NOTE TO CONSULTANTS: ***Edit this specification section with 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), the type of fittings and jointing methods associated with the pipe type and size needed, and other equipment such as sprinkler heads and control/communications equipment. These determinations shall be made at the direction of the Engineer and the P-Patch Program Coordinator, through the design/technical review process. Read this section carefully before proceeding with editing of this specification and delete this note and the following instructions from the Construction Documents.***

GENERAL INSTRUCTIONS: At the beginning of the design process the Consultant is required to download from the SPR Design Standards web site at www.seattle.gov/parks/projects/standards, the SPR Design Standard 33 10 00 – P-Patch Water Systems Design, and read that document and incorporate the principals therein as part of the design process.

The attached Standard Specification represents the minimum acceptable standards for design and construction of all P-Patch Water Systems to be built in Seattle Parks. The Consultant shall not make any changes (add, delete, or alter) to this Standard Specification unless they are approved by the Parks Engineer prior to its inclusion in the Contract Documents. Some items within this specification are shown in bold text are for emphasis only.

However, the Consultant has the added responsibility to not only comply with these standard specifications, but to also expand them as required, or as may be dictated and/or warranted by the following:

A. As directed by the Park Engineer as a result of SPR's Design & Technical Review (ProView) process.
B. Special conditions for each project and site.
C. Environmental considerations and constraints.
D. The integrity of the proposed design.
E. The health, safety and welfare of the general public, etc.
F. Meet Uniform Plumbing Code (UPC) requirements.
G. Meet Seattle Public Utilities requirements (back-flow device testing).

Additionally, all SPR Standard Details related to the P-Patch Water System design shall be used as shown on the SPR Design Standards website (without alterations) and shall be included in the Contract Documents on the Plan Sheets.

INSPECTION CRITICAL PATH:
(P-Patch Water System Testing, Inspections & Close Out Procedures)

1. Pressure Test and Visual Inspections of trenches, main lines and valves (at 150 psi, for 30 minutes).
2. Pressure Test and Visual Inspections of trenches, lateral (sub-main) lines and hose bib assemblies (at the design pressure).
3. Preliminary Punch List Inspection of the entire system, control/communications equipment, and trench backfilling. Punch list is developed.
4. Substantial Completion Inspection (10 working days after punch list inspection) punch list items are substantially complete.
   a. Inspection of backflow prevention device by a Backflow Assembly Tester (BAT), hired by the Contractor, who will present the certification report to P-Patch Program Coordinator, SPR's Plumbing Shop & Seattle Public Utilities.
   b. M & O manuals and red lined drawings of "as-built" conditions submitted to P-Patch Program Coordinator and the Parks Engineer.
5. Physical Completion (Final) Inspection of the entire project (all punch list items have been completed).
6. Transfer to Operations - The P-Patch program Coordinator and SPR Project Manager fills out the appropriate form and the P-Patch Program takes over all maintenance responsibilities.
7. Warranty Period - (for a period of one year after documented Substantial Completion date). The Contractor takes care of any outstanding Warranty items. "Acts of God", vandalism or lacks of appropriate maintenance are the only exceptions to the Contractor's Warranty responsibilities.

RECORD DOCUMENTS: It is the Design Consultant's responsibility to ensure that the following steps are taken to record the "as-built" information of all underground utilities.

Step 1: The Contractor shall keep a current working set of drawings with all as-built changes or actual conditions as work proceeds, to be submitted to Consultant at completion of irrigation system installation.

Step 2: The Contractor shall locate all piping and equipment with trenches open as system is constructed to be entered onto red-lined plans.

Step 3: The Contractor performs all required tests, audits, etc. with adequate notice as spelled out in specs.

Step 4: The Contractor shall transfer the "as-built" information to a scaled drawing (same as Contract Documents) and provide to the Consultant/Designer prior to substantial completion of project, so the Consultant/Designer may provide the final Record Documents at Physical Completion.

Step 5: The Consultant/Designer shall prepare AutoCAD record documents with the Contractor's and/or SPR Surveyor's "as-built" information included, to be submitted to the Engineer on a CD or DVD along with all other required information, M&O manuals, etc. The CD or DVD shall also include .pdf, .jpg or .tif format files of the record documents, along with Mylar hard copies of the record documents to be submitted to the Engineer at Physical Completion of the project.

