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## PART 3

# CITY OF LAKE WALES
## Water System Standards

## 3.1 General

Contractor shall furnish all labor, equipment, and materials and shall perform all operations in connection with installation of a complete water distribution system ready for use in accordance with the specifications and the City's requirements, either specific or implied. This includes any and all restoration required to duplicate original site conditions prior to the commencement of construction. All excavation, trenching and backfill for the installation of underground piping systems shall be conducted as specified hereunder. All standards cited shall be the latest edition at the time of project design. In addition, the installation of a jumper meter will be required for all new developments.

## 3.2 Submittals

One copy of the shop drawings shall be submitted to the City Utilities Department for review on all materials. The City retains the right to refuse any proposed substitution.

### 3.2.1 Plan Submittal

The Developer's Engineer shall submit signed, sealed and dated design calculations along with the WaterCAD or WaterGEMS based model with the plans for all water distribution projects (residential, commercial, or water main extensions) that will be City owned. Calculations shall show that the water mains will have sufficient hydraulic capacity to transport peak hourly flows, while maintaining a minimum distribution pressure of 40 psi, and the combination of maximum daily flows and fire flows, while maintaining a minimum residual pressure of 20 psi. A peak factor of 3.0 (peak hour) and 1.7 (maximum day) shall be utilized in the analysis. Friction losses through mains shall use a Hazen and Williams "C" value of 130 for all pipes. Minor head losses shall be incorporated in calculations including losses through meters, detector checks, and backflow prevention assemblies.

## 3.3 Design Requirements

### 3.3.1 Minimum Line Size

All new water mains shall be a minimum of eight (8) inches in diameter. Where water mains serve less than six lots and fire flow is not required, and there is no possibility of a future extension, the water main size may be reduced, at the discretion of the Utilities Department. All mains shall be looped for uniform flows throughout the system.

### 3.3.2 Looping of Distribution System

It is the City's policy that all new water lines shall be looped to minimize dead-end conditions and the need for flushing of the system. Wherever possible, lines shall be looped to provide at least two points of connection to the existing system. Where this is not feasible, as determined by the City Utilities Department, then easements and/or rights-of-way shall be provided to facilitate looping as future construction allows.

# 3.4 Products

### 3.4.1 Materials

(1) All materials shall be new, of first quality, manufactured in the United States (or Public Utilities Department approved equivalent), and conform to the appropriate AWWA standard, latest revision and be on the City of Lake Wales preferred item list.

(2) All materials in contact with potable water shall be certified to comply with National Sanitation Foundation (NSF) Standard 61.

### 3.4.2 Ductile Iron Pipe

(1) Ductile Iron is not acceptable for water mains within the City of Lake Wales, unless otherwise approved by the Utility Director.

### 3.4.3 Polyvinyl Chloride (PVC) Pipe

(1) Four- (4) inches diameter to twelve (12) inches diameter shall meet the requirements of AWWA C-900-89 with a minimum SDR of 18 (blue only).
(2) PVC pipe larger than 12 inches shall meet the requirements of AWWA C-905, with a cast iron pipe outside diameter. Pipe shall have a pressure rating of 165 psi, and shall have a SDR of 18 (blue only).
(3) Each length shall be clearly labeled so as to allow identification and specification conformance. Pipe shall bear the National Sanitation Foundation Seal for potable water pipe.
(4) All PVC pipe shall be blue in color.
(5) Connection for PVC water pipes 4" to 10” and larger shall be rubber compression ring type. Bell shall consist of an integral wall section with a solid cross-section elastomeric ring, which meets the requirements of ASTM D1869. Bell section shall be designed to be at least as strong as the pipe barrel.
(6) PVC water pipe two- (2) inches diameter and smaller shall conform to ASTM-2241 with an SDR of 21 schedule 40 equal or better.
(7) Tracer wire shall be blue #10 Copper Head High Strength (HS) wire with joint seal; all non-metallic pipes is required to have tracer wire.
(8) Caution tape should be placed 18” above the newly installed water line. The tape should be 3-in in width.

