

5 - WATER DISTRIBUTION SYSTEM PROVISIONS

5.01 WATER DESIGN

5.01.01 GENERAL WATER DESIGN

Contractor shall conduct all water system improvements in accordance with the following:

- The City-adopted project special conditions of approval;
- The approved improvement plans including any supplemental updates thereto;
- The City-approved permit(s);
- The Standard Specifications of the State of California Department of Transportation, the latest edition, and the Standard Plans of the State of California Department of Transportation, the latest edition;
- The City of Napa Standard Plans, including any supplemental updates thereto;
- These Water Distribution System Provisions;
- The latest version of the applicable AWWA standards;
- The regulation(s) and requirement(s) of appropriate agencies (e.g. State Department of Transportation, Department of Fish and Wildlife, Pacific Gas & Electric, Napa Sanitation District, AT&T, et al.).

Contractor shall submit any proposed revisions to the approved plans in writing which shall be reviewed and approved prior to any work taking place. The Water Division Engineer may allow modifications to the Water Distribution System Provisions or Standards for the convenience of the City on a case-by-case basis; all water system standard(s) modification(s) shall be subject to the review and approval of the Water Division Engineer.

If standards or other government regulations (including but not limited to minimum separation requirements) are in conflict, the stricter requirement shall prevail.

Contractor shall submit all record drawings to the Water Division office in a timely fashion.

The terms Applicant, Developer, Customer, and Contractor are used throughout these Water Distribution System Provisions and are intended to mean the same and can be used interchangeably.

5.01.02 WATER SYSTEM DESIGN AND INSTALLATION

Water mains shall consist of either fusible C900 or C905, standard C900 or C905 with epoxy-coated fittings, metallic zinc-coated ductile iron pipe with epoxy-coated fittings, or standard ductile iron pipe and fittings with cathodic protection that shall be noted in the approved improvement plans.

When new water system connections are made to existing metallic water mains, cathodic protection shall be installed on the existing pipeline as directed by the Water Division.

Water mains shall be installed within the public right-of-way and shall include fire hydrants, service laterals, meters, and their appurtenances (i.e., public water facilities) as directed by the City. Installation of new water facilities within a dedicated water line easement shall be at

the sole discretion of the Water Division Engineer. Unless otherwise approved, easements shall be a minimum of 20 feet wide, centered on the water line and designated as Public Water Utility Easements.

All new distribution pipelines shall be a minimum of 6 inches or be of sufficient size to supply adequate fire flow unless otherwise approved. Standard top of pipe cover depths shall be 36 inches unless otherwise approved by the Water Division Engineer. Cover depths shall be measured from the top of the pipe barrel to the finish street surface.

Water services shall be sized appropriately for the intended use and comply with the current California Plumbing Code. The Water Division Engineer may request an engineered water analysis of the private water system (new or existing) to evaluate capacity and service size. Undersized water services shall not be permitted under any circumstances. A Water Fixture Count for determining the proposed water service size shall be performed per the latest edition of the California Plumbing Code as required by the Water Division and the Building Division.

Water service laterals shall not exceed the size of the public water main that is connected to the service. The allowance of size-on-size water service laterals shall be at the sole discretion of the Water Division Engineer. In the event proposed demands cannot be met by the City's distribution system, the Water Division Engineer shall conduct a hydraulic analysis (or direct the Applicant to conduct a hydraulic analysis at his or her own expense) to determine water system deficiencies that shall be addressed at the sole expense of the Applicant.

Water mains shall be installed as part of a looped system to ensure reliable service. Dead-end mains shall be avoided whenever possible.

Future water main extensions to the boundary of a subdivision where streets are stubbed shall be at the sole discretion of the Water Division Engineer.

Changes in pipeline grade to clear existing or proposed underground facilities shall be achieved through vertical offsets with the use of fittings, if required. All fittings shall be made with fully restrained joints and shall adhere to the requirements of City Standard Plan W-15. Deflection of pipelines may be used to avoid existing or proposed underground facilities if approved by the Water Division Engineer; deflection at pipe joints shall not exceed 3 degrees (minimum radius = 345 feet).

Signs, fences, trees, foundations, streetlights, or other permanent structures shall not be installed within 10 feet of a City water main or water facility, or within a public water utility easement.

Thrust blocks and restrained joints shall be installed as required and conform to the City of Napa Standard Plans W-14A, W-14B and W-14C.

All freeway/expressway crossings shall be fusible C900 or C905, have a minimum 12-inch carrier pipe inside an appropriately sized casing pipe, and conform to City Standard Plan W-13B and these Water Distribution System Provisions.

Installation of a private pressure system may be required where sufficient pressure is not available from the existing or proposed water distribution facilities.

Only those personnel trained and equipped to meet the various standards and requirements contained herein shall conduct water system installations.

Installation of new water mains shall include saw-cutting and removal of asphalt and trench excavation; furnishing and installation of all pipe, fittings, valves, anodes, tracer wires, bonding fittings; connectivity testing; placing and compacting bedding and backfill material; pressure testing; chlorinating; installation of temporary trench paving tying back into the existing water

system; and other miscellaneous work to ensure a complete and functional water system is turned over to the City.

5.01.03 DISTRIBUTION MAINS

Distribution mains shall refer to the main pipeline within a public right-of-way or easement that supplies water to one or more service connections. Installation shall include the main pipeline and associated fittings, valves, combination air-vacs, top blow-offs, and other materials necessary to provide a complete and functional system.

Only authorized City personnel shall operate existing valves on the water system at all times. The Applicant or Contractor shall be responsible for notifying the Water Division of a scheduled shutdown a minimum of 48 hours (two working days) in advance.

Main extensions shall extend from the end of an existing main to a point defined in the approved plans. Contractor shall be responsible for notifying water customers affected by the water shutoff a minimum of 48 hours (two working days) prior to commencement of the work.

City water mains extended from an existing main at a dead-end, with the feasibility of being extended further in the future, shall end with a tee that connects to a fire hydrant (per City Standard W-8), equipped with a mechanical joint cap at the end. The extended main shall be installed with restrained joints per City standards. If the length of the new main is less than the required restrained length, the new main shall be installed with restrained joints to the point of the existing main, with a wing wall installed on the live section of the main. A concrete thrust block shall not be installed at the end of the main unless otherwise permitted by the Water Division Engineer.

Final tie-in locations shall be potholed in a timely manner to verify line and grade and facilitate adjustments, if necessary. Separation between the newly installed water system and the tie-in location on the active water system shall not exceed 10 feet. Tie-ins shall be at the same line and grade and be conducted under direct inspection by the Water Division Engineer or Designee.

Permanent connection(s) between the existing water system and newly built water main(s) shall conform to the tie-in locations shown in the approved plans and occur only after approval by the Water Division Engineer. Final tie-ins shall occur only after successful completion and passing of the pressure, chlorinating, flushing, and bacteriologic tests.

Contractor shall be responsible for notifying the Water Division of a scheduled tie-in a minimum of five working days in advance of the tie-in. Contractor shall notify all affected customers a minimum of 48 hours in advance of the water system shutdown.

