituted.

If Flowable Fill is to be used, a fabric mesh shall be installed between the ? first lift? and the “Flowable Fill”. Flowable fill shall be in accordance with Section 4.7.AH of this manual.

- d. Compaction Methods. The above specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with exception that the first two feet of backfilling over the pipe shall be compacted by hand-operated tamping devices. Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is the only material utilized and encountered and the operation has been approved by the County.
- e. Density Tests. Density tests for determination of the above specified compaction shall be made by an independent testing laboratory and certified by a Florida Registered, Professional Engineer at the expense of the Developer or Contractor. Test locations will be determined by the County but in any case, shall be spaced not more than 30.5 meters (100 feet) apart where the trench cut is continuous. If any test results are unsatisfactory, the Contractor shall re-excavate and re-compact the backfill at his expense until the desired compaction is obtained. Additional compaction tests shall be made to each site of an unsatisfactory test, as directed, to determine the extent of re-excavation and re-compaction necessary.

Copies of all density test results shall be furnished on a regular basis by the Engineer, to the Department of Lee County Utilities. Failure to furnish these results will result in the project not being recommended for acceptance by Lee County.

13. Protective Concrete Slab

Protective concrete slabs shall be installed over the top of trenches, where required, to protect the installed utility against excessive loads, or when insufficient cover exists. Concrete slabs shall also be installed, when required by the County, in drainage ditches between the buried utility line and the bottom of the ditch to prevent damage during ditch maintenance operations.

14. Restoration

- a. Sidewalk and Driveway Restoration. Existing sidewalks and driveways removed, disturbed, or destroyed by construction, shall be replaced or repaired in kind. The finished work shall be equal or better in all respects to the original and shall be approved by the County.

Roadway and Pavement Restoration. Pavement or roadway surfaces cut or damaged shall be replaced by the Contractor in equal or better condition than the original, including stabilization, base course, surface course, curb and gutter or other appurtenances. The Contractor shall obtain the necessary permits prior to any

roadway work. Additionally, the Contractor shall provide advance notice to the appropriate authority, as required, prior to construction operations. Roadway Restoration (within Lee County Department of Transportation–jurisdiction) - Restoration shall be in accordance with the requirements set forth in the "Right-of-Way Utility Construction Activity Policy" and these Standards. The materials for construction and method of installation, along with the proposed restoration design for items not referred or specified herein, shall receive prior approval from Lee County DOT.

Where existing pavement is to be removed, the surface shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge parallel or perpendicular to the roadway centerline with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.

Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration. Said surfacing shall remain for ten (10) days in order to assure the stability of the backfill under normal traffic conditions. Thirty (30) days following this period and prior to sixty (60) days after application, the temporary surfacing shall be removed and final roadway surface restoration accomplished.

In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the stipulated dimensions, if needed. Following the above operation, the Contractor shall proceed immediately with final pavement restoration in accordance with the requirements set forth by Lee County Department of Transportation.

- c. Roadway Restoration (outside Lee County Department of Transportation jurisdiction). Work within the rights-of-way of public thoroughfares which are not under jurisdiction of Lee County, shall conform to the requirements of the Governmental agency having jurisdiction, or the Florida Department of Transportation, if no governmental agencies have jurisdiction. Work within State Highway right-of-way shall be in full compliance with all requirements of the permit and drawings, and to the satisfaction of the Florida Department of Transportation.

15. Protection and Restoration of Property

During the course of construction, the Contractor shall take special care and provide adequate protection in order to minimize damage to vegetation, surfaced areas, and structures within the construction right-of-way, easement or site, and take full responsibility for the replacement or repair thereof. The Contractor shall immediately repair any damage to private property created by encroachment thereon.