### 3.4.4 Polyethylene Water Service Tubing

Polyethylene tubing shall comply with PEP 3406 and ASTM Designations D-1248 (Materials), D-2737 (Tubing). Tubing shall be approved for potable water service by the National Sanitation Foundation and bear the NSF seal. The product shall be rated for a minimum working pressure of 160 psi and the standard dimension ratio (SDR) shall not exceed 9 for poly tube (blue only) size. Fittings shall be brass equipped with compression type connections, “Insta-Tite”, as manufactured by Mueller Company, Ford Company, or an approved equal.

### 3.4.5 Fittings

(1) All fittings shall be rated for not less than 150 psi working pressure.

(2) Malleable iron fittings shall be brass conforming to the applicable provision of Federal Specification WW-P-521D, Type II, and may be used in sizes two (2) inches and under only.

### 3.4.6 Gate Valves

(1) Gate valves two (2) inches and over shall be of the resilient wedge type epoxy coating on the interior and exterior and shall be in accordance with AWWA C509 with 0-ring type stem seal and two (2) inch square operating nut for buried services. Valves shall be mechanical joints unless otherwise noted and open left (counter clockwise). Gate valves for above-ground service shall be outside screw and yoke (OS&Y), rising stem type with cast iron hand wheels.

(2) All valves shall be American made; minimum 150-psi cold water rated and shall be cast with manufacturer's name and pressure rating.

(3) Underground valve identification (UVI) markers shall be provided at each valve location as shown in the details. Gate valves operation nut shall always be a depth of no more that 4-ft. In areas where depth of the operating nut is greater than 4-ft, allowances should be made to install extensions, to maintain the required 4-ft depth for easy accessibility.

### 3.4.7 Valve Boxes

Boxes shall be cast iron of standard design with adjustable drop section to fit disc or cover over valve. Interior diameter shall be not less than five (5) inches, with cast iron cover marked “WATER”. Provisions must be made to install water main and service line markers on top of curb for easy identification. Valve box shall have a 24”x 6” circular slab and 2” P200 NFG Test Box for tracer wire with end cap. A valve tag to be added showing the valve size and number of turns on it.

### 3.4.8 Fire Hydrants

Shall be in compliance with AWWA C502 and the following requirements-

(1) Dry barrel compression type.
(2) O-ring seal at operating nut stem and means for lubrication.
(3) Traffic model with flangible sections at ground line.
(4) Open left (counter clockwise).
(5) Two-2 1/2 inch hose nozzles and one 4 1/2 inch pump nozzle with National Standard threads.
(6) Main valve openings shall be not less than 5 1/4 inches.
(7) Paint shall be one (1) coat primer and two (2) coats finish to match City standard.
(8) Pipe outlet shall be six- (6) inch mechanical joint.
(9) Operating nut shall be pentagonal.
(10) All hydrants shall be installed plumb and in true alignment with the connection pipe to

the water main and must not exceed 10 feet from the mainline. A minimum of 18" clearance shall be provided between hose nozzles and finish grade. The 4 ½" steamer nozzle connection shall face the road.

(11) Acceptable are American Darling Hydrant B84B-5, Mueller Centurion A-423 or Kennedy K-81D. (No substitutes)

(12) Flow test required. Flow testing may be performed by contractor in the presence of the Fire Marshall. If city staff is required to complete the flow test, the contractor will be charged at the rate of $150.00 per hydrant.

(13) Fire hydrant shall be installed to grade.

(14) Not all hydrants will require a sample point; determination will be at the discretion of the Utilities Director.

(15) There shall be no trees, shrubs, etc. planted around the fire hydrants, gate valve clusters, and any existing or newly installed water mains.

### 3.4.9 Valves and Hydrants

(1) Set valves on solid bearing.

(2) Extension stems shall be provided on all valves where the operating nut is more than three feet below finish grade, with sufficient extension to place the operating nut between 24 and 36 inches below finish grade. Provide approved stem guides in valve boxes.

(3) Center and plumb valve box over valve. Set box cover flush with finished grade. In unpaved areas, pour a circular concrete pad 24" x 6" around the valve box.