The Water Division Engineer may forbid connection to the existing water system if it is determined that the newly installed system is not complete and functional or does not conform to the approved plans.

5.01.04 BLOW-OFFS

Contractor shall install blow-off(s) as shown in the approved plans, and conform to City Standard W-8, W-10A, or W-10B. The plans shall indicate the size, type, and location of the proposed blow-off(s).

Blow-offs shall be installed on all dead-end mains smaller than 6 inches in diameter or at other locations as required by the Water Division Engineer. Fire hydrants shall be installed at the

ends of all water mains 6 inches and larger in diameter, which shall serve as the blow-off assembly.

The piping between the outlet valve and the riser shall be at a continuous downgrade of not less than ¼ inch per foot.

Blow-offs installed in unpaved areas or rural settings shall be set at the existing ground surface and may require special covers, markings, signs, protective bollards, concrete pad, etc., as directed by the Water Division Engineer.

5.01.05 COMBINATION AIR RELEASE AND VACUUM VALVES

Contractor shall install combination air release and vacuum valve(s) as shown in the approved plans, and conform to City Standard W-11A or W-11B and the latest version of AWWA C512. The plans shall indicate the size, type, and location of the proposed combination air release and vacuum valve(s).

Combination air release and vacuum valves or top blow-offs shall be installed at high points within the distribution system, or at other points designated in the approved plans. Other locations may be required as directed by the Water Division Engineer.

The piping between the outlet valve and the riser shall be at a continuous upgrade of ¼ inch per foot.

Combination air release and vacuum valves placed in urban settings may require special screening or approved covers, protective bollards, etc., as directed by the Water Division Engineer.

Combination air release and vacuum valves installed in unpaved or rural settings may require special covers, markings, signs, protective bollards, concrete pad, etc., as directed by the Water Division Engineer.

5.01.06 VALVES AND VALVE BOX INSTALLATIONS

Contractor shall install valve(s) as shown in the approved plans, and conform to City Standard W-9 and the latest applicable version of AWWA standards. The plans shall indicate the size, type, and location of the valve(s).

Resilient seated gate valves shall be used for pipe sizes smaller than 12 inches.

Butterfly valves shall be used for pipe sizes 12 inches and larger, unless otherwise approved by Water Division Engineer.

When possible, all valves shall be installed at the intersections of two pipelines, and within straight runs so that no more than 500 feet of water main would be out of service during water system shutdowns.

Valves shall be installed in a level position with the operating stem in a vertical position and be stabilized and supported separately from the pipeline.

Valves installed in unpaved or rural settings may require installation of additional signs, markings, witness posts, concrete pads, etc., as directed by the Water Division Engineer.

Valve box caps shall be set flush with the finished pavement surface.

Valve box caps shall be marked "WATER".

5.01.07 FIRE HYDRANTS

Contractor shall install fire hydrants as shown in the approved plans and conform to City Standard W-8 and the latest version of AWWA C502. The size and location of all fire hydrants may be subject to final approval by the City of Napa Fire Department, with exception of fire hydrants used at the end of water mains as blow-offs. Standard bury depths shall be 24 inches.

A minimum of one fire hydrant shall be located at each intersection and shall be installed in the parkway and/or sidewalk area adjacent to the curb. The Water Division Engineer may, upon request approved by the City of Napa Fire Department, change the location of fire hydrant(s) within such strip as necessary.

Hydrants will be required on opposite sides of the streets where raised median strips are present, where heavy traffic loads are common, and where the street consists of more than 80 feet of dedicated width. Contact the City of Napa Fire Prevention Division for additional hydrant spacing and placement information.

The Water Division Engineer may require, on a case-by-case basis, the installation of additional fire hydrants above the number required by the City of Napa Fire Department for the convenience of the City.

5.01.08 WATER SERVICES AND METERS

Contractor shall install water services as shown in the approved plans and conform to City standards and the latest version of the applicable AWWA standards. The plans shall indicate size, direction, and location of the water service and meter box. The Water Division Engineer will, insofar as practicable, work with the Applicant to locate the water meter along the property line at a point designated by the Customer.

The allowance of size-on-size water service laterals shall be at the sole discretion of the Water Division Engineer.

Water service laterals shall not exceed the size of the public water main that is connected to the service. In the event proposed demands cannot be met by the City's distribution system, the Water Division Engineer shall conduct a hydraulic analysis (or direct the Applicant to conduct a hydraulic analysis at his or her own expense) to determine water system deficiencies that shall be addressed at the sole expense of the Applicant.

Water meter boxes and vaults shall be located outside all driveways and traveled ways, and be accessible at all times for inspections, reading, testing, and maintenance.

Water services within areas where the static pressure is in excess of 80 pounds per square inch (psi) shall be equipped with a pressure regulator that conforms to the most current California Plumbing Code. Conversely, installation of a private pressure system may be required where sufficient pressure is not available from the existing or proposed water distribution facilities.

All water service laterals shall be metered connections, with the exception of those designated by the Water Division Engineer.

All fire services with designated private hydrants shall be metered through an approved fire service meter as directed by the Water Division Engineer. Fire services without private hydrants shall have tattletale meters installed as part of the detector assembly on the backflow device.

Water meters installed in high-density urban settings may require the use of separate meters (i.e., hotel, restaurant, residential, or mixed-use) as directed by the Water Division Engineer. Water meter banks shall be clearly labeled on the outside of the meter boxes to delineate units served.

Meter installations in multi-family residential settings (e.g., apartments, condominiums, townhomes, etc.) will require the use of a master meter.

Water meter(s) installed in unpaved or rural settings may require installation of additional signs, markings, witness posts, concrete pads, etc., as directed by the Water Division Engineer.

Water meter installations may be scheduled upon receipt of payment, parcel address(es) and responsible party; meter installations shall only occur after successful completion and passing of the pressure, chlorinating, flushing, and bacteriologic tests and after all backflow devices have been certified and tested.

5.01.09 BACKFLOW DEVICES

Contractor shall install backflow device(s) as shown in the approved plans and conform to applicable City and latest version of AWWA standards. The plans shall indicate size, location, and reference the applicable City Standard. Backflow device(s) shall be

installed in a manner that provides the clearances shown on the applicable City standard to facilitate inspection and maintenance.

Backflow devices installed on residential, commercial, industrial, or irrigation water services shall be installed as close to the meter or property line as practical, but in all cases before the first branch line. Residential water service(s) shall be equipped with an approved double-check backflow prevention assembly. All commercial, industrial, or irrigation water service(s) shall be equipped with an approved reduced-pressure (RP) principle backflow prevention assembly.

A Water Division Representative with Cross-Connection Specialist Certification may, at his or her own sole discretion, require the installation of an RP device in lieu of a double-check backflow device assembly (i.e., the type of backflow protection required is commensurate with the degree of hazard that exists on the premises).

Backflow devices installed on fire services shall be installed as close to the meter or property line as practical, but in all cases before the first branch line. The Water Division Engineer may approve, on a case-by-case basis, fire service backflow device installations inside a building or closet for installation within high-density urban areas.

