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**6.01 Preliminary Considerations**

All public water main extensions shall be designed by a professional engineer registered in the state of North Carolina and shall be approved by the Department of Environmental Health and Natural Resources, Division of Environmental Health. All designs shall comply with the Town of Apex specifications and "Rules Governing Public Water Systems."

All water main extensions and distribution facilities which connect to the water distribution system of the Town of Apex shall be considered as public facilities up to the metering point. Therefore, all such facilities must be installed in public street right-of-way or centered within an easement, having a width of not less than 20 feet. No plantings or structures are allowed within water easements.

Where water main extensions are proposed, the extension shall terminate at the furthestmost property line fronting the property. Where deemed necessary to enhance water flow and/or pressures in the effected area, this extension may be required to be "looped" to an existing water main within the area being developed.

Where water mains "dead end" or are terminated for future extension, at least one 18-foot joint of ductile iron pipe shall be installed with a thrust collar, main line valve, and blow-off assembly. The "dead end" water main shall terminate within a right-of-way or dedicated easement where required by the DPW.

Proposed connections to existing "dead ends" may require upgrading or looping of existing line to satisfy the Water System Facilities Plan.

Ductile Iron Pipe (DIP) shall be used for all water mains. Restrained Joint Ductile Iron

Pipe shall be used at all stream, wetland, and other areas as determined by the DPW.

Where public water mains are installed within easements crossing private property, the TOWN'S Public Works Department shall have the right to enter upon the easement for purposes of inspecting, repairing or replacing the water mains and appurtenances. Where paved private streets, driveways, parking lots, etc. have been installed over the public water mains, the Town of Apex shall not be responsible for the repair or replacement of pavement, curbing, etc. which must be removed to facilitate repairs. The Public Works Department shall excavate as necessary to make the repair, and shall backfill the disturbed area to approximately the original grade. Replacement of privately owned pavement, curbing, walkways and any other private infrastructure shall be the responsibility of the property owner or Homeowner's Association.

For any work involving temporary interruption of water service, service shall not be interrupted for more than 4 hours.

## **6.02 Design**

### **a. Location:**

Water mains shall be located either in the north or east side of the street pavement.

Water mains shall be laid at least 10 feet laterally from existing or proposed sewers. Where local conditions prevent a separation of 10 feet, the water main may be laid closer, provided that the elevation of the bottom of the water main is at least 18 inches above the top of the sewer.

Where a water main and a sanitary sewer cross, and the vertical separation is less than eighteen (18) inches, both the water main and sewer shall be ductile iron pipe, equivalent to water main standards for a distance of 10 feet on each side at the point of crossing. The water line pipe section shall be centered at the point of crossing. A water line shall not pass under a sewer line.

### **b. Cross Connection Control In The Water Distribution System:**

No facility may connect to the Apex water distribution system prior to approval from the DPW. The installation of an approved reduced pressure zone back-flow preventer and/or double check valve assembly will be required. These devices will be of manufacture and models approved by the State of North Carolina, and the Southern California Foundation for Cross Connection Control and Hydraulic Research.

All existing and proposed water services as well as all dedicated fire and irrigation lines must be equipped with an approved back-flow prevention device. For projects having any combination of these lines, suitable approved devices must be provided to contain or "isolate" each level through containment.

Approved double check valve assemblies shall be installed above ground or inside of the building, as long as there are no unprotected taps between the main and the building. Double check valves may also be permitted in below ground vaults provided test cocks are piped above ground.

An approved dual check valve must be installed at the meter service on residential service lines. OS & Y shut-off valves shall be used on all fire lines and back-flow prevention devices (2-inch and larger) and each back-flow preventer will have approved test cocks.

"Processed water" is water where extra chemicals are added by the user on site to reduce freezing, pipe corrosion, etc. If a fire line or domestic service is connected to any "processed water" source, or booster pump system, back-flow protection shall be provided by using the USC approved Reduced Pressure Zone (RPZ) type device. Fire lines require a reduced pressure detector assembly, with detector meter. This RPZ device shall include gate valves and test cocks, and meet the requirements of AWWA C-506-78. If the RPZ is 2.5-inches or larger, then it must be supplied with OS & Y shut-off valves. The unit shall be within an above ground vault or inside of the building.

If the back-flow preventer is located on site for fire lines, it shall be located outside of the structure. All internal or confinement devices (isolation) will have strainers upstream of the device with the exception of devices for fire lines.

