NOTE TO CONSULTANTS: Edit this specification section with Track Changes turned on, any of the text necessary to fit the project requirements. Several choices need to be made related to type of pipe, based on the size and situation, and the type of fittings and jointing methods associated with the pipe type and size needed. These determinations shall be made at the direction of the Engineer through the design/technical review process. (Remove this Note).

PART 1 - GENERAL

1.01 Description:

A. The pre-construction work includes but is not limited to the following:

1. Pre-mobilization DVD of Existing Site Conditions.
2. Location and Documentation of all underground utilities and controls.
3. Protect from harm any trees or other site elements and objects not designated for removal.
4. Temporary security fencing.
5. Temporary Erosion and Sedimentation Control (TESC) facilities.
6. Temporary construction access pads.
7. Staging & Stockpile Areas.
8. Other Temporary Facilities as required.
9. Installation, Continuous Maintenance, and final Removal of each element included in this Section.

1.02 Key Abbreviations: The following abbreviations shall apply to this Section:

SPU	Seattle Public Utilities
SPR	Seattle Parks & Recreation
DPD	Department of Planning & Development
WSDOT	Washington State Department of Transportation
PPI	Plumbing Practices Institute
WDS	Water Distribution System
DIP	Ductile-Iron Pipe
HDPE	High Density Polyethylene Pipe
PVC	Poly-vinyl Chloride Pipe
LIV	Lateral (Sub-main) Isolation Valve
BPA	Backflow Prevention Assembly
BAT	Backflow Assembly Tester
FH	Fire Hydrant
VB	Valve Box
GV	Gate Valve

1.03 General:

A. Water Distribution Systems (WDS): The work includes but is not limited to the following:

1. Site Preparation, Construction Sediment, tree and plant protection, site

demolition, existing utility locating and protection, traffic control, and site restoration as may be required.

2. Water Utility piping and appurtenances from the source of potable water (Meter or Deduct Meter) to 5 feet outside the building line, drinking fountain or irrigation system point of connection.
3. Fire Protection Systems, meeting all DPD and Fire Department requirements.

1.03 Related Sections: The following Sections contain requirements that relate to the Work of this section:

Section 01 76 00 - Protection of Existing Facilities
Section 01 56 39 - Temporary Tree & Plant Protection
Section 01 57 19 - Temporary Erosion & Sediment Control
Section 02 41 13.23 - Site Utility Removal
Section 21 10 00 - Fire Water Distribution Systems
Section 22 11 16 - Marina Potable Water Systems
Section 31 00 00 - Earthwork
Section 32 11 23 - Mineral Aggregates
Section 32 80 00 - Irrigation Systems
Section 33 00 13 - Potable Water Systems for Drinking Fountains

1.04 Reference Codes and Standards:

A. City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction (most recent edition).

B. APWA: Comply with the current edition of the Standard Specifications for road, bridge, and municipal construction as published by Washington State Department of Transportation and the American Public Works Association of Washington.

C. NFPA Compliance: Install fire water systems in accordance with NFPA 24 “Standard for the Installation of Private Fire Service Mains and Their Appurtenances”.

D. Local Fire Department/Marshal Regulations: Comply with governing regulations pertaining to hydrants, including hose unit threading and similar matching of connections.

E. UL Compliance: Provide fire hydrants that comply with UL 246 “Hydrants for Fire-Protection Service”, and are listed by UL.

F. AWWA: Comply with the latest edition of the Standards of the American Water Works Association.

G. Local Water District Regulations: Comply with Construction Standards of Seattle Public Utilities.

H. Where differences occur between state laws, local ordinances, industry standards, DPD, SPU, Fire District requirements, and the Contract Documents, the most

stringent requirements shall govern.

I. Seattle Parks & Recreation (SPR) Standards for Design and Construction: For related technical specifications and details refer to other sections of these construction documents or by searching the SPR Design Standards web site @ www.cityofseattle.gov/parks/projects/standards.

1.05 Quality Assurance:

A. Basic Qualifications - The Contractor must be a **Washington State Licensed Plumber** and all testing or repair of the backflow prevention equipment (for either exterior or interior water systems) shall be done by a **Washington State Certified Backflow Assembly Tester (BAT).**

1.06 Submittals:

A. Product Data: Submit manufacturer's technical product data and installation instructions for fire water system materials and products.