Backflow device installations in high-density urban settings may require special screening, landscaping, or approved covers, protective bollards, etc., as directed by the City Planning Division.

All backflow prevention assemblies shall be a model and size approved by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California and listed on the Foundation's current list of approved backflow prevention assemblies.

The approved backflow prevention assembly list can be obtained at <http://fccchr.usc.edu/list.html>

Meter shall be installed in the lock position before backflow devices can be tested. Use of jumpers, hose bibs, or other devices shall not be permitted. Water service will not be unlocked until passing results are received by the City of Napa.

5.01.10 TEMPORARY WATER SUPPLY (FIRE HYDRANT METERS)

Contractor shall install fire hydrants for the primary purposes of extinguishing fires and water utility maintenance activities. Only an authorized City representative(s) or permitted customer(s) shall withdraw water from fire hydrants.

Water withdrawn from any hydrant shall be taken through a hydrant meter. In all cases where the City grants a permit to take water from a fire hydrant, the permitted customer shall use the eddy valve on the hydrant meter assembly to regulate the delivery of the water.

Contractor can obtain a permit to withdraw water by submitting a Hydrant Meter Set Form (www.cityofnapa.org/newdevelopment, under Construction Water/Hydrant Meters) to the City's Revenue Division. The City shall collect a deposit prior to issuance of any hydrant meter.

All hydrant meters and backflow devices shall be fully supported to ensure the weight of the meter and backflow device are not bearing on the steamer opening of the hydrant.

The water meter and backflow device shall be protected from damage at all times and be returned to the City in good working order. The City reserves the right to determine whether or not a meter and/or backflow device is in good working order; retention or release of the deposit will be based on the condition of the meter and/or backflow device and shall be at the sole discretion of the City.

5.01.11 MATERIALS

Contractor shall furnish all materials required to complete the work.

A list of material sources shall include, but not be limited to, type, manufacturer, and model number of proposed materials. Specific manufacturers and part numbers may be indicated within these Provisions and City Standard Plans. The list of material sources shall be approved by the City prior to the installation.

Submitted materials shall conform to the requirements contained herein. All substitutions and "or approved equal" shall be reviewed by the Water Division Engineer prior to installation. Submittal of an approved equal will be reviewed on a case-by-case basis.

The list shall be furnished in sufficient time to permit proper inspection and testing of materials furnished from such listed sources in advance of their use. Such samples shall be furnished, without charge, as may be required. Inspection and tests, if deemed necessary, will be made by the Water Division or designated representative, but it shall be understood that such inspections and tests, if made at any point other than the point of incorporation in the work, in no way shall be considered as a guarantee of acceptance of such material, or of continued acceptance of material presumed to be similar to that upon which inspections and tests have been made.

Manufacturer's warranties, guarantees, instruction sheets, and parts lists, which are furnished with certain articles or materials incorporated in the work, shall be delivered to the Water Division before final acceptance. In certain instances, the Water Division Engineer may require electronic format of submittals.

Specific requirements for water facilities are described as follows.

A. Fusible Polyvinyl Chloride Pipe (Fusible PVC)

Fusible PVC pipe shall be manufactured to conform to the latest version of AWWA C900. Fusible PVC shall be blue in color, pressure Class 305, and DR-14, or approved equal pipe.

The pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in the latest version of AWWA C900, applicable sections of ASTM D2241, ASTM D3034, or ASTM F679. Testing priority shall be in conformance with the latest version of AWWA C900, which shall be tested to those standards.

All piping shall be made from a PVC compound conforming to cell classification 12454 per ASTM D1784. Testing shall be in accordance with the latest version of AWWA standards for all pipe types. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

Fusible polyvinylchloride pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe. Fusible polyvinylchloride pipe shall be manufactured in a standard 40-foot nominal length.

Each pipe shall be marked to conform to the latest version of AWWA C900, and shall include as a minimum:

- Nominal pipe size
- PVC
- Dimension Ratio, Standard Dimension Ratio, or Schedule
- AWWA pressure class
- AWWA Standard designation number
- Extrusion production-record code
- Manufacturer's trademark or trade name
- Cell Classification 12454 and/or PVC material code 1120 may also be included

B. Polyvinyl Chloride Pipe (PVC)

C900 PVC pipe shall be manufactured to conform to the latest version of AWWA C900. PVC pipe shall be blue in color, pressure Class 305, and DR-14, or approved equal pipe.

The pipe shall be tested at the extrusion facility for properties required to meet all applicable parameters as outlined in the latest version of AWWA C900, applicable sections of ASTM D2241, ASTM D3034, or ASTM F679. Testing priority shall be in conformance with the latest version of AWWA C900, except for pipe made to the ASTM D3034 or ASTM F679 standards, which shall be tested to those standards.

All piping shall be made from a PVC compound conforming to cell classification 12454 per ASTM D1784. Testing shall be in accordance with the latest version of applicable AWWA standards for all pipe types. Pipe shall be homogeneous throughout, and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

The ends shall be square to the pipe and free of any bevel or chamfer. Pipe shall be manufactured in a standard 20-foot nominal length.

Each pipe shall be marked to conform to the latest version of AWWA C900, and shall include as a minimum:

- Nominal pipe size

- PVC
- Dimension Ratio, Standard Dimension Ratio or Schedule
- AWWA pressure class
- AWWA Standard designation number
- Extrusion production-record code
- Manufacturer's trademark or trade name
- Cell Classification 12454 and/or PVC material code 1120 may also be included

C. Ductile Iron Pipe (DIP)

Ductile iron pipe shall be zinc-coated and manufactured to conform to the latest version of AWWA C151 and designed to conform to the latest version of AWWA C150. Cement mortar lining shall be required to conform to the latest version of AWWA C104. The coating materials shall be metallic zinc wire with a zinc content of at least 99.99 percent by mass, and bituminous paint topcoat compatible with zinc. The interior pipe lining shall conform to the latest version of AWWA C151. Each pipe shall be marked to conform to the latest AWWA standard and shall include as a minimum:

- Nominal size
- DIP
- Pressure class
- Nominal thickness
- Manufacturer's mark and year
- Zinc coating and thickness

DIP shall be pressure class 350. Joint type shall be "push-on joint" standard with the manufacturer, except where shown otherwise on plans.

DIP shall be zinc-coated U.S. Pipe, or approved equal. The mean mass of the metallic zinc coating shall be a nominal of 200 grams per square meter, with a minimum of 170 grams per square meter when measured in accordance with the section titled "Test Method for Determining Zinc Mass" of this specification. Use of regular DIP (i.e., not zinc-coated) shall be at the sole discretion of the Water Division Engineer and will require the installation of magnesium anodes.

All ductile iron pipe and associated fittings shall be encased with V-Bio polyethylene encasement (polywrap) in accordance with ANSI/AWWA C105/A21.5, ASTM A674, ISO, or approved equal. Encasement shall be secured with 2-inch-wide polyvinyl pipe wrap tape.

D. Coated Fittings

All ductile iron fittings shall be exterior coated and conform to the latest version of AWWA/ANSI C116/A21.16 (Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings). Use of regular non-coated fittings shall be at the sole discretion of the City and will require installation of magnesium anodes.