**c. Back-flow Prevention Devices**

Only devices approved of manufacture and models approved by the State of North Carolina, and the Southern California Foundation for Cross Connection Control and Hydraulic Research shall be used within the limits of the Town of Apex.

All devices 0.75" to 2" must have a ball valve that is full port with a blow-off proof stem, resilient seats, and a 400 psi WOG rating (water, oil or gas). All devices 2.5" to 10" must have fusion bonded, epoxy coated resilient wedge valves. All test cocks must have approved ball valves of the appropriate size.

Back-flow prevention devices shall be tested and certified when they are installed. In order to have an additional water meter installed, the CONTRACTOR should contact the Public Works Department. All back-flow devices must be tested and re-certified on a yearly basis. Maintenance must be performed for all rubber parts every 5 years. All testing and maintenance must be performed by certified personnel. All certifications shall be sent to the DPW.

All back-flow prevention devices must be installed above ground, and in the horizontal position.

All back-flow prevention devices shall be installed with a minimum clearance from the vault floor of 12-inches and a maximum clearance of 60-inches. There shall be a minimum 18-inch clearance around all devices. Drainage shall be provided; 2 times the diameter of the device (4-inch minimum).

**d. Fire Flow Requirements:**

All water distribution system extensions shall provide water pressures and fire flows at a standard acceptable value for the applicable zoning requirements. Fire service lines shall be sized so that a minimum residual pressure of 20 psi can be maintained in the Apex water distribution system.

One- and two-family dwellings having a fire-flow calculation area which does not exceed 3,600 square feet require a minimum fire flow of 1,000 gallons per minute. One- and two-family dwellings that exceed 3,600 square feet in fire-flow calculation area and all other buildings require a minimum fire flow as specified in the 2006 North Carolina Fire Code, Appendix B, Table B105.1, with a minimum of 1,500 gallons per minute. Fire walls without openings, constructed in accordance with the International Building Code, may be used to create separate fire-flow areas.

Fire flow requirement may be reduced up to 50 percent when the building is provided with an approved automatic sprinkler system installed in accordance with the International Fire Code.

**e. Size of Mains:**

- 1) All water distribution system extensions shall conform with the current Water System Facilities Plan.
- 2) Residential Zoning Districts - Water mains shall be 6-inch and 8-inch minimum in residential districts. Six-inch shall be used only where it completes a good grid, but in no case in blocks of more than 600 feet in length. Maximum lengths of 6-inch and 8-inch lines without connection to a larger feeder main are 1200 feet and 2000 feet, respectively. Water distribution facilities for Multi-Family Units, Apartments, Condominiums, and Townhouse Developments shall comply with the provisions for Business, Commercial, and Industrial Zoning Districts indicated below.
- 3) Business, Commercial, and Industrial Zoning Districts - Water mains shall be 8-inch and 12- inch minimum. Eight-inch shall be used only when it completes a good grid and the maximum length of 8-inch lines without connection to a larger feeder main is 1,200 feet unless special approval for deviation from this requirement is granted by the DPW.

**f. Fire Hydrants:**

- 1) All fire hydrants shall be installed on a minimum 6 inch water line. Only one fire hydrant may be installed on a 6-inch line. Multiple hydrants require an 8-inch water line, or greater. Each hydrant leg shall be installed at a 90° angle with respect to the main water line; no bends in hydrant legs shall be permitted. No water services shall be permitted on hydrant legs.
- 2) In all residential districts, there shall be a fire hydrant located at each street intersection. The maximum distance between fire hydrants in these districts, measuring along public street centerlines and/or private travel ways, shall be 500 feet. On group housing projects, all parts of the building shall be within 300 feet of a fire hydrant, based on the actual ground distance outside the building perimeter. For single-family residence projects, a hydrant shall be located at the end of each cul-de-sac.
- 3) In all business, commercial, office and institutional, shopping center, multi-family, mobile home and industrial districts there shall be at least one fire hydrant at each street intersection. The maximum distance between fire hydrants in these districts, measuring along public street center lines and/or private travel ways shall be 300 feet. If a building is completely equipped with a fire sprinkler system and the project is developed with a private water distribution system all parts of the building should be within 300 feet of a hydrant. Hydrants positioned greater than 50 feet from the public water main shall occur on looped water main.
- 4) All premises, where buildings or portions of the building are located more than 300-feet (commercial) or 500-feet (residential) from a fire hydrant, shall be provided with approved on-site fire hydrants and water mains capable of supplying the fire flow required by the Fire Department. Hydrants must also be within 50' of any fire department connection.
- 5) A clear level space of not less than 10 feet shall be provided and maintained on all sides of a fire hydrant for immediate access. Clearance from the ground surface to the steamer nozzle shall be between eighteen (18) inches and twenty-four (24) inches.
- 6) All fire hydrants shall be initially tagged "NOT IN SERVICE". This tag shall not be removed until approved by the Inspector.