PART 1 - GENERAL

1.01 Description: Furnish and install P-Patch Water Systems in conformance with the drawings and specifications, complete and ready for use. The work consists of furnishing all materials necessary for a complete installation, including, pipe, pipe sleeves, fittings, back-flow prevention device assemblies, valves, valve boxes, swing joints and all appurtenances related thereto. Included shall be all labor necessary for installation, including trenching, plumbing, back-filling, electrical work, adjustments, and all other items of labor necessary for a satisfactory operating system.

1.02 Quality Assurance: Basic Qualifications - The Contractor must be a Washington State Landscape Industry Professional and has passed the Certified Landscape Professional (CLP) exam. The irrigation system must be installed under the direct supervision of a Certified Irrigation Technician or Journey Plumber. All potable water system components shall be installed by a Washington State Licensed Plumber and all testing of the backflow prevention equipment shall be done by a Washington State Certified Backflow Assembly Tester (BAT).

1.03 Definition: Within this specification section the term "The Engineer" refers to the Parks Engineer and all their representatives that may be involved with the project. Those may include (but are not limited to) Parks Engineering and Design Services staff (including Landscape Architects, Engineers and Architects), Parks' Construction Manager and Inspection Staff, Parks Surveyors, Parks' Facilities Maintenance Shops staff (including Plumbers and Electricians), and Parks' Resource/Operations Staff (including District Senior Gardeners and other maintenance staff) as required and appropriate for the project.

1.04 Reference Sections:

Section 26 00 00 - Electrical
Section 31 00 00 - Earthwork
Section 33 10 00 - Water Distribution Systems

1.05 Submittals:

A. Submit complete materials list prior to performing any work. Submit manufacturer catalog data and full descriptive literature, including current manufacturer's price list.

B. Equipment or materials installed or furnished without prior approval of the Engineer will be rejected and such materials will be required to be removed and replaced with approved materials at the complete expense of the Contractor.

C. Submit shop drawings for review and approval prior to beginning work.

1.06 Project Conditions:

A. Underground utilities and elements: The Contractor shall call Utility Notification Center at (811) or (800) 424-5555 or click www.callbeforeyoudig.org to locate all underground utilities (on or near Public Rights-of-Way / Property Lines) prior to digging and/or driving stakes. The Contractor can also engage the services of a

private utilities locating service for location of utilities within the site by calling Locating, Inc. @ (425) 392-6412, CNI @ (206) 255-8650 or Applied Professional Services @ (425) 313-1034 to locate utilities within the site. (Note: these firms will charge for services rendered). The Contractor is also required to call the SPR Inspection Request Line at (206) 684-7034 or by email at parksconstruction.inspection@seattle.gov to make arrangements for utility locates within park property, in addition to contacting the professional utility location services. The Contractor shall request that the SPR Plumbing, Electrical, and Sewer Crews, along with the SPR Environmental Services Staff be contacted with at least two (2) working days notice. The Contractor can also contact the Engineer for "as-built" information for on-site underground utility system information by calling the SPR Inspection Request Line @ 684-7034 or by email at parksconstruction.inspection@seattle.gov .

B. Site Inspection and Layout: Before proceeding with any work, the Contractor shall inspect the site, carefully checking all grades and verifying all dimensions and conditions affecting the work to satisfy him/her that he/she may safely proceed. Changes or alterations to the system to meet actual conditions shall be made at the Contractor's expense. Always use appropriate fittings for changes in direction or elevation. Do not bend the pipe more than that allowed by this specification. The irrigation plan is diagrammatic and is not intended to show exact locations of existing or proposed piping, valves and hose bibs. Pipelines shown parallel on drawing may be placed in a common trench but separated by at least 6 inches and all pipes of dissimilar materials shall be installed per UPC and SPR standard details included with the plans.

C. When renovating or working around an existing park irrigation system, the Contractor and the Engineer (including the SPR Plumbing and Electrical Shops personnel) shall locate, test and document the condition of the existing system prior to the Contractor beginning the Work.

D. All materials shall be inspected by the Engineer (including SPR Plumbing and Electric shops personnel) prior to installation of any and all materials required to complete the work. The Contractor shall call the SPR Inspection Request Line at (206) 684-7034 or by email at parksconstruction.inspection@seattle.gov to make arrangements for inspections.

