

# POTABLE WATER MAINS

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## PART 1 GENERAL

### 1.1 SECTION INCLUDES

- A. Furnishing of all plant, labor, equipment, appliances and materials, and in performing all operations in connection with the construction of the water mains, including valves, hydrants, and appurtenant structures, complete and in strict accordance with the specifications and drawings.
- B. Setting of line stakes for all water mains, as required. Layout work to utilize points previously established by the OWNER as shown on the Drawings. Consult with the OWNER on any problems encountered. Approved construction plans as well as record drawings for all projects must include both plan and profile view of main and appurtenances. Intervals on line staking/pipe markers for survey purposes to establish profiles shall be no less than 100' apart in sub-divisions, and no less than 200' apart in rural areas.

### 1.2 RELATED SECTIONS

- A. Section 02110 - Site Clearing and Grubbing
- B. Section 02111 - Site Protection and Restoration
- C. Section 02200 - Earthwork
- D. Section 02511 - Flowable Fill
- E. Section 02664 - Water Distribution System Design Guidelines
- F. Section 02670 - Water Main Testing and Acceptance
- G. Section 02675 - Disinfection of Potable Water Mains
- H. Section 02900 - Erosion Control
- I. Section 02936 - Seeding

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. Materials used in the work to conform to the current specifications of the American Society for Testing Materials (ASTM), Section C of the American Water Works Association (AWWA) Standards, the American National Standard Institute (ANSI), and Commercial Standards (CS).
- B. Only new materials shall be used in the construction of potable water mains and their associated appurtenances.
- C. All water distribution pipe materials are to be lead free for all projects entering into contract with BCWS on or after January 1<sup>st</sup>, 2013. The term "lead free" means (1) not containing more than 0.2% lead when used with respect to solder and flux; and (2) not more than a weighted average of 0.25% lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.
- D. All chemicals and products added to the public water supply must be third party certified as meeting the specifications of ANSI/NSF Standard 60.
- E. All materials and products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61.
- F. Do not use lubricants that may support microbiological growth for slip-on joints. Do not use vegetable shortening to lubricate joints.
- G. Do not use natural rubber or other material which may support microbiological growth for any gaskets, O-rings, or other products used for jointing pipes, setting meters or valves, or other appurtenances that may provide exposure to potable water.
- H. The use of asbestos cement pipe is prohibited in the construction of potable water systems.
- I. The use of butterfly valves less than 16" in size is not permitted without specific approval from BCWS on a case by case basis. Butterfly valves shall meet the requirements of AWWA C504.

## 2.2 DUCTILE IRON WATER PIPE AND FITTINGS

- A. Conform to AWWA C150 (ANSI A21.50), pressure class 350 for 4" to 12" diameter and pressure class 250 for 14" to 20" diameter, except as otherwise noted; and AWWA C151 (ANSI A21.51).
- B. Concrete Lining: In accordance with manufactures' specifications.
- C. Exterior Coating: Coal tar pitch applied in accordance with Sec. 51-8 of AWWA C151 (ANSI A21.51). All standards, latest revision.
- D. Pipe Joints:
  - 1. Provide mechanical joints where indicated, with necessary accessories, conforming to AWWA C111 (ANSI A21.11). Provide gasket composition suitable for exposure to potable water.
  - 2. Provide push-on joints where the joint type is not indicated, with necessary accessories, conforming to AWWA C111 (ANSI A21.11). Provide gasket composition suitable for exposure to potable water.
- E. Fittings: Ductile iron, manufactured in accordance with AWWA C110 Class 350; or compact ductile iron, manufactured in accordance with AWWA C153 Class 350; provide with concrete lining in accordance with manufactures' specifications.
- F. Fittings to be bituminous coated and designed to accommodate the type of pipe used.
- G. Pipe Markings: Pressure rating, net weight of pipe without lining, length of pipe, and name of manufacturer clearly marked on each length of pipe.
- H. Polyethylene Encasement: Provide encasement for all ductile iron piping using flowable fill (roadway open cuts) and any other areas where corrosive soil exists when ductile iron piping is used.

## 2.3 POLYVINYL CHLORIDE (PVC) WATER PIPE

- A. 14" to 48" Diameter: Conform to AWWA C900 Standard for PVC pipe, with cast iron pipe equivalent outside diameters, class 235 (DR 18).
- B. 4" to 12" Diameter: Conform to AWWA C900 Standard for PVC pipe, with cast iron pipe equivalent outside diameters, Class 235 (DR18).