Should the removal or trimming of trees, shrubs, or grass be required to facilitate the installation within the designated construction area, this work shall be done in cooperation with the County and/or local communities which the work takes place. Said vegetation, removed or damaged, shall be replanted, if possible, or replaced by items of equal quality, and maintained until growth is re-established. Top soil damaged in the course of work shall be replaced with at least a 4" layer of suitable material. Following construction completion, the work area along the route of the installation shall be finish grade to elevations compatible with the adjacent surface, with grassing or hand-raking required within developed areas.

16. Cleanup

Work site cleanup and property restoration shall follow behind construction operation without delay. In order to facilitate an acceptable construction site, debris and waste materials shall be removed from the site immediately and daily trenching length versus pipe laying shall be coordinated to provide the minimum overnight trench opening. Construction site maintenance, along with on-going cleanup and final property restoration acceptance, shall be as required by the County.

17. Excavation Site Safety

Whenever an excavation site or trench is left unattended by the Contractor or an area is not within 100 feet of observation by the Contractor, the excavation site or trench shall be filled and/or, at the County's discretion, protected by other means to prevent accidental or unauthorized entry. Such protection shall include barricades and other protection devices requested by the Engineer or County including temporary fencing, snow fencing, or temporary "structure" tape.

Such safety items shall not relieve the Contractor of any site safety requirements or liabilities established by Federal, State and local laws and agencies, including OSHA, but is intended as additional safety measures to protect the general public.

7.5 ADDITIONAL INSTALLATION REQUIREMENTS

A. Pipe

1. Inspection of Material

The Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. All pipe and fittings shall be subjected to visual inspection at time of delivery and also just before they are lowered into the trench to be laid, and joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product or

any part may be rejected when, in the opinion of the Owner or Engineer, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

2. Pipe Cleanliness

The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

3. Pipe Gradient

Lines shall be laid straight and depth of cover shall be maintained uniform with respect to finish grade, whether grading is completed or proposed at the time of pipe installation. Lasers are the preferred method of establishing pipe gradients, however, batter boards with string line paralleling design grade, or other previously approved means, shall be acceptable in assuring conformance to required grade.

4. Identification

When PVC pipe is to be installed, 7.6 cm (3") detectable marking tape, of appropriate color, shall be placed along the entire pipe length. In all cases, marking tape shall be installed a minimum of 46 cm (18") above the water main during backfill operations, and the tape manufacturer's specification. All PVC pipe, PVC fittings, Polyethylene Tubing, and identification tape shall be color coded per standards outlined in the Utility Location and Coordinating Council's Uniform Color Code as specified in Section 4.7.AG

5. Pipe Joint Deflection

Whenever it is desirable to deflect pipe, the amount of deflection shall not exceed 80% of the maximum limits as shown in AWWA Standard C600.

6. Rejects

Any pipe found defective shall be immediately removed and replaced with sound pipe at the Contractor's expense.

7. Polyvinyl Chloride Pipe

PVC pipe may be damaged by prolonged exposure to direct sunlight and the Contractor shall take necessary precautions during storage and installation to avoid this damage. Pipe shall be stored under cover and sufficient backfill to shield it from the sun shall be placed as the pipe is installed.

8. Anchors

Restraining joints shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support, and shall conform to the details shown on the drawings in

Section 9. Concrete thrust blocks may be utilized as additional restraint if approved by Lee County Utilities.

9. Joints

The particular joint used shall be approved by Department of Lee County Utilities prior to installation. Where shown on plans or where, in the opinion of the Department of Lee County Utilities, settlement or vibration is likely to occur, all pipe joints shall be restrained. Approved retainer glands will be permitted for restraint of ductile iron and PVC pipe.