Ductile Iron fittings shall conform to the latest version of AWWA C110 or AWWA C153 and shall have the same cement mortar lining specified for ductile iron pipe.

E. Restrained Joints (for PVC)

Restrained joints shall be installed as shown in the approved plans, conform to all applicable City and latest version of AWWA standards and the following:

- Pipe Joints (bell and spigot): PVC Bell Restraints rate for Class 305 PVC DR-14 Pipe shall be “Bulldog” or approved equal. At joints where “Bulldog” restraints cannot be used, EBAA Iron 1500 Series PVC Bell Restraints or approved equal.
- Pipe Joints (fittings): Ductile iron mechanical joint fittings with restrained locking glands rated for Class 305 PVC pipe shall be used. Joint restraint shall be EBAA Iron Series 2000PV Mechanical Joint Restraint or approved equal.

F. Restrained Joints (for DIP)

Restrained joints shall be installed as shown in the approved plans, conform to all applicable City and AWWA standards, and the following:

- Pipe Joints (bell and spigot): DIP restraint gaskets shall be U.S. Pipe TYTON JOINT Pipe with FIELD LOK Gaskets or approved equal.
- Pipe Joints (fittings): Ductile iron mechanical joint fittings with restrained locking glands shall be EBBA Iron MEGALUG or approved equal.

G. Flanged Joints (for PVC)

All stainless-steel bolts and studs shall be the proper length to ensure proper bolt-up is achieved between two Class 125 Standard Cast Iron Flanges, flanged valve and cast-iron flange, and any other flanged configuration. All bolts, studs, nuts, and washers shall be Type 304 Stainless Steel with Teflon blue nuts and conform to the latest version of AWWA C111.

H. Flanged Joints (for DIP)

All stainless-steel bolts and studs shall be the proper length to ensure proper bolt-up is achieved between two Class 125 Standard Cast Iron Flanges, flanged valve and cast-iron flange, and any other flanged configuration. All bolts, studs, nuts, and washers shall be Type 304 Stainless Steel with Teflon blue nuts and conform to the latest version of AWWA C111.

I. Flanged Adapters

Flanged adapters shall be Rockwell International, Baker Series, or Columbus Standards, Inc. All bolts, studs, nuts, and washers shall be Type 304 Stainless Steel with Teflon blue nuts.

J. Flanged Bolt-up Kits

All stainless-steel bolts and studs shall be the proper length to ensure proper bolt-up is achieved between two Class 125 Standard Cast Iron Flanges, flanged valve and cast-iron flange, and any other flanged configuration. All bolts, studs, nuts, and washers shall be Type 304 Stainless Steel with Teflon blue nuts and conform to the latest version of AWWA C111.

K. Gate Valves

Gate valves shall be a resilient-seated type and manufactured to conform to the latest version of AWWA C-509 and be non-rising stem with square operating nut, open left, and have stainless steel nuts and bolts. Gate valves used for combination air and vacuum valves shall be Mueller H-10914 or approved equal.

All certified drawings and parts lists shall be submitted to the Water Division Engineer.

Gate valves shall be used for all pipe sizes smaller than 12 inches, unless otherwise approved by the Water Division Engineer.

L. Butterfly Valves

Butterfly valves shall be manufactured to conform to the latest version of AWWA C504. Valves and operators shall be class 250 and constructed for direct burial applications. Unless otherwise approved, butterfly valves shall be manufactured by Mueller Company, Kennedy Valve Manufacturing Company, or Henry Pratt Company.

The valve operators shall conform to the latest version of AWWA C504 and shall be designed to hold the valves in an intermediate position between fully open and fully closed without fluttering or creeping. Manual valve operators shall be of the worm-gear or traveling-nut type and fully enclosed. Adjustable stops shall be provided to stop valves in the fully opened and fully closed positions.

Valves shall open with a counter-clockwise rotation of a 2-inch square operating nut. The minimum number of turns to close the valve shall not be less than two turns per inch of valve size.

Operator components shall, at the extreme operator position, withstand without damage an input torque of 300 ft-lbs.

The Contractor shall submit all certified drawings and parts lists of the valve and operator to the Water Division Engineer.

Butterfly valves shall be used for pipe sizes 12 inches and larger, unless otherwise approved by Water Division Engineer.

M. Combination Air Release and Vacuum Valves

Combination air-release and vacuum valves shall be A.R.I. D-040 or approved equal and be manufactured to conform to the latest version of AWWA C512 and be designed for a working pressure of 150 psi.

Combination valves shall consist of an air and vacuum valve with an air-release valve connected to its chamber, and a drainage valve at the base (for testing and maintenance purposes).

The valve shall be capable of: (1) venting large quantities of air when not under water pressure; (2) permitting the entry of air to prevent a vacuum; and (3) positive action in releasing air entrained in water under pressure.

The valve body and cover shall be cast iron, trim shall be bronze, and float shall be stainless steel. Cast-iron parts shall be coated to retard corrosion.

N. Fire Hydrants

Fire hydrants shall be vertical flange shoe and "Dry Barrel" manufactured to conform to the latest version of AWWA C502, and shall be Mueller "Super Centurion," American Darling "B-62-B" or Kennedy "Guardian." No substitutes accepted.

Fire hydrant valves shall be slow opening.

All hydrants shall be 6-inch mechanical joint inlets. The upper portion of each hydrant shall be painted aluminum color before project is completed.

Fire hydrant (DB Marker 6) pavement markers shall be installed on all streets (public and private) per Standard Specification W-21.

O. Transition and Flexible Couplings

Transition and flexible couplings shall be manufactured to conform to the latest version of AWWA C111, and shall be Rockwell International Type 441, Baker, Dresser, Ford, and Smith-Blair, or approved equal. Transition and flexible couplings shall be cast-iron or steel sleeves with wedge-type rubber gaskets suitable for use in potable water supply systems.

The coupling shall be designed for 150-psi working pressure, unless otherwise approved by the Water Division Engineer.

Each coupling shall be sized to properly fit the ends of the two pieces of pipe being joined and have a sufficient number of bolts to compress the gasket without distorting the followers.

P. Copper Tubing and Fittings

Copper service tubing, fittings, saddles, et al., shall be manufactured to conform to ASTM Specifications B88-47 Type K soft copper and the latest version of AWWA C800.

The tubing shall be installed without splicing in lengths up to 50 feet, where possible.

Q. Miscellaneous Appurtenances

Miscellaneous appurtenances, including check valves, service materials, saddles, regulator valves, insulators, pumps, pressure tanks, valve boxes, and miscellaneous hardware shall be of the type shown on the plans and/or submittals, and be of a quality acceptable to the Water Division Engineer.

Upon request, Contractor shall deliver samples of any such miscellaneous appurtenances to the Water Division Engineer for examination and testing and, if rejected, remove all similar appurtenances from the job site, including that which may have already been installed.