- C. Smaller Than Four Inch Diameter: Conform to ASTM D1784 and D2241. Schedule 80 PVC.
- D. Joints: Join by means of a push on bell joint which is to be an integral part of the barrel in conformance with AWWA C900. Provide gasket composition suitable for exposure to potable water.
- E. Fittings for PVC Pipe Less Than Four Inch Diameter: PVC conforming to the material requirements for PVC pipe described herein.
- F. Fittings for PVC Pipe Four Inch Diameter and Larger: Mechanical joint conforming to paragraph 2.2(E) of this Section. Provide gasket composition suitable for exposure to potable water.
- G. Pipe to bear the National Sanitation Foundation seal of approval. Comply with the requirements of Type I, Grade I of the ASTM resin specification D-1784. Certificates of conformance with the foregoing specifications to be furnished with each lot of pipe supplied.
- H. PVC water mains shall be blue in color.

#### 2.4 POLYETHYLENE WATER SERVICE TUBING

- A. Service Tubing shall be 1" copper tubing size (CTS) polyethylene plastic tubing (PET) suitable for underground water services, in conformance with ASTM D2737 (PE 3406), with a rated working pressure of 160 psi. For dual service installation use 1" CTS tubing between service tee and meter box.
- B. Fittings shall be in conformance with AWWA C901.

#### 2.5 GATE VALVES (TWO INCH AND LARGER SIZE)

- A. Minimum design working pressure of not less than 200 p.s.i. and a test pressure of not less than 400 p.s.i.
- B. Valve body, bonnet, stuffing box, and disc castings to be manufactured of ASTM A 126 Class B gray iron, with resilient seated design conforming to AWWA C509, interior coating conforming to AWWA C550, and non-rising stems. Provide "O" ring seals.
- C. End Connections: Provide mechanical joint end connections for buried applications.

- D. Valve Manufacturer and Type: Please see Appendix F29 BCWS Approved Parts List.
- E. Furnish one two inch square operating nut with each valve.
- F. Operation: Valves to open with counterclockwise turns.
- G. Provide a concrete protector ring for each valve box location.
- H. Valve Boxes:
  - 1. Two piece telescopic type with cast iron frames and covers as shown on the drawings.
  - 2. Valve boxes to have a suitable base that does not damage the pipe, and shaft extension sections to cover and protect the valve, and to permit easy access and operation.
  - 3. Valve boxes to be of suitable length for the bury depth and to provide a cover of not less than 3 1/2 feet over the pipe. PVC C900 risers are allowed when depth of cover exceeds 7' on operational valves and may be used at any depth for tracer wire dummy valve box installations. The minimum thickness of metal of the valve box at any point shall not be less than 3/16 inch.
  - 4. Manufacturer and Type: Please see Appendix F29 BCWS Approved Parts List.
  - 5. BoxLok or Valve Box Adaptor II product required on all gate valves for box alignment/stabilization. Butterfly Valve Adaptor required on all butterfly valves. See Appendix F29 BCWS approved parts list.
- I. Provide a concrete valve marker post placed behind valve for each location of mainline valve boxes in rural areas. Distance and direction (arrow) from valve shall be brass stamped on top of marker. When applicable, provide a curb marking to indicate valve location with a "V" when located in non-rural areas such as neighborhoods. See section 2.11 for marking specifications.
- J. Install a gate valve on a 2" service line in lieu of a corporation stop.
- K. Any valve installed at a depth of 6' or greater will require at least a 2' valve extension to be installed and locked on during installation of valve. Before any valve extension is installed, product must be reviewed and approved by BCWS for installation.

## 2.6 BUTTERFLY VALVES (SIXTEEN INCH AND LARGER SIZE)

- A. Butterfly valves are only allowed on water mains 16" in diameter or larger. Concrete valve markers are required on all butterfly valves with brass stamp indicating gear ratio/number of turns/direction of turn for open/close identified as well as arrow pointing to direction and distance to valve from marker. Adaptor brand or approved equal for Butterfly Valves must be installed on all valves for stabilizing/aligning valve box.

2.7. CASING PIPE

- A. Steel casing for water distribution mains installed under highways and railroads shall conform to AWWA C200 and SCDOT Utility Accommodations Policy, latest revision. Exterior of the pipe shall be coated with coal tar epoxy coating or bituminous coating. For water services, BCWS may require 2" poly/PVC casing under cul-de-sacs, areas where services are extended longer than normal or when crossing under piped drainage. Other areas may require casing as called out on approved plans.
- B. All joints shall be butt welded unless otherwise shown on the Drawings.
- C. Casing Spacers:
  - 1. Provide stainless steel band casing spacers.
  - 2. Pipe dunnage will not be used.
- D. End Seals:
  - 1. Provide flexible end seals with stainless steel bands, or
  - 2. Use brick and mortar to seal the ends.
- E. Minimum wall thickness for steel casing pipe shall be as follows:

D.I./PVC Carrier Pipe (Restrained Joint) Nominal Diameter (Inches)	Casing Pipe (Welded Steel) Nominal Diameter (Inches)	Casing Pipe (Welded Steel) Nominal Thickness (Inches)
6	12	0.188
8	14	0.188
10	16	0.188
12	18	0.250
14	20	0.250
16	24	0.281
18	30	0.312
20	36	0.344
24	36	0.375
30	42	0.469

Note:

1. Casing pipe specifications and carrier pipe clearances are more stringent for railroad crossings.
2. For piped drainage crossings, downsizing of casing will be considered and accepted by BCWS on a case by case basis as long as load bearing capacity is reviewed and determined by Design Engineer. Steel casing is not required when crossing above piped drainage. DIP shall be used when crossing over piped draining with less than 3' of cover.