B. Shop Drawings: Submit shop drawings for fire water systems, showing piping materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures.

C. Record Documents: At project closeout, submit record drawings of installed water distribution system or fire water system piping and products, in accordance with requirements of Division 1.

D. Maintenance & Operations Information: Submit maintenance data and parts lists for water distribution system or fire water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.

1.07 Application for New Water Service: The Engineer shall contact **SPU Customer Service at (206) 684-5800**. Refer to the City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction (most recent edition). After payment for the new service has been received, Seattle Public Utilities' Water Operations will furnish and install the water service, water meter and meter box. The Contractor shall be responsible to request service coordination with the Engineer and shall allow 8 weeks for installation by Seattle Public Utilities' Water Operations.

1.08 Clearances with Water Mains and other Utilities in Public Rights-of-Way: When proposed underground utilities are within the clearance limits of Water Mains specified in the City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction (most recent edition), notification shall be provided by calling **(206) 615-1318** at least 15 Working Days in advance of construction for approval by the Engineer.

1.09 Backflow Prevention Assembly (BPA) Inspection: When a BPA is required in any temporary or permanent connection with a Water Main, the Contractor shall request inspection by making the following notification at least 2 Working Days in advance of making the connection to the Water Main (see the City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction (most recent edition): Call **SPU Inspection Services Administrative Authority @ (206) 684-3536.**

PART 2 - PRODUCTS

2.01 Water Mains:

A. Ductile-Iron Pipe (DIP): Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51, standard thickness, Class 52. The pipe shall be lined with cement mortar conforming to ANSI/AWWA C104/A21.4 and coated with an asphaltic coating. Each length shall be plainly marked with the manufacturer's identification, year cast, class of pipe, and weight. Type of joint shall be rubber gasket, push-on type (Tyton), or mechanical joint (M.J.) conforming to ANSI/AWWA C111/A21.11. Flanged joints shall conform to ANSI B16.1.

B. Ductile Iron Fittings:

1. DIP Fittings shall be short-bodied ductile iron C110 or C153 for 350 psi pressure rated mechanical joint fittings and 250 psi pressure rated flanged fittings. All fittings shall have a cement mortar lining conforming to ANSI/AWWA C104/A21.4. The fittings shall be furnished with flanged ends or mechanical joints.

(or)

1. DIP Fittings shall be ductile iron, Grade 65-45-12 in accordance with ASTM A-536. Fittings shall have deep bell push-on joints with gaskets meeting ASTM F-477. (Transition gaskets are not allowed). Fittings shall be DEEP BELL as manufactured by HARCO (Harrington Corporation) of Lynchburg, VA, or approved equal.

2. DIP Restrained Joints shall be made up with mechanical joint pipe and fittings. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1 and shall be EBBA Iron, Inc., MEGALUG, Star Pipe Products, or approved equal.

(or)

2. DIP Fitting to Pipe Joint Restraint (1-1/2" through 4"): Joint Restraint shall be knuckle type and shall be one piece residing within a ductile iron housing having machined serrations and shall be activated by one bolt. Housing and grip ring shall be of ductile iron to ASTM A536. Bolt and nut shall be Type 304 stainless steel. Joint Restraint shall be as manufactured by HARCO (Harrington Corporation) of Lynchburg, VA, or approved equal.

3. DIP Fitting to Pipe Joint Restraint (6" through 12"): Fitting to Pipe Restraints shall meet the requirements of UNI-B-13-94. Grip ring serrations shall be machined. As cast serrations are not permitted. Restraint rods, bolts

and nuts shall be of ductile iron per ASTM A563 or low alloy steel to AWWA/ANSI C111/A21.11. Fitting to Pipe Restraint shall be supplied by HARCO (Harrington Corporation), Lynchburg, VA, or approved equal.

4. DIP Solid Sleeve Pipe Couplings shall be long pattern sleeves constructed of ductile iron with a minimum pressure rating of 250 psi working pressure.