E. Take care, to neither disturb nor damage any existing above ground or underground utilities or elements. Keep streets, sidewalks and site clean, free from debris and affected drains open and free flowing at all times.

F. During the installation of the new water system, if underground utilities are encountered, including (but not limited to) existing irrigation systems, the Contractor shall notify the Engineer two (2) working days in advance and perform repairs to that system per this section and/or as directed by the Engineer. This shall also apply to the connection of new irrigation systems to existing older systems. Repairs and connections shall be done per SPR Standard Details and/or as directed by the Engineer in the field. (Note: No telescoping repair couplings will be allowed).

1.07 Water System Warranty: Contractor shall provide a One Year written Warranty as per the last page of this section. The Warranty shall include restoration of planted or paved areas due to settlement of trenches.

Note: The Warranty shall include one complete winterization and one complete de-winterization of the irrigation system. (Applies only for construction projects that carry over into the winter months or where extended maintenance & establishment periods are in place).

PART 2 - PRODUCTS

2.01 Water Distribution System Piping:

A. Copper Pipe and Fittings:

1. All Copper Piping shall be Type 'K' Copper and shall conform to industry standards and be in conformance with applicable ASTM or ANSI standards.
2. Copper Tubing: ASTM B 88, Type 'L' water tube. For tubing up to 2" diameter, use 'soft' copper (annealed temper). For tubing with diameters larger than 2", use 'hard' copper.
   a. For 2"O.D. and smaller: Cast-copper alloy solder-joint pressure fittings and soldered joints with Alloy Sn95 solder.
   b. Any copper pipe installed under or thru any paving and within 3' of the paving must be braised at each joint, per UPC Building Codes.
3. Copper Fittings:
   a. Cast-Copper-Alloy, Solder-Joint Pressure Fittings: ASME B16.18.
   b. 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.
   c. Threaded Ends: Threads conforming to ASME B1.20.1.

B. Brass Pipe and Fittings:

1. Brass pipe shall be seamless red brass per ASTM B 43 rated for 250-psi working pressure.
2. All Brass Pipe and fittings shall conform to industry standards and be in conformance with applicable ASTM or ANSI standards.
3. Brass fittings shall be Class 250 fittings rated for a minimum of 250-psi working pressure and shall conform to ANSI/ASME B16.15 and ASTM B584.

C. High Density Polyethylene (HDPE) Pipe and Fittings:

1. Polyethylene (PE) 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 steel Inside Pipe Sizes (IPS). 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.

2. Polyethylene (PE) 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 11 (160psi 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.

3. Polypropylene Compression Fittings for HDPE (PE) pipe: Fittings (2" O.D. and smaller lines only) shall be "Polypropylene Compression Fittings" suitable for use on HDPE pipe per ASTM D3035 (IPS diameter, OD controlled). Fittings shall be long term rated for 230 psi complying with ISO 14236 and meet the dimensional and performance requirements of AWWA C800. Fittings shall comply with NSF 61 and shall be "listed" by NSF. Fitting "Bodies" shall be Polypropylene. Fitting "Compression Nuts" shall be 'Acetal'. Joint seal activation shall be accomplished solely by the Compression Nut. Joint "Seals" shall not "interfere" with pipe insertion. No beveling or lubrication of pipe shall be required. Fitting components shall not require dismantling prior to assembly on to pipe. Fittings shall be "3G" or "UTC" with "Slide & Tighten" capability as manufactured by Philmac Pty Ltd. and represented by The Harrington Corporation (HARCO) of Lynchburg, VA (434) 845-7094 and distributed locally by H.D. Fowler, Bellevue, WA.

4 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.

5. 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.

6. **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**.**

D. Joint Restraints shall be used with the ductile iron fittings.

1. Fitting to Pipe Joint Restraints (4" O.D. and smaller) shall be knuckle type as manufactured by HARCO (Harrington Corporation) of Lynchburg, Virginia, or approved equal. The grip ring 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 per ASTM A536. Bolt and nut shall be Type 304 stainless steel.

2 Pipe to Pipe Restraints for pre-belled pipe 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 supplied by HARCO (Harrington Corporation) of Lynchburg, VA.