## 2.8 FIRE HYDRANTS

A. Conform to AWWA C502.

B. General:

1. Provide with compression type shutoff and mechanical joint inlet connection.
2. Provide with two 2 1/2" hose nozzles (NST threaded) and one 4 1/2" pumper nozzle (NST threaded). Nozzle caps to be chained to the hydrant.
3. Hydrant operation: Hydrants to open by turning counterclockwise.
4. The fire hydrant is to be of a dry barrel, dry top design; Provide for a bury depth as shown on the Drawings, with a two piece cast safety flange and stem coupling that breaks cleanly when struck. The main valve on the hydrant to remain closed, should the hydrant nozzle section be broken off by a traffic accident.
5. Hydrant valve opening: 4-1/2 inches.
6. The hydrant shoe to have a protective, thermosetting epoxy coating applied inside the assembly.
7. Provide restrained joint assembly as indicated on the Drawings.
8. Install blue reflector in paved roadways to identify the location of fire hydrants. Reflectors to be of the type approved for the intended purpose by the SCDOT and meet applicable standards. Reflectors shall be in the center of the travel lane on the hydrant side of the highway.
9. No hydrant extensions are allowed unless approved by BCWS. Install a height adjustable assembly as specified in the hydrant details.
10. Gradelok assembly or equal required unless otherwise specified by BCWS.

C. Manufacturer and Type: Please see Appendix F29 BCWS Approved Parts List.

D. Hydrants to be marked with the name of the manufacturer, size of the valve opening, and the year of manufacture, all in accordance with AWWA C502.

- E. Interior Factory Coating: Electrostatically-applied, fusion-bonded, epoxy coating in accordance with AWWA C550.
- F. Exterior Factory Coating:
  - 1. General: Electrostatically-applied, fusion-bonded, epoxy coating in accordance with AWWA C550.
  - 2. Base factory color: Standard Red.
- G. Hydrants shall be painted Standard Red. Use two coats of an epoxy coating approved by the manufacturer for field painting. Fire hydrants privately maintained and owned shall be painted in a different color other than standard red or have a color scheme that identifies them as part of a private water system.

## 2.9 RESIDENTIAL AND SMALL BUSINESS SERVICE CONNECTIONS

- A. All service connections shall include physical connection to the existing water piping for each residence or small business. All service connections shall be placed at the appropriate property corner. Contractor shall ensure that this stub out connection is within 18" of the property corner marker of the lot being served. For townhome projects or projects with minimum green space between driveways for utility placement, BCWS requires 3' minimum green space on property line location within BCWS easement for installation of utilities.
- B. Service Saddles: Minimum tap size – 1". Please see Appendix F29 BCWS Approved Parts List. Use 1" stainless steel saddles on 2" water mains for service connections.
- C. Corporation Stops: Minimum size – 1". Shall be pressure rated at 300 psi. Please see Appendix F29 BCWS Approved Parts List.
- D. Curb Stop: 18" before the grip joint tee. Please see Appendix F29 BCWS Approved Parts List.
- E. Insert Stiffener: Please see Appendix F29 BCWS Approved Parts List.
- F. Single Service Installation: Install 1" 160 PSI CTS polyethylene tubing (PET) at the property corner. Install a curb stop at the end of the CTS tubing.

- G. Dual Service Installation: To split 1" CTS polyethylene plastic tubing (PET) to serve two customers, Use 1"x1"x1" joint tee for CTS PET. Install 3' of 1" CTS PET on both side of the grip joint tee to allow for BCWS meter box installation.
- H. Meter: All meters regardless of size installed on BCWS system must be a Radio Read meter manufactured by Sensus to be complete with a lid.
- I. BCWS will accept the responsibility of programming the meter transceiver unit (Flexnet) and recording the longitude and latitude.
- J. Pressure Regulator: When required, Watts Series N35B Water Pressure Regulator. No substitution.
- K. Irrigation service shall be installed on its own tap and not combined with other potable water service connections unless otherwise specified and approved by BCWS. This applies to residential, small business and commercial irrigation services. A backflow assembly is required and specified in section 2.10.