R. Magnesium Anodes (Bag)

Anodes shall be prepackaged high potential magnesium anodes. Lead wire for the anodes shall be 30 feet long, No. 10 AWG solid-copper wire with black RHW-USE insulation. Lead wires shall be silver-soldered to anode core with the connection encapsulated in epoxy resin.

All metallic fittings shall be continuity bonded or directly bonded to an anode.

S. Bond Wire Connections

- Open cut: Bond wire shall be No. 10 AWG/HMWPE bond cable and shall be installed for all non-epoxy coated metallic joints, bell, and spigot connections; tie-in points; and valves to ensure connectivity along entire water main installation.
- Horizontal Directional Drilling: Bond wire shall be No. 8 AWG/HMWPE bond cable and shall be installed for all non-epoxy coated metallic joints, bell, and spigot connections; tie-in points; and valves to ensure connectivity along entire water main installation.

T. Tracer Wire:

Tracer wire shall be taped to the top of the pipe at a minimum of 5-foot intervals, and at all crosses, tees, and elbows. When taping tracer wire to pipe, wrap the tape once around the tracer wire before wrapping the tape around the full diameter of the pipe.

Tracer wire material shall be installed as follows:

- Open Cut: Tracer wire shall be at a minimum No. 10 AWG annealed bare copper UF solid type wire with cross-linked polyethylene insulation minimum 30 mil thickness or subject to the approval of the Water Division Engineer. The insulation shall be blue in color. Connectors shall have a dielectric gel and must be sealed.
- Horizontal Directional Drilling: Tracer Wire No. 8 CCS Extra High Strength Hard Drawn 1150 lb. or approved equal, and installed for all non-metallic pipe. HDPE coating with minimum 45 mil thickness. The insulation shall be blue in color.

U. Sand Backfill

Sand Bedding shall conform to the following specifications:

CLEAN WASHED UTILITY SAND		
SEIVE SIZE		WATER DIVISION SPEC.
37.5 mm	1 1/2"	
25 mm	1"	
19 mm	3/4"	
12.5 mm	1/2"	100
9.5 mm	3/8"	
4.75 mm	#4	75-100
2.36 mm	#8	
1.18 mm	#16	
600 µm	#30	
300 µm	#50	0-70
150 µm	#100	0-30
75 µm	#200	0-15
Sand Equivalent		>20
Minimum Resistivity		≥5.00 ohms- cm (x1,000)
Soil PH		4.5 & <9
Chloride		≤500 ppm
Sulfate		≤150 ppm
Plasticity Index		Non Plastic
Organic Impurities		Not Present*

*This sand is a clean natural sand mined and processed in fresh water. It is free from clays, seashells, and other organic materials.

V. Controlled Low Strength Material

Controlled Low Strength Material (CLSM) shall be a hand-excavatable, self-leveling, self-compacting mixture of cement, pozzolan, coarse and fine aggregate and water which has been mixed in accordance with ASTM C 94 and is in a flowable state during placement. Prior to beginning any work, you shall submit to the City Engineer for review, the proposed CLSM mix designs which shall show the proportions and gradations of all materials proposed for each class and type of CLSM to be used.

Density shall be between 120 PCF minimum and 135 PCF maximum. Compressive strength at 28 days for flowable CLSM shall be between 50 psi minimum and 150 psi maximum.

Cement shall be Type II in accordance with the requirements of ASTM C 150. Pozzolan shall be added to improve the flowability and shall be Type F in accordance with the requirements of ASTM C 618. Coarse and fine aggregate may include native soil materials derived and separated from project excavations. Aggregate shall consist of sands and gravels with fines content not exceeding 30 percent. Fines content shall have a plasticity index of 3 or less. Clay balls formed by fines shall not exceed 10 percent on a wet mass basis. The maximum size of any clay balls shall not exceed ½-inch. The maximum particle size in the soil cannot exceed 1/8 of the open distance between the pipe and the trench wall or 1-1/2 inch, which ever is less. All material shall be free from organic matter and not contain more alkali, sulfate, or salts than the native materials at the job site.

CLSM shall be delivered to the job in standard transit mix trucks. CLSM shall be delivered in place by means of tailgate discharge, conveyor belts, pumped in place, or other means acceptable to the City Engineer. CLSM shall be directed in place by means of vibrator shovel or rod to ensure that all voids, cervices, and pockets are filled with CLSM. Care shall be taken to avoid over consolidation of the material separating the large and fine aggregate. CLSM shall be placed in appropriate lifts or with methods to prevent movement of the pipe, including by flotation.

CLSM shall be protected from running water, rain, freezing or other conditions that could damage the material until the material has been accepted and final fill completed. No equipment, traffic, or backfill shall be allowed on the CLSM until the surface of the CLSM is able to withstand a 20-psi load without displacement or damage. If necessary, you shall provide steel trench plates that span the trench until the CLSM has reached the required strength.

W. Lubrication

Lubrication shall be NSF 61-approved water-soluble and non-toxic, be non-objectionable in taste and odor imparted to the fluid, be non-supporting of bacteria growth, and have no deteriorating effect on the PVC or rubber gaskets.

X. Miscellaneous Iron and Steel

Miscellaneous iron and steel shall conform to the provisions in Section 55 of the 2015 Standard Specifications.

Y. Reinforcement

Reinforcement shall conform to the provisions in Section 52 of the 2015 Standard Specifications.

Z. Concrete

Concrete shall conform to the provisions in sections 51 and 90 of the 2015 Standard Specifications. Thrust blocks shall be constructed of Class C concrete, as a minimum.

5.02 CONSTRUCTION

5.02.01 PRE-CONSTRUCTION MEETING

Contractor shall schedule a pre-construction meeting prior to installation of any water infrastructure intended for City ownership. Contact the City of Napa Water Division Inspector at 707-257-9521 or 707-257-9544 to schedule the pre-construction meeting. The Water Division Inspector shall be notified of the pre-construction meeting at least two business days in advance of the meeting.

5.02.02 WATERMAIN AND WATER SERVICE INSTALLATION

Contractor shall install all water mains and services as shown in the approved plans and conform to applicable City and latest version of AWWA standards.

This section applies to installation of new water mains, new water services and work with existing water mains and services.

Contractor shall strictly adhere to all manufacturer requirements and storage procedures, including storage of all pipe lubricant, gaskets, and appurtenances.

For water service installation or reconnections, the Water Division Inspector or Engineer reserves the right to require a completely new water service installation based on field conditions.

Each section of pipe shall be carefully inspected for damage that may have occurred in transit. Any damaged or rejected pipe shall be marked appropriately and removed from project area immediately.

Each section of pipe and each fitting shall be thoroughly cleaned out before it is lowered into the trench. Cleaning of each pipe or fitting shall be accomplished by swabbing out, brushing out, blowing out with compressed air, washing out with water, or by any combination of these methods to achieve removal of all foreign matter.

If clean pipe sections and fittings cannot be placed in the trench without getting dirt into the open ends, the Water Division Engineer may require that a piece of tightly woven canvas be tied over the ends of the pipe or fitting until it has been lowered into position in the trench. After the pipe or fitting has been lowered into the trench, all foreign matter shall be completely brushed from the bell and spigot ends before assembly.