E. Thrust Blocking is required for all mainline pipe where necessary and as directed by the Engineer in the field.

F. Use Teflon tape on all threaded fittings, regardless of pipe type.

2.02 Sleeves:

A. Sleeves required for main and lateral (sub-main) lines located under paving (pathways and service roads within the site) where vehicles are anticipated, shall be, HDPE, DR-11 (or better). The inside diameter (I.D.) of the sleeve shall be twice (2 times) the outside diameter (O.D.) of the inserted pipe with a maximum of one (1) insert pipe per sleeve.

B. Sleeves under roadways (street rights-of-way, boulevards or parkways) where heavy vehicular traffic is anticipated, shall be HDPE, DR-11 pipe. The inside diameter (I.D.) of the sleeve shall be at least twice (2 times) the outside diameter (O.D.) of the total inserted pipes with multiple pipes inserted per sleeve (only as directed by the Engineer).

C. All sleeves shall be inspected and approved by the Engineer after forms are placed (for wall penetrations) and/or before paving operations are executed.

2.03 Pressure Reducing Valve (PRV):

A. PRV shall be capable of a minimum 150 psi working pressure as specified. Pressure fall off through the PRV shall not exceed designer's specified limit. PRV shall be the same size as the mainline where installed.

B. PRV shall be of the type, manufacture and size shown on the Plans and Details and/or the following: ***for (3/4" to 2") use Wilkens 600 Series PRV, for (2-1/2" and larger) use Wilkins 500 Series PRV with Wye Strainer: Watts No. 777S***, or approved equal.

2.04 Backflow Prevention Devices (BPD): May include a Double Check Valve Assembly (DCVA):

A. The backflow prevention devices shall meet the requirements specified in the City of Seattle Standard Plans and Specifications for Road, Bridge, and Municipal Construction, (most recent edition). Proper drainage shall be provided at all backflow prevention devices. Drainage problems shall be brought to the attention of the Engineer at the time of system layout.

B. The backflow prevention devices shall be type and size as shown on the Plans and Details and/or the following: ***for (3/4" to 2") use Febco Master Series Model 850U Double Check Valve Assembly (DCVA), for (2-1/2" to 10") use Febco Master Series Model 850 DCVA or for other water features (as directed) use Febco Model 825Y (3/4" to 2") Reduced Pressure Assembly (RPA)***, or approved equal.

C. The manufacturer must be on the "Approved Cross Connection Control Devices" list of the Washington State Department of Social and Health Services for that size device.

2.05 Manual Valves:

A. Gate Valves (GV): (2" O.D. and smaller) 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.

B. Lateral (Sub-main) Isolation Valves (LIV): (2" O.D. through 3" O.D.) 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. Components 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. Gasketed joints shall be SBR Rubber and comply with ASTM F477. Internal seals shall be EPDM rubber.

C. Curb Stop (Shut-off) Valves: shall be all bronze construction with 'tee' handle, 175 psi water working pressure, Mueller Oriseal Mark II, or approved equal.

D. Manual Drain (Stop & Waste) Valves: shall be all bronze construction, 175 psi water working pressure, Mueller Oriseal Mark II, or equal.

E. Manual Valves (MV): (Size varies) **s**hall be of types, manufacture and sizes as shown on the Plans and Details and/or the following:

1. Gate Valves: Shall be Kennedy, Mueller, or Hammond, or approved equal.
2. Lateral (Sub-main) Isolation Valves: Shall be HARCO, or approved equal.
2. Drain Valves: Shall be Mueller Mark II Oriseal H-10284, stop and waste, or approved equal.

2.06 Quick Coupling Valves (QCV):

A. Shall be of the type, manufacture and size shown on the drawings and/or the following: Buckner QB44LRC-10 with 1 inch outlet, single lug 2-piece with locking lid and matching key, or approved equal. All quick coupling valves shall be installed in a 10" diameter valve box as shown in the Details.

A. Shall be one (1) inch, all brass, and two piece bodies, with locking brass tops and have galvanized steel swing joints as shown in the Details. Provide five (5) operating keys and hose swivels on each project.