**g. Valves:**

Valves shall be installed at the connection to existing water mains, on all branches from feeder mains, and on hydrant branches according to the following schedule:

<i>Location</i>	<i>Number of Valves</i>
Cross Intersection	3 valves
Tee Intersection	2 valves
Hydrant Branch	1 valve

Main line valves on straight runs between intersections shall be spaced at interval distances not exceeding the following:

<i>Main Size</i>	<i>Maximum Spacing</i>
6"	600'
8"	900'
12"	1200'
16"	1600'

Gate valves shall be used for water mains through 12-inch size. For water mains 16-inch and larger, butterfly valves may be used. Valves shall be Mueller or approved equal.

Where fire service lines from the public distribution system are required, each fire line shall have an isolation valve located within the public right of way or appropriate easement. The valve type for a fire service line shall be a Post Indicator Valve as illustrated in Detail 6.16.

**h. Services:**

- 1) General – No services shall be located on hydrant legs or dedicated fire lines. Each dwelling unit, whether attached or detached, shall be metered. Gang meters are not allowed for single family residences. The only exception to this metering requirement shall be in the case of apartment buildings or multiple commercial units within a single building where metering of individual dwelling units may be impractical.

Water services shall be extended from the main to a meter box located within the street right-of-way or within an easement. The installation of the tap, service line, and meter box shall be the responsibility of the DEVELOPER or the property

owner, and shall be performed in the presence of the INSPECTOR. Water service supply line shall be continuous from the water main to the meter, no connections or joints are allowed, up to and including 2-inch services.

- 2) Multiple Meters - Multiple meters on branched services are acceptable for multi-family projects, providing they conform with the following table:

<b><i>Size Of Individual Service (Meter)</i></b>	<b><i>Size Of Feeder Service</i></b>	<b><i>No. Of Branches</i></b>
3/4" **	3/4"	2
3/4"	1"	3
3/4"	1 1/2"	5-10
3/4"	2"	11-20

**\*\* For individual irrigation system meters only**

All multiple meter installations shall conform to the standard detail drawing and shall contain a curb stop on the feeder line. The curb stop shall be buried and shall be equipped with a curb box. Refer to Detail 6.15.

- 3) Meter installation - The Town of Apex shall provide and install the water meters subject to the following conditions:

- The TOWN has received a copy of the waterline purity test results and the PROJECT ENGINEER'S certification.
- The DEVELOPER (or property owner) has paid all acreage fees.
- The DEVELOPER (or property owner) has paid prescribed meter fee.
- The DEVELOPER has installed all specified improvements or guaranteed their installation as prescribed in the TOWN Code

**i. Looping to Existing Water Mains:**

New water mains in cul-de-sacs or dead-end streets shall be extended or "looped" to existing mains in adjacent streets when, in the opinion of the DPW, it is practical to do so in order to enhance flow and pressure in the affected area.

**j. Private Irrigation Systems:**

No private irrigation system shall be installed within the public right-of-way or any public easement without an encroachment agreement. An approved yard hydrant may be installed within the median centerline of a divided roadway section if indicated on the proposed construction plans. Yard hydrant locations and quantities are subject to approval of the DPW. All yard hydrants shall be metered per Apex standard policy.

Irrigation systems shall be installed utilizing an approved back-flow prevention device for high hazard applications.

Trench drains shall be required around any irrigated median and subdivision or site entrance.

**6.03 Materials**

**a. General Requirements - Water Distribution Mains:**

All water mains to be installed within the jurisdictional limits of the Town of Apex shall be ductile iron pipe, restrained joint ductile iron pipe, or ball-and-socket pipe.

**b. Ductile Iron Pipe:**

All ductile iron pipe shall be designed as per AWWA Standard C150. Pipe shall be manufactured in accordance with all applicable requirements of AWWA Standard C151.