No pipe or fitting shall be lowered into any trench containing water. The trench bottom shall be free from pieces of rock or other material that could potentially damage the pipe. Water shall be pumped from wet trenches, and the trenches shall be kept dry until the joints have been completed and the open ends of the main have been closed with watertight plugs or bulkheads.

Whenever pipe-laying is discontinued on any job for short periods, or whenever work is stopped at the end of the day, the open ends of the main shall be closed with approved watertight plugs or bulkheads. The plug or bulkhead shall not be removed unless the trench is dry. Every effort shall be made to keep the trench dry at all times.

Each section of pipe shall be lowered into the trench by means of slings of a type approved by the Engineer, and the pipe main assembled piece by piece. Bells usually face the direction in which the work is progressing. Care shall be taken to provide for uniform support of the pipe in the bottom of the trench, as well as to prevent damage to the interior coating or lining. If damage occurs, repairs must be made before the damaged pipe will be acceptable. All pipe shall be cut squarely to length using manufacturer-approved methods.

5.02.03 TRENCH PLATES

Trench plates for water trenches shall conform to Section 2.13.03 and the General Construction Notes. Trench plates installed on highly travelled streets (including all arterials) **will be** required to be set flush with the existing asphalt concrete. Plates shall be skid resistant, pinned and welded.

5.02.04 DIRECTIONAL DRILLING

A. Prequalified Drillers

Due to the specialized nature of the work to be performed, the directional drilling operations shall be completed by one of the pre-qualified drillers approved by the City of Napa Water Division.

Only prequalified drillers from the approved pre-qualified drillers list shall be permitted to complete the directional drilling operations for the project.

Driller shall use key personnel identified with prequalification documentation provided to the owner and City Inspector. The key personnel shall remain for the entire duration of the drilling operations. If key personnel for the driller are different than those listed on the prequalification submittals, Contractor shall provide the modified list of key personnel with qualifying resumes as part of the submittal package.

B. Drilling Operations

Work site as indicated on drawings shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made.

Entry and exit areas shall be drilled so as not to exceed the bending limitations of the pipe as recommended by the pipe supplier.

Contractor shall confine all activities to designated work areas.

Bore path and alignment are as indicated in the contract documents. The path of the bore may be modified based on field and equipment conditions upon approval of City Inspector and owner. Entry and exit locations and control-point elevations shall be maintained as indicated in the contract documents.

The drill path shall be accurately surveyed with entry and exit areas placed in the appropriate locations within the areas indicated on drawings. If using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.

Bore depths shall not exceed specified depths (as shown on the Plans) unless otherwise authorized by Engineer.

Instrumentation shall be provided and maintained at all times, which accurately locates the pilot hole, measures drill-string axial and torsional loads, and measures drilling-fluid

discharge rate and pressure.

Bend radii shown in the contract documents are minimum-allowable radii and shall not be reduced.

C. Drilling Equipment

1. General

The directional-drilling equipment, as a minimum, shall consist of a directional drilling rig of sufficient capacity to perform the bore(s) and pullback of the pipe(s), a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations, and trained and competent personnel to operate the system.

All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in good working order for the duration of this project. All required equipment shall be included in the emergency and contingency plan as submitted per these specifications.

The directional-drilling equipment must be of a sufficient size (with a sufficient drill-bit size and type for proper and safe installation of the pipeline) to safely complete the longest/largest bore length of the project.

Correct location of all underground utilities that could impact the installation is the Contractor responsibility, regardless of any locations shown on the drawings or previous surveys completed.

Utility location and notification services shall be contacted by the Contractor prior to the start of construction.

All existing lines and underground utilities shall be positively identified, including exposing those facilities that are located within an envelope of possible impact of the installation as determined for the project specific site conditions. It is the Contractor's and operator's responsibility to determine this envelope of safe offset from existing utilities. This will include, but is not limited to, soil conditions and layering, utility proximity and material, drilling system and equipment, and foreign subsurface material.

2. Casing and Carrier Pipe Installation

All freeway/expressway crossings shall be fusible C900 and have a minimum 12-inch carrier pipe inside an appropriately sized casing pipe. Carrier pipe shall be installed into the casing pipe after pullback operations, unless otherwise authorized by Engineer.

Fusion bead within casing pipe and exterior of carrier pipe shall be removed prior to inserting carrier pipe into casing. Removal of the fusion bead shall be conducted with proper bead removal equipment and be completed by the fusion technician per the manufacturer's recommendations.

For each crossing, casing spacers shall be installed on the extent of the carrier pipe (with a maximum 10-foot separation between each spacer) prior to the insertion of the carrier pipe into the casing pipe. The ends of the casing pipes shall be sealed with split-type casing seal after the completion of the pipe, pull-back of the casing pipe, and installation of the carrier pipe.

Contractor shall trim casing pipe to proper length (after pull-back). Contractor shall take extra precautions when trimming carrier pipe, when carrier pipe is within casing. Damage

to the carrier pipe or casing pipe shall be repaired by the full removal of the damaged pipe and fusing new pipe (as necessary) to replace the damaged section.

3. Pilot Hole Bore

Pilot hole shall be drilled along bore path. In the event that the pilot bore does deviate from the bore path, Contractor may be required to pull-back and re-drill from the location along bore path before the deviation.

Contractor shall limit curvature in any direction to reduce force on the pipe during pull-back.

The minimum radius of curvature shall be no less than that specified by the pipe supplier and as indicated on the drawings.

4. Reaming

After successfully completing the pilot hole, the bore hole shall be reamed to a diameter which meets the requirements of the pipe being installed. The following table is offered as an estimated guide:

Nominal Pipe Diameter	Bore Hole Diameter
< 8 inches	Pipe Dia. + 4 inches
8 inches to 24 inches	Pipe Dia. x 1.5
> 24 inches	Pipe Dia. + 12 inches

Multiple reaming passes shall be used at the Contractor's discretion and shall conform to this specification.

In the event of a drilling-fluid fracture, returns loss or other loss of drilling fluid, Contractor shall be responsible for restoring any damaged property to original condition and cleaning up the area in the vicinity of the damage or loss.

At the terminus of each new casing (after installation), all voids between the drilled hole and the new casing that are not filled with drilling fluid, shall be filled with concrete slurry. Filling the voids with other backfill materials (including sand, native soil, or rock) may not be used instead of concrete slurry.

5. Drill Head

The horizontal directional-drilling equipment shall produce a stable fluid-lined tunnel with the use of a steerable drill head and any subsequent pre-reaming heads.

The system must be able to control the depth and direction of the drilling operation.

Drill head shall contain all necessary cutters and fluid jets for the operation and shall be of the appropriate design for the ground medium being drilled.

6. Drilling-Fluid System

Drilling fluid shall be composed of clean water and the appropriate additive(s) for the fluid to be used. Water shall be from a clean source and shall meet the mixing requirements of the mixture manufacturer(s).

The water and additives shall be mixed thoroughly to assure the absence of any clumps or clods.

No hazardous additives may be used.

Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall(s).