## 2.10 BACKFLOW PREVENTION

- A. Conform to Berkeley County Ordinance governing Cross Connection and Control.
- B. All meters 1" or greater shall have a backflow assembly installed. All backflow prevention assemblies are required to be RP devices unless otherwise specified and approved by BCWS. All meters larger than 2" shall be installed above grade as part of the backflow assembly as identified on BCWS details. Designated fire protection lines with no domestic water connections, non-foaming fire suppression systems, or pumper systems can be evaluated for double check valve backflow prevention protection. Hard cover freeze protection is required for all backflow assemblies 2" and smaller. Soft bag covers are allowed on the larger than 2" assemblies, however if they are damaged or not performing as designed during the 2 year warranty period will be required to be replaced. Please see BCWS approved parts list Appendix F29.
- C. All backflow assemblies regardless of size shall be installed above ground and within 3' of meter location for 2" and below services and combined with above ground assemblies for larger than 2" meters. See BCWS details for specifics. Effective 1 July 2006, BCWS no longer accepts vault installations.

- D. All backflow assemblies shall meet SCDES specifications for the applicable application.
- E. Only a Reduced-Pressure Assembly or a Pressure Vacuum Breaker Assembly shall be allowed on lawn irrigation system (both residential and commercial).
- F. Fire sprinkler lines will need to be evaluated at the time the construction prints are reviewed. A determination of the type of assembly being installed shall be made at that time and be included on the construction prints.
- G. No permanent structures, shrubs or plants shall be implemented within 5' of any size/type of installed meter or backflow device unless specifically approved by BCWS. BCWS is not responsible for replacing if damaged during maintenance of device unless BCWS authorized placement within utility easement.
- H. Fire service lines no longer require metering. Reduced-Pressure Assembly is required and connections to BCWS water mains require the backflow assembly size to match the tie-in valve size. Freeze protection required on all BFDs upon final inspection by BCWS Operations staff.

## 2.11 MARKER

- A. Line Marker: Provide Composite Utility Markers, Model Number CUM 375 as manufactured by Carsonite, Carson City, Nevada. Markers to be 66" in length (1'-6" BURY) and 3.8" in width, blue with notation "CAUTION WATER PIPELINE". Additional notation to include "BEFORE DIGGING OR IN CASE OF EMERGENCY CALL BCWS (843) 572-4400.
- B. Valve Marker: Provide 4"x4"x5' reinforced precast concrete monument to mark each water distribution valve. Cast the letters "WV" into the monument and attach a brass plate on top with distance and direction of the valve. Install valve markers behind the valves and within the R/W or general utility easement.
- C. Service Marker Stake: Provide 2"x4" treated yellow pine stake, 4' in length maximum (18" bury maximum) to mark the end of service connections without meter boxes.

- D. Mark curb with “/” for location of each water service. Orientation of slash marks shall be in the same direction for each service. Markings shall be stamped and no more than ½” deep, located on top of the curb. Markings shall not be located too close to an existing joint in the curb and shall not extend across the whole curb/gutter section. Markings shall line up with each service for locating purposes.
- E. Mark curb with “V” for locations of valves. Markings shall be stamped and no more than ½” deep, located on top of the curb. Markings shall not be located too close to an existing joint in the curb and shall not extend across the whole curb/gutter section. Markings shall line up with each valve for locating purposes.

#### 2.12 TAPPING SLEEVE

- A. Please see Appendix F29 BCWS Approved Parts List.

#### 2.13 CUT-IN SLEEVE AND VALVE

- A. Please see Appendix F29 BCWS Approved Parts List.

#### 2.14 Tracer Wire

- A. Place continuous 12-gauge insulated solid copper tracer wire over all water mains and with all water services to be terminated at curb stop/meter box location. Insulation color shall be blue.

### **PART 3 EXECUTION**

#### 3.1 GENERAL

- A. Perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings or as otherwise specified. During excavation, pile material suitable for backfilling in an orderly manner a sufficient distance from the banks of the trench, or other excavation, to avoid overloading and to prevent slides or cave-ins. Remove all excavated materials not required or suitable for backfill and deposit where, and as, directed by the OWNER. Reference Section 02200 – Earthwork.
- B. Grade work area as needed to prevent surface water from flowing into trenches or other excavations. Remove any accumulated water by pumping or by other approved method. Install sheeting and shoring as necessary for

the protection of the work and for the safety of personnel. Where, in the opinion of the OWNER, damage is liable to result from withdrawing of the sheeting, it is to be left in place and the Contractor will be so notified in writing.

- C. Comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by Associated General Contractors of America, Inc.