2.07 Valve Boxes:

A. Valve boxes shall be of the type, manufacture and size shown on the Plans and Details and/or the following:

1. Use Armor or NDS Pro Series 10 inch diameter round valve boxes with locking lids for quick coupler valves, green color, or approved equal.
2. Use Armor Super Jumbo Valve Boxes with Pentagon Lock or NDS Pro Series Jumbo boxes with bolt down locking lids and extensions as required (for single valve assembly only), green color, or approved equal.
3. Backflow Prevention Device Assemblies and pressure reducing valves (1-1/2" O.D. and larger) shall be installed in a Fogtite #25-TA Concrete Vault as shown on the Plans and Details. For backflow prevention devices and pressure reducing valves (1-1/4 O.D. and smaller), use Fogtite #2 Meter Box or Christy Concrete Vault with metal lid and extensions and/or bricks as required, or approved equal.
4. Use Armor or NDS Pro Series 6-7 inch diameter round box for grounding rods, green color, or approved equal.

B. Manual drain valves and individual gate valves shall be enclosed in a Cast Iron Roadway Box, as manufactured by Olympic Foundry, Tyler Pipe from Hughes Supply, Inc., or Armor "Polyiron" 5-1/4" valve box, or approved equal, with bottom, top, and lid, sized and extensions, as required. Lid shall have the word "water" printed on it.

D. Provide two (2) sets of all keys required for valves, valve box covers, and protective sleeve covers unless otherwise noted.

2.08 Other Supplies:

A. Electrical tape shall be black plastic, three-quarters inch (3/4") wide and a minimum of 0.007 inches thick and the all-weather type.

B. Teflon tape shall be used for all threaded connections. Tape shall be set back a minimum of one quarter inch (1/4") into the pipe threading.

C. Pressure gages for the pressure reducing valve assembly shall be liquid-filled with one quarter inch (1/4") gage cock attached, or approved equal.

2.09 Identification:

A. Underground - Type Plastic Line Markers (Detect-a-Tape): Permanent, bright-colored, continuous-printed plasticized aluminum tape, intended for direct-burial service; not less than 3" wide x 5 mils thick and shall be placed directly over the pipes at 6” below finished grades. Provide blue tape with black printing reading "CAUTION IRRIGATION LINE BURIED BELOW".

2.10 Backfill Materials:

A. For backfill around all irrigation heads use common builder’s sand, or per Section 31 00 00 - Earthwork.

B. For suitable bedding material around all pipes and equipment as shown on the Details, use: native topsoil with no rocks or other debris more than 1 inch diameter or common builder’s sand.

PART 3 - EXECUTION

3.01 Layout of Water System:

A. Stake the water system following the design shown on the Plans before construction begins. Alterations and changes to the layout may be expected in order to conform to the site conditions and to obtain full and adequate coverage of area to be irrigated. It is understood that corrective measures in the system may become necessary, but no changes or alterations to the system as planned shall be made without the prior authorization of the Engineer.

B. Before starting work, determine that work may proceed without disruption of the activities of other trades.

C. The Contractor shall carefully check grades to ensure that the area is ready to begin work.

D. The Contractor is responsible for taking all reasonable investigative actions and precautions when working around all utility systems.

3.02 Trenching:

A. The contractor will save and maintain any sod from the ditches and replace it after system installation. Sod shall not be displaced for more than 72 hours. Survival of the sod shall be warranted as specified in the City of Seattle Standard Specifications (most recent edition).

B. Exercise care when excavating trenches near existing trees per Section 01 56 39 - Temporary Tree & Plant Protection. Where roots are two inches (2") and greater in diameter hand excavate and tunnel. When large roots are exposed, wrap with heavy burlap for protection and prevent excessive drying. Trenches dug by machines adjacent to trees having roots two inches (2") and less in diameter shall have the sides hand trimmed making a clean cut of the roots. Trenches having exposed tree roots shall be back-filled within twenty-four (24) hours unless adequately protected with moist burlap or canvas.

C. The top six inches (6") of soil shall be kept separate from subsoil and shall be replaced as the top layer when backfill is made.

D. Trenches shall be excavated for all pipe to provide the minimum depth of cover below finish grade of 24" for live lines (mains), and 18" for laterals and all others, no wider at any point than is necessary to lay the pipe or install equipment. Trenches shall be excavated with vertical sides. Locate outside of paved areas wherever possible.

E. Materials unsuitable for bedding of pipe to be removed to a depth 4" below trench bottom, and replaced with suitable bedding material as directed by the Engineer. Suitable bedding material shall be: excavated trench material, free from rocks, roots, sticks, debris or other sharp objects over one inch in diameter; or sand, as required.