Contractor shall be responsible for the proper documentation and disposal of all drilling fluids, including temporary storage, transportation, and off-haul to final destination, in accordance with local, state, and federal requirements and/or permit conditions.

No additional chemicals or polymer surfactants shall be allowed to be added to the drilling fluid, unless they have been submitted per this specification.

A drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid for the project.

The mixing system shall be able to ensure thorough mixing of the drilling fluid. The drilling fluid reservoir tank shall be sized for adequate storage of the fluid.

The mixing system shall continually agitate the drilling fluid during drilling operations.

The drilling fluid pumping system shall have a minimum capacity to supply drilling fluid in accordance with the drilling equipment pull-back rating at a constant required pressure.

The delivery system shall have filters or other appropriate in-line equipment to prevent solids from being pumped into the drill pipe.

Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. The use of spill containment measures shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps, vacuum truck(s), and/or storage of sufficient size shall be in place to contain excess drilling fluid. A closed-loop drilling fluid system and a drilling-fluid cleaning system shall be used to whatever extent practical, depending upon project size and conditions. Under no circumstances shall drilling fluid that has escaped containment be reused in the drilling system.

7. Drilling Control System

Calibration of the electronic detection and control system shall be verified prior to the start of the bore.

The drilling head shall be remotely steerable by means of an electronic or magnetic detection system. The drilling head location shall be monitored in three dimensions:

- Offset from the baseline
- Distance along the baseline
- Depth of cover

Point of rotation of the head shall also be monitored.

Contractor shall ensure the pipeline will stay within 3 feet of design depth and horizontal location as defined on the project Plans unless otherwise authorized by the City inspector.

D. Pipe Pull-Heads

Pipe pull-heads shall be utilized that employ a positive through-bolt design, assuring a smooth wall against the pipe cross-section at all times.

Pipe pull-heads shall be specifically designed for use with fusible polyvinylchloride pipe and shall be as recommended by the pipe supplier.

E. Pipe Rollers

Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe during handling and pullback operations.

A sufficient quantity of rollers and spacing, per the pipe supplier's guidelines, shall be used to assure adequate support and excessive sagging of the product pipe.

F. Fusion Process

Unless otherwise specified, fusible polyvinylchloride pipe lengths shall be assembled in the field with butt-fused joints. Contractor shall follow the pipe supplier's guidelines for this procedure. All fusion joints shall be completed as described in this specification.

Fusion bead for the Fusible C905 casing pipe (interior and exterior) and the exterior of the Fusible C900/Fusible C905 carrier pipe shall be removed. Removal of the fusion bead shall be conducted with proper bead removal equipment and be completed by the fusion technician per the manufacturer's recommendations.

Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process, and in accordance with this specification and pipe supplier's guidelines.

Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.

Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine.

Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following properties, including the following elements:

1. Heat Plate

Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly, and cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.

2. Carriage.

Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.

3. General Machine.

Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

4. Data Logging Device.

The current version of the pipe supplier's recommended and compatible software shall be used. Data-logging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

G. Joint Recording

Each fusion joint shall be recorded and logged by an electronic monitoring device (data-logger) connected to the fusion machine. The fusion data-logging and joint report shall be generated by software developed specifically for the butt-fusion of thermoplastic pipe. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data-logger shall be logged manually and be included in the Fusion Technician's joint report.

H. Pipe Pull-Back and Insertion

Pipe shall be fused prior to insertion, if the site and conditions allow, into one continuous length. Carrier pipe (12-Foot Fusible C900 Water Main) shall be installed into the casing pipe (16-Foot Fusible C905 Casing) after pull-back operations, unless otherwise authorized by Engineer.

Fusion bead within casing pipe and exterior of carrier pipe shall be removed prior to inserting carrier pipe into casing. Removal of the fusion bead shall be conducted with proper bead removal equipment and be completed by the fusion technician per the manufacturer's recommendations.

Contractor shall handle the pipe in a manner that will not over-stress the pipe prior to insertion. Vertical and horizontal curves shall be limited so that the pipe does not bend past the pipe supplier's minimum allowable bend radius, buckle, or otherwise become damaged. Damaged portions of the pipe shall be removed and replaced.

The pipe entry area shall be graded as needed to provide support for the pipe, and to allow free movement into the bore hole.

The pipe shall be guided into the bore hole to avoid deformation of, or damage to, the pipe.

The fusible polyvinylchloride pipe may be continuously or partially supported on rollers or other Owner- and Engineer-approved friction decreasing implement during joining and insertion, as long as the pipe is not over-stressed or critically abraded prior to, or during, installation.

A swivel shall be used between the reaming head and the fusible polyvinylchloride pipe to minimize torsion stress on the pipe assembly.

Buoyancy modification shall be at the Contractor's sole discretion and shall not exceed the pipe supplier's guidelines in regard to maximum pull force or minimum bend radius of the pipe. Damage caused by buoyancy modifications shall be the Contractor's responsibility.

Once pull-back operations have commenced, the operation shall continue without interruption until the pipe is completely pulled through the bore hole.

The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, or movement and distortion of surface features. Contractor shall correct any damages caused by the Contractor's operations.

Fittings shall be centered in place to accurate line and grade. Thrust blocks or restrained joints shall be installed as required.

Mechanical or push-on joint fittings can be used with mechanical or push-on joint pipe. The plain end of the pipe usually is provided with one or two painted gauge lines that show whether it has been properly positioned in the bell socket after assembly. The pipe manufacturer's instructions as to the location of these lines shall be followed.

When installing mechanical joint pipe, the assembly of the joint requires use of a torque wrench for the proper amount of pressure.

SUGGESTED TORQUE	
BOLT SIZE	FOOT POUNDS
5/8 inch	45-60
¾ inch	75-90
1 inch	85-100
1-½ inch	105-120

From time to time, pit-cast pipe will be found in the existing water system. Pit-cast pipe was manufactured in four classifications, each having a different outside diameter than modern-ductile or cast-iron pipe. Before making extensions, existing pipe shall be measured to determine if special transition fittings are required.

Flanged joints at fittings or valves, where required, shall be neatly fitted, made with approved gaskets, and shall be water-tight. All bolts, nuts, and gaskets shall be sized to conform to size of flange and pressure class required.

5.02.05 TRACER WIRE

Contractor shall connect by tracer wire the full length of the new water main, new service laterals, and fire-hydrant laterals. Requirements for installation and testing shall be as follows:

1. Tracer wire shall be required on all non-ferrous water mains and services.
2. Tracer Wire Installation
 - (a) Open Cut installations and for pipe diameters 14-inches and smaller:
Tracer wire shall be at a minimum No. 10 AWG annealed bare copper UF solid type wire with cross-linked polyethylene insulation minimum 30 mil thickness or subject to the approval of the Water Division Engineer. The insulation shall be blue in color. Connectors shall have a dielectric gel and must be sealed.
 - (b) Horizontal Directional Drilling applications
Tracer Wire No. 8 CCS Extra High Strength Hard Drawn 1150 lb. or approved equal, and installed for all non-metallic pipe. HDPE coating with minimum 45 mil thickness. The insulation shall be blue in color.
3. Tracer wires shall be interconnected at all pipe tees, pipe crosses, and pipe services. Splices shall be "KURNEY" (split-bolt) or "KUPLETAP". Installation tape shall be vinyl electrical with two coats of "Scotch Kote".