### 3.2 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

- A. The drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. Conflicts must be disclosed to the OWNER as soon as encountered.
- B. Call the Palmetto Utility Protection Service (1-888-721-7877) and all utilities or agencies potentially having underground utilities within the work vicinity at least three business days (72 hours) prior to construction.
- C. Horizontal Conflict: When the actual horizontal separation between an existing utility and a proposed utility piping does not permit safe installation of the proposed utility by the use of sheeting, shoring, tying back, or temporarily suspending the service, the proposed alignment of the piping may be altered provided that the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and permits, and written approval is issued by the owner of the existing utility and BCWS.
- D. Vertical Conflict: When the actual vertical separation between an existing utility and a proposed utility piping does not permit the crossing without damage to the proposed or existing utility, the proposed grade of the piping may be altered provided that the new maintains adequate cover and grade, complies with regulatory agency requirements and permits, and written approval is issued by the owner of the existing utility and BCWS.
- E. Water Crossings:
  - 1. In above-water crossings, pipes should be supported and anchored adequately, protected from damage caused by freezing or other means, and accessible for repairs or replacement.
  - 2. In under-water crossings a minimum of two (2) feet of cover shall be provided over the top of the pipe. Crossings over water bodies that are greater than 15 feet wide shall have:
    - a. The pipe material and joints designed appropriately.

- b. Valves that are located so the under-water section can be isolated should testing or repair be necessary. The valves should also be easily accessible and not be subject to flooding.
- c. A blow-off device provided on the opposite side of the crossing from the supply service sized appropriately. Blow-off discharge should be directed away from the water body.
- d. DIP with mechanical joints used for lines being installed in rock.

F. Paved Entrance Crossings:

- 1. When installing new paved entrances to residential or commercial property or when paved surfaces (i.e. turn lanes) are extended over existing BCWS water main, split casing is required for protection of line that shall extend at minimum 5' outside of paved area when existing water main material is PVC with less than 4' of cover.
- 2. Option to replace PVC with DIP for these crossings shall be reviewed and approved by BCWS and scheduled/coordinated with minimum 7 day notice prior to any scheduled water main shutdown. If water main crossing entrance material is DIP no additional protection is required if main line maintains at least 2' of cover at crossing. In cases where existing line is C900 PVC with at least 4' of cover BCWS will evaluate whether DIP or casing is needed to avoid unnecessary shutdowns, additional fittings and potential leak points and issue these comments during plan review. If these are field discovered conditions BCWS representative will make the call on crossing requirement.
- 3. Contractor responsible for restraining existing and new line fully where needed when coordinating these crossings.
- 4. BCWS reserves the right for protection of all lines under new paved entrances and deviations from the above requirements requires explicit BCWS review and approval.

G. Water Main and Storm Drain Separation:

- 1. In open drainage crossing, a minimum of three (3) feet of cover shall be provided and ductile iron pipe installed. In piped drainage crossing, a minimum of three (3) feet horizontal separation or two (2) feet vertical separation shall be maintained. DIP shall be used on all crossings above/below piped drainage regardless of separation. For crossings above piped drainage absolute minimum separation of deflection or general crossing is .5' with at least 2' of cover using DIP. Steel casing shall be used in all other cases when the above criteria cannot be met.
- 2. Where ductile iron pipe is required, center a full joint of ductile iron pipe over/under the drainage pipe. Space the water pipe joint to maximize horizontal separation.

3. No water main shall pass through, or come into contact with, any part of a storm drain manhole or junction box. Minimum 2' separation is required.

H. Water Main and Wastewater System Separation:

1. Construct new water mains more than 25 feet (measured horizontally at any point along the main) from a wastewater tile field and/or a wastewater spray field.
2. Construct new water mains a minimum of 18 inches above or below a sewer line, preferably constructing the water main above the sewer line. Where new water mains cross under sewer lines, adequate structural support will be provided for the sewer line to prevent damage to the water main. In instances where a new water main crosses a new sewer main, a full length of pipe will be used for both mains with the lengths situated such that the joints of each line are as far from the point of crossing and each other as possible. In cases where the sewer main is existing, one full length of water main shall be located such that both joints are as far from the sewer line as possible. Reference Section R.6158.4(D)(12) of the State Primary Drinking Water Regulations.
3. Construct new water mains at least 10 feet horizontally, measured from edge to edge, from any existing or proposed sewer.
4. Construct new water mains at least 10 feet horizontally from sanitary sewer force mains. In crossing situations, there will be a minimum of 18 inches of vertical separation at the crossing as required in 3.2.G.2 above.
5. As conditions occur that make the distances listed above in 3.2.G(1-4) impractical, SCDES may allow alternates on a case by-case basis, so long as it is supported by data from the design engineer. An alternative design shall:
  - a. maximize the distances between the water main and sewer line and the joints of each;
  - b. use materials which meet the requirements of SCDES's State Primary Drinking Water Regulations, section R.61-58.4(D)(1) for the sewer line; and,
  - c. allow enough distance to make repairs to one of the lines without damaging the other.
6. No water pipe shall pass through or come in contact with any part of a sewer manhole.