- a. Mechanical Ductile Iron Pipe Joints. All types of mechanical joint pipes shall be laid and jointed in full conformance with manufacturer's recommendations which shall be submitted to the Department of Lee County Utilities for review and approval before work is begun. Torque wrenches set as specified in AWWA Specifications C111 shall be used; or spanner type wrenches not longer than specified therein may be used with the permission of the Department of Lee County Utilities.
- b. Push-On Ductile Iron Pipe Joints. Push on joints shall be made in strict, complete compliance with the manufacturer's recommendation. Lubricant, if required, shall be an inert, non-toxic, water soluble compound incapable of harboring, supporting, or culturing bacterial life. The Department of Lee County Utilities may require manufacturer's recommendations be submitted to the Engineer for review and approval before work is begun, and may require the manufacturer to ensure that the Contractor has been advised of his recommended methods of installation.
- c. PVC Pipe Joints. The joints of all pipelines shall be made in conformity with the recommendations of the pipe manufacturer. The particular joint used shall be approved by the Department of Lee County Utilities Engineer prior to installation. No sulfur base compound joints shall be used.

B. Installing Valves and Boxes

1. Valves shall be carefully inspected, opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Gate valves, unless shown otherwise, shall be set with their stems vertically above the center line of the pipe. Any valve that does not operate correctly shall be removed and replaced.
2. Valve boxes shall be carefully centered over the operating nuts of the valves so as to permit a valve wrench or key to be fitted easily to the operating nut. Valve boxes shall be set to

conform to the level of the finished surface and held in position by a ring of concrete placed under the support flange as shown on the details in Section 9. The valve box shall not transmit surface loads to the pipe or valve. Care shall be taken to prevent earth and other material from entering the valve box.

Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug out and reset. Before final acceptance of the work, all valve boxes shall be adjusted to finish grade. Valve operating risers shall be installed with any valves required to ensure that the operating nut is 30" or less from the ground surface.

C. Service Connections

Service connections shall be installed at the locations and in the manner shown on the drawings. Refer to 7.3 for approved service connection materials.

Service clamps for PVC mains shall be full-circle bearing type as shown on the drawings and double-strap tapped saddle service clamps for ductile iron mains.

Corporation stops and curb stops shall be fitted with a compression connection outlet with split-lock devices polyethylene or copper pipe.

On curbed streets the exact location for each installed service shall be marked by etching or cutting a "R" in the concrete curb; where no curb exists or is planned, locations shall be adequately marked by a method approved by the Department of Lee County Utilities.

D. Concrete Encasement

Concrete encasement shall be constructed in accordance with details as shown in Section 9 when:

1. A waterline crosses at a depth which provides less than 46 cm (18") clear distance from an effluent reuse line. Encasement shall extend a minimum of 3 meters (10 feet) on each side of the point of crossing. Either pipe may be encased.
2. A waterline running parallel to an effluent line provides less than 3 meters (10 feet) separation. Either pipe may be encased.
3. The Engineer has ordered the line encased.

The points of beginning and ending of pipe encasement shall be not more than 15.25 cm (6") from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

E. Flush Out Connections

Flush out connections shall be installed at the locations and in accordance with the details shown in Section 9.

F. Casing Installations

1. General

The provisions of this section shall represent the minimum standards for the installation of casing pipe for water main pipeline.

Effluent reuse mains to be placed under Lee County Department of Transportation roadways shall be installed in a casing. The steel casing and procedures shall conform to the requirements of Lee County DOT as outlined in "Administrative Code "AC-11-12" and any supplements thereto. All work and materials shall be subject to inspection by DOT.

The Department's property and surface conditions shall be restored to the original condition in keeping with the Department's specifications and standards.

In general, all underground water lines crossing existing major Lee County roadways, Florida State Highways and railroads shall be installed under these traffic ways within steel casing pipe. Specific crossing requirements shall be obtained in advance from the authority having jurisdiction.

It shall be the responsibility of the developer or engineer to submit the necessary permit documents and data to the appropriate authority and receive approval thereof.

The Contractor shall maintain traffic on the roadway and shall keep all workmen and equipment clear of the travelway during the work. All safety regulations of the Department and any permit(s) shall be complied with.