(4) Prior to installation all hydrants should be inspected for direction of opening, nozzle threading, operating nut and cap-nut dimensions, tightness of pressure containing bolting, cleanliness of inlet elbows, handling damage and cracks. The contractor asserting the inspection must submit a report.

(5) Set hydrants plumb and locate pumper nozzle facing the roadway.

(6) Hydrants shall be set at the bury line with a minimum of 18" clearance from the hose connection to finish grade. The breakaway must NEVER be buried.

(7) At each hydrant a control valve (normally shall not exceed 10 ft.) shall be attached directly to the water main by a gland, swivel tee, or a tapping saddle as approved by the City and must face away from the road to prevent any incidents in case of a break. Exceptions to the 10 foot rule will be handled on an individual basis by the Utilities inspector or by the Utilities Director.

(8) Hydrants shall be painted in accordance with City requirements.

(9) All valves, hydrants, and major interconnections must be GPS identified.

(10) Privately maintained hydrants shall have a base hydrant color of red. Publicly maintained hydrants shall have a base color of yellow.

(11) NO trees are to be planted within 25 feet of a potable water main.

(12) Where hydrants and water meter services fall at the same location the water meter services shall be installed on the property line and the hydrant will be installed a minimum two (2') from the water meter services.

### 3.4.10 Marking of Hydrants

(1) Marking of hydrants should always include hydrant number for easy identification.

(2) Classifications of Hydrants: Hydrants should be classified in accordance with their rated capacities as follows:

a. Class AA-Rated capacity if 1,500 GPM or greater.
b. Class A- Rated capacity of 1,000-1,499 GPM.
c. Class B- Rated capacity of 500-999 GPM.
d. Class C- Rated capacity of 499 GPM or less.

(3) Hydrant Color Code: All hydrant barrels are to be painted safety yellow (B54437 6401-44358)(Sherwin-Williams industrial enamel paint). The top and nozzle caps should be painted with the following capacity indicating color to provide simplicity consistency.

a. Class AA- Light blue (B54T104 7969-9993)
b. Class A- Green (B54T01104 4085 SAFETY GREEN)
c. Class B- Orange (B54E39 617-4056)
d. Class C- Red (B54R38 6174064

### 3.4.11 Steel Pipe Sleeves and Carrier Pipe

(1) All construction projects requiring steel sleeves shall conform to the minimum D.O.T requirements for roadway crossings. Railroad crossings shall conform to railroad requirements. The following casing sizes shall be used for the corresponding carrier pipes:

| CARRIER PIPE (Normal OD.) | STEEL CASING (Required Dia.) |
|---|---|
| 6" | 12" |
| 8" | 16" |
| 10" | 20" |
| 12" | 24" |
| 16" | 36" |
| 20" | 40" |

(2) Casing pipe shall be steel and conform to the requirements of AWWA Standard C-200.
(3) Joints shall be butt welded in accordance with requirements of AWWA Standard C-206.
(4) The pipe shall be coated externally with coal-tar primer followed by hot coal-tar enamel in accordance with AWWA Standard C-203.

### 3.4.12 Air-Release Valves

Shall be constructed with cast iron body and cover, stainless steel float and Buna rubber seat. All interior parts shall be stainless steel or bronze. Shall be Model No. 200 as manufactured by Apco Valve and Primer Corporation, Schamburg, IL, or Clow Style 5401. The Utilities Department shall size valves, as required.

### 3.4.13 Pressure Reducing Valves

**(1)** Pressure reducing control valves with return flow feature (2-way flow)

The valve shall be the Ames model 910-17 (Globe) or 910-17 (Angle) pressure reducing control valve with return flow feature as manufactured by Ames Company, Inc.

**(2)** Combination Pressure reducing and sustaining control valve.

The valve shall be Ames 912G (Globe) or 912A (Angle) combination pressure reducing and sustaining control valve as manufacture by Ames Company, Inc.

**(3)** Pressure Reducing Control Valves

The Valve shall be 910G (Globe) or 910A (Angle) as manufactured by Ames Company, Inc. or approved equal.