(or)

4. Pipe to Pipe Restraints: Pipe to Pipe Restraints shall meet the requirements of UNI-B-13-94. Grip ring serrations shall be machined. As cast serrations are not permitted. Restraint rods, bolts and nuts shall be of low alloy steel per AWWA/ANSI C111/A21.11. Pipe to Pipe Restraints shall be as manufactured by HARCO (Harrington Corporation) of Lynchburg, VA, or approved equal.

5. Gate Valve to Pipe Restraints: Valve to Pipe Restraints shall be ductile iron per (ASTM A536) grip rings with machined serrations and ductile iron restraint rods. The ring that grips the pipe shall meet the requirements of Uni-B-13-94. The restraint rod nuts shall be made from low alloy steel per AWWA/ANSI C111/A21.1 or ductile iron per ASTM A536. All valve restraints shall be as manufactured by HARCO (Harrington Corporation) of Lynchburg, VA, or approved equal.

2.02 Potable Water Service Lines:

A. Copper Pipe: All copper piping/tubing shall be Type K copper and shall conform to industry standards and be in conformance with applicable ASTM or ANSI standards. Service lines shall be Type “K” copper conforming to the requirements of ASTM B-88-47. All pipes shall bear the seal of the National Sanitation Foundation for potable water pipe. All pipe joints shall be made in accordance with the manufacturer’s recommendations.

B. Copper Tubing: ASTM B 88, Type ‘K’ water tube. For tubing 2” diameter and smaller, use ‘soft’ copper (annealed temper).

1. For tubing 2 inches and smaller: Cast-copper alloy solder-joint pressure fittings and soldered joints with Alloy Sn95 solder.
2. For tubing 2” diameter and larger: Use ‘hard’ copper.
   a. Any copper pipe installed **under** a concrete slab shall be braised at each joint, per UPC Building Codes and be protected from contaminants by an approved wrapping material. Where the copper water line passes **through** a concrete slab it shall be protected from any contact by use of an approved wrapping material.
   b. All piping that is installed under a concrete slab shall be **supported** by the slab to protect the piping from settling and/or breaking.

C. Copper Fittings:

1. Cast-Copper-Alloy, Solder-Joint Pressure Fittings: ASME B16.18.

2. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.
3. Threaded Ends: Threads conforming to ASME B1.20.1.

2.03 High Density Polyethylene (HDPE) Pipe and Fittings:

A. HDPE Pipe: Pipe shall conform to the requirements of AWWA C-901. Pipe shall bear the seal of the National Sanitation Foundation for potable water pipe. Pipe joints shall be made in accordance with the manufacturer's recommendations. Solvent welded pipe joints will not be permitted. Minimum working pressure shall be 160 psi.

B HDPE Pressure Pipe **(2" O.D. and smaller)**: Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350-02 with a cell classification of PE: 345464C. The pipe shall have a manufacturing standard of ASTM D3035 (IPS). The pipe shall be DR 9 (200psi WPR) unless otherwise specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, and per AWWA C901, have nominal burst values of three times the Working Pressure Rating (WPR) of the pipe. Pipe shall also have the following agency listing of NSF 61.

C. HDPE Pressure Pipe **(3" O.D. and larger)**: Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350 with a cell classification of PE: 345464C. The pipe shall have a manufacturing standard of ASTM F714. The pipe O.D. sizes 4" to 24" shall be available in both steel pipe sizes (IPS) and ductile iron pipe sizes (DIPS). The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, listed as NSF 61, and per AWWA C906 Pressure Class (PC) 100 have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe. Peak flow water velocity of 5 ft/sec shall be used in the hydraulics engineering design.

D. Butt Fusion Fittings: Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02, and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

E. Electro-fusion Fittings: Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Electro-fusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electro-fusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting. Mechanical saddles shall not be allowed.