Pipe Diameter	Depth of Cover	Pressure Class
6-8 -inch	3-20* feet	350 psi
10-12 -inch	3-14 feet	350 psi
14-20 -inch	3-10 feet	250 psi
≥ 24 -inch	3 - 8 feet	150 psi

Pipe joints shall be of the push-on type as per AWWA Standard C111. Pipe lining shall be cement mortar with a seal coat of bituminous material, all in accordance with AWWA Standard CI04.

Ductile iron pipe shall be furnished in 18 or 20 foot lengths.

**c. Hydrants:**

Fire hydrants shall be of the compression type meeting AWWA standards, designed for a minimum working pressure of 250 psi.

All hydrants shall be equipped with two 2.5 inch nozzles and one 4.5 inch pumper

nozzle. Each nozzle shall be bronze with cast iron caps secured thereto with a suitable steel chain. Nozzles shall have National Standard threads.

The hydrants shall be open-left and equipped with a pentagon-type operating nut (National Standard) measuring 1.5 inches from point to flat. Hydrants shall be of the "dry top" type with the upper rod threads completely enclosed in a sealed grease or oil chamber, equipped with "O-ring" seals and a Teflon thrust bearing.

The hydrant valve opening shall be of sufficient size to insure such flows and corresponding minimum losses as set forth by the American Water Works Association. The minimum valve opening shall be 4.5 inches.

The hydrants shall have a 6-inch shoe or boot, mechanical joint. Hydrants shall have bronze to bronze threads provided between the hydrant seat or seat ring and the seat attaching assembly. The hydrant shall be of the "safety" type so that, if the upper barrel is broken off, the hydrant valve will remain closed and reasonably tight. All hydrants shall be furnished with a barrel and a maximum of one stem extension as required by the final field location to provide a nominal minimum bury of 3 feet, 6 inches (3'-6"). No more than one extension may be installed on any single fire hydrant (i.e., two six-inch extensions shall be replaced with a single one-foot extension); furthermore, the cost of removal and replacement of extensions shall be borne by the Developer.

### **Special Restraint Systems for Fire Hydrant Installation**

In lieu of reaction blocking for fire hydrants, hydrants shall be installed with an approved special restraint system. Special restraints shall be Mueller Aqua-Grip, Grip Ring, Mega-Lug, or approved equal. Such restraints shall be individually integral to the fire hydrant shoe, the fire hydrant shutoff gate valve, and/or the tapping valve such that the special restraint system, in whole or in part, adequately restrains the entire hydrant service leg back to the water main. Special restraints shall be constructed of ductile iron and provide full circumferential engagement to the ductile iron pipe. Such special restraints shall have a minimum working pressure of 250 psi with a minimum Factor of Safety of 2:1. Restraints shall be supplied with inspection 'break nuts' that shear upon the attainment of proper installation torque. Restraints that 'point load' around the circumference of the pipe will not be allowed without restraint gland and rodding.

#### **d. Gate Valves:**

- 1) 12-inch and smaller - Gate valves 12 inches and smaller shall be designed and manufactured in accordance with AWWA C-500, or of the resilient wedge type conforming to AWWA C-509. They shall be designed for a working pressure of 250 psi. They shall be open-left, non-rising stem, cast or ductile iron body, double disc, parallel seat, fully bronze, mounted and equipped with "O-ring" seals and a standard 2-inch square operating nut. Valve ends shall be mechanical joint.

- 2) 16-inch and larger - Gate valves 16 inches and larger shall be designed for a working pressure of 250 psi. Sixteen-inch gate valves shall meet all other requirements as stipulated above for valves 12-inch and smaller. Gate valves larger than 16-inch size shall be manufactured and supplied with other special features, such as gears and by-pass, etc., as may be required by the DPW.
- 3) Tapping Valve - All tapping valves shall conform to the Standard Specification for gate valves, 12 inches and smaller, as noted above, except that the inlet end shall be flanged, faced and drilled per ANSI B16.1 for 125 lb. standard. The outlet end shall be of the mechanical joint type capable of receiving a standard tapping machine.
- 4) All gate valves shall be resilient seat gate valves. All gate valves to be furnished by the CONTRACTOR shall be new and must comply with the specification AWWA C509-87 or latest specification. All valves used must be the same make. The end connections of all gate valves furnished shall be mechanical joints conforming to ANSI Specifications A21.11-85 (AWWA C111-85) or latest specification. The valves shall be nut operated, non-rising stem and shall open left. The stuffing box shall be equipped with "O-ring" seals. They will have iron bodies, and be fully bronze mounted.

**e. Butterfly Valves:**

Butterfly valves may be used in lieu of gate valves for water mains 16-inches or greater if approved by the DPW.