**Note: All pressure reducing valves shall be supplied with inlet and outlet pressure gauges.**

### 3.4.14 Meter boxes

The contractor shall supply and install meter boxes to finish grade. All boxes must be located at property corner and within the right-of-way; boxes must not conflict with sidewalks or driveways. The City shall determine type and size of meter box.

Where there is a double service there shall be a one (1) foot separation between meter boxes. The one (1) foot shall be measured from edge of meter box to edge of meter box.

Where meter boxes and hydrants fall at the same location the water meter box and service shall be installed on the property line. The hydrant to be installed three (3) feet from the water meter box service.

### 3.4.15 Corporation Stops and Curb Stops

Units shall be brass, equipped with connections compatible with the connection service pipe type, in accordance with AWWA Standard C-800. Corporation stops shall be B4-777W-NL, as manufactured by the Ford Meter Box Company (Ford or Mueller). Curb stops for double services shall be Catalog Number UVBS43-42W and for single services shall be Catalog Number B43-342W. All curb stops shall be furnished with provisions for locking**. Barrel locks must be supplied and installed at the developer's expense. When the project is complete the developer/contractor shall deliver the barrel lock's key to the City's Utilities Department. The barrel lock shall be INNER-TITE E-S5001 and the key for the barrel lock shall be INNER-TITE E5008. A red plastic weather cap for the barrel lock shall be supplied. The red plastic weather cap shall be INNER-TITE E-0018R.**

### 3.4.16 Backflow Preventers

(1) The backflow shall be of the reduced pressure type, with shut-off ball valves provided at each end, and shall comply with the applicable provisions of AWWA Standard C-506.

(2) Minimum backflow device on any irrigation applications shall be a (PVB) Pressure Vacuum Breaker or better.

(3) Adhere to Florida Department of Environmental Protection (DEP) minimum set for degree of hazard.
(4) The use of freeze plugs on backflow preventers is at the option of the developer/installer.

**3.4.17 Expansion Joints**

Pipe expansion joints shall be suitable for the applicable service with a minimum of 150-psi working pressure and shall be Style No. 500, as manufactured by Mercer Rubber Company, or approved equal.

**3.4.18 Flanged Coupling Adapters**

Units shall be manufactured by Smith-Blair, South San Francisco, California, Ford Meter Box Company or approved equal. Model Numbers shall be Type 912, for pipe sizes to 12"; and Type 913, for larger sizes; and shall be compatible with ANSI Standard, 125 lb. flanges.

**3.4.19 Cast Couplings**

Units shall be as manufactured by Ramco Industries Inc., Bothell, Washington or approved equal, as follows: Alpha – wide range, two-bolt pipe coupling with built in restraint.

**3.4.20 Tapping Sleeves**

Sleeves shall be stainless steel, tapping sleeve with MJ outlet with outlet flange. Units shall be manufactured by Smith-Blair, South San Francisco, California, Model No. 655 or approved equal.

**3.4.21 Crosses**

Crosses are not permitted in the distribution system.

**3.4.22 Service Saddles**

Saddle shall be double strap all stainless steel.

# 3.5 Installation

**3.5.1 Preparation** - Remove scale and dirt, on inside and outside, before assembly.

**3.5.2** Pipe and Fittings

(1) Trenches shall be maintained in a dry condition at all times unless otherwise approved by the City's Inspector.

(2) Upon completion of all testing, the water main must be cleaned by means of pigging to remove debris. Two pigging swabs, both one size larger than the installed pipe shall be inserted at the jumper connection as shown on the City's water detail standard.

(3) Water and sewer piping separation shall be 18 inches.

(4) Install pipe to indicated elevation to within tolerance of 5/8 inches. Minimum cover shall be 36-inches unless otherwise stipulated or authorized by the City.

(5) Extra digging must be done to remove hard pan soils and clean loose dirt brought in before installing new mains to prevent main line breaks due to compaction.

(6) Route pipe in straight line, except as noted. Deflections from a straight line or grade are not allowed, except with fittings.

(7) Install pipe to allow for expansion and contraction without stressing pipe or joints.