### 3.3 RIGHT-OF-WAY/BCWS EASEMENTS

- A. The necessary rights-of-way and easements for water main construction will be secured by the Developer. Street widths and rights-of-way may in some cases be smaller than the Contractor would normally require when

using standard construction methods.

- B. Restore rights-of-way and easements to pre-construction conditions or better. Reference Section 02200 – Earthwork.
- C. Permanent BCWS easements shall require reasonable access at time of final acceptance for use of BCWS maintenance equipment.

### 3.4 PROTECTION OF PROPERTY AND EXISTING STRUCTURES

- A. Use every reasonable precaution to avoid damage to surrounding property and finished work of others. If it becomes necessary to remove fences, posts, or any valuable property, they are to be replaced in a “like or better” condition when located on public right-of-way or private property. Inside of permanent BCWS exclusive easements, no permanent structures, shrubs or plants shall be implemented within 5’ of installed utilities unless specifically approved by BCWS to avoid damage during maintenance. BCWS is not responsible for replacing if damaged during maintenance of device unless BCWS authorized placement within utility easement.
- B. Particular attention should be paid to storm drains and temporary sediment and erosion control measures. Any drainage feature, either temporary or permanent, which is filled, is to be opened as soon as the progress of the work will allow.

### 3.5 PREPARATION

- A. Perform all survey work required for construction, including the establishment of base lines and any detailed surveys and bench marks adjacent to the work. A base line is defined as “the line to which the location of the work is referenced, i.e. edge of pavement, road centerline, property line, right-of-way or survey line.” If required, stake permanent and temporary easements to ensure that the work does not deviate from the designated easements. Establish bench marks such that they will not be destroyed during construction.
- B. Provide a level of survey detail as required for establishing the correct locations of all water mains, valves, hydrants, and accessories as shown on the Drawings. Record drawings must include water main profile as part of final as-built drawings submitted.

- C. Reference Points: Install construction reference points as necessary. Preserve and protect all reference points, base lines, permanent property staking, and benchmarks.

### 3.6 CLEARING AND GRUBBING

- A. Clearing and grubbing is the responsibility of the Contractor if required.

### 3.7 EXCAVATION

- A. All excavation is unclassified regardless of nature of the material encountered.
- B. Perform all excavations by open cut from the surface for the water main locations and depths shown on the Drawings. Exercise care to avoid cutting tree roots.
- C. Excavate trenches to provide ample room for handling pipe and making joints. Minimum trench width no less than 12 inches greater than the external diameter of the pipe.
- D. Accurately grade trench bottom to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints.
- E. Dig bell holes and depressions for joints after the trench bottom has been graded and, in order that the pipe rest upon the prepared bottom for as nearly its full length as practicable, only of such length and width as required for properly making the particular type of joint.
- F. Whenever the bottom of the trench is unstable and does not afford a good foundation, remove such part as may be necessary and replace with select fill material. Except for crushed bedding, stones shall not come in contact with the pipe or be within six inches of the pipe.
- G. Install all water mains, unless otherwise indicated on the Drawings, to provide a depth of cover between the top of the pipe barrel and the original ground surface or finished grade of not less than 36" for pipelines up to 12" in diameter and not less than 48" for pipelines greater than 12" in diameter. Should conditions arise which prevent the depth of cover outlined above, the pipe material shall be DIP, and if exposed will be insulated to prevent freezing. Thermoplastic pipe shall not be used above grade.

### 3.8 PIPE LAYING

#### A. General:

1. Materials used for piping as specified herein. Pipe and accessories to be new and unused materials. Rest the full length of each section of the pipe solidly upon the pipe bed of undisturbed earth, with the recesses only to accommodate pipe bells and joints. Take up and relay any pipe that has its alignment, grade or joints disturbed after laying.
2. Thoroughly clean the pipe interior of all foreign matter before being lowered into the trench. Keep pipe interior clean during the laying operations by means of plugs or other approved methods. Do not lay pipe in standing water, or when the trench or weather conditions are unsuitable for the work. Keep water out of the trench until the jointing of the pipe is completed. When the work is not in progress, securely close the open pipe ends so that no trench water, earth or other foreign substance can enter the line. Replace any section of pipe found to be defective, either before or after laying, with new pipe at no additional expense to the Owner.
3. Lay ductile iron pipe in accordance with AWWA C600.
4. Lay PVC pipe and make connections in strict accordance with AWWA C605.

B. Handling of Pipe and Accessories: In such a manner as to insure delivery to the site and installation in the trench in a sound, undamaged condition. Take particular care not to damage any ductile iron pipe coating, either interior or exterior.