Butterfly valves shall meet or exceed AWWA Specification C-504 for Class 150-B, latest revision.

Valve bodies shall be of close grain cast iron conforming to ASTM Designation A-126, Class B.

Valve disc shall be cast bronze or cast iron with bronze or stainless steel sealing surfaces. The disc shall have adjustable stops preset by the factory and the seats shall be natural rubber.

Butterfly valves shall be open-left, manually operated with the operator assembly meeting all requirements of Section 12, AWWA C-504. Operating torque's shall comply with Table 1 of AWWA C-504 for Class 150-B valves. Valves shall have mechanical joint ends and a 2-inch square operating nut, unless otherwise indicated on the approved project drawings.

All butterfly valves shall be installed within a 5' diameter manhole encasement per Detail 6.17 of these specifications.

**f. Valve Boxes:**

Valve boxes and covers shall meet the requirements of Section 5.03e of these Specifications for Gray Iron Castings. All valve boxes shall be of the screw-adjustable type equal in quality and workmanship to East Jordan Iron Works or US Foundry. Valve boxes shall be cast from close-grained gray iron, in three pieces consisting of a lower base piece, upper part and cover. The lower base piece shall be flanged at the bottom to fit around the valve and shall not rest on the valve bonnet. The upper part shall also be flanged on the lower end and of such size as to telescope over the lower part with the upper end cast on the upper surface in raised letters the word "WATER." Valve Boxes shall be painted prior to shipment with a coat of protecting asphaltic paint.

**g. Tapping Sleeves:**

The tapping sleeves shall be the split type, ductile iron or stainless steel body, mechanical joint, designed and manufactured for a minimum working pressure of 250 psi. Ductile Iron tapping sleeves shall be Mueller H-615, Rockwell 622 or Romac 55T304. Stainless Steel tapping sleeves shall be JCM 432 or 452, or Romac SST III. The tapping sleeve branch shall be flanged and manufactured in such a manner as to assure proper alignment with the flanged inlet end of the tapping valve. The drilling of the branch flange shall correspond to that of the inlet flange of the tapping valve.

Tapping sleeves shall not be used when connecting pipes of equal diameter. They shall be installed in accordance with the manufacturer's instructions and only on clean, defect free pipe. Tapping sleeves shall be installed no closer than 4 feet from any other fitting or joint along the main to be tapped. Prior to tapping the water main, the sleeve branch shall be pressure tested with 80 psi of air for a minimum of 5 minutes. Any indication of leakage (loss of air pressure) shall require the sleeve to be removed and inspected for defects. After the sleeve is verified free of defects, the sleeve shall be re-installed and re-tested. The contractor shall provide the Inspector with a torque-wrench for verification of bolt installation within the manufacturer's specified torque range.

Tapping sleeves for PVC and AC pipe shall be stainless. Sleeves for pit cast pipe shall be ductile iron.

**h. Tapping Saddles:**

Tapping saddles may be used in lieu of tapping sleeves on mains 16 inches and larger. Saddles shall be made of ductile iron providing a factor of safety of 2.5 with a working pressure of 250 psi. Saddles shall be equipped with an AWWA C110 flange connection on the branch. Sealing gaskets shall be "O-ring" type, high quality molded rubber having approximately 70 durometer hardness, placed into a groove on the curved surface of the saddles. Straps shall be alloy steel.

**i. Blow-Off Assemblies:**

Blow-off assemblies shall be constructed in accordance with Detail 6.04.

**j. Iron Fittings**

Iron fittings shall be ductile iron, all bell, mechanical joint, conforming to the following specifications:

3" - 16" Size - Standard fittings - AWWA C110, latest revision, or Compact Fittings - AWWA C153, latest revision

18" - 48" Size - Standard fittings - AWWA C110, latest revision

Mechanical Joint - AWWA C111

Inside Lining - Cement mortar with bituminous seal coat - AWWA C104

**k. Air Release Valves**

Air release valves shall be placed at all crest locations wherein an elevation change of 10 feet or greater is incurred.

**l. Water Service Accessories:**

- 1) General Requirements - Direct taps without saddles may be permitted to ductile iron pipe in accordance with the following table:

<b><i>Main Size (DIP)</i></b>	<b><i>Maximum Size Of Direct Tap — DIP</i></b>
8" and larger	2"
6"	1 ½"

Service connections larger than 2" shall be made by means of a tapping sleeve and valve.