(8) Install sample points in accordance with Department of Health (DOH) standards in order to properly disinfect a new water system.

(9) All fittings, valves and plugs shall be restrained; thrust blocks are not authorized.

(10) A blue-coated #10 copper head high strength (HS) solid tracer and joint seal shall be installed along all pipe and up to meter services. Tracer wire shall be taped to the pipe and stubbed up at all hydrants and valves.

(11) Pipe shall be laid in a level trench. Hand trim excavation for accurate placement of pipe to elevations indicated. The width of trenches for installation of all lines shall be in accordance with the pipe manufacturer recommendations, OSHA safety requirements, and all applicable codes. Trench widths shall not be less than necessary for safe and proper construction. Where required, excavation support systems shall be provided.

(12) Installation and restoration operations under roads, shoulders or other level areas shall be performed in compliance with the City, County or State requirement, which ever may apply.

(13) Every effort shall be made to cover pipe ends during installation and a watertight plug or other approved seal must be used when installation is not in progress.

(14) The inspector, to minimize public inconvenience or danger to life or property, may limit length of an open trench on existing roads.

(15) At the completion of pipe installation, contractor must pig lines to clean and remove any foreign debris from water main prior to doing disinfection.

### 3.5.3 Service Lines

(1) Water installation shall include service stubs at alternate lot lines or other locations as required by the City Utilities Department. **Meter boxes must be provided by developer and installed to finish grade. All meter boxes must be located at the property corner in the right-of-way outside of sidewalks and driveways**.

(2) A gate valve shall immediately adjoin to the main connection. Valve boxes are required in all cases. The termination of service shall be at the meter box with curb stop.

(3) Services shall not exceed 10-ft from meter. Meters should generally be placed at the front property corners. All services must branch off from a 2” minimum tap into the main.

(4) Road crossing services shall be run diagonally to the respective property corners to avoid having valves in driveway.

(5) A blue-coated #10 copper head high strength (HS) solid tracer and joint seal shall be installed along all pipe and services. Tracer wire shall be taped to the pipe and stubbed up at all hydrants and valves. Warning tape 3" in size must be laid at least 18" above pipe.

(6) The City will install all meters at the Developer's expense. Developer's contractor will be responsible for the installation of meter fittings as illustrated in the City's details.

(7) Construction plans shall include a typical meter installation for each size meter to be installed. (See City details) Where applicable, developer shall provide dual metering to accommodate potable water service separate from irrigation. The proper sizing for service lines is the responsibility of the Developer's Engineer. Meters will be available in the following sizes ¾", 1", 1-1/2", 2", 4" and larger sizes as necessary. Each meter will require a meter box to be installed at finished grade away from roadways, sidewalks, and driveways by the Developer's contractor.

(8) All above ground meter assemblies must be painted blue except for brass fittings of the meter.

### 3.5.4 Meter Set Expectations

**Meter Installation Requirements:**

(1) Address must be clearly marked on the permit box.
(2) Domestic and Irrigation services must be exposed and accessible.
(3) Domestic and Irrigation water services area must be at or near final grade.
(4) Service lines must be pressurized.
(5) Before a meter can be set, the builder is responsible for having the meter box installed and ready for the meter to be fitted.
(6) Meter installation are must be free from trash, clutter, building material, debris, or any other obstruction that would prevent meter installation.
(7) Location of sidewalk and driveways must be clearly marked.
(8) Builder is responsible for silt barriers, meters, assembles & boxes until home closing.
(9) Home builder is responsible for adjustments of meter to final grade.
(10) Service lines serving multi-family and multi-tenant commercial properties must be connected to the meter vaults, each line in the vault must be individually marked with unit it will be servicing.

If the meter cannot be set because any of the items listed above are not in place, a **Failed Meter Set Fee** shall be assessed as follows:

Single family lots
$ 100.00 per visit
Commercial and multi-family projects with 8 meter or less (VAULT):
$100.00 for the first meter
$ 50.00 for the second meter
$ 25.00 for the next six meters
Commercial and multi-family projects with 8+ meters:
$300.00 per building

### 3.5.5 Connections to Existing Lines

(1) All connections to any existing City water main must be scheduled with 48 hour notice and witnessed by City of Lake Wales staff at the developer's expense.