C. Cutting and Trimming of the Pipe: Perform in a neat and workmanlike manner without damage to the pipe or its coating. Cut pipe utilizing a mechanical cutter with sharp blade approved for the material being cut or trimmed.

#### D. Placing and Laying of the Pipe:

1. Examine the pipe for defects and tap with a light hammer to detect cracks while suspended in the sling before lowering into the trench. Reject all damaged, defective or unsound pipe and remove from the site of the work.
2. Deflection from a straight line and grade, as may be required by vertical or horizontal curves and offsets, not to exceed the normal manufacturer's recommended allowance for the type of joint employed. If alignment requires deflections in excess of the above limitations, provide special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the limits set forth.

3. Place pipe in the trench and bed as specified in Section 3.8(A).

- E. Tracer Wire: Install a continuous 12 gauge insulated tracing wire along all non-metallic pressure pipelines (Refer to Water Panel 10). The wire shall be secured to the pipeline by a minimum of one tie per joint or wrapped around the pipe one time per joint. Access to the wire shall be provided at every mainline and hydrant valve box. Color of wire insulation shall be blue. Maximum tracing wire length shall be 1000' without terminating in a valve box or intermediate detector site (dummy valve box). Intermediate detector sites shall not be located in pavement areas. Place precast circular concrete collar over dummy valve box (Ref. Water Panel 10). Splices shall be kept to a minimum, but if required, shall be made with a water tight connector rated for direct burial service. . Should the type of pipe material transition to iron pipe, the tracing wire shall continue over material change and be terminated at an intermediate detector site or at next in-line valve box. All water mains shall be detectable within three (3) feet with electronic locating equipment. Water mains that are installed by a trenchless method (i.e. directional drill), four #14 wires shall be installed with the pipe and connected to the tracer wire at both ends or cad welded to the existing iron pipe at both ends.

Prior to scheduling a final inspection with BCWS, the Contractor shall demonstrate that the locator wire functions properly by providing BCWS with a certificate of continuity test from a third party.

- F. Warning Tape: Place continuous 6" wide brightly colored warning tape, imprinted to read in large capital letters "CAUTION - BURIED WATER MAIN BELOW", or other similar wording approved by BCWS, over all new piping, 24" below grade.
- G. Line Marker: Install Pipeline Marker every 1,000' along water mains and above fittings where alignment changes, and/or as directed by BCWS.

### 3.9 BACKFILLING

A. General:

1. Backfill to a point 2 feet above the top of the pipe with material free of roots, stones, clods, or other unsuitable material. Thoroughly tamp material in 6 inch layers or as required to meet compaction requirements for material used by means of a mechanical tamper, tamping iron or similar tool. Perform tamping with care so as not to

disturb the pipe. Place and tamp backfill under the haunches of the pipe with special care.

2. Perform the remainder of backfilling with machinery. Place excess dirt over the ditch and keep in neat order at all times until the system is completed. Fill any holes or depressions that develop. At the completion of the work, level backfill material and leave in good condition.
  3. Place flowable fill as backfill material for utility trenches at street intersections and at street crossings. Reference Section 02511 – Flowable Fill.
- B. The backfilling, up to the level of 2 feet above top of pipe, will not be permitted with water standing in the trench. If water is present, the trench must be dewatered and kept dewatered during the placing and tamping of the initial backfilling layer.

### 3.10 JOINTING

- A. Install mechanical joints and restrained joints in accordance with Section 3.4 of AWWA C600.
- B. Install rubber gasket joints for PVC pressure pipe in accordance with Section 5.5 of AWWA C605.

### 3.11 SETTING FIRE HYDRANTS

- A. Set hydrants on a suitable base of concrete or crushed stone. Plumb all hydrant stems. Before installing any hydrant, take care to ensure that all foreign material is removed from the interior of the barrel. Open and close the hydrant to ensure that all parts are in proper working condition. After hydrant has been set and secured in place and reaction blocking concrete placed and cured, place clean crushed stone around base of each hydrant and about the supporting base to a height of 12" above the connecting pipe. Extend stone fill at least 18" away from the barrel in all directions. Thoroughly compact all backfill around hydrants to the surface of the ground or to grade for surfaced areas.
- B. Set hydrants plumb in all directions and with pumper nozzle perpendicular to and facing the roadway.
- C. Set hydrants to grade, with breaking flange two inches above ground. Gradelok assembly or equal required. No extensions allowed unless specified and approved by BCWS.

- D. Provide a drainage pit for the hydrant weep holes. Encase elbow of hydrant in gravel to 6 inches (150 mm) above drain opening. Hydrant drains shall not be connected to or located within 10 feet of sewer systems.
- E. Provide joint restraint as indicated on the Drawings.