All water service tubing shall be Type K copper. Material shall not vary from water main to water meter yoke. Polyethylene or other plastic service tubing will not be permitted.

All new water services shall be equipped with a dual check valve which shall be located immediately downstream of the meter.

All water meters shall register in gallons.

Multiple meters may be installed in accordance with Detail 6.14.

Upon request of the DPW and prior to beginning work, the CONTRACTOR shall furnish samples of service accessories to the DPW for approval and to demonstrate compliance with these Specifications. Samples shall include saddles, corporation stops, meter setters, meter boxes, etc.

- 2) Service Saddles - Service saddles shall be all bronze with double bronze straps and with a neoprene "O-ring" gasket attached to the body. The outlet shall be AWWA tapered threads for direct connection to the corporation stop.
- 3) Corporation Stops - Corporation stops shall be designed and manufactured in accordance with AWWA Standard C800, latest revision. Corporation stops shall be equipped with an AWWA standard tapered thread on the inlet end and a compression nut on the outlet end for connection to flared copper tubing. The stops shall be fully shop tested for leaks with air pressure under water.
- 4) Copper Service Tubing - Copper tubing shall be Type K soft copper tubing conforming to ASTM Standard B88.
- 5) Meter Setters & Accessories for 3/4" & 1" Services - Meter setters shall be copper, 12" high with lockable angle meter stop and angle dual check valve.
- 6) Meter Setters & Accessories for Services larger than 1" - shall be as shown on Detail 6.02 or Detail 6.03, as applicable.
- 7) Meter Boxes for 3/4" and 1" Services - shall be rectangular, constructed of high density polyethylene (black). Depth shall be 18 inches minimum. Inside dimensions of top shall be 10 inches by 15 inches minimum. Lids shall be constructed of high density polyethylene (black). Lids shall be solid, and compatible with Itron Model 50W-2 Pit ERT. Lids may be designed with internal housing for the ERT device, or with bracket mount. Boxes and lids shall meet AASHTO H10 load bearing capacity. The CONTRACTOR shall submit manufacturer's specifications for all proposed boxes and lids to the ENGINEER for approval prior to installation.
- 8) Meter Boxes for Services larger than 1-inch - shall be as shown on Detail 6.02 or Detail 6.03, as applicable.
- 9) Meters - 5/8" X 3/4" through 1" - for residential and small commercial service shall be supplied by the TOWN.

## **6.04 Installation of Water Mains, Fittings, Valves & Appurtenances**

### **a. Abandonment of Existing Water Mains:**

Existing water lines located outside road sections shall be removed. All materials and labor shall be provided by the contractor. Any new connections shall be performed by the contractor.

### **b. Unloading & Storage of Materials:**

The unloading and loading of pipe, fittings, valves, and related accessories shall be performed with care so as to avoid any damage to these materials. All such materials shall not be stored directly on the ground, but shall be on pallets, or other suitable supports, so as to prevent the entry of mud and debris into the pipe or other materials. CONTRACTORS shall also endeavor to store these materials in accordance with any special practices as may be recommended by the manufacturer.

### **c. Trench Excavation:**

Water main trenches shall be excavated to such depth that the pipe will have a minimum cover of 3 feet. Where water mains are installed in new subdivision streets, the depth of cover shall be measured from the finished subgrade.

Trench width shall be a minimum of 16 inches plus the outside diameter of the pipe and a maximum of 24 inches plus the outside diameter of the pipe, unless approval for deviation from this requirement is granted by the ENGINEER.

Where water main trench excavation is in rock, the rock shall be excavated to a minimum depth of 6 inches below the bottom of the pipe. This space shall be filled with screenings or other material approved by the ENGINEER. Rock excavation requirements for water mains shall conform to requirements outlined hereinafter in Section 7.05(c).

In trenches where water is present or where dewatering is required, the trench bottom shall be stabilized with No. 67 or No. 57 stone. When material of poor supporting value is encountered in the trench, it shall be removed and replaced with No.67 or No.57 stone or other material approved by the ENGINEER.

All water main trenches shall be protected from the entrance of surface water. Any water observed in the trench shall be promptly removed by pumping, provided that water pumped from trenches is directed to suitable erosion control devices to prevent deposition of sediment into nearby streams, ponds, etc. The CONTRACTOR shall use all means necessary to prevent the entrance of water, including the construction of temporary berms or dikes.