4. Tracer wire shall be placed outside of the valve riser pipe and shall be placed in the notch at the top of the valve riser pipe, as shown on the Plans and these Specifications.
5. Tracer wire shall be taped to the top of the pipe at a minimum of 5-foot intervals, and at all crosses, tees, and elbows. When taping tracer wire to pipe, wrap the tape once around the tracer wire before securing it to the pipe, then wrap the tape around the full diameter of the pipe.

After backfill and compaction, but prior to paving, continuity testing of the tracer wire and traceability of the tracer wire will be required. Contractor shall coordinate scheduling an independent tracing test and provide results to the Water Division Inspector. Any detected damages to the tracer wire shall be repaired at no cost to the City before paving will be allowed.

5.02.06 PRESSURE TESTING

New water mains shall be subjected to a hydrostatic pressure/leakage test for a period of 4 hours at 150 psi. Pressure testing shall be performed after all compaction of trench backfill has been completed and/or subgrade on new streets is fully compacted and ready for paving. Pipelines shall be pressure tested prior to connection to the existing water system. The water mains shall be tested as a complete system including all fire hydrants. Testing of multiple portions of a continuous run of water main shall not be accepted.

The measured pressure shall not change by ± 2 psi during the test.

The pressure/leakage test shall not be made until at least 36 hours after the last concrete thrust block has been poured when Type III cement is used, or at least 7 days after the last thrust block has been poured when Type II cement is used.

Prior to starting the test, the pipeline shall be filled with water for 24 hours. During the filling of the line and before applying the specified test pressure, all air shall be expelled from the pipe. If necessary, taps shall be made as directed at the points of highest elevation and plugged upon completion of the test. The pipeline shall be slowly filled with water, and the specified test pressure applied at the point of lowest elevation by means of a pump connected to the pipe by a corporation cock. During the test, all exposed pipe, fittings, valves, hydrants, and joints will be carefully examined.

The water lost due to leakage shall be none.

Contractor shall remove and replace any cracked or defective material to the satisfaction of the Engineer, and no additional payment will be made therefor. The test shall be repeated until no defects remain. If water leakage occurs in the pipeline being tested, Contractor shall locate and repair the defective joints or fittings, and no additional payment will be made therefor. Contractor shall retest the pipeline until leakage has been eliminated.

Contractor shall be required to conduct pressure/leakage testing on the isolated system, i.e., connections shall not be made to the City's system until all tests have passed. This will usually require that plugs and thrust blocks be used, which may not appear on the plans. Closing pieces will be laid after testing is complete. Testing against closed valves will not be allowed.

5.02.07 FLUSHING AND CHLORINATING

The City shall be notified a minimum of 48 hours prior to commencement of flushing and chlorination operations. Contact the Water Division Inspector at the City's Corp Yard at 707-

257-9544 to schedule flushing and chlorination of all newly installed pipeline(s).

Soil, debris, etc., shall be removed from the water lines prior to chlorination, and a flushing plan, if required, shall be submitted for approval prior to commencement of flushing operations.

The selected chlorination method (tablet, continuous feed, slug, spray) shall comply with AWWA C651 (Disinfecting Water Mains). The pipeline shall be slowly filled to allow proper circulation of chlorination solution and be allowed to stand in accordance with the prescribed method selected.

Upon completion of chlorination, all super-chlorinated water shall be thoroughly flushed from the pipeline(s), service(s), etc., until the replacement water is proved equal to that of the water quality discharged at the supply point within the City's water distribution system.

Super-chlorinated water shall be disposed in accordance with all City, County, and State pollutant discharge requirements. No super-chlorinated water shall be discharged into any storm drains or surface waters; discharge of super-chlorinated water into the sanitary sewer system may be granted but requires prior approval, which shall be at the sole discretion of the Napa Sanitation District (NSD).

Requests to discharge super-chlorinated water into the sanitary sewer system shall be made through the NSD Construction Inspector at (707) 258-6000 and shall be scheduled a minimum of two working days prior to any discharge into the sewer system.

Discharge(s) into the sewer system, if approved, may require additional equipment and reporting requirements, which shall be at the sole discretion of NSD.

If NSD does not grant approval to discharge into the sewer system, flushing and de-chlorination of super-chlorinated water shall be conducted in accordance with all City, County, and State pollutant discharge requirements; a flushing plan outlining the method of de-chlorination shall be provided to the City Water Division Inspector a minimum of two working days prior to commencement of flushing and de-chlorination operations.

5.02.08 BACTERIOLOGICAL TESTS

Upon successful completion of pressure testing, chlorinating, and flushing of super-chlorinated water, the pipeline shall be allowed to stand for a minimum of 24 hours prior to the first bacteriological test, which shall be scheduled with the City of Napa Water Division Inspector at least two working days prior to the first sampling event.

Temporary sampling points within the newly installed pipeline section(s) may, or may not, be shown in the approved plans, but may be taken at blow-off locations (temporary or permanent), newly installed sample station(s), service(s), or as directed by the City Water Division Inspector.

Water samples shall be taken on only Monday, Tuesday or Wednesday. Two sampling events will be required with the first being taken a minimum of 24 hours after completion of de-chlorination and flushing; the second sampling event shall be taken 24 hours later (i.e., 48 hours after the first sampling event).

All sample sets from both sampling events must pass bacteriological testing in order to be deemed ready for connection to the City's water system. Failure of any sample will require flushing, re-chlorination if necessary, and the initiation of a new bacteriological sampling and testing process, as prescribed above.

All portions of the City's form as described in Section 5.02.12 shall be submitted to the City Water Division Inspector prior to connection to the City's water system.

Final connection(s) to the City's water system shall be scheduled at least two working days in advance, and conducted under the direct supervision of the City Water Division Inspector.

5.02.09 FINAL TIE-INS

Contractor shall contact the City to schedule tie-ins to City facilities by calling (707) 257-9521. All tie-ins shall be conducted under City inspection only after pressure testing, chlorination, and bacteriological testing is complete.

5.02.10 CITY-OWNED FACILITIES

Any City-owned materials removed shall be delivered to the City Corporation Yard, 770 Jackson Street, as directed by the City Water Division Inspector.

5.02.11 WATER CONSERVATION

All projects creating a net increase in demand on the City water system shall meet water demand mitigation (offset) requirements as specified by the Water Division per Napa Municipal Code Chapter 13.09. Current requirements may involve completion of offsite toilet retrofits, payment of an in-lieu fee, or an alternative method of equivalent water savings. Upon release of the building permit, specific offset requirements for a project are determined, and developers are notified by Water Conservation staff. In advance of building permit release, preliminary offset requirement estimates are available upon request.

Final requirements, in the form of toilet retrofit certificates, in-lieu fee payment, or authorized alternative method, must be met prior to final occupancy of the project.

5.02.12 CHECKLISTS AND FORMS

Checklist for Water Main Disinfection and Sampling

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