2. Casing Pipe Material and Installation

Casing pipes crossing under County roadways shall be located at suitable approved alignments in order to eliminate possible conflict with existing or future utilities and structures with a minimum 76 cm (30") depth of cover between the top of the casing pipe and the surface of the roadway. Casings shall be new prime steel pipe conforming to the requirements of ASTM Designation A-139. The minimum casing pipe size and wall thickness shall be as shown in the following table, for the water carrier pipe size indicated.

For sizes not included therein, or for special design considerations, approval shall be obtained from the Department of Lee County Utilities. PVC shall be an acceptable casing material for service lines.

<u>Carrier Pipe Nominal Size</u>		<u>Casing Pipe Outside Diameter</u>		<u>Casing Pipe Wall Thickness</u>	
<u>CM</u>	<u>Inches</u>	<u>CM</u>	<u>Inches</u>	<u>CM</u>	<u>Inches</u>
10.16	4	40.64	16	6.35	0.250
15.25	6	45.72	16	6.35	0.250
20.32	8	50.80	20	6.35	0.250
25.40	10	60.96	20	6.35	0.250
30.48	12	76.20	24	7.92	0.312
35.56	14	76.20	30	7.92	0.312
40.64	16	76.20	30	7.92	0.312
45.72	18	91.44	30	9.53	0.375
50.80	20	91.44	36	9.53	0.375
60.96	24	106.88	42	12.70	0.500

- a. For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of Lee County, the Contractor shall comply with the regulations of said authority in regard to design, specifications and construction. State Highway casing installations shall be as specified in the FDOT, "Utility Accommodation Guide", and for railroads, the American Railway Engineering Association, Part 5, Section 5.2, "Specifications for Pipelines Conveying Nonflammable Substances", shall be applicable. However, in no case shall the minimum casing pipe diameter and wall thickness, for a specific carrier pipe size, be less than that specified above.
- b. Any boring and jacking operations shall be done simultaneously, with continuous installation under the roadway until casing pipe is in final position. Correct line and grade shall be carefully maintained. Add-on sections of casing pipe shall be full-ring welded to the preceding length, developing water-tight total pipe strength joints. All welding shall be completed by a certified welder. The casing installation shall produce no upheaval, settlement, cracking, movement or distortion of the existing roadbed or other facilities. Following placement of the carrier pipe within the steel casing, masonry plugs are to be installed at each open end. Said plugs shall be suitable for restraining the external earth load, while allowing internal drainage.
- c. Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The auger shall extend a minimum distance beyond the end of the casing pipe to preclude formation of voids outside of the pipe shell.
- d. The casing pipe shall be adequately protected to prevent crushing or other damage

under jacking pressures. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage. Should the casing pipe be damaged, such damage portion, if not in the hole, shall be replaced; however, if inserted, the encasement pipe shall be abandoned in place, suitably plugged, and an alternate installation made, as directed by the County.

- e. Required boring or jacking pits or shafts shall be excavated and maintained to the minimum dimension. Said excavation shall be adequately barricaded, sheeted, braced and dewatered as required, in accordance with the applicable portions of Section 5.4.C.12.

3. Carrier Pipe

Effluent reuse main carrier pipes to be installed within the specified casings shall be in accordance with 7.3 and the requirements of the installation permit. Pipe and fittings shall comply with the applicable provisions of these Standards. Special supporting of the carrier pipe within the casing shall be required with a design approved by the Department of Lee County Utilities.

Stainless steel carriers with Teflon skids, or The Booster Casing Spacers, being on center and restrained shall be the preferred method for installing the carrier pipe. Skids shall be installed 2.1 meters (7 feet), or less, on center. After the carrier pipe has been tested for leakage, the casing shall have the ends blocked with either a 20 cm (8") wall of brick masonry with a weep hole installed near the bottom of each wall or Cascade Model CCES End Seals with stainless steel bands.