**d. Pipe Installation:**

General - All water main pipe shall be clean before installation. Any dirty pipe shall be thoroughly swabbed by the CONTRACTOR. Pipe showing evidence of oil or grease contamination shall not be used.

Pipe laying and jointing shall be accomplished in strict accordance with the recommendations of the pipe manufacturer and TOWN Specifications.

Open ends of the pipe shall be plugged with a mechanical fitting at all times that pipe laying is not in progress.

Bell ends shall generally face the direction of laying. Where water mains are installed on an appreciable slope, the ENGINEER may require that the bell ends face upgrade.

**e. Pipe Bedding:**

The barrel of the pipe shall bear uniformly upon the supporting trench bottom at all times. The foundations of ductile iron pipe shall conform to the minimum requirements described below.

Ductile Iron Pipe - shall rest on a firm and stable flat bottom trench with bell holes excavated such that the pipe rests uniformly on its entire barrel length.

**f. Backfilling:**

All water mains shall be backfilled in accordance with the Detail 7.01 as applicable and compacted so that the pipe is properly supported in accordance with the pipe manufacturer's recommendations and TOWN Specifications.

No rocks, boulders, or stones shall be included in the backfill material for at least 2 feet above the top of the pipe. In traffic areas, the final backfill shall be placed and compacted in 6-inch layers. Backfill shall be of such density as to ensure no settlement of the trench. A compaction test performed in traffic areas and certified by a licensed Professional Engineer shall be submitted at the CONTRACTOR'S expense. Organic material shall not be permitted for backfill.

Should any water line trench exhibit settlement, the CONTRACTOR shall correct the deficiency to the complete satisfaction of the ENGINEER. Where a water line is in or crosses existing State roads or other public roads, the backfill shall be compacted to at least 95% standard density as measured by AASHTO Method T-99. Where deemed necessary, the ENGINEER shall require compaction tests to be performed (at the CONTRACTOR'S expense) on backfill placed in trenches across such roads.

For permitted open-cut water main extensions and/or tie-ins, the ENGINEER may require that "flowable fill" be used for backfill material. If required, 1 foot of approved natural backfill material shall be compacted over the water main per Apex Specifications, the remaining excavated trench shall be backfilled with "flowable fill". Within seven (7) days after the excavation has been filled, the open-cut area shall be repaired per Detail 3.13.

**g. Setting Valves & Valve Boxes:**

Valves shall be set at locations shown on the plans with care being taken to support the valve properly and to accurately position the valve box over the operating nut of the valve. Where pavement is existing, the box shall be adjusted to finished street grade. When valves are located in street right-of-way, but out of pavement, the boxes shall be adjusted to finish grade and a concrete collar 2-foot square and 6-inches thick shall be poured around the box ½-inch from the top of the casting, in lieu of the poured in place concrete a pre-cast concrete collar may be used such as manufactured by Brooks, Inc. or Buckhorn Products.

When valves are located outside of street right-of-way, the boxes shall be adjusted 6 inches above the finished grade, and a concrete collar 2-foot square and 6-inches thick shall be poured around the casting.

**h. Setting Fittings:**

Fittings shall be installed at the location indicated on the drawings with care taken to insure that joints are fully homed and that the fittings are fully and properly supported.

**i. Reaction Blocking:**

Fittings shall be blocked to solid, undisturbed earth with concrete. This reaction blocking shall be of sufficient size to prevent the fitting from blowing off the main at maximum test pressure, and as indicated in Detail 6.13 of these Specifications. All blocking shall be placed so that the pipe and fitting joints will be accessible for repairs.

All dead end lines shall be plugged and anchored by using ductile iron pipe, thrust collars and blocking as indicated in Detail 6.10 of these specifications.

**j. Setting Blow-Offs:**

Blow-offs shall be installed on all dead end lines as noted on the plans. The blow-off assembly shall be constructed in accordance with Detail 6.04.

**k. Setting Hydrants:**

Fire hydrants shall be installed at all points indicated on the drawings and in strict

accordance with Detail 6.05.

#### **6.05 Installation of Steel Casing Pipes by Boring & Jacking**

The installation of steel casing pipe across designed roadways, railroads, etc. for the placement of water mains shall conform to the specifications presented in Section 7.16 of these Specifications. Carrier pipe shall be restrained joint ductile iron pipe.

#### **6.06 Cutting & Replacement of Existing Pavements**

The open cutting of existing pavements may be permitted for water line installations across designated Town streets and State maintained roadways. The cutting and replacement of such pavements shall conform to Detail 3.13.