### 3.12 SETTING VALVES AND VALVE BOXES

- A. Install valves and valve boxes as shown on the drawings or as directed by the OWNER. Clean valve interiors of all foreign matter before installation. Inspect valve in both opened and closed positions to ensure that all parts are in proper working condition.
- B. Set valves on solid bearing.
- C. Center and plumb valve box over valve. Set box cover flush with finished grade or as directed by the OWNER. BoxLok or Valve Box Adaptor II product required for all gate valve box installations. Butterfly Valve Adaptor required on BV box installations. See BCWS Appendix F29 Approved Parts List.
- D. Valve Marker: Place valve marker at all water distribution system valve locations or as directed by the OWNER.

### 3.13 SETTING AIR RELEASE VALVES AND MANHOLES

- A. Automatic air release valves (ARV) shall be placed at high points in the water main to prevent air locking.
- B. Install above ground ARVs assemblies using pedestal covers as the standard installation method. See BCWS Detail Water Panel 11A for reference. Installation of air release valves in precast flat top manholes with frames and covers will be determined by BCWS on a case-by-case basis where required. ARVs must have a concrete valve marker post for each valve location. Markers shall be brass stamped with distance and direction (arrow) to ARV location.
- C. Install valves and manholes as shown on the Drawings or as directed by the Engineer. Clean valve interiors of all foreign matter before installation. Inspect valve in both the opened and closed positions to ensure that all parts are in proper working condition.
- D. Provide thrust restraint as specified in paragraph 3.14 of this Section.

### 3.14 THRUST RESTRAINT

- A. All sections of water main identified as “PVC” or “DI” on the drawings are to be constructed of standard pipe and ductile iron fittings as specified in this Section. All associated plugs, caps, valves, tees, branches, and bends utilized in conjunction with PVC or DI water mains are to be restrained.
- B. All sections of water main that are to be restrained in accordance with BCWS standards are to be clearly identified on both the construction and record drawings.
- C. Provide additional thrust restraint at any other points where, in the opinion of the OWNER, hydraulic thrust may develop (Refer to Common Panel 3).
- D. Ductile Iron Push-on Joint Pipe, Fittings, and Valves: Please see Appendix F29 BCWS Approved Parts List.
- E. Ductile Iron Mechanical Joint Pipe, Fittings, Hydrants, and Valves: Please see Appendix F29 BCWS Approved Parts List.
- F. PVC Push-on Joint Pipe, Fittings, and Valves: Please see Appendix F29 BCWS Approved Parts List.

### 3.15 CONNECTIONS TO EXISTING SYSTEM

Connection to the existing system will be made by, and at the expense of, the Contractor. The Contractor will provide and install appurtenances as required and shown on the Drawings. Coordinate connections to existing system with BCWS. See construction backflow requirement outlined in Appendix G 02676. All initial connections for construction water usage on existing BCWS water system must be made on a permitted to operate line under BCWS maintenance. Connections made outside of these guidelines for construction water usage will be subject to additional developer/contractor agreements on tie-in responsibilities. BCWS does not recommend metered connections to unpermitted lines due to water turbidity and trash that prevents accurate metering of construction water usage and also causes damage to meter and backflow devices installed.

### 3.16 INSPECTION AND TESTING

- A. Perform pressure and leakage testing in accordance with the requirements of Section 02670 - Water Main Testing and Acceptance.

- B. Pressure and leakage testing must be completed prior to disinfection.

### 3.17 DISINFECTION

- A. Flush and disinfect system in accordance with Section 02675 - Disinfection of Potable Water Mains.
- B. The lab report for analytical testing must provide the chlorine residual at each sample point as well as the bacteriological test result for each sample point. The Contractor is responsible for coordinating and providing these services.
- C. Minimize the potentially adverse environmental impact of heavily chlorinated disinfecting water as specified in Section 02675. If any adverse impact occurs, promptly notify the SCDES and institute mitigating measures accordingly.

### 3.18 SETTING METER BOXES

All meter boxes will be installed as shown in the plans. This only pertains to BCWS capital projects. Care of the box will be the Contractors and the Developers responsibility until final landscaping is complete and the meter has been installed.

### 3.19 BACKFLOW PREVENTOR ASSEMBLIES

- A. A Reduced-Pressure Principle Assembly shall be installed 12" (from the bottom of the assembly) above the finished elevation and above established flood plain.
- B. A Pressure Vacuum Breaker shall be installed 12" above the highest irrigation head in the system.
- C. A Double Check Valve Assembly shall be installed 12" (From the bottom of the assembly) above finished elevation.
- D. All backflow assemblies smaller than 3" shall be installed within 3 feet of the meter. Exceptions to this will be evaluated on a case by case basis.
- E. No meter and backflow assembly shall be installed in a vault. All meters 3" and larger shall be installed as part of the backflow assembly and shall be above grade as noted in section 3.19 A-C and as noted in BCWS detail.

**END OF SECTION**