F. Flanged and Mechanical Joint Adapters: Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

2.04 Gate Valves (GV):

A. Gate Valves **(2" O.D. to 2-1/2" O.D.)** shall be flanged, iron body, brass trimmed, resilient double disc wedge, and integral taper seats with non-rising stem and square actuator. All gate valves shall be Class 150 with a minimum 150 psi - 300 WOG. Gate Valves shall be ductile iron body valves, iron disk completely encapsulated with polyurethane rubber and bronze, non-rising stem with "O" ring seals conforming to AWWA C509 or C515. The valves shall open counterclockwise and be furnished with 2-inch square operating nuts except valves in vaults shall be furnished with hand wheels. All surfaces, interior and exterior shall be fusion bonded epoxy coated, acceptable for potable water.

B. For applications with working pressure above 175 psi, a valve rated as 250 psi or higher shall be used.

C. Valves shall be as manufactured by Clow, M&H, Kennedy, U.S. Pipe, Mueller, American Flow Control, or approved equal.

2.05 Lateral (Sub-main) Isolation Valves (LIV):

A. Lateral Isolation Valves shall be Ductile Iron, 316 Stainless Steel, and Low Zinc Bronze complying with ASTM A536, ASTM A276, ASTM B62-C83600 respectively, or equivalent. Ductile Iron shall be fusion bond epoxy coated. Valves shall be 200 psi rated angle globe valves with integrally restrained ends. Ends shall be male swivel or integrally restrained push on gasketed joint as required. Gasketed joints shall be SBR Rubber and comply with ASTM F477. Internal seals shall be EPDM rubber.

B. Lateral Isolation Valves shall be as manufactured by HARCO (Harrington Corporation) of Lynchburg, VA.

2.06 Valve Boxes (VB): The valve boxes shall be adjustable two-piece cast-iron valve box designed with tabs (lugs) on cover with 5 inches minimum inside diameter. The top section shall be 18 inches minimum length with a valve cover marked "WATER" as manufactured

by Olympic Foundry, Tyler, or approved equal.

2.07 Fire Hydrants (FH):

A. Subject to approval of local jurisdictions, provide the following:

1. Fire hydrants shall be breakaway type and shall conform to AWWA C502.
2. Fire hydrants barrel shall have a diameter of not less than 7-inches, and the main valve opening shall be not less than 5-1/4 inches.
3. The hydrants shall have two 2-1/2 inch hose ports (National Standard Thread), and one 4-1/2 inch pumper connection (National Standard Thread).
4. All nozzles shall be fitted with cast iron threaded caps with operating nuts of the same design and proportions as the hydrant stem nuts.
5. Caps shall be threaded to fit the corresponding nozzles and shall be fitted with suitable neoprene gaskets for positive water tightness under test pressure.
6. A permanent anodized short profile style “Storz” hydrant adapter and anodized Storz blind flange shall be installed on the pumps port. The size of the adapter shall be 4 inch.
7. Hydrant shall be equipped with a suitable positive acting drain valve and one-and-one-quarter-inch (1-1/4”) pentagonal operating nut (counter-clockwise opening).

B. Subject to compliance with requirements, provide fire hydrants from one of the following manufacturers: Mueller Centurion, Clow Medallion, M&H Style 929, Waterous Pacer, or approved equal.

2.08 Misc. Accessories:

A. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.

B. Clamps, Straps, and Washers: Shall be steel, per ASTM A506.

C. Rods: Shall be steel, per ASTM A575.

D. Rod Couplings: Shall be malleable-iron, per ASTM A197.

E. Bolts: Shall be steel, per ASTM A307.

F. Cast-Iron Washers: Shall be gray-iron, per ASTM A126.

PART 3 - EXECUTION

3.01 Installation of Pipe and Fittings:

A. Ductile-Iron Pipe: Install in accordance with AWWA C600 "Standard for Installation of Ductile Iron Water Mains and their Appurtenances".

B. Depth of Cover: Provide minimum 3 foot depth of cover over underground piping and/or in accordance with NFPA 24, Figure A-8-11 "Recommended Depth of Cover above top of Underground Yard Mains".

3.02 HDPE Pipe Joining and Installation Methods:

A. General: Pipe and fittings shall be installed using procedures recommended by the manufacturer.

B. Plain end pipe and fittings shall be made using the butt fusion method. The butt fusion procedures shall be in accordance with the manufacturer or the PPI. The fusion equipment operator shall receive training using the recommended procedure. The Contractor shall be responsible to verify that the fusion equipment is in good operating condition and that the operator has been trained within the past twelve months. Fusion beads shall not be removed.