F. All trenches must be straight, with appropriate pipe-fittings used to allow pipe to be laid without undue bending and not have abrupt changes in grade.

G. The trench bottom must be free of rocks or sharp-edged objects.

H. The use of an underground vibratory plow or similar device to pull pipe will not be permitted.

3.03 Pipe Installation:

A. Brass Pipe and Fittings:

1. Brass pipe shall be installed in accordance with the local Plumbing Code and as shown on the Plans and Details.

2. Use 'Teflon' tape on all male threads to prevent leaks and corrosion.
3. Wrap all brass pipes with black PVC tape where they pass through grouted openings in concrete vaults.

B. HDPE (PE) Pipe joining and installation methods:

1. Pipe and fittings shall be installed using procedures recommended by the manufacturer.
2. Plain end pipe and fittings shall be made using butt fusion. 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.
3. 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.
4. 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.
5. Electrofusion couplings. Polyethylene pipe and fittings may be joined using approved electrofusion couplings. Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Electrofusion 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 electrofusion 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.
6. 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.

C. Sleeves:

1. Pipe trenches located under areas of existing or new paving shall have sleeves installed. Sleeves shall extend 12" beyond the pavement on each

side. Trenches shall be back-filled with sand (6 inches above and 4 inches below the pipe) and compacted in layers to 95% compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in firm unyielding condition. All trenches shall be left flush with the adjoining grade. The Contractor shall set in place; cap and pressure test all piping under paving prior to paving work.

2. All sleeves installed by the Contractor prior to and during the installation of the rest of the irrigation system shall be inspected by the Engineer and the SPR Plumbing Shop with at least two (2) working days prior notice by calling the **SPR Inspection Request Line at 684-7034 or by email at parksconstruction.inspection@seattle.gov with at least two (2) working days notice**.

D. Backflow Prevention Device Assembly:

1. A Water Service Line shall be installed from the meter or the union at the property line to the Backflow Assembly. The Water Service Line installation shall be inspected prior to backfilling by **Seattle Public Utilities Water Department's Water Service Inspectors @ (206) 684-5803 (8:00-9:00AM) or (206) 684-5800 (9:00AM-12:00noon - with same day inspection if before 12:00)**.
2. Install the Backflow Prevention Device Assembly in accordance with the current local plumbing codes, and as shown on the Details.
3. For proper maintenance, the Backflow Prevention Device Assembly shall be located with sufficient clearance from other site features, not in paving and away from traffic patterns.
4. The Backflow Prevention Device Assembly shall be installed in a specified and approved vault per the Details.
5. Drain valves shall be installed in accordance with current local plumbing codes and per the Details.
6. All Backflow Prevention Device Assembly installations, including DCVA, require testing and certification by a Certified Backflow Assembly Tester (BAT), hired and paid for by the Contractor, prior to substantial completion and acceptance.
7. Once the device assembly is installed and certified, the Contractor shall send report copies to **Seattle Public Utilities Water Department Cross Connection Control Office. Call @ (206) 233-2635 for mailing or electronic address**.
8. The device assembly shall also be inspected by **SPR's Plumbing Shop**. To arrange for that inspection the Contractor shall call the **SPR Inspection Request Line @ 684-7034 or by email at parksconstruction.inspection@seattle.gov with at least two (2) working days notice**.

E. Manual Valves:

1. All manual (gate, isolation, lateral isolation, shut-off or drain) valves shall be installed as shown in the SPR Standard Details.
2. Gate, isolation and lateral isolation valves shall be installed in an adjustable two-piece cast-iron roadway 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".
3. All gate valve assemblies shall be installed at least 24" away from any other valve boxes, vaults or other equipment or structures to allow for ease of maintenance and replacement.

F. Quick Coupling Valves:

1. One quick coupling valve shall be installed at the Point of Connection (POC) for use of compressed air for winterizing the system.
2. All quick coupling valves shall be installed in a 10" diameter valve box as shown in the Details.

G. Risers and Hose Bibs:

1. Minimum riser size shall be the pipe size of the hose bib.
2. All threaded joints shall have Teflon tape applied to male threads only. No pipe dope is allowed.
3. Risers are to be capped after installation in preparation for pressure testing.