(2) Where connections are required to be made between new mains and existing water mains, the connection shall be made in a thorough and workmanlike manner using proper materials, fittings, and labor practices to suit the existing materials and conditions. Work must be performed by contractor under the observation of the Utilities Inspector or other assigned City employee.

(3) Where a connection is made to an existing fitting, the contractor shall schedule his work so that the excavation and location of this existing fitting can be completed prior to starting trench work on the line.

(4) **The Contractor under the direction of the City shall do all taps to existing lines in the presence of the City's Utilities Inspector or other assigned City employee.**

(5) Whenever it is required to interrupt existing water supplies to residences or businesses, the contractor shall notify all concerned parties or agencies at least 72 hours in advance of such cut-off. Contractor must first obtain approval from the Director of Utilities.

(6) Saddle taps shall be pressure tested to 150 psi for a minimum of 15 minutes.

(7) Any water main connection work must be done under the observation of the Utilities Inspector or other assigned City employee.

### 3.5.6 Terminations

No distribution line shall be terminated without a gate valve and flushing device, approved by the Utilities Director, at the developer's expense.

### 3.5.7 Jacking and Boring

The boring and jacking operations shall be done simultaneously with correct line and grade carefully maintained for the casing. Holes for casing shall be done with an auger mounted inside the pipe with the auger extending a short distance beyond the lead end of the pipe to preclude caving. Excavation for jacking pits or shafts shall be in accordance with the applicable section of these specifications. Carrier pipe shall have mechanical joints or push-on joints with field lock gaskets followed by 1390 restrainer for pipes 4-inches through 12-inches to prevent damage to either carrier or casing pipe. Ends of the casing pipe shall be sealed with Thunderline Link-Seal after installation of carrier pipe. All road crossings must have a MJ gate valve on each side of the road.

### 3.5.8 Directional Bores

Refer to Part 2 of City of Lake Wales Standards.
HDPE shall be allowed on a case by case basis. Approval shall be obtained from the Utilities Director or a designated representative.

### 3.5.9 The CONTRACTOR shall <u>NOT</u> perform any boring work on Fridays.

# 3.6 TESTING

**3.6.1** **A 48-hour notice must be provided to the City prior to testing**. The water line testing must be witnessed by **both** the City of Lake Wales representative and the engineer. The City will **not** be present if the engineer's representative is not also present. The engineer of record must prepare the required test form. After installation is completed, the system shall be filled with water and flushed at the highest obtainable velocity and at the furthest points. Velocity must be at least 2.5 feet per second. All air must be expelled. A pressure of at least equal to the City's existing system **(150 PSI)** shall be maintained for a period of two (2) hours. Flushing of the system and control of the connecting valve shall be under the observation of the City's inspector or other assigned City employee. All connections and pipe for fire service shall be flushed prior to entering the structure. Flushing must be accomplished by partially opening & closing valves and hydrants several times under expected line pressure. No flushing shall take place through backflow preventers. Should the system appear tight, the leakage test may begin.

**3.6.2** Testing shall conform to AWWA C600.

(1) Testing continuity of tracer wire must be done in the presence of the City's Utilities Inspector.
(2) Hydrants shall be flow tested at contractor's expense. They must also be painted to the National Fire Standard color code before final acceptance.
(3) Engineer must provide contractor with completed testing form. The City is not required to provide this to the contractor.

**3.6.3** Hydrostatic Testing requirements shall conform to AWWA C-600-93 for ductile iron water mains & AWWA C-605-94 for PVC Pipe water mains.

**3.6.4** The contractor will pump his lines to a pressure equal to or greater than 150 psi. Test period shall be two hours.

**3.6.5 HDPE TESTING**

The test procedures consist of two steps; the initial expansion and the test phase.