C. Heat Fusion Training. The supplier of the pipe and fittings shall provide a person certified by the pipe manufacturer and the fusion equipment manufacturer to train contractor fusion equipment operators and inspectors representing the Owner.

D. Mechanical Joining. Polyethylene pipe and fittings may be joined together using Flanges or Mechanical Joint (MJ) adapters. These fittings shall be made from PE 3408 HDPE, with a Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and MJ adapters shall have a manufacturing standard of ASTM D3261. They shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Mechanical saddles shall not be allowed.

E. Electro-fusion couplings. Polyethylene pipe and fittings may be joined using approved electro-fusion couplings. Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Electro-fusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electro-fusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

F. Flange/MJ Adapter Installation. Flanges/MJ adapters shall be attached to pipe and fittings using butt fusion. The flanges/MJ adapters shall be aligned and centered relative to the pipe. Flanges/MJ adapters should be square with the valve or other flange before tightening of bolts. Bolts should not be used to draw flanges into alignment. Bolt threads shall be lubricated, and flat washers shall be used under flange nuts. Bolts shall be tightened using a "star tightening pattern". See the manufacturer's recommendations. Twenty-four hours after first tightening the flange bolts, they must be re-tightened using the same "star tightening pattern used above. The final tightening torque shall be as indicated by the manufacturer.

3.02 Unsuitable Material and Polyethylene Encasement:

A. Whenever the native material in the bottom of the watermain trench is peat, soft clay, quicksand, or other unsuitable material for pipe support, it shall be removed from the trench and replaced by Foundation Material Class A which is defined as following:

Sieve Size	% Passing
2-1/2 inch	98-100
2 inch	92-100
1-1/2 inch	72-87
1-1/4 inch	58-75
3/4 inch	27-47
3/8 inch	3-14
U.S. No. 4	0-1

3.03 Installation of Valves:

A. General: Install valves as indicated and per the manufacturer's recommendations.

B. Shut-off valves: Install shut-off valve ahead of each hydrant.

C. Valves shall be enclosed in a Cast Iron Roadway Box according to the Details, with bottom, top, and lid, sized and extensions, as required. Lid shall have the word "WATER" printed on it.

3.04 Installation of Fire Hydrants:

A. General: Install fire hydrants in accordance with AWWA M17 "Installation, Operation, and Maintenance of Fire Hydrants."

B. Location: Install fire hydrants minimum as specified in the local fire codes, and/or as indicated on the Plans and Details.

3.05 Service connections: Service connections shall be installed in conformance with City of Seattle Standard Plans and Specifications and Details (most recent edition), where applicable.

3.06 Field Quality Control:

A. Inspection: Inspect the pipe for defects before installation and/or fusion. Defective, damaged or unsound pipe shall be rejected.

B. All testing and disinfection shall be in accordance with the most recent edition of APWA Standards and the most recent edition of AWWA Standards, local jurisdiction or as follows, whichever is most stringent.

C. Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline with water 24-hours prior to testing, and apply test pressure to stabilize system.

D. Hydrostatic Tests: Test at not less than 250 psi for a period of not less than thirty

(30) minutes.

E. Test fails if leakage exceeds AWWA specifications.

F. Painting: Thoroughly clean and paint all iron parts of the hydrant, both inside and outside. Paint the outside of the hydrant above the ground line in accordance with AWWA C502-64.

G. Operating Tests: Open and close all valves and hydrants under system water pressure.

H. Check dry barrel hydrants for proper drainage or systems with fire pumps, run pumps during operating tests.

3.07 Adjusting and Cleaning:

A. Flushing: Flush underground mains and lead-in connections to sprinkler risers before connection is made to sprinklers, standpipes, or other fire protection system piping.

B. Flush at flow rate not less than that indicated in NFPA 24, or hydraulically calculated water demand rate of the system, whichever is greater.

C. Disinfection of Water Mains: Disinfection of water mains shall be in conformance with Section 7-11.3(12) of the WSDOT Standard Specifications.

END OF SECTION