H. Backfilling:

1. Backfilling shall be done when pipe is not in an expanded condition due to heat or pressure. Cooling of the pipe can be accomplished by operating the system for a short time before back-fill, or by back-filling in the early part of the morning before the heat of the day.
2. While backfilling the trenches fill and tamp around, 4 inches below and 6 inches above the pipe and fittings with approved suitable bedding material, or sand as required. The remainder of the backfill shall contain no lumps or rocks larger than three inches. A six inch separation is required between all pipes when more than one pipe occupies the trench. If no sodding is required, the top 6 inch of backfill shall be replaced by topsoil where it exists (free of rocks over one inch, subsoil or trash) or selected fill soil or sand if soil conditions are rocky.
3. All roots, rocks and surplus excavation shall be removed from the site unless otherwise directed. Any turf areas buried under ditch excavation shall be raked clean of any excavated material.
4. Trenches under roads or paved areas shall be back-filled and tamped with a mechanical tamper in successive six inch (6") lifts. Paving shall be replaced to the satisfaction of the Engineer.
5. Prior to completing backfill, place detection tape 6 inches below finished grades and directly above the installed lateral and supply mains for future line detection. Provide extra length to clearly expose ends in the valve boxes.

6. Before complete back-filling, all underground appurtenances including risers, valves, double check valve assembly, drain valves, and joints must remain exposed so that they can be viewed during testing.
7. The location, inspecting and testing provisions of these specifications will be strictly adhered to. If, for any reason, any part of the sprinkler system is back-filled before approved location, testing, or inspection is authorized, it must be completely uncovered and exposed until approved for back-filling by the Engineer.

3.04 Clean-Up: Upon completion of operations and prior to watering, clean all adjoining areas such as paving, curbs, and lawns of debris caused by the work on this project, or any part of this project. All hard surfaced areas shall be washed clean. Daily clean up shall be required on all areas used for circulation, parking, or other daily use.

3.05 Testing and Inspections:

A. Pressure Testing:

1. Make hydrostatic tests in the presence of the Engineer and SPR's Plumbing Shop. No pipe shall be backfilled until it has been inspected, tested and approved.
2. Furnish necessary pump, gauges and all other test equipment.
3. All HDPE mainlines with gate (isolation) valves installed and closed shall be flushed and pressure tested with all joints exposed to one hundred fifty (150) psi until watertight. Maximum psi loss in a thirty (30) minute test period shall be five (5) PSI.
4. Similarly, all HDPE lateral lines with risers installed and capped shall be flushed and pressure tested with all joints exposed to service line pressure required for design for 30 minutes. Maximum PSI loss allowed shall be five (5) PSI. The Engineer and SPR's Plumbing Shop shall visually inspect all lateral lines, joints, and swing joints for leakage.
5. To be valid, all tests must be witnessed and approved by the Engineer and SPR's Plumbing Shop. The contractor must give at least two (2) working days notice prior to the anticipated date of inspection by calling the **SPR Inspection Request Line @ 684-7034 or by email at parksconstruction.inspection@seattle.gov with at least two (2) working days notice**.
6. All gauges used in the testing of water pressures shall be certified correct by an independent testing laboratory immediately prior to use on the project. Gauges shall be re-tested when directed by the Engineer and SPR's Plumbing Shop.
7. An Inspection Report shall be made and submitted by the Engineer and SPR's Plumbing Shop immediately after the completion of testing.

B. Equipment Surveying: Upon the Engineer's approval of the Pressure Test, the Contractor shall locate main lines and lateral lines and transfer that information onto the red-lined plan, to be passed along to the Consultant for final "As-Built" Record Document preparation. The Contractor shall provide that service at their cost or can

request that the Engineer provide survey services (if agreed to by the Engineer, in advance) before the backfilling of trenches can be completed.

C. Complete System Inspection (Preliminary Punch List):

1. Upon approved completion of the Coverage Test, trenching and installation of all equipment, the Contractor shall request a Complete System Inspection of the entire irrigation system including: backfilling, irrigation heads, valves, valve boxes, controller and all other equipment.
2. From this inspection, a punch list shall be prepared by the Engineer and presented to the Contractor for completion. The Engineer shall give a date for completion of the punch list, not to exceed ten (10) working days.