G. Testing

1. Flushing

All effluent reuse mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall be at least 4 fps. Flushing shall be terminated at the direction of the Engineer. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

2. Hydrostatic Testing

All components of the effluent reuse distribution system, including fittings, connections and valves shall remain uncovered until tested and accepted; provided, however, that pipe trenches under traveled streets or roads may be backfilled with the permission of the Department of Lee County Utilities. No testing shall be done until all restraining joints are installed and/or all concrete thrust blocking is in place and set.

The Contractor shall perform hydrostatic testing of all effluent reuse distribution system as

set forth in the following, and shall conduct said tests in the presence of representatives from the County and other authorized agencies, with 48 hours advance notice provided.

Piping and appurtenances to be tested shall be within sections between valves unless alternate methods have received prior approval from the County. Testing shall not proceed until concrete thrust blocks are in place and cured, or other restraining devices installed.

All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

Hydrostatic testing shall be performed with a sustained pressure for a minimum of two (2) hours at 1,034 kPa (150 psi) pressure or 2-1/2 times working pressure, whichever is higher, unless otherwise approved by the Department of Lee County Utilities, for a period of not less than two (2) hours. Testing and passing results shall be in accordance with the applicable provisions as set forth in the most recent edition of AWWA Standard C600.

The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD}{P} \times \frac{1}{133,200}$$

Where,

L = Allowable leakage in gallons per hour;

S = Length of pipe tested in feet;

D = Nominal diameter of the pipe in inches;

P = Average test pressure maintained during the leakage test in pounds per square inch

For 1,034 kPa (150 psi), $L = (9.195 \times 10^{-5})SD$

The testing procedure shall include the continued application of the specified pressure to the test system, for the two (2) hour period, by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.

Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until results are within the established limits. The Contractor shall furnish the necessary labor, water, pumps, and gauges at specified location and number and all other items required to conduct the required water distribution system testing and perform necessary repairs.

H. Connection to Existing System

All connections to existing mains shall be made as authorized by the Owners of the existing system. Valves separating the mains being installed from existing mains shall be operated by or under the direction of said Owner's representative. The cost of the work in making the connections shall be paid for by the Contractor.

In the event the proposed main is to be connected to a main which has one or more active services between the point of connection and the first existing line valve, a temporary plug or cap shall be installed on the new main until the pressure tests are complete. Upon satisfactory completion, the cap or plug shall be removed from both mains and the connection made. The connection shall be made as swiftly as possible and any effluent reuse in the ditch shall be kept below the level of the pipe. The pipeline shall then be placed in service by the Owner's personnel.

In the event any existing customers will be without water while a connection is being made, the Contractor shall notify them 72 hours in advance when the effluent reuse water will be turned off and when he estimates service will be resumed. In some instances, these connections may have to be made at night. No customer shall be without effluent reuse service for more than 48 hours.

I. Planned Expansions

As the sewer system grows and the amount of water available for reuse increases, it will become necessary from time to time to expand the reuse distribution piping system to serve additional customers. Funding for such extension of the reuse distribution system will be provided from revenues of the wastewater system.

To determine the specific extensions to be constructed in any year, the Director will maintain a listing of potential reuse customers who have expressed interest in receiving service from the system. The listing is to include a calculation of the cost/benefit, (estimated gallons to be used divided by the costs of the required extension), for each of the potential customers. The cost/benefit will also include adjustments for such factors as: 1) the total number of customers to be served by the extension; 2) any contribution the potential customer wishes to make toward the construction cost; and 3) any storage of reclaimed water that the potential customer is willing to provide as a part of the project.

Annually, the Director will consider all potential customers and place them on the listing in priority order with the greatest cost/benefit being the number one priority. Extensions may be completed in any year depending upon the availability of reclaimed water and funding for the extensions. Actual projects to be constructed in any year will be determined starting with the highest priority and working down the listing until the available reclaimed water and/or funding is exhausted.