After the pipe has been joined, fill it with water and carefully bleed off any trapped air. Subject the pipe to a pressure of 150 psi and check for any leaks. Fill the pipeline with water after it has been laid; bleed off any trapped air. Subject the lowest element in the system to a minimum test pressure of 150 psi, and check for any leakage. When test pressure is applied to a water filled pipe, the pipe expands. During the initial expansion of the pipe under test, sufficient make-up water must be added to the system at hourly intervals for 3 hours to maintain the test pressure. After about 4 hours, initial expansion should be complete and the actual test can start.

When the test is to begin, the pipe is full of water and is subjected to a minimum test pressure of 150 psi. The test phase should not exceed 2 hours, after which time any water deficiency must be replaced and measured. Add and measure the amount of make-up water required to return to the test pressure and compare this to the maximum allowance.

**NOTE:** If specified by the engineer, pressure testing may be conducted prior to pipe installation. It shall be the responsibility of the contractor to ensure that appropriate safety precautions are observed during hydrostatic testing above ground.

# 3.7 DISINFECTION

**3.7.1** Before any portion of the newly installed system can be placed in service, all mains and appurtenances shall be thoroughly disinfected and tested. A licensed representative of the City must be present to witness chlorination and bacteriological sampling.

**3.7.2** Procedures to be used shall conform to AWWA Standard C-651 -92. Pertinent requirements are as follow:

(1) Chlorine solution shall be added to ensure a 50-PPM residual in all portions of the system. Inspectors may designate points where residual is measured.

(2) Retention time shall be not less than 24 hours.

(3) A minimum 25-PPM chlorine residual must remain at the end of the 24-hour period.

(4) Chlorine may be used in the following forms:

(a) Liquid chlorine mixture through an approved solution-feeding device.

(b) Sodium Hypo chlorite in a packaged liquid form with 5% to 15% available chlorine.

(c) Calcium Hypo chlorite in a dry form (powder) with 80% available solution such as HTH or Perchloron.

**3.7.3** After the disinfection process has been completed; all lines shall be thoroughly flushed to a condition equal to the normal base residual.

**3.7.4** Copies of satisfactory bacteriological analysis (a.k.a. Main Clearance) must be taken within 45 days of completion of construction, from representative points within the distribution system to be cleared. Samples shall be taken on two consecutive days at least 24 hours apart with sample location and chlorine residual readings clearly indicated on report (AWWA 651).

Such sample points should include:

1. One set of samples from every 1,200 feet of the new water main.
2. One set from the end of the line (each line).
3. One set from each branch.
4. One set from connection of proposed to existing.

**3.7.5** A Letter of Clearance will be required from the Polk County Health Department before the City will provide service.

# 3.8 WARRANTY

**All portions of the installed water system and site restoration shall be fully guaranteed against material defects of improper workmanship for a period of one year from acceptance by the City. During this time, repairs will be made by the developer at no cost to the City. Any repairs made on the newly installed system by the City during this period will be charged to the developer.**

# 3.9 AS-BUILTS

The engineer of record, or such Registered Engineer as may apply, shall submit to the City three sets of certified "As-Built/Record Drawing" (Blueprint) sized 24" x 36"and one set on electronic media compatible with the City systems shall be provided to the Utilities Department for the water system. The "As-Built" shall contain a certification from a registered Engineer in the state of Florida that indicates that the project has been substantially completed in accordance with the approved plans and specifications, or that the deviations noted on the "Record Drawings" will not prevent the project from complying with the design function of the project.

In order to effectively comply with this requirement, it would be necessary for the certifying Engineer to have provided periodic review and inspection of the installation of those facilities within the project. The Engineer may supplement his review and inspection of the project by utilizing information taken from a valid survey. **The "As-Built/Record Drawings" shall provide information on project facilities that indicates sufficient horizontal and vertical dimensional data in state plane coordinates so that the constructed improvements may be located and delineated.** All dimensions both horizontal and vertical shall be placed on the "As-Built/Record Drawings" and certified by a Professional Surveyor or Mapper and Professional Engineer before submitting to the City.

**"As-Built/Record Drawings" that contain disclaimers that essentially render the Professional Engineer's certification meaningless will not be accepted.**