D. Substantial Completion:

1. Contractor shall write a letter to the Engineer requesting substantial completion of the irrigation system.
2. Refer to Division 01 Specifications for information about how the irrigation system shall be determined to be substantially complete.

E. Record Documents: It is the Consultant's responsibility to ensure that the following steps are taken to record the "as-built" information of all underground utilities.

1. The Contractor shall keep a current working set of drawings with all as-built changes or actual conditions as work proceeds, to be submitted to Consultant at completion of irrigation system installation.
2. The Contractor performs all required tests, audits, etc. with adequate notice as spelled out in specs.
3. The Consultant shall prepare AutoCAD record documents with the Contractor's and/or SPR Surveyor's "as-built" information included, to be submitted to the Engineer on a CD or DVD along with all other required information, M&O manuals, etc. The CD or DVD shall also include .pdf, .jpg or .tif format files of the record documents, along with Mylar hard copies of the record documents to be submitted to the Engineer at Physical Completion of the project.
   a. The "As-built" plans shall be reviewed and all features explained. The "as-built" plans shall consist of red-lined corrections, notes, comments, etc. on a clean bond paper copy. Any major deviations from the original design (as previously approved) shall be documented on the as-builts and explained at the session. All critical dimensions shall be shown.
   b. The Consultant shall review and approve the "as-built" plans submitted by the Contractor. The Consultant shall then prepare AutoCAD Record Documents with the Contractor's and SPR surveyor's "as-built" information included, to be submitted to the Engineer on a CD or DVD along with all other required information, M&O manuals, etc. The CD or DVD shall also include .pdf, .jpg or .tif format files of the record documents, along with Mylar hard

copies of the record documents to be submitted to the Engineer at Physical Completion of the project.

c. A complete Maintenance and Operations (M&O) Manual shall be prepared by the Contractor and three copies of the manual shall be turned over to the Engineer at the final inspection. The manuals shall consist of three ring binders containing: (1) catalogs of all materials used, (2) a complete parts list of all materials, (3) a written summary of all operations data including spring start-up and winterization techniques, controller programming, valve cleaning, irrigation adjustments, backflow preventer operation and any other information required to operate and maintain system, (4) two local distributors.

d. The controller station timing shall be set by the Engineer.

4. The Contractor shall provide the Engineer with the necessary keys and/or other tools necessary to operate/drain/activate the system and spend sufficient time with the Engineer to insure that the system operation, maintenance, and winterizing can continue after departure of the Contractor. The Contractor shall be liable for all damage or loss resulting from failure to comply with the provisions of this paragraph.

F. Physical Completion:

1. Upon completion and approval of all tests, inspections, training, manuals, as-built drawings, and other requirements of this Section, the Engineer shall write a letter to the Contractor transferring the project to the Owner's Maintenance and Operation personnel.
2. Physical Completion of the system will be contingent upon Contractor providing signed and approved irrigation/plumbing/health/electrical permits as may be applicable.

G. Water System Warranty:

1. The Contractor shall submit a written Warranty, on the approved/attached form, stating that all work showing defects in materials or workmanship will be repaired or replaced at no cost to the Engineer for a period of one year from date of Substantial Completion.
2. A final site meeting shall take place eleven months after the date of Substantial Completion. The system shall be examined by the Engineer to determine if the system requires alterations or replacements covered in the Warranty.
3. The sample Warranty Form following this section may be re-typed on Contractor's letterhead and contain the following information:

P-PATCH WATER SYSTEM WARRANTY
(Project Name)

We hereby guarantee that the irrigation system we have furnished and installed for is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications. Exceptions include ordinary wear and tear, acts of god, and unusual abuse, or neglect by the Owner.

We agree to repair or replace any defects in materials or workmanship, which may develop during the period of one year from date of Substantial Completion. We agree to correct any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Engineer, after receipt of written notice. In the event of our failure to make such repair or replacements within a reasonable time after receipt of written notice, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

Project Information

Project Name: _____

Project Location: _____

Consultant (System Designer): _____

Authorized Contractor Representative

Signed: _____Date_____

Title: _____

Effective Dates of Warranty

Start Date (Substantial Completion): _____

End / Warranty Testing Date / Completion of Guarantee Period: _____

Approvals

Approved by: _____
(Project Manager)

Approved by: _____
(Construction Manager)

END OF SECTION