#### **6.07 Water Service Connections**

Water services shall be installed using only the materials as specified herein under Section 6.03.

Taps shall be made only on lines under pressure and after the main has been tested and chlorinated. No taps on dry lines shall be allowed, unless specific authorization is obtained from the DPW.

Taps shall be installed at an angle of 45 degrees to the vertical axis of the water main. Direct taps shall only be made in accordance with the provisions of Section 6.03 hereof.

Water service lines from the main line to the metering point shall be a continuous run with no intermediate connections and/or joints.

Services larger than 2-inches shall be made by using a tapping sleeve and valve. Each service shall be flushed and disinfected after installation, all to the complete satisfaction of the ENGINEER. The CONTRACTOR shall have the same responsibility for disinfection of service laterals as required for mains.

#### **6.08 Water Meter Installations**

Water meter installations shall conform to Details 6.01, 6.02, and 6.03 for meter sizes through 4-inch.

Installations larger than 4-inch shall require a special detail and are subject to the review and approval of the DPW on a case by case basis. Such installations shall be made using ductile iron pipe, complete with bypass line. The installation may be similar to that required for a 4-inch meter except that the vault size shall be increased accordingly.

## 6.09 Hydrostatic Testing

No valve in the existing Town of Apex Water System shall be operated without a Town representative present.

A section of line to be hydrostatically tested shall be slowly filled with water at a rate which will allow complete evacuation of air from the line. The line shall be tested to a pressure of 200 psi as measured at the lowest elevation of the line for a duration of 2 hours. The pressure gauge used in the hydrostatic test shall indicate in increments of 50 psi or less and shall have been calibrated within the last 12 months. At the end of the test period, the leakage shall be measured with an accurate water meter. All lines shall be filled from the lowest elevation. Tests shall include fire hydrants and water line valves.

Pipe size and the corresponding allowable leakage (gal.) per 1000 feet of pipe are as follows:

<i>Pipe Size</i>	<i>Allowable Leakage Per 1000 ft. (gallons)</i>
6"	1.28
8"	1.70
12"	2.56
16"	3.40
20"	4.24
24"	5.10

All visible leaks are to be repaired regardless of the amount of leakage.

## 6.10 Disinfection

All additions or replacements to the Apex water system shall be chlorinated before being placed into service. Such chlorination must take place under the supervision of an INSPECTOR. The utility CONTRACTOR performing the chlorination of the main shall be responsible for any health or environmental damage that might occur as a result of his operations.

Chlorination of a completed line shall be carried out in the following manner:

- a) Taps will be made at the control valve at the upstream end of the line and at all extremities of the line including valves. The taps shall be strategically located so as to allow HTH solution to be fed into all parts of the line.

- b) A solution of water containing high-test hypochlorite (70%) available chlorine shall be introduced into the line by regulated pumping at the control valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of 50 ppm total chlorine immediately after chlorination. The chart below shows the required quantity of 70% HTH compound contained in solution in each 1000 feet of line to produce the desired concentration of 50 ppm.

<i>Pipe Size</i>	<i>Pounds Of High Test Hypochlorite (70%) Per 1000 ft. Of Line — To Produce 50 ppm</i>
6"	0.88
8"	1.56
10"	2.42
12"	3.50
16"	6.22

The HTH solution shall be circulated in the main by opening the control valve and systematically manipulating hydrants and taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate in order that a uniform concentration will be produced in mains.

HTH solution shall remain in lines for no less than 24 hours. Extreme care will be exercised at all times to prevent the HTH solution from entering existing mains.

#### **6.11 Bacteriological Sampling**

Free residual chlorine after 24 hours shall be a least 10 ppm, or the ENGINEER will require that the lines be re-chlorinated.

Flushing of lines may proceed after 24 hours, provided the free residual chlorine analysis is satisfactory. Flushing shall be continued until an orthotolidine check shows that the lines contain only the normal chlorine residual.

Within 24 hours after flushing is complete, the CONTRACTOR shall collect samples for bacteriological analysis, under direct observation of an INSPECTOR. The CONTRACTOR is responsible for the delivery of the sample(s) to a testing laboratory certified by the NC Department of Human Resources, Division of Health Services. The CONTRACTOR shall furnish the ENGINEER with a copy of the results prior to tapping any services.

In the event that three successive bacteriological tests fail, that section of the main shall be re-chlorinated by the CONTRACTOR and new tests performed prior to moving to the next section of the main.